



Deep India meets deep Asia: a seismological view of lithospheric slab interactions under Hindu Kush and Pamir

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It is part of the plate-tectonic paradigm that buoyant continental lithosphere subducts only in tow of a sinking oceanic plate after continent collision and that large deep (> 100 km) earthquakes occur exclusively in subducted oceanic lithosphere. Yet under the Pamir in Central Asia, far away from any (paleo-)ocean basins, continental lithosphere appears to subduct by itself and the Pamir-Hindu Kush seismic zone is one of the most active intermediate (100-300 km) depth earthquake zones globally. We show that large-scale indentation of cratonic Asia by a promontory of the Indian plate is causing subduction of continental lithosphere under the Pamir and that the Hindu Kush earthquakes are due to detachment of a narrow plate sliver. New precise earthquake hypocenters, a large number of source mechanisms and detailed receiver function sections and tomographic images allow us to distinguish an arcuate, stretched and partly torn slab of Asian lithosphere beneath the Pamir and a piece of Indian lithosphere beneath the deepest Hindu Kush earthquakes. This peculiar double subduction zone arises by contrasting modes of convergence under Pamir and Hindu Kush imposed by the different mechanical properties of the three types of lithosphere involved: We suggest that the buoyant northwestern salient of (1) Cratonic India bulldozes into (2) Cratonic Asia forcing delamination and rollback of its lithosphere. At the same time (3) India's thinned margin tears off from Cratonic India and subducts under Asia. The narrow swath of the subducted Indian continental margin forms a prominent high-velocity anomaly down to the mantle transition zone. Its uppermost section is thinned or already severed and intermediate depth earthquakes cluster at the final neck connecting it to the deeper slab. These images provide a rare glimpse of the ephemeral process of slab break-off.