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The 300th Anniversary of the Russian Academy of Sciences

Three Centuries of Academic Geography in Russia

A. A. Tishkov*,#

Institute of Geography, Russian Academy of Sciences, Moscow, Russia

**e-mail: tishkov@igras.ru*

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Abstract—Academic geography is one of the most demanding sciences in Russia. Over the 300 years of its development, it has covered a long way: the results obtained in numerous expeditions by generations of researchers contributed to the formation of a single geopolitical space of the country, the liquidation of blanks on the map of Northern Eurasia, and the mobilization of resources for the development of the economy. The academic geography of the 21st century, characterized by features of a worldview science, strives to respond effectively to the most topical modern challenges and to create, based on the latest research methods, the foundations for the future rational spatial development of Russia. This article traces the evolution of ideas, methods, and schools of geography in the Russian Academy of Sciences.

Keywords: academic geography, history of geographical science, academic expeditions of the 18th–20th centuries, geopolitical space of Russia, scientific schools, institutes of geography, topical research trends

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As a matter of fact, until the early 18th century, there was no coherent system of geographical knowledge. At that time, science itself was not yet differentiated enough to track and analyze the evolution of ideas and schools in each of its areas. After the ancient stage with its deep understanding of the then knowledge about the Earth, a significant stagnation occurred in the Middle Ages. The Renaissance gave an impulse to systematize geographical knowledge, to form a scientific methodological apparatus. In the universities that were created in Europe in the 16th–17th centuries, geography came to the fore. The catalyst for the development of earth sciences was the Age of Discovery.

In that era, geographical knowledge about Northern Eurasia grew in parallel with the expansion of the borders of the Russian state. During the reigns of Vasily III and Ivan IV, these interrelated processes peaked [1–4]: the first expeditions to remote regions of the country were organized, the *Prikaz* [Ministry—*Tr.*] of Stone Works was established (1584), and maps of Russia were prepared within its new borders (Decree of Ivan the Terrible of 1552, "Measure the land and make a blueprint for the state....") [5]. The pinnacle of cartography in the 16th century was the Big Drawing for the Entire Muscovite State of 1598–1600.

At the beginning of the Petrine reforms in Russia, the *Prikaz* of Mining Affairs was established (1700), and later the Berg-Collegium (Collegium of Mining) (1718), which was responsible for the development of the mining industry. In 1701, the School of Mathematical and Navigational Sciences was opened in Moscow, which operated under the control of the Armory, the Navy *Prikaz*, and the Admiralty Office. The year 1701 is significant, among other things, for the preparation of the unique map "Drawing of all Siberian cities and lands" by S.U. Remezov [6]. An important achievement of that period was the creation of a map of the Caspian Sea in 1720 by F.I. Saimonov, an associate of Peter the Great, and K.P. van Verden, which Peter presented to the French Academy of Sciences during his visit to Paris in 1721.

As soon as the Academy of Sciences, established in 1724, began working, the domestic school of earth sciences (works by I.P. Kirillov, V.N. Tatishchev, and M.V. Lomonosov played a great role in its development) was formed as a knowledge system largely targeted at solving practical problems [3, 4]. While in the countries of Western Europe these sciences focused on the goals of colonization, maritime navigation, and foreign trade, in Russia they were oriented to solving the problems of settling the world's largest Eurasian land mass—from the Baltic Sea to the Pacific Ocean—and to developing the economy of the Urals, Siberia, and Transbaikalia.

The formation of Russian statehood is inextricably linked with the geographical factor, which contributed

RAS Corresponding Member Arkadii Aleksandrovich Tishkov is Chief Researcher and Head of the Laboratory of Biogeography at the RAS Institute of Geography.

to the demand for achievements of domestic academic geography throughout all 300 years of its history. As early as the 18th century, this science became *creative*, actively participating in consolidating the position of the state in the Arctic, the Far East, Siberia, Central Asia, and the Black Sea region. In the 19th century, its mission was continued by the works of P.P. Semenov-Tyan-Shanskii and then V.V. Dokuchaev and his students, primarily V.I. Vernadsky. By the end of the 19th century, geography became *mobilizing*, helping the country in the development of spaces and natural resources. It preserved these qualities in the first half of the 20th century, contributing to the victory in the Great Patriotic War and the postwar restoration of the economy. Against the backdrop of economic tasks that had to be solved in the second half of the 20th century, geography acquired *constructive* features, when spatial understanding of the country's socioeconomic development and the formation of scientific foundations for environmental protection and rational nature management were put at the forefront [7, 8].

By the late 20th–early 21st century, academic geography started to change the paradigm of its development, especially in relation to practice. Given the revolutionary nature of updating the methodology of geography and the widespread use of remote, computer, and geoinformation technologies, it becomes innovative and digital. The development of the Internet space and information resources one way or another associated with geography, as well as the postmodern effect of the "universal geographization of the population" (the ability to obtain data quickly on countries, climate, nature, and population using gadgets), contributes to endowing academic geography of the 21st century an expert function for verifying forecasts of world change. Modern geography unites almost 100 independent scientific disciplines; it is impossible not only to cover but even to list them all in a journal article.

Let us note two key episodes that played a crucial role in the development of Russian geographical science: the creation in 1739 of the Geographical Department at the Academy of Sciences under the leadership of Academician Lomonosov and the organization in 1915 by Academician Vernadsky of the Commission for the Study of the Natural Productive Forces (KEPS), which gave rise to the development of almost all areas and academic institutes in the field of earth sciences.

The Geographical Department of the Academy of Sciences, Lomonosov's contribution to the development of geography, and the first academic expeditions. In the 18th century, already within the framework of the St. Petersburg Academy of Sciences, the Russian geographical school was actively developing [2, 3, 8]. Its founder was Kirillov, who headed astronomical, topographic, cartographic, and statistical works in Russia [9]. He was the first to realize the importance of cartography and economic statistics. In 1731, his work *The Blooming Status of the Russian State,* completed four years earlier, was published. It was the first Russian statistical, economic, and politicogeographical description of the country. The scientist devoted a lot of effort to the preparation of the three-volume *Atlas of the All-Russia Empire* but managed to publish in 1734 only the first volume, which included a general map of the entire country and 14 maps of individual regions. Tatishchev, appointed by Peter the Great "to the land surveying of the entire state," divided geography according to Western patterns into general geography, particular geography (description of different countries), and topography (description of individual territories and cities). He created a program for collecting material on the history and geography of Russia, but he himself managed to compile only an introduction to its geographical description and *The General Geographical Description of All Siberia* (1736). Kirillov's *Russian Atlas* was published in 1745 thanks to the efforts of the Academy of Sciences.

An important step in the development of geographical thought was the invitation to the Academy of a young French astronomer and cartographer J.-N. Delisle in 1725. In 1726, he organized the first systematic observations of the weather and auroras in Russia, stood at the origins of the time service, and headed the astronomical work necessary for mapping the territory. In 1728, he also proposed an equidistant conical cartographic projection convenient for the territory of Russia, which is stretched along the parallels, and outlined a plan for creating a network of astronomical stations to construct an accurate map of the country. On Delisle's initiative, the Geographical Department was created at the Academy in 1739. In 1735, the scientist translated *The Atlas of Georgia* by Prince Vakhushti Bagrationi into French, and in 1766 he published a map of Georgia and Armenia in Paris [10].

Lomonosov showed great interest in geography, emphasizing its important role in the life of Russian society. He was engaged in this science and its branches at the Academy from 1747 to 1765; in meteorology, climatology, glaciology, and economic, historical, and polar geography, he is rightfully considered the founder [8]. In 1758, Lomonosov was appointed Director of the Geographical Department of the Academy. He considered the main task in this field to be the subordination of all the work of the department to state interests, which included the creation of a new Russian atlas [10]. The department essentially performed the functions of state administration, including those related to the accounting of natural resources. In 1758, Lomonosov initiated a large-scale (in terms of its scope) "academic questionnaire"—a geographical study of Russia through a general survey, organized a workable apparatus for these purposes, and proposed questions and a methodology for

summarizing materials. The academic questionnaire underlay the origins of demography, statistics, and social and economic geography.[1]

Another area of science owes its development to Lomonosov—polar geography, the study of the northern seas and ice. During all the years of his active work at the Academy, Lomonosov studied the polar regions and the Northern Sea Route with regard to the interests of the development of maritime business and the development of the Far North. His most famous works in this area were *Thoughts on the Origin of Ice Mountains in the Northern Seas* (1761), where he presented the world's first research on glaciology, proposing the division of glaciers into mountain and cover glaciers characteristic of the Arctic archipelagos [11], and *A Brief Description of Various Journeys along the Northern Seas and an Indication of a Possible Passage by the Siberian Ocean to East India* (1763) [8]. Based on the nature of the ice, the presence of driftwood on the shore, and other signs, Lomonosov guessed the features of the Northern Sea Route. In the work of 1763, he also predicted the existence of a continent near the South Pole. Land exploration projects developed by the scientist were largely implemented during the famous academic expeditions of the 1770s [12].

Defining Lomonosov as an outstanding domestic geographer, one should note as his main achievement in this area the development of cartography, the compilation of "land maps," "geographical drawings," "geographical plans" of cities, and the *Russian Atlas*. In this regard, we cannot but mention the activities of P.I. Rychkov, who headed the Geographical Department of the Orenburg Commission, the author of the first atlas of the Orenburg region. In 1759, on the proposal of Lomonosov, he was the first geographer to become a corresponding member of the Academy of Sciences.

Lomonosov considered the territory of the country the main national wealth, and geography, as the science that studies it, a major discipline in the Academy. The foresight of the scientist, who thought about the development of the territories of Siberia and the Arctic and wrote about the need to "multiply the Russian people" as the main goal of the state, was confirmed by the fact that the Academy in the first decades of its existence became the main executor of expeditionary work in the country [10, 12–15].

The First Kamchatka Expedition (1725–1729), led by V.J. Bering, attempted at finding the point "where Asia met America" but failed to achieve this goal. As a result, at Bering's suggestion, the Second Kamchatka, or Great Northern, Expedition (1733–1743) was organized to explore the Russian North "from the Pechora to Chukotka." Work from the Pechora to the Ob' from 1734 was conducted by the Dvina–Ob' Detachment under the command of S.V. Murav'ev and M.S. Pavlov and from the Ob' to the Yenisei, by the Ob'–Yenisei Detachment of D.L. Ovtsyn. The section of the coast between the Yenisei and Lena rivers was assigned to the Lena–Yenisei Detachment of V.V. Pronchishchev, Kh.P. Laptev, and S.I. Chelyuskin. The coast east of the Lena River was explored by the Lena–Kolyma Detachment of P. Lassenius and D.Ya. Laptev. In the Far East, Bering's and A.I. Chirikov's detachments worked. They sought a sea route to North America, while the Southern Detachment of M.P. Spanberg made a description of the Kuril Islands and the way to Japan. As part of the Great Northern Expedition, two land detachments worked: the Academic one of L. de l'Isle, I.G. Gmelin, and G.F. Miller and the Verkhneudinsk–Okhotsk Detachment of P.N. Skobel'tsyn and V.D. Shatilov. The Academic Detachment included Corresponding Members (adjuncts) S.P. Krasheninnikov and G.W. Steller, who explored Kamchatka. The result of their work was the book *Description of the Land of Kamchatka*, published in 1755.

The expedition of Academician P.S. Pallas (1771–1774) to Siberia covered the space from the Ural Mountains to Transbaikalia. Its collections became the basis of the academic Kunstkamera; many of them are kept in the museums of the Russian Academy of Sciences.

From the end of the 18th century, due to lack of funds, the Academy reduced expeditionary activity in the Far East and Siberia. The Russian–American Company came to the fore, which in 1803–1806 sponsored many scientific geographical studies, for example, the first Russian circumnavigation of I.F. Krusenstern and Yu.F. Lisyanskii, during which studies of Kamchatka and Sakhalin were carried out. Since the early 19th century, the vector of scientific interest began to shift to European Russia, which from time to time became a theater of wars involving territorial changes. They required geographical understanding, description, and cartographic support. In 1800, the Geographical Department of the Academy of Sciences was closed [10, 16], and its functions were transferred to the Map Depot (1796–1812), which not only stored the maps but also carried out topographic surveys in the interests of the army and the state.

"Creative geography" of the 19th century: K.I. Arsen'ev, P.P. Semenov-Tyan-Shanskii, and V.V. Dokuchaev. The Academy and traveling geographers. Academic geography as a synthetic science and its individual disciplines in Russia in the 19th century developed under the influence of the ideas of a unified geography of A. Humboldt and C. Ritter and the German geographical school as a whole. Physical geography was

[1] In 1763, Lomonosov proposed compiling an *Economic Lexicon* that would list in alphabetical order all the goods produced in Russia with their description and indication of places and volumes of production and methods of delivery to the buyer in cases where the product was produced for sale. Unfortunately, during his lifetime, this idea of his was not implemented, but the approach itself was later used in economic geography [13].

perceived as "unity in diversity," with the obligatory use of the comparative method. In its bowels, *Erdkunde* (earth science) was forming, which studies the relationship between man and nature. In the 19th century, the formation of Russian geography was largely influenced by the ideas of P.P. Semenov-Tyan-Shanskii, Arsen'ev, and Dokuchaev [17], who significantly developed domestic academic geography and gave it original features.

The creative nature of the national geography of the 19th century manifested itself in the fact that the efforts of geographical researchers contributed to the economic and cultural rapprochement of the peoples of the Russian Empire, the formation of a single geopolitical space from the Baltic Sea to the Pacific Ocean, which grew with the territories of Finland, Poland, the Caucasus and Transcaucasia, the Black Sea coast, Bessarabia, Primorye, the Amur region, Sakhalin, Alaska, Arctic archipelagos, and khanates of Central Asia from 16.0 to 21.8 million square kilometers (1914). In a relatively short time, many geographical discoveries were made through the efforts of members of the Academy, and St. Petersburg became a world center of geographical research [17, 18].

In 1803–1805, the first round-the-world voyage of Krusenstern and Lisyanskii took place. Academicians W.G. Tilesius von Tilenau and G.I. Langsdorf participated in it. In total, about 50 large marine expeditions were organized in the 19th century with the participation of the Academy, during one of which (led by F.F. Bellingshausen and M.P. Lazarev, 1819–1821) Antarctica was discovered [18]. Even more land expeditions, especially to the Arctic, the Far East, North America, and Central Asia, were organized with the participation of the Academy. South America was also studied: in 1821–1828, Academician Langsdorf led a Russian expedition to Brazil. Note also that the geographer Academician F.P. Litke, participant in round-the-world voyages, explorer of the Arctic, and one of the founding fathers of the Russian Geographical Society (RGO), served as President of the Academy of Sciences from 1864 to 1882 and did much to support scientific research in the country.

The results of sea and land expeditions were not only scientific and geographical discoveries. For the Asian, Botanical, Egyptian, Zoological, Ethnographic, and other museums, created in the first half of the 19th century based on the collections of the Kunstkamera, exhibits were brought from all over the world. Museum collections were replenished with collections received during the expeditions of Academician K.M. Baer to Novaya Zemlya (1837) and to Lapland (1840), Academician I.G. Voznesenskii over the Far East and Russian America from Alaska to California (1839–1849), Academician A.F. Middendorf to Eastern Siberia (1842–1845), and Academician N.A. Severtsov to Central Asia (1857–1858).

The outstanding geographer N.M. Przhevalskii, elected an Honorary Member of the Academy of Sciences and awarded a medal with the inscription "The first explorer of the nature of Central Asia," made six expeditions: the Ussuri (1867–1869), the Mongolian (1870–1873), the Lop Nur and Dzungaria (1876–1877), and the 1st and 2nd Tibetan ones (1879–1880 and 1883–1885). Undoubtedly, he was an astute political geographer, foreseeing many border conflicts and development vectors for outlying regions of Russia, state formations of Central Asia, and nuances of relations with China.

The Main Physical Observatory supervised the study of the Russian climate. It was headed by Academician V.Ya. Struve, who made a grade measurement of the meridian arc in the space from the coast of the Arctic Ocean to the Danube Delta ("Struve Geodetic Arc") and obtained data to determine the size of the Earth.

Academician Arsen'ev continued Lomonosov's traditions of economic geography. He headed the Statistics Department of the Ministry of Internal Affairs of Russia and was one of the founders of the Russian Geographical Society and a mentor to the future Emperor Alexander II. His contribution to the development of economic geography and the creation of the Russian system of statistics is so great that our science fed on his ideas until the first third of the 20th century. He proposed several grids of economic zoning reflecting the level of economic development, and his textbook *Brief General Geography* remained the main one in the subject for decades and went through 20 editions [17].

One of the founders and first heads of the Statistics Department of the Russian Geographical Society was Academician P.I. Köppen, a major researcher of population geography, the author of the first "Ethnographic Map of Russia" (1851), and an explorer of the Crimea.

Honorary Member of the Academy since 1873 P.P. Semenov-Tyan-Shanskii successfully combined physical and social geography in his studies. The former is represented by his expeditions of 1856–1857 to the western regions of Central Asia, as well as by the creation of a national school of travel geographers during the period when he headed the Russian Geographical Society (1873–1914). We mean his programs of expeditions of N.N. Mikluho-Maklai, Przhevalskii, G.N. Potanin, A.P. Chekanovskii, I.D. Cherskii, I.V. Mushketov, and P.A. Kropotkin. The contribution of P.P. Semenov-Tyan-Shanskii to the development of Russian social geography manifested itself in his activities as Head of the Central Statistical Commission of the Senate of the Russian Empire in 1863–1885, in the preparation of the five-volume *Geographical and Statistical Dictionary of the Russian Empire* and 11 volumes of the series "Russia: A Complete Geographical Description of Our Fatherland."

An outstanding meteorologist and geographer, one of the founders of geographical climatology, and the creator of agricultural meteorology Professor A.I. Voeikov is not considered a representative of academic science. However, the results of his travels in Europe and North and South America, many years of chairmanship of the Meteorological Commission of the Russian Geographical Society, and scientific works testify to the opposite.

Professor Dokuchaev was not a member of the Academy either, but it is impossible to imagine the development of academic geography in the 19th century without him. He was the founder of Russian soil science and soil geography, an outstanding physical geographer, a researcher of the steppes, and the founder of the doctrine of zoning. Among his students and followers are geologists, geographers, geobotanists, and soil scientists, including members of the Academy of Sciences Vernadsky, N.M. Sibirtsev, G.N. Vysotskii, G.F. Morozov, and G.I. Tanfil'ev.

At the turn of the 19th–20th centuries, Academician Vernadsky, the most outstanding and devoted student of Dokuchaev, laid the foundations for several breakthrough scientific areas of geography. These are not only the doctrine of the biosphere–noosphere, which returns us to unified geography; the idea of space–time; and the doctrine of biogeochemical cycles and the biological circulation of substances—"hematopoietic flows" that connect landscapes and ensure the "spread of life." We owe to Vernadsky the beginnings of the science of the future, which today is based on geoinformation and digital technologies, large volumes of empirical data, global models, and the "carbonocentric" idea of the life triggers of the Earth and its climate. The current generations of geographers should rethink the ideas of the encyclopedic scientist, whose 160th birthday is celebrated in 2023.

Noteworthy is also the formation of a number of geographical disciplines. Thus, Kropotkin (the famous revolutionary anarchist and scientific encyclopedist), who, when in the Peter and Paul Fortress prison, had written the work *On the Ice Age* back in 1874, and the geologist I.D. Lukashevich, who in 1911–1915 put forward a hypothesis about the relationship of glaciation with mountain-building processes, stood at the cradle of domestic paleography. Domestic biogeography in the 19th century developed under the influence of the ideas of Academician Severtsov and his student Academician M.A. Menzbir, an outstanding zoogeographer and Rector of Moscow State University in 1917–1919, as well as a student of Dokuchaev Professor N.A. Krasnov, the first doctor of science in Russian geography (1894).

Domestic geographical climatology and hydrology was formed not only by Voeikov's works but also by those of Corresponding Member of the Academy of Sciences, geographer and cartographer Lieutenant General A.A. Tillo. He explored the upper reaches of Russian rivers (*Catalogue of the Heads of Russian Rivers*) and compiled an atlas *The Distribution of Atmospheric Pressure in the Space of the Russian Empire and the Asian Continent*.

Outstanding geographers participated in the development of Russian geomorphology. Kropotkin substantiated the glacial theory, created the first orography scheme for Eastern Siberia, and revealed the volcanic origin of the relief. Cartographer Lieutenant General of the General Staff I.I. Khodz'ko initiated the Greater Caucasian triangulation.[2] In 1895, the founder of "university geography" Academician D.N. Anuchin published the fundamental work *The Relief of the Surface of European Russia in the Consistent Development of Ideas about It*.

Ecological and environmental areas of academic geography were also forming. Dokuchaev himself paid great attention to the problems of soil fertility, the conservation of steppes and chernozems, and the fight against erosion. His students Vysotskii, Morozov, Tanfil'ev, and V.N. Sukachev laid the foundations for territorial nature protection, and Academician I.P. Borodin—the initiator of nature conservation in Russia, Director of the Botanical Museum of the Academy (since 1912), the founder of the Standing Environmental Commission of the Russian Geographical Society—became its leader [19]. Many representatives of academic geography participated in the work of this commission, and in October 1917 V.P. Semenov-Tyan-Shanskii presented to the Academic Council of the Russian Geographical Society the first draft to create a geographical network of natural reserves On Typical Areas in Which It Is Necessary to Organize Reserves on the Model of American National Parks.

V.I. Lenin's memo to the Academy of Sciences, the GOELRO Plan, and academic expeditions of the 1920s–1930s. The first years after the revolution of 1917 turned out to be rich in events for academic geography. In 1918, in his memo to the Academy of Sciences "Outline of a Plan for Scientific and Technical Work" [20], Lenin set the goals of the Commission for the Study of the Natural Productive Forces of Russia: the optimal location of industry and the independent supply of the country with all types of resources. The tasks of electrification of Russia (GOELRO Plan) and uniform distribution of production were also set. Neither the Imperial Russian Geographical Society nor the universities could satisfy the need for geographical information, so necessary for a growing economy. Systematic work was required on the geographical description of the country, including the

[2] Triangulation is a method to create a network of control geodetic points, as well as this network itself. It consists in the geodetic construction on the ground of a system of points forming triangles, in which all angles and lengths of some base sides are measured.

regions of new development—the Arctic, Siberia, the Far East, the Caucasus, and Central Asia.

Created in 1921, the State Planning Commission, together with the Academy of Sciences, immediately set about zoning and territorial organization of the country's economy. N.N. Kolosovskii's and N.N. Baranskii's "regional school" of economic geography was forming [17].

Thanks to the activities of KEPS, created by Academician Vernadsky in 1915 (since 1930, the Council for the Study of Productive Forces, SOPS), which united field work on the search for natural resources for the young Soviet republic, academic geography became resource and mobilization geography, focused on solving current problems of the new state [21–23]. The vast expanses of Russia were little studied, and information about its resources was very scarce. Thus, according to Academician I.P. Gerasimov, by the time of the creation of the Institute of Geography in 1918, "more or less accurate maps covered only one-fifth of the area of all of prerevolutionary Russia" [24, p. 25]. The need to eliminate glaring gaps stimulated the rapid development of expeditionary activities of the Academy in 1920–1930.

The early Soviet period of geographical research has been studied quite well [21, 25–27]; expeditionary work was its dominant feature. It was supported by Permanent Secretary of the Academy of Sciences Academician S.F. Oldenburg and Academicians A.E. Fersman and Vernadsky. The recognition of the place of geography in the USSR Academy of Sciences was the election of its first full members in this specialty. In 1935, N.P. Gorbunov—a well-known chemist, Chief Administrator of the Council of People's Commissars of the Russian Soviet Federative Socialist Republic (RSFSR) and then of the Soviet Union (1920–1930), and head of the Soviet–German (1928) and Tajik–Pamir expeditions of the USSR Academy of Sciences (1932–1935)—and O.Yu. Schmidt—the leader of the Arctic expeditions on the icebreakers *Sedov, Sibiryakov*, and *Chelyuskin* and Head of the Main Directorate of the Northern Sea Route in 1932–1938—became academicians. L.S. Berg was elected a corresponding member of the USSR Academy of Sciences in 1928 and Baranskii, in 1939; in the same year, the Director of the Institute of Geography A.A. Grigor'ev became an academician.

In 1929, Fersman summed up the expedition activities of the USSR Academy of Sciences for the decade after the October Revolution [26]. Geographers participated in the KEPS/SOPS expeditions: Northern (1921–1929), North Ural (1924–1928), Kirghiz (1925), Yakut (1925–1930), Gydan (1926–1928), Kolyma–Indigirka (1929–1930), Komi–Pechora (1930), Turkmen (1930), Kola complex (1932–1935), Bashkir complex (1932–1933), South Ural (1933–1934), Far East complex (1933–1934), Kamchatka complex (1934–1937), and others. Another large-scale block of SOPS expeditionary work was carried out from 1939 to 1950. It was associated with the threat of impending war, the need to search for reserves of grain production in southern Siberia and Kazakhstan, and the development of industry in the Urals and Siberia. Its results became the basis for the evacuation of industry at the beginning of the Great Patriotic War to the Urals and Siberia; for the development of virgin lands; and in the late 1940s–early 1950s, for the implementation of Stalin's plan on the transformation of nature. Especially noteworthy are the studies of the SOPS Complex Lower Volga Expedition in the 1930s. It was attended by many prominent geographers, soil scientists, and geobotanists such as Academicians B.A. Keller, B.B. Polynov, L.I. Prasolov, Gerasimov, and V.A. Kovda. The results of the expedition were fundamentally new ideas about the genesis of the Caspian lowland, Caspian marine transgressions, processes of soil formation and soil salinization, and vegetation dynamics on the border of steppes and deserts.

In general, the prewar period of the activity of the geographical institutions of the USSR Academy of Sciences can be considered unprecedented: all major industrial, energy, and transport projects were accompanied by geographical surveys; hundreds of expeditions worked annually in different parts of the country (203 in 1933 alone!). The blanks on the map of the Soviet Union were quickly being erased; the theory and methods of academic geography were actively developing. This period was the peak of the activities of the Polar Commission of the USSR Academy of Sciences with its participation in the study of the Northern Sea Route. The All-Union Geographical Society worked as part of the USSR Academy of Sciences. From 1931 through 1940, it was headed by Academician N.I. Vavilov, and from 1940 through 1952, by Academician Berg.

Expeditionary activities of the Academy in remote regions, in addition to field results, stimulated the development of scientific centers and became a harbinger of the creation of a network of regional geographical institutions in the 1940s. In 1927, the Institute of Geography and Cartography was established in Kharkov; in 1933, on the basis of the Faculty of Geography of Tbilisi University, the Vakhushti Bagrationi Institute of Geography was organized; from 1933, the Institute of Peat (now the Institute of Nature Management of the National Academy of Sciences of Belarus) worked in the Byelorussian Soviet Socialist Republic; and from 1938, the Institute of Geography of the Kazakh Soviet Socialist Republic in Alma-Ata.

The test of war: Russian academic geography in 1939–1945. The role of academic geography in the Great Victory is considered in many publications [28–35]. The years of the Great Patriotic War of 1941–1945 was an important stage in the history of academic geography of the 20th century, which revealed its potential for the rapid deployment of research in war-

time and the high-quality provision of geographical information to the front and rear. As never before, complexity dominated in research and cartographic work, new methods were quickly introduced (interpretation of aerial photographs, operational snow, ice, coastal, and hydrographic surveys), and new sources were used for the analysis and synthesis of information—for example, medium- and large-scale maps. Both physical geographers (future Academicians K.K. Markov and S.V. Kalesnik) and economic geographers (Corresponding Member Baranskii) came up with major generalizations: they prepared manuals on military geography [34].

Academic geography united around the Commission for Scientific Assistance to the Soviet Army under the Division of Geological and Geographical Sciences of the USSR Academy of Sciences, which was headed by Academician Fersman. A number of associates of the Institute of Geography under the leadership of Academician Grigor'ev were evacuated to Alma-Ata. The specialists who remained in Moscow worked under the supervision of Professor V.F. Vasyutin. During the war years, the Cartographic Office of the institute was headed by a graduate of the Academy of the General Staff, a participant in the First World War and the Civil War A.V. Strel'bitskii, who defended his candidate's dissertation on cartographic support for the army in 1944, on the eve of his 70th birthday. On the basis of the institute, in 1941, the Interinstitute Cartographic Group was created, the work of which was led by the future academician Gerasimov. The group was reinforced by associates of other academic institutions. Almost all the numerous initiatives of the Institute of Geography during the Great Patriotic War were developed in the research topics of subsequent decades and made the glory of Russian geography. Thus, the work on the assessment of the arable and pasture stock of Kazakhstan, the southern part of the Urals, and Siberia formed the basis of regional atlases and substantiation of the development of virgin lands. Research on the geography of the population, transportation, and the distribution of productive forces helped to revive certain branches of economic geography that had been in decline before the war. Finally, the experience of medium-scale general geographical and complex thematic mapping, accumulated by the Interinstitute Group, was accepted by both the military and civil services, which allowed the Soviet Union to reach the forefront in cartographic support for the economy and defense.

Under the scientific guidance of the USSR Academy of Sciences, the All-Union Geographical Society worked, which, during the blockade of Leningrad, played an outstanding role in providing the army and rear with maps and military geographical information, including forecasts of the ice situation on Lake Ladoga with its Road of Life [32, 36].

A small group of specialists from the Institute of Geography managed to prepare materials of 250 titles and more than 1300 maps for the needs of the front and rear. Gerasimov's group worked in parallel with the institute's Defense Group, established in February 1942 by order of the Presidium of the USSR Academy of Sciences. It was led by Vasyutin, and its tasks were formulated broadly: military–economic and military–geographical description of territories, special mapping, description of foreign countries, military–climatic work, etc. [35].

Soviet academic geography of the second half of the 20th century and the XXIII International Geographical Congress in 1976, Moscow. For a relatively long period after the Great Patriotic War, Soviet academic geography retained a mobilization character and actively participated in the economic life of the country, first in the postwar restoration of the economy; then in the implementation of Stalin's plan for the transformation of nature (envisaged for 1948–1965 but completed earlier); and in the scientific support of state plans for the development of virgin lands (1954–1962), Siberia, and the Far East. Add to this the development of some areas of economic geography, determined by its demand on the part of agriculture, industry, transport, and services.

The end of the 1940s and the beginning of the 1950s were marked by ideological clashes in academic and university geography. Earlier, such clashes had affected biologists (session of the All-Russia Academy of Agricultural Sciences in 1948) and geologists (extended session of the Scientific Council of the Institute of Geological Sciences of the USSR Academy of Sciences in 1948, the work of the Commission of the Presidium of the USSR Academy of Sciences on assessing the activities of the institute and geological science in general, 1949–1950). In the geographical community, discussions were launched against Academicians Berg and Grigor'ev and a number of associates of the Institute of Geography, who were charged with "the chorological concept of geography," "pseudoscientific theory of interacting factors," "pseudoscientific categories of the landscape and physiographic process." At one of the meetings, Academician Grigor'ev "admitted his mistakes," and the institute's Party Organizer V.S. Preobrazhenskii [37] and Komsomol Organizer V.A. Vityazeva [38] recorded this. Gerasimov became the director of the institute.

The "discussion" also went on in scientific journals, splashing out to the pages of central newspapers, which politicized it even more. In anticipation of the implementation of large-scale state investment plans for the transformation of nature, it was necessary to decide who would provide their scientific and geographical support—the USSR Academy of Sciences or the USSR Hydrometeorological Service. There was every indication that the Academy of Sciences would

win. It was then that the well-known painting by a group of artists led by V.P. Efanov appeared, depicting members of the Presidium of the USSR Academy of Sciences listening to the report of young Gerasimov on the prospects of the Stalin plan for the transformation of nature (the original painting is kept in the Russian Museum, and a copy used to adorn the office of the President of the Academy of Sciences).

The Khrushchev Thaw (1953–1964) and plans for the development of the North, Siberia, and the Far East had a positive effect on the development of academic geography, removed some ideological burdens, and slightly opened the curtain between Soviet geography and Western geography. Books by Western colleagues were actively being translated into Russian. In 1955, the geographers of the USSR Academy of Sciences received an invitation to join the International Geographical Union, and in 1956 they already participated in the XVIII International Geographical Congress in Rio de Janeiro.

A regional network of institutions of academic geography began to take shape. On the basis of the Laboratory of Limnology of the USSR Academy of Sciences in Leningrad, the Institute of Limnology was established. In different years it was headed by Academicians N.M. Strakhov (1944–1945), D.V. Nalivkin (1945–1955), and Kalesnik (1955–1977); Corresponding Member of the USSR Academy of Sciences O.A. Alekin (1977–1982); and Academicians A.F. Treshnikov (1982–1988) and V.A. Rumyantsev (1988–2015). In 1946, the Department of Water Problems of the Karelian–Finnish Research Center of the USSR Academy of Sciences was organized in Petrozavodsk, and on its basis in 1991, the Northern Water Problems Institute under the RAS Karelian Research Center, which made a significant contribution to the study of surface waters of the European North. Its organizer and first director was RAS Corresponding Member N.N. Filatov (from 1991 through 2016).

In 1957, during the period of active development of Siberia, the Institute of Geography of Siberia and the Far East (later the Institute of Geography of the Siberian Branch of the USSR Academy of Sciences) was established. Academician Gerasimov was its organizing director (1957–1959), and the first director was Academician V.B. Sochava (1959–1976). Over the years, the Institute was headed by Academician V.V. Vorob'ev (1976–2000) and RAS Corresponding Members V.A. Snytko (2001–2005) and A.N. Antipov (2005–2009). In 1991, the Baikal Institute of Nature Management, SB RAS, was established in Ulan-Ude (Director Academician A.K. Tulokhonov (1991–2013); since 2013, RAS Corresponding Member E.Zh. Garmaev).

In 1968, on the basis of a group of laboratories that were part of the Far East Division, Siberian Branch, USSR Academy of Sciences, the Khabarovsk Integrated Research Institute was established (since 1988, the Institute of Water and Environmental Problems), the founder and first director of which was Corresponding Member A.S. Khomentovskii (1968–1970). Later it was headed by Academician Yu.A. Kosygin (1970–1971), Corresponding Members P.G. Bunich (1971–1973) and M.K. Babushkin (1973–1986), Academician I.P. Druzhinin (1987–1996), and RAS Corresponding Member B.A. Voronov (1996–2019). In 1971, by a decree of the Presidium of the USSR Academy of Sciences, a third institute of geography east of the Urals was established, the Pacific Geographical Institute of the Far East Branch, USSR Academy of Sciences. Corresponding Member A.P. Kapitsa (1971–1978) became its organizing director. Then the institute was headed by Corresponding Member of the USSR Academy of Sciences G.I. Khudyakov (1979–1991) and Academician P.Ya. Baklanov (1991–2016). In 1987, the Institute of Water and Environmental Problems, Siberian Branch, USSR Academy of Sciences, was organized in Barnaul—the first academic institute in Altai. The organizing director (until 1995) was Academician O.F. Vasil'ev, who was succeeded by Professor Yu.P. Vinokurov. In 1996, the Institute of the Steppe of the RAS Ural Branch appeared in Orenburg, the organizer and director of which until 2018 was Academician A.A. Chibilev.

During the period under review, the Institute of Geography of the USSR Academy of Sciences significantly widened its scope of topics and increased its staff. In the year of moving to Moscow (1934) it had about 30 employees; by 1965 its staff already numbered 442 workers; and in the 1970s, over 600. In the years 1935–1937, the institute included the Department of Theoretical Geophysics, headed by Academician P.P. Lazarev, which in 1937 transformed into the Institute of Theoretical Geophysics of the USSR Academy of Sciences under the leadership of Academician Schmidt.

Let us note some more milestones. Soviet geographers participated in the 3rd International Polar Year (1957–1958), the International Geophysical Year (1957–1958), and the International Year of Geophysical Cooperation (1958–1959). Preparation for them was marked by the creation of a Department of Glaciology at the Institute of Geography (1956). Its first leader was Academician G.A. Avsyuk, and from 1968 to 2015 the department was headed by Academician V.M. Kotlyakov.

In the 1960s–1970s, a 12-volume series of monographs on the nature of the regions of the Soviet Union was published, followed by 15 volumes of the series "Natural Conditions and Natural Resources of the USSR" and 22 volumes of the regional studies series "The USSR." An outstanding result of Soviet geographers was the publication of the *Physiographic Atlas of the World* in 1964.

During this period, the theoretical foundations of physical (integrity and levels of spatial differentiation of landscapes, the idea of the characteristic times of dynamics and evolution, lateral interactions, biogeochemical flows and cycles) and social (the supporting frame of settlement, the theory of population migrations, patterns of urbanization and territorial organization of production, understanding of economic and geographical resource science as the basis of nature management, the "impact–change–consequences" concept in assessing human impact on the environment) geography were formed. All this required formalizing approaches and methods, which for the academic geography of the 20th century, in the context of accumulation of huge arrays of quantitative data, meant the development of mathematization and modeling. In 1962, at the Moscow Branch of the All-Russia Geographical Society, there was a seminar on new methods in economic geography, the leaders of which were Yu.V. Medvedkov, V.M. Gokhman, Yu.G. Lipets, and I.M. Maergoiz [39]. In physical geography, the foundations of mathematization were laid by D.L. Armand, A.D. Armand, and Yu.G. Puzachenko.

Academician Gerasimov stood at the origins of constructive geography [40]. He believed that the studies of the 1970s–1980s were distinguished from essentially constructive studies of the 1930s–1950s by a new methodology, which had adopted methods of economic and noneconomic assessment, geographical forecasting, territorial design, expertise, and monitoring.

In the second half of the 20th century, ideological discussion about two geographies—Soviet and bourgeois—was methodologically dangerous. Disputes also unfolded over the unity of the physical and economic wings of geography. In the 1960s, a discussion began around the book by V.A. Anuchin *Theoretical Problems of Geography* and his publications in *Literaturnaya Gazeta*, as well as around the articles by Kalesnik and Markov, in which, among other things, there was a reproach that the theory of unified geography was weak, the role of economic geography was underestimated, and that the director of a leading academic institute, in fact, "leads us to the elimination of geography as such, reducing geography to branches of its physiographic cycle" [37, p. 68]. Academician Gerasimov drew the fire upon himself and even raised the question of leaving the post of director before the Presidium of the Academy of Sciences [41]. It was then that informal thematic groups of an interdepartmental nature emerged, consisting of geographers of the USSR Academy of Sciences, Moscow State University, other universities, and SOPS, which actively lobbied for the creation of the USSR Geographical Service. In addition to Yu.G. Saushkin [42] from Moscow State University, geographers of the Academy—Gokhman, M.B. Gornung, A.A. Mints, Ya.G. Mashbits—also had their say in the discussion [27].

In 1976, one of the most important events in the history of Russian academic geography took place—the XXIII International Geographical Congress in Moscow, in which over 6000 Soviet and foreign scientists from 58 countries took part.[3] On the eve of the plenary and section sessions of the congress, 29 field symposia of commissions and working groups of the International Geographical Union (Moscow, Leningrad, Kiev, Odessa, Minsk, Tashkent, Tbilisi) were held, in which about 2000 scientists participated. On July 27, 1976, the opening of the congress took place in the Kremlin Palace of Congresses, and the work of ten sections started: geomorphology and paleogeography; climatology, hydrology, glaciology, biogeography, general economic geography; population geography; etc. From August 3 to August 10, 14 field excursions were held, and simultaneously the 8th International Cartographic Conference of the International Cartographic Association was working in Moscow. According to many domestic and foreign scientists, the XXIII International Geographical Congress remained unsurpassed in terms of scientific results, organization, and public outcry [43].

From 1986 to 2015, the parent geographical institution of the Academy, the Institute of Geography, was headed by Academician Kotlyakov, who, in fact, laid the foundation for a new scientific infrastructure of academic geography with its innovative areas (spatial development of the country, climate change, glaciology, evolutionary geography, environmental management, GIS technologies).

The second half of the 20th century largely determined the modern integration trends in geographical research—ecologization, humanization, and sociologization. Physical geography was still understood as a system of sciences about natural landscapes and components of the geographical envelope, and socioeconomic (social) geography, as a science about the territorial organization of economic and social life. However, first, the process of the formation of complex interdisciplinary research and the creation of large cartographic works (national atlases of Cuba, Vietnam, Mongolia, the atlas *Natural Environment and Natural Resources of the World*) involved unification of physiographic and economic–geographical forces. Second, numerous studies on the problems of "man and the environment," "human ecology," the geography of recreation and tourism, and geoecology, conducted since the 1970s, intensified this process. Third, the concept of sustainable development, born in the depths of geographical science, in our opinion, created a powerful theoretical platform for the integration of geography. Finally, fourth, in interdisciplinary

[3] The author of this article worked for two years in the organizing committee of the congress under the leadership of Academician I.P. Gerasimov, Professors Yu.V. Medvedkov, A.M. Grin, A.P. Gorkin, etc.

research on the border between geography and other sciences, geography usually acts as a single science.

The postwar period and the second half of the 20th century were marked for academic geography by many achievements in the development of theory and in the applied field and were characterized by demand from society. This was reflected in the unprecedented recognition of scientific achievements: about 30 academic geographers became laureates of the State Prize of the Soviet Union and the Russian Federation.

The modern vectors of development of academic geography overall continue its previous path. These vectors rest on the following:

• knowledge of the spatial organization of nature, economy, and population;

• revealing a new phenomenology in the interaction of geographical spheres and components of the geographical environment with its multiscale changes;

• establishing patterns of spatiotemporal dynamics of the components of the geographical environment—natural and anthropogenic;

• determination of trends, vectors, and mechanisms of the evolution of nature, territorial structures of the economy and population in a changing climate, and the creation of theoretical foundations for geographical forecasting and rational nature management.

Lined up in such a logical sequence, the vectors of academic geography determine the fundamental basis of the modern work of geographers, important for which are many years of systematic, situation-independent research, guaranteeing the receipt of field and experimental spatially oriented data collected using reliable methods—geoinformation systems, electronic mapping, space sensing, isotope and radiocarbon analysis, and computer programs to identify social and economic trends in regional development. All this is organizationally provided by the efforts of dozens of specialized institutes of the RAS Division of Earth Sciences and the geographical faculties of universities where members of the Academy work, as well as long-term scientific programs that are implemented under the scientific and methodological guidance of the Academy of Sciences.

Over the course of the 300-year history of Russian academic geography, its scientific schools have been forming, and today we can mention those that have been continued in the 21st century [44]. These, in particular, are the Dokuchaev school of geography and soil science, which has united Dokuchaev's students and followers; the geographic (landscape) geochemical school of Vernadsky, which was forming at the Academy throughout the entire 20th century, and thanks to Academician Polynov, at the country's leading universities as well; the physiographic school of D.N. Anuchin and Berg, which was composed by many famous academic and university geographers; the domestic geomorphological school, formed according to the traditions of the late 19th century within the framework of geological science but later developed thanks to the "Leningrad branch" of the school of Professor Ya.S. Edel'shtein and the "Moscow branch" of Professors A.A. Borzov and I.S. Shchukin; the Russian school of geographical and hydrological studies of land, which developed within the system of the Academy of Sciences and after the transfer of the State Hydrological Institute and other institutions involved in climate and hydrology to the USSR Hydrometeorological Service, worked in the institutions of the latter; the industry statistical economic–geographical school, created in the 1920s in Leningrad by V.E. Denom, the organizer of the first department of economic geography at the St. Petersburg Polytechnic Institute; the economic–geographical (regional) scientific school of S.V. Bernshtein-Kogan, Baranskii, and Kolosovskii, which includes two wings—Moscow and Leningrad.

In the last 15 years, with the transition to a grant system for supporting science and short-term planning (programs of the Russian Ministry of Education and Science, grants from the Russian Foundation for Basic Research and the Russian Science Foundation), the continuity of geographical research has weakened.

Let us single out several relevant, from our point of view, areas of academic geography of Russia in the 21st century.

(1) Formation of methodological foundations for the collection, accumulation, and use of unified banks of spatially distributed data and academic geoportals that allow access to geographic information metadata.

(2) Development of high-resolution methods for fundamental research in the field of the evolution of the geographical environment and its components and paleoclimatic and paleoecological reconstructions.

(3) Creation of politicogeographical, sociogeographical, and economic–geographical foundations for the zoning of the country, regional development, and territorial organization of the economy and population with account for the new phenomenology of the geography of postindustrial society and the globalization of the world economy in the context of constant destabilization of development. This vector fits the solution of the political and geographical problems of Russia's development, ignoring which led to catastrophic consequences, putting the state itself on the brink of existence.

(4) Strengthening the geographical analysis and synthesis of the new geographical phenomenology of the old-developed regions. Continuation of geographical studies of natural landscapes, especially those of the Great Eurasian natural massif (about 13 million square kilometers). The role of the tundra, swamps, taiga, and steppes as environmental donors of the planet has yet to be comprehended, detailed, and put into the basis of international cooperation.

Academic geography of the 21st century (information about its achievements in the last two decades is contained in publications dedicated to the anniversaries of the geographical institutions of the Russian Academy of Sciences [27, 45–50]) strives to ensure that we could, together with colleagues representing university and industry science, effectively respond to the most acute modern challenges and, relying on the latest research methods, create the foundations for the future rational spatial development of Russia [51].

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CONFLICT OF INTEREST

The author declares that he has no conflicts of interest.

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