Paleoceanography of Isjforden, Spitsbergen, since the Last Glacial Maximum from Sedimentological and Palynological Analyses

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Study area - Isfjorden

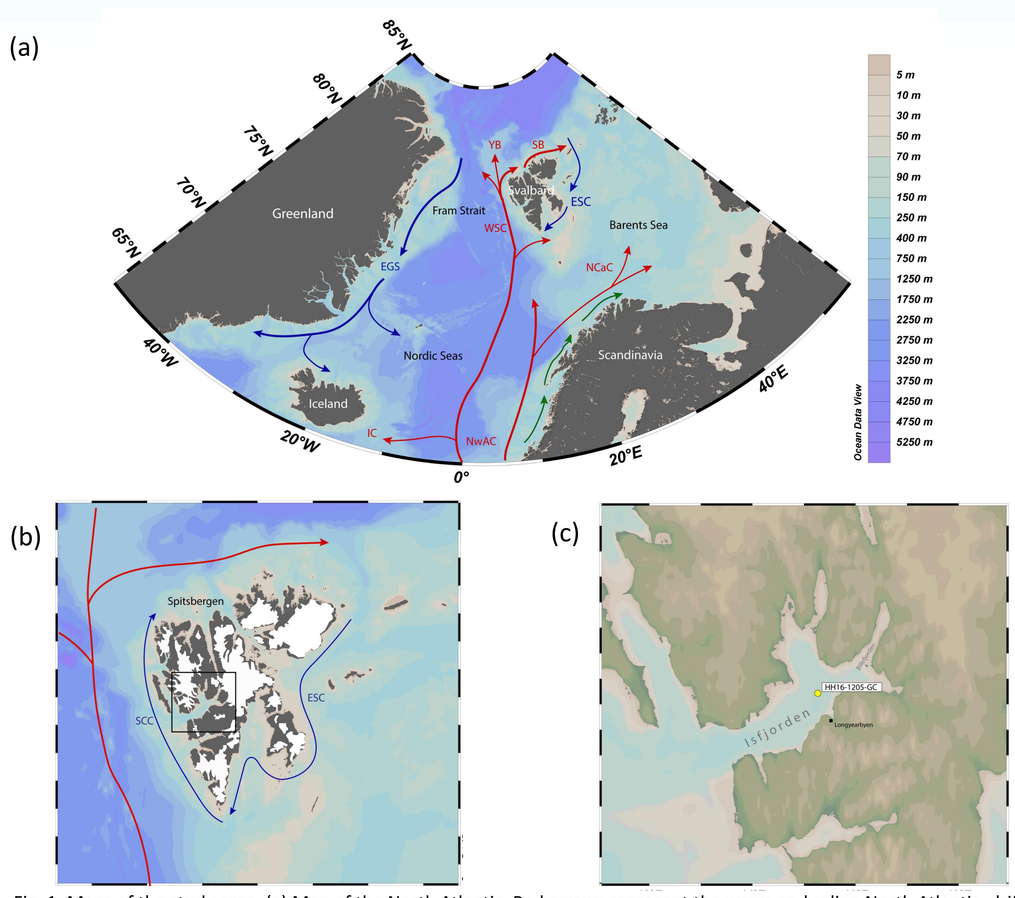


Fig. 1: Maps of the study area. (a) Map of the North Atlantic. Red arrows represent the warm and saline North Atlantic drift, splitting into the Irminger Current (IC) and Norwegian Atlantic Current (NwAC), which divides into the North Cape Current (NCaC), the West Spitsbergen Current (WSC), the Svalbard Branch (SB) and the Yermack Branch (YB). The blue arrows represent the Arctic water flowing south via the East Spitsbergen Current (ESC) and the East Geenland Current (EGC). (b) Map of Svalbard with the South Cape Current (SCC). (c) Map of Isjforden with location of the core.

- Large fjord system surrounded by the second largest drainage basin of Spitsbergen, Svalbard;
- 100 km long, up to 425 m deep, with 13 tributary fjords and bays;
- Glacier coverage of 40%, with 9 tidewater glaciers terminating into it;
- Strong temperature and salinity gradients determined by both continental glacier discharge and the North Atlantic Current
- High temporal resolution recordings.

Objectives

- To reconstruct the history of the glacier dynamics in Svalbard since the Last Glacial Maximum and to establish relationship with hydrographic conditions in the fjords, where ice is drained
- Cross-calibrating the sedimentological and micropaleontological data from the analyses of the marine sediment core **HH16-1205-GC** (78°20.813'N, 015°17.11'E)

→ Better understanding of the glacial dynamics, the properties of water masses and the evolution of the glacial margin

→ Better estimating the glacier melt of the last centuries

Methodology

Palynological analyses:

- Counts of dinocysts , pollen, spores and other palynomorphs
- Application of the modern analogue technique (MAT) to reconstruct past sea surface conditions based on dinocysts assemblage
- Radiocarbon dating on carbonate shells and foraminifera

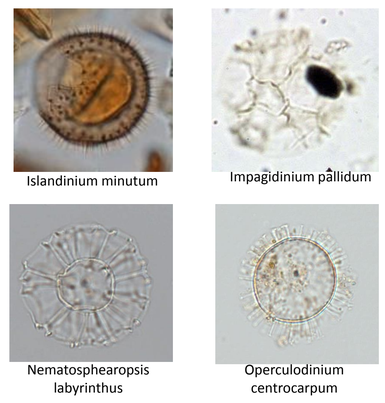


Fig. 2: Examples of dinocysts found in the study area

Sedimentological analyses:

- Measurements of TOC, $CaCO_3$, $\delta\,^{13}C$ and $\delta^{15}N$
- MSCL and X-radiographs for magnetic susceptibility, bulk density, porosity, water content
- Lines scan for high resolution stratigraphy
- Avaatech XRF scanning for element concentrations
- Lithological and grain-size analyses

Previous studies : the working hypothesis

Sedimentological study from Forwick et al. (2009) :

- Proposed relationship between central Spitsbergen ice dynamics and environmental conditions of the western Barents Sea and shelf off western Svalbard.
- Impact of the North Atlantic on the environment and climate of Spitsbergen.

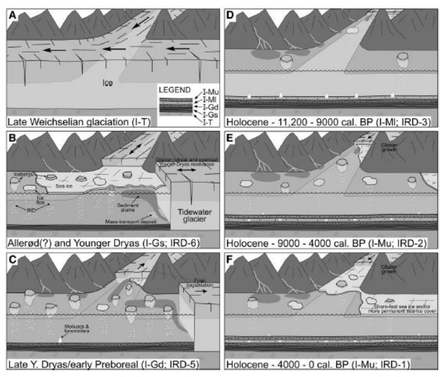
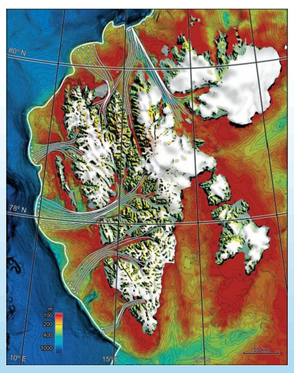


Fig. 3:Summary of the sedimentary processes and glacial activity in the Isfjorden area from the Late Weichselian glaciations until the present (Forwick et al. 2009).



High-resolution sea-floor morphology study from Ottesen et al. (2007):

- A large ice sheet reached the shelf edge around almost all of western and northern Svalbard in the Late Weichselian.
- Ice streams underwent rapid thinning and retreat through cross-shelf troughs and deep fjords.

Fig, 4: Reconstruction of ice-sheet flow regime on the western and northern margin of the Late Weichselian SBSIS from Ottesen et al. (2007)

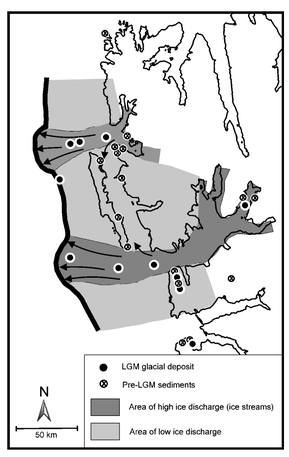


Fig. 5: Ice-sheet configuration on the western Svalbard shelf and coastal region during the Last Glacial Maximum from Landvik et al. (2005)

Seismic and sedimentological study from Landvik et al. (2005) :

- The LGM ice configuration between Isfjorden and Kongsfjorden was as shown in Fig. 5.
- The Late Weichselian SBSIS was mostly drained by a series of fast-flowing ice streams (filling Isfjorden).
- The marginal areas between the major discharge troughs were characterized by thinner and dynamically less active glacier ice.

References

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