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ABOUT THE OUTSET OF MINING IN ESTONIA

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The very beginning of mining reaches far to the twilight of history. In Poland there exist diggings made by Stone Age people for mining firestone. All over the world one can find ruins of various buildings of different civilizations. These buildings, pyramids, fortresses, and temples were made from rocks that were fractured and faced in quarries. In old literary sources, too, data about quarries can be found.

Another evidence that ores have been mined is the application of gold as pieces of jewelry and cult attributes and gold finds in sepulchres and burial places. Though gold does occur in the earth crust in its pure state, it is very scattered and so hard to obtain. If pieces of pure gold happen to occur somewhere, they are mechanically mixed with other metals and rocks. It necessitates gold processing for getting usable metal. Nevertheless, on their arrival in America Europeans found an abundance of gold objects and ornaments. The same is true about Chinese, Indian and other civilizations.

All this confirms that already from time immemorial there occurred mining for getting and processing building materials and metals, especially for mining and processing gold. Mining industry enlarged even more when copper, bronze and iron were taken into use, and became the basis for technical development of that time. In former times handicraft and manufacture, including exploration, production, and processing of ores, was an art that was passed on from generation to generation, keeping the gild secrets. Nowadays such a way of teaching and getting experienced is still being preserved at facing jewels.

In the Middle Ages, when the demand for gold and silver exceeded the output of mining industry, alchemists tried to prepare them from other metals and substances. These efforts remained unsuccessful but, nevertheless, in doing so a lot of new substances and elements were discovered and taken into use. This gave occasion to the development of chemistry and chemical technology. Other metals and corresponding ores were taken into more extensive use. The growing mining industry, especially the underground one, needed new engineering solutions for supporting and ventilating mines, hauling mined ores, and draining mines. Water and wind power belonged to the main energy sources as well as muscular strength of man and draught animals. Wooden gearwheels and arbors were used for power transmission.

Georg Agricola (1494-1555), a man with a classical education, learned in medicine and further trained at Italian universities, was the author of the first systematic book dealing with mining and metallurgy [1]. The book, written in Latin and illustrated by 273 woodcuts, gave a survey of the achievements and described mining and metallurgy on the contemporary level. It was printed in 1556, after the death of the author, and has been translated into many languages. The book occupies a remarkable position in the history of mining industry and technology.

The development of engineering and civilization created a growing need for metals and mineral fuels. Europe, the cradle of mining, had after exhaustion of its best natural resources to retreat before the states of the new world - America, Australia, and later on even Africa where the greatest amounts of natural resources are mined at present. Nevertheless, European countries have preserved an important status with regard to the mining development both in the scientific sphere and education of mining engineers.

Estonia was one of the areas where manufacture of iron from bog ore was quite widely spread in old times [2]. Later the local iron production gradually stopped due to the better quality of imported iron. Limestone was fractured for earthen strongholds and house bases. As lime burning was still unknown here, limestone was piled up without any mortar. In conquered ancient Estonia construction of churches, fortresses and castles began, using a local building material - limestone - in Northern Estonia but granite and clay bricks in Southern Estonia. Near greater construction sites limestone quarries were established. Their output was used at building and producing ashlars as well as at lime burning [3]. Masters for this work came from Gotland and Germany. In the Middle Ages big limestone slabs were transported from here even to Western Europe. The demand for building materials increased with growing building activities.

The mining of fireproof mineral building material from local bowels of the earth began to develop, too. The producers - masters who worked in stone quarries - knew the properties of every layer in detail and were able to say what any particular layer suited best for, how they were to be processed, etc. This practical knowledge and experience was transferred from one generation to the next one up to the recent time when limestone was still used as a building material. Now, when limestone as a building and decorative stone is being rehabilitated again, geologists (Rein Einasto) and producers are trying to elucidate the possibilities of its use, making use of this knowledge and experience buried in oblivion.

A systematic geological exploration of the Estonian area was started at the end of the 18th century. The rocks, paleontology, stratigraphy, and - to some extent - natural resources (limestone, oil shale) were studied. Mainly professors of Tartu University, academicians and professors from Petersburg born in Baltic region were engaged in this activity. Often people from other fields who were interested in these investigations took part in this work, too [4].

Doctor and man of letters Friedrich Reinhold Kreutzwald belonged to the latter. In 1849 he published a paper on the discovery of lead ore in Estonia in the journal "Das Inland" [5].

The geological studies were at a good level from the academic point of view but they found no practical application as Estonia was only a province belonging to the

Russian Empire, to a state with abundant ore deposits in the Urals and coal beds in the Ukraine.

Estonian oil shale was known and described already in 1791 (Acad. Johann Gottlieb Georgi, 1729-1802) [4]. Oil shale and dictyonema argillite were investigated in 1838 by Academician Gregor Helmersen (1803-1885) and later by several other geologists, too, but the problems of oil shale mining became actual only during the World War I. The task of solving these problems was given to geologist Nikolai Pogrebov. Under the circumstances of an acute fuel crisis it was decided to start the production of oil shale. In 1917 K. Sokolovski, a mining engineer, took up this task [6]. The revolution and wars did not enable to realize the planned action. However, oil shale was still mined to some extent. Only after the War of Independence Dipl. eng. Märt Raud succeeded in starting the oil shale industry [7]. He had at N. Pogrebov instigation thoroughly studied and copied all scientific materials on oil shale, available in Petersburg public library.

There was no Estonians among specialists dealing with geology and natural resources in tsarist Estonia. One may ask whether no Estonians were occupied in this sphere of action. The answer to that question is that they were engaged, and quite successfully, in other countries. Already at the end of the last century (1893-1900) mining engineer O. Avesson worked at South-African Witwatersrand gold mines. Later he was the head of the Ülgase phosphorite pit in Estonia. Engineer Ambrosimoff worked as the head of a silver mine in Mexico. Mining engineers Oskar Vuht (1880-1967) and Jaan Aarmann (1885-1978) worked as the heads of coal mines in the Donbas, Jaan Kark (1876-1953) worked in several places in Russia on behalf of the Department of Geology, etc.

Some Estonians were also busy in research and teaching. For example, geologist Elmar Pärna (1878-1916), graduated from Petersburg University and also from Mining Institute, worked as an assistant at the chair of paleontology of Petersburg Mining Institute. In 1916 he was elected an adjunct professor. Unfortunately he died when young [8]. Mining engineer Aleksander Kink* (1882-1937) was another lecturer. He graduated from Petersburg Mining Institute and trained himself in Berlin. He started as an assistant of Petersburg Mining Institute, then worked as a lecturer in Jekaterinenburg. In Estonia he started as an assistant minister of Trade and Industry; later he occupied himself in peat industry and was an entrepreneur. Nikolai Kell, a trained mining engineer, worked as a lecturer at Petersburg Mining Institute and was included into the membership of the Russian Academy of Sciences.

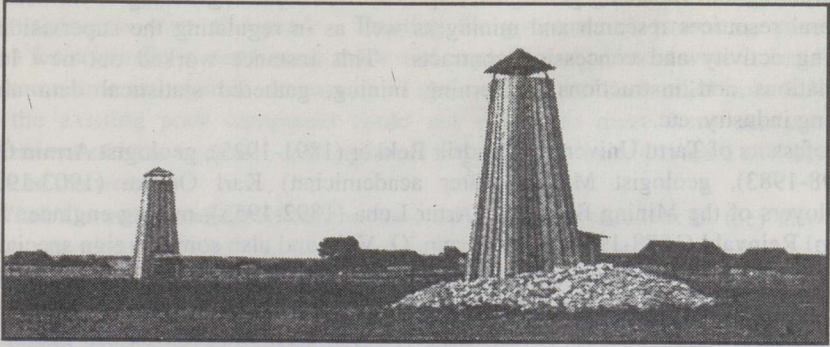
When the War of Independence had come to its end, M. Raud, the head of the oil shale department at the Ministry of Trade and Industry, took up the development of oil shale industry. He recalled experienced Estonian specialists from Russia in 1920. So J. Aarmann came to work as the head of the Kukruse mine, O. Vuht - to become the technical director of the State Oil Shale Industry, and J. Kark - to work in the Ministry of Trade and Industry [9].

First of all, the elaboration of a project for the Kukruse mine was started under the leadership of O. Vuht. Mining engineer Kirschbaum was engaged in preparing this project, too. In 1923 the mine design office was founded with O. Vuht as its

*His daughter Hella Kink is a geologist-scientist, too, at the Institute of Geology, Estonian Academy of Sciences, and at Tartu University.



The tombstone of Kunigunde Schotelmund (1381).
Dominican convent in Tallinn, Estonia



Ventilation tower of the Kukruse underground mine

director. This office was the first organization consisting of specialists who had, besides the projecting of mining, to estimate oil shale resources and to solve other current problems of mining. That is why the year 1923 is considered the beginning of Estonian mining science. Mining engineer Erich Differt was then employed to speed up the design work in this office [10]. Two mines were projected - one in Kukruse and another in Kohtla-Järve which then was called the Kohtla mine.

In 1920 the Mining Department (later called Mining Board) under the leadership of J. Kark was formed in the administrative sphere of the Ministry of Trade and Industry for the management of Estonian mining industry. This service had to organize and administrate the state mining policy. The Mining Board was engaged



Oil shale transport by horses from an underground mine

in directing and financing geological exploration, official registering of licenses for mineral resources research and mining as well as in regulating the supervision of mining activity and concession contracts. This instance worked out new laws, regulations and instructions concerning mining, gathered statistical data about mining industry, etc.

Professors of Tartu University Hendrik Bekker (1891-1925), geologist Armin Öpik (1898-1983), geologist M. Sc. (later academician) Karl Orviku (1903-1981), employers of the Mining Board Dr. Artur Luha (1892-1953), mining engineer Jaan (Ivan) Reinvald (1878-1941), J. Aarmann, O. Vuht and also some foreign specialists were engaged in practical exploration. Mining engineer of a younger generation Karl August Feldveber (1897-1983, graduated from Glasgow University) was a very versatile person who led excavations, projected mines, and took part in geological exploration. Later he worked as a mine surveyor, a chief inspector as well as a professor of Tallinn Technical University where he lectured on mining economy. Students of geology and school teachers, after attending special courses, were employed in the practical work of geological mapping.

By 1938 an extensive oil shale industry had been developed in Estonia with mines and oil works belonging both to the native and foreign (German, English, Swedish) capital. The state aimed at the enlargement of oil shale industry. Besides that, several phosphorite and fireproof clay deposits were explored, and two boreholes for estimating iron ores were bored near Jõhvi.

As the Mining Board was not able to deal with all these tasks alone, in 1937 by a government decree the Estonian Geological Committee was founded including specialists from the Mining Board, Tartu University and Tallinn Technical University. In addition to them two members from among mining engineers, geologists and chemists were appointed by the President of the Republic. The committee was presided by the assistant minister of Economics, and the head of the Mining Board was the assistant chairman [11].

J. Reinvald, mining engineer Artur Alexander Linholm (Linari) (1903-1983), A. Öpik, K. Orviku, Paul Kents (born in 1912), chemist Prof. Erich Jaakson (1891-1950) and peat specialist Dr. Paul William Thomson were the members of this committee. In 1938 A. Luha became the geologist of this committee, and the accepted decisions were put into practice under his direct guidance. The committee costs were covered by the state budget. It was entitled to use the laboratories of universities and other state institutions. The main tasks of this committee were applied geological exploration, discovery of mineral raw and ores, estimation of the stocks of clay, sand, gravel and peat. At the same time the Institute of Natural Resources was founded, mainly satisfying the needs of companies.

By 1940, when Estonia was occupied by the Soviet Union there existed a developed organization for applied geological exploration. These investigations were simultaneously employed for developing fundamental science both in paleontology and stratigraphy. The results of J. Reinvald's study on Kaali meteorite crater can also be considered to belong to the fundamental science. Many results of that kind were appreciated abroad, too. The fact that Professor A. Öpik, after his emigration into Australia, became there a recognized leader of geological exploration attests the high abilities of Estonian scientists. P. Kents and A. A. Linari-Linholm [13] also belonged to highly valued specialists of the world-wide scale.

Under the Soviet regime the work continued in the same manner at first but some rearrangements were also made. Trusting the government's promises, grandiose plans for scientific research were made and expensive equipment were ordered. At the same time an essential increase in oil shale output was demanded from industry. As the existing poor equipment could not enable to meet these demands, an arrestment of both scientists and engineers began. They were deported to Siberia to work in the woods.

When Germans reached Estonia in the course of the World War II, they also paid much attention to oil shale as a strategic raw material. The whole oil shale industry was subordinated to *Baltische Öl Gesellschaft m.b.H.* whose administration situated in Berlin with an office in Tallinn. Leading positions belonged mainly to the Germans. One of them, mining engineer Kurt von Middendorf, had worked in the Kiviõli mine before the war. In mines and in oil industry some Estonians and Ukrainians were engaged as the heads. In mines there worked both the previous miners and Russian prisoners of war. The output was forced by intensifying the work in old mines and constructing new ones. The latter remained half-finished.

The mines were operated till Germans' retreat from the oil shale basin. Almost all Estonian mining specialists and a lot of skilled labour departed together with Germans as they remembered the deportation in 1941 and were afraid of another one. Only some older people with tsarist time education like Prof. J. Kark, J. Aarmann, O. Vuht stayed here. The people who migrated to the West found a job and recognition in the new residence states. One stage of the Estonian mining history, the period of its foundation, had come to the end.

The Estonian mining specialists of the first generation, both engineers and technicians, were educated in Russia, Germany and England, and at the beginning their number was sufficient. The demand for new specialists arose during the rapid development of mining industry when the older ones began to retire. To solve this problem in 1932 the Virumaa School of Mining was opened in Jõhvi. Both skilled labour and foremen were taught there [12].

In 1938 the mining department for educating mining engineers was opened at Tallinn Technical University. The breakout of the World War II did not allow the students to graduate from the University in time. Many of them were mobilized by armies of one or the other side. During the war only five engineers succeeded in graduating but even they left for the West. From lecturers, only Professor J. Kark stayed in Estonia. Only a few students returned from the war to continue their study. They succeeded in maintaining the traditions of Estonian mining engineers and in foundation of a new generation of specialists, able to take over the management of the Estonian post-war mining industry.

The further, quite contradictory development of Estonian mining industry under the Soviet regime and economy is worth of discussing in a separate paper.

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