Abstract: At present, compared with the world's major uranium deposit types, the major characteristics of the proved uranium deposit types in China are hydrothermal type (granite-related type and volcanic type), sandstone type and carbonaceous-siliceous-mudstone type. It accounts for more than 95% of proved reserves, among which granite-related U deposits account for about 28.5% (Cai et al., 2012). Granite-related U deposit is an important type of U deposits in China. Granite-related U deposit refers to the uranium deposits in the inner and outer contact zone of granite mass and overlying basin, and the main mode of output is vein or lenticular. Its metallogenic epoch has no connection with the epoch of the wall rocks hosting ore (Zhu et al., 2018; Du, 1982; Du et al., 1984). According to previous studies, fluorite and uranium are co-associated minerals, and not only fluorite can be seen in almost granite-related U deposits, but also fluorite alteration is the most common in wall rock alteration.

The granite-related U deposits in China

Granite-related U deposits in China are mainly distributed in the uranium mineralization provinces in southeast of China, and the predicted resources of the Taoshan-Zhuguang uranium mineralization belt are nearly half of the total predicted resources of granite uranium deposits (Zhang et al., 2005). Many mines in granite area of the south China have been developed with abundant resources and efficient utilization, but there are still many problems in prospecting work, for example, the unbalance of the degree of the exploration and research, shallow exploration control depth, many hidden ore body around the mining area didn’t found and so on (Xu, 2017), and previous studies on fluorite in granite-related U deposits are also rare.

Fluorite in the granite-related U deposits

There is no difference in appearance between the fluorite in single fluorite deposits and the fluorite in uranium deposits, while the fluorite in uranium mineralization period is purple, violet black, with fine particles, poor crystallization degree and poor transparency. It is mainly distributed in red and gray microcrystalline quartz, with the phenomenon of interspersing and encasing microcrystalline quartz (Andreeva et al., 1980; Zhao et al., 2015). The formation of uraninite temperature mainly between 250–150°C, and the temperature range is consistent with that of quartz and fluorite. The mineralization occurred at relatively low temperatures (<250°C), as W-Y-Nb-Ti-rich pitchblende and uraninite veins associated with quartz, fluorite (Peng et al., 2015; Christophe et al., 2018), which can be understood that this is the reason for fluorite and uranium are co-associated minerals. In granite-related U deposits, when the uranium-containing hydrothermal fluid moves upward from the source zone, with fluorite precipitate out, and fluorite minerals or fluorite alteration are formed, and fluorite precipitates before the U oxides (Peng et al., 2015; Christophe et al., 2018), and the material source of fluorite can be understood as uranium-containing hydrothermal fluid. It is common that the mineral assemblage of uraninite-violet black fluorite among mineral assemblages in granite-related U deposits, and the co-crystallization time is longer, meantime, characterized by many generations (Zhao et al., 2015). In granite-related U deposits, the closer fluorite is to uranium ore bodies, U, Be and Mo in fluorite have the tendency of being richer, which may exist in fluorite as single mineral inclusions (Andreeva et al., 1980).

The role of fluorite in the granite-related U deposits

Fluorite and uranium are co-associated minerals. Uraninite is often filling fissures or cleavages in fluorite, and the main mode of output is vein (Zhao et al., 2015), which is speculated that fluorite can provide a migration channel and enrichment site for uranium mineralization hydrothermal solution. Fluorite alteration is generally developed in the metallogenic period, playing an important role in uranium mineralization, which can be revealed that there are a large number of F, CT and CO$_3^{2-}$ ion components in uranium-containing fluids, meantime, it can record important information about the metallogenic fluid (Peng et al., 2015; Zhong et al., 2017).

Conclusion

Granite-related U deposit is a high-profile kind of uranium
deposit in China. Fluorite and uranium are co-associated minerals, but mineralogical and paragenetic analysis study of fluorite in granite-related U deposit is few. If there are some studies of fluorite in granite-related U deposit, it may provide new research direction for granite-related U deposit and better search for U resources.

**Key words:** fluorite, granite-related, U deposits, co-associated

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