Late Quaternary patterns of deglaciation in Clyde Inlet, eastern Baffin Island

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INTRODUCTION

The maximal extent of the Laurentide Ice Sheet (LIS) on eastern Baffin Island during the Last Glacial Maximum (LGM) has been widely debated during the last decades as different palaeoglaciological models have been proposed (Gilbert, 1982; Miller et al., 2002; Dyke et al., 2004; Li et al., 2011; Brouard and Lajeunesse, 2016). However, little is known in regards to how the LIS margin retreated after the LGM on Baffin Island shelf. Understanding past ice sheet dynamics is important since it could provide an analogue to modern ice sheet behaviour, i.e., Antarctica and Greenland (Margold et al., 2015). This project aims at reconstructing the patterns of deglaciation along the fjord and cross-shelf trough of Clyde Inlet, a 180-km long system located on eastern Baffin Island (Fig. 1).

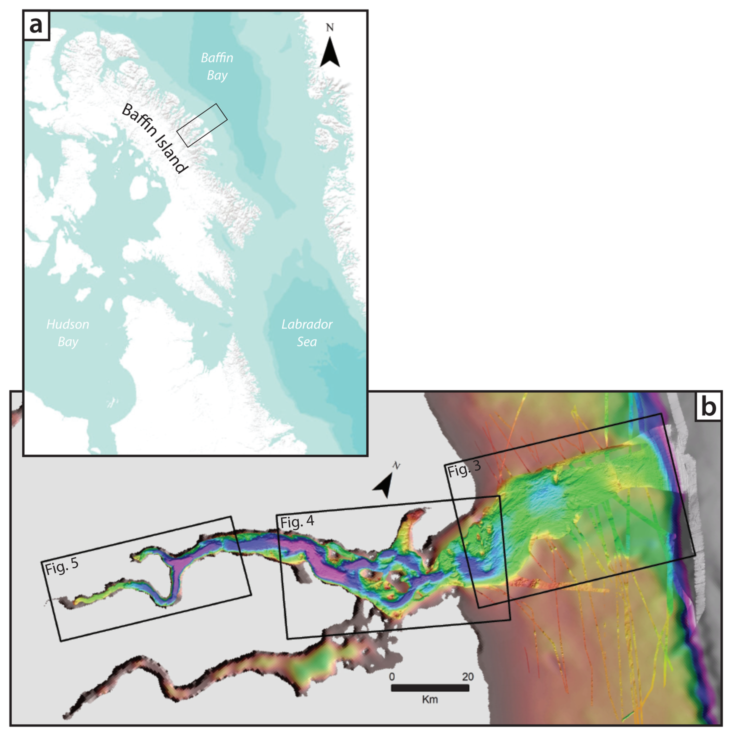

Fig. 1. a) Location of the study area within northeastern Canada. b) Map of the study area showing the coverage of swath bathymetry data.

METHODS

Swath bathymetry (Kongsberg EM 122) and acoustic sub-bottom (Atlas Parasound DS P-70) data were collected in 2017 during expedition MSM66 onboard the RV Maria S. Merian (Fig. 2). Additionally, we used swath bathymetry imagery from various cruises of the CCGS Amundsen (Kongsberg EM 302; Fig. 2) and RV Nuliajuk (Kongsberg EM 2040) from 2003 to 2016.

Fig. 2. RV Maria S. Merian (on the left) and CCGS Amundsen (on the right).

RESULTS

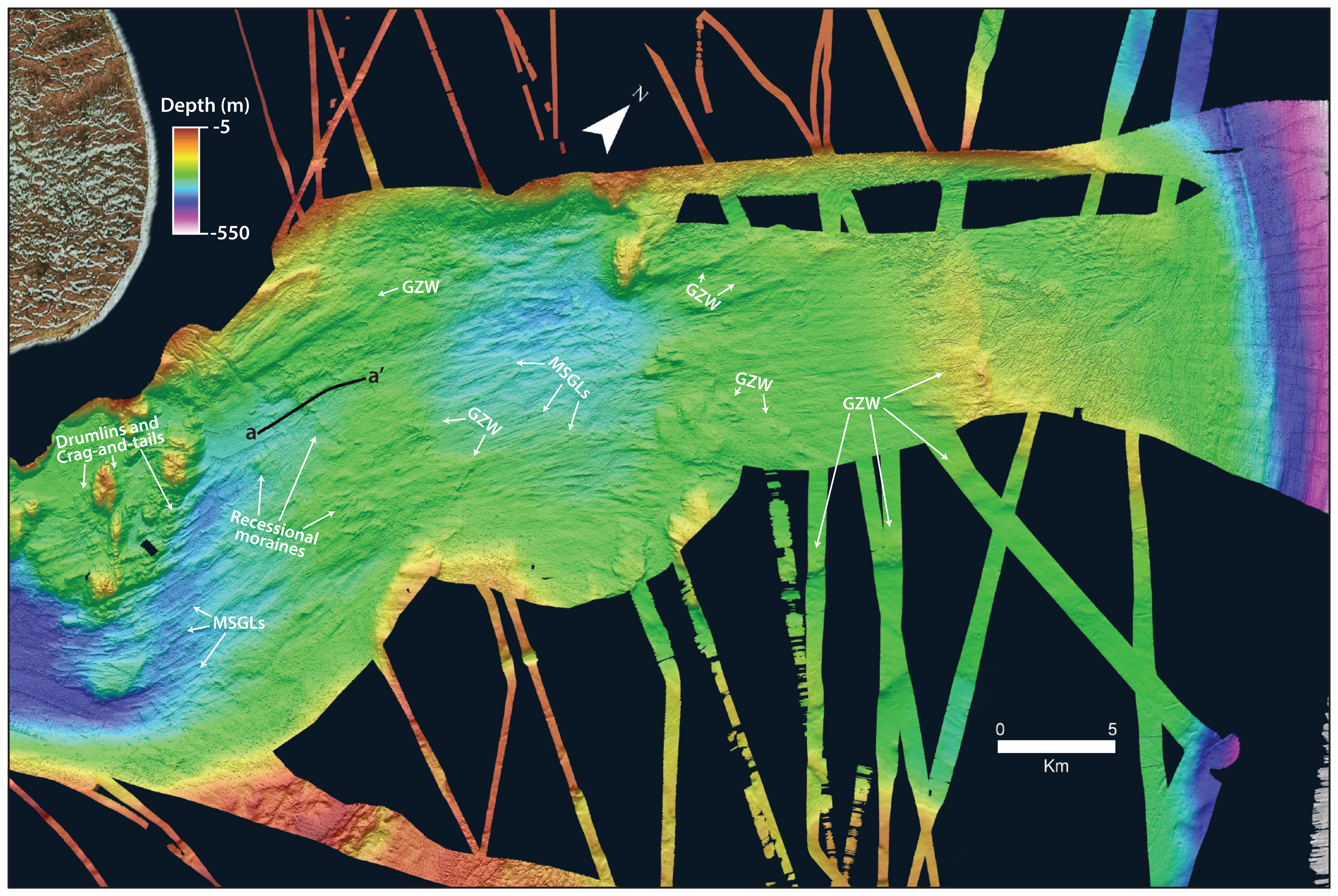

Fig. 3. Clyde Trough swath bathymetry showing the assemblage of ice-contact and elongated landforms. The black line represents the acoustic sub-bottom profile in Fig. 6 (a - a').

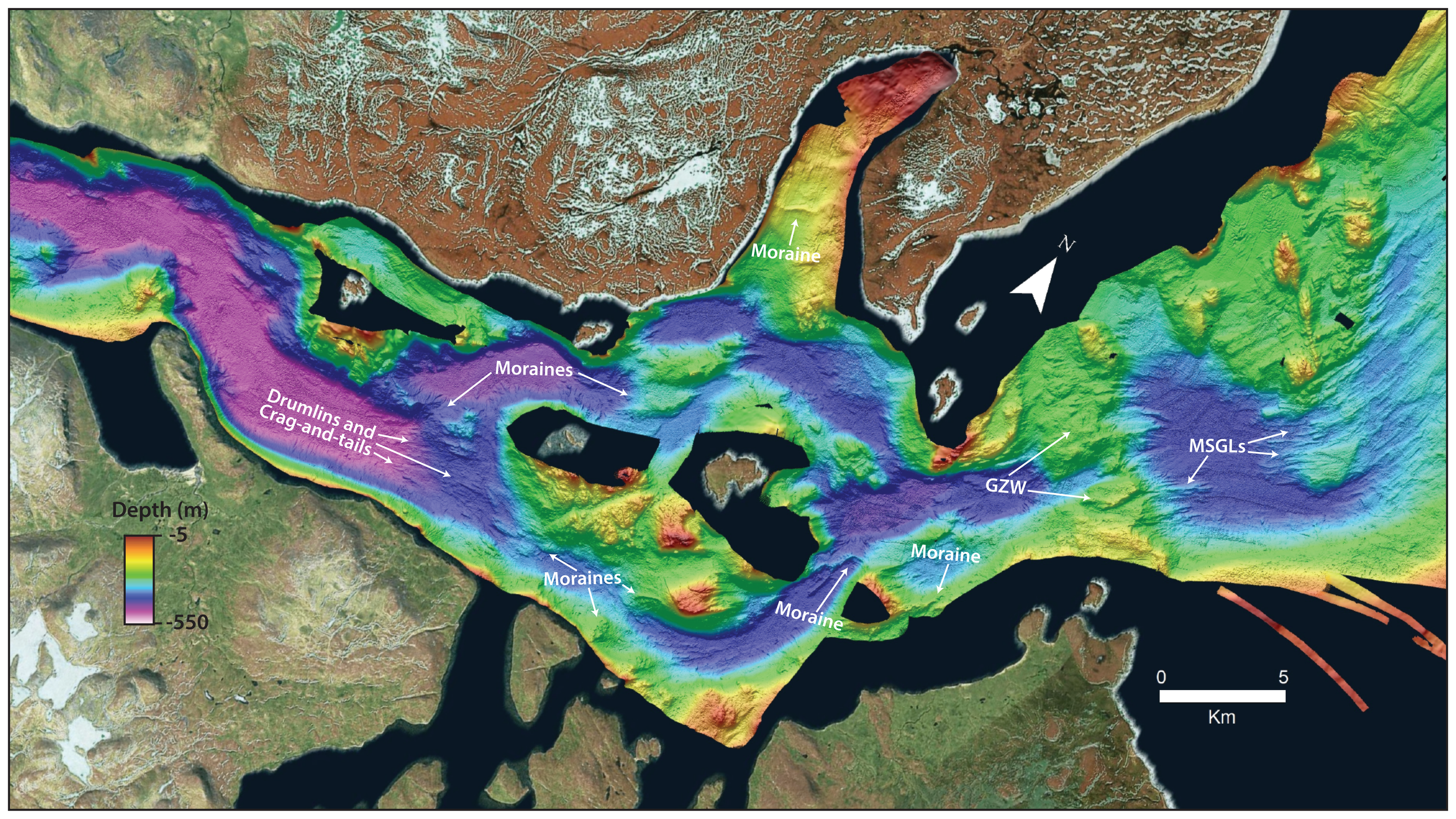

Fig. 4. Outer Clyde Inlet swath bathymetry showing ice-contact and elongated landforms.

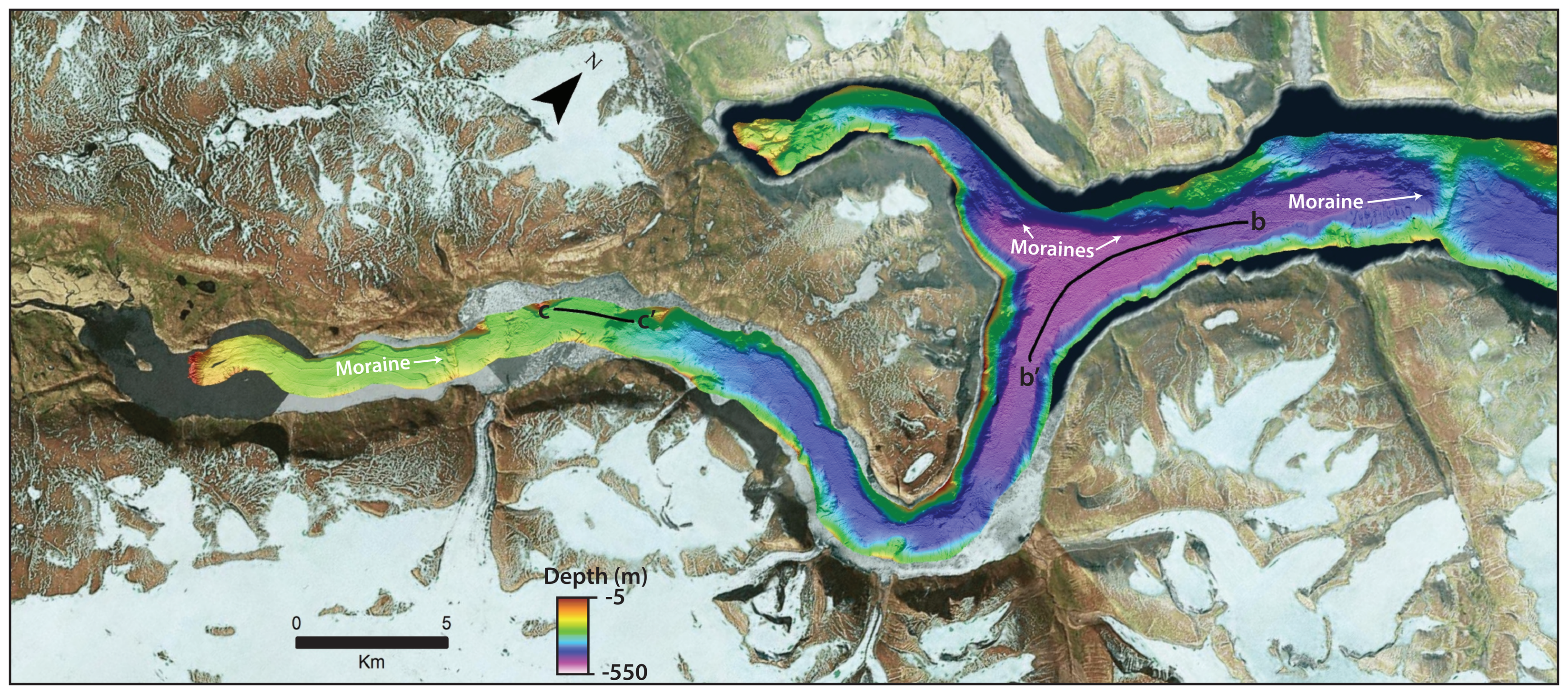

Fig. 5. Inner and middle Clyde Inlet swath bathymetry showing moraine deposits. The black lines represent acoustic sub-bottom profiles in Figs. 7 (b - b') and 8 (c - c').

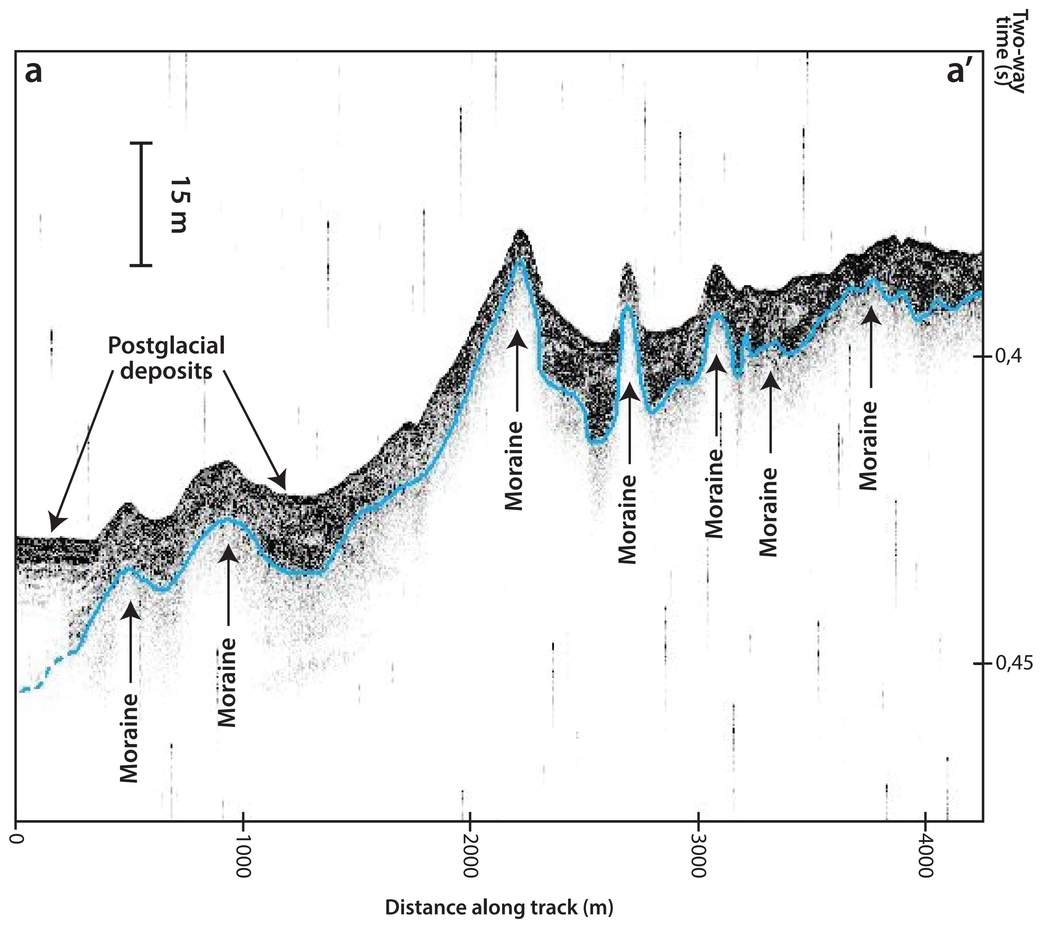

Fig. 6. Acoustic sub-bottom profile in Clyde Trough showing recessional moraines on a GZW. The blue line represents the top of the ice-contact deposits unit. The dashed blue line is used where uncertainties remain.

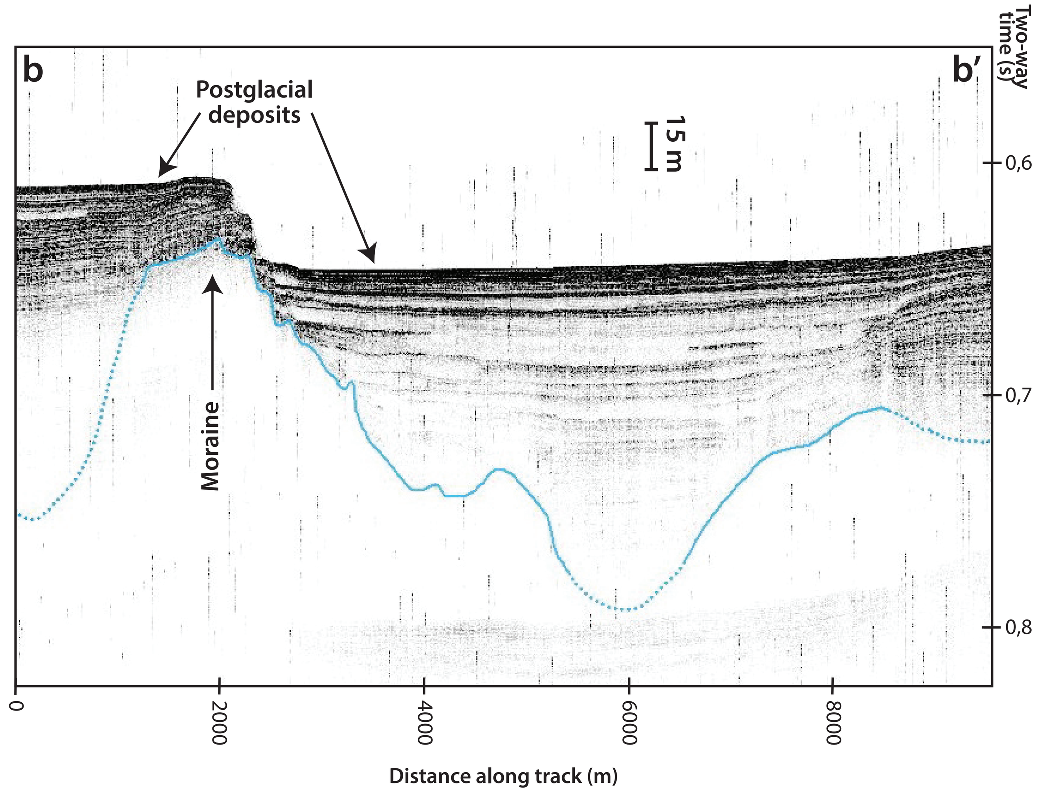

Fig. 7. Acoustic sub-bottom profile in middle Clyde Inlet showing a moraine covered by a thick layer of fine laminated sediments. The blue line represents the top of the ice-contact deposits unit. The dashed blue line is used where uncertainties remain.

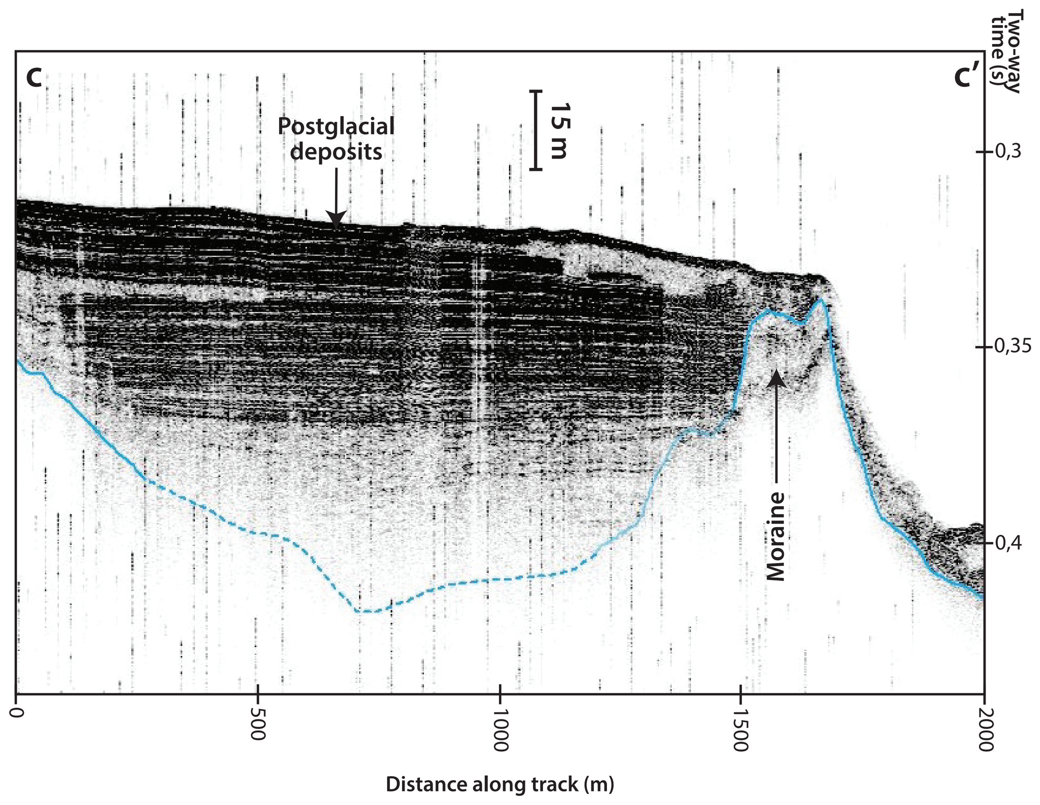

Fig. 8. Acoustic sub-bottom profile in the southern branch of inner Clyde Inlet showing a moraine covered by fine laminated sediments. The blue line represents the top of the ice-contact deposits unit. The dashed blue line is used where uncertainties remain.

DISCUSSION

Elongated bedforms, such as mega-scale glacial lineations (MSGLs), drumlins and crag-and-tails, show that ice streaming was effective in Clyde Trough (Fig. 3).

The late Wisconsinian deglaciation was marked by long-term (centennial- to millenial-scale) stabilizations and slow decay of the LIS, as suggested by the grounding-zone wedges (GZWs) and the recessional moraines observed in the trough (Figs. 3 and 6).

A major GZW at the mouth of the fjord suggests that topography/bathymetry have influenced ice sheet dynamics (Fig. 4). Results from Briner et al. (2007) indicate that the LIS retreated from the mouth of the fjord ca. 11.7 ka BP, at the end of the Younger Dryas chronozone.

Our data allow the observation of at least five moraine systems in the fjord, indicating that the early Holocene retreat of the ice margin was marked by several stillstands and/or readvances of the ice front (Figs. 4, 5, 7 and 8).

CONCLUSIONS

Swath bathymetry imagery and sub-bottom profiles collected in Clyde Inlet show that ice streaming was active until late into the deglaciation. Also, the moraine systems in the fjord suggest that ice retreated in a less catastrophic pattern than previously proposed. Ice dynamics might have been influenced by topography and sea-land interactions, as well as climatic forcings.

Sediments cores were also collected onboard the RV Maria S. Merian for further analyses and will provide a chronological framefork on the deglacial history and processes of eastern Baffin Island.

ACKNOWLEDGEMENTS

We are thankful to the captains, crews and scientific participants on the different cruises for their help and support during the expeditions. This project was funded by Deutsche Forschungsgemeinschaft (DFG) grants to B.D. and C.G. for ship time, as well as by ArcticNet Network of Centers of Excellence, Natural Sciences and Engineering Council of Canada (NSERC) and Sentinelle North grants to P.L.

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