

# Miocene-Quaternary basalts from East Carpathian volcanic chain, Romania: a mineral chemistry and melt inclusion study

Ioan Seghedi<sup>1</sup>

<sup>1</sup> Institute of Geodynamics, Romanian Academy, 19-21 Jean Luis Calderon str, Bucharest 32, Romania, seghedi@geodin.ro

Călimani-Gurghiu-North Harghita (CGNH hereafter) volcanic chain, known for its diminishing age and volume southwards at 10-3.9 Ma marks the end of calc-alkaline magmatism along the post-collision front of the European convergent plate margin. The rocks show  $^{87}\text{Sr}/^{86}\text{Sr}$  values between 0.7035-0.7120 and a linear trend in the Th/Y vs Nb/Y diagram that reflects a common mantle source considered to be the metasomatized lithospheric mantle wedge. Fractionation or AFC are characteristic for each main volcanic area, suggestive of lower to middle crust magma chamber processes (Mason et al., 1995, 1996; Seghedi et al., 2004).

The South Harghita volcanic area is at the continuation of the CGNH volcanic chain. Here at ca. 3 Ma following a time-gap, magma compositions changed to adakite-like calc-alkaline and continued until recent times (< 0.03 Ma). This volcanism was interrupted at 1.6-1.2 Ma by simultaneous generation of Na- and K-alkalic varieties in nearby areas, suggestive of various sources and melting mechanisms. The specific geochemistry is revealed by higher Nb/Y and Th/Y ratios and lower  $^{87}\text{Sr}/^{86}\text{Sr}$  as compared to the CGNH chain.

Identification of primitive magmas has been difficult despite the fact that this volcanic chain, i.e., Călimani Mountains, contains more basalts than any other in the Carpathian-Pannonian region (Mason et al., 1996, Seghedi et al., 2005). Since the most primitive rocks represent the best opportunity to identify the trace element composition of the mantle source beneath the East Carpathian volcanic chain we use mineral and melt inclusions in olivine and composition of the most primitive clinopyroxene to estimate the source composition. The results show extremely diverse olivine compositions ( $\text{Fo}_{90-65}$ ) in single rocks indicative of extensive mixing and back-mixing processes during fractionation. The most forsteritic olivines ( $\text{Fo}_{80-90}$ ) contain either  $\text{Al}_2\text{O}_3$  rich spinels (25-40%), with low Cr/(Cr+Al) ratio (0.2-0.4), or low  $\text{Al}_2\text{O}_3$  spinels (25-40%), but with high Cr/(Cr+Al) ratio (0.6-0.8).

Trace element concentrations of melt inclusions in the most forsteritic olivines give a snapshot of early and hence primitive magma chemistry. The data suggests that the whole rocks geochemistry does not define the source region being an average of various melt components and further fractionation processes. The study of the most primitive basaltic rocks in the East Carpathians suggest two distinct mantle components: a variably metasomatized lithospheric mantle and slightly modified asthenosphere which support slab breakoff (CGNH) and slab-pull and tearing models (SH) (Mason et al., 1998, Seghedi et al., 2011).

The study offers a better insight on melting processes during post-collisional processes of an anomalous mantle potentially affected by previous subduction metasomatism and triggered by the asthenospheric upwelling.

## References:

- Mason P.R.D., Downes H., Seghedi I., Szakács A., Thirlwall M.F., Low-pressure evolution of magmas from the Călimani, Gurghiu and Harghita Mountains, East Carpathians, *Acta Vulcanologica* 7, 43-53.
- Mason P., Downes H., Thirlwall M.F., Seghedi I., Szakács A., Lowry D., Matthey D., 1996. Crustal assimilation as a major petrogenetic process in the East Carpathian Neogene and Quaternary continental margin arc, Romania. *Journal of Petrology* 37, 927-959.
- Mason P.R.D., Seghedi I., Szakács A., Downes H., 1998. Magmatic constraints on geodynamic models of subduction in the Eastern Carpathians, Romania. *Tectonophysics* 297, 157-176.
- Seghedi, I., Downes, H., Szakács, A., Mason, P.R.D., Thirlwall, M.F., Roșu, E., Pécskay, Z., Marton, E., Panaiotu, C., 2004. Neogene-Quaternary magmatism and geodynamics in the Carpathian-Pannonian region: a synthesis. *Lithos* 72, 117-146.
- Seghedi I., Szakács A., Pécskay Z., Mason P. R. D., 2005. Eruptive history and age of magmatic processes in the Călimani volcanic structure (Romania). *Geologica Carpathica* 56, 67-75.
- Seghedi I., Mațenco L., Downes H., Mason P. R. D., Szakács A., Pécskay Z., 2011. Tectonic significance of changes in post-subduction Pliocene-Quaternary magmatism in the south east part of the Carpathian-Pannonian Region, *Tectonophysics* 502, 146-157 doi:10.1016/j.tecto.2009.12.003.