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Magmatism and polymetallic mineralization in southwestern Qinzhou-Hangzhou metallogenic belt, South China

Xudong Huang, Jianjun Lu*, Rucheng Wang, and Dongsheng Ma

State Key Laboratory for Mineral Deposits Research, School of Earth Sciences and Engineering, Nanjing University, Nanjing 210023, China (* Corresponding author: lujj@nju.edu.cn)

As Neoproterozoic suture zone between the Yangtze Block and Cathaysia Block, Qinzhou-Hangzhou metallogenic belt is one of the 21 key metallogenic belts in China. Intensive multiple-aged felsic magmatism and related polymetallic mineralization take place in this belt. Although Neoproterozoic, Paleozoic, Triassic granites and associated deposits have been found in southwestern Qinzhou-Hangzhou metallogenic belt, Middle-Late Jurassic (150-165 Ma) magmatism and related mineralization is of the most importance. Three major kinds of Middle-Late Jurassic granitoids have been distinguished. (Cu)-Pb-Zn-bearing granitoids are slightly differentiated, calc-alkaline and metaluminous dioritic to granodioritic rocks. Sn-(W)-bearing granites contain dark microgranular enclaves and have high contents of REE and HFSE, suggesting affinities of aluminous A-type (A_2) granites. W-bearing granites are highly differentiated and peraluminous rocks. (Cu)-Pb-Zn-bearing granitoids have $\varepsilon_{Nd}(t)$ values of -11 $\sim$ -4 and $\varepsilon_{Hf}(t)$ values of -12 $\sim$ -7, corresponding to T^C_{DM}(Nd) from 1.4 to 1.8 Ga and T^C_{DM}(Hf) from 1.6 to 2.0 Ga, respectively. The $\varepsilon_{Nd}(t)$ values of W-bearing granites vary from -11 to -8 with T^C_{DM}(Nd) of 1.6 $\sim$ 1.9 Ga and $\varepsilon_{Hf}(t)$ values change from -16 to -7 with T^C_{DM}(Hf) of 1.5 $\sim$ 2.0 Ga. Compared with (Cu)-Pb-Zn-bearing granitoids and W-bearing granites, the Sn-(W)-bearing granites have higher $\varepsilon_{Nd}(t)$ (-8 $\sim$ -2) and $\varepsilon_{Hf}(t)$ (-8 $\sim$ -2) values and younger T^C_{DM}(Nd) (1.1 $\sim$ 1.6 Ga) and T^C_{DM}(Hf) (1.2 $\sim$ 1.8 Ga) values, showing a more juvenile isotopic character. Sn-(W)-bearing granites originate from partial melting of granulitized lower crust involved with some mantle-derived materials. W-bearing granites are derived from partial melting of crust. (Cu)-Pb-Zn-bearing granitoids are also derived from crust but may be influenced by more mantle-derived materials. For (Cu)-Pb-Zn deposits, skarn and carbonate replacement are the most important mineralization types. Cu ore bodies mainly distribute proximally to the plutons and Pb-Zn ore bodies occur as distal parts. Skarn, greisen and quartz vein are the dominant types for Sn-W mineralization. For Sn mineralization, chloritized granite type is also important. Greisen type and chloritized granite type occur in granites, skarn in contact zone between granites and wall rocks and quartz vein in wall rocks. Studies on spatial distribution of ore bodies, metallogenic chronology and as well S-Pb-H-O isotopic characteristics indicate these mineral deposits are genetically related Middle-Late Jurassic magmatic-hydrothermal systems. Mineralogical studies show that apatite can provide useful information for petrogenesis and relationship between various kinds of metal mineralization and specific types of granites. Mineralogical features of magnetite, titanite, biotite and wolframite in granites show that these minerals may be used as indicators discriminating the rare metal mineralization potential of granites.