A BIOMARKER RECORD IN THE LATE CENOZOIC SEDIMENTS OF THE EURASIAN CONTINENTAL MARGIN

V.I. Petrova, G.I. Batova, A.V. Kursheva, I.V. Litvinenko, I.P. Morgunova

Federal State Budgetary Institution "Academician I.S. Gramberg All-Russian Scientific Research Institute for Geology and Mineral Resources of the Ocean" (FSBI "VNIIOkeangeologia"), Russia

The sediments of the deep-water part of the Arctic Ocean, which is a final sedimentary basin, contain a stratified sequence of various flows and permit one to estimate the contribution of various sources (river run-off, turbidity flows, ocean slope currents, subaqueous erosion and redeposition of bedrocks) to the formation of sedimentary cover. At the same time, the relative input from these sources is still debatable, especially due to the new data about the significant bedrock outcrops (scarps) detected on the Mendeleev rise (Gusev et al., 2014). The detected outcrop of Miocene or older deposits near the seafloor on the western slope of the Lomonosov Ridge also testify to the possible *in situ* redeposition during the Late Cenozoic sedimentation (Stein et al., 2016).The main purpose of this study was to determine the composition of organic molecular markers which trace the origin of sedimentary material. Together with the mineral particles, dispersed organic matter (DOM) travels the entire way from the immobilization zone to the sedimentary basin, inheriting the geologic history of sedimentary material in its molecular structure.

The object of this study was sediment cores (up to 10 m length) collected during research cruses of "VNIIOkeangeologia" in 2005-2007 (R/V Akademic Fedorov, N/I Rossiya) along the two N-S-striking profiles: (1) from the continental slope of the Laptev Sea along the Amundsen Basin and (2) along the axial part of the Lomonosov Ridge (Fig. 1). Samples of sediments were stored frozen in sterile conditions until the laboratory investigation. Analysis included determination of TOC and $CaCO_3$ and Soxhlet extraction of dissolved part of DOM with $CHCl_3$ (extractable organic matter: EOM). Analysis of group and molecular composition of the EOM, including saturate and aromatic fractions of hydrocarbons (n-alkanes, isoprenoids, cyclanes and polycyclic aromatic hydrocarbons - PAHs), were carried out using preparative liquid chromatography and GC-MS analysis with the Agilent Technologies 6850/5973 GC System respectively.

Clay successions of the sediment cores of the Profile 1 (AF-05-29, 31, 33) are enriched in organic matter (TOC ca. 0.5÷1.0%) and have been formed in reducing environmental conditions. Their appearance can be traced to the northern direction up to the abyssal (AF-05-33, 3500 m) and reflects a significant input of terrigenous sedimentary matter. This assumption agrees with the consistency of *n*-alkanes composition along the stratigraphic section, represented mainly by the higher homologues of humic nature with low maturity level ($C_{17\text{-}19}/C_{27\text{-}31}$=0.1÷0.3; $OEP_{29\text{-}31}$>4). Low mean values of the hopane ratios (T_s/T_m=0.33, 22S/(22R+22S)=0.43), and proportion of biogenic βα-hopanes (30βα/(αβ+βα)=0.14÷0.26) indicate the diagenetic stage of maturity. The tracers of terrigenous input (perylene, retene, cadalene and alkyl chrysenes) were also identified in PAH composition. The hopane maturity parameters indicate the post-diagenetic stage of OM transformation in sediments of the central part of the Amundsen Basin, near the North Pole (T_s/T_m=0.48, 22S/(22R+22S)=0.55). However, the content of terrigenous PAHs is significantly reduced there.

Obviously, the formation of the Cenozoic sediments in the axial part of the Lomonosov Ridge (Profile 2) was more complicated. This is evidenced by the structure of the studied sediment sections. Thus, the sections collected on the flat top of the ridge (ALR-07-17, 20, 22, Fig. 1) consist of brown silty-clay sediments, enriched in thermally mature DOM (T_s/T_m=0.80, 30βα/(αβ+βα)=0.01, 22S/(22R+22S)=0.49) with the low content of TOC (<0.3 %; Fig. 1), and accumulated, probably, as a result of terrigenous flow during deglaciation (Yamamoto et al., 2008). The bottom part of the cores (ALR-07-18, 28) collected from the western and southern slopes of the Lomonosov Ridge consists of dark grey clay enriched in DOM of mixed terrestrial-marine origin and post-diagenetic maturity level (TOC up to 0.7%, T_s/T_m=0.22, 30βα/(αβ+βα)=0.29, 22S/(22R+22S)=0.31). As proposed by Yamamoto *et al.* the dark grey layer formation is attributed to the 6 MIS and could occur as a result of terrestrial soil erosion with ice sheet. Nevertheless, in the studied samples we have identified the abnormal content of oleanenes (up to 30 μg/g of TOC), specific tracers of high plants – cadalene and retene, and increased content of perylene (>30% of total PAHs) which is traditionally considered as a component of DOM formed in shallow marine anoxic sediments during the early stage of diagenesis. Futhermore, both the established affiliation of the ALR-07-18 core section to the zone of Early Miocene erosional unconformity (Rekant et al., 2015; Fig. 1, seismic profile), and its proximity to the Miocene deposits exhumation (Stein et al., 2016) suggest the possible *in situ* formation of this sediments in shelf conditions during regression.

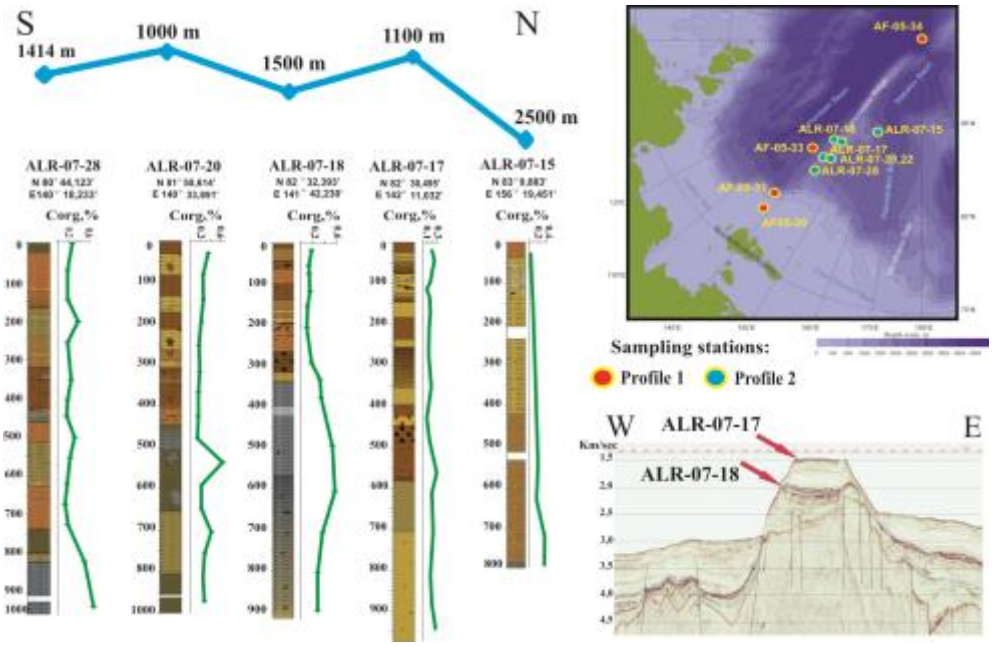

Figure 1 *Map showing station locations and sediment cores collected along the Profile 2.*

References

Gusev, E., Lukashenko, R., Popko, A., et al., 2014. New data on structure of Mendeleev Rise seamounts slopes (Arctic Ocean). Doklady Earth Sciences 455(2), 185-188.

Rekant, P., Petrov, O., Kashubin, S., et al., 2015. History of formation of the sedimentary cover of Arctic basin. Multychannel seismic approach. Regional geology 64, 11-27.

Stein, R., Fahl, K., Schreck, M., et al., 2016. Evidence for ice-free summers in the late Miocene central Arctic Ocean. Nature Communications 7, 1-13.

Yamamoto, M., Okino, T., Sugisaki, S., Sakamoto, T., 2008. Late Pleistocene changes in terrestrial biomarkers in sediments from the central Arctic Ocean, Organic Geochemistry 39, 754–763.