The Deep structure of Western Himalaya – Ladakh-Karakoram

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To understand the deep structure of the western Himalaya, Ladakh and Karakoram, we analysed teleseismic body wave recordings on a ~700 km long profile of 17 broadband seismographs from Delhi through the Himalaya to the Karakoram. The database includes P and S receiver functions, teleseismic P and S residuals and observations of shear wave splitting in SKS. Modelling of P-receiver function suggests the depth of Indian Moho increasing from ~40 km beneath Delhi ,south of the Indo- Gangetic plain, to ~75 km beneath the Karakoram fault. Further north, Wittlinger et al (2004) imaged the Moho at ~90 km beneath western Tibet before shallowing to ~60 km at the Altyn Tagh fault. These results indicate that in the western Himalaya-Tibet region Indian plate underthrusts as far as Bangong- suture and possible to the Altyn Tagh Fault.

The analysis reveals presence of a cold region beneath the Himalaya at a depth of several hundred kilometers. This anomaly can be caused by the remnants of Tethys subduction and, perhaps, is unrelated to the ongoing process. The present day process is reflected in velocities beneath the lesser Himalaya, intermediate between those of the crust and the upper mantle. This observation can be explained by scraping off the ductile lower crust of the underthrusting Indian plate and accumulation of the high-velocity crustal material in the frontal region of the thrustal zone. Seismic waves in the upper 200 km of the mantle are faster than in the global IASP91 model, and the structure includes a low velocity layer sandwiched between two high velocity layers. We interpret the lower layers as an image of subducted mantle lithosphere of the Indian plate. Shear wave splitting, derived from SKS phase data, is different in the south and the north of Indus Suture Zone. In the south, the fast direction of anisotropy is normal to the trend of the Himalaya and can be interpreted as an effect of the NE motion of the Indian lithosphere. In the north the fast direction is oriented E-W and can be explained by the fabric left in the presently extinct subduction zones.