Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.14104

On the ore-forming period of magmatic-hydrothermal deposits A case study of the Yanshanian tungsten deposits in South China

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In South China, a large number of Yanshanian granites are exposed, which bring many magmatic-hydrothermal tungsten deposits. They shows two peaks of mineralization ages: one between 150 Ma and 160 Ma, and the other between 130 Ma and 140 Ma. However, petrographic and petrochemical characteristics of 150-160 Ma granites (mainly biotite monzogranite) in South China reflect that they were undifferentiated (Wang et al., 2017), it is thus impossible for them to generate large tungsten deposits. On the contrary, 130-140 Ma granites (mainly muscovite alkali-feldspar granites) in South China would be tungsten provider due to following favorable conditions (Wang et al., 2017): (1) Their emplacement ages are between 130 Ma and 140 Ma; (2) There is a close spatial relationship between them and tungsten ore; (3) Their petrographic and petrochemical characteristics reflect that their magma was highly differentiated; (4) Their zircons show initial $^{176}Hf/^{177}Hf$ ratio similar to those from the tungsten deposits.

This paper believes that the initial biotite monzogranite magma in the early Yanshanian magma chamber crystallized high melting-point minerals (mainly ferromagnesian minerals), which tended to sink at the bottom of the magma chamber; after over 20 Myr of crystal fractionation, the residual magma in the upper magma chamber must be highly enriched in ore-forming materials; in the late Yanshanian, the extension reached a climax, and the residual magma in the magma chamber was rapidly emplaced along the extensional fault; at a certain height, the fluid solubility in the residual magma drops sharply due to the sharp drop in pressure and temperature, resulting in fluid-melt immiscibility; the residual magma splits into two parts: alkaline-siliceous fluid and strongly felsic melt; the former first reached the upper part of the extensional system due to its low density and viscosity, and formed wolframite-bearing quartz vein; the latter filled the remaining space of the extensional system and consolidated into a muscovite alkali-feldspar granite (Wang et al., 2021). This new metallogenic model perfectly shows the complete metallogenic process of "source - transport - storage" of tungsten metal.