Geophysical Research Abstracts, Vol. 8, 06462, 2006
SRef-ID: 1607-7962/gra/EGU06-A-06462

Pleistocene lamproite occurrence at the southeastern edge of Pannonian Basin (Romania): evidence for an enriched lithospheric mantle source

I. Seghedi (1), T. Ntaflos (2), Z. Pécskay (3)

(1) Institute of Geodynamics, 19-21, str. Jean-Luis Calderon, 020032 Bucharest, Romania, (2) Dept. of Geological Sciences, University of Vienna-Geozentrum, Althanstr. 14, 1090 Vienna, Austria, (3) Institute of Nuclear Research of the Hungarian Academy of Sciences. P.O. Box 51, Bem ter 18/c, H-4001 Debrecen, Hungary

The hidden petrological identity of the lamproite occurrence situated ca. 5 km south of Gătaia (Banat), considered up to now as an alkali basaltic occurrence, has been revealed by an exploration drilling, which pierced a slightly vesicular lava flow at the base of the Şumiga hill (198m a.s.l.) cinder cone, constituted by highly vesicular and intensely weathered scoria.

The isolated volcano, dated at 1.32 ± 0.06 Ma (K/Ar method), is situated at the southeastern margin of Pannonian Basin and at the western margin of the South Carpathians unit, along an important NE-SW faults system. The lamproite melts may have ascended rapidly to the surface from the upper mantle, and extruded relatively undeformed flat-lying Miocene sedimentary rocks at the margin of the Pannonian Basin, which overly older crystalline basement, that experienced intense lithospheric deformation and orogeny during Cretaceous. The Gătaia (Şumiga hill) lamproite represent a short lived magmatic episode, which is associated in time with other contemporaneous volcanic activity, but at 50-150 km toward N-NE, along the South Transylvanian fault system (Lucareţ alkali basalts, Uroiu shoshonites); however the rocks are not consanguineous, deriving from different mantle sources.

The rock is fresh and has a slightly porphyritic texture with phenocrysts of high-Mg olivine and microphenocrysts of euhedral leucite, in a glassy matrix, which contain also microcrysts of olivine, armalcolite, apatite, sanidine, low Al-diopside, fluor-bearing titanium phlogopite, fluor-bearing amphibole and as accessory chrome spinels

and rare titanomagnetite. Ba-sulphate aggregates fill small vesicles. Very rare clots of corroded Al-phlogopite (17.25 wt % Al_2O_3), surrounded by secondary spinels (56.7 wt % Al_2O_3), are enclosed by leucite aggregates, suggesting formation during an earlier event - as high pressure cognate phases. Two types of olivine phenocrysts have been found, the first one mostly corroded, having Fo_{90-93} in the core, and high NiO content (up to 0.75 wt %), which include chrome-spinels (>56 wt % Cr_2O_3) and a second type, which is euhedral, having Fo_{87-90} in the core, low NiO (<0.1 w %) and mostly free of spinels. Both phenocrysts decrease toward the margin their Fo up to 79-81, which is also characteristic for the small euhedral olivine in the groundmass. The first type suggests equilibration in an earlier Ni-rich melt, since the second type was generated in a Ni-poor liquid, equilibrated, as well, to the melt residue, up to the Fo_{79-80}. Silicate melt inclusions up to ~ 50 μm are abundant; also with decreasing Fo contents in the first type olivine, a decreasing of Cr_2O_3 (<50 wt %) in included spinel crystals has been observed. Leucite (21.3-21.9 wt % Al_2O_3) is the second essential mineral of the rock, occurring as euhedral crystals, when in contact with the matrix (having a fine rim of reaction), but mostly as aggregates. Armalcolite (0.5-0.8 wt % Cr_2O_3; $\sim$8 wt % MgO) is abundant and forms long euhedral prisms in the groundmass. The rock looks oversaturated in phosphorous. The first type olivine contains up to 0.1 wt % P_2O_5 and the second type up to 0.7 wt % P_2O_5. Apatites with F ranging from 2.6 to 4.5 wt % occur in the groundmass glass, or as inclusions in olivine and leucite. The apatite composition do not show other compositional variations, whether it occurs as inclusion in phenocrysts, or as euhedral crystals. Clinopyroxene (21.5-22.4 wt % CaO; 0.24-0.92 wt % Al_2O_3) is present as small crystals enclosed in the glass. High concentrations of fluor in titanium phlogopites (2.7-3.9 wt % F; 6.7-10.6 wt % TiO_2) and amphiboles (0.9-2.4 wt % F), imply low X_{H2O}. Sanidine (0.8-1.0 wt % Na_2O) was generating as late stage rosette-like crystals on the account of glassy matrix, suggesting a high-temperature devitrification, as the glass became saturated. The mineralogical composition specificity of Gătaia lamproite is adding to the lamproite clan a new variety, the first and the unique typical lamproite in the Carpathian-Pannonian Region.

The preliminary major and trace element geochemistry attests that the rock is a typical lamproite, close to Leucite Hills and Gaussberg lamproites compositions. The rock is characterized by high Mg# (75.7), high abundances of Ni (478 ppm) and Cr (539 ppm), as well as high primary K_2O contents (8.67 wt %) and K_2O/Na_2O values (6.84). A lamproite attribute of this rock is given by its relatively low contents of Al_2O_3 (9.34 wt %) and CaO (3.43 wt %) in combination with high abundances of Rb (205 ppm), Ba (2750 ppm), Sr (868 ppm) and Zr (1243 ppm), as well as La (134 ppm) and Ce (253 ppm). Depletions of Nb relative to Ba and La, and high ratios of Ba/ La may suggest genetic relationships to a metasomatic event via subduction processes.

The source for Gătaia lamproite, as it is generally envisioned, was probably a lherzolitic-harzburgitic lithospheric mantle, which has subsequently been metasomatized in an ancient event, as a necessary requirement due to its high content in incompatible trace elements as Ba, Sr, Rb and Zr. However, the hypothesis that Lamproites may be related to deeply subducted material should be also considered as Gataia lamproite is situated at the western edge of the Carpathian unit, a typical subduction related environment. Gătaia lamproite had probably a limited available source volume for melting in direct relationship with the ambient thermal regime in a typical post-collisional tectonic setting, during the Late Neogene to Quaternary tectonic evolution, that indicate surface uplift and erosion, marking the collapse of the Alpine orogen.