Geochemistry of uranium and thorium in soils on the Ditrău Alkaline Massif, Eastern Carpathians, Romania

ADRIANA ION[1,2]*

[1]Geological Institute of Romania, Bucharest, RO-012271, Romania (*adi75riana@yahoo.com)
[2]"Al. I. Cuza" University, Iași, RO-700506, Romania

The rocks of the Ditrău Massif (syenite, nepheline syenite, hornblendite, diorite, monzonite, monzodiorite, granitoid) have naturally higher uranium and thorium contents, making the area ideal for the study of the distribution in soils of these elements. The soil types present in the investigated area, according to the Romanian Soil Taxonomic Classification are: lithosol, redzine, eutricambosol, districombosol, typical luvosol, albic luvosol, ethnic luvosol and aluviosols. Uranium and thorium were analyzed in 70 soil samples collected from an equable points net for all type of representative rocks. U and Th concentration were measured non-destructively using gamma-ray spectrometry with HPGe detector, and the uranium and thorium bearing minerals in soil samples were identified by XRD. The pH values were determined using a digital pH-meter.

U concentrations in the soil varies between 0.5 and 9.3μg g^{-1} (6.18-114.86 Bq/Kg) and Th concentrations from 2 to 51.3 μg g^{-1} (8.12-208.28 Bq/Kg), whereas the Th/U ration in soil ranges from 1.87 to 19.52 μg g^{-1}. The pH varies from 3.6 to 7.3 and it controls the distribution of uranium and thorium in soil. Unlike U which is a mobile element, soluble in the U^{+6} state (oxidizing conditions), Th has low mobility under environmental conditions and reflects source area characteristics. XRD analysis enabled the identification of U and Th as major or trace elements in minerals like zircon, thorite, allanite, monazite, pyroclore, aeschynite, columbit, bastnäsite. The distribution of U and Th in soils is primarily controlled by the distribution of the accessory minerals in bedrocks, and secondly by the physical and chemical stability of these minerals in the pedogenetic process. The soils developed on granitoid rocks that occur in the north-eastern and eastern parts of the massif have the highest thorium content among all types of soils. High uranium contents were determined in soil samples developed on syenite and nephelin syenite. A positive correlation between uranium and thorium occurs in almost all type of soils.

Also, the results indicate an U and Th enrichment in the clay fraction.

The origin of garnet peridotites in the Siberian cratonic mantle from chemical, modal and textural data

D.A. IONOV[1], L.S. DOUCET[1], A.V. GOLOVIN[2]

[1]PRES-Lyon & UMR6524-CNRS, Saint Etienne, France, dmitri.ionov@univ-st-etienne.fr (*presenting author)
[2]Institute of Geology & Mineralogy, Novosibirsk, Russia, avg@igm.nsc.ru

Garnet peridotites, the most common rocks in cratonic mantle, are believed to be variably enriched residues of high-degree melt extraction, but the role and conditions of melting, metasomatism and deformation in their origin continue to be debated. A major problem is that peridotite xenoliths in kimberlites are usually altered during and after their transport to the surface, many are small and heterogeneous. We examine new and published [1-3] chemical, modal and textural data on several dozen large, fresh and homogeneous garnet peridotite xenoliths from the Udachnaya kimberlite in the central Siberian craton to better constrain the origin and evolution of garnet-facies cratonic mantle.

The least metasomatized garnet peridotites are similar in major oxide compositions to low-opx spl harzburgites from Udachnaya (interpreted as pristine melt extraction residues [4]) and were formed by 30–38% of polybaric fractional melting from 7–4 GPa to ≤1–3 GPa. Their whole-rock (WR) Al_2O_3 and Mg#, hence melt extraction degrees, do not vary with depth. Co-variations of modal abundances, major oxides and their ratios in WR indicate that garnet is mainly a residual mineral, which survived partial melting and/or exsolved from high-T opx on cooling, whereas cpx is mainly metasomatic. Modal abundances of garnet can be estimated from WR Al_2O_3; rocks with $Cr\#_{WR} > Cr\#_{gar}$ contain accessory Cr-spinel.

In addition to coarse and sheared peridoties, we identify "transitional" rocks with ≤10% neoblasts at margins of coarse olivine. Such incipient stages of deformation may have been overlooked in previous studies of altered xenoliths in the Siberian and other cratons. Regardless of deformation degrees deformed peridotites show stronger enrichments in Fe, Ti, Ca, REE than coarse peridotites, i.e. deformation is accompanied by metasomatism. Both deformed and coarse peridotites occur near the base of the lithosphere (≥1300°C, 6.8 GPa). P-T estimates define a perturbed geotherm [3]; oxygen fugacity decreases with depth less than inferred previously [3, 5].

[1] Ionov *et al*.. (2010) *J Petrol* **51**, 2177-2210. [2] Doucet *et al*.. (2013) *CMP* **165** (6). [3] Goncharov *et al*.. (2012) *EPSL* **357-358**, 99-110. [4] Doucet *et al*.. (2012) *EPSL* **359-360**, 206-218. [5] Yaxley *et al*.. (2012) *Lithos* **140-141**, 142-151.

DOI:10.1180/minmag.2013.077.5.9