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Session12: Geological records of ocean and ice sheet change from the Ross Sea

The dynamism of valley glaciers along the Borchgrevink coast (North Victoria Land, Antarctica) archived in the offshore Quaternary seabed landforms and within the Miocene buried glacio-fluvial delta

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The area of study stretches for 60 - 80 km offshore the Borchgrevink coast in the North-Western Ross Sea from about 73°20' S to 72°36' S of latitude. It is a significant zone for its location within the tectonic Northern Basin and the proximity to the Drygalski Trough, where repeated oscillations/ice grounding events of the AIS (Antarctic Ice Sheet) from the south and of North Victoria Land glaciers from the west occurred during the Late Neogene.

The sparse already available geophysical data were combined with seismic, chirp and multibeam data collected during the 2017 OGS/Explora survey (GLEVORS PNRA project, Glacial EVOlution in the north-western Ross Sea, offshore North Victoria Land - Antartica). Such data were integrated with the collection of two sediment gravity cores, acquired north of the Coulman Island, and with oceanographic measurements (currents by vessel mounted Acoustic Doppler Current Profiler and temperature by Expendable Bathythermograph probes), gathered mostly in the outlet area of the Borchgrevink valley glacier and in the middle of the Drygalski Trough.

This study aims at investigating the deglaciation of the coastal glaciers offshore the Borchgrevink coast, and reconstructing the paleo ice drainage in the area since at least the Lower Pliocene(?) through Quaternary to LGM.
In particular, seismic data recently acquired have highlighted the presence of a coastal composite Grounding Zone Wedge (GZW) which formed during the pauses in the LGM grounding-line retreating of the Borchgrevink and Mariner glaciers, and the existence, northward, of a smaller and isolated grounding wedge deposited in front of the Tucker glacier.

The studied Borchgrevink coastal valley glaciers in the Quaternary time were not coalesced, and probably they advanced and retreated asynchronously: the northern sedimentary wedge of the Tucker glacier is indeed interpreted older than the southern one. Ice-distal small-scale recessional landforms, as arcuate moraines and corrugation ridges, record peculiarities of deglaciation in this area. The Holocene ice flowing lines pattern is recorded in the morpho bathymetry that shows 1) the glacial lineations imprinted within the Drygalski Trough and 2) those lineations, partially superimposed and with a radial orientation, left on the coastal composite grounding zone wedge. The ice marginal and proglacial domains of the northward-flowing Mariner-Borchgrevink glaciers are displayed in the composite GZW and in the more distal zone, which merges into the subglacial domain of the southern ice streams and is variously affected by icebergs ploughmarks.
Under the larger GZW of the inferred Borchgrevink-Mariner glaciers a buried wedge feature appears to continue down-dip a gentle paleo slope and is interpreted as the highest part of a Pliocene(?) old

fluvioglacial delta system. This ancient delta built-up at the edge of wet-based still-standing glaciers by successive sediments outwashes. It deposited over the regional unconformity RSU2 of ANTOSTRAT (Brancolini et al.,1995) and was preserved by the successive glacial erosion, remaining embedded within the extensive prograding glaciomarine clinoforms of the Antarctica Ice Sheet (AIS) ice streams (4.75 - 3.4 Ma or 2 - 0.71 Ma?) that repeatedly advanced to the continental shelf edge.

References

Brancolini, G., Cooper, A.K., Coren, F., 1995. Seismic facies and glacial history in the Western Ross Sea (Antarctica). In: Cooper, A.K., Barker, P.F., Brancolini,G. (Eds.), Geology and Seismic Stratigraphy of the Antarctic Margin. Antarctic Research Series, vol. 68. American Geophysical Union, Washington, D.C., pp. 209–233.