which plagioclase was replaced by K-feldspar and nepheline. An additional potential source for Al_2O_3 and K_2O is phlogopite, whose partial breakdown and subsequent overprint in the matrix is indicated by lower contents of Cl and F and higher TiO_2-contents.

The partial metasomatic alteration of the clinopyroxene can be interpreted as being due to a fluid-aided dissolution-reprecipitation process. Thereby a Cl_2-enriched fluid mobilised Fe, Mg, Al, Si and Ti in the altered areas causing the breakdown and redistribution of the titanomagnetite inclusions and Cl-enrichment in the apatite inclusions. Inclusions in the non-altered areas, i.e. the original magmatic clinopyroxene, did not encounter this Cl-bearing fluid and retain their original composition and texture. This fluid phase probably was a $CaCl_2$-rich brine. It could be derived from the former K-rich brine which lost K but gained Ca during its reaction with plagioclase to form nepheline + K-feldspar.

Hence a metasomatic overprint explains the unusual mineralogical composition of some mafic cumulates in Uralian-Alaskan-type complexes in the Ural Mountains and might also explain the different whole rock ages given by the Nd and Sr isotopic systematics [2, 3].

This study was funded by grant GK392 of the German Science Foundation to J. Krause and of grant RFBR № 09-05-00911 of the Russian Academy of Sciences to E. Pushkarev.

REFERENCES

1. *Fershtater G.B., Pushkarev E.V.* Nepheline-bearing Tylaites in the dunite-clinopyroxenite-gabbro association of the Urals Platinum Belt // Izv. Akad. Nauk SSSR, Ser. Geol., 1992. N 4. P. 74-84.

2. *Brugmann G.E., Pushkarev E.V., Jung S.* Evolution and Emplacement of Alaskan-Type Intrusions in the Uralian Fold Belt, Russia. Sm-Nd and Re-Os Isotope Systematics // Geophysical Research Abstracts. 2003. N 5. P. 14465.

3. *Pushkarev E.V., Fershtater G.B., Bea F., Montero P., Scarrow J.* Isotopic Rb-Sr Age of the Pseudoleucite Tilaite in the Uralian Platinum Belt // Doklady Earth Sciences. 2003. V. 388. P. 97-100.

REVERSELY-ZONED MAFIC BODY AT THE BASE OF THE KOITELAINEN LAYERED INTRUSION, FINLAND: PETROLOGICAL SIGNIFICANCE FOR ORIGIN OF MARGINAL REVERSALS

Latypov R.M.*, Hanski E.*, Lavrenchuk A.V.**
**Department of Geosciences, Oulu University, Oulu, Finland*
e-mail: rais.latypov@oulu.fi
***Institute of Mineralogy and Petrography SB RAS, Novosibirsk, Russia*
e-mail: alavr@mail.ru

An unusual 160 m thick sill-like body of fine- to medium-grained pigeonite gabbro has been recently discovered in between Archaean basement gneisses and the Paleoproterozoic Koitelainen layered intrusion, NW Finland [1, 2]. It has a chilled lower margin but non-chilled upper contact with respect to the overlying chromite-bearing orthopyroxene cumulates of Koitelainen layered intrusion. The body is unique in showing remarkably systematic reverse fractionation trends from the base to the very top. These are exemplified by a significant upward increase in whole-rock Mg# (100*Mg/(Mg+Fe)) from about 30% to 80%, and in normative An (100*An/(An+Ab)) from about 20% to 70%. Especially noteworthy is the upward dramatic depletion in all incompatible trace elements. For instance, La reveals a 250-fold decrease from 27.5 ppm to 0.11 ppm and Zr shows a 340-fold decrease from about 170 ppm to 0.5 ppm. In addition, a systematic upward decrease in ratios of highly incompatible elements (e.g. Zr/Y from 9 to 1; La/Yb from 20 to 1) is observed. In comparison to common basal reversals in layered intrusions, the studied body has a smaller grain size and exhibits a non-cumulative texture precluding a simple dilution effect due to cumulus crystals. The finding of a magmatic body with such anomalous compositional features is puzzling since conventional mechanisms of magma differentiation are not capable of forcing magmatic systems to differentiate in the direction opposite to that predicted by liquidus phase equilibria [3]. Our tentative interpretation is that the anomalous compositions trends have been produced by the emplacement of increasingly more primitive magma followed by the recrystallization of the uppermost part of the partly solidified body, under the influence of the Koitelainen layered intrusion.

REFERENCES

1. *Mutanen T.* Geology and ore petrology of the Akanvaara and Koitelainen mafic layered intrusions and the Keivitsa-Satovaara layered complex, northern Finland // Bulletin of Geol.Survey of Finland. 1997. V. 395. 233 pp.

2. *Hanski E., Walker R. J., Huhma H., Suominen I.* The Os and Nd isotopic systematics of c. 2.44 Ga Akanvaara and Koitelainen mafic layered intrusions in northern Finland // Precambrian Research. 2001. V. 109. P. 73-102.

3. *Latypov R.M., Chistyakova S.Yu., Alapieti T.T.* Revisiting problem of chilled margins related to marginal reversals in mafic-ultramafic intrusive bodies // Lithos. 2007. V. 99. P. 178-206.

STRUCTURE AND CONSTITUTION MAFIC-ULTRAMAFIC MASSIFS AS EVIDENCE OF THEIR POLYGENIC ORIGIN

Lesnov F.P.
Institute of Geology and Mineralogy SB RAS, Novosibirsk, Russia
e-mail: felix@uiggm.nsc.ru; *lesnovf@academ.org*

In the course of last decades, we discussed various aspects of geology, petrology, petrochemistry, geochemistry, mineralogy and metallogeny of various types of mafic-ultramafic massifs (MUM) that are common in folded regions and mainly considered to be ophiolite associations. Based on those data, polygenic formation model for such massifs [1-17], was proposed. The data in question are summarized and somewhat appended below.

Mafic-ultramafic massifs (MUM) located within both folded regions and platforms, are characterized by wide variations in all their parameters. At the low-scale structure-geological maps one can normally observe more or less linear disposition of MUM; this, in particular, can be clearly seen on the global layout of ophiolitic MUM [18]. This property of MUM is explained by their close structural ties with the zones of long-life abyssal fractures. The majority of MUMs have extended-lens shape, and trace both the main and fledging ruptures. Massifs confined to the nodes of crossing fractures, often have subisometric shape. The initial geometry of many massifs is complicated by later block deformations. MUM linear dimensions vary from hundred meters to hundred kilometers along the long axis, and from dozens of meters to dozens of kilometers along the short axis; areas of exposed MUM portions – from several square kilometers to several thousand square kilometers. Here area ratios can demonstrate variations from 100% ultramafic rocks to 100% mafic rocks.

Contact interrelations between the bodies of mafic and ultramafic rocks that make up the MUM, and those between the above bodies and encompassing strata rocks, are of topical significance as far as MUM petrology is concerned. Ultramafic bodies in MUM, as a rule, have steep (much rarely, slanting) tectonic contacts with the encompassing volcanogenic-terrigenous and metamorphic formations. Contact-edge zones of ultramafic bodies are often subject to intensive dynamo-metamorphism, are often schistose, sometimes the relict slab parting is observed. Mafic bodies in MUM lie normally along their hanging contacts; much less often – along the hanging or both contacts of ultramafic bodies. In the general case, mafic bodies and encompassing strata rocks have intrusive contacts, however, they are often complicated by fracture distortions. Very often, close to the major intrusive mafic bodies in encompassing strata, there occur their satellites represented by sills, stocks and dikes; xenoliths and skialites from encompassing strata rocks are present in mafites. Amphibole- and quartz-bearing gabbro and dorites prevail in the endocontact zones of mafic intrusives formed at substantial depths. Endocontact zones of low-depth mafic intrusives are normally the chilling zones formed by fine-grained