

Field excursion 7. Geochemistry in Khibiny mountains and Monchegorsk, Kola Peninsula, Russia

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Dates: 27th to 31st August 2011

Excursion route: Rovaniemi – Apatity – Khibiny – Monchegorsk – Apatity - Rovaniemi

This excursion starts with a workshop in the Geological Institute KSC RAS, in Apatity including presentations on the petrology and geochemistry of the Khibiny alkaline massif and isotope geochemistry and geochronology of the Kola Peninsula focusing on the Monchegorsk intrusions. During a couple of next days there are visits to geologically spectacular ore fields of the Khibiny and Monchegorsk. Different types of mine activity relating to apatite and Cu-Ni with PGE deposits with the environmental issues are to be seen during the excursion.

Cost: €900

Includes accommodation in double rooms for 4 nights. Includes breakfast, lunch and dinner each day (lunch packages during field trips) and all transfers.

Trip will start in Rovaniemi and finish in Rovaniemi.

Number of participants: min 15, max 30.

Saturday 27th August

Leave from Rovaniemi at 9 am, arrive evening in Kirovsk, Russia

Overnight in Kirovsk (Hotel Severnaya)

Sunday 28th August

Workshop

1. Petrology and geochemistry of the Khibiny alkaline massif
2. Isotope geochemistry and geochronology of the Kola Peninsula

Overnight in Kirovsk (Hotel Severnaya)

Monday 29th August

Stop 1. Koashva open pit

The major excursion focus of the Koashva open pit is a member of the Eastern Group of apatite-nepheline Khibiny deposits. The apatite-nepheline rocks are spatially related to urtite and juvite. The Rasvumchorr, Kukisvumchorr, Yukspor, Koashva, Niorkpahk are the biggest deposits of apatite ores located within a narrow zone in the southern part of the Khibiny massif. A typical cross-section of the ore body from top to bottom is as follows:

- a) titanite-apatite uppermost contact zone, titanite mineralization is spread in the upper zone of juvites and ijolites;
- b) breccia of apatite ores, xenoliths of different ore types are settled fine-grained apatite, apatite-titanite or apatite-nepheline matrix;
- c) a rich mottled and banded apatite ore (10 - 20 % wt. P_2O_5);
- d) a poor lenticular, taxitic, and block apatite ore types (5 - 10 % wt. P_2O_5);
- e) apatite-bearing massive coarse-grained urtite;
- f) apatite-free massive coarse-grained urtite.

Most part of this section excursionists shall observe in the open pit.

Stop 2. Mt. Takhtarvumchorr

Depending on weather conditions and time rested after the excursion to the Koashva open pit, excursionists are to be taken to the bottom of Mt. Takhtarvumchorr. Phonolite dykes in foyaite of Mt. Takhtarvumchorr (about 500 m from the vehicle, elevation 100 m). There are a lot of vertical phonolite dykes (up to 1 m thick) at the slopes of this mountain. Phonolite is a fine-grained green

rock consisting of euhedral crystals of nepheline, thin-bladed orthoclase, entangled-fibrous and radiating aegirine, lamellae of phlogopite and grains of sodalite, analcime, natrolite, cancrinite and fluorite. Tinguaitite is also found in the axial zones of the largest phonolite dykes and is distinguished from other varieties of phonolite by its microstructure, in which there are large impregnations of nepheline and orthoclase into the trachytic structure of the main orthoclase-aegirine-nepheline mass. The marginal parts of the phonolite dykes frequently display an unusual cellular-zoned, rhythmically-banded, dendrite-like, breccia or "ruin" texture, imparting a rather attractive appearance. Abundant bladed crystals of troilite are located in the central parts of cells. Minerals: aegirine, analcime, cancrinite, fluorite, natrolite, nepheline, orthoclase, phlogopite, sodalite, troilite.

Overnight in Kirovsk (Hotel Severnaya)

Tuesday 30th August

Stop 3. "Terrace" deposit

The excursionists are to visit the Cu-Ni "Terrace" deposit in the Monchegorsk area with an extremely various rock composition, giant breccia textures and mafic pegmatites and dumps of sulphide ore at the "Fersman's adit". The access to the outcrops is within 300 m distance. The outcrop of the "Terrace" traces the horizon of giant blocks of thinly-bedded rocks known as "sadberites", or hypothetical units of the pluton roof.

The "Terrace" deposit is also confined to the norite and olivine norite complex and the "Crytical Horizon" rocks of the Nyud massif. The structure of the deposit is mainly bedded. The ore does crop out. The disseminated ore bodies occur in layers. In the lower part of the "Crytical horizon", at the "Terrace" deposit, Academician A.E. Fersman discovered a large (2.0 x 3.5 x 6.75 m) sulphide nest with magnetite. It was mined out in 1930s, but the massive sulphide ore samples, though oxidized, are present in the dumps of the old adit.

Stop 4. Vurechuaivench deposit

The Vurechuaivench deposit is a nicely outcropped area with numerous exposures of gabbronorite, where the excursionists may examine the typical section of the ore-bearing reef. The detailed sector demonstrates the main rock mass represented by fine- and medium-grained mesocratic massive, partially metamorphosed gabbronorite of yellow-greenish colour. The rock is intercalated with leucocratic metagabbro and is cut by a metagabbrodolerite dyke. In the northern part of the area there are outcrops of gabbronorite with sulphide impregnation containing PGEs.

The Vurechuaivench prospect is confined to the zone of alternating meso-leucocratic massive and taxitic gabbronorite and anorthosite-plagioclase. The PGE mineralization is related to the extensive zone of lens-like and tabular sulphide bodies. The mineralized zone is conformable to the layering, and contains about 20 sulphide horizons.

The horizons are marked by a 1-3-m thick interval of rich ore, resembling a reef in a way. The length of the rhythmically layered series is 7-8 km along strike, the width is 1.5 km, and the thickness is up to 1 km. The content of ore minerals reaches 5-10 %. Ore minerals: chalcopyrite, pyrrhotite, millerite, and Ni and Co arsenides. PGE minerals: Pd and Pt telluro-bismuthides, sulphides, arsenides and sulphoarsenides. Among these are kotulskite, merenskite, maichenerite, moncheite, sperrhyllite, mayakite, arsenopalladinite, mertite, stibiopalladinite, stillwaterite, and gold and silver minerals, intermetallic phase of silver and gold and hessite with predominant Pt and Pd tellurides (55 %). The grain size varies from 10 to 70 µm. The total PGM content is 0.5-15 ppm.

Overnight in Kirovsk (Hotel Severnaya)

Wednesday 31st August

Drive back from Kirovsk to Rovaniemi, where at 4-5 pm.