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On the role of asthenospheric small-scale convection in formation of foredeep basins at periphery of compressional orogens: A case study of the North Caucasus foredeeps.

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We present results of detailed numerical modeling of foredeep basins formation at periphery of compressional orogens. For this we further developed our model of evolution of rheologically stratified Earth outer shell, which consists of sedimentary cover, lithosphere, asthenosphere and underlying upper mantle. This model permits modeling of active extension-compression by intraplate or mantle-induced forces as well as modeling of adjustment of mechanical and thermal equilibrium disturbed at active stages. To assign correct initial conditions for compressional stage we considered preceding stages: (1) extension of continental lithosphere; (2) postextensional subsidence; and (3) compressional (collisional) stage, when the system orogen - foredeeps forms. Parameters of the lithosphere and asthenosphere and parameters of extensional - compressional processes were selected to provide a result close to the Great Caucasus - North Caucasus foredeeps, including the topography, deep structure, thermal regime, subsidence history, gravity anomalies and so on.

The important prediction of the model is that disturbance of mechanical and thermal equilibrium in the lithosphere and asthenosphere leads to formation of small-scale convection in the asthenosphere. Interaction of asthenospheric convective flows with the base of the lithosphere results in formation of uplifts and depressions in continental collision areas. In particular, small-scale convection can be a leading factor in foredeep basins formation. Detailed comparison of numerical results to the real data permits new interpretation of existing geological and geophysical data for the Great Caucasus - North Caucasus foredeeps region.