Continental subduction drives the Himalayan orogen: Insights from geodynamic numerical modeling

Rui Q[1], Jie Liao[1], Rui Gao[1,2]

[1]School of Earth Sciences and Engineering, Sun Yat-Sen University, Guangzhou, 510275, China
[2]Institute of Geology, Chinese Academy of Geological Sciences, 26 Baiwanzhuang Road, Beijing, 100037, China

The India–Asia collision resulted in the formation of the Himalayan orogen and the Tibetan plateau. Although more than a century of geologic investigations have been conducted on the evolution of the Himalayan orogen, its dynamic origin remains poorly understood. An emerging and unresolved question is what drove the fast convergence between the two continental plates since the last 65～50 Myrs. It has long been recognized that slab pull is the predominant driving force of plate motion (Forsyth and Uyeda, 1975). However, the common fate of oceanic slabs during continental collision is slab breakoff, because the buoyant continental lithosphere inhibits subduction and a necking zone forms at the ocean-continent transition (Duretz et al., 2011). The driving force of continental collision declines dramatically once the breakoff of an oceanic slab occurs. A previous study proposed that the subduction of the Indian continental slab may provide a significant driving force for the collision of the Indian-Eurasian plate (Capitanio et al., 2010). However, the transition process from the Tethys oceanic subduction to the Indian continental subduction is unclear. Besides, how the Indian continental subduction drove the uplift of the Tibetan plateau remains enigmatic. Resolving these questions is essential for understanding the dynamic evolution of the Himalayan orogen.

We present thermomechanical numerical modeling results proposing a continuous subduction process from Tethys oceanic subduction to Indian continental subdcution. Our modeling results suggest that (1) the lower Indian continental crust subducts into the deep mantle, attached to the lithospheric mantle; (2) the upper Indian continental crust does not subduct, but thickens/shortens at shallow depths; (3) the Indian continental subduction drives the continuous collision between the two continental plates

References

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