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Jiama Cu-Mo Skarn-Porphyry Deposit, Tibet

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The Jiama skarn-porphyry Cu-Mo deposit is located 70 km east of Lhasa, Tibet, in the eastern part of the central Gangdese belt. Jiama is the largest copper skarn deposit in China and the largest copper producer in Tibet.

The deposit was recognized in 1951 during 1:250,000 geological mapping while following up significant copper staining in the main drainage. Exploration since 2006 led by IMR-CAGS has established Jiama as a skarn surrounding a Cu-Mo porphyry. Tibet Huatailong Mining Development Co. Ltd (China Gold Group) consolidated all previous licenses in 2008 and conducted extensive drilling from 2009 to 2013 (>170,000-m diamond drilling in >400 drill holes).

Measured and indicated mineral resources were estimated in 2013 as 1,486 Mt at 0.41% Cu, 0.034% Mo, 0.11 g/t Au, 6.14 g/t Ag, 0.05% Pb, and 0.03% Zn. Mining of skarn ore commenced in 2009 with open-pit and underground production.

The stratigraphy comprises Upper Jurassic Duodigou Formation (J_3d) limestone overlain by Lower Cretaceous Linbuzong Formation (K_1l) sandstone, siltstone, and shale, with layering that dips 20° to 30°N. Skarn occurs at the contact of the two formations and extends 4,200 m west-northwest and 2,500 m north-northeast (down-dip direction). Only the distal edges of skarn are exposed at the surface. Vertical skarn zonation comprises diopside (minor top) → garnet (major) → wollastonite (minor base). Mineralized porphyry intrusions are monzogranite, granite, and granodiorite. The intrusion center is >100 m in diameter with surface expression of a cluster of dikes of different orientations, indicating low erosion and good preservation.

The three major ore zones are skarn with Cu-Mo-Pb-Zn-Au-Ag, hornfels with Cu-Mo, and porphyry with Mo-Cu. Chalcopyrite, the main copper mineral, is mainly concentrated in the skarn with lesser amounts in the hornfels and porphyry ore zones. Bornite occurs as fine grains from 0.01 to 0.3 mm in size, or as aggregates disseminated in skarn, especially distal wollastonite skarn. Molybdenite occurs widely in porphyry, hornfels, and skarn as molybdenite-bearing quartz veins and locally as fine-grain disseminations.

Granitic porphyry stocks bearing Mo-Cu are 16 Ma and Au-bearing diorite is 14 Ma (U/Pb on zircon). Re-Os geochronology of molybdenite shows the mineralization peak is 15 Ma (mid-Miocene).

The hornfels zone is evident in satellite imagery as a color anomaly >40 km^2 in size, which, together with similar bleached zones at Qulong, Baiyin Pasture, Elephant Mountain, and Mogulang, defines a linear northwest trend interpreted as a deep fracture zone. Significant copper mineralization coeval with hornfels is defined at Qulong and Jiama. This fracture zone traverses the EW-trending Gangdese belt. The northern margin of the skarn is disrupted by thrusting, which, in turn, is overprinted by copper mineralization. The copper grade in this area

is significantly higher than the hornfels zone.

Ground magnetic surveys show a ring of magnetic anomalies at the distal edge of the main skarn zone. Soil and rock geochemical anomalies show a central copper anomaly over the intrusive center surrounded by successively larger Mo, Bi, Se, and Te anomalies; Pb, Zn, and Au anomalies define the edge of the system.