Lost, but found: A large WAIS drainage basin existed in the southern Bellingshausen Sea during the last glacial period

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The southern Bellingshausen Sea is a poorly studied area of the West Antarctic continental margin. Multibeam swath bathymetry data and sub-bottom acoustic profiles collected on research cruise JR104 with RRS *James Clark Ross* revealed the existence of a major glacial trough ("Belgica Trough") on the continental shelf and an associated trough mouth fan on the adjacent slope. Mega-scale glacial lineations, drumlins and grounding-zone wedges indicate that Belgica Trough represents the former pathway of a grounded ice stream, which was fed by ice draining through Eltanin Bay and Ronne Entrance and which advanced to the shelf break during the last glacial period. These studies revealed that, in contrast to the present drainage pattern of the WAIS, ice flow into the southern Bellingshausen Sea played a significant role during past glacial periods.

Over the last years numerous sedimentological analyses have been carried out on marine sediment cores recovered during cruise JR104. The investigations included core logging, measurements of physical properties, grain-size analysis, determination of organic and inorganic carbon content, analysis of clay mineral assemblages, and AMS ^{14}C dating of calcareous (micro-)fossils and the acid-insoluble fraction of the bulk organic matter (AIO). Our results indicate that the shelf sediments reflect a whole suite of (sub-)glacial and glaciomarine environmental settings as they comprise deformation tills (deposited at the base of the ice stream), sub-ice shelf diamictons (deposited subsequently to the retreat of the grounding line), iceberg turbates, transitional sediments (deposited during the transition from subglacial to glaciomarine conditions), and post-glacial sediments (deposited under seasonally open-water conditions).

Provenance analysis of the fine-grained terrigenous sediment fraction (clay minerals) revealed glacial and glaciomarine transport processes and pathways. The clay mineral assemblages in the diamictons are remarkably homogenous at each particular core site. However, the clay mineral contents in the deformation tills vary significantly between core sites with no clear spatial pattern recognizable. This geographical heterogeneity suggests that during past glacial periods the ice stream flowing through Belgica Trough did not always drain the same source area in the West Antarctic hinterland and that the subglacial diamictons have different ages. The catchment area of the ice stream may have changed geographically either within the last glacial period or from one glacial period to another. The clay mineral composition within the transitional sediments changes from an assemblage similar to that in the subglacial sediments to an assemblage resembling that in the post-glacial sediments. We used this clay mineralogical fingerprint to identify samples that we assume to provide reliable ages for ice retreat from the shelf. The AMS ^{14}C ages of the AIO from six cores point to deglaciation of the outer shelf at ~26 ka B.P., the middle shelf at ~19 ka B.P., Eltanin Bay at ~12 ka B.P., and Ronne Entrance at ~7 ka B.P.. This timing of ice retreat indicates a relatively early and prolonged deglaciation of the southern Bellingshausen Sea.