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A step-like crustal growth pattern in response to the evolution of supercontinent cycles: Evidence from the eastern Central Asian Orogenic Belt

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The crustal growth and reworking processes of accretionary orogen such as the Central Asian Orogenic Belt (CAOB) have been a controversial issue. Here we present *in situ* zircon U–Pb and Lu–Hf isotopic data for granitoids from a microcontinent (the Songnen Massif) and an arc terrane (the Duobaoshan arc terrane), which generally represent two main crustal components in the eastern CAOB to establish a crustal growth model for an accretionary orogen and to trace the influence of the assembly and breakup of supercontinents on crustal evolution in an accretionary orogen. A total of 1064 zircon U–Pb dating analyses for 58 granitoids from the Songnen Massif yield ages from 1227 to 174 Ma, and 497 dated zircons were chosen for Hf isotope analysis, with $\varepsilon_{Hf}(t)$ values and T_{DM2} ages ranging from -8.9 to +13.0 and 2295 to 544 Ma, respectively. In contrast, granitoids from the Duobaoshan arc terrane exhibit distinct zircon Hf isotopic features, with markedly high $\varepsilon_{Hf}(t)$ values (+7.4 to +16.5) and young T_{DM2} ages (329 to 813 Ma).

Based on the above results, this study established a crustal growth curve of the Songnen Massif, which shows a step-like growth pattern with three major periods of development: Paleoproterozoic crustal growth at 2.2–1.8 Ga, Mesoproterozoic growth at 1.6–1.0 Ga, and a third growth at 0.85–0.6 Ga, along with two short pauses at 1.8–1.6 Ga and 1.0–0.85 Ga. The assembly and collision phases of supercontinents corresponded to the enhanced and degressive crustal growth rates of the Songnen Massif, respectively, suggesting that the supercontinent cycles are responsible for the episodic crustal growth pattern in the region. Combined with isotopic compositions of granitoids from the Duobaoshan arc terrane and other microcontinents, we propose that most of the continental crust beneath the microcontinents in the eastern CAOB generated during the Precambrian, whereas a significant amount of lateral crustal accretion occurred during amalgamation of microcontinents in the Phanerozoic.

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