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Continental crust in deep-water basins of East Arctic region

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The nature of the crust in deep-water basins (1.5-4 km) in East Arctic is a matter of debates. The occurrence of continental crust has been demonstrated by deep-sea drilling only for the central part of the Lomonosov Ridge. Many authors suggest that the Mendeleev High and the Makarov and Podvodnikov basins in the Amerasian Basin are underlain by oceanic crust. In these regions the mean P-wave velocities in the consolidated crust are higher than in most continental areas. However, the thickness of this layer is several times larger (15-30 km) than that of the oceanic crust (7 km) and it includes a thin granitic layer (2-5 km). To explain this anomalous structure and thickness of the crust it is commonly supposed that in the Late Jurassic and Cretaceous the oceanic crust was formed in the above regions by sea-floor spreading accompanies by melting out of large masses of crustal material on a hot spot like on the present Iceland hot spot. Other investigators consider the crust in the above regions as a continental one. An important argument is the evolution of the subsidence in time which is quite different from a square root of time that typical of oceanic crust. Thus, according to the dredging data, the Mendeleev High remained near to sea level for 170 Myr since the Late Silurian and until the Early Permian. This would be absolutely impossible for a cooling hot spot on the oceanic crust. Furthermore, the structure of consolidated crust in these areas is similar to that in some ultradeep basins within the continents and on their passive margins, e.g., in the East Barents, North Caspian and North Chukchi basins which were originally formed on continental crust. To produce the water loaded subsidence by 1.5-4 km by lithospheric stretching, the lithosphere should be stretched by 1.5-4 times. However, in most of the seismic reflection profiles, no large tensile deformations can be observed. Under such circumstances the transformation of gabbro in the lower crust into dense eclogites can be proposed as a cause of the subsidence. Eclogites are characterized by P-wave velocities similar to those in mantle peridotites. In the seismic refraction profiles they are commonly placed below the Moho; however, according to their mean chemical composition, these mafic rocks pertain to the crust. Such a situation is typical for the Mendeleev High. The analysis of the seismic refraction and gravity data on the high has shown that a layer of eclogites, $\sim$10 km thick, underlies the Moho in this region. Together with this layer of mafic rocks the crustal thickness appears to be equal to 40 km under the high which is typical of continental crust.