

The Kveithola Drift (western Barents Sea): Preliminary results from the CORIBAR Cruise

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Abstract: The CORIBAR cruise (08/2013) addressed ice dynamics and meltwater deposits by coring inside the narrow (100km long, 13km wide) glacially eroded Kveithola Trough, NW Barents Sea. During this cruise, geophysical data (PARASOUND sub-bottom and multibeam profiles) and sediment cores were also collected from the Kveithola Drift. This drift is a complex morphological sediment body confined to the innermost part of the Kveithola Trough. It consists of two main depocenters separated by a buried glaciogenic grounding-zone wedge. The internal acoustic reflections show a drastic thinning, i.e. long-term condensation, towards the northern flank of the Kveithola Trough. Here, a distinct E-W running moat is developed which underlines the strong influence of dense bottom currents on sedimentation. On the contrary, some of the characteristics of sedimentary facies and preserved biota in the surface sediments of the Kveithola Drift hint to a stagnant environment, strongly affected by low-oxygen conditions. The PARASOUND data and sediment cores from this intriguing sediment drift are expected to contain a high-resolution record of the drift formation processes as well as the Holocene palaeo-environmental changes.

Key words: Shallow-water contourites, ice-stream trough, dense-flow cascading, Barents Sea, Holocene.

INTRODUCTION

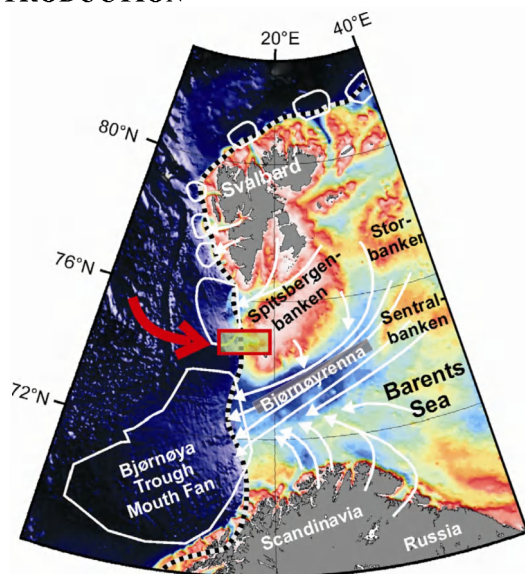


FIGURE 1: Overview map showing the western Barents Sea. Box + arrow indicate the Kveithola Trough (modified from Andreassen et al., 2008).

Whether contourite deposition can occur in shallow waters, i.e. on continental shelves, is debated. Nevertheless, current-controlled sediment bodies in shallow waters may show a shape and internal geometry very similar to those found in the deep ocean. We present here an outstanding example of a contourite drift which has formed under favourable morphological and bottom-flow conditions inside a partly filled glaciogenic palaeo-ice-stream trough.

DATA AND RESULTS

The Kveithola contourite drift is located in the innermost part of the Kveithola Trough. This trough has formed during the past glacial cycles and extends about 100km from the shallow Barents Shelf towards the open Norwegian Sea (Fig. 1). The trough is 13km wide and 200m deeper than the surrounding shallow shelf. Whilst grounding-zone wedges and glaciomarine deposits have formed during deglacial times (Rebesco et al., 2011; Bjarnadóttir et al., 2013), a drift body has grown during post-deglacial times, i.e. after the modern ocean conditions have established on the Barents Shelf (Fig. 2; Fohrmann, 1996; Bjarnadóttir et al., 2013).

During the CORIBAR expedition (RV Maria S. Merian, 08/2013), we run a dense grid of PARASOUND sub-bottom echosounder profiles across the contourite drift and took 8 sediment cores (Hanebuth et al., 2013). The aim was to analyse the environmental processes involved in the history of this depocenter in terms of bottom-flow pattern and intensity, of material source and transport routes, and of palaeoceanographic control.

The body shows two major depocenter separated by the transverse-oriented elevation of a buried grounding-zone wedge, with the western major accumulation centre being 35m thick. The lateral continuity of the sub-bottom reflectors in combination with high-resolution sediment-core scans (magnetic susceptibility, density, XRF) allows for a dense-spaced and robust correlation framework.

Whilst the southern margin of the contourite body is rising and attached to the southern flank of the Kveithola Trough, the northern margin is controlled by a well-developed moat (Fig. 2). The internal strata pinch out here and bed condensation clearly indicates how the confined bottom current has controlled deposition here from the very beginning.

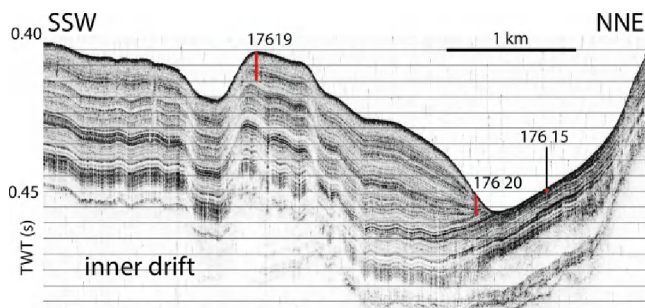


FIGURE 2: CORIBAR PARASOUND profile across the inner part of the Kveithola Drift. Note the abrupt pinch-out of the internal reflectors towards the northern flank where a pronounced moat has formed. The locations of some GeoB sediment cores are indicated by red bars.

The contourite body itself shows a two-stage stratigraphic formation history. The upcoming analysis of the sediment cores, which cover all stratigraphic levels of the contourite drift, will allow insight into the stratigraphic changes as well as into lateral variability of bottom sediment transport control for the entire time of formation.

CONCLUSIONS

A former modelling study has suggested that the gravity-driven bottom-flow conditions inside the modern Kveithola Trough result in a complex pattern of bottom-flowing eddies (Fohrmann, 1996). By combining our long-term architectural investigations and short-term depositional pattern with existing oceanographic data sets and the former bottom-flow simulation, we will be able to investigate:

- How this contourite drift has formed
- Which major environmental forces have control on sedimentation;
- How these conditions have fluctuated on short time-scales;
- How they have varied during the past several thousands of years.

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