



Superficial manifestation of the asthenosphere – lithosphere interaction in different plate tectonic environments

E. Timoshkina (1), V. Mikhailov (1,2)

1. Institute of Physics of the Earth Russian Academy of Sciences, Moscow, Russia
2. Institut de Physique du Globe de Paris, Paris, France, mikh@ifz.ru

Present-day geophysical data and results of laboratory study do not provide strong constraints on possible contrast of physical properties at the asthenosphere – lithosphere boundary which finally determines interaction of these layers. On the other hand, according to results of numerical simulations, distribution of pressure and temperature in the upper lithosphere which determine scenario of superficial tectonic structure formation strongly depends on viscosity contrast at the asthenosphere – lithosphere boundary and also on distribution of density in the asthenosphere with depth. Thus, comparison of numerical modelling results with data on present-day geometry and dynamics of tectonic structures formed in different plate tectonic environments provides useful constraints on physical properties of the asthenosphere.

We present results of numerical modelling of tectonic structure formation in the system lithosphere – asthenosphere in extensional and compressional environment using thermo-mechanical model of the Earth' outer shell that includes sedimentary layer, Earth crust, low lithosphere, the asthenosphere and the upper mantle. Temperature dependent density, rheological asthenosphere and sedimentation/erosion processes are taken into account. We demonstrate how geometry and dynamics of superficial tectonic structures depend on contrast of physical properties at the asthenosphere – lithosphere boundary and on distribution of density within low viscosity asthenosphere. In particular, one of superficial manifestations of the lithosphere – asthenosphere interaction is alternation of compressional and extensional domains in tectonic structures formed under region compression (e.g. collision) or regional extension (e.g. rifting).