Paper Number: 1744

Archean to Paleoproterozoic crustal evolution of Ordos block basement, North China Craton: evidence from detrital zircon U–Pb age and Hf-isotopes of Mesoproterozoic sandstones*

Zhang, C.L.[1], Diwu, C.R.[1], Sun, Y.[1], and Guo L.L.[1]

[1] Department of geology, Northwest University, Xi'an, 710069, China, clzhang@nwu.edu.cn

---

The North China Craton (NCC) is one of the oldest cratons in the word and recorded long-term evolutional history of early crust [1, 2]. However, as an important western part of NCC, the early evolution history of the Ordos Block (OB) basement is poorly understood due to no exposure of basement overlain by a huge thickness of Mesoproterozoic to Phanerozoic sedimentary rocks. This paper provided results from U–Pb dating and Hf isotopic studies on the detrital zircons of five Mesoproterozoic sandstones collected from the five drillcores. 310 concordant $^{207}Pb/^{206}Pb$ age (with age concordance from 90% to 110%) data have been obtained and revealed three major age populations of 2550 Ma~2400 Ma (peak at 2500 Ma), 2250 Ma~2100 Ma (peak at 2150 Ma) and 2000 Ma~1750 Ma (two peaks at 1920 Ma and 1850 Ma, respectively), as well as two subordinate groups of 2750~2650 Ma (peak at 2700 Ma) and 1630 Ma. In addition, there are existed four older zircons with the ages of 3555 Ma, 3298 Ma, 2953 Ma and 2872 Ma. These age peaks most likely represented the tectono-thermal magmatism due to majority of zircons have high Th/U ratios (> 0.30) and show CL images of oscillatory zoning of igneous origin. Of which, the 2700 Ma peak zircons have positive $\varepsilon_{Hf}(t)$ values, suggesting a major crustal growth. The 2500 Ma peak zircons show various $\varepsilon_{Hf}(t)$ from negative to positive values, indicating a significant crustal reworking associated with minor crustal generation, consistent with strong continental reworking occurred at the end of Neoarchean in eastern NCC [1, 3]. The zircons with the age peak of 2150 Ma display a large range of $\varepsilon_{Hf}(t)$ values from −12.74 to +7.96 and T_{DM}^{C} from 2242 Ma to 3236 Ma, suggesting juvenile crustal growth involved in minor Meso- to Neoproterozoic terrestrial materials, which are similar to the magmatic event from 2084 Ma to 2298Ma in the Trans-North China Orogen (TNCO) [4]. Another major age population from 2000 Ma to 1750 Ma is correspond to 1950~1850 Ga granitic magmatism associated with coeval metamorphism reported in the TNCO [5], and their $\varepsilon_{Hf}(t)$ values are negative with the T_{DM}^{C} of 2192 to 3131 Ma (2750~2450 Ma peak range), demonstrating reworking of Neoarchean crustal materials. Based on the occurrence of Paleoarchean zircons of 3555 Ma and 3298 with $\varepsilon_{Hf}(t)$ values of -7.17 and -5.18 and T_{DM}^{C} of 4107Ma and 3803Ma, we proposed that Paleoarchean terrestrial materials was likely built in the OB basement. Such similar old zircons from Paleoarchean rocks was previously recognized only in eastern NCC and regarded as the first phase of crustal reworking of the Paleoarchean crust [2]. Consequently, crustal evolution of OB basement was involved as following: (1) positive ε_{Hf}(2.7 Ga) values and dominated T_{DM}^{C} from 2.45 Ga to 2.95 Ga (peak at 2.7–2.8 Ga) for all age populations indicate a major growth of juvenile crust at ca. 2.7 Ga, agreeing well with the coeval Neoarchean global crustal growth [6]; (2)variety $\varepsilon_{Hf}(t)$ values for two age peaks of 2500 Ma and 2150 Ma suggested strong crustal reworking with juvenile crustal generation at 2.5 Ga and 2.15 Ga, respectively; (3)negative $\varepsilon_{Hf}(t)$ of 2000 Ma to 1750 Ma age group provided an evidence of significant reworking and recycling of the continental crust during later Paleoproterozoic, which strongly affected by the 1.95 Ga to 1.85 Ga tectono-thermal event occurred widely along the TNCO [1, 3].

---

*This research was supported by the National Key Basic Research Program of China (2012CB416606) and MOST Special Funds from the State Key Laboratory of Continental Dynamics, Northwest University.

References:

[1] Zhai M G and Zhou Y Y (2015) In. Precambrian Geology of China: Springer, 3-58
[2] Wan Y S et al. (2015) In. Precambrian Geology of China: Springer, 59-136
[3] Zhao G C and Zhai M G (2013) GR 23: 1207-1240
[4] Santosh M et al. (2015) GR 263: 197-231
[5] Wei C J et al. (2014) Geoscience Frontiers 4: 485-497
[6] Condie K C (1998) EPSL 163: 97-108