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Geology of the Tiegelongnan giant porphyry Cu (Au) deposit near the Bangong suture zone, Tibet, China

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The Tiegelongnan porphyry Cu (Au) deposit is a recently discovered giant copper deposit, with a resource of 1666 Mt at 0.51% copper,and 227 Mt of 0.13 g/t gold. It is located in the south Qiangtang terrane, 30 km north of the western Bangong Suture zone and within the Duolong porphyry Cu-Au district. Since its discovery in 2013, it has been recognized as the largest, highest-grade porphyry Cu deposit in Tibet. The tectonic setting of the Duolong region is debated and thus one hypothesis for porphyry deposit formation is that they resulted from the northward subduction of the Bangong oceanic plate, whereas a second idea suggests that the deposits formed through post-subduction processes. Specifically, northwest- and northeast-striking conjugate faults are inferred to control the intrusion of the porphyries and formation of several porphyry Cu-Au deposits in the Duolong region.

Several stages of diorite, granodiorite, and granite porphyry intrusion control the copper and gold mineralization. Diorite and granodiorite were emplaced at ~123 Ma and porphyries at 121-120 Ma. Approximately 75% of the Cu and Au orebodies at Tiegelongnan are hosted by sandstone and siltstone of the Jurassic Sewa Formation. The Tiegelongnan deposit appears to have undergone extensive erosion, as numerous porphyry fragments, residual native gold, and a supergene leached zone are found in the paleo weathering crust,a which was covered by a non-mineralized volcanic andesite at ~110 Ma. Some syn-mineral secondary fractures could have facilitated the hypogene enrichment of the ores and a post-mineralization fault cuts the orebodies in the southern part of the deposit.

Hydrothermal alteration and sulfide assemblages suggest that the Tiegelongnan porphyry deposit was overprinted by high sulfidation epithermal mineralization. Potassic alteration is recognized below 4100 m level, and it is characterized by the occurrence of hydrothermal biotite but no K-feldspar. It is overprinted by extensive sericitic alteration, which extends from the 4100 m to the 4900 m asl and contains most of the Cu ore. The sericitic alteration zone is surrounded by a barren chlorite zone on its the eastern periphery, and is overprinted by advanced argillic alteration in its center and to the west, from 4300 m to 4900 m asl. Alunite, kaolinite, and dickite are extensively formed in the advanced argillic alteration zone and mostly occur in veins with sulfides. 40Ar/39Ar isotopic ages for hydrothermal biotite, sericite, and alunite are 121 Ma,

120 Ma, and 116 Ma, respectively. The high sulfidation state sulfides (i.e. digenite, covellite. and enargite) are dominant in the advanced argillic and upper sericitic alteration zones, and partially replace chalcopyrite and bornite in the potassic and deeper sericitic alteration zones. There is no high sulfidation epithermal Au deposit preserved possibly because of the extensive erosion post-dating the mineralization. It indicates, also, that epithermal Au prospects could be promising exploration targets in the Duolong region.