Sulfur and Lead Isotope Geochemistry Characters of the Jinchanggouliang Gold Deposit in Inner Mongolia

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1 Geological Outline

Jinchanggouliang gold deposit in Inner Mongolia is an important deposit, it is located in Jinchanggouliang town of Aohan banner, Chifeng city, Inner Mongolia, and about 160 km to the southeast from Chifeng. The tectonic setting lies in the northern margin of North China Craton (NCC) Nuluerhu mountain metallogenic belt. Jinchanggouliang gold deposit, Erdaogou gold deposit to its east, and Changgaogou gold deposit to its southwest formed a circle round Duimiangou intrusive complex, they together constituted Jinchanggouliang-Erdaogou ore-field, accumulated proved gold resource reserves is more than 50t. Among them, Jinchanggouliang gold deposit was divided into east and west mining areas, the orebodies are mainly hold within the metamorphic rocks of Xiaotazigou Formation of Neoarchean Jianping group; The orebodies of Erdaogou gold deposit to the east of it occurred in Jurassic volcanic rocks; The gold ore veins of Changgaogou gold deposit to the southwest of it hosted in Xitaizi porphyritic granite (Fig.1). The most type of its gold ore veins is quartz-sulfide composite vein type. The length of ore veins is generally about 30~1000m, the thickness is 0.3~1.0m, and the average grade is 7.67×10⁻⁶~19.45×10⁻⁶. The ore veins are strictly controlled by faults, distributed spatially along the faults. The ore veins strikes of Jinchanggouliang are NW, NNW and SN, the ore veins strikes of Erdaogou are NW and EW, and the ore veins strikes of Changgaogou are SN and NNE, generally radial distributed around Duimiangou intrusive complex.

2 Sulfur Isotope Composition

The sulfur isotope composition of the ores in Jinchanggouliang mining area δ³⁴S vary from -2.8‰ to -0.6‰, the change range is 2.2‰, average value is -1.61‰; The sulfur isotope composition of the ore in Changgaogou mining area δ³⁴S vary from -1.5‰ to 1.2‰, the change range is 2.7‰, average value is -0.15‰; The sulfur isotope composition of the ore in Erdaogou mining area δ³⁴S vary from -0.7‰ to 2.3‰, the change range is 3.0‰, average value is -0.08‰. In these three gold deposits, the sulfur isotope compositions of ores are similar, the average δ³⁴S values are all concentrated near 0 value, indicating that the magmatic sulfur source is dominant, the change range is narrow indicate that the sulfur source was relatively single.

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3 Lead Isotope Composition

The lead isotope compositions of the ore sulfides in Jinchanggoulia mining area $^{206}\text{Pb}/^{204}\text{Pb}$ ratios vary from 16.824 to 17.317, average value is 16.962, $^{207}\text{Pb}/^{204}\text{Pb}$ ratios vary from 15.302 to 15.480, average value is 15.345, $^{208}\text{Pb}/^{204}\text{Pb}$ ratios vary from 36.849 to 37.706, average value is 37.044, $\mu$ value vary from 9.09 to 9.38, average value is 9.16, Th/U ratios vary from 3.81 to 3.99, average value is 3.85; The lead isotope composition of the ore sulfides in Erdaogou mining area $^{206}\text{Pb}/^{204}\text{Pb}$ ratios vary from 17.704 to 17.280, average value is 17.193, $^{207}\text{Pb}/^{204}\text{Pb}$ ratios vary from 15.398 to 15.408, average value is 15.402, $^{208}\text{Pb}/^{204}\text{Pb}$ ratios vary from 37.246 to 37.465, average value is 37.334, $\mu$ values vary from 9.22 to 9.25, average value is 9.24, Th/U ratios vary from 3.85 to 3.90, average value is 3.87; The lead isotope composition of the ore sulfides in Changgaogou mining area $^{206}\text{Pb}/^{204}\text{Pb}$ ratios vary from 17.166 to 17.297, average value is 17.232, $^{207}\text{Pb}/^{204}\text{Pb}$ ratios vary from 15.424 to 15.435, average value is 15.430, $^{208}\text{Pb}/^{204}\text{Pb}$ ratios vary from 37.453 to 37.465, average value is 37.459, $\mu$ value vary from 9.26 to 9.31, average value is 9.29, Th/U ratios vary from 3.88 to 3.95, average value is 3.92.

A series of parameters such as Lead isotopic compositions of the ores, Th/U ratios, $\mu$ values etc. are similar in Jinchanggoulia, Erdaogou, Changgaogou three gold deposits of the orefield are generally similar. They distributed around Duimiangou intrusive body in the range of 0.5~4 km, and had similar Sulfur and Lead isotope composition, near forming time between magmatic body and gold mineralization indicated that the three gold deposits in the orefield are of the same origin and under the control of the same mineralization, and probably had a close genetic relation with the Duimiangou magmatism.

Lead isotopic compositions of the ores reflected lead of metallogenic materials were mainly from the lower crust or mantle. The sulfur isotope composition of the ore sulfides indicated that sulfur source relatively single and predominately of magmatic origin. Hydrogen and oxygen isotopes show that the ore-forming fluid was mainly derived from magmatic water. Therefore, genesis of Jinchanggoulia gold deposit was magmatic hydrothermal type gold deposit.

4 Conclusion

Based on the studies of the characteristics of deposit geology, orebody's occurrence, ore type, coexisting minerals, wallrock alteration, etc., Jinchanggoulia, Erdaogou, Changgaogou three gold deposits of the orefield are of the same origin and under the control of the same mineralization, and probably had a close genetic relation with the Duimiangou magmatism.