Geophysical Research Abstracts
Vol. 14, EGU2012-4509, 2012
EGU General Assembly 2012

The Moho discontinuity in superdeep sedimentary basins as a top of the layer of deeply metamorphosed mafic rocks in the lower crust

E. Artyushkov
Institut of Physics of the Earth, Russian Federation (p.chekhovich@gmail.com)

In some sedimentary basins on the continents and their margins the sediment thickness reaches 15-20 km. Typical examples are the East Barents, North Caspian, South Caspian and North Chukchi basins. The subsidence history is quite different in them from that of oceanic crust. This indicates that the basins are underlain by continental crust. The basins are too large to be formed by a pull-apart mechanism. They deepen away from the adjacent orogens which precludes their formation from elastic bending of the lithosphere. To produce such basins by stretching, it would be necessary to stretch the lithospheric layer by about two times. No intense tensile deformations can be, however, revealed in the seismic profiles crossing the basins. Under such circumstances, contraction of mafic rocks in the lower crust due to gabbro to eclogite transformation was necessary to ensure the subsidence. The Moho is strongly warped down under the basins. In the absence of large isostatic anomalies, this also indicates that the discontinuity is underlain by eclogites. These rocks are characterized by P-wave velocities similar to those in mantle peridotites, but they are considerably denser. At several stages, rapid crustal subsidence occurred in the basins, which indicates a drastic increase in the rate of gabbro to eclogite transformation. It can be explained by infiltration of mantle fluids into the mafic lower crust which catalyzed the reaction. At the epochs of rapid subsidence, steep basement flexures were forming in the basins. This evidences strong temporary weakening of the lithospheric layer under infiltration of surface-active fluids from the mantle which wet the crystals thus ensuring rapid percolation of the fluids through the mantle lithosphere. Pressure solution occurs in a presence of thin films ($\sim 10^{-5}$ cm) of fluids at grain boundaries which reduces rock viscosities by orders of magnitude. The viscosity decrease was responsible for another important phenomenon. Strong weakening of mantle lithosphere ensured its partial convective replacement by the asthenosphere. This gave rise to a strong crustal uplift at the surface. According to the seismic tomography and electrical conductivity data a rise of the top of the asthenospheric layer is observed under many regions where rapid crustal uplift took place during the past several million years.