CONTINENTAL AND OCEANIC GEOTHERMS IN A MODEL OF MANTLE CONVECTION

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Abstract. A model for formation of thermal structure of the lithosphere and the mantle is developed taking into account the interaction of mantle convection with a fixed continent and an adjacent region of the oceanic lithosphere. The continental and oceanic lithosphere and underlying mantle are treated as a single coupled system. As a result of solution of thermal convection equations with a viscosity contrast in a continental zone the averaged geotherms are calculated for subcontinental and suboceanic zones between the outer surface and the mantle-core boundary. The model estimates of the average thickness of continental (190 km) and oceanic (30 km) lithosphere are obtained using the experimental data on solidus temperatures for upper mantle rocks. The calculated mantle heat flux is 19 mW/m^2 which is in good accordance with the xenolith data. Previously geotherms were usually plotted by joining lithospheric geotherms defined from the thermal conductivity equation to an a priori adiabatic mantle temperature profile. The main difference of the calculated subcontinental geotherm from the results of previous semi-empirical models are the higher temperatures (up to 200 °C) in the mantle at depths from 250 to 500 km. This fact should be considered in mineralogy and geodynamics.

Keywords: continental lithosphere, convection, geotherm, upper mantle.