Geochemistry and geochronology of the Eastern Srednogorie zone, Bulgaria

Svetoslav Georgiev[1], Albrecht von Quadt[1], Irena Peytcheva[1], Peter Marchev[2]

[1] ETH Zurich, IGMR, Switzerland, georgiev@erdw.ethz.ch; vonquadt@erdw.ethz.ch; peytcheva@erdw.ethz.ch
[2]Geological Institute, BAS, Sofia, Bulgaria, pmarchev@geology.bas.bg

Eastern Srednogorie zone is situated in southeastern Bulgaria and is part of the ABTS magmatic and metallogenic belt. Compared to other parts of the ABTS belt the magmatism in Eastern Srednogorie is the most voluminous and compositionally diverse manifestation of the Late Cretaceous magmatic activity. Characteristic features of the magmatism are the elevated alkalinity and the predominance of basic to intermediate volcanics. The available geochemical data consists mostly of major element analyses for separate volcano-intrusive centers.

In this study we present our geochemical and isotope data for a broad representative set of samples, with the aim to characterize the magmatism, and to put new constraints on the geodynamic evolution of Eastern Srednogorie zone.

Single zircon LA-ICP-MS dating and high precision TIMS U-Pb dating reveals that magmatism commenced at ca. 86 Ma, and the peak of the magmatic activity was from 81 to 78 Ma. Basement granitoids are dated as Permian.

All rocks from the studied area display typical MORB-normalized patterns of arc magmas: elevated contents of fluid mobile LILE, negative Nb-Ta trough, increase of Th and LREE compared to HREE. The HFSE ratios of the most primitive magmas suggest that the mantle source of Eastern Srednogorie had the characteristics or a slightly enriched N-MORB source. Our attempt to model the degree of melting following the ideas of Pearce and Patterson, 1993, suggest that the melting took place in a spinel lherzolite field, the calculated degrees of melting are rather high (25-35%), and the oxidizing conditions were around QFM +1.

Hf isotopes of the dated zircons suggest a mantle-dominated source of the magmas. The elevated Th/La ratios (0.24), the LREE to HREE enrichment (La/Yb_n=6.9) and the isotope ratios of the primitive volcanics with MgO > 8 wt% require addition sedimentary material to the mantle source Modeling of the whole-rock isotopic compositions suggests that the initial $^{87}Sr/^{86}Sr$ (0.70403) and $^{206}Pb/^{204}Pb$, $^{207}Pb/^{204}Pb$ $^{208}Pb/^{204}Pb$ (18.43, 15.58, and 38.37, respectively) ratios in the most primitive rocks can be achieved by addition of less than 1 wt% of sediment, plus some input of radiogenic Sr from slab-released fluids.

The more evolved compositions most probably resulted from crystal fractionation mainly of clinopyroxene ± olivine ± plagioclase ± Fe-oxides. In the process of differentiation, the rocks assimilated various proportions of crustal material, which is reflected in their elevated Pb and Sr initial ratios

References: Pearce and Parkinson, 1993. Geological society of London special publication No 76, 737-403