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History of the quaternary study at the Geological Institute RAS: to the 90th anniversary of the institute

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Abstract. The paper is a brief historical review of the Quaternary research in the Geological Institute of the Russian Academy of Sciences. Scientific management of A.P. Pavlov, V.I. Vernadsky, D.I. Mushketov, V.I. Obruchev, A.D. Arkhangelsky, and A.E. Fersman in geological programs and in the Academy of Sciences of the USSR successfully developed the Quaternary studies. The Geological Institute had an important role in the Quaternary research, during the last 90 years, which was made possible by its organizational structure, research and expeditions, organized in close cooperation with the Commission for the study of the Quaternary period, and by a large number of prominent scientists who worked at the Quaternary Department and were leaded and inspired by G.A. Bonch-Osmolovsky, G.F. Mirchink, V.I. Gromov, V.V. Menner, C.V. Nikiforova and others.

1. Introduction

Late 19th century was the time of the rise of studies and wide descriptions of the latest geological deposits. *Alexei Petrovich Pavlov (1854-1929)*, Professor of geology in the Moscow University, addressed the issues of glaciation, the origin of the Quaternary deposits, methodology, and introduced the concept and term of *the Anthropogene* [1, 2]. Not only geologists were interested in these fields of study, but also paleontologists, geographers, soil scientists, biologists, antropologists and archaeologists [3]. The 2nd session of the USSR Geological Congress (Kiev, 1926), decided to coordinate this research by adopting a proposal to the Academy of Sciences of the USSR (AS USSR) for creating the **Institute for the study of the Quaternary**. Since 1927, thanks to the organizational activities of *Vladimir Ivanovich Vernadsky (1863-1945)*, the **Commission for the Study of the Quaternary**, chaired by Pavlov [4] was the center for these studies was.

In 1928, during the international assembly dedicated to the 40th anniversary of the Danish Geological Institute (L'Assemblée générale de la Réunion Géologique Internationale à Copenhagen), an international constituent meeting was held to establish the *Association for the Study of the Quaternary of Europe*. The Soviet delegation supported and made a great contribution to the creation of the Association (*International Union for Quaternary Research* (INQUA), from 1936). All the delegation members: *Alexei Alekseevich Borisyak (1872-1944)*, *Dmitry Ivanovich Mushketov (1882-1938)* and *Alexander Evgenievich Fersman (1883-1945)*, were later associated with the Geological Institute. During this meeting, Mushketov was elected as the first president of the Association bureau [5].

In 1929, the first issue of the *Bulletin of the Commission for the Study of the Quaternary* was published. It is still published annually and is available online [6, 7]. These organizational works became the prehistory in the studies of the Quaternary at the Geological Institute.



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2. Materials and methods

Information about geologists, including the Quaternary scientists, has been consistently collected since 1949. During that time, *Vladimir Vladimirovich Tikhomirov (1915-1994)* came to the Institute of Geological Sciences AS USSR, and set up the Office for the History of Geology (later renamed to department, laboratory and then group for the History of Geology). Numerous bibliographical cards, papers and documents about scientists, and other data were collected. Currently, they are summarizing to the open information system called *History of Geology and Mining* [8].

For example, biographical and bibliographical data about scientists studying the Quaternary can be found on the information system sorted during online search by “Field of interest” (choose *The Quaternary Period* [«Антропогенный период» in Russian]), among them more than 30 scientists are related to the Geological Institute, if one include the “Original title” in the search query (*Institute of Geology* [in Russian]) [9].

General publications, especially about the activities of the Geological Institute connected to its 50th anniversary [10] and then to the 50th anniversary of the Commission for Study of the Quaternary [11], were studied with subsequent papers about the works of the Quaternary department of the Institute. These papers were never translated from Russian.

3. Beginning of the Quaternary studies at the Geological Institute

On the 8th of March of 1930, the Geological Institute of the AS USSR was formed in the city of Leningrad (Petrograd (1914-1924), before and after – St. Petersburg), where, as in the former capital of Russia, the Academy of Sciences was originally located since 1724. Geological Institute predecessor (as well as that for 2 other institutes) was the Geological Museum named after Peter the Great (established 1898).

Vladimir Afanasevich Obruchev (1863-1956) was elected as the first director of the Institute. He was interested in the Quaternary, primarily because of the loess origin problems, glaciation and permafrost, mineral exploration and the history of geology. Since 1939, he was the chairman, and the chief editor (1932-37, 1946-56) of the *Proceedings* and the *Bulletin of the Commission for Study of the Quaternary* (published in up to 2,000 copies) [6]. The study of the Quaternary sediments immediately became one of the main research areas and activities in the Institute, in connection with the general task of geological study with the development of stratigraphy of the USSR and neighboring countries [10].

The complexity of the Quaternary as the object of study required a large-scale involvement of specialists. Since 1931, paleontologist and paleoanthropologist *Gleb Anatolyevich Bonch-Osmolovsky (1890-1943)* stood for a collective solution of the tasks and for the creation of the Quaternary Institute [13]. At a meeting of the Presidium of the AS USSR (February 23, 1933), he was approved as the head of the new *Quaternary Studies Department* of the Geological Institute. He continued organizing expeditions, but at the end of 1933 he was arrested and exiled by Stalin's regime [10, 14].

Since 1928, Dmitry Mushketov began preparation for the Congress of the *Association for the Study of the Quaternary of Europe* (Leningrad, 1932). In 1933-34, he was head of the department of *Tectonics and geomorphology in connection with tectonics* at the Geological Institute. He led research works in the field of Quaternary tectonics (unfortunately, in 1937 he was arrested and executed in 1938 by the Stalin's regime) [10, 12, 14].

4. Relocation of the Geological Institute to Moscow

In 1934, the institute moved from Leningrad to Moscow, along with other main institutions of the Academy of Sciences. Graduates and professors of Moscow University and the Moscow Geological Prospecting Institute joined the Geological institute. *Andrei Dmitrievich Arkhangel'sky (1879-1940)*, a student of Pavlov, became its new director. He made an emphasis to the study of Quaternary deposits, told about the complexity of the study of Quaternary deposits and about their especially importance for the new buildings and large engineering structures [15].

In 1936, the session of the Academy of Sciences of the USSR set new tasks for the Quaternary scientists: to establish a scientific rationale for geological exploration; to study the mineral resources in

the areas of economic development, engineering and hydrogeological support; and preparations for the 17th session of the International Geological Congress (Moscow, 1937). The Geological Institute has become the organizing center for the Congress [10].

The Quaternary Studies Department took part in researching and summarizing data on the stratigraphy of the USSR (especially of important industrial and transport areas), studying the history of the geological development of the territory, with scientific foundation under the methodology of prospecting and exploration of mineral deposits. In the 1930s, a geological correlation was made between the marine and continental Neogene-Quaternary strata of the Ponto-Caspian and the southern part of the Russian Plain, as well as the Quaternary deposits were studied in the areas of large canals construction.

5. Quaternary department in the Institute of Geological Sciences

Right after the International Geological Congress, according to the Five-Year-Plan, the Soviet government decided to reorganize geological institutions in the AS USSR. In December 1937, newly merged *Institute of Geological Sciences*, included 3 institutes and 2 museums. The newly reorganized *Department of Quaternary Geology* was led by another famous Pavlov's student – *Georgy Fedorovich Mirchink (1889-1942)*. In 1936-37 he was a deputy director of the Geological Institute. Under the Mirchink's leadership, expeditions were organized, modern methods for studying Quaternary have been introduced, the new principles of stratigraphy and drawing up of geological maps of the Quaternary were developed, and the first general scheme of Quaternary deposits of the European part of the USSR was compiled (unfortunately he was also arrested in 1941 and soon died in prison) [14, 16].

The department took part in compiling a stratigraphy of specially-important industrial and transport regions of the USSR, studying the geological history, as well as bringing the scientific base to the methodology for prospecting and exploration of mineral resources. The correlation of marine and continental Neogene-Quaternary strata of the south of the European part of the USSR was carried out. The large areas of strategic design and construction of canals were studied. Expeditions in the Urals have elucidated the patterns of the formation of alluvial mineral deposits.

Alexander Fersman headed the institute during the Second World War. He worked during the Institute's evacuation to the Urals region (1942), and after its return to Moscow in 1943. He had experience in mobilization of geological resources gained during the First World War, headed several Commissions of the AS USSR (mineral raw materials and the scientific assistance to the Army), and publish the book *Geology and War* [17]. Quaternary deposits knowledge was important for the military operations.

Since 1943, the Department of Quaternary Geology was headed by *Valerian Innokentyevich Gromov (1896-1978)*. He was one of the organizers of paleontological study of the Quaternary. The research topic was the construction of a standard stratigraphic time-scale of the Quaternary System, the development of principles for stratigraphic boundaries, the history of fauna and flora and anthropological fossils. More than 20 permanent employees of the Department worked in expeditions. They made the first substantiated stratigraphic schemes of Neogene-Quaternary sediments of Siberia, Altai, Tuva, Transbaikalia, Kazakhstan and Kamchatka. Paleontological research in the department was expanded by studying the fossils of small mammals. This cleared the details of stratigraphic schemes, and correlated the sections from Asian and European parts of the USSR [10]. In 1950, Gromov was awarded the Stalin Prize for geological and paleontological research and the development of new methods of subdivisions of the Quaternary sediments based on mammalian fauna and stone industries of ancient humans, summarized in the book [18].

6. Quaternary study at the reorganized Geological Institute

Back in 1945-46, it was decided to start a new organization of the Geological Institute on the basis of 4 departments of the Institute of Geological Sciences (including Department of Quaternary Geology). In 1956, the Geological Institute of AS USSR was re-formed. Department headed by Gromov returned to the reorganized Geological Institute, and was named the *Department of Geology of Quaternary deposits*

and genetic types of continental formations. Mineralogy-petrography Laboratory and Study of the genetic types of continental deposits Cabinet worked with the Department. The Institute also included the Micro-fauna Laboratory and the Laboratory for the study of spores and pollen of the Cenozoic and Quaternary system [10].

In 1956, the Soviet Section of INQUA resumed its work in AS USSR. Among its members, 7 scientists were from the Geological Institute [19]. In 1957, the *Permanent Stratigraphic Commission on the Quaternary Deposits of the USSR* was formed, it included Institute employees Evgeniy Virgilyevich Shantser (1905-1987) – chairman, and Yuri Alexandrovich Lavrushin (born 1931) – scientific secretary.

In the 1960s Department staff continued to study areas, stages and products of glaciation and other types of continental deposits using paleontological and palynological (spore-pollen analyzes) methods, which helped to clarify the paleoclimates. They explained with paleontological evidence the stratigraphy of deposits of the Asian north and northeast parts, the Western Siberia south part, Altai, the European part of the USSR, Tajikistan and the Ciscaucasia. Work continued on compiling detailed regional stratigraphic patterns and models of Quaternary sediments in Western Siberia, Altai and Ciscaucasia. The problem of changing Quaternary paleoclimates was solved with the study of continental glacial formations, the classification of moraines, and the correlation of various loess strata to glaciation stages, as well as the analysis of other types of continental deposits, their spore-pollen spectra, and the fossil fauna of mammals and mollusks. [10]

Since 1970, departments at the Geological Institute have been transformed into laboratories. In the *Stratigraphy Sector*, under the leadership of Vladimir Vasilyevich Menner (1905-1989), the new *Laboratory of Geology and History of the Quaternary* was headed by Ksenia Vladimirovna Nikiforova (1911-1996). Evgeniy Shantser became the Head of the *Laboratory of genetic types of continental deposits* [10]. The stratigraphy of Quaternary and its correlation schemes was improved with help of new physical methods (paleomagnetic, radiometric, paleotemperature, etc.). Archaeological research was also carried out.

The 9th INQUA Congress (1982) and the 27th session of the International Geological Congress (1984), both held in Moscow, gave a boost to the Quaternary research. The attention was paid to the Neogene-Quaternary stratum boundary, in accordance with the plans of the *INQUA Stratigraphic Commission* and the *International Stratigraphic Commission*. The main areas of work were climate-stratigraphic and paleogeographic studies.

In 1980, Irina Konstantinovna Ivanova (1906-1987) secretary of the *Commission for the Study of the Quaternary* (since 1945, based in Geological Institute), paid attention to its 50th anniversary and analyzed its organizational activities [11, 20]. The monograph *Stratigraphy of the USSR: Quaternary system* was published with the help from laboratory staff [3]. Since 1985, samples from deep sea drilling by *Research vessel Academic Nikolaj Strakhov* (owned by the Geological Institute) became available for study. The land sections of marine Pliocene-Quaternary sediments were also studied in the south of Russia, in Ukraine, Moldova, Turkmenistan, Azerbaijan, Georgia, Cyprus and Syria [10].

Mikhail Nikolayevich Alekseev (1923-2008), headed the Laboratory in 1986, then (from 1989) Evgeny Viktorovich Devyatkin (1932-2004). Studies continued in the development of stratigraphic schemes of the Pliocene and Quaternary system, and their correlation. A more detailed zonal biostratigraphy time scales were developed based on the study of mammals' groups, including stages of evolution of rodents. Absolute age data made it possible to construct a single Quaternary time scale and clarified the global correlation [21, 22].

7. Modern Quaternary study at the Geological Institute

In 2004, a Quaternary unit within the Geological Institute of the Russian Academy of Sciences was renamed to the **Laboratory of Quaternary Stratigraphy**, and Andrey Evgenievich Dodonov (1940-2008) became its head. Works continued on a new technical level, to document the timing, determination the causes and build models of past climate changes on Earth.

Currently, the laboratory under the leadership of Alexei Sergeyevich Tesakov is elaborating the detailed stratigraphic time scale of the continental deposits of late Neogene and Quaternary (based on

fossil mammals, palynology and mollusks remains). They also updated the marine stratigraphic time scale based on various groups of micro- and macrofauna (foraminifers, nannoplankton and mollusks). The correlation of biotic and abiotic events of different landscape and climatic zones is carried out. The main modern areas of research include: making global and regional stratigraphic schemes based on a set of modern methods; providing isotopic geochemistry analysis of sedimentary rocks with its chemical stratigraphy; and making global tracking and computer models of geological processes and events, to check for rapid changes and disasters in the history of the Earth [22].

8. Conclusion

The entire 90-year history of the Geological Institute of the Russian Academy of Sciences (celebrated in 2020) is inextricably connected with the study of the Quaternary. This scientific direction was an essential, important and consolidating part of the Geological Institute. The publications of the Institute's scientists in stratigraphy, paleontology, paleogeography, archeology and other areas made a great contribution to the study of Quaternary deposits. Their involvement in international organizations, study of large distant areas, development of new methods, schemes and theories made a major contribution to the Quaternary science. The Geological Institute continues to play a prominent role in organizing and participating in numerous Quaternary conferences, programs and commissions.

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