Paper Number: 1685

Model of regional geodynamics for Arctic and northeastern Asia

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The new regional geodynamic model describing Cretaceous and Cenozoic evolution of the lithosphere in the Arctic and North-East Asia is justified. Model is based on a view about the existence of horizontal convective cell in the upper mantle, involving a conveyor mechanism of the Pacific lithosphere subduction, it being continuously supplied with new substance which is transported through the subduction zone. The numerical simulation are shown that this convective cell is sure to expand horizontally. The above cell expansion occurs first, due to the cell front propagation into the continent and secondly, due to ocean ward movement of subduction zone (roll back).

The proposed model for a nonstationary laterally spreading convection cell that formed in the upper mantle at subduction (or collision) zones can naturally explain a variety of tectonic problems related to the extension of the continental lithosphere that occurs far behind (more than 1000 km) the subduction/collision front. In particular, it explains the origin rift zones in the east and south-east of North Asia, including the Baikal rift zone and rifts in China. The lower horizontal flow moving from the subduction carries of subsiding ocean lithosphere hydrated substance that subsequently gets into the upwelling zone. Uplift and decompression of hydrated rocks results in conditions favouring in intensive melting and magmatism. The above accounts for the existence of magmatic Large Igneous Province.

This model of the upper mantle convection current in the transition area between the Pacific Ocean and the Eurasian continent is universal and can be used as the basis of geodynamic mechanism that controls the movement and deformation of the lithosphere of the Arctic Region. Numerous seismic profiling data obtained for shelf and deep water sedimentary basins in the Arctic Ocean as well as on land geological investigation reveal that since Aptian up to present the Arctic region has been characterized by sublatitudinal lithosphere extension. This extension is explained by the effect the return upper flow to the subduction zone. Extension stresses result in the Alfa and Mendeleev ridges. Thinning continental crust area being created in their rear to form Makarov and Podvodnikov basins during the period 110-60 Ma. The latter eventually caused the forming Lomonosov ridge. During the Cenozoic the Lomonosov ridge was moving with return flow and its motion was accompanied by the formation of Eurasian basin in its rear.