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Geochronology and geochemical features of ore minerals for the Weilasituo Sn-Li-Rb polymetallic Deposit, Inner Mongolia, China

KANGYU ZHU[1], SHAO-YONG JIANG[1], HUI-MIN SU[1] AND XIN-YOU ZHU[2]

[1]State Key Laboratory of Geological Processes and Mineral Resources, Collaborative Innovation Center for Exploration of Strategic Mineral Resources, School of Earth Resources, China University of Geosciences, Wuhan 430074, PR China

[2]Beijing Institute of Geology for Mineral Resources, Beijing, 100012, PR China

Presenting Author: 20131001419@cug.edu.cn

The Weilasituo Sn-Li-Rb deposit as a unique example of cryptoexplosive breccia-type rare-metal deposit is located in the Great Xing'an Range metallogenic belt, China. In the mining district, other types of mineralization also occur including granite-type, quartz vein-type, and sulfide vein-type. The columbite-group minerals in ore-bearing granite and hydrothermal cassiterite from the deposit yield U-Pb ages of 137.8±1.3 Ma and 135.6±2.1 Ma, respectively, which are comparable to those previously reported age data for the most Sn-polymetallic mineralization in the southern Great Xing'an Range area, indicating the regional mineralization concentrated at the early Cretaceous. The mica is one widespread mineral in this deposit that provided a good indicator for the magmatic-hydrothermal evolution. Zinnwaldite from the cryptoexplosive breccia (1.20-1.26 wt.% Mg) are enriched in Mg, but depleted in that from the granite (<0.1wt.% Mg). Micas in the surrounding rock have high contents of Fe (14.7-15.2 wt.% Fe) and Mg (5.75%-6.87 wt.% Mg), which provide a possible input of Fe and Mg from the surrounding rock. Moreover, the lower Fe signature in high-temperature sphalerite (1.78-7.14 wt.% Fe) than that of low-temperature sphalerite (9.5-23 wt.% Fe) also supports that the later fluid evolution is related to the exotic Fe-bearing fluid derived from the wall rocks, which is consistent with the results of the study of zinnwaldite. It is, therefore, possible that the formation of the deposit is the result of the multiple factors including the highly differentiated magmatic rocks, the cryptoexplosion and fluid-wall rock interaction. The Fe-poor granite provides sufficient rare metals and volatiles for Sn-Li-Rb mineralization, while Fe and Mg are derived from the wall rocks. In fact, the accumulation of volatiles (particularly F) would accelerate the material exchange between fluid and surrounding rock, and the cryptoexplosion permits the enough scope for the metasomatism. More importantly, as some rare elements in the mining area can reach industrial grade, e.g., Rb in amazonite and zinnwaldite, Nb, Ta and Ti in cassiterite, In and Cd in sphalerite, these associated critical elements can be considered to comprehensive utilization in the ore process and smelting.