Eoarchean to Paleoproterozoic crustal evolution in the North China Craton

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The early evolution of continental crust, particularly its lower layer, during the first 2.0 billion years of Earth history remains enigmatic. In our recent paper, we present coupled in-situ U-Pb, Lu-Hf and O isotope data for the Precambrian zircons from fourteen deep-crustal xenoliths from five localities in the North China craton. The results show that:

(1) Eo-Paleoarchean Xinyang granulite xenoliths are the oldest pieces of the crust in the southern NCC and perhaps the known oldest unexposed lower crustal rocks in the world, dating back to ~3.82 Ga. The 3.82−3.55 Ga magmatic zircons have predominant sub-chondritic Hf isotope compositions and elevated δ18O values, suggesting Lu-Hf fractionation and crust-hydrosphere interactions on the Earth can be traced back to Eoarchean or even earlier.

(2) The magmatic zircons from the studied xenoliths define four age populations at 3.82−3.55 Ga, ~2.7 Ga, ~2.5 Ga and 1.95−1.85 Ga, and yield a non-linear Hf isotope-age array. These data reveal crustal growth in the North China occurred as early as >3.9 Ga and reached its climax in the Neoarchean. The pre-existing continental crust was reworked at 3.8−3.5 Ga, ~2.7 Ga, ~2.5 Ga and 1.95−1.85 Ga.

(3) The zircons from lower crustal xenoliths record a secular change in O isotopes. An increasing range in zircon δ18O values at ~2.5 Ga marks enhanced recycling of surface-derived materials, including high-δ18O sediments, weathered and altered rocks and low-δ18O altered oceanic crust. Subduction of hydrated oceanic crust back to mantle depths may have occurred at least before ~2.5 Ga and have played an important role in generation of continental crust.

Reference: