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Temporal distribution of porphyry copper deposits and the influencing factors

XUYANG MENG[1] AND JINGWEN MAO[2]

[1]China University of Geosciences (Beijing)
[2]MLR Key Laboratory of Metallogeny and Mineral Assessment, Institute of Mineral Resources, Chinese Academy of Geological Sciences

Porphyry copper deposits, the primary source of global copper resources, exhibit a distinct uneven temporal distribution. They predominantly form in island-arc and continental-arc settings during the Phanerozoic and are very rare in the Precambrian. The exact reasons for the temporal distribution of porphyry Cu deposits remain poorly understood. Researchers suggest that the lack of Precambrian porphyry copper deposits was primarily due to unfavorable tectonomagmatic conditions and erosion. This talk first analyzes the tectonic and magmatic mechanisms conducive to the formation of porphyry copper deposits and suggests that a Precambrian subduction setting could produce oxidized, sulfur-rich magmas for their formation. The temporal distribution pattern of porphyry Cu deposits can be explained by the following three main factors: (1) In the early Earth, particularly during the Hadean and early to middle Archean, lack of large-scale subduction activities or plate tectonics hindered the formation of these deposits; (2) During the middle Proterozoic (1.8–0.85 Ga), a slowdown in plate movement limited the metasomatism of the mantle source which is necessary for forming porphyry copper deposits; (3) The enhanced erosion for the Precambrian rocks and the susceptibility of porphyry Cu deposits to erosion in compressional environments.