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Post collision magmatism and metallogeny at the southern part of the Balkan Peninsula, SE-Europe

Serafimovski, T.[1], Boev, B.[1] and Tasev, G.[1]

[1]Faculty of Natural and Technical Sciences, University "Goce Delcev"-Stip, str. Goce Delcev 89, The Republic of Macedonia; todor.serafimovski@ugd.edu.mk.

The Tethyan Eurasian metallogenic belt (TEMB) was formed during Mesozoic and post-Mesozoic times in the area of the former Tethyan ocean on the southern margin of Eurasia, with the Afro-Arabian and Indian plates to the south. It extends from the western Mediterranean via the Alps and southeastern Europe through the Lesser Caucasus, the Hindu Kush, and the Tibet Plateau to Burma and SW Indonesia, linking with the West Pacific metallogenic belt [1]. The Carpatho-Balkan region is one of the sectors of the TEMB, characterized by specific features. The emplacement of ore deposits is related to a specific time interval, and to specific tectonic settings.

After the obduction of the Eastern and Western Vardar Ophiolitic Units in the latest Jurassic or Early Cretaceous, the post-collisional convergence across the Sava zone produced thickened crust north to northeast of the suture, which crops out within the Rhodope Mountains. The end of the subduction and collision event and related compression occurred in the Priabonian, latest Eocene. The Late Eocene–Oligocene magmatic belt evolved from K-rich trachybasalts (34 Ma) via shoshonites, calc-alkaline and high-K calcalkaline basalts (33 to 31 Ma) to alkaline basalts (28–26 Ma; [2]). The origin of this very heterogeneous magmatism has generally been explained to be related to the postcollisional collapse of the Dinaride orogen (Late Oligocene) followed by the extension in the Pannonian basin (Miocene) and in the Aegean area, Pliocene [3]. Post-collision continent-continent setting includes deposits of Pb-Zn, Sb, As, Au-Cu associated with volcano-plutonic complexes of calc-alkaline affinity. Several major Alpine metallogenic units are developed in the Carpatho-Balkanides and adjacent area, characterized by specific development, mineral associations, and types of ore deposits.

Some regional metallogenic units such as the Serbo-Macedonian-Central Anatolian province are associated with the Oligocene-Miocene/Pliocene calc-alkaline complexes. The origin of these magmatic complexes cannot be unequivocally related to subduction of an oceanic crust and its partial melting, although they are situated in the vicinity of a suture zone, formed after the closure of the Vardar-Izmir-Ankara ocean. It is more likely, although still a tentative model, that the widespread calc-alkaline igneous suites resulted from anatectic partial melting of the lowermost part of continental crust and that locally even some ophiolites were involved [1]. These processes took place during the late Paleogene through early Neogene along the suture Vardar-Izmir-Ankara zone, preceded by uplifting of the central parts of suture zone due to lateral compression.

The ore deposits were emplaced at hypabyssal and volcanic levels, the latter often associated with caldera structures. Some deposits were formed from submarine brines, syngenetic and/or epigenetic with respect to country rocks; they may represent a specific group of deposits developed in this tectonic setting (such as hydrothermal-sedimentary deposits of boron minerals, gold/silver ± lead/zinc, Sb/As/Tl). Some deposits were formed above ophiolites and contain elements which were mobilized by hydrothermal solutions passing through ophiolites (Au, PGE, Cu).

Pb-Zn and Sb are the dominant metals in this tectonic setting. Porphyry copper deposits occur along the contact between two tectonic blocks, the Vardar zone and the Serbo-Macedonian massif (SMM).

Molybdenum mineralization as disseminated and/or vein types occurs sporadically; some of them contain large reserves but at low grade, Mackatica in Serbia [1], Golden Sunlight Mo–Au, Montana [4] etc. Hydrothermal-sedimentary magnesite and boron deposits occur in the Neogene basins.

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