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Nd-Hf isotopic mapping of granitoid plutons in the southwestern Central Asian Orogenic Belt and implications for continental architecture and growth

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The Central Asian Orogenic Belt (CAOB) is the world's largest Phanerozoic accretionary orogenic belt and the most important site of Phanerozoic crustal growth^[1-3]. However, the proportion of juvenile crust production is still controversial, nearly half of the CAOB^[1-2], or it was grossly overestimated^[3]. We attempt to address this problem by regional isotopic (Nd- Hf) mapping for granitoids.

The northern Xinjiang, in NW China, belongs to the southwest sector of the CAOB, and is a Paleozoic collage of various tectonostratigraphic terranes or units. From north to south, it comprises the Altai orogen (or terrane), Junggar terrane, Tianshan and Beishan orogens. Here we summarize the results of isotope mapping based on hundreds of whole-rock Nd-Sr isotopic data of granitoid (and a few mafic) intrusions of this region. This map shows that the central Altai granitoids are characterized by $\epsilon_{Nd}(t)$ values of -5 to +2 with Nd model ages (T_{DM}) of 1.6 - 1.1 Ga^[4]. The Western Junggar granitoids have highly positive $\epsilon_{Nd}(t)$ values from +3 to +9 with T_{DM} from 0.8 to 0.4 Ga. The Eastern Junggar granitoids show $\epsilon_{Nd}(t) = +2$ to +8 with T_{DM} from 0.9 to 0.5 Ga. The Tianshan and Beishan granitoids have large ranges of $\epsilon_{Nd}(t)$ values and T_{DM} . From the northern Tianshan to the middle and southern Tianshan, $\epsilon_{Nd}(t)$ values change from generally positive values (+2 to + 8) for North Tianshan, intermediate values (+3 to -5) for Middle Tianshan, to negative values (-3 to -11) for Southern Tianshan. The Beishan granitoids exhibit mostly negative $\epsilon_{Nd}(t)$ (0 to -15) with a few positive (+2 to + 5) values.

These data allow us to delineate the distribution of ancient reworked continental fragments and juvenile terranes. The Central Altai shows a mixed isotopic signature and it may be a remnant of a reworked (old) continental terrane. The Junggar terrane has a very primitive isotopic feature, suggesting a juvenile accretionary complex (mélange) affinity. This feature is typical of the accretionary orogen of the CAOB. The isotopic characteristics of the Tianshan and Beishan granitoids indicate that juvenile crust mainly occurred in the northern part, whereas the southern part is characterized by recycled ancient crust, which is possibly related to the Tarim craton. Thus, the Tianshan and Beishan granitoids show transitional signatures between the CAOB and Tarim craton. From NW to SE, a progressive change of $\epsilon_{Nd}(t)$ values and Nd model ages (T_{DM}) seems to be established across the Altai-Junggar-Tianshan-Beishan-Northern Tarim craton. The isotopic mapping also allows us to estimate the proportion of juvenile terranes occupy ca. 50-60% of the southwestern CAOB. This implies a voluminous continental growth in this region. Therefore, we conclude that the CAOB, at least in its southwestern sector, is the most important site of Phanerozoic crustal growth, which makes this belt unique and distinct from other classical Phanerozoic orogens.

References:

- [1] Sengör AMC et al. (1993) *Nature* 364: 299–307
- [2] Jahn BM et al. (2000) *Episodes* 23: 82–92
- [3] Kröner A et al. (2014). *Gondwana Research* 25: 103–125
- [4] Wang T et al. (2009). *Lithos* 110: 359–372.

