



Surface Response to Lithospheric Instabilities: Examples From East and West Anatolia

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Geophysical, geochemical and geological studies in various parts of the Anatolian plateau have revealed that the lithosphere has been thinned or entirely delaminated. Currently, two contrasting horizontal tectonic regimes are thought to control surface/deep lithospheric evolution in Anatolia: (1) back-arc/extensional tectonics in the Western Anatolia, and (2) collision/contractional tectonics in the high plateau of Eastern Anatolia; however, the geodynamical process to account for vertical and horizontal tectonics (orogenesis) are not well-understood. We focus on identifying and quantifying lithospheric instability models in Anatolia while applying various thermal, rheological and kinematic boundary conditions. Specifically, three primary geodynamic issues are discussed: (1) modeling the evolution of the lithosphere beneath Eastern and Western Anatolia in order to determine the dynamics of the delamination with convergence; (2) modeling the evolution of crustal/topographic transients related to mantle lithosphere removal; (3) predicting the surface deformation (by strain rate calculations) associated with different geodynamic regimes (e.g., horizontal and vertical). Various rheological, thermal models of crust, and convergence velocities are tested to explore the sensitivity of surface uplift (epeirogenic) responses/deformation to these properties. These modelling results are reconciled with geologic and geodetic constraints on the distribution of active contraction and extension in the region. The vertical tectonics associated with the underlying mantle flow combined with horizontal plate convergence effects show how mantle dynamics and orogenic activity at the same time shape the surface/deep lithospheric tectonics in Anatolia.