Characteristics of Crustal Structure of Hindukush from Gravity and Geoid Signatures

K. Arora, M. Ravi Kumar, V.M. Tiwari and D. C. Mishra, National Geophysical Research Institute, Hyderabad-500 606 Council of Scientific and Industrial Research, India.

Satellite free air and geoid anomaly maps of Himalaya and adjoining regions reflect most of the tectonic elements of this region. Fold and thrust belts and suture zones are characterized by small wave length gravity highs representing shallow high density mafic/ultramafic rocks. The low pass filtered geoid anomaly map shows a prominent gravity low in this depth range oriented NE-SW, in the direction of motion of the Indian plate that is almost perpendicular to the surface tectonics. Low density rocks in upper mantle along with high velocity in seismic tomography and seismic anisotropy at this level suggest cold under thrusted Indian and Asian lithosphere in the upper mantle that makes a thick lithosphere under Tibet. The most significant gravity low is observed over the Hindu Kush Range between the Kohistan arc towards the south and Pamir towards the north that is also present in the low pass filtered regional maps indicating low density rocks in the upper mantle. This section is characterized by interaction of strike slip Chamman fault towards the west with the under thrusted Indian lithosphere. Depth to Moho varies from 38 to 74-83 km under Himalaya and Tibet with lower crust of density 3100 kg/m³ indicating the presence of high density eclogite rock along the Moho. Low density rocks in lithospheric mantle and along the Moho as thick crust are involved in isostatic compensation that makes the region over compensated for a regional topography of about 5 km which may be responsible for continuing uplift of Himalaya and Tibet due to their buoyancy. Spectral analysis of Bouguer gravity and geoid anomaly maps of this region and modeling along selected profiles reveal the crustal structure of the Hindukush area.

Key words: Satellite, gravity, geoid, spectrum, lithosphere, Hindukush, crust