

Early crustal evolution in the western Yangtze Block: Evidence from U-Pb and Lu-Hf isotopes on detrital zircons

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In situ U-Pb and Lu-Hf isotopic data on detrital zircons from Paleoproterozoic-Neoproterozoic sequences in the western Yangtze Block have provided a clearer picture of regional tectonic background and crustal evolution history. The youngest concordant zircon ages for sedimentary units suggest a maximum depositional age of 1014 Ma for the Kunyang Group, 750~649 Ma for the Sinian sequences, and 525 Ma for the Cambrian sediments. The Yinmin Formation, which has been assigned to the middle part of the Kunyang Group, was actually deposited at 1667 Ma and contains zircons whose ages are dominantly from late Archean to Paleoproterozoic (2.7~2.8 Ga, 2.5~2.3 Ga and ~1.85 Ga). The Heishantou Formation in the lower part of the Kunyang Group has two major age populations of ~1.0 Ga and 1.6~1.8 Ga. The younger Sinian and Cambrian sedimentary rocks are dominated by Neoproterozoic zircons with age peaks at ~760 Ma and ~825 Ma, consistent with widespread coeval igneous rocks around the Yangtze Block. The Lu-Hf isotope data suggest that significant juvenile input took place during Archean and Neoproterozoic times, while crustal reworking was dominant during the Paleoproterozoic. The absence of exposed basement rocks that could have been the source of the Archean-Paleoproterozoic detritus suggests an unexposed or now-covered source within the Yangtze Block, probably with minor exotic contributions. These ancient materials are distinct from the exposed Archean-Paleoproterozoic basements in the northern Yangtze block, suggesting that a subarea of old crust exists beneath the young sediments covering the craton. The presence of abundant ~1.85 Ga zircons suggests that the Yangtze Block was probably part of the Columbia supercontinent during Paleoproterozoic time. Comparisons to the other parts of Columbia suggest that South China could have been adjacent to the North China Craton and/or Australia.

Petrogeochemical characteristics and constraints on the tectonic setting of Guiling Monzogranite pluton of South China

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Guiling monzogranite pluton is located in the western Nanling region of south China. SHRIMP zircon dating of the monzogranite and its widely-spread microdioritic enclaves yielded U-Pb ages of 424.4±5.6 Ma and 428±4Ma [1], confirming a Caledonian emplacement of the pluton. The monzogranite shows relatively high contents of SiO₂, K₂O, Rb, Sr, and Ba, low contents of CaO, P₂O₅ and ΣLREE, and ΣREE = 108.51-161.56 ppm. Its A/CNK ratio ranges between 0.94 and 1.03 with K₂O>Na₂O, suggesting that it is a metaluminous to weakly peraluminous granite. The monzogranite also demonstrates strongly negative Eu anomaly. Isotopic analyses of its Sr-Nd-Pb system show that the monzogranite has high ⁸⁷Sr/⁸⁶Sr, ²⁰⁸Pb/²⁰⁴Pb, ²⁰⁷Pb/²⁰⁴Pb, and ²⁰⁶Pb/²⁰⁴Pb and low ¹⁴³Nd/¹⁴⁴Nd. The petrogeochemistry of the monzogranite suggests that the Guiling magmas were dominantly derived from partial melting of the upper crust with addition of a certain amount of deeply subducted material. In contrast, the microdioritic enclaves have higher CaO, MgO, Fe₂O₃, TiO₂, P₂O₅, ΣREE, Cr, Ni, and ¹⁴³Nd/¹⁴⁴Nd, and lower K₂O, Rb, Th, ⁸⁷Sr/⁸⁶Sr, ²⁰⁸Pb/²⁰⁴Pb, ²⁰⁷Pb/²⁰⁴Pb, and ²⁰⁶Pb/²⁰⁴Pb, indicating a different source from its host monzogranite. It is suggested that they were derived from the enriched mantle with partial melting.

Application of the tectonic discrimination diagrams in this study shows that the Guiling monzogranite dominantly falls in the syn-collision and within-plate fields; it is suggested that it was emplaced during the collision between Cathaysian block and Yangtze block during Caledonian orogeny. The ore-forming molybdenite contained within the monzogranite has an age of 424.6±5.7Ma [1], indicating that the quartz-molybdenite vein-type molybdenum deposit hosted by the pluton was produced during the Caledonian orogeny and in the Silurian time.

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[1] Li *et al.* (2009) *Mineral Deposits* **28**(4), 403–412.