The study of the North of Russia by the scientific community of the late 19th – early 20th century

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Abstract. The article presents the history of scientific research in the North of Russia. The scientific community regarded the European North of Russia as an important strategic and economically promising region. The researchers concerned about the problems of economic development of natural resources of the North have focused their attention on the European North of Russia since the 18th century. The article considers the period of the formation of scientific research and the early stage of development of scientific research in the North. It is shown that description and exploration of the territories rich in natural resources contributed to the development of both fundamental geological and geophysical research and the development of applied research trends that assisted the substantiation of the industrial prospects of the northern territories. However, the extremely unfavorable transport conditions of the northern territories interfered with the use of the identified natural resources. This territory had stayed poorly studied until the 20th century. It has been determined that the continuation of scientific research became one of the important aspects of public policy in the North. The results of scientific research were necessary both for the development of transport and for making strategic decisions, as well as for general economic growth and the study of the natural opportunities for the development of the northern economy. The activities of the scientific community became a determining factor in the subsequent industrial development of the northern territories.

1. Economic and geopolitical interests of the country

The north of Russia is one of the most important geopolitical and strategic regions. It has attracted the attention of researchers since the Middle Ages. The enormous natural resources of the European North attracted both Russian and foreign ruling circles, researchers, and enterprising people. Assumptions about the endless reserves of oil, gas, coal, gold, diamonds, and other mineral resources hidden in the subsoil of the North stimulated the development of these territories, primarily for economic reasons. The interests of the Russian authorities, who needed to get a better idea of the economic activities of the local population, the possibilities of taxation, and, above all, the natural resources of the northern subsoil stimulated the study of the North.

The research of the North was also connected with the tasks of protecting national sovereignty and resolving the controversial problems of international relations regarding the belonging of the Arctic seas and northern island territories to Russia. The history of studying the resources of the North of Russia reflects the processes of political development and economic growth of the country. Active development of this area was stimulated by wars. The inability to develop production and create an effective army
without knowledge of the country's natural resources stimulated scientific research, organizational and administrative transformations [1].

The scientific study of the natural resources of Russia has been the main direction of work of the Academy of Sciences during its history. Its first expedition led by the astronomer Louis de l'Isle de la Croyère in 1727-1730 was aimed at clarifying the geographical relief of the northern territories and comparing them with the data of old maps. He visited Arkhangelsk, the islands of Kildin, crossed the Kola Peninsula twice and made the simplest latitudinal definitions of geographical points. Then followed the expedition of 1765 to the Barents Sea, led by V.Ya. Chichagov, and long-term studies of Karelia, the White Sea and its coast by I.I. Lepekhin, N.Ya. Ozeretskovsky, E.G. Laxman, P.B. Inohodtsev and others. One of the first works on the problems of economic development of the natural resources of the North belongs to M.V. Lomonosov [2].

At the end of the 18th – 19th centuries, famous economists A. Smith, D. Ricardo, D.F. Liszt, J.F. Bray, K. Marx, F. Engels widely used the economic concept of “productive forces” in their writings. In Russia, the statistician economist L.V. Tengoborsky was the first who addressed the question of the use of the natural resources and their study in the mid-19th century. He noted that the power and financial prosperity of the country depends on the productive forces that the country possesses. A comprehensive assessment, accounting and unification of the productive forces owned by Russia is necessary for such a vast state. For the North, he determined that cultivated land and meadows occupy 2% of the entire surface in this territory. This is not enough even to supply the small population with food. Here the soil is infertile, and its processing is difficult due to the severity of the climate. Forests, which occupy almost three fifths of the entire surface, make up the country's main wealth [3]. Such an essay written by a Russian economist was not accidental and reflected the involvement of Russia in the ongoing political and economic processes. To a large extent this publication had been predetermined by previous studies. It seems that after the publication of the monograph by L.V. Tengoborsky, no major theoretical studies on the problems of productive forces in Russia appeared until the 20th century. The studies became practically-oriented, when the scientists started the identification and description of the natural resources, as well as research into ethnography of the vast territories of the Kola Peninsula, the Pechora region and the Northern Urals.

2. From naturalistic trips to scientific expeditions

The first scientific descriptions of the orography of the Bolshezemelskaya tundra, ethnographic notes about the Mezen Nenets and the grammar of the Samoyed language appeared after the missionary visits of Archimandrite Veniamin (Smirnov) in 1826–1828. In 1837, the scientific expedition led by the Academician Karl Ernst von Baer was engaged in the study of the flora and fauna of the continental and coastal zone of the Arctic archipelago Novaya Zemlya [4]. In the same year, a scientific trip to the Northeast of the European part of Russia was carried out by a graduate of the University of Dorpat, Ph.D., A.I. Schrenk. Having collected a large amount of materials on ethnography, botany, zoology, mineralogy, etc., he described his route in detail. This description served as the only source of information about the Bolshezemelskaya tundra for a long time [5]. The first scientific expedition of the young geologist A.A. Keyserling in 1843 carried out geological and paleontological studies important for geological mapping of the Pechora region, and made a scientific description of the promising industrialized oil-bearing Ukhta region and the Timan Ridge [6]. Later, other researchers who studied the North of European part of Russia in the 19th century, i.e. E. Hoffmann (1847–1850), V.A. Islavin (1844), M. Castren (1841-1843), S. Maximov (1856–1857), A. Stuckenberg (1874), and others, only touched upon the western, southern, and partly eastern borders of the tundra, leaving its central part unexplored. However, this was the beginning of the studies. The scientific community started the investigation of the Arctic territories of Russia.

In 1882, the Geological Committee was established by a decree of Emperor Alexander III. Its objective was to study the structure of the subsoil and to construct geological maps of the country. Academician A.P. Karpinsky was its director for a long time. The maps for almost a fourth of the European part of Russia were constructed during the first 10 years of the work of the Geological
Committee. Also, the coalfield of the Donets Basin, the oil region of the Caucasus, and the gold-bearing regions of Siberia, most important for the industry, were investigated. The European North of Russia entered the program of systematic study of the geological structure of the country and the mineral resources of its subsoil. The geological description of the territory, mapping, and the study of mineral resources started. Later academician F.N. Chernyshev noted that the Russian geological science had risen to the level of science in Western Europe and America due to these investigations.

In 1887–1889, a geological expedition under the guidance of a world-famous geologist Prof. Evgraf Stepanovich Fedorov (1853–1919) conducted research in the southern part of the Pechora Urals. The expedition carried out research of the previously unexplored basins of the rivers Podcherem, Shchugor and of the upper Pechora. During the expedition, descriptions of the encountered rocks were made, the first geological map of the area was constructed with the described deposits being associated with the terrain, the heights of the main peaks were determined, astronomical points were established that served as the coordinate basis for topographic maps, and coal finds were denoted. Repeated crossing of the Northern Urals from the eastern to the western foothill of the ridge allowed E.S. Fedorov to see the full range of rocks. The leading Russian geologists A.P. Karpinsky, F.N. Chernyshev, and others took part in processing the materials of the expedition. The summary of the materials on the geology of the region was published in 1890 [7].

Intensive research started with direct participation and leadership of F.N. Chernyshev. The first comprehensive expedition to explore the Pechora region took place in 1889–1890 with the participation of astronomer O.A. Baklund, topographer D.S. Sergeev, mining engineer N.O. Lebedev, and ethnographer F.I Istomin. The minerals of the foothills of the Timan Ridge were explored and described, the prospects of the Ukhta oil region were substantiated, and a ten-verst (десятиверстная) geological map was constructed and published. As a result of the expedition F.N. Chernyshev noted that “the vast space in the north of Russia had to be explored for the first time, and this happened in those parts of the Timan Ridge that seem the most mysterious for anyone who has carefully read the literature” [8].

Assessing the role of the productive forces of the North, he came to the conclusion that the North of Russia should cease to be a “steppe” in science while serious scientific research should be carried out. The research of the territory intensified significantly in the 20th century.

In 1901–1902, the geologist N.N. Tikhonovich discovered the radioactivity of oil during the exploratory search for oil in Ukhta. Academician V.I. Vernadsky became interested in this discovery. In 1902–1904, asphaltites were found in the basin of the river Izhma and the stratigraphy of the region was specified during an expedition led by A.P. Pavlov. In 1903, Academician F.N Chernyshev organized an expedition to the Ukhta region for geological surveying. In the same year A.V. Zhuravsky explored the northwestern part of Bolshaya Zemlya and went on a trip deep into the tundra. In 1904, he described the basin of the river Adzva together with D. D. Rudnev [9]; in 1905, he explored the island Matveyev and the watershed between the rivers Adzva and Haudepodera together with M.N. Shparberg; in 1907, he conducted geological surveying of the river Kolva [10]. In 1909, mining engineer M.M. Kruglovsky conducted geological surveys on behalf of the Imperial St. Petersburg Mineralogical Society at the southern border of the Bolshezemelskaya tundra. In 1909–1910, N.A. Kulik, an employee of the Geological and Mineralogical Museums of the Academy of Sciences, participated in the North Pechora expedition of the Main Directorate for Land Management and Agriculture to study and survey the geology of the basin of the river Adzva. At the same time, the study of deer husbandry, vegetation, and the orography of the Bolshezemelskaya tundra was carried out by S.V. Kerzelli [11].

In 1910, N.A. Kulik went on a second trip to the Bolshezemelskaya tundra in order to determine the geological structure of its eastern part. Crossing the tundra in a northwest direction, he reached Vashutkin Lakes and further descended down the river Adzva. According to the materials of this route and the data gathered by A.V. Zhuravsky, Kulik determined that “between the reach of the middle Adzva and the upper reaches of Bolshaya Syn there is a low (up to 211 m), distinct wooden ridge, stretching for 300 km, almost parallel to the Urals”. N.A. Kulik called it the Chernyshev Ridge [12]. Since 1913, N.A. Kulik regularly conducted research in the river basins of the Vychegda, Usa, Malaya Usa, Bolshaya Usa, Yelets, and Sob. Since the 1930s, as a researcher of the Geological Institute and the Arctic Institute
of the USSR Academy of Sciences, he carried out research in the Arctic territories (Vaigach Island, Amderta, Yugorski Shar).

At that time the Kola Peninsula, which, according to preliminary data, possessed minerals and rocks of high technical importance (apatite, nepheline, urtite, etc.) opened opportunities for the researchers of the productive forces of the country. The Kola Peninsula stayed undeveloped industrially until the 20th century. There were no roads or communication lines. It stayed a real Terra incognita. Only some brave researchers dared to study this area, but no systematic scientific work was carried out here. All the expeditions undertaken starting from the expedition of Academician K. Baer in 1837–1839 explored either the coastal parts of the peninsula or the route between Kola and Kandalaksha. The central parts of the peninsula were studied poorly. Expeditions of Finnish scientists V. Borg, J. Linden, A. Mela, N. Felman and others to the western part of the peninsula started at the end of the 19th century. The first expedition to the central parts of the peninsula was organized on the initiative of Y. Palmen, the Professor of the University of Helsinki. Its participants, geologists V. Ramsay and V. Hackman, botanists A.O. Kilman (Chilman), mycologist V.F. Brotherus, zoologist Professor Yu. Palmen, entomologists K. Edgren and R. Enwald and others examined the central regions of the Russian Lapland (1887). The Kola Peninsula was a place on the map of Europe that stayed practically unknown to the scientists. Intermittently during 1887–1914 V. Ramsay and his colleagues methodically investigated the terrain, geology, climate, vegetation and wildlife of the peninsula. The study of the Kola alkaline province began with route research in the Lovozero tundra. During two trips the researchers drew up a map of the area. They collected information about geology, petrography, and mineralogy these territories. Their work made it possible to determine the distribution area of nepheline-syenite rocks. The discovery of the nepheline rock on the Cape Turiy was the result of the latest Kola expeditions led by V. Ramsay. He also gave a preliminary description of the nepheline rock. Researchers regret that he became interested in the development of general geological problems, and this forced him to cease the description of minerals and natural resources. But actually his task did not include the search for minerals. The studies of V. Ramsay and V. Hackman had a great influence on the development of petrography. Thanks to their research, the largest nepheline-syenite region of the world became well-known, serving as a starting point for Russian geologists under the guidance of Academician A.E. Fersman in the future [13]. It is necessary to note the expedition of P.B. Rippas in the upper reaches of the rivers Pana and Varzum and the work of B.A. Popov (who discovered the Lovozero iron ore massif and studied the Khibiny massif together with V. Ramsay) in northwestern Lapland among the Russian researchers of the central parts of the Kola Peninsula.

3. Conclusions
Thus, significant data on the relief, natural phenomena, geology of the European North of Russia, and an unusually large variety of minerals were obtained in the first expeditions. But at that time, the obtained data on the concentration of many minerals were so limited that they did not allow to forecast their industrial use. This was especially true for ore and metal minerals. The researchers could predict the reserves of combustible minerals (coal, oil, peat) and building materials (gypsum, limestone, sand, shale, diabase) more precisely. However, the prospects for using the identified natural resources faced extremely unfavorable transport conditions of the northern territories.

The results of the above works had a certain cognitive and scientific value. However, this territory stayed poorly studied until the 20th century. The lack of convenient communication lines and the small population of these outskirts forced the travellers to follow the routes of their predecessors, which resulted in an almost complete lack of information about the orography and geological structure of the vast areas that lay apart from the only natural communication routes, i.e. the rivers.

The interest in the North was associated with the task to use its rich natural resources practically. The seas and subsoil of the North of Russia were extremely promising for the industry. Both scientists and the leadership of the country understood this. In addition to accurate maps this required a comprehensive and thorough examination of this territory in terms of geography, ethnography, economy, households, science and commerce. Marine fishing, animal hunting and fur trade, reindeer husbandry, forestry,
communication lines, and trade were studied insufficiently at that time, which did not make it possible to start the proper organization of industrial development, the development of rational industry and the planning of practical activities.

However, the awareness of the importance of industrial development of the region faced certain natural, geographic and economic obstacles. The continuation of scientific research became one of the most important aspects of state policy in the North. The results of scientific research were necessary both for the development of transport and strategic decisions, as well as for general economic growth, and the study of the natural opportunities for the development of the economy in the North. The study of the mineral resources of the northern regions was continued by the Soviet government.

References
[1] Brovina A 2016 Izvestia of the Komi Science Center, Ural Branch of the Russian Academy of Sciences 3(27) 89-94
[2] Lomonosov M 1847 A brief description of various trips to the northern seas and an indication of a possible passage to Eastern India across the Siberian Ocean; An appendix about northern shipping to the East across the Siberian Ocean (St Petersburg: Marine printing)
[3] Tengoborsky L 1854 On the productive forces of Russia I (Moscow: University printing house)
[4] Solovjev M 1934 Baer on Novaya Zemlya: [Expedition of 1837] (Leningrad: Publishing House and Typography of the USSR Academy of Sciences)
[5] Schrenk A 1855 A journey to the northeast of European Russia across the Samoyed tundra to the northern Ural mountains, undertaken by Alexander Schrenk in 1837 by supreme order (St Petersburg: Printing House of G Trusov)
[6] Keyserling A und Krusenstern P 1846 Wissenschaftliche Beobachtungen auf einer Reise in das Petschora-Land, im Jahre 1843 (St Peterburg: Publishing House of C Kray)
[7] Fedorov E 1890 Mountain magazine II 101
[8] Chernyshev F 1915 Proceedings of the Geological Committee XII 1 2-21
[9] Rudnev D 1905 Proceedings of the Russian Geographical Society 16(3) 571-585
[10] Zhuravsky D 1909 Proceedings of the Imperial Russian Geographical Society XLI 1 197-232
[11] Kerzelli S 1911 Across the Bolshezemelskaya Tundra with nomadic people (Arkhangelsk: Provincial Printing House)
[12] Kulik N 1914 Proceedings Society of Agriculture at Imperial St. Petersburg. University. impression III 20
[13] Duzhilov S 2005 Proceedings of the II Fersman scientific session of the Kola branch of the Russian Mineralogical Society, dedicated to the 140th anniversary of V. Ramsay (Apatity: Publishing House “K & M”) 8-9