224

DEPOSITIONAL MODEL FOR SEDIMENTATION BENEATH THE MCMURDO ICE SHELF IN WINDLESS BIGHT, ROSS SEA REGION.

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Sedimentological, geochemical, microfaunal and geotechnical measurements combined and radiocarbon ages from two cores collected through hot water drill holes in the Windless Bight region of the McMurdo Ice Shelf allow us to reconstruct its history since the LGM. The two sites are 5 and 12 km southeast of the present ice shelf calving line in a water depth of ~930 m. The oldest sediment recovered (~24-18 Ky) is diamicton, which contains trace amounts of fragmented and reworked biogenic-silica and is largely derived from material originating in the Transantarctic Mountains (TAM). This material was deposited beneath the ice shelf during a period when the calving line was several hundred km to the north and the grounding line much closer, or even surrounding the bathymetric deep core sites. Interestingly, and unlike glacial age diamicts elsewhere on the Ross Sea continental shelf, this material is not over-consolidated, suggesting that the ice sheet may not have grounded in this region.

Most of the overlying deglacial and Holocene age (<18 Ka) sediment is fine sandy mud with present to common biogenic silica remains (notably diatoms), indicative of deposition in, or near open-water as the calving line retreated during deglaciation. Biogenic productivity is high in McMurdo Sound, and ocean current measurements suggest such fine material could easily be transported under the ice shelf to the core sites. However, the increasing abundance of coarse sand and gravel grains in both cores from ~3 Ka to the present day cannot be easily explained in terms of ocean transport. The most likely scenario is one where the proportion of sediment derived from basal debris from glaciers on both the TAM and Ross Island increased greatly during this period. This corresponds with a relative decrease in the abundance of biogenic silica, perhaps indicating a reorganisation of ice sheet and ocean dynamics at that time.