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Proterozoic Fe-Cu-Au-REE Metallogenic System of “Dongchuan” Group in Central Yunnan Province

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Central Yunnan region is well known for its abundant Fe-Cu resources from recambrian terrane, in which the Yinmin Fm.-Lvzhijiang Fm. (1.4~1.7Ga) of the Early mesoproterozoic Dongchuan Group hosts the most Fe-Cu-Au-REE deposits. In this study, we combined the entire Proterozoic strata in central Yunnan Province, reconstruct the stratigraphic framework and the evolution process of Kunyang Rift in 1.7Ga. We also took the Yinachang deposit as an example to systematically study its geological, geochemical and other characteristics, and then proposed a mineralization model. According to the comparison between characteristics of the IOCG deposits in Central Yunnan, combining with the tectonic-magmatic activity of the Kunyang Rift, we conclude that a Fe-Cu-Au-REE metallogenic system developed in an intraplate extension environment. The major results from this study include.

1 Reconstructed Stratigraphic Framework and the Evolution Process of the Kunyang Rift in Central Yunnan

The oldest strata in Central Yunnan, the Shaihaiwan Fm.-Pingdingshan Fm.(1.8~2.3Ga), is now nominated as “TangDan Group”. Regarding this Group as the metamorphoused basement, a large-scale intraplate extension took place in the central Yunnan Province 1.7Ga ago, accompanied by intense mafic-acidic magmatism, generally known as the “Kunyang Rift”, which is highly consistent with the breakup of Columbia Supercontinent. Different degreed extension in different districts of Central Yunnan formed several disconnected graben basins. In the epicontinental environment of the basins, several synchronous heteropical strata were sedimented from

1.7Ga to 1.4Ga, such as the “Dongchuan Group”(consist of the old Dongchuan Group in Dongchuan district, the lower Kunyang Group in Central Yunnan district and the Yinachang Fm.), the Hekou Group in LaLa district, the Dahongshan Group in Dahongshan district. The extension ended in the middle of Mesoproterozoic (1.4Ga), the strata was then uplifted and weathered, and unconformably overlaid by the younger “Kunyang Group”(1.1~1.4 Ga, formerly called the Upper Kunyang Group).

2 Ore-forming Model of the Yinachang Deposit

The Yinachang deposit was formed in the Wuding-Lufeng graben basin, ore bodies were controlled both by carbonatite of Yinmin Fm. and the magmatic breccia, accompanied by regional-scale albitization and deposit-scale sim-skarnization and hydrothermal alteration. The ore assemblage of the deposit can be divided into Fe+Cu+Au+REE assemblage and Cu+Au assemblage, the mineralization stage include early stage, main stage (including Fe oxide-REE substage and Cu-Au substage) and post-mineralization stage. Fe and REE elements were extracted from the wall rock, while the Cu and Au elements were derived from the acidic remelting of lower crust when the deeper mafic magma uplifted in the extensional environment. Researches in microphysiography, composition of fluid inclusions suggest fluids in early pre-mineralization stage are high-temperature, high-salinity magmatic hydrothermal fluid, containing alkalic components, volatile phase and Cu, Au, which formed during the immiscibility effect of felsic magma. This fluid caused a regional albitization of carbonate, and extract Fe and REE elements into the fluid. Metasomatism between magmatic fluid and carbonaceous

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wallrock caused the precipitation of Fe and REE in the magnetite-REE substage, and the dehydration of wallrock produced the metamorphic hydrothermal fluid for the sulfide-gold substage. In this stage, meteoric water mixed into the ore-forming fluid, changed the physical and chemical conditions of the system, and Cu, Au were no longer stable as clathrate in fluid, but precipitated as sulfide (Cu) and substance (Au). In the stage of post-mineralization, dominant fluid became pure meteoric water, the mineralization was ended.

3 An Intraplate Rift-related Ore System in Central Yunnan

Many Fe-Cu-Au-REE deposits are distributed in Central Yunnan Province, such as the Xikuangshan deposit, the E'touchang deposit and the Dahongshan deposit. They have many similarities to the Yinachang deposit in geology and geochemistry. Geochronologic data demonstrates that their dominant mineralization occurred about 1.5~1.6Ga, and were closely connected with the forming of Kunyang Rift and related magmatism. They have similar geological/geochemical characteristics and ore-forming mechanism to IOCG deposits, therefore can provide important deposit examples for the IOCG research worldwide; Coexisting with these deposits, there distributed the sediment-hosted Cu deposits such as the Dongchuan deposit and the Yimen deposit. They were formed during the splitting and sedimentary of Kunyang Rift, and were strictly controlled by the anorogenic magmatic-hydrothermal activities. It reflects the tectonic-magmatic-metallogenic events in central Yunnan Province in the period of Early Mesoproterozoic (1.4~1.7Ga), and gives us a new direction on prospecting.

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