Evolution of the Kveithola sediment drift inside a glacially-carved trough (NW Barents Sea)

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Abstract

Kveithola is a glacially-carved, E-W trending trough located in the NW Barents Sea, an epicontinental shelf sea of the Arctic Ocean located off northern Norway and Russia. A set of confined sediment drifts (the "Kveithola Drift") is located in the inner part of the trough. In general, drift deposits are commonly characterized by high lateral continuity, restricted occurrence of hiatuses and relatively high accumulation rates, and thus represent excellent repositories of paleo-environmental information. We provide for the first time a detailed morphological and seismostratigraphic insight into this sediment drift, which is further supported by some preliminary lithological and sedimentological analyses. The complex morphology of the drift, imaged by combining all available multibeam data, includes a main and a minor drift body, two drift lenses in the outer part of the trough, more or less connected drift patches in the innermost part and small perched sediment patches in a structurally-controlled channel to the north. The seismic (PARASOUND) data show that the main and minor drift bodies

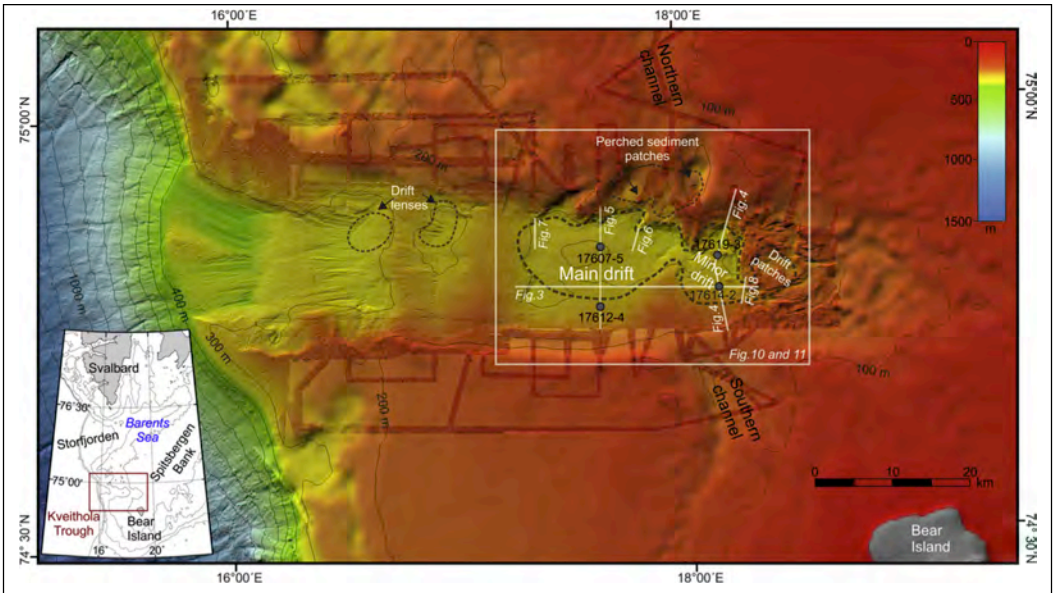

Figure 1: *Bathymetric map of the Kveithola Trough produced using all available multibeam datasets (see text for details) superimposed onto IBCAO data (Jakobsson et al., 2012). Grid size: 20 m for depth less than -700 m depth and 40 m for deeper data; vertical exaggeration: 2.7; Light Direction Attitude 35°; Azimuth -30°. A dashed black line indicates the outline of the Kveithola drift bodies. Location map of the study area is shown in the bottom-left corner.*

are mainly well-stratified, characterized by sub-parallel reflections of moderate to high amplitude and good lateral continuity. The reflectors show an abrupt pinch-out on the northern edge where a distinct moat is present, and a gradual tapering to the south. Internally we identify the base of the drift and four internal horizons, which we correlate throughout the drift. Two units display high amplitude reflectors, marked lensoidal character and restricted lateral extent, suggesting the occurrence of more energetic sedimentary conditions. Facies typical for contourite deposition are found in the sediment cores, with strongly bioturbated sediments and abundant silty/sandy mottles that contain shell fragments. These characteristics, along with the morphological and seismic information, suggest a strong control by a bottom current flowing along the moat on the northern edge of the drift. Though both Atlantic and Arctic waters are known to enter the trough, from the west and the north respectively, brine-enriched shelf water (BSW)

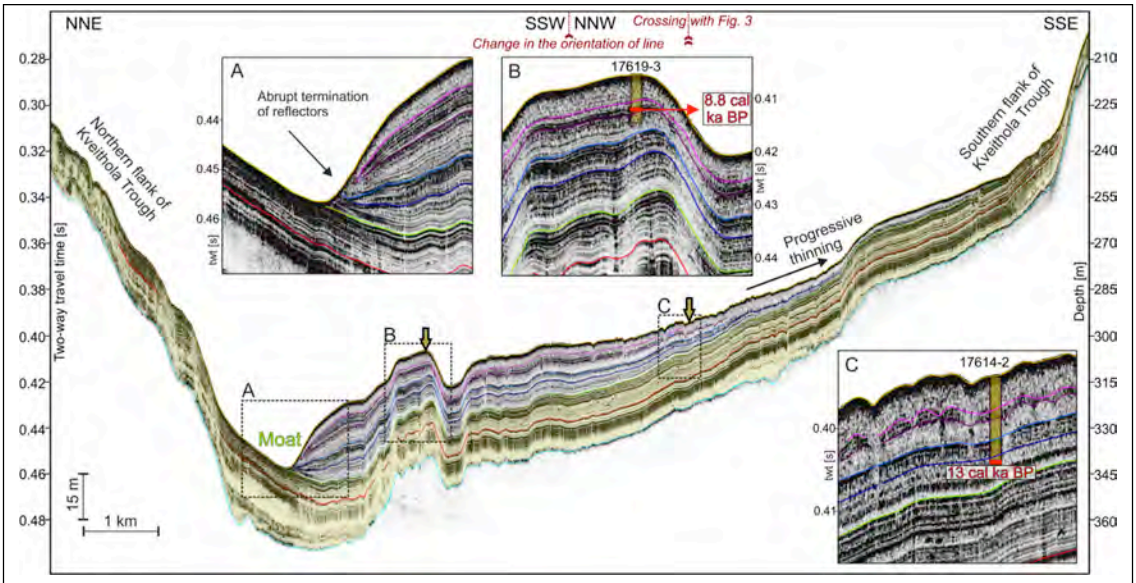

Figure 2: *Transversal NNE-SSW PARASOUND profile across the main Kveithola Drift body. The drift shows an abrupt pinch out towards the moat on the northern edge and a progressively thinning tail on the southern edge. Locations of core GeoB17607-5 from the central (expanded) part of the drift and of core GeoB17614-2 from the marginal (condensed) part of the drift are also shown. See location in Fig. 1.*

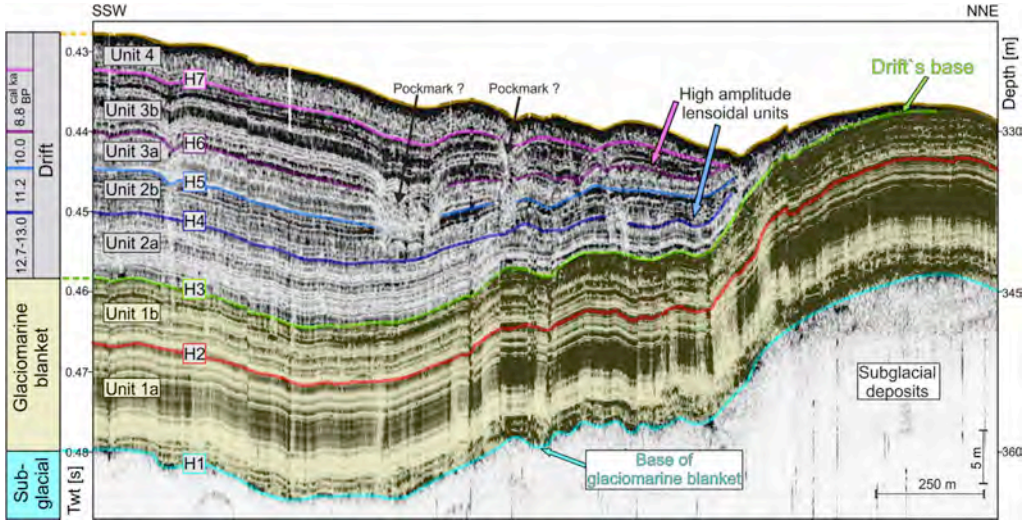

Figure 3: *Close up of NNE-SSW PARASOUND profile across the northern edge of the Kveithola Drift. Identified seismic horizons and intervening units are indicated. The available datings are indicated in the column to the left. The relatively minor extent and higher amplitude of Units 2.b and 3.b are apparent. See location in Fig. 1.*

produced during winter and flowing westward in the moat, is suggested to be responsible for the genesis of the Kveithola Drift . The formation of BSW is inferred to have started around 13 cal. ka BP, the onset of drift deposition, suggesting that conditions leading to atmospheric cooling of the surface waters and/or the presence of coastal polynyas and wind or floating ice shelves have persisted on the western Barents Shelf since that time. The units inferred to have been deposited under more energetic sedimentary conditions (tentatively dated to the Younger Dryas and to 8.9-8.2 cal ka BP) are suggestive of stronger BSW formation. In general, we infer that variations in the bottom current regime were mainly related to BSW formation due to atmospheric changes. They could also have been a response to successive episodes of grounded and sea ice retreat that allowed for a first limited, later open shelf current, which progressively established on the western Barents Sea shelf.

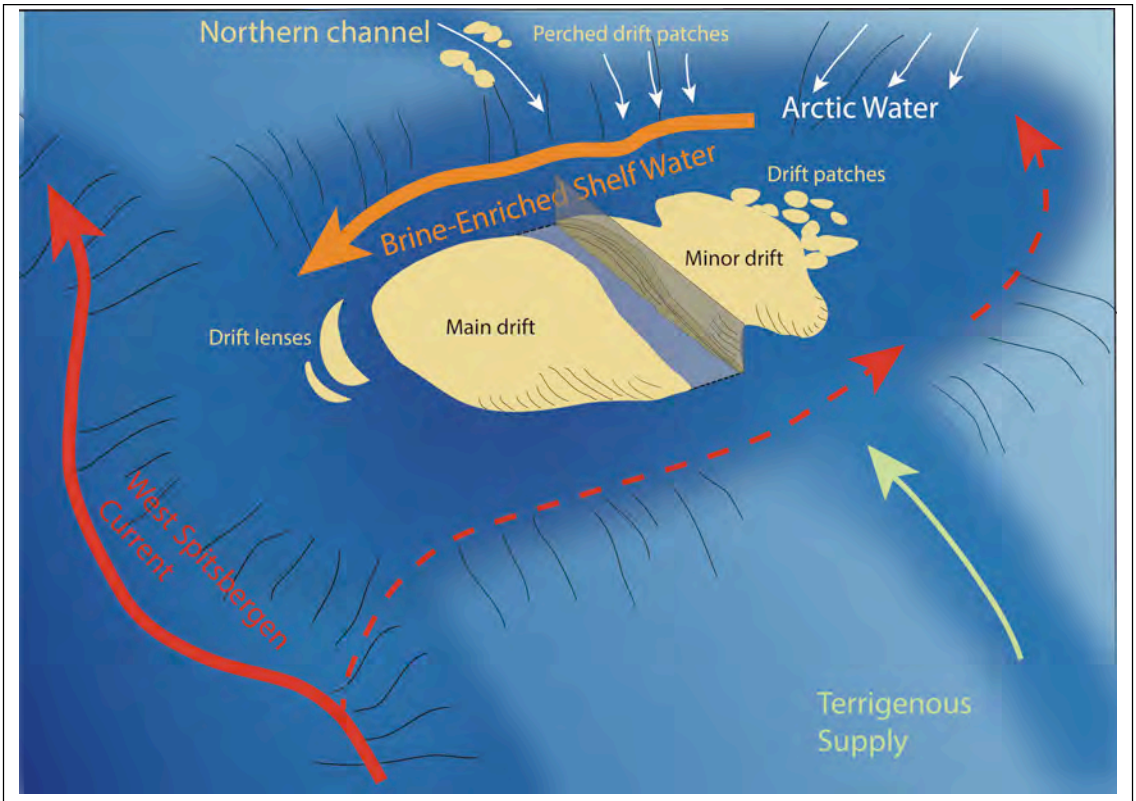

Figure 4: *Schematic diagram of the inferred currents in the Kveithola Trough area. A branch of theWest Spitsbergen Current (WSC) (red arrow), may enter the trough, follow the bathymetry and turn west on the northern side. In white is the cold Arctic surface water coming from the north. Bottom current flow (orange arrow) within the moat to the north of the Kveithola Drift is inferred to be comprised of brine-enriched shelf water spilling from morphological shelf depressions to the north of the Kveithola Trough. A possible preferential terrigenous supply (mainly through a structurally controlled southern channel) is also shown (light green arrow).*

References

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