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Metallogeny of the Zahedan-Nehbandan magmatic belt and implications to porphyry Cu exploration in southeastern Iran

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The Late Cretaceous to Eocene Sistan suture zone in southeastern Iran separates the Lut continental block in the west from the Afghan continental block in the east. A major belt of Oligocene to Miocene igneous rocks occurs between the cities of Zahedan and Nehbandan, stretching for ~200 km from south to north parallel to the border with Pakistan and Afghanistan. Known porphyry Cu mineralization is associated with the intrusions and intrusive complexes at Kuh-e Janja (16.5±2.0 Ma), Kuh-e Seyasteragi (19.2±1.4 Ma), Kuh-e Assagie (27.5±2.0 Ma), and Kuh-e Lar (32.8±3.0 Ma).

Small intrusions and intrusive complexes in the Zahedan-Nehbandan magmatic belt are mostly intermediate to felsic in composition and have calc-alkaline or shoshonitic affinities. Associated volcanic and volcanoclastic rocks are common. The igneous rocks are hosted by deformed late Cretaceous to Eocene flysch sequences that formed in the Sefidabeh forearc basin developed during the subduction and closure of the Sistan ocean. The geochemical composition of the intrusive rocks and their ages suggest that igneous activity and related mineralization in the Zahedan-Nehbandan magmatic belt may have formed as a result of post-collisional processes. The locations of the intrusive centers in the Kuh-e Assagie and Kuh-e Lar may be controlled by strike-slip faults, which are major post-collisional structures.

The recent discovery of the Janja porphyry Cu-Au-Mo deposit below Quaternary alluvial terraces highlights the exploration potential of the Zahedan-Nehbandan magmatic belt. In addition to post-collisional porphyry deposits, other deposit types such as skarns, polymetallic veins, or epithermal deposits may be hidden below the regionally extensive Quaternary cover.