

Detrital zircon U-Pb and Hf isotopic data of the Liaoyuan Group from the northern margin of the North China Craton and their implications for the Late Paleozoic tectonic evolution

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Detrital zircon U–Pb dating and Hf isotopic analysis was carried out for the Paleozoic Liaoyuan Group from the central Jilin Province, NE China to constrain the Paleozoic tectonic evolution of the northern margin of the North China Craton (NCC). The Liaoyuan Group is subdivided from bottom to top into the Shifeng, Wanyue, and Yishan formations. Dating of detrital zircons from four samples (two feldspar–quartz sandstones, a muscovite–quartz schist, and a rhyolitic tuff) from the Shifeng and Yishan formations yielded six prominent age populations at 485, 440, 425, 396, 366 and 340 Ma, as well as some Paleoproterozoic and Neoproterozoic ages (~2.5 and ~1.8 Ga). Zircons with ages of 485–396 Ma display a large spread in $\epsilon_{\text{Hf}}(t)$ values and decreasing $\epsilon_{\text{Hf}}(t)$ values with age, whereas 396–340 Ma zircons typically have positive $\epsilon_{\text{Hf}}(t)$ values and an overall increasing trend in $\epsilon_{\text{Hf}}(t)$ values with a transformation in tectonic setting. Grains with ages of ~396 Ma have the largest variation in $\epsilon_{\text{Hf}}(t)$ values (–29.36 to +11.83) and have T_{DM2} ages of 2869–599 Ma. Combining the present results with previous data, this study yields the following conclusions: (1) the maximum deposition time of the Shifeng and Yishan formations is the early Carboniferous (~340 Ma); (2) six magmatic events occurred at the northern margin of the NCC during the Paleozoic (at ~485, 440, 425, 396, 366 and 340 Ma); (3) clasts from the Shifeng and Yishan formations were derived mostly from the northern margin of the NCC; (4) Final closure of the Paleo-Asian Ocean, as recorded at the northeast margin of the NCC, occurred after the early Carboniferous; and (5) the marked change in the detrital zircon Hf array at ~396 Ma indicates that the collision between an early Paleozoic island arc terrane and the NCC occurred during the Early–Middle Devonian.

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