Geophysical Research Abstracts
Vol. 13, EGU2011-4183, 2011
EGU General Assembly 2011

Indian and Asian continental subduction episodes during collision : tectonic context and slab dynamics

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We interpret high wavespeed tomographic anomalies shallower than 1100 km beneath the India/Asia collision zone as continental slabs subducted during collision. Combining anomaly positions with paleogeographic reconstructions of India, we constrain the spatio-temporal evolution of multiple episodes of continental subduction likely related to these anomalies. To the west of the collision zone, two episodes of steep subduction of the northern margin of India occurred. The first episode, involving about half of the Indian margin, started at about 40–30 and ended by a slab breakoff process probably around 15 Ma. The second episode involves only a very narrow portion of the Indian margin, subducting beneath the Hindu Kush mountains since about 8 Ma. To the east of the collision zone, no anomaly related to steep subduction along the northern edge of India is found. We interpret two tomographic anomalies beneath Burma and the Andaman Sea, as two successive episodes of southeastward extrusion followed by subduction.
We also characterize several subduction episodes of the Asian plate. In Pamir, tomographic vertical cross-sections show clearly the interaction between the Indian plate subduction to the north and the Asian one to the south. Between 1100 and 900 km depth, north of the Indian slab, a high wavespeed tomographic anomaly is interpreted as an earlier episode. We estimate the timing of those episodes and made a budget of the Asian lithospheric mantle. It permits us to estimate the timing and the amount of thickening linked to each subduction episode that built the Tibetan plateau from the north.
Our results show that along the Alpine-Himalayan convergence zone, the dynamics of subduction processes recorded in the mantle is very heterogeneous along and across the range. By combining our knowledge of the crustal deformation during the collision to the position of slabs in the mantle, we made a precise reconstruction of the evolution of both Asian and Indian plate margins. We were able to characterize the tectonic context of distinct episodes of subduction and the resulting slab dynamics.