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Geodynamic Model of the Earth Crust Structure from the Control Source Electromagnetic Soundings (CSEMS) and the Super Deep Drilling Data.

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On the basis of multiannual results of the deep soundings with the use of powerful controlled sources it is suggested to subdivide the Earth's crust into two parts, namely, upper and lower. The upper crust of 10–15 km thickness is more conductive and is the most actively involved in geological processes. Its principal peculiarities are sharp horizontal heterogeneity and a wide range of variations of specific electrical resistivity of rocks (from 1 to 10^5 Ohm·m), a high brittleness, and the presence of fluids that drain the suprastructure from the day surface owing to penetration of surface (meteor) waters to the depths. The lower crust (in the depth interval from 10–15 to 35–45 km) is distinctive by the higher electrical resistivity (10^5–10^6 Ohm·m) and horizontal homogeneity of electric properties. Electrical conductivity of the lower crust is mostly determined by the influence of planetary physical–chemical parameters (pressure, temperature, viscosity), phase transitions of substances, and geodynamic peculiarities of evolution for different segments of the Earth, rather than by geological processes observed near to the day surface.

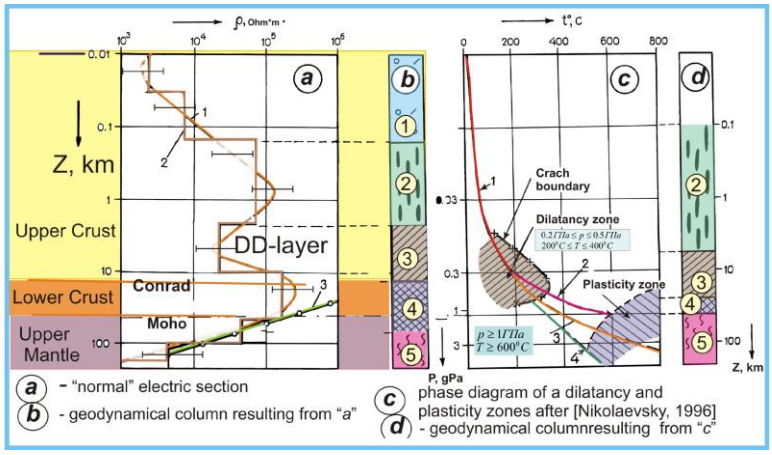

Figure 1. Geodynamic model of the Earth Crust and Upper Mantle

The general analysis of the data suggests the following conclusion. The deep soundings using the controlled sources (CSEMS) indicate that there is a zone of sharp increase in resistivity in the Earth's crust in the depth range of 10–15 km and this zone marks the boundary between the Upper (brittle) and Lower (quasi-ductile) parts of the Earth Crust (Fig. 1). It should be noted that just in this depth range (about 12 km), with a 10% discrepancy occurred all four accidents during borehole drilling of the Kola Super-Deep Hjle SG-3. The main cause of these accidents is attributed to the worsening of drilling conditions due to a sharp increase in rock strength. So we can make conclusion that at the depth of 12 km exists as if "boundary of impermeability" as for the drilling, so for electrical current penetration to the depth. Taking into account also seismic data we can make supposition that the depth of about 12 km can be considered as the hypothetical Conrad discontinuity. In this case, the nature of the Conrad boundary should be related to the change in the physical state of rocks from

brittle to the viscous one instead of traditional opinion that relates it with changes in chemical composition of rocks from aluminosilicate (SIAl) to the silicate magnesian one (SIMA). The cause of the increase in viscosity (strength) of rocks around the Conrad boundary can be related to the bigger role of the vertical (lithostatic) pressure in the lower crust due to elimination of tangential stresses existing in the upper crust and leading to dilatancy effects at the depth range from 5-7 to 10-12 km.

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