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The lithospheric movements and state beneath northeastern margin of the Tibetan Plateau [U+FF1A] constraints form density structures

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Tibetan Plateau (TP) has been a research hotspot by geoscientists over the years. As its tectonic succession density structure is significant to the study on movements and evolution of lithosphere, crustal-mantle interreaction and deep dynamic processes. 3D density distribution of lithosphere in the northeastern margin of the TP was obtained in this study using gravity data and seismic data. Firstly, 3D P wave velocity model was determined by seismic tomography using seismic wave data from local earthquakes and teleseismics. Then the velocity model was transformed into initial density model to provide a constraint for the following gravity inversion. Gravity anomalies result from density heterogeneity of lithosphere were separated from the integrated observed gravity anomalies after the gravity effects induced by interface (Moho and deposit) undulations and deep density inhomogeneity under lithosphere were removed. We applied Algebraic Reconstruction Technique (ART) to realize the inversion solution. Our density model shows and reveals that: distinctly lateral density heterogeneity exists in the study area. A mosaic of high and low density anomaly is visible in the upper-middle crust while prominent low density anomaly is observed beneath in the lower crust beneath the study area. The crustal density structures provide a good condition for the generation and occurrence of earthquakes as well as the lower crustal flow. The trend of density isopleths is coherent with that of surface fractures in the crust. However, it presents a clockwise rotation in the mantle. This phenomenon indicated that the TP was obstructed by rigid Alashan and ordos blocks when it flowed to the northeast. In 80km-100km depth, there are explicit amplitude differences between density model and P wave velocity model. We confer that the high temperature and strong tectonic squeezing may have induced partial melting or changes of rock structures and compositions, which further affect the seismic propagation velocities. Both the subduction power from Indian plate and the obstruction force from Ordos and Alashan blocks constrain the present movements and state of northeastern margin of the TP.