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Looking at the roots of the highest mountains: the lithospheric structure of the Himalaya-Tibetan orogen from a geophysical-petrological approach

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By combining geophysical and petrological information, we investigate the crust and upper mantle of the Himalaya-Tibetan orogen, characterizing the lithosphere from the thermal, compositional and seismological viewpoint. The resulting crust and upper mantle structure is constrained by available data on elevation, Bouguer anomaly, geoid height, surface heat flow and seismic data including tomography models. A new 2D crustal and upper mantle cross-section up to 400 km depth in the western Himalaya-Tibetan region is presented, crossing the Tarim Basin, Tian Shan, and Junggar region. Our results show a Moho depth of $\sim$40 km beneath the Himalayan foreland basin, progressively deepening northeastwards to $\sim$90 km below the Kunlun Shan. Northward, the crust-mantle boundary remains nearly flat at 50-65 km depth. The lithosphere-asthenosphere boundary lies at 260-290 km depth below the Himalaya and Tibetan Plateau, Tian Shan and Altai Range, and it shallows to $\sim$230 km depth below the southern Tarim Basin and to $\sim$170 km below the Junggar region. The modeled lithospheric mantle composition is compatible with a generic lherzolitic mantle-type, slightly changing to a more undepleted composition in the deep lithosphere beneath the Tarim Basin due to metasomatism. The Central Asia Orogenic Belt region (Tian Shan, Junggar region and Altai Range) is characterized by a FeO-MgO-rich mantle, likely related to subduction slab-derived fluids. We apply the same modeling approach to existing lithospheric models in the eastern sector of the Himalaya-Tibetan orogen, and compare the results to understand the connection between the present-day lithospheric features and the geodynamic context of the area.