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Continental Architecture and Crustal Growth in the SW Sector of the Central Asia Orogenic Belt: Evidence from Nd Isotope Mapping

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The Central Asia Orogenic Belt (CAOB; e.g., Jahn et al., 2000a; Windley et al., 2007) or the Altaid Tectonic Collage (Sengör et al., 1993) is the world's largest Phanerozoic accretionary orogenic belt and the most important site of Phanerozoic crustal growth (e.g., Sengör et al. 1993; Kovalenko et al., 1996a, 1996b; 2004; Jahn et al., 2000a, b). However, the proportion of juvenile crust production is difficult to be precisely determined. According to Sengör et al., (1993), juvenile crust was abundantly generated and represented nearly half of the CAOB. This was echoed by Jahn et al. (2000a, b) but Kröner et al. (2013) considered the quantity of new crust grossly overestimated. In order to better evaluate the proportion of juvenile crust in the CAOB, we use the approach of isotope mapping based on the available whole-rock Nd and zircon Hf isotope data.

The northern part of Xinjiang Province (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, altogether forming a typical domain of the CAOB. Here we summarize the results of isotope mapping based on hundreds of whole-rock Nd, Sr and zircon Hf isotopic data of granitoid (and a few mafic) intrusions of the region. This map shows that the central Altai granitoids are characterized by having $\epsilon_{\text{Nd}}(t)$ values of -5 to +2 with Nd model ages (T_{DM}) of 1.6 - 1.1 Ga. The Western Junggar granitoids have highly positive $\epsilon_{\text{Nd}}(t)$ values from +3 to +9 with young T_{DM} from 0.8 to 0.4 Ga. The Eastern Junggar granitoids show $\epsilon_{\text{Nd}}(t) = +2$ to +8 with T_{DM} from 0.9 to 0.5 Ga. The Tianshan and Beishan granitoids have large ranges of $\epsilon_{\text{Nd}}(t)$ values and T_{DM} . From the northern

Tianshan to the middle and southern Tianshan, the granitoids show a decreasing trend of $\epsilon_{\text{Nd}}(t)$ values, 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 $\epsilon_{\text{Nd}}(t)$ (0 to -15) and a few positive (+2 to +5) values. Zircon Hf isotopic data of the granitoid in some regions also show such a similar variation.

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), comprising accretionary ophiolites, oceanic plateaux and island arcs and wedges. 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 old recycled 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 $\epsilon_{\text{Nd}}(t)$ values and Nd model ages (T_{DM}) seems to be established across the Altai-Junggar-Beishan-Northern Tarim craton.

The isotopic mapping also allows us to estimate the proportion of juvenile terranes at about 50-60% within the southwestern CAOB. This implies a voluminous continental growth in this region. Combined with isotopic data and the rough areal distribution of old and juvenile terranes in western CAOB (Kröner et al., 2013), the proportion of juvenile terranes in the western CAOB can

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be estimated at >50%. 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. Obviously, a more accurate assessment of crustal growth rate needs more isotopic mapping in the entire CAOB.

Key words: Granitoids, Nd isotope mapping, accretionary orogeny, juvenile crust, Central Asian Orogenic Belt.

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