



On the role of lithosphere – asthenosphere topography in geodynamics

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Most of geodynamic models suggest that the role of lithosphere – asthenosphere boundary is to move upward when lithosphere extends or to move downwards when it shortens and to return back later at thermal relaxation stage. Some numerical studies (see e.g. list below) demonstrates that after mechanical and thermal equilibrium was disturbed during extension or compression (by intraplate or mantle induced forces) small-scale convection in the asthenosphere arises as the main process of restoration of equilibrium in disturbed Earth outer boundary layer (which includes the lithosphere and the asthenosphere). This convection develops in transition zones from extended / compressed to undisturbed lithosphere and acts long time after cessation of active tectonic processes. It plays important role in formation of rifts, sedimentary basins, compressive orogens etc. Style of small-scale convection depends on horizontal pressure and temperature gradients, on density profile within the asthenosphere, on redistribution of surface loads by sedimentation and erosion.

The main geodynamic manifestations of the small-scale convection are: uplifts at the periphery of continental rifts (rift shoulders), subsidence at the periphery of compression orogens (foredeep basins). Small-scale convection makes sedimentary basins much deeper than convenient thermal subsidence predicts and supports uplift in orogens after cessation of external compression.

All these features are demonstrated on numerical model of evolution of rheologically stratified Earth outer shell developed by presenters.

References

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