Study of lithium isotope in hydrothermal quartz veins from the Qulong porphyry copper deposit in Tibet

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Evolution details of ore-forming fluids and the precipitation mechanism of ore mineral have always been the focus of metallogeny research. However, the traditional hydrogen and oxygen isotope tracing method of ore-forming fluid has been strongly questioned in recent years because it is difficult to avoid the impact of secondary inclusions and high-temperature isotope fractionation. In Qulong porphyry copper deposit , a typical representative of Gangdise porphyry copper belt of Tibet, we attempt to use the lithium isotope to trace the origin of ore-forming fluid. We analysed lithium isotopic compositions of different stage quartz veins and altered minerals. Preliminary results show that there is a positive correlation between δ^7Li and$\delta^{18}O_{V\text{-}SMOW}$ of quartz veins. From early quartz vein to late ones, δ^7Li and $\delta^{18}O_{V\text{-}SMOW}$ values decrease synchronously. This trend indicates that the early ore-forming fluid originated from degassed magma water and meteoric water gradually joined in it in late stage. This attempt may provide a reliable and effective tracing method for ore-forming fluid.

Petrogenesis of Early Cretaceous intrusive rocks from southern margin of the North China Craton: Constraints from zircon U-Pb ages and Sr-Nd-Pb-Hf isotopes

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The spatial extent of the influence of the deeply subducted Yangtze slab on the North China Craton (NCC) remains a controversial issue. The zircon U-Pb ages and Sr-Nd-Pb-Hf isotopic data of Early Cretaceous intrusive rocks in Sanmenxia area from the southern margin of the NCC provide a constraint for that. These intrusive rocks, including Gaomiao (GM), Quli (QL), Canfang (CF), and Wangmao (WM) intrusions, consist of quartz diorite porphyry, granodiorite, and granodiorite porphyry.

Zircon U-Pb dating results indicate that the GM, QL, CF, and WM intrusions formed in the Early Cretaceous (129 Ma, 115 Ma, 130 Ma, and 130 Ma, respectively). The occurrence of Neoproterozoic zircons (620 and 542 Ma) and inherited Late Triassic (214 - 225 Ma, n=6) metamorphic zircons within the QL intrusion, suggests that the primary magmas could be derived from partial melting of the Yangtze Craton basement that was superimposed by ultrahigh pressure metamorphism. In contrast, the occurrence of Paleoproterozoic and Archean ages within the GM, CF, and WM intrusions, indicates that their primary magmas were mainly originated from partial melting of the NCC basement.

The GM, QL, CF, and WM intrusions have high SiO_2 (60.65 - 67.62 %) and low MgO (0.35 - 1.15 %). They are enriched in LILEs and LREEs, and depleted in HFSEs and HREEs. The GM, QL, and CF intrusions have strong negative εNd (t) (-22.2 to -16.7) and εHf (t) (-29.6 to -21.4) values as well as low initial $^{206}Pb/^{204}Pb$ ratios (17.19 to 17.33), suggesting that they were mainly derived from partial melting of ancient lower crust, whereas the WM granodiorite porphyries have relatively high εNd(t) (-12.5 to -11.9) and εHf (t) (-21.7 to -16.6) values, indicating that they could be derived from partial melting of lower crustal materials with involvement of mantle components.

Taken together, we conclude that the southern margin of the NCC had been influenced by the deeply subducted Yangtze slab during the Triassic.

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