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SHORT EPISODES OF CRUST GENERATION DURING PROTRACTED ACCRETIONARY PROCESSES: EVIDENCE FROM CENTRAL ASIAN OROGENIC BELT, NW CHINA

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Accretionary orogens are major sites of generation of continental crust but the spatial and temporal distribution of crust generation within individual orogens remains poorly constrained. Paleozoic (~540–270 Ma) granitic rocks from the Alati, Junggar and Chinese Tianshan segments of the Central Asian Orogenic Belt (CAOB) have markedly bimodal age frequency distribu-

tions with peaks of ages at ~400 Ma and 280 Ma for the Altai segment, and ~430 Ma and 300 Ma for the Junggar and Chinese Tianshan segments. Most of the magma was generated in short time intervals (~20–40 Ma), and variations in magma volumes and in Nd–Hf isotope ratios are taken to reflect variable rates of new crust generation within a long-lived convergent plate setting.

The Junggar segment is characterised by high and uniform Nd–Hf isotope ratios ($\epsilon_{\text{Nd}}(t)=+5\dots+8$; zircon $\epsilon_{\text{Hf}}(t)=+10\dots+16$) and it appears to have formed in an intra-oceanic arc system. In the Altai and Chinese Tianshan segments, the Nd–Hf isotope ratios ($\epsilon_{\text{Nd}}(t)=-7\dots+8$; zircon $\epsilon_{\text{Hf}}(t)=-16\dots+16$) are lower, although they increase with decreasing age of the rock units. The introduction of a juvenile component into the Chinese Tianshan and Altai granitic rocks appears to have occurred in continental arc settings and it reflects a progressive reduction in the contributions from old continental lower crust and lithospheric mantle. Within the long-lived convergent margin setting (over ~ 200 Ma), higher volumes of magma, and greater contributions of juvenile material, were typically emplaced over short

time intervals of ~ 20 – 40 Ma. These intervals were associated with higher Nb/La ratios, coupled with lower La/Yb ratios, in both the mafic and granitic rocks, and these episodes of increased magmatism from intraplate-like sources are therefore thought to have been in response to lithospheric extension. The trace element and Nd–Hf isotope data, in combination with estimates of granitic magma volumes, highlight that crust generation rates are strongly non-uniform within long-lived accretionary orogens. The estimated crust generation rates range from ~ 0.1 to ~ 40 km³/km/Ma for the Paleozoic record of the CAOB, and only comparatively short (20–40 Ma) periods of elevated magmatic activity had rates similar to those for modern intra-oceanic and continental arcs.