

3-D Modeling Contribution for Producing Near Mine Exploration Targets at Olympias Gold-Rich Polymetallic Carbonate Replacement Deposit, Halkidiki, N. Greece

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The Olympias deposit, Halkidiki, Greece, is a complex gold-rich polymetallic carbonate replacement deposit (CRD; 16.1 Mt at 7.87 g/t Au, 128 g/t Ag, 4.3% Pb, 5.7% Zn), which is one of several important mineral systems in the region that include the Skouries porphyry Au-Cu deposit and several other CRDs (e.g., Mavres Petres, Madem Lako, and Piavitsa). Olympias is the largest CRD and is hosted in the Permo-Carboniferous Kerdyllia Formation of the Serbo-Macedonian Massif, a high-grade metamorphic sequence consisting dominantly of biotite-quartz-feldspar gneiss, granitic gneiss, amphibolite and, importantly, marble. Eocene- and Oligocene-age granitic intrusions also occur throughout the Kerdyllia Formation, mainly as pegmatite and granite dikes and sills of several generations that range from syn- to post-metamorphic in age. Relogging of over 70 km of historic drill core from the Olympias deposit has revealed eight different ore types ranging from Pb-Zn-, Au-As-, to Au-As-Si-Mn-rich types that exhibit a wide variety of textures. Mineralization is dominantly hosted within the marble and partly in the granitic gneiss unit of the Kerdyllia Formation. Surface and underground mapping shows that the deposit appears to be controlled by two dominant fault zones. Kassandra fault is a north-northwest dextral listric fault gradually getting an NNE trending and East fault is a north-northwest normal fault steeply dipping (80°–70°) to the northeast. It appears that these faults probably acted as conduits for the mineralizing fluids. Three main types of hydrothermal alteration were identified, depending on the rock type affected and the structural regime: strong argillic alteration (kaolinite, montmorillonite, paragonitic illite) was identified enveloping the mineralization and is developed tens of meters or more from the ore, particularly within the gneiss. Calc-silicate alteration (epidote, hornblende, phlogopite, pyroxene, and magnetite) developed near the amphibolite gneiss and marble contact, and silicification (quartz, rhodochrosite) is related with a late-stage epithermal event, mainly associated with faults and pegmatite-granitic dikes and sills. Surface mapping and cross sections from relogged drill core were used to help reconstruct a 3-D model of the deposit using Datamine Studio 3. The results show the close association between major structures and high-grade Au mineralization, and provide potential new target areas for exploration.