Geophysical Research Abstracts
Vol. 18, EGU2016-2507, 2016
EGU General Assembly 2016

Crustal types of the Circumpolar Arctic

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Deep seismic studies revealed unusual crustal structure in the Arctic Ocean. The thin (about 10 km) oceanic crust with seismic velocities Vp= 6.8-7.2 km/s is observed only in the narrow mid-oceanic ridge zone (the Gakkel ridge). The thick (25-35 km) continental crust covers the whole continental margins and the central part of the ocean. The continental type of the magnetic field with large local anomalies of different signs and irregular shapes is also observed in this area. However, the crust of the central Arctic (the Lomonosov, Mendeleev and Alpha ridges) differ from the crust of the Eurasia by the lower thickness of the upper granite-gneiss layer (velocities Vp=6.0-6.6 km/s): it is only 5-7 km in comparison with 15-20 km in the continent. The origin of such crust may be explained in two ways. Most frequently it is accounted for by the destruction and transformation of the continental crust by the basification that implies the enrichment of the crust by the rocks of basic composition from the mantle and the metamorphization of the continental rocks at the higher temperature and pressure. But in the central part of the Arctic Ocean the crust looks as an original one. The regular form of the large ridges and the continental type magnetic field were not destroyed by the basification processes which are usually irregular and most intensive in some local zones. The basification origin may be proposed for the Canadian and the South-Barents deep sedimentary basins with “suboceanic” crust (10-15 km of sediments and 10-15 km of the lower crust with Vp= 6.8-7.2 km/s). The other basins which stretch along fault zones outlined the central deep water part of the Arctic Ocean have the “subcontinental’ crust: the thickness of the granite-gneiss layer decreases in these basins and sometimes the high velocity intrusions are observed in the lower parts.
The different crustal types are observed in the North Atlantic where the oceanic crust with linear magnetic anomalies is combined with “subcontinental” crust of the Farrero-Iceland and Rockall ridges. This transition type is also revealed along the Greenland and West Europe margins.
An important feature of the High Arctic is the system of faults outlining the central part of the ocean. The faults indicate clear differences in their tectonic evolution. Two of them are the long seismic active zones of global significance: they are traced along the North America continental margin and the Gakkel Ridge and may be continued far to the continents as the high seismicity belts. The faults between the central Arctic and the East Siberia-Alaska margins are divided in several passive seismicity segments. Along the most fault zones the deep basins are formed, the crustal type is changed and the Moho has step form.