Origin of the igneous rocks from Ruen zone (SE Europe): geochemistry, isotope data and analysis of the zircon population

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U-Pb zircon dating, whole-rock isotope and trace element geochemistry are crucial to understand the origin and evolution of magmatic processes. In the present study, we combine them with analyses of the zircon population to better constrain the postsubductional evolution of parts of the Western Tethys in SE Europe. For this purpose, we studied the Ruen zone (RZ) that spread out over 120 km with NW-SE direction (135-140°) in Serbia, Bulgaria and FYR Macedonia, showing variable wide of 5-12 km. The magmatic and tectonic RZ cross-cut two major metamorphic terrains: The Upper and Lower complex of the Serbo-Macedonian Massif [1]. The main volcanic rock types of RZ are trachyrhyodacites, which are in the focus of our research.

The trachyrhyodacites are famous for their unique large crystals (1-2 to 5 cm) of sanidine. Besides them, phenocrysts of plagioclase and quartz clearly appear on the subporphyric level, whereas mafic minerals (biotite and amphibole) are subordinate. Trace elements concentrations reveal high values for K, Rb, Ba, Th, U, La and distinct Ta-Nb negative anomaly. The obtained Sr isotope data correlated with SiO_2 show that assimilation and fractionation processes are dominant during the magma evolution.

The estimated crustal input of 50 % within the volcanic rocks is based on zircon population analyses of the distribution of xenocrysts (contamination), inherited cores (assimilation), ante- and autocryts, (magma replenishment in a long-lived chamber). The age is determined on the youngest zircons and zircon rims at 31.1 ± 1.3 Ma using LA-ICP-MS techniques. Older U/Pb ages from inherited cores define two clusters at 220-250 Ma, and 400-460 Ma.

We may conclude that the trachyrhyodacites evolved with significant change in the chemical and isotopic composition, through fractional crystallization (FC) and assimilation (AFC) in upper-crustal magma chamber trapped in the thick continental crust. Such conditions favor the growth of large sanidine crystals and explain the increase of initial $^{87}Sr/^{86}Sr_i$ isotope ratios (average values of 0.709), as well as the 50% of zircon inheritance. Igneous and metamorphic host rocks from the basement showing such ages (220-250 Ma and 400-460 Ma) are already known and can be considered as source material for the assimilation. The zircon population analysis was helpful as additional support of the isotope constraints of the rock petrogenesis and history.

[1] Antic et al. (2015) *Gondwana Research*, **36**, 523-544