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Anorogenic plateaus, contribution of petrological processes

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Away from active plate boundaries several high topography realms (East African Plateau, South African Plateau, Anatolian Plateau. . .) are commonly explained by different mechanisms: (1) tectonic mechanisms with rift-flank uplift resulting from mechanical and/or isostatic relaxation, (2) passive mechanical response of a lithospheric uplift due to the impingement of a mantle plume, (3) an isostatic rebound after a lithospheric delamination or (4) dynamic topography leaded by flow in the mantle inducing deformation of its surface . Less attention has been paid to relationships between spatiotemporal variations in density and geothermal gradient and their influence on the evolution of topography of continental interiors. In this context a classic concept of the continental lithosphere as comprising three static layers of different densities (upper and lower crust, upper mantle) is not adequate to assess long-term changes in topography and relief in regions associated with pronounced thermal anomalies in the mantle. We have therefore developed model based on equilibrium assemblage computations. Our model calculates density as a function of pressure, temperature, and chemical composition. It not only provides a useful tool for quantifying the influence of petrologic characteristics on density, but also allows the modeled "metamorphic" density to be adjusted to variable geothermal gradients and to be applied to different geodynamic environments. In this study we have used this model to simulate a scenario in which the lithosphere-asthenosphere boundary is subjected to continuous heating over a long period of time, and demonstrate how anorogenic plateaus can be formed solely as a result of heat transfer within the continental lithosphere. Our results show that, bdensity changes within the lithosphere may have an important contribution in the evolution of anorogenic plateaus.