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Mantle convection defines heat flow variations and dynamics of the lithosphere

D. Khristoforova

Physics Department, Kazan State University, Kazan, Russian Federation (daria.khr@mail.ru, +7 843 2924454)

Studies of terrestrial heat flow measurements have been applied to the problem of pattern formation in the thermal gravitational convection in the mantle. The most realistic numerical experiments to date have been conducted. The periodical pattern of cells, in which fluid flows are separated by the distance approximately equal to the thickness of a convecting layer, is observed in hydrodynamic models as well as in experiments. Three types of convection cells are usually observed. These are two-dimensional rolls, square and three-dimensional hexagonal cells with upwelling (l-type) and downwelling (g-type) centers. Convection cells are elements of flow pattern, and one question is, which planforms, i.e., cell's configurations in the (x, y) plane are observed in the mantle. Heat flow data are evidence of the hexagonal cells of l-type in the asthenosphere. This suggests that upper mantle is heated from below (the cells of g-type are formed in fluid heated from within). The existence of heat flow «hexagons» suggest that mantle flows are complicated with defects. Observed heat flow cells are characterized by an extensive ascending region, isolated descending stripes with small areas extent, and narrow transition zones. These heat flow features may be especially important indicators of cellular convection in the mantle. Such a pattern of cells is also typical for the recent vertical movements of the lithosphere but it has a more complex structure owing to the specific feature. Correlation between average heat flow of the lithosphere plate and its horizontal velocity is also established. Heat flow from the Earth's interior assumes two scales of convection. The large-scale variations in heat flow can be related to the outer core dynamics.