



Geology, mineralogy and fluid characteristics of the Masjed Daghi epithermal gold deposit, NW Iran

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The Masjed Daghi gold district lies in the Arasbaran Metallogenic Zone (AMZ). The (AMZ) lies at the junction between the Alborz-Azerbaijan Magmatic Belt (AAMB) in north, and the Urumieh-Dokhtar Magmatic Arc (UDMA) in west central.

The AAMB extends for 1800 km in east-west direction and consists of Cenozoic calc-alkaline and subordinate alkaline and shoshonitic rocks. The UDMA is another Cenozoic magmatic assemblage dominated by calc-alkaline rocks that extends for over 2000 km in NW-SE direction in west-central Iran.

The UDMB bears features characteristic of Andean type continental arcs, and is considered to be related to the subduction processes associated with the closure of Neotethys in late Mesozoic-Cenozoic ages. The UDMB hosts many porphyry Cu-Mo, base metal skarn and epithermal precious metal deposits.

The AMZ covers an area ~2400 km² and contains many epithermal precious and base metals systems, Hg-Sb-As veins, and porphyry Cu-Mo and associated skarn systems, represented by the world-class Sungun. Some 15 epithermal precious metal occurrences have been discovered over the past 10 years.

The country rocks include Eocene andesite, trachyandesite, dacite, tuffs and agglomerates, intruded by a shallow diorite porphyry intrusion. Mineralization occurs in brecciated and vuggy quartz and quartz-barite veins. Some 12 veins, 50-700 m long and 2-20 m wide, are mapped. Pyrite is the main ore mineral, associated with minor chalcocopyrite, molybdenite, sphalerite, galena and Fe-oxides. The gold contents vary between 0.1-30 ppm. The auriferous veins are surrounded by more or less concentric zones of argillic, silicic, alunite and chlorite alterations. The epithermal system at Masjed-Daghi appears to be associated with a porphyry Cu-Mo system at deeper levels. This is supported by the occurrences of phyllic and potassic alteration, as well as the elevated contents of Cu (1000 to >10,000 ppm), Mo (50-400 ppm) and As (100-3000 ppm) observed in samples from trenches and drill cores.

Fluid inclusion data from the ore stage quartz and sphalerite show Th values in the range 150-290 and 120-218 oC, and salinities in the range 3-12.8 and 3-11.2wt% NaCl equivalent, respectively. The wide range in salinity can be explained by mixing of two fluids with different salinities. Most inclusions are liquid-dominant; no coexisting liquid- and vapor-rich inclusions were identified.

The $\delta^{34}\text{S}$ values of sulfides are in the range of +1.2‰ to -1.1‰ implying a dominant magmatic source for sulfur, either directly derived from magmas or leached from magmatic country rocks.

With regard to the abundant hypogene alunite and kaolinite (advanced argillic alteration), lack of carbonates, low Pb-Zn contents, and the occurrence of barite in the veins, Masjed-Daghi can be classified as a high-sulfidation precious metal deposit.