

## Using sub-ice-shelf sediments to reconstruct glacier history – a case study from Pine Island Glacier

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### **Abstract**

Only a handful of studies have successfully recovered sediment samples from beneath Antarctic ice shelves with published data limited to cores from beneath the Amery Ice Shelf, Novolazarskiy Ice Shelf and sediments recovered as part of major drilling efforts in the Ross Sea. The lack of data from these environments is surprising given their potential to record former grounding line positions, ice shelf history (i.e., thinning and retreat), changes in ocean circulation, as well as much needed boundary information about sub-ice shelf sedimentary processes. Over the past 5 years, we have collected sediment cores from beneath several Antarctic ice shelves (George VI, Larsen C, Pine Island Glacier and Filchner-Ronne) in order to investigate ice shelf, ocean and grounding line history. Sediments were recovered using a BAS-designed percussion corer, which has proved to be enormously effective and simple to deploy. Here we present an overview of these sediments with specific emphasis on cores recovered from beneath Pine Island Glacier ice shelf. Three 20-cm-diameter holes were drilled through the 400- to 500-m-thick ice shelf (sites PIG A-C) and sediment cores were recovered at each sites. Sites A and C were located on the seaward flank of the prominent sea floor ridge thought to be the last point of grounding, and site B was located on its landward side. All cores record an abrupt change in sedimentation which is related to the glacier unpinning from the ridge. We show that the present thinning and retreat of Pine Island Glacier is part of a climatically forced trend that was triggered in the 1940s (Smith et al., 2017). Incursion of marine water beyond the crest of this ridge, forming an ocean cavity beneath the ice shelf, occurred in  $1945 \pm 12$  years with final ungrounding of the ice shelf from the ridge occurring in  $1970 \pm 4$  years. The initial opening of this ocean cavity followed a period of strong warming of West Antarctica, associated with El Niño activity. An important implication of our finding is that even when climate forcing weakened, ice-sheet retreat has continued.

**Keywords:** ice shelf history, grounding line retreat, CDW

### **References**

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