

Reformatory potential of the mine engineering education in the Russia history of the post-reform period

Vladimir Georgiyevich Afanasyev, Irina Valeryevna Voloshinova, Anton Borisovich Mokeev and Sergey Igorevich Podolsky

National Mineral Resources University (University of mines), 21st line 2, 199106, Vasilyevsky Island, Saint-Petersburg, Russia

Abstract. The period between the 80th years of the XIX century and the early XX century is considered to be the time of explosive development of different industry sectors in Russia, especially mountain profile – the coal and oil production, and metallurgy. This growth has necessitated an increase in qualified engineering personnel within these sectors of economy, though in Russia there was only one higher educational institution of mountain profile – the Capital Mining Institute. Transformations in the sphere of higher mining education are considered by the example of the main activity of the Mining Institute Directors during the post-reform period.

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Introduction

The last decades of the XIX century are considered to be the time of a new qualitative breakthrough in the world history. This time is characterized by the extension of the subsoil exploitation, the discovery of new mineral deposits, involvement in the world economic relations of the new, previously untouched territories. In all the leading countries of the world there appear geological services, and new systematic geological exploration works. A significant event for Russia was the creation of the Geological Committee [1] in 1882, which became the centre of the geology study in Russia. Naturally, the main consideration was given to the search for minerals for production development and enforcement forces. In this regard, the emphasis was laid on the organization of mountain formation, which task was to provide the explosively developing industries with the qualified professionals. Meanwhile, there were used not only our own knowledge and achievements, but also the experience of other countries, who managed to succeed in this sphere. Within the frame of multiple visits and internships, there was performed a knowledge exchange between the domestic and foreign specialists, and that eventually turned into the desired tradition that united many educational institutions in different countries [2]. This underlines the relevance of the topic and the interest in it not only of the domestic, but also of the foreign researchers [3].

The main part

During the 1881-1903 years, the St. Petersburg Mining Institute was headed by 5 Directors, who were united by common goals and interests. [4] First, three of them Erofeev V.G., Meller V.I., and Laguzen I.I. were Professors, Heads of the

Palaeontology Department - geological science, which in the late XIX century experienced a rapid growth. The significance of palaeontology could be witnessed by the fact that there was founded the Paleontological Society in Russia in 1916, which in 1973 was passed to the system of the Academy of Sciences, as well as the fact that the Palaeontology Department in the Mining Institute for a long time worked as an independent one. Secondly, Vorontsov N.V. and Iossa N.A. were metallurgists. This industry also experienced an explosive growth due to the sharply increased demand in metal conditioned by the rapid development of the machine building, shipbuilding and railway construction.

Geologist and palaeontologist, a mining engineer Vasily Georgiyevich Erofeev began working at the Mining Institute as a tutor in palaeontology in 1842. His first independent research work was the classification and description of the paleontological collections of the Mining Museum. In order the students could better comprehend the paleontological material, Erofeev created a training collection, which main feature resided in its visibility. In 1845 in England there was published a "Geognostics map of European Russia" by R. Murchison, which for several years was the main textbook for the geology classes, and Erofeev combined the geological map with the paleontological illustration of individual systems. He located fossils on the colour plates, painted into the representative colours of the R.I. Murchison's geological map. It was an innovative method of organic combination of palaeontology and a geologic map, which was then used in different countries [5].

After his foreign training, Erofeev continued to teach palaeontology at the Institute of the Mining Engineers Corps. Soon, he was awarded by the

Professor title. V.G. Erofeev was actively involved in the development of the new Mining Institute Statute, which was supposed to determine the inner row and disintegrations of the learning process of the Institute, to identify for the coming years the status of educational institutions. Erofeev categorically opposed to the Mining Institute teaching only highly technical disciplines, as this would lead to virtually closure of the Mining Institute as a higher education institution. Erofeev's opinion was taken into account. The new Statute entered into force in 1866, and this date is considered by the historians of the Mining Institute not least memorable than 1773 - the year of formation of this higher education institution [6]. After the adoption of the new Statute in 1866, Erofeev headed the Department of Palaeontology. He creates the first textbook of palaeontology - "Fossil Mollusks", which not only was the only textbook for students, but also served as a guide to many engineers in their practical activity. Since 1873 he worked in the Mining department, studied the prospects for certain types of mineral resources a number of Russian gubernias, studied geological structure of Samara, Simbirsk, Kazan and Novgorod gubernias. Regarding the outcomes of his work, there were compiled spreadsheets of geological rocks for these areas. The greatest recognition was rewarded to Erofeev's contribution to the discovery of rock salt deposits in the Slavo-Bakmutskaya salt-field in the southern Russia within the Donbas area [7].

Erofeev was a member of many scientific societies and institutions. Within a few years he took an active part in the work of the Russian Geographical community, was a member of the French Geological Society, an honorary member of the Russian Mineralogical Society. In August 1881 V.G. Erofeev was appointed for the position of the Principal of the Mining Institute. In addition, from the year 1882 to 1884 (before his death), he successfully combined this work with the position of Director of the Geological Committee that from that time until the present days has been an exception to the rule [8].

In 1885 the position of the Mining Institute Principal was taken by a world famous metallurgical engineer, a graduate of the Mining Institute, Nikolay Vasilievich Vorontsov. Since 1871 Vorontsov ruled the "Perm cannon plants" enterprise and was the founder of a steam hammer, which 50-ton upper striker's impact force was 10 thousand pounds. This was the largest at that time, worldwide known "King Hammer". It was designed and produced in 1875 at the Perm steel cannon factory. For his achievements in the field of metallurgy, for the hammer project, Vorontsov at the Vienna exhibition was awarded the "Cooperation Medals", which was specially intended for the outstanding inventors whose contributions to

science and technology were ranked as world heritage [9].

In 1870 Vorontsov headed the rail-rolling and mechanical Putilov factory in St. Petersburg for its modernization. Technological progress of such enterprises reflected mainly in two indicators: the blast furnaces capacity increased, the old methods of iron production were replaced by Martin furnaces. During the time of Vorontsov managing, at the factory there were erected six Martin furnaces and two Perno ovens, which at that time were a novelty in metallurgy, there was also built a Bessemer factory for two converters. By his initiative the territory of the factory was belted by the network of narrow-gauge steam driveways connecting the workshops. At the same time the factory was connected by a special branch with the railway line, providing marketing of its products. Finally the Putilov factory became the best of steelmaking and rail-rolling factories in Russia [10].

On January 14, 1885 he was appointed as a principal of the Mining Institute with leaving his previous positions. In 1889, Vorontsov introduced the new educational programme, contributing more practical knowledge provision for the Institute students. There was introduced the teaching of mechanical technology and oilfield industry. Students created projects on mechanics, the art of building, metallurgy and mining, and attended the geological excursions, visited factories and mines, carried out a geodesic shooting.

Development of the mining industry in Russia was extremely prevented by the weak development of the railway network, and metallurgical and mining Ural was cut off this region almost to the end of the XIX century, which significantly increased the cost of its products. Being a principle of the Mining Institute, Vorontsov didn't leave his production activities. He designed several mining and metallurgical railways, examined Baskunchaksky salt carrying railroad, conducted research on the connection of commercial road of the Donetsk coal basin with the iron ore of Krivoy Rog [11]. Built by Vorontsov narrow-gauge railways in the factories, which he personally managed, as well as developed by him projects showed their profitability for industrial development.

Since 1893 in Russia began an unprecedented industrial growth. It covered primarily ferrous metallurgy and mechanical engineering - those industries that receive government support. It was then, when there was finally formed a complex of heavy industries in the south of Russia (on the border of the Great Russian and Ukrainian gubernias). The new machine building plants were built in St. Petersburg, Moscow and Moscow suburbs. There started the development of oil fields within the Grozny area. In all these activities there actively participated a lot of

mining engineers – the graduates of the Mining Institute.

After the sudden death of N.V. Vorontsov in 1893, as a new principal of the institute there was assigned Valerian Ivanovich Meller. The most important achievements in science made by Moller were widely recognized. First of all, those were the guides for different geological expeditions in the Urals, which made it possible to make detailed geological maps of the region. In 1885, there was discovered a large Bazenovskoe asbestos deposit on the eastern slope of the Middle Urals (development since 1889). There begins the production of manganese ore (Sapalskoe field, 1880; Marsyatskoe field, 1896). Since 1900 there started the development of the Satkinskaya group of magnesite deposits on the western slope of the Southern Urals. In 1888 there was discovered the Degtyarskoye deposit of copper ore. There were also developed several deposits of construction and facing stone.

The international activities of Moller as a representative of Russia in the first two International Geological Congress in 1878 in Paris and in 1881 in Bologna were very fruitful, where he was elected as a vice - president of the Congress. It is noteworthy that the contacts with foreign colleagues ensured him that in Russia, with its scales there is needed a single Geological Survey. This belief led to the fact that together with G.P. Gelmersen , V.G. Erofeev, G.D. Romanovsky, A.P. Karpinsky, and other reputable scientists, he became one of the founders of the Geological Committee of Russia in 1882.

As for his work as a principle, here we shall pay attention to the continuity of what was started by N.V. Vorontsov and was reflected in the "Regulations on the Mining Institute", approved by the order of Nicholay II on March 18, 1896. The Institute continued to be a public institution of higher education, having its main aim in education of mining engineers [12]. Of particular significance there was the inclusion in the list of compulsory subjects of the mechanical mineral processing course, the expansion of the Construction art course from foundries to civil engineering structures, as well as the oil business and electrical engineering. Unlike the Statute of 1866, with the approval of the Minister, there was allowed for students to have lectures on subjects unrelated to mining engineering. In 1900, Meller for health reasons resigned and, according to academician A.P. Karpinski, who knew him perfectly well, "becoming more and more isolated, he conducted recently completely secluded life, overshadowed by family losses and serious illness" [13]. He died on June 4, 1910.

The next after V.I. Meller, who took the position of the palaeontology department head, was Laguzen Iosif Ivanovich, who became the principal of

the Mining Institute in 1901. The first research work of Laguzen about the new type of corals from the Upper Silurian formations of Estlianskaya gubernia was published by the Imperial Mineralogical Society in 1867. Laguzen began his career after he obtained the position in the Institute museum [14]. He practically studied Jurassic and Cretaceous sediments of Simbirsk Volga region. His researches formed the basis for the dissertation. In May 1874, in accordance with the decision of the Minister of State Property, Laguzen was confirmed as an associate in the department of palaeontology, and in 1885 he was elected as a professor. In 1895-1897 he published the first to be written in Russian language "Short Course of Palaeontology," which served as a reference book and a guide in determining the fossils found in Russia [15].

A significant contribution to the development of this industry in Russia was made by the principal of the Mining Institute (1900-1901), a metallurgical engineer Nikolai Aleksandrovich Iossa (1845-1916). Being born in the Urals, has successfully graduated from the Mining Institute as a young man, conducted a series of experiments with high-grade steel, performed multiple trips abroad - in 1870 to Germany, and in 1876 to the USA to the international exhibition in Philadelphia as an expert metallurgist. Later, since 1882 N.A. Iossa performed governmental orders, leaving for the Altai, where he was able to establish the smelting of silver, copper and lead in local factories [16]. In addition to expertise and engineering works, Iossa became the teacher: since 1882 he was the professor of the Mining and Technological Institutions. His authority is strengthened by his occupation as a chairman of the chemical engineering department of the Imperial Russian Technical Society. In this position he is remembered as the head of the Steering Committee of the Exhibition of objects and light oil production at the turn of the 1887-1888 years [17]. It is not surprising that in January 1900 he headed the Mountain Institute. However, this post became for him like a stage for leading in the same year the Mining Department of the Ministry of State Property and Agriculture, which he managed until 1907. In this position N.A. Iossi acted as a major administrator: he organized exploitation of the Suchan mines in the Far East, has developed the measures to improve the manufacture of tools in Perm on the cannon factories, he helped to solve manufacturing problems in the Georgian Chiatura on the manganese and quartz mines. In addition, in 1910 he created and headed the Russian Metallurgical Society. N.A. Iossi understood the importance of addressing not only the technical development tasks, but also the social status of the mining and metallurgical workers. With his active participation in the crisis period of the early XX

century, the mining legislation was amended with the significant additions: there were added provision for occupational diseases and securing for state-owned factories miners in any case of disability; besides, there was improved the work of schools within the mining sector [18].

Conclusion

The Mining Institute, the largest educational institution of the capital, for a long time has been the only professionals training centre for transforming the mining and manufacturing industry in Russia. This fact is recognized not only by domestic, but also by foreign researchers [19]. It was also a "testing ground" for testing the new concepts in the rock formations that were gradually introduced into other regions of the country and were practically applied during the production process. The scientific and educational work of the Mining Institute principals is a good example of how productively and dynamically there were developing in Russia in the late XIX - early XX centuries different industries, such as geology and metallurgy. Their activity has greatly expanded knowledge of these industry sectors, and pedagogical talent allowed further educating a whole galaxy of scientists, known around the world. All these became possible taking into account the combination of scientific and practical activity of the leaders in addressing not only current but also future tasks [20]. A position of the Mining Institute's principal was a springboard for a number of leaders of the mining industry that later became major industrial administrators. Modern British and American historians believe that the active modernization of the mining industry was an obligatory condition for industrial growth enforcement in Russia, which largely occurred in the 1880s and at the beginning of the XX century. This was surely to be contributed by the development of mining education in Russia [21].

Findings

Conversion of the mining industry, as one of the locomotives of Russian industry, could not be possible without the active policy pursued by mining engineers, graduates of the Mining Institute and its principals.

Scientific and practical activity of the Mining Institute leaders contributed to the re-equipment of the mining and technical industry, construction of the new production capacities, and implementation of social protection for the mining sector workers.

Corresponding Author:

Dr. Afanasyev Vladimir Georgiyevich

National Mineral Resources University (University of mines), 21st line 2, 199106, Vasilyevsky Island, Saint-Petersburg, Russia

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