A geophysical perspective on the lithosphere–asthenosphere system beneath the Qinghai–Tibet Plateau and adjacent areas

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The subduction of continental lithosphere has been demonstrated in the Alps (Panza and Müller, 1979), and it has been recognized in several other collisional belts such as the Himalaya (e.g. Zhang et al., 2014). Selected 3D models of the crust and upper mantle of these regions have been obtained assembling cellular models expressed in terms of shear waves velocity (Vs), thickness and density of the layers, to a depth of 350 km. The main features of the structure of the crust and upper mantle in Tibet and neighboring regions represent a clue to understand the modality of the convergence and collision process between the Indian and Eurasian platesf and the influence of this process on the uplift of the plateau.

The mechanical property models are obtained by means of advanced non-linear inversion techniques, such as the "hedgehog" non-linear inversion method of group and phase velocity dispersion curves for the determination of VS (see Brandmayr et al., 2010 and references therein) and the inversion of gravity data. The "hedgehog" method allows for the definition of a set of structural models without resorting to any a priori model, considering the Vs and the thickness of the layers as independent variables. Given the well-known non-uniqueness of the inverse problem, the representative solution of each cell is determined through the application of optimization algorithms and is also validated with the use of independent geological, geophysical and petrological data, e.g. the distribution of seismicity with depth.

Integrating the available seismic and seismicity data and constructing the rheological structures along the Qinling-Dabie orogen (Deng et al., 2017) one can infer that: (1) there are strong lateral variations in the crustal velocity between the western and eastern sections of the Qinling-Dabie orogen, indicating a different origin and tectonic evolution between these two parts; (2) the lateral variations are also manifested in the rheological structure.

References

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