NEW EXHIBITIONS IN THE ORE-PETROGRAPHY MUSEUM

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The article is dedicated to new expositions of the Ore-Petrography Museum, which has systematic collection of all known types of magmatic rocks and ores. Nevertheless the museum was planned to support the institute's researchers, there are collections created for educational purposes revealing geological processes and history of geological studies of Russia.
14 figures, 3 references.
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Ore-Petrography Museum of the Institute of Geology of Ore deposits, Petrography, Mineralogy and Geochemistry of the Russian Academy of Sciences is the only specialized museum in Russia that is a home for a systematic collection of every magmatic rock type on the Earth. The museum has regional collections representing rocks and main ore types of most ore districts in Russia and elsewhere. It also keeps thematic collections illustrating certain features of magmatism and ore-forming processes of various geological stages and geodynamical environments that had place during the Earth evolution.

The history of the Ore-Petrography Museum started in 1930 with establishing several specialized institutions based on the Geological and Mineralogical Museum in Leningrad (currently Fersman Mineralogical Museum of the RAS in Moscow), the only academic geological organization at that time. Two specialized institutes: Mineralogy, Geochemistry and Petrography Institute (PETRIN) and Geology Institute (GIN) were formed. F.Yu Levinson-Lessing directed the Petrography Institute. He created the Petrography Museum at the Institute as a tool for scientific work as a research library of stone. The current collection was comprised mainly from gathering of the employees of several institutes, which the Petrography Museum was the part of. The Petrography Museum was located at Staromonetniy Pereulok No 35 (Fig. 1) when the Academy of Sciences moved to Moscow from Leningrad in 1934.

The institutes of Mineralogy and Geochemistry merged into the Lomonosov Institute of Geochemistry, Mineralogy and Crystallography (LIGEM) in 1932 and were lead by academician A.E. Fersman. Those institutes: LIGEM, PETRIN and GIN were united under the Institute of Geological Sciences (IGN) in the years 1937 through 1955 and then the scientific departments of this entity formed the core of the current Institute of Geology of Ore Deposits, Petrography, Mineralogy and Geochemistry (IGEM). Academician F.V. Chukhrov managed IGEM from 1956 till 1988.

The changes of the names and structures of institutes whose part the Petrography Museum was did not change the status and direction of the museum's research, because it involved a wide circle of problems, including fundamental theories of the genesis rocks and ores. Integrated expeditions were the main form of geological research at that time. The following regional integrated expeditions were formed: Tajik-Pamir, Kola, Kazakh, Urals, Caucasus, Eastern Siberian and other expeditions which worked for many years.

These expeditions discovered numerous ore-magmatic provinces and regions, metallic and non-metallic mineral deposits. The collections of the museum were flooded with a huge amount of samples of rocks and ores, so the subject of the collection went far beyond purely petrographic studies. For this reason it was renamed into Ore-Petrography Museum in 1993.

The museum comprises more than 40,000 storage units, including collections of thin and polished sections. The main types of ores and rocks, rare and unique samples are exhibited in 28 expositions including seven recent theme exhibitions devoted to various rock types and to researchers who studied them (Fig. 2). A combination of historical objects, rock and ore

Fig. 1. Building of the Institute of Geology of Ore Deposits, Petrography, Mineralogy, and Geochemistry (IGEM), in whose compass window Ore-Petrografic Museum is situated. Photo: M.K. Sukhanov.

Fig. 2. Scenery of exhibits. Photo: M.K. Sukhanov.

samples and minerals made the displays more vivid and informative.

Exposition: *Scientists of the Institute on the labor frontline during the Great Patriotic War*

The exposition has a center location in the museum. It catches the visitor's attention immediately and excursions around the museum start there. It creates a good reason to speak on the history of the Institute, achievements of its staff, all the more so many of them started to work during the War and later became prominent scientists. The exposition illustrate the work of D.S. Belyankin, V.P. Petrov, A.I. Tsvetkov, M.A. Favorskaya, B.V. Zalesskiy, M.F. Strelkin, I.I. Ginsburg, I.A. Preobrazhenskiy, D.I. Scherbakov, V.F. Morkovkina, P.I. Lebedev, O.D. Levitskiy, Ye.A. Radkevitch, S.S. Smirnov, D.S. Korzhinskiy, A.V. Pek, T.N. Shaldun, V.I. Gonshakova, V.S. Koptev-Dvornikov and others. Their photographs and most importantly the samples of ores from the deposits they studied: refractory ceramic clays in the Urals, tin, tungsten and lithium deposits in Kazakhstan, base metal and mercury deposits of Kabardino-Balkaria, Northern Ossetia and Georgia, tin deposits of the Russian Far East and many others were part of the exhibits.

Exposition: *World of Minerals*

This exposition is dedicated to the anniversary of Fedor Vasilyevich Chukhrov, who headed IGEM from 1955 till 1986. His studies

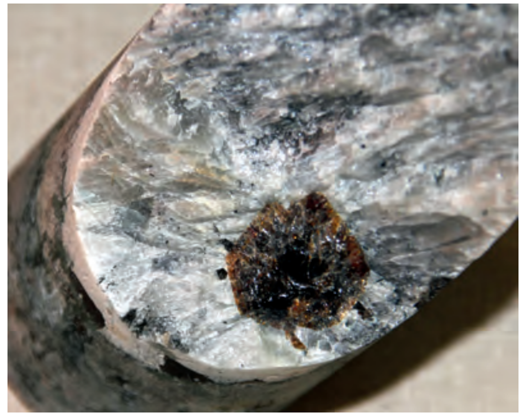


Fig. 3. Rhodochrosite (Mn,Fe)CO_3. Kara-Oba, Central Kazakhstan. 10 x 18 cm. OPM-IGEM # 5501, from collection of F.V. Chukhrov. Photo: M.K. Sukhanov.

Fig. 4. Crystal of fersmanite $Ca_4(Na_2Ca_2)(TiNb_3)(Si_2O_7)_2O_8F_3$ in pectolite veinlet cutting massive urtite. Khibiny massif, Kola Peninsula, Russia. Section of crystal, 1.5 x 1.5 cm. OPM-IGEM #1341, from collection of M.N. Sokolova. Photo: M.K. Sukhanov.

of typomorphic properties of minerals, colloids in the Earth's crust, oxidation zones of sulfide deposits, weathering crusts and deposits related to them were widely recognized.

F.V. Chukhrov supervised composition of several volumes of Minerals reference book, which summarized all studies of mineral species and became a table-book for many scientists and practical geologists. Chukhrov's works significantly stimulated development of mineral resources in Kazakhstan. He was awarded an Order of Lenin and two Orders of the Red Banner of Labor, Order of the Badge of Honor, other medals and was granted the USSR State Award in 1951.

Samples which F.V. Chukhrov gathered himself are among the exhibits of the exposition: bauxite from Poços de Caldas, Brazil; Mazaugues, France; montmorillonite from Morro do Niquel; kaolin from Cornwall, England; rhodochrosite from Kazakhstan (Fig. 3). Various photos are on display with the photograph of the first graduates of the Moscow Geological Institute, later the Moscow Geological Exploration Institute (MGRI), with F.V. Chukhrov and other students who became later researchers at IGEM among them (Fig. 4). Some rare minerals are displayed: fersmanite $Ca_4(Na_2Ca_2)(TiNb_3)(Si_2O_7)_2O_8F_3$ (Fig. 5) and chukhrovite $Ca_3Al_2TR(SO_4)F_{13}$ $\cdot 10H_2O$, which was discovered by L.P. Yermilova, a researcher at IGEM in 1960 and named after F.V. Chukhrov.

Exposition: *Non–metallic Minerals*

We celebrated the 100^{th} years of the birth of Valeriy Petrovich Petrov (Fig. 6) in 2008. He headed the department of Non-metallic Natural Resources at IGEM. An international conference was convened in his memory at the Institute, and a new exposition was on display to describe his life.

V.P. Petrov was the true expert in the geology of the Caucasus and Trans-Caucasus, having explored remote areas of the region on foot and on horseback. He organized the provision of a resource base for refractory ceramic industry in the Urals during the Great Patriotic War and initiated the development of the perlite industry after the War. V.P. Petrov with his colleagues and students took part in utilizing iron-free granites, alkaline kaolinites and porcelan stone, loose talc rocks in weathering crusts, brucite, wollastonite and fine mica as new materials for ceramics.

Valeriy Petrovich was awarded with three Orders of the Red Banner of Labor, the Order of the Badge of Honor, many medals, including international ones for his achievements.

The exposition shows perlite, obsidian, clays, asbestos, graphite, cut and gem stones (lazurite, nephrite, rhodonite, chrysolite, wollastonite-hedenbergite skarn) and ornamental stone (Fig. 7, 8), Petrov's bibliographical material, his photographs and scientific works are also displayed.

Exposition: *Rare–Metal Magmatism*

This exposition is devoted to magmatic rocks that host deposits and are sources of rare metals so important for the modern electronic industry. These metals include tan-

Fig. 5. First graduates of Moscow Geological Institute (present Russian State Geological Prospecting University) with their teacher professor V.I. Luchitsky, 1931.
1st row (sitting from left to right), F.V. Chukhrov, prof. V.I. Luchitsky, V.S. Myasnikov, and P.V. Kalinin;
2nd row (standing from left to right), V.P. Florensky, A.V. Sarycheva, A.V. Zak, A.M. Mamedov, N.V. Petrovskaya, A.M. Ershov. Photo from archive of N.N. Smol'yaninova.
Fig. 6. V.P. Petrov at field work (1960s). Photo from archive of V.V. Nasedkin.

talum, niobium, beryllium, lithium, rubidium, cesium, and rare earth elements. Deposits of these elements are related to certain types of granites, so-called rare-metal granites. Deeply differentiated multi-phase granite intrusive complexes usually carry such mineralization.

The latest magmatic derivative phases of the massifs are leucocratic granites of elevated alkalinity. Rare-metal lithium-fluorine granites were found in the Ladoga area, Trans-Baikalia, in Primorye, in Mongolia, the Czech Republic, France and other regions.

Vyacheslav Ivanovich Kovalenko made a big contribution to studies of these magmatic associations. He developed a theory of late magmatic rare-metal deposits, suggesting quantitative assessment of rocks for potential mineralization and applied it to metallogenic analysis of the territory of Central Asia. He was one of the discoverers of rare-metal deposits in Mongolia. He was awarded with Russian Federation State Prize and many medals.

The exposition's display includes ore-bearing carbonatites, fluorite ores and samples of rare metal rocks, which were discovered, described and named by V.I. Kovalenko. One of them was ongonite (topazolith), the rocks that gave clues to understand rare metal magmatism and mineralization. Specimens of rare-metal pegmatites from Primorye from collection of M.G. Rub and her monograph "*Rare-Metal Granites*" are also on display.

Fig. 7. Landscape obsidian "View of the Ararat Valley". Armenia. Polished sample, 20 x 8 cm. OPM-IGEM #Gkh-16, collection of V.V. Nasedkin. Photo: M.K. Sukhanov.
Fig. 8. Wollastonite-hedenbergite skarn. Dalnegorsk, Primorsky Krai, Russia. Polished plate, 22 x 9 cm. OPM-IGEM #M1-2, collection of A.D. Babansky. Photo: M.K. Sukhanov.

Exposition: *East–African Rift*

East-African Rift is the largest of the rifts shown in the topography in the world. It stretches over 6,000 km from northern Syria to central Mozambique. The width of the rift valley is from 30 to 100 km and its depth ranges from a few hundred to thousand meters. The valley was formed as a result of geological shear faulting along the boundaries of the African and Arabian tectonic plates. It is pronounced as a huge graben with steep walls and a flat bottom partially covered with shallow lakes, swamps and salt marshes. Crystaline rock cliffs rise on the sides of the rift, and the highest in Africa volcanic structures rise on the adjacent plateaus: Kilimanjaro with Kibo peak at 5895 m and mount Kenya at 5199 m.

The Rift was formed by a meridially-trending fault system in the crust that was formed in the Mesozoic-Cenozoic and was accompanied by intense lava eruptions. Volcanic activity along the East-African rift was very intense and still continues.

The exhibition displays volcanic rocks of the region, including many alkaline rocks, labeled with local names: katungite (pyroxene free and rich in melilite olivine leucitite), ugandite (melilite free melanocratic leucite basalt), limburgite (hyalo-nephelinitic basalt with plagioclase and nepheline glass as a groundmass) and also carbonatites and sodium carbonate.

The exposition was composed of specimens from the large (around 300 samples) collection of A.A. Krasnov, a former researcher at IGEM. He participated in the Soviet African Expedition with E.E. Milanovsky, N.A. Logachev, V.I. Gerasimovsky, A.P. Kapitsa and other prominent scientists.

Exposition: *Extraterrestrial Matter and Impactites*

This exposition was composed as reflecting a new avenue of research at the museum: meteorites and impact rocks. Indeed it is important to study space in the 21st century to understand the origin of our planet and its evolutionary history.

There were many people who came to the museum with a request to find out if the rock they found was a meteorite. These cases inspired the idea to form an open Russian Society of Meteoritics Enthusiasts with support from the Ore-Petrography Museum. The main course of the society's activity was education and popularizing scientific knowledge. This public organization was registered with its equity capital as a collection of meteorites. The collection consists of 23 specimens of hondrites, iron meteorites and palassite, 10 specimens of impactites and 2 specimens of tectites. As per the agreement between the Museum and the Society the collection was kept at the museum and can be on display and studied for scientific purposes.

Meteoritic matter is represented in the collection of the museum also included new by found meteorites: Doronino found in 2003 and Pallasovsky discovered in 2004. The samples of these meteorites are kept only in two museums round the world: GEOKHI RAS and IGEM RAS (Fig. 9). The material of these meteorites was studied for the first time at IGEM (Milanovskiy *et al.*, 2003, 2005).

The history of Pallasovsky meteorite is very remarkable. P.S. Pallas, a prominent German nature scientist, was invited by Catherine the Great and worked in various areas of Russia for 20 years studying plants, fauna, geology and geography of Russia. Being in the Irkutsk region in 1771, he was informed about a boulder of iron and olivine weighing around 700 kg. He decided to transport it to St. Petersburg, and in 1777 it was delivered to the Mineral Cabinet of

Fig. 9. Fragment of Pallasovsky meteorite (pallasite), olivine crystals in nickel iron (kamacite + taenite). Sample section, 8 x 8 cm. OPM-IGEM, from collection of Russian Society of Meteoritics Enthusiasts. Photo: M.K. Sukhanov.

Kunstkamera. This boulder was named Pallas iron. Pallas himself regarded this boulder as a rare type of terrestrial iron ore. Ernst Chladni proved Pallas boulder to be of extraterrestrial origin only in 1794. It was of rare meteorite type that had only around 50 known discoveries and falls and thus called pallasite. Pallas worked in the Volga region in 1773 and made many important discoveries. A railway station was named after him and the monument was erected to his tribute later in 1904, when the railroad was built. Pallasovka became a town 200 years later and meteorite was found in its vicinity and it was surprisingly exactly of the pallasite type (Fig. 10).

The exposition shows a classification of meteorites in diagrams, photos, thin sections, monographs, and papers dedicated to lunar matter with particular emphasis on studies carried out at IGEM. The impact matter on display was derived from known impact craters: Ries, Zhamanshin and Popigay. The new specimens acquired recently were found at Glorietta Mountain in 1884 in the state of New Mexico, USA, and Tamdakht, Morocco, fell in 2008.

Exposition: *Magmatic Rocks from Polar Siberia Collected by E.V. Toll Expedition in 1885–1902*

The exhibition displays materials on the development of Russian Polar regions, which is especially important this time, when the ownership of territories of the arctic shelf zones and Northern Pole is disputed in the context of the resources of these regions. The exposition shows the priority of Russian scientists in studying and exploring the Arctic.

Eduard Vasil'yevich Toll (1858 – 1902) was a Russian geologist and explorer of polar regions (Fig. 11). He took part in an expedition to the New Siberian Islands headed by A.A. Bunge, whose collection is also housed at the museum. He explored the islands of Big Lyakhovsky, Fadeyevsky, the western shore of New Siberia Island and Kotelniy Island. He headed an expedition to northern regions of Yakutia in 1893 and was the first to describe plateau between the Anabar and Popigay rivers, the mountain range between the Olenek and Anabar rivers and named it the V. Prochintsev Range. He led the expedition of the Academy of Sciences on the Zarya self-propelled schooner to the New Siberian Islands in 1902. The main purpose of the expedition was to discover the Sannikov Land, presumably the most northern island in the Siberian part of the Arctic Ocean. He performed extensive hydrographic, physical-geographic and geological research during the cruise and wintering on the north shore of the Taimyr Peninsula and the western shore of Kotelniy Island, and he was the first to conduct dredging in the Arctic Ocean. E.V. Toll and three of his companions went missing when crossing the sea on weak ice from the is-

Fig. 10. Pallasovsky meteorite and Nikolai Kharitonov with his family who found it. Photo from archive of A.E. Milanovsky.

lands of Bennett to Kotelny in November 1902. The rescue expedition headed by the military officer, who became later the famous Admiral A.V. Kolchak, was organized in 1903. The expedition found the last camp of E.V. Toll on Bennett Island, his writings and samples (Fig. 12).

The fate of samples of Toll's expedition was unknown till recently, when they were found during inventory in the Ore-Petrography Museum. F.Yu. Levinson-Lessing seems to have kept them at the museum when it was separated from the funds of Geological and Mineralogical Museum of the Academy of Sciences in the 1930s.

The exposition includes samples of rocks along with original documents: photographs, maps, letters, reports and publications (Fig. 13). E.V. Toll wrote in a draft of dismissal petition: *"I have an honor to report to Your Excellency that I have no more energy to accomplish the duties of the curator of Mineralogical Museum of the Emperor's Academy of Sciences. Having no assistants, I have the following responsibilities on my own: keeping, ordering and scientific analyzing the rich Siberian collections and bringing the museum to a higher level in general....".*

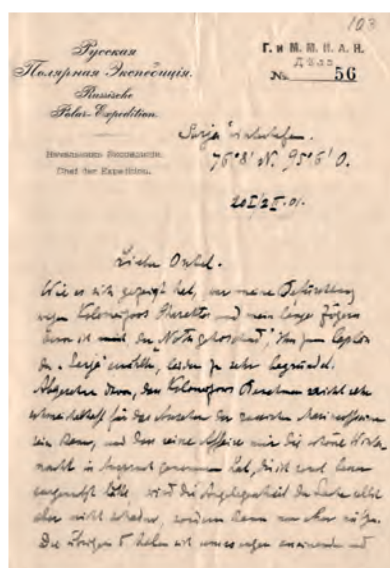
Many geographical places were named after E.V. Toll: a mountain on New Land Island, a mountain on Bennett Island, a bay on the north-western shore of the Taimyr Peninsula, a cape on Tsircul' Island in Minin's skerries, a plateau on Kotelniy Island.

A scientific team of the Geological Institute of Academy of Sciences currently works in the areas of E.V. Toll's last expedition. This team handed newly found samples from the New Siberian Islands, geological maps, photographs, which were placed in the new section of the display named "The Research is Continued" (Fig. 14).

Fig. 11. Eduard Gustav (Vasil'yevich) von Toll (1858–1902), academic curator of Mineralogical Museum of Imperial Academy of Sciences (present Fersman Mineralogical Museum). Photo from the book by P.V. Vittenburg (1960).

Fig. 12. Analcime basalt from the Bennett Island, East Siberian Sea, the last point of the Toll's route. Specimen 9 x 8 cm. OPM-IGEM#1305. It was brought to the Mineralogical Museum of Imperial Academy of Sciences by lieutenant A.V. Kolchak, chief of rescue party on search of E.V. Toll. Photo: M.K. Sukhanov.

Fig. 13. Letter from E.V. Toll written on stationery of Russian Polar Expedition, January-February, 1901. From archive of OPM-IGEM.



Русская
Полярная Экспедиція.
Russische
Polar-Expedition.

Начальникъ Экспедиціи.
Chef der Expedition.

Г. и М. М. И. А. Н.
№ 56

76°8' N. 95°6' O.

Liebe Onkel.

Fig. 14. Bennett Island: view of the Toll Valley and Preobrazheniya Cape, 2013. Photo: A.B. Kuzmichev.

The expositions are characterized by a combination of historical documents, samples of rocks and ores. Such an approach provides most comprehensive information and is very informative for education and in science.

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