

Porphyry copper potential of Asia

Jane M Hammarstrom*, Steve Ludington, Mark J Mihalasky, Gilpin R Robinson Jr.

*USGS, Reston, USA, VA, Email: jhammars@usgs.gov

The porphyry copper potential of Asia was assessed as part of the first global assessment of undiscovered copper (Cu) resources conducted by the USGS in cooperation with international colleagues. The geology-based assessment followed the USGS 3-part form of quantitative mineral resource assessment in which (1) permissive tracts for the occurrence of porphyry copper deposits are outlined based on mineral deposit model characteristics, (2) grade and tonnage models are used as analogs for resources in undiscovered deposits, and (3) probabilistic estimates are made of numbers of undiscovered deposits (Singer and Menzie, 2010). The probabilistic estimates of in-place undiscovered copper resource for each permissive tract were made by combining undiscovered deposit estimates with grade and tonnage models using Monte Carlo simulation. A simple economic filter was applied to the results to address the question of what portion of in-place undiscovered porphyry copper resources might be economic to extract depending on assumptions about metal prices, mining methods, capital costs, recovery rates, mining depth, and availability of infrastructure.

Permissive tracts were defined using appropriate lithologies in magmatic arcs or belts of a given age range. The Central and Eastern Asia region hosts 14 world-class porphyry copper deposits including Oyu Tolgoi (37 Mt contained Cu) in Mongolia and Almalyk in Uzbekistan (24 Mt Cu). Mean estimates of in-place undiscovered copper resources in the region (450 Mt Cu) exceed identified resources (140 Mt Cu). Some 270 Mt of undiscovered in-place copper resources may be economic. The Southeast Asia region, which extends across southern China eastward and southward through the Indochina Peninsula includes 12 permissive tracts. The region has eight world-class porphyry copper deposits, including the two largest deposits of this type known in China, Dexing (8.4 Mt Cu) and Qulong (8.0 Mt Cu). Mean estimated undiscovered resources (420 Mt Cu) greatly exceed the identified resources (56 Mt) in the region; about half of the undiscovered copper resources (200 Mt) may be economic. The Southeast Asia Archipelagos region is a large area that includes the Philippines, Taiwan, Malaysia, Indonesia, and the Melanesian nations of Papua New Guinea, the Solomon Islands, Vanuatu, and Fiji. Fifty-three porphyry copper deposits and 17 world-class deposits, including Grasberg in Indonesia (24 Mt Cu), are known in 31 tracts in the Archipelago region; more than half of the known porphyry copper deposits are located in the Philippines. Mean undiscovered resources (300 Mt Cu) exceed identified resources (130 Mt), and the potential economic undiscovered resources (140 Mt Cu) are comparable to the amount of copper that has already been identified in the region (130 Mt). These 3 regions in Asia represent almost half of the area of the assessed world regions, yet contain only 18% of the identified copper resources. About a third of the 63 permissive tracts in Asia lack any known porphyry copper deposits. Although the Americas dominate the mean global estimate of in-place undiscovered porphyry copper resources of 3, 100 Mt Cu, Asia, with an estimated 1, 170 Mt of undiscovered Cu (38% of world total) could provide significant future resources.