Timing and Sr-Nd-Hf constraints on the oldest Cenozoic magmatism in Kraishte, W Bulgaria

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Series of Cenozoic subvolvanic bodies and dykes crop out in the Kraishte region forming a NNW (150-160º) trending strip between the Penkyovtsi trust and the Trun-Kosharevo fault zone. Harkovska et al. (2004) pointed out the distinctive character of these rocks, compared with the other Paleogene volcanics in W Bulgaria. They usually form concordant sill-like bodies, which morphology is controlled by the Mid-Cretaceous Penkyovtsi trust and parallel shear zones. Compositionally the rocks are plagiorhyolities to plagiorhyodicites with normal calk-alkaline seriality. K-Ar whole-rock dating yielded ages from 42.2±1.6 Ma to 47.4±1.8 Ma, which were interpreted as possible resetting during low-temperature hydrothermal alteration. The authors paid attention on the missing Pb-Zn deposits that are otherwise linked with the Pg magmatic rocks in SW Bulgaria, Serbia and Macedonia.

In the frame of the SCOPES project we sampled and studied dykes and sills that cross-cut the Carboniferous Ruy pluton in Trun region, and some subvolcanic bodies – close to the villages of Erul, Jarlovtsi, Leshnikovtsi and Gorna Glogovitsa. The rocks are fine-porphyric to aphiric. They consist of irregularly hydrothermally altered plagioclase (An_{26-29} to An_{38-42}), biotite, needle amphibole and quartz, whereas K-feldspar is only present in the ground mass, but never as phenocrysts. Accessory minerals are apatite, zircon, monazite (in Gorna Glogovitsa). The major element chemistry is in agreement with published data (Harkovska et al., 2004). Trace element geochemistry defines mainly VAG-affinity. The rocks are enriched in LREE, with Ta-Nb negative anomaly, shallow negative Eu-anomaly and with a sum of REE 70-100 ppm. Moreover, they reveal adakite-like characteristics with Sr/Y ratio >45 (48-71), low Y content <18 (5.9 to 8.3) and La/Yb>20 (30-40).

Sr-Nd isotope data define a mantle dominated source of the plagiorhyolites and plagiodacites. The initial strontium ratios ($^{87}Sr/^{86}Sr)_i$ in the least altered samples are consistent around 0.7047, and εNd vary in a narrow range between -0.2 and +2.4. The Hf-isotope system in the zircons are also clearly mantle-influenced and εHf in the magmatic Paleogene zircons and zircons rims are positive – mainly between +4 and +6, but reaches +10 in the Erul volcanics.

The subvocanic rocks are dated more precisely using U-Pb method on zircons and monazite and two techniques - LA-ICP-MS and ID-TIMS. Leshnikovtsi plagiorhyolite is dated at 43.58±0.56 Ma (LA-ICP-MS data on zircons). ID-TIMS of chemically abraded zircons of the Erul body yield an age of 45.71±0.08 Ma – this is the youngest of four concordant zircons, whereas the other three define ages between 47.99±0.03 Ma and 45.71±0.04 Ma. In the Gorna Glogovitsa body Paleogene zircons are sparse and concordant between 43 and 45, the majority being around 44 Ma, and monazites are slightly younger – mainly between 42-43 Ma. Considerable amount of inherited zircons and cores are present in the zircon population of all dated samples, ranging from 330 to more than 1000 Ma. The εHf of these zircons define crustal source for their protoliths.

The new data for the Paleogenic subvolcanic rocks confirm their formation in Pre-Preabonian (Lutecian) time between 43 and 45.8 Ma. The older concordant zircon ages are possibly related to negligible lead inheritance from xeno- and antecrysts, whereas slightly younger monazite ages of 42 Ma might be reset by hydrothermal fluids. The mantle Sr-Nd-Hf isotope and trace-element characteristics infer subduction or post-collisional tectonic setting. Adakite-like characteristics are described in many old tonalitic (TTG) rocks, and also in the Upper Cretaceous Timok and Ridanj-Krepolin belts in Serbia. They do not necessarily infer subduction and slab melting and could be explained by high-pressure amphibole fractionation in the lower crust. Adakite-like magmas are usually fertile; consequently the new data may provide evidence for a new perspective ore-bearing region in W Bulgaria.

References

Harkovska, A., Z. Pecskay, M. Popov. 2004. The Kraishte magmato-tectonic zone (Western Bulgaria) – a review. – Geologica Balcanica, 34, 3-4, 3-19.