Geophysical Research Abstracts
Vol. 19, EGU2017-1692, 2017
EGU General Assembly 2017

3-D thermo-mechanical modeling of continental indentation: Implications for the India-Asia collision

Lin Chen (1), Lijun Liu (2), Fabio Capitanio (3), Taras Gerya (4), and Yun Chen (1)

(1) Institute of Geology and Geophysics, Chinese Academy of Sciences, Beijing, China (chenlin@mail.iggcas.ac.cn), (2) Department of Geology, University of Illinois at Urbana-Champaign, (3) School of Earth, Atmosphere and Environment, Monash University, (4) Institute of Geophysics, ETH-Zurich

The northward indentation of Indian continent into the southern margin of Asia is associated with the formation of the Himalayan mountain range and the Tibetan Plateau behind it. Here, we use 3-D thermo-mechanical numerical simulations to investigate the relation between the progressive orogenic wedge formation, as underthrusting proceeds, and the evolution of the plateau in the continental interiors. Our results show that the indentation-driven shortening is mainly accommodated by the combination of underthrusting of the lithospheric mantle of the indenter and localized crustal thickening beneath the collision zone. The crust of the indenter is scraped off and congested at the collisional zone as it underthrusts beneath the retro-continent, forming a crustal-scale orogenic wedge overlying a two-sided subduction system. The early stage of the orogenic development is characterized by rapid vertical uplift, width extension and northward migration. In the later stage, the mountain belt spreads outward, eventually forming a broad high-standing and flat orogenic plateau, comparable to the morphology of the present Himalaya-Tibetan Plateau. Our models also predict a long-lived topographic tail at the eastern border of the indenter, suggesting that the elongated southeastern margin of the Tibetan Plateau is likely a fossil remnant of continental indentation. We conclude that the Himalayan orogeny along the Asian southern margin plays a relevant role in the regional scale formation and evolution of the Tibetan Plateau during the convergence, controlling the rigidity of the indenting margin.