Geological environment and genetic constraints of the Shamlugh ore deposit, Alaverdi district, Lesser Caucasus, Armenia*

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The Shamlugh Cu deposit and associated ore deposits of the Alaverdi district are hosted by calc-alkaline middle-Jurassic volcanogenic and volcanosedimentary rocks of the Somkheto-Karabagh arc. The metallogenic endowment of the arc, extending from southern Georgia through northern Armenia and the Nogorno-Karabagh region results from the important Mesozoic magmatic history generated by the long-lasting north-eastern subduction of the Tethys under the Eurasian margin along the Sevan-Akera suture zone.

Mineral reserves at Shamlugh are 4.5 Mt @ 3.54% Cu, 1.71% Pb, 4.96% Zn, 8.1 g/t Ag and 1.7 Mt @ 0.7 g/t Au. The deposit is classified as "Mednokolchedan" or copper-pyrite deposit in Soviet literature, a term used to describe massive copper-rich sulfide bodies with or without genetic implications. The Shamlugh deposit has also briefly been described as epigenetic. Mineralization style at the deposit includes massive replacement ore bodies at the lithological contact between the volcanoclastic host rock and a 155.0±1.0 Ma old subvolcanic rhyolitic sill (U-Pb zircon dating by LA-ICP-MS). Stockwork and vein mineralization is found at depth. The ore mineralogy is simple and includes principally pyrite and chalcopyrite. Alteration assemblages include chlorite and sericite in the footwall and sericite in the hanging wall. Late stage carbonate and barite veins are present mainly in the upper parts of the deposit. Other characteristics include accumulations of gypsum as well as lobes of red Fe-rich cherts. Sulfur isotope values are between 0.6 and 4.6 $d^{34}S_{CDT}$‰ for sulfides, consistent with the magmatic isotopic signature of sulfides and between 16.7 and 17.5 $d^{34}S_{CDT}$‰ for sulfates, consistent with the isotopic signature of contemporaneous seawater sulfate. These characteristics, including the presence of mm scale tubular textures possibly linked to acidophilic bacteria, suggest that the Shamlugh formed in a similar environment to volcanogenic massive sulfide deposits. The presence of the Teghut Cu-porphyry deposit found within 20 km of Shamlugh, where mineralization is dated at 145.85 ± 0.52 Ma (Re-Os on molybdenite) and the tonalite host rock at 152.7 ± 0.72 (U-Pb zircon dating by LA-ICP-MS) suggests a relatively rapid switch in mineralization environment at the district scale.

Studying Shamlugh is also of interest in order to gain better understanding of the metallogeny of the Somkheto-Karabagh island arc. Sr, Nd, and Pd isotope investigations are currently in progress

to compare the Shamlugh deposit and its geological environment with other deposits hosted within middle-Jurassic host rocks along the arc (e.g., Kapan and Drmbon deposits).