Complex study of the anomalous structure of the North Atlantic oceanic lithosphere based on integrated analysis of GOCE satellite gravity and geological data

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We present the results from modelling the gravity and density structure of the upper mantle for the off-shore area of the North Atlantic region. The crust and upper mantle of the region is expected to be anomalous: part of the region affected by the Icelandic plume has an anomalously shallow bathymetry, large igneous province, caused by plume, the northern part of the region is characterized by ultraslow spreading and ice coverage, Baffin Bay has a complicated structure – paleo spreading ridge. In order to understand the links between deep geodynamical processes that control the spreading rate, on one hand, and their manifestations such as oceanic floor bathymetry and heat flow, on the other hand, we model the gravity and density structure of the upper mantle from satellite gravity data.

The results demonstrate the presence of strong gravity and density heterogeneity of the upper mantle in the North Atlantic region. In particular, there is a sharp contrast at the continent-ocean transition, which also allows for recognising mantle gravity anomalies associated with continental fragments and with anomalous oceanic lithosphere. According to the recent studies, high-MgO lavas, erupted at various locations in the North Atlantic, characterize the nature of mantle melting during the crust formation process. The presence of large igneous province in North Atlantic leads us to the idea of strong geochemical heterogeneity and temperature anomalies.

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