Preliminary data on the age and geochemistry of Mesta volcanic complex and Central Pirin pluton

Petyo Filipov[1], Peter Marchev[1], Carsten Münker[2, 3], Maria Kirchenbaur[2,3]

[1]Geological Institute, Bulgarian Academy of Sciences, 1113 Sofia; p_philipov@geology.bas.bg
[2]Institut für Geologie und Mineralogie, Zülpicher Straße 49a, 50937 Köln
[3]Steinmann-Institut für Geologie, Mineralogie und Paläontologie, Poppelsdorfer Schloss, 53115 Bonn

Introduction

Mesta volcanic complex (MVC) and Central Pirin pluton (CPP) have been regarded by many authors as a volcano-plutonic association (Arnaudova and Arnaudov, 1982; Zagorchev et al., 1987; Harkovska et al., 1998). In order to verify this concept we carried out: (1) new studies on the mineralogical, geochemical and isotopic composition of 15 whole rock samples and (2) high-precision U-Pb zircon dating of 7 samples from MVC and CPP, complemented by two $^{40}Ar/^{39}Ar$ measurements of sanidine from the volcanic rocks, to constrain the time span of volcanic and plutonic igneous activity..

Geological setting

MVC and CPP are part of the Macedonian-Rhodope-North Aegean Magmatic zone (Harkovska et al. 1998). MVC crops out in an elongated SSE-NNW-oriented graben structure, situated between the western Rhodope block to the east and Pirin horst to the west. Two polygonal calderas (Kremen and Banichan) and two linear volcano-tectonic zones are distinguished within the volcanic complex (Harkovska, 1989). The subvolcanic and volcanic rocks are represented by stocks, domes, dome-flows, cryptodomes, dykes and pyroclastic flows. The volcanic rocks have exclusively felsic compositions, represented by rhyolites (oldest phase in field relations), trachyrhyodacites and rhyolitic ignimbrites. The CPP consists of porphyritic granites and equigranular granodiorites geochemically and isotopically similar to Mesta volcanic rocks.

Analytical techniques

Whole rock samples were analyzed for major and trace element concentrations as well as Sr-Nd-Hf isotopic composition. The major element measurements were obtained at the Institut für Geologie und Mineralogie, Köln on Philips PW 2400 X-ray spectrometer. The Sr-Nd-Hf isotopic compositions were measured at Steinmann-Institut, Bonn on equipment Thermo-Finnigan Neptune MC-ICP-MS. Zircon U-Pb dating as well as trace element content measurements were performed at the Geological Institute of BAS using New Wave UP193FX LA coupled to ELAN DRC-e quadrupole ICP-MS. Sanidine samples were dated by $^{40}Ar/^{39}Ar$ method at the University of Geneva. Cathode-luminescence images of zircon samples and microprobe analyses of feldspars and amphiboles were made in Belgrade University and ETH-Zurich.

Results and conclusions

The zircon ages (34.4-32.61 Ma) of the MVC and CPP suggest a short intrusion time span. The whole rock samples, yielding slightly varying isotopic compositions ($^{87}Sr/^{86}Sr$ - 0.7108-0.7130; $^{143}Nd/^{144}Nd$ - 0.512227-0.512285), are consistent with common magma sources. The large number of inherited cores in the studied zircons implies considerable assimilation of varying in age and chemical composition crustal lithologies. Mantle-crust mixed magma source is also predicted by the εNd-εHf model. In conclusion, our new data convincingly confirmed the genetic relations between MVC and CPP.

References:

Arnaudova R., V. Arnaudov. 1982. Comparative geochemistry and conditions of formation of the "South Bulgarian granites". – Geologica Balc., 12 (4), 21-36

Harkovska, A., Y. Yanev, P. Marchev. 1989. General features of the Paleogene orogenic magmatism in Bulgaria. – Geologica Balc. 19, 1, 37-72

Harkovska, A., P. Marchev, Ph. Machev, Z. Pecskay. 1998. Paleogene magmatism in the Central Rhodope area – a review and new data. Acta Vulcanol., 10 (2), 199-216

Zagorchev, I., S. Moorbath, P. Lilov. 1987. Radiogeochronological data about the Alpine magmatism in the western part of the Rhodope massif. – Geologica Balc., 17 (2), 59-71