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Proterozoic IOCG metallogenic system of “Dongchuan” Group in central Yunnan province, China-A case study on the Yinachang deposit

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Central Yunnan is well known for its abundant Fe-Cu Resources from Precambrian terrane, in which the early mesoproterozoic Yinmin Fm.-Lvzhijiang Fm. (1.4~1.7Ga) provides the most Fe-Cu-Au-REE deposits in China. Yet, there are some foundational/Economic geology problems remain unsolved. In this research, we combed the entire proterozoic strata, and investigated the Proterozoic magmatic activities in central Yunnan Province, reconstructed the stratigraphic framework and revealed the evolution of Kunyang rift in 1.7Ga. We also took Wuding Yinachang deposit and other deposits as example, systematically studied their geological and geochemical characteristics, summed up a mineralization model. After comparison on the symptoms between Fe-Cu-Au-REE deposits in central Yunnan and IOCG examples around the world, we strongly believe that there exist a rift-related IOCG metallogenic system. Our study obtained the following points of understanding:

1. After contrast the sequence and isotope age of the old Dongchuan group in Dongchuan Region, Lower Kunyang group and Yinachang Fm. in Wuding region, we referred them as “Dongchuan Group”(1.4~1.7Ga), including Yinmin Fm., Luoxue Fm., E'touchang Fm. and Lvzhijiang Fm.; The Upper Kunyang group on the east of Tanglang-Yimen regional fault is now named as “Kunyang Group”(1.1~1.4Ga); we also classified the Shaihaiwan Fm.-Pingdingshan Fm. under “DongchuanGroup” in Dongchuan region into “TangdanGroup”(1.8~2.3Ga); Hekou Group and Dahongshan Group in the west of Lvzhijiang regional fault are the synchronous strata of Dongchuan Group, we kept their primitive name.

2. Diabase and magmatic breccia intrude around 1.6~1.7Ga, their geochemical features indicate that there existed an extension, timely accorded with the splitting of Columbia supercontinent(1.7Ga). As the oldest terrane in central Yunnan, “Tangdan Group” composed the

basement of Kunyang rift. “Dongchuan Group” was sediment in the epicontinental environment of the rift, so did the Hekou group and Dahongshan group, with some differences on sedimentary face. The extension ended in the middle of mesoproterozoic 1.4Ga, the “Dongchuan Group” was uplifted and weathered, and the unconformably overlaid by the younger “Kunyang group”.

3. The Yinachang deposit was formed in the Wuding-Lufeng graben basin, ore bodies were controlled by carbonatite of upper Yinmin Fm. and lower Luoxue Fm., indicates a intense hydrothermal metasomatism. Mineral assemblage, element correlation and S, Pb isotope tracing demonstrate Fe-Cu-REE assemblage and Cu-Au assemblage, and the Fe and REE element were extracted from the wall rock, while the Cu and Au element were coming from the magma remelted during the remelting of lower crust when the deeper basic magma uplifted in the extensional environment.

4. Researches in microphysiography, composition and isotope on fluid inclusions suggest three stages of the ore-forming process: Pre-mineralization stage, dominant mineralization stage and post-mineralization stage, and the dominant mineralization stage is comprised by magnetite-REE substage and sulfide-gold substage. Fluids in Pre-mineralization stage are high temperature, high salinity magma fluid, containing alkalic components, volatile phase and Cu, Au, which formed during the immiscibility effect of felsic magma. This fluid caused a regional albittization of carbonate, and extract Fe and REE elements into the fluid. Metasomatism between magmatic fluid and carbonaceous wallrock causing the precipitation of Fe and REE in the magnetite-REE substage, and the dehydration of wallrock produced the metamorphic hydrothermal for the sulfide-gold substage. In this substage, meteoric water mixed into the fluid, changed the physical and chemical conditions of the system, Cu, Au is no longer stable as clathrate in fluid, but precipitated as sulfide (Cu) and substance (Au). In the stage of post-mineralization,

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dominant fluid became pure meteoric water, the mineralization was ended.

5. Similar Fe-Cu-Au-REE deposits are distributed in “Dongchuan Group” in central Yunnan Province, such as Xikuangshan deposit, E’touchang deposit and Dahongshan deposit. Geochronology demonstrates that their dominant mineralization occurred about 1.5~1.6Ga, and were closely connected with the forming of Kunyang rift. Another age segment is 0.7~1.1Ga, which represents the convergence and disintegrating of Rodinia supercontinent.

6. Statistics indicates two kinds of deposits in “Dongchuan Group” in this area. One is the Fe-Cu-Au-

REE deposits which have similar geological/geochemical symptoms and ore-forming mechanism to IOCG deposits, such as Yinachang deposits; The other is the SEDEX Cu-Au deposits such as Dongchuan deposit and Yimen Deposit. They respectively 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.

Key words: “Dongchuan Group”, Kunyang rift, Yinachang deposit, IOCG, Metallogenic system