**The Relationship between Radioactive Mineralization and Tungsten Mineralization in Shirenzhang Tungsten Deposit, North Guangdong**

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1 Introduction

Uraninite and other radioactive minerals have been found in the Shirenzhang tungsten deposit, north Guangdong, which provides one new avenue for seeking the potential successor in this crisis mine. Based on occurrence and compositional variation of uraninite, and the radioactive element contents, this paper discussed the relationship between radioactive and tungsten mineralization preliminarily.

2 The Occurrence Characteristics of Uraninite

By identification of rock-mineral and and Scanning electron microscopy, energy spectrum analysis (EDS), uraninite is found in granite and greisen, especially in tungsten veins of Shirenzhang, accompanied with other radioactive minerals such as thorianite, thorium, uranium-bearing thorium, uranothorites, and thorium-containing uranium, which constitute uranium-thorium isomorphous series. The particle size of uraninite, thorite and thorianite is generally small, normally only 10–50 μm. They are often in close symbiosis with zircon, xenotime, monazite and other minerals (they are coarser, but not more than 100 μm). It was also found that uraninite or thorianite coexist in the crystal crack or in the edge of wolframite. Besides, radioactive minerals (such as uraninite, thorite, thorianite, etc.) are often surrounded by a ring-side pyrite structure and contain galena inclusions sometimes.

3 The Compositional Variation of Uraninite

X-ray diffraction (XRD) analysis confirms that the main component of uraninite is UO₂, and SEM spectroscopy (EDS) analysis shows that, the UO₂ content of uraninite occurring in quartz veins range from 82.83% to 100%, with an average of 92%, meanwhile, the ThO₂ content is 3.15%–14.57%, with other more impurities; the UO₂ content of uraninite occurring in greisen is only 85.5%, with ThO₂ content up to 11.88%. However, that of uraninite in granite is intervening. Moreover, the uraninite also has zonal structure, with UO₂ content higher on the edge of the mineral and lower in the core, but ThO₂ content is opposite. As hydrothermal activity enhance, uraninite particles increases, with UO₂ content gradually increases from 84.63% to 96.62%, followed by reducing impurities. In contrast, the uraninite is coarse which occurs in pure tungsten veins or only exists between quartz crystals. The uraninite has often smaller particle size which occurs in sulfide-rich veins, with other symbiotic minerals such uranothorites, thorianite and thorite, etc. Affected by late hydrothermal alteration, secondary minerals, including lead uranium, soddyite and coffinite, will precipitate in the edge of uraninite.

4 Analysis of Radioactive Elements

The contents of radioactive element U and Th were tested by inductively coupled plasma mass spectrometry. It was found that the U content of various lithologies in mine are higher than their Clark values (2.7 ppm). Among them, the U content of granite is up to 29.20 ppm, the
average of which is 2 to 10 times higher than South China uranium productive granite, while U content of greisen is from 13.4 ppm to 32.5 ppm, and 24.14 ppm in average. The values are both in the range of U content of uranium productive granite (10 ppm–25 ppm), showing that granite and greisen have good prospects for uranium exploration. The U content of most quartz veins is very low, and a few has sharp increase of U content because of containing radioactive minerals (uraninite, thorite, thorianite, monazite, xenotime, zircon, etc.) may be. There is a positive correlation between U and Th content in mine. Vertically, radioactive elements are relatively enriched in the 500 m section. From 550 m to 166 m, radioactive element content presents two variation trend from small to big, it is shown the prospecting significant in the deep. In addition, the distribution regularity of radioactive elements content in the tungsten veins is homogeneous and dispersive, and radioactive minerals are found in local because of the aggregation of radioactive elements.

5 Relation between the Radioactive Mineralization and Tungsten Mineralization

The analyses of the mineral assemblages discussed above suggest that pyrite often forms the rim of uraninite, or secondarily develops on the edge of uraninite and thorium, or filled in the cracks of uraninite. It indicates that the uranium mineralization formed in wolframite-sulfide-quartz stage and its formation time is slightly earlier than pyrite.

According to the electron probe (EPMA) analysis, the age of uraninite is from 151 Ma to 157 Ma, which is consistent with the tungsten mineralization age, and the main period of uranium mineralization in southern China. Those constitute the same metallogenic series. Meanwhile and belongs to the products of same mineralization hydrothermal activity in the Yanshannian metallogenic explosion stage, which shows distinct prospect of exploring uranium mineralization in tungsten mine. Besides, the greisen-type tungsten ores is also an important direction for seeking radioactive mineralization.

References

