

## Four Exploration Stages at the Dalli Porphyry Cu-Au Deposit, Central Iran

Hooshang Asadi Haroni,<sup>1,\*</sup> Yongjun Lu,<sup>2</sup> William Xavier Chávez, Jr.,<sup>3</sup> and Maral Malekian<sup>4</sup>

<sup>1</sup>Department of Mining Engineering, Isfahan University of Technology, 8415683111,  
Isfahan, Iran

<sup>2</sup>Centre for Exploration Targeting and Australian Research Council Centre of Excellence for  
Core to Crust Fluid Systems, School of Earth and Environment, University of Western  
Australia, Crawley, WA 6009, Australia

<sup>3</sup>Geological Survey of Western Australia, 100 Plain Street, East Perth, WA 6004, Australia

<sup>4</sup>New Mexico School of Mines, Minerals Engineering Department, Socorro, New Mexico,  
USA

\*Corresponding author: e-mail, hooshang.asadiharoni@uwa.edu.au

The Dalli porphyry Cu-Au system is located within the Urumieh-Dokhtar magmatic arc segment of the central Tethyan metallogenic belt. The giant Sar-Chesmeh and Sungun porphyry Cu-Mo-Au deposits are located in the southeast and southwest ends of the Urumieh-Dokhtar magmatic arc, respectively. Dalli is the first porphyry Cu-Au system discovered in the central segment of the Urumieh-Dokhtar magmatic arc. This deposit consists of three conical-shaped porphyry centers that crop out within an NE-SW-trending corridor. During the reconnaissance stage by Rio Tinto in 2003, the first porphyry center was identified by mapping hydrothermal alteration with Aster satellite data and ground control. During the prospecting stage in 2004, an Iranian junior company (DORSA) reevaluated the Dalli occurrence and successfully identified two more porphyry centers within a 6.5- × 3-km zone of hydrothermal alteration.

Disseminated Cu-Au mineralization is associated with dioritic to granodioritic plutons showing potassic alteration comprising well-developed late magmatic K-feldspar and biotite. Local phyllic alteration overprint consists of quartz-sericite, specularite, and intensive stockwork and sheeted quartz-magnetite-hematite-sulfide veins surrounded by barren local argillic and extensive propylitic alteration. <sup>206</sup>U/<sup>238</sup>Pb age data on zircon of the altered plutonic rocks, analyzed at the Curtin University in Australia, indicate an emplacement age of ~16 million years, within the common mid-Miocene ages for Iranian porphyries. In normalized multielement diagrams, Dalli host intrusions are characterized by enrichments in large ion lithophile elements and depletions in high field strength elements, and display features typical of subduction-related calc-alkaline magmas.

In 2005, DORSA carried out geochemical sampling and ground magnetic surveys during preliminary exploration. By applying an additive index analysis on the soil data, two strong Cu-Au mineralized zones were identified and named South Hill (190 × 225 m) and North Hill (200 × 400 m). Rock channel sampling data revealed 0.2 to 3.4 g/t Au and 0.2 to 1.2% Cu at these porphyry centers. A reduced to the pole magnetic map revealed strong and larger magnetic anomalies at these centers. Due to the close association of magnetic anomalies with Cu-Au mineralization, the magnetic map was combined with the Cu-Au geochemical and geological maps to generate drill targets tested by four holes (228–401 m). These holes intersected several zones of economic Cu-Au mineralization, and the project was upgraded to detailed exploration status. An IP/RS survey was carried out at both centers; this information was combined with the earlier exploration data and generated targets for six more drill holes (375–551 m). Drill core and rock channel sample data were used to calculate a proven reserve of 10 Mt at 0.65 g/t Au and 0.5% Cu for the South Hill and an inferred resource of 45 Mt at 0.54 g/t Au and 0.2% Cu for the North Hill. Logging, 3D modeling, and

mineralogical studies indicated that 88% of the mineralization occurs as sulfides comprising chalcopyrite and minor bornite and chalcocite with supergene oxides (malachite, azurite, and cuprite), indicating weathering under near-neutral pH conditions. Native gold was identified as microscopic inclusions in chalcopyrite, pyrite, and quartz. The discovery of the Dalli porphyry Cu-Au system highlights the importance of the central segment of the Urumieh-Dokhtar magmatic arc as a potentially significant, economically important, underexplored mid-Miocene Tethyan porphyry province.