Petrology and Geochronology of Pre- to Post-Ore Igneous Rocks from the Asarel Porphyry Cu(±Au±Mo) Deposit, Central Sredna Gora Zone, Bulgaria

Stoyan Georgiev[1], Irena Peytcheva[1], Elitsa Stefanova[1], Atanas Hikov[1], Albrecht von Quadt[2], Marcel Guillong[2], Desislav Ivanov[3]
1. Bulgarian Academy of Sciences (BAS), Sofia, Bulgaria, 2. ETH, Zürich, Switzerland, 3. Assarel Medet JSC, Panagyurishte, Bulgaria

The Panagyurishte ore region of the Central Sredna Gora Zone, Bulgaria, is a part of the Upper Cretaceous Apuseni-Banat-Timok-Sredna Gora magmatic-metallogenic arc belt (ABTSB). In the frame of the AGIMERA project, we focus on potential of porphyry copper deposits (PCDs) as sources of Cu and critical raw materials. The application of novel geochemical methods and precise geochronology in the study of the Asarel magmatic-hydrothermal system may result in improvement of the deposit model and provide additional knowledge on metal concentration. The ore formation is closely related to subsequent intrusion of pre-, syn-, and post-ore shallow magma bodies and dikes. The magmas are calk-alkaline to high calc-alkaline with diorite to granodiorite composition. The presence of small mafic enclaves, together with some slightly reverse zoning in the plagioclases and various εHf_{90} of zircons (-3.80 to 1.22), suggests mafic magma recharge and mixing. The early amphibole fractionation in water-saturated conditions and delay of plagioclase crystallization took part in the evolution of the magmas and facilitated transporting metal-enriched fluids. The crystallization of amphiboles shows shallow crustal depths (8.13–6.36 km), temperatures of 882° to 839°C, and H_20 (in the melt) of 5.5 to 5.2 wt %. Different redox conditions were found during the zircon growth from pre- to syn-ore stages and syn- to post-ore magmatic stages, indicating that the first ones are more oxidized and in favor of metal precipitation. The depletion of Ce* may additionally partly result from concurrent growth of allanite. The precise CA-ID-TIMS geochronology distinguished the age of porphyries from the pre- to syn-ore stages at 90.29±0.42 Ma and from the syn- to post-ore stages at 89.56±0.11 Ma, consequently a short magmatic-hydrothermal life of the system (0.73 Ma).

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