Petrogenesis of the Late Mesozoic Qitianling composite pluton from the Nanling Range, South China: Implications for tungsten and tin mineralization

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Voluminous granite plutons were emplaced in the Late Mesozoic in the Nanling Range, South China, accompanied by large-scale W-Sn polymetallic mineralization. The Qitianling pluton is a unique composite pluton, which the tin deposit located in the south and the tungsten deposit in the north. The South Granites of the Qitianling emplaced at 155–156 Ma. The North Granites emplaced at 160 Ma. The South Granites show large variation in chemical compositions and in whole-rock Nd and *in situ* zircon Hf isotope, with $\varepsilon_{Nd}(t)$ = -7.2 to -4.5 and $\varepsilon_{Hf}(t)$ = -16.7 to 1.8, respectively. We suggest that their origin is attributable to a magma mixing process between felsic magma derived from melting of Proterozoic basement rocks and mantle-derived mafic magma, which is supported by the widespread MMEs in the South Granites. Compared with the South Granite, the North Granites of the Qitianling show relative low K_2O□Rb and Th contents and high Pb and Sc contents. In addition, the North Granites have apparent lower $\varepsilon_{Nd}(t)$ (-8.9 to -7.9) and $\varepsilon_{Nd}(t)$ values (-10.8 to -3.9) than the South Granites, which suggest that they derived from the partial melting of the Proterozoic basement rocks with little mantle materials involved. The isotope compositions of the South and North Granties of the Qitianling declare that they originated from different sources, which is also supported by the distinct compositions of biotite, sphene and apatite from the South and North Granites.

We argue that plutons associated with tin mineralization have high F content and A-type characteristics, with relative high Nd and Hf isotope compositions, indicating high portion mantle materials involved. On the contrary, plutons associated with tungsten mineralization have relative low F content with low Nd and Hf isotope compositions, indicating little mantle materials involved. The portion of the mantle materials contributing to the formation of the granites makes the different F content of the granites, which result in the mineralization type (tin or tungsten) associated with the granites.