# A Magmatic Perspective of the Tibetan Orogen

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**ABSRACT**

The Himalayan-Tibetan orogen is renowned for its immense topographic height that was formed by the India-Asia continental collision, which started with the closure of the Tethyan ocean. From subduction accretion to collisional orogeny, long-term geodynamics of the Neo-Tethyan oceanic lithophere, as well as the associated crustal growth of the convergent margin in Asia, have been involved in the tectonic processes yet poorly constrained for decades. Questions remain in several major issues, such as when India hit Asia, what the impacts on the continental arc are, whether the plateau was uplifted by the collision alone, and how the mountains evolved in crustal thickness and composition. Some clues that reside within the magmatic records from the Gangdese batholith may help us unravel the orogenic history. This study delineates the source characteristics of the Gangdese plutonic complex through time by integrating new geochemical data with the relevant geochronological constraints, and further explores the tectonomagmatic evolution in southern Tibet. The observation that the Mg numbers of the Gangdese magmas remain roughly constant at 40-50 with increasing $SiO_2$, together with the evidence of lower crust re-melting at ca. 80 Ma, suggests that basaltic underplating or recharging near the Moho interface is the main drive for the generation and refinement of the continental arc. Thus the La/Yb ratios that are correlated to the melting regime of the juvenile crust, can be utilized as a geochemical proxy to determine the relative crustal thickness. The integrated data show that, after the accretionary orogeny in the Late Cretaceous, the Tibetan crust was not significantly thickened until the Oligocene. Collectively, the crustal growth is deciphered as a juvenile arc that evolved into a more fractionated continental arc from the Cretaceous to Paleocene, and then being rejuvenated by asthenospheric sources during the Eocene magmatic flare-up. The development of the arc crust was through a series of magmatic addition that was associated with the slab geodynamics inferred to be from normal to shallow subduction, and then rolling back until breakoff of the Neo-Tethyan slab.