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THE INSTITUTE OF GEOLOGY

MINING ROAD

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The book includes the materials collected by the participants of KA334 Mining Road Project of Karelia ENPI CBC Program during the process of preparation of a tourist route from the city of Petrozavodsk and its outskirts to the city of Outokumpu (Finland). The book contains descriptions of the most interesting and significant sites of the territories of the both countries and is intended for the readers who would like to expand their notions of the history of mining industry on the territory of Karelia and Finland, as well as aimed at being used by tourist companies for organizing trips in both directions.

The book is structured according to geographical principle and includes sites situated along Outokumpu – Petrozavodsk route. The articles have photos and references to additional materials that could be get about the present sites.

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FROM THE COLLECTOR

The book – the product of work of many specialists in different fields – the participants of KA334 Mining Road Project, ENPI KARELIA CBC Program – is presented to the attention of the reader.

The main task of the book is to present to non-specialist audiences, mainly to the ones that closely deal with tourist business, more complete information about the history of origin and development of mining-and-industrial sights: quarries, underground diggings, mining plants on the areas surrounding the tourist route that the authors call "Mining Road" in order to use the materials as guidance ones when preparing specialized excursions, as well as to draw the business's attention to the geological sights that – for different reasons – did not become mining plants or have a number of esthetic characteristics to be attractive for tourists.

There are some logical principles combining the materials of the book. First, the considered sights are located in close vicinity to the road that the authors call "Mining Road"; second, they are devoted to the history of the development of mining practice at different mineral deposits; third, they include information about geological and natural sights that did not become the objectives of mining, but today can stand in one row with them as natural monuments. That is the sense of the civilization development – not to set mining activity in opposition to recreational one, but to unite them into integrated complex servicing people during different life stages.

There was a very hard task in front of the authors – to combine the sights, which are often impossible to combine, into complete unit. Indeed, mining, nature protection and recreational activities, in many people's opinion, are incompatible. However, the history of the development of mining industry shows that during certain periods it brought fame to Karelia, allowed putting it forward to the leaders of mining industry, ensuring in different centuries outstanding construction projects of Saint Petersburg, Moscow, Kazan and other cities, providing the needs of the army and ordinary people with iron, nonferrous metals, building materials for centuries, and then became the basis for the creation of memorial places reminding of the magnitude of that times. What led to such an unexpected twist in the fate of the region's mining industry, leaving it aside from noisy and environmentally hostile production facilities? This secret can be the reason to study the events of the past, draw time parallels and understand where we should move in the present. Today the sights of mining activity of the past can be and are becoming remarkable monuments to our ancestors' efforts invested in the best interests of their motherland.

Knowing and understanding of the history allow us understanding and assessing the results achieved in the past, avoiding the mistakes that had been made earlier in order not to repeat them in the future. That is why when selecting the material the authors were not limited only by retelling technical and geological specialties that are the description of the chosen sites, but they also tried – where it was possible – to show the spirit, content of the time they were writing about, in order to lay the bridge between the people who ensured the prosperity of our territory in the past and the present population of the Republic of Karelia and the Republic of Finland.

Common destiny combines also near-border location of our territories. The border between our countries at different times moved to one or another side, the territory developed according to the laws of that time and geopolitical influence of the certain cultures. They say, history knows no 'if'. Our region happened to be in the situation when to the question "What if…?" you can very often find a comprehensive answer and show on certain examples how the history of the development of the territory could be formed in this of that case.

It is impossible to consider the development of mining industry sites apart from the epoch when they were used for the people's good. And the authors paid separate attention to the description of political, social and economic features of the periods that during different times the territory through which the Mining Road goes lived.

We have tried to make the profile of the mining industry development for the latest 200 years. It is impossible to embrace everything. There are too many descriptive, cartographic, factographic materials showing the aspects of the mining industry development on this or that areas, in different funds, archives and in researchers' the hands. We hope that our efforts on restoring the picture of mining industry development on the presentational territory will let raising one more layer of history. The history that is not simple, the history that is connected to the specific peculiarities of mining, the history that brought fame to our territories in the past. We do not want it to be forgotten in the future.

Vitaly Shekov
KA 334 Mining Road Project Coordinator

FROM THE EDITORS OF THE FINNISH EDITION

The Mining Road Project guide will lead the reader through interesting and educational journey from the city of Petrozavodsk on the coast of Onego Lake in Russia along Blue Road in Finland via North Karelia to the heart of Savo Province, the city of Kuopio. Following the route the book will tell the travelers versatile geology of the territory, the history of the mines working in these parts during different periods of time and the history of the culture connected to these events. Geological and historical sites presented in the preliminary pages of the book are ready for use. The guide and the sites presented in it give local tourist companies the possibility to develop their own programs and suggestions on geological and mining-and-industrial topic and diverse them with new tourist sites. They give also basis and possibility for making many-sided comprehensive view to the history of mining industry development, the geology of the described region.

The most ancient Archaean crystalline basement of the Earth's crust in the province of North Karelia (age of more than 2 500 mln. years) and bordering with it younger crystalline basement of the Proterozoic (age of less than 2 500 mln. years), as well as many geological processes connected with them, substantiated the prerequisites for forming the deposits of natural stone, precious crystals, commercial ores and minerals in the region. This very fact gives the ground to claim that the crystalline basement of the province of North Karelia has been the source of mineral resources on the territory of Finland already since the 1500-s. From there come the industrial roots of Outokumpu mine that became the basis for creating in the region mining industry, which is still prosperous in Finland. The utilization of the resources of the Fennoscandic craton crystalline basement gave an impact to local people for diverse cultural-and-historical development of villages located near the mine, plant and mine cities.

The Mining Road Project divides the province of North Karelia into historical areas and the areas interesting from the point of view of ore deposits development. The sites suitable for tourist routes tell about the history of the region's mining industry, which started in the Stone Age and is connected to the geographical areas of the Earth and does not take into account the present borders. From the other side, long and multiple-stage history of the regions' border existence regulated the economic life trends, relations between the peoples via trade and wars; and it had strong influence also on the existence of the mining industry. In the 1880-s and the beginning of the 1900-s the mining industry development of North Karelia province was mainly influenced by the proximity of Russia and Saint Petersburg, that were the main market of produced goods; and the market, in its turn and to a considerable degree, was the source of financial resources.

Until now only few mining enterprises could serve as historical sights. The centers of tourist services were built in such places as Outokumpu mine and the places of soap stone excavation, and the most important one is the exposition of the Stone Center in Nunnanlahti near Joensuu. The third most important place is metallurgical plant in Möhkö that worked in 1838–1907. It was a center of mining industry activity, especially from the 1880-s, providing a wide range of services connected to the plant work. As far as iron ore forms as a consequence of geological processes, the sites of mining and mining-and-processing industry within the frameworks of the Mining Road Project complete the collection of places telling about geological development that can be used in tourist business.

Erkki Luukkonen, Geological Survey of Finland
East Finland Office in Kuopio
Merja Marin, Outokumpu Mining Museum

FROM THE EDITORS OF THE RUSSIAN EDITION

Project KA334 Mining Road started in 2012. The Institute of Geology of Karelian Research Center RAS is the leading organization in Project KA334 of cross-border cooperation program ENPI CBC Karelia. The present edition is one of the results of the participants' activity and the aim is to introduce the history of mining on the territory of the two countries along the route Otokumpu (Finland) and Petrozavodsk (Russia). The articles will be interesting for everybody who set a high value on the history and preservation of geological and mining-and-industrial monuments. Of course, by no means all the mine openings and mining buildings are considered as the monuments of geological heritage. The authors of the book (Russian and Finnish specialists) underline all these in the articles. In my opinion, when have read this book, you, dear readers, in this or that way would definitely like to see on your own the sites of mining-and-industrial culture as they are at the present stage. There is enough space here for thoughts and assessments, because natural resources play a great role in the economy of any country. Exactly on the territory, we are talking about, for already several centuries different groups, associations, companies have been developing mineral resources with changing state structure – the Russian Empire, the Grand Duchy of Finland, Finland, the USSR, Russia. That period of time, naturally, was rich in historical events; notably, the considerable volume of mine openings of the past was connected to the excavation of building stone, the rest are metals (the ore of iron, copper, lead, stannum, silver), feldspar, quartz, graphite, marble, gem stone (garnet).

Along the suggested route already today tourists can visit the museum of underground digging and the museum of mining industry in Outokumpu, Finnish Stone Center and soap stone mine situated in Nunnanlahti, the museum at former metallurgical plant in Möhkö (now this place is a very busy village visited by many tourists), the monument of industrial culture "Marble Quarries of Ruskeala in the XVII – beginning of the XX centuries" in form of Mountain Park, the Regional Museum of North Priladozhye (Sortavala), the Museum of Precambrian Geology in the Institute of Geology (Petrozavodsk). This edition provides interesting information about all these sites.

As an example I suggest coming back to the outskirts of Outokumpu. When visiting the old mine I drew my attention to the active development of tourist center based on the history of mining industry of that place. Now on the territory of the former mine there is a golf course, museums, mentioned above. The museums present the history of the mine work and the life of miners. The underground space is used for lecture halls and cafes.

You can find many interesting materials in the articles about the history of Outokumpu mine, molybdenic mine in Matasvaara, metallurgical plant in Möhkö, Vartsila, Tulmozero mining plant, Pitkaranta mines and plants.

Honorable "gray marks" of quarries keep the history and warmth of the quarrymen's hands. Unique quarries of Serdobol granite, Juven and Ruskeala marbles are the starting pages on the architecture of Saint Petersburg.

I would like to think that the present edition will work towards the correct use of geological, mining-and-industrial and historical-and-cultural heritage of the two countries to develop recreational activity and tourism and to accompany all these by improving comfort for the inhabitants and tourists. For instance, climbing to the peak of Kuhavuori mountain can be unforgettable, if everything is arranged like it is done in Koli, Finland, located not far from Sortavala.

V.V. Schiptcov
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FROM THE EDITORS OF THE RUSSIAN EDITION

This book summarizes the joint work of the participants of Mining Road Project, which is a bright example of cross-border cooperation between Karelia and Finland. The main objective of the project is working out tourist route from Finnish city Outokumpu to Prionezhye. The book includes scientific description of the sites that in prospect can turn into tourist ones or are already the ones. Today in the region, including this tourist route, there are municipal museums in Sortavala, Pitkaranta and Kurkijoki. However, the possibilities of creating new tourist sites are far from being exhausted now. Many of the historical-and-geological sites mentioned in the book need to be turned into museums in the long view, and this is one of the factors of their transformation into tourist sphere. The book content, the authors' scientific researches can be a kind of step towards the realization of this task.

The book is structured according to the principle of travelling from Outokumpu to Priladozhye. Specific geopolitical location of this region, its nature-and-climate and landscape features, natural and historical monuments gave it individual characteristics with keeping unified processes of North Europe. These factors provided the basis for the principles of forming this book. Both Finnish and Russian authors are united with scientific interest to this region in the sphere of history, geology, historical cartography, regional studies.

The authors use a wide range of the most diverse sources from different archives, scientists' studies in their articles. Many of the given sources are mentioned for the first time.

The topics of the articles are beyond local aspects. The deals touch upon many historical events related to the region, devoted to outstanding architects, geologists, metallurgists, stone production specialists.

There are a lot of illustrations of diverse character in the book: maps, schematic maps, drawings, pictures, portraits, photos. They are not only for demonstration, but are important sources, bring scientific senses and analytic potential. I would separately underline the abundance of precious photos, which, when thoughtfully "read" (the analysis of compositions, different backgrounds, ethnographic contexts, the moods of the captures people) are scientific sources.

The history of the mine, plant, small town, small district – all these, from the first glance, local objects of research are hiding the question: "How did people live in this region during different times?" From Outokumpu to Priladozhye – borderline territory, boundary area. It gave historical, ethnical, cultural, toponymical, linguistic, demographic peculiarities to the historical destiny of the people living here. Living next to the border… The border in historical dimension tends to change. It was changed in favor of the Moscow State, then of the Russian Empire, then of Sweden, then of Finland, then of the USSR. It caused the changes also in the destinies of certain people.

However, there is a very good reason for naming the book "Mining Road". And this is not just a priority. There were different reasons for that. Geological sites are the main part of the tourist route. Therefore the authors did their best to give them historical-and-geological character. Only in this aspect geological sites can be attractive for tourists. It appears, that this name gives essential aspects to the problems of this region: someday one of the leading ones in the sphere of building material production and metallurgy. Today most of these sites survive a complicated stage of their history. Addressing to the past is always logical in the moments of the future development conceptualization. Practice-oriented character of the articles content is valuable not only as materials for cultural tourism, but is of a great interest in planning social-and-economic development of the region. This is the cultural tourism that can now become a certain driving force of our region's development. Capitalization of science is one of tactical steps the realization of political strategy of tourist sphere in Karelia. I am sure this book will work for this task.

I can not conceal, I have read this book with great interest. Many names of settlements, lakes, rivers and other geographical sites were familiar to me from childhood – I was born in North Priladozhye. The interest to the history of and reverence to the beauty of this region's nature remained for life. The book will arouse great interest of the scientists of different spheres, regional historians, as well as everybody who is not indifferent to the destiny of dear Karelia. Its appearance will be quite an event and it will be popular.

M.L. Goldenberg
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GEOLOGY AND ORE DEPOSITS IN COMMON, UNITING ACROSS BORDERS

Tapani Tervo (GTK) and Satu Hietala (GTK)

Mining Road – geological evolution

Principal rock units in North Karelia

The bedrock of the eastern part of the Province of North Karelia consists of **granitoids and gneisses** (shown in pale yellow in the maps), with intervening schist belts that represent the remnants of sedimentary rocks and thick, extensive sequences of lavaflows. Areas comprising **rocks of volcanic origin** (shown in light green on the maps) also alternated with **mica schists and gneisses** (gray areas) that originally formed as layers of sand and clay deposited at the Earth's surface. Together these areas form part of the so-called Archean craton, which formed between 3100 and 2500 milion years ago and which represents a deeply eroded continental mountain range.

The Archean area is bordered to the west by the North Karelian Schist Belt, which consists of sediments that were originally deposited on the deeply eroded Archean basement between 2500 and 1900 million yerars ago. The sediments are represented by gravel and sand, silts, clays and muds, limestones and also some that were derived from volcanic eruptions. The underlying Archean basement is evident in several domal culminations, west of Joensuu and at Kontiolahti.

The North Karelian Schist Belt can be divided into an **eastern belt of quartzites** (shown in yellow on the map), **sedimentary rocks of the Höytiäinen Basin** (pale blue areas on the map) and the **East-Savo Province** (dark blue areas). The **volcanic rocks** of the Tohmajärvi area (dark green on map) are associated with the mica schists of the Höytiäinen Basin, while the rocks belonging to the **Outokumpu assemblage** are related to the marine sediments that formed the East-Savo Province. The youngest rocks in the region are plutonic rocks, predominantly **granites** (shown in red on the map).

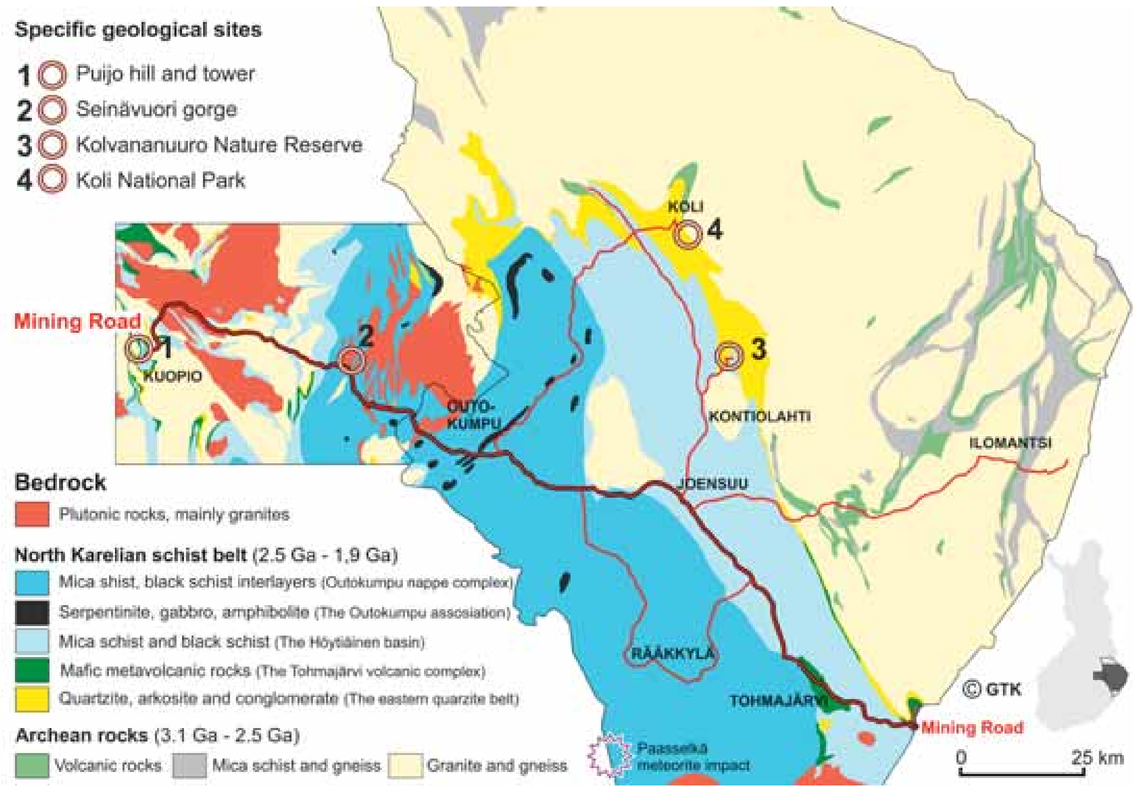

Fig. 1. Principal rock types in North Karelia showing locations of geological sites along the Mining Road

Evolution of the North Karelian bedrock

The Archean bedrock of eastern Finland began with the segregation of various kinds of granitoid magmas from sources in the upper mantle and lower crust and the formation of greenstone belt as a result of volcanic activity, erosion and sedimentation. The rocks we now see attained more or less their present form 2600 million years ago and subsequently formed the basement on which the sediments of the North Karelian Schist Belt were deposited. The history of the Schist Belt can be inferred from studying sediments and structures and from isotopic dating of suitable rock units.

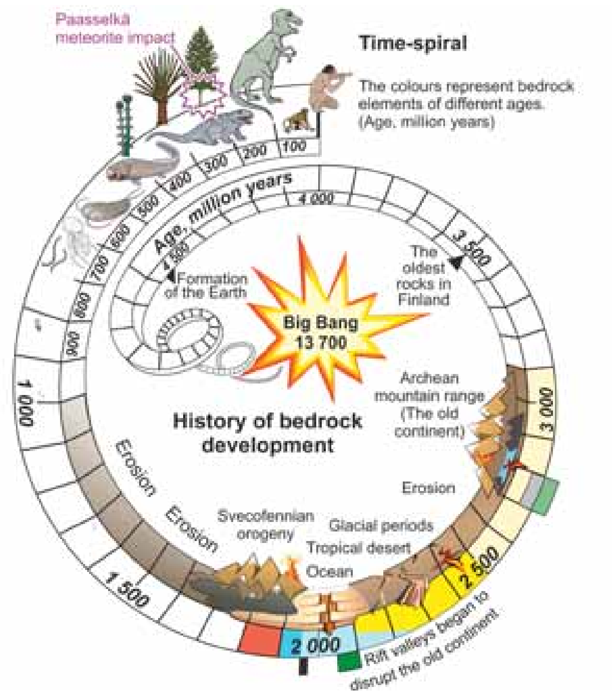

Fig. 2. Evolutionary spiral illustrating the relative ages of different rock types in eastern Finland, with colors corresponding to those on the geological map. Geological events through time are depicted schematically within the inner circle (Tapani Tervo, GTK)

The **eastern quartzite belt** was deposited under relatively stable conditions, during which rivers transported sand and gravel derived from weathering and erosion of the Archean basement into depressions and basins that formed by faulting and rifting of the ancient contintental margin. Molten lava intruded along these fault networks, sometimes spreading laterally within the quartzites and basement, forimg extensive sheets of dark dolerite, or erupting at the surfec as basaltic lava. About 2350 million years ago, glaciers covered the region but by 2300 million years ago Fennoscandia had migrated to equatorial latitudes and experienced deep tropical weathering, which is recorded by a metamorphosed lateritic weathering profile, or paleoregolith up to 80 meters thick. At this time, oxygen began to accumulate in the atmosphere, due to the evolution and expansion of photsynthetic cyanobacteria.

About 2100 million years ago, this stable continental margin and shelf began, as a result of rifting, to founder and the deposition of deeper water sediments, including sands, silts and clays, and carbonate muds commenced, which were eventually metamorphosed to form the schists of the **Höytiäinen Basin**. In the southern part of the area, at Tohmajärvi, volcanic rocks are also present, including lavas that erupted on the seafloor, with characteristic pillow-shaped features, as well as the products of explosive, pyroclastic eruptions, which were also eventually deposited into deep water. Deep within the basin, hot, magmatically derived fluids caused leaching and convective transport of metals, that percolated through the sedimentary rocks and in some places precipitated metals, resulting in the formation of economic accumulations of ore.

The sediments of the **East-Savo Province** were also deposited in deep marine conditions on the continental slope and floor of the widening ocean basin. This was particularly important event with respect to the formation of mineral deposits, as the Outokumpu copper ores were formed by hydrothermal fluids deep beneath the seafloor, and transported as isolated fragments by thrust faults for tens, if not hundreds of kilometers across the ocean basin and continental margin.

This event represented the initial stages of the collisional processes between tectonic plates that ultimately gave rise to the bedrock of eastern Finland as we see it at present. Closure of the ocean basin led to emplacement of the rocks formed in the deep ocean basin, including sedimentary and volcanic rocks over the old Archean continental margin, leading to the formation of large mountain ranges, just as in the modern Earth. At the same time, about 1885 million years ago, higher temperatures and pressures deeper in the crust led to melting and crystallization of granitic magmas, which obliterated the original features of the sedimentary and volcanic rocks, resulting in completely new mineral assemblages and rock types.These processes too, led to the transport and accumulation of different metals to form various types of ore deposits. The final stages of this collisional event saw the slow crystallization of large volumes of granite deep within the crust.

Following this mountain-building event and stabilization of the Finish bedrock, there was a prolonged period of erosion and exhumation of the deep crust. Estimates of pressure and temperature made from the mineral assemblages preserved in North Karelia indicate that they originally formed at depths of between 10–25 kilometers. Accordingly we can conclude that an equivalent amount of rocks have been removed by erosion, although this should not be interpreted as meaning that the mountain belt would have exceeded 10 kilometers in height. This is because of the way in which erosion of the uppermost crust causes gradual rather than rapid uplift of the relatively lower density deep crust. As a result of this ongoing erosion, ore deposits formed or buried deep in the crust were gradually brought to the Earth's surface whre they have become accessible for mining.

During this prolonged period of erosion there were very few rock-forming events but the most significant of these was the emplacement of kimberlite pipes between 1230 – 630 million years ago. Kimberlites are relatively rare and rather unusual rock types, being derived from depths of nearly 200 kilometers and being emplaced very rapidly at the surface accompanied by volcanic eruptions. A number of these kimberlite intrusions have been found in eastern Finland, in the Kaavi and Kuhmo districts. Another interesting event recorded in eastern Finland is the meteorite impact site beneath the lake Paasselkä.

The Ice Ages along the Mining Road

For several hundreds of thousands of years, Finland has been repeatedly covered by continental ice sheets, with intervening periods of glacial retreat. The current ice-free interglacial period began with the onset of global warming about 18000 years ago. Over a period of about 5000 years, the margin of the ice-sheet retreated from central Europe to what is now the southern coastline of Finland, while eastern Finland was progressively exposed from beneath the ice between 12400 and 10800 years ago.

As it melted, the ice sheet separated into a number of separate lobes, with deposits of sand and gravel marking the progression of glacial retreat, interspersed with several episodes of hundreds of years duration when the glacial front remained stationary, or even advanced again.The Mining Road passes through ice-marginal formations formed between two of the retreating glacial lobes.

From the point of view of exploration and mining, the glacial transport of mineralized boulders by ice has been important in finding a number of ore deposits in Finland. Perhaps the most famous example is the boulder found at Kivisalmi near Rääkkylä in 1908, which led to the discovery of the Outokumpu ore body.

Ore deposits as by-products of geological processes

Ores and mineral deposits within the Archean bedrock

The soapstone occurrences in the Juuka-Nunnanlahti area formed about 2800 million years ago, commencing with the eruption of magnesium-rich komatiitic lavas within rift valleys on the seafloor. These lavas erupted at extremely high temperatures, around 1600 degrees and therefore were of extremely low-viscosity, flowing for great distances along the seafloor from theire eruptive vents, with coarse-grained olivine cumulates forming in topographic depressions. Later, about 2700 million years ago, hydrothermal fluids rich in carbon dioxide percolated through and reacted with the lavas, changing the olivine at first to serpentine and finally to soapstone. The chemical reaction fron associated with this process progressed slowly through the rock over tens of millions years.

These same submarine processes that produced the ponded coarser-grained olivine cumulates lava flows provided favourable conditions for the formation of nickel sulfide mineralization. One such example and indeed the only deposit of this kind found so far, was mined at Tainiovaara, near the town of Lieksa, in 1989. Similar komatiitic lava flows are also present in proximity to the Pampalo gold deposit in the Ilomantsi district and also near the Otravaaara pyrite diepist, that was mined in the early twentieth century as the raw material for producing sulfuric acid. The same rock units that contain soapstone are also prospective for talc deposits but up untile now, the economic importance of soapstone has been greater in the Archean bedrock of North Karelia than that of gold, nickel and talc.

However, an additional and relatively rare metal mined from the Archean of North Karelia was molybdenum, from the Mätäsvaara mine, near Lieksa. This was discovered in 1903 but profitable mining commenced during the 1930's; much of the processing equipment was dismantled for security reasons during the Winter War of 1939–1940 but mining soon resumed until declining demand led to closure of the mine in 1947.

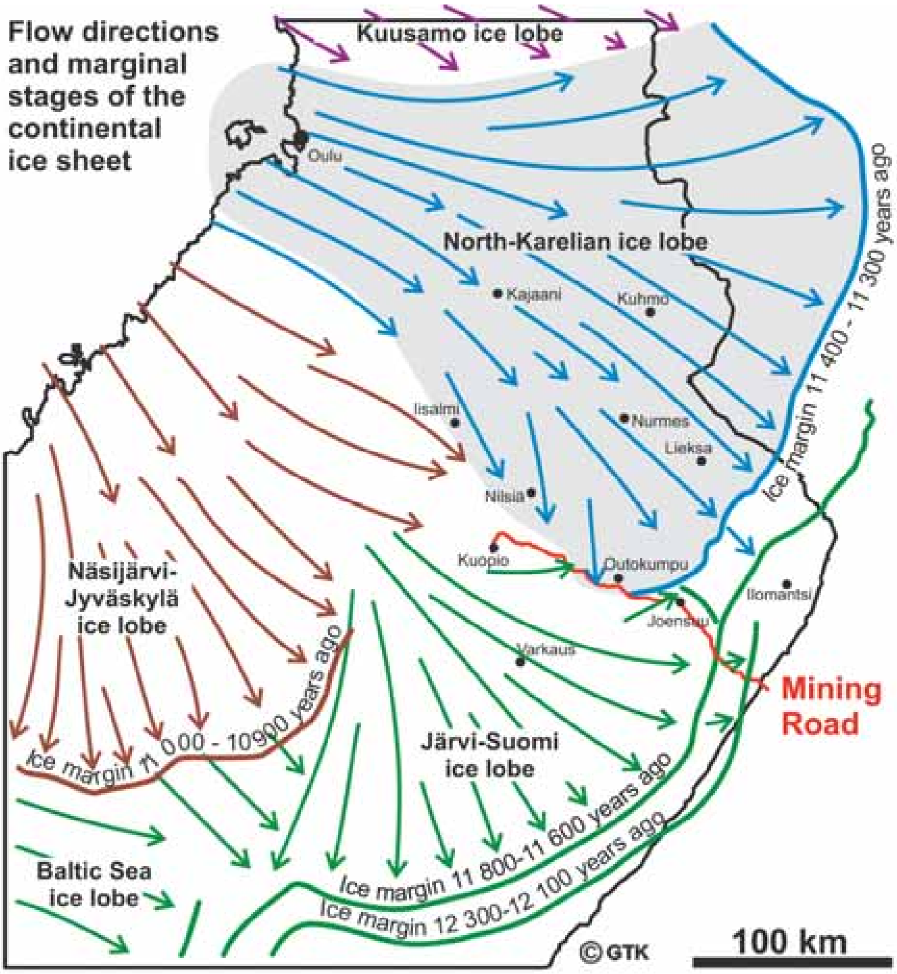

Fig. 3. *The Mining Road traverses the ice-marginal formations of two large glacial ice lobes*

Industrial minerals and ore deposits in the North Karelia schist belt

The eastern quartzite belt contains a number of small deposits of aluminosilicate minerals, some of whch have been exploited commercially. Kyanite has been the most important commodity mined, from small quarries in the Eno district, at Höllärinvaara, Ilokallio, Porraskallio, and Severinkallio, with a combined production between 1930 and 1970 of about 700 tonnes from which 80 tonnes of kyanite was separated. The highest grades were up to 80–100 %. Kyanite is used as a refractory material in manufacturing firebricks and lining kilns, and in ceramic components in electrical products, as well as in brake pads and for ornamental purposes as crushed rock aggregate and screenings.

There are also several small uranium deposits within the quartzites between Juuka and Tohmajärvi, most of which are entirely within the quartzites, as at Ipatti, Martinmonttu and Ruunaniemi. The only deposit to have been commercially exploited is at Paukkajanvaara, where uranium was concentrated at the contact between a doleritic dyke and quartzites (Saltikoff et al., 2006 and references therein). The Pakkajanvaara deposit was rather small and production ceased in 1961 after only four years, during which about 40 000 tonnes of ore was mined with an average grade of 0,14 % uranium.

Small, low-grade copper deposits have also been worked in the Kontiolahti and Eno district, again in association with doleritic dykes. Of historical interest is the mining around Herajoki, which led to construction of a small copper smelter (cf. Figure 6).

The origin of the Hammaslahti copper-zinc deposit in the Höytiäinen Basin, which was mined from 1973–1986, was closely associated with the Tohmajärvi volcanic complex; convective flow deep within permeable sediments and volcanics, at temperatures around 310 degrees caused leaching of metals, accompanied by production of hydrogen sulfide and carbon dioxide. Metals precipitated and accumulated at discharge vents on or beneath the seafloor, with the main ore minerals being chalcopyrite, pyrrhotite and sphalerite.

The Outokumpu-type deposits of the Eastern Savo Province occur within a distinctive assemblage of rock types including graphitic black schists, calc-silicate rocks, quartz rocks and serpentinites, that for a discontinuous chain of occurrences that can be traced from the Outokumpu-Polvijärvi-Liperi area for nearly 250 km northwards. The deposits have been mined for a range of metals at Outokumpu (Cu, Zn, Co, Au, S), Vuonos (Cu, Ni, Zn, Co) and Kylylahti (Cu, Co, Au), of which the latter is currently in production. Reserves at Kylylahti are expected to last for another ten years, while the largest deposit at Outokumpu was mined for 80 years and laid the foundation for the Finnish mining and metals industry and for ongoing research and development in the mining sector.

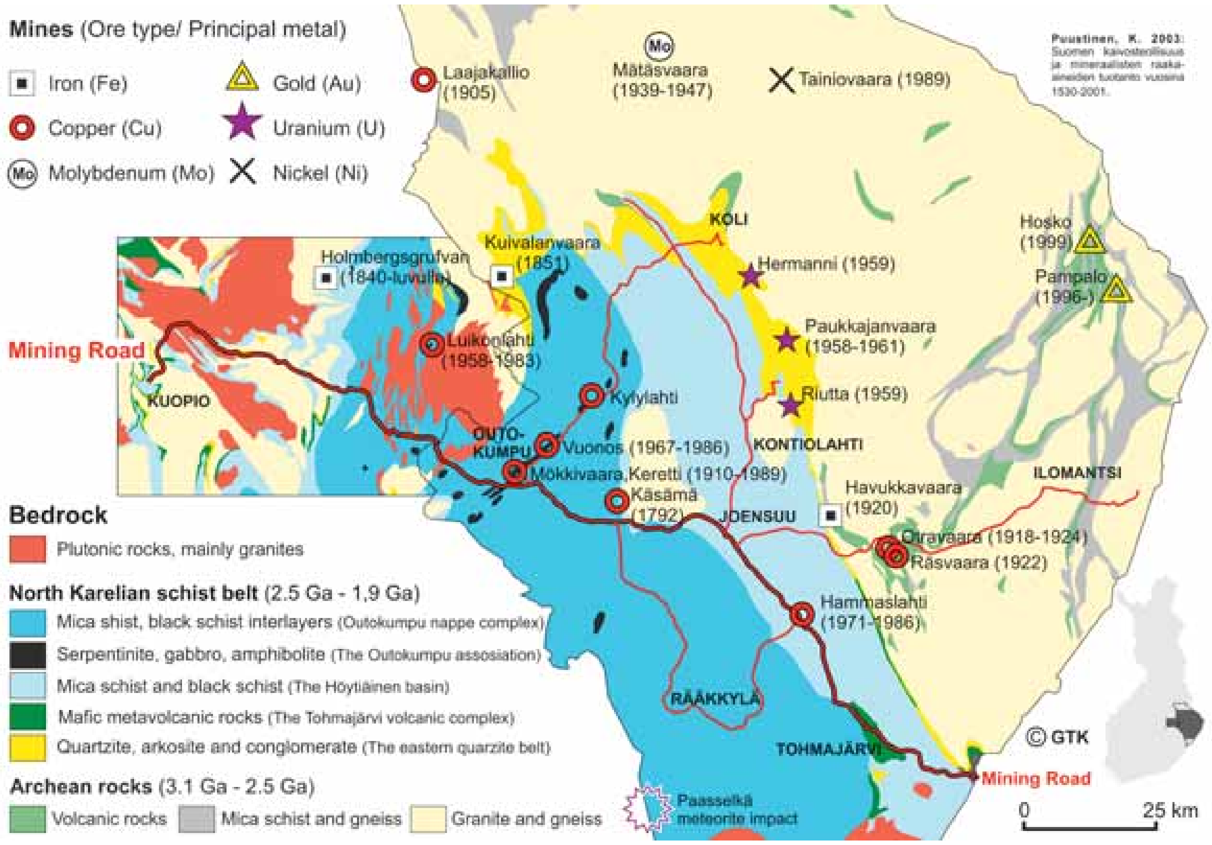

Fig. 4. Metallic ore deposits mined in North Karelia

Between 1910–1989 a total of 28,5 million tonnes of ore was mined at Outokumpu, with a mean grade of 3,36 % copper, 0,88 % zinc, 0,23 % cobalt, 22 % sulfur, 0,22 % nickel and 0,8 ppm gold. The ores were located predominantly within the quartz rocks that were formed from leaching of serpentinites beneath the seafloor. Nickel and copper ore bodies were mined at the Vuonos deposit from 1972–1986, with total production of 11 million tonnes averaging 2,14 % copper, 1,31 % zinc, 0,14 % cobalt, 20,7 % sulfur and 0,16 % nickel. In addition to the Kylylahti mine which is near Polvijärvi, there were several other Outokumpu-type deposits mined between 1961–1983 in Northern Savo, at Luikonlahti and Riihilahti (Saltikoff et al., 2006 and references therein).

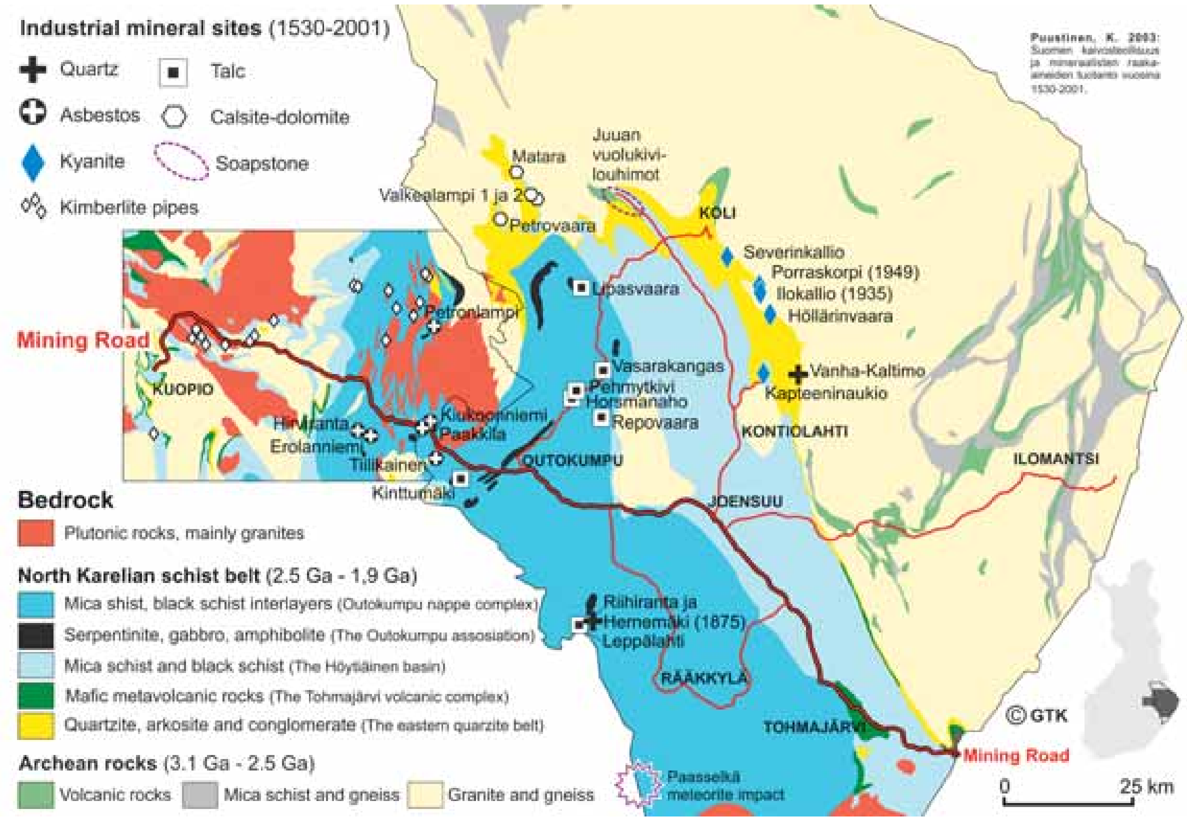

Fig. 5. Industrial mineral occurrences and mines in North Karelia

The Outokumpu region also contains a number of significant talc deposits, including those at Sola, Lipasvaara, Vasarakangas and Horsmanaho. There were also some asbestos occurrences associated with serpentinites at Paakkila in the Tuusniemi district and at Maljsalmi near Outokumpu but mining stopped in the 1970's because of hazards to community health. Ther was however, an even longer tradition of asbestos mining in eastern Finland, for some 4500 years ago it was being used in the manufacture of combware pottery (Nikkarinen, Aatos and Teräsvuori, 2001, and references therein).

In the area between Kuopio and Kaavi there are also some distinctive intrusive rocks, occurring as pipe-like brecciated bodies known as kimberlites. Kimberlites are host rocks to diamonds and several intrusive pipes in the Kaavi area contain diamonds, at abundances up to 0,4 grams per tonne and in some instances of gem quality. In addition to the Kaavi and Kuopio areas, diamondiferous kimberlites have been found elsewhere in Fennoscania, at Kuhmo, Kuusamo and in the Archengelsk region of Russia.

Bog-iron, ironworks and the Herajoki copper smelter

Bog-iron, or perhaps more appropriately in Finland, lake-iron is composed of limonite, a complex iron hydroxide, or oxyhydroxide, that forms when ferrous iron (having a cation valency of +2) precipitates from solution. The most favourable places for the formation of limonitic ores are sandy lake bottoms or springs, but sometimes bog-iron will form where groundwaters discharge beneath or at the edges of peat deposits. The iron content of limonitic bog-ore varies between 20–48 % and manganese contents may be as high as 30 %. The iron ore occurs in diverse forms, as fine-grained mud, or more typically as pellets, which are easier to extract and recover. The rapid rate of accumulation of bog-ore means that it is effectively a renewable natural resource.

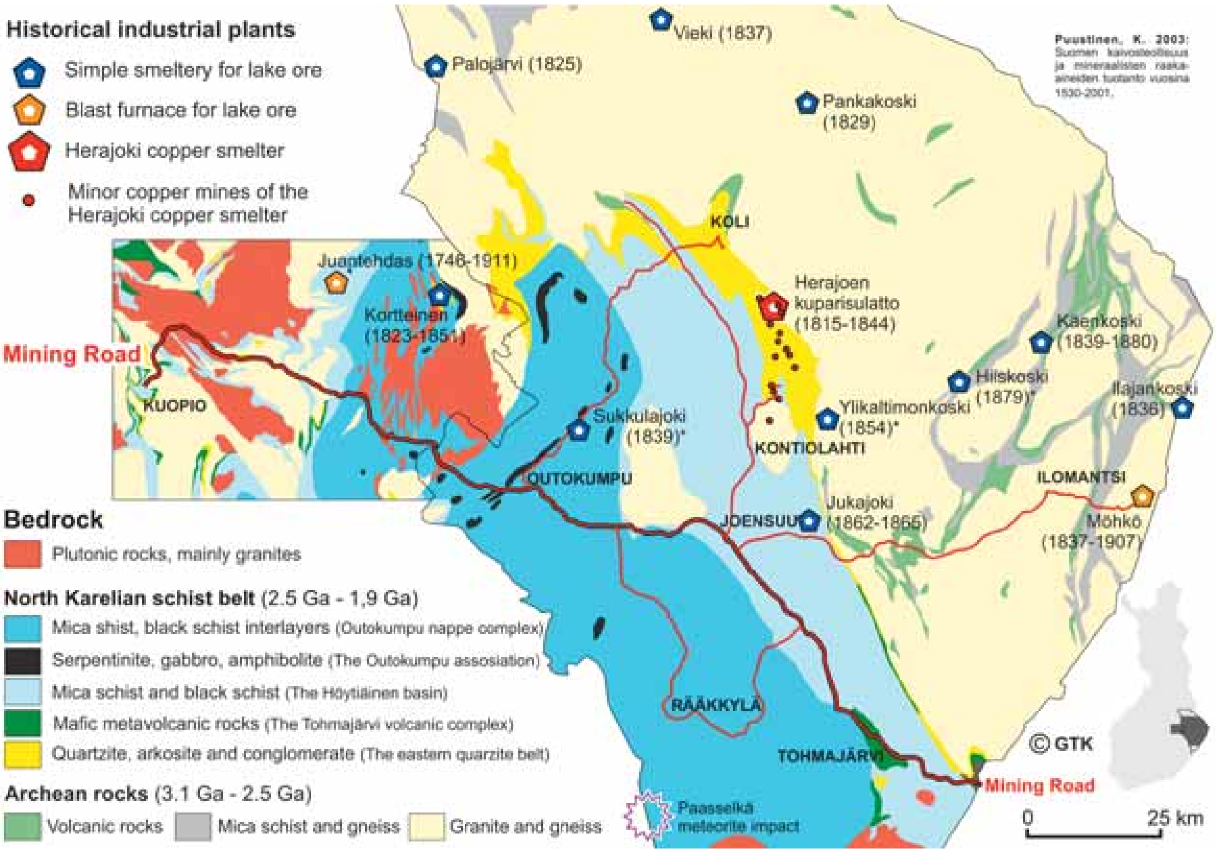

Fig. 6. Geological map showing ironworks that exploited bog-ores or lake-ores in North Karelia, and the Herajoki copper smelter

Production of iron ore from lakes and swamps was at its greatest during the 1860's to 1880's, when it formed a significant industry. Most of the production was from small-scale kilns and furnaces, of which three furnaces and seven kilns were located along the Mining Road in eastern Finland (cf. map 6). The Möhkö ironworks, which have nowadays been restored for tourism, utilized ore recovered form 59 lakes, of which the largest amount, of 4031 tonnes from Lake Koitere, with a mean grade of 41,3 % Fe (Puustinen, 2003).

Figure 6 also shows the location of the Herajoki copper smelter and the small mines that supplied raw materials, commencing in the early 19th century. In 1814, the Russians Nabokov and Snjettov started construction of the Herajoki smelter at the site of an earlier grainmill. The copper furnace was completed in 1815 and processed copper ore from fourteen small copper occurrences. Smelting was already discontinued for a short time in 1817, and then finally, in 1844.

Sites of interest along the Mining Road in Finland

The Mining Road traverses both former and currently active mining districts. Several areas have been developed for tourism and education, to illustrate the history of mining from the Neolithic period through to the present day, and how these activities promoted travel and trade prior to the establishment of current national borders. On the other hand, the numerous changes in location of the border in eastern Finland have had a major influence on trade and investment, which have in turn affected development of the mining industry. The proximity to Saint Petersburg was particularly important during the 19th century and the earliest part of the 20th century, both through its demand for raw material and metals, as well as a source of finacing for mining activities.

At present there are only a few sites that have been restored or designed specifically for the purposes of education and tourism. These include the mining museum and historical mining area around Outokumpu and the Finnish Center for Natural Stone Research, with its geological displays and related tourist facilities, built around the soapstone quarrying and dressing plant at Nunnanlahti. The third significant site is the Möhkö ironworks, which were fully operational between 1838–1907. The extensively restored industrial facilities and mining village provide a copreheisve insight into bog-iron production in the latter half of the 19th century.

Because ore deposits are formed as a result of diverse and complex geological processes, it is important to understand the geological background and history of the Mining Road, through descriptions of a number of scenic and informative localities, such as the Puijo hill at Kuopio, the Seinävuori Gorge near Tuusniemi, the Kolvannanuuro Gorge near Kontiolahti and the Koli National Park (Figure 1). The glacial boulder trail at Kivisalmi also offers insights into the importance of glacial processes in shaping the landscape and the way in which they have generally made exploration more difficult, by covering the bedrock with layers of sediments, while at the same time, transport and dispersal of mineralized boulders in till has proven to be an effective exploration tool, as boulders can be traced back to their point of origin. It was precisely this, for example, which led to the discovery of the Outokumou ore. Finally, in the Kuopio city area, a number of geological sites present a link between urban and cultural lansdscapes and geological processes.

The Puijo tower, considered by many people in Kuopio to mark the center of the universe, is a natural starting point for the Mining Road in Finland. From the viewing platform on the top of the tower it is possible to look east towards the other end of the Mining Road at Petrozavodsk, far beyond the horizon, some 360 kilometers away. Some of the more sharp-eyed Savo locals even claim that on a clear day they can actually see that far.

If some of the other statements about the geological history and formation of ore deposits along the Mining Road seem equally unbelievable, this is not at all surprising, given the difficulty humans have in grasping the magnitude of geological time, over billions of years and the changes that have taken place. In this way, the situation is very similar to the view from the Puijo Tower – while expansive and impressive, most of the world is invisible, hidden beyond the horizon, and yet, as we all know, it is still there. In the same way, our own lifetimes represent our “field of view”, with respect to geological time. With the aid of “geological binoculars”, we can look back through time, and this is what the Mining Road offers to the interested traveler.

Puijo Tower and the Puijo Geology Trail

For the people of Kuopio in particular, but also for the rest of the population of Savo, the 75 meter Puijo Tower represents the center of the world.

Fig. 7. The Puijo Tower stands 306 meters above sea level and 224 meters above the surrounding Lake Kallavesi. (Photo: Jari Nenonen, GTK)

The justification for this is that on the opposite side of the world, somewhere between New Zealand and Antarctica, there is supposedly a place where the prow of a boat is always pointing towards Puijo – rather than Rome. Conversely, irrespective of which direction a hypothetical traveler took when leaving Puijo, he or she would always end up at that same point 20 000 kilometers away. Altneratively, there would be a shortcut through the center of the Earth which would be about 7000 km less, given that the diameter of the planet is about 12800 kilometers.

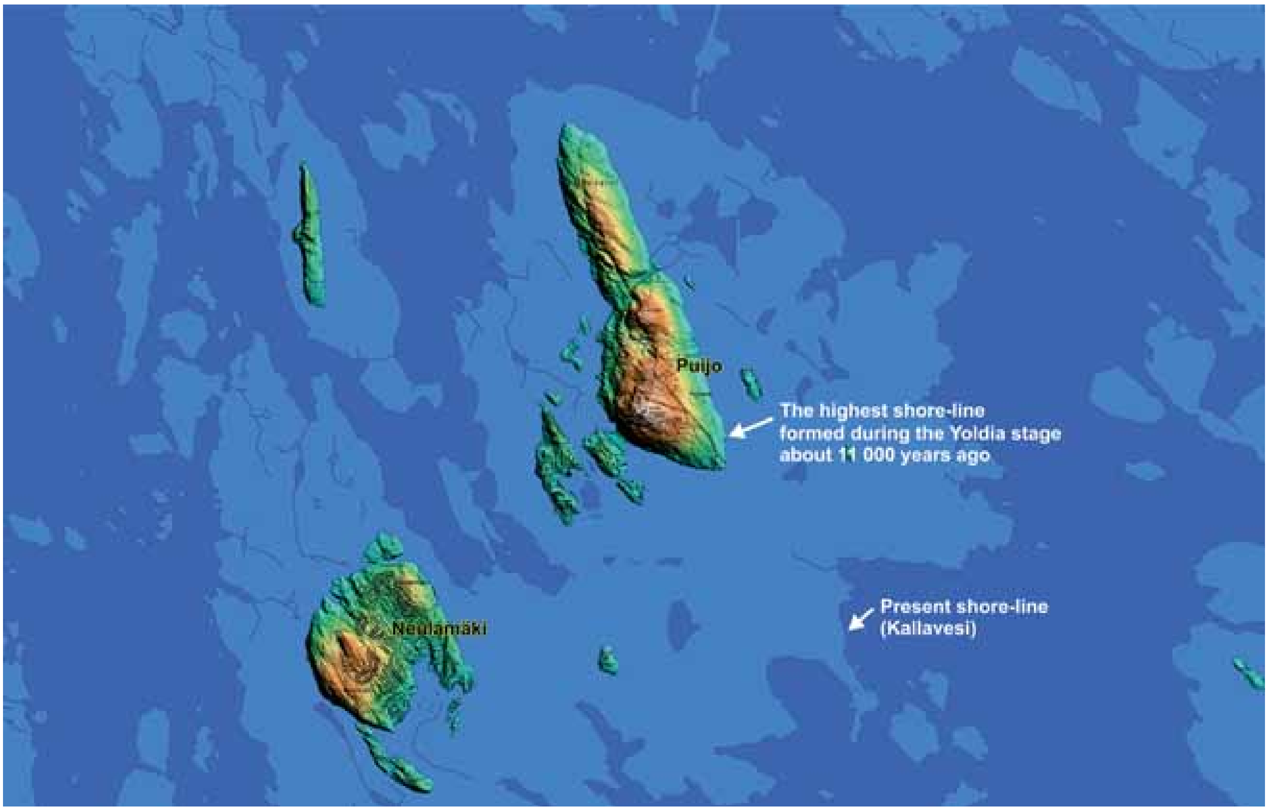

Fig. 8. About 11000 years ago, after the retreat and melting of the continental ice sheet, the Puijo hill formed an isolated island within the Yoldia Sea

The top of the Puijo Tower is 360 meters above sea level and 224 meters above the level of the surrounding Lake Kallavesi. The panorama that opens up from the tower is like the memories from an unfolding story of a long journey, in which the images are recorded in various features and details of the surrounding landscape that have formed over billions of years, in strange and varied environments. The bedrock reveals a record of plate tectonic movements through space and time, and the scenery below provides an insight into the entire geological history of the eastern Finland.

The oldest rocks in the Kuopio area are granitic gneisses and migmatites formed over 2500 million years ago, in an ancient mountain range that had already worn down by 2300 million years ago, when the Earth's crust began to fracture and rift once more. By 2100 million years ago, the rifting had led to the formation of a new ocean basin. The most significant event, responsible for formation of most of the features we see, occurred somewhat later, around 1900 million years ago, when the old Fennoscandian continental plate was located at latitudes comparable to those of modern Egypt. A tectonic collisional event between the old continent and an oceanic plate, lasting tens of millions of years, caused melting of the old crust, as well as the sedimentary rocks deposited on the continental margin. As these rocks were buried deeper and deeper, molten material, which was less dense than the surrounding rocks began to rise upwards, which together with stacking of the crust by large thrust faults, led to the formation of massive mountain ranges, rather like those of the modern Alpine-Himalayan collision zone. Prolonged uplift and erosion of the mountains gradually exposed the roots of the mountain ranges, so that the rocks of the Puijo area represent a crustal section from a depth of about 15 kilometers.

The last million years of landscape evolution has been dominated by successive advance and retreat of continental ice sheets, each of which has left its own traces. The Kuopio area was exposed from beneath the retreating glaciers about 11000 years ago and while most of the region was beneath the waters of the Yoldia Sea, Puijo already formed an isolated island, with the shoreline at that time being about 60 meters higher than at present. The landscape we see today results from progressive uplift, or so-called post-glacial rebound, since then.

A geological trail has been constructed around the summit area at Puijo, highlighting the most important features of the bedrock, and providing a window into the geological history of the region. This story is supplemented by another heritage trail through Kuopio illustrating the ways in natural stones have been used in the built environment, as described in detail in Section 3.2.

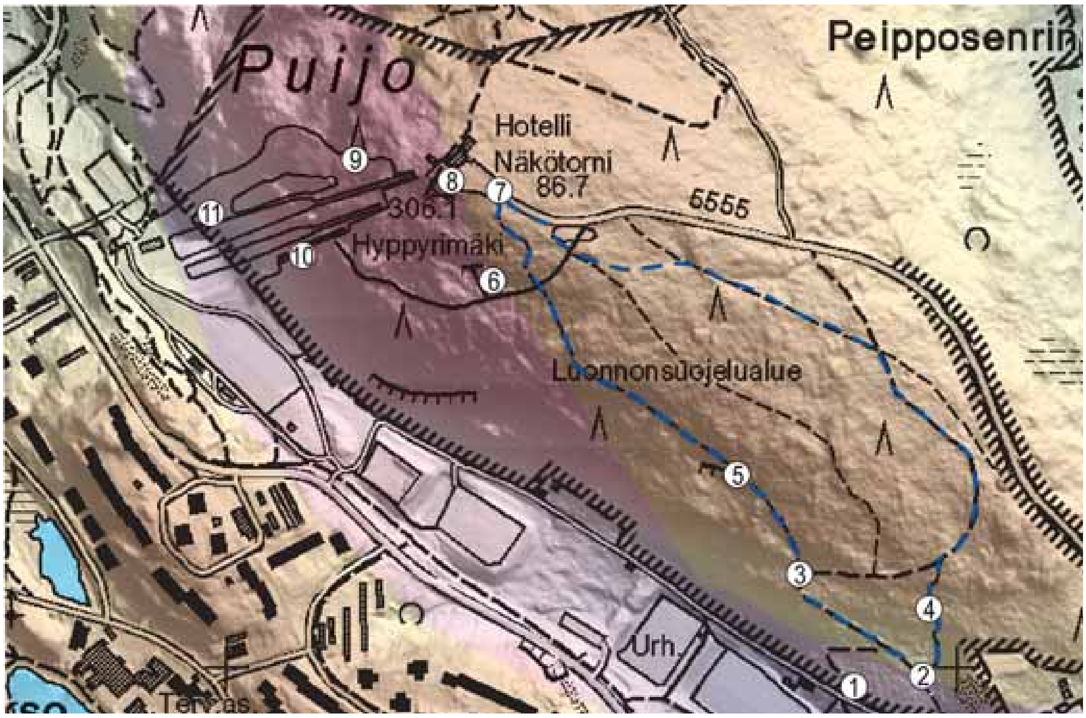

Fig. 9. Map of the Puijo area showing the location of the 11 sites along the geological trail, including information boards and descriptions of how various rock types are used as building stones. The sites do not need to be visited in any particular order

The Puijo Marker Stone (1)

Finnish KKJ coordinates
N6977.881 E3534.055
Finnish ETRS-TM35FIN coordinates
N6974957.763 E533869.953

The Puijo Marker Stone is a well-known landmark erected in 1903 by the Kuopio Traveller's Association, which was an affiliated branch of Finnish Travellers' Association (later known as the Finnish Tourist Association), which was originally formed in 1887 to promote tourism in Finland. The monument is still in its original location, at the intersection of the road to the summit, Puijonrinteentie and the old Puijo road, Puijontie and for many years it was an important meeting place. A second, similar marker is located at the junction of the modern Puijontie road and the road to Puijonlaakso, Puijonlaaksontie.

The Puijo Marker Stone consists of porphyritic granodiorite, with large, somewhat lenticular feldspar crystals, or phenocrysts that show a general alignment with the foliation in the rock. It is possible that the rock represents the 2500 million

Fig. 10. The Puijo Marker Stone (Photo: Jari Nenonen, GTK)

year old so-called augen gneisses that characterized the bedrock of the Kuopio area, although the actual locality from which the stone was obtained is not known. The marker consists of a basal plinth upon which the main oblong, and rather triangular-shaped stone has been set. Both stones are roughly hewn but the front of the main stone has been smoothly chiseled and engraved with the emblem of the Finnish Tourist Association, which comprises a spoked wheel and the winged feet of Hermes, the guardian of travelers, as well as the word "Puijo" and a guiding arrow.

The old toboganning pavilion (2)

Finnish KKJ coordinates
N6977.920 E3534.131
Finnish ETRS-TM35FIN coordinates
N6974996.748 E533945.922

Fig. 11. The site of the former toboggan run pavilion. (Photo: Jari Nenonen, GTK)

The old road winding up to the Puijo summit provided an easy route to the first official toboggan run to be opened in Finland, at Puijo, in 1913. In 1916 a café was established at the base of the run, and a pavilion was constructed, with storage facilities for toboggans and sleds. The stone foundations are all that remain today and it is possible to see the way in which irregularly shaped angular and rounded blocks have been selected so as to interlock effectively. No mortar was used in construction, although smaller stones were inserted into gaps remaining between larger blocks, in the typical manner of dry-stone construction. The other type of construction using mortar previulsy relied on the use of lime, which has nowadays been replaced by cement. The stones used in the pavilion foundations were obtained locally, representing glacial erratic boulders.

The Puijo Spring (3)

Finnish KKJ coordinates
N6978.058 E3533.960
Finnish ETRS-TM35FIN coordinates
N6975134.692 E533774.990

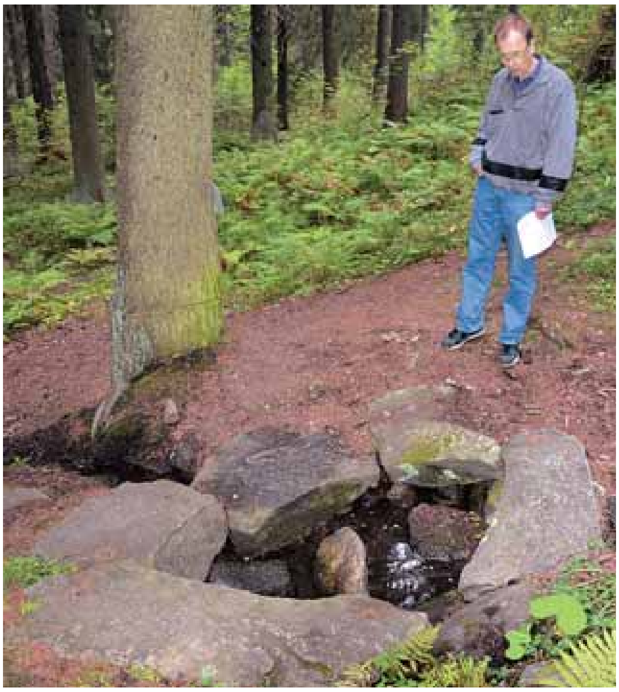

Fig. 11b. Spring at Puijo (Photo: Jari Nenonen, GTK)

Groundwater forms when rainwater and snowmelt percolate into the ground, where flow rates and pathways are controlled by porosity of sediments and fracture networks in bedrock. Wherever the watertable intersects the ground surface, water can discharge at a spring.This spring has been lined with stones, to form a well, from which travelers have drawn water for many years. Although the discharge rate is relatively small, the spring continues to flow throughout the summer months.

The Yoldia Sea shoreline (4)

Finnish KKJ coordinate system
N6977.995 E3534.156
Finnish ETRS-TM35FIN coordinates
N6975071.718 E533970.911

The last, Weichselian glaciation lasted for about 105000 years and began to retreat from the Kuopio area 11000 years ago. The surrounding areas were initially covered by water, apart from several

Fig. 11c. Boulders accumulated on the old Yoldia-stage shoreline (Photo: Jari Nenonen, GTK)

islands, and during the so-called Yoldia marine stage, the sea level was 143–145 meters higher than the present level of Lake Kallavesi. The old shoreline is evident as a line of large boulders that record the effects of wave action removing finer-grained sediments from till, leaving the larger boulders behind.

Tonalitic gneiss (5)

Finnish KKJ coordinate system
N6978.175 E3533.893
Finnish ETRS-TM35FIN coordinates
N6975251.644 E533708.016

At this locality, the outcrop conists of a alternating veins comprising lighter-colored quartz and feldspar and darker tonalitic and quartz diroritc material. These rocks are sometimes referred to as basement gneisses, for they represent the basement upon which younger rocks were deposited.

Fig. 12. Natural exposure of tonalitic basement gneisses more than 2 500 million years old, outcropping at Puijo. (Photo: Jari Nenonen, GTK)

They mostly represent plutonic rocks, but relicts of even older volcanic events can also be found. Tonalitic basement gneisses are abundant in the Kuopio area, and well exposed along the shore at Väinölänniemi, Rönönsaari, Valkeislampi and in many road cuttings in the Lehtoniemi and Saaristokatu, Neulamäki and Puijonlaakso.

The basement gneisses represent the deep erosion and peneplanation of a mountain belt resembling the modern Alps and are found throughout eastern Finland, in North Karelia, Kainuu, in the Pudasjärvi area of Northern Ostrobothnia and in Lapland. These rocks are over 2500 million years old, with the oldest found so far being a trondhjemitic gneiss at Siura near Pudasjärvi, which has an age of more that 3500 million years. The oldest rocks known from Northern Savo are quartz diorite gneisses from Kiikkukallio near Lapinlahti, which are 3200 million years old. The gneisses in the Kuopio area have not however, been dated.

Granodiorite (6)

Finnish KKJ coordinates
N6978.464 E3533.537
Finnish ETRS-TM35FIN coordinates
N6975540.526 E533352.158

Granodiorite is a member of the granitic family of plutonic rocks (Fig. 5) and has formed through slow crystallization of partially molten rock, or magma, at depths of from 5–20 km below the Earth's surface. The granodiorite at this locality at Puijo is reddish in appearance and medium-grained (2–5 mm crystal size). It has intruded into older basement gneisses (Fig. 4) and quartzites (Fig. 7) during the collision between the older Karelian continent and the Svecofennian tectonic plate at about 1870 million years ago. During this event, the Karelian basement gneisses and sediments deposited on the continental margin were thrust beneath the Svecofennian plate, to depths of 10–15 kilometers. By analyzing crystals of zircon using the U-Pb isotopic method, a precises age of 1 872±5 million years has been obtained for this granodiorite.

Fig. 13. An outcrop of granodiorite.
(Photo: Jari Nenonen, GTK)

Gateposts (7)

Finnish KKJ coordinates
N6978.584 E3533.560
Finnish ETRS-TM35FIN coordinates
N6975660.478 E533375.147

Fig. 14. Historical gateposts at Puijo
(Photo: Jari Nenonen, GTK)

These gateposts constructed in 1909 have made use of blocks of stone from various sources, including Nilsiä quartzite (large cubic block), graphite from the old Laivonsaari quarry, amphibolite from Puijo, soapstone from Juojärvi and copper ore from Outokumpu.

Puijo tower and gateposts (8)

Finnish KKJ coordinates
N6978.597 E3533.486
Finnish ETRS-TM35FIN coordinates
N6975673.473 E533301.177

The present Puijo observation tower is the third to have been built on this site. A wooden tower was first built in 1856, replaced in 1906 by a second tower, made of brick, with a granodiorite foundation.

Fig. 14b. Dresed blocks of granodiorite used in the foundation for the Puijo Tower.
(Photo: Jari Nenonen, GTK)

The current tower, made from concrete, was completed in 1963. The foundations of this tower are of rectangular dressed blocks of fine-grained granodiorite bound with cement mortar. Some of the blocks have presumably been recycled from the foundations of the earlier tower and others presumably derive from quarrying undertaken in connexion with construciotn of the adjacent Puijo ski-jump.

Quartzite (9)

Finnish KKJ coordinates
N6978.644 E3533.325
Finnish ETRS-TM35FIN coordinates
N6975720.453 E533140.242

Quartzites formed originally as layers of almost pure quartz sand, deposited between 2400–2100 million years ago along the shoreline, as a result of prolonged and extreme erosion and weathering of the Archean basement. Sandy sediments gradually lithified and cemented to form quartz sandstones and were eventually recrystallized and metamorphosed to quartzites around 1900 million years ago.

Fig. 15. Quartzite on the upper slopes of the ski-run, next to the track down from the summit of Puijo. (Photo: Jari Nenonen, GTK)

These pale gray, vitreous rocks can be seen in Kuopio on the western slopes of Puijo, behind the Neste petrol station in Puijonlaakso, at Taivaanpankko, on the eastern side of the Neulamäki hill, in the vicinity of the lake Vuorilampi, at Jynkkä and on the island of Laivonsaari. Similar, more extensive occurrences of quartzites are to be found at Tahko and Kinahmi near Nilsiä, at Kiihtelysvaara and Koli in North Karelia, in Kainuu, at the Rukatunturi fell near Kuusamo and in Lapland, including the fells of Ylläs, Pyhätunturi and Sallatunturi.

Amphibolite dyke (10)

Finnish KKJ coordinates
N6978.460 E3533.274

Finnish ETRS-TM35FIN coordinates
N6975536.526 E533089.264

Dykes form when molten rock flows along and crystallizes within fractures in the Earth's crust and may range in thickness from several centimeters to hundreds of meters. The chemical composition of these dykes is described as mafic, or basic, which means that the total silica (SiO_2) content of the rock is less than 53 %. The rock is termed amphibolites because of the abundance of dark green hornblende, which is a typical prismatic member of the amphibole group of minerals. The other main mineral in amphibolites is the pale plagioclase feldspar. The minerals

Fig. 15b. Amphibolite outckop, representing basic volcanism. (Photo: Jari Nenonen, GTK)

are commonly elongated and aligned, imparting a distinct foliation to the rock. Dyke rocks are classified as subvolcanic, or hypabyssal, which indicates that magma has solidified during ascent, rather than erupted at the surface, due to changes in temperature and pressure. At this locality, the dyke is 2–3 meters wide and has intruded along the contact between quartzite (on the upper side) and granodiorite. Because the granodiorite has been dated at about 1870 million years, the amphibolites dyke must be somewhat younger.

Quartzite (11)

Finnish KKJ coordinates
N6978.517 E3533.181
Finnish ETRS-TM35FIN coordinates
N6975593.502 E532996.301

The rock wall excavated on the northern side of the 120 meters skijump exposes the same kind of quartzites as at Site 7. Reddish patchy minerals are potassium feldspar, which formed during incipient melting of the quartzites when buried at great depth. The quartzites have been intruded by dark, fine-grained dykes of a rock known locally as microtonalite; these dykes have not been dated but they must be younger than 1870 million years old.

There is a total of nine markers and information boards erected along footpaths and bycycle routes around the city of Kuopio that describe the history and origin of the bedrock and glacial landforms in the area. With the aid of these it is possible to see outcrops of conglomerate deposited as river sands and gravel on the Archean basement some 2300–2200 million years ago, as well as basaltic lava flows with pillow structures, telling of ancient volcanic activity. The pillow lavas are 2060 million years old and represent basaltic flows that erupted through submarine fissure and flowed across the ancient seafloor.

Several guides have also been written previously about geology and the use of natural stones in buildings in Kuopio. These guides are freely available and can be downloaded from the Geological Survey of Finland public domain website at: http://www.gtk.fi/tietopalvelut/tietokannat/rapgeo.html

Fig. 16. Outcrop of quartzite in the lower part of the Puijo ski-run. (Photo: Jari Nenonen, GTK)

Fig. 17. Guided tours explaineing the use of building stones in Kuopio are arranged at Lake Valkeislampi in summer. (Photo: Jari Nenonen, GTK)

Fig. 18. An example of the information plaques erected at sites of geological interest, in this case describing the conglomerate outcrop at Locality 3. (Photo: Jari Nenonen, GTK)

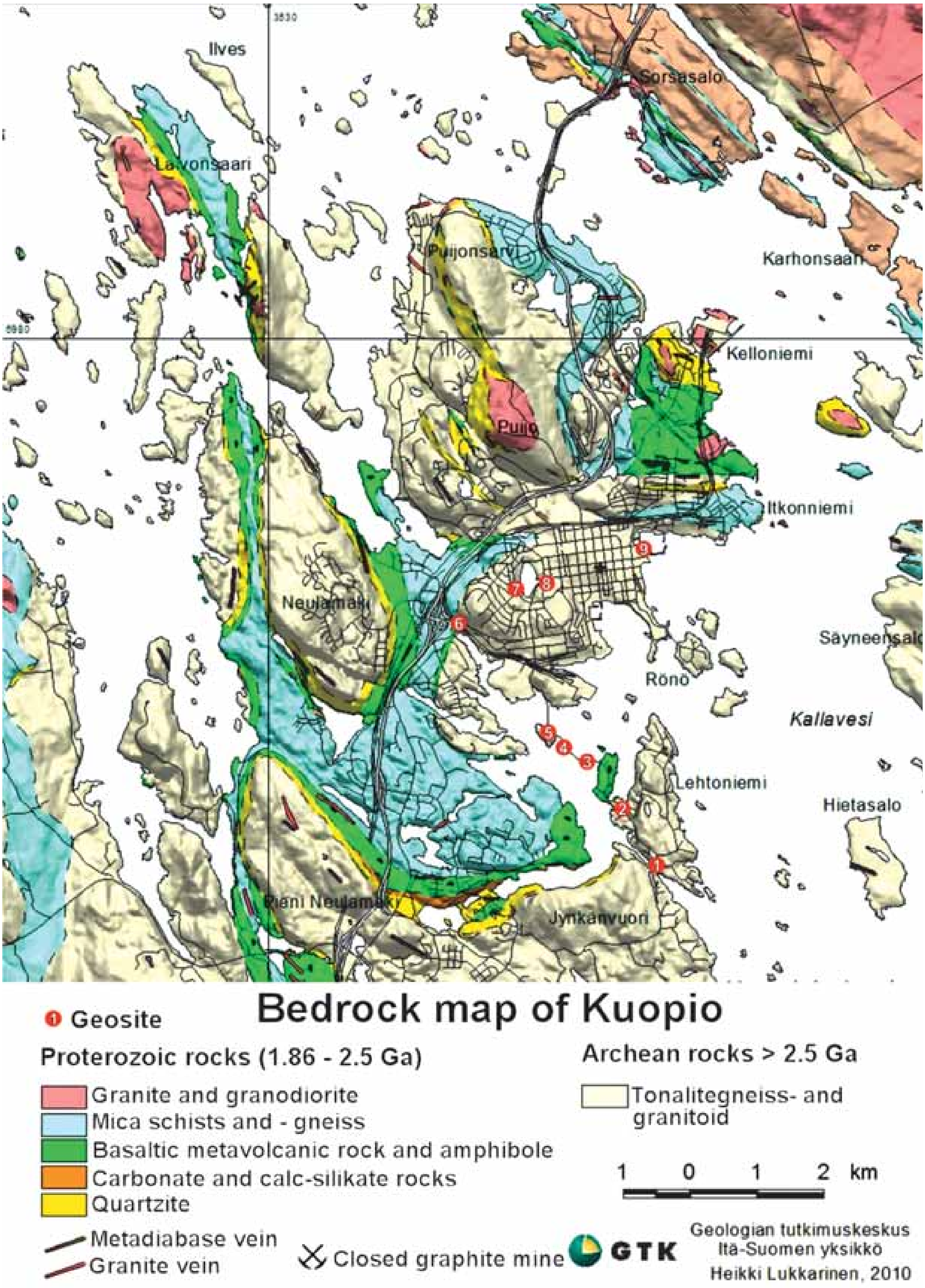

Fig. 19. Locations of geological sites in the Kuopio area marked by explanatory information plaques

Seinävuori Gorge

The bedrock of Finland is a complex, fractured mosaic of variably sized blocks, traversed by innumerable faults, shear zones and other linear features, of varying width and length and formed at various times. Variations in fracture intensity and orientation exert a strong influence on landforms and topography, commonly expressed as rectilinear river valleys and narrow, elongate lakes, or rocky ravines and gorges. In some cases such features have been partially obscured and buried beneath glacial and glaciofluvial deposits, only to emerge further away.

The Seinävuori Gorge is an impressive sight and a representative example of erosion having exposed an ancient fracture system. Such fracture zones are common in the Kuopio-Kaavi area and generally have a northwest-southeast trend which is clearly reflected in the shapes and orientations of lakes and rocky ridges. This prevailing trend is cut by a more northerly fracture system, to which the Seinävurori Gorge belongs.

These fracture systems were originally formed during the tectonic collisions that took place 1900 million years ago, which culminated in mountain building events and intense folding and faulting that weakened the bedrock. The major fracture networks in eastern Finland formed as stresses gradually relaxed by about 1800 million years ago, but many of these fractures and faults have been reactivated during younger tectonic events as well.

Fig. 20. Seinävuori Gorge (Photo: Jari Nenonen, GTK)

The Seinävuori Gorge is about 500 meters in length and 20–40 meters wide, and the rocky walls have a maximum height of about 25 meters. The main rock type in the gorge is granodiorite, a variety of the granite family that crystallized from partially molten rock about 1860 million years ago, at depths of 10–20 kilometers, in the roots of an ancient mountain range. The area also contains remnants of older mica gneisses that originally formed as sediments deposited on the sea floor. Prolonged erosion over nearly two billion years has brought these rocks from great depths to the surface of the Earth.

Erosional processes have been particularly active during the past hundreds of thousands of years, due to repeated glacial advance and retreat. As can be seen in many places, slowly moving ice has carved, striated and polished the rock walls and surfaces of Seinävuori. The area was exhumed from beneath the ice sheet about 11000 years ago, at which time it was located close to the shoreline of the ancestral Baltic Sea, known as the Yoldia Sea. The water level was about five meters above the current level of Pieni Seinälampi, the small lake which lies within the gorge, which implies that Seinävuori would have been a narrow estuary on the coastline, extending as far as the southern end of the modern gorge. Because of subsequent post-glacial uplift and tilting however, the Seinävuori area was never connected to the Baltic Sea during the next phase of development, known as the Suur-Saimaa Stage.The Seinävuori Gorge is well signposted and can be reached by turning northwards from Route 17, the main highway between Kuopio and Joensuu, about 6 kilometers west of Tuusniemi. There are clearly marked information signs, and facilities include a viewing platform and small jetty, toilets, a spacious wooden lean-to for shelter, with a fireplace and a shed for firewood; the shelter, jetty and viewing platform are also wheelchair accessible. There is a 2.5 kilometer trail around the lake at the bottom of the gorge, but a longer option, nearly 20 kilometers in total, can be arranged, by walking through the gorge to Kaavinkoski, with shelter available along the route, at Mäkimaja and Ahvenlampi.

The Outokumpu ore district and associated minerals

There are four significant ore deposits that have been mined in the Outokumpu district – Keretti, Vuonos, Kylylahti and Luikonlahti. The processes that led to the formation of these deposits began in a deep ocean basin about 1950 million years ago.

The overall environment was magmatically active and ultramafic serpentinites beneath the ocean floor were of the right composition for leaching and enrichment of metals, including nickel. Heat supplied by intrusion of molten rock into the ocean crust caused convection of hot saline fluids through permeable rocks, leaching metals which were again deposited within hydrothermally altered serpentinites or discharged at vents on the sea floor, where metals precipitated as sulfides and mixed with carbonaceous muds.

The next stage in ore formation was the burial beneath younger sediments, metamorphism and tectonic transport as large thrusted complexes onto the old Karelian continental margin at about 1900 million years ago. Rocks and minerals underwent transformations and recrystallization under elevated temperatures and pressures, liberating nickel form the seprentinites, which then combined with sulfur, probably derived from the adjacent fine-grained muds, to form the nickel sulfide ores. Continued reaction between the serpentinites and enclosing metamorphosed muds was also a factor in formation of the highly distinctive minerals associated with the Outokumpu ores.

The following stage in the formation of the Outokumpu ores was associated with large scale folding accompanying plate collision and melting in the deep crust. The sediments that had been deposited on the seafloor, now converted to mica schists, graphitic schists and gneisses, were displaced from their original location by faulting and stacked on top of one another as a series of fault slices and overturned folds overlying the Archean basement, although it too was locally involved in this thrusting event. The sulfide ore bodies within the Outokumpu serpentinites were also remobilized at this time, completing the transformation of early sub-seafloor metallic disseminations into one of the largest copper ore deposits mined in Europe.

Fig. 21. On left, chrome diopside from the Mökkivaara quarry at Outokumpu (sample dimensions 10 × 6 cm). At right, uvarovit garnet from the Keretti Mine at Outokumpu (sample width 5 cm). (Photos: Jari Nenonen, GTK)

The Outokumpu ore bodies were very much in their present form by 1870 million years ago but were still buried at depths greater than 10 kilometers below the surface, beneath the mountain ranges formed during collision. They were eventually exposed at the surface of the Earth after prolonged erosion. The Outokumpu ores were mined for copper, zinc, nickel, cobalt, and to a lesser extent gold and silver. The principal ore minerals were chalcopyrite, sphalerite, pyrite and pyrrhotite.

The displays at the Outokumpu Mining Museum illustrate not only the history of mining and the origin of the ores but also the Outokumpu Deep Drillhole and the more important results of related downhole geophysical measurements. The Outokumpu Deep Drill Hole was 2516 meters deep and was the subject of detailed scientific investigations undertaken by both Finnish and international research groups.

An additional feature of the Outokumpu ore deposits is the abundance of unusual and attractive minerals that are highly sought after by collectors. Outokumpu is accordingly one of the most diverse places in Finland with respect to mineralogy, with 74 different mineral species having been so far identified, most of which are closely associated with the ore bodies.

Many of the more spectacular minerals at Outokumpu contain variable amounts of chromium, for example chromite and the amphiboile mineral tremolite. Some of the most highly valued minerals are deep emerald green uvarovite garnets and chrome diopside, both of which typically occur in the sulfide ores and associated banded quartz rocks and calc-silicate skarns. The intense green color and relative abundance of the chrome diopside in particular has made it a very popular mineral for cutting and polishing as a gem mineral. Occasionally colorless varieties are found, from which brilliants have been prepared.

Diopside is a calcium-magnesium silicate, with the chemical formula ($CaMgSi_2O_6$), although it also contains trace amounts of titanium, aluminium, manganese and chromium. The latter imparts the greenish color, while some other varieties may be colorless, white, brown or black.

Uvarovite ($Ca_3Cr_2(SiO_4)_3$) is a member of the garnet mineral group, which usually forms well-shaped or euhedral crystals and has a vivid and beautiful green color. Uvarovite crystals from Outokumpu are now something of a collector's rarity and represent some of the largest specimens of the mineral ever recorded. Uvarovite has also been found in Finland at the Luikonlahti mine at Kaavi, and also in the Kemi chromite mine in Lapland.

In addition to chromium-bearing minerals, the Outokumpu ores also contain some unusual amphibole minerals and tourmaline, talc, kyanite, rutile, serpentine and staurolite. A special variety of fibrous calcite, known as catseye calcite, was previously found at the Vuonos mine and can still be collected from nearby waster rock dumps. When polished, the fibrous calcite produces a special reflective effect, resembling that of a cat's eye.

There have also been three new mineral species found and described from Outokumpu. **Eskolaiitti** (Cr_2O_3) is chromian oxide belonging to the hematite group, which was first identified at Outokumpu in 1958. The mineral was named after the internationally known Finnish mineralogist and metamorphic petrologist Professor Pentti Eskola and occurs as small grains, several millimeters in length, intergrown with other ore minerals. Although it is black in color, when crushed it forms a greenish powder. A second mineral found first at Varislahti, near Outokumpu, in 1959, is **Cobaltian pentlandite** ($(Co,Ni,Fe)_9S_8$). This is a cobalt sulfide mineral containing trace amounts of nickel, occurring as small grains exhibiting a cubic cleavage and having a bronze-yellow color, with a vitreous luster. Another rare form of pentlandite found at Outokumpu is argentopentlandite, which contains trace amounts of silver. **Karelianite** (V_2O_3), is a black vanadian oxide occurring as very small crystals that, like eskolaite, belong to the hematite family. It was found in a glacial erratic boulder to the southwest of Outokumpu in 1963, which was also the first recorded occurrence of the mineral. Karelianite is typically associated with pyrrhotite, chalcopyrite and pyrite.

The Paakkila asbestos mine near Tuusniemi.

Another mineral found in the Outokumpou ore district is asbestos, which has been mined at Paakkila near Tuusniemi, and Maljasalmi, southwest of Outokumpu. In both cases, the asbestiform mineral was fibrous anthophyllite, which belongs to the amphibole group. The country rocks at Paakkila consist of biotite gneisses, while the asbestos minerals occur within lenticular bodies of serpentinite that are often transected by pegmatite veins. A total of eight different lenses were exploited, the largest of which was 100 meters in length, while the maximum depth was 60 m.

The first attempts at mining at Paakkila were in 1901 and since then there have been several small-scale operations. In 1918 the company Suomen Mineraali Oy took over mining until 1959, when ownership of the deposit was transferred to the publicly listed company Paraisten Kalkkivuori Oy. Production was finally discontinued in 1975 due to growing awareness of the deleterious health affects associated with mining and commercial use of asbestos.

Between 1918–1975 a total of 350000 tonnes of anthophyllite asbestos was produced at Paakkila, of which domestic consumption amounted to 120000 tonnes. Asbestos was principally quarried from open pits, apart from a brief period in 1950 when underground mining was attempted. The amount of waste rock that needed to be mined was considerable, around 90 % of the total amout quarried. Most of the mining and processing operations were sited in the central part of the Paakkila peninsula.

The asbestos obtained from Paakkila was known for its resistance to acid attack and its high melting point, around 1500° C. The Paakkila mine was also the largest asbestos mine of its type globally, while the processing and enrichment plant, which was in operation until 1975, was the only such facility in the Nordic countries and one of the few examples of its kind anywhere.

The two former open pits at Paakkila are now filled with water and have become a popular site for recreational diving, particularly due to the turquoise color and exceptional clarity of the water. There are limited facilities for visitors at the site, including a lean-to shelter by one quarry and a route marked for divers.

Fig. 22. The old asbestos quarry at Paakkila (Photos: Jari Väätäinen GTK and Viljami Hyyppönen, GTK)

Outokumpu and the Kivisalmi boulder trail

During early February 1908, Ossian Asplund and Axel Eskelin were engaged in dredging a shipping canal at Kivisalmi, near Rääkkylä, when their excavator scoop stuck fast to a large and heavy object. To their surprise their first attempts to shift the obstacle resulted only in scraping of small fragments of shiny metallic material. Eventually the five tone boulder was lifted ashore, but only after having been detonated into five separate fragments. At first they thought they might have found a large meteorite and therefore sent a sample of the boulder to the offices of the Geological Commission in Helsinki.

In his office in Helsinki, Otto Trustedt, who was an experienced mining engineer and also familiar with exploration for ore deposits, quickly realized that this was a highly mineralized boulder of ore and set about investigating its origins. The samples were found on assaying to contain copper (3,74 %), as well as some nickel and zinc, with large amounts of iron (29,85 %) and sulfur (33,63 %). When Trustedt visited Kivisalmi in March 1908, it was immediately apparent that the boulder had been transported to its present position by glacial activity. Because the dominant ice-transport direction in the area was from west to east, it seemed reasonable to search for the source rocks to the west of Kivisalmi. However, there were also older glacial striations in bedrock that indicated an alternative transport direction, form the northwest. Solving this problem became less urgent when it was noted that the boulder also contained a some rather distinctive quartzite bands, and similar rocks had previously been encountered during geological mapping in the Liperi area, to the north of Kivisalmi.This proved to be a false lead but meanwhile some other boulders dredged up Kivisalmi boulder were found to consist of serpentinite and amphibole rocks identical to those that Trustedt's colleagues B. Frosterus W. Wilkman had described from the Kuusjärvi area, some 50 km northwest of Kivisalmi.

Trustedt commenced investigations at Kuusjärvi in the autumn of 1908 and soon found mineralized boulders containing chalcopyrite, to the south of what is now the town of Outokumpu. Based on ice-transport observations from till, he undertook geophysical surveys that soon revealed a significant magnetic anomaly in proximity to a hill named Outokumpu. The distribution of mineralized boulders also indicated the potential for ore discovery further to the northwest but Trustedt was determined to test the more obvious targets first and the first hole was drilled at Outokumpu in September 1909. The drilling program was managed by the mining foreman Claes Törnqvist. After many technical difficulties, a hole drilled on 17th March 1910 intersected nine meters of ore, from a depth of 28,85 meters. This proved to have a higher metal content that the Kivisalmi boulder, and signaled the discovery of the Outokumpu ore bodies.

Fig. 23. At left, blasted fragments of the Kivialmi boulder and dredge operator Axel Eskelin, who first thought that the boulder might have been a meteorite. At right, OttoTtrustedt, whose investigations led to the discovery of the Outokumpu ore, within two years of finding the Kivisalmi boulder

The Mining Road includes a deviation from the main route, from Outokuympu to Rääkkylä, in order to demonstrate the precise distance that the Kivisalmi boulder had been transported by ice from its source at Outokumpu. Conversely, the return journey gives an insight into the skill that Trustedt displayed in planning and implementing an exploration program that led to discovery of the ore bidy, within the space of only two years.

Near Viinijärvi, the Kivisalmi Boulder Trail traverses the sandy plains known as Jaamankangas, which was deposited in front of the retreating ices sheet. Further on, to the east of the village of Rääkkylä, the Vuoniemi esker is worth visiting, as it extends for some distance across the lake, with an 18 meter high lookout at its far end. The main purpose of the journey is nevertheless to visit the monument and park on the northern side of the Kivisalmi canal.

Of the three memorial stones erected at the site, one is dedicated to the two discoverers of the boulder.

Although these workmen, Ossian Asplund and Axel Eskelin initially thought they had found a meteorite, they could not have known that an impact crater indeed lay a mere 14 kilometers to the south of Kivisalmi, on the southern horizon as viewed from the modern bridge. The roundish shape of Lake Paasselkä still retains a semblance of the crater that formed when a meteorite struck the area some 228 700 000 years ago.

Fig. 24. At upper left, the modern bridge over Kivisalmi canal; at upper right, digital terrain model showing the two ice-flow directions. Below, map of surfical deposits showing the route of the Kivisalmi Boulder Trail

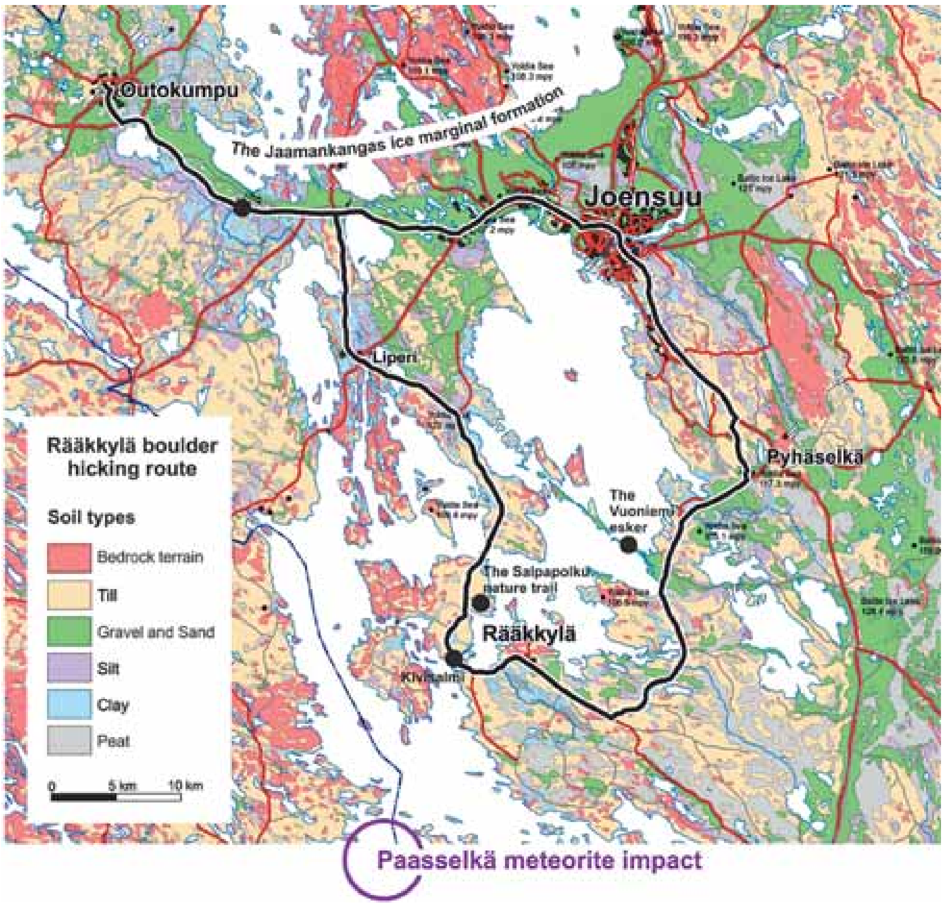

Fig. 25. Geological map of surficial deposits, showing route of the Kivisalmi Boulder Trail and location of the Paasselkä impact crater

Paasselkä was only confirmed as an impact site in 1999, when drilling into bedrock beneath the lake led to the discovery of brecciated granite containing quartz grains with the characteristic and diagnostic shock lamellar structure. It is also possible to find fragments of impact breccias along the shores of the lake.

Paasselkä is also known for its mysterious unexplained light phenomena. Local residents have reported strange lights since the 18th century and rumours spread concerning the "Spirits of Paasselkä". According to eyewitnesses, the lights are extremely bright, whitish or reddish and appear in the central part of the lake, relatively high above the surface. Sometimes they have been observed to move rapidly, resembling a fireball, but on other occasions they remain in a fixed position. One local tradition is that a Russian warboat foundered in the lake, in the midst of a great celebration and the lights represent the spirits of those that perished. Other explanations that have been offered include so-called earthlights, will o' the wisps (or ignis fatuus), release of methane form the lake bottom or piezoelectric effects.

Kolvannanauuro

Kolvannanuuro is the best known gorge in North Karelia. It formed in much the same way as the Seinävuori Gorge near Tuusniemi, as described earlier in this guidebook, except that instead of trending north–south, it has a northwest-southeast orientation, which is the more prominent fracture trend in easternmost Finland. The walls of the gorge rise to a height of about 50 meters and the gorge forms part of a series of valleys that can be traced for tens of kilometers and apparently represent a fault zone with horizontal displacements along the zone of up to two kilometers. As a result, there are a number of distinctive brecciated fault rocks exposed in places along the gorge.

Fig. 26. Kolvannanuuro forms part of series of deep valleys that follow a prominent fracture system for tens of kilometers. (Photo: Tapani Tervo, GTK). Inset map shows digital terrain model and hiking trail along the gorge

Kolvannanuuro and its surroundings are the only places in Finland where the presence of ancient glacial deposits has been unequivocally demonstrated. Outcrops on the southwestern side of the gorge display all of the features typically associated with glaciers, including tills and diamictites and varved clays, but totally lithified, in contrast to modern glacial deposits. Siltstones also contain sporadic dropstones, which would have fallen from floating icebergs. These glacial deposits formed some 2350 million years ago. Evidence of glaciation at this time is not common, but has been documented from other continents as well.

The northeastern walls of Kolvannanuuro Gorge reveal a very different story, being composed of pale greenish sericitic quartz sandstones or gray quartzites that have formed through weathering and erosion of the ancient Archean continent. A very deep weathering profile, up to 80 meters thick had formed on the underlying bedrock under hot and humid tropical conditions about 2300 million years ago. All minerals were leached from the soil, apart form quartz and residual aluminium-rich clays such as kaolin, that were later metamorphosed to form the white mica sericite, and the alumonisilicate minerals kyanite and andalusite during later tectonic mountain-building events. Where the ancient soil profile, or paleoregolith contains significant amounts of kyanite, it has been quarried for a variety of industrial applications. Some 600 meters to the west of the carparl from which the Kolvannanuuro hiking trail commences, there is a quarry from which kyanite-andalusite quartzites was extracted for beneficiaition tests.

About 2100 million years ago magmatic activity increased in the area, which is expressed as swarms of mafic dykes, or diabases, and subhorizontal sills. In the Kolvannanuuro area the dykes are typically oriented in a northwest-southeast direction. The margins of the dykes sometimes contain sulfide minerals and in the early part of the 19th century they were quarried to supply the copper smelter at Herajoki. Small historical copper workings are present near Kolvannanuuro, at Hokkalampi and Kyykkä.

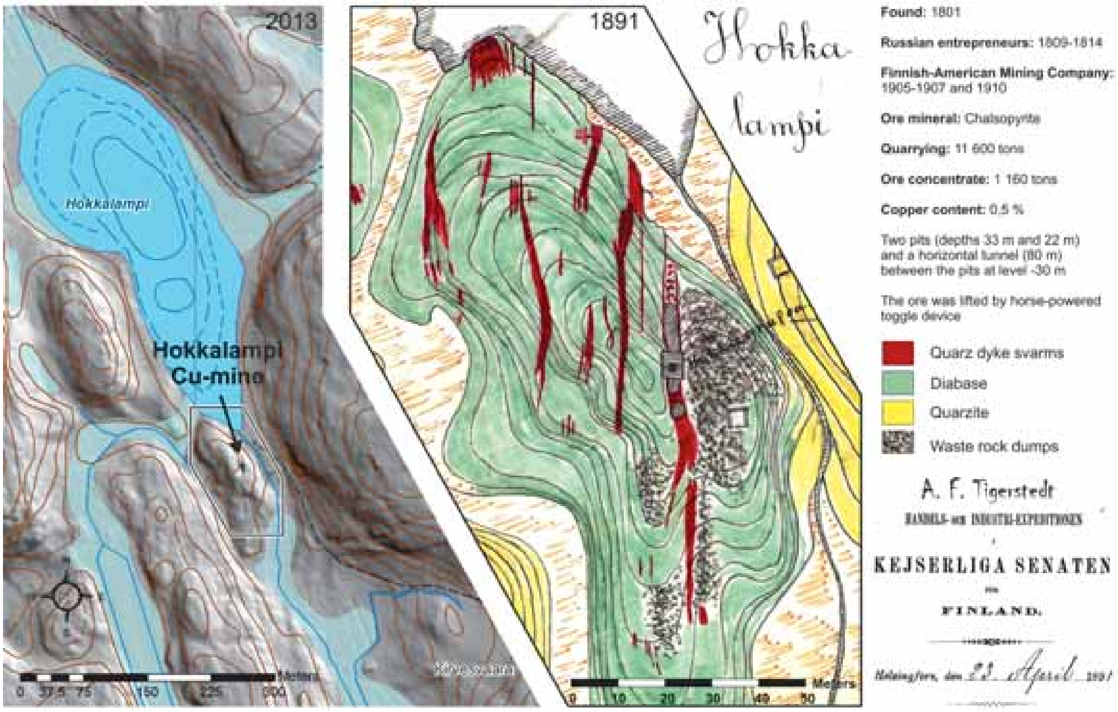

Fig. 27. The historical copper workings at Hokkalampi

Roadsigns marking the route to Kolvannanuuro begin from the Joensuu – Kajaani highway about 3 kilometers north of the town of Kontiolahti. An alternative approach is from the Joensuu – Eno highway about 4 kilometers before the Eno town center. There is a well-marked hiking trail through the gorge, some 5 kilometers in length, but the terrain is rather rocky and difficult! In some places it is necessary to scramble over steep slopes and boulders, which can be very slippery when wet or icy. Between 4 to 6 hours is recommended for the return trip.There are numerous information signboards along the route, describing fauna and flora as well as four separate signs describing geological features.

There are no facilities for tourists or information boards at either the kyanite quartzite quarry near the starting point for the Kolvannanuuro nature trail, or at any of the small historical copper workings. This may nake it difficult for the interested traveler to gain an appreciation of the geology of the area, unless there is an opportunity to visit the area with a geologically trained guide.

Fig. 28. The former Hokkalampi copper workings. (Photos: Jari Nenonen, GTK and Tapani Tervo, GTK)

The Juuka soapstone quarries, the Sinikoo Visitors's Center and the Finnish Natural Stone Center

North Karelian soapstone was already recognized as a valuable resource for in the Bronze Age, 6000–5500 years ago, when it was mined and traded, for example as moulds and crucibles for copper smelting in central Europe. However, the peak of industrial production of soapstone was at the turn of the 19th century, when there was great demand for soapstone in the Saint Petersburg and cities in Finland. Soapstone was widely used in facing and ornamentation in buildings of the Jugend period but its poplularity began to wane with the advent of functionalism as an architectural style.

A soapstone renaissance began at Nunnanlahti in the 1980's when the manufacture of ovens was renewed, with an expanded range of products and designs, quarried and dressed on site using advanced custom-built equipment. The Sinikko display center and restaurant attracted increasing numbers of tourists and customers, enabling them to see all stages of the process from quarrying through to finished products.

More recently the Finnish Natural Stone Center was purpose-built next to Sinikko, and has also become an important destination for tourists, with its permanent geological display and thematic art exhibitions. The Geocenter display provides an introduction to geological processes and minerals from around the globe, as well the history of mining metals and indusrial minerals. There are also educational resource available, such as well as opportunities for examining gemstones and sculptures in the rock gradens. Every year the thematic exhibition presents artworks and sculptures from around the world and there is a shop from which minerals, stoneware and other related souvenirs can be purchased, while there is an additional area outside devoted to sales of soapstone products such as bricks, tiles, and paving stones.

Fig. 29. Soapstone ornamentation incorporated into the facing of a Jugend-style office building in Helsinki, dating from 1901. (Figure: Jari Väätäinen, GTK)

Fig. 30. Permanent exhibits at the Finnish Natural Stone Center introduce visitors to the history and evolution of the Earth, mineral and metallic resources, and mining and industrial processes. (Photo: Jari Nenonen, GTK)

Koli National Park

The topographic relief of North Karelia is generally rather subdued, but there are some areas with more varied elevation, reflecting fracture patterns and relative resistance to erosion of different types of bedrock. Quartzite for example is relatively resistant, and is the dominant rock type in hilly terrain and ridges. The most impressive example is the Koli range, along the western shores of Lake Pielinen, with the highest point being Ukko Koli, 347 meters above sealevel and 253 meters above the level of the lake. There are few places in Finland that exhibit such differences in elevation, the nearest being the Pyhätunturi fell, far to the north in Lapland.

The bedrock of Koli represents the deeply eroded remnants of an ancient mountain range and preserves a record of many significant events in Earth history, making it an area of international significance. The overall landscape owes its origin to three main rock units, gneisses and granites of the Archean basement, towards the west, the Koli quartzites and the mafi sills intruded both above and below the boundary between the Archean rocks and the overlying quartzites.

The combined geological profile and photograph in Figure 31 depicts a view northwards from the Mäkrä hill. The highest hills of the Koli range consist of quartzites, that were formed form pure quartz sands deposited nearly 2300 million years ago. The quartzites consist of a number of faulted blocks and lenses that were emplaced onto the Archean basement during the tectonic collisional event 1900 million years ago. The contact between the Archean basement rocks, which are more than 2500 million years old, and the overlying Koli quartzites can be traced along the eastern slopes of the Koli range, at an elevation of about 300 meters. The shoreline of Lake Pielinen is also underlain by Archean rocks, at a level of about 80–100 meters, so that erostion of the quartzites has been some 200–250 meters less than that of the Archean rocks. The diabase dykes have crystallized from magmas that flowed along and then solidified within fracture networks beneath the surface, during three separate events, at 2200, 2100 and 1970 million years ago. The so-called Koli Sill, which is the oldest and most prominent intrusion, also outcrops on several islands in Lake Pielinen (Sikosaari, Iso-Hölö and Pieni-Hölö), as it has resisted erosion more effectively than the surrounding Archean granites. The western branch of the Koli Sill also forms the elevated ridge at Paimenenvaara.

The topographic profile described above also records nearly a billion years of Earth history. From such a perspective, the glacial process that shaped and rounded the present landforms is a mere instant in time. Successive glacial advances scoured and gouged loose blocks of rock from deeply weathered and fractured bedrock, forming valleys and accentuated the contacts between different rock types, in particular the boundary between Archean basement and quartzites.

The boundary between the Koli quartzites and the underlying basement coincides with a deep lateritic weathering horizon, as at Kolvannanuuro, and can be viewed along the hiking trail from Mäkrä-aho baclk towards Koli. The weathering profile, or paleoregolith, can be traced as a zone of sheared, foliated sericitic quartzite about ten metrers thick, with Archean granite to the east and pebbly conglomerate to the west. Although this transition does not seem especially impressive in outcrop, it represents a significant period in Earth history, straddling the boundary between the early Earth, in which the atmosphere contained very little oxygen, to an environment in which free oxygen began to accumulate.

The clays derived from the weathering profile were deposited amongst the quartz sands and gravels and were later metamorphosed to form quartzites with sericite and kyanite. In some places, the kyanite forms fibrous veins with an ice blue hue. The crystallization of kyanite also indicates that the rocks were subjected to pressures of about 3000 atmospheres, or 3 kilobars, and temperatures of 350–500 degrees Celsius. Such conditions can be expected to prevail at depths of about 10 kilometers in tectonic collision zones.

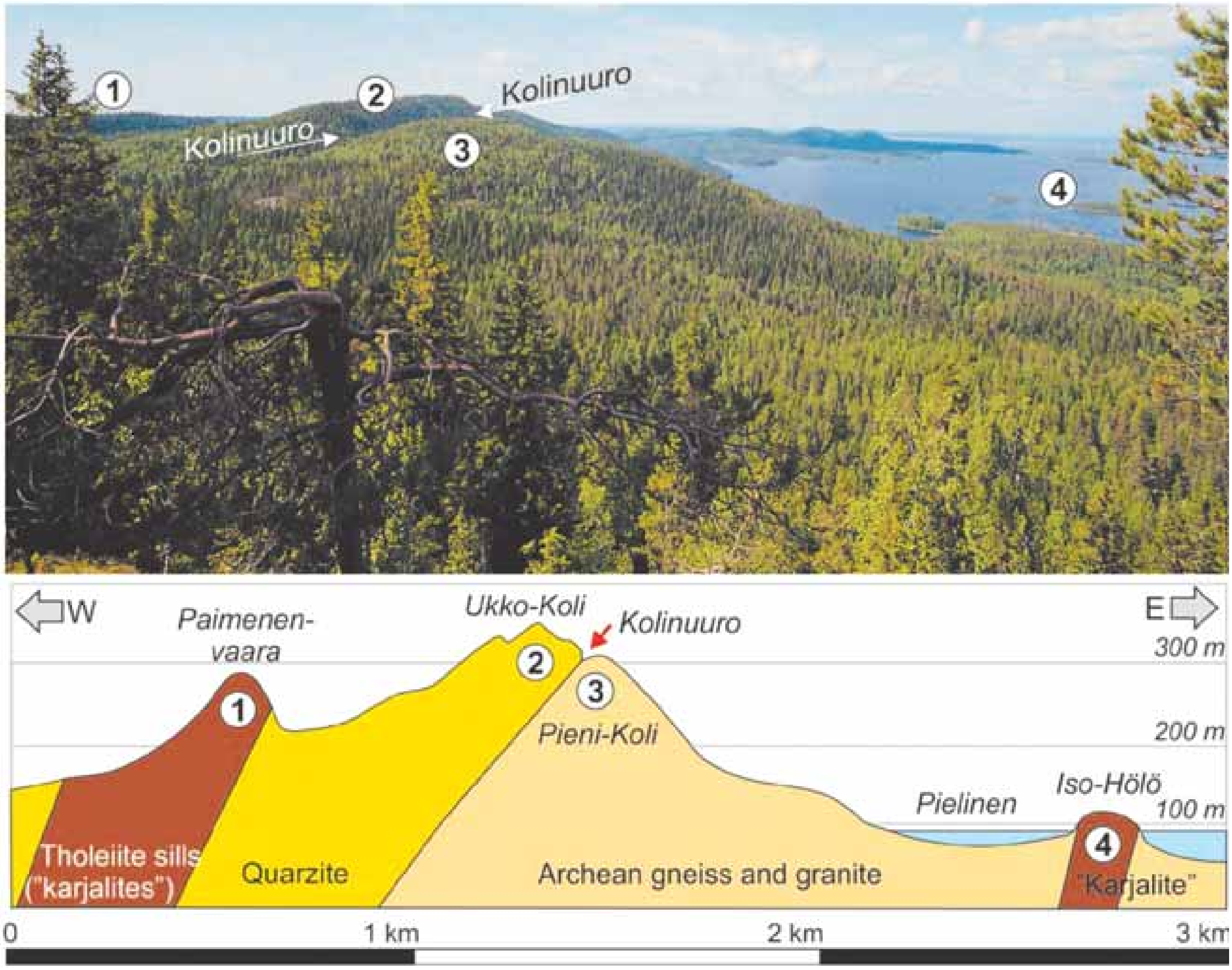

Fig. 31. Landforms in the Koli area reflect the underlying rock units and structures. (Photo: Timo Huttunen, GTK)

In addition to its geological interest, the view from Koli eastwards across Lake Pielinen is one of the most spectacular and admired in all of Finland. Koli became important to the emerging national consciousness of Finland in the late 19th century and early 20th century, together with an awarenss of the Karelian cultural heritage as a focus for expressing nationalist aspirations. The Koli National Park, which was declared in 1991, also has a cultural dimension in that human settlement and acitivity over the centuries has influenced the landscape in many ways. Throughout the 18th century, slash and burn agriculture was the main form of land management, as a result of which, the slopes of many of the hills are dominated by deciduous forest. There is also a rich folklore heritage relating to various natural landforms, such as caverratic boulders and rocky bluffs. Koli was apparently of great ritual significance in prehistoric times, with sacred sites of reverance and worship, and as a forum for settling disputes and administering justice. The natural history center at the Ukko Koli summit provides an introduction to the natural and cultural heritage of the Koli area, while there are nearly 80 kilometers of marked hiking trails. Some of the sites along these routes are of geological interest and a geological map accompanied by an excursion guide has also been produced by the Geological Survey of Finland.

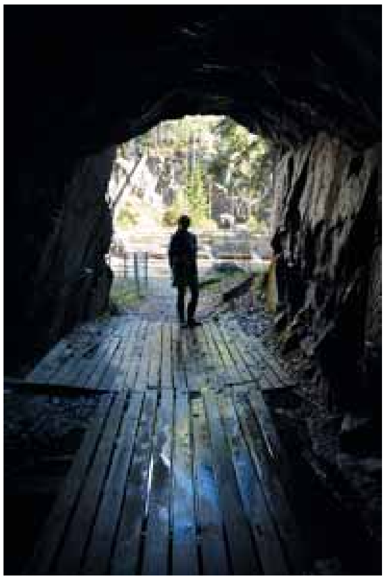

Fig. 32. The former molybdenite mine at Mätäsvaara is now the venue for a variety of concerts and theater performances in the summer months. At right, entrance to the tunnel at Mätäsvaara (Photos: Jari Nenonen, GTK)

Mätäsvaara molybdenite mine

There are very few ore deposits associated with Archean granitic rocks but the molybdenite mine at Mätäsvaara near Lieksa forms an exception. The molybdenite (MoS_2) ore at Mätäsvaara occurs within a strongly foliated and schistose Archean granitoid gneiss, which is about 2700 million years old. The main ore zone is associated with a silicified shear zone with quartz veins and the molybdenite was mined from five separate lenses a gray granitic gneiss. The overall length of the mineralized zone is about 600 meters, with a width of 50 meters. There are no significant ore minerals at the deposit apart from molybdenite, which occurs as veins, small aggregates and fracture fillings, or as disseminations within quartz veins. The toal amount of ore mined at Mätäsvaara was 1,15 million tones, with an average grade of 0,14 % Mo. Further information, including the history of mining, is available at: http://www.matasvaarankaivos.fi/

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THE HISTORY OF OUTOKUMPU MINE
(KUPARINEN OUTOKUMPU – Outokummun kaivoshistoriaa)

Merja Marin

The discovery of a boulder of copper ore at the Kivisalmi canal in 1908 led to the discovery of the Outokumpu ore and establishment of the mine in 1910. This can be taken to mark the foundation of the modern mining industry in Finland.

In early February 1908, dredging of a canal at Kivisalmi, near Rääkkylä, was interrupted by the discovery of a large boulder with a metallic luster. At the recommendation of the Geological Commission, the industrial governing board hired an experienced exploration geologist and mining engineer, Otto Trüstedt, to determine the source of the mineralized Kivisalmi boulder. In autumn 1908 Trüstedt found an extensive magnetic anomaly, nearly 500 m long, to the north and northeast of the hill known as Outokumpu. Using funds provided by the government he designed a comprehensive exploration program involving magnetometry and bedrock drilling.

The mining engineer Trüstedt decided to commence a drilling program at Outokumpu in September 1909, under the direction of the mining foreman Claes Törnqvist from Pargås. The budget had already been exceeded, and extra funding had been applied for, but two days before the decision arrived, on November 17, 1910, the drill intersected nine meters of copper ore, from a depth of 28.85 meters. The Outokumpu ore body had been found.

Fig. 1. Mining engineer Otto Trüstedt (1866–1929) was responsible for the discovery of the Outokumpu ore deposit. Trüstedt,who was of German descent, was born in Paris and graduated in mining engineering in Sweden. Before discovering the Outokumpu ore he worked at the Pitkäranta mine. Photograph: Central Archives for Finnish Business Records

Trüstedt kept very accurate records of exploration expenditure, which revealed that 9899,50 marks were spent on exploration, with 20 test pits having been excavated, 700 m^3 of earth removed and a total of 191,25 meters of bedrock drilled.

Discovery of the ore led to further investigations into the amount and grade of ore, with no concerns about the availability of funding. In 1913 a copper concentrator was completed and the following year, the company Outokumpu Kopparverk was established.

The events leading up to the discovery of the Outokumpu ore boday are a remarkable example of application of skill and dedication in very challenging circumstances. The approach and methods that Trüstedt employed are the same as those in use today, even though there have been improvements in technology and instrumentation.

The early years of mining

In the 19th century Finland was a rather poor and predominantly agriculturalregion, and part of the Russian empire. Even though the first iron mine was establishedat Ojamo near Lohjain the 16th century, the industry was mainly focused on limonitic ore from lakes and bog-ore. Prior to the discovery of Outokumpu, the most advanced mining operations in Finland were at Pitkäranta, where ore was mined between 1810–1920. This was for example the first place where exploration was done using deep diamond drilling in Finland, in 1888, under the supervision of Canadian engineers.

Fig. 2. The first production facility was built at Outokumpu in the 1910’s. The era of modern mining industry in Finland has started but the beginnings were rather modest

Following the discovery of the ore, copper mining and smelting commenced in 1913, drawing on expertise and labor from Sweden and the Pitäranta mine. At first, the ore was shipped to central Europe for smelting.

In 1914 the Finnish government and the private company Hackman & Co formed the mining company Outokumpu Kopparverk. In the early years, most of the copper was sold to St. Petersburg, but when production peaked at 25000 tonnes in 1916, the Finnish metals sector became a more significant market, in particular the State Mint, which received 480000 kg of copper in 1917.

Mining started from the small open-pit mines at Kumpu B and Kaasila but soon proceeded underground. Before the main central shaft was sunk, climbing up and down hundreds of meters of stairs and ladders was hard work and exhausting for the miners.

In the early years of mining, work was done in up to three ten- to twelve-hour shifts, until the law was amended in 1917, making a maximum of two eight-hour shifts.

Fig. 3. Workers at the copper mine in 1926

The beginnings of the modern Finnish mining industry

Numerous mining investors in Sweden, Germany, North America and Britain were interested in the potential of the Outokumpu ores. The Finnish government purchased Hackman & Co's equity from the mine in 1924 and the mining engineer and geologist Eero Mäkinen was appointed managing director. Mäkinen had a clear vision of the value of the Outokumpu ores and how to extract and utilize the copper, which he regarded as a major national asset that needed to be exploited for the benefit of the Finnish people. However, there were also many members of parliament and officials in government circles who were critical of the role of state ownership an intervention. Some of the objections bordered on the ridiculous, due to a general lack of geological understanding. One extreme opinion was that the ore was said to be so tough, that it would prove impossible to crush and mill.

As a state-owned company, Outokumpu developed rapidly and industrial utilization of the ore began in earnest. In 1928, a new mining complex was completed, designed by architect W. G. Palmqvist, was completed. In addition to the narrow-gauge railway, the wide-gauge railway between Outokumpu and Joensuu was constructed in 1928. The new concentration plant was built on the slopes of the Outokumpu hill, utilizing gravity in a novel way for successive stages of processing ore.

Fig. 4. Eero Mäkinen, managing director of Outolumpu Oy

As a result of a further phase of expansion, the mining division's production capacity increased from 60 000 tons to 100 000 tons per year. In addition to the new shaft and headframe, a range of new mining machinery and equipment was installed and introduced: electric locomotives and ore trucks, a crusher, elevators for hoisting ore, equipment and mine employees, as well as air compression systems for powering pneumatic drills and other machinery.

The first vertical lift shaft was meters per second. built in 1927–1928 and was used for transporting both men and the ore. The speed of the lift was approximately 2,5.

Fig. 5. Miners entering the lift

Fig. 6. Washing facilities and changing room for the miners was completed in 1927

Fig. 7. The old mining complex during the 1930's

The power plant built near the old mine began generating electricity in 1928 and soon supplied the entire mining complex and surrounding community. Firewood and peat for fuel was transported by narrow-gauge railway to the power plant. After the wide-gauge railwaywas introduced, sawmill waste from the Joensuu area was also used for power generation. Electricity production reached maximum output by 1933, but heat produced by cogeneration continued to be supplied to the Outokumpu community until the 1960's.

The road to independence

Outokumpu became an incorporated company listed on the stock exchange in 1932. However, the global recession and collapse of the copper market also affected the Outokumpu Company through decreasing revenue and weakening the profits. Nevertheless, production continued to expand, with construction of the Mökkivaara shaft and further production facilities between 1936–1939.

Fig. 8. The area surrounding Mökkivaara

Chalcopyrite concentrate was transported for refinement from Outokumpu to Imatra, where a metallurgical processing plant had commenced operations in 1935. In addition to the copper smelter, there was also plant at Imatra for producing sulfuric acid. The intention was to develop full-scale metal production capabilities in Finland, from concentration of copper matte, through blister copper, to electrolytically refined copper and finished metal products. However, after the Imatra plant was destroyed by bombing in 1941, smelting facilties were rebuilt at Harjavalta in 1945.

The time of war compensation

The 1940s was a time of war in Finland but after negotiation of peace in Moscow in 1944, Finland was obligated to pay war reparations over a six-year period, amounting to a massive 300 million dollars (at the equivalent of pre-war 1938 exchange rates). Although this was a very heavy burden, it also enabled Finland to further develop the metals and engineering industries. This in turn stimulated demand in the mining sector because the expanding manufacturing and metals industries required more raw materials.

Copper from Outokumpu was used to pay a large proportion of war reparations: in 1945 90 % of copper production was used by Finnish industry for paying compensation.

New mines at Outokumpu

During the 1950's, Finland paid all of its war reparations paid to the Soviet Union, the last train with a compensation load crossing the border on 18.9.1952. This was also the time when the Finnish welfare state took shape and Outokumpu Ltd. was fast becoming an important mining industry player in Europe.

The Keretti mine operations in 1954 and became for a time the second largest copper producer in Europe. The headframe above the shaft was also the highest in Europe, at 96 meters. Mining ceased at Keretti in 1989.

Fig. 9. The Keretti mine

The Vuonos deposit was discovered some six kilometers from Outokumpu in the middle 1960's and the Vuonos mine was opened in 1972. Although the ore was not particularly rich, the high price of nickel, together with the difficult financial situation at the time facilitated the decision to commence mining. The Vuonos mine was different from previous mines at Outokumpu from an engineering and designe viewpoint as declines were constructed instead of a shaft and headframe.

New equipment and machinery for mining

The 1960s saw an accelerated modernization of mining processes and the introduction of a number of significant innovations. For example Tampella Oy and Outokumpu Ltd. developed new machines for underground mining, equipped with rubber tyres. New forms of explosive and blasting practices were also introduce, replacing earlier dynamite.

Fig. 10. A photograph of the OKU-jumbo, developed in the 1960's

Fig. 11. Wagner front-end loader hauling ore. The capacity of the bucket was 35 cubic meters

Machines used in mining became more efficient and cost-effective over time. Working conditions underground also improved as the introduction of safer equipment and work practices reduced accident risk.

Mining and the community

Fig. 12. Kitchen and cooking facilities for workers. A typical family dwelling: kitchen and living room

The first doctor was employed jointly with the Kuusjärvi municipality after 1910 and a hospital was built as early as 1913. At that time, not all communities in North Karelia had access to medical services or a resident doctor. As the number of employees at the mine increased, the company built a new hospital in 1937–1939, equipped with an operating theatre and X-ray facilities for examining the respiratory ailments of miners.

In addition to health benefits, Outokumpu Oy established a pension fund in 1938 and from it pensions were paid to employees who attained 65 years of age, providing they had spent at least 15 years in the service of the company. During the 1930's Outokumpu Oy also established an office (known as Huoltokonttori) for providing financial assistance and advice concerning taxation and insurance for employees and their families, particularly those experiencing economic hardship.

A number of other benefits and subsidies for employees were introduced, including arranging bus transportation to and from the mine, provision of firewood and electricity sold at subsidized prices, hot meals for mine workers and free access to public saunas and laundry facilities. The company also owned farmland enabling the mine to be self-sufficient in grains and vegetables.

The 79 years of mining at Outokumpu came to an end with the closure of the Keretti mine in 1989. The 96 meter high headframe at Keretti nevertheless remains as a monument to the history and legacy of mining, and was classified as registered building in 1998. Guided tours can be arranged to the top of the headframe. The Vuonos mine buildings are again in use, currently refitted of the purposes of reefing talc. The Mökkivaara mine infrastructure was however, dismantled at the instigation of Outokumpu Oy in 1992.

Since closure of the Keretti mine, the area surrounding the old mine at Outokumpu has been developed and restored as an educational and tourist destination and this process is continuing under the theme of Outokumpu: The City of Treasures. The older buildings, designed with their distinctive architectural style, also form a nationally significant cultural heritage site.

The Mining Museum was established more than 30 years ago within a building that was constructed in 1927 for the use of mine employees and has a series of displays illustrating life and work at the mine, spanning its history from the early days to the present. By walking through the underground tunnels the visitor may get a genuine feel for the conditions under which the miners worked. Several new tunnels were excavated recently and opened to the public during 2014, to improve and extend underground access.

The theme park "Children's Mine" was opened in 2014, where children can familiarize themselves with mining history through both indoor and outdoor activities.

The mining museum and areas surrounding the old mine is open to visitors for guided tours, but it is also possible to tour the area at any time. Special tours can be organized for children. Additional activities include the mine train, or frisbee golf or participating in treasure hunts. There are also restaurants and cafés for refreshment.

For further information: www.aarrekaupunki.fi

THE MÄTÄSVAARA MOLYBDENUM MINE, PIELISJÄRVI AND LIEKSA

Anne Merilajnen

The Mätäsvaara mine was situated in the former rural muncipality of Pielisjärvi (nowadays Lieksa), close to the boundary with neighbouring Nurmes, and roughly 30 km from both of the towns Nurmes and Lieksa. Because of this distance, a separate mining community grew up around the mine, with at one stage nearly 1000 residents. The mine produced molybdenite (MoS_2) with production reaching a peak in the years of 1941–1944, while Finland was at war. Because of the critical status of molybdenum, the mine was subject to military supervision and carefully monitored, with varying degrees of security and secrecy surrounding mining activities.

Discovery

Discovery of the Mätäsvaara molybdenite deposits can be attributed to a labourer and itinerant merchant named Erkka Ikonen, who was also known to the locals as "Mad-Erkka" – Hullu-Erkka in the original Finnish – due to his propensity for wandering throughout the region, equipped with hammer, drill and sample bags, in the search for mineral wealth. Ikonen regularly sent samples to Professor Aarne Laitakari at the Geological Survey, then known as the Geological Commission of Finland. Laitakari examined the specimens with interest and became convinced that the area had mineralization potential and so encouraged Ikonen to continue searching. Eventually, the Mätäsvaara deposit was discovered, during construction for the Joensuu – Nurmes railway in 1903.

Mining operations commenced immediately, with the first attempt at quarrying being made by Karl Theodor Forström. However, despite the significance of the discovery, grades were low and Forström lacked the technical expertise for processing the ore, so that mining operations ceased after a few years. Several of the oldest quarries and test pits dating from Forsström's time are still visible, and the large quarry used nowadays as an outdoor amphitheater has accordingly been named after him.

Mining rights to Mätäsvaara were transferred to Wärtsilä Oy in 1916 and drilling and beneficiations tests continued throughout the following decades. However, processing still proved problematic and the total production during the time that Wärtsilä Oy operated the mine was actually less than the output during Forsström´s time. In 1935 Wärtsilä Oy relinquished its mining rights to Mätäsvaara, selling out to Vuoksenniska Oy, which had more experience in metals and mining. This proved to be a turning point in the history of Mätäsvaara as the Vuoksenniska Oy management were committed to mining in earnest. With the looming threat of war in Europe, there was growing demand for molybdenum as a strategic metal in weapons manufacture, and following an appraisal of investment requirements and feasibility studies, Vuoksenniska Oy decided to commence mining in 1938. Construction of facilities began immediately and included building a power plant, as well as maintenance workshops. Vuoksenniska Oy was also required to cover the costs of constructing and branch line, essential for connecting the mine with the main railway network.

A community built around Mining

In addition to employing local people, the mine attracted workers from all over Finland, notably Imatra and Outokumpu, while management were from southern Finland and as far afield as Sweden and Norway. Owing to its remote location, the company was obliged to provide accommodation for workers and so a distinct community grew up around the mine. Vuoksenniska Oy built a total of 83 residential dwellings, most of which were centrally heated and connected to the mains water supply. At the peak of mining, Mätäsvaara was a thriving town with restaurants and shops, including a well-stocked bookshop, and was home to more than a thousand inhabitants. A school was opened in 1943 and sports teams were active, represented by the Mätäsvaara Malmi-Veikot (Mätäsvaara Ore Boys) and Mätäsvaara-Mänty (Mätäsvaara Pines). Soccer was played on the former tailings dump, and required considerable stamina from players that periodically sank ankle-deep in the soft mud. The national women's organization Martat was very active and during the war years, the Lotta Svärd organization, which was a voluntary defence organization for women was strongly supported. An amateur theatrical group was established in 1945 and community choral groups were popular.

Mining and transport of ore

There were four principal mineworkings at Mätäsvaara, known as the Forest Pit (Metsäkuilu), Central Pit (Keskuskuilu), Tramway Pit (Ratakuilu) and the Forström Pit (Forsströmin kuilu). Of these, the Forest Pit contained the richest ore, while the lowest grades were found in the Forsström Pit. The Tramway Pit was located directly above the underground ore stopes and contained good grades. Ore was mined firstly by the cut and fill method but later by topsill slicing, although the specific technique used, known as shrinkage stoping, was not particularly suited to mining the ore, given the highly discontinuous nature of the mineralized lodes.

In the early phases of mining the ore was loaded by pairs of miners into one tonne trucks that were manually pushed along a tramway for storage in ore silos. The ore from the central shaft was hoisted in a five tonne ore bucket. Miners and equipment and supplies were transported by a separate lift, with a carrying capacity of ten people, in a separate shaft. During later stages of mining, a German-built diesel engine was used, for moving ore trucks up to 2,5 tonnes.

After transport along the tramways, the ore was emptied into silos, passing firstly through a jaw crusher which reduced mean size of fragments to about 90 mm. The feed was then transferred via a short conveyor belt to longer, slow-moving belt, which raised the ore to a level 18 m above ground level. During transport along this conveyor belt, impurities, such as pieces of wood were removed. The ore was then further crushed twice before storage in a concrete silo with a capacity of 900 tonnes, from which another conveyor belt transported the feed to two ball mills that further ground the ore to a size suitable for froth flotation in tanks. The resultant concentrate contained about 90 % molybdenite and 0,2 % copper. The concentrate was then dried and packed into 50 kg cardboard boxes. The whole process generated a considerable volume of tailings, which was fed as a slurry directly into Lake Viekinjärvi, 7 km away, via an excavated drainage channel. Total production between 1940–1947 was 1 154 000 tonnes of ore with a mean molybdenite grade of 0,14 %. Selective mining during the final years of operations, where only the richest material was mined, led to somewhat improved production grades.

There was great demand for water for both the power plant and the crushing and processing facilities. Water was pumped from the small lake Konnalampi, about two kilometers away and piped to the concentrating plant. The power plant used a steam boiler, at first heated with coal but later, during wartime, it was converted to run on biomass. The power plant also generated electricity for use in the surroundings, although the miners were still at that time using carbide lamps underground. Two air compressors were in use for generated pressured air for pneumatic drilling underground and pumps were also in continual use for removing excess water from the mine.

Working conditions at the mine

The mine itself was a rather harsh and uncomfortable working environment, surrounded by noise, dust and acrid fumes from blasting and diesel machinery. Drillers were paid on the basis of holes drilled and were therefore driven to work as hard as possible, despite the lack of adequate and waterproof boots, gloves and clothing.

Fig. 1. The surroundings of the Mätäsvaara mine in 1940–1941. Pielinen Musuem Collection

The end of an era

The Mätäsvaara mine was in full operation from 1939 to 1947, during which time it produced 16 160 tonnes of molybdenum. Mätäsvaara was the only source in Finland of this rather rare commodity and the entire production went into military applications. During the war years, Vuoksenniska Oy had close contacts with German industry, which purchased the majority of the molybdenum concentrate. After the war, demand in Germany fell dramatically and the mine experienced severe financial difficulties, despite intervention from the Finnish government. The market price for molybdenum continued to fall, and exports to Sweden also declined, so that exports were no longer able to cover operating costs, even with increased government aid. By 1946, the mine was operating at a loss, with debts increasing by millions of Finnish marks per month and was almost completely dependent on government support; when this was withdrawn the following year, Vuoksenniska Oy had no option but to close the mine.

Following the decision to close the mine, most of the infrastructure was dismantled and it was also intended to demolish residential housing for relocation elsewhere. The chimney of the power plant was actually demolished by detonation. Some of the houses were indeed transported elsewhere and the municipality of Pielisjärvi, as it was then known, acquired many buildings, some of which were used as schools and childcare centers. The old shafts and pits filled with water and the concrete silos remained empty beside the railway line, and vegetation gradually established itself on the former tailings area.

More recently, the abandoned minesite has become the venue for cultural and tourist activities. In particular, the quarry named after Karl Theodor Forsström serves as an open-air theater and concert arena throughout the summer months.

Mätäsvaara now

The modern Mätäsvaara village is located at the junction of roads 5260 and 5261, some 30 kilometers northwest of the city of Lieksa. From Vieksi, on the national highway 75, the distance to Mätäsvaara is only about four kilometers, form where it is possible to take the alternative 5261 route to Lieksa, via Varpanen and Kylänlahti and passing by the site of the former mining town, which is nowadays rather quiet. Neverhteless, most of the houses are occupied and have been renovated, although most of the rows of older semidetached dwellings appear rather dilapidated and derelict. The old shopping complex is situated at the Vieki crossroads and the nearby concrete workshops are in very poor condition.

The main quarry at Mätäsvaara, named after Forsström, is situated just a few hundred meters from the old townsite, in the direction of Vieki. There is a small ticket booth on the right hand side of the road and somewhat rusty information sign providing a brief summary of the history of the mine. On the left a road leads across the railway line to the former tailings area, which can be used for parking. The quarry is just a short walk and definitely well worth visiting. Athough largely filled with water, the wall still rise several tens of meters above water level and are quite imposing. Concerts and theater performances are held here in the summer months, with scaffolding and seating for audiences and a sales kiosk. Two tunnels can also be seen, one of which is partitioned off, presumably because it serves as a store for equipment, while the other leads from the viewing area to the water's edge. The tunnel would be a suitable place for displaying a small exhibit relating to the history of the mine.

The quarry precinct is fenced off for safety reasons and according to a sign at the gate, this has been done at the initiative of the local community association at Varpanen. There is also a walking trail around the quarry. On the left hand side of the amphitheater there is a deep shaft, presumably a ventilation shaft but there is no other evidence of mining activity visible at the surface, nor have any buildings been preserved.

Fig. 2. The Mätäsvaara quarry in autumn 2012. Photo Juhana Venemies

Fig. 3. The Mätäsvaara quarry in autumn 2012. Photo Juhana Venemies

THE IRONWORKS AT MÖHKÖ

Ulla Vartiajnen

The Möhkö ironworks were located in the village of Möhkö, close to the present Russian border, in the rural municipality of Ilomantsi, which is the oldest settled district in the province of North Karelia. Much of the Ilomantsi area lies with the catchment areas for Lake Koitere and the Koitajoki River. The Koitajoki flows over many rapids and cascades, of which the 3?5 m drop at Möhkö is one of the largest. In addition to smelting of iron, the cascades have been used to power numerous sawmills and grinding grain and cereal crops. The Koitajoki also provided a vital transport link to the neighbouring communities, as well as enabling the transport of bog iron dredged from surrounding lakes. The Koitajoki waterways also enabled the final product of smelting, to be delivered to market destinations. Two other industrial ironworks in the Ilomantsi district, at Ilaja and Käenkoski, were also situated on the Koitajoki, downstream from Möhkö.

Fig. 1. Möhkö village and ironworks in the 1880's. Photo Jean Schmidt. Ilomantsi Museum Foundation

Iron production at Möhkö ceased in 1908 and the foundry and land title were transferred to W. Gutzeit & Co., which was the predecessor of Enso-Gutzeit Oy. Specialized and skilled workers found new employment at other ironworks and the population of Möhkö gradually dwindled. This coincide with a period of expansion in the forestry industry and many of those residents that remained in Möhkö sought work in the forest and in transporting flotillas of timber along the rivers and lakes. When Finland was fighting during the Second World War, Möhkö was in a strategic location and was at one stage occupied by Soviet forces, during which time most buildings in the village, include the workers' accommodation quarters at the former ironworks. Enso-Gutzeit continue to be a source of employment in the area through its forestry activities until the 1960's, after which there was a further decline in population as people sought alternative employment and tended to move to urban growth centers. The village gained a new lease of life in the 1970's when a local community association was established together with a museum of mining and smelting history. The Finnish National Board of Antiquities began an extensive project of refurbishment in 1989 and Möhkö is now popular with tourists.

Treatment of bog-ore in Finland

Iron was traditionally produced in Finland from ore extracted from bedrock mining in Sweden, as well as from deposits of limonite, or bog iron, recovered from Finnish lakes and swamps. Bog iron was most abundant in the lakes of eastern Finland, in the provinces of North Karelia, North Savo and Kainuu. The earliest attempts at mining took place in the 18th century and by the early 19th century there were numerous forges and furnaces in operation. Timber and bog-iron were the principal industries in North Karelia during the 19th century since raw materials were in plentiful supply; timber from the extensive forests, and iron from the hundreds of lakes and rivers. Bog-iron was also obtained from swamps. Cascades and rapids provided water power for running mills, while the network of rivers enabled transportation, and the situation was improved still further by the construction of railways in Savo and Karelia towards the end of the century. There was also a plentiful supply of labour to satisfy the needs of emerging industries, for the increasing value of timber and paper competed with and gradually displaced, the more traditional rural occupationst, such as slash and burn farming, which became less and less viable.

Iron production and the ironworks in eastern Finland were largely financed by Russian capital, as there was great demand for raw materials from Finland, supplying iron foundries, workshops and arms manufacturers in Sankt Petersburg. The most prominent Russian business investor in Finland was Nikolai Putilov, who owned the Haapakoski, Huutokoski and Oravi ironworks. An important Finnish industrialist around the same time was Nils Ludvig Arppe, who produced and refined iron ore at Ilomantsi and Värtsilä.

The earliest methods used in iron production were of so-called direct forging, resulting in the production of wrought iron bars with a very low carbon content. The oldest furnaces were of a rather low shaft-kiln type, above, with air being supplied by bellows, or even making use of windy conditions. The kiln was freshly lined with clay for each new load, then filled with a mixture of ore and charcoal. After firing for the required time, the clay kiln was broken and the mixture of pig-iron and slag was removed for forging to remove as many impurities as possible. The resulting iron was the reheated and beaten on an anvil to make more malleable wrought iron.

During the latter part of the Middle Ages, somewhat larger furnaces were in use, constructed of stone bound with clay mortar, and which could be heated repeatedly. These also used charcoal as fuel and produced pasty lumps of ore that were removed with tongs for refinement by hammering. This technology was widely used through the 17th and 18th centuries but improvements to the process during the 19th century enabled the industrial scale production of bar iron. This was achieved by building larger furnaces and improving air supply, which also raised the kilns to higher temperatures, allowing a great mix of carbon with the iron, thus producing pig-iron, which was unsuited for working into wrought iron. This problem was overcome by stirring the molten iron, which removed the excess carbon and resulted in both greater production rates and improved quality of wrought iron bars, which in led it turn to further technical innovation. An additional advantage of producing iron in these larger modified blast furnaces was a reduction in the amount of slag produced.

There was nevertherless an additional problem to be overcome in using from limonite from lakes and swamps for producing bar iron, in that phosphorus contents were unacceptably high, typically causing embrittlement of the iron. The recently invented puddling process and the reverberating furnace design provided a solution to this problem since the molten iron was no longer in direct contact with the charcoal fuel, and the puddling of the molten iron, with an iron stirring rod, took place in a closed system. From the 1950's onwards, this technology gradually replaced the older furnaces and kilns in at the ironworks in eastern Finland, resulting in cheaper and more efficient production of good quality iron bars from bog ore.

Iron works in eastern Finland that used bog ore were much more dependent on trade with Russia than the foundries in southern and western Finland that were imported crushed iron ore from mines in Sweden. In the 1880's however, there was a quota imposed on the amount of iron that could be exported from Finland to Russia without being subject to additional import tariffs. The volume of iron produced was reduced of necessity and after the turn of the century, exports declined even further. This was largely to an increase in domestic production within Russia, made possible by exploitation of extensive iron and coal deposits, funded by an influx of foreign capital. Increasing domestic production in Russia caused prices to fall and made Finnish exports less competitive. As a consequence, most of the ironworks based on mining of bog ore ceased operations within the first decade of the 20th century.

Fig. 2. The ironworks at the Kuokkastenkoski rapids, at Nurmes, which operated from 1879–1906. Image courtesy North Karelian Museum

Fig. 3. The Annantehdas ironworks at Suojärvi, which produced iron between 1814–1905. Image courtesy North Karelian Museum

Treatment of bog-ore in Ilonmantsi

The first official records relating to production of iron in the Ilomantsi district date back to the 17th century, when bog-ore was extracted and refined for marketing in the village of Kuuksenvaara. During the 18th century, production in Ilomantsi actually declined, due to the increasing availability of iron from Petrozavodsk, on the shores of Onego Lake. Ore was still mined and iron produced from lakes and swamps on a small scale, but was unable to satisfy the growing demand.

There were 13 iron kilns established in eastern Finland between the years 1792–1840, of which two were in Ilomantsi, at Ilaja (1836–1847) and Käenkoski (1839–1880).

The Ilajankoski kiln was situated on the Ilajanjoki River, in an area that now lies within the national border zone. Local landowner Christer Huovinen was already producing iron to meet his own needs at the turn fo the 19th century and operations were expanded and continued by father and son Elias Dahlström from 1836 onwards. During the years that they managed the ironworks included in addition to the kiln, a hammer and forge for beating bar iron and a small mill.

The Ilajan ironworks were eventually purchased by Nils Ludvig Arppe, whose main interest was in acquiring the surrounding forests, though he did continue to invest in the ironworks, building an additional kiln. However, operations ceased in 1847, as the local sources of bog iron became depleted.

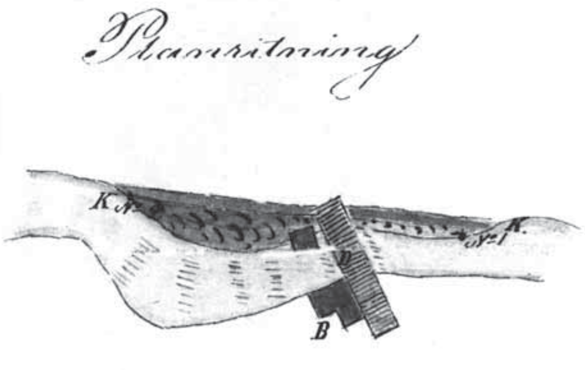


Fig. 4. Surveyor's plan of the kilns at the Ilaja ironwork, showing the millon the opposite side. D. Dam wall. K. Proposed canal. Accommodation was situated about 200 meters further west. Image courtesy of Ilomantsi Historical Society

Dahlström also founded the Käenkoiski kiln along the Pirttikoski River in 1839, which consisted of a hammer and forge for producing bar iron, charcoal producing facilities, a storehouse for iron, a mill and buildings for housing workers. Most of the bog iron was obtained from nearby Lake Koitere and the smiths at Käenkoski had a reputation for producing good quality iron bars. The main problem however, was seasonal water shortages, preventing the ironworks from operating all year round. The last iron bar was forged at Käenkoski in 1880.

Fig. 5. Anders Johan Mustonen, owner of the Käenkoski ironworks. Image from Ilomantsi Historical Sociey collection

The owners' of the Möhkö ironworks

In June 1836, Carl Gustaf Nygrén applied to government for permission to commence extraction and refinement of bog-iron at Möhkö, on the Koitajoki River, in the Ilomantsi district. Nygren was from Ilomantsi by birth and worked variously as a watchman and later as the postmaster at Sortavala. He was granted approval on the condition that the furnace would be operational within three years. However, Nygrén's plans fell through when the original financier died during the first year of construction, while his successor, the Englishman Cazalatt absconded overseas during the second year, and the project came to a halt. Nygrén was required to renew his permit in 1847, which he did, but shortly after sold both the rights and the land to Adolf von Rauch.

The brothers and business partners Adolf and Carl von Rauch from Saint Petersburg completed the construction of the first kiln and furnace at Möhkö, as well as a diversion channel and dam on the Koitajoki River. Nils Ludvig Arppe, who owned large areas of forest and sawmills in the Ilomantsi area, did not take kindly to these competitors and initiated legal proceedings in an attempt to have the dam dismantled. Due to continuing pressure from Arppe, the von

Rauch brothers abandoned their plans for Möhkö and sold out to Arppe at the end of summer in 1851.

Nils Ludvig Arppe obtained financing for developing the Möhkö ironworks from a relative, Johan Hallonblad, with whom he had already acquired a number of sawmills in the 1840's. Arppe was dissatisfied with the level government intervention in the timber industry, which he felt frustrated his business plans. Arppe already owned the Ilaja kiln and in 1850 established the ironworks at Värtsilä. Soon after he was able to purchase the Möhkö ironworks and the Käenkoski kilns. Although Käenkoski and Ilaja operations in 1860, expansion continued at Möhkö and Arppe's business interests had thus moved from the timber industry to iron production.

Fig. 6. Nils Ludvig Arppe. Photo courtesy Ilomantsi Historical Society archives

Nils Ludvig Arppe died in Värtsilä in 1861 and the industrial assets that he had managed passed to his estate. In 1879, a family-owned company was established, named N. Ludvig Arppen perilliset ("The heirs of N. Ludvig Arppe)", which was intended to continued the iron production at Möhkö. This family-controlled business was later listed publically on the stock exchange and in 1898 resumed trading under the name of "Värtsilä Osakeyhtiö". A separate subsidiary was formed for managing forestry assets in 1902, known as Ilomantsin Metsäkiinteistö Oy ("Ilomantsi Forests Ltd"). This arrangement was made so that Värtsilä Oy could finance the Möhkö operations through the sale of timber and in 1902 all land owned by Värtsilä Oy in the Ilomantsi region – a total of 98 000 hectares – was transferred to Ilomantsin Metsäkiinteistö Oy.

However, the days of prosperity for the Möhkö ironworks were coming to an end. The Finnish iron manufacturers had been struggling for some time as a result of Russia, which was the most important trading partner, having raised import tariffs. The iron producers in eastern Finland were in a somewhat better position than those elsewhere in Finland in that they were allowed a quota that could be exported without tariffs. At the turn of the 19th century, the expansion of domestic iron production capabilities within Russia led to a further lessening of demand for Finnish iron. Moreover, because of its remote location on the eastern border, the Möhkö ironworks was disadvantaged with respect to domestic markets in Finland. The ironworks at Värtsilä, also near the Russian border, was in a better position because of railway access and managed to survive, but costs of transport from Möhkö were proving uncompetitive.

As a result of increasing financial difficulties, it was decided to split Värtsilä Oy into several separate operations, with the establishment of Aktiebolaget Wärtsilä Osakeyhtiö, to be based at Värtsilä and focused exclusively on iron ore production. The Möhkö ironworks were shut down and the entire plant and site were sold to Ilomantsin Metsäkiinteistö Oy in 1907.

Ilomantsin Metsäkiinteistö Oy was not involved in any industrial activities at Ilomantsi, although there had been plans for a timber mill. W. Gutzeit & Co. became interested in the forests in the area and was determined to make purchases before foreign-owned businesses say the potential of the region. Accordingly, in early 1908, Aktiebolaget W. Gutzeit & Co bought the entire assets – including debts – of Ilomantsin Metsäkiinteistö Oy. As a result of this transaction, which included nearly 100 000 hectares of forest, the Gutzeit company owned nearly half of the municipality of Ilomantsi, around 200 000 hectares.

The Möhkö ironworks were situated on the island that was formed in the Koitajoki after dredging the diversionary channel and on the surrounding riverbanks, and included both furnaces, a sawmill, grinding mill and various workshops. The main office building, known as Pytinki, and various outbuildings and storehouses were also located in the immediate vicinity, as were some residential dwellings. Other facilities, such as for production of tar and turpentine were constructed on the island, named Pietarsaari. The charcoal burning and brick kilns were located somewhat to the west of the main complex. Charcoal burning was done on the edge of the area, at Mustakorpi and Anninkoski, where other necessary materials necessary for production were also stored. Additional housing was built at Tervamäki, where foremen and their families dwelt, while other laborers lived south of the river, at Lutikkalinna and to the north of the ironworks, at Kiikkumäki and in barracks built near Jokivaara, an area which had previously been used for crop farming.

Fig. 7. The Möhkö ironworks and surroundings during the 1890's.

The manager's residence, known as Pytinki, or Herrala, was built around the time that the ironworks were established, in 1849 and according to local tradition, it was designed by a Polish architect. It was commissioned by Adolf von Rauch, who was from Saint Petersburg, and the building not surprisingly reflects some of the Russian classicism fashionable at the time.

Fig. 8. Pytinki and surrounding gardens in the 1890's. (Image courtesy Ilomantsi Museum Foundation)

Raw materials

While the term "bog iron" is widely understood in English usage, in Finland it might be more appropriate to refer to "lake iron", for the limonitic precipates sought by the iron industry. In eastern Finland in particular, ore was recovered principally from lakes, although there was extraction from bogs and swamps as well. The extensive lake systems have provided ideal conditions for the limonite formation, wherever the lake sediments are relatively sandy and permeable. Deposition of limonite occurs preferentially on the bottom of sandy lakes, relatively near the shore, at depths of 1–5 meters, forming layers typically 20–30 centimeters in thick. The process of ore formation requires dissolution and transport of iron, derived from the weathering of bedrock, which enters into solution in groundwater. Groundwater flows into the lake basin, either within permeable aquifers or through springs that discharge directly onto the lake floor. Ore commences precipitation upon some solid material, such as sand grains and grows incrementally, layer by layer to form a rusty crust. For this reason, sandy lake bottoms are favoured for their higher rates of groundwater flow and discharge. The process of ore deposition is an ongoing one, the rate of replenishment being dependent, amongst other factors, upon rates of groundwater flow and iron concentrations. The limonitic lake ores – iron hydroxides with the chemical formula $Fe_2O_6H_6$ – also contain trace amounts of phosphorus and manganese.

Bog-iron occurs in varied forms, colors and textures, and colors, ranging from yellow to brown to almost black. It can be porous and brittle, or form roundish oblate disks, sometimes very large, or can occur as pea-shaped aggregates.

The iron content of the limontic ore used at Möhkö was on average around 37 %, and varied from lake to lake, and even within different parts of an individual lake. The amount of bog-ore recovered annually was of the order of 19 000 tonnes.

Fig. 9. Limonite ore

Extraction of ore from lakes required a permit and in the case of the Möhkö ironworks, nearly a hundred lakes were claimed and exploited. Most of these lakes were within the municipal boundaries of Ilomantsi as it was then, although some of them are now in the adjacent municipality of Tuupovaara (which nowadays belongs to the City of Joensuu), or on the other side of the national border, in Russian Karelia. There were also some lakes in the municipalities of Korpiselkä (nowadays in Russia) and Eno (which has also recently merged with the City of Joensuu). Precipitation of limonite is sufficiently rapid that it is effectively a renewable resource, allowing mining to take place from the same lake at intervals of ten years or so. The highest yields were from Lake Koitere, even though the distance from the southern shores of the lake to Möhkö was almost fifty kilometers. Duiring the years 1870–1881, some 59 lakes were being harvested for ore, with an average distance of about twenty kilometers to the ironworks.

Fig. 10. Distribution of lakes, temporary stockpiles and transport routes supplying the Möhkö ironworks

Bog-ore was collected manually during the summer months, from barges built from logs harvested from standing dead pines, which are renowned for their durability. The ore was collected with a team comprising 1–2 workers for recovering the ore and another for sieving and washing. A long-handled net was pushed along the floor of the lakefloor, and pieces of ore that were recovered were poured into a sieve and washed, before being piled in a heap in the center of the barge.

When the barge was fully loaded, it was steered ashore and the ore was offloaded and stockpiled, in a heap known locally as a rutnikka. The amount of ore was also noted, in order to pay the miners accordingly. Stockpiles could be up to five meters high and tens of meters long. The ore was roasted in the autumn, using timber as fuel, to burn off impurities and reduce the mass of the stockpile.

Fig. 11. Dredging and recovering ore from the bottom of Lake Kotijärvi, in the Kuolismaa district, around the year 1904. Photographer Aksel Saloheimo. Image courtesy Ilomantsi Museum Foundation

Charcoal derived from wood was used for smelting iron and was produced by local farmers who then sold the charcoal, although there were also charcoal kilns managed by the ironworks as well. ironworks, although the.

Figure 12. Charred logs ready for hoisting ashore at the Möhkö ironworks during the 1890's. Photograph courtesy Ilomantsi Museum Foundation

Wood for making the charcoal was obtained from forests owned by the company; in late winter, open pine forests were burned, and the timber left standing and allowed to dry through the following summer. During the next winter, the trees were felled and cut into lengths of two meters or so. This work was strenuous but manageable for men – and women – even without the aid of horses; the sawn timber was loaded onto a sled, again about two meters long, and hauled to the banks of the Koitajoki River. The timber was then rafted down the river to Möhkö in springtime and hoisted from the river along rollers and stacked in long rows; this work too, was accomplished by families employed by the ironworks, as well by using horsepower.

Fig. 13. Employees of the Möhkö ironworks involved in cutting and transporting timber for the charcoal kilns during the 1890's. Photograph courtesy Ilomantsi Museum Foundation.

Fig. 14. Charcoal kiln at Möhkö, in the year 1930. Photograph of Rudolf Salomaa. Photograph courtesy Ilomantsi Museum Foundation.

The smelting process also required limestone, or dolomite for the calcining process, which removed unwanted impurities such as sulfur and silica. The dolomite used at Möhkö was mostly obtained from quarries at Pälkjärvi, on the shores of Lake Jänisjärvi, some distance to the south. Before loading the furnace for firing, it was necessary to crush the dolomite to a fine powder; this was done using a steam-driven crusher that had been modified from its original function of transporting pig iron from Möhkö by road.

The pig-iron manufacturing process

The iron ore was smelted in a conventional blast furnace or kiln, which at Möhkö was referred to locally by the names tomina or pätshi, which were of Russian origin. The kilns were built from mortared stone and brick and surrounded by a protective shelter constructed of logs and sawn boards

The Möhkö iron kilns produced pig-iron, which was suited for melting but not for forging. Bar iron was produced from pig-iron by removing excess carbon and impurities such phosphorus in a variety of ways, after which it was suitable for forging nails and tools such as scythes. Bar iron was produced by removing carbon, traditionally by reheating the pig-iron and beating with a heavy hammer, but other methods were also available; the puddling process was introduced from the 1850's and replaced the need for hammering out impurities. The pig-iron was instead heated in a sealed vessel and impurities were driven off by burning. The molten iron was poured into suitable molds, resulting in cast iron. It was Nils Ludvig Arppe who pioneered the use of puddling at the Wäsrtsilä ironworks.

Iron-ore blast furnaces at Möhkö

	Constructed	Dismantled
1. Furnace	1849	1856
2. Furnace	1850	1856
3. Furnace	1856	1908
4. Furnace	1872	1908

The Möhkö ironworks represented a significant proportion of the total production of bar iron sourced from lakes and swamps in Finland, with a mean annual output of 3300 tonnes. Bar iron manufactured at Möhkö was known by the appellation sukuna. In 1898, a total of 5849 tonnes of bar iron was produced, which in turn required extraction of 15609 tonnes of limonitic ore from lakes and consumption of 43515 tonnes of charcoal. Ingots at Möhkö were poured as rather flat oblong brick-shapes or semicircular disks weighing about 50 kg and were stamped with the initials L.A.

Fig. 15. The initials stamped on Möhkö ingots

Fig. 16. The buildings housing the blast furnace constructed at Möhkö in 1872. Photographer Jean Schmidt. Courtesy of Ilomantsi Museum Foundation

The smelting process was overseen by the kiln foreman and the loading attended to by various workers. Required materials were transported by horse and dray, or mechanically winched to the platform at the top of the kiln which was then filled carefully, with successive layers of charcoal, fine-grained ore and crushed dolomite. Hydroelectric power provided the energy for pumping air, which was itself heated beforehand, into the kiln to promote combustion.

As heating progressed, molten iron and slag concentrated at the base of the kiln, but due to its lower density, the slag tended to float on top of the iron. It was therefore possible to carefully release the molten slag from an opening in the side of the kiln. After a sufficient amount of molten iron had formed, an opening that had been sealed up prior to heating was breached using and iron bar, allowing the iron to flow along a channel into moulds prepared of sand. The flow of air into the kiln was interrupted during the pouring process, to avoid the risk of flames flaring up and injuring workers. The whole process of pouring iron was repeated four or five times daily.

The ironworks were able to make use of hydroelectric power produced by a plant built at the Möhkönkoski rapids, which was capable of generating 1.260 horsepower. The rapids had also been dammed, during construction of the canal diversion, which redirected water for driving both the sawmill and a mill for grinding grain, as well as supplying water to the blast furnace.

Another canal was constructed at Möhkö in the 1870's both to improve access by boats, involving a system of four lochs and weirs, as well as to allow construction of a second blast furnace, which made use of a water wheel to supply power for pumping air into the kiln. A brick building was constructed around the waterwheel and its housing. A dry dock was also built alongside the channel, where steamships and barges could be berthed during the winter months. Barges were also built and other boats repaired in the docks.

Fig. 17. View of the canal at the Möhkö ironworks in the 1920's. Photograph courtesy Ilomantsi Museum Foundation

Additional industrial activity at the ironworks

Items made of cast iron produced at Möhkö were mostly used for construction and maintenance at the ironworks themselves but there was also some marketing of specialist goods. There was a constant need for casting moulds and for iron doors and plates for the furnaces and also for various components for the flywheels at the sawmill, as well as replacement parts, such as stone nuts and axles for the grain mill.

Anvils were produced for a time during the 1860's at the Käenkoski ironworks and also bells and hot irons for clothing.

A workshop for industrial scale production of nails was established at Möhkö in 1874, and was situated near the rapids in proximity to the old blast furnace. It was powered by a 12 horsepower waterwheel that drove two hammers. The nails were produced from bar iron that was obtained from the Värtsilä ironworks, brought to Möhkö on the return journey after delivery of shipments of pig-iron. The bars were rectangular, 16 m thick and 3 meters long. The nail forge was manned by the smith and several apprentices. Finished products were mostly transported back to Värtsilä, though some were sold amongst the local community as well. The manufacture of nails at Möhkö continued until 1915, some years after the closure of the ironworks, and was owned by the Kivinen brothers, who managed the hardware store at Sortavala.

Fig. 18. The blacksmith Salomon Saviranta in his forge in the 1920's. Saviranta also worked at the ironworks producing nails. Photograph courtesy Ilomantsi Museum Foundation

A blacksmith's workshop was built at the Möhkö ironworks at the very beginning of operations and consisted of four forges, in order to provided iron to meet the needs of the ironworks. Various iron components were constantly required, for example in constructing and repairing the furnaces. After closure of the ironworks, the blacksmith's workshop was transferred to the ownership of Enso-Gutzeit Oy and remained in operation until the 1970's.

Bricks were also produced at Möhkö, to meet the needs of building at the ironworks. As an example, the construction of a chimney stack for the new blast furnace required 50 000 bricks. The brickworks were located behind the Tervamäki hill, near the charcoal kilns. Suitable clay for firing was brought by barge from the shores of Mekrijärvi or Nuorajärvi. The clay was mixed in a pugmill from where it was extruded onto a kneading table, before being manually pressed into moulds by the brickmakers. The bricks were then transported in the moulds to a suitable site for drying, where the moulds were removed. After drying for several weeks in the open air, the bricks were then fired in kilns.

Fig. 19. Making a road grader at the Möhkö blacksmiths' workshop in the 1930's. Photograph courtesy Ilomantsi Museum Foundation

During the 1870's, charcoal production in kilns commenced, operating on the principle of dry distillation or pyrolysis. This had the advantage of previous traditional methods of allowing recovery of a number of useful byproducts, including tar, turpentine and methanol.

A separate kiln for further refinement of tar and turpentine was built at Möhkö in 1893. Due to the risk of fire, the kiln was situated on the banks of the stream at Pietarsaari. Resin was also obtained as an additional specialized byproduct of the turpentine refinement process.

Pitch was also produced through the distillation of tar, for which a specific production facility was built in 1900. Because this too was highly flammable, the production plant was sited separately, presumably also on the island of Pietarsaari. Pitch was mixed with resin and tallow and used for caulking of the undersides of wooden boats.

In 1871 a single-frame pitsaw was installed adjacent to the flourmill, making use of the same millrace and waterwheels, which generated the equivalent of 25 horsepower. In 1873 two circular saws were added, enabling improved throughput, with boards and planks being the main products; the mill was also capable of handling more specialized timber, such as the 500 logs harvested from dead pines, ordered by the Ilomantsi Lutheran Parish in 1902, for construction of a large barn. Small volume of timber were also cut for various individual customers.

A flour mill was built at Möhkö in the 1860's, comprising a mill with rooms for the wheels and gearing, and equipped with two millstones and six pestles for grinding oatmeal. All of these were driven by water from the same millrace that powered the sawmill. In 1865, there were 50 households that were making use of the mill for grinding their grain and the Möhkö flourmill remained under the management of Enso-Gutzeit Oy until the 1960's.

Fig. 20. The Möhkö sawmill and flourmill buildings in the 1920's. Photograph courtesy of the Museum of North Karelia

Transport of ore and bar iron

The principal product provided by the Möhkö ironworks was bar iron, which was transported to the Värtsilä works for refinement and sale in Saint Petersburg. During the summer months, the bar iron was taken partly along the waterways and partly by horse and dray, whereas in winter it was conveyed by horse and sleds.

Two different routes were in use for transporting goods to Saint Petersburg:

• western route: Möhkö – Koitajoki – Nuorajärvi – Lylykoski – Luhtapohja – Jäsysjärvi – Pielisjoki – Joensuu – Pyhäselkä – Orivesi – Saimaa – Saimaa canal – Gulf of Finland – Saint Petersburg

• eastern route: Möhkö – Karali – Anoniemi – Oravaniemi – Läskelä – Tarposenranta – Lake Ladoga – Koschkin – Neva – Saint Petersburg

Fig. 21. Transportation routes for the bar iron from Möhkö

The transport of bar iron was a demanding task for both man and horse. In water, loads of iron, as well as charcoal and ore awaited freezing of water routes, and preparation of winter roads. The transportation was mostly undertaken by local employees from Ilomantsi, but additional workers from surrounding communities also took part.

Sleds, with a width of about 50 cm, were loaded with up to 500–600 kg of freight. The first stage of the journey, from Möhkö to Läskelä, typically lasted more than three days, with various options for overnight accommodation along the route. It was common to travel in groups of 5–10, often known as artels, a term derived from Russian, referring to a guild, or fraternity of people with a common profession or trade. The Sukuna artel from Möhkö had quite a reputation and most other traffic on the route made way for them whenever they were passing.

Prior to the advent of steam-driven shipping, transport on water was by rowboat, with eight men at four pairs of oars, and carrying a load up to 1300 kg.

The first steam-driven tugboat used at Möhkö was a paddle steamer, named "Möhkö", built in 1869, which hauled barges of ore from from Kelsimänsärkkä the Ylä-Koita stockpiles, in the upper reaches of the Koitajoki River. The Möhkö also towed barges laden with bar iron to the unloading wharf at Karali, for overland transport. Another steam tugboat, named "Helmi" (or "Pearl") was built in 1889 for transporting ore from Koitere lake and later a third boat was named "Koita". The tugboats were capable of towing from three to six wooden, flat-bottomed barges, of which there were more than twenty available at any given time at Möhkö.

Fig. 22. A steam-powered Möhkö tugboat towing several barges. Photograph courtesy Ilomantsi Museum Foundation

Fig. 23. Barges lining the shore at the ironworks. Photograph courtesy Ilomantsi Museum Foundation

At the time when construction commenced at Möhkö, the area was not accessible by road. To recify this issue, a track suitable for horse and drays was cut from the Ilomantsi town center to Möhkö, via the village of Kuuksenvaara, to the narrow stretch of water at Oinassalmi, where there was a ferry crossing. As the road approached Möhkö, a distinctive crunching sound was noticeable underfoot, as crushed slag from furnaces was being used as road aggregate.

Connexions between Ilomantsi and Värtsilä improved markedly when a road was built via Korpiselkä to the Värtsilä ironworks in 1897. During summer, it was possible to travel on horseback along bridle tracks from Ilomantsi to outlying communities at Kuolismaa and Vuottoniemi. A road between Möhkö and Kuolismaa was completed in 1906 and at this time the Möhkö company decided to build barracks for overnight accommodation, which became known as Lutikkalinna (or "Bedbug Manor").

Fig. 24. The bridge over the Koitajoki River at Möhkö in 1930. The road from Ilomantsi to Kuolismaa passed through the grounds of the manager's residence "Pytinki". Photograph courtesy Ilomantsi Museum Foundation

The employees at Möhkö

The Möhkö ironworks employed some 60–100 workers, including foremen and office staff, in addition to skilled labourers in the furnaces and kilns, workshops, sawmill, flourmill and at the charcoal kilns. In addition, hundreds of local inhabitants found casual or seasonal work extracting ore from lakes, from charcoal burning and in freight transport.

The population at Möhkö grew particularly during the period from 1850–1880. The end of the 1850's was the time when investments by Arppe were at their peak, with refurbishment of the blast furnace and expansion of operations. A second furnace was constructed in the 1870's which again generated additional demand for labor. The greatest number of people officially employed at Möhkö was 532, in 1901.

The manager of the entire operations, or förvalttari, from the Swedish term, was responsible for overseeing the procurement and transport of the necessary raw materials, for supervising the smelting process and monitoring output and quality, and ensuring the transport of the finished product for sale to customers. He was also responsible for the personal wellbeing – physical and mental – of employees and their families.

Fig. 25. The manager of the Möhkö ironworks, Aksel Berner-Saloheimo and his family at the turn of the 19th century. Photograph courtesy Ilomantsi Museum Foundation

The manager was assisted in the office by 1–2 secretarial staff and office clerks and there were a number of other employees in professional capacities, such as teachers, shopkeepers and foresters. The welfare of sick employees was taken care of by a first-aid officer and the blast furnace and smelting process was also the responsibility of a designated foreman.

In the blast furnaces, various employees were engaged in specialized tasks such as loading the kiln and pouring the molten pig-iron. Workers were needed for transporting essential raw materials to the ironworks. Operation and maintenance of the charcoal kilns and the open air production of charcoal in clay-covered woodpiles also required skilled labourers. There were also diverse occupations listed on the ironworks payroll, including a miller, sawyers, overseer of the turpentine production and brickmakers.

Fig. 26. Clerical staff Vikto Sutinen and Iina Nousiainen at work in the Möhkö ironworks office in the early 19th century. Photograph courtesy Ilomantsi Museum Foundation

Fig. 27. Karl Sanfrid Hallberg, the son of C. J. Hallberg, overseer of the ironworks, was employed as forester at the iron works and was also a keen hunter. Photograph courtesy Ilomantsi Museum Foundation

Many other trades were represented at the ironworks. Those working with iron included blacksmiths some of whom were specialized in the production of nails and commonly passed their skills on from generation to generation. Other tradesmen resident on site included shoemakers, tailors, tanners, carpenters and joiners and bricklayers. Some of these were also employed in duties in the ironworks, for example in the furnaces.

Fig. 28. Forester Antti Nevalainen with his daughter. Nevalainen worked as both shop assistant at the Möhkö ironworks as well as forest ranger. Photograph courtesy Ilomantsi Museum Foundation

With increasing mechanization, the concept of the working day also changed. In traditional farming, the work schedule had been determined by daily rhythm and the changing seasons, while life at the ironworks was determined by machines. The working day at Möhkö lasted 12 hours in winter, from 06:00 to 18:00 and 14 hours in summer, from 05:00–19:00. The blast furnaces were fired every day and operated in two shifts and the commencement of the working day was signaled by ringing a bell hanging outside the general store. The same bell was rung to inform workers of a half-hour break for meals, in the mornings and afternoons. Some types of work, such as transporting goods and materials, recovering iron ore from lakes and charcoal burning were dictated by weather conditions and undertaken by contract rather than according to schedule.

The management and senior staff at the Möhkö ironworks received an annual salary, whereas workers in the kilns were paid on a daily basis and blacksmiths received payment according to the number of nails produced. Workers involved in transporting goods and materials, and in recovering ore from lakes, or charcoal burning, were also paid on successful completion of contracts or assigned duties. These casual employees were also able to draw wages, or take food and provisions in advance, to be deducted later on, which carried the risk of become progressively indebted to the company. Benefits in kind to employees were otherwise a routine feature of life at the ironworks, typically covering housing, firewood, lighting, animal fodder and access to pasture for grazing or plots of land for agriculture.

Fig. 29. Pekka Pesonen, foreman at the ironworks, surrounded by his family. Photograph courtesy Ilomantsi Museum Foundation

Most of the workers were housed in their own cottages, or in barracks built by the company which offered single-room accommodation with a floorspace of about area of 30 m^2, with shared facilities including sauna, laundry, barns for cattle, storerooms, toolshed and carpentry workshop and basement storage. The managerial and clerical staff lived in the Pytinki residence. Other senior staff lived at Tervamäki, where accommodation consisted of a living and cooking area and several adjoining rooms.

Fig. 30. Lutikkalinna or Koivikko barracks on the banks of the Koitajoki River. Photograph courtesy Museum of North Karelia

Fig. 31. A group of three barracks situated along a hillslope, named Kangaskasarmi, Keskikasarmi and Suokasarmi. Photograph courtesy Museum of North Karelia

Life at the ironworks

N. L. Arppe founded a school at the Möhkö ironworks in 1859, where the curriculum included biblical history, the Lutheran catechism, reading and writing, an introduction to arithmetic, the history of Finland, and geography. In 1875 the company school changed its status to an official elementary school. At first classes were held in the main hall at the Pytinki manor but the company funded a separate school building in 1879. This was the first school to be built in Ilomantsi and shortly after a well-qualified teacher arrived, Gustaf Ahra, having graduated from the teacher's college in Jyväskylä.

A library was established at Möhkö in 1865, housed in the building known as the Reading Room, with fiction and literature and religious works proving most popular. There was also another reading room in the ironworks where employees could read newspapers.

Fig. 32. Möhkö elementary school. Image courtesy of Ilomantsi Museum Foundation

The Möhkö temperance society ”Tuki” was founded in 1889, largely through the efforts of the schoolteacher Gustaf Ahra and the foreman Aksel Berner, who strongly opposed excessive drinking.

Youth groups were also active, with several branches devoted to choral singing, sports and temperance issues. Regular monthly meetings and other activities were held in the Reading Room. The highlight of the year was the midsummer festival at Jokivaara or Pietarsaari. The Finnish national anthem "Maamme" (or "Our Land" was first heard in Ilomantsi at one of the Möhkö Young People's gatherings.

The main goal of the Ilomantsi Bothnian farmers's association was to promote agriculture and grazing in the Möhkö region.

Fig. 33. The Board of Management of the Ilomantsi Bothnian Farmers' Association. Image courtesy of Ilomantsi Museum Foundation

A trade union branch was officially established at Möhkö in 1905, with about a hundred members signing up initially. Relations between management and employees gradually began to change, with workers beginning to express discontent with working conditions and the standard of accommodation offered by the company. The trade union organized traditional May Day celebrations and marches and ran raffles to help establish a credit union for supporting housing loans.

There were also two national and ideologically different groups active around the turn of the 20th century, the more radical of which strongly resisted Russianizing influences (known as "Nuorsuomalaiset"). The Möhkö foreman Aksel Berner belonged to the more moderate "Suomettarelainen" movement, but he was sufficiently passionate as to change his family name to Saloheimo on the 100th anniversary of the birth of Snellman on 12.5.1906. A celebration was held at the ironworks, and in honor of this, there was a half-day holiday declared for the whole community.

There was already a shop trading at Möhkö in the early 1850's. In addition to clothes and food, the shop sold lamps and lanterns and replacement parts, buckets, files, locks, glues, lacquer, Christmas decorations, ropes and twine and accessories for horses. The Möhkö store also arranged wholesale purchases for customers and other retailers when required, supplying merchandise for local shopkeepers such as Misha Bogdanoff and Topi Palviainen. During the winter months, fishermen from the Aunus region of Russian Karelia, travelled to Möhkö by sled, to sell herring from the White Sea. Russian travelling salesmen also sold traditional bagels and "orekhat", or gingerbread.

The use of coins and banknotes for money transactions was still rather uncommon at the beginning of the 19th century. Because of this, N.L. Arppe introduced bills of exchange with denominations of 5, 10, 25, 50 and 75 kopeks and also 1 rouble. Due to their unusual elongate shape, they were referred to as "Arppe's longtongues". Thes bills were in circulation within about a hundred kilometer radius of the Värtsilä and Möhkö ironworks.

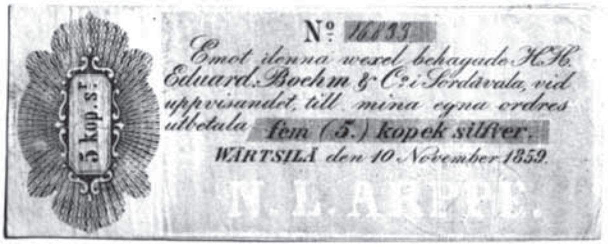


Fig. 34. An example of the bills issued by Arppe and known as "longtongues". Image courtesy of Ilomantsi Historical Society Archives

THE HISTORY OF VARTSILA METALLURGICAL (HARDWARE) PLANT FROM 1850 TO THE PRESENT DAY

I.V. Borisov

Vartsila plant turned 160 years on December 2, 2010 – on that day of all days (according to Old Style November 20, 1850) the government of Finland gave to Nils Ludvig Arppe, a wood-monger, an official permission for building metallurgical production in Vartsila.

The history of one of the oldest enterprises of Karelia – Vartsila metallurgical (hardware) plant – is very well studies and described in books by Finnish researches treating the history of former Priladozhskaya Karelia with respect and love. Local historian Sudakov V.P. devoted several publications in "Krasnoe Znamya" newspaper for 1985–1987 to the post-war history of Vartsila metallurgical pant, also there was unpublished manuscript of this offer dated 1984–1985. This material was has been prepared based on Finnish and Russian publications devoted to the history of Vartsila plant.

There some versions of the name "Vartsila" origin. According to V. Nissil, it could be personal name "Vartsi" that means "mat bag" or "sack", – a clumsy, awkward man could be called this way. Other Finnish researches suppose that "vartsi" is a bag for carrying some things. Under one legend, a long while ago a carrier of such bag – "vartsi" – left it on the coast of the rapid Juvanjoki river, where he stayed to live. Therefore "vartsi" may also mean the place where bag carriers lived.

Official documentation mentions settlement Vartsila since the year of 1500. Then there were only four houses of taxpayers in it. The population of the village was increasing step by step. In 1585 in Vartsila there were 4 dwelling houses, in 1586 – 7, in 1590 – 5, in 1637 – 59, in 1722 – 34, in 1739 – 64. In the late XVIII century about 250 people lived in Vartsila[1].

In 1783 the descendant of the last Karelian feudal Valit, who was in a position of voivode in Korela, student Jozef Valenius decided to start building a saw mill in Vartsila of Tohmojarvi volost, but the construction was stopped by his early death.

Only half a century after that pastor Gustaf Lofstrom continued the construction of the saw mill in Vartsila. On October 4, 1833 he bought pieces of land for the saw mill from some landowners in Vartsila.

On April 12, 1834 G. Lofstrom got permission (license) from the governor for building the plant on the occupied land at the river Juvanjoki. This very day (April 12, 1834) was for a long time considered by the Finns as the birthday of Vartsila industry.

From 1836 a major industrialist Nils Ludvig Arppe (1803–1861) became the actual owner of Vartsila saw mill. He completely bought the mill from Lofstrom in 1848. By that time Arppe had already owned several plants in other areas of Finland. Let us talk about this man in more details.

Nils Ludvig Arppe was born on December 9, 1803 in place Suurlahti of Kitee volost in North Karelia. His Father Nils – Ludvig Arppe (1766–1823) was a district judge of Karelian Court, his mother – Greta Sophia Arppe (Vegelius) (1783–1809). Ludvig Arppe's father was married three times, from the first and the last marriages there were four and four children. The upbringing of Ludvig Arppe was strongly influenced by his younger sister Sophia Fabritiuks, in the family of which Arppe had to live in his young days, and his grandmother Katarina Vallenius-Fabrituks (1765–1833). Ludvig Arppe always had good friendly relationships with his stepbrother Edward Arppe (1818–1894), who became a professor of chemistry and later – the Rector of Helsinki University and the Senator. More over, two first Ludvig's wives and Edwards' wife were the Porthan sisters. The sister of Ludvig Arppe's mother, Katerina-Fredriga Vegelius (1798–1848) was married to an entrepreneur from Sortavala, Collegiate Assessor Johan Halonblad (1789–1848).

The estate of the Arppes in Suurlahti was not far from the estate of the Fabritiukses in Puhos. Ludvig Arppe's grandmother Katarina-Elizabeth was for the second time married to the owner of the estate and a saw mill in Puhos Gabriel Fabritiuks and brought up her children and the children of her passed-away eldest daughter Greta-Sophia. In relatively poor Karelia the estate in Puhos was rich. The estate was surrounded by park. The estate's owner had a well-stocked library.

[1] Касанен Т.И. Воспоминания о Вяртсиля. Хельсинки, 1945.

Fig. 1. Portrait of N.L. Arppe by E. Jarkefeldt

Ludvig Arppe received elementary education at home under the care of his grandmother together with the other children of his age. He graduated school in Savonlinna. From 1820 Ludvig Arppe became a student of Academy in Turku, where he studied legislation and law. He finished the education in 1823 and started working as a trainee in the court of Vaasa. Soon Arppe had to stop his career in the court and come back home because of the family situation. Arppe's father died in the spring of 1823 and the owner of the estate in Puhos Gabriel Fabritiuks died in 1824. G. Fabritiuks had a son from his first marriage, Johan, but he tuned to be unable to conduct the affairs of the big household in Puhos. Therefore Ludvig Arppe had to take upon himself control under the estate and the saw mill in Puhos[2].

Business relationships between Arppe and Fabritiuks were normal for a short time. The latter did not interfere in the household management, but in course of time he became suspicious based on psychological disorder, and he died in 1833. Ludvig Arppe had to care for the support of his successors and his sister Sophia's children by himself. By that time he had made some property, generating revenue. Arppe bought plots of lands and took control over some more saw mills, including the one in Vartsila. Arppe was not enough of his own funds and he had to ask the husband of his mother's sister Katarina-Frederika, Assessor Johan Hallonblad, for help. According to the agreement concluded between them Hallonblad and his successors were to get half of all the revenues from all the bargains and enterprises to which the Hallonblads invested.

As it was already noted, during the 1830-s Arppe was a co-owner of the saw mill in Vartsila.

Vartsila saw mill was built on the lower rapid of the Juvanjoki River, on its left coast. The height of the rapid together with a stanch was almost 5,8 m. Higher up there was a second rapid, about 3,6 m height, where a mechanical workshop and the blacksmith's shop stood, and a third rapid, where a mill worked. The total length of the rapid, where water-driven constructions of the saw mill worked, was almost 37 m, and the width – more than 14 m.

Fig. 2. The Juvanjoki River in Vartsila

In order to supply logs to the plant there was a two-meter width chute to be closed by two shutters. Through the other chute water was supplied to waterwheel, 5 m in diameter and about 2 m width, with 42 vanes. The waterwheel was turning under the water head and the other mill mechanisms were turning together with it.

The saw mill efficiency was strongly influenced by the amount of water in the rapid, maximum capacity was reached in spring and in autumn. Sawn wood was sent from Vartsila to Russia for sale: first by barges by the Juvanjoki River and Janisjarvi Lake, then by land to hithe Torpasenranta near Laskela, further by cargo sailing vessels by Ladoga Lake to Petrokrepost and by the Neva River to Saint Petersburg or Kronshtadt. This transport way kept

[2] Мустелин О. Нильс Людвиг Арппе. Порвоо, 1973.

unchanged till the middle of the 1980-s, when the railroad was made to Sortavala via Vartsila[3].

In the 1830-s sawn wood from Puhos saw mill went to Saint Petersburg or Kronshtadt by light narrow-gauge railroad via isthmus to lake Puhjajarvi near village Annikaniemi and then, by land, to Lahdenpohja and on vessels by lake Ladoaga and the Neva. There was also another way: via the system of lakes and straits of the upper Saima to Joutsen and Lappeenranta, and from there on vessels to the Vyborg Bay. In winter, when lakes and swamps were frozen-over, the transportation was implemented only by sledding with the help of horses, what was very expensive.

In the autumn of 1832 Ludvig Arppe addressed the Senate asking for permission to build and use a steam vessel on Saima lake system. In January 1833 he got this permission for a period of 20 years. During the winter of 1833 a steamship called "Ilmarinen" was built in Puhos. It was launched in July 1833. The engine – wheeled running, steam-power unit and steam station were bought in England, firewood served as fuel material. The steamship had 5 loaded boats as a tug. At off-work time "Ilmarinen" transported passengers or was rented out. The vessel "Ilmarinen", built by N.L. Arppe, is considered to be the first Finnish steamship that was used on inland water of Finland. The project was successful; the steamship began to generate profit. "Ilmarinen", probably, worked until 1844.

Vartsila was the most profitable saw mill from all the mills N.L. Arppe owned. When transporting sawn wood from Vartsila there were less transshipments and the way was a little bit shorter. And all these conveyed Arppe the suggestion that the center of his industry should be transferred to Vartsila.

After 1833 Ludvig Arppe's younger sister became the owner of the estate in Puhos. A student Karl Gustav von Essen was invited as a school teacher for her three daughters; he professed and promoted the religious teaching of "Pietism". Soon all the dwellers of Puhos estate, except for Ludvig Arppe himself and Edward Arppe, were under his influence.

Relationships between Ludvig Arppe and the Essens became almost hostile. The life in Puhos was getting burdensome for Arppe and he decided to build his own estate on Suurlahti lands in Kitee – "Koivikko". Those years N. Ludvig Arppe started to visit his friends and relatives of Katerina-Friderik and Johan Hallonblad in Sortavala more often. There was completely different atmosphere in this house, it was easy and joyful, and they played the piano, danced and sang. The Hallonblads had a lot of children. Despite the fact that Ludvig was much older than they, they all agreed well, and the three eldest – Eliza, Janetta and German – became his close friends.

The other house where Ludvig Arppe relieved his feelings after he left Puhos, was the house of Sophia Porthan-Schantz, his future mother-in-law, in Palkjarvi.

Fig. 3. The house in Palkjarvi (Alahovi).1891

In 1820 Sophia von Schantz married to the eldest son from the first marriage of Katarin-Charlotte Fiendt (nee Dunkan) – the mistress of a big estate in Palkjarvi. From her second marriage Charlotte had two more sons – Judge Karl von Fiendt (1802 – 1846) and Erik von Fiendt (1807 – 1888), later the general-major of the Russian Army. Arppe had good friendly relationships with both of them. First, all the big family Porthan-Fiendt lived in the family estate "Alahovi". Then for the Pothans family Charlotte built their own house on the coast of Palkjarvi lake within one kilometer distance from Alahovi. This house was called "Standgardiski" ("Coast estate")[4].

After her husband's death Sophia Porthan lived in the estate with her three daughters Janetta, Mimi and Tilda. His mother-in-law Charlotte helped her financially, and after her death in 1834 a new host of Alahovi, Charlotte's eldest son, Karl Fiendt, took charge of the care for Sophia's family. Charlotte's younger son, Erik Fiendt, served as a staff officer in Saint Petersburg after he finished the Military Academy and visited Palkjarvi on rare occasions. Lud-

[3] Касанен Т.И. Воспоминания о Вяртсиля. Хельсинки, 1945.

[4] Мустелин О. Нильс Людвиг Арппе. Порвоо, 1973.

vig Arppe was on friendly terms with both brothers Fiendt, and Erik, living in Petersburg helped him with commercial affairs. When he retired in the rank of the General-Major Erik von Fiendt settled in the family estate of Alahovi in Palkjarvi and became its last host. His wife was Elisa Hallonblad. The Hallonblads family often visited Sophia Porthan's house in Palkjarvi.

In summer 1840 Ludvig Arppe, who at that moment was already 36 years old, asked Sophia Porthan for a hand of her eldest daughter, nineteen-years-old Janetta. The wedding was celebrated in Palkjarvi on September 3, 1840.

In October 1840 the young family moved to the new house "Kojvikko". Ludvig Arppe lived with Janetta for 2,5 years, they had two children: Edward (future owner of Vartsila saw mill) and Janette. Janetta died at the second childbed.

On October 1848 the other Porthan's daughter Mimi married to Ludvig Arppe's stepbrother Edward who had just got the degree of the professor of chemistry in Helsinki University.

In January 1846 Ludvig Arppe married to the youngest Porthan sister – Matilda, who at the age of 18 years old had to bring up her eldest sister's children. Matilda delivered Arppe 6 children. On November 22, 1855 Matilda died at childbed.

In August 1856 Arpee married for the third time. The home teacher of his children, 22-years-old Amalia Seitz, who had been living in the Arppe's house for already two years, became his wife and the hostess of "Kojvikko" estate. After the death of Ludvig Arppe Amalia had to support and bring up 11 children, three of which were her own.

By that time they lived in the host house in Vartsila. According to Ludvig Arppe's last will the foster parents of his infant children were his brother Edward and Amalia Arppe[5].

The activity of woodmongers in Finland in the beginning of the XIX century was under the strict control of the Finnish Government that gave not so much encouragement to development in the country of sawing production significantly draining the stand of timber along the coast of Ladoga. Ludvig Arppe did not like the strict limitations of the woodmongers' activity in Priladozhskaya Karelia introduced since 1851, and it was one of the reasons made him switching to more profitable metallurgical production.

[5] Ibid.

Fig. 4. Amalia Seitz – N.L. Arppe's widow with children. After 1861

As back as on March 30, 1850 Arppe made an application to the Senate for organizing ironworks in Vartsila, and the license was get already on November 20, 1850. Therefore November 20, 1850 can be considered as an official date of establishment of Vartsila metallurgical plant. For the construction of the new plant in Vartsila the government gave Arppe a considerable non-interest bearing credit in the amount of 10 000 rubles and granted him remission of taxation for the period of 15 years. The products of the pants were provided with special brand mark[6].

Two blast furnaces for melting marsh and lake iron ore, two smith forges for obtaining rod iron, two nails-making machines, drawbench, dome reverberatory kiln were built at Vartsila metallurgical plant during two years (1850 – 1852). At the same time they prepared lake iron ore in the neighborhood of Vartsila.

Water for the blast furnace was supplied from the rapid of Vartsila saw mill through a specially covered channel. Need for ore was ensured by many la-

[6] Касанен Т.И. Воспоминания о Вяртсиля. Хельсинки, 1945.

kes and swamps in the near neighborhoods. Arppe had to get fuel for the plant from his own woods in Tohmajarvi and, if necessary, by state and private woods.

The Hallonblads family, namely, German Hallonblad, also took part in financing the production of Vartsila metallurgical plant.

The project of the blast furnace, foundry and mechanical shop was made by a Swedish-English mining mechanical engineer, Nikolay Smith. And he also managed the construction of the plant at the initial stage. Later a Swedish-English engineer Hill replaced him. It is worthy of note that the plant in Mohko was built according to the drawings of Vartsila plant.

In November 1850 in his letter to Erik von Fiendt from Palljarvi Nils Ludvif Arppe informed: "*…more than 60 000 poods of ore has already been mined, 200 cubic meters of stone have been broken out, two coal stocks are ready, pit for the blast furnace has been excavated. The weather conditions prevent constructing the blast furnace, but I hope to blow it in by the next winte*r"[7].

The first blast furnace in Vartsila was started only on September 27, 1852, and this day can be considered as the birthday of Vartsila plant. On the eve Arppe together with German Hallonblad (Johan Hallonblad's son) came with the inspection of the readiness of all the constructions in Mohko and Vartsila.

The furnace was designed and installed in such a quality manner that during some years it did not require any updates. For that moment the blast furnace in Vartsila was the biggest one in Finland – with the height of 42 feet. One blast period could last two-two and a half years. In average the furnace produced 600 poods of cast-iron per day, and the quality of the cast-iron was the best in Europe, despite the fact that ordinary, not very rich in iron and contaminated with impurities, marsh and lake iron ores served as raw materials.

In February 1854, on the eve of the Crimean War, the furnace produced 9652 poods of cast-iron for two weeks.

After the Crimean War, starting from the middle of the 1850-s, the demand for Vartsila cast-iron in Russia began to go down. Russia changed customs tariffs and, though the quality of Vartsila cast-iron remained high and the import of it to Saint Petersburg was customs free, it was hard for Ludvig Arppe to compete with English suppliers of cast-iron and iron.

In 1858–1872 the production of cast-iron in Vartsila decreased to 2000 tons per year, and then there emerged a need to expand the production and turn the iron foundry into an integrated iron and steel works.

In the autumn of 1859 Ludvig Arppe made an application to the Senate for building melting furnaces and a rolling mill in Vartsila in order to produce as wide range of goods as possible, namely: rod iron, section bars, square, rolls, and iron sheets. In order to manage such works Arppe invited German specialists – they had to start the works, and local workers had to continue after teaching.

According to the project the following constructions and equipment had to be built and installed at the plant: two steam hammers, 2 tons each, 7 melting and 6 heating furnaces, one heating reverberatory furnace for sheets, one steam station in 10 hp for the drive of two rolling mills, one steam station in 36 hp for the drive of rolling mill for thin sheets, one steam station in 8 hp for the drive of maintenance shop machines, guillotine-shears for steel cutting.

In October 1859 there was a fire accident at Vartsila plant and the roof of casting section of the blast furnace was damaged. The furnace itself and its constructions were not damaged, but the consequences of the fire accident influenced the dates of new production facilities commissioning.

On August 14, 1861 the restored Vartsila plant was ready to start production, though a new blast furnace was commissioned as early as in February, 1860. Besides the above mentioned equipment, 10 steam boilers, which were heated by the gases from the heating and melting furnaces, were installed at the plant[8].

A mere some months after the plant was commissioned, on December 9, 1861, Nils Ludvig Arppe, who lived in Vartsila for the last years, died.

He died right at that moment when his forces and organizational skills would have come very useful for managing industrial productions in Vartsila, Mohko, Laskela and other places where Arppe's metallurgical plants and saw mills worked. Ludvig Arppe was buried next to old Protestant church in Kitee into one grave with his first two wives – Janetta and Matilda.

[7] Мустелин О. Нильс Людвиг Арппе. Порвоо, 1973.

[8] Экономическая жизнь Приграничной Карелии. Сортавала, 1926.

Fig. 5. The grave of N.L. Arppe in Kitee. 2012

His children on their full age started to administer Arppe's property.

Ludvig Arppe's eldest son, Edward Arppe (1841–1887) became the owner of Vartsila metallurgical plant at the age of 20. He received the education of chemist.

Fig. 6. Court Counselor Edwrd Arppe (1841–1887), Ludvig Arppe's eldest son

In 1855 he built in Vartsila a big "Siemens-Martin furnace" (open-hearth furnace) with the productivity of 7,5 tons of steel per day, and it was the only one in Finland[9].

Starting from the middle of the 1870-s the second son of Ludvig Arppe – Klas Ludvig Arppe (1846 – 1891) – took the post of the plant manager and he was the head of the plant till the end of his life.

Fig. 7. Klas Arppe (1846–1891), younger son of L. Arppe

For that moment more than 120 people worked at the plant.

Klas Ludvig Arppe wrote in 1891: "… *the next summer ore has to be got from many lakes and places of one lake. The transportation of ore should be organized in winter, when north Boreas builds bridges over all the rivers, streams and swamps; agreements for coal burning with most of the neighborhood inhabitants have to be concluded in time and at the same time the delivery of fuel wood in winter and the drive via rivers and lakes in summer for own charcoal kilns should be organized. Cast iron from Mohko to be delivered in winter 12 miles direct to Vartsila, in summer – by water ways with several transshipments. Ready goods and part of cast iron from Vartsila to be transported via Janisjarvi to the stock in Oraviniemi, then 19 versts by land to Torpasenranta hithe by Laskela, delivered by barges via Ladoga to Petrokrepost and further via the Neva to Piter or Kronshtadt*."[10]

[9] Мустелин О. Нильс Людвиг Арппе. Порвоо, 1973.
[10] Мустелин О. Нильс Людвиг Арппе. Порвоо, 1973.

In the 1870-s the production of metal at Vartsila plant increased considerably, the range of products expanded. Vartsila steelworkers learnt to pour smoothing irons, a jour grills for furnaces, fireplaces and gates, different items of arts and crafts and even bells. One of such bells was gifted by a merchant T. Laurikajnen to Ruskeala Protestant church in 1878. There was not enough lake ore and then they started to bring ready cast iron from Mohko plant that was also owned by the Arppes family.

A new wooden church under the project of Paul Hendunen was built in Vartsila, in front of the plant, in 1887; and it stayed until 1941. In 1992 former citizens of Vartsila mounted a Memorial sign on the place of the church, and in 2007 Sortavala Orthodox Parish built there a beautiful church in the name of Bl. Kn. Aleksandr Nevsky, dedicated by Manuil, Metropolitan of Karelia and Petrozavodsk, on September 18, 2010.

Fig. 8. The Church of Bl. Kn. Aleksandr Nevsky

With the death of Klas Ludvig Arppe in 1891 the history of Vartsila Metallurgical Plant as a family enterprise ended. The era of Vartsila stock company started.

In 1891 firm "Aktibolaget N.L. Arppe Anfirgar" became a new owner of Vartsila plant. There were contradictions among the member of the firm, and the shares – by sale – went to the other people not included into the Arppes family.

In 1891–1940 all the managers of Vartsila plant in turn lived in the Arppes' family estate, built in Vartsila in 1858. Around this white house there was a birch park, planted by the hands of Ludvig Arppe.

Vyborg – Sortavala – Joensuu railroad was built in 1894, and the next year the plant was connected to Vartsila station by 4-kilometers railroad.

On July, 20 1894 firm "Vartsila Aktiebolag", authorized fund of which was 1 875 000 markkas, became a new owner of Vartsila plant. During its first administration Mr. F. Helsingius, Mr. K.H. Rencund, S. Sohlberg were selected. Colonel Frederik Sohlberg was appointed the Executive Director, and he made his job very successfully. The plant was an integrated one, and in the beginning of the XX century the final products of processing were wire and nails.

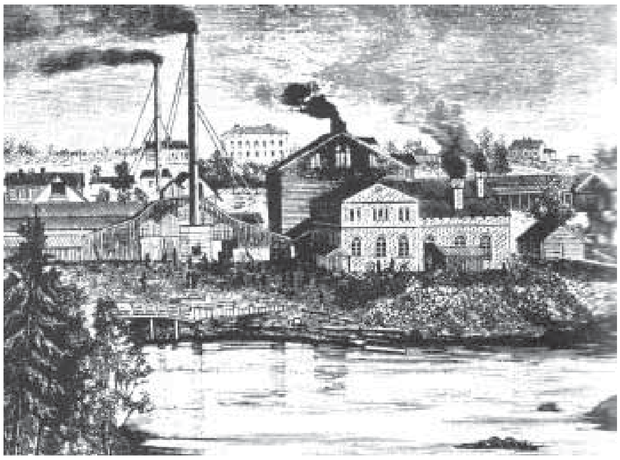


Fig. 9. Vartsila Metallurgical Plant.
End of the XIX century

In the beginning of 1908 the firm changed the name to "Aktiebolaget Vartsila" with authorized fund of 1 500 000 markkas. The same persons as earlier were selected to the Board of the Stock Company.

The second Siemens-Martin furnace was commissioned at Vartsila plant in 1910.

In 1916 Aktiebolaget Vartsila SC bought the main part of the shares of firm "Hamekoski AB" occupied with wood processing, and after that it was decided to increase the authorized fund of the company up to 6 000 000 markkas.

In March 1916, after Colonel Frederik Sohlberg died, an engineer J.T. Lindroos was appointed the Executive Director. An engineer Oskar Fok became the Technical Director of the plant, Uno Mattlar and H. Kreutz von Scheele – the heads of the shops.

1917–1918 working year was difficult for all the Finnish economy and especially for Vartsila plant. During the civil ("liberation") war unrests were at the plant and it caused additional difficulties.

At the beginning of 1919 Vartsila SC bought the shares of firm "Laskela Bruk AB", dealing with sawing production, as well as the rest of the shares of Hamekoski AB. An electric-melting shop and a plywood factory under the name of "Karelia Vuud" started to work in Hamekoski[11].

As early as in September, 1919 settlement Vartsila separated from Tohmajarvi community to become an independent community with the population of 4691 people, the activity of which started from January 1, 1920. Vartsila got the status of village in 1921. Besides, at that time the emblem of the plant and all the community were approved: "black anvil with dark-red fire on it in the silver field". This emblem is still used in the Finnish part of the village.

In the first half of the 1920-s Vartsila metallurgical plant included the following: three Siemens-Martin furnaces with productivity from 11,5 t up to 20 t of steel, rolling, wire, nails shops, melting house and repair shops. From 15 000 to 16 000 tones of metal were melted at the plant annually. The rolling shops manufactured wire, rings, nails and other products and reinforced concrete. 2000 workers operated for the plant.

Later the company divided into smaller ones. Laskela Enterprise (later – paper mill and timber mill) departed, Hamekoski Plywood Factory became independent. Hamekoski electric-melting shop was still the property of Vartsila Metallurgical Plant.

In the spring of 1926 a professional engineer Wilhelm Vahlfors became the Executive Director of Vartsila SC.

An electrolytic-and-galvanic shop was built in Vartsila in 1930.

A great number of specialists (white collar workers) required to administer Vartsila plant and its shops. Besides the Executive Director, the Technical Director, three engineers, head of the office, an accountant, an economist and a forester, almost 20 clerks and a large group of masters and other low-level managers worked at the plant in the beginning of the 1920-s. Besides the plant practiced the agriculture that brought products for the plant workers. The cattle farm completely met the needs of the plant workers in milk.

[11] Экономическая жизнь Приграничной Карелии. Сортавала, 1926.

On August 23, 1936 the Finns opened a monument (bust) to N.L. Arppe near the main office of Vartsila plant. The bust was probably thrown off and remelted in the second half of the 1940-s. But the granite pedestal still stays in Vartsila.

Iron ore for Vartsila Metallurgical Plant from the 1850–1930-s was mined from the bottoms of 50 lakes, located near Tohmajarvi, Kitee, Kiihtelysvaara, Sujstamo, Suojarvi, Ruskeala, Palkjarvi, Uukuniemi, Korpiselka, Ilomansi. A great amount of ore was got from the bottom of shallow bay Kontioleppalahti in the Sothern-Western part of Big Janisjarvi Lake. The ore was roasted on fires, melted in blast furnaces, and then high-quality steel was got from cast iron in Siemens-Martin plant[12].

On the coasts of Small Janisjarvi lake, in Ulonvaara (opposite the present-day camping site "Janisjarvi") and in Kintsiniemi (north from Soanlahti village), "flux stone" (dolomitic marbles), used when melting cast iron, for Vartsila plant was extracted. Dolomite burnt under the temperature of + 1500–1600^0 was also used for facing inside surfaces of Siemens-Martin furnaces.

On the coasts of Small Janisjarvi lake «lining» and building stone (quartzites and granites) were also quarried. You can still see there awash and forested stone quarries.

Dolomitic stone quarry on cape Kintsiniemi in the eastern part of Small Janisjarvi lake worked from 1850 till the end of the 1930-s, and also, probably, in the 1946–1950-s. The stratum of rose-pink-and-grey, yellowish-and-grayish-brown marbleized and quartz bearing dolomites of Pjalozero level of the upper Jatulian (about 2 mlrd. years), with the height of up to 8 m, was exploited there.

The working was driven in the precipice of the mountain range of the north-western course, with height up to 20–25 m above the lake level, and has the form of fosse, 200 m long, 10–20 m width and from 15 to 30 m depth, the central part of which was filled with block masses.

This is the place where you can come up to upright, here and there with "negative" grade, barings of the quarry and study the geologic cross-section.

[12] Ibid.

Fig. 10. Marble Quarry "Kintsiniemi" in the Central Part, 2007

The rocks spread 310^0 in azimuth and go south-west from the observer at the angle of $20–25^0$ and more. Rose-pink-and-grey dolomitic marbles and overlaying rust-colored malmrocks can be seen in the ledge. On the surface of the malmrocks laminations here and there you can see ripple marks. In the middle part of the section, on the surface of dolomites, there are leather coats and copper pitch ore incrustations. There are a lot of dolomite pieces with lace-doily or rectilinear fibers of hematite in the quarry dumps. In the lower layers of the section you can often meet dolomite sectors with cavities, made by beautiful clear quartz.

North from the quarry, closer to the coast of small Janisjarvi Lake, small dumps of finely broken stone, mainly dolomite, up to 1–2 m height can be seen. Between the coast and the western part of the mine the dumps of stone assume a regular shape and, probably, are the remains of the roads and the bases of some constructions.

West from Kintsiniemi quarry, among trees and bushes, from the ground covered with grass the fragments of some metal items, probably, remains from crushing plant, are visible.

Fig. 11. Marble Quarry "Kintsiniemi" in the Eastern Part, 2007

North from the mine the embankment dumped from stone, 70 m long, 6–8 m width, up to 0,5 m height above the water, goes to the lake. In the past it was used for transporting dolomite for shipping on barges.

About ten workers – people from adjacent villages, Kintsiniemi, Soanlahti and others, – always worked in Kintsiniemi quarry. Mine foremen came from Ruskeala. The stone was produced by drilling-and-blasting way: manually, with the help of hammers and drilling tools holes (blast-holes) were hitched in the rock, filled with gunpowder and blasted. In the first third of the XX century they started to use pressurized air drilling machines. Along the bottom of the quarry and the embankment light narrow-gauge railroad, via which marble was transported manually or on horses, was laid. In the 1930-s marble in the quarry was produced by Kuntsi, Sito Liukkonen, Georgiy Liukkonen, Lauri Haaranen and others.

After the Winter War, on March 13, 1940, Vartsila plant turned out to be on the territory of the Soviet Union. Leaving it, the Finns took away most part of the plant equipment.

In July 1941 the 168th rifle division and the 367th regiment of the 71st rifle division stood on Ristolahti – Vartsila area. The command post of the 367th regiment was located on the outskirts of Vartsila, in the pine wood, near the cemetery.

In the autumn of 1941 the Finns came back to Vartsila, began to restore the plant.

Probably, in the times of the Finns, in 1941–1944 an ammunition factory worked in Vartsila. A prison camp was organized in the village.

According to the agreement dated September 19, 1944, two thirds of the territory of Vartsila community came over to the USSR, including the biggest part of Vartsila village, railway station and the plant itself. The plant equipment was dismantled and taken out to Finland.

The restoration of work of the housing facilities and the power plant with 300 kW capacity in Ruskeala village, from which Vartsila metallurgical plant at the first got the energy for lightning the plant and the village, started. The state allocated a huge amount of money for the restoration of metallurgical production in Vartsila – 20 333,4 thousand rubles. The Council of Ministers of the USSR put Vartsila plant staff to the task of restoring the plant without reconstruction, in the condition it was before the war[13].

By the end of 1945 8350 m^2 of residential space were restored in Vartsila. A club-house appeared. A school for 85 children was opened in a two-storey house. A kindergarten was built. A bread-baking plant producing 3 tons of bread per day worked. Two canteens, a bath-house, a laundry, a hairdressing saloon, a hospital, shops appeared. Subsidiary holding – hot-houses and greenhouses – was organized.

Designed capacities of Vartsila plant were set in 1945: 25 000 t of steel with simultaneous operation of two furnaces; 20 500 t of rolled steel, 4 000 t of electrodes. But these capacities were reached only in 1951–1952.

In the 4th quarter of 1945 Vartsila metallurgical plant was transferred from the system of private metallurgy under the supervision of the Ministry of the Internal Affairs of the USSR.

Starting from 1945 S.G. Naryshkin worked at Vartsila plant. He was born in the family of metallurgist in Dnepropetrovsk, finished Dnepropetrovsk Metallurgical Institute, in 1941–1944 fought at the Leningrad front. In 1945–1949 S.G. Naryshkin worked out the project and managed the restoration of Siemens-Martin plant, then during two years was occupied with the reconstruction of furnaces. Later he became the honored metallurgist of the USSR, Chief Engineer Deputy, the Director of the plant, the Cavalier of the two Orders of the Red Banner of Labor.

From 1945 Petr Vasilievich Hilko also worked at the plant in Vartsila, he started from the post of the head of the rolling plant. He was born in the family of the worker of Dnepropetrovsk metallurgical plant. In 1926 he finished Dnepropetrovsk Metallurgical Institute, from 1930 worked in Magnitogorsk, in the beginning of the 1930-s was on work travels in Germany, Italy, France, England, then worked at Norilsk plant. From 1953 till 1960 P.V. Hilko was the Head of Technical Department, Chief Engineer of Vartsila plant, the Director of the plant. From the beginning of the 1960-s he was transferred as a chief rollerman to Cherepovets Metallurgical Plant, in 1960–1962 he worked as the Head of Technical Department and Production and Technical Department of the Board of Iron and Steel and Nonferrous Industry in Leningrad and Volgograd Council of National Economy. He took part in designing Cherepovets plant in the 1965–1969-s, was a chief specialist for metallurgy and chemistry of the planning committee of the North-Western economic region. Honored metallurgist of the RSFSR. He was twice rewarded with the Orders of the Red Banner of Labor[14].

More than 1500 people (workers, office workers, technical and engineering employees) worked at Vartsila metallurgical plant in March 1946.

In order to restore the plant a correctional labor camp of the Central Administration of Prison Camps of industrial construction was organized in Vartsila on August 7, 1946. 2300 of prisoners were brought for the work.

The plant produced not only nails, ingots, but also barbed wire.

Equipment, brought for the plant restoration, lied around in a common heap along the railroad. There was no technical documentation to many types of the equipment, including rolling mills. A qualified specialist – metallurgical engineer of the rolling production Petr Vasilievich Hilko – still managed to puzzle out the dismantled details of the rolling mills and the following mills were assembled under hid guidance: "DEMAG", semifinishing mill "600", medium section mill "400". At the same time reheating furnaces for ingots for DEMAG mill and blanks for the shop of bar steel rolled stock and the wire shop were designed and built[15].

[13] Судаков В. Вяртсильский металлургический завод: дела и люди // Красное Знамя, Сортавала, № 142, 1985.

[14] Судаков В. Вяртсильский металлургический завод: дела и люди // Красное Знамя, Сортавала, № 142, 1985.

[15] Судаков В. Вяртсильский металлургический завод: дела и люди // Красное Знамя, Сортавала, № 145, 1985.

A hardware shop, comprised of two departments – wire drawing and nail – started its work in 1946 in Vartsila. The head of the shop was Nikolay Nikolaevich Gromov. He was born in 1926, from 1941 till 1944 fought at the Karelian front.

In the same year a timber mill, providing the production and the construction with sawn wood, was commissioned in Vartsila.

A state plan of the productive-and-financial activity of the plant for 1947 was for the first time made at Vartsila metallurgical plant in the first quarter of 1946. The calculations were made in complicated conditions, as far as there were no documentations and plans, no equipment passports, forms and standards for specific calculation of raw materials, semifinished products, auxiliary materials, fuel, and energy resources. Everything was calculated afresh, and it was a monumental work. The staff of the planning department (the head was V.N. Rajskij) worked 12 – 14 hours per day without days-off.

In 1946 the plant spent 6,3 mln. rubles, given for its restoration.

The first Siemens-Martin furnace on wood-gas fuel was commissioned and the first melting of steel in the amount of 15 t was made at Vartsila metallurgical plant on December 15, 1946. This information can be found in the plant's archives, but it contradicts the other one according to which the commissioning of the furnace was in February, 1947[16].

The restoration of one of the Siemens-Martin furnaces was implemented in January 1947. The temperature in this furnace was increased up to + 750^{0}C and it allowed starting melting the steel.

Under the guidance of the head of the rolling shop V.P. Hilko, in April 1947 semifinishing mill DEMAG and wire mill of the rolling shop were commissioned. 1 066 blanks, 596 t of angle iron, square iron, hexagons and round bars were rolled from Martin ingots at these mills.

The production at Vartsila plant was completely restored in 1947. For that moment (according to the information of the head of the planning department V.N. Karpov) the plant included the following: Martin-Siemens, rolling, hardware, iron-foundry, repair-and-building, electrical repair, railway, boiler-and-installation and power shops; a timber mill; vehicle fleet with 10–12 cars; 40 horses; housing and public utilities; communication service; the department of indent supply; subsidiary holding; 20 hectares of potato field; grasslands. Timber was harvested and it was used for construction materials and gas logs[17].

In 1947 the output of steel (the head of the Martin-Siemens shop Naryshkin Sergey Gavrilovich) was 5 146 t (36 % of the plan), rolled metal – 746 t (10 % of the plan), hardware – 547 t (12 %).

At that very time, with an engineer captain A.D. Konovalov as the head of the plant, the plant was transferred from wood-gas fuel to reduced fuel oil. All oil facilities as a single set were built: reduced oil receiving tanks (3 tanks, 800 t each), transfer heating shop tanks, central and intermediate pump stations, outside and internal shop line, oil steam traced pipelines and so on. Fuel oil came from Uhta. The work of Martin-Siemens furnaces and reheating furnaces of the rolling mill on fuel oil gave positive results[18].

By the end of 1947 the first technical project of Vartsila plant restoration was completely made.

A special furnace group from stone masons and stove-setters was created in Vartsila for the restoration of Martin-Siemens furnaces. They trained on the first furnace and then successfully restored the second Siemens-Martin furnace and reheating furnaces of the rolling shop and transferred them to reduced fuel oil.

There were no own human resources and: no steel melters, no mill rollers, and no hardware specialist. Teaching was right at working places with reading lectures on basic metallurgy.

For 1947 272 people were prepared for work at metallurgical plant, including 76 people – in martin-Siemens shop, 132 – in rolling shop, and 64 – in hardware shop.

But still the plant did not fulfill the plan for 1947. It was related to, first, the fact that there were no scrap yard at the plant and irregular scrap could not be upgraded because of the absence of oxygen. Second, it was not enough electric energy; it supplied from Hamekoski with interruptions, and only 400 kilowatts-hours against the need of 1250–1500 kilowatts-hours.

The plant needed its own source of power supply, and it was given a power train by "Metropilitan-

[16] Судаков В. Вяртсильский металлургический завод: дела и люди // Красное Знамя, Сортавала, № 145, 1985.

[17] Судаков В. П. Вяртсильский металлургический завод. Рукопись, 1985.

[18] Судаков В. Вяртсильский металлургический завод: дела и люди // Красное Знамя, Сортавала, № 145, 1985.

Vickers" company, that was commissioned only in March 1948. As back as 1944 the English – as help to the USSR – brought to Murmansk their power train "Vickers" № 941 with 2,5 thousands kilowatts-hours capacity. It worked in Murmansk port till 1948 and then it was transported to Vartsila, where continued working till 1958, after that it was changed by the home made one[19].

The year of 1948 was hard for Vartsila metallurgical plant. The Head of the plant Konovalov A.D. put the tasks: to finally transfer all the furnaces to oil fuel, to commission the power train, to built and commission an oxygen plant and so on.

Still there was no scrap yard and regular furnace charge what restrained the smooth work of Siemens-Martin furnace specialists and rollermen because of the absence of ingots. The condition of crane equipment was unsatisfied due to worn-out state of electric motors.

Nevertheless the plan of 1948 was fulfilled in basic indicators: ingots – 5 560 t (105 %), rolled metal – 759 t (147 %, 723 % by 1947), rod iron – 1 382 t (79 %, 874 % by 1947). The plant also produced nails, wire, electrodes, cast-iron castings, bundling chains[20].

A new Siemens-Martin shop was commissioned on May 1, 1948. 1 255 t of ingots (139 % of the norm) were melted in May, 1 003 t – in June. Steel output from 1 m^2 of furnace seat was 3,72 t in May and 3,87 t in June against the plan of 2,71 t.

When the first furnace went for repair and the second furnace started to work and also because the stocks of regular furnace charge ran out, the Siemens-Martin shop failed to implement the plan systematically. The absence of needed raw materials restrained the work. There was irregular furnace charge, but it was very hard to handle it. Therefore they were forced to load a considerable amount of chip scrap, light scrap and other imperfect wastes into the furnaces, and it decreased the output of good ingots, trailed out melting, increased fuel consumption.

Disruption supplies of bricks caused the increase of interchangeable equipment use –mould boxes and casting bottoms.

The total duration of melting was 10 hours but steel melters under good conditions provided flash meltings of 6,5–7 hours.

Bad quality of received steel-making pig irons was an obstacle, they often were with different compositions.

Local Janisjarvi marble ("flux"), that contained increased amount of earth silicon and demanded preliminary burning, was used when melting. But there was no burning and it led to increased use of dead-burned magnesite grain.

Starting from March, 1948, after the power train was commissioned, a rolling shop started to work at Vartsila plant ("DEMAG", wire "285" and small-section "305" mills). In general, for 1948 the plan of marketable products was 200 % over-fulfilled. The mills were worn-out and the plant workers made their capital repair by themselves[21].

Plan of rolled steel output for the hardware shop was frustrated. Turnover of employees was very high at this production facility (411 people came, 550 people left).

In 1948 the foundry shop put into production the casting of good-quality mould boxes and permanent-mold casting. But in general the foundry did not fulfill the plan of 1948.

In 1949 the hardware shop over-fulfilled its production program despite the fact that wire drawing and nails-making equipment stood idle. Here also was excess consumption of metal and technological materials (sulfuric acid, lime, filters).

Electromechanical department was actively restoring the plant. For that purpose the following work were done at the plant: restoration and installation of 5-tons cleaning crane of ingot-casting bay in the Siemens-Martin shop, building of oxygen plant, installation of 4 wire mills and metal-working machines, gun carriage "Nils" for treating DEMAG roll, a Scotch boiler. All the equipment was commissioned on time. Even the absence of centralized supplies of fasteners, fittings, needed steel grades, and other equipment did not prevent it[22].

Wall newspaper "Metallurg" (chief editor V. Dojnikov) started to be published in Vartsila from 1949.

[19] Судаков В. П. Вяртсильский металлургический завод. Рукопись, 1985.

[20] Судаков В. Вяртсильский металлургический завод: дела и люди // Красное Знамя, Сортавала, № 145, 1985.

[21] Судаков В. Вяртсильский металлургический завод: дела и люди // Красное Знамя, Сортавала, № 194, 1985.

[22] Судаков В. П. Вяртсильский металлургический завод. Рукопись, 1985.

Mainly young people (more than 50 %) worked at Vartsila metallurgical plant. There was a drama club. Sport society "Metallurg" was organized, sport base (skis, skates) was opened. The first in the district circle of swordsmen (leader – V.L. Zajfman) started its work with the club.

Automobile customs crossing point Vartsila at the Finnish-Soviet border was opened in 1949.

General plan of the plant development was elaborated at the end of 1949. The following designed capacity of the plant was defined: ingots – 30 thousand t, rolled metal – 15 thousand t, rod iron – 10 thousand t, hardware – 9 thousand t. But the real figures were lower: in 1949 the output of ingots was 15,98 thous. t, semi-finished products and regular rolled steel – 1,86 thous. t, nails – 1,33 thous. t[23].

On August 21, 1949, Nikolay Dmitrievich Karpov came to Vartsila for work, later he became the Head of the Siemens-Martin shop, and then – a famous metallurgist of the country, a Hero of socialist labor.

By the end of the 1940-s the following buildings were built in Vartsila: school for 85 children in a 2-storey building, a kindergarten, a bread-baking plant producing up to 3 t of bread per day, hospital for 35 places, two shops. Shops and school were connected to centralized heating. Lighting appeared in the streets.

By October 1950 steel melters A. Podoprikhin and Makhail Voronov made a flash melting (the head of the Siemens-Martin shop – Knyazkov). The shift of foreman N.D. Karpov was famous for their performances. On October 8, 1950 this shift made a flash melting for 5 hours 15 minutes against the norm of 9 hours! From that time the competition of "fast workers" began.

In 1951 the output of Vartsila plant was: 26 044 t of ingots, 109 t of wire, 2391 t of nails, 174 t of electrodes, 4,9 t of clamps. Compare to 1949 the prime cost of the products decreased: ingots – 1,5 times, blanks – 15–20 %. The plant started to reach the project capacity[24].

In 1952 under the guidance of the chief foreman N.D. Karpov the furnace burners were remade and the productivity of the Siemens-Martin furnaces 50 % increased and the time of meltings decreased.

In April 1952 Vartsila steel melters made flash meltings for 5–6 hours against the planned 7 hours and 30 minutes. Then a record of melting was gained – 4 hours and 45 minutes. A. Podoprikhin, V. Fadin, steel melter Aleksey Sijtyagjaev, his helper Rossalenko became the foremost workers. Nikolay Dmitrievich Karpov was appointed the head of the hardware shop.

In 1952 the output of Vartsila metallurgical plant was: 30,37 thous. t of ingots, 3,38 thous. t of blanks and rolled metal, 3,17 thous. t of nails and it was approximately twice as much as in 1949.

Construction of railroad bridge across the Janisjoki River started in 1953, the installation of crane with magnetic holding plate for faster unloading and handling of scrap was going on.

In April, 1953 Vartsila plant was transferred from the control of the USSR Ministry of Internal Affairs to the control of the Ministry of Iron and Steel Industry. Due to the lack of workers and technical and engineering employees the plant actually stopped its work[25].

In May 1953 the plant was manned up at the expense of Siemens-Martin and rolling production specialists sent from the plants of Ural, Siberia, and southern Russia as well as at the expense of the graduates from workschools. 297 people came to the plant in May, 590 – in August, 844 – in December[26].

There was a catastrophic lack of residential space in Vartsila village. There was a need to urgently increase the living space in the village from 6,8 to 56,2 tous. m^2. Then they started to rearrange barracks for residential space. Major construction works began.

Construction trust "Sevzapaluminiy" with its main base in Volkhov conducted major construction works in Vartsila in 1953–1956. But the facilities of this organization were not used in full force. In order to settle the builders temporary constructions and carcass barracks were built. Prefab houses produced in Finland were also built in the village. Permanent type buildings for the kindergarten, the nursery and residential space with heating, water-supply and

[23] Судаков В. Вяртсильский металлургический завод: дела и люди // Красное Знамя, Сортавала, № 195, 1985.

[24] Судаков В. П. Вяртсильский металлургический завод. Рукопись, 1985.

[25] Судаков В. Вяртсильский металлургический завод: дела и люди // Красное Знамя, Сортавала, № 196, 1985.

[26] Судаков В. П. Вяртсильский металлургический завод. Рукопись, 1985.

sewage systems started to appear. A boiler station, pump station, temporary waste treatment facilities were being built. A new street of one-flat houses (75 houses) appeared in Vartsila. A 8-flat slag-concrete house was built in the center of the village, and a similar one – at Lenina Street. The construction of a kindergarten for 120 places started[27].

New workers at the plant – the graduates from workschools – did not have working skills. Therefore at first there were a lot of violations of rules of safety regulations. The plan of 1953 for the output of different products was only 27–50 % fulfilled.

An evening school and the course of advanced studies worked with the plant.

From October 5, 1953 Vladimir Nikolaevich Troynitsky became the construction manager at Vartsila plant, before he worked as the head of Capital Building Department at Magnitogorsk Complete Feed Plant and Director Deputy for Capital Building of Beloretck plant[28].

The plan of 1954 was only 46,7 % fulfilled as only one Siemens-Martin furnace worked.

In 1954 in the neighborhood of Vartsila village, on the coast of Maloe Janisjarvi lake a pioneer camp appeared, and during only the first shift 63 schoolchildren – the metallurgists' children – came. This camp named "Kosmodrom" after 1961 when Yuriy Gagarin flew to the space.

The plant of the next, 1955, year was 105 % fulfilled by Vartsila plant. During the same year 3000 m^2 of residential space were built, but still there was lack of flats in order to attract qualified labor power. The hardware shop workers (the head – N.D. Karpov) got new equipment – drawing machines "Kratos" and nail-making machines GP-2[29].

There were still many production engineering problems left at Vartsila plant. Thus, wagons were rolled to the furnaces manually, the electric locomotive stood idle, steam was of low quality, and furnace charge was separated slowly, what forced to produce steel without brand.

In 1956 two frame cranes were installed in the mechanical repair shop, two 20 m^3 compressors for spraying fuel oil with air (instead of steam spraying), energetic pump B-400 and other mechanisms – in pickling department. 94 new workers were taught and 313 people upgraded their skills.

The task was completely fulfilled concerning all the parameters. But still the plant's capacities were not use in full force: Siemens-Martin shop – to 55,6 %, machine "600" – to 62,7 %, wire drawing department – to 72 %, nail presses – to 67 %. The scrap yard and crane equipment did not allow working two furnaces at the same time. The third furnace needed a new chimney[30].

875 workers and 175 technical and engineering employees and office workers, 27 young engineers and technicians worked at Vartsila plant in 1956.

The movement of multi-tasking machine operators was starting up: nailer I. Sadyrin worked at 4 machines at the same time and his mate V. Grigoriev – also. Each of them made 2 t of nails during one shift.

The Siemens-Martin furnace was equipped with automatic controllers. Vartsila plant workers competed with the staff of Ruskeala Marble-and-Lime Plant in ahead-of-schedule implementation of the plan of 2 years and the sixth five-year plan.

A bronze monument to V.I. Lenin appeared in the square in front of the entrance office in 1957. Here, in the square, meetings of the workers were held.

Fig. 12. A bronze Monument to V.I. Lenin Appeared in the Square in Front of the Entrance Office in 1957

In the same year the residential areas of Vartsila village increased at 1226 m^2. Young specialists were provided with residential space first of all. Many streets of Vartsila were lightened. Canalization was made in the village, water-supply – on the streets

[27] Судаков В. Вяртсильский металлургический завод: дела и люди // Красное Знамя, Сортавала, № 197, 1985.

[28] Судаков В. П. Вяртсильский металлургический завод. Рукопись, 1985.

[29] Судаков В. Вяртсильский металлургический завод: дела и люди // Красное Знамя, Сортавала, № 197, 1985.

[30] Судаков В. Вяртсильский металлургический завод: дела и люди // Красное Знамя, Сортавала, № 198, 1985.

Novaya and Zavodskaya. Enclosed bus stop was built. Four bridges were constructed over the channels and streams of Vartsila village.

In 1958 a new home-made power-train B-400 from Bryansk, with 5 thous. kWh capacity was installed at the plant; it worked until the 1960-s.

A team of steel-melter Abdakyr Seityagjyaev started to use an innovation – steel deoxidation not in the furnace, but in the ladle, what decreased the time of cooking, saved expensive manganesian iron and made 65 % of all the melting is the shop flash ones. A. Seityagjyaev was awarded the Order of the Red Banner of Labor for high working performances by November 7, 1958. Steel-melter V. Fadin and foreman A. Podoprikhin got the titles of "honorable metallurgist".

Ivan Kuzmich Sadyrin, foreman Arkadiy Ivanovich Poperekov became the best nailers of that year at the plant. They suggested producing nails at semi-automatic machine GP-2, working with the speed of 500 strokes per minute. Nikolay Porfirievich Desnitskiy was the Head of the Hardware Shop at that time.

From 1954 to 1958 the output of gross products at the plant 1,5 times increased, of hardware – 5,7 times, productivity – 57 % increased, the prime cost was 5–10 % decreasing annually.

In 1958 the staff of Vartsila Metallurgical Plant was awarded the Red Challenge Banner and cash bonus of Karelian Council of National Economy. Certificates of appreciation were given to the head of the Siemens-Martin shop N.D. Karpov, the foreman of mechanics V.L. Kolyvanov, the head of shift N. Mugotasimov, the head of the foundry V.A. Panov, the chief foreman of the Siemens-Martin shop A.I. Podoprikhin, wire-drawer N.Y. Urban[31].

81 457 m^2 of woven wire screen were produced at Vartsila plant. That was the start of screen department of steel-wire (then – hardware) shop, with rolling capacity of 1,6 mln. m^2 of screen per year; it was used for constructions areas and state fur farms of the country.

In 4 years, in 1962, industrial training of schoolchildren was organized at the plant. Then for that purpose a shop with ten machines and twenty working benches was built.

The reconstruction of out-of-date hardware shop started in 1963. Youth design bureau played a main role in this work.

More than 40 % of women – laboratory assistants, crane operators, quality engineers, screen makers – worked at the plat by 1964. Screen makers worked at 14 machines. Now wire was cut not manually, as earlier, 4500 times for a shift, but with pneumatic cutters.

The products of the plant was still of a good quality, however the customers sometimes noted soft spots and expressed their wishes on improving the quality. Murmansk DSK wrote: "We have been getting products from Vartsila for four years. This is our only responsible supplier."[32]

Automatic control for Siemens-Martin furnace was being introduced in 1964. Then Cejtlin V.B. worked as a chief power engineer of the plant.

Nikolay Porfirievich Desnitskiy, the director of Vartsila plant, retired approximately in 1964. Sergey Gavrilovich Naryshkin, working since 1945 first that head of the Siemens-Martin shop, then the head of the planning department, became a new director.

Vartsila metallurgical plant was further developing in 1965–1966. The volume of gross output was 3,8 mln. rubles. Steel output reached 40,4 thous. t, rolled metal – 34,2 thous. t, hardware – 34,3 thous. t. The prime cost of products decreased[33].

Reconstruction of the plant was implemented during these years: wire netting and weaving department was organized, nail-making area was improved (up to 13000 t of nails per year), the construction of nails stock was completed, drawing benches were additionally equipped (up to 40000 t of wire per year), two conveyor galleries, a canteen, a central stock were built, maintenance shop was widened.

However the plant could not realize all the planned measures because of limited finances for capital construction. Thus, the construction of a net stock and the reconstruction of net-finishing department in the wire netting and weaving department were not completed; in nail-making department the works on packing area and nails stock were not finished. Due to

[31] Судаков В. Вяртсильский металлургический завод: дела и люди // Красное Знамя, Сортавала, № 199, 1985.

[32] Судаков В. Вяртсильский металлургический завод: дела и люди // Красное Знамя, Сортавала, № 8, 1985.

[33] Судаков В. П. Вяртсильский металлургический завод. Рукопись, 1985.

the lack of money it was impossible to purchase one more, tenth, drawing bench as the plan required[34].

Vartsila village was being built actually only at the expenses granted for the development of the plant itself. By 1966 Vartsila was lacking 24 thous. m^2 of residential area, a school, a kindergarten for 280 places, a bath-house, a laundry, a hospital, and a canteen. A new water pump station and a sanitary sewer system with treatment facilities were needed.

But still the metallurgists worked very well. The volume of gross output compare to the previous years increased by several times.

The number of workers at the plant was also increased: from 968 people (1945–1950) to 1126 (1955–1960).

The melting of steel at Vartsila plant stopped on October 15, 1966 because of low profitability. The Siemens-Martin furnaces were stopped. Only rolling and steel-wire shops remained.

In this concern "Giprometiz" institute elaborated the project of the plant reconstruction in March, 1967. According to the project the plant was supposed to output 65 thous. t of hardware products (nails and nets) per year, and it was so in practice.

It was also planned to arrange zinc plating of wire for metal net. It was supposed to open a shop producing chains from high-resistance steel for timber-rafting with the capacity of up to 10 thous. t.

During 1967–1969 the production of rolled blanks was liquidated, planned-lossmaking output of rolled steel was decreased, and the growth of hardware products production was ensured at the expanse of the rolled steel brought from Cherepovets plant in big coils.

The drawing benches were almost completely updated in steel-wire (hardware) shop, nail-making production was reconstructed.

After the Siemens-Martin shop was closed, in 1966–1967 many distinguished steel-melters moved to Lipetsk, where a new metallurgical plant started its work (Novo-Lipetsk Plant), further named after V.A. Andropov.

The reconstructed Vartsila hardware plant fulfilled the plan of 1969 on salable production in time; the prime costs was 2,1 % decreased, the productivity was 7 % increased.

After the liquidation of the Siemens-Martin shop only foundry, where the capacity of the only cupola furnace was 4 t of cast-iron per hour, worked at the plant. At the start this shop stood idle, and then it began to fulfill the orders from Magnitogorsk, Leningrad, Saratov, Zaporozhye, and it produced mainly moulds. The initial raw material was billet 80x80 mm. The billet was cut with thermal cutting, heated in plasma furnace up to $1200–1250^0$ and in hot state rolled at the wire mill.

Fig. 13. In the Foundry of Vartsila Plant. The 1970-s

From 1972 Vartsila metallurgists started to export products – to Guinea, Kuwait, Togo. In the same year rods from carbon steel were sent to different cities of the country: Ryazan, Rostov, Voronezh, Kiev, Sverdlovsk, Ulyanovsk, Rovno, as well as to Estonia, Mari Autonomous Soviet Socialist Republic and to the North Caucasus. In 1972 there were 11 "honorable metallurgists of the USSR" at Vartsila plant. The Director S.G. Naryshkin was awarded the title of "the Honored Worker of the National Economy of the KASSR"[35].

By 1975 the number of countries to which products from Vartsila were supplied increased: Africa, Arabian countries, Poland…

A 100-flat house with three built-in shops was built in Vartsila village.

The workers of the net shop produced nets that mainly came to the cities where metropolitan railway was being built. This team became the winner of the Watch "30 years of the Victory – 30 shock weeks".

In a new five-year plan it was supposed to increase the output of the products by 25 % more against

[34] Судаков В. Вяртсильский металлургический завод: дела и люди // Красное Знамя, Сортавала, № 9, 1985.

[35] Судаков В. Вяртсильский металлургический завод: дела и люди // Красное Знамя, Сортавала, № 53, 1985.

1975. Producing for profit was being introduced. B. I. Averin was the Head of the Planning Department.

Vartsila hardware plant became profitable in 1976. For the period of 1970–1975 the volume of output was increased by 50 %, workforce productivity – by 58 %, the production for the amount of 800 thous. rubles was realized above the plan.

Fig. 14. The workers of the Net Shop of Vartsila Hardware Plant. The 1970-s.

In 1979 the production of heavy wire coils was arranged at the plant.

Compare to 1970 the population of Vartsila village was decreased and was 2935 people.

Fig. 15. Vartsila Plant in the 1970-s.

From 1980 the assimilation of novel technology of the output of extended precision group rolled steel was started, it saved the metal. The industrial boiler system was being reconstructed. Trap device for oxide scale, 10 times decreasing the content of oxide scale in waste waters, was built.

The construction of a new hospital was started in Vartsila village. Student construction brigades from Petrozavodsk State University and other universities of the country took part in it.

In 1994 Vartsila hardware plant was transformed into Vartsila Hardware Plant OJSC.

From 2002 the plant became part of a big industrial group "Uglemet-Trading" of the Russian Holding Company Mechel OJSC and got the name of Vartsila Hardware Plant CJSC.

In 2009 as a result of reorganization Vartsila Hardware Plant CJSC, as well as all the metallurgical resources of Mechel Group, was passed under the control of UK Mechel-Stal LLC.

For that moment 390 people worked at the plant[36].

During recent years Vartsila Hardware Plant produce the wide range of metal products (hardware): screws, wire, nails, dowels, hard components, tapping screws, steel mesh grid (with polymeric cover and without it). The products are exported to different countries: Latvia, Lithuania, England, Estonia, Finland, Sweden, Norway, Austria, Belgium, Germany, Italy, France, Hungary, the USA, and Portugal. An approximate annual output of the plant is about 50 thousand tones of hardware products per year.

Steel wire is made by cold drawing method at multiple-component drawing benches by SKET Company. The shop is equipped with thermal devices and the equipment for making polymeric cover. The main type of the raw material is rolled steel of low-carbon steel grades, supplied by Mechel. Types of wire are: universal low-carbon steel wire with diameter of 1,2–6mm, without covering (for making nails, bundling, fences); steel welding wire; low-carbon constructional steel wire with diameter 1,6–6 mm; cold-formed low-carbon steel wire; steel wire with polymeric cover with diameter of 2,8 and 2,5 mm. The products are supplied in coils from 100 to 1500 kg[37].

Tapping screw are manufactured at automatic multistation machines by cold forming method using pressure reduction, without covering, the dimensions are from 3×16 mm to 5×60 mm.

Nails are produced from low-carbon steel wire without heat treatment. The assortment includes common round cross-section nails with cone head with the dimensions from 1,2×20 mm to 6×20 mm; square section nails under the standard of Finland

[36] Металлург.Вяртсиля, № 6, 2009.

[37] Буклет «Вяртсильский метизный завод», Вяртсиля, 2003.

with dimensions from 2,1×50mm to 5,5×200 mm; roofing round nails with flat head with the dimensions from 2×20 mm to 3×40 mm; composition round nails with cone head with 3,5 mm diameter and 40 mm length; special nails under the USA standard (anchor, finishing, of periodic profile for bottom production). Nails can be zinc-plated and without covering.

Steel mesh grids are made with square cells of 15–50 mm from flat spirals at the modern machines, UDAFV model. The material is low-carbon round section wire without heat treatment, without covering and wire covered with different-colored plastic material. Such grids are used for screening materials, fences, heat insulation works. They are supplied is rolls 800–2000 mm width and weighing up to 80 kg.

Now Vartsila Hardware Plant is one of the biggest producers of hardware products in the North-Western region.

Until 2010 the director of Vartsila Hardware Plant was V.G. Kamelin, heading the plant for almost 20 years. S.V. Fedorov, earlier working as the Operational Director, became the new manager.

GEOLOGICAL SITES OF THE NORTHERN LAKE LADOGA AREA (PRILADOZHYE) AS NATURE AND MINING MONUMENTS

O.Б. Lavrov and L.V. Kuleshevich

The tour route, offered under the Mining Road Project, extends dominantly across the northern Lake Ladoga area (Priladozhye), one of Karelia's scenic places where wildlife areas are in harmony with products of human activities. The tour is the opportunity to visit sites of environmental value and mining areas and to learn a lot about the geological structure of the area, various rocks and minerals and mineral production in the past and present. Tourists can visit the following places of interest (Fig. 1).

Fig. 1. Scheme of the route
(red dots indicate places of interest to be visited)

Janisjärvi (a lake and an astrobleme)

Janisjärvi is a big lake (also known as Bolshoe Janisjärvi) located in Northern Priladozhye and intersected by the River Janisjoki. It is part of the Ladoga Lake basin (geographic coordinates of the centre of the lake are 61 59' N, 30 57' E). The Finnish word *Jänisjärvi* means Hare Lake. Its water surface area is 174,9 km², and its total area (with islands) is 176,4 km². There are 43 islands on the lake. Its maximum length is 18,2 km and its width is 15 km. The islands cover an area of 1,5 km². The winding shoreline stretches along the continent for 98 km (123 km with islands). Water volume is 2038 M m³. The lake is oval-shaped and is slightly elongate from north to south. The islands are located along the shores, except for three isolated islands in central Bolshoe Janisjärvi. The hilly rocky shores are are largely covered with forest. Roche moutonee, are occasionally encountered. This French term used for a small elongate protruding knob or hillock of bedrock, so sculptured by a large glacier as to have its long axis oriented in the direction of ice movement. The lake's catchment area is 3650 km².

Water from Lake Maloye Janisjärvi, which is located to north and is no more than 2 m deep, flows along short and narrow Luopussalmi Strait into Bolshoye Janisjärvi.

The lake is also fed by at least 20 rivers and creeks flowing from swamps and lakes. The River Janisjoki, which has many rapids, flows from the southern end of the lake into Lake Ladoga. The B. Janisjärvi lake basin consists of two main depressions located in the northern and southern parts of the lake. The depressions are separated by a narrow underwater ridge with Iso-Selkäsaari, Pieni Selkäsaari and Hopeasaari Islands located in the central part of the lake. The water depth on the ridge is less than 10 m. The depressions extend from NW to SE. The southern depression is the deepest (50 and 57 m). The northern depression is up to 37 m deep. There are also bottom lows (down to 13 m) and ludas (sand or gravel bars), especially abundant in the northwestern part of the lake. Most of the underwater slopes are gently dipping.

The bottom of the littoral zone of the lake consists dominantly of rocky ground, while its offshore area is composed of rocky-sand and sand deposits with iron ore inclusions and ore commisures (on rocky-sand ground). In August, water transparency varies from 2,4 to 3 m. The water is dark-yellow with a slight reddish tint.

You can drive from Värtsilä to Puikkola down to Ruskeala along the western shore of Lake Janisjärvi. The geology of the lake area is well understood and has been described in many publications, but little attention has been given to volcanic rocks uncommon to the region. The first paper in which a new point of view is proposed was written by well-known Finnish geologist Pentti Eskola (1921). Based on Eskola's data and the similarity of Janisjärvi rocks to the impactites of the Lappajärvi (Finland), Min and Dellen (Sweden) astroblemes, M.R. Dens assumed in 1971 that Janisjärvi is also an astrobleme. Note: an astrobleme is a meteoritic crater on the earth surface, and impactite is a rock formed as a result of the strike of a meteorite against the earth surface. This hypothesis has been supported in the 1970s by V.L. Masaitis and V.P. Belov, who proved that the Janisjärvi structure displays all the characteristics of a highly eroded meteoritic crater or an astrobleme. The K-Ar age of the Bolshoi Janisjärvi impactites is estimated at 770 Ma. A target for the crater was provided by the metamorphic rocks of the Naatselkä and Pälkjärvi suites of the Lower Proterozoic Ladoga series represented by quartz-biotite schist, arkoses, andalusite-cordierite schist and other schists. The schists occasionally contain muscovite, staurolite, garnet and plagioclase.

Impactites are exposed on the small islands in the centre of the lake and on Point Leppäniemi, on the west shore of the lake. Brecciated rocks are encountered on the shore southwest of Point Leppäniemi and on Hopesaari Island. The main varieties of impactites are called suevite and tagamite. These unusual vitreous rocks occur on Pieni Iso-Selkäsaari and Hopasaari Islands and on Point Leppäniemi. Individual tagamite boulders are occasionally encountered on the pebbly southeastern shore of the lake.

Old and new Kaalamo quarries

Kaalamo is a small rural town in the Sortavala District, West Karelia, and a railway station located at the 287,4 km between Rytty and Matkaselkä. Kaalamo lies 12 km from the Finnish border. The historical record of Kaalamo is meagre. The Finnish word "Kahlaamo" means "shallow river zone".

a

b

c

Fig. 2. Old Kaalamo quarry with an excavator (a) and rock types: diorite-gabbro contact (b), pyroxenite (c)

The Kaalamo pyroxenite-gabbro-diorite massif was being mined by Finnish mining companies from the late 19th century to the late 1930s. There, the Finns quarried mainly pavement material, ballast crushed stone and small amounts of big easily polished monoliths, up to several metres in size.

The big differentiated Kaalamo massif near Kaalamo Town, composed of pyroxenite, gabbro and diorite, is best-known. It combines 19 satellites formed at ca.1,89 Ga.

Gabbro-diorite and diorite are the most durable rock varieties that constitute the massif, but coarse-grained pyroxenite with yellow chalcopyrite (copper sulphide) pockets is most impressive. The rocks host sulphide mineralization and were exhumed by a later magma phase from a great depth. They now occur as xenoliths (fragments of dark greenish-black coarse-grained rocks) in gabbro-diorite.

Mining history. The first big quarry near Kaalamo Town was opened by the Finns. It was in operation before the war but was then abandoned and flooded. On aerial photographs you can see an old excavator in the centre of this artificial lake (Fig. 2) which looks like an exotic monster. The basements and blocks of some buildings and bridges in Northern Priladozhye are made of Kaalamo gabbro-diorite.

Nowadays, the Kaalamo Mining Company (Karelprirodresurs OJSC) is running four quarries using modern sophisticated Metso Minerals equipment (information from a website). Its annual production efficiency is 1,5 M tons of high-quality crushed stone, and its reserves are expected to last for 50 years. Karelprirodresurs has won the Roads of Russia tender and is a leader in building stone production. The high-quality crushed stone produced by the company is used for crushed stone-asphalt roadbed and for repairing the St.Petersburg–Sortavala – Pryazha–Petrozavodsk highway (Blue Road). Crushed stone from Northern Priladozye is also transported to other regions of Russia: 60 % of the products are used for highway construction, 30 % for railway construction and 10 % for civil and industrial engineering.

Ruskeala

Ruskeala is a town in the Kaalamo rural community, Sortavala District, Karelia. The Finnish word “ruskeala” is translated as “brown”. Ruskeala is located on the bank of the River Tohmajoki. The Sortavala-Värtsilä highway extends across the town which is 25 km from Sortavala. One of Ruskeala’s attractions is a new Lutheran church built on a hill near an old one. Its interior is decorated with Ruskeala marble. The main place of interest in Ruskeala is a former marble quarry, Ruskeala Canyon, now filled with water, where Ruskeala Highland Park has been established (http://ruskeala.info/park).

Note: marble is a metamorphic rock of carbonate composition. It consists of calcite $CaCO_3$, dolomite (Ca, Mg)$[CO_3]$2, or both carbonate-class minerals. The rock commonly displays a fine- to medium-grained structure and a massive, banded or foliated texture (often owing to primary bedding), sometimes with various natural ornaments.

It has unusual ornamental properties associated with the presence of some other minerals and indicated by variations in marble colour. As marble has a low hardness, it is easily polished and is durable and weather-resistant. No wonder it has been used in architecture since times immemorial.

Mining history. In the late 17th century the Swedes, who then owned the land at Ruskeala, opened the first quarries to produce marble. According to various sources, quarrying at Ruskeala began in 1765–1768. In 1766, Samuel Alopeus drew the attention of the Russian authorities to local marble. In 1768, Catherine II signed the Act “On marble production for the construction of the Isaac Cathedral”. Since then, Ruskeala quarries began to produce stone for decorating palaces and temples, primarily the Isaac Cathedral in Russia’s capital. In 1768–1854, marble production at Ruskeala was booming.

There were two periods in the application of Ruskeala marble. In 1765–1854, it was used as ornamental and facing stone to decorate buildings in St.Petersburg and tzar’s country residences, while in 1854–1930 it was used for building and industrial lime, crushed stone and fine-grained decorative marble production. Since 1898, the marble deposit was rented by the Finns, but they also used crushed marble. Some buildings in Helsinki and Sortavala are faced with Ruskeala marble.

In the Soviet Union, marble production was resumed, but by the 1970s large-scale operations were terminated because the rock was found to be fractured. However, Ruskeala marble was used as facing stone to decorate Leningrad underground stations and was converted to lime and crushed stone at a plant near the main quarry.

Ruskeala marble was used to decorate the most beautiful and significant buildings in St.Petersburg and palaces in its suburbs, e.g. the Isaac Cathedral. The floor of the Kazan Cathedral, the window-sills of the Hermitage, the window frames of the Marble Palace, the façade of Mikhailov's Castle and Primorskaya and Ladozhskaya Stations of the St.petersburg underground are made of marble. Ruskeala marble was used for the construction of palaces in Pushkin, Pavlovsk and Strelna.

Note. Six dimension stone deposits and eight occurrences of carbonate composition (marble) that can be used for facing slab production are known in Karelia (Mineral resources of the Republic of Karelia. Petrozavodsk. Karelia. 2006). Facing stone is expected to meet strict technological requirements: microfractures in stone blocks are unacceptable. A block is expected to display one colour or to be ornamental. Ruskeala marble is commonly grey (light-, dark- or greenish-grey, Fig. 2). Colour is associated with small inclusions of black carbonaceous substance and the presence of such minerals as tremolite-actinolite, sometimes serpentine and epidote and lesser quartz or diopside. Ruskeala marble is used as facing stone, crushed stone, raw material for rock milk production and filler in composite materials.

Only one deposit, Ruskeala-1, with reserves of 14,4 M m^3 and C_2-reserves of 20,6 M m^3 has been developed for quarrying in the past few years (in 2007) (Mineral resources of Karelia, 2006). Rock and facing slab samples are exhibited in the Museum of Precambrian Geology at the Institute of Geology, Karelian Research Centre, RAS, Petrozavodsk, and in Northern Priladozhye. Welcome to the museum! There, you will learn a lot about the mining history and application of Ruskeala marble.

The Main Ruskeala Quarry (Ruskeala Canyon) extends from north to south for 460 m and is up to 100 m wide. The distance from the highest point of the quarry wall to its bottom is over 50 m. Water transparency is 15–18 m. The greenish colour of the water is produced by the algae that grow on the quarry walls. In the old quarry there is a system of underground workings and galleries connected by vertical mines.

The total length of the workings is several kilometres. Most of them are flooded. It is impossible to pump out the water, and this artificial lake is now used for diving and boating in summer. The quarry has been owned by various countries and nations in the past few centuries. The guides will tell you about the traditions of Swedish, Finnish, Russian and Karelian quarrymen.

The main quarry is surrounded by other quarries; some of them are abandoned, while others are active. They differ not only in shore pattern but also in water colour: one quarry has grey water, another one has sky-blue water and the main one has blue-green water. As quarrying has been terminated, the walls of the quarries are weather-beaten and have turned dark. However, the lumps of marble, lying on the ground here and there, retain their original colour. Stone ornaments are especially impressive in the old "dimension stone" quarry, where large marble blocks were produced. The foot paths around the main quarry are made of fine-grained marble. Visitors can take small grey marble samples or buy souvenirs in a local shop.

Speleologists's websites contain information on the Underground Karelia Project developed by the Speleological Commission of the St.Petersburg Section of the Russian Geographic Society. The main goal of the speleologists is to examine Ruskeala Highland Park and the so-called Ruskeala (Marble) Collapse Structure located near the main hiking trail of the park.

A.Gribushin and A.Artemyev (Director of the Kolmas Karelia Tourist Company), who initiated the founding of Ruskeala Park, noted that the establishment of this 17th-early 20th century open-air museum is a good example of private investment in the cultural heritage. Here, the eternal beauty of the nature is combined with traces of past quarrying. Unfortunately, there are few examples of this kind in today's Russia. *Note:* The establishment of Ruskeala Park was funded by the Kolmas Karelia Tourist Company and was opened for visitors on 19 May, 2005.

(http://ruskeala. info/park)

The River Tohmajoki (waterfall and rocks)

The River Tohmajoki is one of the biggest streams in the northern Lake Ladoga area. The Finnish word "Tohmajoki" means "turbid, muddy river". It flows from Lake Ruskojärvi, Finland, extends across the state border near Matkaselkä Town and flows into Lake Ladoga near Helylä Town. In the upper reaches, Tohmajoki is a small swampy river. Some of the river zones are up to 20–30 m wide. In May, the river is deep and wide. It has many rapids and small falls. Some are classical rocky rapids with chaotic bars, others are steep and local.

Note: waterfalls, rapids and bars are landforms produced by rivers in highlands.

Falls. The River Tohmajoki often forms falls among ca. 7 m high rocky scarps near Ruskeala Town. *Rocks/ rock exposures* are understood as outcrops among various rocks, including marble.

The Ruskeala Falls is the most picturesque waterfall. Its Finnish name is *Ahinkoski* (water-goblin). Ahinkoski consists of four 3–4 m high falls, where the River Tohmajoki overflows to form two separate stream channels (Fig. 3). Ahinkoski Falls is near the highway which connects Russia with Finland (3 km from Ruskeala Town). Local residents sometimes call it Falls Near Three Bridges, because here the winding River Tohmajoki crosses the highway three times. A visitor can watch the Ahinkoski Falls from the highway. There are a parking lot, a rest area with benches, an arbour and a small beach nearby.

a b c d

Fig. 3. The River Tohmajoki (a–b) and Ahinkoski Falls (c–d)

Rymäkoski Falls. In the early 20th century there was a small hydropower plant built by the Finns at the second waterfall on the River Tohmajoki. It supplied the town and local enterprises with electrical power. Nowadays, a visitor can only see a small abandoned concrete bridge and an old tumbledown brick building. Nord Hydro CJSC is going to restore this small power plant. To get to the Rymäkoski Falls, stop 4 km before Ruskeala Town and drive along an inconspicuous forest path toward Rymäkoski Falls. However, you can't drive all the way down to the falls because part of the path is paludified. Therefore, you will have to walk for the last 200 m. However, the falls itself and the ruins of the old power plant are worth seeing. The water flows through the holes in the concrete structure, gains speed and falls from a height of 8 m onto the rocks and the slab. One can see a rainbow in water drops flying high in the air.

Water bars. Upstream, in Ruskeala Town, the River Tohmajoki forms another group of small rapids, so-called bars. *Note: rapids* are 1,5–2 m deep turbulent river reaches with chaotically arranged rocks jutting out of the water.

The Ahinkoski Falls is a major attraction on the River Tohmajoki. Many tourists, travellers and native residents of Karelia come here to enjoy its beauty. A bathing scene from the movie "The sunrise is quiet here" by Stanislav Rostotsky was shot at the Ahinkoski Falls.

In spring and early summer many tourists and nature lovers come here to enjoy rafting and kayak boating. The River Tohmajoki is suitable for rafting because a visitor slides down the quiet stream over a large distance and then suddenly finds himself surrounded by roaring water. There are about 30 rapids and bars of varied size within a 45–50-km river reach, as noted at tourist websites. The area is extremely beautiful.

Rytty

At the outskirts of Rytty village, which extends across the route, you will see an abandoned farm and a house built by the Finns in the early 20th century. A combination of red brick and "local" stone is rare in the agricultural architecture of the northern Lake Ladoga area (Fig. 4).

A monument to commemorate the Headquarters of the 168th infantry division and the Soviet soldiers, who died in action in 1941, is located nearby. The memorial is made of cement with local stone inclusions and a star-shaped cavity which symbolizes "the extracted heart".

a b c d

Fig. 4. Rytty Town, a Finnish dwelling-house and a farm (a–c) and a memorial to the soldiers who died in action (d)

Kirjavalahti Bay

Kirjavalahti Bay and Kirjavalahti Town are located 15–16 km east of Sortavala. There is a road leading to the scenic shore of Lake Ladoga which looks like a Norwegian fjord. The high rocks of Kirjavalahti form a steep wall which extends into the deep water of the northern bay. On a good sunny day the lake surface shines brightly. Hence its name which is translated as "shining, glittering bay". The bay shores are elevated and the slopes, gently covered by thick forest and bushes, are gently dipping. Reed commonly grows near the shore. Kirjavalahti Bay juts out into the north shore of the lake west of the highest Point Paksuniemi. In front of Kirjavalahti Bay is Pussisaari Island. As the bay is protected against winds of all directions, you will enjoy boating and can safely lie at anchor in any part of the lake. Most of the bay is 15–30 m deep, but near the highway it is only 1–3 m. The water is well heated in summer. While driving along the bay, stop and take a dip into the blue water.

Kirjavalahti Bay and the town on its shore had a different name before. In the Swedish maps published in 1590–1648 the small village built on the north shore of Kirjavalahti Bay is called Orjatlahti, which is translated as "reserved land bay". Kirjavalahti village was already shown on the Russian maps produced in 1721 and 1825 and on the Finnish maps made in the 1900s.

It should be noted, however, that it is not until the 1930s that the road along the rocky north shore of Kirjavalahti Bay was built by the Finns. Until then, there was only a mountain path; walking along the path took a lot of time and effort. Located on the lake shore by the rocks is chemist T.Jaskeläinen's summer cottage.

Chemist T. Jaskeläinen's cottage is also known as ***Sortavala Composers House***. The house was built in 1935 as a summer cottage for the Jaskeläinen family. Since 1947, the cottage and the plot of land were rented by the Composers Union although they were state property. In the 1990s they became the municipal property of the Republic of Karelia. The two-storeyed cottage is now a historical monument. Its walls are made of large boulders (Fig. 5). The cottage is protected by the Karelian Cultural Heritage Conservation Centre as a monument of regional significance and is rented free by the Composers Union. You can book a room here and relax, bathing in the lake and enjoying the beautiful landscape. Some websites apply to potential visitors: "If you wish to come back to the quiet 1960–1970s, then Sortavala Composers House is just what you need. There is no European comfort here, but you will feel a peace of mind enjoying the scenery. In the evening, fire in a stove will keep you warm". And all this will undoubtedly come true!

Many famous composers and painters used to come here. In the 1970s, Boris Alexeyevich Smirnov-Rusetsky stayed in the cottage every summer. He was impressed with the virgin nature, the rocks and the shining water of Kirjavalahti Bay. Here, he created about 200 etude-tableaux that formed the big North and Sortavala Cycles. They are understood as complete pieces of art showing Karelia's nature (Sortavala Cycle. Cardboard, pastel, 25×35. State Oriental Museum, Moscow).

The well-known song "Karelia will long be in your dreams" was created by the composer Kolker and the Poet Kim Ryzhov at Jaskeläinen's cottage on the shore of Kirjavalahti Bay in the summer of 1963. Lydia Clement was the first to sing the song.

Geology. Northern Kirjavalahti Bay is one of the key areas where geologists have developed basic modern regional Precambrian stratigraphy and the general concepts of the modern geological evolution and metallogeny of Svecokarelian rocks in Karelia and the rest of the Fennoscandian Shield.

Sedimentary, sedimentary-volcanic and volcanogenic rocks that formed at 2330–1800 Ma have been subjected to folding, zonal metamorphism and large-scale granitization. Tectonic movements and erosion have exposed the deep layers of various rock complexes and made them easily accessible for study. The basement of the 4,0–4,5 km thick cover is composed of dome-shaped gneiss. Traces of volcanic activity are visible on extensive lava fields that consist of basalt and tuffs produced by old volcanoes. Carbonate rocks also occur. The Ladoga rock series is composed of various metamorphosed sediments (sand and clastic rocks), e.g. arkose, quartzitic sandstone and conglomerates. Numerous granitic and migmatite-granitic domes are scattered over considerable distances. Intrusive rocks, such as gabbro and plagiogranite, form small bodies among them. Commercial minerals are represented by dimension stones (granite, granite gneiss, amphibolite), uranium (Varalahti, Impilahti), molybdenum (Suoenlampi), base metal, graphite and other occurrences.

a

b

Fig. 5. Sortavala Composers House (a–b) on the Kirjavalahti Bay shore.

Information from the newspaper “Ladoga” (6 November, 2009), the journal “Serdobol” (no. 5) and websites.

Läskelä (hydropower plant and waterfall)

Läskelä is a town in the Pitkäranta District, Karelia. The Finnish word “läske” means “farmstead (dwelling)**”**. Another meaning is “river that flows down into a lake”. The town is the administrative centre of the Läskelä rural community with a population of about 3600. There is a railway station at the 17th km of the Janisjärvi-Pitkäranta branch in the Harlu-Välimäki railway section. The North Ladoga Läskelä Paper Plant, a subsidiary of Ascot OJSC, Moscow, is the most significant company in the town. It produces 3100–3300 mm wide paper from pulp for newsprint and wallpaper. The Läskelä Quarrying Company, located nearby, produces crushed stone. Grey granite blocks are used for the construction of houses and streets. One of local attractions is a Lutheran church.

Läskelä was founded in the late 17th century**,** when the first sawmills, supplied with water from Lake Ladoga, were built on the north shore. An impetus to the quarrying industry was provided by the construction of St.Petersburg in the early 18th century. In 1899, Läskelä Pulp Factory was built in the town and a hydropower plant was constructed to supply electrical power to the factory. After the October revolution until 1940 the factory was a Finnish company, but in 1940 it became the property of the Soviet Union under a Soviet-Finnish agreement.

After World War II, in 1945–1946, the factory was restored and put into operation.

In 1999, the Läskelä Paper Factory celebrated its hundredth anniversary. Curiously, the equipment installed at the factory in 1911 is still functioning! Therefore, local residents often call the factory “a working museum” (Fig. 6 a).

***The River* Janisjoki** (“hare river” in Finnish) flows across Finland and Russia. The river is 95 km long. It collects water from an area of 3900 km^2 and flows across the Sortavala and Pitkäranta Districts and large Lake Janisjärvi. The river flows from Lake Aittojärvi, Finland, into Hidenselkä Bay of Lake Ladoga. Janisjoki is one of Karelias’ deepest rivers. Old Finnish towns, such as Hämekoski, Harlu and Läskelä, where small hydropower plants and sawmills were built, are located on the river banks. Elevated rocky banks extend over most of the river length, but toward the mouth they are gently dipping. Before the Läskelä Hydropower Plant dam the river is deep and quiet. The spruce-trees, growing on the bank, are reflected in the water (Fig. 6 b).

The Hydropower Plant in Läskelä on the River Janisjoki was built in the late 19th century. It was restored later and is now in operation. In September 2011, the small Läskelä Hydropower Plant was put into operation by Nord Hydro CJSC. *Note:* Nord Hydro is a managing hydropower-generating company involved in a project on the reconstruction of old power plants and the construction of new ones.

The company is operating in Karelia and many other parts of Russia. It is known from the company’s website that the total design capacity of the hydropower plants on the River Janisjoki, Finland, is 8,0 MWt and that of the power plants in the northern Lake Ladoga area (Hämekoski, Harlu and Läskelä) is 10,48 MWt.

a b c d

Fig. 6. Läskelä: paper plant (a), River Janisjoki (b), waterfall (c), stepwise cascade downstream from the dam (d)

Läskelä Falls (Fig. 6 c) is seen from a car bridge on the main highway which extends across the town, near the hydropower plant.

As there are no buildings on one river bank, you can walk down to the water, climb up a small rock (Fig. 6 d, bedrock exposures), take pictures and watch the roaring stream rolling down the inclined slab. If you walk to the other side of the dam, you will see the smooth surface of the "almost plain river" (Fig. 6 b). The Läskelä Hydropower Plant dam is under a car bridge. The height variation of this spectacular waterfall is about 10 m and the bar is 50 m long. As the River Janisjoki is deep even in the driest years, the waterfall demonstrates its power all year round.

The River Janisjoki is popular with water tourists. It attracts them with its vigour and numerous rapids and bars, tumbledown dams and three operating dams. The main ca. 60 m long bar is located between Janis and Läskelä.

West of the town is the ***Läskelä Quarry*** (owned by the KarelTransNerud Managing Company, OJSC), in which high-quality crushed granite (granite, gneiss granite) is produced as 5–20 mm, 20–40 mm, 40–70 mm and 20–70 mm fractions. The company has up-to-date quarrying equipment, and highly durable crushed stone, produced from gneiss granite, is used in construction. There is also a small sand quarry near the town, in which the layering and deposition sequence of the sand are well-defined. The sand (ballast material) is used in road construction.

Near the Janisjoki River mouth is Mäkisalo Island.

Mäkisalo Island

Linnamäki and the history of Korela tribe settlements. In 1983–1984, Karelian archaeologists studied an old settlement excavated in the Pitkäranta District referred to in a paper by J.Appelgrön as Linnanmäki on Mäkisalop Island and located on Lake Ladoga, 1.5 km from the Janisjoki River mouth.

It is known that the northern Lake Ladoga area was originally colonized by hunting and fishing tribes as early as the Mesolithic epoch, about 8 000 years ago. Settlements were established on the shores of Lake Ladoga. The area was inhabited since the end of the first millennium by an Old Karelian population known as Korela. The Old Korela settlements (shelters), established in the early half of this millennium (altogeher, 24 settlements), are located on the highest selgas and on the shore and skerries of the northern Lake Ladoga area. Many toponyms with the ending "linna" (fortress) have survived. Over 90 Old Karelian fortified settlements are mentioned in J.Appelsgrön's paper published in the late 20th century, while A. M. Talgrön referred to 20 sites in Karelia where fortified structures were erected.

Linnamäki settlement is located in southeastern Mäkisalo Island, on the hilly shore (the word "Linnamäki" means "settlement mountain"). Unlike other known monuments of this type, the Linnamäki defence fortifications are complex and are relatively well-preserved. J. Appelgrön argues that it is the tallest known fortress. The rectangular position of the wall near the main entrance of the settlement suggests that there must have been a tower there, which is not typical of Old Karelian settlements. The constructive characteristics of Linnamäki fortress indicate that Old Karelians used the experience of Novgorod and Pskov in fortification architecture; therefore, the settlement was hardly established earlier than the middle-late 14th century. Linnamäki settlement was only used as a shelter for a short period of time when a military threat was obvious, because there were no buildings and other structures inside and because it could not stand a long siege.

Välimäki (town and deposit)

Välimäki Town is located in the Pitkäranta District. Reference books say that it is a railway station located at the 26th kilometre between Läskelä and Impilahti. It is 1 km from our trail. The Finnish name Velimäki means "hill located between something".

The titanomagnetite ore deposit, which is located there, is also called Velimäki (Mineral resources of the Republic of Karelia. Petrozavodsk. Karelia, 2005). In the 1911 publication "Iron ore of Russia", prepared by the Geological Committee (1911, p. 214), K. I. Bogdanovich spelled the name of the town as Velimeki. It is also described in "Geology of the USSR" (1962).

To get to the Velimäki deposit, where iron ore was quarried over 100 years ago, turn off from the main highway near Impilahti Town (from the road crossing toward a dumping site), walk across the railway and along a forest path. The area is covered with thick forest and unusually tall fern. The cutting area, where there was a narrow-gauge railway before, extends from the quarries toward the Ladoga Lake shore. Walking from the cutting area for several hundred metres along the path, you will soon see ore dumps in the form of pyramids and bars. Workings, ruins of structures and the basement of houses, surrounded by black current bushes, are preserved to this day. Piles of the dismantled railway, used to transport iron ore to Ladoga Lake shore and to load it on barges, are occasionally encountered.

The Velimäki titanomagnetite deposit was discovered by the geologist Holmberg in 1855 and was quarried from 1889 until 1905 by Putilovskoe Joint-Stock Company. Annual production was 10000–12000 tons (Mineral resources of Karelia" (2005). Ore was enriched *in situ* and shipped via Lake Ladoga to the Vidlitsa cast iron smelter and Putolov iron smelter in St.Petersburg.

Note. Titanomagnetite ore is understood as titaniferous iron (magnetite) ore. If the mineral magnetite Fe_3O_4 contains up to 12–20 % Ti, then it is defined as titanomagnetite. Karelia now has 26 iron deposits and 69 iron occurrences:

1 – iron formation (40 locations);

2 – iron ore units in dolomite and schist (6 locations);

3 – phosphorus-iron-titanium (6 locations) in gabbro-anorthosites, gabbroids and pyroxenites of various ages and vanadium-iron-titanium sulphide oxide units in gabbro-dolerite (8 locations);

4 – iron ore units in skarns (1 location);

5 – iron-titanium-vanadium-bearing units in amphibolites and gneiss schists (1 location);

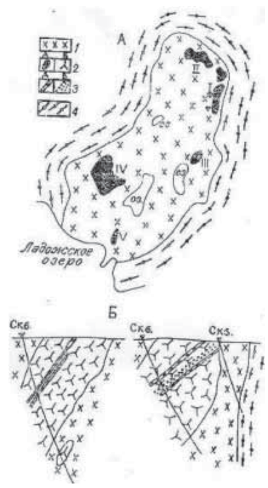
6 – bog ore (33 locations).

Only iron formation deposits, common in West Karelia, e.g. the Kostomuksha iron deposit, are of commercial value.

The Velimäki iron deposit is located on the north shore of Lake Ladoga, 6 km southeast of Läskelä Town. It is known to have been mined since the 19th century by the Putilov Plant JSC. In 1889–1909, ore concentrate was produced at the Vidlitsa cast iron smelter. According to V.A.Obruchev, briquettes with 60–62 % iron were produced from concentrate and cast. Annual ore production was up to 13 000 t.

The deposit is genetically related to the Velimäki intrusive massif (Fig. 7 a), which occurs among Lower Proterozoic Ladoga rocks. The massif is about 1,89 Ga old. It is 3,5 km long and 2,0 km wide and has an oval shape elongated in a northeastern direction It is composed of peridotite, pyroxenite, gabbro-diorite, monzonite and vein rocks of syenite composition. Mineralization is confined to schlieren-like amphibolized pyroxenite bodies occurring mainly at the massif margins. Altogether, five big pyroxenite bodies, so-called ore prospects, were identified: Velimäki I and II, Chupukanmäki, Harkinmäki and Hehkinmäki, where 10 ore bodies in the form of steeply dipping sheets and columns, 180–600 m in length and 40–200 m in width, were delineated. The bodies consist of ilmenite-magnetite-titanomagnetite ore which displays a lenticular-veinlet, commonly disseminated texture and contains the following useful components: up to 22,3 % bulk Fe, up to 6,25 % TiO_2, 0,1–0,61 %, 0,1–0,61 % V_2O and 0,02–/53 % P_2O_5 (Mineral resources of the Republic of Karelia. 2005). The ore was found to contain elevated gold concentrations (up to 0,54 g/t Au) associated with chalcopyrite – yellow-coloured copper sulphide (~0,05 % Cu). The total amount of ore produced is 388 000 t. A small amount of raw ore was used without enrichment for smelting, while the rest of the ore (98,5 %) was enriched using the magnetic separation method, and the iron content of the concentrate was increased to 59,73– 62,48 %. There is no information about the titanium content of the ore produced in the late 19th century.

Prospecting and exploration, conducted in 1951–1954 (Gromova, 1951f), has shown that the Velimäki deposit is of no commercial value because its ore is low-grade and its ore reserves are small. The study of the mineralization by deep drilling has mainly revealed low-grade disseminated ores that contained 5,62 % soluble iron and up to 2,5 % TiO_2. Occurring among them are scarce massive ore interbeds, varying in thickness from several centimeters to 0,6 m, which contain up to 32,29 % soluble iron, 5,29 % TiO_2 and 0,26 % V_2O_5. The predicted complex ore resources of the Velimäki ore occurrence in the delineated area of 204 000 m^2 and to a depth of 200 m are about 130?5 M t and bulk Fe concentration is 15,46 %.



а

б

Fig. 7. Geological scheme of the massif with titanomagnetite ore, after B.A.Yudin (a) and the former quarry of the Velimäki deposit (b)

Impilahti Town (history, Ladoga skerries and rock-climbing)

Impilahti (Karel. *Imbilahti*, Fin. *Impilahti*, Swed. *Impilax*; arch. Rus. *Imbilyahta* or *Impilax,* the word is translated as "girls bay") is a town in the Pitkäranta District, Republic of Karelia (Fig. 8). There was a railway station there (at the 33rd km between Leppäsilta and Velimäki, but it was torn down later. The town is located on the picturesque shore of Impilahti Bay of Lake Ladoga (Fig. 8). Monuments from various epochs, obelisks and old buildings, e.g. a school building (formerly priest's house), are preserved. Practical courses for St.Petersburg University students, majoring in geology, geography and biology, are held nowadays in the school building; in summer, the town is crowded with young people who study the nature and geology of Priladozhye. Impilahti has its own administration, a good infrastructure, a modern sawmill and fish farms. Modern cottages on the bay shore blend in with the beautiful environs. Narrow paths and roads lead to Impilahti Bay.

History of Impilahti. The earliest information about Impilahti dates back from the 16th century. The following residential areas near Impilahti are mentioned in the 1500 census book of the Vodskaya pyatina which describes the Nikolsky Serdobol pogost: "village Imbilaksha on the Inbinsky navolok near Lake Onega in Lahta" (3 farmsteads) in Ostrovskaya perevara; "village Imbilaksha above Lahta(1 farmstead) in Ostrovskaya perevara; "village Gunushkovo on Inbinsky navolok(4 farmsteads) in Arendezhskaya perevara; "village Inbilaksha" (2 farmsteads) in Keresyurskaya perevara; "village on Imbilsky navolok" (4 farmsteads) in Undoyalskaya perevara; "village Inbilaksha near Lake Ladoga in Lahta" (1 farmstead). The first five villages were then owned by a Korela namestnik (provincial governor appointed by the Great Prince). The latter village belonged to the Valaam Monastery. The Impilahti Orthodox parish already existed before 1589. A church was built on Kammonen Hill in Impilahti in the early 17th century. Two churches, one of which was built in village Kitelä in 1686, belonged to the Impilahti community.

In 1617, Impilahti, together with the rest of the Korela uezd (administrative unit), was annexed by Sweden. Swedish rule in the late 17th century was a new period in the history of Impilahti. Poorly educated people of various social groups came from the West. The Swedes brought their concepts of Lutheranism and education. "Attempts were made to learn the people to read, but the stupid people were clearly reluctant to get educated. After a church service the pastor asked them what they had learned, but they wouldn't listen and hurriedly left". After 1680, however, education was spreading, and some people could already read and write. Unfortunately, hard drinking was a stumbling-block on the way to education. Rantusskaya Church was the centre of the Impilahti parish. In 1614, the Impilahti parish was part of Suistamo settlement in 1614 and Suistamo pogost in 1638. In 1643, Impilahti had its own priest, Vasily Ruhkonen. The Orthodox priest and a deacon in Impilahti as early as 1671 were mentioned in the Court Book. At that time they often had to appeal for donations to locals. As farming was not profitable there, the position of the Orthodox parish weakened markedly in the late 17th century.

In 1721, Impilahti was again ceded to Russia under the Nishtadt Peace Treaty. In 1744, it was ceded to the Vyborg province, which became part of the Great Principality of Finland in 1811. In 1870 a school was opened in the town, and in 1873 a sawmill was put into operation.

Since 1917 Impilahti was part of independent Finland. In 1932, the construction of the Läskelä-Pitkäranta railway, which extended along the gorges, was over (Fig. 8 c). The old church has not survived, but we know how it looked like from old photographs and a stone gravure (Fig. 8 e-f).

After the Soviet-Finnish War the town was ceded to the Soviet Union and became part of the Pitkäranta District of the Karelian-Finnish SSR on 9 July, 1940.

The Impilahti volost (administrative unit in Old Russia) marked the boundary of western and eastern traditions in the layout and architecture of rural communities, dwelling-houses and farm outbuildings. For many centuries the older culture, which borrowed some features of the East Karelia building tradition, merged with the culture brought by newcomers, and vice versa. Karelian rural customs gave rise to compact villages built near rivers, lakes and roads. Villages became more scattered under the influence of Savo colonists and began to spread to previously uninhabited areas. In the Impilahti volost (administrative unit), eastern features in the structure of the shoreline of village Koirinoja were obvious as early as the 1930s. The village extended along the bay shore, and the butt-ends of the houses faced the bay – the most significant and typical feature of old villages in East Karelia.

a

b

c

d

e

f

j

h

Fig. 8. Impilahti: environs (a – b, authors' photo); railway (c); priest's house now used as an educational facility for St.Petersburg University students (d); an old church and a memorial sign mounted where Impilahti church was located earlier (photo from website); monuments to the soldiers who died in 1918 (e) and a common grave of the soldiers of the 99th airborne division who died in the Impilahti area in 1944 (f) (authors' photo, A. Bravo)

***A tale of Impilahti Bay**,* where a small Karelian village with the same name is located, resembles the stories told by German romanticists. The well-known researcher A.A.Andreyev, who studied Europe's largest lake in the late 19th century, was the first to retell the tale in his book "Lake Ladoga". The tale says: "Two young people, who passionately fell in love with each other, lived there. The boy was from a poor family, and the girl from a well-off family. The girl's parents thought that the boy was not good enough for their daughter, and they did their best to frustrate the couple's plans to get married. However, the love of the young people was stronger, so the parents decided to take extreme measures." What they did is unknown. An older, poetic version of the legend tells about the ominous witchcraft of Saami shamans (wizards), while a more prosaic, modern version says that the boy was sent to serve in the army. The girl could not do anything about that – she was locked at home. Living apart broke the girl's heart. As Andreyev noted, "the good-looking girl was suffering, wasting away, and one night she escaped, jumped down from a high granite cliff into the lake and turned into *impi*, a fairy-tale creature which looks like a charming water nymph.

Every day, at midnight, she came from the depth, bathed, played around in the water and screamed, as if calling somebody. The echo spread over the area, and the villagers were scared by the terrible sounds. The girl's parents were afflicted by the death of their daughter and soon died, the boy disappeared without a trace, and the bay was named Impilahti.

Like any other researcher, Andreyev interpreted the tale in his own way. He believed that the gloomy, mysterious rocks on the bay shore, full of hidden charm, created a poetical mood. The impi's screaming could be related to either fish, swimming around on a moonlit night, or birds of passage.

However, even these days some people (geologists, tourists and anglers) argue that they saw the impi sitting on a big stone and crying. Go to Impilahti, come at night to the lakeshore, touch the undisturbed, almost primeval nature, and you will probably see that the water nymph is not just a whim of local villagers...

Impilahti Rocks near village Impilahti are well-known to tourists and rock-climbers. Various national youth competitions, rock-climbing championships and combined sporting events have been held here before. Of interest for rock-climbers is a 50 m high vertical red-grey highly fractured rock. It is one of the best areas for active recreation and sport. There are scarps in the left portion of the main rock massif, so that people can climb up safely. The rocks are about 20 m high.

About 1 km from the main massif, next to Impilahti Bay, is Petrovsky Bay. The tremendous vertical cliff extends here deep into the lake. In 1995, several tracks were cut out in the rocks for a national youth championship. The main Impilahti massif, up to 45 m high, has no rock-climbing facilities.

To get to the rocks, walk down the road across village Impilahti. The massif is 3–4 km away, on the left shore of the extensive fjord of Lake Ladoga. First walk past a few dwelling-houses and then along a well-trampled path past a small lake. The walk will take 40–50 minutes. If you walk on and, on reaching the next hill, turn left to a path, you will soon come to Petrovsky Bay to enjoy the beautiful nature and solitude in this quiet place.

a

b

Fig. 9. Rocks in the bays (a – b) popular with rock-climbers (photo from the website http://www.ptz-climbing.ru/resources/4808-original.jpeg)

Impilahti Rocks are indescribably beautiful in any season. Scattered below the rocks are huge boulders. Farther away, you will see a grass meadow and gently sloping rocky ridges – a good place to put up a tent and stay. You will enjoy Impilahti with its pine forest, reed thicket in the warm bay and a large field which turns yellow in early summer as flowers bloom and looks like a multi-coloured mosaic cover in mid-summer.

Leppäsilta (Linnavaara pegmatite quarries)

At the outskirts of Leppäsilta Town, on the opposite side of the main highway, 20 km from Pitkäranta, are the quarries of the ***Linnavaara*** feldspar deposit. Quarrying began there in 1975. There are pegmatite veins in Lower Proterozoic Pitkäranta-suite amphibole-biotite schist and amphibolite. The rocks generally strike approximately N–S and dip east. The biggest North Vein, over 400 m long and up to 75 m thick, consists of differentiated pegmatite which contains 5 to 25 % (average 14 %) of microcline varieties (Mineral resources of the Republic of Karelia. Petrozavodsk. Karelia. 2006). In addition to feldspar and quartz, pegmatite contains considerable amounts of fine-squamosed mica, tourmaline, garnet and tantalite-columbite mineralization. Beryl is occasionally encountered.

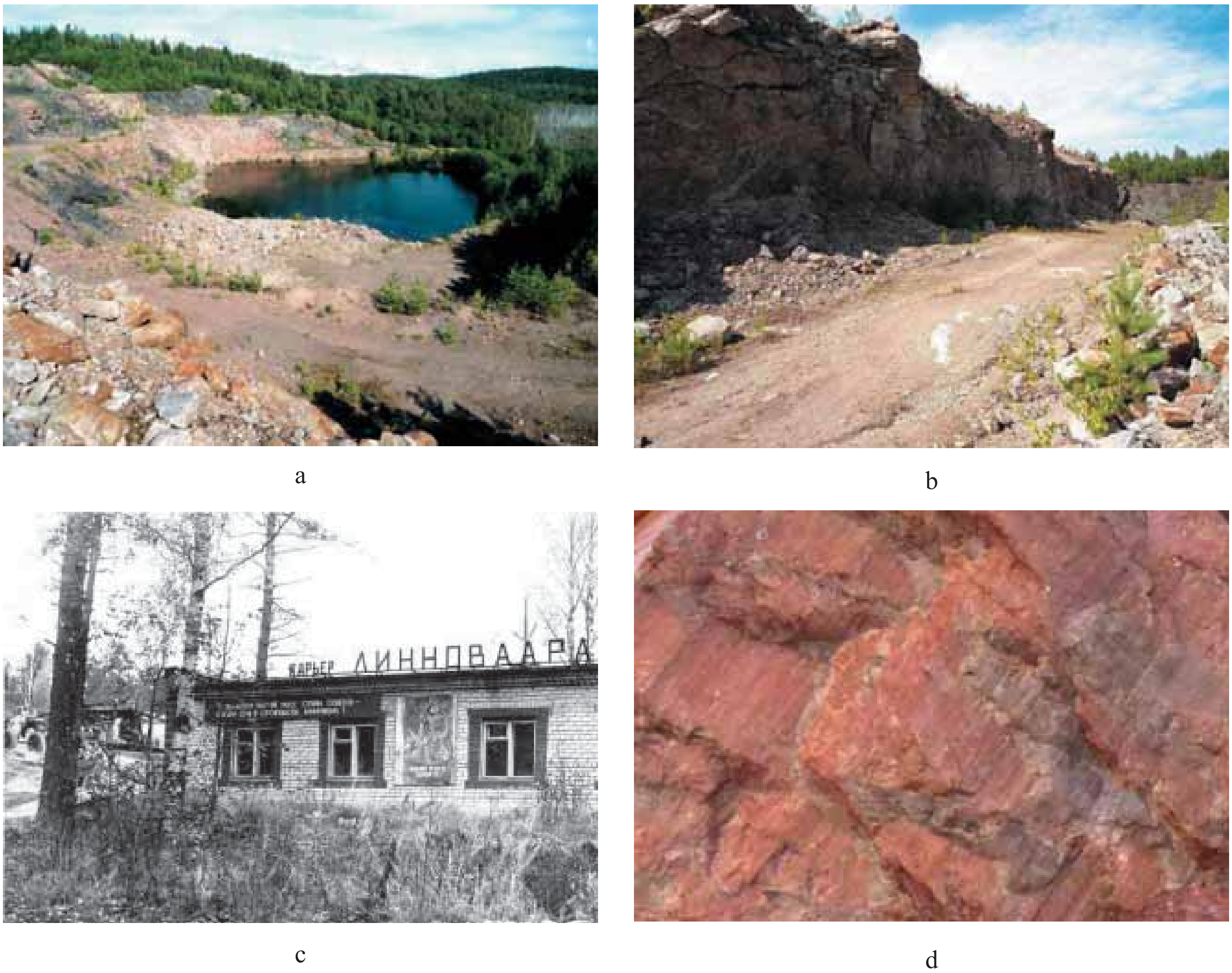


Fig. 10. Linnavaara pegmatite deposit (a – b), old Mining Administration Office (c) and microcline pegmatite (d)

Feldspathic materials are used for the production of ceramics, insulators, porcelain and glazed pottery. $\Sigma(K_2O + Na_2O)$ concentration and the oxide ratio (potassium modulus) are essential for the application of feldspar. At Linnavaara they are estimated at 10,62 % and 1,74, respectively.

Syskyjansaari-Mursula (church and quarry)

The Syskyjansaari (Mursula) fine- to medium-grained pink to red facing granite deposit (Fig. 11 a–b) lies on Syskyjansaari Peninsula (formerly known as St.Herman Island) in northern Lake Ladoga, 8 km south of a Sortavala Pitkäranta highway (12 km NW of Pitkäranta. The highway extends south of the turning-point near the former Kitelä Town.

Herman's skit (small secluded monastery) was the northernmost hermitage of the Valaam monastery. It was situated on Syskyjansaari (St.Herman) Peninsula, near the Mursula quarries. The former Mursula village is also on Syskyjansaari Island, Pitkäranta District. In 1901–1904, the Orthodox St.Prince Alexander Nevsky Church was built in village Mursula and consecrated in 1904. The church belonged to Herman's skit of the Saviour and Transfiguration Monastery on Valaam Island. It has been abandoned later and is now in poor condition. The Finns mounted a memorial boulder with inscription near the church.

Note: Granite is one of the most common crystalline rocks used in the building industry. It has some unique properties such as high mechanical strength, frost resistance and durability. This, together with obvious ornamental features, has made it a popular material used for centuries by architects and designers. Granite is used for facing the exterior of buildings, the construction of embankments or immense monuments and for interior decoration. Granite and granitic products meet consumer demand and are not affected by seasonal variations in air temperatures.

a b c

d e f

Fig. 11. Syskyjansaari granite and granite-gneiss textures (e, f), granite quarrying by monks (a, photo from *Valamojasensanoma*, 1982, p. 75) and a church in village Mursula (b, c, photo from the website http://www.geocaching.su/?pn=101&cid=2415)

Granite quarrying: background. Local granite quarrying was first described by pastor Samuel Alopeus (1720–1794), a Sortavala researcher and the first Karelian historian. In the late 18th century monks made the first attempts to quarry dark-grey granite on Putsaari Island and red granite in the Impilahti pogost (rural community) near the old village Mursula on Syskyjansaari Island. In the 19th century most of these quarries were owned by the Valaam Saviour and Transfiguration Monastery. Herman's skit, the northernmost hermitage of the monastery located on Syskyjansaari Island, supplied red granite (Fig. 11 a).

In the 19th – early 20th century the granite quarried by Valaam monks was known as monastery or Valaam stone. These days you can only see the ruins of the church in the Mursula Mining Administration area and listen to old legends. Granite was used to face buildings on Valaam Island and in St.Petersburg and Moscow. Syskyjansaari granite was used to decorate the tsar's pavilion at Vitebsky Railway Station, in Kshesinsky's mansion, in the Church of the Ascension of the Lord on Gribiedov Canal in St.Petersburg, a monument to Catherine the Second, which towers solemnly near Nevsky Avenue, the balustrades of the Cathedral of Christ the Saviour and the Council of Ministers building in Moscow.

Most granite deposits quarried in northern Priladozhye are confined to so-called granite domes, among them the Mursula dome. One of the deposits is also called Mursula. *Note:* granite domes in Priladozhye are geological structures formed of the exposed round granite or granite gneiss remnants of an older Archean basement that are widespread among Proterozoic rocks on the Ladoga Lake shore.

Red, pink-red and medium-grained granites constitute the Mursula dome and pass locally into gneissose granite (Fig. 11 e – f). Gneissose granite displays a more foliated (gneissose) structure. It consists of microcline, plagioclase, quartz and biotite. It is highly ornamental, is easily polished, has a bright pinkish-red colour due to the presence of microcline and exhibits slight schistosity or plication produced by mica and feldspar that extend in one direction. Syskyjansaari granite is classified and recognized as a highly ornamental rock of class I. Black rock, known as amphibolite and also used as a facing stone, is occasionally encountered among granites.

The quarrying of the deposit was resumed in 1972. Polished Syskyjansaari granite with a smooth surface structure is a highly ornamental facing material. It is used to face the exterior and interior of buildings, monuments and memorials, facades, steps, porches, plinth walls and portals, seafronts, to make ritual articles, to pave squares and to decorate the balustrades, walls, staircases and floor of buildings.

Kitelä (garnet deposit)

Kitelä (Fin.*Kiitel)* is an abandoned village in the Pitkäranta District, Republic of Karelia. There is no bus stop there, and the place is now known as a 42th km platform between Leppäsilta and Koirinoja. There is a memorial stone in the village which reminds of the local Orthodox church (not preserved) (Fig. 12 a – c). Located near the village is the Kitelä garnet-almandine deposit. The abandoned quarries are overgrown with spruce-trees and paludified, but if you are an ardent mineral collector, you will always find a piece of beautiful crimson-coloured almandine that will remind you of your trip to Kitelä (Fig. 12 d – f). Every year amateur prospectors come here for quarrying.

Nikolay Ozeretskovsky described the Kitelä quarries in his book "A trip to Lakes Ladoga and Onega", SPb, 1792. Petrozavodsk, 1989): "This area is famous for its garnet which is abundant there. Walnut-sized garnet crystals are encountered, and little children collect them in the field. Garnet crystals are exposed on the earth surface when peasants furrow the land with a wooden plough.

However, they are hosted by soapstone, called "kidelja kivi kallio", which occurs in the forest about 1 versta (3,500 feet) from the village and is exposed on the earth surface over a long distance. Small garnet exposures are scattered over the area. You can easily cut off a garnet crystal because the rock body is soft and breaks when you strike it with a hammer. At one place I saw earlier traces of hammering; the earth around the rock body was dug out to make it easier to cut out garnet crystals. According to old Kitelä residents, this is how the Swedes used to quarry garnet. Most of the garnet crystals on the rock surface are small and fractured, but big, intact, very pure garnet crystals, which could be used in rings, are encountered inside. In Serdobol, I saw a ring made of Kitelä garnet; its dark-red colour was so pure that it looked transparent. This area is of interest for naturalists and earth treasure hunters."

a b c

d e f

Fig. 12. Kitelä: Orthodox church (a – b), memorial stone (c), granite (d) and garnet (e – f) quarries.

Source: http://www.kirjazh.spb.ru/biblio/ozerec/ ozerec3.htm.

The deposit has been known since the early 18th century[1]. It is confined to sillimanite-bearing schist (Pälkjärvi suite, Ladoga series). Garnet occurs in a productive body, covering an area of 280×80 m, which is pierced by workings that extend to a depth of over 5 m. Schist contains up to 20 % of rhombododecahedral and smaller quantities of rounded garnet crystals (Fig. 12 e) measuring 0,5 to 2,5 cm. Garnet is of pyrope-almandine composition and contains a small amount of spessartine. Dark-crimson, dark cherry-coloured and light lilac varieties occur. Industrial tests of garnet were performed by Tsvetnye Kamni Company, and Glavyuvelirprom recommended Kittelä garnet as a jewellery stone, based on the results obtained.

Koirinojankoski Falls

Koirinojoki is a small river which flows into Koirinojanlahti Bay of Lake Ladoga, near village Koirinoja (translated as “dog/marten creek”). There are several waterfalls in the middle and lower reaches of the river, and the area is known as Karelia’s Undiscovered Pearl. The banks of Koirinoikoski Falls consist of pink garnet blocks (Fig. 13).

The garnet is particularly beautiful at sunset. The lower waterfall (padun) is low, while the upper one is six metres high and has two scarps. The lower waterfall is accessible to visitors. Downstream, you can see poles jutting out of the water – the ruins of the damps of old Mitrofanov tin smelter.

The smelter was built by Vsevolod Omelyanov and named after prelate Mitrofan of Voronezh, Peter the Great’s supporter. The Upper Koirinoja Falls is two kilometers upstream from the Lower Falls, in village Koirinoja, near the Blue Road. However, few people come to the Lower Falls because the area is unknown to tourists, has no standard public amenities and is hard to get to. There was a Finnish hydropower plant there long ago, but the only remnant left is a water chute. Located near village Koirinoja is a rapakivi granite deposit. All public amenities should be made available here to attract tourists and to make the area one of Karelia’s places of interest.

[1] Mineral resources of the Republic of Karelia. Petrozavodsk. Karelia. 2006. P. 355.

a b

Fig. 13. Lower and Upper Koirinoja Falls near village Koirinoja

Pitkäranta: a city and tin, copper, zinc and iron mines

Pitkäranta ("long shore" in Finnish) is a small industrial city and a district centre. Part of the land in the former Salmi uezd, including the Impilahti volost (administrative unit), was part of Karelian Priladozye with Pitkäranta as an administrative centre.

Background. Historically, Pitkäranta is connected with Russia, Sweden and Finland. Originally a Russian settlement, Pitkäranta was part of the Nikolsky-Serdobolsky pogost of the Karelian uezd. The first reference to Pitkäranta settlement in the Votskaya pyatina Census Book (Veliky Novgorod) dates back from 1500. The settlement consisted of three farmsteads with a population of 30 people. In 1638, the village consisted of seven farmsteads inhabited by 50 people, and in 1681 five farmsteads with a population of 30 people. In the late 15th century land cultivation and seasonal work were the main occupations of the population. Agricultural land in northern Priladozye made up 3–5 % of the area occupied by some pogosts. The climate was favourable and the soils were fertile. Hunting was not popular. As the region was near the state border, it was often devastated during Sweden-Russian wars. The Swedes invaded it repeatedly in the 13rd-14th centuries. In the early 17th century the Swedes occupied the region, and in accordance with the Stolbov Agreement, concluded in 1617, the entire northern Priladozye, including Pitkäranta, was ceded to Sweden. In the 17th century Pitkäranta settlement was the property of the widow Elizabeth van Sassen and was part of the Suistamo pogost.

Associated with the Swedish occupation is Varashev Stone, one of the oldest historical monuments in the area, mounted in 1618 as a border sign on Varetsky Point near village Pogrankondushi which lies 2 km from the Ladoga Lake shore. It was its geographic position that has made the settlement famous. It is mentioned in the archives as Kondushi. This border zone was of interest to Russia, Sweden and Finland for centuries. Russia's state border extended near the settlement in various periods of time. The settlement occupies a strategic position – from the hill on which it is situated one can control a large territory and a large part of the Lake Ladoga area. Varashev Kamen marked the Russia-Sweden border which extended from the Ladoga Lake shore northward from 1618 until 1721. The Swedish occupation is associated with another historical monument mounted in the cemetery of village Uksu (there seems to be a counterpart in Sweden) to commemorate the 100th anniversary of the end of the last Sweden-Russia war. There is another border stone in village Pogrankondushi which marked the old Finland-USS border in 1917–1940. The stone is popular with Finnish tourists as a historical monument and a rare example of border signs. After the defeat of Sweden in the North War, Pitkäranta was ceded to Russia according to the Nishtadt Peace Treaty. When Catherine I was in power (1725–1727), the settlement was the property of Earl Bruken, who belonged to the Empress'court. In 1727, the Impilahti pogost was first mentioned in the land archives.

The pogost became Peter the Second's (1727–1730) estate which comprised Pitkäranta. Since 1730 until 1764 the Impilahti pogost and Pitkäranta Town were the property of Alexander Nevsky Monastery. Since 1764 until 1797 the town and pogost were owned by the Emperor's Economy Board and later became the property of the State Treasury. Salmi pogost of the Serdobol uezd (which bounded on Impilahti pogost) extended for 49 versts from village Uksa which was located on the Ladoga Lake shore next to Olonets pogost and was Earl Orlov's property. Pitkäranta was actually a Russian territory from 1721 to 1811. In 1812, in accordance with Emperor Alexander the First's Act, the Vyborg province, which comprised Pitkäranta, again became part of the autonomous Principality of Finland and was governed by Finland for one and a half century. It is not until 1940 that the territory was returned to Russia.

Pitkäranta received a sudden boost in the 19th century when the area became the target of geological research. Since the 1840s, Russian and foreign geologists, metallurgists and miners would often come to the settlement. They conducted scientific studies and reported their results. Pitkäranta became famous. It was visited by the metallurgist Obukhov and Iossa, the geologist Inostrantsev, the metallurgist and artillery man Gadolin, the scientist Nordenskjold, who studied the Arctic later, and the traveller Eliseyev. Some minerals, found in Pitkäranta and its environs, were named after outstanding German, Swedish, Finnish and Russian geologists.

The first comprehensive scientific paper on Pitkäranta's geology by German geologist Otto Gottlob Trustedt was published in German as early as the beginning of the 20th century. Trustedt managed local mining companies from 1879 to 1890 (Fig. 14 a – b). He produced a map of mines in the Old Ore Field of Pitkäranta.

The architect M.Oshvintsov, sub-lieutenant E. Baranov and peasant A.Anisimov were the first to explore Pitkäranta ores in 1814, e.g. copper ore on Mount Alasuomäki, where a mine was opened in the 1930s by the manufacturer Omelyanov. He built a copper smelter and launched ore production. By 1840, he had invested over 225 000 German marks in ore production at Pitkäranta. Mitrofanievsky smelter was built in village Koirinoja, at the western environs of Pitkäranta, and European Russia's first tin smelting was performed on 23 June, 1842 under the supervision of the well-known Russian metallurgist Grigory Andreyevich Iossa. Water, supplied from a dam on Koirinoja Falls, was flowing along two chutes to the wheels, where the ore, delivered from Pitkäranta mines and the tin-copper smelter, was washed. In the mid-1830s, a small copper smelter was built at the Kelinoja River mouth in the eastern environs of Pitkäranta, and another smelter, later known as Alasavota, was built next to it by the miner Heinrich Klee. In the 1840s, all of Pitkäranta mines and smelters were purchased by the Pitkäranta Company, a St.Petersburg joint-stock company. In 1860, two more tin-crushing and washing plants were put into operation.

a

b

c

Fig. 14. Otto Gottlob Trustedt, a German geologist who studied the geology and ores of Pitkäranta (a, b), and a map of mines (c) based on his study (after Bulach & Frank-Kamenetsky, 1960)

In 1887, a glass plant, equipped with two continuously operating and two periodically operating furnaces based on Siemens' system, was built in Pitkäranta. The glass was highly durable. G.Grendal said that Pitkäranta glass is equal in quality to glass produced at the best foreign plants.

Since the 1890s, iron production and cast iron smelting have become a priority. In 1914, Ristiniemi, a Finnish joint-stock company, continued ore mining using a more advanced technology. Ore was delivered to the Vidlitsa smelter. The mines were operating until the early 1950s. Nowadays, you will only see some traces of past activities such as dumps, moss-covered piles of ore, the ruins of mines and basements and metal piles (Fig. 15).

The construction of the first smelters and mining communities provided an impetus to the industrial development of village Pitkäranta, which gradually turned into a town. The Church of the Ascension and a pier were built there later. In the early 20th century Pitkäranta became the industrial centre of Priladozye. Of great significance for the prosperity of Priladozhye was the construction of the Karelian Railway by the Finns in the 1930s. In January 1931 the railway was extended to Pitkäranta.

The chemist's building (so-called Valden's house), known for its beautiful old stucco moulding, now hosts. There was a garden full of various plants by Valden's house. The house was given later to Pitkäranta Museum of History.

During the Soviet-Finnish War (1939–1940) the town was almost completely destroyed. Nowadays, many war graves and two memorial-historical complexes remind us of those tragic events in the Pitkäranta District. In 2005, the Proprietors Board initiated the erection of another monument to war heroes, tank T-26, at the corner of Gogol, Gorky and Pushkin Streets. During the last two wars the tank was used in battles by both Finns and Russians.

Pitkäranta deposits. There are two tin deposits and 12 tin occurrences in the Kitelä-Pitkäranta area, Karelia. Kitelä and Pitkäranta are the biggest skarn deposits with estimated ore reserves. Smaller ore occurrences of no commercial value are Hopunvaara, Hopunlampi, SW Lypikko, East Uksa, Heposelkä, Kulismajoki, Ristinoja, Valkealamou and Vinberg. Mineralization is emplaced in the western and southwestern endocontact zone of the Salmi rapakivi-granite massif, and is associated with its intrusion. Why not go there to collect nice mineral samples (Fig. 15).

Sn and Sn-Zn-Cu mineralization is characteristic of the Pitkäranta and Kitelä skarn deposits and ore occurrences from Uksa to Heposelkä.

The SW Lypikko, Hopunvaara, Jopunlampi and West Uksa skarn-greysen deposits display Sn-Zn-Pb-Cu-Fe, Sn-W-F and Sn-Zn-Cu-W-F (tin-base metal- rare metal-fluorite) mineralization.

The Pitkäranta deposit is located in the City of Pitkäranta and its environs (Fig.). It has been known since the late 18th century, but is now of no commercial value. The deposit was being mined discontinuously to a depth of 90–120 m from 1842 to 1904. Tin, copper, silver and even gold were mined. 488 t of tin, 6617 t of copper and 11,2 t of silver were produced in that period (Geology of the USSR, vol. XXXVII, Karelian ASSR, part II, p. 109).

The deposit falls into the Old and New Ore Fields. Mineralization is confined to altered carbonate beds at the granite dome margin. Altered carbonate rocks, which contain garnet, diopside, vesuvian and epidote, are termed skarns.

The rocks extend for up to 2,5 km. The ore deposits are 75–170 m to 1,1 km long and 1 to 25 m thick. Some of the lenticular ore bodies have been completely worked out to a depth of 35 m.

The Old Ore Field contains Sn, Zn, Cu, Cd, Au and Fe ore. Its total predicted tin resources and reserves are estimated at 34 300 t. Average Sn concentration is 0,2 % and maximum Sn concentration is 1,22 %. Average Zn concentration is 3,8 %, maximum Zn concentration is 14,3 % and the total Zn resources are 1677 thousand tons. (Mineral resources of the Republic of Karelia. Petrozavodsk. Karelia. 2005).

The New Ore Field contains Sn, Zn, Cu, Cd and F ore. Predicted Sn resources are about 2,6 thousand tons, average tin concentration is 0,84 % and maximum tin concentration is 1,66 %. Average Zn concentration in the ore is 3,14 %, maximum Zn concentration is 11,4 % and Zn resources are estimated at 72,6 thousand tons.

The Hopunvaara ore occurrence is located north of Pitkäranta. It is complex tin and fluorite-iron-zinc mineralization in skarns and greysens after them. The ore is thinly-rhythmically laminated and massive and contains an average Sn concentration of 0,3 % (0,16–0,64 %) and a maximum Sn concentration of up to 14,4 %). Sphalerite ore bodies contain 0,64–1,95 % Zn (maximum Zn concentration is 2,35 %), 0,31–19,4 % fluorite, 0,68 % Cu and 0,69–17,3 % Fe magnetite. Ag concentration is 8,2 g/t, Cd concentration is 238,4 g/t and Bi concentration is 262 g/t. Sn is concentrated dominantly in cassiterite (75–80 %) and to a lesser extent in garnet, amphibole and magnetite. The ore is hard to enrich.


Hopunvaara quarry adit

Rock and ore dumps near Herbetz-1 mine

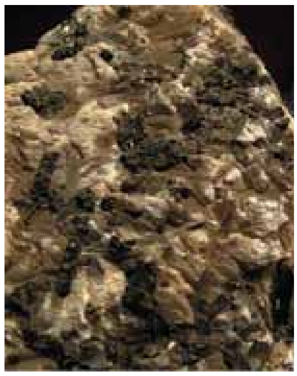
Bekk mine

Mushketowite mine Bekk

Chalcopyrite mine
Old Ore Field

Magnetite, Lypikko Ore Field

Hopunvaara magnetite skarns



Cassiterite, Old Ore Field

Fig. 15. Workings, dumps and ores and mineral samples

Copper mineralization at *the Heposelkä and Hopunlampi occurrences* hosts small copper resources (1900–3300 t). The ore contains an average Cu concentration of 0,26–0,6 %. Hopunlampi tin ore forms squeezed lenses and contains 0,15–0,59 % Sn and 3,34 % Zn.

Ore mineralogy. The major ore mineral of tin is brown cassiterite SnO_2, which occurs in the rock as fine crystals and grains (Fig. 15). Zinc is part of sphalerite, a dark–brown, almost black mineral (Zn, Fe) S which contains Fe impurities and a yellow low-iron mineral with Mn and Cd impurities and smaller amounts of In. Copper is part of chalcopyrite $CuFeS_2$ or cubanite, lead is part of galena PbS, tungsten is part of scheelite $CaWO_4$ and iron is part of magnetite Fe_3O_4 or mushketowite, which forms little beautiful black roses. The unusual non-metallic minerals in skarns are dark-red, black and green garnet, vesuvian, epidote, calcite, zonal ball-shaped magnetite-epidote intergrowths and octahedral magnetite. Greysenized skarns contain scheelite, Be-minerals (helvite-genthelvite) and Ag-Bi and As-minerals.

Lypikko

The Lypikko area is known for various types of ore deposits and occurrences that contain Sn, Zn (0,61 %), Cu, Be, F and Fe. *The SW Lypikko* skarn deposits contain 0,27–0,43 % Sn, and their ore reserves are estimated at 5,4 thousand tons. Chalcopyrite, sphalerite, cubanite, magnetite, pyrite and fluorite are also present. Tin bodies and greysens (*South Lypikko)* carry 0,17–0,45 % BeO (average BeO concentration is 0,25 %) and rare-earth elements. If you like history, take a trip to the old mines and ore dumps.

Note: skarns are heterogeneous dominantly carbonate-garnet-diopside rocks formed after carbonate rocks near their contact with garnet under the influence of solutions that separate from them.

The Lypikko pegmatite deposit contains about 30 veins near the contact of the Lypikko gneissose granite dome in Proterozoic Pitkäranta rocks. Pegmatite is non-differentiated plagiomicrocline mined since 1965 for feldspar production.

Lypikko-2 gneissose granite deposit is sutuated in the Pitkäranta District, 7 km southeast of Pitkäranta. If you wish to visit a modern quarry and collect good fluorite samples, apply for permission to the Mining Administration (Fig. 16). Lypikko-2 quarry was built and put into operation to produce highly durable crushed stone for highway construction in Karelia, the Non-Chernozem Zone and the Moscow region.

It should be noted that the Road Construction Directorate of Karelstroimaterialy Company has been producing crushed stone there since 1977 from the dumps of the Lypikko deposit. In 1979–1981, the Karelian Geological Prospecting Survey conducted the detailed prospecting of Lypikko-3 gneissose granite as a raw material for crushed stone production and had its reserves approved. The construction of the quarry was over in 1985, and Mosavtodor Company began quarrying in 1987. In 2006, the balance reserves of the deposit were re-estimated at 20.02 M m^3. Nowadays, Mosavtodor Company offers a variety of products from Northwest Russia.

Gneissose granite in the quarry is cross-cut by late-phase fine-grained rapakivi granite and pegmatite veins, polychromatic (bright violet and white, Fig.16b) fluorite veins, greenish-yellow mica and coarse microcline crystals are encountered.

a

b

Fig. 16. Lypikko gneissose granite deposit (a), fluorite (b)

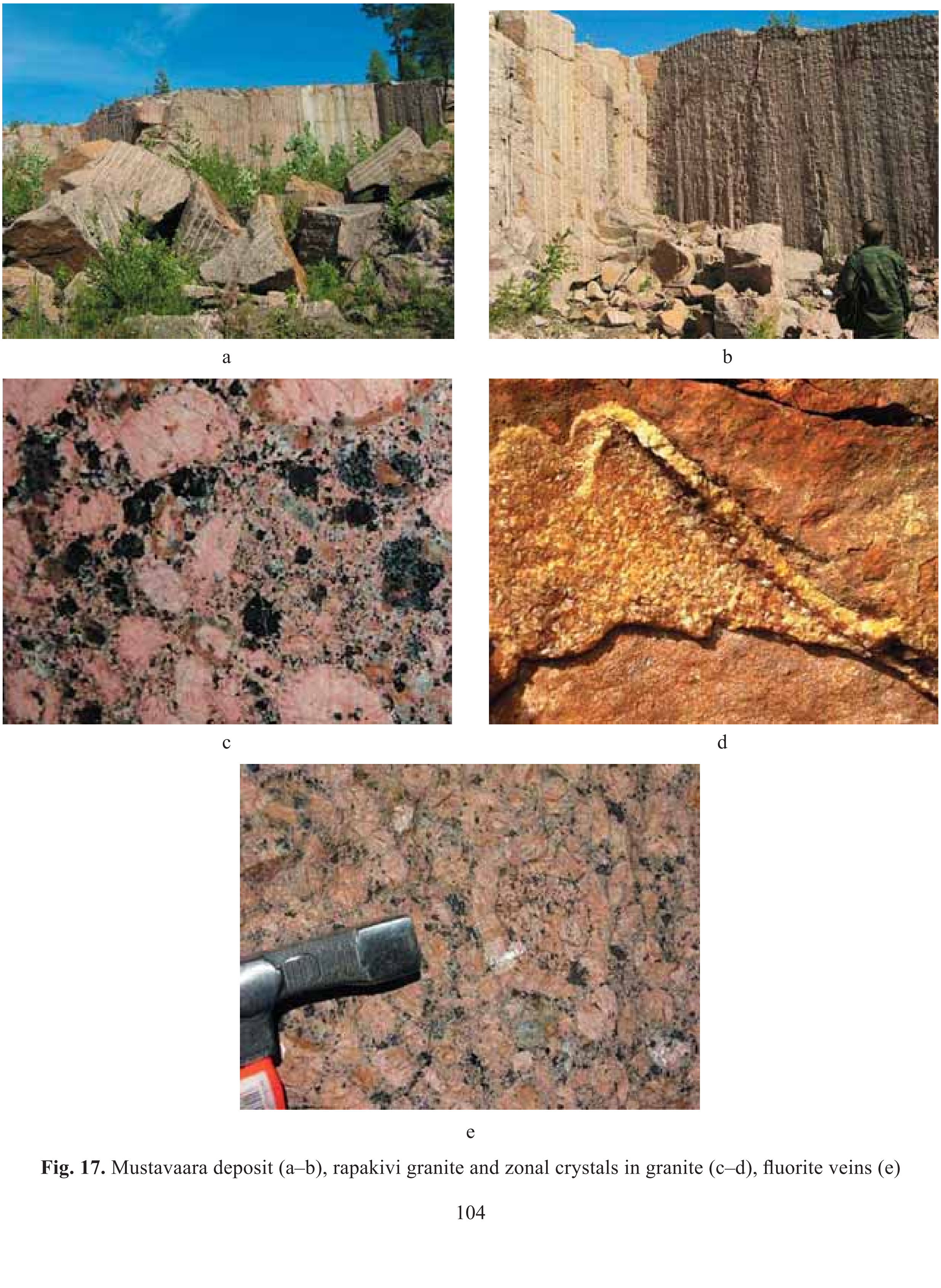
Mustavaara

The Mustavaara rapakivi granite deposit (translated as “black mountain”) is situated 5,5 km northeast of Pitkäranta, in the southwestern Salmi granite massif (Fig. 17).

Note: “rapakivi” means “rotten stone”. This coarse-grained granitic rock is easily broken by weathering. Disintegrated coarse phenocrysts resemble “rotten stone”.

There is an earth road to the quarry. Grey-pink porphyraceous granite, which makes 90 % of the massif, is the most beautiful dimension stone variety. Later-phase fine and equigranular granites are less abundant. Rounded phenocrysts in granite occur as pink microcline crystals measuring 1 to 2–4 cm. Some of microcline phenocrysts have a light –coloured oligoclase rim (Fig. 17 c–d). Finer-grained matrix consists of microcline, oligoclase, biotite and black and smoky quartz. Light-yellow fluorite (CaF_2) veinlets in granite, produced by hydrothermal solutions associated with later-phase granite intrusion, are occasionally encountered (Fig. 17 e).

The deposit was quarried by RK Granite OJSCP. In 2004, dimension stone production was suspended because the rock was found to be highly fractured.



a b c d e

Fig. 17. Mustavaara deposit (a–b), rapakivi granite and zonal crystals in granite (c–d), fluorite veins (e)

Sorrow Cross Memorial

The Sorrow Cross Memorial was mounted on 27 June, 2000 in Pitkäkangas at a road crossing near Pitkäranta to commemorate the Soviet-Finnish War of 1939–1940 and to symbolize the reconciliation of the two neighbouring nations (Fig. 18). The sculpture was designed by the architects V.N. Shevlyakov and L.Karma and created by Leo Lankinen. The mounting of the cross was initiated by war veterans and their children. The construction was funded from Russian and Finnish governmental and private sources and volunteers. Behind the monument is a memorial plate on which the date 1939–1940 is carved.

The monument was created in the form of a 6 m high cross made of cast iron at Tyazhbummash Plant, Petrozavodsk. It shows two women leaning against the cross on both sides. They symbolize two mothers – Finland and Russia, whose sons killed each other in a fierce battle.

The monument stands on a small hill. There are a few bedrock exposures nearby.

Fig. 18. Sorrow Cross

The Heroes Valley Memorial and Historical Complex has been erected to commemorate the tragic events of the 1939–1940 Winter War. The Nietjärvi Historical and Memorial Complex is part of Mannerheim Line with a system of trenches, pillboxes and reinforced concrete, anti-infantry and antitank structures. There were heavy battles here at the final stage of the Svir-Petrozavodsk operation conducted by the Karelian Front in 1944.

RUSKEALA MARBLE QUARRIES

I.V. Borisov

Ruskeala in the XVI–XVII Centuries

Until now, there is no exact answer to the question when Ruskeala settlement appeared. Some researches suppose that Ruskeala settlement is more than 500 years old.

The Census Book of Korelskiy County of the Vod land dated 1500 by D. Kitaev does not mention Ruskeala neither as the part of Nikolsko-Serdobolskiy Pogost, nor as the part of the neighboring Iliinsko-Ilomansinsky Pogost of Korelskiy county. This book reflects the situation for the end of the XV century, after 1478, when Novgorod Republic fell under the jurisdiction of the Duchy of Muscovy, surrendered to Grand Prince Ivan III. In the cadastres dated 1500 there is information only about closer to present-day Ruskeala settlements, for example "Kaloma-At-The-River-Kaloma" (present-day Kaalamo).

The Swedish Land Records of Kexholm County (Korelskiy County) dated 1590, 1618, 1631 also do not mention Ruskeala (though, it notes the closer villages – Mataselga, Kalatoma and Pirttpohja). In the XVII century Rujsselka village was for the first time mentioned on the place of Ruskeala village. And the question arises: did Ruskeala settlement exist in the XVI–XVII centuries? Based upon the documentation – no, it did not.

The Swedes, that captured Korelsky County, built a small Lutheran church, subjected to the parish in Kitee, in Rujsselka village (at the territory of present-day Ruskeala), on Kontkasenmaki mountain (the mountain got this name at the end of the XVIII century after the family name of peasant Kontkanen). The exact date of its construction is unknown, but in 1676 this church was mentioned in Swedish documents. Late information about it is missing, as in 1691 Ruskeala church archives burnt together with the priest's manor that was not far from the church.

The statement of some researches that Ruskeala church was built in 1632 on marble mountain, where later stone was quarried, does not have any grounds, as all Lutheran churches were then built exactly on Kontkasenmaki mountain. The reason was, presumably, the message of D. Semenov that in 1863 he saw a stone with "1632" stamped word near Ruskeala quarries[1]. Most probably, this date means the year when Ruskeala Lutheran Parish was established, but not the place where the church stood.

Probably, "Ruskela" name comes from Karelian, Finnish "rusk", "ruskea" – "brown, ginger, red" as there are lot of bright-brown sand enriched in ferrum oxides around the settlement; actually, in ancient times sienna for making paint was extracted in Hanki. Local river (starting from the XIX century – the Tohmajoki) was also called this way as water in it really has brown color because of humic substances and ferrum oxides. Academician V.M. Severgin in 1805 was the first one to state the hypothesis that "ruskal" ("ruskiala") means "red land"[2]. There is also a guess that Ruskeala is a "Russian village", though it is a real fact that during the first years of marble quarry mainly the Russians lived in Ruskeala.

For a long time local historians and scientists considered that Ruskeala marble deposit was discovered by Serdobol pastor Samuil Alopeus in 1766. But the documentation testify that marble in Ruskeala was started to be quarried much more earlier, way back in the time of the Swedes, approximately in the second half of the XVII century.

Former employee of the Regional Museum of North Priladozhye Alla Fedorovna Boyarinskaya as far back as in the middle of the 1990-s found an interesting map № 34 in Swedish dated between 1718 and 1730 in the department of cartography of the library of the Russian Academy of Sciences of Saint Petersburg among "The Collection of Maps of the Most Important Swedish Battalions". This map showed a new border between Russia and Sweden according to the Treaty of Nystad dated 1721. There were three circles with "Marmorbrottet" (marble quarry) inscription drawn near the marble mountain that after the war turned out to be on the territory of

[1] Семенов Д. Путевые заметки по Финляндии. Санкт-Петербург, 1863.

[2] Севергин В. М. Обозрение Российской Финляндии или Минералогические и другие примечания, учиненные во время путешествия по оной в 1804 году Академиком, Коллежским Советником и Кавалером Васильем Севергиным. Санкт-Петербург, 1804.

Russia[3]. Marble, obviously, was quarried for making construction lime.

Ruskeala in 1721–1768. The Discovery of Ruskeala Marble Deposit in the 1760-s

From 1632 till 1712 Ruskeala territory was a part of Lutheran Parish in Kitee.

After the end of the Great Northern War (1700–1721) a new border between Russia and Sweden was marked. In Ruskeala (Rujsselka) area the border went north of marble mountain with the old quarries, closer to Ruokojarvi lake. From Ruokojarvi the border stretched to the east to Pirttipohja village and further – to the north-west via the middle of Janisjarvi to Soanlahti and etc. To the north-west of Ruskeala a new border went to place Rics and further – to Puhajarvi Lake. Therefore, the border, marked in 1721, was rather different from the present-day (between Russia and Finland), and when making the demarcation of it Russian authorities took into account the valuable marble deposits that stayed at the territory of Russia. It is notably that new maps of 1720–1730 still did not contain the name of Ruskeala village. And Ruskeala Volost was established in 1720 (it existed until 1944), and the name was given after Ruskeala Church.

After the completion of the Great Northern War, Emperor Peter the Great gave a considerable part of the former Korelsky County (Kexholm County) lands to private ownership. The surroundings of Ruskeala were gifted to Duke, future Field-Marshal Alexander Borisovich Buturlin (1694–1767). And that is how Ruskeala estate appeared. In order to till the land, Duke Buturlin resettled part of the peasants from his estates located in central Russia. At the end of the XVII century Buturlin's grandson sold the estate to Orlov Princes.

An independent Ruskeala Parish was organized in 1727. In 1732 in the eastern part of Rujsselka village, on Kontkasenmaki Mountain, on the old place, a new Protestant church with a pulpit made of huge single piece of wood was built. A cemetery was not far away.

In February 1742, during yet another Russian-Swedish war, the Swedes attacked Leppalahti and Ruskeala from the side of Palkjarvi.

According to N.Y. Ozeretckovsky, 1945 people lived in Ruskeala and in surrounding farm yards in 1754. By that time, the trade route from Kitee (present-day Finland) to Ladoga Lake via Serdobol got the meaning of a post road. Then a post station was built at the coast of the Ruskolka River, near the bridge[4].

We can assume that in the first half of the XVIII century the locals quarried marble as "flux stone" for Olonets ironworks and construction lime production in old "Swedish" Ruskeala quarries. But these works were of handicraft and episodical character. Nobody guessed the possibility of using Ruskeala marble as construction and decorative stone yet. Eventually old "Swedish" Ruskeala quarries were finally abandoned and forgotten. Marble deposits in Ruskeala were again discovered only many years later, in the 1760-s, in the days of Catherine the Great, who was decorating the capital with homemade marble and granite.

Stone for Saint Petersburg construction was searched for in Russia as early as under Peter. When building Saint Petersburg the Emperor had to face many problems that threated to ruin his ambitious plans. Besides the lack of full understanding among his close associates, there were serious objective difficulties: marshland, shortage of construction materials, workers and specialists. Probably, because of these reasons Peter the Great issued two famous edicts in 1714.

The first edict dated October 9, 1714 ("About Prohibition to Build State Houses in the Whole State for Several Years") prohibited "any stone buildings, of any name whatsoever, under penalty of the destruction of estate and exile".

The second edict dated October 24, 1714 ("About Bringing a Certain Amount of Crude Stones by Visitors to Saint Petersburg on River Vessels and by Land on Carts") obliged visitors to the capital to bring a certain amount of stones. Those people who did not bring stones to the capital had to pay a penalty – one grivna for every stone.

During the first decades of Saint Petersburg construction mostly stone from carbonate rocks deposits – dolomites, dolomite limestones, limestones

[3] Собрание карт новейших шведских баталий, карта № 34. Библиотека РАН, Санкт-Петербург, отдел картографии (1718–1730).

[4] Озерецковский Н.Я. Путешествие по озерам Ладожскому и Онежскому. Санкт-Петербург, 1792.

("tosnenskaya platform", "putilovskaya platform"), calcareous puff-stones ("pudostskiy stone"), located at a small distance from the capital, no more than 120 km – was used. However for the decoration of the capital stronger and decorative stone – marbles and granites, the deposits of which were not known in Russia yet – was needed.

Stone for the construction of Saint Petersburg was also being searched for in Russia under Empress Anne of Russia. In 1735 Russian Academy of Sciences concluded a contract with a foreigner, stone master Yakov Stein, according to which he *"was taken to the service of Her Imperial Majesty for quarrying stones and with this promises, to honestly honor the interests of Her Imperial Majesty the best way he can in those places of the Russian State where he would be sent for searching stones situated there, and quarry and mine big and small pieces of the stones found there during previous studies – be they marble, porphyritic or some other ready for use…"*[5].

Yakov Stein worked mainly in the Urals, where several deposits of marble were found at the end of the 1730-s. However, during his expeditions the master could happen to be also near Serdobol, where there were deposits of marble and granite. Nevertheless, unlike the Urals, there was no industrial quarry of stone in Priladozhskaya Karelia for a long time, until the end of the 1760-s. Starting from the 1740-s, along with foreign, some Ural marble was used for the decoration of the capital's palaces.

Only under Empress Catherine the Great there was a real breakthrough in marble and granite quarry for the construction and decoration of Saint Petersburg. The following words are ascribed to her: "August told he found Rome built of brick and left it marble, and I shall tell I found Saint Petersburg almost completely wooden and will leave there buildings decorated with marble."

Almost right after her accession to throne Catherine the Great issued the edicts prompting the construction of stone buildings in Moscow and Saint Petersburg. The first edict dated December 11, 1762 "About Setting up a Commission for Arrangement of the Cities of Moscow and Saint Petersburg" and the second one dated June 12, 1763 "About the Construction of Stone Public Building in All the Towns".

Already during the first years of Catherine the Great's regnal, under the suggestion of academician M.V. Lomonosov, astronomic-and-graphical studies started on the whole territory of Russia; during these studies land-surveying, the plans of many towns, and "Historical and topographical descriptions" of territories were made. Not only scientists and land-surveyors, but also local intellectuals – bureaucracy, teachers, priests and other informed fanciers from different population stratums – took part in this work for the benefit of the Motherland. Russian North and Karelia as the closest region to the capital attracted the most focused attention of the researchers.

The construction of Saint Petersburg demanded a great amount of natural stone, including marble and granite. Already in the 1760-s expeditions to the Urals, where earlier developed marble deposits had been abandoned, were sent again. The attention was also paid to Vyborg government situated in close vicinity to the capital.

In 1764 Catherine the Great signed an edict "About New Revision in Finland". Inspectors sent to Vyborg government under command of the Board Councilor Gibertovsky found this area in a very distressful situation, noted low level of household, bad crop of bread, poverty of the population, and did not pay any attention to its forest and stone resources. At that time the preacher of Evangelic-Lutheran religion, pastor Samuil Alopeus lived and worked in Serdobol. He strongly disagreed with the conclusions of the esteemed commission and prepared his description of the territory, specifying considerable deposits of construction stone – marble and granite. It was an extraordinary man that should be told about a little bit more.

Samuil Alopeus (Samuel (Alopaeus) was born on January 9, 1721 in Saint Petersburg in the family of eastern Finns, hereditary priests, though the ancestor of the family Tuomas Kettunen was a peasant. In the middle ages his grandchildren translation the family name (from Finnish "ketu" – a fox) into Latin and became the Alopaeuses or the Alopeuses (from Greek "alopeeks" – a fox). Samuil's father – Johannes Alopeus – was an abbot of the Ingrian church in Kupanitsa (place Kupanitsa). In 1712 he was ordained priest and as a captive moved to Saint Petersburg. His mother – Anna Maria Majdelin was a daughter of Saint Petersburg abbot of the Ingrian church[6].

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[5] Столпянский П. Из прошлого Петрограда: к истории строительных материалов. Журнал «Зодчий», Санкт-Петербург, 1915.

[6] Karjalainenelamakerrasto. Porvo. 1961 (Карельская биография. Порво. 1961, перевод Кяхконен Э. Э., 2012 г.).

During 1739–1744 S. Alopeus studies in academic gymnasium (university) in the city of Abo (Turku). When he finished it, from 1745 until 1750, he worked as a teacher of foreign languages (German and Russian) in the cathedral school in Vyborg. There were 5 classes and 7 teachers in the school. The amount of pupils was constantly increasing, but the financing left much to be desired. The salaries of the teachers were minimal and they did not stay for a long time there.

In 1751 in Narva S. Alopeus was ordained priest of Evangelic-Lutheran religion and sent to Finnish-Swedish Parish in Saint Petersburg as a priest from Vyborg consistory. For four years the pastor served in wooden St. Anna's Church (built in 1734) near Nevsky Prospect. Now at the place of this church stone St. Maria's Church stands (built in 1805).

In May 1755, at the age of 35 years, Samuil Alopeus was sent as a preacher of Evangelic-Lutheran religion to Serdobol, where he became an abbot of Sortavala Parish. At that time Serdobol was a small "badly built" wooden town with almost "dead" trade. 420 people, selling beer and wine, lived there in 1764. There were also 39 cows and 29 horses. On cape Kirkkoniemi ("church"), next to present-day "Verkhniy" ("Upper") market of Sortavala starting from 1740 a small logged, cross-type in plan view, Lutheran church stood. Probably during the construction there was a hurry, and the ground was not fixed properly, therefore the church was fast deteriorating, tottering, and by 1775 it was in a so bad conditions that there was no sense to fix it.

Upon Samuil Alopeus's initiative a decision about the construction of a new church in Serdobol and about the collection of donations among the parishioners for the construction needs was taken. Pastor Alopeus, chaplain Melatopaus and county commissioner Henrik Melart prepared the request to the government and soon the necessary permission was got, and 256 grivnas and 33 kopecks were collected from the parishioners. Probably, tireless pastor Alopeus, dreaming of a new church, made the drawings of it himself. However, soon the construction of the church was postponed because of the war with Sweden (1788–1790) started. Only in 1801 a new church and a bell-tower were built in Serdobol, at Kisamaki Mountain.

Serdobol Lutheran Parish was small and poor, and pastor Alopeus would have to work hard for the glory of God to strengthen Christian faith.

Samuil Alopeus applied a lot of efforts to arrange the church documentation. He was the third pastor in Serdobol Parish, but before him the church records were kept disorderly. They started to record more carefully christianizing, wedding ceremonies, betrothals, conformations, to carry the protocols of church meeting. Unfortunately, all the church archives died later during the latest war.

Thanks to Alopeus's efforts the Bible and other church books appeared in the church; they were brought from Tallinn and Turki – altogether 16 copies. Under the order of the church administration Samuil Alopeus translated "A Shorter Catechism" printed in Saint Petersburg in 1780 from Russian into Finnish for Finnish-speaking parishioners.

With Alopeus they started to regularly hold parish meetings where main questions of the parishioners' life were decided. When managers of the masters' estates tried to interfere with the church affairs and place pressure upon the peasants, the pastor protected his parishioners from the despotism.

The representatives of Lutheran clergy in Karelia played an important role in the life of their parishes. Pastors were the most esteemed and educated people, but they were carrying not only church troubles on their shouldres.

Samuil Alopeus, as a teacher in the past, started greedily to revive education in Serdobol. He even gave a room for school in his service housing. Thanks to his efforts in a 2-grade school, where two teachers worked, was opened in Serdobol Parish in 1786. Samuil Alopeus not only paid a lot of attention to the problems of the school, but also taught the Bible and German in it, as they could not find a teacher for a long time. Only in 1792 a teacher of German Johann Schumacher came from Saint Petersburg[7]. In 1765 Alopeus was elected assessor of Vyborg consistory, and in 1770 he was bestowed a title of governorate archpriest.

Samuil Alopeus was not only a priest but also an investigative researcher. He was especially fond of mineralogy. From his early youth Alopeus fell in love with minerals and during his service for the Church he was interested in the possibilities of their practical use for the good of the state. Travelling to their parishioners, even to Petrovskie Zavody, the pastor collected valuable information about nature, household and po-

[7] Karjalainenelamakerrasto. Porvo. 1961 (Карельская биография. Порво. 1961, перевод Кяхконен Э.Э., 2012 г.).

pulation of the region, that he later summarized in his book named “A Short Description of Marble and Other Stone Quarries, Mountains and Stone Rocks, situated in Russian Karelia”, published in German and then in Russian in Saint Petersburg in 1787.

This book saw the light of the day thanks to the recommendation of the President of Free Economic Society, Adjutant General and Chief of the Finnish Jager Corps prince Fedor Evstafievich von Angalt, who in 1783–1786 made an inspection trip in Russia and visited also Serdobol, where he met pastor Alopeus. F.E. Angalt was affected by the detailed story of Samuil Alopeus about stone resources of the region and his collection of minerals and advised the pastor writing a book about it.

Fedor Evstafievich Angalt (1733–1794) was taken to the service in Russia in the rank of General-Lieutenant in 1784. Approximately in 1785 he visited Serdobol where he thoroughly talked to Samuil Alopeus. Upon his return to the capital F.E. Angalt presented a report to the Empress; he was rewarded the Orders of St. Alexander Nevsky and St. Andrew the First-called.

The book of S. Alopeus was dedicated to F.E. Angalt. It was highly appraised by academician N.Y. Ozertckovsky, who was in Serdobol in 1785. Extracts from this book were published in German periodical in 1798. Thanks to Samuil Alopeus’s book we have a possibility to restore in details the course of events, related to the searches, exploration and development of Ruskeala marble deposit.

According to A.F. Boyarinskaya “Alopeus’s book is the first area study of South Karelia” and its content much wider than its name. The pastor placed all his longstanding laborious observations of Karelian nature, as well as the information of the region’s history, ethnical composition of the population, the languages and confessions, households into the book. The book is written absorbingly. The author as though travels along a beautiful, full of secrets land of mountains, lakes, forests and stone. The pastor’s attentive eyes see everything, and his inquiring mind is trying to explain it.”[8]

For the book publication, again under the initiative of F.E. Angalt, Samuil Alopeus was admitted as a member of Free Economic Society (FES) created in Saint Petersburg as back as in 1756 with the purpose of developing economic activity of the country. In the transactions of FES in 1790–1793 S. Alopeus published nine works on history, nature and regional economy (3 articles and 6 short notes): 1. Essay About Furnaces That Save Firewood. Information about the Receipt (FES transactions, 1790, 1 p.); 2. About Healing Diseases With Vapor-Bath (FES transactions, 1792, 2 p.); 3. Serdobol Roe Deer (FES Transactions, 1792, 3 p.); 4. The Description of Location of Kexholm County of Karelia (FES transactions, 1793, 2 p.); 5. The Description of Karelian Waters (FES Transactions, 1793, 2 p.); 6. Note about the Preparation and the Use of Juniper (FES Transactions, 1792, 9 p.); 7. The Description of Serdobol Fishery and Different Fish Species in Local Waters (FES Transactions, 1792); 8. About Common Hunt in Karelia. Information about the Receipt of the Essay (FES Transactions, 1793); 9. About Household Use of Juniper and Brewing Beer from Juniper Berries. The Essay of Mr. Pastor, the Member of FES. (FES Transactions, 1793).

According to A.F. Boyarinskaya, “the extensive region Samuil Alopeus was sent to, turned to be a fertile ground for the skills of investigative researcher that were sleeping inside of him. The virgin nature of the region, undisturbed mountain, forest and land resources stirred the interest and started the curious pastor searching. Visiting his parishioners far away, he had the possibility to see everything with his own eyes. The wild magnitude of stones was especially beckoning him by its mysteriousness. He confessed that he loved “the kingdom of stones” from his early youth, and it “prompted him to practice the learning mountains and rocks properties not only within his parish”, but in other places where he was “both as a member of Vyborg consistory and by his own wish”.

Apparently, during the last years of his life Alopeus was writing and publishing his works very actively. In 1788 professor N. Shulten who visited Ruskeala quarries, was in his house in Serdobol. He described Alopeus as a quiet, communicable man, with good character.

Pastor Alopeus had a big family. From his first marriage with Anna-Maria Sigfen 11 children were born. After her death he married for the second time to widow Auna Helena Danneberg, who died in 1788. Ulrika Sophia Ursinus was his third wife[9].

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[8] Борисов И.В. Каменное ожерелье Ладоги. Санкт-Петербург, «Издательский дом Герда», 2010. С. 190.

[9] Karjalainenelamakerrasto. Porvo. 1961 (Карельская биография. Порво, 1961, перевод Кяхконен Э.Э., 2012 г.).

Pastor Samuil Alopeus died 14.10.1793 in Serdobol, and he served until the Senior Pastor of South Karelia. His grave is unknown.

As it was already noted, in 1764, fulfilling the governmental program on collecting information about nature and economy in the regions, as well as really wishing to prosperity to South Karelia, Samuil Alopeus prepared a note called "A Short History of Natural Features of Ancientries and Household of This Land", and send it to Vyborg. In this document the pastor drew the attention of the authorities to the considerable deposits of construction stone near Serdobol, thus disproving an official opinion about the poverty of the region. Having got the exact topographical descriptions of all the parishes of Vyborg County from the county emissaries and preachers Mr. Engelgard made a complete description of the whole county and presented it to the Catherine the Great.

On March 7, 1764 there was an Imperial Edict by General-Lieutenant I.I. Betskoy "About the Construction of the Building the Academy of Arts and Constituting a Special Expedition for This"[10]. Already in July 1764 an apprentice of stone-cutting craft Andrey Pilyugin was sent from the Chancery of Construction of Houses and Gardens to the Expedition of Construction of Saint Petersburg Academy of Arts, and there was a task put in front of him: to find the deposits of stones suitable for the construction and decoration[11] of the Academy of Arts building in the vicinity of Saint Petersburg, including Vyborg county[12].

And in 1764 Andrey viewed the exposure of "pudostskiy stone" (calcareous tuff) on the river Pudost, and in July 1765 he went to Vyborg to study rapakivi granites there[13].

In August 1765 Andrey Pilyugin came to Serdobol to review the marble exposures that a year earlier Samuil Alopeus informed about in his letter to the Governor of Vyborg. Serdobol pastor told Andrey about marble deposits in Ruskeala and Joensuu in details and gave him experienced guides. Pilyugin carefully studied the marble exposures, took small samples of stone and at the beginning of September 1765 came back to the capital, to the Expedition of Construction of the Academy of Arts.

The Project Commission liked Ruskeala marble and already in October 1765 Andrey Pilyugin came to Ruskeala again to hold additional researches, take new samples and define the place for a test pit. Samuil Alopeus gave the apprentice what help he could – rendered valuable advices, helped with people and was very attentive to the started business. The pastor's dream was coming true – finally people needed the Karelian stone, and not just for an ordinary construction, but for the decoration of rich capital buildings!

At the end of January 1766 Samuil Alopeus sent to Vyborg a letter with his suggestions on organizing stone excavation in Ruskeala. Coming to the capital the next spring the pastor proved that his suggestions were taken into consideration and based on them Andrey Pilyugin was given the instruction of the Chancery of Construction on further organization of the works. At the same time an edict was sent from the capital to Vyborg Government Chancery; according to the edict "*all working people, who left Karelia because of poverty for searching livelihood in other provinces, have to be recalled and used for quarrying, and none of them will not be given passport henceforth*."[14]

At the end of June 1766 Andrey Pilyugin came to Serdobol again, but not alone – together with four stone cutters. For 800 rubles given by the Chancery of Construction, with Samuil Alopeus's help he hired twenty workers for marble quarry in Ruskeala and Joensuu. First the expedition went to Joensuu to a small island Aresaari on the north of Ladoga Lake, not far from the mouth of the Janisjoki River, where a test quarry was laid. Today this island is called Kalkkisaari ("lime'). On September 11, 1766 the first marble samples from Aresaari Island (Joen) were sent to the capital. At the beginning of October right after them Alopeus sent one more boat loaded with nine marble blocks.

Marble was started to be quarried in Ruskeala only after the works on Aresaari Island had been finished, namely on August 9, 1766. This is the official date of Ruskeala (Ruskolka) quarries birthday. At the end of October the works at marble quarries in Ruskeala were stopped because the depletion of the allocated money. A bit later the Director of the

[10] РГИА, ф. 1329.

[11] РГИА, ф. 789, оп. 14, д. 421, л. 4, п. 27.

[12] РГИА (Опись дел И. И. Бецкого, 1763–1773), оп. 19, отд. IX, д. 1846, 1765, п. 36.

[13] РГИА. ф. 789, оп. 15, д. 421, л. 8, п. 41.

[14] Алопеус С. Краткое описание мраморных и других каменных ломок, гор и каменных пород, находящихся в Российской Карелии. СПб, 1787.

Chancery of Construction, the President of the Academy of Arts, Actual Privy Counsellor I.I. Betskoy gave pastor Alopeus 100 rubles for "great works, travels, expenses, correspondence" uncured by him. Andrey Pilyugin was also distinguished – in 1767 he was made a master of stone-cutting craft[15].

Andrey Pilyugin visited Ruskeala for the last time in February 1767. Then together with him a machinist Kans came to carefully view the Ruskolka River (Tohmajoki) concerning the possibility to install there "sawing and grinding machine with other constructions[16]".

In summer 1767 and 1768 Andrey Pilyugin headed the expedition organized by the Chancery of Construction to Saint Petersburg, Vyborg and Novgorod counties for searching stone for the pedestal of the monument to Peter the Great, but he did not manage to find a suitable block sample. It was done later by Colonel Ivan Vasilievich Zverev, who also took an active part in organizing marble quarry in Ruskeala. Up to the point of his death in 1770 Andrey Pilyugin took the post of the master of stone-cutting craft at the Imperial Academy of Arts.

The life of Andrey Pilyugin, the master of stone-cutting craft, who was one of the originators of construction stone quarry in Vyborg County, ended tragically. This talented, hard-working man could have done a lot for the good of Russia, but he was fated to die in full bloom of his powers. On September 22, 1770 Andrey was on a visit at academic concierge Rafail in his house in Millionnaya Street in Saint Petersburg, and there he quarreled for some reasons with a stone-cutting master, an Italian, Jacques Baptiste Rajani. When sorting things out, Rajani, in a fit of wrath (for some unknown reason), knifed Andrey into the heart, and it was a mortal injury. Andrey Pilyugin died in a week, on September, 29. The police determined the event as an accident resulting in injuries[17].

On September 13, 1767 mining inspectors – Captain of the Guards Kozhin and Colonel Ivan Vasilievich Zverev – came to Serdobol from the capital. They met pastor Alopeus and asked him to accompany them to the started marble quarries in Joensuu and Ruskeala. On the same occasion the Serdobol pastor showed the distinguished guests the exposures of marble five versts south from Serdobol, on the territory of the present-day Park-Hotel "Vinter's Summer House (Villa)". The result of the capital inspectors' trip was a "Circumstantial Record" that they made and, upon return to Saint Petersburg, presented to General-Lieutenant Prince Yakov Alekseevich Bruce.

Based on the report of General-Lieutenant, Colonel of the Guards, and Chevalier, Prince Y.A. Bruce dated January, 16, Empress Catherine the Great, on January 20, 1768, signed the edict of the Senate "About Producing Marble and Crude Stone for the Construction of St. Isaac Church in Serdobol and Ruskeala Churchyards of Kexholm County with Arranging there Grinding Mills"[18].

The sense of this consultum was the following:

1. It is necessary to start quarrying marble and "crude stone" (granite) in Ruskeala ("Ruskola") and Serdobol ("Sardopol") churchyards of Kexholm County, as well as in other place along Ladoga (Joensuu) and Onego (Tivdia) Lakes for the decoration of St. Isaac Cathedral and other buildings of Saint Petersburg. ("*… If Her Imperial Majesty… deigns to designate that… marble and crude stone should be used for this building* (St. Isaac Church – I.B.), *so he* (Y.A. Bruce – I.B.) *is to be ordered to quarry marble and crude stone, where he would find it, because both in Kexholm County – in Sardopol and Ruskolka churchyards – and in other places along Ladoga and Onego Lakes marble rock have appeared to be"*).

2. The quarried marble is to be used not only for the construction of St. Isaac Church, but also other buildings by order of the empress ("(and if)…*marble turns to be such as to be used not only for this building* (the church – I.B.), *but henceforth where ever Her Imperial Majesty would command, different sorts of it, according to the type of buildings, can be used both for external and internal decoration*").

3. It is necessary to build mills for sawing and grinding stone at marble deposits in the specified places, and to hire "*mechanical craft masters*" as contract workers, and to for the supervision – one or two officers ("*In these marble rocks it behoves to certainly build mills for sawing and grinding and by these to hire under contracts mechanical craft masters, whatever kind is needed, and for seeing after the working people – one capable man of the Officer rank, and if needed – two…").*

15 РГИА. ф. 789. оп. 15. д. 84. л. 4.

16 Алопеус С. Краткое описание мраморных и других каменных ломок, гор и каменных пород, находящихся в Российской Карелии. СПб, 1787.

17 РГИА. ф. 789, оп. 15, д. 17, 1770.

18 РГИА. ф. 1310, оп. 1, п.50, л. 18–19, 1768.

4. The wastes from stone quarrying are to be also sold on account of the construction of the church ("And if there will be… pieces not suitable for the construction… during quarrying, to let them to be sold and the money to be included into the sum for the construction…").

5. Local authorities, on the territories of which quarrying is implemented, have to assist to the mining.

6. In order to implement the works with marble, masters and apprentices are to be sent from Ekaterinburg plants.

According to the other edict of Catherine the Great Ruskeala marble quarries were passed under the supervision of the Chancery of Olonetskie Petrovskie Zavody in the same year of 1768.

At the end of 1768 Captain Kozhin came to Ruskeala again together with a machine master Henry Dunkel, who was entrusted to install "a machine for sawing and grinding stones" at the river Riskolka. During one month Kozhin was observing the quarry of marble in Ruskeala and Joensuu and defined that marble quality was getting better with the depth. From the best pieces of marble, produced in the quarries master Berger made a "*pedestal where medals and inscriptions to the memory of St. Isaac Cathedral laying are to be stored*", some marble tables and "*other small works for experience*".

Being in Ruskeala, Captain Kozhin "*established further work with the quarries*", laid buildings for sawing machines, house with flats for the officers, master and supervisor, barracks for workers and soldiers and many other constructions. On July, 21 he set off for the capital taking the marble works made by Berger. Catherine the Great highly appreciated the work of Captain Kozhin and awarded him a title of the Councillor of State.

In August 1768 the Councillor of State Kozhin came to Serdobol again and brought four Italian stone-cutters, who had to stay as masters with marble quarries. Minziahi was appointed master in Ruskeala.

During autumn of the same year at the direction of Kozhin an expedition house with flats for the captain, the ensign and the treasurer, barracks for the corporals and soldiers and different household constructions were built[19].

[19] Алопеус С. Краткое описание мраморных и других каменных ломок, гор и каменных пород, находящихся в Российской Карелии. Санкт-Петербург, 1787.

From that time all three marble quarries of Karelia – in Ruskeala, Joensuu and Tivdia – started to produce stone for the decoration of the capital's palaces and churches, and first of all, for St. Isaac Cathedral.

Ruskeala Marble Quarries under the Jurisdiction of the Office of Saint Isaac Cathedral Construction (the 1769–1796-s)

In 1769 Ruskeala marble quarries, that had just been laid, were passed under the jurisdiction of the Office of Saint Isaac Cathedral Construction (the Commission on Saint Isaac Cathedral Construction). Next to the quarries, opposite marble mountain, on the left coast of the Ruskolka River, working settlement Ruskeala appeared; stone-cutters, workmen, who came mainly from the Urals, and mining chiefs started to live there. Household and living constructions were placed on the only street – Naberezhnaya. A powder shop (store) was built closer to the quarries.

Next to the working settlement, on the side of marble mountain, an orthodox cemetery appeared. The remains of it can be seen now.

A small, unnoticeable village Ruskeala with a frontier post and a post-office changed considerable just for a few years. Stone-cutter and marble-cutters from Ekaterinburg, Italian and Russian stone masters, mining engineers and architects from the capital were coming there. It seemed amazing that marble from the coast of the Ruskolka were to be used for the decoration of the majestic Saint Isaac Cathedral, there were being built in Saint Petersburg as early as in the days of Peter the Great.

In the 1770–1780-s the main quarry of marble was on Belaya Mountain that was called so by Russian (Ural) stone-cutter after the color of the marble it comprised of. From far away the rocks made of marble really seem to be grayish-white and light-gray, though in close up you can see the inhomogeneous geology of marble – white, dark-gray and greenish-gray stripes.

About the situation at Ruskeala (Ruskola) marble quarries at the end of the 1770-s – the beginning of the 1780-s we can find out from the mentioned book of Samuil Alopeus. He wrote that in Ruskeala "*marble mountains are laying around a circle, that has*

5 versts in circumference, but in the middle of this circle there are also mountains of bad gray stone, but the most part of them consists of marble rocks that are different in goodness, strength and color. Here marble of soft and rude rocks of different colors, including red and blue, can be found." The pastor marked some sorts of marble. The most widespread – "*ash-gray wavy with yellow and greenish fibers*" marble that was quarried on Belaya Mountain. Door and window panels in Marble Palace, the decoration of Saint Isaac Cathedral in Saint Petersburg and columns in Gatchina (Antinio Rinaldi was the author of the projects) were made from white marble. The depth of Ruskeala (Ruskola) quarry at the end of the 1770-s – beginning of the 1780-s reached 14–16 m. The deeper the quarrying was, the better marble was getting. About one hundred workers were occupied with the works.

The second sort – "green marble of not complete green color, and with white, yellowish and black fibers and stains, wavy, spotted and doodled" – laid in the neighboring Zelenaya Mountain. When grinded it had a good look and reminded Italian Verd Antique marble.

"… Marble of gray, white, black, not uniform, but wavy spotted (color), fibered and doodled", as well as "dark-gray with white spots" was also found in Ruskeala, but not developed.

According to Alopeus, marble in Ruskeala and in two other marble quarries – Joensuu and Tivdia – at the end of the 1770-s – the beginning of the 1780-s was quarried the following way.

First, along the quarry bench-floor ("*under the mountain*") workers made a horizontal cutting ("*digging")* with 6–8 m depth and, probably, 1,5–1,8 m width. For this in marble rock mass of the bench with the help of iron drilling tools, about 0,7 m long and 25 mm thickness, with welded steel points, they were boring holes. It was done as follows: one worker was holding the drilling tool and the other was hitting on it with a big hammer. The one, who was holding the drilling tool, turned it after every hit. In order to cool down the instruments and remove mud (dust) from the holes, they were constantly pouring cold water into them. They continued boring until the holes reached necessary depth. Two workers bored a hole from 2 to 2,8 m in the rock per day depending on the strength of stone.

After the needed amount of holes was made in the "digging", the holes were dried, filled with gunpowder, closed up with dry clay, where hole for firing the gunpowder was made with copper wire. At noon or in the evening, when workers were released from the works, the holes were fired with wicks. As the result of an explosion big pieces of marble were broken away from the rock. This work continued until the "digging" along the mountain reached the needed dimensions.

Then up from the mountain bench, above the "digging", where rock crevices were seen, they drilled equally deep holes "*one opposite another*", using drilling tools, first short ones, then longer and, finally from 6 up to 8 m, depending on the height of the bench. After boring these holes were also equally filled with gunpowder and fired with wicks. Because of an explosion, the dug down mountain shook and huge pieces were broken away from it, and then they – if needed – were drilled out or cut with iron gads. After all these, the produced blocks ("fragments") were cut with chisels and numbered according to size and wooden pattern.

Samuil Alopeus noted that in order to saw marble in Ruskeala the Councillor of State Kozhin and machine master Dunkel, laid sawing and grinding machine, that cost hatful of money for the treasury, at the river Ruskolka probably, at the end of the 1760-s. However after the transfer of the master to Tivdia (the present-day Kondopoga area), the machine and a dam made with it were damaged. They even did not try to fix and start-up the mechanism as the calculations showed that the work made by hand saws was much cheaper that the maintenance of the sawing machine[20].

Transportation of Ruskeala marble to the destination point – Saint Petersburg – at the end of the XIX century looked the following way. First stones in winter were carried on sledges 30 verst to Heljulja ("Gelilja"), where they stayed until spring. When navigation started marble blocks were loaded on specially built galliots and sent along choppy Ladoga Lake and the Neva River to the capital.

The transportation of marble from Ruskeala to Heljulja quay was very expensive and complicated. The prepared blocks weighing many tons with the help of leverages and pulleys were loaded on special sledges made from long and strong birches lined

[20] Алопеус С. Краткое описание мраморных и других каменных ломок, гор и каменных пород, находящихся в Российской Карелии. Санкт-Петербург, 1787.

with iron. The trees roots served as front bends of the runners. Such sledges were quite durable and could stand the load up to 16 tons and more. The necessary number of horses was put to the loaded sledges: in front – a couple of the strongest in shafts, and after them – on thick and firm ropes with bows – one after another – from 10 up to 80 horses depending on the load weight. Shaft-horses had to be the first to move the load with the help of drivers, and after this all the caravan moved and half-trotted for a verst until the heave sledges stopped. Then again a lot of forces needed to make the sledges move. It took 2–3 or 4 days to move 30 versts with heavy stones in good weather, but in bad weather it took longer. This very distance in good weather with light stones for which 20 or less horses were put was covered only for 1 day.

Every four years the Office of Saint Isaac Cathedral Construction gave the transportation of marble by water and by land to contractors based on public sale. Semen Timofeevich Kanaev, a merchant from Saint Petersburg, was one of the contractors, occupied with the transportation of stone from Ruskeala to Gelila in the 1780-s. He was paid 41,4 kopecks per stone weighing 300 poods and less, 73 kopecks per stone weighing 300–500 poods, 16 kopecks for every pood for stones weighing 500–700 poods and 17 kopecks for every pood for stone weighing 700–1000 poods.

At the same time Pavel Karataev, a merchant from Petrozavodsk, transported marble by water; and he was paid 5 kopecks per pood, but on condition that in case of misfortune he lost his vessel and the treasury lost stones.

An academician, the Court Counsellor of the Imperial Academy of Sciences, doctor of medicine, the member of Free Economic Society, Nikolay Yakovlevich Ozeretckovsky, who was in the expedition around Ladoga and Onego Lakes by order of the Academy of Sciences, visited Ruskeala in the summer of 1785. The notes, summarizing private results of his trip along Ladoga and Onego, were for the first time published in form of magazine articles in "Novye Ezhemesyachnye Sochineniya" ("New Monthly Essays") in 1786. The main results of the expedition were published by the scientist in his book "Travel along Ladoga and Onego Lakes" printed in 1792 and republished with additions in 1812. The scientist – with equal level of knowledge – gave the first sketches of physiographic characteristics, the outline of geological structure and relief, the description of flora and fauna of the territory he has studied. The scientist also widely and fully described the lakes themselves. N.Y. Ozeretckovskiy was the first one in the geographical literature of his time to give such a comprehensive outline of the homeland lakes, thus becoming one of the originators of Russian limnology.

N.Y. Ozeretckovskiy came to Ruskeala ("Ruskola") marble quarries from Serdobol. He made a very short and laconic description of the quarries. It did not contain any new information and differed very little from the data presented by Samuil Alopeus in his book. N.Y. Ozeretckovskiy noted that in the quarries of Belaya mountain they quarried "*marble of the most ash-gray color with yellow and greenish sprays; but in chain of mountains the circle of which stretches around five versts there is also marble of other colors including blue and red, namely there is green marble with the addition of white, yellowish and black strings and spots, there is gray, white and black with sprays, strings and spots, there is some grayish brown and gray with white dots*". Marble was getting better with the depth of mining. The treasury hired independent workers to fulfill works in the quarries. Transportation of marble was done by contractors. Some of them carried stones on carts from Ruskeala to the "*Geljuli*" river, others, on durable galliots – by water to the capital[21].

As it was already noted, the activity of Ruskeala marble quarries was mainly aimed at providing Saint Isaac Cathedral, which was being built from 1768 under the project of Antonio Rinaldi, with facing stone. It was already the third project of Saint Isaac Church.

The first wooden church, named after Saint Isaac of Dalmatia, on the natal day of whom (May, 30) Peter the Great was born, was built near the Admiralty in 1707. This modest in its composition and art solution building in course of time failed to meet both its purpose and architectural look of the city that became the capital of Russia; therefore soon it was decided to build a new church from stone.

On August 6, 1717, on the cost of the Neva River, almost at the same place, where now the monu-

[21] Озерецковский Н.Я. Путешествие по озерам Ладожскому и Онежскому. Санкт-Петербург, 1792, 1812.

ment to Peter the Great ("The Bronze Horseman") stands, under the edict of the emperor the second church of St. Isaac was laid. However architect G.I. Mattarnovi choose a bad place for the construction – on still unfixed coast of the Neva. The church was opened in 1722. Soon, because of the banks caving the soil started to creep, and the church walls cracked. The attempts to restore the church after a thunderbolt and a coming next fire resulted in the church missed its initial look and it was dismantled on the reason of decay in 1763.

As early as on July 15, 1761 by the edict of the Senate, architect S.I. Chevakinskiy was assigned to design a new St. Iasaac Church. Starting out from the initial intentions, he enlarged architectural forms, designed an expressive bell tower and suggested moving the building of the new church far from the Neva, specifying the place where Saint Isaac Cathedral stands now in one of the variants. However, the dates of the construction were postponed and the talented architect did not manage to realize his plans.

When Catherine the Great ascended the throne in 1762, she approved the idea of reconstructing St. Isaac Cathedral, connected to the name of Peter the Great, however she entrusted the design and construction of the cathedral to a young architect Antonio Rinaldi.

Antonio Rinaldi – one of the outstanding masters of the Russian architecture of the XVIII century; his oeuvre reflected the transition from the decorative saturation of late Baroque to the accurate forms of Classicism. Having worked in Russia for more than 30 years, A. Rinaldi left a considerable mark in the architecture of Saint Petersburg and it suburbs. About 25 large constructions, created by Rinaldi, remain, among them: Marble Palace, St. Catherine Church in Saint Petersburg, series of palaces and gardens in Oranienbaum, Gatchina, and memorial constructions in Tsarskoe Selo etc.

Antonio was born approximately in 1709 in a noble family in Italia. Naples played an important role in developing Antonio as an architect. The greatest architect of the late Italian Baroque Luigi Vavintelli was his teacher.

Antonio Rinaldi became one of the first representatives of a new wave of Italians architects, who found their creative homeland in Russia in the second half of the XVIII century.

A. Rinaldi came to Russia in 1752 under the invitation of Prince K.G. Razumovsky. The architecture of Ancient Russia, preserved in the Ukraine, affected Rinaldi as an architect. Among the Ukrainian works of Rinaldi the following are famous: the residence of K.G. Razumovsky in Baturin, the palace of K.G. Razumovsky in Glukhov, Church of the Resurrection in Pochep and others.

A. Rinaldi came to Saint Petersburg in 1754. Being in Saint Petersburg he built in Yamburg (Catherine Cathedral), in Moscow (the great hall of Catherine Palace) and etc. However, his best works that defined the architect's meaning in the history of Russian and the world's architecture were created in Saint Petersburg.

In 1754 Antonio Rinaldi became the architect of the "small court" – the close associates of the future emperor Peter III. In 1761 Rinaldi already had a strong position of the first court architect of the successor to the throne. Already then the future empress Catherine the Great favored him.

After Catherine the Great ascended the throne Antonio Rinaldi became the leading architect of Saint Petersburg. He designed and built up palaces, cathedrals, triumphal arcs and columns, theatres etc. At the same time, he created series of palaces and gardens in Oranienbaum and Gatchina.

Construction of the third St. Isaac Church under Antonio Rinaldi's project started on May 8, 1768. According to the project, the cathedral should have five domes with complicated patterns and a high built-on bell tower. The church was being built at the same place that architect S. Chevakinskiy specified earlier, i.e. where the cathedral stands today.

According to the author, the whole cathedral had to be decorated with marble from Russia and other countries. The construction of the church started 5–6 years behind time, and, probably, during this time the marble suitable for lining – that as it is known, was found in Ruskeala and other places of Karelia in the middle of the 1760-s – was being searched.

Light-gray, bluish-gray Ruskeala marbles from Belaya Mountain went to outside and inside lining of the cathedral walls. Bases, column capitals, window surrounds of the facades were made of them. In the interior Ruskeala marbles were used for the walls lining and etc. Marbles from Tivdia also took part in the decoration of Saint Isaac Cathedral (wall lining, columns, pilasters, frisos, architraves, surbases), as well as marbles from Uven Island that looked similar to Ruskeala marbles[22].

During the construction, Antonio Rinaldi had to introduce a number of changes in his project. As a result the item that appeared was very much different from the initial plan and did not suit for Catherine the Great. Therefore the construction of the cathedral was slow: from 1768 until the departure of Rinaldi to Rome in the 1790-s and continued in the days of Paul I by an architect B. Brenna.

Alongside with Saint Isaac Cathedral Antonio Rinaldi started to build Marble Palace (1768–1785) in 1768.

This building was the first Saint Petersburg construction the faces of which were faced by natural stone of different types using many manners of its dressing. The style – Russian classicism with Baroque motifs.

Before using marble in the Palace lining A. Rinaldi developed his skills in handling stone by making mile stones on Peterhof and Tsarskoye Selo roads, Chesme, Moreyskaya, Crimean Columns, Kagul Obelisk and Orlovsky Gate in Tsarskoye Selo, Chesme Obelisk and Eagle Column in Gatchina.

Marble Palace was built at the direction of Catherine the Great for Prince Grigoriy Orlov as "a building of gratitude". The construction cost was 1 463 613 rubles. And Orlov, in his turn, gave the empress for the palace one of the biggest diamonds in the word for that time weighing 37,9 g, that further was put into the tsar scepter and got "Orlov" name. Its cost was 1 399 410 rubles[23].

Especially for the construction of the palace marble and other stones were being searched throughout Russia. Part of marble came from Italy, part – from Vyborg County and Olonets Province, part – from the Urals. Ruskeala marble was for the decoration of the palace was given by the Office of Saint Isaac Cathedral Construction.

According to D.A. Kyuchariants, when building Marble Palace Antonio Rinaldi "was aimed at harmonious fusion of the building concept with the northern nature – gray expanse of the Neva waters, with soft colors of the pale sky"[24]. That is why Karelian marbles – pale-pink Tivdia and light-gray Ruskeala and Uven and other stones – were used for the palace exterior finish.

Lower floor of the Marble Palace is faced by pink rapakivi granite from near Vyborg. The walls of the second and the third floors are decorated with Serdobol granite from Tulolansaari island. Architrave, upper surbase and the surrounds of the first floor windows are made also from it. Ruskeala ash-gray marble was used only for the surrounds of the second and the third floor windows.

Polished pilasters of Corinthian order from light-oink Tivdia marble, window panels from wavy-striped black-and-white Uven marble with swags from white Ural marble are clearly seen on the gray background of the walls. Main and central facades and side risalits at the height of the second and the third floors are decorated with columns from Tivdia pale-pink marble.

Fig. 1. Marble Palace (1768–1785, A. Rinaldi) in Saint Petersburg

From sometime richly decorated with stone interior of the palace only the interiors of Main Staircase and Marble Hall remained until today. The magnificence of the staircase implemented from dark-green Brusno calley-stone and Ural marble is underlined by carved door surrounds from striped black-and-white, probably, Uven marble. A wide range of different rocks is used in the interior of the Marble Hall: pink Tivdia marble, Italian green serpentine marble, Italian marble of gold yellow color and grayish-gray Ural marble, white statuary marble from Greece, laurite from Baikal, multicolored artificial marble-stucco. Only Ruskeala marble is missing here.

Therefore Ruskeala marble takes a modest place in the decoration of Marble Palace. It can be exp-

[22] Броницкий М.Ф. Камень в архитектуре Санкт-Петербурга XVIII–XIX вв. Ленинград, 1948.

[23] Булах А.Г., Абакумова Н.Б. Каменное убранство центра Ленинграда. Ленинград. ЛГУ, 1987.

[24] Кючарианц Д.А. Антонио Ринальди. Ленинград, 1976.

lained, first, by the limited amount of the stone, as at that time it was mainly used for the decoration of Saint Isaac Cathedral, second, by not enough contrast color pattern of the stone.

In the 1770-s a small amount of ash-gray Ruskeala marble was used in the interior decoration of the Winter Palace. The palace was built by an architect V.V. Rastrelli in 1754–1762 in the style of Russian Baroque. In 1762, when the construction of the palace was completed, the interior decoration of many halls and rooms was not finished yet. V.V. Rastrelli resigned. Then for the decoration and partly reconstruction of the rooms of the Winter Palace, connected with the change of style from Baroque to classicism, Catherine the Great engaged Saint Petersburg architects – I.E. Starov, D. Kvarengi, Y. Felten, A. Rinaldi and others. Exactly at that time they started to widely use marble in the interiors. Ruskeala marbles, as well as the ones from Tivdia and Uven, were used for the decoration of walls, pilasters and window sills and floors lining.

There was a great fire in the Winter Palace in 1837, and almost all the decoration from natural stone was hardly damaged. Marble decoration of the interiors as it looked before 1837 was never restored. Still today you can see window sills and pedestals of sculptures made sometime from Uven and Ruskeala marble in the Winter Palace.

At the end of the XVIII century Antonio Rinaldi used Ruskeala marble outside the capital – in the decoration of Tsarskoe Selo and Gatchina, in the construction of mile stones ("*marble verst pyramids*") of Tsarskoye Selo (1772–1775) and Peterhof (1777–1778) roads.

Catherine the Great once told about Tsarskoye Selo: "When this war (Russian–Turkish) continues, my garden will look like a toy. After every military act a presentable monument will be erected in it".

In 1771–1778 under the edict of Catherine the Great, in memory of the glorious victory of Russian seamen in the sea battle over Turkish fleet of "Sublime Porte" in Cesme Bay of the Aegean Sea (June 24, 1770), under Antonio Rinaldi's project (1771), in the Catherine Park of Tsarskoye Selo, in the middle of Bolshoy pond, Cesme Column was built. As back as in 1771 the empress ordered the Office of Saint Isaac Cathedral Construction to prepare "in the most marble Olonets mountains marble suitable for the construction of this column, and roughly treat there, and finish in Petersburg…, then by parts to move to Sarskoe selo and install on the intended place".[25]

Cesme Column was being constructed concurrently with deepening and changing the shape of Bolshoy pond. Complicated, indented coastline imitates the contour of the Aegean Sea. Next to the column there are two islands reminding of the islands of the Aegean Sea, near which the Russian fleet had two famous historical victories. The column height is 25,5 meters. Its foundation is made from Vyborg rapakivi granites. The column foot (four-sided frustum of pyramid) is implemented from rustication of gray Serdobol granite, red and pink Tivdia marble.

The column itself consists of two tubes: lower (big one) is made of striped Ruskeala marble and upper one – from pink Tivdia marble. The column is decorated with rostrums from pink Tivdia marble and a bronze eagle. Two anchors are laying on the pedestal. There is a signature of the foot: "In commemoration of sea victories, scored in the Archipelago – between Asia and Chios Island, on June 24, 1770 – under the leadership of General Prince Orlov and Admiral Grigoriy Spiridov ten Russian war-ships and seven frigates defeated and put to rout Turkish Captain-Pasha Zhefir Bej with 16 battle ships. There were more than one hundred frigates, galleys, brigantines and small vessels…"

To commemorate the victory of the Russians in 1770 on the Morea Peninsula in the Mediterranean Sea, Moreyskaya column of 7 m height under the project of Antonio Rinaldi was installed in Tsarskoe Selo in 1771. Four-sided pedestal is implemented from marble and granite, steps, the foot and the capital – from white Italian marble, the obelisk – from pink Tivdia marble. Ruskeala marble was also used in the column construction. Installed between the ponds of Staryi (Old) garden of the Catherine Park, the column creates the illusion of the Morea Peninsula.

To commemorate the victory of General P.A. Rumyantcev over the Turkish army on the Kagul river on July 21, 1770, under the project of Antonio Rinaldi Kagul Obelisk was built in Tsarskoe Selo in 1771–1772. Two opposite and main in positioning sides of the obelisk, looking at the palace and Bolshoi (big) meadow, are made of marble with light vertical fibers. Probably, this is marble from Ruskeala.

The entrance to Tsarskoe Selo park at the end of the XVIII century was via front Orlovsky gate (Gat-

[25] Пудовкин В.Г. Рукопись. Архив РМСП, 1974.

china gate), installed under the order of Catherine the Great in 1777–1782 by Antonio Rinladi in honor of Prince Grigoriy Orlov who in 1772 won the epidemic of Siberian plague that broke out in Moscow. The project of the gate was approved by the empress in 1771. Marble works were being conducted under the supervision of stone craft master I. Pinketti in 1772–1777 in the workshops of the Office of Saint Isaac Cathedral Construction, where the parts from natural stone were produced for all other projects of A. Rinaldi.

The pedestal of Orlovsky gate is implemented from red granite quarried on the northern coast of Ladoga Lake near Impilahti. Clear-shafted columns and pilasters – from pink Tivdia marble. They are clearly seen on the background of gray marble, probably, the one from Ruskeala, the main part of the gate is faced with. Serdobol granites also take part in the decoration of the gate.

On the side looking at Gatchina road there is an inscription in golden letters: "Moscow is released from disaster by Orlov" (poet V. Majkov). On the park side – "When in 1771 there was murrain of people and disorders, General Prince Grigoriy Orlov, upon his request, got the order, went there, set the order and obedience, brought livelihood and healing to the orphaned and the poor, and suppressed the rage of the plague by his good creations"[26].

In Gatchina, in Dvortcovy park, at the beginning of the 1770-s under the project of Antonio Rinaldi Cesme Obelisk was built to commemorate the victory of the Russian fleet over the fleet of the Ottoman Empire in Cesme Bay in 1770. This monument was installed in Gatchina according to the order of its owner, Prince Grigoriy Orlov, the brother of Aleksey Orlov who supervised Cesme operation, concurrently with the similar monument of glory in Tsarskoe Selo. The obelisk is located on the end of the cape, deeply coming into Beloe Lake. The lagoon near the cape has a symbolic association with Cesme bay of the Aegean Sea.

In the construction of Cesme obelisk A. Rinladi used multicolored Olonets marbles – pink from Tivdia, white and gray from Ruskeala. The stylobate is made from red Karelian granite. Lower pat of the pedestal (tetrahedron) – from dark-gray and middle part (tetrahedron) – from grayish-silver Ruskeala marble. Four-sided, up to 6 m height, pyramid crowning the pedestal is made from flat-pink Tivdia marble.

In 1770, when Orlov Princes were at the summit of fame, Antonio Rinaldi, installed the Eagle Column in Gatchina. It is crown by marble eagle – the allegory of the Orlovs rise. The column height is 6,4 m, the diameter is 50 cm. The composition consists of three parts: granite rectangular foundation, marble pedestal, the column – from white marble with fibres. It was manufactured by the masters of the Office of Saint Isaac Cathedral Construction. In its initial implementation, except for other Karelian stones, Ruskeala marbles were also used. This column was changed to a new one in 1858–1860.

In 1790–1792 in Gatchina, on Dlinny Island, opposite the single Eagle Column, an architect Vincenzo Brenna built the Pavilion of Eagle (or Temple, from French "temple" – church, temple). The pavilion is implemented in classical style in the shape of semi-rotunda of 9.5 meters height with semi-circular colonnade, and it is perceived as a solemn antique cathedral, devoted to the supreme god – Jove, the Thunder-bearer. The sculpture of eagle, the god's companion, reminds of this. Front side of the pavilion is decorated with 4 paired columns of Tuscan order (as well as the Eagle Column) and two single ones, backing onto the back wall.

The columns height reaches 3 m. They are made of silver-gray marble with white spreads, probably, quarried in Ruskeala. The pavilion is initialed on low-level stylobate from laminated stone. The back semicircular wall is blank and spanned by a hemispherical dome. There are three rectangular niches inside the pavilion walls, and it was supposed to install there the statues of Apollo, Venus and Diana. The whole building is crowned by the sculptural image of Eagle.

In the 1780-s, when Ruskeala marble was widely used in Saint Petersburg, Tsarskoe Selo and Gatchina, the construction of Russian border battery started in Ruskeala, on Kontkasenmaki mountain. The construction of fortifications ended in 1788. The fortifications were made as stone-earth embankment of 1,5–2 m height and 2,5–3 m width. There was a boarded hideout at 10 meters distance from the embankment, in deepening (here and there up to 6 meters depth). Even now, behind the school sports ground you can see the remains of

[26] Пудовкин В.Г. Рукопись. Архив РМСП, 1974.

stone-earth embankments, the old Finnish house stands on.

300 meters from the main battery, down the mountain shoulder, there was one more Russian battery – forward one. Its traces were partly destroyed during the construction of the road approximately in the 1970-s. A gun stick from Russian gun and a bullet were found here during earthworks.

During Russian–Swedish war of 1788–1789, on May 17, 1789 Finnish–Swedish detached unit was trying to battle through Serdobol but was stopped by the fire of the Russian battery and could not move further from Ruskeala.

It was happening the following way. On May 15, 1789 the Russian detached unit, leaving Serdobol towards Sweden (Finland), came to Matkaselka. Major Hans Henri Grippenberg decided to stop the movement of the Russians and with his unit of 200 hundred people moved towards them, towards Ruskeala. The unit of Captain Vetterhof in the amount of 270 people had to come out from Kitee, cross the border and block Ruskeala–Serdobol road.

The Swedes started to attack on May, 17. Grippenberg located his artillery (Captain-Lieutenant Sharpentierp) on the other side of the Ruskolka River (the Tohmajoki), on Otrakkalanmaki mountain, opposite the Russian fortifications. Swedish canons started to fire to the border battery and at the same time they conducted the soldiers via the bridge to the fortifications. Grippenberg was injured into the chest during this fight, but he did not leave the battle field. Captain Findt was also injured – the bullet entered the head. Accurate fire of the canons suppressed the defenders and the Swedes broke into the fortifications. The Russians dropped back to the village, where the fight lasted 4 more hours. But, despite the fact Ruskeala battery was taken, Grippenberg could not deliver destruction to the Russians and left Ruskeala. He went to Savo in July 1789[27].

To commemorate the fight in Ruskeala in 1789 the Finns installed an obelisk from marble block masses on the field of the pastor county estate, closer to the Tohmajoki, in 1939. In the 1970-s, when V.I. Soloviev was the director of Ruskeala plant, this monument was completely dismantled.

Ruskeala Marble Quarries under the Jurisdiction of the Office of the Mikhailovsky Castle Construction (the 1797–1800-s)

Under Emperor Paul I Vincenzo Francevich Brenna was the first architect of the court. He took the Russian service in 1780 and came back to his homeland in Italy in the 1800-s. And constructions in so called “pavlovsky style” are connected with his name.

The most popular constructions of V. Brenna in Saint Petersburg, where Ruskeala marble was used, were Mikhailovsky Castle, Obelisk “To the Victories of Rumyantcev”, the monument to Peter the Great, and in Gatchina – the Pavilion of Eagle.

Ruskeala marble quarries happened to be under the jurisdiction of the Office of the Mikhailovsky Castle Construction in 1797, though the construction of Saint Isaac Cathedral, started by A. Rinaldi, had not been finished yet. When Emperor Paul I took the throne, the walls of Saint Isaac Cathedral were only made for surbases, but being absorbed by his undertaking – the construction of Mikhailovsky Castle – he ordered to take almost all the marble from the uncompleted cathedral. Fulfilling the tsar’s wish, V. Brenna had to deform Rinaldi’s project – to reduce the dimensions of the upper part of the cathedral and built only one dome instead of five. Marble facing was made only until the surbase, and there were bricks upwards. As a result in 1801 a squat unprepossessing building that did not harmonize with parade look of the capital was created. It made the government and the Synod think about its reconstruction already in 7 years after the construction works had been completed.

Mikhailovsky (the Engineers' – from 1823) Castle was built in classicism style under the project of V. Brenna in the 1797–1800-s on the place of the wooden palace of Elisaveta Petrovna, near the Moyka. An architect V.I. Bazhenov initially took part in the elaboration of the project, but by the day of laying of the foundation-stone V. Brenna was already the chief (court) architect.

The castle’s architecture does not have any contradictions with the imagery of the most V. Brenna’s constructions. The main disadvantage of the castle is that it does not present a united architectural idea. But the interior is magnificent, though shambolic.

[27] Сортавальский уезд. Финляндия, 1890.

According to the order of Paul I who was in a harry to finish the castle construction, the stone for its facing, as it was already noted, was taken from uncompleted Saint Isaac Cathedral of Antonio Rinaldi, as well as from the palace of Catherine the Great on cape Pella. Probably, under Paul I Ruskeala marble quarries did not actually work and there was a catastrophic shortage of stone.

Semi-basement of the castle is made of Serdobol granite, as well as the high and wide stairs of the "north" face of the building. Parade "south" face is richly decorated with marble. Its columns and pilasters are carved from pale pink Tivdia marble. Lower part of the portico is faced with rustication of gray Ruskeala marble into which the inserts of white-and-black striped Uven marble are carved. The portico niches are also faced with Ruskeala marble, and columns and pilasters feet and the building surbase are also made of it.

In 1800 V. Brenna installed the monument to Peter the Great (the sculpture had been earlier made by K.B. Rastrelli) in front of the grand gate of Mikhailovsky Castle. The monument pedestal is made of rapakivi granite, the foundation and the lower part – from Serdobol granite block masses, the middle part is faced with Tivdia and Ruskeala marble slabs.

Fig. 2. Obelisk "To the Victories of Rumyantcev" (1899, V. Brenna) in Saint Petersburg

In 1799, under the project of an architect V. Brenna, a marble-granite obelisk "To the Victories of Rumyantcev" was built on the bank of the Moyka River. In 1801 the obelisk was moved to the square close to the Neva, and in 1818 – to the park near the Academy of Arts, opposite the Cadet Corps where military leader P.A. Rumyantcev studied. The obelisk pedestal before 1834 was faced with Tivdia marble and later it was changed to rapakivi granite. Upper part of the pedestal is comprised of Serdobol granite block masses and the row of the diminishing upwards slabs and bars of Ruskeala and Tivdia marbles. Four-sided pyramid of the obelisk is made of three big pieces of Serdobol granite.

At the very end of the XVIII century Ruskeala marbles were slightly used in Peterhof, for example, in facing the pedestals of "Roman Fountains" (1798–1800, F. Stengel, T. Nasonov, F. Brower).

Ruskeala Marble Quarries under the Jurisdiction of the Commission on Kazan Cathedral Construction (the 1803–1811-s)

From January 1, 1803, Ruskeala marble quarries were passed from the jurisdiction of the Berg-Academy to the Commission of Kazan Cathedral Construction ("the Commission on Kazan Church Building").

In September 1804, during his third expedition to the Russian north, an academician Vasiliy Mikhailovich Severgin visited Ruskeala. He came there from Serdobol Via Ruttu and Kola frontier post, probably, by the road that still exists. It is not improbable that this road was specially built to transport marble from Ruskeala at the end of the XVIII century.

Following the results of his trip a book "Survey of Russian Finland" was published in 1805; in this book the scientist, first of all, gave the characteristics of mineral resources deposits, as well as presented detailed information about the population and economy of the region.

V.M. Severgin (1765–1826) was born in Saint Petersburg in 1765, in the year when the great scientist M.V. Lomonosov died. The Severgins family was peasants. His farther was a libertine court musician. Vasiliy Severgin studied under the classical scheme: academic gymnasium – academic university – the Academy of Sciences. He became a famous chemist and mineralogist.

In 1789 V.M. Severgin was elected an adjunet in the Department of Mineralogy, and in 1793, under the recommendation of the director of the Academy of Sciences, E.R. Dashkova, he was conferred the title of an academician (the professor of mineralogy) and had this title up to the point of his death.

As a scientist, V.M. Severgin was at the very top of the development of then existing natural science in European Academe, and at the same time he constantly meant the study of Russia and the creations of its nature, the enrichment of Russian scientific literature and spreading knowledge in the Russian society.

Numerous memories and articles of V.M. Severgin were written mostly in Russian and only some of them – in Latin and in French; they describe the items relating to the spheres of mineralogy, physics, chemistry, the physics of the earth, technology, agriculture and so on; there he stated the idea of close connection between mineralogy and chemistry. In his works Severgin followed the famous Hayue in mineralogy and Lavoisier in chemistry.

Mineralogy was the most important direction of the scientific activity of V.M. Severgin. His works were devoted to collecting and describing minerals, their chemical composition. He deserves the credits for the elaboration of a complex of main characteristics of minerals, their systematization based on the works of his predecessors.

V.M. Severgin stood at the origins of progressive beginnings in the sphere of science, enlightenment, industrial production development.

For 35 years of his scientific activity he deserved the title of the continuer of high scientific-and-patriotic traditions of the great scientist M.V. Lomonosov.

At the beginning of the XIX century V.M. Severgin made three trips inside Russia, during which he paid his main attention to the issues of natural sciences area, mainly mineralogy. Severgin took active part in periodicals.

Work "Survey of Russian Finland" by V.M. Severgin reflected constant interest of Russian governmental and scientific community to the mineral resources of North Priladozhye and, though it was published at the beginning of the XIX century, reflected the approaches specific to "travel notes" of the second half of the XVIII century with their sharp attention to natural resources, the condition of production forces, trade and so on and with relatively summary attention to the history, ethnography, folklore and culture of the studied regions.

In his book "Survey of Russian Finland" V.M. Severgin gave short description of Ruskeala settlement and Ruskeala marble quarries, as well as other deposits of natural resources. The book contains information about the population of North Priladozhye: the academician tried to give comparative analysis of the Finns and the Karelians of Priladozhye. In the specified work there are several toponymical legends and folk tales about the origin of local names; information about the system of resettlement in North Priladozhye and about important populated localities.

According to V.M. Severgin "Ruskal or Ruskala (in Finnish – "red land") consists of 10 wooden houses, one wooden chapel and a stone gunpowder shop. This settlement is located on the River Ruskala. Here are marble mountains from where marble for the construction of Saint Isaac Cathedral Church in Saint Petersburg was quarried…"

In 1804 only 6 people worked at Ruskeala marble quarries.

V.M. Severgin paid special attention to the characteristic of different types of Ruskeala marble and the description of the quarries. He wrote: "Marble here is divided into five numbers according to the five places, where it is quarried, including also the one from Uven. The main quarry № 1 is located one verst from treasury house" and reaches "70 sagenes (more than 140 meters) long and 14–17 sagenes (28–32 meters) depth. Marble is whitish, flaky, spreading depthward by draining cans, without petrifactions and is called salinsky marble. It is considerably mixed by yellowish and greenish asbestiform actinolite and tremolite. In marble there is a sharp lode of 2-vershok thickness coming from the surface into the very depth, consisting from dark-ferriferous fine-grained quartz-mica rock, where there is … fahl ore… here and there… Near the treasury house, on the other side, near Ruskeala, there is a high mountain, called Zelenaya and marble quarried from it – Zelenogorsky. It is gray, mixed with tremolite and asbestos, can be polished well. Panels 1,5 arsheens length and 0,5 arsheens width are made of it. This is marble № 2. The coasts of the Ruskala from the both sides here contain white big-flaky marble, mixed with gray, it is similar to Uven one. Formerly this place was a solid mountain that was sometime cut by the stream of this river waters"[28].

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[28] Севергин В.М. Обозрение Российской Финляндии. Санкт-Петербург. Академия наук, 1805. 133 с.

The scientist marked three more types of marble: “marble № 3, bluish with yellowness, i.e. with yellowish tremolite”, marble № 4, bluish with green, i.e. with green actinolite”, “marble № 5 Uven, striped, consisting of white and gray stripes, similar to Ruskeala one, also with actinolite and with asbestos”.

V.M. Severgin saw manufactured “sample floor items from octangle, dark in the middle, to the angles of which quadrangles of white color are put” in quarry № 1.

The academician was sorry that “there are a lot of crushed marble here, hips of marble lie idle. It would be useful for making lime. This part of Finland could sell it, all the more so Ladoga Lake is located nearby. It would be also desirable that the locals use the example of constructing fences, walls, sheds, houses from cobalt-stone by binding granite round stones with lime as in Livonia. It would safe the forest, and the buildings would be guarded from fires, fields would be cleaned from stones and lime would not lie idle”. It should be noted that in the works of Free Economic Society V.M. Severgin suggested using crushed up free lime from marble on moss-grown meadows in order to increase their productivity.

So, the information of V.M. Severgin considerably completed earlier data of S. Alopeus about Ruskeala marbles. It is interesting that in 1804 “zelenogorsky” marble (marble № 2) had been already quarried on Zelenaya Mountain. And it was undoubtedly connected to the beginning of Kazan Cathedral construction.

Kazan Cathedral was being built in 1801–1811 under the project of an architect Andrey Nikiforovich Voronikhin (1760–1814). Andrey was a bondman of prince A.S. Stroganov. In 1777 the prince sent the talented young man, who was very good in drawing, to study in Moscow, and some years later – to Saint Petersburg and Europe. From 1790, upon his return to Russia, Andrey Voronikhin began to build private houses, decorate a number of rooms in Stroganov Palace. In 1797 for his painting “View to Stoganov Summer House” he was entitled an academician of scenography.

In November, 1801 Paul I assigned the function of supervision for Kazan Cathedral construction to A.S. Stroganov, and he immediately addressed to his favorite Andrey Voronikhin.

Kazan Cathedral is one of the biggest buildings of high classicism style, richly decorated with natural stone from inside and outside. This is one of the most wonderful and original constructions in Europe.

A stone Church of Nativity of the Blessed Virgin earlier stood at the place where the cathedral construction was started. Foundation stone laying ceremony for a new cathedral was held on August 27, 1801. According to the will of Paul I, the architect likened the cathedral exterior to the Saint Peter's Dome in Rome, what was reflected in the solemn two-sided colonnade. But Kazan Cathedral is not a copy of the Saint Peter's Dome. Initially A. Voronikhin planned to build to colonnades, but the means did not reach to that. However, the existing now colonnade (“the Voronikhin’s”) differs much from its Roman prototype.

Kazan Cathedral was planned as the monument to the Patriotic War of 1812. The body of Field-Marshal M. I. Kutozov was buried in it in 1813.

The cathedral building is installed on a massive base from Serdobol granite monoliths. The solemn colonnade of 96 Corinthian columns, made of pory yellowish-gray Pudost calcareous tuff, rests on the same granite. Inside of the cathedral, 56 pairwise Corinthian columns from rapakive granite monoliths, quarried in Vyborg, strike by their beauty. Ruskeala marble of grayish-white and gray color with green stains (“zelenogorsky”, marble № 2) was used for facing the cathedral mosaic floors together with other stones of Karelia – Nigozero shungite shale, rapakivi granite, Tivdia marble. The Royal Pew and the archbishop’s ambon are implemented from Ruskeala and Tivdia marble. The filigree carving on Ruskeala marbles of the Royal Pew elbow boards strikes especially.

It is not inconceivable that architect Andrey Voronikhin could have been at Ruskeala marble quarries approximately in 1803–1804. This guess is based on the fact that at the beginning of the XIX century Andrey Voronikhin made his wedding tour with his young wife to the quarries of Vyborg County, where stone for Kazan Cathedral were being quarried. He certainly was in Vyborg, in Monrepo mines. Probably he visited Ruskeala quarries that worked approximately from 1804 till 1808.

Ruskeala Marble Quarries in the Years of Saint Isaac Cathedral Construction under the Project of A.P. Montferrand (the 1818–1858-s)

It is known that in the years of the latest Russian-Swedish war of 1808–1809 marble was not quarried in Ruskeala. Ruskeala marble quarries were officially at a standstill even in 1816, and this is proved by the document "Communications with Finnish Governor-General about the protection of Ruskeala marble quarries and payment to the carts working at the mining"[29]. In this document Finnish Governor-General Steinheil wrote that according to the information from the inspector of Ruskola and Tivdia marble quarries, Collegiate Assessor Ermakovsky, Ruskeala quarries had been damaged by fires happening next to the quarry, "threatening marble masses by cracks", and asked to prevent it.

On "General Plan of Ruskola Marble Quarry" of 1815 there are 4 actually abandoned quarries: of "white" marble ("the Main" quarry), "black" marble (south from "the Main" quarry, on the coast of the Ruskolka river), "green" marble (on Zelenaya mountain) and "striped" marble (east from Zelenaya mountain, on the right coast of the Ruskolka River").

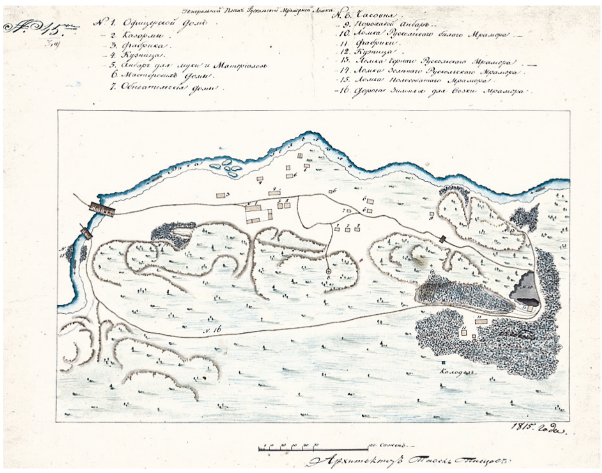

Fig. 3. General Plan of Ruskola Marble Quarry, 1815

On April 20, 1817 Emperor Nikolay I issued a decree about the start of marble quarry in Ruskeala for Saint Isaac Cathedral being under reconstruction.

In 1818 Ruskeala marble quarries were again passed under the jurisdiction of the Commission on Saint Isaac Cathedral Construction. In order to produce mining works special Expedition of Ruskola marble quarry was created. By that time the quarries had already been abandoned for many years, without supervision. It was necessary to clean them and put in proper condition. It was decided to use the marble that remained after Kazan Cathedral construction for Saint Isaac Cathedral.

As back as in 1809 a competition for elaboration of the reconstruction project of Saint Isaac Cathedral was announced in the capital. The biggest architects took part in it: A.D. Zakharov, A.N. Voronikhin, V.P. Stasov, D. Kvarnegi and others. But all of them suggested building a completely new church, not taking into account the demands of Emperor Alexander I to keep the existing church building started by A. Rinaldi and finished by V. Brenna in 1801.

In 1813 there was the second competition, but it also did not reveal any architect following the tsar's wishes. Then Alexander I charged a French engineer, the Chairman of the Committee on Construction Issues and Hydraulic Works, Agustin Betancourt, with preparing suggestions on reconstruction of the old cathedral and selecting a proper architect for this. Betancourt chose a young Frenchman-drawer, an architect Auguste Ricard de Montferrand. Then in Russia he was called "Avgust Avgustovich".

Auguste Montferrand came to Russia from Paris under the recommendation letter of A. Betancourt's friend and immediately started to work. He spent a lot of time in the institute library, studying the shapes of different churches, and made 24 beautiful pictures of the future Saint Isaac Cathedral in different styles. Alexander I liked these works so much that in 1816 A. Montferrand was appointed «the emperor's architect» and he was assigned to prepare the project of Saint Isaac Cathedral.

Initially prepared by A. Montferrand document only vaguely resembled a real architectural project, but Alexander I liked it and he approved it on February 20, 1818. This «project» provided keeping the chancel, the dome supporting pillars, two walls of the old cathedral that also kept its width and height. Only western wall of the building was to be dismantled. The cathedral was crowned by a big dome and four small ones.

[29] ЛОГАВ. ф. 1, оп. 2, д. 200, 46 л., 1815–1818.

The Commission on Saint Isaac Cathedral Reconstruction was appointed; big statesmen and specialists became the members of it. The Commission made to A. Montferrand a number of substantive remarks on the technical part of the project, but he did not pay any attention to them and even published his project. The criticism increased. An architect A. Mauduit became the initiator of it. A number of technical remarks were reasonable enough, the works were suspended, and the investigation was started. However A. Mauduit made some incorrect passes at A. Montferrand, caused by simple envy to the successful compatriot. A. Montferrand protected himself, underlining that he was depending on the Emperor's wish to keep a part of the old cathedral built by A. Rinaldi.

After the Emperor himself interfered, the chief architect A. Montferrand began to correct his project introducing new changes into it. The works could not be completely stopped, as 5 million rubles had already been spent, the cathedral foundations were laid and granite monoliths for the columns were being produced in the quarries.

The new project of A. Montferrand approved by Alexander I on April 8, 1825, kept only a small part of the old church – the chancel walls, the foundation and two eastern pillars.

The works on building Saint Isaac Cathedral were officially supervised by the Commission on Saint Isaac Cathedral Construction assigned in 1818. Auguste Montferrand was the chief architect. Experienced engineers were in his team, and with their help he found the structural solutions that were 50–80 years way ahead of that time. Alexander I and Nikolay I, whose orders not always coincided with the project performers' opinion, paid constant attention to the construction.

In 1835 A. Montferrand introduced new, quite substantial changes, into the project that were approved by Nikolay I.

Stone porticos with granite columns were being built before the walls construction what contradicted the rules of architecture, but there was no other way. The first one from the 48 granite columns was installed in 1828, the last one – in 1930.

Walls and pillars were built in 1836. Entablements and the most part of attic were finished. 24 columns of the dome drum were installed during just two months in 1837.

In practice, the construction of the building was finished by 1840, and after that the creation of sculpture decoration, painting and mosaic works were being conducted during 18 years.

For the construction and decoration of Saint Isaac Cathedral in the 1830–1840-s different rocks were used in very big quantities – granites, marbles, cleaving stones, to a lesser extent – quartzites, green copper minerals, azurites and others – and it was the reason for calling Saint Isaac Cathedral "the museum of facing stone".

The building pedestal is faced with rapakivi granite. Colossal colonnades of the four porticos with 48 columns are impressive. 24 columns stand around a big dome, 32 decorate four small domes. In total – 112 columns from rapakivi granite quarried in the quarries of Finland.

Fig.4. Saint Isaac Cathedral (1818 – 1858, A. Montferrand) in Saint Petersburg

All the cathedral walls with attics are faced with panels of gray and light-gray Ruskeala marble quarried in the Belaya mountain quarries. Different door porticos are also cut from Ruskeala marble. Marble plates were fixed to the walls brickwork with the help of metal staples. Ruskeala marble participates also in the floor facing. Final treatment of marble parts was being made on the cathedral construction site.

The huge interior of Saint Isaac Cathedral, housing up to 15000 people, is richly decorated by natural stone. Lower part of the walls and the pillars are faced with "plate shale" of Nigozero deposit near Kondopoga. Upper – white Italian and light-pink Tivdia marbles are used (pilasters and columns). Under the pilasters there are medallions and boards from dark-green solomenskaya breccia. Plates from

Genoese, Siennese and other imported marble of different colors are put into the walls.

Fig. 5. The Walls of Saint Isaac Cathedral are Faced with Ruskeala Marble

Mosaic floors of the cathedral are faced with plates of dark-gray and light-gray Ruskeala marble and other rocks.

Saint Isaac Cathedral was dedicated on May 30, 1858. The main life-work of the great architect A. Montferrand was fulfilled.

On June 28, 1858, almost one month after the dedication of the cathedral, A. Montferrand died of a twinge of rheumatism. He was buried in Paris, at Montmartre Cemetery, where his grave was lost soon.

Marble quarry for the new Saint Isaac Cathedral was started at the end of 1819. On September 10, 1819, the Commission on Saint Isaac Cathedral Construction ("reconstruction") charged the inspector of Ruskeala marble quarries Iosif Efremov of starting marble quarrying and increasing the number workers (official and independent) at the quarries up to 250 people[30].

According to A.G. Bulakh, probably, in 1820 and in 1821 the chief architect of Saint Isaac Cathedral Auguste Ricard Montferrand visited Ruskeala marble quarries, personally observing the quarry of stone at Belaya Mountain. But documentary support on this issue has not been found yet.

In order to provide the workers of the quarries with products and goods the Expedition of Ruskeala (Ruskola) marble quarry concluded an agreement with a peasant from Yamozero village of Sujstamo Church Yard of Serdobol County Klementiy Osipov on September 4, 1819. According to the agreement the contractor had to supply the following food and goods on fixed prices to Ruskeala quarries: rye flour (3 roubles per pood), wheat flour (7,8 roubles per pood), peeled barley (4,9 roubles per pood), buckwheat (4,9 roubles per pood), wheat grits (7,7 roubles per pood), grist (6 roubles per pood), pea (5,2 roubles per pood), salt (2,4 roubles per pood), hemp-oil (17,75 roubles per pood), butter (17,2 roubles per pood), salted meat (6 roubles per pood), soap (23,3 roubles per pood), leather, soles, gloves and etc.

The other document dated October 28, 1822 says about giving the permission to a Serdobol commoner Grigoriy Petrovich Lapin for the supply of provisions for the quarries workers and to a contractor Anton Ievlev for the quarry of marble for a palace of some knyaz[31].

G.P. Lapin (1768–1830) was in deed occupied with contract work at Ruskeala marble quarries. His body was reinterred by his son, merchant Matvey Lapin (1780 – the 1840-s) at Ruskeala Orthodox Cemetery in March 1834. Here, at the old cemetery, that now looks more like a forest, 4–5 marble gravestones with signatures wiped out by time, including the one on the grave of G.P. Lapin, remain.

One can hardly read on the other grave-stone: "The body of a departed master of Tivdia marble quarries Semen Sazonov is buried on this place. He was 33 years old and he left orphans his wife and four children, he died in the year of 1821, on September, 27." And this is a fact that for some time master from Tivdia marble quarries worked at Ruskeala quarries.

In the 1820–1840-s marble quarried in Ruskeala was transported to Saint Petersburg the same way as it had been done at the end of the XVIII century: about 30 versts in winter it was transported by the road till the quay at the Geljulja (Heljulja) River and, when navigation period started, about 300 km along Ladoga Lake and the Neva River.

In Leningrad District Archives of Vyborg there is a document (reference) № 257 dated October 13, 1820: "The list with the reference of chief cup bearer, member of the State Council, Actual Chamberlain of Prince Golovin, Finnish Governor-General, to the General from the infantry, Prince Steinheil". This document says that in order to transport marble from

[30] ЛОГАВ. ф. 1, д. 213, д. 197, 1819.

[31] ЛОГАВ ф. 1, оп. 2, д. 213, 10 л, 1822.

Ruskeala marble quarries to the quay in Geljulja settlement, at 26 versts distance, the Commission on Saint Isaac Cathedral Construction concluded a contract with a peasant Semen Ser and Kirill Sadovnikov.

In the same document, the member of the State Council, Actual Chamberlain and Chairman of the Commission on Saint Isaac Cathedral Construction, Prince Nikolay Nikolaevich Golovin asks Finnish Governor-General, Prince Steinheil "… to charge the one who should to of making necessary orders from local authorities so that the road established from the quarries to Geljulja settlement for transporting marble by which it was transported before… shall be cleaned and local authorities shall make no stops of marble transportation, but shall render the respective assistance, or any small stop in marble transportation by force of the concluded contract shall be addressed to the Treasury, and in conclusion, to arrange a convenient place by the quay for storing the marble… "[32]

According to the "List of workers and servants of Ruskeala marble quarry" made up on November 13, 1824, 70 men and 29 women were numbered at Ruskeala marble quarries. At that time the Collegiate Counselor Andrey Davydov was the inspector deputy of Tivdia and Ruskeala marble quarries. He was more than 50 years old and he lived in Ruskeala together his wife Paraskaveya Alekseevna and their six children.

Lieutenant Efimov, 28 years old, served in Ruskeala as a treasurer, Terentiy Tokarev (46 years old) married to Ekaterina Davydova. Ivan Suysmin (29 years old), who lived together with his wife Avdotiya Vasilievna and two children, worked as an indersteiger. Besides, an ober-steiger Dorofey Timofeev with his wife, daughter and son was on secondment at Ruskeala expedition.

In 1824 Vasiliy Zubrinskiy, who was 41, worked at the quarries as a stone-raiser. He lived in Ruskeala with his wife Avdotya Nikitina and five children at the age of from 7 to 17 years and his old mother Natilia Zubrikova. Stepan Tokarev (42 years) was at the same position. He had a wife – Paraskevya Fomina – and two children, 14 and 8 years. Egor Tokarev (39 years) also worked as a stone-raiser, he lived in Ruskeala with his wife Marfa Saveleva and a son of 14 years. The list of the stone-raisers also mentions Grigoriy Sujsmin (25 years), Danila Ivanov (22 years), Ivan Tokarev (29 years).

In 1834 mainly young people aged from 18 to 25 years worked at Ruskeala quarries: Mikko Gejkala, Matti Kinnun, Kondratiy Fedorov, Pietar Immonen, Anty Kozon, Efetta Gillutar, Ertu Immotar, Lavri Immona, Kristina Kjarnjaka; and less people of middle age – from 34 to 46 years worked: Ertu Immotar, Marja Pavlova, Ivan Matveev. Besides, 26 workers from Tivdia marble quarries were at Ruskeala quarries[33].

The Collegiate Counsellor Ermakovskiy was the inspector of Ruskola marble quarries at the beginning of the 1830-s.

According to early data, in some years of the 1820-1830-s, when marble was extensively quarried for Saint Isaac Cathedral, the number of workers at Ruskeala quarries reached 300–700 people.

In the 1820–1840 the Commission on Saint Isaac Cathedral Construction gave the quarry and transportation of Ruskeala marble to local and guest merchants under contracts; and they, in their turn, hired local peasants for these works.

In 1827 the Commercial Counsellor Ivan Fedorovich Sherbin carried "*770 pieces of marble weighing 84695 poods and 11 ponds (136 t)*"[34] on vessels by Ladoga and the Neva from Ruskola marble quarries for the construction of Saint Isaac Church.

Merchant Matvey Kuptcov was occupied with winter transportation of marble blocks from Ruskeala to the quay in Heljulja in 1831–1832. According to the contract dated October 18, 1831, he assumed a commitment to carry 166 "pieces" of marble under different prices, namely: "*weighing up to 100 poods in a piece – per 11 kop., up to 300 poods – per 16 kop., from 350 – 400 poods – 22 kop., 450 – 700 – 39 kop., 700 – 1000 poods – 60 kop., 1000 – 1074 poods – 65 kop., 1074 – 1267 – 80 kop. per pood…*"

Merchant belonging to the top guild Sergey Ivanovich Molchanov was occupied with the transportation of marble to Heljulja and to Saint Petersburg from 1832 till 1835. On August 18, 1832, he concluded a contract with the Commission on Saint Isaac Cathedral Construction according to which he had to "quarry" marble "at Ruskola quarry" "for the surbase of big entablement" of Saint Isaac Cathedral, treat it and supply to the church under construction

[32] ЛОГАВ ф.1, д. 212.

[33] ЛОГАВ ф.1, д. 216.

[34] РГИА ф. 1311, оп. 1, д. 401, л. 85.

during three years. In general C.I. Molchanova was obliged to quarry 477 big pieces of marble weighing 226 299 poods[35].

On July 19, 1833 the Commission on Saint Isaac Cathedral Construction sent a letter to the Governor of Vyborg County asking to assist merchant Sergey Molchanov in getting permission for marble transportation from Sortavala authorities[36].

In winter of 1833 merchant Matvey Kuptcov transported 175 "pieces" of marble (instead of 166 as the contract stated).

In 1832–1833 during the transportation marble from Ruskeala to Heljulja there was an incident that was even considered by the top governmental authorities. It is stated in the letter № 637 dated July 11, 1835 of the Commission on Saint Isaac Cathedral Construction to the Governor of Vyborg County[37]. According to this document, on March 23, 1832, a local peasant Mikel Sijtonen hired by Matvey Kuptcov, transported by winter way "marble stone under symbol № 20 from Ruskola quarry (the dimensions are 3,05 × 1,9 × 0,95 m), but due to muddy season emerged left it halfway to Geljulja quay in Rjutti (Rjuttju) village".

The next year, when merchant Sergey Molchanov transported marble from Ruskeala, M. Sijtonene, carried the left stone to the quay in Heljulja. However it appeared that both M.Kuptcov and S. Molchanov had not paid Sijtonen for his work. Then the peasant addressed to Serdobol city administrator Karl Kugren for help, and he addressed to the Commission on Saint Isaac Cathedral Construction that suggested the aggrieved applying to court.

During the transportation of marble blocks to Heljulja incidents between contractors and the owners of the lands through which stones were being carried were often. Thus, the petition of merchant belonging to the top guild S. Molchanov to the Commission on Saint Isaac Cathedral Construction dated July 15, 1835, says that he paid to the land-owners "*land money, even with a great upcharge compare to how much they should get…*", but the latter were all the time unsatisfied with the charge and prevented marble transportation by his actions demanding to increase the charge. In this concern S. Molchanov asked the Commission on Saint Isaac Cathedral Construction to define "*how much land money should be paid to every owner and this establish unhindered marble transportation*".

Having considered this petition, on December 13, 1835, the Commission on Saint Isaac Cathedral Construction sent the Governor-General of Vyborg a letter-asking to render help to merchant S. Molchanov in solving this problem. But, probably, there was no reaction, therefore, almost in a year, on November 24, 1836, the Chairman of the Commission on Saint Isaac Cathedral Construction Prince Lita sent to the Governor-General of Vyborg one more letter reminding the stoppages of marble transportation from Ruskeala quarries. In this letter Prince Lita asked the Governor-General to give a direction "*both about opening free transportation of the produced marble from Ruskola Quarry to Geljulja quay so that the treasury can not be subject to this issue and loss, and about defining lawfully the following charge to private owners for the use of their lands during marble transportation in winter…*"[38]

On November 26, 1836, the Chairman of the Commission on Saint Isaac Cathedral Construction sent to Adjutant General, Knyaz A.S. Menshikov letter № 1128, where he asked "*to take measures on stopping such obstacles from the side of private owners…*", as well as "*to charge a reliable civil servant of agreeing on site the owners on the charge they are willing to have for marble transportation through their lands, and as this transportation is being done only by snow, when any owner do not have any damage, the charge should not be big*". It was suggested to take bonds from the land owners "*in order to avoid any disputes on the issue", as far as these disputes cause unexpected expenses and "the construction of the house of God slows."*

On December 21, 1836, the Governor-General of Vyborg County sent the Commission on Saint Isaac Cathedral Construction an official answer on marble transportation, the content of which is unknown. And the discussions on this issue lasted for three more years. Only on December 9, 1839, the Commission on Saint Isaac Cathedral Construction allocated 1 174 roubles in paper money to reward the

[35] РГИА ф. 1311, оп. 1, д. 601, л. 154, 167.

[36] ЛОГАВ ф. 1, оп. 2, д. 231, 6 л, 1833.

[37] ЛОГАВ ф. 1, оп. 2, д. 236, 11 л, 1835–1836.

[38] ЛОГАВ ф.1, оп. 2, д. 240, 33 л., 1835–1837 (Дело по жалобе купца Молчанова на притеснение местных властей при доставке мрамора из Рускольских ломок для Исаакиевского собора).

land owners for using their lands during transportation of marble from Ruskeala to Heljulja[39].

Engineer-Captain von Derschau was one of the latest contractors dealing with the transportation of Ruskeala marble for Saint Isaac Cathedral at the end of the 1840-s – the beginning of the 1850-s[40].

In the 1830–1840-s a small amount of Ruskeala marble was used for the manufacture of artware.

An idea of using Ruskeala and Tivdia marble to produce different vases, candleholders, tabletops, mantelpieces and other small architectural forms leaped in A. Montferrand's mind, probably, at the end of the 1820-s. In order to save money A. Montferrand decided to set up the production directly on the sites of the stone quarry to transport not raw parts, but finished products, and it took some years.

In 1830, after agreeing with the big authorities, the new production was set up. A. Montferrand sent drawings to the site of production and got different stone items from there. Despite different obstacles from the side of the Commission on Saint Isaac Cathedral Construction, the production of stone artware was gradually set up. A. Montferrand once wrote that "*vases were ordered to the quarries only to see the level of workmanship with which products in Tivdia and Ruskola are produced*". On April 15, 1831, A. Montferrand submitted to the approval of the Commission on Saint Isaac Cathedral Construction his "drawings of marble products that can be made at Tivdia and Ruskola marble quarries…" The projects of fireplaces, vases of different forms, pedestals, grave stones and tabletops were pictured on 10 pages.[41]

On May 20, 1831 the projects of A. Montferrand were approved and he started to manufacture full scale templates that were ready by June, 15 already.

From 1831 to 1834 a great number of products were manufactured, and 90 boxes were needed to send them to the capital. These were multicolored vases, bowls, urns, pedestals, tabletops…

[39] ЛОГАВ ф.1, оп.2, д. 239, 38 л., 1837–1839 (Переписка с Финляндским генерал-губернатором, Комиссией по строительству Исаакиевского собора и полицейскими властями губернии по жалобе подрядчика Молчанова о притеснении со стороны крестьян при перевозках мрамора и об урегулировании этого вопроса) ЛОГАВ ф. 1, оп. 2, д. 16, 39 л.

[40] ЛОГАВ ф.1, оп.2, д. 253, 43 л., 1847.

[41] Шуйский В.К. Огюст Монферран. Москва, Санкт-Петербург, 2005.

The first marble products of "Tivdia and Ruskola marble quarries" were carried to Saint Petersburg in 1834 and placed to the shops with Saint Isaac Cathedral constructions.

For several years more than 100 marble products were sold. However the raised money did not cover the expenses for the production work. The manufacture of artware from Ruskeala and Tivdia marble according to A. Montferrand's drawings was stopped in the 1840-s, but they were being sold until the middle of the 1850-s.

In the first third of the XIX century Ruskeala marble was quarried not only for the decoration of the capital's churches and palaces, but also for the production of construction lime. As back as in the beginning of the 1820-s a lime plant ("Ruskola Lime Establishment"), where quarried marble was burnt for lime, was commissioned in Ruskeala. The plant was under the supervision of Saint Petersburg State University. An interesting document on 32 pages remained in Leningrad District Archives of Vyborg – "A case over auction selling of the property of Ruskeala Lime Plant" for 1827–1832[42]. In letter № 2072 dated November 10, 1827, rector of Saint Petersburg State University Anton Segurov suggested to the University board closing "Ruskola Lime Establishment" and selling by public auction all its property situated in Ruskeala, Rautakangas ("*Rauda-kangas*") and Heljulja ("*Geljulja*").

According to the enclosed inventory made on July 16, 1826, the mentioned lime plant in Ruskeala had 10 ("*kozhukhs*") burning kilns, where crushed marble was burnt for lime. The kilns were made of marble pieces and "plates" and had four-cornered section and only one – oval section. The wall thickness of kilns at the bottom was 1 ¼ arsheens and was gradually decreasing upwards reaching ¾ of arsheen.

The first kiln ("*kozhukh*") made of marble with four charging holes on every side, length – 3 sagenes and 2 arsheens, width – 1 sagenes and 1,5 arsheens, height – 1 sagene and 0,5 arsheens, stood empty, without lime. A roof from boards and slabwood was made under it. The second kiln with six charging holes on one side, length – 6 sagenes and 2 ¾ arsheens, width – 2 sagenes and 1,5 arsheens, height – 1 sagene and 0,5 arsheens, covered with roof, was completely filled with burnt lime.

[42] ЛОГАВ ф.1, оп.2, д. 16, 39 л.

The other eight kilns were empty. The third kiln, made of plates, with three charging holes on one side, length – 3 sagenes, width – 2 sagenes and 0,5 arsheen, height – 1 sagene and 0,5 arsheen, was without roof – there were only poles with rafters. The fourth kiln with four charging holes, length – 3 sagenes and 2 arsheens, width – 2 sagenes and 1,5 arsheens, height – 1 sagene and 0,5 arsheen, was made of marble. There was no roof under it also. The fifth kiln, marble one, with four charging holes, length – 4 sagenes, width – 2 sagenes and 1,5 arsheens, height – 1 sagene and 0,5 arsheen, also stood roofless. The sixths kiln, also marble one, with six charging holes one two sides, length – 6 sagenes, width – 2 sagenes and 1,5 arsheens, height – 1 sagene and 0,5 arsheen, had a board shed. The seventh "*kozhukh"* made of marble and plates with three charging holes, length – 3 sagenes, width – 2 sagenes and 1,5 arsheens, height – 1 sagene and 0,5 arsheen, was also cover by boards and slabwood. The eighths kiln with four charging holes on one side in two rows, length – 4 sagenes and 0,5 arsheen, width – 3 sagenes, height – 1 sagene and 0,5 arsheen, was made of plates and had oval section. The ninth kiln, marble one, with four charging holes on one side, length – 4 sagenes, width – 2 sagenes and 1,5 arsheens, height – 1 sagene and 0,5 arsheen, stood without any cover. The tenth kiln did not fit for use and was filled with ruined rocks.

A shabby logged barn, length – 4 sagenes and 1,5 arsheens, width – 2 sagenes and 1 arsheen, height – 1 sagene and ¾ arsheen, stood next to the burning kilns in Ruskeala.

Besides, a great number of different materials and things were stored at the plant warehouse: slabwood, firewood, clay, sand, barrels, iron hooks, iron drills, shovels, hand saws, wooden buckets, wooden wheelbarrows and etc.

The lime plant in Ruskeala ("Ruskala") built a new two-room logged house on stone foundation.

In Rautakangas, on the coast of the "*Geljulja*" (Heljulja) river, 4 versts from Geljulja village, Ruskeala lime plant according to the inventory, owned a wooden barn, length – 12 sagenes, width – 4 sagenes. 295 barrels of "*kiptolka*", 60 empty barrels for lime eligible for repair, boards and logs were stored in it.

80 barrels with lime, boards, a screen were stored in a barn that "Saint Isaac Marble Quarry" owned in the village of Geljulja, on the river coast, from 1824; and near the barn – logs from poles, rafters and beams, boards for roof.

In document № 4291 dated December 29, 1827 "About the assessment of Ruskeala lime construction" Adjutant General Zakrevskiy informed that the Central Administration of Academies ordered Saint Petersburg University to sell all the property of the lime plant that the University owned.

On May 29, 1828, the Emperor approved the regulations on the Committee on selling the property of Ruskeala Lime Plant. The regulations stated that during the construction of the buildings of Saint Petersburg University there were disorders with administration of accounts and that the persons connected to it had to be presented to the court. Financial frauds were also connected to the activity of Ruskeala plant that supplied lime for the construction of Saint Petersburg University. The Treasury was hardly damaged by these actions, therefore the decision on selling all the property of Ruskeala plant in compensation of the Treasury and laying all the damage at those found responsible at law was taken.

By the end of 1828 the Treasury had spent more than 76 614 million rubles on marble quarry and lime production in Ruskeala.

Document № 342 dated March 12, 1830, stated that "Ruskola Lime Establishment" was up for auction for 2909 rubles and 72 kopecks. The auction was supposed to be held before February 7, 1830[43]. And only many years after, at the end of the XIX century, lime plant again started its work in Ruskeala.

By the beginning of the 1830-s Ruskeala settlement was completely formed on a new place – on Kontkasenmaki Mountain, on the land of the former village of Rujsselka. Ruskeala became the center of Ruskeala volost.

On September 29, 1829, the parish meeting decided to build a new church in Ruskeala instead of the old, run-down one. Place for it was chosen on Kontkasenmaki Mountain, north from the old church built in 1732. The project of the church was elaborated by architect Granstedt and approved by famous architect K. Engel. The construction of the church was in 1833–1834. The church belonged to cruciform churches with bell tower that were wide spread in the first half of the XIX century. A pyramid-shaped dome was situated in the center of the church.

[43] ЛОГАВ ф.1, оп.2, д. 16, 39 л.

A two-storey bell tower with pilasters was crowned by a cross. The church could admit 800 people.

An entrepreneur from Saint Petersburg, Bota, who for some time was the owner of Ruskeala quarries, gave the church an altar. The church was dedicated in 1834. Starting from that time they started to hold burying at a new cemetery, in a little bit of place Hanki (the same place as nowadays). The house of the priest was located next to the church. Ruskeala church was under repair several times, the latest one – in 1928 under the project of architect Juhani Viksted Viist from Vyborg.

An 11-reedwork organ was installed in the church in 1912. The bell tower had two bells. The big bell was cast in Stockholm in 1750. The other bell, cast in 1878 in Vartsila, was presented by merchant T. Laurikainen. The church altar pictured the Ascension of Christ and was bought on the money that Italian national A. Pota had paid as a tax for marble quarry in Ruskeala quarries.

The houses that stood around the church belonged earlier to Rujsselka village. When leaseholders of the pastor became independent, a village appeared around the new church and it was named Ruskeala. This village was surrounded by Rujsselka village and limited by the Tohmajoki River from the north, by Kallitsa village – in the direction of road to Sortavala, and by Kaalamo village – near the Karankoja stream.

Mining Service Captain V.P. Sobolevsky visited Ruskeala marble quarries in 1838. He published his note in a book "Review of Old Finland and Description of Ruskola Marble Quarries, appeared in 1839".

V.P. Sobolevsky described Ruskeala deposit as follows: "Ruskola marble comprise a huge rock mass (about two versts length and 0,5 verst width), directed from the north-west to the south-east. Marble rock mass comes out to the day in form of a single range and rises in some places more than 150 feet above the Ruskolka river horizon. Mineral masses, surrounding it, belong to, from one side, different corniferous rocks of a quite tight displacement and actinolite, and from the other side, either mica schist, or the rocks close to it… Independent from the main rock mass, lime stone forms some more parts, the biggest one of which is on the southern coasts of Singan-Lambi Lake…

The main rock mass is comprised of fine-grained (thick) marble, that in some places has crystalline structure. Chemical analysis showed that the lime stone comprises magnesia alba (dolomitic limestone, or dolomite). The dolomite underlays by confluent masses that do not contain any petrescences. The mixtures of it: actinolite, nordenskioldine, white quartz, pink mineral, calc spar looking as soap rock, in form of rhombohedric joints. Big amount of green actinolite is present in marble in the southern part of the main rick mass (called Zelenaya mountain), but it is also present in marble of Singan-Lambi coasts. Nordenskioldine (yellow mineral of ray structure) is connected with tremolite, forms white stripes and fibres in marble. The workers call it "squartz". It is harder than straight limestone, and stone cutters do not like treating it. White quartz is present in marble in form of fibres and bonnies. Quartz dolomite has a considerable hardness. Soap rocks are rare.

General color of Ruskeala marble is gray-bluish with white, bluish or dark-gray stripes and fibres. It has greenish color in Zelenaya Mountain and near Singan-Lambi Lake. Here you can find very beautiful white marble and next to Singan-Lambi – also black. There are no bright color marbles similar to Tivdia ones here, however, in terms of density, these marbles belong to the strongest dolimites suitable for construction …

Several lodes of green rock cutting marble of the main rock mass can be seen in the quarry itself. Their rock can be from chlorite dissepiments… white rock is accompanied by calc spar, magnetic and gray pyrite, gray copper ore (Severgin evidence it) and pieces of mica schist…

Marble cut by the Ruskolka river is called coast one. When considering it, mica and sheeting can be seen… Marble rock mass underlays in the depth on mica schist…"[44]

V.P. Sobolevsky noted that more that 300 people worked at Ruskeala quarry in 1838, and in previous years the number of workers reached 700 people.

The "Main" marble quarry for that moment presented "a huge open-pit mining surrounded by heughs of marble up to 8 sagenes (more than 16 m) height from all sides". According to approximate calculations of Lieutenant Gettung, about 7200 cubic sagenes of marble, i.e. 12,5 million poods (200 000 t), were quarried at this quarry from 1769 till 1838.

[44] Соболевский В.П. Обозрение Старой Финляндии и описание Рускольских мраморных ломок. Санкт-Петербург, 1839.

A lot of marble remained as break stone. This break stone (crushed stone) and exhaust “pieces” were transported from the quarry via a pass in the northern part of the quarry directly to the valley of Liko and Sulo lakes. The bottom of the “open-pit mining” was at the same level with the valley.

According to V.P. Sobolevsky works on marble quarrying at the end of the 1830-s were conducted in a very simple way, by stages, almost the same way as at the end of the XVII century. At the beginning, with the help of “gunpowder-firing cuttings”, huge “masses” of stone were chopped off the mountain. For this purpose, they made a horizontal cutting (“piedmont”) along the bench-floor of the quarry and at the same time – two vertical cuttings (“goffans”) on the sides of the “mass”, up to 5,6 m long and about 1,7 m width. For this, they stripped down boreholes of “1 ½ inches in diameter, up to 8 vershoks depth”, and put 1/8 pound of gunpowder into each one. Then they started finally chopping off a block mass from the rock; for that purpose, along future break line, at the distance of 2,1–6,3 m, they drilled out “cylinders” of 7,5 cm in diameter to the depth of 5,6–9,1 m for which per 3 poods of gunpowder was needed.

Two types of drill rods were used for drilling: dihedral ones (for soft rocks) and tetrahedral ones (for hard rocks). The length of ordinary drill rods reached 1,4 m, and for drilling the “cylinders” – up to 9,8 m. The works were being done in pairs: one worker held drill rod, the other one hammered on it.

On “piedmonts”, where drilling was inconvenient, unlike the goffans, two workers in summer time drilled out holes of complete length up to 4,5 m, in winter time – up to 3,5 m, and in very hard rock – only 0,4 m.

By this way “masses” of marble weighing up to 300000 poods with volume of no less than 170 cub. sagenes were chopped off.

For more convenient treatment of “mass” its “piedmont” was scattered by break stone. Marble “mass” broken off the rock was then divided into block masses with the help of gunpowder and the block masses in their turn were divided into “pieces”. If there were cracks in stone, wedges were driven into them. To finally divide stone they drilled out a hole, charged it and fired.

Works at the quarry were being done continuously: both in summer and in winter, and drilling – even at night. For safety reasons, chopping-off “mass” was done during lunch time, after evening work or early in the morning, before workers came to the quarry. Every day, three times, long cannonade stunned the outskirts of Ruskeala.

Before 1831 heaps of stone were double – “piedmonts” were in two levels, i.e. the clift was divided into two parts. First the upper “mass” was detached, then – the lower. Starting from 1833, under contractor S. Molchanov, they started to detach stone in a single step, i.e. to the whole length of the quarry.

Water collecting in the quarry was constantly removed by one pump. When the water flow was big, it would have been possible to make a hole into the deep valley of the Ruskolka River and give it a natural runoff.

Ruskeala quarries made “pieces” (blocks) of marble of different sizes from small ones – dimensions are 1,2 × 1,2 × 1 m, weight – almost 900 kg, up to big ones – dimensions are 3,05 × 3 × 0,95 m, weight – up to 25,7 t.

Starting from the middle of December and till snow started to melt the quarried pieces of marble were being carried on sleighs to the coast of Ladoga Lake. For this, from 500 to 2000 horses and almost the same number of drovers were occupied every day. To carry the smallest stone they put three horses in harness, to carry larger stone – from 6 to 10 horses. The biggest block masses of marble were being carried by 130 horses. It usually took one day for the carriers of marble to come 28 versts of road from Ruskeala marble quarry to the coast of Ladoga Lake.

They left marble blocks lying on the coast until the navigation period started, when galiots with bread came from the capital and returned with stone.

V.P. Sobolevskiy wrote that “Ruskola quarry… has a good influence of this poor region, lacking any industry. Here piss poor Finns, what their faces and sackcloth showed, find daily livelihood, coming to the quarry from different places. When were there, there were about such people. In winter time local people were occupied with transportation of marble at a big profit. Thus, great constructions, astonishing the posterity, do good for the contemporaries, make thousands of hands moving and give fair ways of living…”[45].

[45] Соболевский В.П. Обозрение Старой Финляндии и описание Рускольских мраморных ломок. Санкт-Петербург, 1839.

According to color and the place of origin V.P. Sobolevskiy pointed out 5 sorts ("numbers") of Ruskeala marble. Marble under № 1 quarried on Belaya Mountain had gray-bluish, sometimes whitish colors, with black and white strings and stripes. There were a lot of nordenskioldine that caused appearance of white stripes and stains. Marble № 2 – "from Zelenaya mountain, gray, strongly penetrated by green actinolite" was quarried in the previous years on Zelenaya mountain for the floors of Kazan Cathedral and then was not developed. One more sort of "zelenogorskiy" marble (№ 3) that earlier was quarried for small crafts, could be met on Zelenaya mountain, on the coast of Singan-Lambi lake. Marble № 4, comprised of white and gray stripes, could be met in the bed of the Ruskolka River. This sort, according to V.P. Sobolevskiy, was developed at the end of the XVIII century for Marble Palace decoration. Besides, marble № 5 with white and bluish stripes could be met in Belaya mountain, but it was not used anywhere. Next to the gunpowder shop on Belaya mountain, beautiful white marble was met, and by Singain-Lambi lake – even black one.

By the middle of the XIX century, when the interiors of Saint Isaac Cathedral had been finished, almost the same sorts of marble as V.P. Sobolevskiy noted were pointed out in Ruskeala marble quarries. According to "The description of marble samples of Ruskola quarries with specification of the Quarry number and with description of wonderful works made of these marbles", made by the supervisor of the quarries on September 12, 1857, "according to color and place of origin" the following six types of marble were separated in Ruskeala:

"№ 1. General color is gray-bluish, and sometimes whitish, with gray and white strings and stripes. It contains a lot of nordenskioldine and therefore gets yellow stripes and stains. It was quarried in great amounts for Saint Isaac Cathedral before 1854.

№ 2. Zelenogorskiy marble presents gray marble, strongly penetrated by green actinolite. Now it is left, but earlier was quarried for the floors of Kazan Cathedral.

№ 3. Zelenogorskiy. It is located on Zelenaya Mountain by Singan-Lambi Lake. Earlier it was used for small crafts, and recently, before 1854, was quarried for the floors of Saint Isaac Cathedral.

№ 4. In one mountain from № 1, white and blue stripes can be seen in it. It has not been used anywhere yet.

№ 5. Beregovoy. Stripped marble comprised of white and gray stripes. It forms the bed of the Ruskolka River between the mill and the bridge. Some day was quarried for Marble Palace.

№ 6. Gray-white with black stripes, in the mountain located on the coast of the Ruskolka River. This marble has not been used anywhere yet"[46].

For today 5 historical classifications of Ruskeala marble, made by different researches within the period from 1785 till 1963, are known. They differ slightly from each other. Summarizing the data, one can say that on Belaya Mountain from 1769 till 1854 they quarried "ash-gray", light-gray. "gray-bluish", "bluish-gray", "whitish with black and white strings, sometimes with yellowish and greenish bonnies of tremolite and actinolite, marble called "slinskiy" (the beginning of the XIX century) and "belogorskiy" (the XIX–XX centuries).

On Zelenaya Mountain, starting from the beginning of the XIX century, for a short time two types of greenish-gray "zelenogorskiy" marble was quarried; one of those was used for artcrafts manufacture, and the other – for facing the floors of Kazan Cathedral.

The rest types of Ruskeala marble (striped "beregovoy", "white with bluish stripes" and dark-gray or "black") were developed in very small amount.

After 1854, when facing of Saint Isaac Cathedral's walls and interiors was finished, Ruskeala marble was almost not used anymore for the decoration of buildings in Saint Petersburg. The exception is the palace of Prince N.A. Kushelev-Bezborodko ("Small Marble Palace") on Gagarinskaya Street in Saint Petersburg. This building was built under the project of architect G.A. Bosse in the 1840-s and in 1857–1862-s it was reconstructed by architect E.Y. Schmidt. Initially the palace belonged to Prince N.A. Kushelev-Bezborodko, then – to Princess E.M. Yurevskaya.

According to A.G. Bulakh, the elevation of this building was completely faced with festive Karelian marbles – Ruskeala ones (of two sorts) and Tivdia one. High base of the palace is decorated with rustic plates of veiny gray-green Ruskeala marble quarried on Zelenaya Mountain. The other, more soothing light-gray, type of Ruskeala marble was used in facing the bel etage and the second floor. This marble

[46] ЛОГАВ ф. 1, оп. 2, д. 258, л. 2, 1857.

covers main area of the walls, and pilasters, dividing it, are made of tender pink Tivdia marble[47].

However, visual inspection of the stone in the facing of the basement level wall and window apertures of Small Marble Palace, made in 2005 by a number of authors (Bulakh A.G., Vlasov D.Y., Zolotarev A.A. and others) showed that the rock used here may belong to Ruskeala marbles only on a provisional basis. It is very specific in structure and mineral composition. The stone in the rustication of the palace walls is not marble itself, but a rock, almost completely consisting of silicate minerals – tremolite and diopside, with subordinate quantity of carbonate minerals – calci-spar and dolomite. This rock is considerably aired and is characterized by wavy-striped and wrinkled composition with interdigitation of white, black and light-gray, sometimes yellowish, lenses, bonnies and sripes[48].

At the end of the 1850-s, during his trip along Ladoga Lake, limnologist A.P. Andreev visited Ruskeala quarries. In his book "Ladoga Lake" published in 1875 he wrote the following about Ruskeala. "The place where deposits of marble located belong to Ruskeala church parish and it is quarried on the conditions suggested by the parish. Marble transported from the place of quarry in winter by horses for about 15 versts to a small river, the Geljulja, where it is loaded to big flat-bottomed boats. In spring it is carried by these boats to the place on the Geljulja River where galiots can approach; it is loaded on them there and sent to the destination place. There is no constant quarry; marble is produced when it is necessary as needed… Many merchants and some inhabitants of Serdobol have their own vessels (galiots, "donshkouts") on which they sent to Saint Petersburg willow bark, Serdobol (Ruskeala) marble, sometimes graphite and from the outskirts – granite of different type, feldspar, quartz, and bring from Sarmaks or Novaya Ladoga flour, different sorts of wheat, peas…"[49].

Professor of geology and mineralogy Platon Alekseevich Puzyrevskiy (1830–1871) visited Ruskeala quarries in 1861. Ruskeala marble with its whitish, partly grayish color due to admixtures of mica and graphite, seemed to the geologist characterless. P.A. Puzyrevsky separated two types of Ruskeala marble: dolomitic one that was earlier used for decoration of buildings and calcitic one – used for construction lime burn.

Due to the peculiarities of composition and structure Ruskeala marble in external facing of buildings can be ruined very fast. As back as during the Saint Isaac Cathedral construction A. Montferrand noted how some plates of Ruskeala marble were crumbled and lost polishing. Therefore already in the 1870–1890-s the first restoration of the cathedral wall was done: part of the ruined Ruskeala marble plates were replaced by the inserts of pale-gray Italian marble "bardiglio". Merchant A.A. Barinov who had his own quarries on Tululansaari Island, near Serdobol, and stone-cutting workshop in Saint Petersburg, was one of the suppliers of marble for the cathedral restoration in the 1875–1880-s[50].

The instability of Ruskeala marble in external facing can be explained by its inhomogeneous structure – the presence of skarn (silicate) minerals and sulphides. In conditions of Saint Petersburg with its moist oceanic climate, the air contains the increased amount of sulfur and carbon dioxides what speeds up the process of marble deterioration. Carbon dioxide dissolves carbonate minerals and then pores, holes and cracks appear on the surface of stone. Sulfuric acid turns marble into hydrous sulphate of lime and other sulphates the crystals of which exert pressure on the flakes of the minerals and cause the destruction of stone. Because of ferric sulphates formation, owing to oxidation of pyrites, the surface of marble is covered by aeruginous stains. In normal natural conditions Ruskeala marble starts to ruin in 150–200 years, but in the conditions of Saint Petersburg – already in 30 years!

The History of Ruskeala Quarries in the 1870–1930-s.

Probably, already in the 1860-s Ruskeala started to orient to production of construction lime. At that time most of the population in Ruskeala was the Finns and the Karelians. When the construction of Saint Isaac Cathedral was finished, the Finns bought out the abandoned Ruskeala mines and organized there extraction of calcitic marble for the production

[47] Булах А.Г. Каменное убранство Петербурга. Шедевры архитектурного и монументального искусства Северной столицы. Москва – Санкт-Петербург. Центрполиграф, 2009.

[48] Булах А.Г., Власов Д.Ю., Золотарев А.А. и др. Экспертиза камня в памятниках архитектуры. Санкт-Петербург «Наука», 2005.

[49] Андреев А.П. Ладожское озеро. Санкт-Петербург, 1875.

[50] ЛОГАВ ф. 1, оп. 2, д. 265, 2 л., 1875.

of construction and later – technological (for paper bleaching) – lime. Marble crushed stone remained from the previous works became a good support for lime production development. Already at the beginning of the 1860-s 6 burning kilns, where marble was burnt for lime, were built next to the quarries[51].

Explosions again thundered in Ruskeala quarries. Calcitic marble, suitable for producing lime, can be found not everywhere within the frameworks of the deposit; it forms just separate, deep-lying, levels among dolomitic and calcitic-dolomitic marbles. At first, they tried to develop calcitic marble by mines, but soon switched to underground mining – by hafts and drift ways, what decreased the expenses on removing many-meter mass of dolomitic marbles, so called "uncovering".

Extraction of marble in Ruskeala quarries and underground mines in the 1870–1930-s looked the following way. Drilling people made blast-holes of 35 mm in diameter in pit banks. At the end of the XIX – beginning of the XX centuries drilling remained manual – with the help of drill rods and hammers. Starting from the 1920-s pressurized air drilling machines started to be used at the production.

After the drilling, the blast-holes were dried, filled with gunpowder and then blast. It was done by powder men. As the result of an explosion marble was broken into pieces from several centimeters to several tens of centimeters. If marble pieces were very big, they were being drilled and blast one more time or split by chisels and heavy hammers.

Loading workers manually loaded pieces of marble into carts that then runners also manually carried along the rails of light narrow-gauge railroads to the places where they were lifted to the surface. Pit shafts and inclined rails, placed along the inclined quarry banks, were used for that. Carts with marble and mine cages with workers were lifted to the surface and empty carts and workers were taken down to the mines and shafts with the help of special lifting mechanisms first manually, then – with animal traction, and in the 1920–1930-s – by steam and electric machines.

The carts with marble, lifted by the stone-raisers, other workers took and manually put along the rails of suspension railroad to the burning kilns of the lime plant. Part of marble went to rock-crushing plant where break stone and decorative chips were made. There was a small area at the deposit where blocks of marble were extracted.

Fig. 6. Shaft № 2 of Ruskeala Quarries. The 1920-s

During the last third of the XIX century Ruskeala quarries and plant changed hands several times, however none of the entrepreneurs wanted to and could afford to develop the production. AO "Ruskeala Mramor" leased Ruskeala deposit in 1896 and organized a big enterprise on lime production.

In the 1890-s the construction of Ruskeala lime plant was started between the quarries and working settlement Otrakkala. The first three with the productivity of 17–20 t of lime per day started its work there in 1895[52].

In 1937 six more semi-gas shaft burning furnaces with the productivity of 30–35 t of lime per day were commissioned at Ruskeala lime plant.

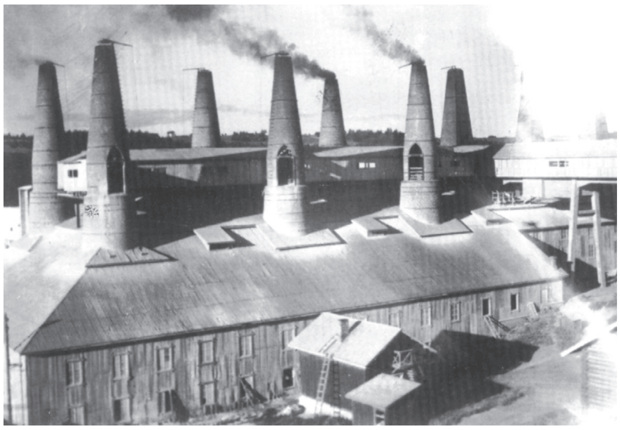

Fig. 7. Ruskeala Lime Plant. The 1930-s

In 1899 next to Ruskeala Lime Plant the Finns built the plant office from bricks and marble, and it still remains.

[51] Семенов Д. Путевые заметки по Финляндии, Санкт-Петербург, 1863.

[52] Семенов Д. Путевые заметки по Финляндии, Санкт-Петербург, 1863.

In 1924 Finnish geologists made exploration of a new area (deposit) “Ruskeala-2” located 1 km north-eastward from the old quarries. Extraction of marble for lime and break stone production was started there in the 1930-s.

In the 1880–1930-s Ruskeala marble deposit was intensively developed for lime and break stone production with the use of huge blasts, selectively, driving considerable underground cavities what finally led to the deterioration of the facing stone deposit. Geologist P.A. Borisov called such an extraction “destructive”[53].

Inhomogeneity of the structure of marble deposits of “Ruskela-1” – interdigitation of calcitic, suitable for getting lime, and dolomitic, not suitable for this, marbles, was the reason for the development of the deposit by selective way with the use of underground diggings combined with mines.

According to P.A. Borisov, most part of “Ruskeala-1” deposit, in “Glavny” (Main) quarry area, so called “Finnish deposit”, before 1940 was worked in 7 levels by 3 quarries (№ 5, 6, 7) and underground mines. The biggest quarry (“Glavny” or № 6) by 1940 reached maximum dimensions: almost 400 m long, 50–105 m width and from 20 to 90 m depth.

The researches of I.V. Borisov made on the basis of surveying plans of Ruskeala mine openings of 1945 and topographic map of “Glavny” quarry dated 2003, let making some amendments to earlier existed notions about the structure of the underground working driven by the Finns in the 1880–1930-s.

It is found that “Ruskeala-1” deposit, in area of former “Glavny” quarry, was worked in 6 levels, on 5 of which underground workings were driven, in combination with open quarries. The levels are located at a distance of 12–14 m from each other (in general – 12,5 m). At present most part of them is under water. Characteristic of the working levels (from the bottom up) as of the date of making the surveying plans of 1945 is given below.

The deepest, lower 6-th level, is located on +54 m above the Baltic Sea level. It is 38,5 m lower than the water level in “Glavny” quarry and 50–55 m lower than the quarry crest. Underground workings of the 6-th level were driven at the end of the 1930-s in the northern part of “Glavny” quarry, 70–80 m south from its northern side. The working had a complicated ameboid shape and small sizes: maximum length from the north to the south – about 50 m, maximum width from the west to the east – about 30 m.

From the pit of 60^0 inclined shaft № 3, driven along the eastern edge of the former “Glavny” quarry, at grade of the 6-th level in the western direction there was a roadway of 40 m long and up to 7 m width. The shaft pit, probably, went down to + 26 m above the Baltic Sea level and therefore reached 70 m depth.

In the western part roadway of the 6-th level was divided into three branches – workings (insets) of 20–25 m long and from 7 to 16 m width and with up to 2,5–7 m height backs above their floor, where at the end of the 1930-s calcitic marble was produced for lime.

In order to transport loaded and empty carts two pairs of rails parallel to each other were put along the bottom (floor) of the roadway. Closer to foreheads these rails were branched into two-tree directions. Total length of the railroad from the pit shaft to the farthest forehead reached 40–45 m.

Now speleodivers sometimes enter shaft № 3 from the side of drowned “Glavny” quarry via the roadway of the 5-th level of 50 m long, 6 m width and up to 3 m arch width. The rails of light narrow-gauge railroad are still lying on the roadway bottom. Exit from the roadway to the shaft is fenced with handrails installed as back as in the 1930-s. Along the sides of the shaft pit two stairs with handrails, from which short roadways go towards the drowned quarry every 12 meters, are fixed. Wooden flooring remained in the places where the roadways join the pit shaft.

Workings of the 5-th level were lactated +69–70 m above the Baltic Sea level with fluctuations from 64,8 m (in the northern part) to 70.8 m (in the south-western part of “Glavny” quarry), i.e. at the depth where starting from the 1920-s the bottom of “Glavny” quarry was located. Length of the worked-out section of this level from north to south reached 320 m, width – from 40 m (in the south and north) up to 70 m (in the middle part) and more than 100 m (in the northern part of “Glavny” quarry).

Height of the underground workings arches above their floor was from 4,1 m (in the northern part) to 6,4 m (in the southern part of the deposit), and in some places – up to 7–10 m. Closer to the western edge of “Glavny” quarry a chain of 9 solid blocks

[53] Борисов П. А. Каменные строительные материалы Карелии. Петрозаводск, 1963.

of marble with dimensions of from 7 × 10 m^2 to 20 × 30 m^2, more than 10 m height, spreads from north to south; part of them can be seen through water column. In the past, these solid blocks supported the underground workings backs of the 5-th level before it was deliberately ruined in the 1920-s.

Underground workings of the 5-th level were mainly located within the borders of the present day drowned "Glavny" quarry, except for its southern part, and went 40–90 more to the north from its northern side. The western border of the mined-out 5-th level was at 20–40 m distance from the western side crest of "Glavny" quarry having there a "negative" slope; and the eastern one is located 20–40 m west from the eastern side crest of the quarry inclined 50–55^0 to the horizon westwards. So, the eastern and the western sides of "Glavny" quarry differ much from each other in shape, what can be first of all explained by the dip of marble layers in western and south-western directions and partly, by morphology of the former underground workings. Southern border of the 5-th level workings is located 80–100 km north from the southern side of "Glavny" quarry.

Underground and then open workings of the 5-th level were joint to the surface by vertical shaft № 2 driven in north-eastern side of "Glavny" quarry at + 117–118 m above the Baltic Sea level.

The shaft pit has rectangular section of 5×7,5 m and reaches the depth of 50–55 m. From the pit at + 70 m mark (at 47 m depth from the shaft top) a 50 m long roadway went into south-western direction and it then branched into many complicated underground workings spreading all around the space of the 5-th level.

Most part (80–85 %) of the underground workings of the 5-th level was destroyed by the following mining works when "Glavny" quarry was deepened in the 1920-s, therefore now we can not define their real shapes and borders. There is no doubt that these workings were quite large – up to 20–35 and more m width, many tens and hundreds of meters long and up to 5–6 and more meters height backs above their floor. In general, about 100–120 thous. m^3 of marble, that was mainly used for lime production and for decorative chips and break stone, were quarried on the 5-th level before 1939.

Fragments of the underground workings, which are now under water, remained only north from the northern side of "Glavny" quarry. One of the workings goes first 70 m to the north-western direction and the rest 30 meters – westwards. The working width in forehead reaches 25 m with up to 8,5 m height backs above the floor. Width of the rest part is 10–12 m and backs height is the same. At 20 m distance from the mouth this working is connected to the other quarry of 15–25 m width and 4–5 m height backs, spreading 60 m south-westward. Between the described workings there is a huge solid block that initially had the dimensions of 20×25 m^2 in the plan; the height is up to 10 m.

In order to transport carts to the pit of shaft № 2 a light narrow-gauge railroad went along the bottom (floor) of the 5-th level workings. One of the railroad ramifications went north-westwards and formed a 145 m long loop around the specified huge solid mass; from that loop some pairs of 30–35 m long rails went to the foreheads.

The other ramification was put 125 m south-westward and southward where it was divided into some up to 50 m long branches approaching the foreheads.

The 4-th level workings are located in general at +81–82 m above the Baltic Sea level with fluctuations from 81 m (in the northern part) up to 83,5 m (in the southern part if "Glavny" quarry). They were driven mainly in the northern part of "Glavny" quarry and went 300 m more beyond its limits in north-western and northern directions.

Small cavities-rockshelters (№ 3 and № 4) can be seen in the northern side of "Glavny" quarry that are the upper parts of the drowned underground workings of the 4-th level. Location of "rockshelter" № 4 coincides with 150-meter roadway that before 1939 connected shaft № 1 to "Glavny" quarry.

According to surveying plan of 1945 a hauling roadway of up to 5 m width was driven in south-western direction from shaft № 2 towards the quarry. At 40 m distance from the shaft pit it sharply turned to the north and north-west and went 150 m more to shaft № 1 filled with rocks now. At a section of the first 70 m the tunnel width was 10–15 m, in rare bulges – up to 20 m, the backs height above the floor – in general 4,5 m with fluctuations from 3 m up to 10–14 m.

Along the rest 80 m, to the pit of shaft № 1, the roadway section was considerably smaller – width – 4–8 m (in rare bulges up to 15 m), and the backs height – 2,6–3,0 m.

100 m from the beginning of the working in south-western direction from the roadway an inset of 10 × 4 m^2 section, went in south-western direction from the roadway; it gradually passed into a cavity of more than 50 m long and up to 20 m width, that come into "Glavny" quarry in the area of "rockshelter" № 3.

In south-western direction from shaft № 1 a tunnel was driven, in 15 meters it opens on to a spacious working of complex configuration with solid blocks. It spreads almost 155 m westwards with its width from 15 m (in western part) to 50 m (in eastern part). The backs height above the floor fluctuates from 4–5 m to 13–15 m. The working floor is located at from + 81,7 m (in the east) to + 82,4 m (in the center) and + 83,4 m (in the west) above the Baltic Sea level.

7 solid blocks – "columns" with section from 5 × 10 m^2 to 10 × 11 m^2 and 8–15 m height, supporting the workings backs, are located on different sides from the working axis at 7–20 m distance from each other.

50 m south-eastwards from the center of so called "Ruskeala gap" (a hole on the bottom of the old quarry formed in the backs of the third level underground workings) a narrow tunnel starts and already after 10–12 m it sharply widens and turns into a spacious working of 40 m long and 20–30 m width, coming eastward to "Glavny" quarry. Also from this working one can get to roadway coming to shaft № 1.

All underground working of the 4-th level are now under water, the level of which in "Glavny" quarry is +92,6 m and in distant cavities – about +93 m.

Before 1939 a light narrow-gauge railroad ran along the bottom of a hauling roadway from the pit of shaft № 2 to shaft № 1. At 12 m distance from the pit of shaft № 1, where spacious underground working started, it doubled. One ramification, 25 m long, went westwards, the other one, 65 m long – first south-westwards and then north-westwards.

At the beginning of the XX century workings of the 3-d level were located at +93–95 m, i.e. a bit lower of the present-day water level in "Glavny" quarry. Part of these workings coincided with the borders of the quarry, and part – in form of drift ways and roadways of complicated configuration and insets – went hundreds of meters north-westwards.

A long drift way with two mouths and one very small "rockshelter" have remained in north-western side of "Glavny" quarry until now. Foots of these workings are located at 0,5–1 m height from the water surface in the quarry, therefore their examination do not need special diving equipment. However, for safety reasons, it is now forbidden to visit the drift way.

"Main" entrance of the described drift way has a rectangular section, more than 3 m width and 2–2,5 m height. Height of the quarry bank in this place is 17–18 m. 4 m from the beginning the pit of the drift way is comparted by a stone wall of 50 cm thickness, where a rectangular section hole is made in the middle for a door of 1,6–1,7 m width and 1,9 m height. Beyond the partition the drift way dramatically grows in size due to a side entrance (inset) and then it continues in shape of a gradually narrowing tunnel many tens of meters north-westwards.

Inside of the drift way, next to the entrance, in the wall, hooks hammered into marble, remained; they were, probably, used for fixing lamps. Traces of sub-horizontal blast-holes of 35 mm in diameter bored "in a row" at 20–30 cm distance from each other at 1,7 m height from the working floor, can also be seen in the wall.

"Side" entrance to the drift way of the 3-d level is broken through the edge of the quarry at 25 m distance south from the "main" one. It had an oval section – 2,5 m width and 2 m height. The first 20 m the tunnel runs north-westwards, then it slowly turns to the north-east and after 10–15 more connects to the main pit of the drift way. Traces of blast-holes of 35 mm in diameter bored almost horizontally to 1–2 m depth remained on western wall of the quarry.

Fig. 8. "Side" Entrance to the Drift Way of the 3-d Level from the Side of Ruskeala "Glavny" Quarry. 2003

At present time the both entrances to the drift way are closed by railings for safety reasons.

In the point where "side" tunnel is adjacent to the main one, in so called "hall", the drift way reaches 6–7 m width and 2,3–3 m height. The pit of the drift way runs north-westwards, gradually narrowing. At 15–20 m distance from the "hall" the drift way width decreases to 3 m, the backs height is up to 2,2 m, and after 10 m more – the oval section of the tunnel decreases to 2 × 2 m^2. At 40 m distance from the "hall" the drift way starts declining westwards, in general keeping north-western course.

Approximately 90 m from the mouth the drift way doubles, forming a spacious chamber of 3–4 m width and 2,5–3 m height. One tunnel runs south-westwards and the other one, filled with stones, north-eastwards and northwards. On the chamber bottom water, that, probably, leaks out from above through an air pit filled with stones, collects.

Fig. 9. In the Drift Way of the 3-d Level 100 m from the Mouth of the Working. 2009

Tunnel coming north-westwards is gradually narrowing to the initial sizes of 2 × 2 m^2. Made of marble pieces body of dismantled 1,2–1,3 m long railroad, washed out here and there, runs from the western side of the working. Due to the body the distance to the backs of the working decreases to 1,6 m. From the eastern part of the tunnel there is a drainage channel of less than 0,5 m depth filled with transparent water. In spring the water level in the drift way increases per 30–40 cm. Fragments of rusted rails of the railroad and hammered of boards air pipes of rectangular section remained in this part of the working.

Approximately 50 m from the fork the drift way pit starts to smoothly turn westwards, and after 90 m it sharply ends with a heap formed in post-war time during blowing up of the working by bomb technicians for the population's safety. Before 1939 the described drift way was a part of the neighboring marble quarry and its length could be approximately 200 m.

The second branch of the 3-d level drift way ran north-eastwards and northwards for about 50 m, and in the beginning of the XX century came out to a spacious underground working of more than 130 m long and 25–40 m width with 7 solid blocks, located under similar working of the 4-th level. In the 1930-s the underground workings of the 3-d and the 4-th levels were connected together by means of fall of the rock masses that separated them, and as a result there appeared a big cavity with total length of more than 150 m, width from 30 to 55 m and 12–15 m height. Now this working is drowned for approximately 2/3 of its volume, so there are considerable cavities of 2–7 m height, up to 60–90 m long and 30–50 m width above water.

At the end of the 1930-s in the 3-d level backs that appeared to be too thin because of a new quarry mining (only 2,5–3 m) a technogenic gap – a hole with 19 × 23 m^2 dimensions – appeared. Now the dimensions of Ruskeala Gap increased per some miters compare to 1945. Distance from the crest (+102 m) of the gap-hole to the bottom of the underground working of the combined 3-d–4-th levels (more than 82 m) is 19,7 m, to the water surface (about 93 m) – 9 m.

Fig. 10. "Ruskeala Gap" in the 3-d Level Backs. 2008

10 m eastwards from the gap edge there is a small technogenic bell-pit with dimensions of 1 × 4 m^2.

In 2013 for safety reasons metal fence was installed along the perimeter of "Ruskeala Gap".

Water in the working of "Ruskeala Gap" freezes up in December, and during winter time because of water dropping from above bizarre ice stalagmites and stalactites, looking like fictitious beings, are formed here. Ice in the cave melts till the end of July.

It is no less beautiful in "Ruskeala Gap" in summer time. Especially there, where poor sun rays fall on water and are reflected by divergent circles on white-marble walls of the caves. Underground waterfall rushes in the depth of the working. Bats live in the most distant "halls".

Speleologists from Saint Petersburg, from the Commission on Speleology and Karstology of Russian Geographical Society, studied underground workings of "Ruskeala Gap" in 2007–2013. A project of arranging underground workings of the 3-d level (drift way and workings in the area of "Ruskeala gap") for the organization of a new speleologist route in Ruskeala Mining Park are being elaborated.

The 2-d level of Ruskeala deposit working is located at approximately + 105–106 m level. Remains of the open workings of this level are located in northern part of "Glavny" quarry, along circular road, and also 130–150 m north-westwards from it, in the area of "Ruskeala gap".

Along the northern edge of "Glavny" quarry marble benches – "Ekaterininsky", "Ivanovsky" and other "cliffs"- remained. However, most part of the old benches of the quarry are covered by the heaps of rocks of more than 100 m long and up to 10 m height, that formed during post-war time. "Ekaterininsky cliff" is very nearly the only one relict of the bench of the quarry of the end of the XVIII century, therefore it was named after Catherine the Great. This cliff is made of very beautiful and rare for Ruskeala finely banded marble. The other cliffs of marble of the end of the XVIII–XIX centuries were destroyed by the following mining works.

In the area of so called "Ivanovsky cliff", in the foot of the 2-d level quarry filled with marble block masses, there is an uncovered gap to the 3-d level. Here, from under the block masses, air is constantly coming, and amazingly big and beautiful snowflakes are formed on stones in winter time.

Underground workings of the 2-d level – two drift ways – completely remained. They were driven at the end of the 1930-s towards each other from the opposite slopes of the rock and are connected with the pit of shaft № 2 at approximately + 105 m level.

Drift way № 1 is broken through on the northern slope of Belaya Mountain in south-western direction.

Fig. 11. Drift Way of the 2-d level of Ruskeala Quarries. 2010

Length of the tunnel is almost 48 m, width – 4,5–4 m, height of the backs having arch shape, is from 1,9 (on the edges) up to 2,5 m (in the center). Before 1939 a light narrow-gauge railroad, by which empty carts from the plant were brought to the shaft pit, ran along the bottom of the working. Rails were put on cross-ties made of pieces of the same rails, located at 30 cm distance from each other. Traces of sub-horizontal blast-holes of 35 mm in diameter and more than 2 m long can be seen in the backs of the drift way.

A suspended railroad, by which workers manually carried empty carts, ran from the furnaces of Ruskeala lime plant to drift way № 1 before 1939. Carts loaded with marble from "Glavny" quarry and underground workings of the 3-d, 4-th and 5-th levels went up along the pit of shaft № 2 to the very top, where they were taken by workers and rolled along the other suspended railroad to burning furnaces of the plant.

Carts and workers were moved up and down along the shaft pit first by horse drive, and then, starting from the XX century – with help of steam and electric machines.

In winter of 1940 drift way № 2 served as a bomb shelter, where local population was hiding. According to old photos, benches and board beds were made along the drift way walls, boxes with food and water reserves stood there.

In the soviet time, there was a horse stable for some time here, and in the 1970–1980-s – core storage. After Ruskeala Mining Park was opened, entrance to the drift way was equipped with a nice metal grating that can be locked. Before the 1970-s mouth of the drift way was blocked by a stone wall with a small door opening.

Drift way № 2 is broken through in north-western side of the quarry from west to east, and comes out to the pit of shaft № 2 at an acute angle. Length of the drift way is more than 15 m, width – from 3 m (in the mouth) to 5 m (at the shaft pit), backs height above the foot – 1,7–1,9 m. Traces of prolong blast-hole can be seen on the walls and backs. Drift way № 2 served for workers movement. Entrance to it is also closed with a grating, which stays open during excursions as well as in drift way № 1.

At the end of the 1930-s the Finns tried to connect the shafts by a narrow tunnel along the northern side of the shaft, but the worked were not completed.

Earlier exits of the drift ways to the shaft were fenced with metal handrails with an opening for carts and workers. In the soviet times remains of a wall made of marble could be still seen here.

Wooden flooring with a hole, through which mining platforms with carts and workers were moved up and down separately, was made in the shaft pit at the 2-d level before 1939. Square niches of $20 \times 20\ cm^2$ section, up to 20 cm depth, cut in marble at 1 m distance from each other, can still be seen in the shaft pit. Edges of wooden beams, on which the flooring was fixed, were earlier inserted into them. To prevent the flooring from possible falling metal ropes, fixing to hooks hammered into the walls, were used in the 1930-s.

Pyramid-shaped tower with metal framework was situated under the pit of shaft № 2. It was faced with boards and protected lifting mechanisms from precipitation. Fragments of concrete foundation of pit-head frame still remain in the top of the shaft. At present metal guard rails are installed along the perimeter of the shaft hole.

On the opposite side, over the road, in the forest ruins of the Finnish rock-crushing plant ($26 \times 26\ m^2$), where fractionated break stone and decorative chips were made from marble pieces, still remain. The ruins lie in a rectangular area. Walls and ceilings of the plant are made of hard concrete.

Approximately 150 m north-westwards from the northern side of "Glavny" quarry, in the area of "Ruskeala Gap" an old treed quarry, the foot of which is adapted to the level of +103–104 m (the second level) is located. This quarry was driven in marble rock mass in the 1930-s also for the production of break stone and lime. It has a shape of a trench spread in latitudinal direction for 200 m, width is from 30 m (in eastern part) to 20–25 m (in the center) and 100 m (in western part). The quarry depth is in general 13–15 m. In post-war time marble was being quarried here until the 1970-s.

Workings of the uppermost, the first level, were at about + 114 m with fluctuations from 112 m to 116 m. Their traces in shape of technogenic steps can be seen along north-eastern and eastern sides of "Glavny" quarry. Probably, quarry № 7 ("Italian"), where in the 1974–1985-s marble blocks were quarried by sawing, belongs to this level.

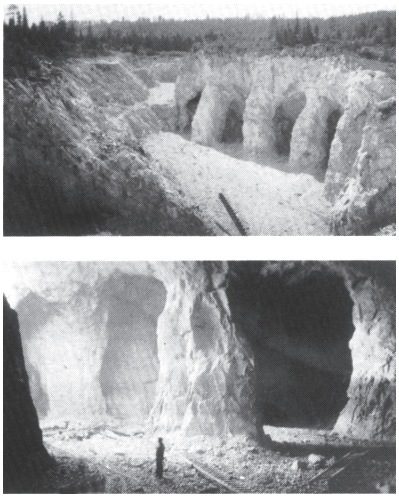

Fig. 12. Upper photo: "Glavny" Quarry of Ruskeala. Lower photo: In Underground Workings of Ruskeala. The 1930-s

In the 1930-s, when "Glavny" quarry was deepened and widened, part of underground workings was destroyed, but their mouths could be seen in the sides of the workings. Tunnels of the 5-th level remained functional.

At present, bottom of the former "Glavny" quarry in its northern and central part is located in general at the level of the 5-th level floor (+68,5–70,5 m), and therefore it is situated at the depth of 22–23 m below water level (92,6 m). In north-western part of the quarry there is a strange hole, probably, reaching the 6-th level (+54 m), and this is the deepest place of "Glavny" quarry (about 40 m below water).

In southern part of the quarry the bottom of "Glavny" quarry lies at the level of the 4-th underground level floor (+83,5 m) and thickness of the water layer here is only 9 m.

Under the water level (+92,6 m dated 16.05.2003) the sides of "Glavny" quarry rise at different heights – from 5,4 m (in south-western part, where trench for water discharge was) to 23,4 m (in north-eastern part, next to shaft № 2).

So, total depth of "Glavny" quarry fluctuates, depending on the sides height and the bottom depth, from 14,5 m (in south-western part) to 35 m (northern part) and 47,5 m (north-eastern part). Maximum depth of the quarry in the area of the specified hole in north-western part of the quarry can reach 55–60 m (according to divers – 72 m). Now, the former "Glavny" quarry of Ruskeala is called "Mramornoe Lake" (Marble Lake) or "Marmorny Canyon" ("Marble Canyon).

Fig. 13. "Glavny" Quarry of Ruskeala Turned into Beautiful "Mramornoe Lake"

Fig. 14. "Ruskeala Marmornyi "canyon"

According to submarine studies of 2005–2010, there is a great amount of technogenic garbage – fragments of high lift dump tracks, an earth mover, a crane, rails, carts, hard hats and etc. – on silt-covered bottom of the former "Glavny" quarry.

Water transparency in the drowned quarry depends on the season and the depth, distributing as if by "layers". In the upper layer, to the depth of 15 m, visibility is from 6–8 m (in summer time) to 12–15 m (in winter time), in general (15–24 m) – only 15–20 cm, in the lower layer (deeper than 25 m) – 1–1,5 m.

According to book "Ruskeala in Memories and Photographs" published in Finland in 1985[54], one of the latest managers of Ruskeala quarry and plant in the 1930-s was William Forsstrom. During these years the enterprise was developing successfully. It included several operating quarries, three shafts with a system of horizontal workings, the total passage way of which was several kilometers. Rock-crushing plant, where break stone and chips were manufactured from marble, worked, and, of course the biggest enterprise of the region – Ruskeala Marble and Lime Plant. A new quarry on "Ruskeala-2", explored by the Finns in 1924, was being prepared for work.

In 1924 Ruskeala Lime Plant comprised of six, located in pairs, burning kilns with spherical section cone-shaped tubes, commissioned in 1937, and three kilns with pyramid-shaped tubes built in 1895. Pairwise kilns were put into a wooden construction with a high roof, above which only tubes were rising. The other three kilns were in the other room of smaller dimensions.

A covered dolly way on high supports, by which marble went to the kilns, approached to the plant from the quarries sides. From this dolly way carts with marble were carried to the mouth of the kilns and overthrown. In the kilns, working on firewood and wood gas, marble was burnt under $+500^0$ and turned into lime, which after that was transported to a storage located at 50 m distance from the plant.

In the first third of the XX century population of Ruskeala and Otrakkala villages worked mainly in the quarries and at the lime plant.

From 1834 there was a beautiful Lutheran Church (K. Engel), built in 1834, at the top of Kontkasenmaki (Kontkanenmaki) Mountain. It housed 800 people. Not far from it, in Hanki, there was a Lutheran cemetery. According to the memories of the Finns, from the church bell tower it was possible to trace the Tohmajoki (Ruskolka) River's circuitous course in lower part of Savotansilta and next to Turri mill. The lime plant tubes, hills of

[54] Рускеала в воспоминаниях и фотографиях. Хяменлинна, 1985 (перевод Кяхконен Э.Э.).

Otrakkala working village and railroad settlement Matkaselka could clearly be seen. At the west the eye stopped at the hills of Kitee, and at the north a group of buildings of the county insane hospital in Palkjarvi could be seen. At the east the eye was delighted by forest landscape of Issankanvaara with several houses. The chime on Saturday and Sunday evenings, wafting over Ruskeala and its outskirts, created blissful atmosphere.

Fig. 15. Workers of Ruskeala Marble Quarries. The 1930-s. Part of Ruskeala People Worked at Their Plots in the Pastor's Estate

The pastor's estate (Papella) was first located very close to the church, on Kontkasenmaki Mountain. There was a beautiful land view opening from the windows of the pastor's house, a road way was next to it. In the 1930-s the estate got a new place, behind the cemetery, on the way to Kaalamo.

Next to communal house, not fat from Ruskeala church, there was a village post-office, where Elli Salorinne worked for a long time. She came to a tragic end during her trip for correspondence in 1936.

In 1934 there was a solemn holiday in Ruskeala devoted to a centenary of Ruskeala church.

Before 1939 big landholders in Ruskeala were Gabriel Pirhonen, brothers Paavo and Pekka Putkonen and others. Paavo Putkonen took part in municipal and church activity of the settlement, as well as issues connected to the workers of quarries and marble-and-lime plant. Pekka Putkonen was an organist in the church. He also had his wind band that often played on holidays.

Heikki and Juho Vihervaara, Korka and the Elfvengrens lived in their houses next to the road to Sortavala.

On the cross-roads to Ruskeala before 1939 there was a shop of Vostochno-Karelskoe cooperative society. Houses of Arvi and Artur Kahkonens stood on the other side of the road. Fritjof Pirhonen was their neighbor.

Next to the church shoemaker Franc Tolvanen and Mojlanen lived in their houses.

Before the war, on the way from Ruskeala church to Kaalamo there was a small piece of land (torppa) Peukalonpaa of teacher Virtanen, where cantonist Isidor Tejttinen with his wife Hanna lived. Near, on the same side of the road, there was an izba of widow Kettunen with two sons.

A smooth forest path started from Peukalonpaa; it lead to the cemetery, where it turned to the right to Rujsselka village.

Kaalamo road ran by Kirkkolampi Lake ("church lamba") that was also called Koulunlampi ("school lamba"). Anni Juutilainen, an active member of youth society, lived on its coast till 1939. An editor-in-chief of "Golos Karelii" newspaper, Toivo Lankinen, with his wife Kaisa, spent summer holidays here, in the neighborhood of her.

On the left side of the road, on Kontkasenmaki Mountain, there was a new pastor's estate (Silmakivi), lands of which belonged to the church community. The last leaseholder of the pastors' estate was Mikko Keinonen.

Lijsa Pulkenen and Matti Veikkalainen, Aleks Miljoi with Inda, Ilmari Koski, Inda and Hilma Veikkalainen lived on Veikkalainen Mountain, to the left of Kaalamo road.

A Sunday school financed by Olga Paalanen worked in Ruskeala before 1939.

Heikki Holopainen, who moved with his family to Harlu in 1929, Matti Tiilikainen lived a little closer to the Tohmajoki river.

Village population took active part in different societies where Adam Parviainen, Juho Hendalin, Moilanen and Tauno Keinonen were the speakers.

Otrakkala village was located on the slope of a same-name mountain north of Ruskeala marble-and – lime plant. According to the memories of the former villagers, a few tens of people lived here on their small pieces of land (torppas) before the war. The land-owners (torppars) were depended on the owners of the land allotments, on whose lands they had small plots-vegetable gardens. Harvest from a vegetable garden-torppa was sufficient only before the beginning of winter.

A considerable part of able-bodied population of Otrakkala worked at Ruskeala marble quarries and shafts that were the main employer for Ruskeala Volost.

Vaine Mononen, Juho,Kakkonen, Anton Piiranen, Oskari Koski, the Tunkkunens, Matti Nissanen, Juho Kuttunen, Melkenen, Mukko Lehikoinen, Mikko Korhonen, Poutiainen brothers, the Nissinens, Marti-Soininen, Harinen, Peki Luukkainen and others lived in Otrkkala in the 1930-s.

Young people met on plain rock Haukkakallio, not far from Otrakkala, for playing in summer evenings.

At the beginning of the XX century the biggest land allotments (estates) of Ruskeala Volost were land plots of Laurikainen, Ratinen and Ruut. In the 1930-s Jurio Jarsta, who came to Ruskeala from Eura, bought the estate of Laurila Laurikainen. He possessed also an estate in Matkaselka, and it was later given for housing. The estate of Ruut together with a mill was vested to the possession of Tirri. Ratinen's estate was vested to the family of Eronen.

Before the division of property Jurio Jarsta sold part of his mowing by auction every summer. There was no lack of buyers. They were mainly workers of the marble quarries and shafts and local torppars. In the 1930-s J. Jarsta was one of the biggest landowners in the county; young men and women worked at his lands. Forest that belonged to Jarsta, were rich with mushrooms, clusterberry and blackberry[55].

In the 1920-s in Ruskeala there was a quite big land allotment of merchant Peka Talvanen, who also had a shop. On his land P. Talvanen grew bread, made hay that then sold. There were good products in Talvanen's shop; they were brought from Sortavala and Vyborg, though they cost more expensive than in other places. Later Talvanen sold his land to the former manager of Ruskeala marble quarries and the plant William Forsstrom who built a house and lived in it cultivating the land till 1939. Then Talvanen sold also his shop and on for this money he bought a land allotment in Naatselka village, north of Otrakkala.

As it was noted, at the beginning of the XX century Ruskeala marble was mainly used for the production of construction lime, break stone and decorative chips. However, at the beginning of the XX century this beautiful stone was used for facing walls of the Savings Bank in Helsinki[56].

At the same time, floors of a lobby in former hospital "Diakonis" (1907, Vivi Lenn) and a terrace of a restaurant of "Vostochno-Kerlskiy Cooperative" in Sortavala were faced with Ruskeala marble.

Ruskeala marble was also used at the end of the XIX – the first third of the XX centuries for making grave-stones at the cemeteries in Ruskeala, Puikkola, Sortavala, Pitkaranta and even in Saint Petersburg. Unfortunately, until now only some of them "survived".

On the 1900–1930-s decorative chips from Ruskeala marble were widely used in stone architecture of Sortavala and settlements of Priladozhye. Stairs and floors made of concrete with the filling from white marble chips can be seen in many stone buildings of Sortavala: Narodnyi Bank (1905, E. Saarinen, G. Geselius, A. Lindgren), United Bank of the Northern Counties (1913, U.V. Ulberg), the Bank of Finland (1915, U.V. Ulberg), Administration of Finnish Orthodox Church (1931, U.V. Viiste) and others. In 1943, when Sortavala became a Finnish town for a while, chips from Ruskeala marble were in big amounts used for facing floor of a Church dedicated to Saint Peter and Saint Paul (1873, N. Grebenko).

Quarry stone, break stone, decorative chips, lime were brought from Ruskeala to Serdobol along the old road via villages Ruttu and Heljulja, there loaded on carts or ships and sent to the destination point. Before the beginning of the XX century Ruskeala marble as "fluxing stone" could be sent to metallurgical plants in Pitkaranta and Vartsila.

Events of the "Winter" (Russian–Finnish) war of 1939–1940 affected Ruskeala only slightly, except for local bombing of the territory of Ruskeala plant by the soviet troops in February of 1940. Then, the villagers from Ruskeala and Otrakkala, first of all women and children, took cover in bomb shelters made in the drift ways of Ruskeala quarry. Part of Ruskeala menfolk was mobilized to take part in military operations against RKKA (The Red Workers' and Peasants' Army) in the regions bordering with Russia.

Probably, in summer 1940, when Ruskeala territory was temporary a part of the USSR, Ruskeala church burnt. According to the witnesses, reflection of the terrible fire could be seen even beyond the

[55] Рускеала в воспоминаниях и фотографиях. Хяменлинна, 1985 (перевод Кяхконен Э.Э.).

[56] Экономическая жизнь Приграничной Карелии. Сортавала, 1929.

new border. During the period from summer 1940 till June 1941, soviet migrants coming to Ruskeala tried to resume the production at the quarries and the lime plant.

On July 10, 1941 the Finnish troops crossed the border with the USSR. The 168th rifle division under the command of Colonel A.L. Bondarev battled fearlessly against Finnish divisions. In the middle of July the Finns took possession over Matkaselka railway station.

On July 17, 1941 the 19th division (under the command of Colonel Hannuksela) of the 7th army corps of the Finns (under the command of Hagglund) got an order to gain possession of Kangaskula village, Kaalamo railway station and clean the area of Matkaselka – Ruskeala. The attack of the Finns was stopped for a while by the 168th rifle division of Colonel A.L. Bondarev along the line: Ruskeala – Sarkisurja – Lahdenselka-Janinsjarvi. However the 402nd regiment was in threat situation and it was secretly moved to line Kangasjarvi – Kaalamo – Ruskeala.

On July 22, the Finnish troops occupied Otrakkala and on July, 23 – Ruskeala, and moved to Suuri Ruttu. On July 26–28 units of the 168th rifle division conducted defensive battles along line: Puhajarvi – Kumuri – Pesunmaki – Tohmajoki-Lahdenkula. The division headquarters was in Ruttu village and prepared a counter-attack to the area of Hirvikangas – Vahvajarvi. At the end of July personnel of the Finnish field-hospital was moved from former insane asylum Palksaari to Papilla neat Ruskeala. The wounded were brought here till August 28, 1941. There was a lack of places in the hospital, in certain days the number of the wounded reached 400 people. It was hard work for the doctors. So, surgeon Kivirikko performed operations for three day without sleeping. On August 13, after temporary step-back, the Finns again took the railway station and Sortavala.

On August 16, commanders of the 23rd army were ordered to evacuate the 168th rifle division to Balaam, and it ended on August 18–19, 1941[57].

Starting from September 1941 former population of Ruskeala Volost started to come back to Ruskeala. Till 1944 the Finns arranged the production of lime and decorative chips.

[57] Ахолайнен Ю., Сиппола А., Салонен П., Миссинен Р. Южно-ботнийцы в войне-продолжении. Общество ветеранов г. Алавус. КН. 3, 2001 (перевод Кяхконен Э. Э.).

Next to the remains of the burnt-out Ruskeala church foundation there was a communal house – former county chamber. A temporary church was organized in it in 1941–1944.

In July – August 1944 during the preparation of a step-back, the Finns partly dismantled the equipment of the lime plant and the shaft and brought it to Finland.

The History of Ruskeala Quarries and Ruskeala Settlement in the 1944–1990-s.

The first part of workers with shovels and picks came to Ruskeala to restore the plant and the quarries in November 1944, horse drive carts appeared[58].

The second wave of migrants came to Ruskeala in 1946. Aleksey Mikhailovich Vasiliev, who then was 14 years old, was one of the first who came to Ruskeala with his sisters, brothers and a father. After finishing an industrial school in Segezha, he worked at Ruskeala plant as a locksmith, then – a senior master of mining shop and a drill runner. His sons followed in his footsteps and also worked at the plant[59].

In 1946, not far from the river Tohmajoki bed, west of former "Glavny" quarry (№ 6), quarry № 5, where marble was quarried by drilling and blasting operations, was opened under the guidance of Grigoriy Yakovlevich Saenko. Distance between the crests of these quarries is only 17–35 m now. Quarry № 5 is stretched north-westwards for more than 220 m. Its width is 50–100 m, the depth is 20–45 m.

The top level of the working is at +114 m, what can be compared to the level of the 1-st level, the second level – at +105–106 m (the second level). East side of the quarry looks like a stepped slope of 20–30 m height above the water level in the working. West side is much lower.

Quarry № 5 worked until the 1970-s and is now drowned. In 2003 the water level in the quarry was at +90,7 m above the Baltic Sea level.

In 1947 the restored Ruskeala plant started to produce lime again.

[58] Стельмухов В. Будет ли второй расцвет? // Красное Знамя, Сортавала, 2–3 августа 1988.

[59] Судаков В.П. Из одного корня // Красное Знамя, Сортавала, 12.11.1987.

According to the memories of the plant's veteran Lidia Ivanovna Lesina, right after the war workers of the plant lived in the remaining houses, even per two families in a room. Quarry № 5 was opened. Quarried marble was put upwards from the quarry in carts with help of winch along inclined rails. Then "runners" pushed these carts to the storage. "Loaders" manually put marble into other carts named "katyusha" and carried along the line on a loading gallery and filled furnace with marble.

According to the memories of a former worker of Ruskeala quarry Vasiliy Semenovich Shalaev, "stone blocks in the quarry after explosion were broken with heavy hammers, and small ones after crushing were collected with scovens and shovels".

Veteran of the plant A.K. Ivonen told: "Living conditions were bad. In winter time there were almost no roads from the houses scattered over farm yards within 4 km radius from the plant. It was especially hard for the workers to get to the plant in winter cold, snow drifts. Boxes and trestle-beds were the furniture in houses. Only some people had iron beds. A small house, where all doctors received patients at once, served as an ambulance station"[60].

In 1949, trying to open drowned quarry № 6 (former "Glavny") three workers died. Some scientists' claim that this quarry was intentionally drowned by the Finns in 1944 does not have any a reasonable basis. Water in the abandoned quarry (ground, atmospheric) was collected by natural way in 1940–1949. In 1949 its level, probably, reached the floor of the 4-th level.

In 1950–1951 the first panelized houses for the plant's workers were built in Ruskeala settlement. In 1948–1950 in Otrakkala, on the place of a burnt-out during the war settlement, so called "second" settlement was built. Light-construction houses (barracks) with comfortable and spacious rooms appeared on Detskaya Street. A new kindergarten grew on the burned area. Plant's laboratory and a propaganda room were arranged in former canteen. A post office, a canteen, a shop and an aid post were also built.

As back as in the 1970-s many people lived in barracks in Otrakkala. The plant's canteen, a shop, a hostel for the workers, an electrical substation worked. In 1997 there was only one house in Otrakkala belonging to the family of the former director of Ruskeala plant V. I. Soloviev. Until now there are some houses where people live along Sortavala-Vartsila road, a shop works. However there is no more old barrack settlement in Otrakkala for a long time, there is a waste ground on its place.

Starting from 1951 Ruskeala Marble-and-Lime plant, except for lime, started to produce marble chips of two fractions.

In 1950–1952 "Ruskeala-1" deposit was in details explored by Leningrad department of "Geolstromtrest" in order to find commercial marble reserves suitable for quarrying blocks. In 1952 VKZ (All-Union Committee for Natural Reserves) approved the reserved of facing stone in category $A+B+C_1$ in the amount of 17 962 000 m^3 with an average yield of preliminary worked blocks from rock mass – 25 %. However during next years most part of these reserves was severely damaged as the result of using large-scale blasts when quarrying marble for break stone and lime.

Geologists found out that "Ruskeala-1" deposit was comprised of three rock masses. The first rock mass is presented by interlaid dolomitized and calcitic marble of striped pattern (alteration of white and gray stripes with greenish and yellowish fibers and bonnies of silicate minerals), the second one – by calcitic white marbles, and the third one – by dolomitized gray, with disseminations of silicates, marbles. Calcitic marbles for that moment turned to be almost completely mined out by the Finns during the period from 1886 till 1939.

In 1952–1953 "Ruskeala-1" deposit was also explored for lime for pulp and paper industry.

In 1952–1955 "Ruskeala-1" deposit was explored for marble to produce construction lime in quarries № 5, № 6 and № 8a. After 1965 stone for these purposes was quarried beyond the contour of the approved reserves[61].

In 1952–1957 SZTGU explored "Ruskeala-2" marble deposit, located 2 km from "Ruskeala-1". Its deposits were approved on May 9, 1958, by TKZ (Territorial Committee for Natural Reserves) in the amount of 33 mln. t in categories $A+B+C_1$ as raw material for production of construction lime, break stone and lime powder. Afterwards a quarry that worked until the beginning of the 2000-s, was laid here.

[60] Судаков В.П. Рускеальский мраморно-известковый // Красное знамя, Сортавала, № 16, 1982.

[61] Технико-рабочий проект на строительство Рускеальского карьера мраморных блоков. Пояснительная записка, ч. 1–3, Ленинград. Гипронеруд, 1975.

The first earth movers appeared in Ruskeala quarries in 1958. Fragments of these machines are still lying on the bottom of the drowned quarry.

Since 1960 Ruskeala Marble-and-Lime Plant started to produce decorative chips. A grinding mill for making lime powder with 25–30 thous. t capacity was installed in the lime shop. A bit later a fully-mechanized crushing-and-screening plant, processing up to 120 thous. m^3 of solid rock mass per year, was mounted[62].

In 1958–1968 part of "Ruskeala-1" deposit was developed for break stone with three quarries (№№ 6, 7, 9) by enterprise p/y B-8437 of the USSR Ministry of Defense. Quarries № 5 and № 8 also worked.

Before 1968 Chief Engineer of Ruskeala Marble-and-Lime Plant was Ostapenko, before that Brazhzhe was the Director of the plant.

According to the memories of a former worker of Ruskeala plant V.I. Soloviev, in 1967 decorative chips from Ruskeala marble was sent to Brest Plant of Reinforced Concrete Products and Gas Fittings, Petrozavodsk Integrated Plant of Building Constructions, Segezha and Kondopoga Paper Mills, Petrozavodsk Plant of Silicate-Wall Products, to Pskov, Riga, Mogilev, Gorkiy. Sovkhozs "Iskra", "Sortavalskiy" and other bought lime powder.

Fig. 16. Workers of Ruskeala Marble-and-Lime Plant. 1970

The building of the lime shop was burnt in 1969. However only few months later a new shop, working according to a modern process scheme, was built at the plant. Mechanization came to the plant. Earth movers and grinders appeared instead of heavy hammers, motor vehicles and transporting conveyors – instead of wheelbarrows and carts. Staff of Ruskeala plant consisted of some hundreds of workers of various professions – drilling technicians, powder men, excavator drivers, drivers, operators on marble burning, crusher operators and etc.

New quarries, where marble was quarried for the production of break stone, lime and lime powder, were laid at Ruskeala marble deposit.

Fig. 17. In One of the Marble Quarried of Ruskeala. 1970

When "Ruskeala-1" deposit was developed for lime and break stone in the 1950–1960-s, large-scale blasts were used and they caused appearance of additional cracks in the rock mass and therefore the areas, where facing stone could have been taken, were spoiled.

In this regard, in 1968–1969 SZTGU held special revision works at "Ruskeala-1" deposit in order to find out the consequences of using large-scale blasts for marble quarry and reassess the reserves of marble suitable for facing plates production. The blasts mostly affected quarries № 5, № 7, № 8a and № 9.

As a result of the completed works, on March 6, 1970 the USSR State Reserves Committee (GKZ) approved marble reserves of "Ruskeala-1" deposit for facing blocks in the amount of 12 494 000 m^3 in categories $A+B+C_1$ with an average yield of blocks for striped varieties of marble of 14 % and dolomitized varieties – 21 %. Calculated yield of facing plates from blocks was 10–18 m^2/m^3.

In November 1969, under the task of Glavnerud of the USSR Ministry of Construction Materials Producing Industry (MP SM USSR), Gipronerud fulfilled feasibility study on the practicability of building Ruskeala quarry of blocks with 11,3 thous.m^3 per year capacity on the place "Ruskeala-1" deposit.

[62] Стельмухов В. Будет ли второй расцвет? // Красное Знамя, Сортавала, 2–3 августа 1988.

During the studies the following types of productive marbles were revealed at the deposit: white calcitic, white-grayish, slightly-dolomitized, gray dolomitized and strongly-dolomitized.

Dolomitized gray and calcitic-dolomitized striped marbles were taken for developing. Yield of blocks from dolomitized marbles rock mass was 21 % (middle-sized – 13,2 %), from the rock mass of alternation – 14,6 % (big and middle-sized blocks – 10,8 %).

Technical tests were made at Moscow Stone Processing Factory. Yield of plates from 1 m^3 was 11–13 m^2. An upper, 1,5-meters weathered layer was separated. Marbles in 10-meters width zone along the perimeter of quarries №№ 5, 7, 8a, 9, as well as to the depth of 5 m, where drilling-and-blasting operations were held, turned to be not suitable for the production of blocks. The deposit, earlier developed for block stone, was spoiled by large-scale blasts during the process of developing marble for break stone and lime. It could have been avoided, however the lack of explored and prepared reserves of stone, rush for volumes led to actually destructive demolition of the deposit.

Nevertheless, two allotments that had potential for quarrying facing stone were separated within the frameworks of "Ruskeala-1" deposit. According to the documentation, on allotment № 2 marble had to be quarried by inclined rope saws (inclination angle 45^0) by layers of 2 m thickness with 6 m bank height. Calculated dimensions of setts in general were 15 × 8,5 × 2 m. They had to be divided into blocks by charged with detonating cords blast-holes of 32 mm in diameter and bored "in line" at 100–200 cm distance from each other.

On allotment № 4 marble blocks had to be quarried by banks of up to 3 m height with the help of stone-cutting machines CM-177 A.

It was supposed to send Ruskeala marble to Kondopoga and Moscow Stone Processing Factories, Leningrad Plant of Gypsum and Marble Products. Here, plates of different surface finish (sawn, grinded, polished), which could be used for facing walls, columns, pillars, for laying floors, stair flights and for making monuments, had to be manufactured from marble blocks. Waste products (chippings and crushed stone) were supposed to be used for decorative chips production.

Estimated designed capacity of the block quarry was 14 500 m^3 of marble per year, the one of marble chips shop – 260 000 t per year[63]. However, practically it appeared to be much less.

Construction of the new block quarry was started in the spring of 1973. There were no specialists for organizing the production. Therefore three workers from Ruskeala went to the Urals, to Verhniy Ufaley town, for practical training.

By June 31, 1973, a stone-cutting machine CM-177 A was mounted at the block quarry under the guidance of an Ural master Nikolay Mikhailovich Dvoinishnikov. Marble sawing was started. A team comprised of V.L. Karpovskiy, V.P. Sosnin, V.N. Sokolov served the stone-cutting machine.

Rope sawing machines KP-528 started to work at Ruskeala block quarry in August of 1974. These machines were designed to work only during warm season, when water was supplied; therefore they had to be updated (master V.I. Makarov). It is interesting that as back as in the 1960-s, under the guidance of V.I. Soloviev, Ruskeala Marble-and-Lime Plant made a test quarry of marble by rope saws at Kovadjarvi deposit in Pryazha district hoping for an increase of the raw materials reserves.

In the summer 1975, the stuff of the just commissioned block shop with the help of rope saws produced 71 m^3 of blocks for the decoration of one of the pavilions of VDNKh (Exhibition of Economic Achievements) in Moscow. For the implementation of this order N.M. Dvoinishnikov, N.I. Shabalov and V.I. Soloviev were awarded bronze medals and the third cash bonus, and the machine's operator N.I. Shabalov was, beside that, awarded a Moskvich car[64].

At the end of the 1970-s Ruskeala marble from the block quarry was used in the decoration of "Primorskaya" metro station in Leningrad; this station was recognized one of the best in the world for its architectural-and-aesthetic merits. White-gray striped marble decorates the wall, and gray marble with green interburdens and spots – rectangular columns of the hall. Ruskeala marble also participates in mosaic floors facing. However, there was not enough marble for complete decoration of the metro station due to unstable work of the quarry.

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[63] Технико-рабочий проект на строительство Рускеальского карьера мраморных блоков. Пояснительная записка, ч. 1–3, Ленинград. Гипронеруд, 1975.

[64] Судаков В.П. Рускеальский мраморно-известковый // Красное знамя, Сортавала, № 16, 1982..

Fig. 18. "Block Quarry of Ruskeala ("Italian"). 2010."

At the beginning of the 1980-s a small amount of Ruskeala marble from the block quarry was used for the decoration of "Ladozhskaya"[65] metro station, as well as when constructing the memorial of Brest Fortress.

At the end of the 1970-s Ruskeala block quarry became a kind of a base for the Republican Interplant Training Center, where people from related enterprises of Moscow region, the Urals and Karelia came to study.

In the 1974–1980-s marble blocks in Ruskeala were quarried as follows. With 5 m bank height the length of working area for one rope saw was 15–18 m, thickness of the sett to be detached – from 1,3 m to 1,8m. Multi-drilling stations for drilling blocks were also included into the set of mining equipment. Horizontal blastholes were drilled at 25 cm distance from each other, charged with detonating cords and blasted. Setts detached from the rock mass were moved by screw jacks, loaded by crane to KrAz trucks and transported to a dumping station. There the blocks were reloaded to flat cars and sent to Kondopoga, Leningrad or Moscow for sawing.

According to the project Ruskeala block quarry had to become the main raw materials base of Kondopoga Stone Processing Factory, however, already at the beginning of the 1980-s the volumes of block stone extraction decreased considerably, because Ruskeala marble was hard to saw and grind due to its inhomogeneity.

Starting from the very first day of its work, the quarry failed to fulfill the plan, producing only 800 m^3 of block stone per year instead of 10–13 thous. m^3 as it was stated in the project. One of the reasons was a high cleavage of marble appeared after large-scale blast of the 1890–1970-s. The real yield of blocks was only 3% (according to the project – 21 %).

The other reason of Ruskeala block quarry unprofitability was a lack of labor force, specialists and modern equipment. Instead of 140 people as it was supposed to be under the project, only 30–35 people worked in the quarry. The lack of labor force can be explained by hard working conditions, as well as by critical housing shortage. "Here, in a huge fosse, cold, piercing winds are constantly blowing; in winter time moist and hard snow mass simply strikes down, makes it hard to breathe." – S. Grigoriev wrote[66].

Teams of Valeriy Karpovskiy and Vladimir Semenchenko worked in the quarry in the 1970-s. Then payment for work based on the final result was introduced, instead of the one as per tariff as it was before. In these conditions the lack of spare parts and equipment influenced the production strongly. There was no even a trailer where one could hide from cold. But the main point was the absence of understanding and attentive attitude to the people from some managers' side.

Valentin Ivanovich Soloviev was the Director of Ruskeala Marble-and-Lime Plant in the 1968–1979-s. And for 7 more years he worked as a Chief of the block quarry.

V.I. Soloviev came to Ruskeala from Vyborg district of Leningrad region in 1968. He was appointed the Director of Ruskeala Marble-and-Lime Integrated Plant, which included several plants, on July 24, 1968. After Heljulja Brickworks was closed, it was again named the plant.

V.I. Soloviev was occupied with restoration and arrangement of Ruskeala settlement. Two freight cars of marble chips were sent to Sakhalin, and for that the Plant of Panel Products made the reconstruction of an old kindergarten. Later, a new kindergarten was built in Ruskeala. In the 1970-s a project of a new school, agreed in the Ministry of Industry, was ordered. Ruskeala got a refusal in financial support for the school construction. However, there was a happy occasion – after all, the school was built due to the transfer of money from an organization that

[65] Зискинд М.С. Декоративно-облицовочные камни. Москва «Недра», 1989.

[66] Григорьев С. Мрамор Рускеала // Красное Знамя, Сортавала, № 150, 1981.

did not have any project. Besides, the construction of a boiler station and other necessary buildings and communications was being done. A club and a hospital appeared in the settlement.

V.I. Soloviev suggested moving Otrakkla settlement, where he lived himself, to the area of Matkaselka railway station, closer to the lake. It was explained by the fact that the plant's protected zone was 1,5 km, and the construction of houses in Otrakkala, located in close vicinity of the burning furnaces and quarries, was forbidden.

In 1977–1978 a general lay-out of Ruskeala settlement was elaborated and the construction of new houses and a trade center was started.

In the 1970-s, on the coast of the Tohmajoki river a borehole, where the geologists found radioactive gas radon, was drilled. A special commission came in order to assess the possibility of opening a balneotherapeutic health resort in Ruskeala. However, the bureaucracy did not support this project as there were three radon boreholes already known in Karelia.

In 1985–1986 PO "Karelstroymaterilay" decided to close the unprofitable enterprise – Ruskeala block quarry worked from 1973. The production of break stone was increases at Ruskeala Marble-and-Lime Plant. During those years A. Tcymbalyuk worked as Deputy Director of the plant, I.V. Maltcev was the head of production department.

In the 1960–1970-s Ruskeala plant supplied its products to 10 republics and 7 regions of the USSR, starting from 1975 – to 500 addresses. From the end of the 1970-s – the beginning of the 1980-s the plant started to send chips (decorative break stone) over the whole USSR – into 7 union republics and 26 regions and krays.

In 1980–1983 under the task of RPO "Rosmramorgranit" MP SM USSR held the reassessment of the reserves of "Ruskeala-1" deposit. During the geological works the earlier defined zone of increased cleavage with 11 m width along the quarry banks and up to 5 m depth under the quarries floors, appeared as a result of the large-scale blasts, was confirmed. This zone was excluded from the calculations of block stone reserves.

The geological researches held at "Ruskeala-1" deposit in the 1980-s also showed that most of the deposit's blocks were affected by intensive microcleavage, what had a negative influence on the yield of polished plates meeting the regurements of GOST 9480-77 – 8–10 m^2/m^3 for striped marbles and 10–13 m^2/m^3 for dolomitized marbles. Plates cracked during sawing and polishing.

Good plates could be used for inside and outside facing, decorating stairs and floors in rooms with traffic density of less than 100 people per hour. Wastes from quarrying and sawing blocks were suggested to be used for decorative break stone production.

Geologists found out that striped and dolomitized varieties of marbles were not suitable for the production of construction lime because of increased content of silicate mineral in them. Calcitic marbles, intensively quarried in the 1890–1970-s till the depth of 40–90 m, turned out to be suitable for the production of air-setting construction lime. Their reserves were 1,7 mln. m^3.

During the geological surveying it was finally stated that Ruskeala marble deposit belonged to metamorphosed volcanosedimentary formations of Sortavala series of the lower Proterozoic, presented by amphibolic, amphibole – biotitic shists, calc-silicate hornfels and marble that compose south-western limb of anticlinal fold (Ruskeala antiform). Carbonate rocks form a group of boudinaged lenticular deposits, the biggest one of which, so called "Finish deposit", 1,7 km long, 0,5 km thickness, was developed from 1766 till the 1940-s by three quarries and underground workings.

Carbonate rock mass is divided into three units: lower unit with 200–300 m thickness – interlaid white and gray calcitic and calcitic-dolomitic marbles, middle unit with 80 m thickness – clean white calcitic marbles, upper unit with up to 200 m thickness – gray and dark-gray dolomitic and calcitic-dolomitic marbles. Ruskeala marbles are skarned here and there, and then they contain silicate minerals: tremolite, actinolite, serpentine, serpentine, quartz, glists, deteriorating physical and mechanical properties of the rock.

Color of marbles changes from dark-gray and black (due to the inclusions of carbon black) to snow-white, sometimes with greenish and yellowish stripes and bonnies of up to several centimeters width (due to the inclusions of tremolite and actinolite). Structure of marbles is fine-grained and small-grained, the texture is fissile, striped, spotted. Marbles with the alteration of ash-gray, almost black, and white stripes and marbles with radiated sheaf-like aggregates of actinolite and tremolite and spots of serpentine are the most decorative. These two types were mainly developed in the previous centuries for the decoration of palaces and churched of Saint Petersburg.

The geological surveying of the 1980-s at "Ruskeala-2" deposit showed that those marbles could not be used for facing blocks production due to high cleavage. This marble could only be used for the production of decorative break stone, and the production wastes – for getting lime powder of 2 sort. In general marble of "Ruskeala-2" deposit was also not suitable for the production of construction lime due to the increased content of silicate minerals, except for a small allotment suitable for getting magnesian air-setting lime of 2–3 sorts.

According to the calculations of 1984, an enterprise, quarrying marble of "Ruskeala-1" and "Ruskeala-2" deposits had to theoretically produce 14,5 thous. m^3 of blocks, 265 thous. t of decorative break stone and 100 thous. t of lime powder per year.

On November 13, 1984, State Reserves Committee (CKZ) of MP SM USSR decreed to accept balance reserves of marble (as of 01.01.1984) in the amount of 14 455 000 m^3 ("Ruskeala-1" deposit) and 25 182 000 t ("Ruskeala-2" deposit) in categories A+B+C$_1$. At "Ruskeala-1" deposit the reserves for different types of marble were approved in the following amount: striped marble – 9126 thous. m^3, calcitic marble - 1744 thous. m^3, dolomitized (gray) marble – 3575 thous. m^3. On deep levels of this deposit the reserves of marble were approved in C$_2$ category in the amount of 175 thous. m^3 for calcitic marbles and 20 416 thous. m^3 for striped marbles[67].

In the 1980-s Ruskeala deposit was treated by two quarries by Ruskeala Marble-and-Lime Plant of production association "Karelstroymaterialy" of RPO "Rosmramorgranit of the USSR MP SP. Marble of "Ruskeala-1" deposit was used only for facing blocks, marble of "Ruskeala-2" deposit went for the production of decorative break stone, limestone meal and construction lime. The quarries and the screening-and-crushing shop were designed by "Soyuzgipronerud" and "Lengiprostrom" institutes. Low-quality lime was produced, after manual sorting of marble, in the burning kilns built in 1937.

In 1983 there was the following output of Ruskeala Marble-and-Lime Plant: facing blocks – 0,835 thous. m^3, decorative break stone – 177,6 thous. m^3, limestone meal – 49 thous. m^3, magnesian air-setting construction lime of 2–3 sorts – 11,5 thous. m^3.

Production of limestone meal was started in Ruskeala in the second half of the 1970-s. It was used for limestone acidic soil. Due to the special chemical composition limestone meal from Ruskeala marble was of low-quality, and taking into account the perfect features of marble as a construction material – expensive. Many sovkhozs of the republic and Sortavala department of Selkhoztekhnika, to which the meal was supplied, took it with often stops. There were non-productive times in the work of the enterprise that could not ship the product anywhere.

In the middle of the 1980-s Ruskeala Marble-and-Lime Plant started also to produce fractionated break stone, in general, 200–215 thous. per year.

A new break stone shop was built in Ruskeala in 1986. However, the enterprise that was being built for 13 years, was off-market by that moment. The plant worked unstable. Its profitability was only 5 %, and in 1987 "went into the red".

In 1988 Ruskeala Marble-and-Lime Plant, after many years, came out of the state of non-fulfilling the plant for a while. Then, for one month the plant gave 1229 t of construction lime against the plan of 900 t, and limestone meal and decorative break stone – according to the plan[68].

However, it was the last, "swan song" of Ruskeala plant. In the very beginning of the 1990-s the burning kilns were finally stopped. Output of break stone was curtailed drastically, as well as marble quarrying in "Ruskeala-2" deposit.

The following financial and political troubles in the country finally destroyed the vitality of Ruskeala Marble-and-Lime Plant. Further it just stayed up by implementing irregular orders for its products – break stone, and on very rare occasions supplied blocks from the abandoned block quarry. Only one quarry of "Ruskeala-2" deposit was developed for break stone.

Having worked till the beginning of the 1990-s, the burning kilns of Ruskeala Lime Plant are now ruined. There is no wooden construction above the kilns. Overpasses are being destroyed. The monu-

[67] Протокол № 162 Заседания Центральной Комиссии по запасам полезных ископаемых при Министерстве промышленности строительных материалов СССР от 18.11.1984.

[68] Дмитриев Д. Рускеальцы выходят из прорыва // Красное Знамя, Сортавала, 11.02.1988.

ment of industrial culture, left off-hand, is in danger of turning into a heap of bricks and metal.

At the beginning of the 2000-s in the abandoned block quarry, where in the 1970–1980-s marble was being sawn, mining men destructively blasted one of the banks and transported the received small blocks to Saint Petersburg. This marble, for example, was used for unsuccessful restoration of a column in front of the entrance to the building of Tax Administration on Isaakievskaya square, as well as for making grave stones. Pieces of the detached by the blast marble lied for a long time in the block quarry, but they disappeared gradually somewhere.

At the beginning of the 2000-s the block quarry of "Ruskeala-1" deposit belonged to OOO "Idan Kivi", and the quarry of "Ruskeala-2" deposit with break stone plant – AOOT "Ruskealskiy Mramor". On December 1, 2009 Ruskeala marble plant with the quarry was finally closed.

Now Ruskeala Lime Pant, that stood without work for 20 years, turned into stone-and-metal ruins.

Tourists started to visit former "Glavny" quarry with traces of underground working and the lime plant as back as in the 1960-s, when marble was actively quarried and processed in Ruskeala. Travel and excursion office (director V.A. Chekeeva) worked out a wonderful excursion. However, at the end of the 1990-s further visiting of the former marble quarries by tourist became dangerous, and then the Administration of Sortavala Municipal District decided to lease out former "Glavny" quarry to OOO "Kolmas-Plus" for organizing on its territory Mining Park, where all safety requirement would be fulfilled. In 1998 the territory of former "Glavny" quarry (№ 6) got the status of the monument of historical-and-cultural (mining-and-industrial) heritage of the Republic of Karelia.

In 2000–2001 OOO "Tekhproekt" and Agency on Intellectual Property "Apis" (director – A.I. Gribushin) elaborated the development concept of "Ruskeala Marble Quarries" tourist site, and it was the theoretic basis for the creation of Ruskeala Mining Park during the next years[69].

The creation of Ruskeala Mining Park of 5 ha square started in 2003. In 2004 OOO "Kolmas-Karelia" took measures on arrangement and improvement of former "Glavny" quarry (№ 6): metal guard rails and stairs along the route were installed, paths were laid, parking for cars was organized, and territory of the land allotment and waters of the drowned quarry were cleaned form litter.

In 2005–2006 organization of lightening along the route and color backlighting of the quarry, that worked in 2008, was started. Information billboards were installed, landscape works were done. As of 2004 more than 370 thous. rubles were invested into the Mining Park organization, and as of the beginning of 2010 – already about 3 mln. rubles!

Ruskeala Mining Park is located on "Blue Road" international route, connecting three Baltic countries. There is an intensive tourist flow to both sides along this road. At the beginning of the 2000-s up to several thousands people crossed Vartsila-Niirala international crossing point every day. In 2007–2008 the throughput capacity increased up to 780 thous. people annually. Under prognoses, in case of improving economic situation in the world, up to 1 mln people will cross Vartsila-Niirala international crossing point annually. At least 25 % of them will definitely visit Ruskeala Mining Park.

Ruskeala Marble Quarries is the first tourist site on the way from Russian–Finnish border. Recently the flow of Russian tourist wishing to see the wonderful Mining Park, that does not have any analogies in Russia, has increased. Now the park is very well advertised. Drive to the park via old settlement was improved. There is an agreement with the locals concerning this road.

A new tourist route supposing the visit of so called "Ruskeala Gap" (technogenic hole in the backs of 3–4 levels of the working) and "Italian" quarry (where in 1974–1985 marble blocks were quarried with the help of rope sawing machines, that were first elaborated in Italy) was launched in Ruskeala Mining Park in 2013.

Now Ruskeala Mining Park, created based on unique technogenic-and-natural complexes of former "Glavny" quarry, "Ruskeala Gap" and "Italian" quarry, is one the most popular tourist site of Karelia and the whole North-West of Russia. More than 50 thous. tourists from different countries visited it in 2012, and in 2013 – already 65 thous. tourists.

Mining Park notion includes the natural component and the corresponding infrastructure, as well as the relevant subject matter in form of entertainments, programs, forms of active and passive rest.

[69] Gribushin A.I., Borisov I.V., Kondratiev V. The Development Concept of "Ruskeala Marble Quarries" Tourist Site

Ruskeala Marble Quarries belong to excavation cavities (made by means of equipment) and to technogenic-and-natural landscapes or complexes, created during the process of long open and underground working of marble deposit, as well as is a unique monument of mining-and-industrial (historical-and-cultural) heritage. Being on the stage of postechnogenesis, mining working of Ruskeala deposit are trying to "heal" the man-caused impact wounds, taking the shapes similar to those we can meet in the nature untouched by human activity. Quarries are becoming beautiful lakes with bluish-green water in white-marble cups, heaps – hills covered with young forest, drift ways and shafts – mysterious "caves".

THE HISTORY OF RUSKEALA MARBLE QUARRY IN 1818–1924 REGISTERED IN OLD MAPS

Mija Eerikainen

Information about the history of the development of marble quarry in Ruskeala can be got from the old maps preserved in the archives of the National land reform. This archive keeps copies of the maps and relevant documents made in the days of the most significant land surveying in Finland[1]. Probably, originals of the maps related to the marble quarry were initially kept in Vyborg where part of the documentation on the land surveying is being preserved. Different territories are marked with strokes in the old land surveying maps, and studying them, one can find out for example how the land-use system was being changed or who the owner of the land was during the certain period.

In this article I have tried to show the use of the maps made during the land surveying works, what changes happened on the territory of Ruskeala marble quarry in 1818–1824. Maps related to the marble quarry of the given period were found in the archive of the land reform. In the article I consider the places where quarries and land plots were located and where roads and borders ran. Besides I have studied the old names of the quarries, the relevant literature and the archive's collection in the National language center where all the toponyms of Finland and neighboring regions are gathered. Most part of the archive is folk tales collected by researches and students, however, part of the names were got with the help of name competitions[2].

Reference: Google earth 14.07.2013 (kuvien päiväys 7.05.2011).

Fig. 1. The Territory of Ruskeala Marble Quarry

The Quarries in the 1820-s.

Starting from the end of the 1810-s Ruskeala marble quarries were under the jurisdiction of the Office of Saint Isaac Cathedral (Iisakinkirko) Construction[3]. In 1818 and 1823 land surveying was also conducted at the quarries and based on them a map was made (see map 2). The map given in the reference is a copy of the one made in 1842. Head of the map says that it shows the part of the Ruskeala Parish pastor's (preacher's) lands that was passed into the ownership of the marble plant under lease agreement[4].

According to Danielson-Kalmari (1931) dispute about borders that happened between Ruskeala and the quarry workers was the reason to conduct land surveying and create a map in 1818. In 1814 the

[1] Lehtinen 2005, 126.

[2] Kotimaisten kielten keskus. www.kotus.fi /index.phtml?s=373.

[3] Ruskeala: Ruskealan pitäjän muistokirja 1964, 76.

[4] Kartassa: Den delen af Ruskeala Sockens Kyrkoherde Bohlets Ägor som under arrende rätt blifvit upplåten till Marmorverkets disposition i berörde Socken af Kexholms Norra Härad och Wiborgs Län.

pastor complained to the Governor's Office of the fact that the workers from the marble quarry misappropriated part of the lands of his official property. After investigation land surveying was done at the quarries and it resulted in the project according to which land area would be given to the marble quarry workers from the pontificate for rent. This territory had already mostly been in the workers' hands. However, disagreements still continued to be, because according to the director of the quarry the workers did not have enough land for getting construction materials and firewood. Then the Governor ordered to expand the area of rent in order workers could have enough wood, and additional land surveying was done for that reason[5].

The map created in 1818 and updated in 1923 showed the territory rent by the quarry. From the left side of the map this area bordered with the river and from the right coast there was Sortavala-Kite road that, nevertheless, was not the border of the quarry. There are frontier markers giving the evidence of the border direction and not bordering with the river on the map. Some forest lakes (ponds) can be seen on the territory, including: Sursuolambi (Suursuolampi), Sungalammi (Sunkalampi), Piensuolammet. Suursuolampi was part of the quarry's territory. The map also shows the neighbors: from the left there is the pastor's official house territory, and from the right – land plots that were under the jurisdiction of the pastor[6]. Territories (number 43, 44, 46, 47, 48) from the right side of the map are marked with explanatory notes before the surveying of 1923 where they obviously had not been included earlier. Besides small territories numbered with figures 45, 49 and 50, between Sortavala – Kite road and the river, were added to the map comments later. Probably, there territories related to the border dispute, however the map comments say nothing about these disputes, so today there is no possibility to find out what territories exactly the disputes were about.

Source: The Archive of the National Land Reform (KA)

Fig. 2. Map of Ruskeala Marble Quarry, 1818–1823

The territories of different parts are marked with different colors on the map, but the colors are impossible to interpret. Based on the comments to the map one can guess that land plots are marked with red color, meadows and grasslands – with green color, main burns – with pale-red, swamp grasslands – with light-brown stripes and bogs – with green stripes. The land is divided into sorts in the map comments; however the information of land surveying dated 1823 revealed other results. Based on the map comments it can be considered that the area of the whole territory was 129 hectares. Most of the territory, approximately 36 hectares was qualified as main burns. Meadows and grasslands, sedge meadow, for example, were divided by 22 hectares approximately, but the lands of patchy meadows contained a lot of other classes. Based on the precise classification of meadows it can be noted that they were an important part and it was extremely significant to emphasize different types of meadows. According to the map comments most part of the territory was forest; however there were also main burns, mines, roads. The map notes that compare to other territories area around ponds was more swamped.

When studying the maps it should be noted that meadows, forest areas, water ways as well as relating information, for example, soil fertility, were especially well explored. This owes to the fact that in Finland most part of the maps were created under the results of the officials' work, and the most outstanding map-makers were civil and official bodies in the sphere of land surveying and military officials. In civil mapping there were two points of departure:

[5] Danielson-Kalmari 1931, 67–72.

[6] Kartassa: Präste Gårdens enskilta Bohlstads Ägor Ligga på denna sidan, Präste Gården Underslagne Hemmans Bohlstads Gränsa Hitintill.

calculating tax rates or landed property. Often mapping was done because the people in power strived to mend their fences and increase their income from the received taxes. In order to create a map it was necessary to have the formerly formed as well as general delimitation (see the most important general delimitation in the next chapter)[7].

Looking through the lower part of the maps dated 1818/1823 one can notice that the land area of the territories that were by the river bend, is more divided into categories, and one plot was also marked with 22 number, where the houses of the marble quarry workers were situated, but they are not marked on the map precisely. Constructions are located on the plot under number 23 and spots of vegetable garden are marked under number 24. A plot or a construction partly standing above the water can bee seen on the same territory, but the map comments do not contain the detailed information about it. Across the land plot and grasslands there runs a road coming from Sortavala-Kite road to plot number 10 named “marmorbrottet” or marble quarry. Land plot number 9 is placed near the quarry. Next to the road running to the quarry, beside meadows and a main burn, there is for example plot number 19 the soil of which contains clay, sand and is party stony and where a fragile alder forest grows. B*önehus* (a chapel) *and kruthus* (a gunpowder warehouse) are also specified on the territory of plot number 19.

Only number 10 is marked as marble quarry in the map comments; however many other points say about marble, for example, number 44, next to Sunkalampi lake near which the mountain with green marble in it is marked; and right on the river bend, next to Sortavala-Kite road, the mountain with striped marble is marked with number 45. According to the book of remembrance of Ruskeala parish the territory of the quarry was decreasing on the river bend and they started to search for marble deposits in the northern part between Sunkalampi and Suursuolampi[8]. By the river bend the territory is marked as number 33 and it looks like a big quarry. The map comments give the only word for it – *“berg”*, or mountain. Search for marble evidence that the bog where test quarrying of marble was being done was under number 43. Mountains with numbers 47 and 46 signify the places where marble had to be.

[7] Strang 2000, 18–21.

[8] Ruskeala: Ruskealan pitäjän muistokirja 1964, 77.

From General Delimitation to the 1860-s

The following measures of the quarry were done in 1835 (see map 3). At that time the map was made considering two villages, Ottrakkala and Matkaselka, on the territories of which the general delimitation was done in 1843. In Sweden and in Finland of the 1700-s the general delimitation meant the beginning of land parceling (land redistribution reform) according to which peasants (farmers) got lands as one share. The purpose of the new delimitation was to develop agriculture and to encourage new settlements and therefore new taxation. As far as the delimitation as a rule was made in all villages and in this concern a map of every village was traced, the creation of a great amount of cartographical documents became the consequence of this delimitation. The landscape (the territory) on these maps was shown very precisely, and moreover, the sketches of the previous measurements could be depicted on many plots[9]. Land territory of the quarry was imaged on the maps of Matkaselka and Otrakkala, however in the map comments made in 1844 there is a part of notes to the map of the pastor’s official lands. Compare to the map dated 1818/1823 the borders of the territory do not seem to be changed. The pastor’s official house on the other side of the river is a border neighbor, but from the other side there are plots of villages Matkaselka – A and Otrkkala – P and O. Some geographical names were also changed, for example, Suolalambi lake was changed to Suursuolampi place and Likolambi was changed to Sulampi place on the new maps.

On the map of the general delimitation one can note that the most important full-flowing river (logging way) was left on Sortavala-Kite road, the road running to the main quarry (number 220), and fields and land plots are marked in details next to it. Land plots are marked in more details on the new maps than it was done of the maps dated 1818/1823, though, on the other side, the map comments do not mention the differences related to the chapel and gunpowder stock. Besides additional plots appeared around the main quarry, there is a vegetable garden near one of them (number 225). The direction to Sortavala-Kiite road was from the plots marked with dashed line.

[9] Lehtinen 2005, 47, 56; Strang 2000, 21.

Another road is also shown on the map: it runs to the main quarry, and there are no plots next to it, only meadows, forests and main burns. The road ends at Sortavala-Kiite road, and there is a large plot on the river coast next to this place. This plot is not related to the quarry's lands, but there is also no comment to whom it belongs. The same plot is imaged on the map of the pastor's official house dated 1838, and there is *"Gästgifveriet"*, or guesthouse, inscription above it.

Source: The Archive of the National Land Reform (KA).

Fig. 3. Part of the Map of the General Delimitation in Matkaselka and Otrkkala Villages

According to the map comments there were also some changes in land-utilization. First of all fields were classified in a different way – not the way when they were divided into categories. The area of the fields is about 12 hectares and land plots – about 2 hectares. Meadows were counted to be about 17 hectares, and lands for main burns – only 8 hectares, that is, considerably fewer than earlier when they included about 36 hectares. In general the area of the whole quarry's territory in 1844 was approximately 131 hectares based on the map comments. Most part of the territory was forested zone, but it also included quarries, main burn lands, bogs and roads.

The map comments emphasize several quarries. Number 220 is sjelvabrottet, or the quarry itself. On the territory next to Sunkalampi lake word *"bergbrottet"*, or the "quarry mountain" is marked with number 341. The mountain containing green marble is outlined with big strokes on the same place on the map of 1818/1823. The territory of this mountain still seems to be much more diminished on the new map of the general delimitation. Numbers 335 and 342 next to Sunkulampi lake are the mountains that probably were also quarries. There is *"bergbundenmo"*, or cliffy (rock) material, inscription on the new map of the general delimitation under number 119, where deposits of striped marble were earlier. The same cliffy rock is marked as number 118 that was marked as a mountain earlier on the old map.

Studying the new map of the general delimitation one can note that populated territories of the fields by the river bend and next to the river were expanded, and new land plot were also added around the main quarry. Population growth and extraction works increase are shown on the landscape. Information on the population size is given for different years, for example, in 1818 approximately 50 people lived on the territory of the quarry, and starting from the 1820-s Finnish workers wishing to stay here permanently also came to this territory. Workers from Russia applied for a job in the quarry earlier[10]. According to France Peter von Knorring (1833) the number of workers at Ruskeala quarry grew up to five hundred at times, and in summer time contractor works were implemented at the quarry[11].

The next map and comments to it were made in 1864, the map was verified by the district court in 1865. However the map was based on the map of the general delimitation of 1835 and there were no big differences between them. No big changes were marked on the territory. The peculiarity was that the border line came along the map of 1864 across Suolalampi lake, while earlier it had run west of this lake. A big change was obviously related to the owner, as far as in 1844 the map's head said that the territory of the marble quarry was part of the pastor's lands, but in 1864 the map's head already said that the area of the quarry was *"kronohemmanet"*, or the tsar's house. The head of the map said that a separate tsar's house was built under the tsar's decision in 1863[12].

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[10] Ruskeala: Ruskealan pitäjän muistokirja 1964, 76–77.

[11] Knorring 1833, 76.

[12] Kartassa: Karta öfver Det, enligt Hans Kejserliga Majestats Nådiga Utslag af den 5 Februari 1863, nybildade enstaka kronohemmanets No 4 egor uti Otrakkala by i Ruskeala socken, Sordavala härad och Wiborgs Län.

Toponyms of the Quarry

The maps and the enclosed documents mention some names of the marble quarry, but the general delimitation map give relatively few toponyms. Still, based on the maps, one can estimate, for example, to what village the quarry was related. The map of 1818/1823 does not show the village to what the quarry was related, however it is evidently that starting from the days of the general delimitation the land belonged to Otrakkala village, as far as the plots were drawn in Matkaselka and Otrakkala villages by the general delimitation map dated 1835. There were 4 basic places in Otrakkala village where the quarry was marked with number 4[13].

The names of the villages situated in the neighborhood of the quarry reflect the history of the territory's population and names of the populated localities in different languages. Names of the most of the villages are old and they are referred to in documented source since the 1500-s, for example Matkaselka village was referred to as Matkoselga in the 5th tax book of Novgorod dated 150014. Otrakkala village is mentioned as Ozratanvaara in the documents dated 1590. The same document says that a man named *Jfuan Osratain* lived in the village, that is the name of the village, probably, comes from the name of its inhabitant15. The name still contains *"osra"* word that means "barley" in Karelian dialect16. So, the name shows the word in Karelian language relating to the Karelian people who used to live on this territory.

According to the map the quarries were situated in Ruskeala parish. Ruskeala parish, or community, was created in the 1720-s, and before that Ruskeala had belonged to the parish in Kitee[17]. In the dialect "Ruskeala" word sounds like *"Ruskkiila"*[18]. Besides "Ruskeala" had different forms, for example, old Russian name *"Ruskolsk"* (Русcкольскъ)[19]. Besides word "Ruskeala" also implied a church school that was organized with the church. The church was situated near the quarry, on the other side of the Tohmajoki river. The church was built in 1834, but before that a church in Ruskeala was a bit southwards of Ruskeala village. On the other side there are a lot of different explanations of the initial location of Ruskeala or the origin of its original name.

The book of remembrance of Ruskeala parish says that the place called Ruskeala appeared in documents in the second half of the 1600-s, and it is considered to be related to the development of Lutheran parish. J.V. Ronimus (1906) in *the 5th tax book of Novgorod* still mentioned Red lake that was marked between the lakes of Vahvajarvi and Janisjarvi as a small lake named Ruskolampi. This name is as well connected to the name of Ruskeala[20]. Word *"ruskie"* in Finnish means almost red or red-brown color, and in the languages kindred to Finnish, for example in Karelian, word "ruskie" means red or red-brown color[21]. Ruskolampi that probably then got the name of Ruokolampi, nevertheless was long ago the territory traditionally called Ruskealaksi or Ruskeala settlement. People told that Ruskeala name originated from brown soil near Kirkkolampi. The first church of Ruskeala chapel is obviously located next to Kirkkolampi lake[22]. The place called Hanki is situated in this locality today.

Several names are used on the territory of the quarry. In Finnish language this place was usually called quarry or marble quarry, and the quarry workers were called "*louhokselaiset" (miners)*[23]. France Peter von Knorring (1833) mentioned that the constructions near the quarry were called by word *"savod" (zavod, a plant)*[24]. The quarry also had several toponyms containing word *"savotta"*, for example Savotansilta, Savotankoski[25]. So, word *"savotta"* was obviously connected to the marble quarry. Savotta is a general Finnish word meaning forest harvesting operations or big work contract, but initially savotta is an adopted Russian word from *"zavod" (*plant)[26]. In Russian-language documents and maps Ruskeala marble quarry is often called by word *"lomka"* (stone-pit, quarry). Word *"lomka",*

[13] Maarekisteri 80 (MMA).
[14] Ronimus 1906, 47.
[15] Asiakirjoja Karjalan historiasta 1987, 269.
[16] Toivonen 1955, 420.
[17] Ruskeala: Ruskealan pitäjän muistokirja 1964, 21.
[18] 1-kokoelma: Ruskeala (Kotus).
[19] Novyj i polnyj geografi tšeskij slovar Rossijskago gosudarstva 1788, "*Рускольск*".
[20] Ruskeala: Ruskealan pitäjän muistokirja 1964, 28, 40, 94, 231; Ronimus 1906, 49.
[21] Häkkinen 2009, 1075.
[22] Ruskeala pitäjänä ja kuntana 1938, 7–8; Ruskeala: Ruskealan pitäjän muistokirja 1964, 91–92
[23] 1-kokoelma: Ruskeala (Kotus).
[24] Knorring 1833, 76.
[25] 1-kokoelma: Ruskeala (Kotus).
[26] Häkkinen 2009, 1133.

or the place where stone is being produced (quarried) was also adopted from the Russian language to the Finnish Eastern dialect, but it is mostly used as *"lompka"*[27]. Obviously Finnish-language name "lomka" was not related to the quarry as far as there were enough toponyms starting with *"savotta"* word.

The marble quarry could also be called Matarinvaara[28]. Comments to the map of 1818/1823 also mention Matavaara (the map comments: Mataravara), that in fact meant a mountain near the old main quarry. Maatavaara contains word *"matara"* that means a type of plants. There are many species of bedstraws, but rare coppices of bedstraws (Galiumtriflorum) grow on the territory of the quarry; and this owes to the fact that the quarry's area had been famous for its rare plants since the 1800-s[29]. According to N. Ozeretskovski the mountain near the main quarry refers to the Russian-language name Belaya (White) Mountain, or Valkoinen vuori[30]. Zelenaya (Green) Mountain, or Vihrea vuori, marked with number 33 on the map of 1818/1823, was also on Ruskeala marble quarry[31]. In Finnish it was called Harkamaki[32].

The Tohmajoki river running along the sides of the quarry's territory was another important object related to the quarry. The Tohmajoki river trends from Tohmajarvi lake into Ladoga crossing different lakes though it is not completely united with Tohmajarvi lake as it only supports the river trending from Ruokojarvi into Ladoga. The Tohmajoiki was called lower course of the Helulanjoki because it ran via Helula into Ladoga[33]. Literature about Ruskeala marble quarry also mentions the Helulanjoki, for example Ozeretskovski says about the Gelul river, and Z. Topelius – that marble was transported to marble saw mill that was located a bit southwards of the Helula river[34]. The river next to the quarry was called Suurijoiki in the comments to the map of 1818/1823. Probaly, the Tohmajoki is also called the Suurijoiki, there were no these two names in two other famous works. Certainly on the area of Ruskeala parish there were other rivers having the parallel name of Suurijoiki, for instance Kiteenjoki had the name of Suurijoiki[35]. In the Russian-language literature the Tohmajoiki is called the same name as in the Finnish-language and the Swedish-language texts. According to A. Sobolevski, the river was called Ruskolka, and V. Severgin used the river's name Ruskal[36].

The Quarries Starting From the 1860-s.

Starting from the second half of the 1860-s it was quite at the quarry, though the extraction of marble and lime burning were resumed from time to time. And a lot of changes started at the marble quarry already in the 1890-s. Researches began at the quarry in 1892–1893 to find marble suitable for use. The results of the exploration were promising and later industrial administration started to build a railroad to the quarry. In 1896 money were allocated for the construction of 3,5 km feeder to the quarry. Aktiebolaget Ruskeala Marmor was established under the guidance of Karl Forsstrom in 1896, later it was changed to Ruskeala Marble Stock Company[37].

A hypsometric map showing the territory's relief in details was made at the quarry in 1897 (see fig. 4). The highest points were marked with brown color, and lowlands – with blue. The map showed, for instance, roads running mainly on the lowlands, not on the uplands. A railroad and the point where test excavation (mining) works were made in 1893 were pictured on the map. *Gamla Marmorbrott,* or the old marble quarries, is marked on the map, but the other quarries are not specified. Land plots and constructions are not specified as well on the map. Yellow lines coming across the map attract attention. They are drawn on the territory rented by Ruskeala Marble at the very beginning of the company's foundation[38]. In any case, by the start of the company's work the activity was focused on the already known territory that did not included the areas of Sunkalampi and the Tohmajoki river bend, where quarries had been earlier.

Source: The Archive of the National Land Reform (KA)

[27] Ruoppila 1986, 28; Yleiskokoelma (Kotus).

[28] Bremer 1825, 192.

[29] Ruskeala: Ruskealan pitäjän muistokirja 1964, 19–20.

[30] Ozeretskovski 1812, 101.

[31] Sobolevski 1839, geognostitšeskaja karta okrestnostei Ruskialy.

[32] 1-kokoelma: Ruskeala (Kotus).

[33] Yleiskokoelma (Kotus).

[34] Ozeretskovski 1812, 102; Topelius 1845, 189.

[35] 1-kokoelma: Ruskeala (Kotus).

[36] Sobolevski 1839, geognostitšeskaja karta okrestnostei Ruskialy; Severgin 1805, 70.

[37] Ruskeala: Ruskealan pitäjän muistokirja 1964, 78–80.

[38] Ruskealan marmorilouhosta koskevat asiakirjat (KA).

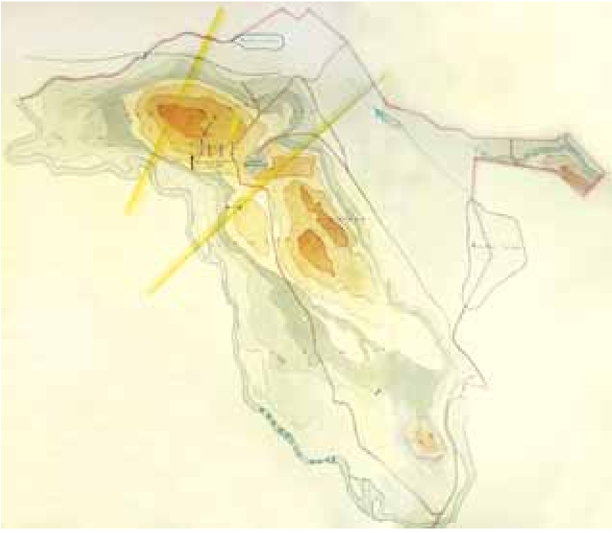

Fig. 4. The Hypsometric Map of Ruskeala Marble Quarry, 1897

New general delimitation was conducted on the territory of the quarry in 1924. Compare to the previous maps the map of 1924 (see fig.5) is larger and in Finnish while the old maps were in Swedish. On the moment of the map being published Ruskeala marble quarries were already part of Finland that got its independence in 1917. Before that, since 1811 Ruskeala was part of Vyborg district that was included into the Grand Duchy of Finland[39]. The name of the map of 1924 says that the map deals with Kivimaki building, number 4, of the plot in Otrakkala village of Ruskeala parish in Sortavala area and in Vyborg district. The borders were marked the same way as it was on the old map of the general delimitation. Land surveying and map creation are recorded in documents and besides the map comments mention that 4 peasants were put poles on the rented areas.

Territories on the map are marked with different colors, for example, fields are yellow, land plots are red, fields are light-green, rocks are gray, and rock quarries are light-gray dots. In the map comments the total area of the surface is approximately 138 hectares. Fields occupy about 10 hectares, meadows – about 9 hectares and plots for cultivation – about 20 hectares. One can see on the map that fields are divided with straight poles, and the fields are mostly concentrated on the territory of the Tohmajoki bend. Besides the map specifies many plots for cultivation around Suolalampi lake; part of them used to be meadows. The map comments note that main burns occupied 14 hectares; the owner's lands were included into part of the quarries. Forest zone takes the most of the territory – almost 90 hectares. Rocks, quarries and bogs were included into the forest zone.

Fig. 5. Stone Mountain, the Map of the Land Plots and the Comments, 1924, the Territory by the Tohmajoki River Bend

The map also marks that in the 1800–1900-s slash-and-burn farming was decreasing and the amount of field was getting down for the duration. Slash-and-burn farming was the most important way of sowing in Ruskeala as back as in the 1700-s, but gradually slash-and-burn farming fell into a decline what led also to decrease in the value of wood. They cultivated mostly fields, but anyway contamination of the territory with stones slowed down the work. Hay was started to be grown on the fields where harvest was bigger than on the others[40].

Map 5 shows that there were not so many land plots, though they were placed of course between Sortavala-Kite road and the river. Under the map of 1818/1823 striped marble was marked with big dashes on the same place. According to the map of general delimitation a guesthouse was also situated near Sortavala-Kite road. A plot with a mill stands on the same point on the map of 1924. According to the book of remembrance the parish there was Tirki mill in Ruskeala and it was located in the most distant place from Otrakkala village[41]. Some land plots and yards are marked further along the road that runs across the fields to the quarry. Cowsheds, saunas, barns are for example specified on the plots. On the map of 1924 one can notice that on earlier maps, by the Tohmajoki river bend, the places of settlement

[39] Ruskeala: Ruskealan pitäjän muistokirja 1964, 22.

[40] Ruskeala: Ruskealan pitäjän muistokirja 1964, 58–60.

[41] Ruskeala: Ruskealan pitäjän muistokirja 1964, 251.

were nearest the field. It was also D. Semenov (1866) who told about the settlement; according to him houses were built for the workers, but in the 1860-s they were already destroyed, but the church relating to the territory of the settlement still stayed[42]. Not far from the settlement there was a chapel marked on the map of 1818/1923, but it is not referred to on the map later. "The cemetery of the Russians", or obviously the Orthodox cemetery, was marked with number 146 on the map of 1924; this cemetery was not specified on the maps of the previous years.

On map 6 one can see the quarry's area and how many constructions were there. The main plot is shown in the vicinity of railroad where, for instance, the apartments of the office (number 528) and a production facility (number 531) are drawn. A lime kiln (number 532) and a lime bog (number 531) are specified nearby. Lime kiln was called "*tomina*" at the quarries[43]. Tomina is a word adopted from the Russian language meaning a blast furnace (domna), a furnace for melting iron. For example, blast furnaces at Mohko Ironworks in Ilomantsi were called tomina[44]. Another different constructions, for instance, a machinery department (numbers 482, 555, 574), a weighing room (number 507), a forging shop (number 503) are marked on the territory of the quarry. An underground story for dynamite was situated far from the plant's territory on the river coast.

A lot of paths tending to the main quarry along Sortavala-Kite road are specified on the old maps on routes on the territory between the quarries. The logging river by the quarry was probably the road tending direct to the plant's territory to the manager (number 31) passing by Suolampi lake.

The early maps specified only the old main quarry on the territory of the quarries, but words "louhimo, nykyinen" – the modern (new) quarry – 1 place (number 497) and word "louhimo", 5 places (numbers 403, 453, 573, 575, 585), appeared on the map of 1924 on the area of the main quarry. Besides eight more places (numbers 451, 471, 473, 493, 491a, 577, 578, 579) are denoted by words "vanhalouhimo".

Source: The Archive of the National Land Reform (KA)

Fig. 6. Stone Mountain, the Map of Land Plots and Comments, 1924, Point of Extraction

Three places (numbers 401, 485, 486) are referred to as word "louhittu/louhimonpohja" and two places (numbers 401, 485, 486) – to "louhimonseinä". Two quarries were located near the lime kiln in the neighborhood of Sunkalampi lake. It is difficult to understand under the map when all the quarries were established, because there were no exact surveying map in the archives at the end of the 1880-s, there was only the relief map. The new archive did not have the maps of the 1700-s according to which the quarries could be specified to be located in different places either. Some places were called old quarries. Besides, there is an old lime kiln (number 457) on the territory. It is also stated on the map that there were many heaps of wastes, for example numbers 445, 504, around the plant's territory. The wastes were not included into work at the quarry in the 1920-s, and at the beginning of the 1800-s masses of marble chips were accumulated on the area[45].

The fact that one of the lakes had practically disappeared became a big change in the landscape. A small lake left from Suolampi lake was on the map earlier. The lake was next to the railroad. By the way, between Suolalampi and Suolampi there was a pond (lamba) shown on the map of 1924 considerably smaller. Disappearance or decrease of the lake could

[42] Semenov 1866, 210.

[43] 1-kokoelma: Ruskeala (Kotus).

[44] Murrearkisto (Kotus); Ilomantsi – vihreän vyöhykkeen keskus 2006, 67.

[45] Severgin 1805, 73.

be related to the intensification of agriculture also because of the fact that a land for cultivation was situated in the bog zone on the map of 1924. Ruskeala Marble Company itself practiced forest and land industrial activity and cultivated bogs near the quarry as fields[46].

Names of lakes and rivers were changed many times in the maps; for example on map number 6 Suolami is called Likolampi under the map of the general delimitation and Pahalampi under the map of 1897. Small lakes emphasized by word "*suolampi*" – bog lake – are seen on all the maps[47]. On wider area lake was called Suolalampi that is probably stated there as part of Otrakkala village where a quarry named Suolamaki also was[48].

Studying the maps it should be noted that on map number 6 the territory of the old quarry was used already from the first half of the 1800-s. Using the territory around it was intensified by the 1920-s. A railroad and large buildings for the plant were for example built there, and the center of influence of the quarry's territory was around the main quarry where many other quarries also were. In other points, where marble deposits had been earlier, land plots appeared later. The borders of the whole territory of the quarry did not change much starting from the 1820-s till the 1920-s, but the territories on the inner side of the border, for example areas of lakes and land for cultivation, suffered changes. Changes were also seen on the areas of the settlements, because in the 1920-s land plots were marked on the area of the Tohmajoiki river bend and the land plots and the fields were expanded from the first half of the 1800-s, but starting from the 1920-s there was mainly field in the are of the Tohmajoiki river bend.

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[46] Ruskeala: Ruskealan pitäjän muistokirja 1964, 84.

[47] 1-kokoelma: Ruskeala (Kotus).

[48] 1-kokoelma: Ruskeala (Kotus).

NATURAL STONE IN THE ARCHITECTURE OF SORTAVALA

I.V. Borisov

"Language of architecture, as well as language of music, can be understood all over the world without a word"
Alvar Aalto

In north-western part of Russia, on the coast of the great Ladoga Lake, there are towns and settlements, which before 1917 were part of the Grand Duchy of Finland, and before 1940 – part of the Republic of Finland. Now this is Russia, and to be more precise – the Republic of Karelia. Unfortunately during the last 50 years population of this region has decreased considerably, many Karelian and Finnish settlements have become decrepit or completely vanished from the surface of the globe. Some unique architectural monuments were destroyed in the fire of wars and reforms. The town of Sortavala – formerly powerful cultural, educational, spiritual and economical center of Priladozhskaya Karelia and the whole Finland – have had better luck in this concern. This town has mainly preserved its unique historical-and-architectural ensemble, created by Finnish architects within the period of 1880–1939. Sortavala is sometimes called "a small architectural encyclopedia of Finland", as far as old buildings, situated on its territory, in broad lines reflect the evolution of the development of Finnish architecture from eclecticism to functionalism.

Natural stone, deposits of which literally surround the town all around, played a great role in the construction of Sortavala before 1939. All sorts of granites, granite-gneisses, amphibolites, amphibolite shists, gabbrodiorites and marbles decorate the town and make it deferent from the other small towns of Russia.

In order to see the bird's eye panorama of Sortavala, one should climb the top of Kuhavuori Mountain (translated from Finnish "pike-perch-mountain"), that is – by a giant stone block-"fish"- hanging out over the surroundings. The mountain range was polished by an age-long glacier that came across it, and the sides-slopes are roughed down by ancient earthquakes.

A kind of a "map" of the town and its surroundings opens up in front of us from the top of Kuhavuori. There, in the north, in the bluish gauze of distance, dark ranges of ancient ruined volcano stand like a wall, in front of them – in the valley, where the Tohmajoki and the Kitenjeki Rivers marry – Paasonvuri rock stands as a watch-tower, the witness of many war battles of the XII–XIII centuries, that many times saved the local people, the Karelians, from raids of enemies.

In the west, towards Finland, small forested hills are stretching one after another like sea waves. In the south, under a chilling cliff – the quietness of a bog lake Airanne, surrounded by fields with forest rests, behind which – another lake, another fields and forests.

Eastwards from us, in the lowland, surrounded by rocks, on the coast of Ladoga Lake, there is the town. Narrow Vakkolahti bay splits it into two parts connected by a stone bridge. In summer time the towns' buildings can hardly be seen due to the plenty of green. However when there are no leaves on trees, older streets of the town along which the buildings of unusual for the Russians, "Scandinavian" architecture were built, spreads before the eyes.

And above the town, above Lappajarvi bay, reddish rocks of Riekkalansaari Island (translated from Karelian – "Greek, orthodox island"), crowned by pines, mount up. There, under these rocks, consecrated by cross, in the XIV century approximately, the Novgorodians established Nikolsko-Serdobolskiy Pogost with the Church of Nicholas the Wonderworker, from where, in fact, derives its origin the town of Serdobol (Sortavala).

As back as in the XII century a young Novgorod boyar republic started to reclaim the northern lands settled by the tribe of korela. Then, Sweden also started to extend its influence eastwards. A hard struggle between Sweden and Novgorod resulted in concluding the Treaty of Oreshek (also known as the Treaty of Noteborg) in 1323. Then Nikolsko-Serdobolskiy Pogost, among other seven pogosts of Korela land, was passed to Novgorod.

In 1478 Novgorod republic ceased to exist and its lands were moved under the rule of Moscow. Ivan III divided former Novgorod lands into pyatinas and counties. The Karelian Isthmus and North Priladozhye became part of Vodskaya Pyatina. As of 1500 Nikolsko-Serdobolskiy Pogost in its territorial dimensions was one of the biggest pogosts of Korelskiy County. It occupied the territory from Kitee (in the west) to Salmi (in the east) and from Suojarvi (in the north) to Riekkalansaari Island (in the south). About 200 villages with 6768 people of population entered Nikolsko-Serdobolskiy Pogost then. The center of the pogost was on Riekkalansaari Island, in Rantue (translated from Karelian – "coastal") village, where the Church of Nicholas the Wonderworker – the protector of seamen, travelers and merchants – stood. People from all over the pogost came here for feast rites, wedding ceremonies, and burial services. After completion of the services, benches from the church were brought out to the church yard and peasants could talk, exchange some news, and solve household issues, trade. The Church of Nicholas the Wonderworker had a long life and was many times repaired and rebuilt. Now it works and belongs to Valaam Stavropegial Friary of the Transfiguration of the Saviour.

Fig. 1. The Church of Nicholas the Wonderworker in Rantue on Riekkalansaari island

Nikolsko-Serdobolskiy Pogost, as well as the whole Korelskiy County was an "apple of discord" between Russia and Sweden. In 1850 the Swedes gained possession of Korelskiy County and secured it to themselves by the Treaty of Plussa of 1583.

In 1590 Russia made an attempt to turn back the lost territories. The war with Sweden ended in 1597 by concluding the Treaty of Teusina according to which the land of korela was returned to Russia.

In 1611 the Swedes again raided into the lands of Korelskiy County, took possession of it and became its owners for almost one hundred years according to The Treaty of Stolbovo dated 1617.

During the wars the indigenous orthodox population many times left their home grounds and went into the interior of Russia – Olonetc, Tver. 189 Karelian families left Nikolsko-Serdobolskiy Pogost from 1627 till 1635 only.

In order to stop the out-migration from Korelskiy County, Swidish King, Gustav II Adolf, in 1628 issued a decree according to which the population of the captured lands, trying to get to Russia, were condemned to death. This oppressive law was in force during the whole period of the Swedes being in Karelian land, till the beginning of the XVII century.

In the letter dated June 17, 1632 King Gustav II Adolf expressed a thought about possible establishment of new trade cities on the captured territories – in Ingria and Karelia. Governor-General of the conquered lands, Johan Skutte took the king's hint as an order and charged legate Henrih Spor with its implementation. The latter soon claimed that the town of "Sordavala" was founded, though, in reality, it did not exist for ten years more because there was no one wishing to settle in it.

In 1642 the issues about the foundation of the town of Sortavala was some times considered by the Sate Council of Sweden headed at that moment by former Governor of Ingria and Kexholm County Peter Brahe. Already the next year a new Governor-General Erik Gullenstern started to hold negotiations directly with the population and the merchants about conditions of moving them into the new town the place for which was chosen opposite the orthodox church of Nicholas the Wonderworker, on the continent, in half-empty village Keliemalaniemi (Kellomaniemi).

The first twenty five Karelian orthodox merchants moved to the town of Sortavala in 1646. They agreed to become burghers (townsmen) only after the Sate Council of Sweden exempted them from taxes for starters and gave privileges for the right of trade and credit granting.

According to the most part of the present-day researchers, the name of Sortavala town can be connected to slash and burn. Karelian word "sorta" means wood cutting for main burn, and “sortavala” can be translated as “a territory handling for a main burn”. There are other variants of “sortavala” translation – “the power of the devil”, “oppressive place” and etc. When establishing the town, the Swedes used the old Karelian name of the territory that in Swedish manner sounded like “Sordavala”.

The first construction in the new town was being implemented under the direct supervision of Erik Gullenstern by wide two-row quarters according to cage scheme. Land surveying was implemented by Trayanus Berker.

By the middle of the XVII century the lands around Sortavala town were reformed into Sortavala County, the owner of which starting from 1651 became Gustav Baner, the son of the famous Swedish military leader, Johan Baner. The county was liquidated, however the emblem of the Baners family served as basis for printing the emblem of Sortavala town: two crossed lances with flags on a shield.

During Russian-Swedish war of 1656–1658 Sortavala town was occupied by the Russian troops. However, in 1661, due to unfavorable environment, the Russian government had to conclude the treaty of peace with Sweden, again recognizing the Swedish King’s right to former Korelskiy County. At the end of this war another hundreds of indigenous population left North Priladozhye, including Sortavala town. The Finns and the Karelians of Lutheran confession came to the wastelands from Finland.

In 1697 land-surveyor of Ingria. Erik Beling, made a new plan of Sortavala town. For that moment the square of the town was 8,5 ha and included 100 land plots, situated by two-row quarters along the long axis of the cape of Keliemalaniemi. This scheme of “old town” was kept almost unchanged during 280 years, till the 1920-s. In the eastern part of the town, at the cape of Kirkkoniemi (translated from Karelian, Finnish – “church cape”) there was a logged, cruciform Lutheran church, built in 1674. In 1803 it was demolished and now a covered market is on its place.

At the beginning of the Great Northern War, in January 1705, a big Russian detached unit under the command of P.A. Apraksin, made a march on Sortavala across the ice of Ladoga Lake from the side of Olonetc, took possession of the town and destroyed a Swedish military station situated there. Being in Sortavala for three days, the Russian unit came back to Russia. The Swedes again entered the town that turned to be burnt-out.

As back as at the beginning of the 1710-s, when Russian troops captured the towns of Vyborg and Korela (Kexholm), Sortavala, ruined by war and left by the population, was actually transferred to Russia, though it continued to officially be under the rule of the Swedes till the end of the Great Northern War.

In 1721, under the Treaty of Nystad, the former town of Sortavala, turning into an ordinary village, Serdobol, with the population of thirty people, together with the whole Kexholm County, was officially attached to Russia. Many people came back to Serdobol in 1727, and the population grew up to 150 people.

According to the most part of scientists, the name Serdobol appeared as a result of adopting the Karelian name of the territory “sortavala” to the Russian language. On the first stage of the transformation the name could sound like “Serdovol”. However this word is meaningless, and it was changed by Russian “Serdobol”, what then meant “a near relative” or “kinsfolk”.

In 1741 Sweden declared a war upon Russia, trying to return the lost territories. In 1742 Serdobol passed through an attack of Swedish-Finnish troops. This short war ended in 1743 by signing the Treaty of Abo (or the Treaty of Turku) according to which Sweden again recognized the defeat.

In 1744 Serdobol village, together with Serdobol Pogost, became part of Kexholm Province of Vyborg County that was just formed. Swedish laws, court and tax system, official Swedish language and church administration remained effect on the territory of the county.

From the end of 1760 till the beginning of the 1770-s, marble (in Joensuu and Ruskeala) and granite (the islands of Putsaari and Tulolansaari) was started to be quarried within the outskirts of Serdobol in order to decorate churches and palaces of Saint Petersburg and the tsar’s country seats. Sawing production was developing. Trade became prosperous again in Serdobol.

On July 26, 1783, Empress Catherine the Great issued a decree about returning the status of a town to the village of Serdobol. Already in 1784 the town of Serdobol became the center of a vast county, the territory of which occupied almost all North

Priladozhye (the present-day Pitkaranta, Sortavala District and part of Lahdenpohja District).

In the same year civil servants, among whom there were many of German descent, came to Serdobol. A small military post was placed on Skantcholm (Skantsinsaari) Island, fortified as back as under the Swedes, in the bay of Lappajarvi. Customs house was opened in the northern part of the town.

Orthodox Church dedicated to the Saint Apostles Peter and Paul was built in 1785 on Kirkkoniemi cape, opposite the old Lutheran church, at the direction of Serdobol city-provost Fedor Morskoy. In 1839 a bell weighing 336 kg cast in Moscow was installed on the bell-tower.

The emblem of Serdobol town was approved by Catherine the Great in 1788. Its description said: "In a blue field, on golden flagpoles, red flags lying crosswise".

In 1799 "The plan of the district town of Serdobol" was made, and it was almost completely similar to the Beling's plan of 1697. For more than a hundred years the dimensions and location of the town's quarter did not change. The biggest houses were located then along the main street Turunkatu (Komsomolskaya).

In 1801 west of the town, on Kisamaki Mountain (translated from Finnish – "the mountain of merrymaking", under the project of Juhani and Matti Salonen, a new Lutheran church, designed for two thousands people, was built. The old church on the cape of Kirkkoniemi was dismantled in 1803. The church on Kisamaki Mountain was overhauled in 1843–1844 (Erik Kuorikoski) and in 1892–1894 (Ivar Aminov). On February 2, 1940, when soviet planes were bombing the town it was burnt-out. A building of a boarding-school was built in the 1970-s at the place where the church used to be.

The last Russian-Swedish war of 1808–1809 did not touch Serdobol. The fights took place mainly on the territory of the present-day Finland. At the time Belozerskiy military unit stood in Serdobol; it participated in small battles near Ruskeala, Palkjarvi Lake and Joensuu town.

Under the Treaty of Fredrikshamn (or the Treaty of Hamina), concluded in 1809, the state border of Russia was marked where the present-day border between Sweden and Finland is. On the Christmas eve, on December 11, 1811, Emperor Alexander I presented the Finnish people manifesto, declaring the establishment of the Grand Duchy of Finland, the parts of which "Old" (Vyborg County) and "New" (freed from the Swedes) Finland became.

In 1812–1837 in the conditions of boom in trade the "Old town" was built actually anew. In 1835 land-surveyor Aron Johan Shreder made the plan of the town, but the Senate did not confirm it.

New plan of the town of Serdobol was made by architect K.L. Engel on February 24, 1837 and approved by the ruler on February 6, 1838. According to the Engel's plan, the construction was moved to a new area, and the "Old town" remained the same. Beautiful wooden houses in Empire style were built on new land plots, on the coast of Vakkolahti Bay, from 1838 till the 1860-s. Among them, the house of druggist Erik Relander remained the biggest private building of Serdobol for a hundred years. In February, 1940 this buildings was burnt-out, as well as many other building of this part of the town.

The Engel's plan gave a basis for future development of the general lay-out of the whole Sortavala town. Engel made a mistake – laid new quarters and streets above the existing "Old town" what supposed demolishing the buildings thst were still quite good.

In 1857 land-surveyor A.F. Lennstrom implemented exact measuring of the town's streets and yards. For that moment there were only 242 constructions in the town and 191 from them were on the territory of the "Old town".

A new plan of the town, elaborated by the county's architect Karl Albert Edelfeld, was approved by Alexander II in 1860. This plan mainly reminded the Engel's plan, however it preserved the directions of the streets network of the "Old town", as it was in the XVII century, turned the territory of Kisamaki Mountain into a park, widened the port and let to improve fire safety in the town.

Construction of the Saimaa channel and further getting by the town of Joensuu the right to hold foreign trade destroyed the trade route that ran through Sortavala during a thousand years. The development of the port was stopped. Till the end of the 1880-s only about twenty buildings were built in the town. The establishment of Sortavala Normal School in 1880 and further construction of academic and living buildings outside the town, on the south coast of Vakkolahti bay, in Kumela village, caused for a while some movement in the life of the small town. Part of these buildings still exists. Building of

Karelian railroad, connecting in 1893–1894 the towns of Vyborg, Sortavala and Joensuu, gave a new impulse to the development of the town, where new industrial enterprises started to appear.

A new Orthodox Church dedicated to the Saint Apostles Peter and Paul, under the project of architect Nikolay Grebenko, was built in the northern part of Sortavala in 1873. Two years after the old church on Kirkkoniemi cape was dismantled, and later a chapel was built on its place by the Valaam Monastery.

In 1893 the Senate approved a new plan of the town elaborated by a Vyborg architect Ivar Aminov. According to this plan, the town started to expand south-westwards, behind Vakkolahti bay, where a railway station and Taka – Kumala district, bordering upon it from the west, appeared. Under Aminov's plan it was also supposed to extent the port; however there was no chance to fulfill it as the territory separated for the port turned out to be shallow.

During the following decades the town was developing under the plan of I. Aminov, taking into account the previous plan of K. Edelfeld.

In 1903 in there was a big fire in the ramshackle "Old town" and tens of houses were destroyed. It served a start for demolishing old wooden constructions and construction the first stone high-rise buildings. Many masterpieces of the towns' architecture were created for a short period of time – from the end of the XIX century till 1915.

On December 31, 1917, the Soviet Government headed by V.I. Lenin signed a decree about giving Finland complete independence from the Soviet Russia. Serdobol town was renamed to Sortavala.

In the 1920-s 90 % of the wooden houses in the "Old town" were demolished, and stone quartets appeared on their places. Architects from Vyborg and Helsinki became the designers of many-storeyed houses. In the 1920–1930 new populated localities appeared outside the town: Puikkola, Nousiaisenmaki (in the north-east), Vakkosalmi (in the west), Genetc and Mansikkamaki (in the south-east), which later became the suburbs.

Peaceful life of Sortavala town was interrupted by the Soviet-Finnish (Winter) war, continuing from the end of November, 1939 till the beginning of March, 1940. During an air strike of the Soviets on February 2, 1940, one-third of the town was destroyed by air bombs and fires.

On March 13, 1940 the treaty of peace was signed; according to it the Soviet Union got the whole Karelian Isthmus, the town of Vyborg and Priladozhskaya Karelia, including also Sortavala town. The Finnish population was evacuated within three days, and the soviet migrants from Leningrad and other cities of the country started to move to the vacant territories.

At the beginning of the Great Patriotic War, on August 15, 1941, Sortavala was captured by the Finnish troops. The town's population and the remains of the military units standing on the defensive were evacuated to Valaam Island, under from there – closer to Leningrad. The 168-th rifle division under command of Colonel Andrey Leontievich Bondarev showed an exclusive courage and true grit defending the town. One of the streets of Sortavala was later named after this famous commander.

A flow of migrants from Finland rushed to Sortavala starting from the autumn of 1941. Dropping back, the Soviet troops left the town actually undamaged. Only Karelian bridge crossing Vakkolahti bay was exploded by bomb technicians as aback as in 1932, and some buildings were damaged by fire. The Finnish migrants for short time sorted out the mess in the town, restored the bridge, some damaged houses, repaired the defiled and robbed Church dedicated to the Saint Apostles Peter and Paul and dedicated it again in 1943.

In June, 1944 the Soviet troops started conducting an attack in Karelia, Finland rationally dropped out of the war and its population had to be evacuated for already the second time during the latest years. Starting from the end of September, 1944 Sortavala became the soviet town again. Migrants from Belarus, the Ukraine, and the Volga Region moved here already at the end of the same year. Economy was being restored. A furniture factory in Heljulja and a printing works, a fish processing factory, a brewery, a bread-baking complex and a milk processing factory in the town itself resumed their work. School and technical schools started to work. Agriculture, quarrying and processing of stone was developing.

The dynamic development of the town was interrupted at the beginning of the 1990-s, when industrial enterprises and sovkhozes, that were formerly prosperous, started to close down. The town's economy is still in a degraded condition, though during the recent years some small positive changes can be noted.

Fig. 2. Water-Tower on Kuhavuori Mountain

The first meeting with the architecture of Sortavala can be made on Kuhavuori Mountain. Starting from 1914 or 1916, there is a stone Water-tower, looking like a small ancient fortress, on its top. Under the tower, inside the amphibolite rock, there is concrete tank, of 450 cubic meters volume, where from 1913 till 1983 drinking water circulated, before 1947 – by free-flow, and after – forcibly coming through pipes from Helmijarvi ("pearl lake") mountain lake, located at 6 km distance from Sortavala. A deep vault with thick concrete walls starts behind a heavy cast-iron door. Sortavala boys often step down the worn-out stairway here hoping to find a secret underground way, by which, they say, it is possible to come out on Riekkalansaari Island, near the Church of Nicholas the Wonderworker. From the outside the tower is faced by blocks and plates of gray Serdobol granites, processed in "rock" and "large-spotted" finishes what gives the stone different color shades. The Water-tower on Kuhavuori Mountain is a kind of hymn-monument to Serdobol granite, a wonderful construction and decorative-facing stone, named after the town of Sortavala-Serdobol.

We would like to meet the town of Sortavala closer, to walk along the quite old street. We step down the mountain by a long concrete stairway carefully arranged by the Finns on the scarp slope in 1927. In front of us there is "Pevcheskoe Pole" ("Singing Filed") – a big forest meadow with unique acoustic properties, where four times – in 1896, 1906, 1926 and 1935 – huge All-Finland Holidays of Songs were held. The biggest one was the singing holiday of 1935 dedicated to the centenary of the first edition of Karelian-Finnish epos "Kalevala". Four and a half thousand people of chorists and musicians from 148 musical bands of Finland took part in it. There were more than 20 thousand of guests what exceeded the town's population for more than 3 times! Musical contents on "Pevcheskoe Pole" of Vakkosalmi park continued in the post-war period; an international holiday of songs under the name of "Worlds Meet" took place here in 1992, Karelian Festival – in 2012.

Let's walk along the alleys of the old park by the foundation of "Lotta" café built for the All-Finland Holiday of Songs of 1926 and burnt out by hooligans in the 1990-s, by the remains of the Dance floor building burnt out at the end of the 1990-s, by amusement rides and enter the town behind Vakkosalmi channel.

Sortavala town was for a long time wooden, what looked strange with the plenty of construction stone deposits, supplying marble and granites for Saint Petersburg, around it.

The first stone building of Sortavala – two-storey port cornhouse – was built in 1799 at the beginning of Turunkatu Street (now – Komsomolskaya). Obviously, granite blocks from the quarries of Tulolansaari served the material for it. Due to bad clayey soil this building stood for only 30 years and was dismantled.

In the 1820–1830-s the techniques of classicism started to interfere into the construction practice of Sortavala, but the town still was wooden. Truly speaking, houses of many rich townspeople looked like stone ones, as they were faced with big boards, imitating stone rustication, and the portals were decorated by columns with elements of order architecture. Natural stone – local granites, granite-gneisses and amphibolites – was used only for making foundations and bases of buildings.

The oldest construction in the town that came down to us is a house of merchant Konstantin Krasilnikov, built in Empire style in the 1838–1840-s (on the corner of Ratushnaya – Lenina and Kirkkokatu – Gorkogo Streets). In 1876 this house was bought by Elizabeth Hallonblad and rebuilt by architect Leander Bakman. After Elizabeth's death, under the will, the house was given to the town's library. In 1995 it was restored and arranged for the pensioners' rest. Then the children's rehabilitation center was placed in it.

In the second half of the XIX century constructions in eclecticism style, that embodied the main features of different architectural directions of the previous centuries, appeared in Serdobol-Sortavala. Until now two constructions of that time remained in the town – stone Church of Nicholas the Wonderworker and a Town Hall.

As back as in 1825 General-Governor Zakrevskiy visited Serdobol. He drew the attention of the spiritual authorities of Finland (Vyborg) County to the bad conditions of the old Church dedicated to the Saint Apostles Peter and Paul on Kirkkoniemi cape and advised building a new stone church. It was beyond the scope of poor orthodox Serdobol people's efforts to build a stone church. And an unexpected help suddenly appeared.

In the middle of the 1860-s a famous entrepreneur from Saint Petersburg, Councilor of Commerce, merchant belonging to the top guild, Grigoriy Petrovish Eliseev, when meeting with Metropolitan Isidor of Petersburg, Novgorod and Finland, mentioned that he could invest a big sum of money for charitable uses in favor of orthodox church. The Metropolitan had known about the needs of Serdobol Parish and advised Eliseev to help with the construction of a stone church in Serdobol. According to Grigoriy's and his brother Stpefan's wish, an architect, Councillor of State, afterwards an academician, Nikolay Pavlovich Grebenko (1820–1880), who was famous for the construction of Saint Petersburg churches, the reconstruction of the merchants Eliseevs' house on Nevskiy Prospect, as well as for other buildings, took up elaboration of the church project and supervision of the construction works.

In 1867 N.P. Grebenko came to Serdobol to examine the area allocated for the construction. First he chose an area next to "old" Peter-Paul Church (a stone church of St. Apostle Johnsonian the Theologian stands on this place since 1931), presented to the Parish by the townspeople Egor Shatalov and his wife Natalia in 1862. In 1869 the foundation was started to be laid there, but soon the works were stopped due to the bad condition of the clayey soil. After long searches, Nikolay Grebenko managed to find the area where strong hard-rocks were laying at a small depth. It was a complete quarter at the intersection of Johannesenkatu (now – 40 years to VLKSM (All-Union Leninist Young Communist League)), Kirkkokatu (Gorkogo) and Nikolaevsakaya (Karelskaya) Streets. The town's authorities agreed to allocate this area for a new church in exchange for the one the Parish had.

The initial project of the church worked out by N.P. Grebenko in 1867 was not approved and it had to be corrected in order to give the church more orthodox style. It was the time of searching for the "national style" in Russian architecture. The new project was approved by the Synod on November 6, 1869. Already the following year the place was dedicated and the construction of the church, lasted for three years, started.

The new stone church in Serdobol, by succession named Peter-Paul (dedicated to the Saint Apostles Peter and Paul) Church, was built in 1873 in "Russian style" with elements of Baroque and classicism.

Fig. 3. Church dedicated to the Saint Apostles Peter and Paul (1873, N. Grebenko)

Orthodox traditions are observed in its architectural concept: a high bell tower, in the foundation of which there is an entrance, backs onto the main volume of the church from the west. A big lantern dome drum is crowned by a ribbed cover with a central dome crowned by the orthodox Cross specific to pre-Mongolian period. Four domes installed between the cross branches are poorly marked and play a clearly decorative role, meeting the requirements of the official five-domed. The room of the church was designed for 270 people.

The church iconostasis (two-row – in the main side-chapel and one-row – in aisles) was also designed by Nikolay Grebenko. According to the architect's drawings carved and gold-plated iconostases were manufactured by the master of gold-plating K. Serebryakov, the supplier of His Imperial Highness's court of Grand Prince Konstantin Nikolaevich. The icons were painted by Pavel Savvich Shultcov (1820–1893), a painter, an academician, famous for his paintings of Uspenski Cathedral in Helsinki.

The church had three altars: the main one – in the name of the Saint Apostles Peter and Paul, the right one – in the name of the assumption of Anna, the left one – Blessed Sergius and Herman, the Wonderworkers of Valaam. The altar in the name of Anna was dedicated on October 15, 1872, the other two – later. On July 14, 1873 Metropolitan Isidor of Petersburg, Novgorod and Finland came to Serdobol for the dedication ceremony. The following day, on July, 15 at six o'clock in the morning he dedicated the altar in the name of Blessed Sergius and Herman, the Wonderworkers of Valaam, and at nine o'clock in the morning – the main altar in the name of the Saint Apostles Peter and Paul.

The Church dedicated to the Saint Apostles Peter and Paul was installed on a high base, made of big, preliminary worked blocks of light-gray gneissic Serdobol granite, mined in the quarries near Nukuttalahti village, on the north of Riekkalansaari Island, at only four kilometers distance from the town. Surface of stone is treated in "small-pointed" finish. Stairs from the three sides of the church are made of the same stone.

Territory around the church is fenced by a jour cast-iron grating fixed on a stone foundation. The grating base is made of pieces of different rocks united with cement, and its surface is covered by plates of gray Putilovskiy limestone from near Saint Petersburg.

The Church dedicated to the Saint Apostles Peter and Paul was earlier heated by five big tin furnaces. On the bell tower there were seven bells weighing: 1000 kg, 550 kg, 21 kg and four bell per 17 kg.

In 1925 the Church dedicated to the Saint Apostles Peter and Paul was transferred into the rank of cathedral. On that year Sortavala became the residence of the Head of Finnish Orthodox Church, Archbishop Avva German.

During the "Winter War" of 1939–1940 the church building was not damaged, the bells were evacuated to Finland, but the biggest one, weighing 1000 kg, disappeared from the storage in Juvaskula. In spring of 1940 the iconostasis was taken to pieces, the parqueted floor – taken off and the soviet authorities organized a stable in the defiled church. Before the march-back in August of 1941, the soviet soldiers mined the bell-tower.

The Church dedicated to the Saint Apostles Peter and Paul was restored by the Finns from the spring of 1942 till July, 1943. New concrete flooring appeared there. The builders used decorative chips from white Ruskeala marble, black Kaalamo gabbro and red Kirjavalahti granite as the filler, evenly scattered on the floor surface or forming regular-shaped patterns in forms of octactinal star and cross.

Fig. 4. Element of Flooring in the Church dedicated to the Saint Apostles Peter and Paul

On August 1 (14) the church was again dedicated by Archbishop Geramn.

After the Great Partiotic War the Church dedicated to the Saint Apostles Peter and Paul in Sortavala was renamed in the name of Nicholas the Wonderworker. It was never closed despite the propaganda of atheism that was spread all over the country. On the

Feast of the Holy Trinity of 1986 the bells in it sounded again. In 2006–2001 the Church of Nicholas the Wonderworker was restored and now it looks almost like it looked 140 years ago. In 2013, near the church, charity providers and Sortavala Parish installed a monument devoted to the departed Alexis II Patriarch of Moscow and All Russia, who visited Sortavala three times on his way to Valaam – in 1938, 1939 and 2001. It is notable that the pedestal and guarding of the monument are dark-red gneissic granite quarried on Suskuansaari Island.

Building of the Town Hall (from 1973 till 2013 central town's library was situated here) was built in 1885 under the project of Finnish architect Frans Anatolius Sestrem (1849–1885), also famous for constructions of Lutheran churches in Kurkijoiki and Kitee. Base of Sortavala Town Hall is made of Serdobol granites, quarried on Riekkalansaari Island. The blocks are carefully fitted together and treated in pean-hammered finish, underlining the natural gneissosity of the rock. Spacious basement of a book storeroom are behind the granite walls of the base.

Upper part of the construction is made of wood and is full of different architectural decorations. Wide and high main staircase from Serdobol granite leads to a smart portico supported by wooden octagon columns. The interior of a big double-height hall with a bay window, balconets and pilasters is impressive.

Fig. 5. The Town Hall (1885, F.A. Sestrem)

Separate magnificent building in classicism style with elements of Revival style and Empire appeared in Sortavala at the end of the XIX century. Their authors were guest architects: Ivar Aminov, Ezef Stenbek, Julius Bazilier, Verner Polon, Jacques Akhrenberg, Gustavson Shulman and others. Most of the wooden buildings of that time were constructed by Sortavala self-taught architects Johan Oskar (1848–1920) and Oskar Johan (1873–1942), the Leanders, the father and the son who used the constructions of other architects as patterns of style. The Leanders designed simple, modest houses, however, with an accurate, precise construction. If a customer could afford it, houses were decorated by a fine detail design of cornices, frontons, assembly roofies and interiors. These constrictions were decorated not only by bizarre carved window surrounds, consoles, cornices, steeples, various details depicting plants and animals, but also by stone bases, which were made of blocks of different rocks mined at the outskirts of Sortavala – gray gneissic Serdobol granites, dark-read and pinkish-gray granite-gneisses and gneisso-granites, black amphibolites and biotite- amphibolic shists. When being quarried these rocks were cut into blocks of platy and prismatic shapes, therefore they were handy for laying out foundations, bases and staircases of houses. Base stones were abated from the face surface in "rock" and "pitch" finish that preserved natural beauty of the rock.

Starting from the 1890-s the architecture of Sortavala was developing in Art Nouveau style, the beginning of which is characterized by arising Finnish national romanticism (neoromanticism) – an authentic architectural style reflected in construction of Finnish towns and summer houses at the turn of the XIX–XX centuries. Finnish national romanticism was close to European Art Nouveau, but slightly differed from the latter, as it was formed in the conditions of an intense revival of the Finnish national self-consciousness within the period of great geopolitical changes in Russia. The main features of neoromanticism were the following: stylistical unanimity of buildings and the environment, correspondence of outside look of buildings to their inside content, sophisticated silhouette, special select and combination of finish materials. The main point was the novelty with a romantic address of the Finns to the roots of their architecture, including the Middle Ages.

The notion of neoromanticism was introduced by E. Leino, defining new occurrences of the Finnish culture, but later it was changed by closer in meaning term "national romanticism", underlining strictly national peculiarity of this occurrence. The main form of expressing Finnish national romanticism was karelianism that absorbed many representatives of the

Finnish culture who were interested in ethnography and folklore of Karelia from the 1890-s. It was the time of the interest in the art of "Kalevala folk", when ethnographical expeditions in search of the roots of Karelain culture were held all over Karelia.

National romanticism proved itself in the works of artists (Gallen-Kallela and others), composers (Jean Sibelius), architects (Elial Saarinen, Lars Sonk and others). As V.S. Gorynov and M.P. Tubli wrote, *"the main achievement of the Finnish architects of that time relate to the sphere of construction of city houses and public buildings. Specific Finnish style, having quite stable characteristics, was created exactly here. One of the sources of this style was the architecture of the Middle Ages' fortresses and churches that still remain in Western Finland. They are the constructions made of rough-finished stones with the traces of very simplified Gothic… However the architects- neoromanticists were not satisfied with the examples of the Middle Ages' constructions on the Finnish territory. Looking for more distinctiveness of settings from granite – the material that had to express the national spirit of the Finnish architecture, the architects addressed to "baronial" style of Scotland and the creation of G.G. Richardson*"[1].

Creation of G.G. Richardson (1838–1886), the most significant figure of "Romanesque renaissance" in the architecture of the United States, spreading to Europe via England, was a quite important source of national direction for the Finnish architecture of the beginning of the XX century. The constructions of Richardson were featured by: emphatic monumentality, using rough-finished stone blocks for facing walls, using ornamental elements. Richardson was against any flimsiness, he built for a full due. This feature of Richardson's architecture conditioned its wide influence in the sphere of construction of banks, insurance corporations, courts, military ministries and other constructions that had to represent financial stability and firmness of the sate principles by their look. Richardson's important feature is "regionalism". He was the first to use finish and color of local natural stones, what let creating a harmonious unanimity of architecture and its environment.

At the turn of the XIX–XX centuries the tendency towards reappraisal of values based on drive for spiritual renewal, as a counter to the penetration of industrial technology and labor organization methods into the sphere of art, appeared in the society. "*You can not paint and sing so as it could make you good people. You have to be good people before painting and singing, and then colors and sound will complete all the best you have inside of you… Good architecture is directly connected to religion and can be a creation of only heavenly-minded and righteous, but not spoiled and godless nation"*, an English architect, J. Ruskin, the creation of whom, of course, also had influence on the development of the Finnish national romanticism, wrote[2].

Fig. 6. Railway Station Hotel (the 1890-s)

Architects-neoromanticists were united by their orientation to folk, folklore where they saw beauty and poetry. Intuitive way of knowing for neoromanticists was higher than logical one and according to them it allowed getting into the very essence of existence.

Finnish architects-neoromanticists (Eliel Saarinen, Lars Sonk, Armas Lindgren and others) tried to use elements of the Medieval architecture (towers, arches) and patterns expressing the might of the northern nature (using zoomorphic and floral ornaments, natural stone treated in "rough" finishes) in their creations. "*The best color is the color of natural stone", Finnish architects said*. "*Using national natural stone was an expression of the Finnish national character. Rock granite foundation of constructions was a symbol of the national true grit*"[3], Ritva Tuomi wrote.

[1] Горюнов В. С., Тубли М. П. Архитектура эпохи модерна. СПб, 1994.

[2] Рита Никула. Природный камень в окружающей застройке. Финляндия, 1995.

[3] Ibid.

The period of neoromanticism was short in the history of Finnish culture, it hardly lasted from the middle of the 1890-s till the middle of the 1900-s, but left in it its bright and unique imprint.

Stone construction started to develop in Sortavala after a horrible fire of 1903 that destroyed most part of the "Old town". Already in 1904 a stone building of "Karjalan Ruata" firm, belonging to the Kivinens brothers, appeared on Turunkatu Street. Architect Gerhard Sohlberg worked out the project. An exhibition hall of the people's artist of Russia Kronid Alexandrovich Gogolev has been working in this building since 1989. The artist's works made in wood-carving technique had a great success at exhibitions in Moscow, Saint Petersburg and other cities of Russia, in Finland, Germany, Sweden, Japan and other countries.

In 1905 in the center of Sortavala, on the corner of Kirjalankatu and Koulukatu (Karelskaya and Gagarina) Streets, under the project of young Finnish architects Eliel Gotlib Saarinen (1873–1950), German Gesallius (1874–1916) and Armas Lindgren (1874–1929), with the participation of architect Johan Oscar Leander, a building of the National Joint-Stock Bank (Leander's house) was built from brick and stone.

Features of neoromanticism are clearly seen in this building: active silhouette, plastic figure, using floral ornament for decoration. Risalits, decorative fastigiums, bay windows and other architectural elements add originality to the construction. A small volume of natural stone was used. Thus, not high base of the bank is made of big blocks of gray Serdobol granite, face side of which is treated in "pointed" finish, and due to that the stone seems lighter than in natural shear. The main entrance is decorated with the same granite ("rock" and "pointed" finishes) and dark-red gneissogranite from Kirjavalahti ("rock" finish).

A villa of Sortavala district doctor Gustav Johannes Vinter built in 1909 on Turaniemi peninsula (translated from Finnish – "fairytale cape") at 10 km distance from Sortavala, also became a creative achievement of Eliel Saarinen on Sortavala land. The features of this construction built in the style of Finnish national romanticism are: an asymmetrical, complicated silhouette with two terraces and columns, a spacious double-height hall in "cottage style" with a fireplace form red brick. High staircases, leading to the terrace from the side of the quay and the arboretum, are made of Serdobol granite plates. Base of the building, the columns supporting the balcony, sustaining walls and the staircases parapets are made of lake gibbers and chips of stone, bounded by strong cement. The quay with a beautiful view to the arms and islands of Ladoga Lake is faced with rough-finished blocks of amphibolites, granites and gneisses from the local quarries.

Architect Eliel Saarinen was born in 1873 in Rantasalmi town. He graduated from the Polytechnic Institute in Helsinki. He studied painting in the University School of Arts. In 1896–1904 he worked in "Gesellius-Lindgren-Saarinen" firm. The main constructions of that time are: Talberg's house, building of "Pohjola" Insurance Company, "Olofsborg" house, the National Museum in Helsinki, the pavilion of Finland at the Exposition Universelle in Paris, villas "Hvitträsk" and "Hvittorp" in Kirkkonummi. Eliel Saarinen designed also the railway station in Helsinki (1914), the Town Hall in Jeonsuu (1914), "Estobank" building in Revel (1912) and other. In 1923 the architect moved to the United States of America, where buildings in Chicago, Detroit, Cranbrook were built under his projects. Some his works were awarded prizes at international competitions.

Fig. 7. The Villa of Doctor G. J. Vinter (1909, Eliel Saarinen)

One more bright construction in the style Finnish national romanticism – merchant Siitonen's house, the author of which was a young architect from Vyborg Paavo Uottila, appeared in 1907 in Sortavala, opposite the National Joint-Stock Bank, on the other side of Karelskaya Street. The richest shops of Sortavala were on the first floor, spacious flats – on the second and the third floors. Due to the shortage of finances, only a half of the building was built. However, even in such unfinished condition the merchant Siitonen's house looks gorgeous. The most distinctive part of this construction was a corner tower ended by a helmet-shaped dome covered by dark-red copper. During the "Winter" war the building was hardly damaged by bombing. Under the restoration the rooms' interior was completely destroyed and plaster decoration of the building was changed very much. For the recent years the dome under the tower was restored, however, unfortunately, not from copper, but from galvanized iron. Natural stone was very slightly used for the decoration of the house of merchant Siitonen. Decorative chips from Ruskeala marble was used when moulding steps of "round" stairs.

In 1901 and 1911 in the western part of the town, on Kisamaki mountain (translated from Finnish - "the mountain of merrymaking"), in one line with the old wooden Lutheran church, a famous Finnish architect Jakob Ahrenberg (1847–1914) built two elegant high-rise buildings – the Lyceum and the Gymnasium. Thus, a united architectural ensemble, that adds a special picturesque to the towns, was formed. Both constructions are made in pseudo-Gothic style what was specially reflected in the whole decoration system.

Fig. 8. The Lyceum (1901, J. Ahrenberg)

Façade of the Lyceum has a symmetrical composition with a central risalit rising above the side part. Windows of the second floor are double, of ogival contour. Windows of the third floor have the same shape and differ only by bigger width. All decorative elements are made of red brick contrasting to the white color of the roughcast walls. Corbel courses and cordons nicely emphasize the floors. Graceful blind arcading under the cornice and bartizans with narrow loopholes built over the risalit. Natural stone was used in small amount for decoration of the building: base cincture, retaining wall and pedestals of the terrace fencing in front of the building side entrance are made of big blocks of gray Serdobol granites. Educational establishment of Sortavala college is situated now in the building of the former Lyceum.

Main façade of the Gymnasium (Female School) is asymmetrical. A four-storey unit with a high triangle fronton rises from the left wing. More extended right part of the building with an attached closed porch balances it. Blind arcading, cinctures, framing of ogive and lancet windows are also made of red brick. Filling of the four-storey unit with brickwork reminding modest decoration of the medieval West-European fortresses is very spectacular. Natural stone – Serdobol granite – was use wider than in the neighboring building of the Lyceum. A base, especially high one – in the left part of the building, an elegant decorative cincture, a high porch with a stair are made of gray granite. Sortavala district library is now situated in the building of the Gymnasium.

Fig. 9. The Gymnasium (1911, J. Arenberg)

Johan Jakob Ahrenberg was born in 1847 in Vyborg. He graduated from the Royal Swedish Academy of Arts in Stockholm. He completed his education travelling through Europe, Asia Minor and North Africa. This man of versatile talent left rich scientific heritage as an ethnographer. Ahrenberg was awarded a silver medal of Saint Petersburg Academy of Arts for his research work in the sphere of theory and history of architecture. Jakob Ahrenberg was also known as a belletrist-writer. Starting from 1885 he held the office of county architect. Classical Lyceum (1890), the Governor's House (1897), the House of Provincial Government (1895), Finnish Real Lyceum (1896), Female Lyceum (1906), General Post-Office (1914) and other buildings were built here under his projects.

In the 1920-s a high retaining wall of the terrace was made of blocks of Serdobol granites and biotite-amphibolic shists along Koulukatu Street (now – Gagarina), at which the main facades of the Lyceum and the Gymnasium look. It is notable that dark-gray biotite-amphibolic shists, mined very nearby, on the north slope of Kisamaki mountain, were ruined very much for the past decades, what can be explained by their inhomogeneous structure and the presence of carbonate and sulfide minerals that are weakly resistant to deflation. Serdobol granite, the second half of the retaining wall is made of, just the other way around, due to its mechanical properties looks very "fresh".

In 1913–1915 in the center of Sortavala, one after another, three beautiful buildings richly decorated with local natural stone - the United Northern Bank, AO "Zhelezo" Trade House and the Bank of Finland, the author of which was a famous architect from Vyborg, Uno Werner Ullberg, - appeared. First of all he was famous for his works in Vyborg. The period from 1910 till 1915 was especially fruitful for Ullberg: he fulfilled several projects in different cities of Finland at the same time.

Architect Uno Werner Ullberg was born in 1879 in Vyborg. In 1898 he graduated from Vyborg Swedish Lyceum and in 1903 – Finnish Polytechnic Institute (in Vyborg), getting the specialty of an architect. Ullberg made several educational tours of Western and North Europe and Russia in order to study architectural styles. In 1906 U.W. Ullberg and A. Gulden established "Gulden-Ullberg" architectural bureau in Vyborg and started to prepare projects of buildings for rich companies.

In 1908 under the project of U.W. Ullberg and A. Gulden the Headquarters of a big trading company "Hackman & Co", famous since 1816, was built on Severnyi Wall in Vyborg. This building is fulfilled in the style of Finnish national romanticism (neo-romanticism) and is richly decorated with two sorts of granite – dark-red porphyric and light-gray medium-granular. The building's portals and window surrounds are decorated with "cones on branches" and other floral ornaments, figures of animal heads skillfully carved from light-gray granite. Carved from gray granite, sailing-ship of the main portal keystone strikes by the art of execution. The building of "Hackman & Co" brought fame to the novice architect in Finland. Later U.W. Ullberg established his own architectural bureau and headed it till his whole life.

In 1911–1915 Ullberg built some more buildings in neoromanticism style in Vyborg: Finland Trade Bank, merchant Selgren's shop and an apartment house of AO "Karelia". Five-storey building of AO "Karelia", built in 1913, can be especially distinguished by its beauty. Façade of the building is faced with light granite from Kiviveistamo deposit (Finland), which forms a contrast to brick dark walls. It gives the construction monumentality effect. Piers between the first floor windows are decorated with granite bas-reliefs presenting the old emblems of Karelia and Vyborg and roasters of sailing-ships. The building housed shops, offices and living quarters.

The years of 1913–1915 were the most fruitful ones in the life of architect Uno Ullberg. It was exactly the time when three unique buildings in Art Nouveau style were built in Sortavala under his projects: the United Northern Bank, "Juhtion Rautta" Trade House and the Bank of Finland; they gave the town special color and attraction.

The building of Sortavala office of the United Northern Bank (the present-day Post Office, Karelskaya Street) was built in the summer of 1913 under the order of Sortavala offices of the United Bank of Finland and the Northern Joint-stock Bank that worked in Sortavala from 1877 and 1894 respectively. Construction headman from Sortavala, K.F. Puolamaki, supervised the construction works. In 1919 as a result of a merger of the two banks the United Northern Bank was established, and the new building housed an office of the bank - operating area, working and living quarters as well as a book store.

Architect U. W. Ullberg fulfilled the building in the style of Finnish national romanticism with all its particularities. From the side of the "main façade", looking at Karelskaya Street, the construction resembles a mediaeval castle. This impression is created by two tetrahedral bay windows in the shape of semi-towers ended by hipped roofs and placed at the wings of the "castle", and by using gray color granite in the facing of the basement level. Emphatic massiveness of the basement level implemented in stone harmonizes with emphatic verticality of the construction. High tiled roof, hipped roofs of the semi-towers with steeples and other architectural elements give high, romantic spirits to the construction.

Lower part of the "main" façade of the building is richly decorated with light-gray with bluish shade Serdobol granite quarried in the quarries near Nukuttalahti village on Riekkalansaari Island. Narrow basement corbel, slightly projecting above the wall, is made along the very basement of the building from granite blocks treated in small-pointed and pean-hammered finish. Above the corbel the basement level is faced with mosaic-like placed small squares of granite treated in small-pitch finish. Window boards of big arched windows, a small rectangular window and a very small dormer window are smoothly cut-out of the same granite.

The main entrance to the building located at its left wing resembles arch galleries of mediaeval town halls. Two big tetrahedral poles hacked out from Serdobol granite from Riekkalansaari Island are installed on the sides of the entrance to the arch. One of them plays a role of a column, the other one – a pilaster deeply built-in the wall. Surface of the poles is treated in rock-and-pean-hammered finish. The poles bases are also granite. There are no capitals; the arch rests directly upon the poles.

A cartouch – an original architectural element in form of semi-unrolled scroll with the bank's monogram and cornucopias filled with fruits – is fixed in the upper part of the column. All the elements of the cartouch are carved from greenish-gray very soft talc chlorite schist ("pot stone") mined in Nunnanlahti quarry on the south coast of Pielinen lake in South-Eastern Finland. This deposit started to be developed from 1893 when "Suomen Vuolukivi Oy" company was founded. Already by the end of the XIX century pot stone from Nunnanlahti was widely used in facing Saint Petersburg buildings that were built in the National Romantic style.

Above the granite facing, walls of the former bank's building are made of bricks and roughcast "granite like". Lime grout with fillers from ground white quartz and black Kaalamo gabbro was used for that.

Indoor premises of the former banks partly preserved the initial look. Emerald-green and white glased tile stoves amaze by their beauty. A special romantic spirit is created by: stucco floral ornament of the walls, plastic staircase the steps of which are moulded from the grout with white Ruskeala marble chips filler and the landings are faced with dark-blue and white shaped ceramic tiles, rhomb-shaped windows with colored glasses.

Twelve years after, in 1925, U.W. Ullberg, in broad, very simplified, lines repeated the silhouette of Sortavala office of the United Northern Bank in the same-name building in Kakisalmi (Priozersk). However there is no rich stone decoration and the attractiveness typical of neoromanticism style that became a thing of the past.

The building of "Yhtion Ruatta" company's trade house (now a commercial bank and "Ladoga" newspaper office are situated in it), under the project of U.W. Ullberg, was built in summer 1915 in Sortavala, on Karelskaya Street, at 200 m distance from the United Northern Bank. Headmen from Sortavala, K. F. Puolamaki and Juho Hartikainen supervised the construction works. Sortavala stock company on iron and construction materials trade, founded in 1897 in the town, acted as a customer. The building housed iron and construction materials shop, warehoused and twelve living quarters.

A number of researchers suppose that this building is completed in neoclassicism style. It is only partly true. Ullberg performed during the time when traditions of neoromanticism grew weak and the ones of neoclassicism grew strong in Art Nouveau architecture. The building which balances the divisive anti-eclectic directions of Art Nouveau – neoromanticism and neoclassicism – became the result of the creative process.

The "main" façade of the building looking at Karelskaya Street, has an asymmetric composition with the main entrance displaced to the left wing, what was specific for neoromanticism.

Two side bay windows on the second floor richly decorated with "like granite" stucco ornament are also indicative of the architect's devotion to the fading traditions of neoromanticism. However three windows between the bay windows are decorated with stucco frontons, the shapes of which were taken from classic architecture.

Features of neoclassicism are mostly shown up in the silhouettes of pilasters and semi-columns of the simplified shapes of the order architecture that decorate the basement level, in symmetric fenestration of the "main" façade, in wide stucco cornice crowning the building.

The building's basement level decorated with dark-red granites and gneissogranites, mined in the quarries on the northern coast of Kirjavalahti bay at 15 km distance from Sortavala, looks very beautiful. Rectangular massive pilasters and octahedral semi-columns cut from granite solid blocks are installed in the piers between arched windows and at the doorway edges. Simply-shaped bases and capitals, stairs of the low staircases and the basement corbel along the whole perimeter of the building are made of the same Kirjavalahti granite. All the architectural elements have "small-pitch" and "large-spotted" finish of the stone face. End pilaster decorating the main entrance to the building is treated in "rock" finish from the flat end what allows viewing the features of the stone structure.

It is worth noting the figured frontons of the doors decorated by stucco ornament "like granite" with the images of symbols (a hammer, an ax and other) reflecting the activities of the building's owners. The building walls above the basement level from the "main" façade side and full height, from the flat ends and the yard, are roughcast "like granite" of dark-pink color, but now they lost the initial attractiveness.

From the yard side the Trade house looks different. Risalits, bay windows, asymmetrically placed windows are the peculiarities of this part of the building. One of the entrances from the yards is emphasized by a wide staircase made of Kirjavalahti granite plates.

Entering inside the building, we can see well-preserved plastic staircases, the stairs of which are moulded from grout with the filler form stone chips and, of course, beautiful glased tile stoves.

One more gorgeous building, where Sortavala office of the State Central Bank of Finland was placed, was built in summer 1915 in Sortavala, on the edge of "Treugolnaya" square (Vainamoinen Street) under the project of Uno Werner Ullberg by headman K.F. Puolamaki. Now an office of the Central Bank of the Russian Federation is situated there.

Fig. 10. The Bank of Finland. (1915, U. Ullberg)

The bank of Finland is the most significant construction of Sortavala in neoclassicism style with some shade of neoromanticism. This building strikes by its power, monumentality, and rough beauty of stone in facing.

For better understanding of the architectural peculiarities of the Bank of Finland, we should address to the history. In the architecture of Finland at the end of the XIX – beginning of the XX century rationalistic trends, that gave life to neoclassicism style, were also developing along with the national-romantic direction. The architecture of classicism attracted architects first of all by the "the unanimity of plan and elevations". The styles changing process was slow.

Finnish neoclassicism that supplanted neoromanticism in the 1910-s, was formed under the influence of Swedish architecture and Saint Petersburg's neoclassicism of the beginning of the XX century. Many buildings of banks, trading companies, stock companies, richly decorated with natural stone were being built in Saint Petersburg at that time. Granites, gabbro, quartzites, malmrocks and other rocks were used in different color combinations, diverse sculptural and architectural forms. Different finishes were used in treating stone surface: ground, smooth, polished, pointed, pean-hammered, rock and other.

The bank of Finland in Sortavala has much in common with bank buildings of Saint Petersburg of the beginning of the XX century. All "main" façade of this monumental, like a rock, construction is faced with gray gneissic Serdobol granite brought from “Nukuttalahti” quarry on Riekkalansaari Island. When selecting the stone finishes, Uno Ullberg, like many other architects of the beginning of the XX century, adhered to a principle that facing stone should be getting lighter with the height of the construction walls. Along the lower part of the building a narrow basement corbel is made of granite plates treated in “small-pointed” finish. Above it, approximate for 2/3 of the first floor height, the wall is faced with rustications – big granite blocks treated in “rock” finish. This way of treating stone underlines the natural beauty of granite, gives it relief, picturesqueness, shows play of light and shadow, and due to that the lower part of the building’s wall looks similar to a natural rock. The rest part of the “main” façade wall is faced with squares of granite laid chequer-wise. Their surface is treated in “large-pointed” finish lightening the stone.

The bank of Finland is garnished with different decorative elements also made from Serdobol granite. Thus, vaults above the first floor windows and above the main entrance to the building are laid of radially placed voussoirs. Rectangular windows of the second floor are framed with architraves made of small squares and profiled plates. Keystones of the windows are decorated with wondrous floral ornaments. All these elements bring the spirit of romanticism to the composition of the building. Massive granite sills of the lower windows are impressive. They rest upon large figure brackets from the same granite.

The main entrance to the bank is specially emphasized. A high granite staircase, on the edges of which massive granite stands with the bank’s signs bas-reliefs are installed, goes to it. Carved flower beds are fixed on the stands. More delicate stone workmanship can be seen in the elegant crown of the keystone above the entrance to the building.

The interiors of the inside of a building are very interesting. Two-color operating area, the drawings of which were elaborated by architect K. Borg, impresses most of all: its floors are covered with color ceramic tiles, the walls are faced with redwood panels, the doors are garnished with fielded panels, bizarre ornament is on the ceiling. Color and white glased tile stoves, similar to the ones in the former operating area of the United Northern Bank, are preserved in some rooms. Staircase to the second floor from the side entrance is implemented in the same plastic traditions, and the staircase flights are faced with the same ceramic tiles that were used in the first Ullberg’s construction in Sortavala.

The building of the bank of Finland with good reason can be called “the museum of stone” where the natural beauty of Serdobol granite, the virtuosity of the stonecutters and high spirit of the Finnish architecture of the beginning of the XX century are combined.

Having built two banks and a trade house in Sortavala, U.W. Ullberg devoted all his energies to improvements of the capital of Vyborg County. About 30 different buildings were built in Vyborg under his projects in the 1918–1930-s: trade-houses and residences of F. Rikhard (1918) and V. Dippel (1921), a residential house (1923), sugar warehouse of “Hackman & Co” (1925), “Karjala” newspaper offices, buildings of a Lombard (1931), an art gallery and a school of painters (1931), Provincial Archives (1933), Hospital Maternity and Women’s Wards (1937) and others.

The constructions of U.W. Ullberg were highly praised at the Meeting of the Northern countries’ Architects that took place in Vyborg in 1926.

Two more stone buildings in neoclassicism style – a shop of Finnish agricultural goods (Lenina Street) and a residential house of “Kellomaniemi” Stock Company (the corner of Vainamoinen and Suvorova Streets) – were built under the project of Ullberg in 1926 and 1927 in Sortavala. Natural stone was slightly used in their decoration. Only not-high bases are made of smoothly polished blocks of Serdobol granite.

Fig. 11. Residential House of “Kellomaniemy” Stock Company (1927, U. Ullberg)

An elegant house of Vigelius, the director of one of Sortavala banks, under the project of Kaarlo Borg, was built on the same corner in 1926.

The first five-storey building in Sortavala appeared in 1930 on Turunkatu Street (Komsomolskaya) and was made under Ullberg's project. Sortavala office of the Savings Bank of Finland was on its first floor, and the other floors were occupied by living quarters. Serdobol granites here also decorates only the base.

Fig. 12. The House of Vigelius (1926, K. Borg)

A public garden under the project of U.W. Ullberg and park architect Beng M. Shalin was laid out in 1935 on "Treugolnaya" square between the Streets of Brahenkatu (Vainamoinen), Karjalankatu (Karelskaya) and Ratushnaya (Leinina), in front of the building of the Bank of Finland. A wall from big cut blocks of Serdobol granite, broken in two pints by small stairs of the same stone, was made along its perimeter.

Sculptor Alpo Sailo installed a bronze figure of a rune singer, sitting on bearskin and playing kantele, on a massive pedestal from Serdobol granite in the center of the park. Some time ago famous in Priladozhskaya Karelia rune singer and hunter Pertti Shemeikka became the prototype for this monument.

Fig. 13. "Rune Singer" Monument (1935, A. Sailo)

The first in the town building in functionalism style was built under the project of U.W. Ullberg in the same year of 1935, opposite the Parish building on Valaamskaya Street (Kirova); it was a bus station with a big billboard where all bus routes were specified. This building was the last Ullberg's construction in Sortavala.

Ullberg held the office of the town's architect in 1931–1936. During that time he worked on the restoration and reconstruction of the town administration buildings, a club-hotel and a theater, designed residential and public buildings, the town's central stadium, wooden constructions of the beach, an open summer theater, park kiosks and pavilions, houses for working villages in Vyborg.

Uno Werner Ullberg was one of the worthiest among architects and public figures of Vyborg and Vyborg County from the beginning of the XX century till the 1940-s. Ullberg died in 1944 in Helsinki and was buried there. Architect Alvar Aalto made a monument on his grave.

At the end of the 1920-s – the beginning of the 1930-s a new architectural style came to the towns of Finland to replace neoclassicism; it was functionalism that expressed drive for rationalistic vividness of forms ("the form should correspond to the function"), simplicity of architectural composition, refuse from using decorative elements, use of modern construction materials and technologies. Natural stone in decoration was used more and more seldom and carried more functional load. However, a number of constructions dated the end of the 1920-s in Sortavala still preserved the influence of neoclassicism and neoromanticism styles receding into the past. Thus, the building of the Folk school in Kumela, built under the project of architect Y.A. Vaskinen, in 1929, according to symmetrical composition of the façade, belongs to the constructions in neoclassicism style. The basement level of this massive construction is faced with big blocks of gray Serdobol granite from Riekkalansaari Island. The surface of stone is treated in "large-pointed" finish. Corbel course along the bottom of the first floor windows separates stone base from roughcast white part of the building. The main entrance to the school from the side of the quay is decorated by two columns completed of granite cylinders. Cubes of bases and octahedral boards of capitals are made of the same granite. Stonecutters manufactured the columns' cylinders the way that their long axis goes along gneissic banding of the rock, and they made thin hatching in the same direction thus underlining the natural pattern of the stone. From the side of the school yard, a high granite staircase leads to the entrance to the building, garnished by two pilasters from small granite cubes.

Proximity of the Valaam Monastery had a great influence on the spiritual life of Sortavala and the whole North Priladozhye. A small chapel (architect G.I. Karpov) from red brick, belonging to Valaam Stavropegial Friary of the Transfiguration of the Saviour, stood in Kirkkoniemi for some time on the place of the dismantled in 1877 old Church dedicated to the Saint Apostles Peter and Paul. In 1931 this chapel was re-built into a church under the project of Finnish architect Juhani Oskari Viiste, and in 1932 – dedicated by Archbishop Avva Greman in the name of Saint Apostle John the Theologian. This church combined the functions of "home", "archbishop" and educational church for training seminarians. The Church of Saint Apostle John the Theologian is made in non-traditional for Orthodoxy style – without strict west-east orientation, without domes and with an open chancel in form of an a jour metal grate manufactured at Sortavala dock, and from outside it resembled the previous church of Saint Apostles Peter and Paul. Nine bells, imitating the chimes of the Valaam Monastery were at the bell tower. Chancel tables were made from white marble, probably, the one from Ruskeala. Part of the church equipment for the Church of Saint Apostle John the Theologian was brought from the extinct "Soldier's Church" located on Skantsinsaari Island (the territory of the fish processing factory) in Lappajarvi bay. Lofts were made from the door side. The church was heated by the central heating system together with the building of Administration of the Finnish Orthodox Church.

In 1939 the director of the Church of Saint Apostle John the Theologian was Archbishop German himself, his deputy – the rector of Sortavala Seminary, Archpriest Nikilay Valmo.

During the period from March, 1941 till July, 1941, when Sortavala was a soviet town, the Church of Saint Apostle John the Theologian was hardly damaged, its property was ransacked. At that time a tinsmith's workshop was located there. The church, revived by the Finns, was again dedicated on March 6, 1943.

After the Great Patriotic War the Church of Saint Apostle John the Theologian was again ransacked. Then its reconstruction started – two volumes were built out, a window in the bell tower was made, new partitions and ceilings were made. Till the 1990-s a movie directorate was situated here.

At the beginning of the 1990-s the building of the Church of Saint Apostle John the Theologian was given to Sortavala Orthodox Parish, restoration works and then church services started there. It was the time when a big octahedral baptistery was made in the central volume of the church. First the baptistery was faced (the author and the performer – V.V. Drozdov) with small polished plates of white, gray, dark-green and almost black homogeneous and striped marble from Ruskeala, greenish-yellow serpentine and light-brown ("honey") onyx marble from the distant Pamir Mountains. V-shaped section plates for candle holders made of polished black Kaalamo gabbro lied on the cover of the baptistery. Rectangular section plates for candle holders, placed in the wall niches, under the icons, are made of the same stone. In 2010, during the yet another restoration of the church, this baptistery was dismantled, and the stone from it appeared to be in the Regional Museum of North Priladozhye.

Stairs of solea are moulded from grout filled by Ruskeala marble decorative chips. The chancel is light with stucco as if from travertine. The church's floors are also moulded from multicolored (light-yellow, dark-gray, dark-pink) grout with marble chips filler. Its surface is decorated by broken and crossing lines. The doors are three-leaved with small glassed-in cells.

Outside the church an open concrete colonnade leads towards the building of the former Administration of the Finnish Orthodox Church.

An amazingly beautiful building, where the Administration of the Finnish Orthodox Church and the Seminary were housed, was built under the project of architect Juhani Viiste in 1931–1932 next to the Church of Saint Apostle John the Theologian, on Valaamskaya Street. Starting from 1923 the Finnish Orthodox Church got autocephaly and became independent from the Russian Orthodox Church. First the Administration of the Finnish Orthodox Church was in Vyborg and later it moved to Sortavala.

The building of the Finnish Orthodox Church Administration is notable for the singularity of volumetric and spatial composition with the domination of the Byzantine architecture motives. It consists of several volumes – four-storey and two five-storey ones, joint by a massive arch, resting on high columns roughcast "granite like". One of the five-storey volumes is ended by a small belvedere, on the dome of which an orthodox cross was again installed at the end of the 1990-s. The basement level is separated from the rest part of the building by a cornice and treated "granite like" with the plaster in the composition of which small pieces of gabbro and quartz (so called "rock face") were used. Gray Serdobol granite from Riekkalansaari Island was used only in facing of the narrow base corbel along the perimeter of the construction and the setting of a wide and high staircase leading under the arch with a jour metal gates.

Fig. 14. Administration the Finnish Orthodox Church (1931, J. Viiste)

Old moulded staircases and staircase landings are preserved in the interiors of the Administration the Finnish Orthodox Church. The staircases' steps are made of strong red-claret-colored grout filled with Ruskeala marble chips. The staircase landings (also from the grout) are decorated with color ornament of simple geometric forms composed of pieces of marble, gabbro and granite.

As for the interior of the building of the Finnish Orthodox Church Administration, a spacious double-height assembly hall (now there is School of Art for Children in it) decorated by pilasters from polished dark-brown spotted Italian marble, light-gray Serdobol granite and dark-blue porphyrite strikes by its solemn beauty.

The Seminary was founded in Sortavala on August 1, 1918 under the initiative of Sortavala priest Sergiy Solntcev, who was its first rector, in order to prepare priests for the orthodox church of Finland. The Seminary did not have its own premises for a long time and in different years it was located in different buildings until it finally moved to a wooden house, next to which the building of the Finnish Orthodox Church Administration was built. Starting from 1931 Nikolay Valmo was the rector of the Seminary.

During the soviet times the building of the former Administration the Finnish Orthodox Church was called "the Ford's house" as there was a signature advertising cars of "Ford" company on its gable façade. The cars themselves were placed in a roomy basement of the building. Apartments, private shops and the School of Art are situated in the "the Ford's house" now.

In the middle of the 1930-s, under the conditions of economic crisis, nothing essential was built in Sortavala, except for the earlier mentioned bus station (U. Ullberg). This construction prepared the townspeople for perception of a new style – functionalism. A many-storeyed house, which differed markedly from the surrounding buildings by straight lines, the presence of balconies and the white color of plastered walls, was built for druggist Turkam under the project of architect Erkki Huttunen, opposite the shopping square, in 1937. The main staircase of the building is made of Serdobol granite. The main façade of the house was hardly damaged due to the soviet aviation's bombing on February 2, 1940, and then it was restored according to Huttunen's own drawings in 1943 acquiring the look it has now – without balconies.

One of the brightest constructions of Sortavala in functionalism style is Seurahuone Hotel (in the postwar time – Officers' Club, now – Youth Entertainment Centre). This building was built as back as in 1908 under the project of architect Onni Tarjane in the style of Finnish national romanticism. A famous artist and philosopher Nikolay Rerikh with his family had a rest here in December 1916. The hotel was completely rebuilt in the spirit of functionalism by architect Erkki Huttunen in 1939. A big concert hall, a restaurant appeared in it, the number of hotel room was increased. And with this, the construction lost its picturesque romantic silhouette. However, with absolute absence of decoration, the architectural composition of the building is expressive thanks to elaborate combination of geometric forms. A terrace is made along the whole length of the "south" façade looking at the coast of Vakkolahti bay. An elegant spiral stairs runs down from it. The building's walls are plastered and painted in white color. Serdobl granite from Riekkalansaari Island went for facing low base and setting of wide and high staircases from the "north" façade side.

Buildings of Vostochno-Karelskiy Cooperative with living quarters, shops and a restaurant in the style of functionalism were built under the project of KK architectural office in 1939, on the opposite, south coast of Vakkolahti bay, right opposite Seurahuone Hotel. It is notable that natural stone is widely used in the decoration of this architectural complex. The building of the restaurant is especially richly garnished with stone (now – the hotel and "Shans" shop). The basement level of the construction, resembling a silhouette of a ship, from the quay side, is completely faced by the blocks of light-gray porphyric Serdobol granites looking like typically Serdobol granites, but slightly differing from them by structure and texture. Probably, this stone was quarried on the territory of the present-day Finland. The blocks are with "pointed" finish. Floor of the open terrace resembling ship's deck, is laid by polished plates of light-gray striped and homogenous Ruskeala marble. Portal of the restaurant and architraves of the shops' show windows are decorated by mirror-bright "boards" of dark-gray, almost dark, gabbrodiorites mined in the quarries near Kaalamo railway station, at 30 km distance from the town.

In 1932 a stone bridge that got "Karelskiy" name was built via Vakkolahti bay splitting the town into two unequal parts. Its length was 220 meters. Project of the bridge was implemented by Stockholm engineering office "Christian and Nielsen". Pillars of Karelsky bridge are laid from big blocks of Serdobol granite that are capable of bearing heavy loads. In 2012 the old bridge was completely dismantled and rebuilt from modern reinforced-concrete materials. Only granite pillars remained untouched.

In the 1930-s the quays of Sortavala were wrapped into stone. The northern coast of Vakkolahti bay is faced with big blocks of dark-red plagiogranites, mined on the coast of Kirjavalahti bay, and stripped grayish-read migmatites that were developed in the northern part of the town. The southern coast of the Vakkolahti along the former brewing plant and land abutment of the bridge were laid with polyangular plates of black amphibolites and biotite-amphibolite shists quarried in the nearest cliffs. In both cases the stone is treated in "pitch" and "rock" face.

Stone for facing the quays was selected properly. On the southern coast of the Vakkolahti the coastline facing by dark amphibolites and amphibolite shists looks like a natural continuation of the cliffs. Using regular shape blocks of dark-red granites and granite gneisses in the facing of the northern coast quay of the Vakkolahti was, probably, determined by the architect's wish to create high romantic spirits, to emphasize the beauty of the "Old town" constructions. Unfortunately, during recent decades the facing of the northern quay have been seriously damaged. In 2012, when dismantling the old bridge, the builders completely destroyed the Finnish facing of the land abutments of the bridge from Serdobol granite and amphibolite shists and change it to a new one – from pink-gray rapakivi granite from "Vozrozhdenie" quarry in Leningrad region.

In the 1930-s pavements of some old streets were renovated. If earlier the streets and squares of the town had been laid with ordinary cobble-stone and covered up with sand, now they started to use regular rectangular shape blocks similar to big bricks - block stone. They were manufactured from crushed stone of granite and granite gneiss quarries located within the town and outside it. In the post-war years these pavements were dismantled and the street of Sortavala lost their attractiveness, they became ordinary, asphalt, like in many other cities. Elements of the pavements are preserved on small parts of the main street of the town – Karelskaya – in front of the entrance to the bridge from Kumela side. Similar pavement from red granite near former Seurahuone Hotel was dismantled during the construction of the new bridge in 2012.

In the 1930-s the town's sidewalks were framed by stone kerbsides laid from long board-like blocks of gray Serdobol and red Kirjavalahti granites, local dark-red granite-gneisses and black amphibolites, pinkish-gray rapakivi granites from near Vyborg. It is interesting to note using different granites and granite-gneisses for making water gutters and top rows of sewer manholes that still can be met in the old part of the town of Sortavala.

Natural stone in Finland in the middle of the XIX – the beginning of the XX centuries was used not only for construction and decorative purposes, but also for manufacturing grave-stones. Several old Finnish cemeteries, where you can still see wonderfully made in stone creations of Finnish masters – monuments, flowers, guards, have been preserved until now in North Priladozhye. Such Finnish cemetery has been partly preserved also in Sortavala. There are a few tens of monuments made for the period from 1860 till the 1940-s on it. Works from light-gray and gray gneissic Serdobol granites from Riekkalansaari Island, dark-gray gabbro and gabbro from near Kaalamo are prevailing among them.

Fig. 15. Monuments of "Finnish Cemetery"

Grave-stones from Sortavala granite-gneisses, red Kirjavalahti granites, red porphyric granites from Putsaari Island and white Ruskeala marble are very seldom here. Visitors of Sortavala necropolis can not only observe the diversity of stone rocks and finishes, but also touch the town's history, inscribed in the names that crossed the Great Divide. Every monument and memorial ensemble made of natural stone is real piece of art presenting the ability of a high order of the Finnish stone-cutters of the "culture of stone" epoch gone into the past. It is known that the last in the history of pre-war Sortavala workshop on making grave-stones was founded in 1910 and that A. Tuominen, a master with twenty-year experience, managed it.

The "Finnish Cemetery" necropolis in Sortavala is a "Museum of personalia and memorial stone" that needs to be preserved and restored. During the post-war years this cemetery was barbarically plundered and desecrated: graves were opened, broken and the monuments were taken away… The population of Sortavala and the town authorities are trying to save the necropolis and during several years they raise a question in front of the Karelian Ministry of Culture about assigning the territory of the "Old Finnish Cemetery" a status of historical and cultural monument.

Stone from Priladozhye left a deep mark in the history of Sortavala construction. As we could see, light-gray and gray plagiogranites and plagio-gneissogranites from Riekkalansaari Island, similar in their properties to the famous Serdobol granites widely used in Saint Petersburg and its outskirts from the end of the XVIII till the middle of the XIX century, were in the most demand in the town. In the second half of the XIX century many quarries where Serdobol granites had been quarried earlier – on Tulolansaari, Vannisensaari and Riekkalansaari islands – were abandoned despite the fact that a great amount of good stone still remained there.

When systematic construction started in Sortavala, from the end of the XIX century, some old quarries revived and new ones were opened. The main suppliers of block and memorial stone for town – Serdobol granites – were the quarries located on Riekkalansaari Island, near Nukkutalahti and Parola villages, at 4 and 8 km distance from Sortavala, respectively.

Dark-red and grayish-red granites, gneissogranites and granite gneisses (migmatites), forming considerable rock outcrops along the northern outskirt of the town, take the second place in the amount of use in the construction of Sortavala. These rocks were developed from the end of the XIX century till the end of the 1930-s for getting construction blocks, quarrystone, break stone and block stone. Blocks of nice color and texture were used for setting bases, staircases and facing the quay.

Kirjavalahti granites – decorative dark-red granites and gneissogranites, forming the deposit on the northern coast of Kirjavalahti bay, 18 kilometers from the town – left a significant mark in the history of Sortavala construction. Starting from the end of the XIX century till the 1930-s these rocks were used for decorative design of the town's buildings, producing parapets, block stone, facing the quay.

Dark-gray, almost black, amphibolites, amphibolic and biotite-amphibolic shists were also widely used in the construction of Sortavala, but mainly as break stone and quarrystone, less frequently – as block, flake stone. They were quarried in small quarries within the town: on the southern coast of

Vakkolahti bay, on the cliffs of Sieramaki, Kisamaki and other places. The biggest quarry, where black amphibolites and dark-gray granite-gneisses were intensively developed for break stone, quarrystone and blocks from the end of the XIX century and till the 1930-s, worked on Pieni Kuhavuori, in the south-western part of the town.

Dark-gray, almost black, gabbro-diorites and gabbro, quarried in the quarries near Kaalamo settlement and railway station, 30 kilometers from the town, were used in a small volume in the decoration of some Sortavala buildings in the 1930-s. The quarries of this place gave good block, facing and memorial stone, as well as quarrystone, break stone and decorative chips that found demand not only in Sortavala, but in other settlements of Priladozhskaya Karelia.

Ruskeala marbles in the construction and decoration of Sortavala were used mainly as decorative chips and very seldom – as plates for facing floors. Porphyric light-gray granites of North Finland, putilovskiy limestones, Vyborg rapakivi granites were used in even smaller amounts.

As exemplified by the town of Sortavala, we can clearly see the big importance that natural stone had in the construction and improvement of the Finnish towns in the past.

QUARRIES OF THE VALAAM MONASTERY

I.V. Borisov

In the northern part of the great Ladoga Lake, at 40 kilometers distance from the town of Sortavala, there is an archipelago of the Valaam islands, known to the whole Russia and far beyond it. One of the biggest and the most active monasteries in the country, where monks and pilgrims are praying for their nearest and dearest day and night, is located here for already many centuries.

The Holy Valaam Convent, founded by the first apostles of the Karelians, the Venerables Sergius and Herman, in the X century on at that time desert islands of the Karelian Sea (for some time it was the name for Ladoga), suffered much, as well as the whole long-suffering Russia. Being on the outskirts of the state, Valaam was many times ravaged by the Swedes, but every time, after they were expelled, it rose up from the ashes and nonentity. After the last Russian-Swedish war (1808–1809) the territory of Russia increased due to the lands of Finland and Finland – due to the lands of Russia. The Valaam Monastery, under the will of Emperor Alexander I, for many decades, till 1917, appeared to be on the territory of the autonomous Grand Duchy of Finland; and under these circumstances it started to promptly develop as a spiritual center of the North-West of Russia and Finland.

After 1819, following the Emperor, industrialists and merchants started to come to the monastery making big contributions to "the Honest and Great Lavra" on Ladoga. Valaam was getting richer, and in the middle of the XIX century, with hegumen father Damaskin (he headed the monastery in 1831–1881), started to grow with islands-lands, organize its own workshops, quarry stones and conduct fundamental construction works. It was the period of spiritual and economic prosperity of the Valaam convent.

In 1866 the Valaam monastery bought a big and high island on the north of Ladoga, in Finnish called Suskujansaari ("autumn island"), as a place consecrated by the Ionian deeds. However the authorities of Finland took legal action over cancellation of the contract based on the laws according to which monasteries were prohibited to buy land on the territory of the Grand Duchy of Finland. The court proceedings lasted till 1869, when Alexander I himself interfered. As he was the ruler of the Grand Duchy of Finland, he had the right to buy Finnish lands. Therefore the Emperor bought Suskujansaari Island for his name, and on August 28, 1878 passed it together with some other islands of Ladoga Lake to the Valaam Monastery for "possession in perpetuity".

At the end of the XIX century, on Suskujansaari Island, that was renamed Saint Herman's Island in the honor of Venerable Herman, the Wonderworker of Valaam, the monks founded Herman's Skete that was one of the most distant sketes of the Valaam Monastery. A beautiful church in the name of Saint Blessed Prince Alexander Nevsky was built here from stone and brick under the project of V.I. Barankeev in 1903. Next to it there were wooden constructions: tree-storey building with cells, a monastery canteen, storage and household constructions. The monks were occupied with agriculture, fishing, tended their fruit-and-berry garden. Also they quarried granite on the territory of the island. A good quay berth, where sailing ships and steamships from Valaam and Saint Petersburg came, was built on the Ladoga coast.

The church of Alexander Nevsky, preserved in ruins until now, was built from red Valaam brick. Its base and staircases were laid with blocks of red "Valaam" granite, quarried nearby, on Saint Herman's Island. The church's window sills were made from thick polished plates of greenish-gray striped marble from Uven Island, the steps of the bell tower staircase – from gray "monastery" granite from Putsaari Island (Saint Sergius's) that also belonged to the Valaam Monastery. The staircase steps and the porch are made of hewn plates of "Valaam" granite and Tiurula gneisses.

In the post-war time, the church of Alexander Nevsky, started to rapidly ruin. Barbarians took off the bells, cross from the dome, hardly damaged marble window sills. Bent cross on the bell tower, which nobody managed to tear off even with the help of machines, survived by a miracle. For some time the church housed a storage, a workshop. The church, representing an architectural monument, is now in critical condition – the chancel walls are completely ruined, the vault of the church central part, which is dangerous to come into, is also threatening to crash down. Only the built-to bell tower is holding up more or less.

Fig. 1. The Church of Alexander Nevsky on Suskujansaari Island

In the 1870–1910-s, on Saint Herman's Island (Suskujansaari), the Valaam Monastery quarried blocks of decorative dark-red massive and gneissic granites and gneissogranites, that under the name of "Valaam" granites were widely used in the architecture of the Valaam Monastery, Saint Petersburg and Moscow.

Suskujansaari Island is almost completely comprised of these beautiful and string granites. Weak cleavage of the solid mass allows getting considerably large blocks of up to 2–6 m^3 volume in the quarries.

The quarries of "Valaam" granites were located 300–500 meters from the church of Alexander Nevsky. They were called differently: "Valaam", "Tcerkovnogubskie". One of the quarries had the name of some monk Evgeniy, the other one – Victor.

The following buildings in Saint Petersburg are faced with "Valaam" granites: walls of Moscow Merchant Bank (1901–1902, L.N. Benois); base of the first Russian Insurance Company (1889–1901, L.N. Benois); walls of the Buddhistic Monastery (1909–1915, G.V. Baranovskiy); the Church of Our Lady of Lourdes (1908 –1909, L.N. Benois, M.M. Petryakovich); friso of M.F. Kshessinskaya residence (1904–1906, A.I. Hohen). The Czarist Quay Berth in Kronshtadt is decorated with this granite.

Whether for the superb color or because it was the favorite stone of Russian emperors, this stone was called so – "czarist".

"Stroitel" magazine wrote that in October, 1900 Construction Commission from Saint Petersburg visited Saint Herman's Island ("Susku Salmi") and viewed a huge granite sett intended for the monument to Emperor Alexander III "*at the quarries of sculptor K.O. Guidi*". "*This sett was 25 arsheens length, 13 arsheens width and 15 arsheens height…*", i.e. 17,5 × 9,1 × 10,5 m, and its volume was 1530 cubic meters. "*All works on preparing blast of the granite sett by electricity were charge to Saint Petersburg pyrotechnician-electrician Vrublevskiy. The blast was successful and separated a beautiful sett, very suitable for the monument pedestal, from the rock… When the sett is put down, it will be covered by a special construction known under the name of "enclosure". In this "enclosure" the sett will be treated to a proper look, as the pedestal for the monument will be 9 arsheens length, 5,5 arsheens width and 4,5 arsheens height*" (6,4 × 3,9 × 3,2 m), the volume – 76,4 cubic meters. So, after treating by stone-cutters, the granite sett volume had to be 20 times decreased[1].

In 1908 the pedestal of 6,3 × 3,85 × 3,15 m with the monument to Alexander III (the project of P. Turchinskiy) was installed on the square in front of Nikolaevsky (Moskovsky) railway station in Saint Petersburg. Now the monument to the emperor is in court of honour of the Marble Palace, and the granite sett for it was long ago cut into pieces for the monuments to F. Lassalle, Rimsky-Korsakov, N. Glinka

On Valaam Island different architectural elements are made from red granites and gneissogranites of Saint Herman's Island: two columns of the old covered porch, steps of the parvis and solea, window sills and floors of the Cathedral of the Transfiguration of the Saviour (1887–1896, A. Silin, G.I. Karpov, N.D. Prokofiev); uprights, lower part of the iconcase and part of the floor in the Chapel of Joy of All Who Sorrow (1896), staircase and porch of the Chapel of the God's Cross Sufferings (the 1880-s, K. Bradt); window sills of the Church of the Resurrection (1901–1906, V. I. Barankeev); pedestals and crosses on the Hegumen's Cemetery and so on.

[1] Журнал "Строитель", СПб, 1900 .

After the revolution of 1917 and the following separation of Finland from Russia, quarries of "Valaam" granites on Suskujansaari Island were in actual fact closed. This stone was barely used in Finland, except for the manufacture of monuments and other small articles.

Starting from 1972 "Suskujansaari" granite deologist, studied by geologist as back as in the 1950-s, started to be developed for blocks again by Ladozhskoe quarry administration of PO "Karelstroimaterialy". When quarrying stone, they used so called "low impact blasts", that caused the deterioration of the significant part of the deposit – technogenic cracks decreasing the output of large-size blocks appeared in the granite massif.

Till the end of the 1990-s "Suskujansaari" deposit was developed by different organizations. There were periods of revival and decline of the production. Granite dressing shops, where monuments and other architectural forms were manufactured, worked on the territory of the enterprise during different periods of time.

In the 1970–1990-s granite from "Suskujansaari" deposit was widely used in construction and decoration of different building in Russia. Monument-ensemble "Malaya Zemlya" ("Small Land") is made from it in Novorossiysk, monument-ensemble "40-th Anniversary of the Victory" – in Kursk, decoration of Drama Theatre and "Battle of Kulikovo" monument on Krasny Hill – in Chelyabinsk, memorial in "Peski" and city quay on Onego Lake – in Petrozavodsk, monument to the Victory – in Kondopoga, railway station is decorated by it in Tynda.

Facades of the buildings of the CPSU (the Communist Party of the Soviet Union) regional committees in such cities as Saransk, Bryansk, Kuibyshev, Kazan, Bratsk, Omsk, Novosibirsk and others are also faced with granite from Suskujansaari Island.

Besides, granite from Suskujansaari Island was used abroad: in Mongolia – the airport building in Ulaanbaatar, in Czechoslovakia – "Moskovskay" metro station in Prague and so on.

From the beginning of the 2000-s until now "Suskujansaari" deposit has been developing by ZAO "MKK-Ladoga" (director – N.I. Martynova). The main task of the company for the next years is conducting capital mining works on tidying up and cleaning the quarry territory and its top levels; after that it is supposed to start plan excavation of granite blocks that the market is expecting. Now the blocks ate quarried along with the capital mining works. Granite is sent to Dagestan, Leningrad and Moscow region, Togliatti, Obninsk, Saint Petersburg. The quarry is developed with the help of modern machines that excludes big blasting works. Granite blocks treating shops work near the quarry: facing plates, grave stone articles and block stones are made of them here. Part of the blocks in "raw" condition is sent to customers in different parts of Russia and abroad. Granite from Suskujansaari Island is still highly valued for its decorative and physical and mechanical properties, though the dimensions of the quarried blocks are still small.

Suskujansaari Island granites are here and there penetrated by dikes of dark-gray, almost black, massive amphibolites that were also developed by the Valaam Monastery in the 1870–1900-s for construction purposes. Plates for laying foundation and pavements (flake stone) were made, elegant icon-cases (the Chapels of Joy of All Who Sorrow and of the God's Cross Sufferings) and window sills (the Church of the Resurrection) were cut, as well as artware – ink-pots, candle holders, crosses that palmers bought with great wish – were manufactured from Suskujansaari Island amphibolites.

Eastwards of Suskujansaari Island there is a small island Tilkusaari, where the Valaam Monastery also developed black amphibolites used in the architecture of Valaam, for example, in the manufacture of decorative uprights of the Cathedral of the Transfiguration of the Saviour.

Fig. 2. Old Quarry on Suskujansaari Island

Historical quarries of "Valaam" granites founded as back as in the 1870-s, are preserved in the eastern part of Suskujansaari Island, approximately 500 m southwards from the church in the name of Saint Blessed Prince Alexander Nevsky, 200–300 m from the coast of Ladoga Lake and in other places. The old quarries, one after another, stretch along the western slope of rock upland of submeridional strike for about 300 m. Workings look like semi-cuttings of 20–40 m long, 6–15 m width and 1–4 m depth and are considerably filled with crushed stone.

A road, by which tourists can go, runs from the church to the old quarries.

Active "Suskujansaari" quarry occupies the central, high part of the island and reaches considerable dimensions: about 500 m length, up to 250 m width and 5–15 m depth, in 2–3 levels of working.

Fig. 3. The Present-day "Suskujansaari" Granite Quarry

ZAO "MKK-Ladoga" made two sightseeing platforms for tourists within the borders of the quarry.

The territory, where an architectural monument – the church in the name of Saint Blessed Prince Alexander Nevsky, historical quarries of the end of the XIX century and active "Suskujansaari" quarry are situated, can be used for organizing bus-foot tourist excursions for 1–2 hours. The Regional Museum of North Priladozhye systematically organizes excursions for students and tourists of Saint Petersburg to "Suskujansaari" quarry starting from 2004.

On Putsaari Island (St. Sergius's), situated northwestwards of Valaam, next to "Lahdenpohja coast", the Valaam Monastery quarried big blocks of gray, light-gray, ash-gray, grayish-pink, pink and pinkish-red porphyric granites in the second half of the XIX century.

The quarries were located in several places. Blocks of pink and gray porphyric granites of general volume of 1,3 cubic meters were quarried in "Monastyrsky" quarry, near Lourinlampi lake. Blocks of similar granites of the volume up to 2–4 m^3 were mines in several quarries situated on the south-eastern coast of the island. Quarries were also situated near the Memorial Cross and on the western coast of the island, in Haukanlaouhi and Mattinela.

Fig. 4. Granite Sett – "the Stone of Love" on Suskujansaari Island

Gray sorts of granites were called "monastyrskie" (monastery). Different constructions are made from them on Valaam Island: base of the outside monastery square; columns in front of the entrance to "Czarist Cells" (the 1890-s); a base and floors of the Cathedral of the Transfiguration of the Saviour (1887–1896); a base and fence posts of the Chapel of the Sign of the God' Mother (1862, A.M. Gornostaev); a base of the Water-supply (1860–1864) and Working-and-stable (1878–1881) houses; a base, a staircase and fence posts of the Church of Nicholas the Wonderworker (1853, A.M. Gornostaev); columns and a staircase in front of the entrance to the Church of All Heavenly Bodiless Powers (1849, A.M. Gornostaev) and part of the fence base of the Skete of All Saints; a base, staircases, columns with arches of the Church of the Saint Resurrection of Christ, as well as steps and fence posts of the “Main” staircase, the terrace’s retaining wall, bases of residential and household facilities of the Resurrection Skete (1901–1906, V.I. Barankeev); columns in front of the entrance to the Church of the Venerable Fathers, Lit Up With the Fast and Prayers (1876, G.I. Karpov); the terrace’s fence posts, cross pedestals of the Hegumen’s Cemetery; fence posts of the Main staircase (1877), “Monastyrskaya” terrace and “Treharochny” (three-arch) bridge; Memorial Crosses and in the Skete of All Saints (1854), in the Skete of St. Nicolas the Wonder-Worker (1863), at the foot of Eleon mountain, in the Precursor Skete and so on.

Gray granites of Putsaari Island found their use also in Saint Petersburg. Base of the Cathedral of the Resurrection of Christ (A. Parland, I. Makarov) was faced by them in 1883–1907.

Porphyric pink granites, also quarried on Putsaari Island, were used in the construction of the pedestal of the monument to Catherine the Great (1869–1873, M. Mikeshin, D. Grimm, V. Shreter, G. Balushkin, N. Osetrov).

Local granites were in small use on Saint Sergius’s Island itself. For example, the big Memorail Cross (1879), a base and a staircase of the Church in the name of the Venerables Sergius and Herman, the Wonderworkers of Valaam (1899) are made of them. Granite was also used for facing wells and channels, connecting the inside lakes with Ladoga.

Fig. 5. The Church the Venerable Sergius on Putsaari Island

In the eastern part of Putsaari Island, from the end of the XIX century, so called the Skete of Sergius that was bigger than the earlier mentioned skete on Saint Herman’s Island, was located. The monks and their assistants trenched channels, installed granite memorial crosses on Saint Sergius’s Island.

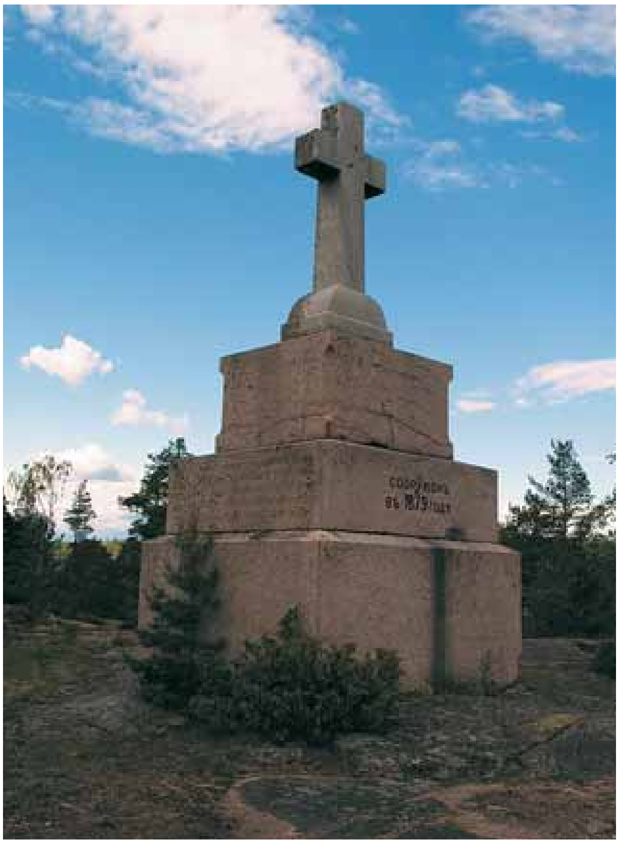

Fig. 6. The Memorial Cross on Putsaari Island

The church is built from red brick and granite. Wonderful gardens appeared on lifeless rocks of the island. Boats and ships came to the stone berths every day during navigation period. Work was humming in the quarries…

In post-war period the Skete of St. Sergius was devastated. The quarries were also uncared. However, due to its location and natural landscapes, Putsaari Island always attracted “wild” tourists who broke the silence of this hidden place on Ladoga.

In the 1990-s the Valaam Monastery, being in the process of revival, started to restore the Skete of St. Sergius on Putsaari Island. Monks and novitiates came here. They settled in one of the preserved constructions. The church was restored and now church services some times take place there. Not far from the Memorial Cross the old berth, from which vessels with big granite blocks put away, was restored. Life came back to Putsaari Island some time ago called “Small Valaam”.

There is no such technogenic landscape formed during granite quarrying as on Suskujansaari Island. The old quarries, that still could give a big amount of granite for construction and decoration of buildings, are keeping silence. However, is it necessary to disturb the ancient rocks? I think, no. Let them keep the warmth of the old stone-cutters' hands and tell us about glorious past of this area.

Developments of construction stone for the needs of the Monastery in the XIX century also took place on the islands of Valaam archipelago, comprised of dark-gray, almost black, sometimes with gingery shade, massive gabbro-dolerites.

The biggest quarries were on Valaam islands in the following locations: on Cape Simnyakovsky; on the south-eastern coast of the island; opposite the apartment house of the dairy farm, across the strait; on the way to the Skete of St. Nicolas the Wonder-Worker; in the northern end of the peninsular between Moskovsky and Vneutrenniy straits; by the bay of Skitskiy.

Valaam gabbro-dolerites were in wide use on Valaam, where foundations and bases of many constructions are made of them: inside (1785–1801) and outside (1801–1838) squares of the Monastery; Water-supply (1860–1864) and Working-and-stable (1878–1881) houses; Winter Hotel (1854, A.M. Gornostaev); the apartment house of the dairy farm; cell building of the Skete of St. Nicolas the Wonder-Worker (1858, A.M. Gornostaev); the Church of All Heavenly Bodiless Powers and cell building of the Skete of All Saints (1842–1849); the Church of the Venerable Fathers, Lit Up With the Fast and Prayers and the bell tower on the Hegumen's Cemetery (1876, G.I. Karpov); as well as steps of the Main staircase (1877); fence posts and pillars of Vladimirsky (1861) and "Treharochny" (three-arch) bridges; retaining wall and memorial articles on the Hegumen's Cemetery.

In rare cases masters cut elegant icon-cases, like, for example, in the Chapel of the Sign of the God' Mother (1862), from Valaam gabbrodiabases.

Old quarries of gabbrodiabases on Valaam are extant. One of them are hiding from the travelers' eyes in the very heart of the thick forest, the others can be clearly seen on the cliffed coast. However non of them will ever give stone despite the great reserves of it, as far as Valaam Island is a natural and cultural monument of universal importance.

In the second half of the XIX century, in south-western part of Valaam Island, the Monastery mined rotted rock from coarsely graded semi-stable gabbro-dolerites and scattered roads and fertilized soils on the island with it.

It was already earlier mentioned that the Valaam Monastery also used for its need one more stone – Uven marble, that was brought from Uven Island at the end of the XVIII century and since the 1830-s, after the quarry was closed. This marble was widely used on Valaam in the architecture of the Monastery complex buildings and for producing construction lime.

According to researcher A.F. Zakharov[2], mainly people from the nearest parishes – the Karelians and the Finns, who were famous as the best stone-cutters at that time – worked in the Monastery's quarries in the XIX century.

Masters from Vologda, Yaroslavl and Novgorod counties also participated in this work. They worked in gangs with permanent staff where close relatives, who handed down their secrets of stone treatment from generation to generation, worked together often. Masters fulfilled only "clean" works on cutting and polishing stone. The monks, attached to the stone-cutters as novitiates, helped them to fulfill subsidiary and dirty works.

Stone quarrying and treating works were well organized in the Monastery. Special shops worked in this diversified economy: stone-cutting, stone-pecking, stone-polishing and for making monuments.

The most active stone quarrying was in the years of the construction of the Cathedral of the Transfiguration of the Saviour (1887–1896). The gangs of David Vasiliev from Bolshaya Tulola village of Serdobol parish, Semen Pikine from Jarve village of Janivara parish, Nikita Artemiev from Rekolosaari village of Serdobol parish bored and quarried granite in 1889–1893 on the islands of St. Sergius and St. Herman.

The window sill boards and staircase steps for the Cathedral of the Transfiguration of the Saviour were cut by the gangs of Andrey Grigoriev and Jakov Safronov from Otchozhi village of Serdobol parish

[2] Захаров А. Ф. К вопросу об использовании природного камня габбро-диабаза острова Валаам бывшим Спасо-Преображенским мужским монастырем. Реферат. Архив Валаамского музея-заповедника. 1987, 1988.

and Mikhail Kononov from Drugaya Reka village of Petrozavodsk county.

Polishing of the window sill boards and steps of the parvis from red “Valaam” granite and figure architectural elements from black amphibolite was made by the gangs of Jakov Ranin from Migli village of Jakimvara parish, Peter Nikitin from Otchozhi village of Serdobol parish and Vasily Moshkin from Pocheskoy village of Petrozavodsk County.

The gang of Ivan Reinikaine from Ruskeala village of Serdobol parish manufactured the columns from red “Valaam” granite in from of the entrance to the cathedral.

The old quarries of the Valaam Monastery is one more interesting page in the history of mining industry of the North-West of Russia, a special page of the Valaam Monastery’s history that still inspires researches and attracts tireless travelers.

THE TREASURES OF KITELYA

I.V. Borisov

It is hot and moist.
Behold, it is red, like blood, like the evening glow,
like the blown flower of the pomegranate,
like thick wine from the vineyards of En-gedi,
like thy lips, my Sulamith,
in the morning after a night of love.
This is the stone of love, wrath, and blood.

(A.I. Kuprin)

Many lovers and experts of precious and semiprecious stones dream to visit the area of former Kitelya village situated on the northern coast of Ladoga Lake in Karelia, where deep red with violet hue almandine-garnets have been mined for over 500 years. But not everyone can get here and find worthy gems in ancient rocks. Despite the fact that the mine Kitelya is the largest one of almandine-garnet in Russia, local gems rarely please jewelers. Kitelya garnets are often opaque, fractured, contain inclusions of mica and currently considered to be technical, collectible and inexpensive semi-precious stone. Good jewelry crystals are rare, and therefore highly valued.

Karelians have been the first inhabitants of Kitelya since 1500, they came here from the coast of Lake Ladoga for farming. There was a good land, rich natural hayfields and forests. While plowing fields, peasants of Kitelya often found rounded, dark red stones in the land, which they called “Kitilya kivi”. Thus, the name of the village Kitilya appeared which means “the place where there are crystals”. Later an official while rewriting the name of the village changed one letter in it – and it became Kitelya. Local farmers did not know the real value of the stones and at first collected them to please themselves, or gave to children to play. But when Novgorod and Moscow merchants saw the gems, they identified them as anthrax (from the Greek “Ἄνθραξ” – coal) or “chervtsy” – the name of garnet which was the lord of all the stones in Rus.

In the Middle Ages, red garnets as well as other fiery red stones – rubies, topazes, spinels – were brought to Russia and Europe from the countries of Asia and Africa through Alabanda city in Asia Minor – the oldest gems milling center. One of such red stones milled in Alabanda was “alabandsky stone”, or almandine.

Fiery red garnet (pyrope, almandine) has been venerated since VI B.C. Roman writer and scholar Pliny the Elder (23–79 years A.D.) said the following words about pyropes: “Anthrax takes the first place among the crimson-red stones takes carbuncle, because it resembles fire”. In Latin these red gems were called “granatus” (“like a grain”) for their similarity with grains of pomegranate fruit. In Russia, cherry, raspberry and red garnets with purple (violet) hue were called “anfrax” or “venisa”, now they are called almandines.

Red garnet was worn in pectorals by Hebrew priests, since that time garnet is one of the twelve sacred stones of the Christian Church.

Garnets were believed to have medical properties. It was considered that this gem healed the heart, brain and memory, cheers the soul, stops bleeding, and smoothed the stomach. According to a legend, a garnet in a ring guaranteed its owner good disposition of his friends, averted the danger, protected from adultery, cast away dark thoughts. It was a stone of love: a gift of the ring with a garnet symbolized the assurance of friendship, love and gratitude.

There were no garnets in Russia for a long time. People even believed that red, fiery stones could not appear in a cold Russian land. But this belief changed dramatically when at the beginning of the XVI century garnets were found in Kitelya.

In the first half of the XVI century residents of Kitelya sold the gems to merchants from Moscow, Tikhvin, Olonets, Tver. Several years ago in Tver in the cultural layer of XV–XVI centuries archaeologists discovered garnets and after the analysis those gems turned out to be identical to the garnets from Kitelya field. The gems could come here as a result of trade or during the exodus of Ladoga Karelians to the province of Tver in the 1580s, and then in the

XVII century, when the Swedes hosted the land of Karelians, spreading Lutheranism and intolerable economic oppression.

The Swedes heard a lot about Kitelya gems and in their daring plans dreamt to possess them. After the seizure of Korela (modern Priosersk) and the whole Korela county, in November 1580 the Swedish military commander Lauri Thorstein brought to King Juhan III to Stockholm several shale samples with crystals of "rubies found in the vicinity of Kitely. The Swedes really took ordinary red garnets for more valuable rubies.

Fig. 1. Almandine-garnets from Kitelya

October 23, 1583, after the conclusion of an armistice with Russia, by the order of Yuhan III a military unit went from Kexholm to Kitelya (former Korela) to mine precious stones for the Swedish treasury. Not far from the village, in the rock, where the field of gems was, the Swedes organized their mining. For that purpose they dug deep ditches on the surface and at the bottom of the rock, the traces of the ditches can be seen even nowadays. After a while first two barrels full of "Karelian rubies" were sent to Stockholm. Nowadays in the National Museum in Stockholm, there are several such garnet gems mined in Kitelya at the end of the XVI century.

In Karelian folklore, there is one little-known legend about how the Karelians cheated Swedes. "The Karelians were the first who mined garnets in Kitelya. When the Swedes came here, the Karelians sold them part of the found gems at very high price as precious rubies. Swedes took Kitelya gems in two or three barrels to Stockholm. When the king learned about the deceit, he sent a troop to Kitelya to punish the Karelians, but when the troop came to the village it was empty".

At the end of the XVI century Russia proceeded military actions against Sweden, and the actions were successful. According to the treaty of Tyavzino of 1595 Russia regained the land in Lake Ladoga seized by the Swedes. The Karelians returned to Kitelya for a while. In 1610 Swedish troops under command of Jacob Delagardie invaded the Karelian lands again. Under the treaty of Stolbovo signed on February 23, 1617 Russia was cut off from the Baltic Sea, and lost the Karelian and Ingrian lands. The Karelians who did not want to remain under the Swedish yoke went into the depths of Russia again. By the middle of the XVII century over 30 thousand of Karelians left the Karelian county. Their new homelands were Olonets, Tikhvin, Valdai, Bezhetsk, Tver. Many residents of Kitelya also left the village taking a handful of dark red gems, similar to the blood droplets, as a keepsake or for sale.

The Swedes came back to Kitelya again and continued mining garnets. Perhaps by that time, they already knew the true nature and the price of these stones. Some more barrels of gems were sent to Stockholm. Probably by the middle of XVII century Kitelya Mine was a series of horizontal and vertical gaps, going deep into the rock for many meters. The shale rock taken out and ground to gruss was dumped at the foot of the cliff in a ridge around 100 m long. Traces of the dumps of gruss overgrown with spruce forest can be seen here even nowadays. But the exact time of occurrence and effect of that mining is still unknown, probably, the XVII century, the period of Swedish occupation.

Garnet gems could be easily removed from soft, pliable mica slate. Most of the crystals were of poor quality, opaque, with cracks and inclusions of mica flakes, almost unsuitable for jewelry. These garnets were formed inside of mica slates in a strong metamorphism at high temperature and pressure. Under such conditions, the crystals could not acquire a good crystallographic form (facet) and cracked. Nevertheless, "Karelian rubies" – garnets from Kitelya were valued highly enough in Sweden to the late XVII century.

Even under Swedish rule in 1686, the Karelians built the first Orthodox Church of Archangel Michael in Kitelya, which joined Impilahti community of Suystamo churchyard. The Swedish authorities sometimes allowed building Orthodox churches, hoping to stop the Karelians migration to Russia.

After the Northern War, Russia returned Karelian lands and gained access to the Baltic Sea. The Karelians started coming back from the inner regions of Russia. Some of the Finns, who came earlier in the Ladoga with the Swedes, remained in the liberated lands. Garnet mines in Kitelya were abandoned. Local residents told legends of buried treasures there and stories about their former masters, the Swedes. The Karelians and the Finns called the place where the gems were mined earlier "Kidelya Kiwi Kallio" The village of Kitelya became part of the Impilakhti Orthodox parish.

At the end of the XVIII century, when the science of minerals successfully developed in Russia Kitelya gems were defined as a garnet variety and it was called carbuncle or almandine. The price for this quite a widespread in nature mineral was not as high as it was in the past Swedish times. For this reason, specially organized garnet mining was no longer held in Kitelya. The gems, as earlier, were taken by peasants during plowing the fields, or, were broken out in the surrounding rocks, and sold to itinerant merchants at a cheap price. The merchants in turn resold the gems to jewelers, and sometimes ordered decorations for themselves and their loved ones. Kitelya almandines were treated as cabochons and inserted in silver frames in earrings and rings. Young boys collected cherry-red translucent pieces of garnet and made bead necklaces for their brides. In general, red garnets in Karelia, including Kitelya gems, were widely known as semi-precious stones that decorated women hats and boots.

In 1773, the old church of the Archangel Michael in Kitelya burned. Parishioners immediately decided to build a new church in its place, on the hill, near the churchyard. The Archbishop Gabriel gave up a blessing. In 1777 the church was built and consecrated in the name of the Elijah the prophet and the Archangel Michael. In the same year Kitelya parish was formed, formerly known as Impilakhti parish. By the beginning of the XIX century "Old Kitelya church" was in poor condition and it was rebuilt in 1831.

In the summer of 1785 Russian Academician Nikolai Yakovlevich Ozeretskovsky visited Kitelya, and here's what he wrote about it in his book: "This place deserves notes due to garnets, there are lots of them here. These gems can be more than a small walnut in size, and small boys collect them in the field, when the peasants plow their land, but the gem nest is in soapstone, in the town of Kidelya Kiwi Kallio, which lays in the forest village for no more than a mile ... In Serdobol I saw the ring, made from the local garnet, which dark red color was so clean that the stone seemed to be almost transparent ".

In the XIX century the price on Kitelya garnets fell more and more. The world market was filled with Czech and African pyropes and Asian almandines of high quality. Kitelya peasants still occasionally collected grenades while plowing fields and from time to time sold them to buyers, and they, in turn, resold the gems in Moscow and other cities for further processing. For locals, it was a small and unstable perk. However, there were such people, for example, in Serdobol and Pitkaranta who tried to get rich a little mining Kitelya gems. Every summer, they went in the vicinity of Kitelya in search of treasure, and some of them managed to find "nests" with quality gems. However, these prospectors could not make a fortune.

We have information about a peasant from Serdobol Stepan Korguev who seached garnets in Kitelya in the 1820-s. Stepan got interested in Ladoga gems when one day in Serdobol he saw a merchant who had a wonderful silver ring with a blue- red stone. The merchant told Stepan that the ring he had got from his father, and the latter has made it from a garnet found in the river flowing through Kitelya. Korguev was searching the banks of the river Syuskyuyanyoki and looking for "nests" with quality garnets in the rocks. Sometimes he even managed to find a dozens of large, dark red with violet hue crystals.

Once Stepan Korguev showed Dahlberg – the governor of Serdobol – large and beautiful garnets. The governor liked the gems very much, and reported about the discovery to the capital. The news of the Kitelya gems reached a passionate collector, the owner of the richest collection of jewels and mineralogical cabinet, member of the Council of the Allotments Department Count Lev Alekseevich Perovsky.

Contemporaries left contradictory information about him. On the one hand, Earl L. Perovskiy (1792–1856), the illegitimate son and a child of Count A.K. Razumovsky, received a good education at Moscow University, a member of the most important battles of Patriotic War of 1812, was a virtuous, incorruptible, intelligent, and active person. He received the highest awards for his work and quickly moved up the career ladder. In 1823, after military service holding the rank of colonel, he became an actual privy councilor. From 1829, he served as a Vice-President of the Allotments Department, since 1841 – as a Minister of Internal Affairs, retaining the same position, since 1852 he was a Minister of Allotments. His energy, foresight and statesmanlike approach to business, enterprise positively affected many innovations and undertakings of the ministry. At the same time, contemporaries noted, not all deeds L.A. Perovskii as minister were successful. Often Count showed negative aspects of his character-trickery, inclemency or even cruelty, ambition, thrift. Perovskiy had one passion, overshadowing other delights of the world – a passion for gems and this passion was sometimes stronger than love and respect to people.

L.A. Perovskiy learned about the discovery of quality garnets in the area Serdobol and decided to test their quality, and invited to the capital Yakov Vasilyevich Kokovin – a famous gem expert from the Urals. Count Perovskiy had long been interested in this lapidary from the Urals, in whose hands the stones turned into elegant vases and expensive jewelry. Yakov Cocovin was born in 1784 in a family of Ural stonecutters and gem experts. At the age of twelve he became a renowned master of stonecutting, and even the president of the Academy of Arts Count Stroganov heard about this boy. In 1799 Yakov entered St. Petersburg Academy of Fine Arts, he graduated from it with honors in 1806. He studied in two classes – design and sculpture. At first, Yakov stayed in the capital and worked on a bronze factory, but a year later moved to Yekaterinburg, where he worked as a foreman at the mountain shielding marble factory, and in 1827 he was appointed a Director of the Ekaterinburg lapidary factory. By the time people called Yakov Kokovin "a genius of stone "

L.A. Perovskiy asked Kokovin about gems in the Urals, and instructed him conduct an inspection and exploration of gems on Gogland island and Serdobol where Finnish garnets were found.

Arriving in Serdobol Kokovin learned that Stepan Korguev who found rare garnets, died. Before his death Stepan asked Yuho Karvunen to hand the gems to a distant relative, who lived on Gogland island.

V. Oparin wrote in his novel "Genius of stone" that when Korguev's relative learned what a reputable courier was sent to Saint-Petersburg for the gems, he said to Yakov Kokovin, who wanted to buy them: "It's not me who found these gems, so I can't take money for them. However we went for garnets with Stepan for several times, but we had different fortunes. He had a fortune to find garnets; I had a fortune to live. Take them free, Yakov Vasilievich. Let the people in Saint-Petersburg know that the land of Olonets has gems".

Ten smooth blood-red garnets which Stepan Korguev found in Kitelya, YakovVasilievich Kokovin brought to Staint-Petersburg and presented them in the rag to the Count Lev Alekseevich Perovskiy. He took the gems close to his eyeglass with two fingers one by one and meticulously inspected all of them. Then he ordered his servant to wash the garnets in cold lye and put them into a silver box. For bringing the gems from Serdobol the Count awarded Kokovin with gold coins and gold watches. Three of the ten Kitelya garnets, L.A. Perovskiy kept, and seven crystals he presented to the emperor, and was honored.

After this Count L. Perovskiy gave Y.V. Kokovin a new task – to look for emeralds in the Urals. Arriving to the Urals, Yakov Kokovin together with the Ural pitch-worker Maxim Kozhevnikov organized emeralds searches, and in January 1831 they found the first field. Sretenskiy and then Mariinsky mines were founded. Superb emeralds inflowed Saint-Petersburg. For the discovery of emeralds Yakov Kokovin was awarded with the Order of St.Vladimir, 4th degree and Maksim Kozhevnikov with a sum of money.

Soon Count L. Perovskiy decided to get wealthy by hiding the best emeralds and invited to participate in this affair Y.V. Kokovin, who supervised the production of the gems in the Urals. Yakov Kokovin refused to cheat. The Count belied Kokovin and accused him of stealing emeralds. Yakov Kokovin was fired and imprisoned in a jail in Yekaterinburg. However, people did not believe that the stone expert was dishonest. On the contrary, they respected his talent, honesty, skills and responsibility. All this angered Count Perovskiy who sought further charges for the master. In Prison Yakov fell ill with tuberculosis, and, three years later when he was released, died in 1840. For many decades Yakov Kokovin was considered to be a thief. Only 150 years later Yakov Vasilyevich Kokovin justified by history[1].

In the second half of the XIX century people still were interested in Kitelya garnets, but mined the

[1] Опарин В. Гений камня. Москва…

gems very rarely, and usually were satisfied with garnets harvested their fields by peasants. Travelers and explorers whenever possible tried to call in Kitelya. For example, in 1859 a limnologist Aleksandr Petrovich Andreev came to the village. That's whathe wrote in his book in 1875. "*There is place in the mountain where mass froze in some layered brace and in this brace you can see some walnut size garnet gems, they look like crushed balls. These beads are easily distinguished from the mountain and called "kidelya." These garnets can sometimes be quite large, but their inward could always crushed and glued with some cement. Small, clean and beautiful water almandine, gentle colors can be separated in this glued mass. We did a gold ring with these gems and are proud that we extracted a sample of a gem from the northern shore of Lake Ladoga".*[2]

In 1883, near the dilapidated "Old Kitelskoy" church on the road to Pitkaranta, on a hillock at the expense of the merchant Vasily Ratinov a new church was built, on September, 11 it was consecrated in the name of Prophet Elias and Archangel Michael. The quality of construction was poor, and in 1897 the church repaired.

On February 24, 1901 "New Kitelya" church burned due to a stove malfunction. A stone church had to be built on the site of the burned church, but the parish did not have enough money. Then it was decided to build a new church of wood again. The project of the new church was done by a famous architect from Serdobol Y.O. Leander. Newly rebuilt church was consecrated on November 29, 1907 in the name of the Prophet Elijah. It resembled the church of Peter and Paul in Serdobol. As soon as the parish paid all the debts for the new church construction, they began to repair the old one.

Those two churches stood close to each other till the Winter War. In January and February 1940 the front line ran right through Kitelya. When shelling almost all the houses, outbuildings and both churches burned in Kitelya, the forest burned out for many kilometers around. Soviet immigrants who came to Kitelya in the spring of 1940, could not cut for firewood those trees that were left because of the shrapnel and bullets in them. The craters from bombs and shells were everywhere in the fields. Garnets sparkled like drops of blood in turned over by explosions land.

Thick forest grows at the site of the church of the Prophet Elijah in Kitelya now. It hides the remains of the foundation from the curious eyes. The wide concrete stairs without handrails leads you to the hill where the church stood. To the east of the ruins of the church, behind the altar, you can see a dug out grave of priests Alexey and Mikhail Shepelevsky, a father and a son. Alexei Shepelevsky was a hegumen of the Elias Church in Kitelya from 1867 to 1887. He organised a mobile school in the villages and developed local public school, building of the "old" church stone foundation was initiated by him.

In the early XX century, when the the priest Basil Sobolev was a hegumen in Kitelya parish "new" church (after the fire) was built as well as new chapels in Kyutesyurya, Syuskyuyarvi and Ruokojarvi. In 1909 Sobolev moved to Serdobol, and Isaac Musovskiy, whose father was a sexton in Kitelya was appointed. Two years later, Vladimir Tolstohnov became the hegumen of Kitelya parish. He tried to translate the church paperwork into Russian, but at the end of 1917, when Finland was declared independent he was dismissed. At the request of the congregation Isaac Musovsky took this post again. From 1933 to 1937 the hegumen of Kitelya parish was a Sortavala seminary graduate Paavo Saarikoski. Alexander Olanto was the last priest.

We know that a famous Finnish writer Kyullikki Mäntylä was born in Kitelya and lived there for a long time. Her stories and novels about the Karelians and the nature of Northern Ladoga were very popular.

In the 1970s Kitelya deposit was studied by the Soviet geologists and was widely discussed in popular and scientific literature. Students from Leningrad and Moscow came here for internship. There was no much harm to the nature and Kitelya garnet mines from the students and amateurs, as garnets were collected in small amounts in the old fields and dumps.

One could easily got to the garnet mines by train, that stooped right next to them (station "42nd km").

Almandine-garnets deposit in Kitelya is the largest in Russia. It occupies the territory of nearly 1,5 to 3 km, and 300–500 m deep. This deposit was explored by geologists and its reserves were booked. Garnets from this place can be used as abrasive material and as a collectable stone. As jewelry raw materials kitelya garnets are of very poor quality. Suitable for crystals jewelry are very rare here, less than 10 %.

[2] Андреев А.П. Ладожское озеро, СПб, 1875.

Fig. 2. Garnet mines in Kitelya

Since the early 1990s, specially organized groups of miners from St. Petersburg and Moscow started coming to Kitelya. Residents from Pitkyaranta and Sortavala also began to collect the gems. They used old dumpsites soil riddled for several times with meshes and sieves hoping to find crystals. But that was not enough so they dug new trenches in the rocks without any license.

Fig. 3. Modern garnet mines in Kitelya

Nowadays the historic garnet mines in Kitelya are in chaos. Newly made trenches look like gaping wounds on the body of the rock, the old dumpsites dug and riddled for several times, lots of trees were cut, the land is littered with cans, plastic bottles, at the bottom of the rock one can find ugly tents and buildings. If a traveler comes here he can meet an untidy man who will advise to keep aloof from this place. But if there is a group of travelers, the "residents" of the mine will try to hide in the forest with their treasures.

At present "freelancers" from Sortavala, Pitkyaranta, Saint-Petersburg and Moscow mine garnets in Kitelya illegally. Kitelya garnets and jewelry made of them (mostly beads) you can easily buy in Saint-Petersburg, Moscow, Ruskeala, Outkumpu (Finland), on Balaam and other places. Usually they sell garnet grains or beads of peeled and rumbled crystal fragments. If you cut out the core of a Kitelya garnet, it becomes translucent and bright. Jewelers sometimes do, this and such gems – cabochons, of course, are more expensive.

Kitelya garnet mines are not available to the mass tourists, because it is located 1,5 miles from the highway. From the ruins of the "new" Kitelya church toward the mines there is a field road, suitable only for offroaders. The beginning of this road is clearly indicated by two or three old larches.

Fig. 4. Pupils collecting Kitelya garnets

Tourists are invited to visit another place with garnets, which is available even for large buses. It is just 200 m from junction Pitkaranta-Mursula, on the old road, which in Soviet times led through "American" mountains to Pitkaranta. When this road was widened in the 1990s, the rocks composed of mica schists with garnet were exploded. That is a southern part of Kitelya garnet deposit but the gems here are not so big and bright as in historic mines and in other parts of the field remote from the roads. Nevertheless, tourists stop here very often; they try to find gems in the mica at the bottom of low cliffs, and many of them succeed.

From year to year the amount of garnets here is getting smaller and smaller, and the time will come when once again we will have to take up a hammer and a chisel, to dislodge a piece of rock with dark red gems born billions of years ago in the depths of the Karelian mountains. Perhaps, one day Kitelya garnets will be mined on an industrial scale as an abrasive material or for collectable stones. Ministry of natural resources has several times set Kitelya garnets deposit for an auction, but no one in our country wants to buy it so far.

THE STONE PITS OF TULOLANSAARI ISLAND

I.V. Borisov

In the north of Lake Ladoga, 67 km east to Sortavala there is a large and beautiful Tulolansaari Island, which became the cradle of Ladoga rune-singers, a birthplace of the famous Hermitage Atlanteans and a place of masterpieces of the famous artist and thinker Nicholas Roerich. In the beginning of 1940 there were 6 villages with two thousand people on the island, and now no one lives here except for visiting fishermen and tourists.

Tulolansaari Island (in parlance – Tulon, Tulola) is one of the largest islands on Lake Ladoga, there are only two islands larger than Tulolansaari, they are Riekkalansaari and Mantsinsaari. From the north and north-east coast Tulolansaari is washed by Hiydenselkya Strait ("Strait of silvan"), from the west – by Honkasalonselkya ("Strait of pine thicket"). From the south and southeast of Tulola Island is protected from the open Ladoga with a group of small islands satellites – Oryatsaari, Karpansaari, Pellotsaari and others.

According to one Karelian legend, Tulolansaari Island (from Karelian island of aliens, a place of arrival") got its name after the following event. "Some Sortavala residents went on a journey on a float boat, and said that the place the wind would send them to they would call the Tulola. The wind drove them to a great island which they called Tulolansaari. They stopped at the highest point, Mount Pekkisenmyaki from where settled throughout the island".

According to another Karelian legend, the first inhabitant of Tulolansaari was a character of Karelian-Finnish epic "Kalevala" and runesinger Wainamoinen, who was born on Lake Ladoga and sailed there for a long time until he came to a deserted island, where he performed his first feats. Here is a rune which tells us about it:

"Thus our hero reached the water,
Rested five years in the ocean,
Six long years, and even seven years,
Till the autumn of the eighth year,
When at last he leaves the waters,
Stops upon a promontory,
On a coast bereft of verdure;
On his knees he leaves the ocean,
On the land he plants his right foot,
On the solid ground his left foot".[1]

And the legend was not just a fiction. On the island of Tulolansaari, for 200 years, from the beginning to the end of the XVIII–XIX centuries seven generations rune-singers Vanninen lived in the village Pieni Tulola. The last member of this family was Andreyi (1807–1891 years). He was born in a village Rautalahti in the family of a rune singer Boris Vanninen, who came here from Tulolansaari. Andrey recorded 23 runes after his father, and then all hislife performed them at weddings and celebrations. He sang about how the blacksmith Ilmarinen forged wife of gold, how Winamoinen played kantele made of bones of pike on a rock Kuhavuori Sortavala and of Karelian birch – on Tulolansaari. Andrey also played lyrical and wedding songs, knew a lot of spells. From Rautalahti Andrey moved to Vakkosalmi not far from Sortavala, and then to the island of Riekkalansaari. Andrey was not married. He was quite short, frail as a child he fell ill a lot but lively and verbose, he was not shy about his height, and was cheerful and good-natured, brave, honest and not envious. Andrey was considered to have a mythical power and a meeting with him brought luck. Andrey was a professional matchmaker, and all the couples he matched (about 200) were happy. Andrey was invited to every house as a welcome guest, as people believed that luck and love came with him. Andrey brought joy, music, songs.

On Tulolansaari Island, in the village Suuri Tulola before the war a boy called Samppa was born in the family of other rune-singers Uimonen. Samppa carefully preserved rune-singing tradition of his family till the end of his life. In 1993 after a long separation from the homeland, elderly Samppa came to his native village on Tulolansaari, where he saw only fields overgrown with grass and bushes. In the same year in Sortavala in a park near the monument "A rune singer" Samppa performed several ancient runes playing kantele. And that was the last bright page in history of the rune singers' island.

Till 1940 there were six settlements on Tulolansaari Island, they are Pieni Tulola, Suuri Tulola,

[1] Борисов И.В., Касаткин В. Карельское Приладожье. Китай, 2012 г.

Mentselya, Putsinlahti, Cannas (Rasil) and Soukanranta, which are mentioned in one of the runes of "Kalevala": "Far and wide the sweet tones echo,Ring throughout the seven hamlets".

At the beginning of the XX century the number of inhabitants on Tulola Island reached nearly 2000 people, most of them were Lutherans and about 10 % – Orthodox. Most Orthodox lived in Mentselya and Lutherans – Suuri Tulola and Putsinlahti. Thanks to fraternities friendship and understanding between the islanders were surprisingly good. The island inhabitants were engaged in agriculture, fishing, crafts, and worked in local stone pits.

Pien and Suuri Tulola settlements, located in the northern part of the island, from the beginning of the XX century belonged to the school district of Tulola. Till 1917 a place of interest in Suuri Tulola ("big Tulola") was a beautiful two-storey house with an attic (Tulolanhovi), owned by Andrei Andreyevich Barinov – a famous merchant of the 2nd guild from Saint-Petersburg. In the summer of 1918, after the death of A.A. Barinov a famous artist and thinker Nicholas Roerich lived in this house with his family.

Fig. 1. A.A. Barinov's house on Tulolansaari, 1930s

According to the memoirs of S.N. Roerich, "...the house stood on the hills and on the northwestern side of the island (Tulola), close to the marina ... On the northern side of the island were known stone quarries and carried out for granite monuments in St. Petersburg. The island was full of game ... The house itself was large, with mezzanine, wood, with large rooms ..."[2]

Tulolansaari period was very productive for N.K. Roerich. Here he wrote the novel "The Flame" made dozens of pencil sketches for future paintings, among them are "Sunset Rider", "Morning Rider," "Night Rider," "The Call", " A Sorcerer", "Giant's Tomb", "Tulolansaari Island " and others.

Clean air, infused with herbs and pine needles, slightly moistened and warmed by the northern sun, fabulous beauty of the island and Ladoga bays, communication with terse but wise islanders – all this contributed to the recovery of the artist, who suffered from chronic lung disease.

A.A. Barinov's house as well as the other thirty houses fell to decay in once populous village Suuri Tulola. From the boat now you can see only a large glade, where the village was before the war. A Professor of Saint-Petersburg State University. Andrey Glebovich Bulakh called this place "Roerich's glade".

Fig. 2. "Roerich's glade" – the place where Suuri Tulola village was

According to a researcher from Saint- Petersburg Vladimir Vasilyevich Vikhrov[3] A.A. Barinov was born on September 21, 1839 in Saint Petersburg. He was a merchant of the 2nd guild from 1872 to 1910. For many years he lived in the "northern capital" on Vasilevsky Island, in the house of the cemetery church of Our Lady of Smolensk. From 1872 to 1895 he owned monumental workshop, located in the same building in the Smolensk cemetery. Since 1883, after the death of his stepfather, Matvei Ivanovich Ovechkin, according to his will, Andrey became the owner of the granite stone pits and houses on Tulolansaari Island. Since 1894 he also owned a house with a granite and marble products workshop on Vasilevsky Island, formerly owned by his cousin

[2] Письмо С.Н. Рериха П.Ф. Беликову от 21 августа 1974 г. // Сборник"Непрерывноевосхождение". Т. 1. С. 181.

[3] Вихров В.В. О местах проживания семьи Рерихов в Карелии/ в книге Краснолуцкого А. Сортавала. Санкт-Петербург, 2012, с. 572–580.

Nikolai Ivanovich Barinov. Since 1895, he moved to this house on a permanent basis.

A. Barinov's workshop produced a large number of tombstones made of natural stone in the Smolensk cemetery and Tikhvin Cemetery of the Alexander Nevsky Monastery, such as tombstones for F.M. Dostoevsky (1883, sculptor – NA Laveretsky, architect – H.K.Vasiliev), A. Kuindzhi (1914, pink and gray granite) and Rimsky-Korsakov (1911).

The workshop also manufactured pedestals of monuments of famous people of Russia – A. T.Markov, F.M. Novosilsky, A.F.Petrushevsky, I.F. Krusenstern (1873, sculptor – I.N. Schroeder, architect – I.A. Monighetti red granite) in Saint Petersburg; A.S. Pushkin (1880, sculptor – A.M. Opekushin, architect – I.S. Bogomolov, Serdobol granite) in Moscow; Peter the Great (1873, sculptor – I.N.Schroeder, architect – I.A. Monighetti, Serdobol granite) in Petrozavodsk; Emperor Alexander II in the village Putilovo; F.F. Bellingshausen (1870, sculptor – I.H. Schroeder, architect – I.A Monighetti) and PK Pakhtusov (1886, sculptor – H.A. Laveretsky, architect – A. Silin) in Kronstadt.

In addition, A. Barinov's monumental workshop took work on the decoration of the Orthodox churches. For example, the iconostasis of St. Nikolas the Wonderworker church in Chernaya Rechka (1871), the altar in the Church of the Resurrection in the Trinity-St. Sergius Monastery, in Strelna (1898), the icon-case of the icon of St. Sergius of Radonezh in the church of Aleksandrovsky metochion in Jerusalem (1905), the iconostasis of the church of twelve apostles of St. John convent in Saint-Petersburg (1908).

By 1910 A.Barinov's granite and marble workshop was awarded with three medals: one silver (1874) and two gold (1883 and 1885).

Andrei Barinov died in 1910 in Saint Petersburg. At the Smolensk cemetery where he was buried, there is a marble and granite chapel (crypt) at the Barinov family burial place. His wife Maria Pavlovna (Chirkova) inherited the property, including two houses and the monumental workshop in Saint Petersburg, a house and stonepits on Tulolansaari Island. After her death in 1916, the house and workshop of Saint-Petersburg were passed to her father Pavel Nestorovich Chirkov, a stone-cutter. Since 1911, Barinov's company was officially named "A. Barinov, A. Chirkov the successor" and existed till 1917. In 1918, the stone pits on Tulolansaari Island were arrested by the Finnish government as the property of foreign citizens.

Andrey Barinov's parents were Andrey Andreevich Barinov (1822–1843), a state bricklayer in Quartermaster office in Putilova village, and Olga Grigorievna (1818–1880), a native of Saint-Petersburg, she owned a monumental workshop at the Smolensk cemetery from 1849 to 1871 and was consisted a merchant of 2nd guild in 1861–1871. In 1871 Olga Grigorievna married for a second time a merchant Serdobol Matvei Ovechkin from who supplied Serdobol granite for monuments, he also got married for second time. In 1871–1878 Olga Grigorievna lived with her second husband in Serdobol. She died in 1880, and was buried, like her first husband, Andrew Barinov, in St. Petersburg, at the Smolensk cemetery.

Andrey Barinov's stepfather Matvey Ovechkin (1821–1883) was the son of a serf from Ingria. According to a legend, the owner of the granite stone pits on Tulolansaari traded him on a puppy when Matvey was a boy. Local peasants sometimes called him "barinov". The owner of Tulolansaari quarries did not have children, and he left all his property to Matvey Ovechkin.

From 1856 to 1882 Matvey lived in Serdobol. Around 1870 he built on Tulolansaari solid house of red pine, purchased in Lapland, the house was a kilometer north from the stone pits. In Tulolansaari stone-pits Matvey quarried stone blocks (Serdobol granite, quartzite) and sent them to Saint-Petersburg. His stonemasons produced various items from those blocks. In 1876 a large flower vase of black stone, made by Ovechkin stonemasons was exhibited in Helsinki. For this vase Matvey Ovechkin was awarded with a bronze medal, and his workers – with money. Matvey died in 1883 at age 62 and was buried in Saint-Petersburg at the Smolensk cemetery.[4]

After 1918 nobody looked after the Barinov's house and it decayed. In 1926, the rural community Suur Tulola village "Tulolan Hovey" bought Barinov's house, and arranged carpentry and weaving workshops in it. They also held local holidays there. In the early 1960s, the house was demolished for building material that were used in the construc-

[4] Вихров В.В. О местах проживания семьи Рерихов в Карелии/ в книге Краснолуцкого А. Сортавала. Санкт-Петербург, 2012, с. 572–580.

tion of houses for the mill workers in Hiidenselka village next to Tulolansaari.

Now, in the place where Barinov's house was one can find just a pile of stones and overgrown trees. A public organization "The Light of Ladoga", and the vice-president Yuriy Aleksandrovich Gorbachev, intend to take the place where Andrey Barinov's house was under protection and to set a memorial plate of Nicolay Konstantinovich Roerich there.

One such marble plate is attached to the shore boulder near the old quay Lintaniemi by Vladimir Sergeyevich Golovachev – a teacher of St. Petersburg Arts school number 10, a graduate of the Polygraphic Institute.

Until 1940 there was only one pier on the island – the cape Lintaniemi. Ship "Yaanaslahti" connected the island with the mainland. A woman called Anni lived near the pier with her daughters. Her house was always full of people waiting for the ship, so one could get the latest news there.

Fig. 3. The basement of A.A. Barinov's house. 2012

In 1836, in the southwestern part of the village Suuri Tulola on Juho Pulkkanen's project the islanders built two-storey school of brick and stone with water supply and sewerage. And until that time, the children went to school in another part of the island, within 4–5 kilometers. Simo Yatinen was a teacher of the new school. He graduated from Sortavala pedagogical seminary, he also was a secretary of the fraternity and head of finance, accountant of the cooperative cash-office, a choir director, a member of the municipal the church council and. In the 1930s many houses of the settlements got electricity, through cable laid across the strait from Riekkalansaari Island. Unfortunately, the school building "Tulola" was took to bricks and tile in the 1960s. Then other buildings of the village were taken away for firewood.

Only 1–1,5 km south of the former village of Suuri Tulola in the rocks there are stone pits where from the 1770s until the 1910s famous Serdobol granite was quarried and used for decoration of palaces and temples of Saint-Petersburg, Peterhof, as well as for the manufacture of tombstones and monuments.

According to geological studies, the island is mainly composed Tulolansaari migmatized rocks Ladoga series Proterozoic – schist, gneiss, granitic gneiss, quartzitic sandstone, quartzite and etc. Most of the island is occupied by rocks suites Naatselkya – quartz-biotite schists and gneisses. The coast area and Mentselya – Putsinlahti are composed of more ancient rocks and unfragmented pyalkyarvinskaya and kontiosaarskaya suites: conglomerates, sandstones, quartzitic sandstones, schists, gneisses. In gneisses dark red garnet-almandine is often met, it forms significant placers on the west coast of the island. In the northwestern part of the island (north of Cape Uytonniemi) along the coast, exposed dark amphibolites formed by billions of years ago effused basalts and basaltic andesits.

In the central and eastern parts of the island Tulolansaari large stratal intrusion of plagiogranites gray come to the surface, their area varies from $200 \times 500 \times 600$ m^2 to 1,200 m^2. The major outcrops of these granites are situated within Ruotsenkallio and Mustikkamyaki hills, forming a large deposit of Serdobol granite "Tulolansaari" with reserves of raw materials more than 9 million m^3. This field was developed by several quarries for building-stone mainly in the XVIII–XIX centuries.

Plagiogranites "Tulolansaari" deposit has light gray, with a bluish or ashy hue, medium-grained granitic structure, lack of xenoliths of older enclosing rocks and schlieren clusters. In granite and quartz occasionally there are pegmatitic veinlets with capacity of 0,5–5 cm and massive texture, sometimes slightly gneissic. A smooth transition into the enclosing rocks of granite Ladoga series-granite-gneiss, gneiss-granites, gneisses can be observed.

Plagiogranites of Tulolansaari Island mainly consist of minerals like plagioclase (30–40 %) and quartz (20–40 %), with small amounts of microcline, biotite, muscovite, amphibole.

Serdobol granite easily acquires any texture of "rock", "dot", polished. After polishing they become dark gray with a mirror surface. Can be well split up, forming straight face of the blocks. The splintery particles can be about 0,6 m wide, 15 cm thick, 4 m long. In the past, the field "Tulolansaari" produced monoliths large enough for making columns and sculptures.

According to the Institute of Geology, Karelian Research Center of RAS on the site "Ruotsenkallio" average volume of blocks is 1,4 m^3, maximum – 33 m^3. Blocks outcrops larger than 1 m^3 are 20%. In the central part of the plot average volume of the blocks is 1,2 m^3, up to a 100 m^3. The distance between the longitudinal cracks is 1,6–5,4 m; between the cross cracks – 1,5–1,8 m; between the stratal – 0,3–1 m. Some blocks in dumps of old quarries have clear rectangular outlines with cross section from 0,5 × 0,15 m to 0,7 × 0,8 m and length – from 4,2 m to 4,8 m. There are blocks up to 10–12 m long.

On the site of the "Glavniy" quarry where in the middle of the XIX century monoliths were mined for columns and Atlanteans of the New Hermitage, the distance between the cracks in the steeply dipping systems was 8–9 m, 2,2–4 m in average. Average block sizes reach 3,5 × 0,7 × 0,7 m. There are often blocks of up to 6–9 m long and 2–4 m wide. The maximum volume of the blocks is 80 m^3.

Granite of the deposits is estimated at 23 points, but it may be higher, because in the past this granite was very widely used in the architecture of Saint Petersburg because it was a decorative facing, column and sculptural material easy to handle.[5]

From the 1930s to the present day Serdobol granite field "Tulolansaari" has not been developed. It was examined by different geological organizations in the 1950–1980-ies, and was recommended for further detailed study as a possible source of the large-block facing and stone restoration.

In the late XVIII – early XX centuries Russian architects defined "Serdobol granites" as dense, fine-grained gray granite, of different shades, which was mined in the quarries on the islands and shores of Lake Ladoga not far from Serdobol (Sortavala). Naturally, the name of these granites is related to the place of their initial discovery and production, but it combines several varieties of plagioclase granite, mostly of gray color, small- and medium-grained structure, massive and gneissic (up to gneiss-granite) texture. One kind is dark gray homogeneous fine-grained granite, the other is mottled banded stone due to the presence of darker dust and biotitic inclusions. There are also massive, fine-grained bluish-gray granite, etc. Almost all of these granites contain thin feldspathic layers and veinlets. The group of "Serdobol granite" could also include diorites, granodiorites, and gneiss-granites as they have similar coloring, characteristics, and the place of production.[6] In the late XIX – early XX centuries dark gray fine-grained micaceous quartzite and quartzitic sandstones were mistakenly taken for the dark variety of "Serdobol granite"; the latter were broken on the Ristisaarii Island and in the eastern part of Tulolansaari, as well as amphibolites developed on the northwestern coast of the island.

It can be assumed that the gray granite on Tulolansaari was first developed by the Swedes in XVII century (during the occupation of Korelskiy County), which is indirectly may be confirmed by the name of the shore – Ruotsenranta ("Swedish coast"), and mountain-Ruotsenkallio ("Swedish rock or quarry ") in the eastern part of Tulolansaari. In the 1770s, here, on the mountain Ruotsenkallio new stone pits of Serdobol granite were started.

Official mining of Serdobol granite on the islands and in the vicinity of Serdobol began, apparently, in the early 1770s, after the decree of Catherine the Great on January 19, 1768 "On the production of marble and rough stone in Kexholmsky and Serdobol and Ruskeala churchyards for the construction of the Church of St. Isaac".

According to Serdobol Pastor Samuel Alopeus (Samuel Alopaeusa) granite on Tulolansaari Island was mined before 1784. He wrote that "on an island Putsalo (Putsaari-I.B.) of Lake Ladoga, and on so called in Mentselezunde (Mentselya-IB) Tulola island (Tulolansaari-I.B.), in Sortavala churchyard, the bluish clean granite is broken out, which was used for the outer walls of the magnificent Marble Palace and other great buildings. Stone breaking in Menzel still more continues. In the summer of 1784 to huge buildings were built with many great square stones and pillars 2.5 feet tall, they were of sent to St. Petersburg by the ships. And this stone pit is

[5] Рылеев А.В. и др. Изучение минерально-сырьевых ресурсов каменных строительных материалов Карелии. Институт геологии КарНЦРАН, Петрозаводск, 1984.

[6] Борисов П.А. Каменные строительные материалы Карелии. Карельский филиал АН СССР, Петрозаводск, 1963.

1,5 verst from the place where galliots arrive and the stones can be loaded ...".[7]

In the summer of 1785 Russian scientist Nikolai Yakovlevich Ozeretskovsky visited Tulolansaari and left this record about the stone pits. "Tulola Island lies four miles from Juvenia, on the other side of Serdobolskaya bay, near the shore of the lake. Its circle is eight miles. The bluish granite is mined there and used in St. Petersburg at the magnificent structure of state-owned buildings. This granite is not in clumps, but drain layers and makes the whole island which is very high; water does not prevent the granite mining. Galliots arrive to the island and load the hewn granite".[8]

Thus, light gray Serdobol granite which was used to decorate the Marble Palace (1768–1785, Rinaldi) was produced on Tulolansaari island in Mentselya, the late 1770 – early 1780's. This granite tiled walls of the second and third floors of the palace, the trims of the first floor windows, architrave and cornice are also made of it.

"The Round Room" of Marble Palace is decorated with 8 columns made of polished Serdobol granite; the columns are up to 5 m high. Referring to Samuel Alopeus, we can assume that these columns were made of granite quarried in 1784 on Tulolansaari Island. This opinion is shared by the famous expert on the history of Karelian stone mining V.G. Pudovkin. He argues that it was the first time when Serdobol granite was used for making columns.[9]

Another researcher of stone M.S. Ziskind believes that the columns in the hall of the Marble Palace were established by the architect A.P. Briullov while the restructuring of the premises in 1844–1851.[10]

It is also confirmed that in the early 1840s Serdobol granite from Tulolansaari was used for the construction of the bulls of Nicholas Bridge (1842–1845, architect A. P. Briullov) in Saint Petersburg. Initially this first permanent bridge over the Neva River was called the Annunciation bridge, then Nikolas bridge and lately it has been called Lieutenant Schmidt Bridge. Here is what the magazine "Inzhenerniy" wrote about it in 1885. "All granite for Nicholas Bridge was quarried in one mine on Tulola island, and now abandoned which is a 4-space coal or pool in the size of our tithes and up to 6 fathoms deep. Long side walls of the pool are cliffed, the end are hewn with ledges. The distance from the shore is about ½ verst".[11]

Many researchers believe that in the 1840–1850-ies Serdobol granite from the island Tulolansaari was used for making Atlanteans and several columns of the New Hermitage, the base of the Kazan Cathedral and several monuments of Saint Petersburg. Unfortunately, there is still no complete and reliable information about the use of Serdobol granite from Tulolansaari in the architecture of "northern capital" and other cities. The stone pits producing Serdobol granite were located not only on Tulolansaari, but also on the neighboring islands Riekkalansaari and Vannisensaari, as well as on the mainland Cape Impiniemi. The granites from these fields are slightly different from each other in structural and textural features, but in the architecture they look almost the same, at least not for an expert.

Serdobol granite from different quarries of Northern Ladoga was widely used in Saint-Petersburg. It decorates various buildings of the "northern capital": the Marble Palace (1768–1786, architect A.Rinaldi; walls, window frames, the eaves); the Neva Gate of Peter and Paul Fortress (1786–1787, architect N. Lvov); the Mikhailovsky Castle (1797–1800, architects V.I. Bazhenov, V.F. Brenna, stairs and the basement); Obelisk "Rumyantsev's victories" (1797–1800, architect VF Brenna; the stele, the pedestal); the monument to Peter I (1800, architect V.F. Brenna; the pedestal); the Kazan Cathedral (1801–1811, architect A.Voronihin; the basement); the columns of Fame (1845–1846, sculptor N.E. Efimov, columns); the Winter Palace (after 1837, columns); the New Hermitage (1842–1851, architect A.I. Stakenschneider, sculptor A.I. Terebenev, Atlanteans, herms, columns); Nikolaevsky Bridge (1842–1845, architect A.P. Briullov; supports Nikolaevsky palace (1853–1861, architect A.I. Stakenschneider, columns); Novomikhailovsky Palace (1857–1861; columns), a monument to Ivan Krylov

[7] Алопеус С. Краткое описание мраморных и других каменных ломок, гор и каменных пород, находящихся в Российской Карелии. Санкт-Петербург, 1787.

[8] Озерецковский Н.Я. Путешествие по озерам Ладожскому и Онежскому. Санкт-Петербург, 1792, 1812.

[9] Пудовкин В.Г. Сердобольский гранит // журнал "Природа". Мурманское книжное издательство, Мурманск, 1985.

[10] Зискинд М.С. Декоративно-облицовочные камни. Москва. "Недра", 1989.

[11] Каменоломни сердобольского гранита// Инженерный журнал. № 6,7, 1885.

(1855 sculptor P.K. Klodt; the pedestal), a monument to Nicholas I (1856–1859, architect, O. R. Montferrand; the pedestal), a monument to Catherine the Great (1869–1873, sculptor D.I. Grimm; thr pedestal); Liteiny Bridge (1875–1879, architect A.E. Struve; supports); Trinity Bridge (1897–1903; supports); bowls of fountains in the gardens of the Admiralty (1872–1874) and at the Winter Palace (1896–1901); A.F. Kshesinskaya's mansion (1904–1906, architect A.I. Gauguin); Vavelberg's house (1911–1912, architect M.M. Peretetkovich); the building of October Railway administration (1911–1912, architect. A.A. Grechashnikov), etc.

Fig. 4. The monument to Peter the Great at the Mihailovsky Castle

Serdobol granite also decorates various buildings of Peterhof: The Lion cascade (1853–1861., architect A. Stakenschneider, columns); the Pink Pavilion (1845–1848, sculptor A. Terebenev; herms); the Belvedere (1852–1856, architect A. Stakenschneider, sculptor A. Terebenev, columns, caryatids).

Serdobol granite was also used in Tsarskoye Selo during the construction of granite terraces (1810), the Orlov Gates (1770s.), some of the triumphal columns (1770s.).

Fig. 5. A bowl of fountains in the gardens of the Admiralty

In Veliky Novgorod Serdobol granite was used for pedestal of the monument "Millennium of Russia" (1862).

As it was already noted, the elegant pedestal of monument to Peter I (1873, sculptor I.N. Schroeder, architect I.A. Monighetti) in Petrozavodsk and to A.S. Pushkin (1880, sculptor A.M. Opekushin, architect I. S. Bogomolov) in Moscow were made of Serdobol granite. As well as a high staircase and basement of the Pushkin Museum of Fine Arts in Moscow (1912).

Serdobol granite from Riekkalansaari island was widely used in the architecture of the Finnish city Serdobol – Sortavala in the 1870–1930-ies. But that granite had markedly different structure from other Serdobol granite deposits, especially those that were mined in the quarries "Nukuttalahti" (they have a typical gneissic pattern).

Most problems arise in determining the place of production of Serdobol granite monoliths for making columns and Atlanteans of the New Hermitage, columns and caryatids of the Belvedere. It is likely that a significant portion of the stone material for these architectural products was produced on Tulolansaari island, and the rest – on Vannisensaarii island of Cape Impiniemi . These experiments allow to assert that column and sculptural stone was quarried at the so-called "Glavniy" stone pit of Tulolansaari field (I.V. Borisov;s classification – "Ruotsenkallio –1"), now filled with water.

The sculptor Alexander Terebenev was the author of the famous Saint-Petersburg Atlanteans. Future sculptor was born in Saint-Petersburgn in 1815. At the age of 12, Alexander was admitted to the Imperial Academy of Fine Arts. In 1835 he finished the academic course with a small gold medal and was awarded the title of artist of the 14th class. Alexander Terebenev was invited to stay at the Academy scholarship for his further improvement, but he refused, as it was impossible to feed a family only with the retirement benefits. Alexander Ivanovich had to leave the Academy and seek orders. In April 5, 1844 the Construction Commission on building the Imperial Museum entered with him into a contract to manufacture ten Atlanteans for the Hermitage.

But signing a contract, Alexander Terebenev did some miscalculations and greatly underestimated the cost of the project, and soon found himself in a very difficult financial situation. Nevertheless, he started the work with great zeal and began making sculptures of solid granite, the material which was not familiar to Russia.

Working on herms (tetrahedral pillars topped with sculptures in the form of the head), Alexander Ivanovich hired more than a hundred assistants of artisans and masons and taught them for more than a year to process Serdobol granite. We can see today these exquisite herms between the windows of the second floor of the New Hermitage.

For his workers A.I. Terebenev hired an outhouse and took care of them, according to an artisan G.A. Balushkina, “as the mother and father of their children”.

The models of herms and Atlanteans Alexander Terebenev produced himself. Using a clay model of the Atlantean in full-size (4,8 m), the sculptor started to make the first figure of Atlantean of Serdobol granite, simultaneously continuing to train the workers; it took him one year and a half. But the Atlantean made by Terebenev was more beautiful and expressive than ancient marble sculptures in the temple of Zeus in Agrigento.

Only then they started making other Atlanteans. For five years, from 1844 to 1849, the work on the ten sculptures lasted. Over a hundred assistants helped Terebnev. Each worker was doing his job, someone got off bottoms, someone worked on hands, legs or torso. Faces of the sculptures Alexander Ivanovich finished with his own hands.

The work on the Atlanteans and the artisans training took more time and delayed the work beyond the agreed term of three years. The money was spent, there was nothing to pay to the artisans and workers. Besides, one of the monoliths appeared to have a crack, and the expensive stone had to be urgently replaced by a new one, which pattern was very different from the previous one. Then Alexander Terebenev appealed to the Construction Commission for additional funding of the project, but left himself with little or no money. In 1845, A.I. Terebenev received a medal for the model of an Atlantean and the title of academician. Upon completion of work, he was also awarded the Order and was appointed the “head of sculptural works” in the imperial gardens and palaces.

When all ten statues were polished, their set on low pedestals of Finnish granite rapakivi among the columns of the portico at the main entrance to the New Hermitage. “Mythological Atlanteans – wrote in1954 A.I Samoilov – A.I. Terebenev presented in the form of majestic giants, holding the great weight on their mighty shoulders. Proud Giants heads, crowned with wreaths, slightly tilted down. Strong hands bent at the elbows... Muscles of the nude figures also full of enormous power. Simple bearskins entwine their hips. All this strikes with grandeur, austerity and simplicity ...”

Fig. 6. The Atlanteans of the Hermitage (1844–1849, A. Terebnev)

Conference-secretary of the Academy of Arts V.I. Grigorovich wrote about A.A. Terebenev’s work the following: “Nowhere in Europe and no sculptor has produced granite, as the ancient Egyptians and Greeks produced it. Now this Egyptian art became Russian and huge Egyptian sphinxes are not a miracle in comparison with huge caryatids brilliantly made of stone ... by Terebenev"[12]

From a distance, the dark muscular stone figures of Atlanteans seem like twins. Facial features and body proportions are similar. But if you look closely, you will notice that the sculptures are made of different types of stone. The Atlanteans of the "front row" look quite light, but those that lurk in the corners of the wall are very dark. Gloomy, shaded lateral Atlanteans are deliberately placed by A.I. Terebenev in a "frame" for the entire group. In contrast, the lightest gray figures are placed in the center. At the front and on the side there is another "dark" and a few gray Atlanteans. Behind them there is another one unusual and striped like a sailor Atlantean. He is not like his brothers because made of gneiss not granite. It is known that one of the granite monoliths proved to be defective, and it was "in rush" replaced with a new one. But the sculptor was hardly pleased with such inappropriate garish coloring of the figures, so obviously there is no coincidence that he turned it back, facing away from the viewer, as if he hid it behind the portico support.

The other Atlanteans are not all alike: some of them are made of light gray granite. At the base of the other figures the stone is grayish-pink. Some of the figures contain narrow black biotite mica stripes ("schlieren"), and some whole "pieces" of black rock xenoliths of the surrounding granite rocks, which accidentally appeared in it during the solidification of the magma from which the granite was formed. Dark gray to black stone cannot be called granite at all. Such rocks, depending on the content of quartz, are called diorites. Building term "granite" is actually very vague. Geologists mean a very specific rock by this term.

We can say with quite certainty that the three "dark" figures of Atlanteans, covered by a thin white "mesh" of feldspar veinlets, and possibly some of the bright ones were produced on Tulolansaari island. At the same time, the Atlanteans, which stone contains spots of pink granite are identical to Impiniemi Cape granites. The origin of three Atlanteans still cannot be defined.[13]

Alexander Ivanovich Terebenev loved working with Serdobol granite and once again proved that by making beautiful sculptures, which decorated the building of Peterhof, built under the supervision of A.I. Stakenschneider, the Pink Pavilion (1845–1848) and the Belvedere (1852–1856).

The Pink Pavilion, completely destroyed by the Nazis, was an asymmetrical one-storey building with a tower with an open terrace upstairs. A gazebo formed by sixteen high granite pillars adjoined to one of the walls of the tower, beautiful women heads completed the supporting joists of the gazebo. Perhaps these herms were made by A. I.Terebenevym from the same granite as Atlanteans of the New Hermitage.

The Belvedere, built on the Babigonsky hills, remained up to now and it is a tall building resembling a Greek temple. Around the second floor perimeter there is a terrace, decorated with twenty eight columns of polished Serdobol granite. A wide staircase leading from Meadow Park to the main decoration of the building – a massive portico with four beautiful caryatids, were also made of Serdobol granite by Alexander Terebenev.

A.I. Terebenev worked a lot, carrying out orders for monuments, busts, bas-reliefs. But to the end of his life the master never stopped thinking of such big and meaningful images, as Atlanteans. So, in 1851 he submitted a petition the Academy of Arts to grant him the title of professor and began work on the figure of Prometheus, which did not complete.

The last years of his life Alexander Ivanovich spent in poverty and disease, dismissed from the office and deprived of pensions. Forgotten and helpless, he persistently asked for work, he wanted to be useful to his country. July 31, 1859 Alexander Ivanovich Terebenev died. He was buried in the Volkov Cemetery in Saint Petersburg at the expense of his former artisan G.A. Balushkina as Terebenev's family did not have any money[14].

Analysis of the materials gained during the examination of the old quarries allows us to understand

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[12] Самойлов А.Н. Александр Иванович Теребенев // Русское искусство. Очерки о жизни и творчестве художников. Москва "Искусство". 1954.

[13] Морозов М.В., Кемпе У., Борисов И.В. В поисках Атлантиды // Сборник научных трудов. Санкт-Петербург, 2008.

[14] Булах А.Г., Борисов И.В., Гавриленко В.В., Панова Е.Г. Каменное убранство Петербурга. Книга путешествий. Санкт-Петербург. Издательство "Сударыня", 2004.

how Serdobol granite was produced on Tulolansaari Island. At first master chose the site of the rock where the stone is uniform, dense and thick without cracking. Then he marked up the future outline of the block. Special furrows 6–7 cm deep were made with a hammer and chisel over the perimeter of the work peace. And then vertical boreholes with diameter of 15–20 mm were manually drilled in these groves at a distance of 5–15 cm. For this workers used hammers and drills with the tips. One worker was holding a drill, and the other hit the drill with a heavy hammer. To avoid holes to be flocked with sludge and the metal cooled the water was poured into the holes from time to time. In the absence of crack formation, limiting the thickness of the monolith, horizontal holes were drilled further in the rock. Then they separated the block from the mass. Until the middle of the XIX century wooden, and later – metal wedges were used and the workers hammered them into the furrows between the drilled holes as a result granite cracked in given directions. In winter, the drilled holes could be filled with water, and the ice crushed the stone. In the second half of the XIX century, powder was also used to split the block, however, it caused the formation of additional cracks in the rock.

After the granite blocks were separated from the cliff, stonemasons continued the work. Using some simple miners' tools-chisel, bouchard, mallet, hammer and others, they removed extra pieces of rock from the surface of the block, giving the workpieces the desired shape and size.

According to the Journal of Engineering for 1885: "... Extracted ... granite massifs of different values from 250 to 500 pood weight lowered to the pier for ship loading and delivery to Petersburg, on the inclined plane of the 2–3 parallel bars, using ropes 6 inches in circumference put under the stone rollers; the ropes were attached by one end to a thick iron bar that was inserted into the borehole near the place where stone had been quarried".[15] That procedure was used in the places where the quarry was located near the lake. From distant quarries the stone was taken to the pier in Mentselya down the specially constructed road 1,5 km long on the sled and drags. Remains of this road can be seen in the forest now.

With the beginning of navigation granite blocks were loaded onto sailing ships with a deck and two removable masts ("Soimy"). One such vessel could carry from 20 to 35 blocks with the volume of 0,5–1,1 m^3 or 10–15 blocks with the volume of 1–2.5 m^3, the blocks were mainly placed in the hold. Large workpeaces weighing 16 tons or more were typically placed on the deck.

Stone-laden ships slowly retreated from the shores of Tulolansaari to a difficult voyage along the restless Lake Ladoga to Saint-Petersburg. People on the shore were gazing them after, until the last sailing hid behind a rocky headland of the island. There, far away, the big city was expanding, which was decorated with the stone from the lost in Ladoga skerries Tulola island.

For decades miners of Tulola using cut in granitic rocks of the island, reaching from the depths durable and beautiful light gray with a touch of heavenly granite for building palaces, temples, houses and streets of the capital and making them more beautiful.

The largest and oldest Serdobol granite pit "Glavniy" ("Ruotsenkallio-1") is located in the eastern part of Tulolansaari Island, on a flat watershed between the mountains Ruotsenkallio and Mustikkamyaki. Perhaps it was the place in where the XIX century a significant part of large monoliths for columns and Atlanteans of the New Hermitage, columns and caryatids of the Belvedere, temples and palaces of Saint-Petersburg was produced. This stone pit operated from the 1770s and was abandoned in the middle of the XIX century. In 1885, it was flooded with water.

Fig. 7. Students of SpbGU on the stone pit of serdobol gtranite"Ruotsenkallio-1". 2005

According to field studies conducted by I.V. Borisov (1995–1996), "Glavniy" pit has a complex

[15] Каменоломни сердобольского гранита// Инженерный журнал. № 6,7, 1885.

shape, but in general it is a trench stretching to the west-north-west for more than 100 m.

The pit "Glavniy" contains migmatized gneisses and biotite schists of the Ladoga series steeply dipping sheet deposit of light gray plagiogranites (Serdobol granite), up to 250 m, elongated in a northwesterly direction.

In the center of the granite body there are gray with a bluish and ashy hue, fine-grained, massive plagiogranites; from the center to the edges granites get darker and smoothly pass into the gneiss-granites and granite-gneisses.

The western part of the quarry has a plan view of a trapezoid: the southern edge is 75 m long, the northern – 40 m, with width of 30–40 m. The pit walls slightly (only 0,5–2 m) rise above the water level in the output, which can reach depths of 10–15 m. The volume of the flooded part of the pit is about 20–25 thousand m^3.

Quarry-lake is surrounded by dumps of crushed granite on the north, west and south. Blades look like ridges, stretching along the pit walls and towering over the water at 2–4,5 m. The largest dumps are located along the southern boundary of the flooded quarry: their height is 2–4,5 m, the width at the base is up to 20–30 m, at the top – 5–15 m, the length is 95 m. Along the northern edge of the pit the dumps are extended to 40–45 m, with a width at the base to 15 m, the top-up to 4 m and height – 1,8–2,8 m.

Fig. 8. The scheme of the granite quarry "Ruotsenkallio-1". Borisov I.V., 1995

Dumps of crushed stone with the height of 0,2–0,5 m are found on almost all areas around the stone pit "Glavniy", but not all of them have clear-cut shapes and borders. On the west and east of the quarry defective blocks of granite of various shapes and sizes scattered in a mess.

In the southern part of the stone pit "Glavniy" there is a shallow hollow where earlier the water was discharged from the quarry. Opposite this hollow, on the northern board output, the cross-over to the adit level was constructed.

In the north-eastern side of the flooded quarry the granite output rises above the water in three steps-ledges 0,5–1 m high. The area between the ledges is covered with a thick layer of moss. It's the most interesting place for observations and excursions.

Here, in cleared areas of moss, clearly visible natural fracture array determines the correct shape and large size of the blocks produced in the past. There are steeply dipping fissures northwestern and northeast extension, gently dipping stratal fissures. The distance between the steeply dipping fissures is on average 2,2–4 m (to a maximum of 8–9 m), and the thickness of the sheet jointing is 0,4–1,1 m. Size of the blocks in the outcrops ledges vary from 3 × 1,5 × 0,5 up to 5, 8 × 1,8 × 0,6 and even – 9 × 3 × 0,8 m. According to V. Ryleev[16] the maximum volume of the blocks here is 80 m^3. Blocks output of more than 1 m is 45 %. At the sites of "Glavniy" quarry which were not flooded there are some intermittent fissures 20–30 cm long, 7–8 cm deep, to 5 cm wide (on top), they were made along the natural fractures in the granite rock for edging the blocks.

In ledges there are clearly visible traces of vertical holes of three types: 1 – with a diameter of 25–27 mm, 0,5–1 m deep and drilled at a considerable distance from each other along the cracks northwest trending; 2 – with a diameter of 15 mm drilled close to each other at a distance of 5–7 cm along the northeastern strike and 0,2–0,5 m deep; with a diameter of 3–20 mm, drilled close to each other at a distance of 10 cm.

The northern boundary of the flooded quarry passes exactly plagiogranites contact with their host biotite gneisses of the Ladoga series.

The eastern part of the quarry "Glavniy" is a complex trench with obscure shape and size (10–20) × (30–40) × (2–2,5) m, with volume more than 1000 m^3, significantly cluttered with crushed granite and defective blocks.

To the west of the quarry "Glavniy", a bit away from it there is a broad band of workings, 0,5–1 m

[16] Рылеев А.В. и др. Изучение минерально-сырьевых ресурсов каменных строительных материалов Карелии. Институт геологии КарНЦ РАН, Петрозаводск, 1984.

deep, with the total area of 1–5 m2, surrounded by small blocks of light-gray fine-grained granites.

In the northern side of the quarry, on a gentle slope you can find some fragments of a basement, obviously of a barrack for workers or a lodge.

The area around the pit is surrounded with a thin pine forest.

The old, barely noticeable in the forest road 1,5 km long leads from the area of the former village Mentselya to the pit “Glavniy”. In the past granite blocks were transported here to the wharf for loading onto ships.

At 350–400 m from “Glavniy” quarry to the east side of the mountain Ruotsenkallio, there is a triangular in shape site with spruce plantings. In the XIX century probably there was an old cemetery there. Only inconspicuous burial mounds and two overturned monolith of granite tombstones remained. At the corner of the described spruce, near the glade there is a granite plate-monolith size 4,5×0,5×0,15 m (obviously set up at the end of the XIX century.) in memory of the glorious Tulola stonemasons. Its base is dug 5 m deep in the land and reinforced with crushed stones. The surface of the plate is covered with traces of drilling holes up to 18 mm in diameter, drilled at a distance of 5–8 cm from one another. This texture resembles the surface of the washboard. At the time of discovery, in 1995, the plate was heavily tilted toward the ground. In 1997, it was returned to the upright position, and is still in this position.

Fig. 9. The monument to the stonemasons of Tulolansaari

Serdobol granite quarry “Glavniy” is a unique natural man-made landscape and since 2002 has had the status of a monument of historical and cultural heritage of Karelia. Despite the fact that the main, the most interesting part of the quarry flooded with water, this object is very interesting from the standpoint of man-made landscape and the history of mining. The obvious implication of this quarry the extraction of column and sculptural stone makes it one of the most significant monuments of the history of mining in the Northern Ladoga and Kareliain general. The object can be very attractive for tourists who dream to visit the homeland of famous Atlanteans of the Hermitage. Since 1995, the Regional Museum of Northern Ladoga organizes scientific and cultural excursions entitled “Tulola – the Atlanteans’ homeland”.

A whole group of small Serdobol granite quarries “Ruotsenkallio-2” is 800 m to the southeast-east of the quarry “Glavniy” on the western slope of Ruotsenkallio Mount (elevation of the summit + 86,3 m), 400 m from the eastern shore of the island Tulolansaari . As it was already mentioned, the development of gray granite on Ruotsenkallio Mount could be started by the Swedes, in the XVII century.

In the pit “Ruotsenkallio-2” the stone was produced throughout the XIX century and the beginning of the XX century. Large blocks of light-gray, medium-grained, massive and weakly gneissic Serdobol granite were broken out here for construction of different buildings in Saint- Petersburg. It is possible that granite mining was stopped in 1914. Granite blocks from Ruotsenkallio Mount lowered to the lake shore on specially laid joists for loading onto ships.

The workings data was studied in detail by Borisov I.V. in 1995–1996. Along the western slope of Ruotsenkallio Mount which stretches in the north-west for about 400 m in the band 40–80 m wide, there is about 20 small granite quarries. They passed over the entire surface of the mountainside and have the form of stepped (2–4 ledges each) trenches ranging from 10 to 140 m^2, 0,5–4,5 m deep (average12 m), 2,8 m wide and 5–40 m long. Occasionally there are trenches with total area of more than 100 m^2 and 3–4,5 m deep. All workings were put down eastward, with orientation of the “main” ledges along the strike of the mountain slope to the north- west.

According to A.V. Ryleev the average distance between the steeply-dipping longitudinal cracks is 1,6–5,4 m (maximum of 8–10 m), between the cross – 1,5–1,8 m between the stratal – 0,3–1 m The average volume of blocks in the array is 1,4 m and a maximum of 33 to 100 m^2 Output of the blocks of more than 1 m is 20 %. Here you can produce blocks of up to 10–12 m long. In the dumps there were prepared blocks with cross-sections of 0,5 × 0,15 m to 0,7 × 0,8 m and a length of 4,2–4,8 m.[17]

Extreme eastern border of the workings extend along the contact with the host plagiogranites migmatized biotite gneisses of the Ladoga series. The maximum width of the development to the border with gneisses is 20–40 m. During the extraction of granite to the west of the stone pit there are dumps of crushed stone, hide that 1/3 or 2/3 of the true boundaries of the workings. At one of the sites there are 4 ledges with the height of 0,5–1,2 m. The total volume of the workings of "Ruotsenkallio-2" is about 5000 m^3.

In one place, near the old slaughter, there is a large block of granite 8.5 m long, 1–1,2 m wide and 0,6–0,8 m thick. A transverse crack divides it into two unequal parts, a length of 5, 3 and 3 m. In the dumps of crushed stone and defective blocks fairly large granite monoliths size: 4×0,85×0,45 m; 3,5×1,1×0,5 m, etc can be seen. In the mining benches there are mined, but not removed block of the following size: 1,7×1,4×0,7 m; 1,5×1,1×0,7 m etc.

In the ledges and on the extracted blocks there are traces of holes 25 mm in diameter, drilled at a distance of up to 10 cm or more.

The territory, where the production and the dumps were, now is covered with pine forest. Workings ledges are covered with a thick layer of moss. The pit "Ruotsenkallio-2" is also of a considerable interest for the history of landscape and mining. Along with "Glavniy" quarry it is a unique natural man-made complex and has the status of a monument historical and cultural heritage of Karelia (since 2000). The largest and most accessible workings of this complex is included in the tour program "Tulola – the homeland of Atlanteans", organized by the Regional Museum of Northern Ladoga .

An interesting Serdobol granite quarry ("Ruotsenkallio-3") is located in the south-eastern slope of the mountain Ruotsenkallio in 400 m to the southeast of the pit "Ruotsenkallio-2", 250 m from the eastern shore of Tulolansaari Island.

In the XIX century at those workings blocks of light-gray, medium-grained, massive and weakly gneissose plagiogranites (Serdobol granite) were mainly quarried. It was used for construction and decoration of Petersburg buildings and construction sites. Granite blocks were dragged to shore on specially engineered joists, where they were loaded on sailing ships and sent to the capital. At the beginning of the XX century the quarrying was abandoned. The object was studied in detail by I.V. Borisov in 1995–1996.

Fig. 10. Students of SpbSU with an "unfinished" Atlantean

"Ruotsenkallio-3" is a kind of an open to the lake quarry, its size is (5–26) × (75–85) × (2–3) m, and it stretches along the strike of the slope at the foot of the mountain. The height of the western ledges of the quarry reaches 2–3,5 m. The production is 2000 m^3. Outlines of the quarry are complex with complicated and dense natural fracture array on the workings site. Steeply dipping and vertical cracks of East-West direction dominate; the cracks of northeast direction are less developed. The blocks of trapezoidal stele, cuboid, and platy forms were typical for that quarry.

The working platform of the quarry is almost entirely inundated with and defective units their size is 1,8 × 0,75 × 0,4 m; 1,0 × 1,5 × 1,8 m; 1,1 × 1,0 × 0,5 m; 2,0 × 1,0 × 1,0 m; 1,2 × 0,7 × 0,3 m; 1,0 × 1,1 ×1,0 m and volume is 0,5–2,7 m^3.

On many blocks there are traces of vertical holes with a diameter of 22 mm and 25 mm, drilled in two mutually perpendicular directions "in line" at a distance of 10–20 cm and at a depth of 0,7–1,2 m. Some holes are 50 mm in diameter.

"Ruotsenkallio-3" quarry is also a monument of historical and cultural heritage of Karelia and included in the tourist route "Tulola – the birthplace of the Atlanteans."

150 m to the southeast of "Ruotsenkallio-3" granite quarry and 50 m from the lake there is an inte-

[17] Рылеев А.В. и др. Изучение минерально-сырьевых ресурсов каменных строительных материалов Карелии. Институт геологии КарНЦ РАН, Петрозаводск, 1984.

resting working of dark-gray quartzitic sandstones and quartzites. Its location can be determined by a small tail of crushed stone and blocks, slipping down the slope to the shore.

In 1963 P.A. Borisov mentioned that on the shore of Tulolansaari island next to Lyaskelya there was an old quarrying of dark gray, almost black micaceous quartzite, where blocks and plates up to 2 × 1,5 × 0,6 m in size were mined.[18]

Indeed, in the late XIX – early XX centuries blocks of quartzite and quartzite-sandstone with the volume of 0,2–0,5 m^3 were quarried there for construction purposes and for making tombstones. Stone was taken out on the trench to the mouth of the working, and dragged to the shore, where it was loaded onto ships. Those dark massive quartzites and quartzitic sandstones could be taken out to St. Petersburg under the guise of "Serdobol granite" as a limnologist A.P. Andreev wrote.[19]

That quarry was studied in detail by I.V. Borisov in 1995–1996. In the plan the quarry looked like a trench 6–8 m wide, 1–2,5 m deep, and extended almost to the north for about 40 m, up to 500–550 m^3.

The mined layer consists of "drain" massive micaceous quartzite and dense quartzite-sandstone with a capacity of up to 6 m, which occurs among schistose and micaceous quartzite sulfidized sandstones of Ladoga series. The rock mainly consists of quartz (70–75 %), plagioclase (5 %), biotite (20 %), sericite, epidote, apatite and ore mineral.

In the south-western part of the trench one can see the contact of massive, dark gray quartzite and quartzite sandstone with softer schistose micaceous quartzite sandstone unfit for building. The rock layers extend in East-West direction and gently fall to the southwest. Cracks in the array are located mainly along the seams, but have a steep drop. There are also intersecting cracks of northeast and northwest direction. "Major" sides of the working are oriented along the east-western cracks.

In the southern part of the trench the quarrying was carried out by two ledges up to 1, 5 m high. The working is swamped with large chunks up to 6–12 m^3.

Many defective units thrown along the sides of the trench and on the lake shore have traces of the holes 22 and 27 mm in diameter, drilled in mutually perpendicular planes at a distance of 6–8 cm from each other.

The pit of "Ruotsenkallio-4" is easily accessible for inspection. Hiking trail on the Ruotsenkallioko mountain with the new quarrying of Serdobol granites runs alongside. This quarry has also been a monument of historical and cultural heritage of Karelia since 2000.

Two more interesting production quartzites and quartzitic sandstones ("Suuri Tulola-1" and "Suuri Tulola-2") located in the 200–300 m south of the outskirts of the village Suuri Tulola in the woods, on the western slope of an unnamed mountain, to the west of Kianmyaki mountain and to the north of Ristimaki mountain.

Probably in the late XIX – early XX centuries in these workings blocks of quartzite-sandstone and quartzite were broken, and later were used for local construction on Tulolansaari island or exported under the guise of "dark" Serdobol granite for construction purposes in Saint-Petersburg and Sortavala. "Suuri Tulola" quarries were studied by I.V. Borisov in 1993.

The pit "Suuri Tulola-1" was put down across the strike of relatively gentle slope rock, and looks like a trapezoidal shaped trench, its size is (8–15) × 17 × (1,5–2) m and the volume is 200–250 m^3. The quarry area is inclined towards the fall of the slope to the west, and swamped with crushed stone. In northern pit the wall of the quarry is covered with rusty streaks, formed by the weathering sulfidized sandstones and steeply tilted inward rocky massif. The massive material is dark gray fine-grained micaceous quartzite sandstone and quartzite with occasional whitish- gray quartz runs. The array on the site is broken by steeply dipping fractures of the northwestern and northeastern strike. In the ledge there is a hole with a diameter of 50 mm. In the defective units lying on the ground there are traces of holes 15–17 mm in diameter drilled "in line" at a distance of 10 20 cm .

The qurry "Suuri Tulola-2" is located in 20–30 m north from the previous one, down the slope. It is a trench running across the slope rock from its very sole bottom, its length is 20 m, the width is 6 m (bottom) to 10–12 m (above) and the depth is 0,5 m (below) to 2,5 m (above). The volume of production is 100–120 m^3. The working platform (sole) of the trench is heavily tilted towards the falling slope. Traces of drill holes were not found.

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[18] Борисов П.А. Каменные строительные материалы Карелии. Карельский филиал АН СССР. Петрозаводк, 1963.

[19] Андреев А. П. Ладожское озеро. Санкт-Петербург,1875.

The workings "Suuri Tulola" are of particular interest to local history and the history of mining and of landscape science, but not attractive for tourists because of their remoteness from the hiking trails and small size.

To the west of Ruotsenkallio mountain in the upper part of the western slope of Mount Mustikkamyaki (86,7 m) and its foothills there are more than a dozen of small mines, made in the late XIX – early XX centuries in the course of exploration and production of Serdobol granite.

According to A.V. Ryleev at the top of the mountain Mustikkamyaki, there is a small production area up to 200 m^2 in size. At the foot of the mountain there are some larger working areas 400 m^2 in size and 1–3 m deep. The workings opened one upper adit level of granites and only in the large cavities 2–3 layers were exploited.

The distance between the cracks varies from1,6 to 9,6 m. Diagonal cracks split the rock onto wedge blocks.

On the site there are plagiogranites (Serdobol granite) with increased or irregular fracture, consisting of plagioclase (33–41 %), quartz (24–42 %), microcline (up to 6 %), biotite (11–24 %), amphibole (4–8 %).[20]

The pit "Mustikkamyaki" has not been studied well enough to evaluate the tourist potential and the place in the history of mining and landscape science. A significant distance from hiking trails and the island shores play their negative role. Further geological landscape studies are required.

Until 1940 in the northwestern part of the island of Tulolansaari on the peninsula, there was a small settlement called Pieni Tulola. Matti Yurvanen's house was the starting point of the winter crossing of the strait. When the ice was still light those who wished to go to the city gathered there. Although at a distance from each other, together the islanders were not afraid to go out on the light ice. The boldest of them went ahead. Pekka Uimonen was the bravest.

Not far from this village, on the shores of the lake, to the north of the Cape Uytonniemi where the concrete lighthouse is situated, along the high and steep cliffs on the distance of 500–600 m there is an intermittent chain of small mine workings. In the late XIX – early XX centuries the Finns mined there blocks of small-medium dark gray, almost black, thick and slightly schistose biotite amphibolite with an average size of 1 × 1 × 2 m for construction purposes and manufacturing monuments. It is possible that those amphibolites in the past were also mistakenly thought to be a kind of dark Serdobol granite. Throughout the coastal slope, pitted with small excavations, there are some notable quarries that were studied by I.V. Borisov in 1993.

80–100 m to the north of the lighthouse at the Cape Uytonniemi at the top of the coastal array, there is an area of 20 × 20 m^2 marked with a group of small obscure workings ("Uytonniemi-1") of 10 m^2 in size and 0,5–1 m deep. The territory is swamped with crashed stone. One block in the array reaches a length of 2 m, with a thickness of 1,1 m. On its surface there are traces of 30 (!) holes drilled "in line" 20 mm in diameter at a distance of 5 cm from each other. In the dumps there are blocks of different sizes, one of which reaches a length of 0,8 m on its surface traces of 9 holes of 20 mm in diameter, drilled "in line" at a distance of 5 cm apart.

150 m north of the lighthouse at the Cape Uytonniemi at the top of the coastal slope, a fairly large pit "Uytonniemi-2" is located where at the end of the XIX century – the 1930s blocks finely grained dark gray biotite amphibolite size to a maximum of 2 × 2,5 × 1,2 m were mined.

This quarry is a long trench 6–7 m (at the beginning) and 16–18 m (at the bottom), 6–7 m wide, 1,5–3 m deep, and is passed at the very top of a steep coastal slope along its stretch. The volume of the working is up to 150 m^3. In the plan the quarry has a trapezoid shape, elongated north-northwest.

The "main" ledge with a height of 3–3,5 m is clearly visible. There is a block prepared to separation more than 2 m high and 0,9–2m wide. On the outer edge of the block there are traces of 29 vertical holes 20 mm in diameter drilled in the 1/2–2/3 depth (1,3 m) at a distance of 5 cm from each other.

The "side" ledges of the working are passed by crushing zones. In general, a fracture in the area is moderate, the average distance between steeply dipping fractures is 1–2 m.

The platform (bottom) of the pit has almost horizontal position, and ends with almost 3 meter long natural ledge behind which there is a trail of crashed stone and defective units of various sizes and shapes.

[20] Рылеев А.В. и др. Изучение минерально-сырьевых ресурсов каменных строительных материалов Карелии. Институт геологии КарНЦ РАН, Петрозаводск, 1984.

The blocks mined in the quarry were dragged to the shore for less than 100 m, with the help of boards and rollers, and then loaded onto ships.

"Uytonniemi-2" is of a great interest to local history and the history of mining in the region. It also might be interesting for tourists, but is located away from the tourist routes.

A whole group of amphibolites workings (Uytonniemi-3) is located 300 m north of the lighthouse Uytonniemi also at the top of the steep coastal cliff.

Here, the area of 100 × 40 m^2 is marked with three quarries where in the first third of the XX century the Finns quarried blocks for building and construction sites, the size of the blocks was maximum 4,0 × 0, × 0,4 m – 2,6 × 1,4 × 1,2 m.

The pit "Uytonniemi-3a" (the southern one) looks like a trench 15 × (12–22) × (1,5–4,5) m, its volume is 450–500 m^3. In the ledge there are traces of holes 22 mm in diameter, drilled "in line" at a distance of 5–10 cm from each other, and the diameter of the single holes is 30 mm and 40 mm. There are dumps of crushed stone.

The central pit ("Uytonniemi-3b") is located 25 m north from the previous one and has the form of a trench (1,5–4) × 30 × (2–4) m.

The most northern quarry complex ("Uytonniemi-3c") lies 20 meters north from the previous one and has the form of trench with a size (1–2) × 15 × (1,5–2,5). The volume of the latter two workings is difficult to determine because of their fuzzy boundaries. The traces of holes were found there.

This complex of workings is of a considerable interest for the history of mining and landscape science. Since the object is located not far from the water tourist route, it can be visited by tourists. The pit should be declared a monument of industrial culture.

500–600 m north from the lighthouse at the Cape Uytonniemi at the top of the cliffs there is another pit of amphibolites – "Uytonniemi-4", the largest in the area. It is a trench the size of which is (15–20)× 30 × (3–6), and the volume is 1500–2000 m^3. The boundaries are fuzzy and quite complex. There are more than 3 quarry ledges 1,5–2,5 m high.

The real number of ledges is difficult to determine because almost all the space is filled up with blocks up to 1 × 1 × 2 m or less. The walls of vertical ledges have traces of holes approximately 27 mm in diameter drilled at a distance of 10–15 cm from each other. On the pieces of the crushed stone there are traces of holes 22 mm in diameter, located "in line" at a distance of 8–10 cm and 15–17 cm from each other. In the early XX century in this quarry blocks up to 1–2 m^3 were mined for construction purposes and manufacturing tombstones.

The quarry "Uytonniemi-4" can also be of interest to local lore, mining history, landscape science, but it is not attractive to tourists, because despite its large size and relatively easy accessibility the pit is significantly swamped by crushed stone and blocks.

Settlements of Rasila, Putsinlahti and Mentselya are located in the southeastern part of the island of Tulolansaari and until 1940 belonged to the school district "Rasila". The school in the village of Putsinlahti was built in the late XIX century. Initially, it was called "Tulola", and after construction of a school in Suuri Tulola it was renamed into "Rasila". From school located on a hillock one can see a magnificent view of the bay Putsinlahti (a "scoop-bay") , named for its round shape resembling a scoop. The bay is surrounded by high mountains, among which the most notable is Linnamyaki mountain ("fortress"), on top of which there are still ruins of a medieval Karels' hillfort.

Almost the entire population of Putsinlahti consisted of the Lambergs. In 1936 from the island of Riekkalansaari to Tulolansaari, across the strait, a telephone cable was held, and in Putsinlahti a telephone station was built which was in charge of Pekka Lamberg.

Before the War In the eastern part of the island of Tulolansaari there was an ancient village of Mentsely. In the early XX century the largest houses in the village belonged to merchants Vladimir Filippov and Spiridonov, and farmers Hilkamo and Villiano. Almost each house had a garden.

Until 1913 there was a Russian school in Mentselya, but not many students studied there. In the summer of 1908 Archbishop Sergius and Archimandrite Kyprian came to the school. The choir from Putsinlahti prepared a song for the rare guests. The head of the Finnish eparchy liked the song very much and invited the choir to sing once again during the church service.

Before the Revolution the village Mentselya was predominantly settled by Orthodox Karelians, Finns and Russian. Both Orthodox and Lutherans together visited all religious meetings, which were held in public houses and schools of the island. They sang in a church choir. The islanders liked to sing very much. According to a legend, the gift of singing was given to them by Ladoga waves. There were two chapels on the island. To worship the islanders went to the island of Riekkalansaari and Sortavala.

In the southern part of Tulolansaari island there was the village of Soukanranta. This settlement appeared at the end of the XV century and was called Untialai Lohkala. Part of the village of Soukanranta was situated on the neighboring Oryatsaari island that in the postwar period was also called "Small Tulon". Mostly Orthodox people lived there. They met together in public houses on Sunday evenings, and sometimes in the middle of the week to pray and sing. In many families family services were held. There was also a Sunday school in the village.

The most favorite place for youth games was a green lawn of Putomyaki mountain, where on Sunday summer evenings one could heard merry melodies and songs sung by the residents of the village returning on boats home from the mowing. The residents of Soukanranta mainly were engaged in agriculture, and to a lesser extent in fishing.

The most notable house of the settlement was situated on the shore of Sininsalmi strait and belonged to Juho Pulkkanenu – the master who was also engaged in social work and other construction on the island. In 1927 on the Mount Yanatuynen Juho Pulkkanen built a school, where until 1939 the schoolteachers were Hilma chaff Gera Lael Lingvist, Saara Alina Hämäläinen.

In Rasila and Soukanranta school districts building stone mine workings were not found. The local population was mainly engaged in farming and fishing, but some residents earned money on the stone quarries in the northern and eastern parts of the island.

At the end of the "Winter" War (1939–1940) all former Finnish and Karelian population of Tulolansaari island was evacuated to Finland, and immigrants from Astrakhan region and other regions of the USSR arrived to the island. 68 families, who were farmers of the fishing cooperative "Leninsky Put" settled free Finnish houses. The chairman of the collective farm was Maxim Gavrilovitch Markin.

Peaceful life lasted only nine months when the Great Patriotic War. Tulolansaari residents were evacuated to Lyaskelya, then to Vologda region, the Khanty-Mansiisk district.

In 1941–1943 many residents who lived on Tulolansaari before the war returned to the island.

After the war in 1944, Soviet immigrants came to the island, most of them were from Belarus but there were those who had come here in 1940. The restored collective farm "Leninsky Put" was mainly engaged in fishing and crop production. Its chairman in 1945–1952 years was Vasily Popov, in the 1952–1955 – A.F. Mininin, in 1955–1956 – N.A. Kustov. On the fields of Tulolansaari the farmers grew potatoes, beets, carrots, cabbage, cereals like barley, oats, and rye. They also kept cattle, pigs, and sheep. A primary school, a club, an infirmary and a shop were opened. Only in the mid–1950s electricity, telephone, wired radio was conducted to the island. In summer the residents of the village went to the city by boat and in the winter they skied.

In 1956, the farm "Leninsky Put" was liquidated, and its land was attached to the farm "Sortavalsky". In the early 1960s, residents of the island began to move to the mainland – in Sortavala, Sawmill and the neighboring Riekkalansaari island. The last inhabitants left the island in 1968. In 1966, the lands were joined to Toulon State Farm "Priladozhsky", which organized young pastures and meadows for hay on the island till 1993. In 1996 the direction of livestock farm was liquidated, and agricultural land on the island Tulolansaari were not used.

Over the past half-century cultural landscape of the island Tulolansaari changed drastically. Arable land and meadows are covered with bushes, and in many places with the forest. However, even now entrepreneurs harvest hay on the meadows. In the places where houses and outbuildings were only piles of stones remained. Orchards were frozen and degenerate. Tulola Island almost returned to its original state when there were no citizens there. But, nevertheless, one can sometimes feel the presence of people who lived there. The wise forest on the rocks, narrow, disappearing between meadows, dying apple orchards, mysterious ruins of buildings still attract tourists and researches. You can wander through the long overgrown tracks, where the islanders went to each others homes and their children ran to school, and look at the ruins of houses where the life was in full swing, trying to resurrect the past.

According to staff at the Regional Museum of Northern Ladoga region, the island of Tulolansaari with a large number of historical and cultural monuments (archaeological sites, historic quarries, memorable places) can be very attractive and interesting for different groups of people. It is not just the land, which has been waiting for its owner. We are talking about the proper use of natural, historical and cultural heritage of this island for the recreation and tourism development.

According to the concept of a national park "Ladoga Skerries" Tulolansaari island will become a kind of a nature reserve with interesting tourist destinations, "open air museums" and recreation sites. At the same time the forest will be free to go gathering mushrooms and berries.

The Park will not include former agricultural lands of the island, which can still be used in the traditional agriculture and for the organization of private farms. Lots of people would like to buy land on Tulolansaari, however, the government should not hurry to sell it in order to preserve the natural environment, historical and cultural monuments of this island. Before allocating the land for farming, the district administration should carefully evaluate all possible consequences. It is important to consider their historical and cultural significance, as for example, in the case of former house of a merchant A.A. Barinov. As well as historical Serdobol granite quarries, which have the official status of a historical and cultural heritage (of mining) since 2000, but still may be interesting for miners.

To create the national park "Ladoga Skerries" is the only way to preserve the posterity of the unique nature and cultural landscapes of Tulolansaari with peaceful coexistence of farms and specially protected but available for tourists areas.

According to the professor of the Saint-Petersburg University of Economics and Finance , Vladimir Mikhailovich Razumovsky due to unique quarries where memorial, columns and sculpture stone had been mined, archaeological sites and other places of memory Tulolansaari island can claim the status of UNESCO monument. Maybe someday it will. Tulolansaari island should become the reserved area of Northern Ladoga, a kind of "open-air museum", a "temple of science and art", as an artist and a thinker Nicholas Roerich dreamed it to be.

MARBLE ISLAND UVEN

I.V. Borisov

On the north of Ladoga Lake, not far from the mouth of the Janisjoiki River, there is a small island – Kalkkisaari (translated from Finnish – "lime island"), where rare in its beauty, black-and-white wavy-striped marble, resembling petrified seaweeds, was quarried from 1769 to garnish palaces and churches of Saint Petersburg.

Probably, already in the first half of the XVII century people living in the neighboring village of Joensu (translated from Finnish – river mouth) found white stone, which turned into lime when being burnt in the fire, on the specified island spaced at only 200 m from the mainland shore. And they called this stone so – "lime" quarried it quietly for own needs. The local people called the island itself Arensaari or Aresaari.

Fig. 1. Marble Island Uven (Arensaari, Kalkkisaari)

Decades passed… An apprentice of stone-cutting craft Andrey Pilyugin, who came from the capital, and Serdobol Pastor Samuil Alopeus visited Arensaari Island in August, 1765. Under the order of Catherine the Great search of construction stone for the decoration of palaces and churches of Saint Petersburg was started in Vyborg County. S. Alopeus had already known from the local people about the emergences of "lime stone" on Arensaari Island and decided to show them to the specialist.

Andrey Pilyugin viewed Arensaari Island and selected some samples of "lime stone" that appeared to be the real marble. He came back there the following year, and at the end of 1766, with the help of hired workers, founded a test quarry on the island. Marble blocks quarried there were sent on a galiot to the capital in autumn.

Mining men gave a new name to Arensaari Island – Joensu or Joen – after the name of the nearby village. In 1767 "Joensu" quarry was inspected by mining officials from the capital – Captain of the Guards Kozhin and Colonel Ivan Vasilievich Zverev. Industrial mining of decorative marble was started on Joensu Island from 1769, after the decree of Catherine the Great, and it lasted for several decades.

The name of the island and the marble quarry of Joensu sounded in Russian language as Iovensu, Yuvensu, Uven. The latest name – Uven – was mostly used among Russian architects, masters and mining men at the end of the XVIII – beginning of the XIX centuries, therefore the marble, quarried on the island, was called "Uven" (uvenskiy).

"Uven" (Joen) marble quarry worked from 1769 till the 1805–1810-s, and then, after a long break, in the second half of the XIX century; and during that time it gave to Saint Petersburg and the Valaam Monastery a great amount of decorative marble.

Uven marble belongs to dolomitic marbles of the upper level of lime carbonate accumulation of Sortavala igneous-sedimentary series of the lower Proterozoic. It is characterized by clear curved light-gray, white, dark-gray and greenish-gray stripes of 5–20 centimeters width, rhythmically changing each other. Such contrast "black-and-white" with green stone pattern can be well seen even from far away what explains its high popularity at the end of the XVIII century.

Sometimes wavy stripes of Uven marble resemble petrified sea waves. On close inspection rough dark-gray stripes, in their turn consisting of thin light-gray and dark-gray intermediate layers, can be seen in the stone. Aggregates of dark-green actinolite, adding greenish color shade and "fiber" structure to the marble, are not uncommon in these intermediate layers. Uven marble was fairly well nobbled and polished, though its quality was a bit lower than that of the other Karelian marbles due to high cleavage, its limited reserves, structure-and-texture monotony, a large amount of impurities of silicate minerals and sulphides.

From 1769 till 1796 marble quarry on Uven Island was under the jurisdiction of the Office of Saint Isaac Cathedral Construction, however during this period it supplied marble not only for the facades and interiors of Saint Isaac Cathedral (the 1768–1780-s, A. Rinaldi), but for other constructions of Saint Petersburg. Thus, Uven marble went for the manufacture of portico columns and hall of the former residence of Prince Apraksin (the 1770-s), wall fielded panels and door trims of the main staircase in the gorgeous Marble Palace (1768–1784, A. Rinaldi), floor and window boards of the Winter Palace (the 1770-s, I. Starkov, A. Rinaldi and others).

Fig. 2. Uven Islands is Almost Completely Comprised of Marble

Small amount of Uven marble was used by Antonio Rinaldi for the erection of mile stones on Tsarskoye Selo (1772–1775) and Peterhof (1777–1787) roads, Chesme Column (1777–1779) and Orlovsky gate (1772) in Tsarskoye Selo. Unfortunately, there are very few pieces of information concerning the use of Uven marble in the constructions of Tsarskoye Selo and Peterhof, and it is often conflicting.

The Office of the Mikhailovsky Castle Construction started to manage "Uven" marble quarry from 1797, but then marble was hardly quarried on the island. Emperor Pavel I, who was in a hurry to finish the construction of his residence, ordered architect V. F. Brenna to take stone for the castle's facing not only in the quarries, but from the uncompleted Saint Isaac Cathedral by Antonio Rinaldi. Fielded panels, cut into the rustication of Ruskeala marble from the side of the Mikhailovsky Castle's "south" façade were implemented from Uven marble.

From 1803 Uven marble quarry was passed under the jurisdiction of the Commission on Kazan Cathedral Construction. Then Uven marble decorated the stand of "Royal pew" inside Kazan Cathedral (1801–1811, A. Voronikhin).

In the 1780–1790-s Uven marble was also developed by the Valaam Monastery for getting construction lime. Stone buildings were started to be built on Valaam at that time.

Marble on Uven Island was stopped to be quarried for the capital in 1805–1810, and it was forgotten for a long time. It was remembered about only in the second half of the XIX century, when large-scale stone construction works were started on Valaam under the order of Hegumen Damaskin (he was head of the monastery in 1839–1881). Then the Valaam Monastery rented Uven Island and brought out from it almost all break stone, crushed stone and blocks remaining from previous works. Small pieces of marble were burnt for construction lime and bigger ones came to the hands of stone-cutters and later decorated many monastery constructions. It is not inconceivable that mining works were resumed on the island and continued till the end of the XIX century.

Different construction on Valaam are implemented from Uven marble: a base of the Chapel of the God's Cross Sufferings (1842, A.M. Gornostaev); the Chapel of the Sign of the God' Mother (1862, A.M. Gornostaev); decorative inserts of Vladimirsky bridge (1861); fence posts of the Hegumen's Cemetery; a base corbel and floors of the "cemetery" Church of the Venerable Fathers, Lit Up With the Fast and Prayers (1876, G.I. Karpov); friso of the iconostasis in the Cathedral of the Transfiguration of the Saviour (1887–1896, A. Silin, G.I. Karpov, N.D. Prokofiev); a base of the Holy Gates and fence along the eastern line of the Monastery square (1892); the Edicule in the Church of Andrew the First-called (1901–1906, V. I. Barankeev); walls of the wells; base of the Eastern gates of the Skete of All Saints and so on. And any place, where this marble was used, the constructions have the special beauty without which you just can not imagine Valaam.

The Chapel of the Sign of the God' Mother built in 1862 under the project of architect Aleksey Gornostaev in the memory of the visit of Emperor Alexander II to the Valaam Monastery, is a hymn to Uven marble on Valaam. From outside it seems that the chapel is cut from one block mass of black-and-white wavy-striped marble. In deed and not in name it is comprised of several figure marble blocks exactly fitted to each other by a firm hand of stone-cutter master. The spirit of

Old Russian Suzdalian architecture is felt in the whole concept of the construction. This can be seem only in central Russia and Arkhangelsk region where churches made form white lime stone are extant. Pattern of Uven marble here is of two colors – white and black with different color shades up to greenish one. Big, weak-wavy stripes, clearly seen even from far away, delight the eye, relax and set for prayer.

Fig. 3. Uven Marble in the Church of Andrew the First-called on Valaam

Uven marble found its good use also in different constructions on the other islands belonging to the Valaam Monastery. This wonderful stone was, for instance, applied for walls of the well in the Skete of Elijah the Prophet on Lembos island and in the Skete of St. Avramy of Rostov on the Emelyanovy islands, interior furnishing of the Chapel of the Skete of St. John the Precursor (1855–1858, A.M. Gornostaev), window sills of the church in the name of Saint Blessed Prince Alexander Nevsky (1903, V.I. Barankeev) on St. Herman's island.

In the XIX century quarry of marble continued from time to time on Uven Island for the production of lime; and it was the reason for the Finns to rename the island and it started to be called Kalkkisaari ("lime").

Marble for the capital's decoration was quarried by drill-and-fire and drill-and-slip systems. Absence of overburden rocks made the works easier. Fist, mining men made "undermining" – a horizontal cutting – in the shelf. For this, they manually made holes (blast-holes) in the rock by "iron drills", up to 170 cm length and 2,5 cm diameter, continuously pouring water into them. It happened the following way: one mining men was holding the drill and the other was hammering on it. So, a couple of workers drilled from 2 to 3 m in the rock. After the necessary amount of holes was made, they were dried, filled with gunpowder and fired. Due to the explosion, drilled out part of the rock fell into pieces which were then removed. After driving the "undermining" two vertical cuttings were made the same way. Then, from the side of the rock "tail", along the prescribed line, new holes were drilled to the whole depth of the shelf, and they were also filled with gunpowder and blasted. Consequently, a block of marble drilled and dig from all sides, appeared on the bottom of the quarry. If it was necessary, big blocks were cut into smaller one.

Natural cleavage prevented getting large-size blocks, however it was not uncommon when marble block masses of up to 3–4 m long and up to 0,5–1 m width, suitable for making columns, were quarried.

When quarrying and roughing stone there were a lot of crushed stone, break stone and rejected marble blocks that local people used monks of the Valaam Monastery for getting lime.

Uven quarry, despite the fact that many years have passed from the moment it was closed, has been very good preserved. It occupies 2/3 of the island and presents a semi-cutting of 90–100 m long, 35–40 m width and 2–14 m depth, opened to the south, to the lake. North side of the working of 2–5 m height goes on the border of marble rock mass with underlying amphibolic shists and calc-silicate hornfels.

In the western part the quarry reaches its maximum depth (14 m approximately) and takes the shape of cutting with dimensions 25 × 20 m; its bottom, covered with water, lies 2–4 m under the level of Ladoga Lake. This is exactly the place where marble blocks of up to 2–4 m length were quarried for Saint Petersburg at the end of the XVIII century. This deepest part of the quarry was poured by Ladoga water that was constantly pumped. Now it is hard to define the real dimensions of the flooded cutting the banks of which are thickly bushed.

Next to it there is a coast, where sailing decked ships-galiots could come to be loaded wit stone. Marble blanks that can be seen on the lake's bottom and big iron rings forged to the rock give evidence of it.

Bottom of the eastern part of the quarry is located only 2–3 m higher than the present-day level of Ladoga Lake, and at the beginning of the XIX – only 0,7–1,5 m, so, in full-flowing years Ladoga waves could cover almost all the working. And exactly this fact (it is impossible to quarry deeper) became the reason for closing Uven quarry.

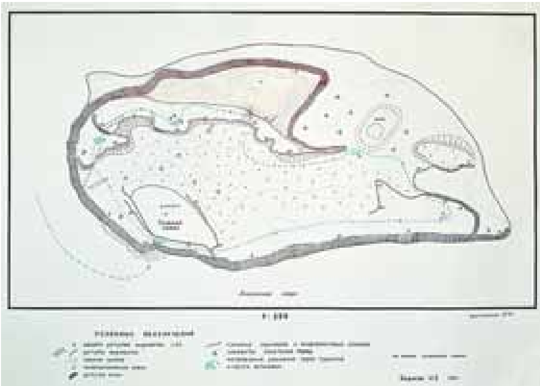

Fig. 4. The plan of Uven Quarry. Borisov I.V., 1997.

The eastern part of the quarry is filled with a layer of break stone left from the previous works. Marble for getting construction lime was quarried here. The ruins of a burning kiln are preserved on the coast.

Uven Island (Kalkkisaari) is a beautiful place for having a rest. Hijdenselga villagers (in the past – Joensu) took fancy to the island. There almost no trees here. On a bright, sunny day, grayish-white marble blinds a little. Light wind from Ladoga refreshes. You can hear the quiet play of the waves – the lake's breath. You feel easy in you mind, it delights your heart to see all this natural beauty…

Tourists and students, wishing to see the quarries where marble was quarried for the famous constructions of Saint Petersburg and Valaam, visit Uven Island several times per year.

In 1998 "Uven" marble quarry was declared to be the monument of mining industry; however it is possible to quarry stone for small restoration works here. In some cases Uven marble can be replaced by similar sort of Ruskeala marble.

THE MINING PHENOMENON OF OLONETS DISTRICT

M.Y. Dankov

In the XVII century the representatives of the glorious "Hamburg" Marselis family and a lucky merchant Henry Butenant moved to the East and since that time were directly related to historical riddles of metallurgy of Olonets District. The Marselis merchant family dates back to the older Marselis Gavril, who lived in "foggy" Muscovy for 30 years and led the trade there linking Russia with North German cities. However, his son Marselis Pyotr Gavrilovich was the most interesting figure, he was born in 1602 in Rotterdam, but a year later, he moved to Hamburg with his parents. Since 1629 the young entrepreneur had entrenched in commercial elite of Russia, and for decades successfully implemented the "super" profitable projects. Having the lease contract with Russian Patriarch Nikon of 1655, through the trading house "De Vogelari & G. E. Klenk" the nimble merchant owned the fishing monopoly in the White and Barents Seas. In addition Peter Marselis, "on the vine" bought timber from Arkhangelsk and sold it in the Netherlands states. The project was named "A Contract for masts from Muscovy".

However, P.G. Marselis was the first among the foreigners who understood the benefit from investing the mining, metallurgy, searches of new fields, and the construction of ironworks. Prior to coming to "unknown" Zaonezhje land in 30-40 years of the XVII century the entrepreneur skillfully manipulated credit and skillfully used financial difficulties of the Dutch Abraham and Andrias Vinius. Thanks to government loan, he and F. Akemi started metallurgical business in Tula. We should note that A.D. Vinius built the first blast furnace in Russia, he was also the owner of many water operating ironworks and had an exceptional contract for casting cannons in Tula region.

Having realized the benefits of the mining manufactory, P. Marselis soon acquired the license to build and operate the armories on the Vage, Kostroma and Sheksna rivers for 20 years. Since 1648 "in the Tula and Kashira in Yaroslavl and other counties" the merchant owned those plants with Akemi, but without Vinius. Having started his business Marselis expanded his armory empire. That was the time "of luck" of the entrepreneur who gained the rent of ironworks at the Protva river for fifteen years from I. D. Miloslavsky. At that time 16 km from Tula "Kashira metallurgical complex" was started. However, the takeoff was inevitably followed by the fall. Despite the Marselis friendly relationships with the "boyars" and favor of the monarch, the iron plants for some obviously criminal "guilt", were "assigned to the sovereign". Here is an extract from the fiscal decisions: "And in 170 (1662–M.D.) by the decree of the Great Emperor, all Marselis's iron plants became the property of the Great Emperor and the other half was given to Philemon Akema". In fact, the state confiscated the property of the lucky metallurgist. Meanwhile, that was not the end of the commercial success of the foreigner. A decade later the "gamburzhinin" became the pioneer of the weapons industry of Karelia.

A retrospective look at biographical quirks of P.G. Marselis proves the idea that the arrival "to Olonets" with the aim to create "a metallurgical paradise" on the edge of the world, was not born spontaneously, it had his own logic and history.

Wild and sparsely populated county graveyards of Olonets district caught the eye of the "Holstein" in the late 60-ies of the XVII century. Owning the skill of an experienced manager and anticipating the economic success, in 1669 he got from Alexei Mikhailovich the privilege to develop iron and copper ore in Obonezhie. Despite the remoteness of the territory and the lack of roads from the metropolis, Marselis certainly understood the value of Karelian iron on the continental fairs. Metal supply was caused by the needs of Moscow government in a good iron, besides homebrew ways were famous on the Northern Dvina and the "City".

Even before Peter Marselis some peasants-"dowsers" were actively involved in the search for ore in Zaonezhie. After the decree of 1666 "for the inquest of copper ore" in "Tolvuyskiy and Shunsky" pogost of Olonets county, the first search expedition directed by a Novgorodian Semeon Gavrilov was formed, it included two foreign pioneers – a Dane founder Denis Yuryshev (Ioris) and Swede, doctor Nicholas Anderson.

S. Gavrilov received a loan of 260 rubles to offset salary, and a substantial supplement for a future plant on Spiridonovskiy stream in Foymogubskaya volost.

The pioneers used the money of Olonetsk prikaznaya izba, Povenets customs as well as "tavern" profits. But Gavrilov did not even start smelting copper on the western shore of Lake Onega. Three years later, allegedly because of "poverty" and the remoteness of the ore production, the concession was closed. So in 1669 the right to develop copper deposits was transferred to P.G. Marselis. Today it is hard to say what type of metal in the distant lands of Karelia a man with "Hamburg grip" dreamed to produce. Probably it was the development of iron ore deposits. However, the old age, poor health, political intrigues did not allow even to start searching the ore in Foymogubskaya volost. In 1672, Peter Marselis died in Moscow. The only heirs to the ironworks, including those in Zaonezhie were his sons Pyotr Petrovich Marselis (the elder) from his marriage with D. Barnesli Marselis and Pyotr Petrovich (the younger), whose mother was A. Akemi.

Karelian metallurgy was taken control of more experienced in economic affairs elder Peter Marselis. His biography, however, as the life of Peter Marselis Jr., is a mystery for researchers. The place and time of birth of the brothers are still unknown. Probably Peter Marselis senior, was born immediately after the first marriage of his father in 1636, in Moscow Manor "Poganiy prud". However, there is evidence that he came to Russia from Copenhagen. He was in the rank of the Danish sea captain in the Royal Navy, and his wife Maria, nee Bekkerfon Delden, appeared in Muscovy the year when his father got the patent for mining on Lake Onega.

It is believed that during the audience with Alexei Mikhailovich, the foreigner handed to the tsar a recommendation letter from the Danish king, and in 1674 it helped him to get the patent confirming the right of the elder P.P. Marselis to carry out work in a remote corner of Olonets district. The tsar ordered: "to search copper and other ores and start plants, to smelt ore and invest their money and hire people".

A Dutch businessman Eremeyvander Gaten (Eremeyfonder Gartner Harmenfan der Gaten) became P. Marselis's companion However, the "bad success in copper ore mining" and the wealth of iron ore discovered in 1674 made them to organize in those places "iron and plants" "with the help of foremen from Kashira plants". Meanwhile, the Russian age of the elder P.P. Marselis was very short. He did not start producing Olonets iron, as in 1675 he passed away due to a severe illness.

Since that time the mining business of "the Marselis family" in Olonets region pass into the hands of "Danish manufacturer" Henry Butenantvonde Rosenbusch. Although according to the will the owner of the mining project was a minor son of the elder P.P. Marselis Krestianin (Christian-M.D.), in fact in the charter of 1677, his guardian G. Butenant, and before 1678 Van der Gaten administered all the affairs.

In this sense, the biography of a metallurgist and merchant Butenant, now excites no less than the life of Marselis. Still the fate of this foreigner mesmerizes with collision of confusing and dramatic episodes. To mention just one, when in July 1702, the "Danish Commissioner "Butenant, the owner of four steel plants in Onega, on the sovereign" order" provided the troops of Peter the Great with twelve-pound cannons and artillery "supplies" "Olonets" cannons made during six months were given to the army which passed "The legendary Czar's Road" and soon contributed to victories at Noteburg and Nyenschantz. However, for some obscure reasons that task put an end to "dashing" fate of the manufacturer. The name of the talented metallurgist, who created Obonezhie ironworks in the year Saint-Petersburg foundation, somehow disappeared from the historical horizon forever. Incredibly, the Kremlin establishment rejected the lucky metallurgist from their environment and the plants stopped working.

It seems that the "Holstein" fell in love with Karelia while making a bargain of Archangelsk with Hamburg and Bremen got acquainted with "Zaonezhie iron". Since old times in Olonets there were iron factories the traces of which remained till the XX century. The foremen smelted the ore in the catalan hearth. The secrets of transformation of "kritsa" into "Karelian uklad" – iron of quality close to samples of modern steel, were passed from generation to generation. "Gamburzhinin" appreciated the scale of the monastery salt production and realized the need of Usolye in "uklad". In Obonezhie Butenant zealously started the business and rebuilt two ironworks. The first one was in Kizhi pogost, at Ust-river, which flows into Lake Onega and was called Ustretskim, the second Foymogubsky plant appeared on Spirovska stream "vurochische" between Kovshezero and Putkozero.

After the death of V. Gaten in 1678, a grasping Butenant and ayoung Marselis received from Tsar Fyodor Alexeyevich the patent for ownership of the manufactory. A year later, Danish King Christian V appointed the manufacturer a "Commissar", and in 1688, granted the title of nobility, and gave the name prefix "Butenant von Rosenbusch". New royal patent of 1685, extended the ownership right for 10 years, "and gave the right to build a plant "in Shungskiy pogost". Notably at the same time his son was involved "in Russian life", his name was Andrew von Butenant Rosenbusch like his father's. As in the history of three Peters Marselis this fact in the research literature, still generates confusion and absurdity. Like his father A. Butenant Junior held a prominent niche at the court. Knyaz B.I. Kurakin noted: "And for exercises with swords and horses" Tsar Peter regularly attracted "a Dane, Andrew Butenant's son" as a teacher. However, we can not confirm the participation of the younger Butenant in his father's business. At the beginning of the XVIII century his name also disappeared from the communique, correspondence and charters.

As for the first mining and metallurgical factories in Karelia, we should note that they were hammering, because iron smelting began later, from the beginning of the 80es of the XVII century. We can find the confirmation in the charter of 1696 by Peter I to A. Butenant "the years are ordered to be considered from 189 (1681 – M.D.) on January 25 when the ore smelting was started". From that time the iron in Zaonezhie was produced in industrial quantities. The royal charter specifies the geography of production, "and the plant for the iron business was built in Foymogubskaya volost between Kovsh and Pudkoozero and Spiridonovskiy stream, in Kizhi pogost beside-Onega lake, on Ustrechka".

Builders led by the "gamburzhinin" erected dams, smithy, farm "barns", later they built large and small furnaces. Butenant probably the first in our region who used the job title of "Master metallurgist," long before Tsar Peter he instilled Western mining technology to develop advanced work methods training for local peasants. Certainly skilled mineralogists, talented blacksmiths, and "coal master" supported him.

In 1683 Butenant-Marselis's iron factories delivered to Archangelsk "6449 pounds 25 grivenkas" of iron. 3,488 pounds 25 grivenkas were sold and sent abroad. The plants significantly increased productivity, "to the year 193 (1685 – M.D.) they produced 6903 pounds 5 grivenkas". Besides the sale of iron through Archangelsk to Europe, and the administration explored the maritime area, supplied iron to the fairs, including Tikhvin and Belozyorsk. A significant amount of iron was brought to Veliky Novgorod and Staraya Russa. By the early 80es of the XVII century the Dane's metallurgical factory successfully supplied the market with iron.

In 1690 after the death of Marselis the plant at Verhozero on Ustmatka was closed for economic reasons, it was not far from Ustretskiy plant. However Butenant built two new water-powered factories: Lizhemskiy hammer plant on the river Lizhma flowing into Chorga-guba of Lake Onega, and Kedrozersky hammer plant. New iron production was "instructed to keep in Novgorod and from 1700 in the embassy prikaz". Andrew Butenant became a mighty owner of Karelian metallurgical empire. Until the mid-90s of the XVII century hired labor of peasants was the main form of production.

In 1694, due to labor shortages, by "the order" chernososhny peasants from Kizhi pogost were attached to Butenant's plants. This act of foreign economic coercion is considered to be indicative in Karelia. Enforcing the locals to work at the plants reinforced the feudal forms of labor and the people were meant to do any work "on the ironworks". In addition to personal dependence "artisans" mined iron ore, smashed lime, burnt charcoal, chopped wood. For this, the Dane guaranteed Moscow payment of peasant duties and taxes. Yet social tensions, geographic distance from the metropolis, the lack of transport communications and difficult conditions, could not stop the Andrew Butenant's plants. Iron smelting technology improved. Peasants mastered release of competitive metal and "things" for the sovereign's "fun battles". The potential of the plants, according to some researchers, reached 22,6 % of the country's steel industry. Besides products of foymogubskiy private plants had a high reputation in the West. The commander of the Baltic Fleet, Vice Admiral C. Cruys confirmed the competitiveness of the metal.

Factory infrastructure, trained personnel, recruitment system of "mining foremen", government orders, created a sense of stability of production. However, development of metallurgy in Zaonezhie suddenly was interrupted at the beginning of the

XVIII century. A. Butenant's producrion was "assigned" to the administration of Olonets Mining District. A.D. Menshikov in the dispatch of 14 July 1703 wrote to the commandant I.J. Yakovlev, "inform you that Andrew Butenant's iron factories with all facilities and the structure and ordered peasants were assigned to fortresses of Schliesselburg and Shlotburg".

July 27, "the governor of Shlyutenburg" again demonstrates the unlimited power. In correspondence to the tsar, he cares about banning to send the production from factories to market "without an order". Only Ustretsky plant managed to keep on production mode till 1720, which was one of four created by Butenant in Foymogubskaya volost.

What was the reason of such "arbitrariness" in Zaonezhie? Historians often refer to unfairly vague wording on the transfer of plants into the treasury, because Butenant allegedly did not execute the order of the government. Such an allegation seems to be at least inaccurate. Obviously, in addition to economic reasons, there were some other reasons for this first in the history of Russia forcible takeover. Let's listen to the opinion of the Danish diplomat Y. Julia. With unconcealed sympathy for Butenant the ambassador reported: "Boutenantde Rosenbusk... was the victim of hard violence." Having royal privileges, he founded "a copper and an iron plants at his own expense, at great cost". However, the "greedy Knyaz Menshikov decided to seize them "since" Rozenbusk did not have the funds for their maintenance. "Then Menshikov refused to "pay... poor Butenant 20,000 rubles for deliveries from factories," eventually "Rozenbusk" received "no factories, no money" and "died in poverty". Thus, according to the diplomat his compatriot ended life in exile without money and political favor.

Transmission of the plants of the elderly A. Butenant to the "sovereign treasury" was indeed initiated by the influential Ingrian Governor-General. Plenipotentiary of the Danish King Frederik IV G. Grund confirms that, as well as notes of the Swede internee Lili Erenmalm. At the same time, we should note that in the Petrine era the role of private steel mills in Russia changed. The war with the Swedish kingdom demanded swift and quality products. Nevertheless, the decree of Tsar Peter in December 1701 ordered Butenant's plants to put "to the court" important military "supplies" in March 1702.

"Bruce Jacob's son" Governor-General of Novgorod basing on the A. Butenant's report, informed that in July 1702 "foymogubskie" plants produced 100 twelve-pound caliber cannons, 75,590 cannonballs of the same caliber, 5160 ten-pound and 1244 four-pound bombs. Additionally the Dane poured over 2039 pounds of iron bars, 200 large crow bar, 99 small crow bars, 100 middle crow bars and 2288 iron spades.

Taking into account the tense situation of the Northern War (1700–1721), it is permissible to make another conclution. Apparently A.I. Butenant was involved in the action of a national scale. It seems that the artillery joined the Army convoy of "The Czar's Road" and played a significant role in the attack of Swedish strongholds Noteburg Nienschanz.

Thereby Olonets cannons cast by Danish technology helped Russia to break through to the shores of the Baltic Sea and found the imperial capital. At the same time, the way of sending cannons to the army is unclear and requires fresh sources. Probably they used flat-bottomed barges to transport the "supplies" to Izhora and loaded guns to the monarch's ships at the source of the river Svir. It is known that by August 1702, the builder of "The Czar's Road" Sergeant M.I. Shchepotev with "mates" gathered and delivered to Povenets in Lake Onega, more than 85 vessels.

Concluding the study we can confirm that due to the efforts of Marselis and Butenant at the turn of the XVII–XVIII centuries in Zaonezhie a new communication infrastructure and industrial environment with the original type of work for the North tenements began to develop. Private ironworks of the "Danes" turned into an economic miracle, playing a significant role in the success of the national arms. Insufficient information on the history of the plants, allows to express the idea of the necessity of the archaeological expedition on the historic industrial sites. The results of the instrumental search can significantly extend the knowledge of the half-forgotten iron" manufactories. The study of the cultural layer of early Petrine time should form a new "archive of historical memory" in order to expand the potential of the little-known monument. An "open air" exposure, a museum and a tourist route should be arranged.

THE HISTORY OF THE MINES AND FACTORIES IN PITKARANTA (1810–1930-s)

I.V. Borisov

A researcher N. Tsebrikov thought Pitkaranta copper ore deposit was known in the 1770s, but stipulated that neither N.Y. Ozeretskovsky and V.M. Severgin who visited Ladoga Karelia nor Serdobol pastor S. Alopeus mentioned this "fact" in their books. Given most of the locals showed travelers the ore deposits in the hope of monetary reward, we can say that no trace of ore was found in Pitkaranta area.

A.F. Furman's research (1810)

We have a documented evidence that in 1810 the Chief Burgomaster of the 7th grade, a member of the Board of the Department of Mining and Salt Affairs, Anton Fyodorovich Furman looked around the village Pitkyaranda (modern Pitkaranta), "a quarter of a mile from the village and 1/8 of a mile from the road on the mountain", to the west of Alasuomyaki Mount, and found an abandoned copper mine. It was an area cleared of sand and boulders and 2 square fathoms (4,5 m^2) in size.

Exploration work started. Boreholes were drilled around the mine, which allowed specifying the location of the ore layer which had dark green scarns with a rare greenish-yellow chalcopyrite (chalcopyrite) impregnation. To the south-east and north-west from the ore layer two mines were opened. At the same time A.F. Furman told to draw a drift in the hanging wall of the ore layer 15 fathoms (31,9 m) from the mine, hoping to find ore at a shallow depth. Then a few more exploratory mines were put down, but only two of them successfully opened the ore layer, which, turned out to consist radiant stone aggregates, hornblende and mineral "very similar to salite", with small and occasional impregnation of chalcopyrite (chalcopyrite). The adit worked to 256 m in the north-west of the mine, 98,1 long and 4,3–6,4 m tall, never met the ore layer and was stopped at the border with granites.

Based on exploration made by A.F. Furman it was concluded that the ore layer he studied was only a fragment of a former larger, but destroyed by erosion ore body, spilled with numerous ore blocks which can be found in the fields to south from the mine. For this reason, the copper mine in Pitkaranta was wrongly assessed as prospectless for further exploration.[1]

Activities of Baranov – Oshvintsov – Anisimov's company (1814–1816)

Despite the negative results of previous exploration in early 1814 three Russian businessmen – Lieutenant F. Baranov, an architect Michael Oshvintsov and a farmer from the village Ruokojärvi Andrey Anisimov appeared in Pitkaranta. Bremer wrote that they found almost all the ore deposits in Suistamo and Impilahti parishes. The companions received the license to explore and develop copper ore at Mount Alasuomyaki (Alansuomyaki) near the future mine "Omelyanov-4", and in the area to the east of it, as well as limestone (marble) and magnetic iron ore (magnetite) in "Hopunsuo swamps" (Hopunvaara).

In Hopunvaara the entrepreneurs hoped to find silver ore, for which they probably took inclusions of arsenic Pyrite (arsenopyrite) and magnetic iron (magnetite).

In the village Ruokojarvi on Anisimov's site the companions set a copper smelter with a blower 2 m high, but could not obtain nothing else but copper matte and slag in it.

Originally smelting plant supposed to be built three kilometers north-east from the village, below the Yuankoski (Yukankoski) falls on the river Kulismayoki, but the mining master Lundstrem told the entrepreneurs that it was hopeless. Two years later the companions lost their rights to own ore mines, as did not have sufficient funds for exploration and mining.

In the summer of 1814 the mining master Lundstrom, who was in the service of the Department of Mines Finland visited the Pitkaranta mine. He conducted a little exploration, which gave new information about the ore. According to O.G. Tryustedt,

[1] Фурман А.Ф. Минералогическое описание некоторой части Старой и Новой Финляндии// Горный журнал. Санкт-Петербург, 1828, кн. 11.

Lundstrom was probably the first to observe tinstone (cassiterite) in Pitkaranta but he did not recognize it and took it for "little schorl crystals in dense sparkling rock". He also investigated the lime (marble) field in Hopunvaara where noted a lode of magnetic iron ore (magnetite) "a finger wide".[2]

Exploration of Pitkaranta deposit by Vorobyov, Chebotarev and Deryabin (1816)

In 1816, exploration of ore Pitkaranta near Alasuomyaki Mount was conducted by a merchant Vorobyov, but soon he sold the mines to a merchant Chebotarev and his fellow a mountain master Deryabin from St. Petersburg. According Tsebrikov during two years on Korkiankallionako Mount where there were signs of copper ore, the companions hold mine exploration and made a 20-meter drift at a depth of 10 m and spent almost 60 000 rubles. Probably Deryabin acted extremely careless and did not possess sufficient knowledge of the mining industry, which adversely affected the results of the exploration.

Lionel Lukin's activities (1821–1823)

In 1821, an English subjects and a miner Lionel Lukin applied for requesting a permission to mine in the deposits of copper, lead, tin, silver, zinc, graphite, including on the territory of Impilahti, Suystamo and Sortavala parishes as well as the left Chebotarev's mine in Pitkaranta. L. Lukin did not have funds for Pitkaranta field development, so he decided to organize a joint stock company with capital of one million rubles, on the use of groundwater, rivers and forest resources of the parishes, and appealed for help to the Russian emperor.

In the petition to His Majesty L. Lukin offered a completely new way of processing ores at Russian smelters. He also requested to ban activities of all mills and grain mills within 60 km from the projected enterprise, and to release it from duties on factory and mining equipment imported into Pitkaranta.

In his application, L. Lukin, announced his intention to put the smelter at the mouth of the stream Koirinoja, at low riffle. On the upper riffle then there was a mill on the lower one – two mills owned by Countess Anna Alekseevne Orlova- Chesmenskaya.

In December 1821 a mining foreman came to Pitkaranta. He was supposed to inspect the mines to assess the prospects of its development in case L. Lukin's project realisation. Extreme cold and deep snow prevented to hold accurate studies, that is why the report was based on the old Lundstrem's data and Lukin's questionable information. The report mentioned tinstone (cassiterite), which was found near Alasuomyaki mountains. The mineral was dark brown, almost black, surrounded by calcite crystals. Tinstone was really easy to be confused with tourmaline, as was in the case of Lundstrem. L. Blode wrote that "tinstone occurs mostly in fascicular, needle-like, crystals and, that is why it resembles schorl" (tourmaline).[3]

In his report, the master also noted that the proposal to establish L. Lukin's joint-stock company "under the protection of the Emperor" with such a large capital of one million rubles, has little hope of success.

In 1823, by the decree of the Senate L. Lukin received privileges (license) to develop 14 kinds of ores in Pitkaranta as well as Suistamo, Impilahti, Sortavala: Ruokojärvi, Saranyarvi, Leppyasyrya, Kitelya, Haukkaselkya, Hepposuo, Joensuu Impilahti, Korkeakallio parishes. However, the corporation for the development of ore was not formed. Shortly after receiving the lincense Lionel Lukin left Pitkaranta without any funds and any hope of success and returned to England, he did not even pay the costs for privileges registration.[4]

Exploration in Pitkaranta stopped for almost a decade. One of the mining masters in his report for 1829 regretted that rarely seen in the North copper mines of Pitkaranta, fell into disrepair. According to his opinion, Pitkaranta was not profitable for ore development, as many researchers often confused tinstone with black garnet, which occurs here abundantly.

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[2] Трюстедт (Трёстедт) О.Г. Питкярантские рудники и заводы. Гельсингфорс, 1907.

[3] Трюстедт (Трёстедт) О.Г. Питкярантские рудники и заводы. Гельсингфорс, 1907.

[4] Копонен П. Мое отечество – Импилахти. Хельсинки, 1993.

Pitkaranta quarries and plants in Vsevolod Omelyanov's days

In August 1830 a retired collegiate counselor (chamber fourrier) Vsevolod Omelyanov applied to the Mining Quartermaster of Finland Niels Nordensheldt for a consultation about the prospects of development ore in Pitkaranta. Nordensheldt, referring mainly on the mining master Lundstrem's data advised Omelyanov to continue exploration in Pitkaranta hoping to find here rich ore. Vsevolod Omelyanov owned large estates in various Russian provinces and a large number of serfs who were the main work force in his enterprise, but he did not have enough finance.

November 23, 1832 the Imperial Finnish Senate granted V. Omelyanov the license to explore and develop 14 kinds of ore in Impilahti, Suistamo parishes and Pitkaranta, but with the condition that three years later he would set up the smelting of metals. He was also allowed to use forests on the entire northern coast of Lake Ladoga. Thus, Omelyanov had very favorable conditions for the successful operation of the mines and smelter, but a year later a decision on forest was canceled[5].

V. Omelyanov did not bear in mind the bitter experience of his predecessors and relied on his knowledge too much, although he was not a specialist in mining and that fact had the negative impact on the situation in the early years of his company.

In 1833 on the advice of the Director of the Mining Department of Finland Niels Nordensheldt Vsevolod Omelyanov made a study trip to England, France and Germany, where he inspected the biggest and most famous in Western Europe mining enterprises and smelters. In Saxony in Freiberg district – the oldest and famous mining center of Western Europe –he oversaw the work of miners and metallurgists, and invited famous Saxon mountain master Gustav Fredrik Albrecht to come from Freiberg to Pitkaranta. The master agreed, and during 1834–1836, successfully directed the mining and construction of Omelyanov's smelter.[6]

In 1834 a mountain metallurgical engineer Gregory Andreevich Iossa visited Pitkaranta and made the first geologic description of Pitkaranta field.[7]

According to G.A. Iossa, the area of Pitkaranta deposit consisted of red-grained granite, sometimes passing into gneiss with the layers stretching to the north-west and the fall in the south-west at an angle of 40 °. During Omelyanov's granite exploration they met a lode (an ore body) with the thickness up to 8.5 m, 533, 4 m long, extending from the north-west to south-east, almost parallel to the shore of Lake Ladoga, and falling to the south-west at an angle of 59 °. "The load consisted of "crystallized garnet, malakolite, diopside, amphibole, chlorite, radiant stone, quartz and calcite... lodestone, iron and copper pyrite, hematite, molybdenum and tin stone. Lodestone was in the form of thin runs 2–3 inches thick, the runs have the same stretchinge and dip with the lode".[8] Chalcopyrite formed granular inclusions in the "lode" and a magnetic iron ore.

The ore body was explored with four mines, which later became known as "Omelyanov-1", "Omelyanov-2", "Omelyanov-3" and "Omelyanov-4". In one of the mines they found two veins of almost pure chalcopyrite with the thickness of up to 0,3 m. iron pyrite inclusions formed impregnation in the vein and copper pyrite, hematite (hematite) – small sequins and crystals. Molybdenite – in the form of small leaves was rarely met. Tinstone (cassiterite) was also rarely met, it formed a thin elongated crystals in the form of bonnies of up to 5 cm in diameter, which were very similar to crystals of tin stone from England, for an opinion G.A. Iossa. Furthermore, cassiterite formed particles disseminated in the rock. At the beginning of exploration in one of Omelyanov's mines they found a small piece of tin stone, consisting of a cluster of dark red crystals, similar to rubies.

In 1834, the exploration of the ore body was conducted at a depth of 14,9 m with the help of shafts drifts hanging to bed-sides of the lode. In September 1834 V.Omelyanov told G.A.Iossa that "one of the drifts... again met tinstone, the amount of which was considerable...". Unique tin ore samples were immediately sent to Saint Petersburg to the Museum of the Mining Institute. But as a whole the ore was poor and unsuitable for industrial development.[9]

[5] Ibid..

[6] Трюстедт (Трёстедт) О.Г. Питкярантские рудники и заводы. Гельсингфорс, 1907.

[7] Иосса Г.А. Известие о нахождении олова и меди в Питкяранте в Финляндии// Горный журнал, Санкт-Петербург, 1834 г., ч.4.

[8] Ibid.

[9] Иосса Г.А. Известие о нахождении олова и меди в Питкяранте в Финляндии// Горный журнал, Санкт-Петербург, 1834 г., ч.4.

G.A. Iossa noted that if good ore had been found in Pitkaranta, then they would have started its development built the plant with the smelters, swilling and stamping factories. The place was supposed to be built 7 miles from the mines on the river Koirinoja, near its fell into Lake Ladoga.

Gustav Albreht's professional management of mining operations from 1834 to 1836 helped V. Omelyanov to succeed in exploration of Pitkaranta field. On a 500 m site, between the old mine exploration and mountain Alasuomyaki (Omelyanov-4 mine was put down at that place) Albrecht laid 25 downhole mines, and discovered copper ore in 22 of them and tin in three mines.[10]

By November 1834 in Omelyanov's 4 pits 1 237,5 tons of copper and tin ore were mined.

Vsevolod Omelyanov had to run the smelter in 1835, but its construction at that time did not begin. The wood was damaged by fire, which made losses in 6000 rubles. The reason for this and another fire in 1838, according to V. Omelyanov, started by envious arsonists and detractors.

Considering V. Omelyanov's disaster, the Finnish government granted him a deferral for two more years to complete the construction of a smelter, with no right to deprive the limited use of the forest.

In 1837 during the inspection of the quarry in Pitkaranta, it was stated that there was a small smelting furnace, a pair of apartment buildings, equestrian etc. For transporting ore from Vologda region in Koirinoja there was a ship with tonnage of 128 tons.

Only in late 1837 "ore processing plant" was completed, it started to work in 1838. Place for the plant was chosen at the mouth of the Koirinoja stream (in Finnish "dog stream"), under a waterfall, where previously there had been a sawmill, built in 1752.

For many years the sawmill supplied timber to Saint Petersburg and Koirinoja dock where boats and galliots were built. Initially four frames worked at the factory, but gradually the production volumes of the sawmill decreased. Till 1824 the enterprise belonged to the Countess A.A. Orlova-Chesmenskaya.

In 1825, the sawmill in Koirinoja was sold to a merchant of the first guild and commerce Adviser Theodoulia Grigorevich Gromov, who was an ancestor of the well-known dynasty of entrepreneurs-lumbermen. He owned several water-powered sawmills in Vyborg province and iron foundry in Suojarvi. Soon Koirinoja factory burned, and had never been restored.[11]

The smelter on the stream Koirinoja Vsevolod Omelyanov called Mitrofanovskiy (different sources are sometimes found the name – Mitrofanievsky, Mitrophanievskiy) in honor of St. Mitrofanii of Voronezh – a bishop, preacher, educator, associate of Peter the Great in the construction of the fleet in Voronezh, and it was apparently due to the fact that earlier in Koirinoja small vessels were used to be built.

In 1838, all V. Omelyanov's mines were filled with water. That year 70 workers fell ill with scurvy sick, 13 of them died. Besides, on a newly built smelter in Koirinoja an accident happened – a worker fell into the waterfall and died. The court tried to understand the causes of this tragedy that did not favor the production.

In this bad for Vsevolod Omelyanov year Pitkarantsky Captain of mining services V.P. Sobolewski visited the mines. The next year his book "Review of Old Finland and description of Ruskolskie marble pits" was published. In the book a few pages were devoted to geology of Pitkaranta area.

According to the mining engineer Gustav Albrecht, V.P. Sobolevsky gave the following description of the geological structure of Pitkarantsky field. "The ore deposit is composed of granitic gneiss and hornblended schist, the latter sometimes replaced with talc slate and lithomarge. All rocks together form a huge reservoir from 8 to 20 fathoms (17–42,7 m – I.B.) thick, the stretching is at 8 and 9:00, an average strata inclination is about 45 to the southwest. Ore is located in two lodes at the touch of granitic gneiss with hornblended slate.

Total thickness of the lodes is 2,5–3 arshines (1,78–2,13 m – I.B.), they are divided with gangue at a distance of 1 arshine. Garnet and crystallized in a solid form malakolite, salite, calcite, hornblende, radiant stone form the rock. They are interspersed with: tin stone, copper, and magnetic pyrite, hematite, molybdenum, zinc blende and zinc oxide. Tinstone is in such small parts here that cannot be seen with the naked eye, although the weight of the rock shows that there is a lot of it in the ore body.

It can be seen as black crystals accumulated in large bonnies. Tinstone similar to that which was

[10] Трюстедт (Трёстедт) О.Г. Питкярантские рудники и заводы. Гельсингфорс, 1907

[11] Копонен П. Мое отечество – Импилахти. Хельсинки,1993.

found in Pitkaranta had never been found, although sometimes the miners came across tinstone of reddish color. Chalcopyrite here is in the form of large grains with iron, often cubic. The local crystallized garnet refers melanite. There are lots of beautiful melanite crystals (rhomboidal dodecahedron).

The lodes stretching is 2 ¾ versts. Content of the ores is not similar, although they are richer than Altenbergskoe tin deposit developed from 1450. All these facts predict success of the Omelyanov's enterprise, as in rich with minerals Russia there is only lack of tin.

The mine has three major mines, the deepest of them is 20 fathoms (42,7 m – I.B.), i.e. 5 fathoms below the horizon of Lake Ladoga.

At 6 miles east of the village Pitkaranda in wooded area Goppenvaare (Hopunvaara-I. B.), dolomitic limestone is mixed with blue elvan, the latter can be taken for real ophite.

Elvan sharply differs from dolomite and consists of thin veins, but both rocks are often fused together in different forms. Some part of Gopenvaara dolomite does not contain elvan at all, so ophite is considered as its component. A mineral similar to agalmatolite is also closely connected with dolomite. Dolomitic limestone comes onto the Earth's surface in the form of slightly rising rocks. On one side they are limited to low elevations of hornblende schist, and other rocks of red granite. The distance between granite rocks and hornblende schist is not more than 20 fathoms, and sometimes dolomite is separated from granite with only 1 fathom.

Hornblende schist extending here goes on the other side of dolomite between 5 and 6 pm, the drop is about 60 ° to the south. So, dolomite and ophite occupy inhornblende schist a stripe of indefinite length 20 fathoms wide. They contain runs or chunks of lodestone. It consists of elongated vugs dotted with noddle of fluorspar in form of purple octahedrons, green small crystals of garnet, vesuvianite, crystallized chlorite etc.

Not far from it dolomite becomes more crystalline, the very sight of the masseson the surface indicates the veiny magnetite. The relation of granite to hornblende schist is clear: the first it is seen as a lode and pieces of hornblende schist can be observed. Hornblende around granite is often replaced with mica, which is evident in the pieces, consisting of large layers of mica. Granite goes through hornblende and mica in a liquid state at high temperature, which may be an indirect cause of the transformation of hornblende in mica.

Relation of limestone to the surrounding rocks is not obvious, Goppenvara dolomite, cannot be used as a building stone due to its low density and hardness, it can be used only for firing on lime, and distance from Lake Ladoga contributes to this".[12]

Despite the fact that Mitrofanovskiy plant was almost entirely built at the end of 1837, for several reasons, such as an epidemic among workers in 1838, retiral of the manager Gustav Albrecht in 1837, etc., it did not smelt metal. At the request of Vsevolod Omelyanov a delay for another year was permitted.

However, due to various obstacles and in 1839 smelters of Mitrofanovskiy plant remained inoperative. For this reason, in summer 1840 a mine foreman was sent to the plant. He inspected the area of the plant, and visited the mine "Vsevolod" (later it was a source of tin) and "L. Eligante (later – "Omelyanov-4"). It turned out that the shafts were filled with water and the melting of metals in the plant had not been begun. As a result, Vsevolod Omelyanov was not granted a state loan of 100 000 rubles.[13]

Until 1840 Vsevolod Omelyanov spent on his company more than 200 000, but did not smelt copper or tin.

In 1839–1840 in Koirinoja Omelyanov continued to improve in the melter, built a preparation plant. At the same time the construction of Omelyanov's estate and residential building for a mining engineer was completed.

November 21, 1840 the Resolution of the Imperial Finnish Senate confirmed Vsevolod Omelyanov's right to develop Pitkaranta field.

According to burgomaster Idestama, who visited the mines in June and August 1840, Omelyanov's exploration expanded for several hundred meters around the ore body, stretching from west to east. Each working was assigned a number from 1 to 20.

Until May 1841 on Pitkaranta mines and Mitrofanovskiy plant about 180 Vsevolod Omelyanov's serfs were employed. From 1838 to 1843 Omelyanov's mines were inactive and stood under water.

[12] Соболевский В.П. Обозрение Старой Финляндиии описание Рускольских мраморных ломок. СПб., 1839.

[13] Трюстедт (Трёстедт) О.Г. Питкярантские рудники и заводы. Гельсингфорс, 1907.

At the end of the 1830s in the third "Omelyanovskaya" mine tin (cassiterite mineral) was found and it was a sensation! According to Gustav Albrecht's calculations, there were 2 % of tin in Pitkaranta ores, and that was higher than the ores of Saxony. For Russia, which incurred deficit of domestic tin the discovery of the "white metal" in Pitkaranta was of great importance.

July 23, 1842 under the guidance of Russian metallurgist Gregory Andreevich Iossa at Mitrofanovskaiy plant the first tin smelting was made. This event was a landmark for the whole Northern Europe, where previously tin was not smelted. For Russia, it was also a significant event.

According to Unto Martikainen in 1842 on Mitrofanovskiy plant of 1,6 tons of tin ore was smelted into 104 kg of tin. Part of the metal was spent to pay for merchants Gromov pro, and some were sent to the industrial exhibition in Moscow, where the molten tin was highly appreciated.[14]

In the Leningrad regional state archive in Vyborg a small document of 9/21 April 1842 for the number 407 stored. It indicates the strong interest of the Russian government to the emerging metallurgical production in Koirinoja. The document contains the follows lines: "To Mr. Governor of Vyborg. To the owner of Mitrophanievskiy amelter in Imbilahti, collegiate advisors Omelyanov. I beg Your Excellency to order the recall of similar announce of the Ministaer of Finance that in the current year duty-free entry to 2000 puds of Finnish copper which Omelyanov intends to bring to Russia through Ladoga Lake was allowed. Infantry General..."[15]

In 1842, the plant operated, but continued to be built. First brief description of Mitrofanovskiy plant in Koirinoja was published by G.A. Iossa in 1843. The plant consisted of a dam, an ore-processing factory and a smelter. The plant was located on the west bank of the Koirinoja stream and was a wooden two-storey building longer than 40,5 arshines (28,8 m), with the width of 21 arshines (14,9 m) and the height of 12 yards (8,5 m). at the bottom there were: a chipping hammer, two wet ore stamps with pitprops for tin ore processing with "9 stamp mills each", 2 shtosgerds, 2 shlemgrabens and 4 kergerds. On the upper floor there were "a washing separation mill, sieves, the place for crushing rolls and ore-mechanism", in the upper part there were some sorting tables.

The dam was arranged over the waterfall, so that it was possible to raise the level of water in the stream to 9 m (then as the natural height of the waterfall was only 6 m), two wooden waterpipes went to the waterwheel of the ore-processing factory and smelter. In the foundry located on the eastern bank of the stream, there are two shaft furnaces for smelting matte copper and black copper, one tin furnace and a cupola furnace for liquid metal dispensing. The ore was delivered to the plant from Pitkaranta on Lake Ladoga by barges. Hourly the pitprops could grind up to 112 kg of ore.[16]

A more detailed description of Mitrofanovskiy plant was composed by the owner of the plant Vsevolod Omelyanov with the help of G.A. Iossao. November 4, 1844 at the direction of the Manager of the Russian Ministry of Finance, the State-Secretary F. Fronchenko. This document was entitled "Inventory and evaluation of Mitrofanovskiy copper-tin smelter in Impilahti parish of Serdobol County" consisted of 45 sheets of handwritten text and now is stored in the Leningrad regional state archive in Vyborg.[17]

According to this inventory, Mitrofanovskiy plant consisted of a dam, an ore-processing factory, smelter, workshops and other household and auxiliary facilities. The dam was arranged above the waterfall, across the stream. Initially, it was wooden, and since the beginning of the 1840s it was decided to build it of stone. By November 1844 Koyrinoya dam was made by only 40 %. According to the project, it was to have a length of 21,4 m across the stream, the bottom – 7,1 m, but the height and thickness of the dam were not specified.

[14] Унто Мартикаинен. Ранние стадии развития Питкярантских заводов// газета "Карьяла", 31.05.2007 г.

[15] ЛОГАВф.1, оп.2, д.28, 2 л., 1842 (Предписание Финляндского Генерал-Губернатора о разрешении вывезти с Имбилакского медноплавильного завода в Россию 2000 пудов меди).

[16] Иосса Г.А. Некоторые замечания о рудниках и заводах Финляндии вообще, и в особенности о медном и оловянном производстве в Питкяранте. Горный журнал, СПб., 1843 г., ч. 4, кн. 11.

[17] ЛОГАВф.1, оп. 2, д. 35, 1844 (Опись и оценка Митрофановского медно-оловянного плавильного завода в Импилахтинском приходе Сердобольского уезда).

Fig. 1. Here, on the waterfall Koirinoja, in 1838–1859 Mitrofanovskiy copper and tin smelter operated. 2012

Fig. 2. The streambed of Koirinoja, near the waterfall. 2012

Two wooden waterpipes went from the dam to the water (liquid) factory wheels. At first they were attached to the rock and then fixed to the poles and log cabins. At the beginning of the waterpipe there was a sluice house that burned down on January 1, 1844.

Below the dam on the west (right) side of the stream Koirinoja, there was an ore-processing factory. It was a wooden two-story building of the same size, which earlier G.A. Iossa indicated: with the length of more than 28,8 m, the width of 14,9 m and the height of 8,5 meters.

On the ground floor for tin ore concentration there were arranged "two wet ore stamps with nine mills each, along with wires and two accumulators... two kesards, one shlemgraben, four snow kergerds and a chipping hammer" crushing rolls and place for ore-shaft. The third ore stamp was being built.

On the top floor of the factory there was a "washing ore sorting machine, a pair of fixed jigging sieves" in the upper part there were some sorting tables and a place for two or three crushing rolls with ore sorting grills.

Three water wheels with the diameter of 7 m rotated under pressure from the water at a speed of 3–4 rpm and was drove by other mechanisms of the ore-processing factory. The first wheel drove the chipping hammer, washing ore sorting machine, ore-crushing rolls and the ore-shaft. The second wheel drove two shtosgerds, two aranidkas (jigging sieves). Subsequently, one aranidka and two wet ore stamps were to be driven by the second wheel. The third wheel moved two wet ore stamps and later two more pairs of aranidkas.

On the factory, copper ore was also concentrated. It passed through a sorting table and aranidkas and was sorted by size into nine grades, and by enrichness – into three sorts.

The concentrate underwent long enrichment in the grinding channels, shlemgrabens, shtosgerds and kergerds and acquired the desired condition, containing about 50 % tin stone (cassiterite).

On the east (left) side of the stream Koirinoja there was the foundry. It was a wooden building with the length of 50 arshines (35,5 m), width of 19 arshines (13,5 m), with a roof covered with boards. From the waterpipes to furnaces across the water there were two passages to furnaces. In one part of the building there were two furnaces for smelting copper matte and black copper and a cupola furnace for melting tin. The interior walls were reveted with white furnaces refractory bricks made in England, and the outer walls and vaults – with Andoma firebrick made of clay mixed with graphite. Furnaces for smelting copper ore were in the same building, reveted with red brick with slate strips and strengthen with iron hoops. The furnaces were connected with a common pipe closed with a vault.[18]

The cross-section of the furnaces was square – 89 cm. The foundation under the furnaces was laid of slate slabs, bonded with lime. The base was lined granite rock.

To divert water from the furnaces there were cut down drains in the granite base.

[18] ЛОГАВ ф.1, оп. 2, д. 35, 1844 (Опись и оценка Митрофановского медно-оловянного плавильного завода в Импилахтинском приходе Сердобольского уезда).

Above the outlet slots on the iron shelves there was a grid iron shed smeared with fire-resistant clay. The same shed was over the furnaces leaves.

The cupola was lined with refractory brick (English and Andoma) inside and covered with boiler iron outside. In the second half of the building there was a prepared place for another two shaft furnaces and two cupolas.

In the wooden hut attached to the plant with the width of 12,8 m and height of 8,9 m was filler wheel with the diameter of 7 m with iron spikes. It was driven by the water running down the water supply and through three iron gears, iron cranks and iron shafts were driven by three wooden blower cylinders with the inner diameter of 35,5 cm, which charged air to the mine furnace and cupolas.

On Mitrofanovskiy plant there were two wooden buildings with reflective furnaces for roasting tin concentrates. Coving and internal walls of the furnace were built of English bricks, and hearths – of Andoma refractory bricks. In a special stone chimney there were traps set for the deposition of harmful impurities, burnout of concentrates.

At the plant there were also several barns with six stalls and brick hearths for firing copper matte, one coal shed, a smithy with three brick forges and hand leather bellows, three stores for supplies, materials and tools, three sheds for brick production and wood storage, a building with two furnaces for brick and lime.

Across the stream above the waterfall Koirinoja there were two bridges. One more bridge was passed through a discharge channel.

The embankment opposite the foundry and the ore-processing factory was strengthened with natural stone. Half a kilometer from the plant a wooden pier for ships was built.

Near the plant there were household and residential buildings. For a caretaker, clerks, artisans and workers there were one barrack and five houses. There were also stables, a barn, a chicken house, a pigsty, a two banyas and two cellars. A large hardware house with 7 rooms, kitchen, 11 doors and 17 windows was built.

On the plant there was all the necessary equipment for ore mining, smelting and construction tools: two drop-hammers for driving piles; two iron drop weighing 320 and 480 kg; two fire tubes; two earth iron drill; one winch; five iron presses for manufacture of bricks; one wooden press for dewatering peat; one lathe; three scales with iron chains and iron weights; carpentry, woodworking and turning tools; tools for melting and casting of tin, copper, and iron; axes; spades; saws; assay labs, mathematical, leveling instruments with utensils (tachometer, microscope, magnifying glass). etc. There was also special literature on mining and metal smelting in Russian, French, German, Swedish and English.[19]

1,5 km above the stream there was a flour mill with a dam on the waterfall with the height of 4,3 m which belonged to Mitrofanovskiy plant.

On this privilege of Imperial Senate of Finland from November 21, 1840 Mitrofanovskiy plant could use forests of Impilahti amd Suystamo and pogosts for fuelwood and charcoal in the volume of “10,408 Russian cubic fathom a year”.

Almost all the workers occupied in the mines and constructions of the plant were Omelyanov’s serfs coming from Vologda region. Their daily earnings were 10 kopeks and that was clearly insufficient for adequate nutrition. The workers lived in very poor conditions. In the 1837–1840-ies Omelyanov employed about 150 people.

In 1843, 102 men and 9 women serfs Omelyanova could not bear the exhausting labor, and willfully left the factory and Pitkaranta mines, and came to the district center-city Serdobol (Sortavala) with a complaint where were immediately arrested and handed over to the city police captain. By the decree of the emeperor guilty serfs were sent to Vologda where they were punished.[20]

In 1844 five German experts: two factory masters, two mining masters and one mechanic worked on Mitrofanovskiy plant. Labor of serfs was still used for heavy work, the number of serfs reached 60 people. According to some data, in 1844 in Pitkarantamines there were: a retired petty officer, 29 Omelyanov’s serfs and some employed workers.

In 1843 G. A. Iossa wrote a detailed article about “Omelianov’s” mines. At that time, V. Omelyanov found a lode with copper pyrite stone and tin, and explored it for 3 versts. Its thickness reached 10,7 m. G.A. Iossa wrote that “the lode mainly consists of green stone and along with copper and tin ore

[19] ЛОГАВ ф.1, оп. 2, д. 35, 1844 (Опись и оценка Митрофановского медно-оловянного плавильного завода в Импилахтинском приходе Сердобольского уезда).

[20] Унто Мартикаинен. Ранние стадии развития Питкярантских заводов // газета “Карьяла”, 31.05.2007 г

contains a solid and crystalline garnet, malakolite, chlorite, asbestos, hornblende, quartz and crystalline solid, calcite, fluorite, galena, molybdenum, magnetic iron ore, zinc blende, tin, copper and arsenical pyrites”.[21]

Mines number 1 and number 2 (“Omelyanov-1” and “Omelyanov-2”) were laid under exploration in the western part of the ore body (“the lode”). They did not met a good ore only a few chalcopyrite interspersed into the rock and some tin-stone, so the work there was stopped. The depth on the mine number 1 was 44,1 m.

According to V. Omelyanov, the mine number 1 was called “Nilsova” mine. It was put down vertically “near the hanging-wall”, and met three mineralized vein of copper and pyrite with total thickness of 0,7 m, with a small amount of magnetic iron ore and tin stone.

The mine number 3 (“Omelyanov-3” or “tin”) was in 100 fathoms (213 m) east from the mine number 1, according Omelyanov (1844) – on the mountain Alasuomyaki. It was put down the drop of the ore body, and in 1843 reached a depth of 44,1 m. The mine revealed almost continuous tin ore, and little copper. Tinstone was fine, formed interlayers and bonnies, stretched out along the lode. The ore body contained runs of quartz and feldspar. G.A. Iossa wrote that in the mine “there are places to give a sample on the tray up to 28 % concentrate and 14 % tin (generally 45 to concentrate or 2 % tin), and itis a lot, he said, because in Saxony they process only 1 % of ore and 0,5 % of tin.

From the mine shaft to the depth of 3,2 m there were two 2,5 m drift. In the eastern end of the drift length was 8,5 m, there was less amount of ore, in the western part the ore was better.

According to G.A. Iossa calculations, in the mine number 3 there were approximately 3348 cubic arshines or 4544 tons of ore, which contained 89,6 tons of tin. Totally they produced 1,280 tons of tin ore, which could be smelt into around 25,6 tons of tin.

The mine number 4 (“Omelyanov-4” or “copper”) was in the 213 m to the east of the mine number 3, according to V. Omelyanov – in Korkankallioaho. Its depth at that time reached 54,8 m only in the mouth of the mine there was tinstone. With depth chalcopyrite became better and formed bonies and interlayers, its thickness was to 2,1 m at a depth of 24,1 m. From the mine there were two drifts: the eastern (12,1 m) and the western (11,4 m). The drifts opened about 7625 cubic arshines (9,600 tons) of ore, from which, according to G.A. Iossa’s calculations 384 tons of copper could be obtained. 2400 tons of ore or 96 tons of copper were mined and raised to the surface in that mine.[22]

Ore extraction in Omelyanov’s mines was conducted with the use of, lifting the ore to the surface and pumping of groundwater with hand winches. Inflow of water into the mine was 65 cubic arshines per day. To prevent the collapse the walls at the top were strengthened with logs.

According to the inventory of Mitrofanovskiy plant made by V. Omelyanov in 1844, the mines in Pitkaranta had the following premises: a barn with horse drives for lifting ore, pumping water, sorting ores; a smithy with a heating furnace and an anvil; sheds for coal; cellar for storing gunpowder mining; a barn for supplies and provisions; barracks and a hut for workers; 4 rooms with 4 furnaces; stable.

The mines were equipped with all necessary tools: iron drills, hammers, axes, wedges, slitters, shovels and crowbars. There were also scales for gunpowder, an air machine for ventilation of mines, iron forged tubs, sump pumps with appliances, paper, iron and steel for drills.

In 1844[23] the position of the ore body explored by V. Omelyanov was studied well enough. It was in the 45–250 m from the mail route Serdobol-Olonets and 0,3–0,6 km from Lake Ladoga. The ore body extended approximately from north-west to southeast, eluding to the east, almost parallel to the shore of Lake Ladoga.

With the purpose of exploration Vsevolod Omelyanov laid 30 pits and several mines, over the entire distance from the Mitrofanovskiy plant to Pitkaranta paying special attention to the last two versts, in the vicinity of the mines. During the investigation he was able to detect a variety of ore minerals chal-

[21] Иосса Г.А. Некоторые замечания о рудниках и заводах Финляндии вообще, и в особенности о медном и оловянном производстве в Питкяранте. Горный журнал, СПб., 1843 г., ч. 4, кн. 11.

[22] Иосса Г.А. Некоторые замечания о рудниках и заводах Финляндии вообще, и в особенности о медном и оловянном производстве в Питкяранте. Горный журнал, СПб., 1843 г., ч. 4, кн. 11.

[23] ЛОГАВ ф.1, оп. 2, д. 35, 1844 (Опись и оценка Митрофановского медно-оловянного плавильного завода в Импилахтинском приходе Сердобольского уезда).

copyrite (chalcopyrite), pyrites (pyrite), arsenic stone (arsenopyrite) tinstone (cassiterite), zinc blende (sphalerite), lodestone (magnetite), molybdenum (molybdenite), galena (galena). In many places, these ores were rich enough. Enclosing rocks were granite, gneiss, schist and "veinstone" (obviously skarns), consisting of "malakolite", hornblende, garnet, chlorite, quartz, feldspar, calcite and other minerals.[24]

In 1840 G.A. Iossa suggested a number of measures to improve t Omelyanov's mining enterprise, he drafted a 400-meter tunnel from the mine drainage number 3 ("Omelyanov-3") to the shore of Lake Ladoga. Thas tunnel was supposed to ensure the loading of ore from the mine directly onto barges. Titanic work on the drainage adit was completed only in early 1880's, but it did not give any good because, by the time the tin mine was closed.[25]

In the 1840s, the exploration of the ore body in Pitkaranta on its extension to the east of "Omelyanov's" mines, was conducted by a merchant Heinrich Klee. In October 1844, the Finnish Burgomaster gave G. Klee five mines partially included into the mining Omelyanov allotment with numbers 7, 8, 9, 10, 11.

During the land surveying of these sites, V. Omelyanov's estate manager peasant Vasily Shushpanov assured that those mines were discovered by Vsevolod Omelyanov and legally belonget to him. How the conflict finished is not known.

According to Tsebrikova, from 1842 to 1847 the tin smelting on Mitrofanovskiy plant was very weak – only 500 puds (8 tons). Up to two puds were used for the needs of the plant, and the rest was sent for sale, including Serdobol. Copper was not produced, they continued to mine the ore, but only stockpiled it on the surface until better times. V. Omelyanov managed to melt a few puds copper matte. According to other reports, from 1842 to 1847, the plant smelted 2273 puds (36,368 kg) of copper.

Vsevolod Omelyanov died in 1847, having spent a huge sum of his business – 1,5 million rubles. His heirs did not want to continue the unprofitable business and sold it for 40,000 silver rubles to entrepreneurs from Saint Petersburg.

The plant built by V. Omelyanov cahged the owner and continued to work, but gradually fell into disrepair, especially after fire. In 1859 the plant was permanently closed due to the high costs incidental to the remoteness of the enterprise from operating mines, located 7 km from Koirinoja. By that time new steel plants worked on the outskirts of Pitkaranta, just 2 km from the mines.

Omelyanov's mines ("Omelyanov-1", "Omelyanov-3", "Omelyanov-4") worked intermittently for a long time, until the end of the XIX – early XX century. Currently at the place of the former Mitrofanovskiy plant, one can hardly find traces of production. The dam above the waterfalls is clearly visible. You can also see the shallow channel punched in dark red granite, with the stream with a 3-meter waterfall. Under the waterfall on a small island, closer to the western shore of the bay, foundation pillars of the ore-processing factory are still visible. Opposite the island on the east coast, in the middle of the forest, under a layer of moss and earth can be found shattered fragments of the foundry. There are several of such stamped bricks in the collections and Pitkaranta and Sortavala regional museums.[26]

The waterfall at the mouth of the stream Koirinoja is of particular interest as a geological monument and a memorial site of the first tin smelting plant in northern Russia, and the first steel plant in Northern Ladoga, and has a high potential for tourism. Unfortunately, the area around the waterfall is littered and is not accommodated for tourists.

The location of former Mitrofanovskiy plant at the mouth of the stream Koirinoja attracts tourists, especially by the beauty of the waterfall. But given a great historical past of this place associated with the activities of the metallurgical plant, it is necessary to landscape the area. In the autumn of 2011 on the initiative of the Regional Museum of Northern Ladoga and the administration of Pitkaranta district stone with a memorial sign "Here from 1837 to 1859 was first in the north of Russia Mitrofanovskiy tin and copper smelting plant" was installed on the waterfall Koirinoja".

[24] ЛОГАВ ф.1, оп. 2, д. 35, 1844 (Опись и оценка Митрофановского медно-оловянного плавильного завода в Импилахтинском приходе Сердобольского уезда).

[25] Трюстедт (Трёстедт) О.Г. Питкярантские рудники и заводы. Гельсингфорс, 1907.

[26] Борисов И.В. Научная справка "Природнотехногенные ландшафты на территории Митрофаниевского плавильного завода в Койриноя (XIX в.)", 2 стр., март 2004 г., утв. н.м.с. РМСП 23.09.2004 г., архив РМСП, дело № 491.

Fig. 3. Memorial sign at the former dam of Mitrofanovskiy copper and tin smelting plant. 2012

This object should be put on the state accounting as a monument (memorial site) of industrial culture of Karelia. In order to gather information and objects for the exhibition on steel production history on the territory of the former steel plant it is necessary to conduct archaeological excavations.

Gustav Albrecht. Henry Klee. "Aleksandrinsky" copper smelting plant (1840–1847)

January 16, 1837 the mining engineer Gustav Albrecht from Freiberg left. Omelyanov's plant because did not get quality housing set by the contract. G. Albrecht married Alexandra Lefstroem – pastor's daughter from Impilahti, and went to live to Impilahti.

To the east from "Omelyanov's" ore area in Pitkaranta G. Albrecht laid exploration production, which opened the ore body. Since 1837 one of the mines in that area belonged to a member of the District Court Borisov, who renounced his rights in favor of the new owner.

According to the laws of Finland, Gustav Albrecht, as a foreigner, could not hold the subsoil, so his wife Alexandra filed an application for a mine.

December 3, 1840 the Senate gave Gustav Albrecht and his wife Alexandra the right (privilege) to develop the ore deposit in Pitkaranta and to construct a smelter at the mouth of the stream Kaleen (Kelinoya). Then G. Albrecht received permission to purchase wood in Impilahti and Suistamo parishes and tax exemption for 10 years during the construction of the plant.[27]

Gustav Albrecht planned to build another copper smelting plant – 2,5 km east from Impilahti, at the mouth of the river flowing from Saavilampi into Lake Ladoga. The government did not permit to build the plant, so he started a limestone ("Chalk") plant, which probably burned marble produced in Hopunvaara and Impilahti[28]. The plant did not work long.

In 1840, two kilometers south-east from the village Pitkaranta and 200 m from the mouth of the stream Kelenoya, which flows into Lake Ladoga, Albrecht started the construction of a small steel plant named Albrecht "Aleksandrinsky" in honor of his wife Alexandra.

In 1841, on the site under exploration in the mine "Pervoyn" (district follow mine "Klee-1") Gustav Albrecht opened a rich copper ore deposit in marble deposit in Hopunvaara mountain, 5 km from Pitkaranta.

January 24, 1842, G.Albreht sold the unfinished plant on the stream Kelenoya, together with ore areas in Pitkaranta for 5000 rubles in silver to the owner of St. Petersburg restaurant Henry Klee who gave the Senate an interest-free loan in the amount of 10,000 rubles for 10 years. The new owner also received for rent four sites of 78 hectares – in the mouth and on the territory of Kelenoya and on the territory from Kitelya to Salmi.

In 1843, H. Klee opened six mines (according to other sources – four), arranging them in a chain along the granite-gneiss rocks encircling Pitkaranta from the north. His assistant was an entrepreneur Alexander Harder[29]. Most of these mines worked for years and decades changing the owners, but their names were not changed ("Klee-1", "Klee-2", etc.) and remained until the closing of the mines at the end of the XIX century.

Aleksandrinsky plant was launched in November 1843. A month later under the supervision of the Swedish masters the first test on copper matte smelting ore, and then to pure copper was carried out at the plant. Klee's plant managed to get 1000 puds of copper.

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[27] Трюстедт (Трёстедт) О.Г. Питкярантские рудники и заводы. Гельсингфорс, 1907.

[28] Копонен П. Мое отечество – Импилахти. Хельсинки, 1993

[29] Трюстедт (Трёстедт) О.Г. Питкярантские рудники и заводы. Гельсингфорс, 1907.

Aleksandrinsky plant included a dam, a furnace for smelting copper ore, a forge, and various devices for preparing ore and furnace charges, which were driven by a water wheel with the diameter of 4 m.

From the description, made by G.A. Iossa in 1844 Aleksandrinsky smelting plant looked as follows. From the dam to the melting factory there was a wooden waterpipe 165 m long, by which the water flowed on the floats of the "overshot wheel" driving the "blowing machine".[30]

The "blowing machine" was a cast iron fan which blows air into the two furnaces and a heating furnace using a capital pipe, leather hoses and a blowpipe. The fan was driven as follows: through the 0,9 m wide hole for the water lapping water flowed on the overshot wheel with the diameter of 4,3 m, which rotated at a speed of 15 revolutions per minute. On the shaft of the overshot wheel a wheel with the diameter of 2.1 m was fixed, which rotated at the same speed. That wheel drove pulley with the diameter of 0,8 m, and a wheel with the diameter of 1,5 meters, rotating at a speed of 42 revolutions per minute. From the latter the motion of the wheel was transmitted to the other wheel with the diameter of 0,6 m, rigidly connected with a wheel with the diameter of 1,5 m, rotating at 105 revolutions per minute. Through the rotation of the belt pulley the wings of the fan were actuated. Through the capital quadrangular wooden pipe with a cross section of 0,3 m the air from the fan went to wind iron fountains with the diameter of 15,2 cm then to bore pipe of sheet iron, and then through the blowpipe and leather hoses to the oven.

In one furnace ore was smelted to copper matte, in the other – copper matte to "black copper", which was then purified in the heating furnace. The smelting furnaces looked like blast furnaces. G.A. Iossa suggested a more advanced design of furnaces, which was used on Alexandrinskiy plant. Oven for smelting copper ore to copper matte had the cylinder, and the furnace throat of the same width. Furnace height was 4,9 m, the width of the furnace throat was 0,7 m in both directions. The height of the furnace shaft reached 1,5 m, the height of the smelting space was 1,5 m, and the width – 0,45 m.

The furnace consisted of the following elements: a lance, a lance arch, a working arch, exterior and interior walls, furnace hubs, exhaust slot for copper matte in the sand and release. The width of the outer furnace walls was 0,76 m at the bottom, and 0,6 m above. The width of the internal walls of the mine was 0,3 m and 0,6 m in the lower space. The outer furnace were made of ordinary brick, the interior – of refractory "English" brick.[31]

In 1844 the plant only smelted ore to copper matte and burned it in the stalls. G.A. Iossa noted that when there was a lot of copper matte and the plant needed masters and workers from Falun, then the furnace for smelting copper matte to black copper and the heating furnace would be run.

Every half an hour "kolosha" was poured out to the furnace. "Kolosha" was a mixture of burned spruce, fir and pine forest, charcoal. 48 "Koloshes" were smelted to copper matte every day, which were 336 puds (5376 kg) of copper ore. In 1844 the plant melted low-grade iron ore, which contained only 1,9 % of copper, but then rich ore was smelted.

According to G.A. Iossa, in 1844 the ore was taken from Klee's mines, put down in the same ore body, which was developed by Vsevolod Omelyanov. At that time, the depth of the mines "Klee" reached 12,8 m. From the trunk of each mine there were drifts in both directions along the ore body (more than 2,1 m).

Copper ore was extracted from the "gangue" (probably skarn), which contained chalcopyrite, "malakolite", white, green and purple fluorspar, quartz, pyrites, blende, lodestone, garnet, molybdenum and tin stone. Shafts and drifts were sunk without lining, as rock and ore body were strong enough. Only the mouths of the mines were strengthened with logs. Ore extraction was made by drilling and exploding using gunpowder. Groundwater inflow into production was fast enough, so it was continuously pumped with a manual winch.

G.A. Iossa wrote that in the future the administration of the mines planned to start pumping water with a horse-drawn dewatering machine. This machine was also planned to serve for lifting the ore which was carried out with the manual winch.[32]

After 1845 Aleksandrinsky plant acquired new sites, which included peat bogs Hopunsuo, Koyta-

[30] Иосса Г.А. Александринский медеплавильный завод близ Питкяранты в Финляндии, принадлежавший Г. Клее // Горный журнал, Санкт-Петербург, ч. 4, кн. 10, 1844.

[31] Ibid.

[32] Иосса Г.А. Александринский медеплавильный завод близ Питкяранты в Финляндии, принадлежавший Г. Клее // Горныйжурнал, Санкт-Петербург, ч. 4, кн. 10, 1844.

suo, Tetrinsuo and lake Nietyarvi. At that time, the plant had 2,500 tons of copper and 1,300 tons of copper ore. In 1845 16 tons of good quality copper was sent from Aleksandrinsky plant to St. Petersburg.[33]

Time has also damages Aleksandrinsky plant. Dark spruce forest, a thick layer of forest litter and moss hide the remains of the plant and smelters foundations. Only black metallurgical slag and fragments of the plant basement reminds us about the plant. Kelenoya stream has shallowed and in summers is almost dry.

Fig. 4. Kelenoya stream, where Aleksandrinsky plant was

The territory of the former plant was studied by Borisov I.V. in the 1990s. The object is located 2 km south-east from the center of Pitkaranta, on the road to the village Yulyaristi, 250–300 m from the railway crossing and 150–200 m from the mouth of the stream Kelenoya. A narrow path leads from Pitkaranta-Yulyaristto road to the ruins.

On the forested area of 40 × 80 m^2 there are traces of the following production:

1. The basement of the main body of the plant, up to 0,5 m high and 3–12 m long;
2. Stone and brick basement of the smelting furnaces with the height of 0,7–1 m and diameter up to 1 m;
3. Stone basement of the water wheel supports;
4. Traces of the ditches of different shapes and lengths, 0,5–1 m deep;
5. Retaining wall built of stones near the stream Kelenoya, up to 5 m long and 0,6 m high;
6. Black sponge slag dumps about 20 × 40 m^2, up to 1–1,8 m high.

[33] Трюстедт (Трёстедт) О.Г. Питкярантские рудники и заводы. Гельсингфорс, 1907.

Fig. 5. Slag dumps of Aleksandrinsky plant. 2012

The ruins of Aleksandrinsky plant are of great interest for historical science and have a high tourism potential. A detailed archaeological research should be conducted on the territory of the former plant, as well as object museumification. This object must be declared a monument of industrial culture (a memorable place).[34]

During the period from 1810 to 1847 years significant exploration work was conducted in Pitkaranta – 2 km of the ore area were investigated, smelters were built. All that demanded a huge amount of money – 1,56 million paper rubles. Despite such significant costs, smelting metals at Mitrofanovskiy Alexandrinskiy plants was weak. In 1843 Alexandrinskiy factory smelted 1,12 tons of copper, and in the next 4 years – 16 tons. Unfortunately, there is no accurate data on smelting for the period of 1842–1847, and the available information is based only on the foreman Thoveld's records (1852).

"Pitkaranta Company" and "Pitkaranta Society" (1847–1867)

After the death of Vsevolod Omelyanov, 17/29 June 1847, his heirs sold Mitrofanovskiy plant to five entrepreneurs from Saint Petersburg – Iossa, Evreinov, Mussard, Seguyn and Duval. The next day Henry Klee sold them Aleksandrinsky plant with all the mines for 120 000 rubles in silver. The total purchase price was 180,000 rubles in silver. "Pitka-

[34] Борисов И.В. Научная справка: "Природнотехногенные ландшафты Александринского медеплавильного завода на Келиноя в окрестностях Питкяранты (1843 – середина XIX века)", 2004 г., утв. н.м.с. РМСП 23.09.2004 г., архив РМСП, дело № 485.

ranta company" was set up. The registered capital of the company was 400,000 rubles. A banker John Seguyn was appointed a life General Director. Lieutenant Colonel Henry Iossa became the leading mining specialist.[35]

In 1847–1850 the Executive Director of "Pitkaranta company" was Anders (Andrey) Komonen. He was a good organizer and a very strict employer. Komonen banned free trade of wine in Pitkaranta and earned hatred of the common people.[36]

July 7, 1848 the Finnish government granted "Pitkaranta company" the right to use subsoil and forests of Pitkaranta and north-east coast of Lake Ladoga.

Having enough funds "Pitkaranta company" soon developed a profitable mining production. In the mines, "Omelyanov-1", "Omelyanov-4", "Klee-5" and "Klee-6" intensive mining began.

In 1849 upon the project of G.A. Iossa they started excavation of the drainage adit from Lake Ladoga to the mine "Omelyanov-3." This tunnel was to provide loading of tin ore from the mine directly into barges. However, the project failed. In 1856 the adit was worked only for 250 meters, and was completed only in the beginning of the 1880s, when tin mine was practically depleted.[37]

Apparently, "Iossa's adit" in Pitkaranta did not come down to us, it was destroyed by subsequent mining and urban development. Nevertheless, such a large object cannot disappear without a trace, and it is necessary to search using geophysical methods.

In the late 1840s, "Pitkaranta company" arranged a new (third) tin ore enrichment smelter factory – "Alasavotta" (the "Lower plant") on the stream Kelenoya, in 3/4 miles north from the old Aleksandrinsky plant. Probably, that factory started to work in 1849 or 1850, according to the documents in the Leningrad regional state archives in Vyborg.[38]

The new plant was, in relation less than 2 km east from the city center of Pitkaranta, 300 m to the northeast from the intersection of the railroad and highway Pitkaranta – Yulyaristi, 60 m from the "bypass" roads in the east.

200 m from the plant, up the stream, the dam was constructed from which a drain led to the plant.

Water flowing down the drain, rotated the wheel with the diameter of 6 m, which, in turn, drove other mechanisms of the ore processing factory. At the factory there was an ore stamp and four hydraulic crucibles. Three melting furnaces for intermediate "raw copper" and pure copper were set. They were equipped with blowers, working from waterwheels. The factory also had a coal bunker.

To provide the plant and the factory "Alasavotta" with water "Pitkaranta company" attempted to connect Nietyarvi lake (5 km north of Pitkaranta) and the stream Kelenoya with more than 4 km long channel. This channel ("Vustano channel") was dug by serfs. 50 thousand rubles in silver were spent on the channel, the desired goal was not achieved. Kelenoya creek was connected with the lake Nietyarvi in the area of Valkialampi lake, but the water flowing through the channel was not enough for the "Lower plant", which in the late 1850s – early 1860s finally stopped working.

Time and people have destroyed almost all traces of the plant "Alasavotta". Only a small building of slag (size 2,5 × 3 m) on the shore of the creek remained. It has long been used by one of the townspeople as a cellar, some fragments of the foundations of buildings, slag dumps covered with a thick layer of turf blades. The place of the plant "Alasavotta" is convenient for tourists, it is practically on the outskirts of Pitkaranta.

Lack of water in the stream Kalenoya also disrupted the work of Aleksandrinsky plant downstream of the plant "Alasavotta". In 1852, "Pitkaranta company" put here a steam engine to drive the blower and for water lifting.

In 1851 (or in 1852) in Pitkaranta above the mine "Klee-1", near the mine "Pervoyn", "Pitkaranta

[35] Трюстедт (Трёстедт) О.Г. Питкярантские рудники и заводы. Гельсингфорс, 1907.

[36] ОГАВ, ф. 1, оп. 2, д. 41, 24 л., 1850 (Переписка с Финляндским Генерал-Губернатором о предоставлении Питкярантскому заводу прав на беспошлинный вывоз меди и олову, на вывоз рудокопов из Саксонии, продажу акций и утверждение устава фирмы).

[37] Трюстедт (Трёстедт) О.Г. Питкярантские рудники и заводы. Гельсингфорс, 1907.

[38] ОГАВ, ф. 1, оп. 2, д. 41, 24 л., 1850 (Переписка с Финляндским Генерал-Губернатором о предоставлении Питкярантскому заводу прав на беспошлинный вывоз меди и олову, на вывоз рудокопов из Саксонии, продажу акций и утверждение устава фирмы).

company" built another (fourth) smelter (the "Upper plant"). The building was 69 meters long. There were 6 (according to other sources 4) furnaces for melting "raw" copper and blister copper, 4 conical crucibles 6,6 m high, one tin smelting furnace, and two blacksmith forges.[39]

The plant had two steam engines (19 hp thickness) which drove blower furnaces, pumps for pumping water out of mines and ore-mechanisms. Nearby there was a coal shed. The new plant was called the "Upper Plant".

When the entrepreneurs started "Pitkaranta company" they had problems with the hired workers brought from the province Simbol. The first two weeks, those workers did not do anything, just drank and fought. Within two months, each of them owes the company so much that the owners of the company had to stop issuing their salaries. Then a mutiny broke out. January 16, 1849 some of those workers broke into the office of the Board and demanded to give them their salary. With the help of the older workers the rebels were pacified. That incident made Baron Ungern-Sternberg, the manager of Pitkaranta mines and factories to apply to the Senate for permission to bring 60 workers from Germany. But the Senate allowed bringing only 30 people.[40]

In general, the workers' life in Pitkaranta was better than on other similar plants in Finland. Accommodation was warm, clean and spacious. Almost all the families had their own apartment or house. Many of them built their houses.

According to geologist O.G. Tryustedt "Pitkaranta company" deserves praise because it significantly increased smelting and ore extraction. If during the period from 1814 to 1852 in Pitkaranta about 83,000 tons of ore was produced, in the next 10 years, from 1853 to 1863, that amount had already reached 160,000 tons. Totally from 1830 to 1860 in Pitkaranta 283,000 tons of ore was produced: 42 % – in the copper mine "Omelyanov-4", 40 % – in the copper mine "Klee-1", 14 % – in the tin mine "Omelyanov-3", and the rest – in the mines "Omelyanov-1", "Klee-4", "Klee-5" and "Klee-6".[41]

In the first years of "Pitkaranta company" production of copper increased significantly. In 1847–1851 up to 8 tons of tin and 48 tons of copper were smelted every year.

When Baron Ungern-Sternberg (1847–1859) was a manager the annual copper smelting increased from 48 tons (1847–1851) to 143 tons (1856), and then decreased slightly to 85 tons (1859). Pretty much copper smelting was due to the competent management of the company and large reserves of copper ore mined by Vsevolod Omelyanov for 15 years in the mine number 4 ("Omelyanov-4").

The tin recourses were poorer. During the first four years of "Pitkaranta company" the plant smelted about 8 tons a year, then in 1852–1855 – 300–400 kg per year, and since 1856 tin smelting furnace stopped completely. In 1852, the only tin mine ("Omelyanov-3") was closed.

Ungern-Shtengberg paid great attention to the development of production, the introduction of technological innovations in the mines. For example, steam engines were used for extraction of ore and dewatering deep mines, though in small mines for this purpose horse engine and manual traction were still used. In the tin mine from time to time a windmill was used for pumping water. The pumps were made of wood.

"Pitkaranta company" built 24 wooden houses for workers, apartments for the manager, his assistant and the priest near the mines. As follows from the mountain master report in 1854, the school and church in Pitkaranta were looked after better than all the other Finnish factories. The workers lived in nice apartments, and their children were taught to read and write by the priest and a teacher. Young women were given the opportunity to study in a specially constructed school of manual labor (housekeeping). It was the best school in the country of manual labor. Workers had high social benefits. There was a benefit society for assisting ill workers

In 1851 a professor of Saint-Petersburg University Stepan Semenovich Kutorga about Pirkarants mines: "*In the local ore deposits there are eight mines protected from rain and snow with wooden huts. Ore... is exploded with gunpowder and lifted from the mines with the help of wheelbarrows. On the surface the ore is split to allocate the empty rock and to grind the ore for smelting…the waste rock throw in the dumps... The split copper ore is sorted into rich*

[39] Трюстедт (Трёстедт) О.Г. Питкярантские рудники и заводы. Гельсингфорс, 1907.

[40] Унто Мартикаинен. Ранние стадии развития Питкярантских заводов// газета "Карьяла", 31.05.2007 г

[41] Трюстедт (Трёстедт) О.Г. Питкярантские рудники и заводы. Гельсингфорс, 1907.

and poor, and the latter goes to the mineral processing facility, and the rich is melted directly on the factory and smelted to black copper. Black copper is cleaned... in the hearth, after several hours of melting….

The ore is cooled by pouring water over it. The cooled iron copper is removed with forceps, it forms a large flat circle. The remelted copper poured from the crucible in the form of cast iron, coated inside with clay. The spilled copper still hot, is crimped under a large hammer. In this form it comes in wholesale to the factories where bars and strands are made of the ore...”.[42]

In 1855, “Pitkaranta company” was purchased by a merchant from Lappeenranta Anton Gutchkov at an auction. October 25, 1857, he sold the company to the new owners – Dutchess A. Kotchoubey, the banker John Seguyn, a collegiate counselor Alexandr Kemmerer. The company founded by them was called “Pitkaranta society”. Petersburg merchant Gyutshov gave the financial assistance.

Since the water to complete the work of the “Lower Plant” (Alasavotta) was not enough, in 1858, above the mine “Omelyanov-4” “Pitkarana society” built a new processing plant, focused on the enrichment of tin ore. Water for washing the ore the factory received from a small lake Peryalampi from which channel, partially lined with stone led to the venture. This factory did not work during the summer drought and winter, when the lake was frozen.[43]

According to Nils Adolf Nordensheldt in 1858, tin ore was found in many mines in Pitkaranta. Cassiterite was yellow-brown, light brown, black. Sometimes there were colorless grains. Cassiterite was often associated with garnet, copper and sulfur pyrites, malakolitom, quartz. Sometimes smaller octahedra sheelite grew on cassiterite crystals.[44]

In 1859, Alexander Kemmerer died and its shares were passed to his heirs – son Yegor Kemmerer, daughters Mary Evreinova (Kemmerer) and Emilia Chulkova (Kemmerer). In 1859, Baron Ungern-Sternberg was fired and replaced by former serf Afanasy Markovich Shiryaev. A.M. Shiryaev ran the factories and mines with diligence and skill. Afanasy Shiryaev studied mining at ironworks of the Dukes Beloselsky-Belozersky in Kata-Ivanovsk in Ufa province. The new management immediately drew attention to the importance of exploration of tin ores. In 1852 the flooded tin mine “Omelyanov-3” was restored, and in 1860 was opened again.

In 1860 two more steam machines for crushing and washing tin ore. 576 puds of tin were smelted. During the following three years, the smelting of tin increased, reaching a peak – 4026 puds (64,416 kg). It was the highest production of tin from the mine in the history of Pitkaranta. The cost of tin at the factory was 8 rubles 60 kopecks. – 8 rubles 95 kopecks for pud. In 1863 it decreased to 6 rubles 60 kopecks. Copper smelting also increased in 1860, it was 10,214 puds (163,424 kg), but then began to decline and fell to 5,336 puds of (85,376 kg) in 1863.

Those positive changes in the production of metals were caused by a number of events. At the beginning of the 1860s more attention was paid to ore sorting. With proper sorting from one cubic fathom copper 431 puds of (6896 kg), tin – 560 puds of (8960 kg) could be obtained: The tin ore won from the mine “Omelyanov-4” was also rich in tin, as well as the ore from the mines of Saxony and Bomens.

When the manager was Ungern-Sternberg 3 472–4 080 kg of ore was obtained from one cubic fathom of unsorted ore, when A.M. Shiryaev – from 6256 kg (1860) to 7424 kg (1863).

In the early 1860s A.M. Shiryaev rented the neighboring forest for 15 years. A detailed exploration and preparation for the development of two peat swamps located in ¼ mile north of the mines and ¾ of a mile to the northeast of the plant (Lake Tetrinlampi and Peryalampi) began. Peat was meant to replace coal and wood-fuel, which was clearly not enough for the smelter. A special machine was bought for peat digging. Extracted and dried peat was tested in smelting copper ores and it gave a good result – one cubic fathom peat replaced 22 sack of charcoal. In 1861, for the smelting of metals was used 192 tons of peat, and in 1862 – 480 tons.

While A.M. Shiryaev’s management the ore production increased dramatically compared to previous years, when the manager was Ungern-Sternberg. If in 1859 the production of gore was 223,279 puds (3,572,464 kg), in 1860 it was 339,807 puds (5,436,912 kg), and in 1861 reached a maximum of

[42] Куторга С.С. Geognostische Beobachtungen im sudlichen Finland. Verh. d. russ. min. gesellsch. in St. Petersburg.1851.

[43] Трюстедт (Трёстедт) О.Г. Питкярантские рудники и заводы. Гельсингфорс, 1907.

[44] Норденшельдт Н.А. Заметки об оловянной руде из Питкяранды// Горный журнал. Санкт-Петербург, ч. 4, 1858.

427,618 puds (6,841,888 kg), in 1863 it declined to 229,239 puds (3,667,824 kg).

The shortage of fireproof materials made A.M. Shiryaev to use graphite found on the island Pusunsaari. Graphite was mixed with clay for making bricks used for masonry stoves and furnaces. [45]

In the early 1860s red copper smelted at Pitkaranta plants was studied by K. Lysenko. Studies conducted in the laboratory of the Mining Department in 1851–1854 found that Pitkaranta red copper contained 99,55 % of pure copper, 0,218 % of silver, 0,06 % of iron, 0,17 % of tin and a very little amounts of zinc and lead. But, despite the purity of the copper it had forging property, increased fragility, brick-red fracture and blistered structure.

New tests carried out by K. Lysenko showed that smelted Pitkaranta copper contains: 97,7 % of pure copper, 2 % of copper oxide, 0,25 % of silver, 0,08 % of iron, but zinc, lead and tin were not found. Probably the negative properties of copper could be explained by the contaminant of copper oxide. Pitkaranta copper purified while remelting with coal received significantly better quality – more dense structure.

Analyses showed that Pitkaranta copper contains an average of 0,25 % of silver. With an average annual production of 160 tons of copper this could give a total of 400 kg of silver, which, according to K. Lysenko did not worth the invested money.[46]

In 1859, the plant was inspected by Lieutenant-General Pashkov and estimated it at 50,000 silver rubles. In 1862, the price of the plant was 150 000 rubles in silver. Those facts prove the success of the enterprise in the early 1860s.

The work on Pitkaranta mines was difficult and dangerous. Some of the mine reaches a depth of 225–235 m. The ore was mined in the open way by breaking pits. The holes were drilled manually. The black powder was used for blasting off the solid. Large pieces of ore were milled with picks and crowbars. Lifting trolleys initially carried out manually, and later – with the help of horses and steam lifts. At first mine were dried manually with buckets and then began to use hand pumps. Resin torches lit the mines.[47]

In the 1860s a limnologist Aleksandr Petrovich Andreev visited Pitkaranta. He made an interesting description of the mines and factories. At that time in Pitkaranta only two of the six mines worked – tin and copper, they were located at a distance of 320 m from each other, and the rest were under water.

The tin mine was “at a depth of 40 fathoms, 35 fathoms below Lake Ladoga and had five galleries”[48]. The building of the sixth gallery had only been started, it was 58 m deep.

At tin mine there was a steam engine to lift ore from the mine and to pump water, a bit further there was a building where the boys broke the ore into small pieces and sorted it.

The tin ore lifted on the surface from the mine was broken into pieces and sorted. After the original treatment the tin ore was sent to the crushing-swilling plant, which made heavy black and fine concentrate containing up to 45 % of tin. Then, the concentrate was smelt in the furnace. The tin was smelted in rods and sealed in barrels at the bottom of which there was a sign: “Tin from Pitkaranta mines in Finland”.

At copper mine there were building with a steam engine for crushing and washing ore, a smelting plant with furnaces and furnace for smelting tin. The steam engine was pumping air into the furnaces, and water raised ore from the mine. Near the plant there were houses of the manager and his assistant, factory office, coal sheds, facilities for workers and other buildings.

Smelted in Pitkaranta copper was valued quite high because contained over 1 % of silver. Smelted copper was transported to Saint Petersburg on the boats (while navigating), and on carts (in winter).

In January 1863, the company had a big fire which burned all the copper smelting department, so the company suffered significant losses. Despite the fact that the plant was quickly restored, copper was smelted only for a few months, and the annual smelting was quite small. It became even lower in 1864, increased slightly (with tin smelting) in 1865, then ended. Before the beginning of 1866 as a whole in Pitkaranta 1581 tons of copper and 208.8 tons of tin were smelted.[49]

[45] Ширяев А.М. Несколько слов о Питкярантских рудниках и заводах// Горный журнал, Санкт-Петербург, 1864, ч. 1.

[46] Лисенко К.О составе и свойствах питкярантской красной меди// Горный журнал. Санкт-Петербург, ч. 4, 1862.

[47] Копонен П. Мое отечество – Импилахти. Хельсинки, 1993

[48] АндреевА.П. Ладожскоеозеро. Санкт-Петербург, 1875.

[49] Трюстедт (Трёстедт) О.Г. Питкярантские рудники и заводы. Гельсингфорс, 1907.

Fig. 6. A scheme of mines of the the “Old ore field” Grendal G., 1896

In 1866, John Seguyn died. “Pitkaranta society” requested a state loan for the development of the enterprise, but it was rejected. Then the company was forced to sell the company (all mines, factories, land) from the auction.

October 5, 1867 all property of “Pitkaranta society” was auctioned. Then Pitkaranta mines and factories were bought for over 20,000 of Finnish marks by a rural merchant from Kitelya Alexey Yudin and his mother Paraskovja Yudina, who sold them to a French merchant at the end of 1867. By the beginning of 1868 Duchess Kotchoubey was the only owner of “Pitkaranta society”.

In 1869 tin mines “Omelyanov-4” and “Klee-1” started working again, the factory began to smelt copper and tin.

In 1873 a mining master reported that in Pitkaranta there was enough ore, but due to lack of funds the owners of the mines and factories felt insecure, that is why the ore mining and smelting of metals did not develop, and gradually decayed. Tin smelted very little and mostly from the old tin sand. Factory forest reserves were severely depleted so the factory had to buy the wood for industrial purposes.

In the second half of the XIX century ores and metals from Pitkaranta were transported by steamers and barges in summer, and in winter on the winter roads along the western shore of Lake Ladoga through the city Serdobol, Kexholm station Frantishkovo to Saint Petersburg.

“Edward Meyer and Co”. The golden age of Pitkaranta mines and factories (1875–1896)

After the death of Efrianda, in 1875, Pitkaranta mines and factories were bought for 28,000 rubles by Saint Petersburg bank “Edward Meyer and Co”. Saint Petersburg merchant Carl Winberg was appointed to manage the enterprise.

A traveler Alexander Eliseev visited Pitkaranta in 1877 wrote the following about the mines: “At a time when we visited Pitkyaranta, the work in copper and tin mines was conducted fairly vigorously and hundreds of workers were digging in deep quarries. Our descending into the tin mine located at a depth of more than thirty fathoms, was not particularly successful, and we rolled down the stairs of the wet ladder, however, we go tonly minor injuries... Going down to the main gallery with lanterns in our hands we wandered around the mines, green wall which sparkled, reflected the numerous lights of the workers, who mined the tin ore”.[50]

In 1880, an engineer Helmar (Hjalmar) Furuhelm (Furuhelm) became a councilor of mines in the banking house “Meyer and Co.”. He got his education in Sweden, Germany and England. He introduced a number of technical changes in the production process of mining and smelting, and using significant bank donations he managed to revive the production in Pitkaranta, which had been in decline for 5 years. H. Furuhelm conducted a research seemingly unpromising mines. He worked on restoration of mining production in Pitkaranta. Helmar Furuhelma activities led to a revival of Pitkaranta mines and factories, to their stable development and prosperity that lasted almost for 25 years.

Primarily, H. Furuhelm drew attention to changing conditions of the ore mining and re-equipment, which in the last 20 years had been obsolete. Some mines were connected with longitudinal drifts, and upon them narrow-gauge railways were paved. Trucks with ore were lifted up to the surface. Ore was sorted straight in the mine, which led to cost savings. Instead of daily wage piecework wage was

[50] Елисеев А.В. По белу свету. Санкт-Петербург, 1915.

introduced. Drills with diamond heads were used for exploration.

Only the most productive sites were developed, which takes less time, effort and explosives. In the 1860s tried to take only the rich ore for smelting, and less rich stockpiled in dumps. Mineral separation was given more attention. During the study tour in 1879 by mining enterprises in Sweden, Germany and England, H. Furuhelm noticed Swedish miners were ideal for the development of the field in Pitkaranta as their equipment was adapted to work with strong crystalline rocks, and at that time it was the most advanced. But only 25 foreign workers) were invited to work in Pitkaranta. Thus, a large part of the workforce in Pitkaranta mines still were former Karelian peasants from the surrounding area Pitkaranta.[51]

A Swedish engineer and metallurgist Johan Gustav Grendahl worked on the questions of technical re-equipment on the advice of H. Furuhelm.

The 1880–1890's were a period of the most intensive development of Pitkaranta mines and factories – the third largest industrial enterprise workforce in Finland. For the processing of the ore mined below the mine "Omelyanov-4", near the Postal street a small enrichment plant was built on the pattern of Harzer with crushers, two filter drums and two sorting tables. Pitkaranta copper ore containing magnetite, scheelite, silicates and garnet was not suitable for mechanical cleaning, for this reason a new way was introduced. Tin ore was sorted by jigging machines with washing facilities.

The old ore washer built by "Pitkaranta company" was renovated and re-launched. It continued to work till the plant closure in 1904. This ore washer was driven by a water wheel with the upper course of the water in the 25 hp and contained the throng with nine pitprop, two jigs, two rotating bunkers and numerous drains of sludge.

In the 1880s, a new tin-washing plant was also planned to build, but the amount of the produced tin ore was not enough.

In the so-called "Upper" factory, in the mine "Klee-1" the old furnaces partially replaced and a new powerful blower was purchased. Those furnaces were in use after a fire in 1881 untill the full implementation of so-called "water method" of copper mining 1885.

Construction of a plant for the extraction of copper by "wet method" became one of the most important measures to modernize the mining enterprise in Pitkaranta. Silver production in Pitkaranta (1882) saved the plants and mines from bankruptcy for many years.[52]

After careful tests, the construction of the exhaust plant started. G. Grendahl designed muffle furnaces, which passed all the tests. In 1885 the new factory was brought into operation in Pitkaranta.

In his book "Pitkaranta. A brief description of Pitkaranta deposit, mines and factories" published in St. Petersburg in 1896[53] G. Grendahl described the situation in Pitkaranta in the 1890s. At that time copper ore was mined in the mines "Omelyanov-4", "Edward Meyer", "Meyer-2", iron ore – in the mines "Nikolai 1" and "Nikolai-2".

"The system of production was underhand stoping. The hight of a highwall is 30–40 feet. At the areas where the rock contains much ore and at the same time is so fractured that can cause the roof collapse, it is necessary to build cribs, sometimes even put framed timber.

The workers' wages were calculated according to deciton of ore delivered to the surface, if several people working at one point owe some ore, the earnings divided between them according to the number of the drilled holes. This method of calculation is quite justified as it encourages workers not only make the largest possible number of holes, but to make them convenient and for the greatest efficiency of the explosion... workers pay themselves for explosive materials and tools for drilling.

Dynamite is used only on special order, and there have been no accidents so far...

The ore haulage to the lifting shafts is made by rail. Mined rock is poured into caufs 5 deciton each and standing on low cars; rise to the surface is made in the same caufs by rail. All mines inclined, as held by the ore-bearing stratum.

Mine drainage is done by metal and wooden suction and discharge pumps. The inflow of water is ge-

[51] Трюстедт (Трёстедт) О.Г. Питкярантские рудники и заводы. Гельсингфорс, 1907.

[52] Трюстедт (Трёстедт) О.Г. Питкярантские рудники и заводы. Гельсингфорс, 1907.

[53] Грендаль Й.Г. Питкяранта. Краткое описание Питкярантского месторождения, рудников и заводов. Санкт-Петербург, 1896.

nerally light in the mines. Two steam engines drain water acting on individual pumps by wooden rods.

Advanced exploration work performed by exploration drifts and shafts, although in recent years manual diamond drilling has been used. To determine the depth of field in the depth they lay a cross measure drift in the hanging wall and make the boreholes. Diamond drills of Swedish firm "Society diamond drilling" are used, as they differ have a practical design, even in the tightest of mines... this system came into use in many places, not only in Finland but also in Russia.

Exploration by manual diamond drilling proved itself with a very good side, as it is extremely comfortable. It gives quite accurate data on the rocks, does not require a lot of time or high costs...

Due to the heterogeneity of mined in Pitkaranta ore, sorting is a very difficult job. To separate three main ore grades, namely copper, tin and iron is not enough, because these latter are separated to a significant number of varieties.

The first rough sorting of the entire mass of the ore is made near the mouth of the mines or in the houses. A rough sorting results in the following varieties: copper ore of grade I, copper ore of grade II, fine ore (containing mainly copper), iron ore of grade I, low-grade ore iron ore, tin ore.

The ore of grade II undergoes secondary manually sorting...

The fine ore is washed in special drums... These operations are made in the summer... it is poured into a rotating drum, immersed up to a third in a box with water. At the wide end of the drum there are spades, raising the washed fines and drop it in the chute on which it is delivered to the sorting tables.

The sorting tables consist of an endless belt moving on wooden rollers. Their length depends on the greater or lesser difficulty of sorting... The workers throw the sorted ore to the boxes placed on the other side of the table...

During iron ore sorting the first-grade ore is obtained, free from impurities of sulfur compounds of other metals and ore, which contains various sulfur metals going to wash, two varieties. One type contains 1 to 1 ½ % of copper, and other less than ½ %.

Both grades are concentrated separately by magnetic separation then they enter the crusher, the obtained ore grains are from 5 to 10 mm. After this ore is further divided in nuclear mills.

Magnetic concentration of copper ore was applied in Pitkaranta for a long time, but is currently suspended because the available reserves specially suited to this method of ore were exhausted....

To impart the magnetic properties of the copper pyrites, it is kilned in furnaces, similar to Gerstengeffer's furnaces.

All produced copper ore in Pitkyaranta is processed by the wet method. Ore is grinded in Blake jaw crushers, and then goes on another double crushing machine, giving it the size of grains up to 2 mm. Zinc blende and salt are added to the ore before grinding. The prepared ore goes to the kiln.

The kilns are... far from meeting demand... but they are satisfying, probably because in the places where copper is mined by the wet method, cheap sulfuric acid and hydrochloric acid are available, and hence you can work well with the ore which was not well roasted...

In Pitkaranta... it was impossible to be satisfied with not quite perfectly roasted ore, since all sorts of acid have to be carried from Saint Petersburg that involves very significant costs; moreover, Pitkaranta ore has relatively high sulfur content".

J.G. Grendal noted that immediately it was not possible to build a furnace with a hearth, which would meet all the requirements, so decided to use 4- storied furnaces in which the upper and lower stories were muffle furnaces. "*The workspace of the top storey was blocked with cast slabs, on the remaining levels... brick vaults are used. The furnace is designed so that the upper and lower levels can produce more or less heat and regulate it...*

With the transformation of the roasted ore from one storey to another, a very thorough mixing is achieved. The storied furnaces come close to the mechanical ones, but have lower fuel consumption and better heat distribution. Roasting the ore in such furnaces is essentially perfect...".[54]

In Pitkaranta furnaces mixing was carried out quite carefully, almost like in mechanical furnaces, and therefore salt consumption was small – only 2 % to 1 % of copper (unless the ore does not contain zinc blende).

Duration of roasting depended on the content of sulfur in the ore, and since in Pitkaranta ores con-

[54] Грендаль Й.Г. Питкяранта. Краткое описание Питкярантского месторождения, рудников и заводов. Санкт-Петербург, 1896.

tained a lot of sulfur, the time of roasting was 6–8 hours...

J.G. Grendal wrote: "Generally chlorinating roasting is extremely difficult by the presence of zinc blende in the roasted ore, and when the content of zinc blende is 15 % it is quite impossible to get a good product.

Ore containing zinc blende should be prepared to chlorination by means of oxidative roasting to convert zinc sulfide to oxide. Otherwise at the first roasting with chlorinating zinc chloride is obtained, and only when all of the zinc sulfide enters the compound the formation of chlorinated copper begins.

At ordinary temperatures of roasting zinc chloride remains constant and only disappears when the temperature rises; still we have to spend anexcess amount of salt corresponding to the zinc content. If zinc content reaches 15 % or more, it turns out that amount of salt is so high that the progress of the operation should be stopped...

Acid gases formed during roasting contain mainly hydrochloric acid and are condensed in special brick towers. A very weak acid is obtained, which is used in solutions leaching.

If the temperature is too high, some copper evaporates together with the gases and. and the subsequent leaching involves great difficulties.

Far better to stick to a lower temperature, although the duration of roasting increases, but the results are more satisfactory... the temperature should not exceed 500 degrees...

During the process of roasting silver contained in the ore goes over silver chloride and obtained by leaching with copper...

When it is necessary to roast ore with high content of lime, it is difficult to achieve good results, since lime combines with calcium chloride to chlorine, subtracting chlorine from iron and copper. If the ore does not contain sufficient amount of sulfur copper is not chlorinated even with abundance of salt...

The ore containing more than 6 % of lime is processed with great difficulty and with greater loss of copper... If the amount of carbon dioxide exceeds 100 cubic cm, and copper content in the ore does not exceed 3 %, the leaching process will be very difficult...

... lately ores containing lime is first treated with an acid obtaineded from the towers to make them more suitable for the chlorination. Since it would be extremely uneconomical to buy acid for this process, when there is not enough tower acid, we have to use the acid gases, which are obtained by treatment of the mother liquor...

Leaching process... goes in wooden vats. At the bottom of the vats first the bars are placed and then boards with drilled holes. Above all this wool is laid which serves as a filter. To capture the liquor which can leak, all vats are placed on a sloping asphalt floor along which the chute passes. Each vat is poured with about three tons of roasted ore and the initial leaching starts, with the help of weak solutions from previous operations. After harder soluble copper compounds are dissolved with the prepared from the condensation towers acid.... The precipitate is washed with water. Leaching operation lasts about 12 hours and is considered complete when after dissolving about 100 g of residue in aqua regia and the resulting solution saturated with a blue color is not seen...

Silver chloride is dissolved in the leaching of copper chloride solution and sodium chloride, of which the latter could remain unaltered in the roasted ore. For a more complete separation of silver chloride it is useful to process any residue immediately after leaching with weak solutions, strong desilvered copper solution, because silver chloride is not soluble with weak solutions...

...dissolution of silver is much faster and easier if roasted ore still hot enough to dissolve, but on the other hand copper dissolution under these conditions is extremely difficult. Therefore it is necessary to choose the right balance between the different solubilities. It turned out that if the roasted ore is completely cooled, then the extraction of silver from it is essentially insignificant...

Silver is deposited from a solution of potassium iodide. For the sake of economy, the latter is only added in an equivalent amount of silver...

Determining of silver is conducted as follows: precipitated silver iodide of potassium (potash) from 500 cc. cm acidified with hydrochloric acid solution. After filtration, a little crushed lead is added to the filter and, wrapped it in the leaf lead and produce cupellation. A goldcrest of silver is weighed on the ordinary assay balance.

The solutions from which silver is precipitated, are collected first in vats lined with lead, then they are passed through the device, in which potassium iodide solution is flowing continuously and finally lift pumps to higher vessels. Precipitation of silver iodide continues for about 70 hours and then desilvered solution is drained and goes to cementation.

When a sufficient amount of silver iodide is obtained, it is first washed and then converted to sodium sulfide in the processing of silver sulfide and sodium iodide. Sodium iodide again goes into process. From desilvered solution copper is obtained using iron. This operation is carried out in vats similar to those in which the dissolution was made....

Copper settlement continues for eight hours, and in order to accelerate it, the solution is agitated during the entire period and stirred. Cement copper is purified from adhering iron by special sieves. In the dry state... it comprises from 85 to 90 % of copper. Previously lead ejectors were used for mixing of solutions, but due to the significant amount of steam that they absorb, in the present day use simple wooden pumps. Due to the corrosive properties of the solutions, leather clothes pumping pistons replaced the clothes from birch bark, it is consistent with its purpose and works for several months without replacement. Birch piston clothing has long been used in the mines in Falun, where the water contains a copper miner and iron sulfate.

During the process of cementation cement copper and mother liquor are acquired...

Refining. Cement copper is dried until the moisture content is no more than 10–15 % then it is mixed with coal and compressed into briquettes. Simple gas reverberatory furnace with one working space is used.

Briquettes are put into the furnace in two steps, since they are quite bulky. After smelting, the entire mass the slag is removed and proceed to the oxidation step. To this purpose an iron pipe is inserted into the bath, insulated by means of clay and equine manure which is injected through the air delivered by the compressor. After 3 to 5 hours metal gets smooth fracture crystal composition. Then the surface of the molten mass is purified from the dross, coated with a layer of charcoal and start to mix it with fresh birch stakes. Mixing continues as long as the copper becomes quite malleable. The finished copper is poured into molds and the ingots of 10 kg each are obtained".[55]

Copper settled from a solution is purified with iron sieves, dried, mixed with coal dust, and compressed into briquettes. These briquettes are then placed in a reverberatory gas furnace, where copper melts and oxidated. After a few hours the metal obtaines a smooth crystal structure, then it is purified from the slag, coated with charcoal and brought to readiness. Part of the silver dust was sold in black in Russia and Germany.

Fig. 7. Ingoting of copper on Pitkaranta plant. G. Grendal, 1896

In 1882 using such "wet method" in Pitkaranta copper ore was desilvered. The largest amount of silver was produced in 1889–1894 (from 682 to 1163 kg), and in other years – from 220 to 850 kg.

Technical innovations introduced by J.G. Grendal led to a sharp rise in copper smelting.

Large amounts of sulfuric acid, Glauber's salt, sodium sulfate, ferric chloride and other substances were obtained while recycling copper. In Pitkaranta factories were built for red paint and glass production.

The plant which produced natural colors started working in Pitkaranta in the late 1880s and was closed in 1896. Many wooden houses in Southeast Finland are covered with Pitkaranta dark red paint

[55] Грендаль Й.Г. Питкяранта. Краткое описание Питкярантского месторождения, рудников и заводов. Санкт-Петербург, 1896.

that proved to be very resistant and durable. Paint was produced from the mother liquor obtained by cementation of copper by extracting sulfate and iron oxide from it.

As J.G. Grendal noted it was difficult to make up a furnace, "... under which the ravages of liquor during its evaporation could withstand... The only metal which I can think about when for making furnaces is iron and is primarily with high carbon content and a low content of graphite. But cast iron is very expensive and prone to cracking... when the temperature changes..."

After very many experiments he could build the kiln, which could withstand the destructive action of acids. This furnace consisted of three parts: the hearth, the furnace and the mine.

"... The furnace is arranged with additional thrust. The air required for combustion is introduced from the bottom of the shaft and comes with great force through the grate...

The mine of the furnace, in which evaporation occurs, rests on four columns. It ends at the bottom of a cast-iron box, which has a round hole with flanging in the middle.

The mine of is composed of refractory bricks. Under the cast-iron box between the columns there is a vessel made of thick wooden beams. The portion of the liquor which, when passing the tower does not evaporate, flows in the vessel through a round flanging. In this vessel, just below the center of the cast-iron box, there is a steam pipe that ends with a porcelain plate with holes. If we now let the steam go into the pipe it out from the porcelain plate with great force goes, pushing the solution from the vessel.... The resulting salt from time to time be raked out of the box... iron tower above evaporation also placed on the columns of condensation tower connected to the first short channel. The resulting salt contains the same components as mother liquor, except for water...

To transfer iron into insoluble or oxidation state, the resulting salt is crushed and incinerated in furnaces, similar to those used in the roasting of copper ores. If the resulting salt from the mother liquor contains significant quantities of zinc chloride, then it becomes more difficult to roast it, as such salt is sintered at a temperature of roasting and this impedes the transition of iron salts in the oxidation state. In this case it is necessary to add a small amount of clay.

Calcined salt is dissolved with hot water in a rotating drum, wherein the sulfuric acid salt solution is obtained. The remaining sludge is composed of completely pure iron oxide, which can be equated to the best red paint and put on sale".[56]

Sodium chloride used in chlorinating roasting ore in Pitkaranta was brought from Russia, England and Germany. They also tried to bring salt from Perm, but the cost of its transportation was too expensive.

Iron fines used for settling copper were bought fromin Russia and Finland. In 1887, with the aim to recycle Pitkaranta sulfate, a glass factory started working. It produced to ten million bottles a year, and it was more than all the others glassworks in Finland produced.

The plant had two continuously operating and two alternating oven, built according to the Siemens system. J.G. Grendal wrote that "the continuously operating furnace" had a circular cross section with the diameter of 8 m. In the furnaces there were on 22 working holes, at which two people worked. The material used for glass preparation were white quartz sand, which was taken from the riverbanks Tosno (district modern "Sablinskiy caves"), calcite, dolomite marble from Hopunvaara deposits (4 km from Pitkaranta) and sulfate from Pitkaranta and Petersburg plants. Pitkaranta glass was very durable as its cooling lasted up to six days in 64 cooling furnaces.

Today almost nothing has left from Pitkaranta glassworks except for fragments of glass, foundations of some buildings, outbuildings, partially lined with large slabs of black metallurgical slag.

According to the Finnish researcher P. Koponen, in 1880–1903 Pitkaranta factory complex was as follows. Between the road Impilahti-Salmi and the shore of Lake Ladoga there were the following structures (north to south): buildings of the glass factory with one and two furnaces, two gas furnaces, chimney, storage of water, later – dining room, storage of bottles, a plant producing colors, Glauber's salt plant (on the shore of Lake Ladoga), a pier. To the northwest from the glass plant there was a metallurgical plant with storage and a scrap yard, a weighing house, an engine room and relay workshops, the general steam, copper smelting separation, gas furnace, cop-

[56] Грендаль Й.Г. Питкяранта. Краткое описание Питкярантского месторождения, рудников и заводов. Санкт-Петербург, 1896.

per smelting department, smokestack, smelter. To the west there were a carpentry workshop, a forge, stables, a mine laboratory.

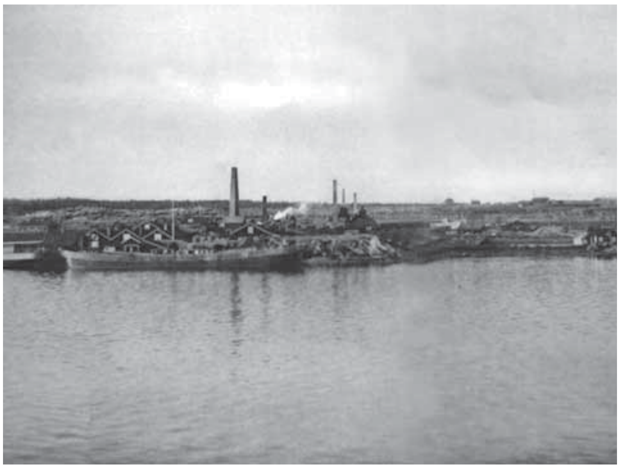

Fig. 8. Pitkaranta plants. G. Grendal, 1896

To the north from the road Impilahti-Salmi a salt warehouse and an engine room for the elevator-tower were built.[57]

In early 1887 new rich deposits of copper ore were explored. Among them there were mines "Meyer-2", "Edward Meyer", "Nicholas-1". Copper ore mining group "Nicholas-Meyer" was much richer than the ore mines of the "Omelyanov-Klee". Since 1888, ore production in the western part of the the "Old ore field" was constantly growing.

According to the Mining Journal in 1890, in 1887 Pitkaranta mines produced 30,272 metric centers (mc) of the rock, obtained 88 000 mc of copper and 13 460 m c of tin ore (32 % of the ore in the rock). Extraction required 2700 kg of dynamite, 16 878 m of incendiary cord, 24,735 percussion caps, 1,487 cubic meters of wood. In 1887 worked 703 workers on the mines. That year, the plants smelted 2003 mc of copper, 103 mc of tin and 3,515 kg of silver. It was noted that the ore reserves were petered out.[58]

Interesting information about the state of one of the mines in Pitkaranta in the early 1890s we can find in the book "Journey to Valaam, and to the holy monastery, the detailed description of all of its attractions". According to the memoirs of a monk mine looked as follows. "At a depth of 120 fathoms, workers (mostly Finnish) break the stone with dynamite, the stone contains copper ore; then these boulders immediately crushed into small pieces and steam engine raises them on the rails to the smelter".

The monk described the mine. He wrote that it was quite dark and dangerous there. So they did not dare to go to the depth and asked their guide to tell them about the workers of the mine and difficult working conditions.[59]

Since the 1880s "Pitkarantsky Mine" was a tourist attraction, and the tour guides offer travelers visiting one of the mines.

In the 1890s, the price of copper fell from 20 rubles to 11 rubles per pud, and copper production became unprofitable. The same year in "meyerskie" copper ore mines magnetic iron ore was found. Magnetite deposits in the area of Pitkaranta in Hopunvaara were explored since 1814. Magnetite ore was also discovered in 1856 in Lyupikko on the bank of the stream Ristioya where at the end of the XIX century the mining was started.

In the early 1890s at the mines and factories in Pitkaranta the measures were taken to improve the living conditions of the workers of the enterprise. In the western part of Pitkaranta, in the "Krasnaya Glinka" there were two hospitals and obstetrical shelter. A hospital and a pension fund were organized. On the shore of Lake Ladoga 24 wooden barracks were built, not far from them the house manager and his assistant were located. Workers and their families were able to enjoy free medical care and medicines. During the illness the workers were given hospital benefits. Families left without a breadwinner due to death, got pensions. All workers were insured against accidents. Upon receipt of disability they received four-year earnings. A good diner was also built for workers.

In order to improve the moral welfare of the employees a priest was invited and several schools teaching in Russian or German were opened. For those who wanted to study music and singing, a bandmaster was invited.

In 1885 on the Mount Uytonmyaki the construction of a new Orthodox church of the Ascension began, which lasted for 13 years. A man, who wished to remain anonymous, at the request of Archbishop Anthony donated 10 000 rubles for its construction. October 2, 1898 the church of the Ascension was

[57] Копонен П. Мое отечество – Импилахти. Хельсинки, 1993.

[58] Горный журнал. Санкт-Петербург, 1890.

[59] Путешествие на Валаам, во святую обитель и подробное описание всех его достопримечательностей. Издание Валаамского монастыря, Санкт-Петербург, 1892.

consecrated by Archbishop Antony. The church was wooden, with bunk iconostasis, bells and central steam heating. Pitkaranta church of the Ascension survived during the Soviet-Finnish War of 1939–1940, but was burnt at the end of World War II in 1944.[60]

In the 1990s, the restoration of the temple started. The architect E.J. Makhaeva drafted a new church, which generally resembles the "old" one. The church was consecrated by Archbishop of Karelia and Petrozavodsk Manuel on July 1, 2000.

As a Lutheran church in Pitkaranta people used the engine room, which at the end of the XIX century was converted into a chapel. In 1921 it was renovated by a renowned architect Uno Werner Ullberg. In 1928, the bell tower was built, which was badly damaged in the 1939–1940 and later-demolished.

All the products of Pitkaranta plants at the end of the XIX century were sold mainly in Russia.

Joint Stock Company "Ladoga" (1896–1899). Company "Alexandrovsry plant" (1899–1903). Joint Stock Company "Ristiniemi" (1914–1916). Joint Stock Company "Pitkaranta Brook AB" (1916–the1920-ies.)

In 1891 Swedish geologist A.E. Ternebom studied Pitkarantsky tin polymetallic deposit. He made a brief geological overview, a description of ores and geological map of Pitkaranta old mines. In the late 1890s the research was refined and expanded by the Finnish geologist Otto Gottlob Tryustedt (Trestedt), who was also one of the directors O. Tryustedt devoted to Pitkaranta mines seven papers published from 1903 to 1914 in German (a few works were translated into Russian), and have not lost their scientific value until now.

In 1896 Pitkarantsky mines and factories were bought by the Joint Stock Company "Ladoga" ("Ladoga stock company"). The founders of JSC were Thomas Schwartz and B. Gerberts. The main consumer of JSC "Ladoga" production was a steelmaker in Saint Petersburg "Alexandrovsky plant". By this time the old ore areas were practically empty, therefore the plants had an acute shortage of raw materials. In the late 1890 – early 1900s the geologist O. Tryustedtom opened new magnetite deposits, located 2–4 km north from Pitkaranta. The talented geologist also identified the main features of the geological structure of the area. Even after many decades the work of Otto Tryustedta helped Soviet geologists to study old Pitkaranta field and open a new tin-polymetallic deposit in Kitelya.

According to O. Tryustedt's calculations, at the beginning of the XX century iron ore reserves in Pitkaranta were 12 million tons, but only a half of the ore may be suitable for commercial development. But even this amount would be enough for nearly 350 years, and in the case of modernization of production – for at least two generations.[61]

The field opened by Otto Tryusted was put into operation in 1896. In the upper reaches of the stream Kelenoya and mountain Hopunvaara mines began to appear, which explored mainly iron (magnetite) ore "Gerberts-1" (1896–1903), "Gerberts-2" (1899–1900) "Valkealampi" (1896–1899) "New ore field"; "Beck" (1896), "Clara-1", "Clara-2", "Clara-3" (1897–1900), "Winberg-1", "Winberg-2", "Winberg-3 '(1897–1898), ore field "Hopunvaara". Best magnetite ore at the end of the XIX century was mined quarries "Hopunvaara". A small magnetite quarry was also near the pit "Klara-1".

In 1897, 3 km southeast of Pitkaranta mines near a convenient harbor Ristinoya (Ristioya), an iron concentrating factory was built, it was connected with mines "Gerberts-1" and a group of mines "Klara" via two cableways Electricity came to the factory with hydroelectric power running the same year. The company experienced a great fire, but was restored in 1902.

Time and people could not destroy the powerful stone-brick skeleton of a large structure, which, no doubt, is the most prominent monument of industrial culture in the vicinity of Pitkaranta. Unfortunately, near the remains of factory the locals made an unauthorized dump.

In 1899 Saint Petersburg steel company "Alexandrovsky Plant" bought Pitkaranta mines and factories and built an iron foundry 3,5 km southeast of Pitkaranta, near the village of Yulyaristi (Alaristioya), on the shore of Lake Ladoga. The place where the

[60] Копонен П. Мое отечество – Импилахти. Хельсинки, 1993.

[61] Трюстедт (Трёстедт) О.Г. Питкярантские рудники и заводы. Гельсингфорс, 1907.

plant was, called Masuuni (in Finnish – "blast furnace"). In the Soviet times, it got a different name – Masuki. Iron ore mined in the ore fields "New" and "Hopunvaara" first came to the concentrating factory, and then to iron-smelting plant. "Fluxing stone" (calcite marble) for the plant was mined, across the bay, near the Cape Ristiniemi. From marble quarries it was carried to the opposite shore, where a blast furnace worked.

Fig. 9. Iron concentrating factory in Yulyaristi. G. Grendal, 1896

The blast furnace Masuuni was blown up around the 1960s, and only piles of red brick with fragments of walls and ceilings remained. Black slag dumps surround the ruins on all sides and down to the shore of Lake Ladoga.

At the beginning of the XX century the situation on the steel market deteriorated. The company "Alexandrovsky plant" went bankrupt and Pitkaranta factories were sold to the Russian Imperial Bank, which closed them in 1903.

According to geologist O. Tryustedt form the 1840s till 1904 on Pitkarantsky mines 1,1 million tons of various ores were produced, the plants smelted: copper – 6617 tons, tin – 488 tons and produced 11,2 tons of silver (1882). During the period from 1880 to 1904 Pitkaranta plants gave 5000 tons of copper, 213 tons of tin, 30,000 tons of iron, 11 tons of silver and 32 kilograms of gold. During the period from 1900 to 1903 in Pitkaranta 14,870 tons of iron were smelted, and 8163 tons of ore (iron content up to 50 %) and 37,412 tons of magnetite concentrate (iron content 60–63 %) were carried to the capital of Russia.[62]

In 1914, the abandoned mines and factories Pitkarantsky were purchased by the corporation "Ristiniemi" and using the latest technology they tried to establish the smelting of copper, tin and iron. A small amount of iron was smelt during the First World War.

Since 1916 the owner of Pitkaranta mines and factories became Joint Stock Company "Pitkaranta Brook AB". It carried out reconstruction of the plant in the Bay Ristioya (former "Alexandrovsky") and mines in Lyupikko. But by the mid – 1920s from 18 000 tons of the mined ore they acquired only 5000 tons of iron ore concentrates and smelted 3565 tons of cast iron.[63]

In the late 1920s, mining in Pitkaranta were stopped because of the reorientation of JSC "Pitkaranta Brook AB" for agricultural and forestry.

Development in the region was restrained by the lack of metallurgical production of charcoal, as in 1920 on the island Pusunsaari, a sawmill and a pulp mill began operating. Both companies were owned by JSC "DiesenWood" (founder – Norwegian industrialist Christopher Dietl Dissen), which possessed significant woodlands along the northern shore of Lake Ladoga. In 1931, a railroad from Laskelya to Pitkaranta was built, that allowed to obtain the nessessary amount of charcoal from the forests of Suojarvi, Suistamo and Korpiselkya[64]. That could cause a revival of iron smelting in the prewar years.

In 1934–1937 the Finnish geologist M.K. Palmunen conducted the exploration study and of Pitkaranta field including: pumping water from flooded mines, exploration drilling from the surface of the cells and mining, tunneling mining exploration, sampling and chemical analyzes. Following these works M.K. Palmunen in his "Survey of mining operations during the period of 1934–1937" noted that Pitkarantsky deposit was worthy of further study and industrial development.

According to M.K. Palmunen the reserves of copper, zinc, copper and zinc were 945,000 tons. Only on the "Old ore field" the reserves of copper-zinc ore was estimated at 825,000 tons. In the 1940s, it was planned to revive the mining industry in Pitkaranta.[65]

[62] Трюстедт (Трёстедт) О.Г. Питкярантские рудники и заводы. Гельсингфорс, 1907.

[63] Копонен П. Мое отечество – Импилахти. Хельсинки, 1993.

[64] Экономическая жизнь Приграничной Карелии. Сортавала. 1926.

[65] Палмунен М.К. Обзор горно-технических работ 1934–1938 годов. Хельсинки, 1939.

Pitkaranta mines in the 1940–1950-ies

The wars of 1939–1940 and 1941–1944 prevented further work in Pitkaranta. Under the terms of the Treaty of Paris in 1947, the latest research of Pitkaranta tin deposits were transferred to the USSR. In the period from 1940 to 1944 Pitkaranta mines were naturally flooded.

In 1940, when the territory of Northern Ladoga became part of the Karelo-Finnish Soviet Socialist Republic, a geological investigation of Pitkaranta field was conducted by P.V. Rodionov. The work continued until the beginning of World War II. It included: drilling from the surface, pumping water from mines. According to the results of studies the ore reserve calculation was made.

In 1946, Leningrad Geological Survey conducted the exploration work in Pitkaranta area. The geologist A.M. Shukevich first suggested the presence of hydrothermal uranium mineralization in the area of the old Pitkaranta mines.

In 1948, on the dumps of old mines Pitkarantsky tin field the detachment number 24 of the "October expeditions" of the Ministry of Geology under the guidance of O.S. Sukhanov found pyroxene-chlorite skarn and skarn limestone with pitchblende mineralization and uranium with the content up to 2,5 %, that became the basis for the continuation of geological surveys.

In the first half of 1949 the detachment number 10 of the "October expedition" was engaged in field exploration in Pitkaranta. In 1949 they restored the upper parts of the following mines: "Edward Meyer", "Omelyanov-4", "Toivo", "Klee-6" and "Klee-5". In 1949, the exploration work on the surface and the revision of the old mine workings proved the presence of uranium mineralization at the "north-west" region in the mines, "Meyer-4", "Meyer-2" and "Edward Meyer" 80 m below the horizon, and "south-east" region in a narrow zone on the upper horizon of the mine "Klee-6" and 40 m below the horizon.

Since July 1, 1949 the geological exploration in Pitkaranta was continued by the "Northern mining administration".

In August 1951, by order of the Council of Ministers (N 14045-rs from 09.08.1951) work Pitkaranta were stopped.

The report of the "Northern mining administration"[66] noted that before the war the owners of Pitkaranta mines conducted predatory and haphazard development of the field, without complying with the basic rules of operation; floors cutting was made arbitrarily chosing the richest land. In the area between the mines "Omelyanov-4" and "Toivo" the ore horizon had been worked out almost completely," whereby a comprehensive shrink stoping of approximately 170 m was made. Large shrink stopings were found in the mines, "Klee-6", "Meyer-2" and "Edward Meyer".

The main objective of "Northern mining administration" was mining-land restoration and exploration work to the extent which is necessary for industrial evaluation of Pitkaranta field uranium mineralization. To this end, the following activities were planned: drainage from the deepest old mines for lifting rock from them; restoration of old workings for auditing geological surveys; revision of old mines dumps and exploration of the skarn zones; opening the subsurface by excavation of the unit vectors across the strike of the skarn zones; exploration of the skarn zones along strike and dip boreholes from the surface to the grid 100 × 100 m; complex geophysical, geological documentation, testing, analysis and topographic surveying work necessary for assessment of industrial deposits and reserves.

In the second half of 1949 "Northern mining administration" started mining-land restoration, and completed this work in the second quarter of 1950. Until the beginning of reconstruction of the mine both sites were almost flooded.

In 1949–1952 following general conclusions were obtained on the mines of the "Old ore field" in Pitkaranta:

– Shafts, usually in the upper part were vertical, and in a depth of 8–15 m were sunk obliquely along the fall ore layers (skarns);

– Mines had a large number of underground mine yards, drifts, etc., filled with water;

– Numerous horizontal workings were put down from the surface from a depth of 5–8–10 m;

– Mine owners conducted predatory and haphazard mining, without complying with the basic rules of operation;

[66] Отчет "Северного рудоуправления" о производстве геолого-разведочных работ в Питкяранта, Ленинград, 1953.

– In some places the thickness of ore worked out almost completely, resulting in a large underground shrink stopings;

– The area of the “Old ore field” is a real danger in the construction of capital facilities.[67]

Along with a detailed exploration of the “Old ore field” conducted by “Northern mining administration” in 1947–1953 geological detachment of “October expedition” carried out an audit and exploration in other parts of the old mines and development of skarn deposits in Pitkaranta.

“Lyupikko” iron foundry (1864–1873)

In 1856 in Lyupikko (Lyuppiko) and in 1860 near Heposelkya iron ore was discovered, and exploration began. In 1856 a peasant I. Pavlov found iron (magnetite) ore near the village Lyupikko, six kilometers to the southeast of Pitkaranta on the stream Ristioya. But this finding did not pleased the miner because he expected to meet copper, and not iron. There was also copper in Lyupikko, but its reserves were relatively low.

Only in 1864, the industrialist Thomson built a small blast furnace near the mine, which was supposed to smelt iron from the local iron ore. But the latter proved refractory and contaminated with harmful impurities of sulfides, thus soon the blast furnace in Lyupikko melted the marsh and lake ore in Salmi.

In 1867 the company “Volstedt Nobel” bought the foundry. Learning about the findings of qualitative hematite ores in the area of Tulmozero, in 1868 Volstedt sent there some people for exploration. Ore for the plant was started to produce since 1869. In 1870, a trusted of Volstedt, Tseliakus found iron ore on the lands owned by the farmers of Vidlitsa parish (Kondushskit and Verhne- and Nizhnekovetskiy societies) and Vedlozersk parish (Tulmozerskiy and Sarmyazhskiy societies). Affairs at the plant were not going well, and in 1873 it was stopped. At the end of the XIX century Lyupikko iron ores smelted ore for Alexandrinsky iron foundry in Masuuni. On the banks of the stream Ristioya five mines were put down, which were preserved, but flooded and partially inundated with rock.[68]

In the second half of the XX century in the area of the former factory “Lyupikko” a cast iron plate was found – a sign, which is now in the collections of Pitkaranta museum. In the place where there the blast furnace was, on the right bank of the stream Ristioya, you can see dumps of multicolored slag, some ruins and flooded mines with dumps.

Brief characteristics and current state of Pitkaranta mines

The development of Pitkaranta tin-polymetallic deposit was largely conducted by mining, in very rare cases – by building trenches. Mines were located within a few “ore fields” – “old”, “new”, “Hopunvaara”, “Lyupikko”, “Heposelka”.

“Old ore field”

“Old ore field” occupies the northern and north-western part of the modern Pitkaranta. In the XIX century there were 22 mines, which in different years mined copper, tin and iron ore. Mines were located at a distance of 100–200 m from each other along the road Sortavala – Olonets, almost two kilometers. Famous Finnish geologist Otto Tryustedt in his monograph on Pitkaranta the “Old ore field” (1907) broke it into three parts: the western, central and eastern. In the western part of the “Old ore field” to the beginning of the XX century there were the following mines (from west to east): “Schwarz-1”, “Schwarz-2”, “Nicholas-2”, “Nicholas-1”, “Meyer-1”, “Meyer-4”, “Meyer-3”,“Meyer-2”, “Edward Meyer”, “Omelyanov-1”, “Matilda” (total: 11 mines). These mines worked from 1887–1890 to the 1899’s. The following description of the mines is based mainly on O. Tryustedt’s information.[69]

The mine “Schwarz-1” was put down in the extreme western part of the ore field in 1890. It was aimed to find copper mines, and worked only for two years, until 1892, supplying magnetite ore. In 1890 it produced 194 tons of ore, in 1891–2319 tons and in 1892–1541 tons (total – 4054 tons). The mine “Schwarz-1” had a vertical hole and the depth of al-

[67] Проект планировки г. Питкяранта. Карелгражданпроект, 1967.

[68] Борисов И.В., Ильин П.В. Питкярантские рудники заводы. Приозерск, 2007.

[69] Трюстедт (Трёстедт) О.Г. Питкярантские рудники и заводы. Гельсингфорс, 1907.

most 100 m. It opened a good magnetite ore. Chalcopyrite (chalcopyrite) was detected only in the form of fine inclusions as well as chalcocite (chalcocite), partly with zinc blende (sphalerite) or in the form of small prismatic crystals filling cavities within the lodestone (magnetite).

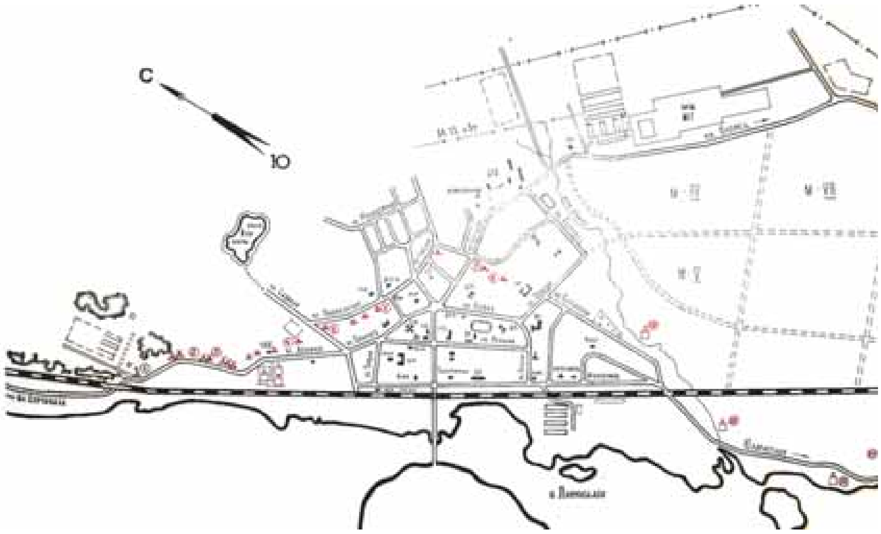

Fig. 10. The scheme of the mines in "Old ore field"

Lodestone near the footwall of the ore body forms a compact deposit with a thickness of 1,5–2 m in rock composed of light-green diopside, garnet and greenish mica. In the middle part of the shaft in the hornblende schist there was baring dense graphite with a thickness of almost 3 m. Despite lengthy attempts of flushing, it was impossible to get enough pure graphite due to the impurities of quartz and mica. Magnetite in the upper part of the shaft was turned into ironstone. In general the whole rock, noted O. Tryustedt was expanded, and riddled with fragments of lightened calcite and iron precipitates. Sometimes there were obscure crystals and metal raids of copper and silver.

The mine "Schwarz-2" was located 130 m east of the mine "Schwarz-1" and used for the mining of iron (magnetite) ore in 1896–1898. In 1896, it produced 4,167 tons of ore in 1897 – 4485 tons, in 1898 – 2146 tons. Total – 10 798 tons Depth production reached 60 meters in the mine, except skarn, pegmatite composed of feldspar, quartz and dark small amount of biotite were also found. In skarns there were from red-brown to black garnet crystals. In chalcocite milky white scheelite was found. Magnetite ore thickness reached 1,5 m, rarely up to 2 m.[70]

In 110 m east of the mine "Schwarz-2" there was the mine "Nicholas-2", which in 1896 was put down with exploratory purposes and during a year gave 1,592 tons of iron ore. Its depth reached only 40 meters. In such radiating rock, as well as on the surface of garnet crystals, geologist O. Tryustedt met tiny needles of black stone tin (cassiterite).

The mine "Nicholas-1" was located more than 100 m east of the mine "Nicholas-2". It operated in 1895–1899 and gave a good copper ore: in 1895 – 1235 tons, in 1896 – 4061 tons, in 1897 – 2279 tons, in 1898 – 1679 tons, in 1899 – 966. It produced 10,220 tons of ore. Depth of production was almost 70 m. The ore layer in the mine "Nicholas-1" had average thickness of 2,75 m and went to 40 m deep. The thickness of the skarn deposits was up to 8 m.

Copper ore here was rich; the enclosing rock consisted mainly of radial and fine fiber congeries, similar to "pitkyarandit". A. Nordensheldt called pitkyarandit a fiber, foliate, crystallized in the form of pyroxene, green mineral (hornblende pseudomorph by augite), mainly consisting of two or three interlocking crystals with garnet, epidote, calcite and hematite. First, this kind of amphibole was found in a large flat masses of loose boulders on the shore of Lake Ladoga, 1,5 km north-west of the mine "Schwarz-1." Otto Tryustedt suggested calling this secondary hornblende its original name – uralite

[70] Трюстедт (Трёстедт) О.Г. Питкярантские рудники и заводы. Гельсингфорс, 1907.

and saving name pitkyarandit for beautiful crystals of “nordensheldite blocks”, which located north of their place of discovery.[71]

Besides copper pyrites, in the described mine there was tin stone with little magnetite and zinc blende. Iron ore was represented by fine-grained magnetite containing green mica. Cassiterite with white to reddish scheelite, formed a small allocation in the rock.

Further to the east of the mine there was the “Meyer” group – a group of mines located in the strip length of 500 m from the mine “Meyer-4” to “Omelyanov-1”. From 1887 to 1899 in the mines of the “Meyer” group, mainly copper ore was mined, to a lesser extent – the iron. Those mines were located 100–120 m from each other in the following order (from west to east): “Meyer-1”, “Meyer-4”, “Meyer-3”, “Meyer-2”, “Edward Meyer”. To the east of them there were the mines “Omelyanov-1” (“Channel mine”) and “Matilda” that O. Tryustedt considered to be a part of the western mines of “Old ore field”.

The mine “Meyer-1” was founded approximately 80 m east of the mine “Nicholas-1” and worked in 1880 (79 tonnes of ore), 1894 (194 tons) and 1895 (176 tons), respectively. Total it was produced 449 tons of ore. Depth production reached 100 m.

The mine “Meyer-4” operated from 1890 to 1896 and in total gave 22,537 tons of ore. Its depth was about 150 m.

The mine “Meyer-3” worked only in 1887 and gave a total 147 tons of ore.

The mine “Meyer-2” operated from 1887 to 1899, and during that time it produced 113,249 tons of ore (mainly magnetite). Its shaft depth reached more than 125 m. The mine “Edward Meyer” with the depth of nearly 200 m, worked from 1889 to 1899. For all the time that mine produced 38,538 tons of ore.

The mine “Omelyanov-1” worked from 1840 to 1853 (in 1853 it gave 1,952 tons of ore), in 1874 (16 tons), from 1888 to 1895.

The mine “Matilda” acted only in 1902 (634 tons of ore).

According to the description of the geologist O. Tryustedt, the thickness of skarn deposits reached a maximum (22 m) in the mine “Meyer-2”. To the west and east of the mine reservoir the thickness reduced to 6.7 m. The drop of layers varied from 55° (“Meyer-4”) to 60° (“Edward Meyer”).

Iron ore suitable for development was only met directly at the base of the skarn layer, and at the top – a very low concentration of magnetic iron ore with an impurity pyrite and zinc blende.

The richest copper ore stretched to an average depth of 30 m approximately parallel to the ground. Deposits of iron ore with a thickness of up to 2 m and a length of 100 m were located between the mines “Meyer-4” and “Meyer-2” and cropped up.

The amount of chalcopyrite decreased with depth – in the lowest depths of the mine, “Meyer-2” was the only lodestone with a finely scattered dark zinc blende. In the mine, “Edward Meyer” iron ore also was found only at a depth of 45 m. O. Tryustedt emphasized that dark blende (sphalerite) was inseparable companion of all Pitkaranta magnetite ore field.

O. Tryustedt noted that on the considered western plot of the “Old ore field” there were no large deposits of pegmatite runs. Pegmatites were mostly coarse, heavily modified and saturated with secondary minerals (brown garnet, scheelite, calcite, etc.). Pegmatite also contained iron pyrite, chalcopyrite, zinc blende.

Skarn in the “Meyer” mines consisted mainly of medium green diopside (“Salite”) with a dark garnet and dark green epidote. Hornblende, actinolite, biotite, chlorite, calcite, scheelite, quartz, amethyst, prase, various chalcedony (agate, carnelian, jasper), fluorite were also found.

The most important ore minerals of the considered site of the “Old ore field” were: magnetite, chalcopyrite, blende, pyrites. Less common were: magnetic pyrite, bornite, copper blende, galena and molybdenite. Molybdenite was very rare in Pitkaranta, it was found mainly on the drift of the “Kanalniy” mine to the mine “Klee-1”, and mainly in the form of inclusions in pegmatite. O. Tryustedt took hematite to mineralogical rarities of “Meyer” mines group. Sometimes goethite was found. In the mine “Meyer-2” there was a little native copper in the form of thin raids on diopside.[72]

The most interesting were oblong-rounded druse cavities, filled with amorphous silica and garnet, epidote, and sulfides (the mine “Meyer-2”, etc.). Oc-

[71] Трюстедт (Трёстедт) О.Г. Питкярантские рудники и заводы. Гельсингфорс, 1907.

[72] Трюстедт (Трёстедт) О.Г. Питкярантские рудники и заводы. Гельсингфорс, 1907.

casionally the inner cavity contained chalcedony (3–5 mm thick), clusters of brownish or black garnet or epidote. Smaller druses with the subtlest layers of striped agate, carnelian and jasper were found mainly in the deep parts of the mine "Edward Meyer".

In many places of the described area tinstone (cassiterite) was marked sometimes in the amount suitable for development. In the upper parts of the development, it was everywhere, so it was constantly sorted. Cassiterite formed small bonnies of radially fibrous aggregates and inclusions in skarn.

In the mine dumps "Meyer-2", "Meyer-3", "Edward Meyer" and "Omelyanov-1" the following minerals were found: light green or white diopside, epidote, hornblende, brown garnet, biotite, chlorite, milk or smoky quartz, calcite, magnetite, pyrite, chalcopyrite, sphalerite, hematite (in the mines of the "Meyer"). In the mine dumps "Meyer-2" there was native copper and silver, "Omelyanov-1" – black garnet crystals up to 2 mm.

To the mines of the group "Omelyanov-Klee" O. Tryustedt attributed the central part of "Old ore field". The mines there were located at a distance of 150–250 m from each other in the following order (from west to east): "Omelyanov-1" ("Chebotarev's mine", "Nilsky mine", "Channel Mine"), "Matilda", which O. Tryustedt considered as part of the western group; "Omelyanov-2", "Omelyanov-3", "Omelyanov-4", "Toivo", "Klee-6", "Klee-5". Mines "Klee-4", "Klee-3", "Klee-2", "Klee-1" O. Tryustedt labeled to the eastern part of the "Old ore field".

The site from the mine "Omelyanov-3" to the mine "Klee-5" was the richest in Pitkjaranta field reserves of copper, tin and zinc ore. Old tin mine called "Vsevolod Omelyanov" start working in 1840, and the mine "Omelyanov-4" in the days of V. Omelyanov was called "Lelegante". Under the mine "Toivo" (the mine operated from 1901 to 1904 and gave 22 844 tons of ore) O. Tryustedt meant only the most deep ones. That part of the deposit produced the largest share of tin in Pitkaranta and the amount of copper mined there was more than in other mines combined.

According to O. Tryustedt, skarn thickness on the site reached 10–14 m ("Omelyanov-4"), decreasing to the east up to 5–6 meters ("Klee-5" and "Klee-6").

Inside and near the skarn zone near the mine "Matilda" at the top and base great masses of pegmatite were found. At the top of the upper limestone horizon with a thickness of 5 m there was a pegmatite vein with a thickness of 10 m. In the old tin mine ("Vsevolod Omelyanov") there was a pegmatite vein.

The most significant accumulations of pegmatite were between the new tin mines and the opencast mine site "Omelyanov-4". Otto Tryustedt noted that three major dumps crossed the part of Pitkaranta field: the dumps "Francis", "Omelyanov" and "Klee". [73]

The richest copper ore deposits were on the west side of the shaft of the mine "Omelyanov-4". The ore body had an average thickness of 5 m and reached a depth of 80–100 m.

In the vicinity of the mine "Toivo" skarn copper pyrite along with more dark enriched zinc blende (sphalerite) and near reset "Klee" had no interest to develop. At a depth of 20–30 m in the mine "Toivo" rich copper ore was gradually replaced by zinc ore.

According to O. Tryustedt, the mines of the middle the "Old ore field" produced at least 3600 tons of copper, and it was twice higher than in the mines of "Meyer" group.

The mine "Omelyanov-3" was laid by Vsevolod Omelyanov in the late 1830s – early 1840s. In 1843, the mine was put down to a depth of about 30 m. There were predominantly tinstone and quite a bit of copper pyrites. All the thickness of the ore body was only 1,5 m near the surface and at depth – up to 2 m. The amount of tin ore varied, in some places it gave 14 % of tin, but on average – only 2 %.

Only in 1860 in a tin mine started a systematic development until 1873 with a short break (1866–1868.). After many years of inactivity the mine "Omelyanov-3" was revived, in 1882 it gave 434 tons of ore. Then the work stopped for two years and continued from 1885 to 1891 (in 1885 – 91 tons of ore, in 1886 – 1958 m, in 1887 – 1604 tons, in 1888 – 1326 tons, in 1889 – 2122 tons, in 1890–1000 tons, in 1891–1102 tons). Only mine "Omelyanov-3", which worked intermittently since the early 1840s until 1902, produced more than 48,000 tons of ore. The maximum depth of the mine "Omelyanov-3" reached almost 220 m.[74]

[73] Трюстедт (Трёстедт) О.Г. Питкярантские рудники и заводы. Гельсингфорс, 1907.

[74] Трюстедт (Трёстедт) О.Г. Питкярантские рудники и заводы. Гельсингфорс, 1907.

O. Tryustedt noted that sometimes in the dumps of "Omelyanov-3" there were pieces of pegmatite penetrated with irregularly shaped, greenish, with the width of a few centimeters, "fragments" of rocks interspersed with tin stone. Cassiterite also filled the gaps within the pegmatite. There were also pieces of granite, with lots of cavities filled with kaolin; in this clay substance tin runs stone with yellowish mica were found.

Tin mine "Omelyanov-4" was also opened by V. Omelyanov in the late 1830s – early 1840s. This mine was the main supplier of copper ore – chalcopyrite.

The mine "Omelyanov-4" reached a depth of 260–270 m, and was one of the deepest in the area of Pitkaranta. It worked from the beginning of the 1840s until 1904 with a few interruptions, and during all that time gave 329,857 tons of ore.

The skarn deposit had a thickness of 10–12 m, but only part of it contained ore. Skarn consisted largely of light green diopside and garnet. Tinstone (cassiterite) in such garnet skarns was extremely rare. In the pegmatite deposits along the base at a depth of about 20 m along the cassiterite there were also sphalerite and chalcopyrite.

In the mine "Omelyanov-4" on quartz a little barite crystalline aggregates were found and some fluorite. Between quartz crystals there were bluish fluorite and light yellow mica, calcite and ore minerals. O. Tryustedt noted that greisen affected all granitic rocks near Pitkaranta.[75]

The mine "Omelyanov-4" was the main source of copper. It mined chalcopyrite in garnet-diopside skarn with magnetite and pyrite. In the mine "Omelyanov-4" there were cassiterite inclusions containing brown garnet pegmatite occurring in parallel skarn deposits. In 1830, at the opening of this part of the ore field, a small piece of tin ore, consisting of dark red, similar to rubies, cassiterite crystals was found.

According to the mine surveying conducted by "Northern Mining Administration" in 1950[76], the mine "Omelyanov-4" reached 181,5 m depth (below – blockage) and had 14 horizons, located from 3,5 m to 12–37 m apart. The mouth of the mine was at about the 39 m STP.

The first underground horizon put down at a depth of 21 m from the ground. The tunnel with the height of 3–6 m traced to the east of the mine "Omelyanov-4" in the direction of the mine "Toivo". With the underlying horizon it was connected by a series of narrow wells to a depth of 3 m and mines were put down to the west of "Omelyanov-4" in the direction of the mine "Omelyanov-3", which later formed a giant cavity with a thickness of up to 47 m.

The second horizon was at a depth of more than 29 m from the surface, and the third – 35 m, the fourth – 39,8 m, the fifth – 44,5 m, the sixth – 51,5 m, the seventh – 58,5 m, the eighth – 66,7 m, the ninth – 72,5 m, the tenth – 76 m, the eleventh – 87,7 m, the twelfth – 94,8 m, the thirteenth – 88,9 m, the fourteenth – 128,7 m above the ground.

The mine "Klee-6" began to operate from the beginning of the 1840s, and stopped in 1900. Mine worked impermanently: from 1840 to 1856, from 1858 to 1861, in 1878, from 1880 to 1887, from 1889 to 1895, from 1898 to 1900. During all this time it produced 44,450 tons of ore. Small tin deposit near the ground mines "Toivo" and "Klee-6" are similar to cassiterite found in small amounts as well as telluric bismuth.

O. Tryustedt noted Pitkaranta tin ores were considered to be so rich that they needed only a simple manual separation for melting. In fact, tinstone (cassiterite) was usually finely interspersed in skarn or pegmatite.

Cassiterite is represented by two varieties: mainly black and rarely seen brown-red color. "Black cassiterite usually forms well-defined rectangular columnar crystals that end either sharp top of a pyramid, or as if cut by a flat face. Cassiterite crystals do not exceed a length of 5–10 mm, occur in groups or skarn formed therein thin intersecting runs".[77]

According to the mine surveying of 1950[78], the first 7 m from the surface (mouth elevation of about 46 m) the shaft "Klee-6" was sunk through sedimentary rocks. The depth of the drained part of the mine could be up to 85 m.

The mine "Klee-5" was little more than 100 meters to the east of the mine "Klee-6". It was opened in the early 1840s by G. Klee, but worked with long

[75] Трюстедт (Трёстедт) О.Г. Питкярантские рудники и заводы. Гельсингфорс, 1907.

[76] Отчет "Северного рудоуправления" о производстве геолого-разведочных работ в Питкяранта, Ленинград, 1953.

[77] Булах А.Г., Франк-Каменецкий В.А. Геологические экскурсии в окрестностях Питкяранты. Петрозаводск, 1961.

[78] Отчет "Северного рудоуправления" о производстве геолого-разведочных работ в Питкяранта, Ленинград, 1953.

intervals only for seven years, until 1888. For all the time the mine produced 2512 tons of ore.[79]

According to O. Tryustedt, lodestone (magnetite) in the middle part of the "Old ore field" was found in limited quantities, namely, with dark zinc blende mainly in the area of the mine "Toivo" at a depth of about 75 m in the mine "Klee-6 "and in the deepest parts of the mine" Omelyanov-4". Dense magnetite was usually fragile and contained cavities often filled with diopside, magnetite, zinc blende, copper pyrites, chlorite, calcite and black garnet, and very rarely tin stone.

In the mine "Omelyanov-4" magnetite forms a lode of 0,5 m. Magnetite inclusions were also observed in pegmatites mine "Omel'yanov-4".

From the mines "Klee-5" and "Klee-6" the largest amount of zinc blende (sphalerite) was mined, but because of its high iron content such zinc ore could not find the application and was thrown in the dumps. In the 1860s engineers tried to allocate metallic zinc from zinc blende from the mine "Klee-6", but the result was negative. After the introduction of the "wet" method for producing copper, a significant amount of zinc blende enriched copper pyrites was recycled.[80]

Zinc blende was also found in hornblende schists south of the mine "Klee-5" (outside the skarn body) as a mass with thickness of 2,5–3 m, penetrated by quartz with galena and copper pyrites.

After 1904 the ore complex was all worked out, except for the deepest horizons. However, on the east side of the lower "Toivo" workings there was still a rich copper ore with a thickness of a few meters. On the western side of the mine "Toivo" skarn was transformed into a loose light green rock with grains of chalcopyrite, variegated copper ore, copper luster and native copper; zinc blende, galena, iron pyrite and magnetite, partially converted in ironstone.

The richest copper ore masses were in the area between "Omelyanov" and "Klee" dumps. The mount of salable copper from those places was 6550 tons.

Quality lodestone was found only in the western part of the ore field "Kanalniy", and in the middle part of the ore field was not suitable for the development of iron ore reserves.

To the eastern part of the "Old ore field" O. Tryustedt attributed mines located to the east of the mine "Klee-5". The mines "Paul" and "Klee-4" were close to each other, 250 meters to the north-east of them – the mine "Klee-3" was, 150 m further there was the mine "Klee-2", another 200 meters on north-east – "Klee-1". 200 m to the southeast from the last mine there was the mine "Maria".

The mine "Paul" worked in 1886–1887 in gave 545 tons of ore. The mine "Klee-4" worked for only 6 years, with long intervals since the beginning of the 1840s until 1904, and gave just 803 tons of ore. Its depth was about 50 m.

The mine "Klee-1" was also opened in 1840 and worked quite successfully with few interruptions until 1883. During all this time it produced 91,084 tons of ore.[81] The mine "Maria" worked from 1902 to 1904 and gave 12,206 tons of ore (1902 – 1757 tons, 1903 – 7055 tons, 1904 – 3394 tons).

The mine "Ristaus" is the most eastern mine of the "Old ore field" (150 m to the southeast from the mine "Maria"). It was founded in 1897 after the discovery of a new ore body using magnetometric studies. The mine worked until 1904 and during that time, it produced 22,827 tons of magnetite ore (1897 – 133 tons, 1898 – 4422 tons, 1899 – 8126 tons, 1900 – 2384 tons, 1901 – 4664 tons, 1902 – 1698 tons, 1903 – 849 tons, in 1904 – 551 tons).

Traces of the old mines of the "Old ore field" is now almost impossible to find in the labyrinth of gardens, courtyards and various buildings of Pitkaranta – the dumps are lined with garages, sheds, wooden houses; the mouth of the mine, in most cases covered with rock and debris.

According to the studies conducted by the Regional Museum of Northern Ladoga and Karelian regional public organization of speleological researches "Kolos" in 2004–2011, the state of technological and natural complex of the former the "Old ore field" now appears as follows.[82]

The mine "Schwarz-1", "Schwarz-2", "Nicholas-2" and "Nicholas-1" were located in the western part of the "Old ore field" probably completely chocked. On the territory of former mines are now

[79] Трюстедт (Трёстедт) О.Г. Питкярантские рудники и заводы. Гельсингфорс, 1907.

[80] Ibid.

[81] Трюстедт (Трёстедт) О.Г. Питкярантские рудники и заводы. Гельсингфорс, 1907.

[82] Борисов И.В. Отчет по экспедиции в город Питкяранта 30 января 2008 г., архив РМСП, г. Сортавала, 2008.

located wooden houses, sheds, cellars, garages, gardens, and nothing reminds of the mines.

The territory of the former mines of “Meyer-1”, “Meyer-4”, “Meyer-3”, “Meyer-2”, “Edward Meyer” is overgrown with young coniferous and mixed forests. Unfortunately, in many places, especially where it is still visible the site of deepening shafts, pits and other man-made landscape, you can find waste. In 2012–2013 the Administration of Pitkaranta choked the mines “Meyer-3” and “Meyer-2” and fenced them.

Fig. 11. The pit top “Meyer-2”. 2013

Four mines of the “Omelyanov” group are located in the central part of the “Old ore field” today the pit tops of three mines – “Omelyanov-1”, “Omelyanov-2” and “Omelyanov-3” are clearly distinguished on the ground.

The pit top “Omelyanov-1” is blocked with a concrete slab with a size of 1,8 × 6 meters. Buildings come close to the pit top. Traces of the mine “Omelyanov-2”, in the form of a small pit under a rock, with fragments of timbering littered with debris and branches are clearly visible in the 40 m north of the stone buildings of the former Folk School.

The mine “Omelyanov-3” is put down in the north-western end of a large trench for 65–70 m, its width is 3,5–5 m (at the bottom) and 6,8 m (at the top) and the depth is 4–8 m. The northern trench board is very steep and high (up to 10–15 m), and the south is much lower – up to 3–4 m. The trench bottom is overgrown with bushes and trees, littered with garbage and stones falling from the top. Along the southern edge of the pit there are brick garages.

The top of the mine is clearly seen in the north-west end of the trench which width is up to 4,5 m and an average depth is about 4 m. More than half of the top of the shaft is littered with debris – cans, bottles, broken glass, metal objects.

According to observations several straits go in all directions from the mine shaft at a depth of about 20 m. Below this mark water is visible. The entire trench bottom, before the pit top “Omelyanov-3” is littered with debris, so to come down to the shaft is almost impossible.

The mine “Omelyanov-4”, was in the eastern end of the trench, but the pit top was preserved, and probably littered with waste rock. In recent years, dumps of the “Omelyanov” mine group have been actively aligned under private construction.

Fig. 12. Cleared dumps of the “Omelyanov” group. 2013

The “Klee” group is located along the current Pionerskaya and Lugovaya streets. In the western end of Pionerskaya street there was the mine “Toivo”, which today is a small indentation, littered with rock and household waste and overlaid on top with a fractured concrete plate. Near the pit top there is a row of brick garages.

At the place where the pit top “Klee-6” was one can still visible small deepings in the landscape. The area around the mine is all built up with garages and cellars.

The dumps between the mines “Toivo” and “Klee-6” are almost completely planned and built up with garages and cellars. But in some places along Pionerskaya street they are still visible in the landscape, and here you can find good examples of skarn with garnet, black, green and gouges copper sulphide inclusions.

The mine “Klee-5” and “Paul” were built up with private houses, and no trace of these developments has been preserved. In the area of the mine "Paul" there is a small concrete building of the former concentrating factory.

The mine "Klee-4" was almost open up to 2009. Only 5 m from its trunk there is a path where people walk. A club "The rock" is located 100 m from the mine. In 2007–2009, shaft was partly strewn with rock and debris. But Pitkaranta administration did not pay enough attention to it. Local residents tried unsuccessfully to fill the shaft on their own. All this ended in a death of the child. After that the mine shaft was filled with soil and debris, and closed with top plates. Currently, the area around the pit top "Klee-4" is fenced.

Fig. 13. The place where the pit top "Klee-4" is

The top pits of the mines "Klee-1" (Lugovaya street), "Ristaus" and "Maria" (city center) are not preserved. In the "Old ore field" is still prohibited the construction of multi-storey buildings at risk of collapse. But the construction of small wooden houses here is actively developing.

In the mid-1890s, when the mines of the "Old ore field" practically exhausted their resources, the geologist Otto Tryustedt using a magnetometer discovered new places of iron ore, located a few kilometers from Pitkaranta (the ore fields "New", "Hopunvaara", "Lyuppiko", "Heposelka").

The "New ore field"

The "New ore field" was located 1,5–2 km northeast of Pitkaranta in valley of the stream Lotyanonoya. From 1896 to 1903 there were three mines ("Gerberts-1", "Gerberts-2" and "Valkealampi") explored mainly iron ore – magnetite. The mines opened thin ore bodies in garnet diopside and serpentine skarn. To get to the mines of the "New ore field" you should turn to the north before the bridge over the stream Kelinoya, and drive on a dirt road about a kilometer to the road junction Nietyarvi-Hopunvaara. Two kilometers to the north – northeast of the city center of Pitkaranta, 500 meters from the said road junction towards Lake Nietyarvi, beside the road there are traces of the mine "Gerberts-1" and the smelting factory.

The mine "Gerberts-1", which got its name from one of the owners of JSC "Ladoga" B. Gerberts, operated from 1896 to 1903, and, gave 31,300 tons of iron (magnetite) ore. The production revealed steeply dipping to the south-east horizon of serpentine skarn of the upper carbonate extended for several kilometers to the north from Pitkaranta to the Valkialampi[83].

The place of the mine "Gerberts-1" was defined by the geologist O. Tryustedt in the mid-1890s during the magnetic exploration. On the geological map of the area, made by O. Tryustedt you can see that the mine "Gerberts-1" reveals the thin ore body (skarn with magnetite and sulfides) with the length of 100–150 m, falling to the southeast at about 45°. During the development of the field at the end of the XIX century two vertical shaft were made at a distance of 33 m from each other ("Western" and "Eastern"), connected by a crosscut at a depth of 28–29 m. Both production revealed the ore body with a thickness of 0,5–1,5 m, respectively, at a depth of 28 m and 43 m 15–16 m.

Ore mining in the mine was carried out by three levels of galleries made at a depth of 18 m, 25 m and 30 m on both sides of the "Eastern" shaft along the strike of the ore body. The length of the top mining horizon is 95 m, the average – 75 m, the lower – 36 m. The upper and middle horizons in the southwestern part are connected with each other, forming an extensive cavity with the length of 20 m and the height of 10 m. Dimensions of underground workings vertically averaged 25–4 m in the bulges o – up to 10 m. The distance between the mining horizons ranged from 1,5 m to 5 m. Underground workings crossed four steeply dipping pegmatite lodes.[84]

[83] Трюстедт (Трёстедт) О.Г. Питкярантские рудники и заводы. Гельсингфорс, 1907.

[84] Ibid.

At the end of the XIX century near the mine there was a small processing factory, magnetite ore was separated from non-magnetic sulfide minerals, and carried by hanging rail to the smelter near Yulyaristi.

Over the past 110 years after the work was stopped, the dumps and the mine “Gerberts-1” have changed a lot, but they formed technogenic natural landscape which is currently of great interest for the history of mining, geology, museology and tourism.

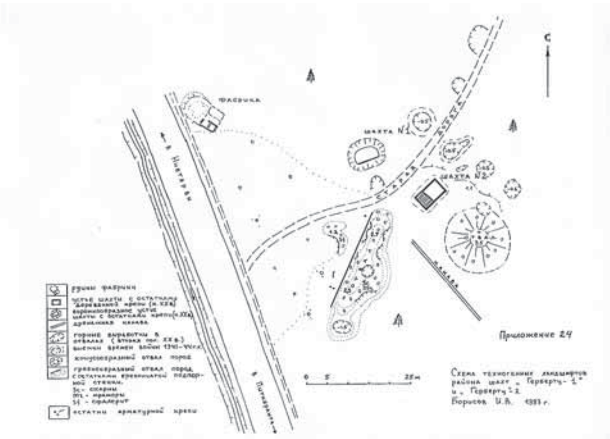

Fig. 14. The scheme of a technogenic natural complex of the mine “Gerberts-1”. Borisov I.V., 1997

Regional Museum Northern Ladoga (since 1997) and Karelian regional public organization of speleological researches “Kolos” (since 2005) study the technogenic natural complex of the mine “Gerberts-1”. In 2011–2013, the flooded mine was researched by the speleologist I.A. Kozlov. The information obtained in the course of work became the basis for registration of the object as a monument of historical and cultural heritage of Karelia (28.08.2013) and the development of the excursion.

As a result of ground-based studies the following information was obtained. On the area of 70 × 80 m^2, overgrown with dense mixed forest, hitherto preserved: the pit top of two shafts, piles of rocks, ruins of the concentrating factory and other traces of mining and premises.[85]

The “Western” shaft, reinforced with beams, begins at a depth of about 5 m from the surface at the bottom of the crater with the diameter of 8–9 m. The excavated dimension of a shaft is approximately 1,5 × 2 m. Water fills the shaft almost completely.

The “Eastern” shaft with the diameter of 3 × 6 m is reinforced with beams to the depth of 16 m, where the rock lies. The mine is flooded with water 4–5 m from the surface.

The beams located above the water (4–5 m from the surface) in the shaft are severely rotted, and at any moment can fall down with loose soil. The approach to mine closer than 2–2,5 m is dangerous.

Fig. 15. The pit top of the “Eastern” shaft of the mine “Gerberts-1” 2011

Below the water level in the shaft the lining is well preserved. The beams densely adjoin to each other, and in the corners are connected to each other with a security lock. The corners of the lining are fixed with vertical logs of a smaller diameter bound together with metal staples.

Throughout the whole period of observations until the 2000s the pit top of the “Eastern” shaft was not closed. In April 2006, across the mine shaft 8–10 logs was laid, which are now in the mine.

At the mine dumps the rock preserved conical and comb shape. The conical dump is 15 meters south-east of the “Eastern” pit top, and has the shape of a truncated cone with the relative height of 4–5 m and 15–17 in diameter (at the bottom) m. The

[85] Борисов И.В. Научная справка “Техногенно-природный ландшафт “Нового” рудного поля” в окрестностях Питкяранта (рудник “Гербертц-1”). Архив РМСП, Сортавала, 2004–2010.

area around the dump is covered with coniferous forest; the surface of the dump is covered with shrubs and young trees.

The comb dump starts at 15 m southwest of the "Eastern" mine shaft. It stretches in a south-easterly direction for almost 50 m, its width is 6.10 m and its height is 2,2–2,8 m. The surface is also overgrown with young trees, surrounded by tall pines and firs. Along the outer side of the dump there is a 25 m timbered rotten retaining wall with the height of 1–1,3 m, from which the mound inside log walls come, forming a stand-section of 3 × 6 m^2. At one point the two lower retaining walls were deeply driven into the ground with a miner's chisel. In 2000 this item was taken and transferred by the author to Pitkaranta museum, which is also retaines a carpentry drill found right there in the wall.

In the dump the following minerals can be found: magnetite, sphalerite-marmatite, galena, fluorite, calcite, vesuvianite, garnet, chlorite, rare chalcopyrite rock. The rock contains skarns and marbles in two varieties – serpentinized and streaked with graphite. At the time, the Finnish geologist Eskola found in the mine "Gerberts-1" rare mineral skarn – fluoborite – in the form of white prismatic crystals up to 2–3 cm.

Near the retaining wall of the comb dump on the ground there are stone plates with reinforced vertical and curved metal pins with the diameter of 28 mm and a length of 40–50 cm to 2 m. Some of them have big fixing nuts. This is probably the fragments of the former supports of the suspension railway.

The comb and the conical dumps are divided with water drainage channel with the length of 25 m, width of 0,5 m and depth of 0,4 m, extended to southeast, toward the hollow. In the past, this channel served to divert water from the pit top of the "Eastern" mine shaft.

40 meters to the west – northwest of the "Eastern" mine shaft, in the leafy grove, there are remains of concrete foundations of the concentrating factory, mills supports with metal bolts and hemispherical frame, where previously a rotating drum for iron ore beneficiation by magnetic separation was.

In 2011–2012 the speleologist I.A. Kozlov made several dives in the "Eastern" shaft of the mine "Gerberts-1". He examined the horizontal production – drifts of two upper horizons (18 m and 25 m), interconnected by wells. The studies were videotaped. Underground workings and securing logs were preserved well.

Fig. 16. Ruins of the concentrating factory of the mine "Gerberts-1"

Since the late 1990s until the present time on the territory of the former mine "Gerberts-1" is approximately one to three times a month The Regional Museum of Northern Ladoga and Museum of Local History in Pitkaranta conduct excursions for schoolchildren, students, tourists from different cities of Russia and Karelia.

Currently the technogenic and natural complex of the mine "Gerberts-1" is regarded as a potential tourist site on which it is necessary to hold special work on the improvement and museumification.

The mine "Gerberts-2" was located 440 m to the southwest of the mine "Gerbertts-1" and opened granitic gneiss garnet-diopside skarn lower calcareous horizon, falling to the southeast. The geologist O. Tryustedt marked a magnetic anomaly at that place, however, of significantly lower intensity and size than in the area of the mine "Gerberts-1". For two years, from 1899 to 1900, the mine "Gerberts-2" produced just 619 tons of iron (magnetite) ore (respectively 407 and 212 m). The depth of the shaft was 25 m. The pit top collapsed and almost unnoticeable in relief.

The mine "Valkialampi" was put down by JSC "Ladoga" in 1896 650 m north of the mine "Gerberts-1", 105 m south of the little forest lake Valkialampi, on a high bank. For three years (1896–1898) the mine produced 2,450 tons of iron (magnetite) ore. The mine revealed a small ore body in garnet-diopside skarn of the lower calcareous horizon at the contact of granite-gneisses and amphibole schists. The position of the ore body, hidden under a thick layer of sand was determined by magnetometric anomalies identified by O. Tryustedt.[86]

The shaft depth was more than 36 m^2. First 10–11 m the production was vertical and passed through loose rock overlying lower-lying skarns, shale and granite-gneisses. In the skarn the mine did bend, and then at an angle of about 50 ° went on the fall of the ore body about 25 m.

From the mine to the surface magnetic ore and rocks containing minerals of sphalerite, chalcopyrite, pyrite, fluorite, calcite, chlorite, galena, diopside, garnet, quartz, hornblende, and amethyst were raised. Poor ore and waste rock dumps were stored in on a slope.

According to studies conducted by the Regional Museum of Northern Ladoga in the period from 1997 to 2007, on the area of 60 × 70 m^2 the pit top and the dumps were preserved. The upper part of the shaft looks like a funnel with the depth of 6–7 m and diameter (at the top of the brow) about 5 m. At the bottom of the funnel there are the remains of lining of the shaft, littered with sand and logs.

Rock dumps are located south of the shaft, on a slope hill. They have a vague outline and a small height (1–1,5 m). The total area is 500–600 m^2. Here you can find the pieces of garnet-diopside skarn with secretions of black garnet, magnetite, copper ore and other minerals.

Fig. 17. The dumps of the mine ”Valkialampi”. 2009

The technogenic and natural complex of the former mine “Valkialampi” is of interest to mining and industrial heritage, and can be visited by tourists. The potential of the object increases due to the attractiveness of the natural landscape (hill, a small forest lake). Unfortunately, the area around the mine is heavily littered with illegal dumps.

The ore field “Hopunvaara”

The ore field “Hopunvaara” is located 4–5 km north-east form Pitkaranta. To get to the old mines Hopunvaara you have to go from the town to the old cemetery and turn onto the road leading to the north-east side of the lake Mustalampi. The name of the ore field was given by the notable Hopunvaara mountain, on the north of which there is a magnetite and marble mine.

At the end of the XIX century at this place there were 10 mines, two galleries, a few trenches and many ditches. Near the workings there are dumps of rock and minerals. In some places, the ruins of mine buildings can be seen. The closest to Mount Hopunvaara complex of underground workings was studied by the Regional Museum of Northern Ladoga[87] since the beginning of the 1990s, the Karelian regional public organization of speleological researches “Kolos” – in 2009–2011. Here, in the valley of the stream, on an area of 60 × 150 m^2, two trenches, the pit top of two mines and a gallery were preserved, where in the second half of the XIX century, marble (as “fluxing stone” for Pitkaranta plants) and to a lesser extent – magnetite and arsenopyrite were mined.

As it was noted earlier, back in 1814 a group of Russian entrepreneurs (Lieutenant F. Baranov, the architect Michael Oshvintsov and the farmer Andrei Anisimov) got the license for the exploration and development of marble (“limestone”) and magnetite (“lodestone”) over the mountain Hopunvaara and Hopunsuo swamp. They hoped to find silver ore. In 1814 Lundstrom, found here a magnetite lode.

The industrial development of calcite-dolomite and dolomitic marble in Hopunvaara as was probably began with the 1850s and lasted until the beginning of the XX century. Since the late 1880s, “hopunvaara” marbles also developed the flux for Pitkaranta glassworks. Marble quarrying was carried out by trenches, two adits and a mine. Underground workings allowed developing deposits of marble at the lowest cost.

[86] Трюстедт (Трёстедт) О.Г. Питкярантские рудники и заводы. Гельсингфорс, 1907.

[87] Борисов И.В. Научная справка “Техногенно-природный ландшафт “Нового” рудного поля (рудник “Валкиалампи”). Архив РМСП, Сортавала, 2004–2010.

Excavations opened the largest in Pitkaranta carbonate lens “Hopunvaara” (size 850 × (15–60) m) of the upper carbonate horizon consisting of various dolomitic marbles: white, light gray (thickness of 1–3 m); light gray, dark gray (thickness of 5–6 m); dark gray to black skarn (thickness of 2–5 m).

According to studies of the Regional Museum of Northern Ladoga[88] the technogenic and natural complex of “Hopunvaara” looks as follows. Its main element is the trench number one (“Main”), with a length of about 110 m, a width of 3–20 m (at the bottom) and 10–20 m (at the top), the depth of 4–7 m, V – shaped profile. It probably was originally was down in a shallow valley of the stream. Mining operations deepened and expanded the trench elongated in the north-east.

At its height ledges 3–4 m there are calcite-dolomite and dolomitic light gray marble skarn places containing elongated oval and dark green diopside with pale green and brown serpentine border.

Fig. 18. The marble quarry “Hopunvaara”, 2009

From the east a small stream pours to the trench. It originates in the nearby swamp, located above the marble production, and then flows to a south-westerly direction.

It is noteworthy that the south-eastern edge of the trench higher than the north-west, at the same time it is more gentle and covered with talus. At the end of the XIX century in the western side of the “main” trench with the aim of improving its marble underground mining a “side” tunnel in the pit top of the cross-section of 1,45 × 1,5 m was drawn.

In the rock there are traces of horizontal holes 40 mm in diameter, 10 cm deep, 12–25 cm from each other. The entrance to the adit is supported with a retaining wall 18 m long and up to 1,8 m high, laid out of small boulders and crushed stone without cement. The retaining walls 6–8 m long and up to 1 m high also support the trench slopes at its narrowest point, 25 m to the southwest of the pit top of the tunnel. At a depth of 8 m from the pit top of the tunnel was blocked with the purpose of security demining operations.

Fig. 19. The pit top of the “Side” tunnel in the quarry “Hopunvaara”. 2009

The second tunnel (“Main”) was drawn 30 meters from the south-western end of the “main” trench, in a northeasterly direction parallel to the latter. In the 1970s, the entrance to the tunnel was also undermined by sappers, so that now there is only a fragment of the inlet trench with a length of 16 m, a width of 7–16 m and a depth of 2.4 m. Probably, this tunnel was connected to the “Side” galleries and went even further. At the end of the XIX century in the south-western part of the “main” trench two mines were opened – “Lime” (“Pelinen Klara?”) and “Arsenic”.

Until the autumn of 2010 the position of the mine “Lime “was unknown. In its place there was a small

[88] Борисов И.В. Научная справка “Техногенно-природный ландшафт “Рудного поля Хопунваара (комплекс горных выработок “Хопунваара”)”. Архив РМСП, Сортавала, 2010.

lake, where water from the stream flowing through the quarry accumulated. According to A.G. Bulakh and V.A. Frank-Kamenetsky, there was the so-called "Magnetite pit", which in the late 1890s mined the best Pitkaranta iron (magnetite) ore with very small admixture of sulfur. The ore here was carried by the overhead railway to the mine "Gerberts-1" and on to Masuuni (Yulyaristi) blast furnace Not far from the place of production there was a small round blast furnace, where metal was smelted. Its ruins were visible at the 1960s.[89]

In September 2010, at the site of the quarry a well preserved shaft was found, which probably at the end of the XIX century – the beginning of the XX century quarried marble and iron ore magnetite. O. Tryustedt mentioned the mine "Lime", which for the period from 1899 to 1902 produced 759 tons of magnetite ore.[90] On the old map (the beginning of the XX century) the mine "Pelinen Klara" is marked here.

Probably the detected production revealed skarns and marbles of the upper carbonate horizon with multilayer ore consisting of thin layers of magnetite, vesuvianite, fluorite, dark green garnet, green mica and apatite. In the north-western side of the marble quarries in addition to the so-called multi-layered ore the "Ore tube" was found with the diameter of 5–10 cm, containing magnetite, vesuvianite, chlorite, garnet, and other minerals. Iron ore was first discovered here in 1814.

The cross section of the mine is 6,8 × 4,2 m. The long axis of the shaft is extended to the northeast. The shaft falls to the southeast at an angle of 70–75 °. The upper part of the shaft is supported with log cabins of five rows with the diameter of 18–25 cm. The logs stitched with metal staples. At a depth of 8 m the first drift begins.

8–10 m southeast from the mine "Lime" there is the mine "Arsenic", as it produced magnetite ore with arsenopyrite (arsenic pyrite), the number of which reached 40 %. The ore also contained sphalerite, chalcopyrite, cassiterite and scheelite.

The pit top has a cross section (2,5–3) × (7–8) m. The shaft falls to the southeast at an angle of 60–70 °, damped with debris at a depth of 4–4,5 m from the surface. 1–2 m from the pit top there is a dirt road Pitkaranta-Mustavaara.

To the north-east of the trench "Main" there is a trench number 3, was drawn in the marbles along the outcrop of granites, almost to the edge of the dirt road. The length of the workings is 24 m, the width is about 2 m, and the depth is up to 1–3 m.

To the south-west of the "main" trench, on a gentle slope along the valley of the stream, dumps of rock of different sizes can be found. The dumps are composed primarily of dolomitic marble, skarn, amphibole schists and covered with dense vegetation. The ore mines dumps, where you can find ore minerals are mixed with marble dumps.

The unique technogenic and natural complex "Hopunvaara" has a high tourism potential. This complex is available, its open development and fragments of underground cavities are in satisfactory condition, there are outcrops of marble with rare minerals. These advantages allow register the object as a monument to the history of mining in Karelia and prepare it for tourists.

The mine "Bekk" is located in the southern part of the ore field "Hopunvaara", 280 m south of the complex "Hopunvaara", 50 meters from the dirt road. This mine opened the ore body with a thickness of 0,5–1,1 m in skarns of the lower calcareous horizon. The mine was owned by JSC "Ladoga" and worked only one year (1896), gave about 96 tons of magnetite ore. In the 1950s and the 1970s–1980s exploration works were conducted in the mine, the traces of which can still be seen.

Technogenic and natural complex of the mine "Bekk" has been studied by the Regional Museum of Northern Ladoga in the period of 1997–2010 and the Karelian regional public organization of speleological researches "Kolos" in 2008–2011. In the course of research on the area of 50 × 100 m^2 two mines, several exploratory trenches and dumps were discovered and studied. Until September 2009[91] it was mistakenly believed that in the mine "Bekk" there is only one mine exploration of the 1950s, and no historical production was preserved. Pumping water from the flooded pit in 2010 allowed us to discover that the mine was put down in 1896. This mine is lo-

[89] Булах А.Г., Франк-Каменецкий В.А. Геологические экскурсии в окрестностях Питкяранты. Петрозаводск, 1961.

[90] Трюстедт (Трёстедт) О.Г. Питкярантские рудники и заводы. Гельсингфорс, 1907.

[91] Борисов И.В. Научная справка "Техногенно-природный ландшафт "Рудного поля Хопунваара (комплекс горных выработок шахты "Бэкк")". Архив РМСП, Сортавала, 2004–2010.

cated in the northwestern part of the ore site in dense coniferous forest near the stream.

The shaft of the drained mine has a cross section of 2,4 × 5,5 m. The top part is strengthened with 22 crowns of logs 0,25–0,35 m in diameters. The logs afloated with water, well preserved, they are flush with each other and reliably connected. For greater strength the angles are strapped with metal straps. The shaft is divided into two unequal sectors. Below the lining, at a depth of approximately 6 m the rock begins.

In the northeast corner of the shaft there is a vertical sump pipe made from a single tree trunk with the selected core strengthened with metal hoops. Below the last crown of the lining the shaft is shut with timber flooring with three small holes: for lowering workers, lifting the gigs with ore and drainage pipes.

Fig. 20. The pit top "Bekk", 2011.

The mine "Bekk", which until 2009 was taken as the historical mine, located in the north-east – eastern part of the ore plot on a hill slope near the outcrop of gneiss-granite. Probably, it was the mine for uranium exploration, put down in the early 1950s in the lower ore skarns carbonate horizon at the contact with the granite-gneisses.

The cross section of the shaft at the pit top is 1,5 × 2,2 m. The mine is flooded to a depth of 2 m from the surface. The pit top is around 2,5 m above the surface, and is surrounded by dumps.

"Exploration" mine was inspected after drying in the autumn of 2010. The depth of the shaft was 8–8,5 m. The top of the mine, to a depth of 1,7–1,9 m is supported with log cabin in 6 rows. From the shaft a short drift with a length of 4–5 m is drawn in a northwesterly direction then turns sharply to the east and continues for another 18–20 m. Thus, the total length of the drift is 23–25 m, the volume of the drift is 60–65 m^3, the total volume of the mine is 100 m^3.

On the territory of the former mine "Bekk" in the northern and central part there are three trenches. These quarries are put down in the 1970s during the geological exploration work of Uuksinskaya party.

The drainage ditch 20–60 m long with the width of 0,5–1 m and with the depth of 0,5–1 m are put down through the mine. On the territory of the former mine in northern and southern parts, there are piles of rocks and minerals. "Severny" dump area surrounds the "exploration" mine from almost all sides. It contains samples of dark skarn magnetite ore.

30 m east of the mine "Bekk", across the stream running through the drainage ditch "Muschketowite" dump is situated. Its area is 15 × 20 m^2 and a height is 0,5–1 m. Unfortunately, this dump is almost destroyed due to unregulated collection of stone, primarily muschketowite, sphalerite and rock crystal. A few decades earlier one could find interesting and rare specimens of muschketowite (pseudomorphs of magnetite to hematite lamellar aggregates in the form of "iron roses") with voids filled with large crystals of brown sphalerite – kleyofan and rock crystal. Epidote-garnet skarns, chlorite, calcite, magnetite, chalcopyrite, galena, pyrite, hematite, apatite were also found here.

The technogenic and natural complex of the former mine "Bekk" is of interest to the history of mining and can be a tourist attraction. To preserve the unique mineralogical heritage of the mine dumps unregulated collection of stone should be stopped here.

The mine "Klara-3" is located 4,4 miles northeast from Pitkaranta, in the central part of the ore field "Hopunvaara", 0,4 km north-east of the mine "Bekk", barely visible on the hill of marshy plain. It leads from the quarry "Hopunvaara" barely noticeable through the swamp. This mine was put down in skarn and marbles skarns of the upper carbonate horizon in 1897 and worked there until 1900. During all this time it produced 2997 tons of magnetite ore.[92]

Technogenic and natural complex of the former mine "Klara-3" was studied by the Regional Museum of Northern Ladoga in 1997 and the early 2000s. Currently on the mine site area of 45 × 120 m^2 there

[92] Трюстедт (Трёстедт) О.Г. Питкярантские рудники и заводы. Гельсингфорс, 1907.

are traces of mining – trenches, pits and dumps[93]. The shaft is covered with rock, and in its place you can see a shallow pit.

100 meters south of the pit top there is a comb shape dump with a length of 55 m, a width of 16 m, a height of 1,2 m, composed mostly of dark amphibole schist, interspersed with skarn magnetite, chalcopyrite and other minerals.

Another dump is located 40–50 m south of the pit top. It is composed primarily of pieces of white and pale green serpentinized marbles, "eozoons" can often be found which are ovate, rounded minerals with the diameter of 10–20 cm, consisting of multiple thin concentric layers of green, yellow, brown serpentine, colorless, pink carbonate material and green or purple fluorite. Initially, in the 1860s, these concentric mineral were mistakenly taken by Professor P. Puzyrevskiy for the remains of ancient organisms "Eozoon Kanadens".

In the dumps of the mine "Klara-3" the following minerals are also found: cassiterite as brown bipyramidal crystals of magnetite ore with serpentine, cassiterite as fragments in calcite, dark green garnet, fine greenish mica, apatite magnetite, dark sphalerite as solid masses together with arsenopyrite, rarely – milky white scheelite with fluorite and others. Over the past decade the dumps of the mine "Klara-3" were taken for souvenirs to private and museum collections. Nevertheless, the subsoil stockpiles still retain good samples of collectable stones.

To the east of the dumps in the thick shallow forest there are remains of a trestle stone foundation with an area of 3 × 4 × 4 m^2 × 6 m^2, up to 0,5 m high.

Technogenic and natural complex of the former mine "Klara-3" does not have the bright features – there are no mines and even the pit top, only dumps may be of some interest for collectors of stones. This object is badly accessible the old ore road is heavily swamped.

The mines "Klara-1" and "Klara-2" are located in the far eastern corner of the ore field "Hopunvaara" on the edge of a swampy plain, close to the rocky granite outcrops. They were opened by JSC "Ladoga" in 1897 in skarns and marbles of the upper carbonate horizon, near the granite outcrops, 40 m from each other. The mines worked until 1900, and gave almost 30 000 tons of quality magnetite ore. The mine "Klara-1" produced 11 158 tons of ore.[94]

In the mines and quarry "Klara-1" and "Klara-2" the following minerals were found: serpentinized skarn and marbles and skarns containing magnetite addition, as fluorite, serpentine, calcite, diopside, sulphides, mica, phlogopite, cassiterite and other minerals. In marbles there were "eozoons" of green, blue-green, gray and bright orange colors.

Since that time the mine, the quarry and the mine dumps of "Klara-1" and "Klara-2" have changed significantly, forming a unique natural and technogenic landscape. According to studies of the Regional Museum of Northern Ladoga, 1997, on forested territory of the former mining area of 60 × 120 m^2 two mines, trenches and piles of rocks were preserved. [95]

The mine "Klara-1", located in the northern part of the ore area, near the low granite rocks, has a cross section 2,5 × 5 m and flooded with groundwater at a depth of 2,5–3 m from the surface. In topside of the mine shaft fragments of rotten log lining, partition wall, wooden pipes for pumping water and a wooden staircase can be seen.

The mine "Klara-2" is 40 m south of the mine "Klara-1" and has a cross section 2,5 × 5 m. The mine is flooded with water at a depth of 1,5–1,7 m below the surface. At the pit top one can see crumbling fragments of timbering, wooden partition wall and a drainage tube with an inner diameter of 12–15 cm, made from a single tree trunk with a scorched core. Partition of thin logs divides the shaft into two unequal parts: a smaller one was used for tripping workers and pumping water on wooden pipes, the large – for transportation of ore and rock.

To the east of the pit top of "Klara-1" there is the trench in which iron ore (magnetite) was open-pit mined. The mine has a T-shaped plan form area (10–20) × 20 m^2, a depth of 10–20 m (?) and flooded by groundwater at a depth of more than 2 m from the surface. High in the north and east walls of the trench run along outcrop of granite, low western wall is located in skarns overlapped with loose sedi-

[93] Борисов И.В. Научная справка "Техногенно-природный ландшафт"Рудного поля Хопунваара (комплекс горныхвыработок шахты "Клара-3")". Архив РМСП, Сортавала, 2004.

[94] Трюстедт (Трёстедт) О.Г. Питкярантские рудники и заводы. Гельсингфорс, 1907.

[95] Борисов И.В. Научная справка "Техногенно-природный ландшафт "Рудного поля Хопунваара (комплекс горных выработок шахты "Клара-1" и "Клара-2")". Архив РМСП, Сортавала, 2004.

ments. In the southern part of the working drainage ditch starts.

Fig. 21. The pit top of "Klara-2". 2011

Fig. 22. Magnetite quarry "Klara-1". 2013.

On the territory of former mines there are also drainage (end of the XIX c.) and exploration (the 1970–1980s) ditches with a length of 6–18 m, a width of 0,6–1 m, a depth of 1–1,2 m.

Not far from the mine shaft "Klara-1" there is the foundation of a kiln. It is oval in shape and 5 × 6 × 1,1 m in size.

Dumps of rocks and minerals within the described area have the following configurations and sizes. 10 m to the north-west of pit top "Klara-1" there is the comb shape dump (22 × (4–6) × (1–1,6) m), built of large pieces of white and dark marble and serpentinized gray skarn. In the southern part of the ore area, 20 meters south of the pit top "Klara-2" there is the so-called "Main" dump complex on the area of 35 × 50 m^2 and a height of 1,2–1,7 m. The surface of the dump is only partially overgrown with bushes. Here there are a variety of rocks and minerals: skarns serpentinized marbles with brightly colored "eozoons", fluorite-mica, magnetite, sulfides, calcite and others.

The content of this dump was reduced over the past decades as by students, geologists and rock collectors who visited the place.

The technogenic and natural complex of former mines "Klara-1" and "Klara-2" is one of the brightest the ore field "Hopunvaara". It should be declared a monument of the history of mining, landscaped for tourists. Because of the remoteness the tours are conducted extremely rare. This place is very attractive for its landscapes, as it is close to the pretty, light pine forest on steep granite cliffs. Not far from the "Main" dump, in swampy lowlands there is a well drilled by geologists in the 1970s, from which radon water pours.

In the northern part of the ore field "Hopunvaara" on the edge of a swampy plain, there are three iron ore mines of the "Winberg" group operating in 1897–1898. Technogenic and natural landscapes of these mines have been studied by the Regional Museum of Northern Ladoga in 1997[96] and the Karelian regional public organization of speleological researches "Kolos" in 2011.

The mine "Winberg-1" was put down by JSC "Ladoga" in 1897, 150 m north of the mine "Klara-1", on the edge of the lowlands near the outcrop of granite. The mine revealed a very thin ore body in skarns of the upper carbonate horizon, and, in spite it worked for only one year, it gave 308 tons of magnetite ore. Skarns also contain inclusions of chalcopyrite and sphalerite.

The studies conducted in 1997 found that on a partially overgrown with bushes and trees area of 25 × 40 m^2 following elements of man-made landscape were preserved: the pit top, tailings facilities and balances. The pit top of the shaft has a diameter of 3 × 5,5 m and is weakly visible in relief. In the upper part of the trunk there are remains of a log lining. The water level in the shaft is located at a depth of about 1,5 m from the surface.

The dumps have vague outlines, and practically blend in the ground. The dump number 1 surrounds the top pit on the area of 12 × 12 m^2, the dump number 2 forms a rounded mound 3 × 8 m^2 20 m north of

[96] Борисов И.В. Научная справка "Техногенно-природный ландшафт "Рудного поля Хопунваара (шахты группы "Винберг")". Архив РМСП, Сортавала, 2004.

the excavation. Near the pit top there are remains of a stone foundation with an area of 3 × 6 m^2, a height of 0,2–0,5 m. In the bushes you can see a small piece of the old ore road.

The technogenic and natural complex of the former mine "Winberg-1" is not very interesting due to a very small size of the dumps, poor preservation of the pit top and remoteness. The mine "Winberg-2" was put down in 1898 in the 260 m to the north-west of the mine "Winberg-1", next to a dirt road, near the rocky outcrops of granite-gneisses. The mine revealed a thin ore body in the lower skarn of the carbonate horizon. The quantity of ore produced in the mine is unknown. This object is not very interesting too. The mine "Winberg-3" is located 250 meters north-west of the mine "Winerg-2" on the edge of the swampy lowlands, 60 meters north-west of the junction of the mines "Winberg-1, 2" and the granite quarry "Mustavaara". The mine was put down in 1898 and revealed a small ore body in skarns of the lower carbonate horizon at the contact with the granite-gneisses. The mine worked for only one year and gave 170 tons of magnetite ore.

In 1997, on the overgrown with dense forest wetland area of 25 × 35 m^2 a pit top was marked, it was surrounded with piles of rocks and ditches. The pit top is defined by the reservoir area of 10 × 10 m^2, filled with water. To the south of the pi top tailings there are dumps 10 × 22 m^2, with the height of 1–1,6 m. The drainage ditches have vague outlines and filled with water. The technogenic and natural complex of the former mine "Winberg-3" is interesting as a tourist destination.

The ore field "Lyupikko" is located 4–5 km southeast from Pitkaranta. If you want to get there, you need to go first by asphalt, and then by a dirt road to get to the crushing and screening plant "Lyupikko" (JSC "Mosavtodor"), then not far from the stream Ristioya turn to the north-west on a dirt road and go through it for about 250 m to the nearest mine dumps "Lyupikko-4"

During the period from 1897 to 1904 only five mines of the ore field "Lyupikko" were put down. Four of them ("Lyupikko-1", "Lyupikko-2", "Lyupikko-3", "Lyupikko-4") are located at a distance of a discontinuous chain of 100–250 m from each other on the west (right) side of the stream Ristioya. They revealed mineralized skarns of the upper carbonate horizon 100–200 m from the south-western border of granite-gneiss. The mine "Lyupikko-5" is located to the southeast of the mentioned mines, on the east bank of the stream.

According to A.G. Bulakh in the skarn dumps of the ore field "Lyupikko" one of the major minerals is vesuvian which often forms large independent clusters. It occurs in the form of well-faceted crystals in the form of rectangular prisms up to 3,5 cm of different colors – brown-red, brown, dark green, light green, black. Serpentine is found in large quantities in the outermost dumps, it occurs in the form of solid green and yellow precipitates. Sphalerite has a brown or black color and is found in large Magnetite forms a solid mass in the shape of crystal of 3–4 mm. Cassiterite as individual crystals or solid black mass is extremely rare. It is found mostly along with magnetite and fluorite in limestone containing serpentine. Lyupikko scheelite is also rarely found in the dumps – usually in the form of white or gray inclusions with pyrite, chalcopyrite, magnetite, and fluorite.[97]

The technogenic and natural complex of the ore field "Lyupikko" was studied by the Regional Museum of Northern Ladoga (1998), Karelian regional public organization of speleological researches "Kolos" and a speleologist I.A. Kozlov (2010–2012).[98]

The mine "Lyupikko-4" is located 250 m north of the dam across the stream Ristioya. According to O. Tryustedt, this mine worked in 1897, and during that time gave 4351 tonnes of magnetite ore.

Today the pit top of the flooded mine can be seen. The walls are supported with logs up to 20 cm wide. According to I.A. Kozlov in 2011, the mine "Lyupikko-4" was found to be unsuitable for diving due to the small section of the dam at a depth of 4 m above the water.

On the territory of the mine "Lyupikko-4", in a dense forest, on an area of 50 × 100 m^2 piles of rocks and metallurgical slag were found. In the dumps there are the following minerals: diopside, chlorite, pyrite, chalcopyrite, sphene, calcite, serpentine. Near the pit top a unique pattern of garnet-magnetite skarn with phlogopite crystals and elegant druse dodecahedral crystal of black garnet-melanite was found.

[97] Булах А.Г., Франк-Каменецкий В.А. Геологические экскурсии в окрестностях Питкяранты. Петрозаводск, 1961.

[98] Борисов И.В., Гурвич С.А., Козлов И. Научная справка "Техногенно-природный комплекс рудного поля "Люпикко". Архив РМСП, Сортавала, 2011.

On the west bank of a stream Ristioya there are dumps of multicolored (dark green, dark blue, brown, black and other colors) slag left from the iron foundry “Lyupikko”.

The mine “Lyupikko-3” is located 150 m north of the mine “Lyupikko-4”. Its pit top has a cross section of 2,7 × 3 m. It is possible that the pit top was previously closed for security purposes. The depth to the water’s edge in the shaft is 2–2,2 m (2011).

According to O. Tryustedt, the mine “Lyupikko-3” worked from 1896 to 1904, and during that time it produced 56,051 tons of iron ore. [99]

According to the scheme of 1907, at the beginning of the inclined, then vertical, shaft the depth reached about 63 m. The first 4 m the first surface the mine is supported with logs. From the mine shaft 4 drift are drown, their length – from 66.5 m (the lowest) to 116.5 m (top). The first and second horizons in northern part of the mine are connected with a wide well. Now all the underground mine cavities are under water.

According to A.G. Bulakh in the mine dumps the following minerals are found: magnetite, sphalerite, pyrite, chalcopyrite, arsenopyrite, vesuvianite, fluorite, serpentine, chlorite, fewer – scheelite, apatite, cassiterite, pyrrhotite, galena, molybdenite, garnet and piemontite.[100]

The mine “Lyupikko-2” is located 200 m north of the mine “Lyupikko-3”. The shaft is divided with the log wall; the logs diameter is up to 35 cm. The depth to the water edge is 1,5 m

250–300 m north of the mine “Lyupikko-2”, 50 m west of the dirt road, there is the pit top of “Lyupikko-1”. According to O. Tryustedt (1907), the mine “Lyupikko-1” worked from 1897 to 1904, and during that time it produced 87,483 tons of magnetite ore.[101]

Shaft diameter of 3 × 6,5 m is divided into three equal sections by two vertical partitions. On the west side of the adjacent territory there are dumps of rock, among which you can find metal sheets (probably pieces of equipment) up to 1,5 m wide, 5 m long, 10 mm thick.

Fig. 23. The pit top of “Lyupikko-1”. 2011

The northern section of the mine shaft is littered with fragments of wooden equipment. In the middle section there is a wooden staircase up to 2,5 m with 7 steps. In the southern section of the mine shaft, near the northern wall there is a structure which is probably a hoist, and in the south-west there are the remains of a wooden drainage pipe with an outside diameter of 400 mm and an inner diameter – 200 mm. Transparency of water is more than 2–3 m.[102]

According to the section of the mine, made by O. Tryustedt in 1907, the depth of the vertical shaft of the mine “Lyupikko-1” reached about 82 m, and had five mining horizons. The ore layers containing magnetite ore with a thickness from 6,5 m (at the top) to 1,5 m at a depth of 80 m were developed in the mine. First ore 40 m the layer drops almost vertically and then begins to deviate to the horizon, which affected the system of mining.[103]

The first subsurface horizon was located at a depth of 18–20 m from the surface and reaches a length of 158 m. The height of the tunnel first 90 m is 6–8 m, the remaining 68 m – 2,5 m. 149 meters from the main shaft the tunnel is connected with the surface by an additional surface pit well.

A second subsurface horizon is located at a depth of 30–32 m from the surface, and has the form of two almost symmetrical drifts drawn on both sides of the shaft, the length of the first one is 83 m (“Southern”) and of the second one is 78 m (“Northern”). The

[99] Трюстедт (Трёстедт) О.Г. Питкярантские рудники и заводы. Гельсингфорс, 1907.

[100] Булах А.Г., Франк-Каменецкий В.А. Геологические экскурсии в окрестностях Питкяранты. Петрозаводск, 1961.

[101] Трюстедт (Трёстедт) О.Г. Питкярантские рудники и заводы. Гельсингфорс, 1907.

[102] Борисов И.В., Гурвич С.А., Козлов И. Научная справка “Техногенно-природный комплекс рудного поля “Люпикко”. Архив РМСП, Сортавала, 2011.

[103] Трюстедт (Трёстедт) О.Г. Питкярантские рудники и заводы. Гельсингфорс, 1907.

height of the drifts is from 8 to 10 m, the width is 6 meters.

The third underground level is put down at a depth of about 50 m from the surface. From the mine shaft in opposite directions along the strike of the orebody two nearly identical drifts are drawn, 78 m and 66,5 m long, up to 10–11 m high and 5 m.

The fourth horizon is located at a depth of about 65 m. From the vertical mine shaft bent toward the ore body through the marbles, the cross-cut up to 10 m is put down. The cavities are inclined along the ore body drop, and extended on both sides of the mine shaft for 41 and 50 m, with the height of tunnels of 10–11,5 m and a width of 5,4 m.

The lowest (the fifth) horizon is worked by the wedging ore body and its production is very small – the length on both sides of the trunk is 11,5 m and cross-section 2,5 × 3,2 m. A cross-cut 20 m long and 2,5–3 m high leads from the mine shaft to these workings. Thus, all underground horizons of the mine "Lyupikko-1" are divided with the cranches with the thickness of 3–3,5 m.

In 2011, the mine "Lyupikko-1" was examined by I.A. Kozlov. He made several dives and found that the mine is available for study. The maximum depth is 72,5 m, but the depth of the mine shaft was greater – 82,5 m. The study was videotaped. The structure of the mine "Lyupikko-1" was the same as the previously studied mine "Gerbertts-1".

The ore field "Heposelkya"

The ore field "Heposelkya" is located 5 km south-east of Pitkaranta. According to A.G. Bulakh to get there, we should go out of the city by rail Pitkaranta – Olonec up to "65 kilometers", at the post 300/400 turn right into the forest, where after only 30 m the workings begin, mainly trenches.

The mines of the ore field "Heposelkya" stretch for 70–100 m along the rocky ledge. The local skarns contain small crystals of garnet or light green actinolite. Characterized by strong silicification. In the dumps the following minerals are found: garnet, actinolite, epidote, diopside, fluorite, scheelite, pyrite, chalcopyrite, arsenopyrite, native copper (very rarely), malachite, and azurite. Garnet skarns are presented in three varieties: brown-brown, green and black and radite grossular as rhombic dodecahedrons.

Actinolite forms crystals of light green color filling the runs in garnet skarn. Bright fluorite forms crystals in the garnet skarn or calcite runs. Scheelite occurs in diopside skarn inclusions as light yellow stone up to 1 cm. Beautiful patterns with lots of sulfides crystals can be found in the most remote from the railway, overgrown dumps in the woods, as well as in a deep ditch, which runs along almost the entire ledge. In the wall of the mine skarns can be studied in their bedrock.[104]

In 2011, the Karelian regional public organization of speleological researches "Kolos" conducted reconnaissance work in the area of the ore field "Heposelkya". It appeared that the mining area here is much larger than it was indicated previously.

The marble quarry "Ristiniemi" is located 4 km south of Pitkaranta in southern Yulyaristi natural boundaries, 450–500 m to the north-east of the cape Ristiniemi.

The mine revealed a steeply dipping lens of calcite marbles with a thickness of 3–12 m and up to 70 m long, extending to the north-east, at the contact with the shale strata granite gneisses of dome structure. Marble is skarned and silicified. In the rock there are inclusions of light green diopside grains, small dark brown and bright red phlogopites 0,5–1 cm in size, grains and rare minerals of chondrodite norbergita (the latter being particularly rare, was opened in these places only in 1954 by a geologist E.I. Nefedov). On the cape Ristiniemi there are biotite schists of Ladoga series of fine-grained pegmatite runs (migmatites).

In the late XIX – early XX century in the quarry "Ristiniemi" mined light gray calcite skarn and silicified marbles as "fluxing stone" for the iron foundry of the steel company "Alexandrovsky Plant" which worked in 1899–1903 near the stream Ristioya in Masuuni.

The technogenic and natural complex of marble quarries "Ristiniemi" was studied by the Regional Museum of Northern Ladoga (1993–2010) and Karelian regional public organization of speleological researches "Kolos" (2010). On an area of 40 × 100 m^2, partly wooded trenches and piles of rocks are preserved.[105]

[104] Булах А.Г., Франк-Каменецкий В.А. Геологические экскурсии в окрестностях Питкяранты. Петрозаводск, 1961.

[105] Борисов И.В. Научная справка "Техногенно-природный комплекс каменоломни "Ристиниеми". Архив РМСП, Сортавала, 2010.

A trench 38 m long, 5,4 m wide, 1,5–7 m deep was put down along the strike of rock strata in the north-east, on the border of deposits of marble and granite-gneisses. The northern part of the trench is 10–15 m long, 2–3 m wide, 1–1,7 m deep; the southern (main) part of the mine is 18 m long, 4–5,5 m wide, reaches a depth of 4–7 m and 1/3 of it is flooded with water. Estimated amount of the rock mined in the quarry rock was about 900 m^3.

In September 2010, the quarry "Ristiniemi" was drained. The bottom of the trench turned to be filled up with large chunks of marble, probably specially dumped. A fragment of narrow-gauge railway could be seen. Two wooden cars without wheels were also found in the pit. To the west of the trench there are dumps (16–20) × (30–35) m^2 of marble.

Approximately 500 m north from the quarry "Ristiniemi" on the Bay of Lake Ladoga, there is a pier lined with pieces of marble, where to the early XX century marble ("fluxing stone") was carried to barges and boats. The stone was transported from about 500 m to the opposite shore of the bay, where Alexandrovsky iron foundry worked.

Marble from the quarry "Ristiniemi" was taken out to the pier on trolleys by the narrow-gauge railway up to 500 m long which is still visible in the woods.

The technogenic and natural complex "Ristiniemi" and the surrounding landscapes can be used in the organization of geological and historical excursions. The quarry is not very interesting as a monument to mining and industrial heritage, because of its small size, simple morphology and distance, but can be an important part of a small "natural park", organized on the territory of about 500 × 400 m^2, between the village Ristiniemi and the cape Yulyaristi.

The most interesting technogenic and natural complexes of Pitkaranta neighborhoods ("Gerbertts-1", "Hopunvaara", "Becky", "Clara-1, 2", "Ristiniemi", "Aleksandrinsky plant", etc.) can be the basis of a special recreation and tourist areas – "Pitkaranta ore park".

SALMI RAPAKIVI GRANITE MASSIF

A.A. Ivanov

Northern Priladozye is one of the most picturesque areas in Karelia. Various types of dimension stone have been quarried here in large quantities since the early 18th century from different-aged geological formations for the construction of St.Petersburg, the capital of Russia[1].

The Salmi rapakivi granite massif and its satellite, the Uljalega massif, located on the east shore of Lake Ladoga near Pitkäranta are of great significance for Russia's mining industry.

Fig. 1. Position of the Salmi (S) and Uljalega (U) rapakivi granite massifs, SW Karelia

The quarrying of the Salmi rapakivi granite massif was not as successful as that of the Vyborg massif, located in the Leningrad region, or rapakivi granite quarries in Finland, from which this wonderful stone has been and is being shipped to many countries. However, several quarries in the Salmi massif were opened some time ago, and small quantities were used in various architectural projects. They produced facing stone to restore balustrades and piece material for road covering in St.Petersburg. Nowadays, all operations in the quarries are suspended.

Urban Härne was the first to use the term *rapakivi* ("broken stone", "rotten stone") in his paper in 1694, but it was not until 1891 that it became widely used after the publishing J.J. Sederholm's paper "Finnish rocks called rapakivi"[2].

The Salmi massif is one of several plutons occurring as a belt which stretches along the southern Fennoscandian (formerly known as Baltic) Shield. It occupies the easternmost position in the belt and is the youngest. The massif has been studied in detail and extensively drilled by many companies and institutes of Karelia, St.Petersburg and Moscow using geological and geophysical methods.

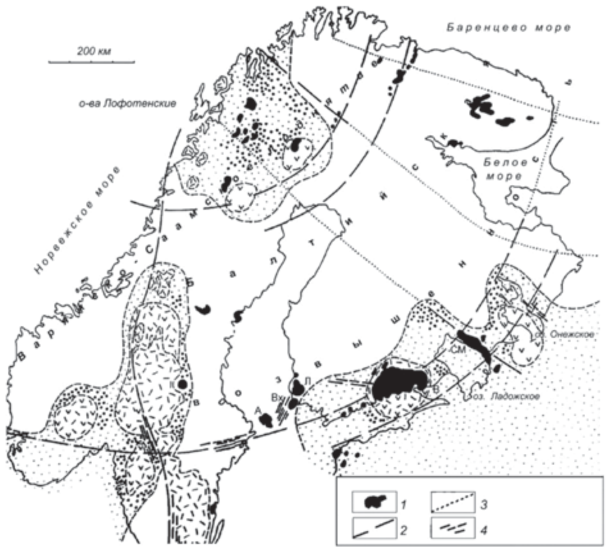

Fig. 2. Scheme showing the distribution of the belt of rapakivi granite massifs on the southern margin of the Fennoscandian Shield[3]

1 – rapakivi granite massif (A=Åland, Vh=Vehmaa, L=Laitila, V=Vyborg, SM=Salmi); 2 = actively evolving suture jointing zones of geoblocks; 3 = passively evolving suture jointing zone of geoblocks; 4 = dolerite and gabbro-dolerite (basic rock) dyke fields and belts.

[1] Зискинд М.С. Декоративно-облицовочные камни. Л.: Недра, 1989. 256 с.

[2] Свириденко Л.П. Петрология Салминского массива гранитов рапакиви. Петрозаводск: Карельское книжное издательство, 1968. 116 с.

[3] Светов А. П., Свириденко Л.П. Магматизм шовных зон Балтийского щита. Л., 1991. 199 с.

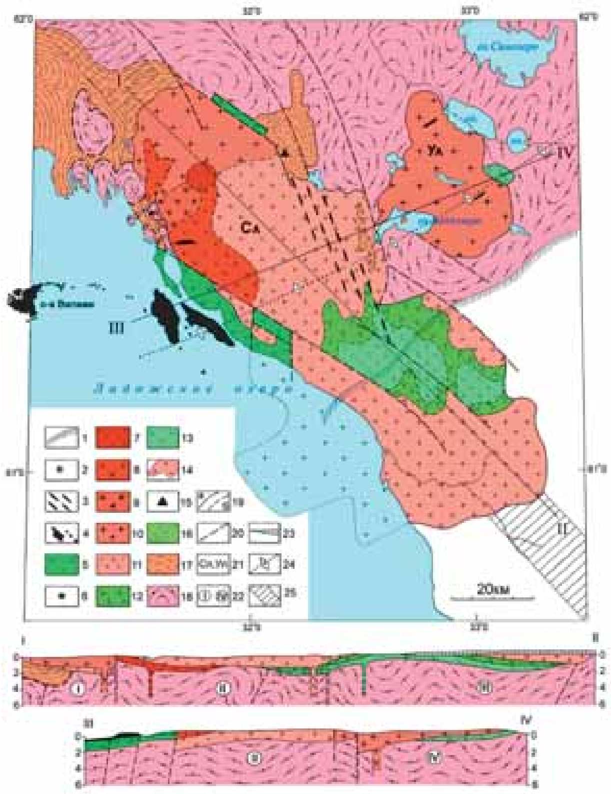

Fig. 3. Structural scheme of the Salmi rapakivi granite massif[4]

1 – Paleozoic cover boundary; 2 – Hopunvaara gabbro-dolerite neck; 3 – gabbro-dolerite and hyalobasalt (sortavalite) dykes; 4 – Valaam gabbro-dolerite sill; 5 – Salmi terrigenous and volcanogenic rocks; 5 – tuffisite veins and dykes. Rapakivi granites: 7 - coarse ovoid porphyraceous granite with fine-grained-structured matrix; 8 – inequigranular, porphyraceous biotite variety; 9 – pyterlites; 10 – equigranular biotite granite; 11 – vyborgite; 12 – gabbronorite; 13 – gabbro-anorthosite; 14 – assumed Salmi rock distribution in the Lake Ladoga area; 15 – Ludicovian basalt volcanic edifice in the Tulomozero structure; 16 – Jatulian-Ludicovian Tulomozero structure; 17 – Ladoga and Sortavala series, northern Lake Ladoga area; 18 – gneiss, tonalite and tonalite-gneiss of domal structures; 19 – geological boundaries: traceable (a), assumed (b); 20 – fault zones; 21 – Sl = Salmi massif; Ul = Uljalega massif; 22 – blocks in the enclosing rocks of the Salmi massif (cross-section); 23 – Paleozoic cover (cross-section); 24 – Polkanov's marginal radial flexure axis; 25 – suture zone of the Karelian and Svecofennian geoblocks.

The rapakivi granite massif covers an area of about 5000 km^2 and occupies a special tectonic position at the intersection of two big tectonic structures that extend across the entire Fennoscandian Shield. One of them stretches as an arc from southwest to northeast across the bottom of the Gulf of Finland and Lake Ladoga and is known as Polkanov's flexure; the other, rectilinear, structure extends from northwest to southeast and is a jointing zone between two big crystalline blocks – Karelian and Svecofennian. As the structures were tectonically active over a long period of time, the granites carry information on the pattern and directions of tectonic movements in the region from the time they were formed to this day. The massif intruded presumably from southwest to northeast along a gently-dipping thrust zone between two big tectonic structures[5].

The Salmi massif is structurally heterogeneous and, as some authors have proved, consists of granites, produced by three to five intrusion phases, and basic rock varieties.

The massif is divided tectonically into three blocks. The southeastern[6], most uplifted block consists of interbedded biotite-hornblende rapakivi granite (vyborgite I) and the rocks of a gabbro-anorthosite complex. The central block is composed of biotite-hornblende rapakivi granite (vyborgite I) that constitute a sheet-like body which dips gently southwest[7].

Vyborgite is spatially overlain by inequigranular, locally porphyraceous ovoidless biotite granite produced by phase-IV intrusion. They are cross-cut by biotite-amphibole rapakivi granite (pyterlite), generated by phase-III intrusion and coarse- ovoid porphyraceous with fine-grained matrix produced by phase-V intrusion[8].

The tectonically lowered northwestern block consists of equigranular ovoidless biotite granite produced by phase-II intrusion. Resting on them is inequigranular, locally porphyraceous, ovoidless biotite granite.

[4] Светов А.П., Свириденко Л.П. Магматизм шовных зон Балтийского щита. Л., 1991. 199 с.

[5] Ларин А.М. Граниты рапакиви и ассоциирующие породы. Санкт-Петербург: Наука, 2011. 402 с.

[6] Великославинский Д.А., Биркис А.П., Богатиков О.А. и др. Анортозит-рапакивигранитная формация Восточно-Европейской платформы. Л.: Наука, 1978. 296 с.

[7] Светов А.П., Свириденко Л.П. Рифейский вулкано-плутонизм фенноскандинавского щита. Петрозаводск, 1995. 211 с.

[8] Свириденко Л.П. Петрология Салминского массива гранитов рапакиви. Петрозаводск: Карельское книжное издательство, 1968. 116 с.

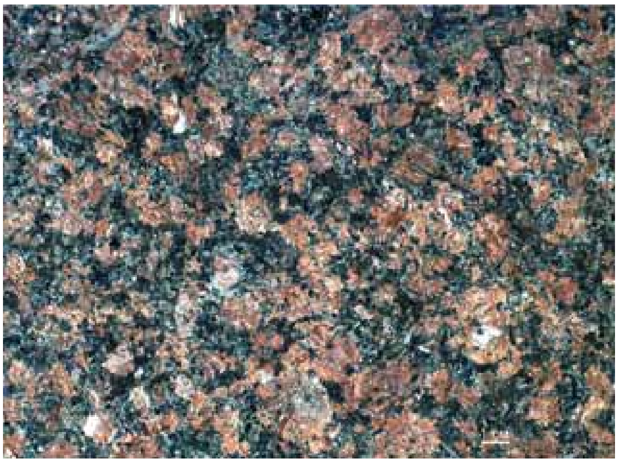

Fig. 4. Vyborgite and phase-I ovoid rapakivi granite

Fig. 6. Pyterlite and ovoid phase-III rapakivi granite that constitute a separate body in the northwestern portion of the massif

Fig. 5. Phase-II equigranular granite which builds up the northwestern portion of the massif

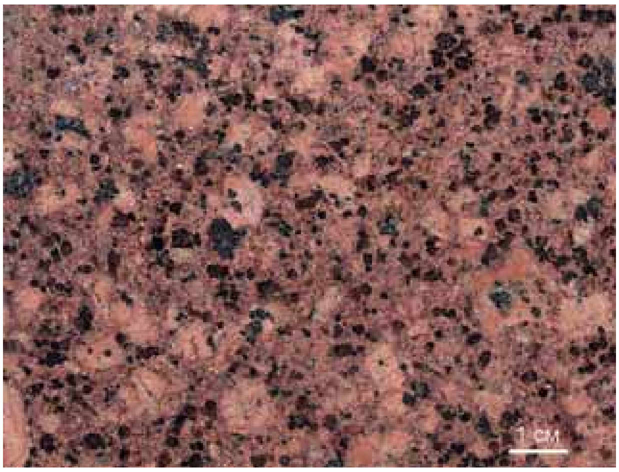

Fig. 7. Phase-IV inequigranular granite making up individual units in the northwestern portion of the massif

Rapakivi granites (vyborgite, pyterlite and coarse-ovoid porphyraceous granite with fine-grained matrix, produced by phase-I, III- and V-intrusion phases, and ovoidless biotite leucogranite equigranular phase – II granite and inequigranular, locally porphyraceous phase-IV granite, related genetically to the endogenous magmatic activity centres of the Fennoscandian Shield margin[9].

The time polychronicity of rapakivi granite and biotite leucogranite intrusion has thus been determined. Rapakivi granite and biotite leucogranite are similar in mineralogical composition dominated by K-feldspar and quartz that make up over 89 % of the rock. Rapakivi granite is subalkaline and barium-rich, and its fluid composition is enriched in CO_2, CO, CH_4, while the fluid composition of biotite leucogranite typically displays elevated water and fluorine concentrations. Rapakivi granite can be correlated with subalkaline granite, and biotite leucogranite with rare-metal granite, based on the fluid regimes at crystallization stages[10].

[9] Свириденко Л.П. Граниты рапакиви и редкометальные граниты Фенноскандинавского щита // Материалы совещания Всероссийской конференции посвященной 150-летию академика Ф.Ю. Левинсон-Лессинга и 100-летию профессора Г.М. Саранчиной. Современные проблемы магматизма и метаморфизма. Т. 2. 1–5 октября. 2012. Санкт-Петербург. С. 214–216.

[10] Свириденко Л.П. Граниты рапакиви и редкометальные граниты Фенноскандинавского щита // Материалы совещания Всероссийской конференции посвященной 150-летию академика.

Geophysical study has shown that the Salmi massif is a subhorizontal sheet-like body that varies in thickness from 2–5[11], to 2–10 km[12]. Geophysical data suggest the presence of feeder channels for vyborgite in the southern portion and for equigranular biotite granite in the central portion.

The Uljalega granite massif, a satellite of the Salmi massif, consists of equigranular biotite granite and occurs as a sheet-like body, as shown by geophysical data.

The Salmi massif is 1547–1530 Ma old[13].

You can see all the above granite varieties in the Pitkäranta area, on both sides of the Petrozavodsk-Sortavala highway, 2 km after Kolatselga. Phase-I ovoid granite (vyborgite), which constitutes the bulk of the massif, is exposed in the road cuts.

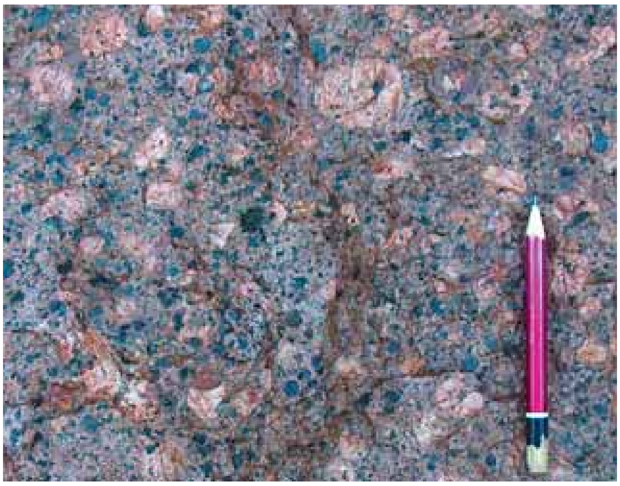

Fig. 8. Coarse-ovoid porphyraceous granite with phase-V fine-grained matrix that build up an individual body in the central northwestern portion of the massif

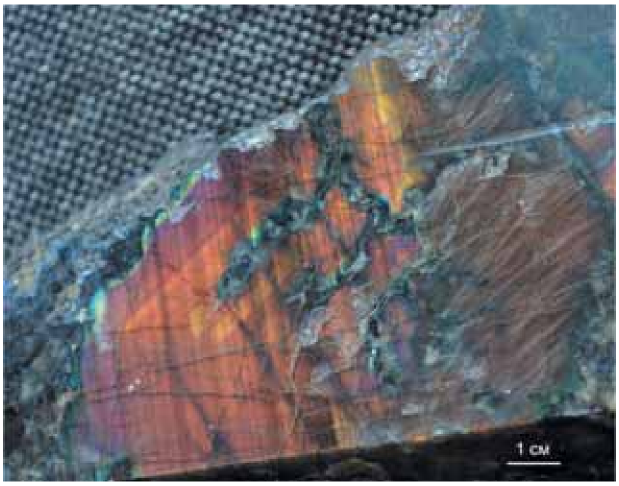

Fig. 9. Spectrolite sample from the Museum of Precambrian Geology at the Institute of Geology, KarRC, RAS

Coarse-ovoid porphyraceous granite with phase-V fine-grained matrix is exposed farher away near Lake Säksjärvi. Inequigranular, locally porphyraceous phase-IV granite is exposed about 200 m before crossing the highway to Pitkäranta.

Also of great interest, in addition to Salmi rapakivi granites, are the rocks of a gabbro-anorthosite complex found in Russian Karelia only in core samples at depth, while in Julämää, Finland, southwest of Lappeenranta, this beautiful stone (its commercial name is spectrolite), related genetically to rapakivi massifs, is quarried. This facing stone is used for making jewellery, depending on the number of iridescent feldspar crystals per certain area.

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[11] Свириденко Л.П. Петрология Салминского массива гранитов рапакиви. Петрозаводск: Карельское книжное издательство, 1968. 116 с.

[12] Amelin Yu. V., Beljaev A., Larin A.M., et. al. SalmibatholithandPitkärantaorefieldinSovietKarelia // Geol. Surv. Finland/ Eds. I. Haapala, O.T. Rämö, P.T. Salonsaari, 1991. Guide 33. 57 p.

[13] Larin A.M., AmelinYu. V., Neymark L.A., et al. Theoriginof Salmiand Uljalegi Anorthosite-Rapakivi Granitemassifs: constraints from precise U-Pb geochronology and Pb-Sr-Nd isotopic data. Abstr. Volume, 7th Intern. Meeting on Rapakivi granites. Helsinki. Finland, 1996. P. 47.

TULMOZERO IRONWORKS

A.L. Potravnov, T.Y. Kmelnik, A.I. Gribushin

The first references to industrial production of iron in Tulmozerye are dated by 1761, when Ironworks of Ivan Barmin was built on a head of the Tuloma River. Detailed information about this plant we can meet in "Travel along Ladoga and Onego Lakes and around Ilmen" by academician Ozeretckovskiy written after his trip along the specified route in 1785 and in 1805.

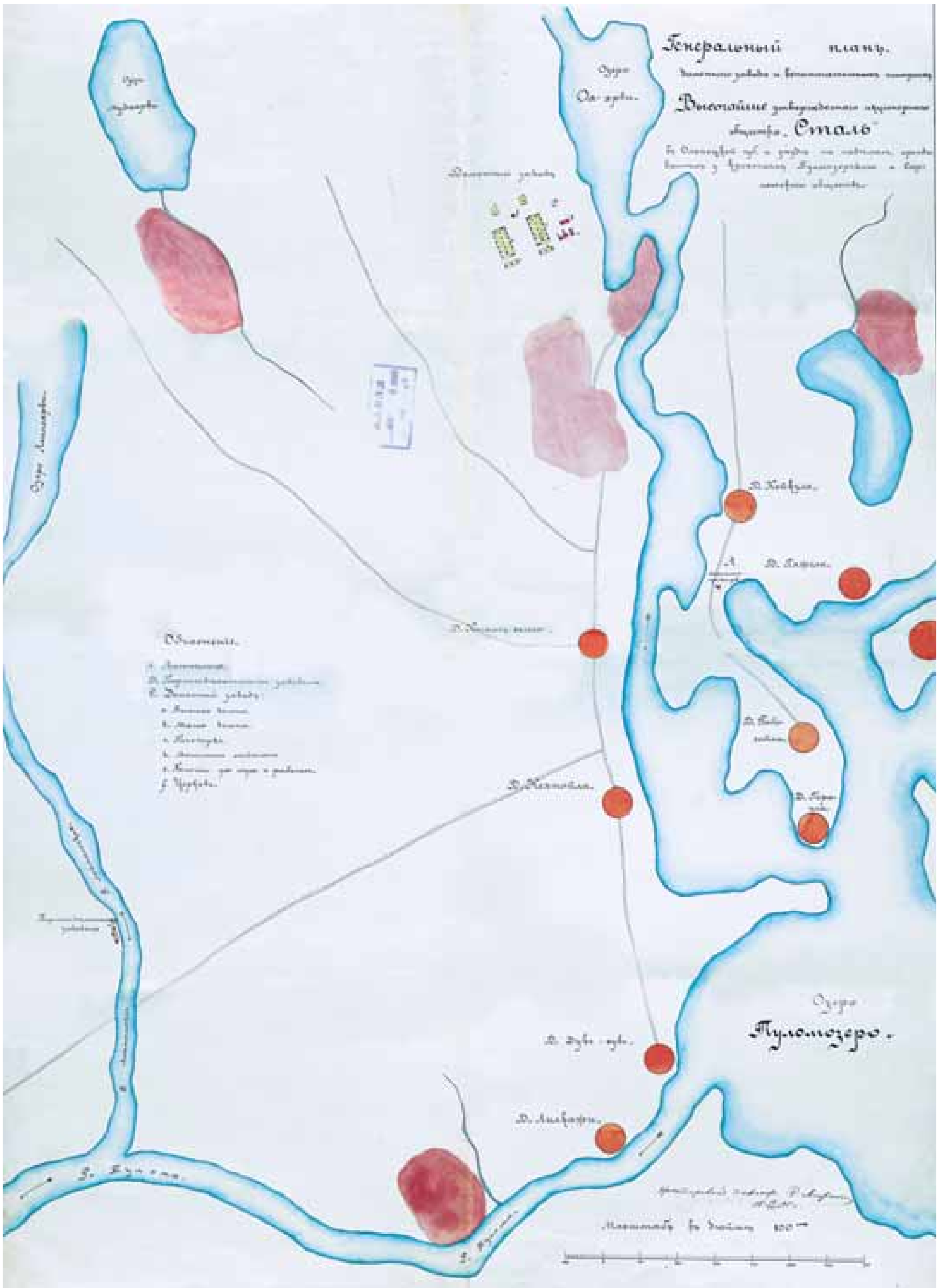


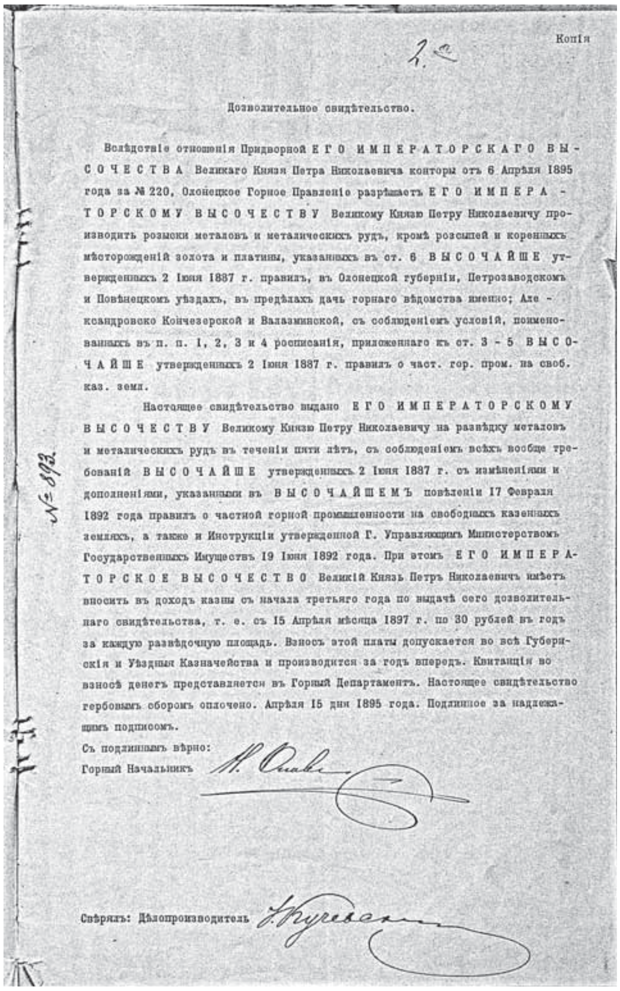
Fig. 1. Location of the Ironworks

We are quoting here:

"Tulmozero iron foundry of Olonets merchants Ivan Barmin, Ivan Ignachevsky and Matvey Chogin is situated in Tulomozersky Churchyard along the left side of the Tuloma River that takes off from Tuloma Lake and disembogues its waters into Ladoga Lake. It was built in 1761; there are following constructions in it: a blast furnace, a dam, a refinery plant of two hearths with four finery hammers, a bloomery plant of three furnaces, a steel plant, a forging shop of three semi-hearths and two mills – sawing one and flouring one. Iron was transported here from sixteen areas, located at the distance of no more than 40 versts from the ironworks. It was at work till April 22, 1778, and when all the works were stopped, on June 27, 1799 it was leased out by the mentioned owners for 12 years to Major Ivan Loginov who never set to it."[1]

The next stage in the development of the iron production was started in the second half of the XIX century. By 1870 lands around Tulmozero were divided into two categories: state forest ones named state Tulmozerskaya forest dacha (estate) and peasant lands of different agricultural societies: Tulmozerskoe, Sarzhinskoe and etc. These peasant lands consisted not only of cultivated fields, but also of meadows, bogs and forests that were used by peasants for their own needs in collecting firewoods, arranging household yards and etc.

At the end of the XIX century, according to the rules of that time, anyone who wished it (with some minor, specially stipulated, exceptions) could apply for survey and exploration of mineral recourses. Having registered such an application and paying certain amount (30 rubles per year for one declared area), an applicant got a Permissible Certificate for the right to explore with forest cutting and exploring shaft digging. If desired to develop the explored deposit the owner of the valid permissible certificate had a right to conclude an agreement on the lease of the plot of land aiming to excavate what he had found there. Depending on the owner, the procedure for the conclusion of a lease agreement was different. For example, in order to conclude an agreement with peasant society, it was necessary to hold a meeting of the society, get consent of the most members of the community, set order and amount of payments and then, based on the decision (sentence) of this meeting, to conclude the lease agreement with the representatives authorized by the meeting. When concluding a state land lease agreement, it was necessary to make it with the Ministry of Public Properties[2]. For this reason the information about those who had started ore extraction in Tulmozerye, earlier mentioned in different publications and articles, not always took into account this peculiarity, therefore there was confusion with dates and owners of these or those mines.


Копія

2.а

Дозволительное свидѣтельство.

Вслѣдствіе отношенія Придворной ЕГО ИМПЕРАТОРСКАГО ВЫСОЧЕСТВА Великаго Князя Петра Николаевича конторы отъ 6 Апрѣля 1895 года за № 220, Олонецкое Горное Правленіе разрѣшаетъ ЕГО ИМПЕРАТОРСКОМУ ВЫСОЧЕСТВУ Великому Князю Петру Николаевичу производить розыски металовъ и металическихъ рудъ, кромѣ розсыпей и коренныхъ мѣсторожденій золота и платины, указанныхъ въ ст. 6 ВЫСОЧАЙШЕ утвержденныхъ 2 Іюня 1887 г. правилъ, въ Олонецкой губерніи, Петрозаводскомъ и Повѣнецкомъ уѣздахъ, въ предѣлахъ дачь горнаго вѣдомства именно; Александровско Кончезерской и Валазминской, съ соблюденіемъ условій, поименованныхъ въ п. п. 1, 2, 3 и 4 росписанія, приложеннаго къ ст. 3 - 5 ВЫСОЧАЙШЕ утвержденныхъ 2 Іюня 1887 г. правилъ о част. гор. пром. на своб. каз. земл.

Настоящее свидѣтельство выдано ЕГО ИМПЕРАТОРСКОМУ ВЫСОЧЕСТВУ Великому Князю Петру Николаевичу на развѣдку металовъ и металическихъ рудъ въ теченіи пяти лѣтъ, съ соблюденіемъ всѣхъ вообще требованій ВЫСОЧАЙШЕ утвержденныхъ 2 Іюня 1887 г. съ измѣненіями и дополненіями, указанными въ ВЫСОЧАЙШЕМЪ повѣленіи 17 Февраля 1892 года правилъ о частной горной промышленности на свободныхъ казенныхъ земляхъ, а также и Инструкціи утвержденной Г. Управляющимъ Министерствомъ Государственныхъ Имуществъ 19 Іюня 1892 года. При этомъ ЕГО ИМПЕРАТОРСКОЕ ВЫСОЧЕСТВО Великій Князь Петръ Николаевичъ имѣетъ вносить въ доходъ казны съ начала третьяго года по выдачѣ сего дозволительнаго свидѣтельства, т. е. съ 15 Апрѣля мѣсяца 1897 г. по 30 рублей въ годъ за каждую развѣдочную площадь. Взносъ этой платы допускается во всѣ Губернскія и Уѣздныя Казначейства и производится за годъ впередъ. Квитанціи во взносѣ денегъ представляется въ Горный Департаментъ. Настоящее свидѣтельство гербовымъ оборомъ оплочено. Апрѣля 15 дня 1895 года. Подлинное за надлежащимъ подписомъ.

№ 893.

Съ подлиннымъ вѣрно:

Горный Начальникъ

Сверялъ: Дѣлопроизводитель

Fig. 2. Permissible Certificate

Besides, one should pay attention to a point of interest of the rules of extraction of minerals regularized by the legislation of that time. If a mine's owner during three years did not extract more than 100 poods of ore per year, the agreement for ore ex-

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[1] Озерецковский "Путешествие по озерам Ладожскому, Онежскому и вокруг Ильменя" 1805.

[2] Ст. 437 и 439 Горного Устава (в редакции 1739 и 1806 гг.), п.п.16–32 "Правил о частной горной промышленности на казенных свободных землях" Выс. утв. 02 июня 1887 г.

cavation was terminated and the mined was declared to be exhausted[3].

Before 1872, on peasant lands of Tulmozerskoe community, local peasants during some period of time, mined "iron glance" – hematite that was brought to Luppiko ironworks in Pitkaranta. This deposit was explored by this ironworks' specialists; however the owner of the plant, the Swede Volstedt, was wary of concluding an agreement being quite satisfied with the fact that the peasants themselves mined the ore and brought it to the plant. The specialty of the situation was also that the ironworks in Pitkaranta was at that time situated on the territory of the Grand Duchy of Finland, and Tulmozerye – in the Olonets Governorate. Only after Russian entrepreneurs started to apply for ore extraction in Tulmozero area both on the state and the peasant lands, Volstedt became aware of the necessity to legally formalize the mines, including an application for survey and extraction. However the right moment was missed and the unwillingness to pay well to the peasants played a low-down trick with the Swede – the peasants of Tulmozerskoe community refused not only to conclude an agreement with Volstedt, but also to be attesting witnesses when taking out mines on the territory of the state forest dacha[4]. In the end, in October, 1872 an agreement with M.F. Groten was concluded for most of the lands of the state forest dacha[5]. Then the history of the mines on the territory of the state forest Tulmozerskaya dacha was connected only to the plant in Pitkaranta and Vidlitcky Ironworks that was a part of Putilovsky Plant, and these mines had no relevance to Tulmozero Plant hereafter. Therefore further we will talk about only the lands of Tulmozerskoe and Sarmyazhskoe peasant communities, on the territories of which Tulmozero plant would start its activity moving forward.

In order to study the iron ores underplaying on the lands of these communities A.F. Krasilnikov as back as in the summer 1871 invited N. Golovkinsky, professor from Kazan University, and to hold the exploration works – mining engineer P.A. Versilov[6]. Preliminary data were quite promising; therefore in March, 1872 a land lease agreement was signed with the peasant communities for 30 years providing that the excavation of ore would be carried out on the land unsuitable for husbandry with 1200 rubles payment per year for all these lands. In summer of the same year, together with Versilov, mining engineer Konstantin Kulibin (a grand son of the famous inventor Kulibin) also held the exploration works; having researched the ore deposits, he concluded that due to the peculiarities of the mode of occurrence the ore would be very expensive (up to 18 kopecks per pood)[7]. However, Krasilnikov, who worked at the ironworks at some tens of kilometers distance from Tulmozerye, was optimistic: there was rich ore, the agreement was concluded, there was a wish to build and commission the plant, there was no only a small thing – money. According to a preliminary business plan (if we call it in the present-day term), prepared in 1879, about 1 million rubles were needed in order to commission and set the plant to work. Under the business plan, the plant was supposed to be built on the Vidlitca River that disembogued its waters into Ladoga Lake[8]. This business plan was started to be distributed in Saint Petersburg. There was nobody wishing to invest such an amount of money in such an unordinary project until it was proposed to Grand Prince Nikolay Nikolaevich the Elder in 1880. The Grand Prince got interested in the idea and charged Colonel Bozheryanov (unfortunately, the full name is unknown) of executing purchase of the complete project. Cession Act was signed on June 12, 1882, and this cession of right cost the Grand Prince 650 000 rubles with an obligation to annually pay 1200 rubles to the peasant communities' account to be preserved. Besides the leasehold for 42 000 dessiatines of land, the Grand Prince acquired materials of geological surveys, a sorting barn, a gunpowder barn, a forging shop, some instruments and 400 cubic sagenes of the mined ore. During the following two years Colonel Bozheryanov spent 260 451 rubles of the Grand Prince's money more until the Highest Commission from the Ministry of Allotments came to Tulmozerye to carry out an audit. The auditors did not come to finding out why the price of the cession was so high. The price was agreed upon anyway. However they took all the following payments with all the thoroughness. They divided the spent money into three groups:

[3] Ст. 1065 Горного Устава.

[4] РГИА Ф. 83 Оп. 1 д. 335 стр. 23–24.

[5] РГИА Ф. 83 Оп. 1 д. 330 стр. 24–27.

[6] РГИА Ф. 58 Оп. 2 д. 607 стр. 33, 34, 38.

[7] К. Кулибин "О месторождении железных руд в крестьянском наделе Туломозерской дачи" Спб, 1873.

[8] РГИА Ф. 58 Оп. 2. д. 607 стр. 50а–50г.

1. The expenditures that were not approved by documents and not confirmed by actual certificates and therefore could not be acknowledged valid. Such expenditures were counted for 89 406 rub. 55 kop.

2. The expenditures about the actuality and amount of which the Commission did not have any information – in the amount of 37 945 rub. 15 kop.

3. The expenditures in the amount of 91 620 rub. confirmed by documents and approved to be really existent.

Besides, the Commission pointed out separately the issue of practicability of the purchase of "Inzhener" steam ship and expenditure in the amount of about 2000 rubles for sand, bricks and clay[9].

However, despite 910 000 rubles that had already been spent, there was no hint at any plant or ore extraction. Nikolay Nikolaevich did not know what to do with this project further, therefore everything was neglected until the moment – already after the death of Nikolay Nikolaevich the Elder in 1891 – Tulmozero project came down to his son Peter Nikolaevich.

Peter Nikolaevich started vigorous activity on developing the project in 1895. First of all, the agreement with the peasants of Tulmozerskoe and Sarmyazhskoe communities for the lease of 42 000 dessiatines of land was prolonged till July 21, 1991 (the date is correct, this is not a misprint!)[10].

Then he invited a former manager of Permikin's plants, N.K. Trofimov, who tried to organize work on ore extraction[11]. At the same time different persons and moneymakers promising mountains and marvels started to come to the Grand Prince. In 1896 the Charter of "Stal" Stock Company was registered; it stated that Secretary of the Grand Prince S.G. Demmeni (authorized representative of Peter Nikolaevich) and engineer A.A. Karyshev, who proposed the patented new was of steel mining, were the founders. Saint Petersburg International Commercial Bank headed by A.Y. Rothstein also got interested in the unordinary and interesting project at the suggestion of merchant Ilya Fainberg. Unfortunately the memories of Moscow merchant Varentcov contain the version of events where the history "Stal" Stock Company and Tulmozero plant was represented as some well-thought-out speculation, however studying the documentation completely disproves this deception. When banker Rothstein found out about big deposits of iron ore not far from Saint Petersburg, he decided to organize a kind of metallurgical holding with 7–8 blast furnaces to be built in Tolmozero, on the Olonka, the Svir and in Petrozavodsk. For better understanding of this banker's idea it is necessary to take into account the fact that the Russian Government's policy in the 1890-s encouraged the development of domestic iron production. It provided for not only different preferences for the producers, but also included prohibition duties for the import of foreign materials and money bonuses for every pood of cast-iron produced at a new Russian plant. These requirements were stipulated in contracts for the delivery of ready products for the needs of the state (defense orders, rails for railroads and etc.). Exactly for this reason Putilovsky Plant built its ironworks on the coast of Ladoga Lake, in the mouth of the Vidlitca River, in 1895–1897. It was a compulsory condition of the long-term contract between the Ministry of Railways and Putilovsky Plant[12].

So, let's come back to "Stal" Company. Negotiations about participation of the Bank started in May 1896 and on June, 22 the protocol about entering the Bank into the shareholder's structure with the acquisition of 50% (33 500) of "Stal" Company's stock, providing for compensations payment to the project's participants - Peter Nikolaevich had to get 1 333 333 rubles in gold, A.A. Karyshev – 200 000 rubles in gold, - was signed[13]. However, being an experienced banker, Rothstein, in order to ensure his risks, on the eve – on June, 20 – managed to get from the Grand Prince a written obligation to return the money invested by the Bank by September 20, 1896, in case the iron ore deposits with iron content of no less than 50% and silicium content of more than 10% on the leased land would be less than 900 million poods[14]. In the summer of 1896 additional studies were done and in August – September 1896 the famous geologists (A.A. Inozemtcev, I.V. Mushketov, R. Helmhaker, V. Piskor) during several meeting discussed the results of this rapid studies. Assessments of the ore reserves differed by times – from 3,5 billion to 280 million poods. Such a variation was due to the fact that

[9] РГИА Ф. 515 Оп. 48 д. 567 стр. 2–7.

[10] РГИА Ф. 83.Оп. 1 д. 36 стр. 29.

[11] Ibid, p. 37–38

[12] РГИА Ф. 83. Оп. 1 д. 25 стр. 12.

[13] РГИА Ф. 626 Оп. 1. Д. 448 стр. 5–8.

[14] РГИА Ф. 626 Оп. 1. Д. 443 стр. 31–32.

nobody made borings and test holes on the explored deposits, and different specialists differently assessed to what depth ore-bearing veins run and how much they would differ from the surface parameters.

On September 19, 1896, despite the fact that earlier declared ore reserves were not confirmed for sure, the Bank decided to buy out 50 % of “Stal” Stock Company’ shares[15]. The mediator, merchant Ilya Fainberg got the right to buy a considerable stock of shares and a place in the Board of Directors. After the entrance of the Bank into the shareholder's structure was legally implemented, Rothstein started heavy activity. Right off the bat, he started to hold negotiations with the Ministry of Railways and the defense authority aiming to get orders for the delivery of steel products[16]. In February 1897 Rothstein, on behalf of the Company, addressed to Minister S.Y. Witte requesting to rent out Izhora Plant to “Stal” Stock Company with the guarantee of state orders for 3–4 million rubles[17]. In spring of the same year the Company started to explore iron ore on almost all the territory of Olonets Governorate.

Apart from solving such strategic tasks, they started to construct Tulmozero ironworks itself that was some time called in the documents “Petrovka” after the name of the Grand Prince. First they would like to place the plant on the same place the plant of Barmin stood – near the origin of the Tuloma River. However, in September 1896, a special commission comprised of M. Tokarsky, H. Lenz and P. Emerikh, having checked the territory, suggested completely different place for the ironworks (the one it is still located at) and prepared the respective report. Arguments for this place were the following:

possibility to easily get to the center of the mines by railroad and by eskers to go further to the north;

the place was surrounded by the heights protecting it from winds;

the plant’s area was below the eskers’ level what gave an opportunity to transport ore by wire road;

adjacent coast of Oja-jarvi Lake was convenient both for heaping up ore and for transportation of it by water and by ice;

convenient geological conditions for construction: ground on the place of the plant – 0,75–1,5 sagenes of sand over hard rock;

flux material for the blast furnace was located not far than one verst from the plant;

deposit of construction materials was nearby;

it was convenient to build railroad from the coast of Ladoga Lake.

When planning the activity of “Stal” Stock Company it was supposed that 10 000 000 poods of ore per year would be sent for melting. Part of the ore (3 000 000 poods) would melt into cast iron by Tulmozero ironworks, the other – would be brought to the other plants of Olonets. During the first year of the Company’s work it was planned to process only 3 000 000 poods of ore (one half – at Tulmozero plant, the other half – at Olonets plant). The commission counted that the price of the ore that would be extracted at the local mines was supposed to be only 6 kopecks per pood; and the price of a pood of ore on the coast of Ladoga Lake (taking into account 50 km of railroad) would be 7,88 kopecks[18].

From the very beginning it was planned that the blast furnaces of Tulmozero Ironworks would be work on char coal, as it was common at the plants of Olonets and the Ural and other countries, for example, in Sweden. Cast iron produced by this way was of the best quality – it was well forged and weakly corroded. Almost all forged products we know (grids, fences, monumants, columns) were made of the cast iron produced on char coal. The case is that during such melting detrimental impurities – sulfur, phosphorus and etc. – did not enter into the metal. And the cast iron produced in blast furnaces on coal or coke was filled by these impurities and therefore was brittle and was impossible to forge. The same specialists counted the average cost of char coal for Tulmozero ironworks – it was 14,78 kopecks per pood including delivery to the plant. As the result, the price for one pood of cast iron was the following:

The following materials were used per one pood of cast iron:

2 poods of ore per 6 kopecks – 12 kopecks.

½ pood of flux per 2 kopecks – 1 kopeck.

1,1 poods of coal per 15 kopecks – 16,5 kopecks

Cost of manufacture – 10 kopecks.

Total cost of production at the plant – 39,5 kopecks

Including freight to Saint Petersburg – 54,38 kopecks[19].

[15] РГИА Ф. 626 Оп.1 д. 444 стр. 16–17.

[16] РГИА Ф. 626 Оп.1 д. 448 стр. 86–87.

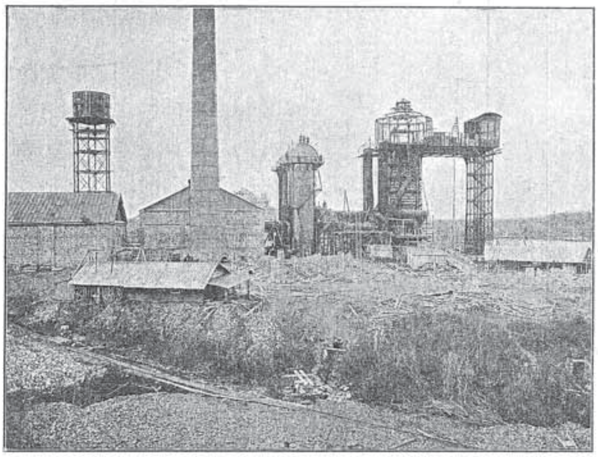
[17] РГИА Ф. 626 Оп.1 д. 451 стр. 14.

[18] В Правление “В.У.А. “СТАЛЬ” СПб, 1896 г.

[19] В Правление “В.У.А. “СТАЛЬ” СПб, 1896 г. Стр. 21.

It was supposed to remelt cast iron into steel and iron in Saint Petersburg, or to sell it to other companies. In order to make the construction of the ironwork cheaper, an own brickworks – or "brick-molding shop" as it was called then – was built on the Loimozh River. Walls of the remained plant are made of bricks with "OC" marking produced exactly by the brickworks. Mainly visitants worked at the plant – special contracts were concluded with peasants from different governorates – Permskaya, Kurlyandskaya. Daily routine at the plant was the following: start of works at 6 a.m., work till 6 p.m. with two breaks – for breakfast from 8 till 8.30 a.m. and for lunch from noon till 1 p.m. On Saturdays working day was one hour shorter. Obligatory days-off were all Sundays and 14 important holidays more: New Year, the Epiphany, the Annunciation Day, the Transfiguration, the Assumption Day, Nativity of the Theotokos, the 1-st and the 2-nd days of Christmas, Friday and Saturday of the Holy Week, Monday and Tuesday of the Easter Week, the Ascension Day and the second day of the Advent. On other red-letter days (there were 28 more days) a worker had a right not to work, but with the chief's consent[20].

It was supposed to built two blast furnaces at the plant – one "Swedish", small one, with the capacity of 1800 poods of cast iron per day, had already been bought and was planned to be used for work on limonites, local bog and lake ore. It was provided that products for local use could be produced from this cast iron right here, at the plant. For that purpose a big casting yard adjacent to the furnace was built. The other blast furnace – big one, with 3000 poods of cast iron per day capacity – was made under the project of engineer Lurmen together with "Stal" Company by G. Lenz specially for Tulmozero hematites. Toward this goal samples of hematite ore with associated rock were sent to Berlin in order to take into account the peculiarities of local rocks to the maximum. Both furnaces were designed taking into consideration the fact that char coal – but not coke that was getting more and more popular – would be the fuel for the furnaces. The main difference of the furnace using coke is its size – it is much bigger and wider, what is required by the specific characters of coke's burning. The blast furnace on char coal was smaller just for one reason – weight of charging material in big furnace destroyed coal and there was no normal burning. Therefore, when designing blast furnace, special local aspects were always taken into account, without mentioning such key parameter as the type of fuel. All drawings of the furnaces and the plan of the ironworks, according to the requirements of the legislation, were agreed in Mining Department in October 1897. Almost all the equipment for the plant was supplied from Europe: Cowper blast heaters were ordered from "Heinrich Stöhler" from Weidenau (Germany), blowing machines by "Ochellhauser Maschinenfabrik-Jiegen" Company – also from Germany, and chamotte brick was bought from English company "Cowen & Co" from Blaydon[21].



Большая доменная печь Тулмозерскаго завода

Fig. 3. Big Blast Furnace of Tulmozero Ironworks

By the end of 1897 a foundation was manufactured for the Swedish blast furnace, six cast iron poles for backing up support ring of the furnace were mounted, stone poles for backing up charging platform and roof were not completed about 6 meters till the end. However the walls of the casting yard and ore-roasting furnace were topped out. Besides, building for boiler and machine shops were prepared. All machines were in stock in Salmi. The foundation and a considerable part of the jacket – a basement for the furnace itself, for the hearth and the boshes, as well as riveted columns for the charging platform – were mounted for the big blast furnace by that time. Walls of the casting yard were built halfway, the main vertical dominant – a 60-meter brick plant stack – was built. In order to supply necessary materials for the construction a brickworks was built and commissioned at 6,5 versts

[20] РГИА Ф. 83 Оп.1 д. 98 стр. 8–10.

[21] РГИА Ф. 616 Оп.1. д. 448 стр. 86–125.

distance and a sawmill – at 5,5 km distance from the plant.

As of the beginning of 1898 the reserves of ore for melting were already 700 000 poods. These reserves were formed as a result of the following works:

1) Three drift ways, one inclined shaft and one vertical shaft were made at Rogo-selga.

2) Piran-selga an inclined shaft was made and two drift ways were started.

3) Drift ways and inclined shafts were opened at the other seven deposits.

In order to prepare char coal two coal stations – Tulmozero and Ulelegi, where 57 carbon-furnaces, different buildings and constructions (barns, forging shops, and residential houses) were built – were erected. For the first year of 1896/97 about 25 000 cubic sagenes of firewood to be burnt for coal were prepared[22].

However the plant got most part of coal by using coal “piles”. One such “pile” was loaded by about 35 cubic sagenes of firewood, then the firewood were covered with turf, sand, and then the process of oxygen-free pyrolysis started, it lasted the clear month. One such pile was serviced by six charcoal-burners. According to the calculations of engineer M. Tokarsky (fuel department head), 411 charcoal-burners were required to supply plant with char coal. The process was faster in a special furnace – one charge of firewood of 2 cubic sagenes was burnt into coal about 6 days. And the efficiency of the furnace was higher – output from one cubic sagene was 66 poods of coal while only 42 poods could be get from a “pile”.

During the same period of time 63 versts of roads were built, a channel was dug, a dum was constructed, and the river rapids were cleaned. A project on constructing railroad from the plant to Salmis (the present-day settlement Salmi), a telegraph line was laid. In Salmis a quay berth was built, a mobile steam crane and “Tarmo” steam ship were bought, administrative and residential houses were built.

However despite such rousing reports, not everything was so sunny. The price for char coal preparation turned to be a bit higher than it was earlier supposed – it cost 25 kopecks per pood instead of the calculated 15. It also turned out that it was necessary to pay the workers more – so arduous were the working conditions, plus the practical outcome of coal after burning was lower than the calculated one. The same situation was with the price of ore. However, despite the difficulties the blast furnaces were installed and commissioned, the work started, cast iron was begun to be melted. The truth is, that there was catastrophic shortage of money and it was decided to postpone the construction of the railroad.

Fig. 4. Plan of Charcoal Plant

Besides these difficulties, it appeared that “Stal” Stock Company did not manage to get state orders and all the negotiations with the defense authority and the Ministry of Railways failed. As a result, by the autumn of 1897 banker Rothstein decided to withdraw from the business and started to sell part of his shares to different industrialists and merchants retaining only 5 730 shares for his bank[23]. This decision did not make any obstacles to the idea of developing “Stal” Company, without be complacent by Tulmozero Ironworks only. On August 14, 1898 in Saint Petersburg, on Peterhofskoe road, 130, a steel-casting foundry that, as envisioned by the Company’s management, had to melt steel from Tulmozero cast iron[24].

[22] Доклад Правления Общему Собранию АО “СТАЛЬ”29.11.1897 г.

[23] РГИА Ф. 626 Оп. 1 д. 444 стр. 39–40, 49.

[24] РГИА Ф. 83 Оп.1 д. 98 стр. 67.

However changes of shareholders and abandonment of the ambitious plans, with no doubt, had their negative influence: several managers of the plant were changed during three years. At the very beginning the manager was engineer Lenz who participated in designing blast furnaces and the plant itself, then he was changed by engineer Tenchinsky and in February 1899 V.E. Pshenitcyn was appointed.

In the conditions of financing gap Pshenitcyn decided to focus on starting up one big blast furnace, holding up the works on construction "Swedish" furnace. The big blast furnace was for the first time "burnt" on July 4, 1899, but the melting process did not go. On September 25, 1899, District Engineer of the Mining Department received a telegram from Tulmozero informing that the blast furnace of Tulmozero Ironworks had started to work by all its six tuyeres, however most part of cast iron for some reason came out via holes for slag and therefore required additional remelting[25]. All efforts of the plant`s specialists to ensure normal melting were vain, and in November of the same year the furnace was blown out. Instead of expected 360 000 poods of pig iron they got 13 937 poods of cast iron in "splashes". Mistakes in the furnace construction were so big, that the plant management decided to not even completely reconstruct, but to dismantle the old furnace and build a new one. A new plant's manager – engineer Iosif Samson – who continued the construction of a new blast furnace – was appointed on April, 21. A peasant from Kurlyandskaya Governorate, Teodor Landman, played an important role during the construction of the new blast furnace. For this contribution, upon the recommendation of the plant, he was highly awarded a silver medal with "for eagerness" inscription to be worn on Stanislavsky Ribbon[26]. However, the petition of Olonets authorities on entitling the blast furnace master also honorary citizen was rejected because Landman had already been awarded the medal.

The new blast furnace of rather smaller capacity – about 1500 poods of cast iron per day – was blown on August 19, 1900 and started to produce commercial cast iron already in September. Except for the new blast furnace construction the other miscounts of the former management were corrected. Simson refused to supply flux stone (Ruskeala marble) at the price of 20 kopecks per pood, finding rather good flux on site. The ore extracted by subcontractor Volynsky was not only bad quality, but also expensive for the plant because the contractor was not interested in cheap open-cut mining and made it by expensive underground one[27]. As a consequence of all these optimizations the production cost of cast iron at Tulmzero plant in 1901 was 72 kopekcs per pood what was much higher than the calculated five-years-old parameters and soon it started to exceed the market price for cast iron[28]. In November 1901 the manager was changed again – engineer Simson quitted and his post was occupied by mining engineer A.I. Lundgren.

However, the days of the ironworks were already numbered. A fatal blow to the plant was delivered in 1902 when a serious test for all the industry – economic crisis – started. For the small ironworks the situation was complicated also by the opening of several big ironworks at once on the south of Russia (in Mariupol, Uzovke and etc) with lower production costs of cast iron. Prices for metal came down with a run and the price for cast iron decreased almost twice – down to 40 kopecks per pood, what was much lower than the production cost. The plant already could not operate at a loss, the shareholders decided to loose the invested money instead of investing new one with no guarantee to return it. According to official information of the factory inspection 3088 factories and plants were closed and 112,4 thousand of people were fired in 1900–1903 in mining industry only. Big south ironworks were loaded per 40–45 %.

Against the industrial crisis, by 1902, the plant already had 300 000 rubles of debts and there was a shortage of floating capital. The Company sold never built-up plot of land in Saint Petersburg, pledged produced and unsold cast iron at the stock in the capital. Letter of the Board Chairman addressed to the Manager of the State Bank and other power authorities asking for support and help were of no effect. The State Bank refused taking the cast iron that was at the plant and at stock in Salmi (236 000 poods) as a pledge, and the blast furnace required maintenance[29]. On July 15, 1902 the plant's manager Lundgren informed the District engineer that the blast furnace of Tulmozero ironworks had been stopped and

[25] Ibid. P. 246–247.

[26] РГИА Ф. 83. Оп. 1 д. 160 стр. 145.

[27] РГИА Ф. 83 Оп. 1 д. 160 стр. 374–383.

[28] Ibid. P. 341

[29] Ibid. P. 142–143.

blown for repair[30]. After this date cast iron was never produced at Tulmozero Ironworks…

For the short period of its activity from July 1899 till July 1902 the plant produced only 518 866 (about 8 300 tons) poods of cast iron. For comparison, Vidlitcky plant, we mentioned about, used to produce such amount of cast iron for one year. After closing the blast furnace the plant was soon declared bankrupt and put up for sale for many times. In 1913 T.B. Tepliz became the plant's owner, but he never took any actions and at the end of 1915 he sold the plant to honorary citizen S.G. Meyer who made an attempt to revive it; however we do not have any information preserved abut his activity except for a new manager (Leopold Wellisch)[31].

The next, even shorter, page in the history of the ironworks is connected already to the soviet times. By the order of the Council of People's Commissars of Karelia, signed by E. Gylling, new geological surveys of Tulmozerye ore reserves were made, aboundoned shops were inspected, analysis and calculation of economic feasibility of ore extraction and cast iron production restoration were made at the end of the 1920-s – 1930-s. By the order of the AKSSR (Autonomous Karelian Soviet Socialist Republic) by 1931/1932 main part of the studies was completed, the expedition of Leningrad Geological Survey Trust (LGST) recognized the deposits of former Tulmozerskaya dacha promising, confirmed in general the assessment of the ores value made by mining engineers in pre-revolutionary time (common number was about 600 thousand tons, in the soviet times five times bigger amount was exactly confirmed and registered in documents). The general conclusion was clear-cut: the deposits are rich, there are more than 180 km^2.[32]

By their order, in February 1932, there were meetings in Leningrad District Committee about restoring metallurgical enterprises of the region – Tulmozero and Sigovetcky plants; G. Lotosh was also present there. The outcome of the meetings was the approval of the plans of the both productions commissioning, more than that, start up of the revived blast furnace in Kolatselga was planned for October 1, 1932. Manpower program and staffing chart were made: if we take only ore carriers (with horses) it was supposed to use 110 of them per day, and the ones to carry ready products (before the construction of the rail road the commissioning of which was planned for 1933) – at least 50. The general number of workers and technical and engineering employees was supposed to be at first more than 500 people, then – more than 750 people. An ambulance station with a doctor and feldshers, security, safety organization and etc. were planned. Except for the Board of the Ironworks' Restoration, its Directorate was formed. According to the documentation of NA RK, Heikki Juvonen was the first director, in September, 1932 he was (after being fired due to an illness to the reserve of the authorized agent of the People's Commissariat of Heavy Industry in Karelia) changed by Ivan Klekov.

However it was impossible to restore the plant by only triumphant reports about the first whistle. Design institutes from Leningrad that were involved into the plant's restoration and its specialists came to a conclusion that the price of cast iron could not be lower than 227 rubes per ton against the planned price of almost two times lower. Taking into account expensive transportation and chronic lack of good roads, it would increase per 40 more rubles at least. The authorized agent of the People's Commissariat of Heavy Industry in Karelia I.P. Babkin reported to the Council of People's Commissars as back as in the autumn of 1932 that "it is necessary to agree to the situation that under the present circumstances, restoration and start-up of Tulmozero Ironworks can not be economically feasible and reasonable".

In order to restore the enterprise in 1933–1934 no less than 4,2 million rubles (and the ideal amount – 6,5 million) were needed, while only 1,5 million were planned for 1933. Taking into account that almost half of that amount would have to be spent to pay "Karelles" for firewood preparation and wood for coal-burning what was extremely needed for the enterprise, to purchase the equipment (including turbines and generators for electric power plant), consumable materials, there was a catastrophic shortage of finances. Except for the financial problems there were complications with the work organization: the designers did not meet the dates of presenting documentation, technologically required reserve of firewood for burning. Construction of a working settlement was stopped because teams of carpenters and stone masons refused to work for new (decreased)

[30] Ibid. P. 171

[31] РГИА Ф. 83 Оп. 1 д. 310.

[32] НА КНЦ, ф. 1, оп. 24, д. 269.

payment; workers from local people were sent to haymaking by village Soviets and they never came back to the plant. There were no qualified specialists-metallurgists; financing of the plant's restoration was implemented for less than 30 %. The firewood, prepared by "Karelles" for char coal production as back as in 1932, was not taken up from the back-water even a year later and part of it was just stolen, the other part – drowned in the Kolas River. It was one of the factors of irrational management and economic management at one of the "shock-work constructions of the first five-year plan".

By the end of 1932 it was clear that the problems arisen during the design and practical works on the production restoration, could not be really solved. All dates of scopes of works were disrupted, i.e. the first five-year plan was not fulfilled. The plant's restoration was not included into the following five-year plan. The Council of People's Commissars of the AKSSR made a decision about temporary closing down of the enterprise[33].

Short, but turbulent, history of the enterprise ended in a quite original way, right before the Winter War. Regulation of the Council of People's Commissars of AKSSR № 991/8cc marked as "Top Secret" was adopt on August 15, 1939; it stated: "In order to deploy military units to transfer the following to Leningrad Military District:

"Kolatselga village with all residential, social, household and other constructions with all local people in the amount of 102 yards to be resettled to the back districts of Pudozhsky, Zaozersky and Sheltozersky…

All residential and nonresidential constructions of former Tulmozero Ironworks that have not been working since 1905 and now half-ruined…"

Already on August 24, representative of Leningrad Military District and A.I. Kondratiev, Chairman of Kolatselga village Soviet, signed the deed of conveyance of household constructions of former (as it was written in the deed – "stand-by") plant. It, in particular, in details listed the constructions undamaged by 1939: residential constructions – 5, the building of the plant, a cooperative, a stable, a carpentry shop, a pumping station, a sauna, a water-pressure booth, a watch-tower, a crushing plant, a smith shop[34].

Fig. 5. Condition of Tulmozero Ironworks in 1942

Under the memories of the locals, 50-meter plant stack was blasted by the retaining soviet troops in 1941.

That is the short and tragic story of Tulmozero Ironworks, the ruins of which continues to amaze everyone who comes here, to the Karelian province. In our opinion, the example of Tulmozero plant should be studied in business-schools in order to show to what making of optimistic business plans that are made in isolation from everyday practice with incompetent analysis of markets and competitive environment in conditions of risks undervaluation may lead.

[33] НА РК, ф. 1667, оп. 1, дд. 1/1, 1/3, 1/4, 1/5; ф. 690, оп. 3, дд. 47/370, 48/395, 58/484, 64/529 и др.

[34] НА РК, ф. 690, оп. 10, д. 6/52

STATE MINING TRUST “KARELGRANIT”: AT THE THRESHOLD OF THE FIRST FIVE-YEAR PLAN

K.V. Shekov

A rich man would buy brain, an unfortunate man would sell his own one, but no one would buy.
(Russian saying)

Instead of Introduction

It is trite but true that almost ninety years ago our ancestors discussed the same issues that we are worrying about now. As before, Karelia is searching for its place in the economic system of Russia, striving to realize its competitive positions, working for the budget increase. Therefore establishment of mining industry in the Republic of Karelia will for a rather long time heat people’s minds, giving the possibility to understand intricate paths of the region’s history development. In this concern it is interesting to look at the story of one of the first organizations in Karelia created to develop Karelian mineral resources. After a number of failed attempts to organize mining in the Republic, “Karelsky Granit” (“Karelian Granite”) State Trust was established in October 1925[1]. The latter, having only two mining enterprises by the moment it was established, united all non-metal mining of KASSR by the end of the 1920-s[2].

Probably, the brightest pages of the Trust’s history were connected to M.A. Nikonov headed the company in 1927–1929. The National Archives of the Republic of Karelia have preserved the materials (including photos!) allowing to provide an extensive coverage of his work in the Trust. Therefore, the chronological framework of the study is outlined by the two dates: the date when Nikonov was sent to work in the Trust (May 1927) and the date when he was removed from the office (August-September 1929) were taken as central points.

Fig. 1. Management of “Karelgranit” Trust (M.A. Nikonov – the fifth one from the left in the first row). The photo was provided by the National Archives of the Republic of Karelia

During these years “Karelgranit” Trust obtained stable position on the internal market, organized export of products abroad. It was the time when the foundation of the development of mining industry in Karelia was being formed – the first five-year plan was discussed and the preparation for the industrialization was held in the Republic.

One more point why – to understand the processes of that time – we have been interested in exactly this period. During these years trusts were widely independent in their activities. By the end of the 1930-s, against the establishment of administrative-command system, the responsibility for the implementation of economic indicators was placed on the local party bodies of the AUCPB (the All-Union Communist Party of Bolsheviks). Henceforth, the issues of enterprises’ economic life were solved in the party, while before 1929, the party’s participati-

[1] Choice of the Trust’s name was determined by the domination of granite in Karelian subsoil riches and, obviously, by the main directions of the Trust’s marketing policy towards supply by construction materials. According to the initial idea of the author (or one of the authors) of the Trust’s name, Chairman of the CCNAE AKSSR (the Central Council of National Economy of Autonomous Karelian Soviet Socialist Republic) N.A. Leskov, the name had to serve also as an advertising signboard informing potential clients about the products. Besides word “granite” elicited advantageous associations with quality, reliability, strength and durability what was supposed to reinforce mutual confidence between the Trust and its partners. See: Из объяснительной записки СНК КАССР к проекту устава треста “Карельский гранит”, 30 октября 1925 г. // Карелия в период восстановления народного хозяйства. 1921–1925: сборник документов. Петрозаводск: Карелия, 1929. С. 198–200.

[2] A number of operating mining enterprises of “Karelgranit” Trust momentarily increased up to ten, when the enterprises of State Stock Company “Karelmursilikat” liquidated at the beginning of 1927 were put its under supervision. See: Карело-Мурманский край № 7. С. 25.

on was limited only by the agreement of managerial staff of enterprises. Taking into account the present-day realia Nikonov's managerial experience is closer and more understandable to us and allows to realize deeply the role of a big trust's manager in the specified historical conditions.

Deposits of granite, diabase, quartzite and talc-chlorite rocks were under the jurisdiction the Trust in 1926[3]. Within the next few years the quarry of granite was organized on the eastern coast of Onego Lake – on Goltcy Island (production of block stone) and "Nemetckaya Gora" place (production of facing stone). Deposit of quartzite developed by "Karelgranit" Trust was situated on the western side of Onego. Shoksha porphyrite was used exclusively as decorative stone and was very expensive, and raw material for rather utilitarian object was mined in Brusno: serial production of grindstone was organized for local peasants in a workshop in Petrozavodsk. Segozero quartzites, quarried on the north-western coast of Segozero Lake ("Voken-Vaara" and "Vida Niemi" deposits)[4], thanks to their physical properties, were used for lining-up of ball mills.

Fig. 2. Workers at the Quarry of Shoksha Quartzite. The photo was provided by the National Archives of the Republic of Karelia

The deposit of talc-chlorites, which were widely used in electric industry, was developed in "Lisya Guba" place, by the same lake. The developments of spar, quartz and glist that were later included into the system of "Karelgranit" Trust's companies were located in the north, in Chupinsko-Keretsky District. And in the south of Karelia, in Sheltozero area, there was a big deposit of diabases, earlier rented from Karelian government by Moscow and Leningrad Departments of Communal Services in order to produce heavy-duty block stone. Sheltozero developments were the largest: as of September 20, 1929, apart from office workers, 1 031 men and 100 women worked at the enterprise. At the same time only one woman worked at Shala developments of the Trust and no one – in Brusno and Segozero[5].

Price for worldwide famous Shoksha raspberry-red quartzites ("porphyrite") on FOB[6] Leningrad terms was 60 rub. per ton; at the same time, products from quartzite became more than order of magnitude higher and reached 800 rub. per ton[7]. Advertising letter of "Karelgrnit" in 1926 contained information about fourteen materials and about thirty items of products supplied for sale, including red moulding sand, white and gray lime and paints – fabricated, semi-finished and raw (sienna, umber, iron minium). Finally hewn dimension stones (68 rub. 57 kop. per square meter), semi-finished and rough facing stone (24 rub., 70 kop.), bridge block stone (14 rub. 12 kop.), break stone (7 rub. 50 kop) were made from granite[8]. Ashlaring for ball mills, edge runners and grindstones – from quartzite. Porphyrite, diabase and calley-stones were suggested as construction and refractory materials[9]…

Demand for the Trust's products was so high and there were so few own finances of the company that they could hardly cover the Trust's operational activities. Lack of finances together with low ratio of capital turnover did not allow the Trust to finance long-term projects on equipping the mining developments. Therefore the prime cost of the Trust' products remained to be high: the domination of manual methods of extraction and treatment of stone, high burden costs and transport tariffs affected.

During the first years of work, due to large budgetary provisions allocated for the development of mining industry, "Karelgranit" got profit[10]. On the other side, 1924/25–1927/28 economic years were the

[3] КУ "Национальный архив Республики Карелия" (далее – КУ НАРК). Ф. Р-46. Оп. 1. Д. 1/9. Л. 62..

[4] КУ НАРК. Ф. Р-46. Оп. 1. Д. 1/9. Л. 62.

[5] КУ НАРК. Ф. П-3. Оп. 2. Д. 358. Л. 1 об. – 2.

[6] Price FOB … (shipping point, freight collect) in international trade reflects commercial terms defining the order of supply and payment of goods till the exporter's border. Purchase and sale of goods under these terms means that the seller pays for transportation of the goods and loading costs.

7 КУ НАРК. Ф. Р-46. Оп. 1. Д. 1/9. Л. 62–64.

[8] КУ НАРК. Ф. Р-794. Оп. 1. Д. 10/125. Л. 16.

[9] КУ НАРК. Ф. Р-46. Оп. 1. Д. 1/7. Л. 89.

[10] Гардин Е.С. Советская Карелия в годы восстановительного периода (1921–1925 гг.). Петрозаводск, 1955. С. 89.

most successful for the budget of the KASSR[11]. Net profit based on the results of "Karelgranit" Trust's activity for the two operating years was 5,9 and 45 thousand rubles, respectively[12]. Under the output and finance plan for 1927/28 operating years the profit of 77 thousand rubles was expected, however that year was ended by the Trust at a loss of 72,4 thous. rubles[13].

And this result of the Trust's activity was logical. In 1928 Moscow revised the plan of government subsidies and the Karelian government, respectively, decreased the state investments into mining industry also[14]. In order to overcome the financial difficulties "Karelgranit" had to ask for big advanced payments from customers and fall back on to an expensive commercial credit. In the end, measures applied by the Trust led to the increase of debts on unjustified advanced payments and, on top of everything else, the necessity to pay credit interests. As it was vexedly noted in one of the reports on the Trust's activity: "It is necessary to work – but there is nothing to do it for!"[15]. Increase of production buildings against limited means and lack of specialists resulted in a chronic crisis in the whole economy of the Trust.

First among equals

Only one month before Nikonov was appointed head of the Trust – Karelain Regional Committee of the AUCPB approved new nomenklatura and included the offices of the Chairman and members of the Board of "Karelgranit" Trust into it[16]. Prospects for the Trust's further development were connected to the sizes of mineral reserves and the possibility to come into the world market. Taking into account the importance of export for the union's budget, this economic block could not be left without the party's attention. One may say that, thereby, the political significance of mining industry was recognized. At the same time, including into the party-and-economic nomenklatura at the level of the party's regional committee meant that henceforth the personnel of the Trust's management would be agreed in the party beforehand. And assessment of its work would be made also there.

On May 4, 1927, the Bureau of Karelain Regional Committee of the AUCPB peremptorily demanded firing the Head of "Karelgranit" Trust A.A. Khokhlov and "seating" the Chairman of Povenets District Committee Nikonov instead of him[17]. (According to the provisions of the Trust's Charter, Manager of the Trust had to be appointed by the decision of the Council of National Economy of Karelia.[18]) The system of nomenklatura just made its first steps. Change of the manager was conditioned by the necessity to have a tested and reliable man in this office, politically prepared and stiff.

Today it is hard to judge what offence was committed by communist Khokhlov to the party and who personally put forward Nikonov (probably, the Chairman of the CCNAE AKSSR A.N. Leskov was due in no small part to that). However, it is known for certain that Mikhail Andreevich Nikonov was unfamiliar to mining industry[19]. We can only guess, how came that the mining trust was headed by a man being miles from geology and mining industry. Reports from the latest places of Nikonov's work[20] noted his moderation and insistence, promptness and initiative; average capacity for work and inaptitude to select workers were among Nikonov's vices[21]. That is, he was not an outstanding manager. However, the administrative reform went full blast what meant a titanic work on selecting and distribution of personnel. There was a catastrophic shortage of specialists, among the AUCPB members they were far less, and, on the contrary, there were many posts that had to be occupied by "inside" people. A candidate

[11] История экономики Карелии: в 3-х кн. Кн. 2. Экономика Карелии советского периода (1917–1991 гг.). Петрозаводск: Петропресс, 2005. С. 24–25.

[12] КУ НАРК. Ф. Р-46. Оп. 1. Д. 3/25. Л. 113.

[13] КУ НАРК. Ф. Р-46. Оп. 1. Д. 7/61. Л. 8.

[14] Фомин В. Контрольные цифры народного хозяйства Карелии на 1929/30 г. // Карело-Мурманский Край. 1929 г. № 11–12. Л. 2.

[15] КУ НАРК. Ф. Р-46. Оп. 1. Д. 9/82. Л. 58.

[16] КУ НАРК. Ф. П-3. Оп. 2. Д. 112. Л. 68.

[17] КУ НАРК. Ф. П-3. Оп. 2. Д. 103. Л. 34.

[18] КУ НАРК. Ф. Р-46. Оп. 1. Д. 3/25. Л. 92.

[19] According to individual schedule dated March 8, 1924, Nikonov got the profession of "a servant of trade and cooperative organizations". And, as follows from his biography, he learned the profession being directly included into public work: from 1917 till 1923 he was elected into the Boards of the Union of Commercial and Industrial Employees, the Union of the Soviet Workers and the Association of Cooperatives. See: КУ НАРК. Ф. П-3. Оп. 6. Д. 7 699. Л. 9 – 9-об.

[20] Starting from July 1923 M.A. Nikonov worked in the office of an Assistant of the General Manager in "Severoles" Trust – till October 1925; later he was elected the Chairman of Povenets District Committee. See: КУ НАРК. Ф. П-3. Оп. 6. Д. 7 699. Л. 3.

[21] КУ НАРК. Ф. П-3. Оп. 6. Д. 7 699. Л. 7, 11.

was voted for without any discussions trusting the opinion of the one who recommended it. Or, in other words, Nikonov was just lucky. He was marked and "promoted".

By the way, the party mandate did not guarantee reliable authority and trust from his new colleagues to Nikonov yet. And, obviously, he had to spend his first time to settle down, probe deep into the current matters, get acquainted with the "team", patch up business relations with the partners…

Due to the changes in the Soviet legislation (Statute on State Business Trusts was approved in June 1927), the text of the Charter of "Karelgranit" Trust was amended also. First of all, the legal status of the manager was changed[22]. Collective leadership was introduced in the Trust. It meant that the Trust Board remained the highest governing body, but decisions – up to and including hiring certain employees – now had to be taken by the majority of votes. In other words, the power of the Board Chairman was limited[23]. On the other hand, all these restrictions faced his ability to find common ground with his colleagues, and Nikonov was very well prepared in this respect. He could negotiate.

As far as "Karelgranit" was a state Trust, overall supervision and control over its activity remained in the hands of the CCNAE of Karelia. The latter also defined the amount of financing for the industry.

Feldspar for Abroad

The "headquarters" of the Trust Board was situated in Petrozavodsk at the following address: the coroner of Onego Lake Quay and Bolshaya Podgornaya Street (pre-revolutionary name of Sverdlova Street) – almost opposite the place where the Karelian Research Center of the Russian Academy of Sciences is located now. The building of the Board presented a two-storey log house lined with deal with general usable area of 66 square meters. The location of the Trust should be admitted convenient as it ensured walking distance to the most public offices and there was picturesque window view to the lake within only some tens of meters. Also here, on the territory of the "headquarters", there were two residential houses for the Trust's employees (two-storey of 216 m^2 area and a one-storey), a barn – the Trust had its own animal-drawn transport and a tiny bath-house[24]. It is interesting that during a year, till October 1927, there was a kindergarten on the first floor of the Board's building – this floor was rented by the People's Commissariat of Education for 55 rubles per month. As far as the Trust developed its activity the rental contract was terminated.

In December, 1925 the Communist Party proclaimed the policy of the country's industrialization. The socialistic project was unrealizable in the country devastated by the two wars and the intervention. In order to equip the domestic industry with the most up-do-date financial means were necessary and the government intensified the export of goods. First of domestic raw materials were offered for export. And forest and mining resources of the Karelian ASSR were getting more valuable. The republic had advantageous geographical position for export. The main export item was wood. It was supposed the mining industry would take the second most important place in the list of exporters after timber procurers…

The management of "Karelgranit" Trust had been for a long time conducted negotiations on supplying its products abroad, however its suggestions were received with incredulity for then. Mining industry had not reached the necessary volumes of production and required serious finance investments; mineral resources required deeper surveys[25]. Experts in quarrying could be counted on the fingers of one hand, and even stone cutters had to be brought from other regions of the country[26].

[22] КУ НАРК. Ф. Р-46. Оп. 1. Д. 9/81. Л. 31–33-об.; Оп. 1. Д. 3/25. Л. 90–94-об.; Ф. Р-794. Оп. 1. Д. 12/142. Л. 254-об.

[23] On March 6, 1930, the Presidium of the CCNAE took a decision about returning the provision about the Board Chairman's sole management by the Trust into the Charter of "Karelgranit" Trust. See: КУ НАРК. Ф. Р-794. Оп. 1. Д. 17/203. Л. 93–93-об.

[24] КУ НАРК. Ф. Р-1023. Оп. 4. Д. 13/328. Л. 16.

[25] Социалистическая индустриализация Карельской АССР. М., Л.: Гос.соц.-экон.изд-во, 1935. С. 127–138.

26 During the first years of the Trust's activity descendants from Kaluga and Tver Regions of the USSR worked at mines. In the specified regions seasonal works on stone treatment were especially well developed, and Karelian peasant, being inexperienced in this type of works, made large percentage of reject. See: Инж. Рантман. Полезные ископаемые Карелии (Степень их использования в прошлом и перспективы на будущее). // Экономика и статистика Карелии. 1926. № 4. С. 24; Сводный промфинплан подведомственной ЦСНХ АКССР промышленности на 1926–1927 г. (По материалам ЦСНХ). Экономика и статистика Карелии 1927 г. №№ 1–3. Л. 26.

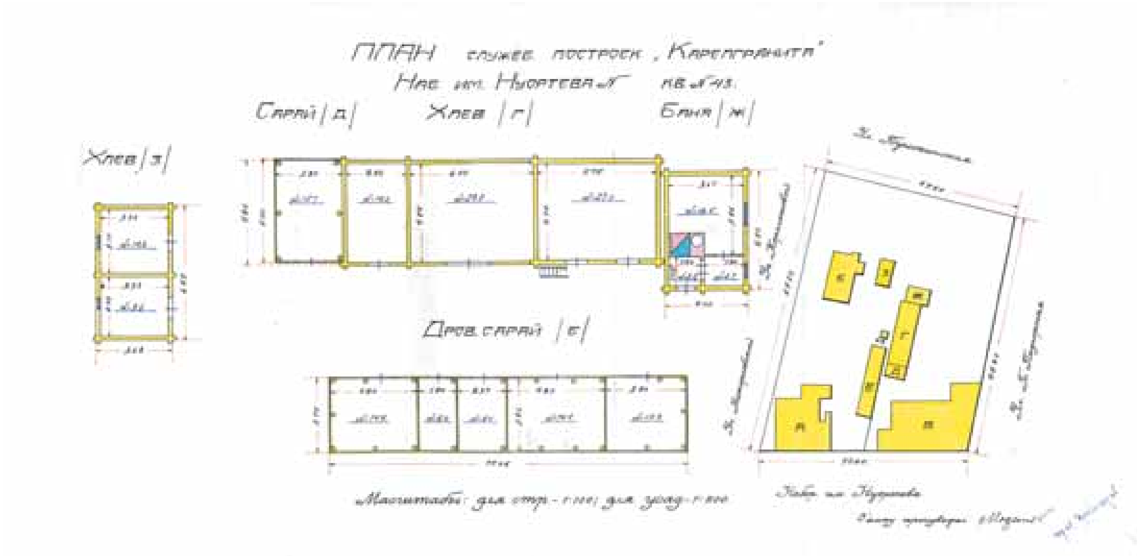


Fig. 3. The Plan of Outbuildings of Karelgranit Trust.
The photo was provided by the National Archives of the Republic of Karelia

And what could Karelia suggest for sale at that moment? In May, 1926, there was a meeting of the Commission on revealing new export items at the People's Commissariat of Trade of the KASSR. A list of products that could be suggested for selling abroad was discussed. The following decision was taken: prepare aspen clapboard, berries, mushrooms and guts of wild animals for sale[27]. The attempts to promote these goods to the foreign market taken within the following next years did not yield any results[28]. During the following meeting in September, 1927 the list was specified and horsehair, birchbark and hand-made wooden goods were included into it[29]. The next meeting was planned for October, 11.

The October meeting was conducted by the Karelian Government Chairman, E.A. Gylling. The participants were informed that the soviet government organized the import of the main groups of products (wheat, wood, oil), however, the main export was bearing losses yet, and it was necessary to start selling something else to cover these losses. The floor was taken by 34-year-old M.A. Nikonov, who had already been the Chairman of "Karelgranit" Trust Board for six months. In particular, he stated about the readiness to supply already in the current year up to 500 thousand poods[30] of spar to be sold on the foreign market (except for the quantity needed to the companies of porcelain industry of the USSR).

"However, - Nikonov noted, - in order to keep up the scope of supplies in the next year it is necessary to solve the issue of building a pegmatite plant in Karelia". On the results of the discussion the following record was made in the resolution: "Further possibility of spar export to be considered in particular dependence to the construction of a pegmatite plant in Karelia"[31].

Pegmatite Plant: Fight between Two Trusts

Of course, Karelia alone could not manage the construction of such large industrial facility as a pegmatite grinding plant. It was necessary to get financial and political support from Moscow. The project was very promising[32]. Based on the surveying information it was found out that the quality

[27] КУ НАРК. Ф. Р-46. Оп. 1. Д. 1/9. Л. 52.

[28] Кантор И.М. Торговля Карелии. Петрозаводск, 1926 г. Л. 121.

[29] КУ НАРК. Ф. Р-46. Оп. 1. Д. 1/9. Л. 26–28.

[30] 500 000 poods = 8 190 240 kg. 750 gr. (1 pood = 16,3804815 kg).

[31] КУ НАРК. Ф. Р-46. Оп. 1. Д. 1/9. Л. 48.

[32] Sphere of application of feldspars was wide. Spars were used for the manufacture of porcelain, faience, stone products, figurines – in ceramics, glazing and enameling industries. Selected pieces of high-grade spar were even used for making artificial porcelain teeth. See: Федоровский Н. М. Полевой шпат. М., Л.: Гос.науч.-тех. Из-во. 1931. С. 4.

of Murmansk feldspar was as good as the best sorts quarried in Scandinavia – it was concluded in the USSR that the product of such quality should be exported. However, the domestic industry also needed raw materials. And the raw materials of high quality were also needed. Technical director of "Karelgranit" Trust K.L. Ostrovetcky, speaking at a meeting on feldspar in April, 1928, noted that the soviet plants – consumers of feldspar had brought pressure upon the miners, refusing outright to take the raw materials of the quality lower than "extra-class".

"It is enough to note that the feldspar of Panfilova Varakka that is recognized as high-class one was for the first time rejected by the plants…"[33] – Ostrovetcky specified.

It turned out that there was too little clean spar to supply abroad and internal market. To increase the capacity of the deposit was possible only in case of organizing pegmatite grinding at the same time[34], i.e. starting to process so called "wastes"[35]. Changing lump spar by cheaper spar powder allowed increasing the profitability of mining enterprises. Of course, in this case the domestic market's sights had to be lowered.

At the same time, competing Trust "Russkie Samotcvety" ("Russian Gems") (that later changed the name to "Mineralnoe Syrye" ("Mineral Raw Materials"), which also wanted to built a pegmatite grinding plant, but not in Karelia – in Moscow, got interested in pegmatite. A serious fight started between Moscow and Karelian Trusts for the right to build a pegmatite plant on its territory. "Russkie Samotcvety" Trust launched an aggressive agitation in the central institutions of the RSFSR (Russian Soviet Federated Socialistic Republic). The issue was being postponed all the time. In return, "Karelgranit" presented an ultimatum, connecting tightly the export of clean spar and the construction of pegmatite plant in Karelia[36]. It was a brave, opportune and politically-precise step. Feldspar "fell out from the export suggestions" of the People's Commissariat of Trade of the KASSR for 1928/29 economic year[37]. It officially informed Moscow that the denial to sell spar was connected to the "lack of clarity" over the plant construction issue. Though, it should be noted that preparation for the construction had already been conducting in Karelia; thus, for example, import plan for the coming year included also the equipment for the pegmatite plant[38].

At the meeting with Export-Import Directorate of the People's Commissariat of Trade of the RSFSR in Moscow that took place on November 12, 1927, a representative reporting on behalf of "Russkie Samotcvety" Trust suggested concentrating the production of spar powder in Moscow Trust and giving export to "Karelgranit"[39]. The representative of Karelia[40] rejected to accept the conditions of the colleagues. The prime cost of Karelian feldspar was too high. "If we take a real price, you will say "It is expensive!" – he explained. That is, losses were inevitable. Taking into account the political significance of export (the country badly needed currency) the construction of pegmatite plant within the Republic was getting necessary for "Karelgranit". The production of spar powder for the internal market would have compensated for the losses from selling high-grade spar abroad.

[33] Островецкий К.Л. Об установлении торговых сортов полевых шпатов // Материалы совещания по полевому шпату. 23–24 апреля 1928 г. Ленинград: Издание геологического комитета. 1928 г. С. 20–21.

[34] Pegmatite (from Greek "pegma", genitive case "pegmatos" – fastening, binding) – eruptive, mainly lode, rock, in its composition presenting mechanical natural mixture of spar and quartz.

[35] The case is that, at the first, when mining feldspar, the orientation was to lump (clean) spar, and most part of stone containing from 6 to 10% of quartz admixtures, was sent to refuses. So, the recovered yield was only 10–15 %. See: КУ НАРК. Ф. Р-46. Оп. 1. Д. 1/9. Л. 32–33.

[36] On October 28, 1927, the Council of People's Commissars of Karelia, under the report of the People's Commissar of Trade, A. Kochanov, decreed "to take up the matter with the Center about construction pegmatite plant not in Moscow, but within the AKSSR territory". See: КУ НАРК. Ф. Р-46. Оп. 1. Д. 1/9.

[37] Operating (economic) year dates from October, 1 of the current year till September 30 of the next year.

[38] КУ НАРК. Ф Р-690. Оп. 1. Д. 11/109. Л. 5, 17.

[39] КУ НАРК. Ф. Р-46. Оп. 1. Д. 1/9. Л. 54–54-об, 56.

[40] There is no name of a person, representing the interests of Karelian ASSR, in the minutes of the meeting.

At the "second"[41] meeting on feldspar on December 5–7, 1927[42] the opponents to the construction of pegmatite plant in Karelia stated a number of considerable remarks at this account. The Karelian side continued to hold its ground.

First, the expert did not hide their doubts regarding big deposits of spar in Karelia[43]. (K.L. Ostrovetcky objected – "As far as the mineral resources of the Urals are not defined Karelia remains the main raw material base"[44]). Second, when preparing their project the specialists of "Russkie Samotcvety" Trust calculated five variants of the plant location – in Karelia, Leningrad, Moscow, Yaroslavl or the Urals – and all these from the point of view of freight. And though the tariff for ground pegmatite transportation was not yet confirmed, the experts were sure that in any case the transportation issue would be not in Karelia's favor. Speaking at the debates, I.I. Ginzburg[45], along with the other participants of the meeting, noted one more argument not for Karelia: "Labor force in Karelia is one of the most expensive in the USSR"[46]. This is third.

A. Perevalov[47] took notice of the fact that most of the factories using feldspar raw materials (they were nine) were located next to Moscow: "If the plant is built in the area of consumption, there will be a possibility to use the raw materials of both Karelia and the Urals and combine these raw materials…". And, in the end, fifthly, the blame for the incomplete work on his project was placed on Ostrovetcky (the remark, obviously, was based on logic: if he had reworked the project he would have understood himself that Karelia was not suitable).

V. Shershnev[48] supported Ostrovetcky. He reminded that there is a whole range of governmental decisions, stimulating the development of industry exactly in national regions, as well as that the law on colonization provided a number of benefits to the enterprises working in Karelia. However, the audience found this argument of no great importance[49].

"In the footsteps" of the meeting, at the beginning of January 1928, the Presidium of the CCNAE AKSSR charged "Karelgranit" Trust of starting to design a plant on burning and grinding pegmatites, at the same time "raising no objections" to the construction of its own plant – to process Ural resources – by "Russkie Samotcvety" Trust. Besides, "Karelgranit" was offered to immediately enter into negotiations with Moscow trust in order to share the market of spar powder consumers[50]. The very fact that Karelia considered the variant of holding negotiations with the competing trust to reach mutually acceptable solution says for they assessed their positions as weak ones. The experts' reports on the meeting shook the assurance of Karelian specialists in the prospects of further fight.

The Art of Intrigue

In summer, the issue of economic efficiency and the place of the plant's construction was passed to the Economic Conference of the RSFSR (ECOCO RSFSR) for solution[51]. However the Union institutions for some reason delayed the decision. And despite the fact that already at the beginning of June, 1928[52] the construction of Petrozavodsk mining integrated plant (it was planned to place enterprises on processing the mineral raw materials mined in Kare-

[41] On January 7, 1927 there was the All-Union Mineralogical Meeting within the frameworks of which the first meeting specially devoted to the development of feldspar industry was held. The "first" "feldspar" meeting took place in March 1927: See: Материалы совещания по полевому шпату. Л.: Изд-во Академии Наук СССР. 1927. С. 50.

42 Островецкий К.Л. Технико-экономическая схема пегматитового завода в Карелии // Материалы второго совещания по полевому шпату. № 71. 5–7 декабря 1927 г. Л.: Изд-воАкадемии Наук СССР. С. 78–81; Захаров Е.М. Экономические соображения о постройке перемолочного завода в Москве. С. 81–92.

43 It is interesting that the assessments of feldspar reserves in Karelia were based on intelligence data. According to K.L. Ostrovetcky extremely high prime cost of feldspar predetermined the choice of places for search and survey by 15-kilometer zone around the rail road. Besides, during the surveys only the places with clean separations of feldspar were taken into account. See: Островецкий К. Л. По вопросу о полевых шпатах С. Карелии // Материалы совещания по полевому шпату. Л.: Изд-во Академии Наук СССР. 1927. С. 21.

[44] Островецкий К.Л. – Технико-экономическая схема пегматитового завода в Карелии // Указ.соч. С. 87.

[45] Ginzburg I.I. represented the Commission of the Academy of Sciences of the USSR Natural Productive Forces.

[46] Островецкий К.Л. – Технико-экономическая схема пегматитового завода в Карелии // Указ.соч. С. 88.

[47] Perevalov V.I. represented Central Porcelain Trust.

[48] Shershnev V.A., the Deputy Chairman of the CCNAE AKSSR

[49] Инж. В.И. Рантман. К вопросу об использовании полевых шпатов Карелии. // Экономика и статистика Карелии. 1928 г. № 2. С. 62–64.

[50] КУ НАРК. Ф. Р-794. Оп. 1. Д. 12/142. Л. 12, 54, 54-об.

[51] КУ НАРК. Ф. Р-46. Оп. 1. Д. 1/9. Л. 57.

[52] КУ НАРК. Ф. Р-794. Оп. 1. Д. 12/142. Л. 249.

lia on its base) was included into the five-year economic plan of the USSR, the question of selecting the place for the pegmatite plant was unclear. It was being considered at different meetings a hundred times and returned for rework again and again. None of the trusts wanted to cede.

Based on the protocol of the Presidium of the CCNAE AKSSR dated June 26, 1928, the elaboration of pegmatite plant project for Karelia was assigned to the Ceramics Institute (note that the alternative project of "Mineralnoe Syrye" Trust was made by German company "DORST"). As far as the Karelian project was under the expertise in the Research and Development Board (RDB) of Mining-and-Mineral Industry in Leningrad (in the end, the latter refused to consider it and readdressed it to Moscow, to the RDB of Glassworks-and-Porcelain Industry), in the capital there were more than ten meetings of the expert commission formed for preliminary study of plants projects and preparation conclusions for them[53]. The Karelian side was not informed about any of the meetings – K.L. Ostrovetcky came to find out about the activity of the commission being on his business trip in Leningrad. Answering the telephone request, there was an answer that the following meeting was planned for October, 4. Coming to Moscow and getting familiar with the materials of the expertise, Ostrovetcky concluded: the "expertise" of the project had been made one-sidedly, the preference had been given to the Moscow variant.

At the meeting of the RDB K.L. Ostrovetcky declared an outright protest concerning the hasty choice of the Moscow project ("Karelgranit" simply had not participated in all the preliminary work thanks to which the specialists made their opinions about the advantages of the plant's location in Moscow). Ostrovetcky also insisted on the necessity to revise the issue of tariffs and the raw materials base. The participants of the meeting as if even agreed on a delay to check the marked disadvantages, but on October, 10 the RDB informed the Mining-and-Fuel Department of the Supreme Council of National Economy (SCNE) about the approval of the project of "Mineralnoe Syrye" Trust. It asked to reserve the amount of half a million rubles for the next year in order to start the construction.

The situation was stalemate. As Nikonov recognized himself at the meeting of the Presidium of the CCNAE AKSSR on June 26, 1928, support of the Mining-and-fuel Department of the SCNE contributed to "Karelgranit" Trust's success[54]. However, "Mineralnoe Syrye" Trust enjoyed the protection of the expert commission and the authoritative assessment of the latter had to have some weight anyway. The final decision was postponed again. Then Nikonov addressed to the People's Commissariat of Communication Lines of the RSFSR asking to set the railway tariff for ground pegmatite transportation in order to use this indicator when calculating transportation costs in case the plant would be built in Moscow or in what place so ever. (The case is that till that moment there had been no such item of goods as pegmatite, so there had been no tariff).

At the end of October 1928 Nikonov set off for Moscow to participate in the meeting of the committee on tariffs. During those days he met with the member of the Presidium of the RSFSR SCNE, A. V. Shotman (in 1923 – 1924 – the Chairman of Central Executive Committee of KASSR) and a famous mineralogist-scientist N.M. Fedorovsky. Nikonov cited them the circumstances around the matter of pegmatite plant construction and asked to provide their assistance for considering the Karelian project "impartially to the greatest possible extent".

As long as the People's Commissariat of Communication Lines calculated the tariff, the Mining-and-Fuel Department suggested analyzing both projects from the point of view of other economic indicators. At the meeting on November 1, 1928, after the report of P.A. Borisov from the Institute of the North it was recorded: the reserves of spar in Karelia were enough for a couple of tens of years. The expert commission refused discussing the other indicators. According to Nikonov, the experts, earlier supporting the project of "Mineralnoe Syrye" Trust, were by all means drawing out the progress of the procedure to a great length and, especially, when the Karelian project was in question. Meetings were postponed, and very different reasons, most often unsubstantiated ones, were used for that – or due to the absence of a certain specialist (the others were allegedly incompetent of making judgments on exactly this issue), or when an

[53] The following story about the events associated with the consideration of pegmatite grinding plants projects is based on the only one source – the report of A.M. Nikonov himself, made at the meeting of the Presidium of the CCNAE AKSSR on November 16, 1928. See: КУ НАРК. Ф. Р-794. Оп. 1. Д. 13/164. Л. 32–37-об.

[54] КУ НАРК. Ф. Р-46. Оп. 1. Д. 3/25. Л. 60–60-об.

economic executive was needed he was absent on the meeting. On November 1, the experts dallied off discussing explaining it by the fact the there were no approved tariff.

Speaking on the meeting, Nikonov required taking into account such important arguments for the Karelian variant as the possibility of complete use of the ore channel of pegmatite deposits (that was in direct dependence on the distance between the plant and the mines), the possibility of using water ways, and, probably, the most important – the consideration of the cargo route without cross-freights. The price of the raw material transportation was comprised of the tariff and the length of the distance along which the raw material had to be transported. However, if the Karelian variant admitted the transportation of powder (or, pegmatite flour, as it was also called) only in one direction, to the south and the south-east: first, from Chupa to Petrozavodsk, and then from Petrozavodsk to the area of consumption. Then in case of the plant be constructed in Moscow, the raw material would be first brought from Chupa to Moscow, that is, to the south-east, then would be processed there, and then would be brought back, to the north-west and the west to: Volkhovo and Gruzino, Novgorod, Rybinsk, Tver and Bryansk. Thereby, the route of the cargo was longer due to cross-freights.

This moment would have become the apotheosis of the two trusts' struggle. According to the calculation of transportation in ton-kilometers, made under the information of the RDB expert commission by November 16, 1928, with the Moscow variant the number of transportations was bigger per 13 639 850 ton-kilometers or 6 888 additional car days[55]. The project of pegmatite plant in Karelia was ahead purely mathematically. The only thing that was left is to get this issue to be considered at the USSR level. And it was initiated.

Successful lobbying of Karelia's interests was the biggest achievement of "Karelgranit" Trust headed by Nikonov. The total cost of the industrial facility was more than a million rubles[56]. Pegmatite reserves were assessed as more than 1 mln. tons and – even in case of underexploitation of the ore channel – ensured the needs of porcelain industry for several decades… By the way, the pegmatite plant construction started only in 1931, and only in 1937, the plant, yet unfinished, was commissioned; but this matter is beyond the frameworks of the present article. As Karelian researcher L.I. Vavulinskaya noted, mastering the production of ground pegmatite had become the event of the Union scale and let being released from the import of feldspar from Sweden and Norway already in pre-war days[57].

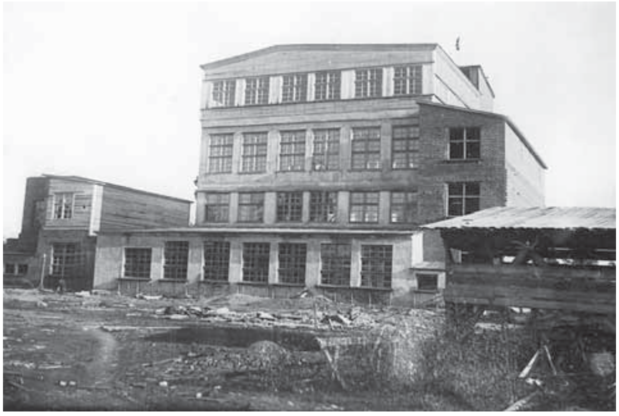


Fig. 4. Pegmatite Plant in Kondopoga (destroyed during the Great Patriotic War of 1941–1945)
The photo was provided by the National Archives of the Republic of Karelia

Become the monopolist

We should note that the initiative to concentrate control over the Republican mining industry in "Karelgranit" did not belong to the state authorities. More precisely, the interests of the local agency of State power and the Trusts coincided in this point – competition for labor force, raw materials and consumers was not profitable for both of them. The CCNAE supposed that the unification of mining in "Karelgranit" Trust would ensure "the possibility of planned development of mining industry"[58] and exactly this point explained the following logic of the authorities' actions.

In 1926 Murmansk Mining partnership conveyed its rights for the development of Panfilova Varakka deposit to "Russkie Samotcvety" Trust. In 1927 the partnership ceased its activity. In March 1927

[55] КУ НАРК. Ф. Р-794. Оп. 1. Д. 13/164. Л. 38.

[56] КУ НАРК. Ф. Р-46. Оп. 1. Д. 9/82. Л. 58.

[57] Вавулинская Л.И. Как развивалась горная промышленность республики до войны // Республиканская общественно-политическая газета "Карелия". 9 ноября 1995 г. С. 4.

[58] Сводный промфинплан подведомственной ЦСНХ АКССР промышленности на 1926–1927 г. (По материалам ЦСНХ). Экономика и статистика Карелии 1927 г. №№ 1–3. Л. 19, 22.

"Karelmursilikat"[59] Stock Company was liquidated and Chupa developments, earlier exploited by the company, were transferred to "Karelgranit" Trust[60]. Thus, the two competing trusts "met" in North Karelia. Speaking at the meeting of the Mining workers union in the autumn of 1928, Nikonov noted that the mining enterprises, governed outside Karelia, pursued narrow and unilateral goals. They were not interested in rational arrangement of mining and development of the territories. At the same time, a local trust, on the contrary, set itself wider tasks, could coordinate these tasks between each other and took into account interests of the local population[61]. And, as an example, Nikonov gave data on providing peasants households with grindstone.

Above all others, Nikonov meant "Mineralnoe Syrye" Trust. In 1927–1928 the Moscow trust explored mineral resources at the north of Karelia and it caused understandable concern in "Karelgranit". Squeezing "Mineralnoe Syrye" Trust from the region weakened the competitor's positions and deprived it of the opportunity to influence economic situation within Karelia. We should underline that the essential for the Republic issue about selecting the place for pegmatite plant construction was for that moment open, and the interests of the parties to the dispute were contending.

Preliminary agreements with the management of Onego developments of diabase about voluntary transfer of Ropruchey developments in exchange for the compensation of means spent by the management for the equipment were reached in June, 1928. A.M. Nikonov personally held the negotiations. Unfortunately we do not have the respective materials about the fact if there was an attempt of similar negotiations with "Mineralnoe Syrye" Trust or not. In order to solve this problem "Karelgranit" Trust addressed to the Karelian government and got approval and support in return. The Council of People's Commissars of Karelia sent the respective petition to the Center in September 1928[62].

In 1927 the Trust started production activity also in the northern capital. As many enterprises of "Karelmursilicat", Mica workshop was passed to "Karelgrnit" Trust. A high demand for mica was turned out to be in the middle of the 1920-s, and "Karelmursilicat" rushed to take the vacant niche on the market having equipped for these purposes the mica workshop in Leningrad. Meanwhile the business had to be shut up. Due to the intense development of mica production in Siberia, the price for mica fell.

Initially, "Karelgranit" Trust wended the way of organizing peasants' gang – in Poluboyar and Loukhi villages. The Trust bought mica from the local peasants: 1 r. 94 kop. per kilogram of sorted mica and 12 kop. per kilogram of mica powder. The development of feldspar enterprises helped to arrange the production of mica on an industrial scale. It appeared that when mining mica together with spar, if it was sorted right away and small sorts were ground into powder, the prime cost was getting much lower. And in that case Karelian mica sustained the price competition even with Ural analogues[63].

The deposits of talcum peach and Leningrad plant on its processing given to the Trust by the Institute of Applied Mineralogy and Metallurgy in 1927 became one more source of growth and expansion of its industrial activity[64]. Thus, during the researches it was found out that thanks to its natural properties, this mineral could be used for the manufacture of switchboards, boards for master switches, resistors and some insulators[65].

Territorial dispersion of the Trust's industrial enterprises seriously complicated control over their current activities. For operative administration of

[59] "Karelmursilikat", obviously, presented an alien formation to the Karelian authorities as far as the All-Russian Syndicate of Silicate Industry (Prodsilikat), the Board of Murmansk Railroad and local trust "Chupgorn" were its shareholders The Charter, organization structure of the stock company, financial participation of the third parties in the business, the necessity of keeping constant contacts with them – all these complicated the tasks of the Karelian authorities on governing the company's activity and influenced the decision on its liquidation.

[60] Семеров П.Ф. Полезные ископаемые Северной Карелии. Экономика и статистика Карелии 1928 г. № 1. С. 126–128.

[61] КУ НАРК. Ф. П-6156. Оп. 1. Д. 72. Л. 107-об.

[62] КУ НАРК. Ф. Р-794. Оп. 1. Д. 12/142. Л. 194, 194-об., 338, 346.

[63] Семеров П.Ф. Полезные ископаемые Северной Карелии. Слюдяное дело в Карелии // Экономика и статистика Карелии 1928 г. № 1. С. 123: П. Ф. Семеров. Полезные ископаемые Северной Карелии. Слюдяное дело в Карелии. С. 130.

[64] Труды 1-й Карельской геолого-разведочной конференции. Петрозаводск, 1933. С. 99..

[65] Низковский П.Л., Елисеев Н.А. Геология и полезные ископаемые Сегозерского района // Экономика и статистика Карелии. 1927. №№ 1–3. Л. 115.

Leningrad plants, the Board member M.S. Polkovnikov was specially sent to the northern capital[66].

In March 1929 it emerged that Polkovnikov was conducting autonomous (or, as it was characterized in the Trust, "separative") policy, wastefully using material and financial resources of the Trust and, in the end, sabotaging the Boards' decrees. Against the high upkeep cost of the representative office in Leningrad – including also separate commercial and supply administration – there were, on top of everything else, overspendings for salaries, weak records of material resources and production performances, failures to fulfill sales plan. The condition of recording and reporting reflected on the deterioration of work discipline, lost productivity, increase of the products prime costs with its very low quality (especially, mica). Condition of the organizational work, in its turn, impacted on the level of interaction between Leningrad representative office and the Trust Board in Petrozavodsk. Urgent requests of the Board remained unanswered[67].

In the summer of 1929, concerning the issue of E.K. Salomaa's trip to Leningrad, the Trust Board decreed to reorganize the structure of Leningrad enterprises, to transfer each of them to independent balance. The Board's decision underlined the following: Leningrad enterprises "had to deal only with production and be on complete self-sufficiency"[68]. The idea of concentrating part of the administration in Leningrad was recognized "unsuccessful"[69] in the Trust, however they did not scold Polkovnikov (the Board's member, after all). Indeed, Leningrad administration of the Trust implemented their direct duties strictly technically, but it was not the main difficulty. "Karelgranit" got three industrial enterprises increasing by that its fixed capital, but this growth was mainly due to real estate. Meanwhile, in order to ensure sustainable failure-free operation of the specified factories and workshops it was necessary to invest finances into them and share part of the risks; they should have found proper specialists and workers and organize production process; finally they should have developed the sales of products and enlarged the customer base. In the light of the foregoing, widening of the economic activity of the Trust due to the Leningrad enterprises did not bring any commercial benefit and besides diverted part of the limited Trust's resources that could have been more efficiently used for solving the problems of mining industry within Karelia.

"Twice Two is Already Four, and Will be Even Better!"[70]

To the overstated numbers of the first five-year plan "Karelgranit" Trust answered by quite concrete counter demands. It resembled a bargain between the Karelian government and the mining association. The Trust claimed about the readiness to fulfill the tense program of forced development of the industry only in case the government would create favorable conditions for that, first of all, would ensure stable government financing. The Trust was rather half-hearted about the "breathtaking" prospects of the first five-year plan.

It was suggested to widen the segment of mining and processing industry and start industrial recovery of wastes[71]. Due to the planned growth in production, it was decided to bring Leningrad enterprises of the Trust to Petrozavodsk (required areas were missing in Leningrad)[72]. It was offered to purchase cargo ships and outfit own fleet[73]. However the main focus of the program was on specifying the data on raw material base and research work. It was underlined that study of the composition and reserves of the Karelian mineral resources had to be implemented by the Trust's specialists. Serious attention was paid to the study of possibilities to use certain types of raw materials for the needs of silicate, construction, glasswork, automobile and aviation and electric

[66] We have not managed to find any additional information about this man.

[67] КУ НАРК. Ф. Р-794. Оп. 1 Д. 16/197. Л. 19-об., 20; Ф. Р-46. Оп. 1. Д. 9/82. Л. 47; Д. 7/61 ЛЛ. 12-об., 22, 25.

[68] КУ НАРК. Ф. Р-46. Оп. 1. Д. 7/61. Л. 35.

[69] КУ НАРК. Ф. Р-46. Оп. 1. Д. 9/82. Л. 47.

[70] Author of the aphorism – satirist Henrik Yagodzinsky.

[71] КУ НАРК. Ф. Р-46. Оп. 1. Д. 3/25. Л. 117-об – 118.

[72] КУ НАРК. Ф. Р-46. Оп. 1. Д. 7/67. Л. 18-об. – 19-об.

[73] Explanatory note to the five-year development plan of the mining industry in Karelia for 1928 – 1932 sated that the cost of transportation tariffs was hardly burdensome on the production prime cost. Thus, the price of transportation of one cubic meter of raw material from Onego Lake area to Leningrad was: via Murmansk railroad – more than 7 rubles, and by vessels of Sevzaprechparokhodstvo (North-West Inland Navigation Company) – 14 rubles. Whereas, the purchase of its own fleet would have let to decrease the transportation component to 6-7 rubles, and it would have made profitable even the sales of such "waste" of production as break stone. See: КУ НАРК. Ф. Р-46. Оп. 1. Д. 7/67. Л. 20.

power industries. The story of the pegmatite plant taught: the key argument in the economic dispute was scientific knowledge. In brief, it was a plan combining the solution of current tasks and work for the future[74].

In May, 1928 the project of the five-year plan of the KASSR mining industry was considered on the meeting of the Karelian Committee of the Miners' Union. The Chairman of the Union V.P. Ukkonen noticed that the figures of the requested financing were too big. By the way, the most part of capital expenditure was planned for the first year of the five-year plan. Nikonov defended this necessity by the intensification of work pace: "We should hurry up with putting into full production in order to satisfy the customers and keep the market"[75]. However, in our opinion, the Trust just secured itself against financial shortage.

The trade union organization management, obviously, did not share these concerns. The union, in general, had another approach to the industry development issues. The union, first of all and above all others, was interested in working and living conditions of the workers. Geological survey, extension and update of production, logistics, and marketing were side issues for them. Or, at least, until the workers were satisfied with the measures.

About Food Supply, Salaries and the Miners' Union

The Karelian district committee of the Miners' Union was organized on July 1, 1925[76] and was headed by V.P. Ukkonen from October, 1926 till January, 1930.

Meetings of the union considered matters of primary trade-union network development, union contracts to be concluded on behalf of labor collectives, participation in labor disputes solution. Trade union organization initiated holding economic and operational meetings, investigated living and supplying conditions of workers, financed construction and maintenance of cultural sites. And, of course, the trade unions had a lot of claims against the managing bodies of "Karelgranit" Trust.

Most part of Ukkonen's life was related to production. Having graduated in 1911 from technical school in Abo (the Swedish name for Turku) and got the education of a technician-shipbuilder, Ukkonen worked in his specialization for a long time. For four years he worked in managing bodies of mining organizations of "Chupgorn" and "Karelmursilikat"[77]. Under the assessment of his colleagues, Viktor Petrovich was straight, stubborn, as well as gushy, even irascible and hot-spirited[78]. At the same time we suppose that his attitude to the issues of the protection of the workers' interests was very profound and rather sincere.

While the Board of "Karelgranit" Trust was fighting to increase the scope of assignments for the needs of the Trust's production facilities update, the mining developments and workshops were often missing bare essentials. Nikonov's entourage was carrying on constant conversations about mechanization, and the plants were missing simple hammers and chisels. "We were allotted a serious task … – a forge-man from "Panfilova Varakka" mine reminded years later. – All works on mining ceramic raw materials were implemented manually. Even blast-hole drilling was fulfilled with the help of heavy hammer… Half-starved, ill-dressed people created, seemed, impossible things." In fact, the only task for a forge-man in mining industry then was to shoe horses that replaced machines for the workers[79].

The other problem was unprecedented turnover of labor force. Annual percentage of the labor force turnover in mining developments of the Trust at the end of 1929 was more than 500%[80]. The main reason to quit was poor supply. Unlike workers of the forest industry where people got increased norm, mining developments were provided under

[74] The considering requirements of "Karelgranit" Trust Board were included into the draft of resolution the Council of People's Commissars of KASSR under the Report of the Trust's manager M.A. Nokonov. So, they were not just a number of whishes, but carefully elaborated system of suggestions, besides, closely connecting between each other. See: Ф. Р-46. Оп. 1. Д. 3/25. Л. 135.

[75] КУ НАРК. Ф. Р-46. Оп. 1. Д. 3/25. Лл. 52 – 53, 62 – 62-об.

[76] КУ НАРК. Ф. П-6156. Оп. 1. Д. 8. Л. 7.

[77] КУ НАРК. Ф. П-3. Оп. 6. Д. 11286.

[78] КУ НАРК. Ф. П-66. Оп. 1. Д. 8. Л. 45.

[79] Неувонен А.А. Годы труда. // На фронте мирного труда: воспоминания участников социалистического строительства в Карелии, 1920–1940. Петрозаводск: Карелия, 1976. С. 105.

[80] Against the average number of workers of 502 people, in sum 2800 people were hired and fired during a year. See: КУ НАРК. Ф. Р-46. Оп. 1. Д. 9/82. Л. 51.

general norms. The informant of the correspondent of "Karelo-Murmansky Krai" magazine confessed that the daily allowance of the workers of Shoksha development of porphyrite was comprised of only tinned foods and salt cod[81]. In order to improve their tight situation stone-cutters went to work to logging enterprises and to log drive.

In the beginning of 1929 the Trust's Board together with the Miners' Union prepared a petition asking to equalize the supply of the workers of forest and mining industries[82]. The explanatory note specified the importance of the export of feldspar. However the Trust's suggestion was not supported. In June of the same year, according to the report of the communist faction of the Miners' Union (V.P. Ukkonen reported) the Bureau of the Karelian Regional Committee of the Party decreed "to charge the faction of the Council of People's Commissars with planning the measures on improving the supply of Chupa developments and salaries."[83] We should note that this decision was taken in the presence of the representative of the Central Committee of the Miners' Union, Vzherbinsky (and it was recorded in the minutes of the meeting), and did not fix any responsibility for the Party's committee. In particular, the decree did not contain the time limit for performance of the decision document and the methods of monitoring (but, Vzherbinsky was obviously satisfied with his "work"). Probably this problem was again raised on the meeting of the Regional Party Committee's Secretariat on September 12, 1929 – Nikonov participated in the discussion on the issue of "food supply" and could not help reminding of their initiative with the trade unions. However, the reports on this point were not recorded, and the resolution did not separate any group of workers[84].

The Karelian government referred to the problem of the miner's food only in spring of the following year, but even then the decree affected not all the workers, but only carriers occupied by bringing out spar and quartz: they were placed on the same footing as the carriers of forest industry[85]. The decision was dictated by the panic over the current critical situation in implementing export plan.

Hard financial situation of the Trust made it solving some problems at the account of other ones. The decision about transferring money from "residential construction" expenditure item to the items of capital repair and new equipment purchase drew a violent protest from the Miners' Union. Due to the specified operation residential construction plan for 1927/20 operating year turned to be not sufficiently financed per 14,6 thous. rubles (against the initially planned sum of 15,9 thous. rub.)[86]. Under the information of 1927/28 operating year residential area on a per worker basis was 4,7 square meters[87]. It is unnecessarily to specify how this area looked like.

The direct result of the trade union's contractual work was high prices for the miners work. Thus, average monthly pay of the workers at Chupa developments of spar, quartzite and mica in the 1920-s reached 129 rubles, the non-manual workers got up to 156 rubles; the same indicator on Shala granite developments was 101 rubles and 120 rubles[88]. High income (that partly compensated the lack of work clothes, good quality instruments, overcrowding due to the deficit of residential area, dreary and expensive food to the workers) allowed the peasants investing this money into technical equipment of their households[89]. However, during the first years of industrialization, there were no necessary products for the peasants on the market, food rationing was introduced. Without having anything to spend the earned money for, the population just set it aside, being unsuspicious of the fact it would be devalued. In order to prevent flying inflation, the Soviet government highly recommended investing savings into public loans or keeping as deposits in savings banks…

To our opinion, it is quite explicable, the workers of "Karelgranit" Trust's mining development

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81 Яновский Б. Недочеты на порфире // Карело-Мурманский Край. № 8. Август–сентябрь 1929 г. Л. 16..

82 КУ НАРК. Ф. Р-46. Оп. 1. Д. 7/61. Л. 25.

83 КУ НАРК. Ф. П-3. Оп. 2. Д. 328. Л. 79, 80-об.

84 КУ НАРК. Ф. П-3. Оп. 2. Д. 343. Л. 30.

85 КУ НАРК. Ф. Р-794. Оп. 1. Д. 17/203. Л. 75-об.

86 КУ НАРК. Ф. Р-794. Оп. 1 Д. 16/197. Л. 19-об.

87 КУ НАРК. Ф. Р-794. Оп. 1 Д. 16/197. Л. 17.

88 КУ НАРК. Ф. Р- 46. Оп. 1. Д. 3/25. Л. 155-об. – 157.

89 Промышленность поднимает деревню. Что дали Рыбреке "Онежские разработки диабаза" / Красная Карелия. 31 января 1928 г. С. 2.

was blaming the Trust Board of everything[90]. And it is very possible that if Ukkonen would not have spent so much time closely intercommunicating with the workers, his attitude to M.A. Nikonov would be more patient. However, business relations between the Trust and the non-governmental organization were exacerbated by continuing labor conflicts at the enterprises and by actual deprivation of the trade union from the elaboration of the Trust's plans and cost sheets. Ukkonen claimed – the economic executive's neglect of the trade union organizations affects its authority among the workers – and relentlessly demanded careful and respectful attitude to the representative offices of the trade union.

Automobile as a Means of Transport

Workers of mining enterprises, local peasant were not interested in production development issues[91]. There were precedents of strikes at the enterprises on grounds of the workers' discontent with the planned mechanization (strange as it may seem, they thought working by rule of thumb was more convenient and profitable)[92]. Therefore the leading role in the rationalization of production and "the mobilization of internal reserves" was given to specialists. In order to recruit them the Trust's Board did utmost.

Engineer M.A. Karasik required the highest salary. He agreed to transfer to "Karelgranit" on condition of concluding labor contract with him for at least one year with the salary of 550 rub. per month. And the Trust agreed, plus to it approving financial allowance for the family members in the amount of 25% from the salary[93]. We should note that the salaries of the Trust Board's members (including also Nikonov) were 210 rubles (i.e. on the level of the People's Commissar of KASSR).

One more specialist, Maksim Ivanovich Goryansky, was doomed to play a special role in Nikonov's destiny. From 1928 Goryansky worked in log workshop of the Trust and during a number of months fulfilled the duties of its technical manager. At that time an automobile was an unusual occurrence, and the workers could not help to get interested in the two automobiles the owner of which was Goryansky. Maksim Ivanovich gave rise to much unfavorable criticism from the workers for harsh treatment and it is not improbable that exactly one of his subordinates asked to check the strict chief. During the special investigation it was revealed that Goryansky had been disfranchised, was not a member of the trade union, and had been hired bypassing the labor exchange. In the middle of the autumn trade-union committee adopted a resolution about firing Goryansky. The Trust ignored this recommendation. Ukkonen kept it in mind.

In March, 1929 the Republican newspaper "Krasnaya Karelia" published an article telling about the patronage extended to Goryansky by "Karelgranit" Trust Board. It gave examples how Nikonov flatly refused of removing him from the office, how the Trust's managements bought tires for one of his cars, about Goryansky's rudeness[94]. Already one week later the working committee of the log workshop sent the newspaper editorial office a letter signed by 32 workers asking to make a rebuttal for "The Irreplaceable Specialist" article: "… Such workers should be appreciated and not consider them alien to the soviet government; as well as the Trust's managers should be considered as not narrow-minded, but as

[90] Indeed, "Karelgranit" Trust Board underestimated the importance of the workers' problems (or, maybe, just thought that somebody else had to decide them). For example, the memorandum about "abnormalities" at Shoksha developments addressed to the Central Executive Committee of AKSSR and dated June 17, 1929 stated the following: "Some of these days the Chairman of "Karelgranit" visited the developments. When the workers started to talk to him about their needs, he did not even start to answer explaining that he was busy." This fact was taken supersensitively at the enterprise and was even reflected in the decision of the workers' general meeting. See: Ф. П-3. Оп. 2. Д. 357. Л. 80.

[91] Under the estimations of the Karelian Trade Union Amalgamation, as of May 18, 1929, a small number of suggestions were realized concerning "Karelgranit" Trust (See: Рабочий класс Карелии в период построения социализма в СССР. 1926 г. – июнь 1941 г.: Сб. Документов и материалов. Петрозаводск: Карелия, 1984. С. 35). The only known to us example of the technical decision elaborated by a worker and distinguished by the Trust's management was rationalization of the transportation of spar at Chupa mining developments by Timoshkin. For his initiative he was awarded 25 rubles and got a two-week vacation. See: КУ НАРК.Ф. Р-46. Оп.1 Д. 7/61. Л. 29.

[92] За снижение себестоимости брусчатки на ОРДе (Из беседы с главным инженером разработок "Диабазов" тов. Пртукиным. // Красная Карелия. 6 марта 1928 г.; КУ НАРК.Ф. П-3. Оп.2 Д. 128. Л. 14-20.

[93] КУ НАРК.Ф. Р-3. Оп.1 Д. 7/61. Л. 28.

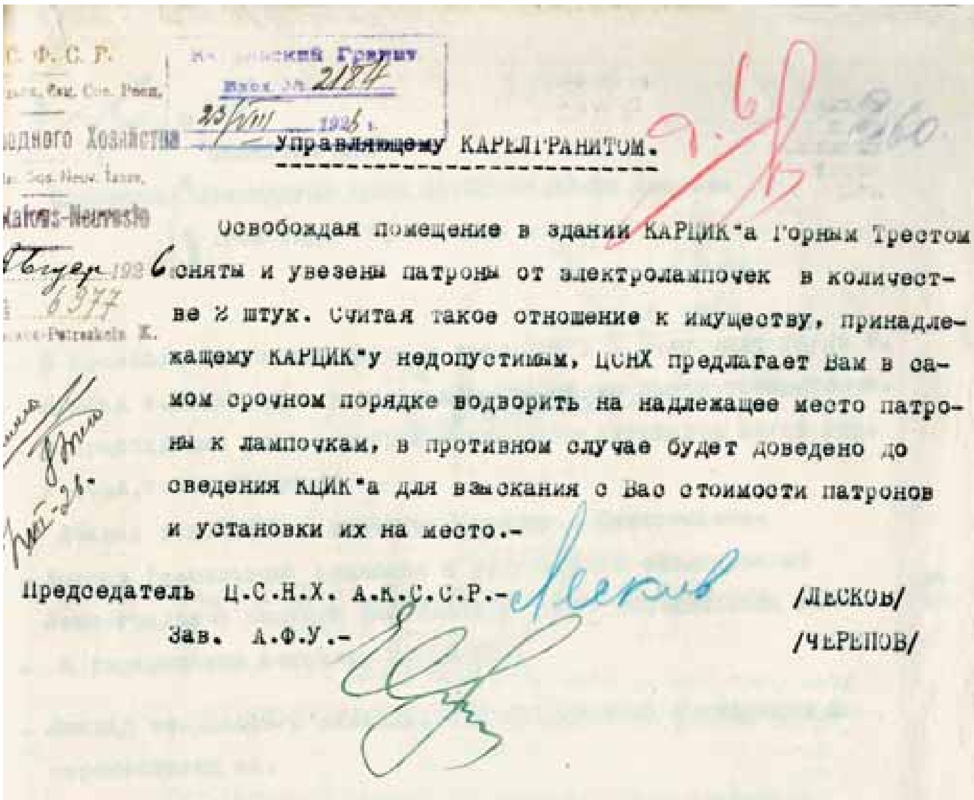
[94] Незаменимый спец // Красная Карелия. 6 марта 1929 г. С. 3.

the economists who were able to hire a specialist who combines the whole plant"[95].

On March 11, 1929, the issue about the rebuttal was brought up at the meeting of the party cell with "Karelgranit" Trust. As M.A. Nikonov explained, Goryansky had been hired temporary, due to the absence of the respective party member, as the one having necessary technical experience, and there was nobody to replace him until that moment. However, the participants of the meeting were most interested in exactly the issue of writing and sending the "rebuttal" to the newspaper. Based on the exchange of opinions at the meeting, it followed that the claim had been composed by a group of Goryansky's supporters, and the workers had signed it only because the claim had been "corrected" by the working committee's secretary Bespalov, the supporter of Goryansky. The decision of the party meeting was non-specific and empty[96] – the task of the event was to give "letting off steam", to give a veneer of the party support to the following urgent measures at the log workshop. On March, 14 Goryansky was fired[97].

And then something that was unexpected to anyone in the Trust's administration happened. On March, 16 a new issue of the newspaper with yet another one article about Goryansky went out. The editorial office of "Krasnaya Karelia" after all reacted to the rebuttal, but presented the fact differently, in their entirety and diversity. A detective story line came out.

In the article, the correspondent (he undersigned as "Svoy" (''insider'')) asked a question why the decision about firing Goryansky had been postponed. "Indeed, it would be reasonably good for "Karelgranit" administration to have such person who has its own car and can drive it… – the author argued, – The administration freely used the car of the subordinate … and everything was "sewed up" and nobody knew about it"[98]. The Trust Boards did not react to yet another charge.



Управляющему КАРЕЛГРАНИТОМ.

Освобождая помещение в здании КАРЦИК'а Горным Трестом сняты и увезены патроны от электролампочек в количестве 2 штук. Считая такое отношение к имуществу, принадлежащему КАРЦИК'у недопустимым, ЦСНХ предлагает Вам в самом срочном порядке водворить на надлежащее место патроны к лампочкам, в противном случае будет доведено до сведения КЦИК'а для взыскания с Вас стоимости патронов и установки их на место.-

Председатель Ц.С.Н.Х. А.К.С.С.Р.- /ЛЕСКОВ/

Зав. А.Ф.У.- /ЧЕРЕПОВ/

Fig. 5. From the Correspondence of Karelian Central Committee and the Mining Trust
The photo was provided by the National Archives of the Republic of Karelia

[95] КУ НАРК.Ф. П-66. Оп.1 Д. 9. Л. 78.

[96] КУ НАРК.Ф. П-66. Оп.1 Д. 8. Л. 18.

[97] КУ НАРК.Ф. П-46. Оп.1 Д. 7/61. Л. 11.

[98] "Спец" с автомобилем и подозрительный рабочком // Красная Карелия. 16 марта 1929 г. С. 4.

Ukkonen vs Nikonov

If we place together the events that led to the resignation of Nikonov from the office of the manager, every time they were connected to the activity of the trade union organization. It looks like Ukkonen successively pursued a line to driving out Nikonov of the Trust Board. The minutes of the meetings of the Trust's party organization help lifting the veil of this secret. (By a twist of fate, both V.P. Ukkonen and M.A. Nikonov, being communists, were the members of the same party cell).

Ukkonen was the only one who objected to Nikonov during the discussion of the issue about the Trust's financial situation at a closed party meeting on April 11, 1929. Then, for the first time, it was found out that instead of 470 thous. rubles the Trust would be allocated "up to 305 thous." and that there would be new reduction afterwards. Ukkonen refrained from comments on the issue of financing volume changes. However, he stated that he had earlier warned about the crisis growth. Based on his words it followed that the current catastrophic conditions of the Trust was the direct result of the work of the managing team headed by Nikonov[99].

At the end of May of the same year the general meeting of the party members and candidates discussed the material that had come from Regional Control Commission: about setting a punishment upon the Chairman of "Karelgranit" Trust Board. M.A. Nikonov personally was found guilty of violating the collective agreement and non-paying salaries to the miners. For this he was imposed a fine in the amount of 100 rubles. Being very puzzled of the court's decision, the colleagues, speaking on the debates, noted that the arrears in payment itself had been caused by insufficient and out-of-time financing of the Trust, "there had been no willful misconduct from Nikonov's side"[100].

On the party meeting dated July 6, 1929 Nikonov already had nobody to protect him. The issue of the party purge was in question. Nikonov was asked more than twenty questions. Some of them – concerning the scandal with Goryansky. What line did he hold with him, did he ride the car with him? Nikonov was imperturbable: "There was an occurrence. I would fire him, but there was nobody to replace him." There was a question about alcohol and with whom he drank. Nikonov also was not embarrassed: "Occasionally drink with close friends". They asked also what property he had, if he received money for renting his barn. The Nikonovs couple inherited the house with an outhouse from the wife's relatives; he got 15 rubles per month for the barn rent…

In conclusion, characterizing his party comrade, Ukkonen said: "He is good as a worker and as a comrade, but if we look at him as a communist and an economic executive, it is not all right. He conducts unclear class line"[101]. Ukkonen once more recollected the protection of M.A. Goraynsky to Nikonov and hinted at his close connection with K.L. Ostrovetcky who also occupied high position in the Trust and also "was untrustworthy."[102] The issue of Nikonov's "Party membership" was open and it became a kind of a "signal" for the Party Regional Committee - rank-and-file members did not trust him. It was time to displace.

Already in August, 1929 the Party Regional Committee started work on selecting candidates for replacing all the managing team of "Karelgranit" Trust. The Regional Committee took a number of hasty and inconsistent decisions. They scarcely decided on Nikonov's dismissal till the manager of Onego developments of diabase G.G. Yurkov was appointed Chairman of the Trust[103]. At the beginning of September, 1929 the decision about Nikonov's dismissal and withdrawal from the Board was just like taken, however it could hardly be understood straightforward. The issue was put to the Bureau's meeting agenda without respect to Nikonov. The question was about the work of Ivanov. The first point of the resolution was devoted to sending the latter to work for "Karelgranit" Trust as a rank-and-file member of the Board; the second point was to discharge Niko-

[99] КУ НАРК.Ф. П-66. Оп.1 Д. 8. Л. 31.

[100] КУ НАРК.Ф. П-66. Оп.1 Д. 8. Л. 35.

[101] КУ НАРК.Ф. П-66. Оп.1 Д. 8. Л. 45.

[102] According to the request of the Regional Committee of the AUCPB to Leningrad dated March 30, 1929, K.L. Ostrovetcky was for that moment arrested by the Main Political Directorate bodies. The Regional Committee asked the colleagues from Leningrad to send mining specialists to Karelia. See: КУ НАРК.Ф. П-3. Оп.2 Д. 357. Л. 64.

[103] It should be noted that this fact was not fixed in G.G. Yurkov's personal record. Most probably, the decision of leading party body was recalled straightaway. Yurkov headed "Karelgranit" Trust only in July 1932. See: КУ НАРК.Ф. П-3. Оп.2 Д. 329. Л. 48; Оп. 6 Д. 12 602.

nov from employment[104]. Mikhail Andreevich was fired as if among other things.

There are no doubts about the reason for firing Nikonov – the issue about financial situation of Kondostroy and Karelgranit was being considered on the same day. The Party was very disturbed that the main exporters of the Republic did not bring any income[105]. And on August, 30 the Secretariat of the Party Regional Committee draw attention to the extreme difficulties in implementing export due to the lack of raw materials. Nikonov and Ukkonen were invited to the meeting (the first one was almost dismissed – it was clear for that moment – and the second one was reelected to a new term in June of the same year). The long-term struggle for pegmatite plant construction in Karelia talked again. As before, feldspar was not enough to satisfy everyone that needed it. This conversation was notable for another thing – in "resolved" part the Secretariat of the Karelia Regional Committee addressed to the party faction of the Council of People's Commissars and faction of the trade unions suggesting them "within one month term elaborating the issue of the further work of "Karelgranit" Trust"[106]. According to the Trust's legal documents it had to become a common task for the CCNAE AKSSR and the Trust Board. However, probably, the Council of National Economy (under the opinion of the Party District Committee) had already exhausted all possibilities to influence the situation, and the issue of the Board's destiny had been predetermined.

One more circumstance connected to Nikonov's resignation generates questions. The case is that the one-year contract with him was terminated four months before its due time. However, at least till the beginning of October, 1928 there was no suitable person to replace him. The inquiries of the Karelian communists to Leningrad District Committee were indicative of it. By words "strongly urge … quickly… above all others …" the Party District Committee asked the colleagues from the northern capital to send a number of responsible workers to the Republic. The document was about eleven persons, but the head of the mining trust was on top of the list[107]. On October 26, 1929, I.A. Murashkin was appointed Chairman of "Karelgranit" Trust Board[108]. In September, the day before Nikonov was discharged from the office, the second plenary meeting of the Karelian Committee of the Miners' Union took place. Under Ukkonen (it was him who suggested firing Nikonov), the Trust's manage had ignored the notes of the Miners' Union about paying salaried not in time and about improving living conditions of the workers. Ukkonen specified that the financial situation of the Trust was catastrophic, that the trade union "had repeatedly reminded" the Board of it, but the Trust's managers were inactive (did not take "active enough" measures). Ukkonen emphasized that the issue of displacing M.A. Nikonov was raised not as a punishment or a reprisal, but as strictly educational measure for lack of the other method to influence him[109].

Instead of Epilogue

Mikhail Andreevich was married, he had a daughter (in 1929 she would have been 15 years old) and three sons (the youngest was 6 ½ years, and the eldest – 13)[110]. The last months of Nikonov's work in "Karelgranit" Trust were tense. He spent much time on business trips, inspecting himself the commercial enterprises, participated in the governmental meetings and negotiations with the partners, travelled abroad. When, in summer 1929 he asked the Board for a vacation to have a rest with his family, the colleagues suggested first coming to Leningrad, Moscow and Kharkov[111]. The business interests were on the first place.

Mikhail Andreevich proved himself as a consistent, far-seeing, and – above all – hardnosed manager. He surrounded himself by real professionals and skillfully organized their joint work. In most of his trips Nikonov was accompanied by the most authoritative specialist of that time, mining engineer K.L. Ostrovetcky. Nikonov managed to wisely correlate political and economic interests of the Trust he headed, the governing bodies of the Karelian ASSR and the Union, the partners of the Trust; and it could not help but was reflected in the first five-year plan of the mining industry development… However, he

[104] КУ НАРК.Ф. П-3. Оп.2 Д. 343. Л. 13.
[105] КУ НАРК.Ф. П-3. Оп.2 Д. 329. Л. 62.
[106] КУ НАРК.Ф. П-3. Оп.2 Д. 341. Л. 125.
[107] КУ НАРК.Ф. П-3. Оп.2 Д. 345. Л. 25.
[108] КУ НАРК.Ф. П-3. Оп.2 Д. 329. Л. 96.
[109] КУ НАРК.Ф. П-6156. Оп.1 Д. 99. Л. 136.
[110] КУ НАРК.Ф. П-3. Оп.6 Д. 7 699. Л. 1. This document is dated 1924.
[111] КУ НАРК.Ф. Р-46. Оп.1 Д. 7/61. Л. 37.

was, of course, unable to solve the endemic problems and contradictions, to answer the challenges of the whole system. However, he used to stop being a decent and fair person in the most difficult moments for him.

Those some facts specified above give an opportunity to look at the events of 1927–1929 from the point of view of the direct participant – to the scale the documents of the National Archives of Karelia let us to.

The personal record of M.A. Nikonov as a nomenklatura worker is closed by the date of his firing from the office of the Chairman of "Karelgranit" Trust. There was no more new information[112]. The Command and Administration System eliminated such workers first. In the 1930-s Stalin needed, first of all, executors. The attitude to specialists was very hostile, suspicious. Nikonov's colleagues and close associates, the specialists devoted to mining – K.L. Ostrovetcky and E.K. Salomaa – were then repressed. It is vey hard to say something definite about further destiny of Nikonov – documents keep silent. However, exactly this fact gives reason for hope. And may be, Nikonov got lucky again?

[112] As we have managed to find out, "as a punishment" for his weak work in the office of the Chairman of "Karelgranit" Trust Nikonov was transferred to Segozero district for utility work, and in 1931 he was appointed Deputy Manager of Shoksha developments. And then he had enough time for talking to ordinary workers. See: КУ НАРК.Ф. Р-3. Оп.2 Д. 525. Л. 44.

PRYAZHA (PRYAZHINSKY) DISRTICT: HISTORY AND THE PRESENT DAYS

E.A. Kalinina

Administrative Arrangement

The history of development of Pryazhinsky (now – national municipal) district starts from February 1930. Before that time there was no such administrative unit on the map of Karelia.

According to the system of regionalization (1927) the territory of Karelia was divided into 26 districts (192 Village Soviets). According to the Republican Government's opinion, this administrative division did not correspond to the forest economic regions. Besides, there were difficulties with recruiting qualified workers and managers for district executive committees, as well as with the considerable expansiveness of supporting the administration in 26 district executive committees. It was admitted necessary to take into account differentiation of the population between the districts according to nationality. In 1929 Karelian Central Executive Committee (KarCEC) took a decision about creating a new system of regionalization in Karelia, now of 18 districts.

In November, 1929 Karelian Central Executive Committee decided to merge part of Vidlitcky, Svyatozersky and Syamozersky districts into one district named Pryazhinsky (Pryazha). The center was defined to be in Pryazha village. Three districts were defined by this way. With this, new Pryazha district was marked as national one (with prevailing Karelian population): among 21 680 residents of the new district 21 265 were the Karelians and the Finns. It should be noted that "About specifying administrative division of AKSSR (Autonomous Karelian Soviet Socialist Republic)" report on the meeting of KarCEC in December, 1929 Pryazha village was characterized as a big village situated on Petrozavodsk-Olonets road, from where the road to the center of Syamozersky (Syamozero) district – Essoila – ran, besides a timber mill and a school were located there[1].

22 Village Soviets entered the newly formed district: Vazhisko-Pristansky, Vedlozersky, Veshkelsky, Kaskesnavoloksky, Kolatselgsky, Savinovsky, Sarigorsky, Svyatozersky, Syssoilsky, Kungozersky, Lahtinsky, Metchelsky, Nalmozersky, Palalakhtinsky, Pryazhinsky, Salmenitcky, Syamozersky, Chasovensky, Chalkoselsky, Schekkilsky, Ulalegsky.

Information about the district dated 1933 noted: the district territory – 6771 km^2, the number of populated localities – 332[2]. The district bordered with Petrovsky district from the north, with Finland along the border of about 200 km – from the west, with Olonetc district – from the south, with Leningrad region – from the south-east, and with Petrovsky district – from the east. There were up to 20 floating rivers and up to 10 lakes with the square from 10 to 25000 hectares and about 200 small lakes and lambas (pools) on the territory of the district. Natural routes of communication – dirt roads, approximately 200 km from them were suitable for automobile traffic. Among natural resources ore and lime were in Tulmozero area. Population of the district was 23 262 people, among them: 364 (1,56%) of the Russians, 674 (2,89%) of the Finns, 22222 (95,52 %) and 22 others.

However, soon territorial borders of the district underwent changes again. Due to the strengthening of the KASSR (the Karelian Autonomous Soviet Socialist Republic) border territory on March 28, 1935 Karelian CEC, and on October, 1 of the same year All-Russian CEC rendered a decision about separating Vedlozersky district with the center in Vedlozero village out from Pryazhinsky and Olonetcky districts. The new, district, which was created as border one, was formed in 1936. Vedlozersky, Kolatselgsky, Savinovsky, Nalmozersky, Palalakhtinsky, Sarigorsky, Syssoilsky, Schekkilsky Village Soviets with the population of 7710 people under the census dated 1933 separated from Pryazha district. Now the district comprised of 14 Village Soviets with the population of 1509 people.

On July 12, 1941 Pryazha district stopped to exist because of the Great Patriotic War. The district resumed its activity as a part of KFSSR (Karelian-Finnish Soviet Socialist Republic) right after it was released on July 29, 1944.

In 1956, after two districts – Pryazhinsky and part of Vedlozersky – were merged, and Veshkels-

[1] Национальный архив Республики Карелия (далее НАРК), ф. Р-689, д. 48/509, л. 11–19.

[2] Ibid, ф. Р-706, оп. 2, д. 1/5, л. 1

ky Village Soviet was passed to Souyarvsky district (1957), the administrative arrangement of Pryazhinsky district was again changed. 19 Soviets – 18 Village ones and 1 Settlement one – were registered now on its territory. 32 050 people lived in the district.

It was not the end of the territorial changes. During the 1950-s – 1960-s there were different administrative reforms: decrease of the district territory, expansion or reduction of the Village Soviets' borders, transfer of transfer of populated localities, rename or abolishment of Village Soviets, change of the district center's status and so on.

Administrative measure of the 1960-s on enlargement and decrease of the number of districts in Karelia led to the liquidation of Pryazhinsky district itself. Based on the Decree of the Supreme Soviet of the RSFSR (Russian Soviet Federated Socialistic Republic) "About Reorganization of Territorial, Regional and District Soviets of Working People's Deputies of the RSFSR" dated December 25, 1962, the Supreme Soviet of the KASSR adopted regulation "About forming industrial and agricultural districts on the territory of the KASSR"[3]. It provided the creation of six new industrial and four village districts on the territory of Karelia instead of 13 existing districts. Thus, Prionezhsky district was enlarged from January 1963. Three districts – Prionezhsky, Pryazhinsky and Kondopozhsky – became parts of it. Newly formed Prionezhsky district had 17,8 thous. km^2 of territory with 46,2 thous. people of population. In the end, from February 1, 1963 Pryazhinsky district was abolished and its territory was included into Prionezhsky district with the center in Petrozavodsk.

Pryazhinsky district as a separate administrative unit was reconstituted on December 28, 1966. On the territory of the newly formed Pryazhinsky district there were 12 Villages and 2 Settlement Soviets, where 23 thous. people lived, 2 timber industry enterprises, 5 sovkhozs and other small industry enterprises worked.

Characterizing the administrative-territorial arrangement of Pryazhinsky district at the beginning of the XXI century it is necessary to note that its territory is equal to 6389 km^2, and 1 city and 6 rural settlements, including 82 populated localities, are located on it. Administrative center – Pryazha settlement – as well as many small and distant from each other villages are remained unchanged. 16 882 people live here, among them city population – 24 % and rural – 76 %. The district is a unique place of compact settlement of representatives of the two Indigenous North Peoples: the Karelians and the Finns. The number of the Russian population is 46,1 %, the Karelians – 36,8 %, the Finns – 6,3 %, other nationalities – 10,8 %.

Pryazhinsky National Municipal district has a developed transport infrastructure. It has automobile and railroad service with Saint Petersburg, as well as with Petrozavodsk and other towns of Karelia. International automobile tourist route "Blue Road" runs via Pryazhinsky district and connects it to Scandinavian countries. Reconstruction of 50-kilometer part of "Pryazha – Lemetti" road, connecting the district to the international automobile entry point "Vartsila – Niirala" on the Russian-Finnish border, has been finished recently. This route is being actively explored by automobile tourists. It is 50 km from Pryazha to the Karelian capital Petrozavodsk; it is 370 km via M-18 road to get to Saint Petersburg by car.

Timber complex, agriculture, mining complex and tourism are the base of the district's economy. 341 enterprises and 218 private entrepreneurs are registered and work in Pryazhinsky district. The district has a great tourist potential: more than 360 monuments of archeology, history and culture of regional importance are located on its territory. More than 170 monuments of all the periods of ancient history – from Mesolithic to the early Middle Ages – have been found as a result of long-term works on Syamozero Lake only. Some places have respect to the history of relations of Russia with Sweden and Finland. Names of a number of locations are mentioned in the chronicles from the end of the XV century. 36 tourist organizations work in the sphere of tourism, and there is a possibility to host 1034 tourists, all at the same time.

Development of the District in Pre-War Period (1930–1941)

Rearrangement of agriculture on socialist principles was started in the district in 1929.By the beginning of 1930 three kolkhozes (collective farms), comprised of 42 households, were organized here. 97 kolkhozes (3029 households) what was 70 % of all the households of the district, were active in the district by January 1932. Kolkhozes were often created by the way of simple merger of the peasants'

[3] Ibid, ф. Р-689, оп. 17, д. 61/511, л. 9.

implements and did not have any modern machines. Socialized livestock was not ensured by fodder, cattle yards, and kolkhozes, as a rule, were weak in organizational-and-household respect. Practices in holding the collectivization, specific to the country in general, were worsened by local specifics conditioned by dispersion and underpopulation of the villages, sharp shortage of labor force, diverting peasants to timber cutting, timber-rafting and other works. It defined a very tight situation of the kolkhozes, caused the deterioration of agriculture development indicators. Yield capacity of the main agricultural plants was gradually lowering, livestock number was decreasing. Development of pig breeding, sheep breeding and vegetable gardening in the district can be considered as one of the positive moments of the pre-war period. It should be noted that 84 kolkhozes (96 % from the number of all the households of the district) were active in the district by 1941.

A process of forming commercial dairy farms (CDF) was going in the pre-war period. If there were 20 such farms with general livestock number of 1500 and 14 pig breeding farms with general livestock number of 450, and by 1940 there were 180 of them. Among them: 84 – commercial dairy farms, 76 – pig breeding farms, 20 – sheep breeding farms. In order to process milk, first butter making factories that produced 9235 kg of milk and 9491 kg of cottage-cheese per year were established in Kroshnozero and Alekka (Syamozersky Village Soviet). 5 butter making factories worked in the district by the beginning of 1941[4].

The first machine and tractor station (MTS), servicing 45 kolkhozes and having 20 tractors, was created in the district in 1933. By the end of 1937 three such MTS appeared: in Veshkelitca, Kroshnozero and Essoila; they had 40 tractors. It is important to note that main types of agricultural works were mechanized by April 1941. The creation of MTS, on one side, contributed to wide use of machines in kolkhozes, and on the other side hardly limited independence of kolkhozes, as all the machines and qualified specialists were concentrated in the system of state organizations. They cultivated land for non-cash remuneration the size of which was set from the top-down.

Cultivated and planted acreages of kolkhozes were developing gradually, from one year to the next. Grain crops – rye, barley, oats that amounted to 80 % of all the crops – were prevailing. Planted acreages were increased at the expense of bogs of the districts. Reclamating works in the 1930-s started in Kroshnozero, Urgilitca, Kindasovo, Korza, Palalahta, Koivuselga, but they were slow as manual labor was used.

The district's industry was poorly developed and represented only by artisan enterprises: a tar distillery, 3 tan-yards, 2 brick-yards, a sawmill, 20 shoemaker's shops; a barrel maker's gang, a wheel gang, a basket weaving gang and a shoemaker's gang of disabled. In April 1934 all local industry was combined into an organized district integrated industrial plant that was formalized as an independent self-financing unit. It included: a brick-yard, a carpentry shop, a sawmill and a smith shop. However the district integrated industrial plant did not fulfill the stated planned tasks from year to year due to the absence of qualified specialists and a sharp shortage of operatives. It should be noted that among 31 mills that the district had, all were closed by 1941.

Forest industry was developing fast at that time. "Pryazhinsky" timber industry enterprise established in 1929 became one of the first logging enterprises. At the end of 1932 it combined 10 logging units. 4 tractor complexes, having at their disposal 34 tractors and about 20 motor vehicles, were organized in the forest in 1933–1937.

The main number of woodcutters was seasonal workers; therefore there was a task of creating regular labor force in front of logging industry. They were recruited at the account of workers coming from the other regions of the country and from abroad. The first communities of migrants were organized in 1929–1930 in Matrosy and Intrenatcionalny (Interposelok) settlements. The name of the latter was contrived by the foreign workers themselves "in international solidarity with the Russian working class building socialism". The Finns, who arrived to Interposelok, settled in the houses that some time ago belonged to Vazhozersky Monastery, as well as in several barracks they built.

In the district system of public education 55 educational institutions worked. Among them there was only one secondary school in Korza (the first class was in 1937–1938 academic year). The number of students in all schools in 1930–1941 varied from 2100 to 4500.

The first kindergartens and day nurseries were established in Pryazhinsky district in 1930. First these

[4] Верхоглядов В.Н. Пряжа. Петрозаводск, 1977. С. 41.

were so called season “children’s playgrounds”. However, in 1931 only 11 kindergartens were left from the organized 44. The main reasons for that were: the absence of centralized financing and unwillingness of the local people to put their children out to the childcare centers. As a rule, kindergartens and day nurseries appeared in the places where kolkhozes gave products for children’s food. The number of kindergartens and day nurseries was gradually increasing; thus, in 1941 there were 29 kindergartens and 35 day nurseries that were visited by 1029 children.

The district’s health care system in 1932 was represented by 3 hospitals (32 places) and one drugstore. By 1941 the three hospitals already had 87 places, 8 ambulance stations, 7 feldsher’s stations, 2 medical and obstetrical stations, 1 child health center, 1 drug store and a sanitary-epidemiological station. However, the medical facilities were recruited by medical staff only for 37 %.

A number of cultural establishments was increased in the pre-war period. If in 1930 there were 13 village reading rooms in the district, and by 1939 there were 16 kolkhozniks’ (collective farmers’) clubs, 17 village reading rooms, 17 regular libraries with the stock of 38 244 books, 23 “Krasny Ugoloks” (propaganda rooms) and 6 cinema units. The first issue of “Krasnaya Pryazha” district newspaper with the circulation of 1500 copies went out on April 6, 1931; it was first printed in Petrozavodsk, and then, as far as a printing work was opened in the middle of 1932, the newspaper started to be published in Pryazha.

So, Pryazhinsky district in the pre-war period was one of the big agricultural districts. In 1940 – 1941 an issue of developing animal breeding (mink and silver fox) and poultry keeping (chickens, ducks) was raised. However these plans were ruined by the war. By 1941 all the agriculture was serviced by kolkhozes. The second direction of the district – timber logging that was increasing production volumes from year to year. One of the most important indicators of cultural development was mainly the elimination of illiteracy. Primary education was organized everywhere, boarding schools were opened for children from distant villages. Cultural-and-educational institutions (kolkhozniks’ (collective farmers’) clubs, village reading rooms and libraries, propaganda rooms and cinema units) became the means of cultural development of the population. “Krasnaya Pryazha” district newspaper that informed the readers about main events happening not only on the territory of the district, but also in the republic and in the country, played an important role in the development of the population’s culture.

The district in the middle of the 1940-s – beginning of the 1960-s

When the Great Patriotic War ended, the country came back to the peaceful labor. There were the following main tasks in front of the country and the Soviet people – to restore the national economy, ruined cities, villages and settlement, schools, cultural and healthcare institutions.

Losses in the national economy of Pryazhinsky district were assessed in 663,3 mln. rubles (without personal damage of the population). A number of settlements and villages were burnt (Chalkoselga, Ugmoila, Nyrki, Khristiny and others). 752 houses were completely demolished, 691 houses were partly destroyed and required capital repair. The building of the District Soviet, the Culture Centre, a school, the Communication Office and the District Consumers Union Office were demolished in Pryazha. A network of concentration camps was situated on the territory of the district during the war: in Pryazha, Kroshnozero, Korza, Ulalega and Kindasovo. In the concentration camp of Kutizhma more than 550 people died just during one winter (were shot, died of hanger and of heavy torture sentences)[5]. As of January 1, 1945 there were 464 men and 1624 women, totally 2088 people, in Pryazhinsky district. And before the war the population counted 16 242 people.

After the war demobilized soldiers started to come back to their home villages and settlements from the front. They were rendered material assistance by food, grain, finances for construction and household facilities.

In order to complete the district with labor force organized recruitment of workers from other regions and republic was widely used. In 1949 families of migrants form Ural, Belarus, West Siberia, Krasnodar Krai, Estonia. According to the plan of migrants’ job placement, it was necessary to place 869 families (2440 people) in Pryazhinsky district in 1949. Twenty families from Belarus came to the district in 1956.

[5] НА РК, ф. П-21, оп. 1, д. 16/305, л.44; д. 16/306, л. 43-87; д. 16/308, л. 64; д. 16/309, л. 127.

The restoration of the district's economy was started right after it was released – in the beginning of July 1929. Pryazha District Executive Committees resumed its work on July 29, 1944. The district integrated industrial plant was started to be restored in September 1944 and already in November – December it made the first products: clothes baskets, stools, sledges, it also repaired furniture. Two MTS started their work in September: Pryazhinskaya in Spiridon Navolok village and Essoilskaya in Korza village.

Despite all the difficulties, by 1949 three timber industry enterprises worked in the district: Pryazhinsky, Syamozersky and Shuisko-Vidansky that use new machines for timber logging and transportation: electric saws, trail tractor KT-12, auto-derricks[6]. In September of the same year hydro-electric power station of Kolatselga, in October – Pryazha electric power station restored by the workers and servants of the detract center, construction of a dam for Vedlozerskaya hydro-electric power station was finished.

Agriculture of Pryazhinsky district after the end of the war was in bad conditions: the number of draught cattle and dairy cattle was cut up, as well as the seed stock, kolkhozes' cultivated field were deserted, reclamation system became unfit for use, there were no tractors and other agricultural machines. Thus, in 1944 the planted acreages were 17,8 % compare to the pre-war level, the horse stock – 8,8 %, the cattle stock – 1,5 %. According to the livestock census of 1944 there were 496 animal units of cattle stock, 210 – horses, sheep – 350. pigs – 47. Decrease of able-bodied population during the war year considerably affected the agricultural production. The number of able-bodied kolkhozniks was decreased almost thrice, at that, men – more than 2,5 times. Approximately tree quarters of all the worked-out workdays in kolkhozes were accounted for by women, teenagers and old people. There was shortage of labor force, specialists and mechanizers.

43 kolkhozes that made 1390 t of hay were restored by the autumn of 1944. In the same year plan for autumn sowing was fulfilled for 115 % (232 ha were sowed against the plan of 200 ha), 43 stables, 50 cattle yards, 6 calf houses, 10 sheep houses for 280 places, 2 pig houses were repaired and set in order. New farms were organized and the ruined farms were restored everywhere. Thus, 42 sheep enterprises and 46 pig-breeding farms were organized in 1949[7].

A number of reforms were implemented in the agricultural sector of the economy in the 1950-s – the beginning of the 1960-s. On May 30, 1950 the Central Committee (CC) of the All-Union Communist Party of Bolsheviks (AUCPB) issued a resolution "About Enlargement of Small Kolkhozes and the Tasks of the Party Organizations in This". In particular, it pointed out to the considerable amount of small kolkhozes that, based on the sizes of the lands assigned to them, could not develop public economy rather successfully, in the territories and republics[8]. In this concern it was decided to start works on enlargement of small kolkhozes. At the same time there was an attempt to solve not only production, but also social problems of village that seemed to be easier fulfilled in large settlements.

Archive documentation and periodicals show the dynamic of rapid enlargement of small households in Pryazhinsky district. The kolkhozniks form "Udarnik", "Zvezda" and "Put Lenina" kolkhozes laid the foundation of the merger. They established "Udarnik" united kolkhoz in May 1950[9]. In June of the same year 15 large households were created from 34 small kolkhozes of the district. However, as the First Secretary of the District Committee (DC) of the Communist Party of Bolsheviks (CPB) I.V. Silin noted in his report "About the Tasks of Kolkhoz Construction in Relation to the Enlargement of Kolkhozes" in April, 1951: "this big meticulous and everyday work was turned into a rapid campaign"[10]. There was no preliminary serious analysis and calculations of the further prospects of the enlarged kolkhozes development, there was no uniting meetings of kolkhozniks. Nevertheless, further work on the enlargement of small kolkhozes was continued. From 72 agricultural and 5 fishing kolkhozes that existed in the district in 1950 by 1954 28 kolkhozes were left and in 1956 they became parts of 2 sovkhozes: "Essoilsky" and "Vedlozersky" from 6 subsidiary holdings: in Pryazhinsky, Shuisko-Vidansky, Vedlozersky timber industry enterprises, Onezhsky

[6] НА РК, ф. П-21, оп. 1, д. 21/354, л. 31-80.

[7] НА РК, ф. Р-706, оп. 9, д. 1/4, л. 11..

[8] КПССв резолюциях и решениях съездов, конференций и пленумов ЦК. Т. 8. М., 1985. С. 214.

[9] "Кунгозерские колхозы "Ударник", "Звезда" и "Путь Ленина" объединились в один колхоз // Красная Пряжа" 1950. 21 мая.

[10] НА РК, ф. П-21, оп. 1, д. 24/437. л. 139–153.

Tractor Plant, “Avangard” Plant and “Yuzhkarelles” Trust. So, during 6 years 77 small collective households were liquidated and 8 new agricultural enterprises were created in Pryazhinsky district.

“Pryazhinsky” (director – N.G. Martonov) and “Svyatozersky” (director – S.V. Zaitcev) state fur farms on breeding minks, polar foxes and foxes were founded In March, 1959. Initially “Pryazhinsky” placed 600 minks, 400 polar foxes and foxes and “Svyatozersky” – 720 minks. The fur farms held selective works, introduced scientifically based food ration, ensured comprehensive care for the animals what allowed to improve the quality of the fur and considerably increase the livestock. Thus, in 1960 fur breeders from “Svyatozersky” state fur farm got and grew in general 4,7 whelps (against the plan of 4,3) per each female animal, in total – more than 2800 animals of minks, and in 1961 – per 5,3 whelps, in total – 3221[11]. By 1965 the households started to specialize in breeding minks.

In post-war years great attention was paid to the construction of residential areas and welfare facilities. At the beginning of the 1950-s a polyclinic, a tea house, a boarding school were put into operation in Pryazha village, a building of primary school for 80 places and a radio station were built in Kudama village, a day nursery for 30 places – in Sodder, the building of the hospital was completed in Chalna.

The most significant achievements were made in solving housing problem. In the 1950-s detached houses’ developers started to be presented preferential credits. It improved the housing situation in rural districts. The development strategy of the KASSR’s (Karelian Autonomous Soviet Socialist Republic) national economy for 1959–1965 from the total amount of finances for the economy within the jurisdiction of the Republican Council of Ministers provided allocation of more than 15,9 mln. rubles for the development of industry, 38,7 mln. rubles, i.e. almost 2,5 times bigger, - for residential construction. Scales of the residential construction grew considerably. In 1956–1960 they built more residential space than for the previous and the following five-year plans, and with that the construction was made mainly at the state’s expense[12].

18 mln. rubles were spent and 22 000 m^2 of residential space were taken into use in the district during 1955–1960. Workers and employees of sovkhozes and timber industry enterprises built 564 living houses, including 108 houses in “Vedlozersky” sovkhoz, 59 houses in “Essoilsky” sovkhoz, 22 houses in “Svyatozersky” sovkhoz,, 69 – in Chalna settlement, 74 – in Pryazha village, 32 – in Matrosy settlement. For three years 14 clubs, 2 hospitals, 2 polyclinics, 3 drug stores, 8 kindergartens and day nurseries, 3 schools, 5 boarding schools, 22 shops, 6 canteens, 9 bakeries and a number of other sites were built. Chalna settlement had 140 subordinate living houses of Shuisko-Vidansky timber industry enterprise of the total are of 10 thous. m^2, 284 detached houses of the total area of 7 thous. m^2. There was a hospital, a polyclinic, a kindergarten, a day nursery, secondary day and evening schools, a children’s music school, a club of logging operators, a gymnasium and other cultural-domestic institutions here[13].

Construction of worker’s settlements was full-scale. Among them were Chalna settlement and Rechka (Shuisko-Vidansky timber industry enterprise), Kudama, Narvozha, Sodder, Malaya Suna (Syamozersky timber industry enterprise), Manga, Tuksha (Pryazhinsky timber industry enterprise), Verkhnie Vazhiny, Kursky (Verkhne-Vazhynsky Village Soviet), Koivuselga. Houses for logging operators, cultural-domestic buildings (clubs, propaganda rooms, libraries, schools, hospitals, first-aid posts, kindergartens and day nurseries, shops, canteens, utility services shops) were built there. All workers’ settlements were equipped with radios and electricity.

District authorities paid a great attention to the improvement of populated localities. Starting from 1950 “Forest weeks” started to be held in the district; the main task of them was planting of towns, villages, settlements, territories of schools, hospitals, children and cultural-enlightenment institutions; laying out a gardens, squares; planting of trees in the forests; protection of the existing plantation from damages and care of them; cleaning the forests around and near populated localities from garbage. During one of such “Forest Weeks” about 3000 tress and bushes were planted, 10 hectares of forest were sowed in Pryazha and other populated localities. However, trees and bushes were often destroyed by livestock[14]. Gre-

[11] Маньшина И. Получай, Родина, святозерскую пушнину // Ленинское знамя. 1961. 2 сентября.

[12] История Карелии с древнейших времен до наших дней. Петрозаводск, 2001. С. 735

[13] НА РК, ф. Р-706, оп. 12, д. 10/287, л. 16–35.

[14] Неделя леса // Красная Пряжа. 1951. 13 мая.

at planting works were done in Pryazha in 1956: 20 apple trees, 50 ash trees, 29 plants of birch, wild ash, bird cherry, 60 larches and 450 different bushes were planted on the streets of the village in the spring[15].

So, timber harvesting and agriculture remained the priority guidelines of the economic development of Pryazhinsky district during the first post-war decades. Shuisko-Vidansky timber industry enterprise became one of the biggest logging enterprises. By the end of the 1960-s it included: three log collection points – in Chalna, Essoila, Novye Peski, and four enlarged logging units in Sodder, Matrosy, Malaya Suna and Nelgomozero. Timber industry enterprise had light narrow-gauge railroad of several direction: Chalna-Kudama, Chalna-Nelgomozero, Chalna-Lidozero. New machines appeared in the timber industry enterprises' arsenal: electric saws powered from portable isolated electric power plants, gas-generator tractors KT-12, cable cranes, semi-automatic lines. Big attention was paid to integrated utilization of wood: waste processing plants for industrial chips were installed, two flows on packing-case boards and wet stave production were started to be constructed and others. Names of the five-year plan's heroes are written in the history of the district. These were A. I. Yuntunen who was assigned the title of "The Best Electric Sawyer of the Country" in 1956, P.S. Gavrilov and S.V. Sablin who became the Heroes of Socialist Labor. In 1956 Shuisko-Vidansky timber industry enterprise was awarded the Order of the Red Banner of Labour[16].

The agriculture was developing in difficult conditions. Reorganization of kolkhozes, from one side, allowed to decrease the administrative apparatus and increase the financing of the branch, and from the other side it led to the merger of small settlements and villages into a united populated locality and, consequently, to the liquidation of a number of villages. Thus, by the decision of Pryazhinsky District Soviet 108 small populated localities were stricken off the register in August 1957[17].

For the purposes of increasing animal production and decreasing its prime cost serious stock breeding work on improving the livestock breed and changing flock qualitative structure was conducted. At the end of the 1950-s kolkhozes introduced new practices in animal management: loafing of cows, artificial insemination, non-stalling of pigs, suckling method of cattle's young stock breeding, what gave the possibility to decrease labor costs of the livestock care. A number of machines was considerably increased in MTSes that got tractors SZT NATI, KT-12, HTZ, ploughs, sowing-machines, harrows, cultivators, potato-planters, cargo-truck loads.

The seeds of cereal crops were gradually decreasing and the areas planted with vegetable crops, root vegetables, perennial and annual grasses were gradually increasing in the district. The crop farming use mineral amendments, chalking of soils, introduced farming rotation what allowed increasing the cropping capacity of a number of agricultural plants. However the yield of feed crops remained poor during the 1940–1960-s.

Social sphere underwent positive changes. A number of educational institutions and student it them grew considerably, the foundations of technical training were laid: state technical vocational school №16 – Shuisko-Vidanskaya forest engineering school that prepared specialists for forest industry – was opened in Chalna. Boarding schools for pupils from distant villages and settlements worked in the district; the network of children's pre-school institutions was widening: in 1961 880 children visited 25 kindergartens, 510 children were in 15 day nurseries. There were 3 hospitals for 240 places, 1 ambulance station, 36 medical and obstetrical stations, 3 child health centers, 7 dental offices, 6 drug-stores in the district. Cultural institutions became active.

Social-and-cultural development of Pryazhinsky district in the middle of the 1960-s – the beginning of the 1980-s.

At the end of the 1950-s the social economy started to loose its effectiveness. Loss of working efficiency, low quality of products, diseconomies indicated it. Then, leading academic economists started to discuss economic reform. By the middle of the 1960-s the necessity of economic reconstruction became obvious. A.N. Kosygin planned the economic reform and actively promoted its implementation. A new system of "planning and economical motivation" was accepted in September 1956. Rights of the enterprises themselves were extended substantially, their economic independence was increased.

[15] Озеленение села // Ленинское знамя. 1956. 6 июня.
[16] Верхоглядов В. Пряжа… С. 65–79.
[17] НА РК, ф. Р-706, оп. 12, д. 5/157, л. 16–19.

Sales volume became one of the main indicators of work. Above-plan sales volume allowed enterprises creating special funds due to deductions from profit. So, the reform strengthened the role of economic methods of administration. Self-sustaining principles of management was reviving, material incentive funds were created, pay to the budget for the production capital funds used by the enterprise was introduce, enterprises were ensured by wider rights in planning and so on. All these measures were designed to increase the interest workforces in the end results of production, the level of intensification of labor and the country's economy in general.

The first outcomes of the reforms were already positive. Rather high rates of growth of leading economic indicators were reached in the country in the 1966–1970-s. Start of Brezhnev's rule was successful for the soviet economy. 1900 large industrial enterprises were built during the eighth five-year plan. The industrial output went up by 50 %.

What were the achievements in the economical and social development of Pryazhinsky district during that period? Introduction of new machines and mechanisms, adopting new production methods were the important directions in the industrial sector of the district. By that time timber rafting was completely liquidated in the district; transportation of wood was organized to a railway line, and the two flow lines built at the log collection point in Novye Peski allowed more effectively treating tree-length material. Thus, Shuisko-Vidansky timber industry enterprise introduced jaw loaders in all logging units what gave an opportunity to separate wood transportation from dragging, increase the working efficiency. Here for the first time a unit on making fir bark residual was created, UPSh-3a sulphate chipping plant was commissioned to produce chips for Segezhsky paper plant. Wood storage places increased the number of functional logging waste processing plants, organized collection and utilization of sawdust for hydrolysis industry, made first steps towards transferring the shops to scientific organization of labour. Self-supporting basis was introduced in timber industry enterprises. These and some other measure let to considerably increase workforce productivity, improve qualitative indicators of work[18].

Three new industrial enterprises appeared in the district during those years. Syamozersky Fish Processing Factory with the center in Kroshnozero settlement was opened in September, 1970. V.O. Rudnitcky, a graduate from Petrozavodsk State University was appointed the director of it. All state fishing teams, catching fish in Syamozero as well as in the reservoirs of fish rearing for sale, were under the jurisdiction of the fish processing factory. On January 1, 1971 Essoilskaya Machine-Meliorative Station (MMS) was reorganized into Mobile Mechanical Division №10 (MMD № 10) of Karelmeliovodstroy Trust. A.M. Lekkerev made a considerable contribution to the development of this branch. One more enterprise – Essoilsky Concrete Products Plant (CPP) – appeared in September of the same year. Its designed capacity was 7 thous. m^3 of reinforced concrete per year in the profile of producing constructions for meliorative industry.

A reform in agriculture was declared about in March, 1956. Role of economical motivations for work was increased, purchasing prices were boosted, a fixed plan of state procurement was set, 50 % extra charge to the main price for supernormal production was established. Kolkhozes and sovkhozed became more independent in some respects. Capital investments to the development of agriculture grew sharply. Purchasing prices for animal production were put up. Certain measures on further strengthening of agricultural material and technical foundation were traced: it was supposed to step up the output of agricultural machines, improve their quality, reliability and life time; the program of electrification, chemization of agricultural industry, field irrigation and amelioration was being elaborated.

Material resources in the main branch of agricultural industry – live stock breeding – ware enhanced essentially in the district in 1976–1980. A new farm in Savinovo was opened; and the livestock breeding complex for 800 animal units built in Essoila was the only one in the republic in its scales and the level of modern equipment. Sovkhozes significantly extended fleet of motor vehicles and tractors. During those years agricultural people started to use high efficiency machines, tractors T-150, combine harvesters E-280, E-301, machines for processing, sowing and care for agricultural plants, fodder conservation, the up-to-date equipment of livestock breeding farms. Certain work for improving food reserves of sovk-

[18] НАРК, ф. Р-706, оп. 15, д. 16/267, л. 23–54, Муниципальный архив Пряжинского национального муниципального района (далее МАПНМР), ф. 1, оп. 1, д. 315. л. 31–32.

hozes was done. During that period, for five years, sovkhozes got 1714 ha of new and reconstructed lands from ameliorators[19].

In the 1970-s – 1980-s the look of the district center of Pryazha and the central bartons of "Pryazhinsky", "Essoilsky", "Svyatozersky" and "Vedlozersky" sovkhozes changed markedly. Considerable amounts of the government financing allowed opening up construction of brick comfortable residential houses. During those years 14 870 m^3 of free residential space were built for agricultural workers only.

Social construction was active. The following buildings were built and got into service: culture centres with gymnasiums in Svyatozero and Essoila settlements, a club in Kroshnozero, a canteen with a delicatessen shop in Pryazha, a canteen in Essoila settlement, a hostel for MMD № 10 workers, schools in Essoila, Pryazha, Svyatozero and Vedlozero, kindergartens in Essoila, Svyatozero, Pryazha, consumer services centers Pryazha, typical pavilions in Chalna and Matrosy settlements, in Essoila, shops, the office of Borough Internal Affairs Department.

Development of communications can be considered as one of the achievements of that period. In the 1970-s a telephone switching central serviced only 20 number, then in the 1970-s – 400. Departments of a new automatic telephone station (ATS) appeared in Essoila, Vedlozero, Chalna; using automatic dialing one could connect not only to the neighboring settlements, but to Petrozavodsk also.

Starting from 1960 local radiobroadcasting was organized in 7 populated localities. The programs of a radio-day were, as a rule, devoted to the successes of timber cutters, potato breeders, stock-breeders, masters of the district live stock breeding, literature compositions, concert programs implemented by district choruses were on the air. Radio programs were twice per week[20].

Opening of the people's museum named after the Hero of the Soviet Union M.V. Melenteva on June 29, 1969 in Pryazha village was an important event in the cultural life the district. It is important to note that Rauha Emilievna Kalske was for many years its irreplaceable manager working on a pro-bono basis.

The activities of the District Culture Centre and village clubs were closely connected to the production. The district traditionally held foremost workers' appreciation nights, harvest festivals, days of stock-breeders, meetings with veteran workers and etc. Cultural institutions took active part in different district and republican creativity competitions.

Vedlozersky folk, Pryazhinsky folk, Essoilsky, Svyatozersky men's choruses, Chalninskaya Finnish vocal group, dancing group of the District Culture Centre, hillbilly band from Pryazha, wind band from Chalna, vocal-instrumental ensemble of the District Culture Centre, Koivuselgskaya vocal group were permanent participants from Pryazhinsky district at amateur arts festivals.

Healthcare institutions network expanded. 8 hospitals of medical district, central district hospital, 5 medical and obstetrical stations and 20 feldsher's stations worked on the territory of Pryazhinsky district.

However, from the beginning of the 70-s the economy's rates of growth started to go down, and by the 80-s production indicators stopped to grow. The main problem of the soviet economy of that period was the fact that it was very poorly connected to the progress in science and technology. Western countries were advancing in such spheres as complex automatization of production and management, electronification and bio- technification of economy, using of nuclear energy, exploration and development of outer space. In our country when scientific and technical policy was elaborated not all the tendencies of the scientific and technical revolution were taken into account. Special attention was paid to automatization and mechanization of production processes as it was supposed that it contains the possibility of reorganizing material production, management and increasing workforce productivity. The economy of the 70-s and the first half of the 80-s was developing in general on extensive basis, focusing on involving additional material and labor resources into production what came out in chase for volumes increase.

Along with the national economy's achievements there were a lot of tough problems. For example, enterprises were slowly decreasing non-production expenses. Overspending of wage and salaries funds happened. The serious issue for timber procurer of the district was raw material base that was over-cut per 1,5–2 times. Undercuts were left in the worked-out areas. With the limited forest resources the issues

[19] МАПНМР, ф.1, оп. 1, д. 613, л. 45–67; д. 651, л. 23–50.

[20] Лажиев Д.Н. В эфире Пряжа // Ленинское знамя. 1967. 27 апреля.

of using angiospermous wood were solved badly[21]. Timber complex enterprises were gradually getting planned loss-making ones.

A number of enterprises and organizations of the district had unsatisfactory economic and financial indicators for 1979–1980. There were a lot of problems also in the work of construction organizations, namely low quality of installation and construction works and breaking the regulatory time limits for construction duration. Thus, state commission accepted only 40 % of total rentable area supply with "good" mark. Unsatisfactory mark was often given when accepting new construction sites supply. Construction of water supply treatment plants, residential space, the building of central hospital and a number of other sites became long term construction projects in the district. Failures to deliver construction materials and machines on time often happened, construction works schedules were broken, storage of construction materials and details was badly organized, absence without leave were admitted, labor saving tools were used poorly on projects under construction[22].

Decline in the birth rate, deterioration of demographic situation, urbanization led to reduction in population on the territory of the district. As far as nobody lived in some populated localities in the 1960-s – 1980-s, the Executive Committee of Pryazhinsky District Soviet removed 39 settlements and villages from the register from 1967 till 1981.

Population decline was the reason for changing the district school network. During 1967 – 1985 underfilled schools were closed and secondary schools were reorganized into eight-year schools. If 44 educational institutions worked in the district in 1967, then 18 schools – in 1985.

So, economic and social life of the district had both certain successes and numerous problems. Despite the commissioning of new industrial enterprises and improvement of a number of indicators in agriculture, active construction of social facilities and free residential space, there was a decline of the district economic growth rates, households were getting planned loss-making one, and, as a consequence social problems intensified.

Pryazhinsky district in Recent Times (end of the 1980-s – 2011)

"Perestroika" (glasnost, democracy) declared in the country in 1985 elevated people's hopes for good changes. Everybody remembers the first steps of "the radical economic reform": creation of cooperatives, supporting individual labor activity, switching of labor collectives to contracting forms of work organization and renting, appearing of the first farmers and so on. And though this historical period have not got weighted estimate yet, it is obvious that a number of social-and-economic, political and cultural processes substantially changed the soviet society. The first production cooperatives were created during that period. "Progress" cooperative on fishing and selling fish was registered in Pryazhinsky district in April 1987.

In the 1990-s considerable changes took place in political and social life of Pryazhinsky district: local self-government was reformed, non-governmental organizations were created, national and spiritual traditions were revived.

In the 1990-s the process of converting state enterprises into joint-stock companies was active. Among them: former Shuisko-Vidansky timber industry enterprise – AO "Shuyales", agricultural enterprises – ZAO "Essoila", "Pryazhinskoe", "Svyatozerskoe", OAO "Vedlozersky", "Essoilsky Concrete Products Plant", "Chalnalestorg", "Dom Byta Pryazha", "Akmo", "Sand". Small state-owned enterprises with limited liability – OOO – and individual – IChP (without registration the right of a legal entity) were established everywhere. 30 small enterprises, 45 limited liability partnerships, 17 individual (private) enterprises, 16 cooperatives were founded in Pryazhinsky district by 1993[23]. According to the information of the Federal State Statistics Service as of January 1, 2011, 364 enterprises and organizations and 312 individual and private entrepreneurs worked in Pryazhinsky district in 2011[24].

Farming was gradually gaining momentum. Department of land reform and land resources for Pryazhinsky district to consider all issues concerning land utilization and settling land allotments on land users was created in January 1991. In March of the same year the Presidium of the District Soviet of

[21] НА РК, ф. П-21, оп.6, д. 66/1, л. 5–17, оп. 7, д. 70/41, л. 6–39.

[22] МАПНМР, ф. 1, оп. 1, д. 562

[23] МА ПНМР, ф. 1, оп. 1, д. 2/24, л. 18.

[24] Муниципальные образования Республики Карелия. Статистический сборник. Петрозаводск,2011. С. 249.

People's Deputies approved the District Commission on Land Reform. 7 peasant (farming) enterprises with the land area of 78 hectares allocated to them were registered already in 1991 in Kaskesnavolok village, Imatozero, Signavolok, Matrosy[25]. In 1992 there were 22 farming enterprises (288 ha of land), in 1993 776 ha of land were assigned to 51 farming enterprises in the district. However, establishing of farming in the district was going with great difficulty. Shortage of machines, construction materials, inventory in free sale, the absence of good roads, electricity supply, communications, infrastructure, increasing prices for compound feeds, fuel, electric energy – all these affected the result of the farming enterprises' work[26]. It is characteristic that only half of the 51 registered farming enterprises worked steadily in 1992.

In the 2000-s a new industry – trout breeding – started to develop in the district. OOO "Sapsa" on Syamozero Lake and OOO "Rybkhoz "Kuzema" on Svyatozero lake reached the design capacity on breeding marketable trout in 2003, OOO "Rybnoe Khozyaistvo "Gonganalitckoe" was established. Seven trout breeding farms worked in the district in 2007.

In 2008 mining industry appeared in the district. Rock-crushing plant of OOO "Prionezhskaya Gornaya Kompaniya" producing break stone from gabbrodiabase of Chevzhevarssky deposit started its work at Padozero station (Chalninskoe rural settlement). The enterprise, where more than 200 people worked, became one of the biggest in the district.

Work on communication development and introducing new information technologies was intensified. Seven new telephone stations were put into operation in Pryazha, Chalna, Essoila, Matrosy and Svyatozero; the district's population could use the Internet services, construction of cellular retranslators of Megafon and MTS companies was stated.

In 2009 in the building of the former primary schools of Pryazha village, after capital repair, Youth Center was opened; it combined all the preschool education institutions: Center of Children's and Youth Activity, Art School of Pryazhinsky district, Pryazhinsky district Children's and Youth Sports School, School Museum of the history of the Great Patriotic War, Youth Reception Room, a room for the rehabilitation of children with disabilities, children's library.

One of the main directions of Pryazhinsky district administration was social protection of poorly-provided social groups. In 1997 social home help for singe disabled and old people was organized. In 2009 there was a decision on creating a comfortable house of temporary stay in Essoila, where 45 old people who needed care were brought from Chalna and Koivuselga.

In the 1990-s – 2000-s the district established twin-city relations with a number of foreign cities and villages – with Finnish communities of Tuusniemi, Juankoski, Varpasjarvi, Lapinlahtiu, with Swedish settlements from Vesterbotten province: Svyatozero with Helnes, Essoila with Tavelshe, Vedlozero with Omsele, Matrosy with Grane, Savinovo with Ortresk, Kroshnozero with Tverolund, Chalna and Pryazha – with Vindeln. Along with the exchange of goods, such form of cooperation as tourism, exchange of school delegations and amateur talent groups were developing. Foreign organizations rendered humanitarian assistance to budgetary organizations and farming enterprises of the district. In 2004 the district set friendly ties with Moletsky district of Litva, and cooperation of agreement was signed with Petrogradsky district of Saint Petersburg. In 2010 Kirovsky municipal district of Leningrad region became a twin-district. Thanks to the cooperation with other regions a number of projects in economic and social spheres gained their momentum.

Pryazhinsky district is continuing to be the place of compact settlement of the Karelians and the Finns. Active work on preserving national culture and language of these peoples is carried out in the district. Karelian and Finnish languages are studied in most of the educational institutions, national on-stage performance groups are created. The tendency to supporting national traditions of the Karelians is also presented in the district's sports life. The first republican sports festival "Kulan kizhat" ("Village Merrymaking") took place in March 2004, in Vedlozero settlement; and the first festival of men's culture "The Honey Pay – the Marvel of the Forest" took place in Essoila in 2006. Both events are new format sport events the program of which includes competitions connected to hunting, fishing, life style of Karelian villages and settlements and they have become annual in the district.

[25] МА ПНМР, ф. 1, оп. 1, д. 1105, л. 28.
[26] МА ПНМР, ф. 1, оп. 1, д. 1107, л. 13.

In 2008 a following step on preserving and developing culture and language of the peoples traditionally living in Pryazhinsky district was made. Based on the decision of the Council of Pryazhinsky Municipal District, after a long discussion during several sessions of the District Council, an amendment to the Charter of the municipal unit according to which the district started to be refereed as Pryazhinsky National District was adopted. The district became the third national district alongside with Kalevalsky and Olonetcsky.

In 2011 the preamble of the Charter of the district was added by the following point: "The population of Pryazhinsky National Municipal District takes care of its historical memory, preserves and develops the national culture, languages, traditions of the peoples traditionally living on the territory of the national district. Local self-governing authorities, when taking decisions, developing programs, elaborating strategies, takes into account the national features of Pryazhinsky National Municipal District, provides for expenditure commitments on supporting culture, traditions, languages and customs of the peoples living on the territory of the district"[27].

Cultural sector of the district in 2000 was presented by 17 clubs, 22 libraries with the stock of 166 thous. copies of books and magazines. Numerous creative teams properly represent the district in Republican, Russian and international competitions. The Karelian culture and traditions, monuments of history and culture are preserved in the district. International festival of rural humor "Kindasovo" takes place in the district annually. In 2001, on the day of the festival, the old village of Kindasovo was visited by 10 thous. guests, including the ones from the other regions and from abroad.

Pryazhinsky National District has always had a good sports potential thanks to the activists of sport and physical culture. Football, basketball, artistic and rhythmic gymnastics, free-style wrestling, sambo, boxing, skiing, fishing sports are developing in the district. The support of sports by entrepreneurs and enterprises of the district for the latest decade allowed doing much for the development of sports in the district and reach new sports results. Opening of a new sports complex (director – S.K. Zaitcev) was a remarkable event not only for the district, but for the Republic of Karelia. Village stadium of that level with natural grass court has become of one few sports sites of the North-Western region of Russia.

"Karelian Federation of Mushing" headed by entrepreneur N.D. Stolyarov was registered in Kudama settlement in 2011. In December of the same year international sled dog race competition took place in Kudama, and Russian Mushing Championship visited by more than 6,5 people was held in January 2012 in Pryazhinsky sports complex.

So, the analysis of the events, facts and statistic information on the results of the first decade of the new century witnesses that a lot of things were done in Pryazhinsky National District to solve the complicated problems of the modern age. New branches – trout breeding and mining – appeared in the district's economy. The material base of the social sphere was scientifically enhanced. Standard of people's living increased. Volumes of private housing construction grew up per 3,5 times, the number of cars per 1 district resident doubled.

However there are still unsolved issues left. The problems of hazardous and slum residential space, construction of welfare institutions, improvement of transport networks of the district, as well as the work of "forest villages", heavy mortality are very pressing ones.

Enhancing the living standards of the population, as well as solving social issues is related to strengthening the economic basis of Pryazhinsky district, increasing the consolidated district budget revenues at the account of creating new and upgrading active enterprises of the district, public utilities, developing tourism, supporting small business and private housing construction. It is necessary to continue work on preserving national features of the district, first of all, culture, language, and lifestyle of the Karelians and the Finns, to support the incentives on creating languages and national centers in the settlements of the district.

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[27] Устав Пряжинского национального муниципального района. Пряжа. 2011. С. 4.

GEOLOGICAL NATURE MONUMENTS IN SOUTHERN RUSSIAN KARELIA

V.V. Makarikhin and P.V. Medvedev

A strip of Precambrian rock exposures between Lakes Ladoga and Onega has been studied by Russian scientists in cooperation with Finnish specialists. Therefore, many geosites, understood as geological nature monuments, should be recognized as sites of historical and geological value, and the names of the people who discovered and described them should be perpetuated.

Stromatolites

The main sites, located near the early traces of life on earth, are associated with stromatolites. The term *stromatolite*, as understood these days, is used for attached buildups of phytogenic origin of the division Lithophyta). Phanerozoic rocks can be reliably related to diverse relict fauna and flora, while rocks older than 600 Ma cannot be studied by biostratigraphic methods.

The first serious attempts to describe and classify stromatolites were made by Russian scientists for Riphean deposits in the Urals. More recently, similar Early Precambrian communities were studied.

Karelia is a type region where various stromatolites, occurring in the least metamorphosed, dominantly carbonate Jatulian rocks, are most abundant. Stromatolites fall into four orders, depending on the shape and pattern of stromatolitic laminae: rod-like (Platellales), columnar (Collumnales), nodular (Colleniales) and sheet-like (Stratiferales) stromatolites.

In rod-like stromatolites, buildups, oriented subparallel, are typically elongate in plan view. In cross-section across strike, the buildups look like columns with slightly convex laminae (Fig. 1).

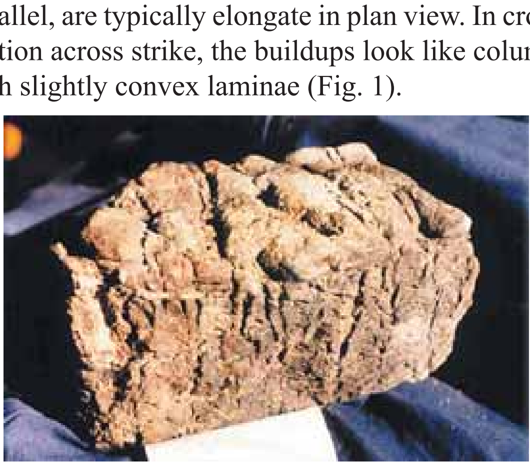

Fig. 1. Rod-like stromatolites

Columnar stromatolites, occurring on top of a bed, look like zonal circles or ovals differing in diameter (Fig. 2).

Fig. 2. Columnar stromatolites

In vertical section, buildups look like columns with laminae bulging toward the bed top. Convex or bun-shaped buildups, not greater than their diameter, are called nodular stromatolites (Fig. 3). Thin rhythmic, commonly undulating lamellae, originally parallel to bedding plane, are termed sheet-like buildups (Fig. 4).

Mount Hopunvaara (61º35'28 "N 31º 28'30" E). Located at the southeastern environs of Pitkäranta. In the mid-19th century, Prof. P.A.Puzyrevsky of St.Petersburg University found an unusual fossil while studying local carbonate rocks. Comparison of this form with *Eozooncanadense* Daus, described earlier from Canada, provided the basis for correlating Lake Ladoga rocks with similar rocks from the American continent (Puzyrevsky, 1866). The fossil was probably the first evidence for Early Precambrian organic remains ever reported from Russia.

Several generations of researchers have studied *E. canadense* for more than a hundred years (Fig. 5–6). The history of study of these fossils and various hypotheses of their origin have been discussed by O' Brien's (O'Brien, 1970). It should be stressed that the Precambrian age of rocks from the Lake Ladoga area (Priladozye), first estimated from paleontological evidence, was corroborated more recently (Makarikhin & Kononova, 1983), and all earlier and later attempts to date groups of Karelian primary sedimentary rocks as Paleozoic were unsuccessful.

Fig. 3. Nodular buildup

Fig. 4. Sheet-like stromatolites

Point Kunnosniemi (62º15'22 N 32º20'16 E). It is located on the north shore of Lake Suojärvi (Fig. 7). Here, the Finnish geologist Adolf Metzger found dolomite boulders with the fossils that he named *Carelozoonjatulicum* (Metzger, 1924). Metzger used a generic name because, like earlier authors, he assumed that the fossil, he first described from the area, is coral. Analysis of additional samples, collected there from coarse eluvial-deluvial clasts and small outcrops, has clearly shown these fossils to be stromatolites.

More recent studies in other parts of Karelia have revealed quite a number of new locations of *Carelozoon*. At least two independent species within this genus, *C. jatulicum*Metz. and *C. metzgerii*Mak., are now recognized. They are indicative of two neighbouring stratigraphic units in the Upper Jatulian (Geology of Karelia, 1987; Satsuk et al. 1988; Makarikhin et al., 1994).

Point Kintsiniemi (62º03' 27 N 31º01'22 E). It is located on the eastern shore of Lake Maloe Janisjärvi, near Soanlahti Town. Beds of the Lower Onega subhorizon that contained the stromatolites: *Colonnellacarelica*Mak., *Paniscollenia*, *Omachtenia-kintsiensis*Mak., *Stratiferajanisjarvica*Mak. on the walls of an abandoned dolomite quarry and on the bank scarps near the small River Soanjoki flowing nearby have been found. Almost the entire rock sequence is composed stromatolite-bearing dolomites. The sheet-like stromatolites *S. janisjarvica* and *O. kintsiensis*, relatively scarce in other Jatulian rock exposures (Fig. 8–9), occur as rock-forming material. Together with the above stromatolite taxa, these rocks are reliably correlated with the stratotype. However, their distinctive appearance makes it possible to recognize an independent (West Karelian) stromatolitic province in this area (Makarikhin et al., 2007; Medvedev et al., 2013.).

Rogoselga (61º44'19 N 32º13'10 E). The carbonate rocks of the Jatulian Onega horizon are exposed in the western Pryazha District, near Kolatselga, a Karelian town. On the local stratigraphic scale they are named the Tulomozero suite. They are characterized by a small percentage of terrigenous rocks and the dominance of clayey-carbonate marine rocks (with hematite aggregates). A type section was constructed on the basis of drilling record for two holes (Nos. 17 and 18) drilled by The Tulomozero Geological Prospecting Team, SZGU in 1951 (geologist O. N. Anishchenkova, Chief Expert S. Naumov). In some of the vertical walls of the old quarries, used for the prospecting and production of iron ore (hematite), you can see a well-defined cross-section through big stromatolitic buildups (Fig. 10). They are confined to ore-free pure pink dolomite beds. Farther north, on the right bank of the River Kolass, small scarp-like light-grey dolomite exposures, lying higher in the stratigraphic section, are encountered. The rocks also contain stromatolitic buildups that resemble some *Butinella*. Unfortunately, the samples collected from these sites have not yet been analyzed. Please mind that the outcrops are not easily accessible (Fig. 11–12).

Soanlahti (62º03'14 N 30º59'36 E). Coastal smoothed low scarp-like largely carbonate rock exposures recognized as an individual suite of the Ludicovian. Some intercalations with the purest dolomite contain stromatolitic buildups of *Soanlachtia* (Fig. 13–14), including two species: *S. partanensis*Med. and *S. haussenii*Med. As Super-Jatulian rocks in Karelia are far less common than Jatulian rocks, these outcrops are of special value for Early Precambrian stratigraphy. It would be interesting to correlate Karelian stromatolite communities with Finnish ones at this stratigraphic level, but so far no monographic descriptions of these fossils have been published (Medvedev, 1993, 2005).

Janisjoki (61º42'15 "N 31º00'07" E). Steep 7–10 m high rocks, composed of Pälkjärvi tuffaceous siltstone (upper beds of Kalevian rocks, Fig.15), occur on the left bank of the River Janisjoki near its mouth. Some rock laminae display tapered columnar buildups of cherty composition (striolites) preliminarily named *Vallusjanisjarvicus.* The columns are oriented normally to the general lamination of the rocks. The lateral surface of the buildups is rough and has many small connecting bridges (Fig. 16). Striolitic layers are sharply convex and relatively thick. The boundaries of the laminae are often poorly-defined. They are arranged in rhythmic manner in a buildup. The presence of siliceous buildups of the Striophyceae class is one of the essential features used to correlate them with similar Kalevian ones in the Onega synclinorium (Makarikhin & Medvedev, 1997; Svetov & Sviridenko, 1992; Medvedev et al., 2005).

Hydrogeological nature monuments

Kroshnozero (61º37'35 N 33º10'10 E). A big natural underground water spring. Located at the outskirts of Kroshnozero Town at the foot of a small hill (western slope of the Korza Ridge). It is the most stable of the four biggest springs known in Karelia. Its capacity (55–70 l/s) is high enough to meet the water demand of Pryazha Town, the nearest district centre. The water has a slight iron taste (up to 4 mg/l), and its total mineralization of up to 90 mg/l is due to the presence of equal amounts of dissolved calcium and magnesium carbonates. As the water temperature is stable, +5º, the local population used it earlier as a natural refrigerator to keep milk cold. Quaternary host rocks are represented by clayey and largely sandy fluvioglacial rocks. Underground water is steadily accumulated in their contact zones (Startsev & Litinsky, 1987).

Fig. 5–6. *Eozooncanadense* Daus. Problematic phytogenic buildups in an adit near Hopunvaara

Juhankoski (61˚47΄02˝N – 31˚24΄12˝E). A waterfall on the River Kulismajoki, 6 km west of Syskyjärvi Farmstead. It is 15 m high. The wall, along which turbulent water flows down, is steep, almost vertical. The scarp is formed of dark massive schist with a 5 m thick dolomite bed at the base. Dedolomitization in the contact zone is considerable, and there is evidence for skarn formation. There is a rest area for tourists with firewood for a campfire on the upper step of the waterfall (Fig. 17). A country road, quite good for driving, leads to the area.

Fig. 7. Dolomite exposures on the shore of Lake Suojärvi studied by A.T.Metzger

Fig. 8. Stromatolitic buildups of *Stratiferajanisjarvika* in a natural exposure on Point Kintsiniemi

Fig. 9. Stromatolitic buildups of *Omachteniakintsiensis* from Point Kintsiniemi in a type sample

Fig. 10. Big stromatolitic buildup in the trench wall of the Rogoselga deposit

Fig. 11. On the way to the Rogoselga ore prospect

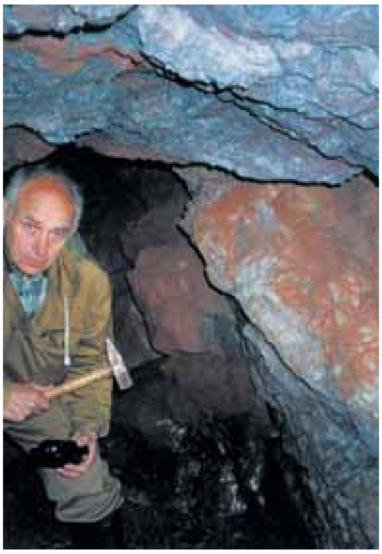

Fig. 12. Hematite adit

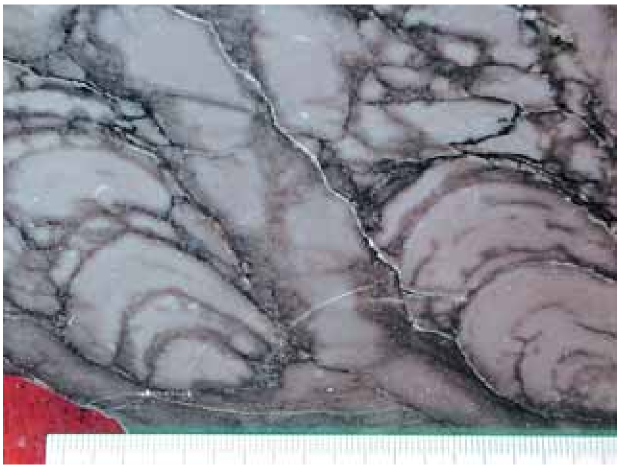

Fig. 13. Stromatolites *Soanlachtiapartanensis:* axial sections across stromatolitic buildups in a sample

Fig. 14. Stromatolites *Soanlachtiapartanensis*: cross-sections on a weathered surface in an outcrop

Fig. 15. Kalevian tuffaceous siltstone exposure pattern on the River Janisjoki

Fig. 16. Axial sections of Stiriophycea on the weathered surface of a rock exposure

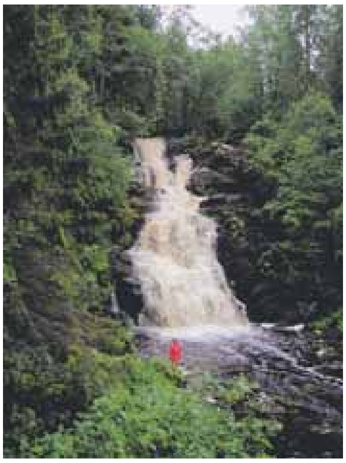

Fig. 17. Jukankoski Falls on the River Kulismajoki, Pitkäranta District

MINING ROAD

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