Magmatic Evolution and Mineralization of Porphyry Copper-Gold Deposits in the Duolong Ore Concentration Area, Tibet

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The Bangong Lake-Nujiang River metallogenic belt is located between the Qiangtang Block and Lhasa Block, and the Duolong ore concentration area is located in the western section of the Bangong Lake-Nujiang River metallogenic belt. Till now, several large and super large copper-gold deposits, such as Duobuza, Bolong, Dibaonamugang, Naruo and Rongna deposits have been discovered in this area, mainly porphyry copper-gold ones.

The main outcropped strata in the Duolong ore concentration area include carbonate rocks of the Upper Triassic Ripeigancuo Formation (T₃r), conglomerates of the Lower Jurassic Quse Formation (J₁q), Middle Jurassic Sewa Formation (J₃s), Lower Cretaceous Meiriqie Formation (K₃m) and the Miocene Kangtuo Formation (N₇k). The surface in the area is mostly covered with the Quaternary eluvial-deluvial sediments (Fig. 1b). The Quse Formation (J₁q) mainly consists of epimetamorphic argillaceous sandstone, interbedded with basic volcanic rock and silicofite. The diagenetic age of the basic volcanic rock is 141–143 Ma. The Meiriqie Formation (K₃m) consists of purple andesite and dacite, and the zircon SHRIMP age of the dacite is 111.1 Ma.

There are multi-stage intrusive rocks within the Duolong ore concentration area, including diabase, diorite and granodiorite porphyry. The basic rocks are mainly diabase, and the age of the Tegelonggou diabase is 169.3 Ma (unpublished data of the author). The intermediate-acidic rocks mainly include diorite and granodiorite porphyry, and their diagenetic age is mainly concentrated in 118–125 Ma. The diagenetic age of the diorite is mainly

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concentrated in 121–125 Ma, and that of the granodiorite porphyry mainly vary from 118 to 120 Ma. Some granodiorite porphyry has a close relationship with the mineralization, and forms many porphyry and hydrothermal deposits (occurrences), with mineralization age varying from 118 to 120 Ma. The porphyry copper deposits within the Duolong ore concentration area was formed in the final stage of northward subduction of the Bangong Lake-Nujiang River, and their mineralization age lies between the Late Jurassic to Early Cretaceous.

During the Jurassic to Early Cretaceous, the Bangong Lake-Nujiang ocean basin continued to subduct northward, and the southern margin of the Qiangtang Block underwent lateral accretion to form wedged accretionary terrane, accompanied by a series of reverse faults. Magmatic rocks formed by the oceanic crust subduction mostly moved upward along with these reversed faults to form basic volcanic rocks and intermediate-acidic intrusive rocks, but the mineralization at this stage was not obvious. In the Early Cretaceous, in the final stage of the northward subduction of Bangong Lake-Nujiang River, the upwelling of the oceanic crust subduction caused the partial melting of the lower crust and formed intermediate-acidic magma. The intermediate acidity magma invaded upwards and formed magma chamber in the deep crust. The ore-forming fluid and ore-forming elements accumulated continuously in the magma chamber and finally formed porphyry deposits in the shallow crust along with the upwelling of the magma upwelling. At this stage, the andesite and rhyolite played a role of protecting the orebodies, while some volcanic conduits penetrated the orebodies and destroyed them. The Duolong ore concentration area was just formed in the accretionary orogenic stage of the plate subduction, and its ore-forming setting is a typical island-arc environment.

The main indicators for prospecting porphyry copper deposits in the Duolong ore concentration area include: intersection between the NE-SW strike-slip faults and nearly EW-trending faults, granodiorite porphyry formed around 120 Ma, ring-zonal shaped propylitization and beresitization, small-scale small-amplitude positive and negative magnetic anomalies, well combined Cu, Au, As and Sb geochemical anomalies, and electrical anomalies with low-middle apparent resistivity and high-middle apparent chargeability by the audio frequency magnetotelluric sounding method.

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