

Detrital zircon U–Pb ages and Hf isotopes of Neoproterozoic strata in the Songnen Massif: Implications for basement composition and tectonic affinity

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The Songnen Massif forms part of the eastern Central Asian Orogenic Belt and the Pacific oceanic tectonic domain, but the nature of its Precambrian basement and tectonic affinity are highly controversial. Here we present LA-ICP-MS U–Pb ages and Hf isotope compositions of detrital zircons from six metasedimentary rocks within the eastern Songnen Massif, and our aim is to constrain the depositional ages and provenance of the strata, as well as the basement composition and tectonic affinity of the massif.

The zircon U–Pb ages mainly define five Neoproterozoic age populations of ca. 760 Ma, ca. 795 Ma, ca. 855 Ma, ca. 890 Ma, and ca. 935 Ma, together with four Paleo-Mesoproterozoic age populations of 1150–1080 Ma, 1400–1250 Ma, 1800–1650 Ma, and ca. 2500 Ma. Neoproterozoic age populations are consistent with the episodes of magmatism documented in the eastern Songnen Massif, suggesting that the detritus were likely sourced from the Songnen Massif itself. In contrast, the Paleo-Mesoproterozoic magmatic activity has yet to be found in the study area, even though detrital zircons and captured zircons with similar ages have been reported in the eastern Songnen Massif. Two-stage Hf model (T_{DM2}) ages of zircons from granitoids that have been reported in the Songnen Massif vary from 1.0 to 2.2 Ga, indicating that the Paleo-Mesoproterozoic crustal material occurred within the Songnen Massif and could provide the clastic sediments for these Neoproterozoic strata. The Neoproterozoic detrital zircons from the Zhangguangcai Range in the south yield positive $\epsilon_{Hf}(t)$ values (+3.1 to +10.6), which are much higher than those of coeval detrital zircons (-15.1 to +1.0) from the Lesser Xing'an Range in the north. The spatial variations in zircon Hf isotopic compositions indicate a lateral heterogeneity of the basement composition of the Songnen Massif. Additionally, the detrital age patterns and zircon Hf isotopic compositions of the Songnen Massif are much similar to those of the Tarim Craton, suggesting the Songnen Massif would have initially formed part of the Tarim Craton in the Neoproterozoic.

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