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Neoproterozoic diamictites-bearing strata in the Tarim and Yili Blocks and their constraints on the Precambrian evolution of microcontinents in the Central Asian Orogenic Belt

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The Tarim and Yili Blocks, as important components of the Central Asia Orogenic Belt, are located in the Xinjiang Uygur Autonomous Region, NW China. Relatively few works of Precambrian research have been done on Tarim and Yili. Completed Precambrian evolution history of the region cannot be reconstructed based on the present achievements. In this work, results of LA-ICP-MS detrital zircon U-Pb geochronological study and in situ Hf analysis on Neoproterozoic diamictites-bearing sedimentary rocks in northern Tarim and Yili are presented, in an attempt to reveal the provenance of studied strata, the age composition of the basement, the crustal evolution history and the paleogeographic reconstruction of Tarim and Yili. The main opinions and conclusions in this work are as follows:

1. Provide systematic constraints on the deposition ages of Neoproterozoic diamictites-bearing strata in the study area, showing new evidence for the division of regional Neoproterozoic glacial epochs and global glaciation correlation.

2. Ages and periods of Precambrian tectothermal events in the Tarim and Yili Blocks are identified. Four main Precambrian tectothermal events have occurred at 2800–2200 Ma, 2050–1800 Ma, 900–700 Ma and 680–600 Ma in the Tarim Block, whereas three periods of Precambrian tectothermal events have occurred at 1900–1400 Ma, 1300–1150 Ma and 700–580 Ma in the Yili Block.

3. Find the provenance of Neoproterozoic diamictites-bearing sedimentary rocks in the study area and reconstruct the supercontinent, through comparison of Precambrian detrital zircon age distribution. Detrital zircon age distribution from the northern Tarim block is consistent with the ages from local exposed Precambrian litho-units, suggesting a local provenance from Tarim itself. Similar Rodinia related detrital zircon age populations are identified in Tarim, Yangzte and northern India. Combining coeval Neoproterozoic active continental margin records, they may be close to each other in the Rodinia supercontinent, as a part of the circum-Rodinia subduction system. The 680–600 Ma age peak from the northern Tarim Block is similar to the Arabian-Nubian Shield, consistent with ages of the East Africa Orogen, suggesting an affinity of the Tarim Block with the Arabian-Nubian Shield in the early stage of the Gondwana assembly. Detrital zircon age distribution from the Yili Block is not completely consistent with the local basement ages. Considering that few works have been done on the basement of the Yili Block, two possible interpretations of autochthonous or allochthonous are discussed. The interpretation that an unknown basement rocks which may be completely eroded or deeply buried in the Yili Block provided the sources of Neoproterozoic sedimentary rocks in Yili is more suitable. The 700–580 Ma age peak from Yili is consistent with ages of the East Africa Orogen, like the Arabian-Nubian Shield and the northern Tarim Block, suggesting a possible correlation between them in the early stage of the Gondwana assembly.

4. In situ Hf analyses reveal the Precambrian crustal evolution history of the northern Tarim and Yili Blocks. Both the Tarim and Yili Blocks have Archean Hf model ages (T_{DM}^{C}) reaching 3.9–3.6 Ga, implying the possible existence of Archean crust material. In the Tarim Block, the Neoproterozoic involvement displays a contribution of both juvenile crust growth and reworking of Neoarchean to early Paleoproterozoic crust, whereas the Paleoproterozoic mainly displays reworking of Archean crust. The Yili Block dispays late Neoproterozoic juvenile crust growth and long-lived continuous Paleo-Mesoproterozoic involvement of both reworked old crust and juvenile material input.