



A diatom-based sea-ice reconstruction of the last 5000 years in Vaigat Strait, Disko Bugt, West Greenland

Longbin Sha (1), Hui Jiang (2), Marit-Solveig Seidenkrantz (1), Karen Luise Knudsen (1), Jesper Olsen (3), Antoon Kuijpers (4), and Yanguang Liu (5)

(1) Centre for Past Climate Studies, Aarhus University, Department of Geoscience, Aarhus C, Denmark (mss@geo.au.dk), (2) State Key Laboratory of Estuarine and Coastal Research, East China Normal University, 200062 Shanghai, PR China, (3) Department of Physics and Astronomy, Aarhus University, DK-8000 Aarhus C, Denmark, (4) Geological Survey of Denmark and Greenland (GEUS), 1350 Copenhagen, Denmark, (5) Key Laboratory of Marine Sedimentology and Environmental Geology, First Institute of Oceanography, SOA, 266061 Qingdao, PR China

Sea ice is a major component of the climate system, because it influences the planetary albedo and the exchanges of heat, moisture and gases between the ocean and the atmosphere. Thus, sea ice is a key parameter in atmospheric and ocean models assessing future climate change. However, observed reliable data on sea-ice cover, such as satellite data, are only available as far back as 30 years with the exception of records from ship logs, which are sporadic and irregular. To obtain longer time series of Arctic SIC, microfossils such as diatoms and dinoflagellate cysts are commonly used.

We have developed a diatom-based sea-ice concentration (SIC) transfer function using 72 surface samples from west of Greenland and around Iceland, and through comparison with the associated modern SIC. Canonical correspondence analysis (CCA) on surface sediment diatoms and monthly average of SIC reveals that April SIC is the most important environmental factor controlling the distribution of diatoms in the area, and permits the development of a diatom-based SIC transfer function.

The consistency between reconstructed SIC based on diatoms from West Greenland core GA306-BC4 and the instrumental and documentary data during the last \sim 75 years demonstrates that the diatom-based SIC reconstruction is reliable for studying the palaeoceanography off West Greenland.

Based on the diatom record from a 446 cm long gravity core DA06-139G, collected from Vaigat Strait in Disko Bugt (water depth 384 m), the reconstructed April SIC varies between 40 and 70% with a mean value around 55% over the last 5000 years. Relatively warm conditions with strong influence of the IC are indicated for the early part of the record (\sim 5000-3860 cal. yr BP), corresponding in time to the latest part of the Holocene Thermal Maximum. The April SIC oscillated around the mean value between 3860 and 1510 cal. yr BP and was above mean afterwards, particularly during the time interval 1510-1120 cal. yr BP and after 650 cal. yr BP, indicating more extensive sea-ice cover in Disko Bugt.

Consistency between changes in the reconstructed April SIC and variations in abundances of the main diatom components from core DA06-139G suggests that sea-ice conditions in Disko Bugt are generally strongly influenced by changes in the relative strengths of the two components of the WGC, the cold Polar water from the EGC and the relatively warm Atlantic water from the IC.