

Structural-tectonic zoning of the Arctic

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Structural-tectonic zoning of the Arctic is based on the processing of geological and geophysical data and bottom sampling materials produced within the project "Atlas of Geological Maps of the Circumpolar Arctic."

Zoning of the Arctic territories has been conducted taking into account the Earth's crust types, age of consolidated basement, and features of geological structure of the sedimentary cover.

Developed legend for the zoning scheme incorporates five main groups of elements: continental and oceanic crust, folded platform covers, accretion-collision systems, and provinces of continental cover basalts. An important feature of the structural-tectonic zoning scheme is designation of continental crust in the central regions of the Arctic Ocean, the existence of which is assumed on the basis of numerous geological data. It has been found that most of the Arctic region has continental crust with the exception of the Eurasian Basin and the central part of the Canada Basin, which are characterized by oceanic crust type. Thickness of continental crust from seismic data varies widely: from 30-32 km on the Mendeleev Rise to 18-20 km on the Lomonosov Ridge, decreasing to 8-10 km in rift structures of the Podvodnikov-Makarov Basin at the expense of reduction of the upper granite layer.

New data confirm similar basement structure on the western and eastern continental margins of the Eurasian oceanic basin. South to north, areas of Neoproterozoic (Baikalian) and Paleozoic (Ellesmerian) folding are successively distinguished. Neoproterozoic foldbelt is observed in Central Taimyr (Byrranga Mountains). Continuation of this belt in the eastern part of the Arctic is Novosibirsk-Chukchi fold system. Ellesmerian orogen incorporates the northernmost areas of Taimyr and Severnaya Zemlya, wherefrom it can be traced to the Geofizikov Spur of the Lomonosov Ridge and further across the De Long Archipelago and North Chukchi Basin to the north of Alaska Peninsula and in the Beaufort Sea. From the north, Ellesmerides are limited by the Precambrian continental blocks – North Kara and Mendeleev Rise, the sedimentary cover within which is represented by undisturbed Paleozoic and Mesozoic deposits.

Analysis of the geological and tectonic maps and the map of the Arctic basement structure indicates that the heterogeneous crustal structure of the Arctic Ocean and its continental framing were formed as a result of simultaneous development and interaction of three large paleo-oceans in the Neoproterozoic and Phanerozoic – Paleo-Asian, Proto-Atlantic and Paleo-Pacific oceans.

A conceptual model that represents our understanding of structural relationships and crustal types of the main Arctic Basin structures is quite simple. The Arctic Basin is bounded by continental margins with continental crust: relatively elevated Barents-Kara – in the west, and generally submerged Amerasia margin – in the east. The latter represents a continental "bridge" formed by thinned and stretched continental crust. It connects two opposite continents – Laurentia and Eurasia, and is essentially a fragmented, tectonically mobile structure.