ZIRCON – "FINGER PRINTS" FOR SOURCE ROCKS: A CASE STUDY OF PALEOGENE VOLCANICS IN SW BULGARIA

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CL imaging and LA-ICP-MS investigation of the zircon population in magmatic rocks provide geochronological and geochemical information about the age of the source rocks and their magmatic, metamorphic or sedimentary origin – the geodynamic setting of magma generation, and finally, the possible composition of the magmatic rock. We applied these techniques to constrain the time and source of the Tsarvaritsa body – a Paleogene volcanic rock with trachyrhyodacitic composition and characteristic coarse sanidine phenocrysts (up to 5 cm). This volcanic rock variety is dominant in the Ruen magmatic zone (MILOVANOV *et al.,* 2007). It crops out in SW Bulgaria with 5–10 km width and more than 50 km in length, striking 320° NW. The trachyrhyodacites have average SiO_2-content of 68.8 wt%, and total alkalis (Na_2O + K_2O) about 8.3 wt%. The K_2O prevails over Na_2O content and the rocks plot in the field of the high-K calc-alkaline magmatic series on the SiO_2 vs. K_2O diagram. The ORG-normalized patterns are characteristic for post-orogenic granitoids, and the REE-normalized values shows similarity with rocks formed in the continental crust.

The studied zircon population (30 grains) consists of mainly inherited old cores with magmatic overgrowths (15 grains), and one third of the population (9 grains) is magmatic Paleogene zircon crystal with fine magmatic oscillatory zoning. Only five of the zircons are xenocrysts (without Paleogene overgrows). LA-ICP-MS zircon dating defines an age of 32.01 ± 0.50 Ma for the magmatic zones and autocrystic grains. The inherited zircon cores and xenocrysts reveal ages in the range of 250–280 Ma (Lower Triassic-Permian) and 400–460 Ma (Lower Devonian-Ordovician).

The common crystallographic forms of the Paleogene zircons are S3, S4, S8, S9 type (according to the typological classification of PUPIN, 1980) with predominance of the {101} bipyramid over {211} and the {110} prism over {100}, respectively. The inherited zircons with 250–280 Ma age have predominantly {101} and {100} forms - types P1, P2, and for the 400–460 Ma old zircons the characteristic morphological types are L1, S1, S6 with bipyramid {211} and prism {110}.

Trace and REE elements were analyzed in three zircon groups: i) in the Paleogene zircons (32 Ma); ii) in the zircons with 250–280 Ma age; iii) and in the 400–460 Ma old zircons. The measured Zr/Hf ratio in all zircon varieties ranges from 36 to 40. The average Y content is 860 ppm (i), 670 ppm (ii), and 2100 ppm (iii), respectively. The Th/U ratio is > 0.4 in the three zircon subgroups. The REE-chondrite normalized patterns of the zircons with 32 Ma and 250–280 Ma age, are very similar with weak Eu-anomaly. The 400–460 Ma old zircons have one order higher HREE (from Gd to Lu) content and a deep Eu-anomaly.

The trace elements and REE content of the Paleogene and old cores/xenocrysts zircons indicate igneous origin of the source rocks on the base of Th/U ratio ≥ 0.4 (HOSKIN & SCHALTEGGER, 2003), as well as Ce-content less than 50 ppm (GRIFFIN *et al.,* 2002). Their Zr/Hf ratio (in the three zircon variety) is typical for crustal zircons. The Eu-anomaly in the REE-normalized pattern in all zircon types shows that during the formation of Paleogene and Upper Permian rocks the plagioclase was involved in the melt, while for the Lower Devonian rocks (400–460 Ma) the plagioclase was probably a stable phase. Moreover, based on the zircon morphology of the (400–460 Ma) old grains we may relate them to the granitoids of mainly crustal origin (PUPIN, 1980).

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