Geophysical Research Abstracts
Vol. 13, EGU2011-1529, 2011
EGU General Assembly 2011

On the temperature and pressure evolution in the forming core and mantle on the stage of Earth's accumulation.

Yurie Khachay (1) and Vsevolod Anfilogov (2)

(1) Institute of Geophysics, Ural's Department RAS, Yekaterinburg, Russian Federation (yu-khachay@yandex.ru), (2) Institute of mineralogy, Ural's Department of RAS, Miass, Russian Federation

For solution of changing P-T conditions on the stage of Earth's accumulation we used the model, which was based on the equation of energy balance with account of convective heat-mass transfer, on a solution of Stefan's problem and on the Safronov equation. Results, which had been obtained fulfilling showed: 1) the account of heat release by the decay of short living radioactive elements ensures the melting state of inner areas of proto planetary bodies with dimensions (200-300) km; 2) the impact of that bodies ensures the merging of mainly iron inner areas, but their masses are not sufficient for keeping of cold silicate crust fragments. Thus new differentiation mechanism is realized on the planet's accumulation; 3) the impact of the melted pre planetary bodies occurs no elastic. The most kinetic energy transfers into the heat energy and it is expended on the heating of the growing planet. On the finishing stage of the core growing, according to the earlier described differentiation model, the part of solid silicate accumulated bodies increases and the impact become more and more elastic. As a result of that the part of potential gravy energy, which transfers into the heat energy diminishes. We obtained some variants of temperature and pressure, which show that to the moment of core accumulation as a whole the inner core is in a solid state, and the outer core- in the melted state. For the Earth's mantle a large uncertainty remains for the possible temperature distribution to the end of accumulation: there are variants, for which the temperatures remain lower than the melting temperature and there are variants for which the whole forming mantle become melted. We obtained estimations of possible changing of viscosity distributions and convective heat-mass transfer contribution in the thermal Earth's evolution on the stage of it's accumulation for existing in literature relations between matter viscosity and it's content and PT -conditions. We had selected from the petro physical and geochemical data these, which confine the most considerable constraints on the character of possible thermal evolution of the early Earth. With use of obtained model bank of possible thermal evolution it had been bounded the area of conditions, for which we can obtain self-consistent variants of thermal evolution, which satisfy to the constraints on the mantle content by petro physical and isotope-geochemical data. Grant RFBR 09-05-00983