



## Chapter 8

# Relationship Between Porphyry Systems, Crustal Preservation Levels, and Amount of Exploration in Magmatic Belts of the Central Tethys Region\*

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### Abstract

Tectonic, geologic, geochemical, geochronologic, and ore deposit data from the U.S. Geological Survey-led assessment of 26 porphyry belts identified in the central Tethys region of Turkey, the Caucasus, Iran, western Pakistan, and southern Afghanistan relate porphyry mineralization to the tectonomagmatic evolution of the region and associated subduction and postsubduction processes. However, uplift, erosion, subsidence, and burial of porphyry systems, as well as post-mineral deformation, also played an essential role in shaping the observed metallogenic patterns.

We present a methodology that systematically evaluates the relationship between the level of erosion, the extent of cover, and the number of known porphyry occurrences in porphyry belts. Porphyry belts that exhibit coeval volcanic-to-plutonic rock aerial ratios between 33 and 66 and limited cover contain numerous identified porphyry occurrences. These belts are relatively well explored because porphyry systems are not eroded or buried. Porphyry belts with volcanic-to-plutonic ratios that are greater than 66, but are modestly covered, contain fewer identified porphyry occurrences. Current exploration in these belts is increasingly identifying porphyry systems under associated epithermal deposits. Porphyry belts that show volcanic-to-plutonic ratios that are greater than 66, but are extensively covered, contain few identified porphyry occurrences. These belts have not been extensively explored but have potential for discoveries under cover. Deformed porphyry belts exhibit variable volcanic-to-plutonic ratios that are typically below 33, but can be as high as 60. Commonly, these deformed belts are extensively covered. Exploration efforts for porphyry deposits in these variably exhumed belts have been limited.

Exploration has resulted in the identification of 62.7 million tonnes (Mt) of copper, 2.0 Mt of molybdenum, and 4.200 t of gold in the 45 porphyry deposits contained in the 26 porphyry belts of the region: (1) 54.7 Mt of copper (87% of total), 1.74 Mt of molybdenum (87%), and 3,370 t of gold (80%) occur in the 25 deposits of the four porphyry belts that exhibit coeval volcanic-to-plutonic ratios between 33 and 66 and limited cover; (2) 5.44 Mt of copper (9%), 0.148 Mt of molybdenum (7%), and 581 t of gold (14%) are contained in the 11 deposits of the 11 porphyry belts that display volcanic-to-plutonic ratios greater than 66 and modest cover; (3) 2.08 Mt of copper (3%), 0.110 Mt of molybdenum (6%), and 244 t of gold (6%) occur in the seven deposits of the three porphyry belts that have volcanic-to-plutonic ratios that are greater than 66 and extensive cover; and (4) 0.388 Mt of copper (1%), 0.006 Mt of molybdenum (<<1%), and 6 t of gold (<<1%) are contained in the two deposits of the eight deformed and covered porphyry belts with variable but typically low volcanic-to-plutonic ratios.

The central Tethys region is receiving considerable exploration attention. It hosts the Kadjaran (4.6 Mt Cu), Sungun (5.1 Mt Cu), Sar Cheshmeh (8.9 Mt Cu), and Reko Diq (23.0 Mt Cu) world-class porphyry deposits. Continued exploration for porphyry deposits in the region will likely lead to new discoveries in known porphyry belts, particularly under cover and below high- and intermediate-sulfidation epithermal systems.

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\*Appendices are available online at [www.segweb.org/SP19-Appendices](http://www.segweb.org/SP19-Appendices).