

Seismic stratigraphy of sedimentary cover in Amerasian Basin based on the results of Russian High Arctic expeditions

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Massive amount of multichannel seismic (MCS) data were obtained by Russian High Arctic expeditions “Arctica-2011”, “Arctica-2012” and “Arctica-2014”. More than 40 MCS lines are located in the Amerasian basin and help to substantiate the seismic stratigraphy model of its sedimentary cover. The proposed seismic stratigraphy model was successively determined for the Cenozoic and pre-Cenozoic parts of the sedimentary section and was based on correlation of the Russian MCS data and seismic data documented by boreholes.

Cenozoic part of the sedimentary cover is based on correlation of the Russian MCS data and AWI91090 section calibrated by ACEX-2004 boreholes on the Lomonosov Ridge. Two major unconformities are traced. The upper regional unconformity (RU) is associated with a major pre-Miocene hiatus. Another major hiatus is recorded in the borehole section between the Campanian and the Upper Paleocene units. It is recognized as the post-Campanian unconformity (pCU) in the seismic sections.

Formation of the regional unconformities is associated with a fundamental change in depositional environment. Formation of RU was initiated by opening of the Fram Strait gateway at the Paleogene/Neogene boundary. Post-Campanian unconformity is linked with the initial stage of the Eurasian Basin opening between the Cretaceous and the Paleogene.

Cenozoic sedimentary units are continuously traced from the East-Siberian and Chukchi sea shelves across the transit zone to the Amerasian basin. Paleogene unit (between pCU and RU) is formed under the neritic depositional environment and it is characterized by an extremely small thickness on the Lomonosov Ridge (less than 200 m), on the Mendeleev Rise and in the Podvodnikov Basin (not more than 300-400 m). Neogene unit (above RU) consists of hemipelagic deposits and occupies the essential part of thickness of the Cenozoic section in Podvodnikov and Makarov Basins. Interval velocities in the Paleogene unit vary within 2.8-3.2 km/s, in the Neogene unit they vary within 1.8-2.7 km/s.

Pre-Cenozoic part of the sedimentary cover is based on tracing major unconformities from boreholes on the Chukchi shelf (Crackerjack, Klondike, Popcorn) to the North-Chukchi Trough and further to the Mendeleev Rise as well as to the Vilkitsky Trough and the adjacent Podvodnikov Basin. Three regional unconformities are correlated: Jurassic (JU – top of the Upper Ellesmerian unit), Lower Cretaceous (LCU) and Brookian (BU – base of the Lower Brookian unit). Above the acoustic basement the pre-Cenozoic section is mainly represented by terrigenous units.

Two major unconformities: RU and pCU are allocated on all MCS lines intersecting the Mendeleev Rise along its entire extent. BU is traced nearly everywhere along the rise excepting certain acoustic basement highs. All unconformities are also traced from the Mendeleev Rise to the continental structure of the Chukchi Borderland.

Sedimentary sequence between pCU and JU which underlies deposits of the Upper Ellesmerian unit is recorded as a synrift unit of the entire area of the Podvodnikov Basin. MCS data show a natural prolongation of the sedimentary cover from the shelf to the Podvodnikov Basin without any breaks and tectonic movements.

Interval velocities in the Upper Cretaceous unit (between pCU and BU) vary within 3.2-3.9 km/s, in the pre-Upper Cretaceous units (between BU and the acoustic basement) vary within 4.1-4.8 km/s.