Geochronology and geochemistry of the Neoarchean-Paleoproterozoic Yudongzi complex, northwestern margin of the Yangtze Block, China

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The Archean-Paleoproterozoic basement Yudongzi complex is a key to understanding the early Precambrian crustal evolution of the Yangtze Block. It comprises mainly orthogneiss, paragneiss and amphibolite, which protoliths are tonalitic-trondhjemitic-granodiorites (TTG), sedimentary and basic-intermediate volcanic rocks, respectively. The TTG gneiss, amphibole plagiogneiss and granitoid gneiss yield magmatic zircon LA-ICP-MS U–Pb ages of 2815±18 Ma, 2692±26 Ma and 2477±18 Ma, respectively. Metamorphic overgrowths on a zircon from amphibolite have an age of 1848±5 Ma. TTG gneisses show medium Sr/Y and variable high (La/Yb)N ratios with low Y and Yb contents. They are characterized by positive Eu anomaly and a distinct depletion of HREE together with negative Nb, Ta and Ti, implying amphibole, garnet and minor rutile as residual phases. Their positive εHf(t) values of +2.1 to +8.1 with TDM2 of ca. 2.80–3.10 Ga suggest a significant rework of a juvenile crust. Amphibole plagiogneisses display a strong enrichment of LREEs and depletion of Nb, Ta and Ti. Additionally, a relative enrichment of Ba, Rb, Pb and Zr, as well as high Cr and Ni contents and Mg# values, imply a mantle source with the participation of continental crust material. Zircon εHf(t) values vary between –0.9 and +3.9, suggesting a proportionally significant input of a juvenile material and therefore interaction between the mantle and pre-existing continental crust. The granitoid gneisses samples are characterized by high Na_2O and Al_2O_3 contents, moderate-high Sr/Y, (La/Yb)N and Na_2O/K_2O ratios, no obvious Eu and Sr anomalies, and depleted Nb, Ta and Ti values that are similar to those of Archean TTG-suits, indicating their property that belonging to TTG-series rocks. They display apparently low MgO, Mg#, Ni and Cr contents, corresponding to those TTG-suits formed via melting of a thickened lower crust, suggesting that they were derived from a partial melting of ancient crustal materials. Zircon εHf(t) values from the granitoid gneisses sample vary from –10.1 to –6.9 with TDM2 of ca. 3.59–3.40 Ga, which demonstrate their crust-originated source nature as well. Thus, the Yudongzi complex probably has experienced significant rework of a juvenile crust at ca. 2.82 Ga and a subsequent crustal growth at ca. 2.69 Ga, followed by a second stage of a rework of an ancient crust at ca. 2.48 Ga. During the Late Paleoproterozoic, the Yudongzi complex was probably involved in the amalgamation of the Paleoproterozoic supercontinent Columbia, and affected by a post-collisional metamorphic event at ca.1.85 Ga.