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Grounding zone system in outer Bjørnøyrenna, Barents Sea – constraints on its genesis and timing

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A 200 km wide grounding zone system in outer Bjørnøyrenna (Bear Island Trough), south-western Barents Sea, has been investigated using 2D high resolution seismic, sediment gravity cores, regional swath and large scale bathymetry data. Observed sediment facies and three radiocarbon dates from the base of glacimarine units indicate glacier proximal conditions in outermost Bjørnøyrenna between 16,800 and 15,800 cal yrs.
The bathymetry data sustain a division into a frontal wedge with a complex morphology of arcuate ridges and depressions, and an upstream part of the wedge characterized by mega scale glacial lineations. A high resolution seismic transect reveals elevation of the sediment deposit of up to 35 m over downstream seafloor and a longitudinal extend of roughly 30 kilometers for the part of the wedge with substantial thicknesses - corresponding to the hummocky frontal wedge. The lobate outline of the sediment wedge together with the arcuate ridge morphologies have earlier led to the hypothesis that the wedge was made of separate lobes which are partly overlapping. The lack of on-lapping strata in a high resolution cross sectional seismic line does however rather suggest the entire wedge to consist of one body of sediment. Based on the distinct morphology and internal structures we infer that the system was deposited during a sudden readvance of the ice front where mega scale glacial lineations have been formed under the grounded ice while pushing and squeezing of soft diluted sediment were the major depositional mechanisms for the hummocky frontal part of the wedge.
10 sediment gravity cores have been recovered from the area. Facies analyses enable the localization of subglacial, glaciproximal, and glacimarine environments in the cores downstream from the wedge, while generally thin non-glacial covers illustrate the Holocene erosive regime on the continental shelf. AMS dates on bulk benthic foraminifera from the bottom of glacimarine units in three of the downstream cores yielded calibrated radiocarbon ages ranging from 16,764 to 15,854 years BP. Following the inferred readvance the ice stream front may therefore have been stable over approximately a thousand years before it retreated further.
Strikingly all facies considered to be of subglacial origin on the basis of shear strength, water and clast content, as well as their position with respect to the sediment wedge contain mud pellets. These pellets, differing from the surrounding matrix in color but not in grain size composition, are suggested to have been expelled during an episode of basal freeze-on of the ice stream. Similar till pellets have been described by Farmer and Cowan (2008) from subglacial facies recovered from the ANDRILL site 1-B under McMurdo ice shelf, Antarctica. Dewatering of till sediments due to basal freeze-on of grounded ice is the favoured mechanism for the subglacial formation of till pellets. Subglacial freeze-on has been suggested based on shear strength variations of tills on the mid-Norwegian shelf by Sættem et al.(1996).

References

Farmer, R.K. and Cowan, E.A., 2008. Morphology and Grain Composition of Sand-Size till Pellets from ANDRILL Core AND1B, Ross Sea, Antarctica, 2008 Joint Meeting of The Geological Society of America, Soil Science Society of America, American Society of Agronomy, Crop Science Society of America, Gulf Coast Association of Geological Societies with the Gulf Coast Section of SEPM. Session 146-15. Poster 122.
Sættem, J., Rise, L., Rokoengen, K. and By, T., 1996. Soil investigations, offshore mid Norway: A case study of glacial influence on geotechnical properties. Global and Planetary Change, 12(1-4): 271-285.