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CENOZOIC MAGMATISM IN THE BORDER AREA OF W BULGARIA - E MACEDONIA - SE SERBIA: TEMPORAL EVOLUTION, GEOCHEMICAL TRENDS AND FERTILITY IN CHANGING COMPRESSION-EXTENSION REGIME

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Abstract

The Balkan Peninsula is one of Europe's mineralized regions with world-class ore deposits. Numerous porphyry Cu-(Au-Mo) and epithermal Au-(Cu) deposits are related to Upper Cretaceous calc-alkaline magmatism formed during oblique northward subduction of the Tethys beneath the European continent and slab roll-back. The next time period with important Pb-Zn-Au-Cu mineralization is Cenozoic (mainly Oligocene) and related to post-collisional magmatism. We present here integrated U-Pb zircon, Sr-Nd-Hf isotope and geochemical analyses on Palaeogene rocks from W Bulgaria, SE Serbia and E Macedonia (FYROM) with the aim to constrain the temporal and tectono-magmatic evolution of the region that favoured significant ore-formation.

After the cease of the Upper Cretaceous subduction at ~70 Ma and the accretion of the Morava-Rhodope/Getic-Supragetic units the region is marked by a collision/compression and break of magmatism. The magmatism started again at -60 Ma when rift-like alkaline basalts in eastern Serbia formed (Cvetkovic et al. 2013). They were followed (after a next break?) by adakite-like sodic calk-alkaline rhyolites-dacites at 47-43 Ma in the Kraishte magmato-tectonic zone (Harkovska et al. 2004). Trace element geochemistry defines mainly volcanic arc granite (VAG) affinity of these rocks. They are enriched in LREE, with Ta-Nb negative anomaly, shallow negative Eu anomaly and with a sum of REE 70-100 ppm. Adakite-like character is defined by Sr/Y>45 (48-71), Y content lower thanl8 ppm (5.9 ppm to 8.3 ppm) and La/ Yb>20 (30-40). Sr-Nd whole rock and Hf-zircon isotope data define a mantle dominated source ($^{87}Sr/^{86}Sr_M$ 0.7047-0.7051; eNd between -0.2 and +2.4; eHf-zircons of+4 to +10). Eocene adakite-like magmatic rocks can be traced further to S-SE in the Rhodopes and are likely related to mantle underplating and partial melting of subduction-enriched lithospheric mantle, but asthenospheric OIB-like mantle source could be an alternative option (Marchev et al. 2013).

After a next break of around 10 Ma the Cenozoic magmatism continued in Besna-Kobila-Osogovo-Thasos/Ruen and Lece-Chalkidiki magmatic and metallogenetic zones (MMZ) with related Pb-Zn-Au±Cu and Cu-Au±Pb-Zn mineralization (Harkovska 1984; Serafimovski 1993). The magmatism in the Ruen zone started in Surdulitsi (SE Serbia) at 36-34 Ma with still quite primitive magmatism despite of the fractionated granitoid composition of intrusive and subvolcanic products. Surdulitsa magmatism should be considered separately from the rest of magmatic rocks in the Ruen zone. The latter reveal an younger age of 32-30 Ma and crustal-dominated granitic/rhyodacitic composition ($^{87}Sr/^{86}Sr_{(i)}$ 0.709-0.716; eNd -6 to-10; eHf-zircons -2 to -8). The magmatism migrated further to SW and show magmatic ages of 29-24 Ma in Kratovo-Zletovo and the Buchim-Borov dol. Less radiogenic strontium ratios (0.70060) and slightly negative sNd values (-2.6 to -3.1) characterize the magma, which is considerably more mantle influenced. Again, in both MMZs the trace element geochemistry defines mainly VAG affinity, enrichment in LREE, and Ta, Nb and Ti negative anomalies. These features are typical for magmas that are generated in the metasomatized subduction enriched mantle lithosphere. The magmatism changed to mainly normal andesite-rhyolite type, but contemporary adakite-like magmas also occur.

Timing and geochemical characteristics of Paleogene magmatism in studied area suggest a repeated change of compression/collision and extension episodes that were plausible for the generation of fertile magmatism. The latter reveal signature of subduction-enriched mantle source but magma composition was additionally crustal modified and controlled by the composition and thickness of the interacted crust.