The calm, cool deep:

Direct observation of ice, ocean and sea floor sediments under the Ross Ice Shelf, Antarctica

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Abstract:

The last time anybody took the measure of water circulating under the Ross Ice Shelf, the Queen of England was celebrating her Silver Jubilee and Robert Muldoon was claiming that a hostile media cost his party votes in an election he nevertheless won.

40 years later, the Queen has gone sapphire, the third estate is complicated, and a team of New Zealand scientists and engineers was at 80S, 174 E, using hot water to drill through the ice shelf once again. Over 2 weeks, observed characteristics of the ice; made repeated CTD, current, and turbulence measurements in the water under the ice shelf; sampled the water; installed an under-ice mooring; cored sea floor sediments (to 65 cm, also repeatedly); and made a suite of geophysical observations.

The boreholes are 500 m apart, aligned in the along-flow direction, in the glacier-left margin of the flow band from Liv Glacier, an outlet of the East Antarctic Ice Sheet that flows through the trans-Antarctic Mountains. The ice at the drill site is about 370 m thick. A ~40 m basal layer of bubble-poor ice containing unevenly distributed sediment was observed at both boreholes. Sediment collected from the reaming tools ranges from clay to cobble size. A very thin, ephemeral layer of new ice crystals was observed at the base of the ice shelf.

Water properties are similar to those observed in 1977 (at a site about 400 km away) but the layer structure is different. We observed 4 distinct zones in the water column: a ~30m thick cold, relatively fresh ice-shelf boundary layer; a homogenous benthic boundary layer ~20 to 40m thick; a ~150m linearly stratified lower mid-cavity zone that remained nearly constant over the period of repeated casts; and above this a finely structured upper mid-cavity zone with highly variable temperature.

Sea floor sediments demonstrate continuous sub ice-shelf conditions since the grounding line retreated past this site, interrupted by an ice regrounding event. We found reworked late Miocene to early Pliocene diatom fragments (preliminary), along with magnetic evidence for gradually declining benthic current strength.

School of Surveying
Te Kura Kairūri

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L1 Lecture Theatre
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