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The anomalous North Atlantic region

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The whole North Atlantic region has highly anomalous topography and bathymetry. Observations show evidence for anomalously shallow bathymetry in the ocean as well as recent rapid topographic change with onshore uplift close to the Atlantic coast and simultaneous subsidence of basins on the continental shelves, most likely throughout the Mesozoic. We present a geophysical interpretation of the whole region with emphasis on data relevant for assessing hypsometric change

Most of the North Atlantic Ocean has anomalously shallow bathymetry by up-to 4 km compared to other oceans. Bathymetry is elevated by up-to 2 km and follows the square-root-of-age model, except for the region between Greenland Iceland Faroe Ridge (GIF) and the Jan Mayen Fracture Zone as well as in the Labrador Sea to Baffin Bay. Heat flow follows with large scatter the square-root-of-age model in parts of the ocean and is anomalously low on the Reykjanes and Mohns spreading ridges. Near-zero free-air gravity anomalies indicate that the oceanic areas are generally in isostatic equilibrium except along the mid-oceanic ridges, whereas anomalously low Bouguer anomalies in the oceanic areas indicate low density in the uppermost mantle. Anomalously thick crust is observed along GIF and extends into the Davies Strait. There is no correlation between bathymetry and heat flow, which indicates that the anomalous bathymetry mainly is caused by compositional variation and isostatic compensation of low density continental lithosphere within the oceanic regions. The location of major oceanic fracture zones and continental fragments appears to be controlled by onshore structures.

The onshore circum-Atlantic areas show rapid uplift close to the coast with rates of up-to 3 cm/yr. This is surprisingly mainly associated with strong positive free-air gravity anomalies, which would predict isostatic subsidence. Some parts of the high topography, however, appear supported by low-density anomalies below the seismic Moho. It is enigmatic that the presumed Archaean-Proterozoic continental Barents Sea region is submerged and includes deep sedimentary basins.