Glacial morphology and bathymetric mapping in Melville Bay, Western Greenland

Caroline Bringensparr

Department of Geological Sciences, Stockholm University

AIM OF STUDY The purpose of this study was to use depth and reflectivity data from a multibeam echo sounder to map the morphology and surface sediment of the seafloor as well as to search for evidence of a grounded ice sheet during the Last Glacial Maximum.

SETTING The data was acquired in June 2013 during the VEGA Expedition and the survey area is located off the coast of Western Greenland, in the southern part of Melville Bay and covers approximately 140 km^2 of seafloor (Fig 1).

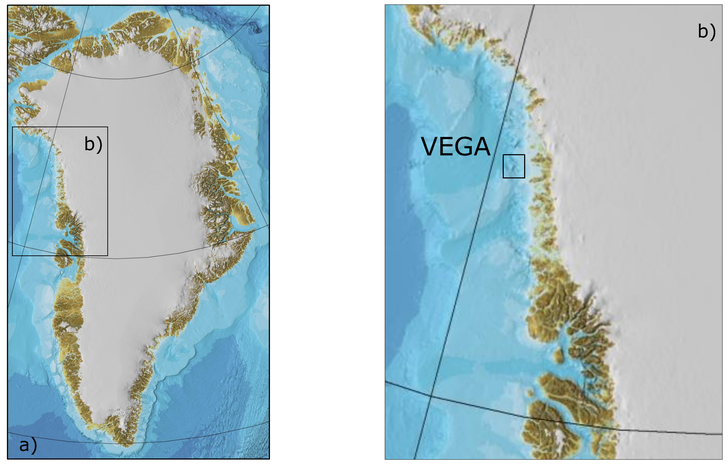

Figure 1 a) Location of survey area for the VEGA expedition, southern Melville Bay, western Greenland. b) Magnification of Melville Bay, with survey area marked out (IBCAO v 3.0, Jakobsson el al., 2012).

METHODS The raw bathymetry data from the VEGA expedition were cleaned and processed in Fledermaus. The data was put together to a 3D-model of the seafloor, which formed the basis for the inter-pretations made concerning the glacial morphology. The reflectivity (backscatter) data was used to per-form a so called Angular Range Analysis – used for classifying sediment types, to define areas of similar sediment composition.

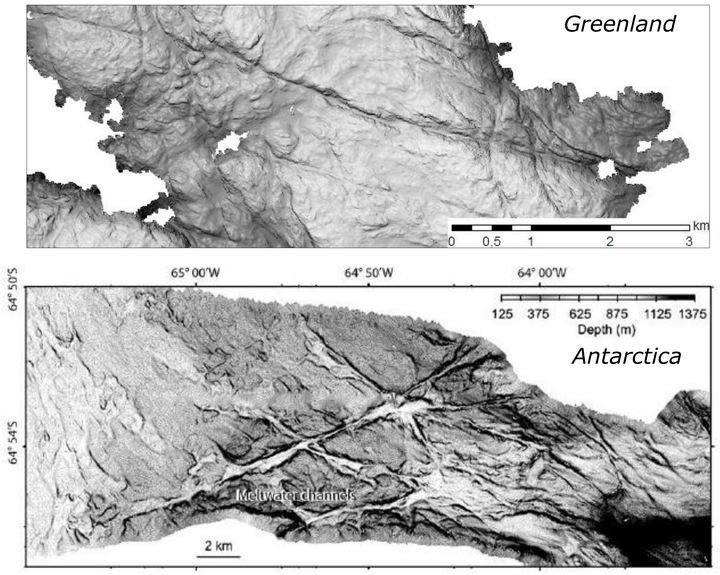

Figure 2 Similarities between melt-water channels in a) Melville Bay and b) Palmer Deep Outlet Sill, Antarctica (Livingstone et al., 2012). Note scale difference!

GLACIAL MORPHOLOGY Within the survey area there were several signs of former glacial activity, among others melt-water channel systems carved into the bedrock (Fig 2), as well as channels formed by the erosional effect of flowing ice-streams (Fig 3).

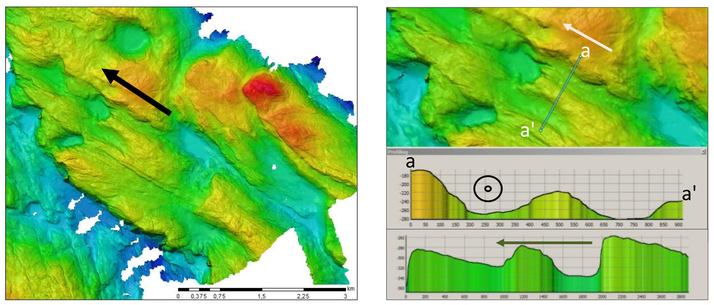

Figure 3 Arrows indicate estimated ice flow direction towards NW. b) Cross-(a-a') and length-profile of an ice channel showing U-shape and over-deepened terraces.

SEDIMENT DISTRUBUTION The Angular Range Analysis divided the area into three parts, where the surface layer consisted of gravel, silt or clay, with coarser grains in the deeper narrower parts and finer grains in the flatter shallower parts of the survey area (Fig 4).

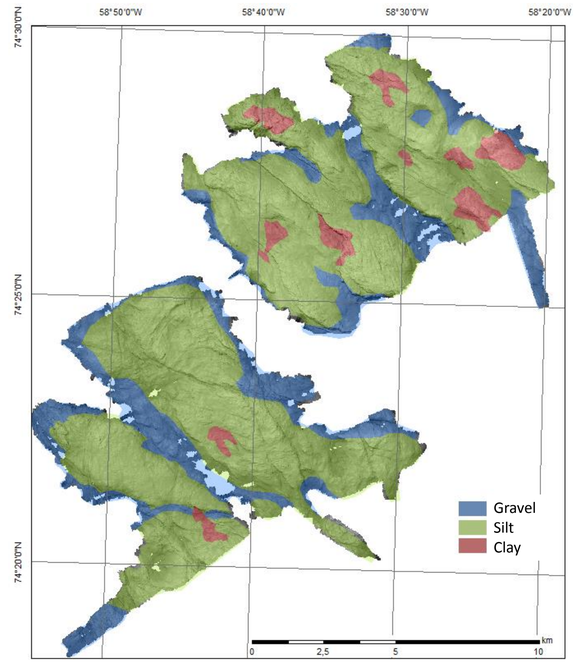

Figure 4 Results from the Angular Range Analysis (ARA), where the backscatter strength was used to estimate surface sediment type.

CONCLUSIONS The majority of the features in the survey area is likely relict landforms that have been further enhanced by glacial erosion during the last glacial. It is likely the erosion was concentrated to areas of locally softer bedrock, or to joints and faults.

The Angular Range Analysis presents results that sug-gests this classification method might not be suitable for hard seafloor with a thin sediment layer, although this cannot be confirmed without bottom samples.

References

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caroline@bringensparr.se