

Geochronological and geochemical constraints on the mineralization of the Weilasituo Sn-Li-Rb deposit, Inner Mongolia, China

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The Southern Great Hinggan Range (SGHR) is located in the eastern part of the Central Asian Orogenic Belt and is a significant Ag-Pb-Zn-Sn metallogenic belt in northeast China. Recently, rare-metal deposits, such as the Weilasituo Sn-Li-Rb deposit and the Shihuiyao Rb-Nb-Ta deposit, have been discovered in this region. The Weilasituo deposit, with its large resources and diverse mineralization types, has garnered particular attention. The mineralization types in Weilasituo include Rb-Sn-Zn granite type, Li-Rb crypto-explosive breccia pipe type, and Sn-Zn-Cu-Pb-Ag quartz vein type. Cassiterite from the crypto-explosive breccia pipe type mineralization has yielded a U-Pb age of 138.4 ± 1.9 Ma, which is comparable to the ages of granite type mineralization, quartz vein type mineralization, and many other Ag \pm Pb-Zn \pm Sn deposits in the SGHR. Geothermometer data based on the mineral composition indicate a decreasing trend in mineralization temperature. In situ analyses reveal enrichment of Fe, Cd, Mn, Cu, and In in sphalerite; Sn, Zn, and In in chalcopyrite; Fe, Nb, Ta, Mn, Sc, Ti, and REE in cassiterite; and Li, Zn, Rb, Nb, Ta, Sn, Cs, and W in mica. The Weilasituo ore-forming intrusion is a highly fractionated, peraluminous, high-K calc-alkaline I-type granite. The temporal compositional variations in granite and mica indicate that the enrichment of rare metals is controlled by magma differentiation, while the mineralization is mainly controlled by hydrothermal metasomatism of Na- and F-rich fluids. Rock geochemistry and Nd-Hf isotope suggest that the wall rock may have contributed to the ore metals. The metallogenic structure, mineralogical features, temperatures, mineral compositions, and in situ S-Pb isotopic signatures suggest that the ore metals of adjacent base metal deposits may not have been derived from the Weilasituo ore-forming intrusion. Moreover, the degree of fractionation of the Weilasituo intrusion is higher than that observed in Ag \pm Pb-Zn \pm Sn deposits in the SGHR.