

Past Environmental Transformation of the Laptev Sea Continental Margin and Water Mass Changes since Last Deglacial Times

Ekaterina TALDENKOVA,¹ Natalia CHISTYAKOVA,¹ Henning A. BAUCH,²
Anna STEPANOVA,³ Yaroslav OVSEPYAN,¹ and Robert F. SPIELHAGEN²

The eastward penetration of Atlantic-derived water (ADW) into the Eurasian Basin of the Arctic Ocean, its interaction with freshwater inputs, as well as variability in iceberg-rafting and sea-ice cover extent were investigated at the Laptev Sea continental margin for the time since ca. 17.6 ka. Using a high-resolution investigation of the lithology, geochemistry, planktic and benthic foraminifers, and ostracods on sediment cores from the western (PS51/154, 270 m water depth) and eastern (PS2458, 983 m water depth) continental slope major steps in the environmental evolution of the region are recognized.

In general, ADW was continuously present in the study area. In the western core from the upper continental slope, which was probably located above the average upper limit of the ADW between 17.6 and 15.4 ka, the ADW manifested itself through open-water polynyas and associated upwelling events. In both cores the oldest time interval is characterized by the presence of rare, but taxonomically diverse, subpolar planktic foraminifers including such species as *Neogloboquadrina pachyderma dex.*, *Globigerina bulloides*, *Globorotalia scitula*, *G. inflata*, *Globigerinita uvula*, *G. glutinata*, *Turborotalita quinqueloba*, *Orbulina universa*, *Globigerinoides ruber*, and *G. sacculifer*. The late glacial and early deglacial period in the western Laptev Sea was distinguished by enhanced iceberg-rafting from Severnaya Zemlya ice caps and probably also the Barents-Kara ice sheet (TALDENKOVA et al. 2010). Melt water inputs periodically created strong water stratification and bottom anaerobic conditions at this site as evidenced by numerous authigenic concretions of vivianite and rhodochrosite (TALDENKOVA et al. 2010). At the same time, in the eastern Laptev Sea core only a slight increase in the number of ice-rafted debris (IRD) is observed which is an order of magnitude less than in the west, thus indicating diminished iceberg-rafting.

Comparison between the records from the Laptev Sea and northern Svalbard shelf (TALDENKOVA et al. 2010, ŚLUBOWSKA-WOLDENGEN et al. 2007) using the ADW indicative benthic foraminifer *Cassidulina neoteretis* allows the assumption of an unmodified subsurface inflow of ADW within its northern branch between 15.4–13 ka, which was strongest after 14.7 ka and in line with the overall climate amelioration.

1 Lomonosov Moscow State University, Moscow, Russia, E-Mail: etaldenkova@mail.ru, natal-y@mail.ru, yaovsepyan@yandex.ru.

2 Academy of Sciences and Literature Mainz / GEOMAR, Kiel, Germany, E-Mail: hbauch@geomar.de, rspielhagen@geomar.de.

3 Paleontological Institute of the Russian Academy of Sciences, Moscow, Russia, E-Mail: a.yu.stepanova@gmail.com.

A local freshwater event at 13 ka (SPIELHAGEN et al. 2005) followed by shelf flooding and the establishment of a freshened shelf water mass resulted in an off-shelf displacement of ADW as suggested by decreasing abundance of planktic foraminifers, disappearance of *C. neoteretis* from core PS51/154 between 12 and 7 ka and the considerable reduction in its relative abundance in core PS2458. In the latter core, the 13 ka event of surface water freshening as expressed by the negative spike in the oxygen isotopic composition of planktic foraminifers (SPIELHAGEN et al. 2005) is exactly accompanied by anaerobic conditions at the sea floor as evidenced by abundant vivianite concretions and the near absence of benthic microfossils.

As evidenced by an abundance peak in *Nonion labradoricum*, the sea-ice marginal zone was located close to the sites around 12–11 ka but then shifted northward during the early Holocene warming. Enhanced ADW inflow during mid-late Holocene (after 7 ka in the better dated core PS51/154) correlated with climate cooling, southward retreat of the seasonal drift-ice margin and enhanced iceberg-rafting from Severnaya Zemlya in the western Laptev Sea (TALDENKOVA et al. 2010). The inflow of ADW during mid-late Holocene differed from deglacial times because of the combined influence of northern and eastern ADW branches.

References

- ŚLUBOWSKA-WOLDENGEN, M., RASMUSSEN, T. L., KOÇ, N., KLITGAARD-KRISTENSEN, D., NILSEN, F., and SOLHEIM, A.: Advection of Atlantic Water to the western and northern Svalbard shelf since 17,500 cal yr BP. *Quaternary Science Reviews* 26, 463–478 (2007)
- SPIELHAGEN, R. F., ERLIKEUSER, H., and SIEGERT, C.: History of freshwater runoff across the Laptev Sea (Arctic) during the last deglaciation. *Global and Planetary Change* 48/1–3, 187–207 (2005)
- TALDENKOVA, E., BAUCH, H. A., GOTTSCHALK, J., NIKOLAEV, S., ROSTOVTSOVA, Y., POGODINA, I., OVSEPYAN, Y., and KANDIANO, E.: History of ice-rafting and water mass evolution at the northern Siberian continental margin (Laptev Sea) during Late Glacial and Holocene times. *Quaternary Science Reviews* 29/27–28, 3919–3935 (2010)

Ekaterina TALDENKOVA
Lomonosov Moscow State University
Geographical Faculty
Leninskie gory
119991 Moscow
Russia
Phone: +7 495 9391608
Fax: +7 495 9328836
E-Mail: etaldenkova@mail.ru