Geology, Alteration-Mineralization and Whole-rock Geochemistry of the Daraloo and Sarmeshk Porphyry Cu +/- Mo Deposits, Central Part of the Dehaj-Sardoeieh belt, South Iran

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Abstract

The Daraloo and Sarmeshk copper deposits occur in a NW-SE - trending fault zone in the southern section of the Cenozoic Urumieh-Dokhtar Magmatic Belt of Iran. In this zone, a belt of alteration-mineralization defines a NW-SE trending zone 10 km long and 0.5-1 km wide with the two deposits located at the NW and SE ends, respectively. The area is characterized by a series of porphyritic tonalite-granodiorite plutons of inferred Miocene age which cut Eocene andesitic volcanic and pyroclastic rocks. All these rocks are intruded by post-ore granodiorite plutons and dykes. Alteration assemblages comparable to those in other porphyry Cu ± Mo systems are well developed in both deposits. The earliest alteration, distinguished by fracture fillings and replacement textures, generated magnetite ± K-feldspar - rich, sulfide-poor zones in the centre of the intrusions and adjacent country rocks. The early magnetite alteration was followed and partially overprinted by a potassic stage which coincides with the main-stage copper mineralization. Propylitic alteration (epidote-chlorite-carbonates) defines an outer halo mainly developed in the volcanic rocks. Feldspar-destructive alteration (phyllic ± argillic), locally controlled by faults and late fractures and mostly in the outer part of the potassic zone and transition to the propylitic alteration, overprints the potassic and propylitic alteration. The mineralization, occurring as quartz-sulfide stockwork and dissemination in both the intrusions and volcanic rocks, is characterized by abundant pyrite and magnetite, minor chalcopyrite, and trace bornite and molybdenite. Magnetite, common in both deposits, occurs both in quartz-sulphide veinlets as well as discrete magnetite veinlets and disseminations. Supergene enrichment is poorly developed at Sarmeshk, but an enrichment zone 5 to 40 m thick occurs at Daraloo. This lack of an enrichment zone at Sarmeshk might be attributed to a less efficient leaching, due to the intense silicic alteration, and lower copper assays in the original mineralization. Geochemistry for representative samples of the porphyritic intrusions and the volcanic rocks indicates they are both subalkaline/calc-alkaline and conform to intermediate compositions (i.e., granodiorite- tonalite and andesite-andesitic-basalt), whereas elemental trends (increase in K_2O, Na_2O and $\sum$REE, decrease in Al_2O_3, P_2O5, Fe_2O_3, TiO_2, MgO, MnO, CaO and Sr) suggest crystal fractionation controlled magma evolution. Trace- element plots (e.g., Nb-Y and Ta-Yb) suggest an intra-continental volcanic arc setting for the rocks with an origin due to partial melting of a subduction-modified metasomatised mantle, as reflected by LILE enrichment, HFSE depletion negative Nb and Ti anomalies in primitive-mantle normalized spider diagrams.