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Geochemical Characteristics of Magnetites from the Lala IOCG Deposit of Huili Sichuan, China, and Their Genetic Research

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The Huili Lala IOCG deposit is located in the southwest margin of the Yangtze block and the central area of west Sichuan and Yunnan provinces. It is an important Fe-Cu-Mo-Au-REE polymetallic deposit in southwest China. This deposit has also been considered as a typical iron oxide copper-gold (IOCG) deposit, which in the mining area consists of metamorphosed volcanosedimentary rocks of the Proterozoic estuarine Dang Group; the strata mainly consists of biotite schist, marble, crystal (magnetite + quartz) albite gneiss, and albite breccia. Magnetite is one of the major ore minerals in this deposit, and it is also the main carrier of Fe.

According to the structure and depositing position, magnetite is divided into four generations: detrital magnetite (Mt1), elongated, oriented magnetite (Mt2), dense, disseminated magnetite (Mt3), and coarse-grained magnetite veins (Mt4). Based on the electronic probe analysis, the Al, Ti, Mn, and V contents in the Lala IOCG deposit are relatively high. The average content of TiO_2 in Mt1 is 46.77%, which indicates the ore-forming fluid of the Lala deposit comes from depths with high-temperature and high-pressure properties. The average content of V_2O_5 is 0.31%, which may be caused by the high formation temperature of magnetite in magma and high developed isomorphous replacement effect. The average content of MnO is 1.19% and the Ti/V ratio is 167.9; those two factors indicate this deposit has obvious marine volcanosedimentary magnetite formation characteristics. Based on the discussion above, high-temperature ore-forming fluid with high content of Fe and Ti is the main source of detrital magnetite. The particle size of Mt2 is significantly larger than that of Mt1, and the significant differences in particle shape indicate that the process of mineralization was influenced by the directional extrusion pressure.

The average contents of V, Ti, and SiO_2 in Mt3 are 582.816 × 10-6, 1,017.75 × 10-6, and 0.05%, respectively. All three values reveal characteristics of formation from hydrothermal solution. The average content of Al_2O_3 is 0.17%, which indicates the formation temperature of magnetite is low. The content of MnO is low, with an average content of 0.01%, and the average ratio of Ti/V is 1.84. Those two values show the characteristics of the terrigenous sediment sources of iron. Mt3 existed with a large amount of carbonate minerals, which indicates Mt3 may have formed via metamorphic hydrothermal replacement. The chemical composition, characteristic parameter values, and crystal structures of Mt4 are very similar to those of Mt3, which proved Mt3 and Mt4 have the same formation mechanism and iron sources.