The Late Weichselian-Holocene transition in the Barents Sea: sedimentological and early diagenetic studies

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Gravity cores and grab samples from the Barents Sea (Fig. 1) were studied with respect to mineralogy, grain size distribution, total carbon content and 'Rock Eval' pyrolysis. The samples were classified as either Late Weichselian or Holocene according to Bjørlykke et al. (1978) and Elverhøi & Solheim (1983).

The grain size distributions show as expected that the Late Weichselian sediments are coarser than those from the Holocene. The 'Rock Eval' results show that while the carbon in the Late Weichselian sediments is almost exclusively reworked with the greatest concentration in the 2–6 μm fraction, the carbon in the Holocene sediments contains increasingly greater amounts of primary carbon up towards the sea bed with the highest content in the <2 μm fraction. There is a close connection between the period of annual ice cover and the carbon content in the Holocene sediments (Fig. 2).

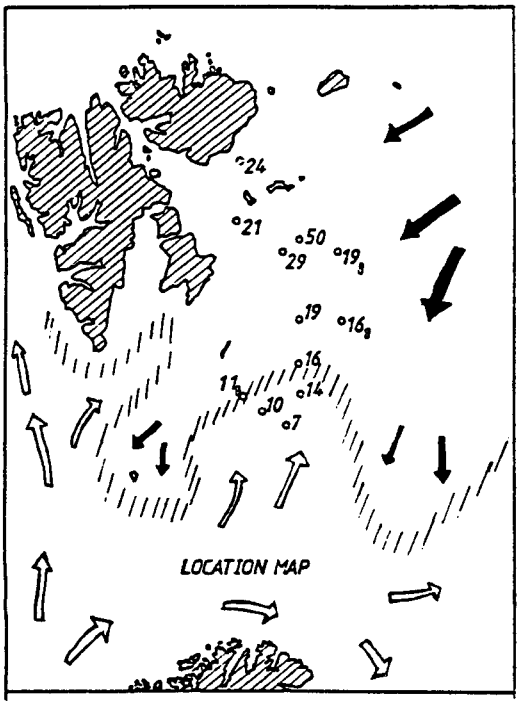

Fig. 1. The sample locations studied and the approximate position of the oceanic polar front. Subscript 'g' indicates grab samples.

The Holocene sediments contain significant amounts of smectite and mixed layered minerals, whereas the Late Weichselian sediments do not. These minerals are indications of the Holocene deposits having, at least partially, a source outside the Barents Sea. Unlike the primary carbon the mineralogical distribution in the Holocene sediments is not much affected by the present hydrological regimes.

The Late Weichselian glacial and climatic conditions were too severe to support primary production of carbon, and sediments from this period contain only carbon reworked from local sedimentary rocks. With the onset of the Holocene and the accompanying climatic amelioration primary production increased, allowing sedimentation of first cycle algal debris. A combination of deglaciation and the accompanying eustatic rise in sea level freed a potential sediment transportation path from the Arctic Ocean. The shelf and land masses surrounding the Arctic Ocean thus became potential sediment source areas for the Barents Sea.

In the absence of any large rivers running into the Barents Sea one of the main agents of Holocene sediment supply is deemed to be dirty sea ice which may originate on the Siberian shelf. Published grainsize distributions of sediments from sea ice (Sharma 1979) compare very well with the silt and clay sized sub-populations from the sediments in the Barents Sea.

Thus, the Late Weichselian to Holocene transition in the Barents Sea seems to have been accompanied by the onset of primary production in the water masses and a change from sedimentation of locally derived material by glacial processes to intrabasinal reworking by marine processes and the supply of extrabasinal inorganic material by sea ice rafting.

References

Bjørlykke, K., Bue, B. & Elverhøi, A. 1978: Quaternary sediments in the northwestern part of the Barents Sea and their relation to the underlying Mesozoic bedrock. *Sedimentology 25*, 227–473.

Elverhøi, A. & Solheim, A. 1983: The Barents Sea ice sheet – a sedimentological discussion. *Polar Research 1 n.s.*, 23–42.

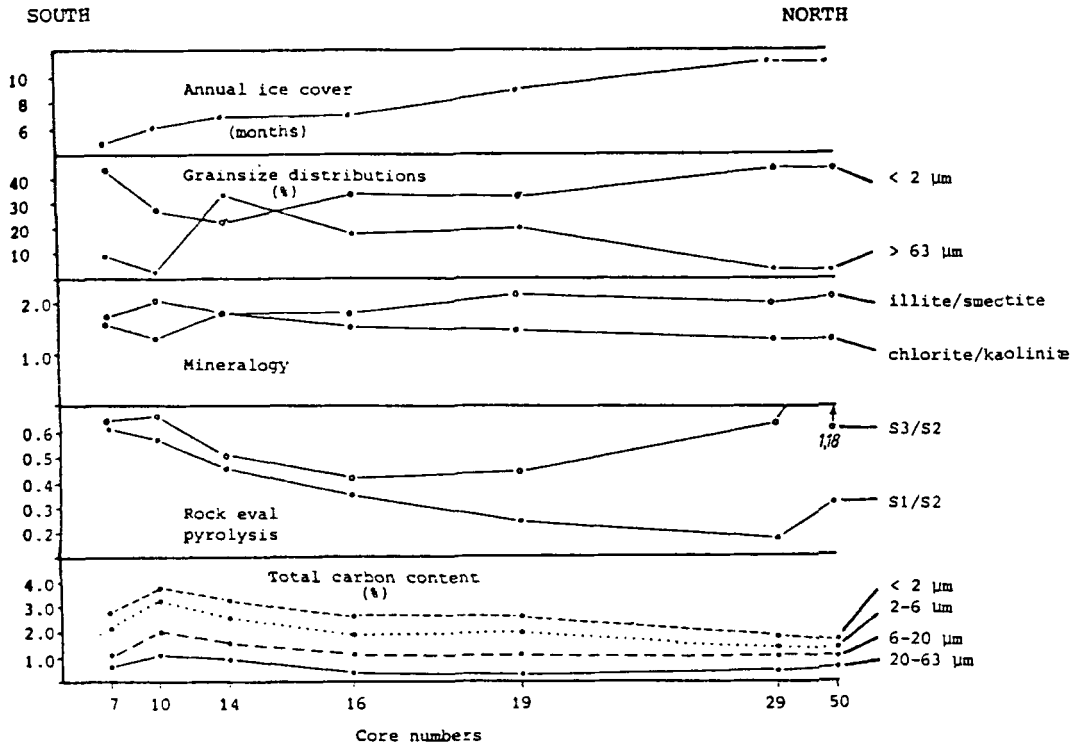

Fig. 2. Summary of the main results for the surface core samples. The period of ice coverage is from Vinje (1977).

Sharma, G. D. 1979: *The Alaskan shelf, hydrographic, sedimentary and geochemical environments.* Springer, N.Y. 488 pp.

Vinje, T. 1977: Frequency distribution of sea ice in the Greenland and Barents Seas, 1971–1980. *U.S. dep. commerce. net. technical information.*