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New discovery of a wolframite-bearing granitic porphyry dike in Pingmiao ore block of the giant Dahutang tungsten deposit (Jiangxi Province, South China): A geochronologic, geochemical and petrogenetic study

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The Dahutang tungsten deposit in Jiangxi Province of South China is a newly discovered tungsten deposit, and one of the largest in the world with an estimated WO_3 reserve of approximately two million tones. Previous studies have shown that the tungsten mineralization shows a close relationship with two-mica granite, muscovite granite and biotite granite [1,2,3].

During a recent field excursion, we identified acicular wolframite occurring in fine quartz veins in the granitic porphyry dikes in the Pingmiao ore block of Dahutang ore district, which has not been previously reported. These fine quartz-wolframite veins only exist within the granitic porphyry, not in the surrounding rocks. In this study, we carried out LA-ICP-MS zircon U-Pb dating, zircon Hf isotopic compositions, whole rock major elements, trace elements, and Sr-Nd isotopic compositions of the wolframite-bearing granitic porphyry dikes.

The LA-ICP-MS zircon U-Pb dating shows a weight-mean $^{206}Pb/^{238}U$ age of 149.1±1.1 Ma. The rocks are rich in SiO_2 (71.88 to 74.29 wt.%), strongly peraluminous (A/CNK=1.29-1.53), and have high contents of alkalis. They show relatively low ΣREE (57.95-74.49 ppm), compared with other tungsten-bearing granites in South China. The rocks also show enrichment in LILEs and depletion in HFSEs.

Combining with data from previous results [1,3,4,5], at least two periods (i.e., 144~150 Ma and 130~134 Ma) of magmatism can be identified in the Dahutang ore district. The granitic porphyry dikes occur in both stages of magmatism, and both of them show a highly fractional S-type granite nature. Geochemical and isotopic data indicate that the source rocks of the magma may have derived from meta-sedimentary rocks rich of argillaceous components, possibly from the Neoproterozoic Shuangqiaoshan Formation that is rich in tungsten and many other metals. In addition to the source control, another important factor for the W-rich nature of the granitic porphyry is likely to be the highly fractional characteristic which produces further tungsten enrichment in the granitic porphyry magma.

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