Geophysical Research Abstracts
Vol. 21, EGU2019-10544, 2019
EGU General Assembly 2019

Anomalous topography, bathymetry, crust, and mantle in the North Atlantic region around Greenland, Iceland and Scandinavia

Hans Thybo (1,2,3) and Irina Artemieva (4)

(1) Istanbul Technical University, Eurasia Institute of Earth Sciences, Istanbul, Turkey (h.thybo@gmail.com), (2) Centre for Earth Evolution and Dynamics, University of Oslo, Norway, (3) China University of Geosciences, Wuhan, China, (4) University of Copenhagen, Department of Geosciences and Natural Resource Management, Denmark

The whole North Atlantic region has highly anomalous topography and bathymetry. Observations show evidence for substantial topographic change with rapid onshore uplift close to the Atlantic coast and simultaneous subsidence of basins on the continental shelves, most likely throughout the Mesozoic.
We present a review of geophysical data and interpretation of the whole region with emphasis on data relevant for assessing topographic change. We review the available data on topography, bathymetry, density, seismic velocity, and heat flow and present interpretations of the structure and composition of the crust and lithospheric mantle.
We find that most of the northern North Atlantic Ocean has anomalously shallow bathymetry although it follows the “normal” square-root-of-age dependence, which however is elevated by up-to 2 km. Nevertheless, the heat flow variation follows the square-root-of-age dependence, although heat flow is anomalously low on the spreading ridges around and on Iceland. In apparent contrast, exceptionally low seismic velocities are observed along the spreading ridges around and below Iceland. Near-zero free-air gravity anomalies indicate that the oceanic areas are mainly in isostatic equilibrium, whereas anomalously low Bouguer anomalies indicate low density in the uppermost mantle. Anomalously thick oceanic crust is observed along the Greenland-Iceland-Faro Ridge and extending into the Davis Strait. We propose that the anomalous bathymetry is caused by compositional variation in the lithosphere, which indicates. that the oceanic lithosphere may include remnants of continental lithosphere.
The onshore circum-Atlantic areas show rapid uplift close to the coast with rates up-to 3 cm/yr. This is surprisingly associated with strong positive free-air gravity anomalies which predicts isostatic subsidence. However, negative free-air gravity anomalies in onshore Canada and Bothnian Bay explain recent uplift in the shields as isostatic rebound after glaciation. Archaean lithosphere is everywhere thick in both Greenland and Fennoscandia, Proterozoic areas have thinner lithosphere and Palaeozoic-Mesozoic areas have very thin lithosphere. It is enigmatic that the presumed Archaean-Proterozoic Barents Sea region is submerged and includes deep sedimentary basins.