

Zircon U-Pb age and Hf isotope in granulite-facies rocks from the Dabie orogen: evidence for Archean crustal relict and Paleoproterozoic reworking

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Although the Yangtze Block is one of the largest Precambrian blocks in China, its early evolution history is poorly constrained because of its sporadic occurrences of Archean basement rocks. In this study, we carried out zircon U-Pb dating in combination with Hf isotope analysis, which were demonstrated to be suited for refining the early evolution history of ancient rocks, for granulite-facies metamorphic rocks at Huangtuling in the Dabie orogen. The results not only provide unambiguous evidence for the presence of Archean crust of the Yangtze Block in this area, but also shed lights on the nature and subsequent evolution of these rocks.

Most zircons in the granulite have magmatic core and metamorphic rim, which were dated at ca. 2.75 to 2.80 Ga and at ca. 2.0 Ga, respectively, representing magm intrusion age for their protoliths and granulite-facies metamorphic age. The ca. 2.0 Ga metamorphic event is interpreted as a response to collision orogeny during assembly of the supercontinent Columbia. The gneiss has a protolith age of 1982 ± 14 Ma, suggesting complementary processes for granulite-facies metamorphism and partial melting. A few inherited cores have $^{207}\text{Pb}/^{206}\text{Pb}$ ages of ca. 2.90, 3.24 and 3.44 Ga, respectively, suggesting the presence of Mesoarchean to Paleoproterozoic crustal relicts. A few Triassic and Cretaceous metamorphic ages were obtained, suggesting that these high-grade metamorphic rocks were influenced by the Triassic continental collision and that their final exhumation is related to the Cretaceous extension. The protolith and the ca. 2.90 Ga inherited zircons show large variations in $\varepsilon_{\text{Hf}}(t)$ with both negative and positive values, indicating that both growth of juvenile crust and reworking of ancient crust. It is inferred that the ca. 2.75-2.80 Ga and 2.90-2.95 Ga events are two major episodes of crustal formation in the Yangtze Block, and the Archean basement of the Yangtze Block occurs as north as the North Dabie zone. The occurrence of inherited zircon with Hf model age of 3.50 Ga and U-Pb age of 3443 ± 13 Ma provide further evidence for the presence of >3.4 Ga sialic crust in the Yangtze Block.