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What is driving India-Asia convergence?

Santanu Bose[1], Wouter P Schellart[2], Vincent Strak[2], João C. Duarte[3,4,5], and Zhihao Chen[6,7]

[1]Presidency University, Geology, India (santanu.geol@presiuniv.ac.in)
[2]Department of Earth Sciences, Vrije Universiteit Amsterdam, Netherlands
[3]Instituto Dom Luiz (IDL), Faculdade de Ciências, Universidade de Lisboa, Campo Grande, 1749-016, Lisbon, Portugal
[4]Departamento de Geologia, Faculdade de Ciências, Universidade de Lisboa, Campo Grande, 1749-016, Lisbon, Portugal
[5]School of Earth, Atmosphere and Environment, Monash University, Melbourne, VIC 3800, Australia
[6]Department of Earth and Space Sciences, Southern University of Science and Technology (SUSTech), 518055, Shenzhen, Guangdong, China
[7]Shenzhen Key Laboratory of Deep Offshore Oil and Gas Exploration Technology, Southern University of Science and Technology, Shenzhen, China.

The Himalaya and the Tibetan plateau, the highest mountain range on Earth, have been growing continuously for the last 55 Myrs since India collided with Eurasia. The forces driving this protracted mountain building process are still not fully understood, and continue to puzzle Earth Scientists. Although it is now well accepted that subduction zones are the main driver for plate motion, plate boundary migration, and mantle flow in the asthenosphere, their role in driving Indian indentation into the Asian landmass has never been tested with geodynamic models. This study uses four-dimensional geodynamic physical models to test the role of lateral subduction zones in driving the India-Asia collision. The objective of our study is to investigate if the slab pull force of the Sunda and Makran slabs have any role to play in the dynamics of the ongoing India-Asia convergence, particularly after the complete disappearance of the Tethyan slab, which was primarily steering the northward travel of the Indian plate since late Jurassic. To address this issue, we performed three experiments by varying the size and configuration of the subducting plate in the initial model setup. Our experimental results show that active subduction of the Indo-Australian plate along the Sunda subduction zone is the main driver of the India-Asia convergence, Indian indentation, the growth of the Himalaya-Tibet mountains, and the eastward extrusion of southeast Asia. Our work further suggests that the protracted growth of collisional mountains on Earth requires nearby active subduction zones and, therefore, Himalayan-type orogens may have been rare in the Earth's history.