

The Modern and Ancient Terrestrial and Coastal Environment of the Laptev Sea Region, Siberian Arctic - A Preface

by Volker Rachold

Since the last decades there is growing evidence that the Arctic plays a major role in the global climate system because on one hand it is extremely sensitive to environmental changes and on the other hand significantly affects the global system. The closely coupled land-ocean system of the Laptev Sea with the East Siberian hinterland and its complex connections, such as the Lena Delta, represents a key region for understanding environmental changes in the Arctic (Fig. 1). Today the Laptev Sea, which is most remote from the influences of the Atlantic and Pacific, is the main sea-ice production area of the Arctic Ocean and the source of the Transpolar Drift. Sea-ice formation is closely linked to freshwater discharge mainly of the Lena river, which is the second largest Arctic river. Changes in the quality and quantity of freshwater discharge and sediment transport as well as coastal dynamics, all of which are related to climate and permafrost conditions in the Siberian hinterland, have a significant impact on the Laptev Sea and, thus, the entire Arctic Ocean.

Due to political changes in the former Soviet Union, in the early 1990s the Laptev Sea region and the Siberian hinterland became accessible for the international scientific community. The first land-based expeditions to the Laptev Sea coastal region AMEIS 91 and ESARE 92 (DETHLEFF *et al.* 1993) were carried out by the GEOMAR Research Center for Marine Geosciences (Kiel, Germany) in cooperation with the Arctic and Antarctic Research Institute (AARI) of St. Petersburg. One year later, in 1993, already three Russian-German expeditions could be successfully organized by the Alfred Wegener Institute (AWI) for Polar and Marine Research, Bremerhaven, GEOMAR and AARI: (1) ARCTIC '93 by RV "Polarstern" to the northern Laptev Sea and its continental margin (FÜTTERER 1994), (2) Transdrift I aboard RV "Ivan Kireev" in the inner Laptev Sea (KASSENS & KARPIY 1994) and (3) a land expedition to the area around Norilsk/Taymyr 1993 (MELLES 1994).

Following these pilot studies, two research programs, (1) "The Laptev Sea System" and (2) "Late Quaternary Environmental Evolution of Taymyr Peninsula", were launched and financed by the German Ministry of Education and Research (BMBF) and the Russian Ministry of Research and Technology. From 1994 to 1997 several expeditions to the Laptev Sea, the Taymyr Peninsula, the Severnaya Zemlya Archipelago and the Siberian rivers could be performed. Much of the outcome is published in a comprehensive collection in KASSENS *et al.* (1999). Based on these results but addressing completely new scienti-

fic problems as well, in 1998 the Russian-German project "Laptev Sea 2000", which again has been funded by the German Ministry of Education and Research (BMBF) and the Russian Ministry of Research and Technology, was initiated. Since 1998 each summer both terrestrial and marine expeditions to the Laptev Sea region could be carried out.

This volume presents a collection of results, which were obtained on the basis of three terrestrial expeditions to the Lena Delta and the Laptev Sea coastal region from 1998 to 2000 (RACHOLD & GRIGORIEV 1999, 2000, 2001). The papers provide an overview of the modern and ancient terrestrial and coastal environment of the region. In particular, three specific themes are covered:

(1) Ice-rich permafrost deposits and their paleoenvironmental significance.

Ice-rich permafrost sequences containing massive ice bodies are wide-spread in the Northeast Siberian lowland. These so-called „Ice Complex" deposits developed during the Late Pleistocene. Five articles presented in this collection concentrate on the genesis of these deposits and their potential as paleoclimate archives.

(2) Genesis and modern characteristics of the Lena Delta.

At its mouth the Lena River forms the largest delta in the Arctic, which occupies an area of $3.2 \cdot 10^4$ km². With the second largest river discharge in the Arctic (520 km³/a) it is the main connection between interfering continental and marine processes within the Laptev Sea. Six papers dealing with modern hydrological and biological aspects and the sedimentation history of the Lena Delta are presented.

(3) Arctic coastal processes and the sediment budget of the Laptev Sea.

Shore dynamics directly reflecting the complicated land-ocean interactions play an important role in the balance of sediments, organic carbon and nutrients in the Arctic basin. However, the contribution of coastal erosion to the material budget of the Arctic Seas has often been underestimated. Three papers of this collection focus on coastal processes of the Lena Delta and the Laptev Sea and on the quantitative assessment of the sediment input to the Laptev Sea through coastal erosion.

The success of three extensive expeditions would not have been possible without the support by numerous Russian and German institutions and authorities. Several institutions from Moscow, St. Petersburg, Tiksi, Yakutsk, Bremerhaven, Freiberg, Hamburg, Kiel and Potsdam, which were directly invol-

¹ Alfred Wegener Institute for Polar and Marine Research, Research Unit Potsdam, Telegrafenberg A43, 14473 Potsdam, Germany

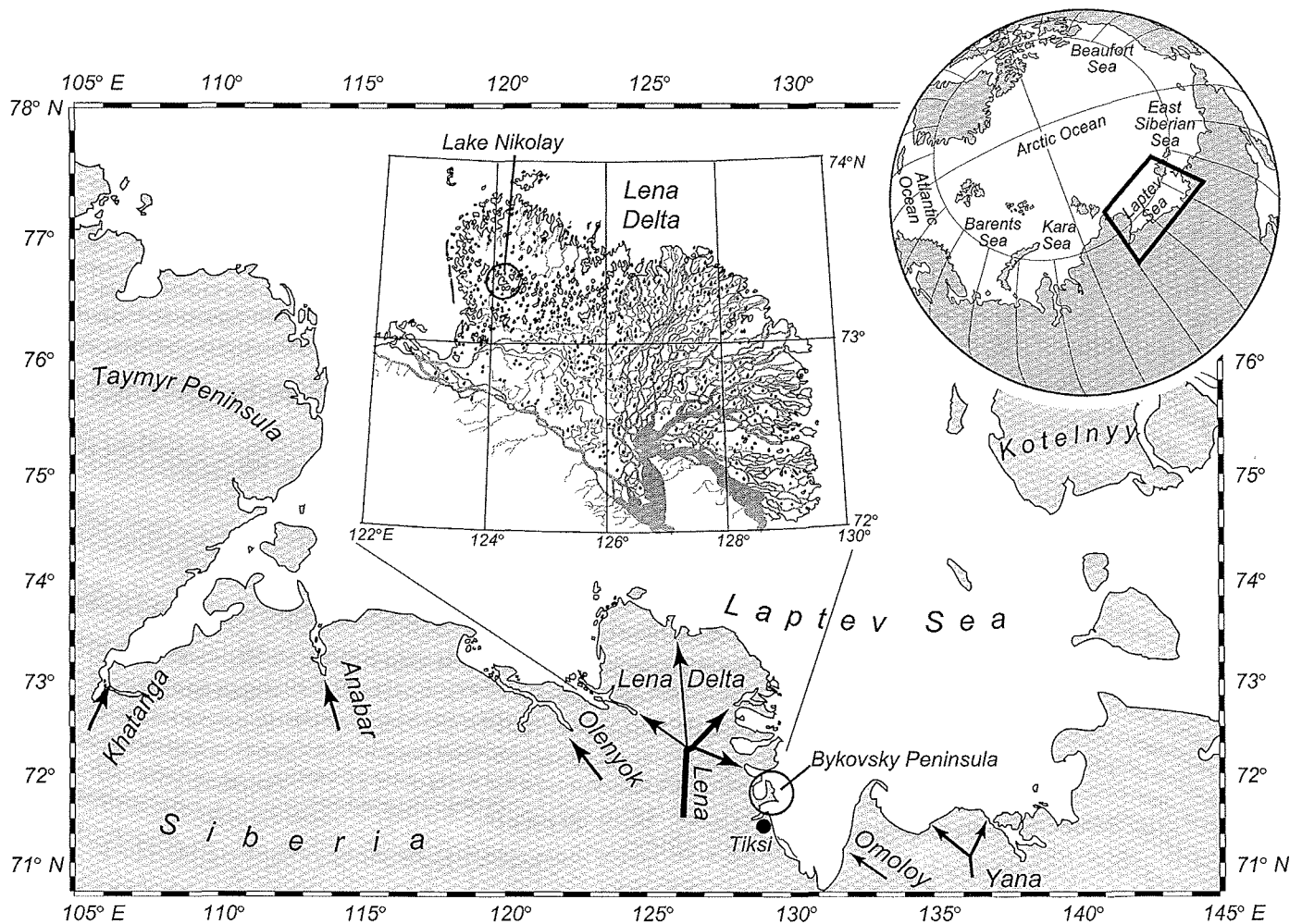


Fig. 1: Location map of the study area in the Laptev Sea region.

Abb. 1: Übersichtskarte des Untersuchungsgebietes im Bereich der Lapteewsee.

ved in the organization of the expeditions, are greatly acknowledged. In particular, the logistic support in Tiksi provided by the Lena Delta Reserve and the Tiksi Hydrobase is highly appreciated. The members of the expeditions wish to thank the captains and crewmembers of the vessels "Dunay", "Neptun" and "Sofron Danilov", the staff of the biological station Samoylov and the pilots of the helicopters based in Tiksi. Several critical referees, who provided valuable and constructive comments and, thus, helped to maintain the scientific standard of the papers presented in this volume, are greatly acknowledged. Financial and logistical support has been acquired from the German Ministry of Education and Research (BMBF) and the Russian Ministry of Research and Technology.

References

- Dethleff, D., Nürnberg, D., Reimnitz, E., Saarso, M. & Savchenko, Y.P. (eds.) (1993): East Siberian Arctic Region Expedition '92: The Laptev Sea - Its significance for Arctic sea-ice formation and transpolar sediment flux.- Rep. Polar Res. 120: 1-44.
- Fütterer, D.K. (ed.) (1994): The Expedition ARCTIC 93, Leg ARK-IX/4 of RV "Polarstern" 1993.- Rep. Polar Res. 149: 1-144.
- Kassens, H. & Karpiy, V. (eds.) (1994) Russian-German cooperation: the Transdrift I Expedition to the Laptev Sea.- Rep. Polar Res. 151: 1-168.
- Kassens, H., Bauch, H.A., Dmitrenko, I., Eicken, H., Hubberten, H.-W., Melles, M., Thiede, J. & Timokhov, L. (eds.) (1999): Land-Ocean systems in the Siberian Arctic: dynamics and history.- Springer, Berlin: pp. 711.
- Melles, M. (ed.) (1994): The Expeditions NORILSK/TAYMYR 1993 and BUNGER OASIS 1993/94 of the AWI Research Unit Potsdam.- Rep. Polar Res. 148: 1-80.
- Rachold, V. & Grigoriev, M.N. (eds.) (1999): Russian-German Cooperation SYSTEM LAPTEV SEA 2000: The Lena Delta 1998 Expedition.- Rep. Polar Res. 316: 1-259.
- Rachold, V. & Grigoriev, M.N. (eds.) (2000): Russian-German Cooperation SYSTEM LAPTEV SEA 2000: The Expedition LENA 1999.- Rep. Polar Res. 354: 1-269.
- Rachold, V. & Grigoriev, M.N. (eds.) (2001): Russian-German Cooperation System Laptev Sea 2000: The Expedition LENA 2000.- Rep. Polar Res. 388: 1-135.