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Metallogeny of Manto-type Copper Deposits of Iran: A Possible Link to the Evaporitic basins

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Abstract

Iran is one of the most significant producers of copper in the world and hosts varieties of copper deposits, including porphyry Cu-Mo, vein-type, volcanogenic massive sulfide (VMS), sediment-hosted stratabound copper (SSC), Manto-type, and skarn.

Manto-type deposits are the second producer of copper in Iran, mostly hosted in basalt, basalt-andesite to andesite volcanic rocks. There are more than 40 Manto-type copper deposits and occurrences in Iran, such as Mari, Abbas-Abad, Vorezg, Robat, Simakan, and Sorkho, and most of them are economically deposits. Most of these deposits occur in Eocene volcanic rocks, and a small amount of them (such as KeshtMahki, Hassanabad, Khorjan, and Simakan) are hosted in the Early Cretaceous volcanic rocks that mainly concentrated in the Saveh-Yazd (in the Urumieh-Dokhtar magmatic belt), Qazvin-Zanjan, Sabzevar-Neishabour, Semnan-Shahroud volcanic zones, and eastern Iran.

The stratabound sulfide ores in these Manto-type copper deposits include chalcocite, chalcopyrite, and bornite, associated with covellite, malachite, atacamite, chrysocolla, and minor azurite in the oxidized and supergene ore zones. Sulfide mineralization usually occurs as a replacement in pyrites and feldspars, vein and veinless, and breccia, which is accompanied by carbonatization, propylitic, and minor sericite alterations. Geological and geochemical data indicate that most of these deposits formed within plate failed continental rift and back-arc extensional environments related to the subduction of the oceanic crust of neo-Tethys beneath the Iranian Plateau.

Furthermore, the temporal and spatial distribution of these deposits in terms of time shows a close relationship with evaporitic basins. This phenomenon suggests a genetic relationship between the formation of Manto-type deposits and the circulation of brines from adjacent evaporitic basins in shallow extensional tectonic environments.