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Metallogenic mechanism of the Shanhu quartz-vein-type W-Sn deposit in South China

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The Shanhu W-Sn deposit is a super-large-scale quartz-vein type deposit in the Nanling Range in South China, but with different mineralization age (~100 Ma) with other deposits. The mineralization mechanism of this deposit remains unclear. We carried out detailed studies on fluid inclusions, carbon-sulfur isotopes and mineral chemistry of this deposit in order to make clear the origin and evolution of ore-forming fluids and precipitation mechanism of W and Sn. Based on the mineral assemblages, W-Sn mineralization processes in this deposit can be divided into three stages: muscovite-cassiterite stage (Stage I), quartz-wolframite-sulfide stage (Stage II), and calcite-scheelite stage (Stage III). The fluid inclusions (FIs) in cassiterite in Stage I yield homogenization temperatures of 216-324^{o}C and salinities of 6.1-7.8 wt. %. The FIs in quartz and fluorite in Stage I yields lower homogenization temperatures of 175-290^{o}C and 176-215^{o}C, respectively. The FIs in wolframite in Stage II also yield higher temperatures (183-355^{o}C) than coeval quartz (136-267^{o}C). The FIs in fluorite in Stage III yield the lowest temperatures (144-192^{o}C) and salinities (0.9-1.6 wt. %). Raman spectroscopy presents that the FIs in Stage I contains both CO_2 and CH_4, and only CO_2 in Stage II and Stage III, implying a gradual oxidation of the fluids. The restricted $\delta^{34}S_{V\text{-}CDT}$ isotopic values (-1.8 to 0.8‰) in sulfides (pyrite, arsenopyrite, chalcopyrite, and sphalerite) imply individual source of magmatic sulfur. Cassiterite show complex structure and trace element variation, suggesting pulsed magmatic fluids during the formation of quartz veins. Various types of scheelite also show distinctive trace element patterns, suggesting the unstable fluid redox conditions. We propose that redox reactions of Sn (II)-Cl complexes with As (III) triggers the formation of cassiterite in Stage I, while fluid mixing with meteoric water leads to the abundant precipitation of wolframite in Stage II. Pulsed magmatic fluids and fluctuation of redox conditions might be pervasive in vein-type W-Sn deposits.