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Asian Continental Growth in the Phanerozoic: Zircon Hf Isotopic Constraints from the Central Asian to Eastern Tethyan Orogenic Belts

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Asia that comprises numerous ancient cratonic blocks and young mobile belts is the largest composite continent on the Earth. During the Phanerozoic, it was enlarged by successive accretion of dispersed terranes that, associated with opening and closure of the Paleo-Asian and Tethyan oceans, had produced a significant amount of juvenile or mantle-derived continental crust. The Central Asian orogenic belt (CAOB), for instance, is celebrated for its accretionary tectonics and massive juvenile crustal production in the Phanerozoic or, more specifically, in the Paleozoic. Here we synthesize zircon U-Pb and Hf isotope data of magmatic rocks from West and South Asia, in particular from Iran and Tibet, along the eastern Tethyan orogenic belt (ETOB) or eastern part of the typically collisional Alpine-Himalaya orogen. The data suggest that, before collision started, the entire region was characterized not only by Tethyan subductions but also by accretionary orogenic processes that eventually led to significant juvenile crustal production from the Jurassic to Eocene or,

in places, to Oligocene. Taking together, both CAOB and ETOB appear to have evolved over time from an accretionary into a collisional system. Zircon Hf isotope data further reveal that in contrast to generating vast portions of juvenile crust in the early, accretionary stages of orogenic development, crustal recycling plays a more substantial role in the later, collisional stages. The latter involves addition of older continental crust into the mantle, which subsequently melted and caused compositional transformation of the juvenile crust that formed in the accretionary stages. Similar features are observed in young volcanic rocks from eastern Taiwan, i. e., the northern Luzon arc or part of the complex subduction system in Southeast Asia that may evolve one day to resemble the CAOB or ETOB by collision with the advancing Australian continent.

Key words: Asian continental growth, zircon Hf isotope, accretionary and collisional orogeny

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