Records of ice retreat: diatom-based messages from the Antarctic continental margin

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Marine sediments from the Antarctic continental shelf archive oceanographic responses to changes in the cryosphere and provide a blueprint for anticipated changes in the Southern Ocean in response to a warming atmosphere and changing oceanic regimes. Diatom abundance and assemblage data are direct evidence used for paleo- ice shelf, ice sheet and sea ice reconstructions. First, lack of light beneath ice shelves prohibits photosynthesis. Consequently, absolute diatom abundance tracks changes in overlying ice cover, an approach used to reconstruct the contrasting Holocene histories of the Larsen A and B ice shelves. A post-breakout layer of diatom debris at the sea floor records the recent development of a seasonally sea-ice covered setting, fueling pelagic and benthic ecosystems. The persistence of Larsen B stands in contrast to the ephemeral nature of Larsen A, providing insight into the relative stability of ice shelves and forces leading to their collapse. Second, at the end of the last glacial period, grounded ice retreated rapidly along ice stream paths. This resulted in the formation of short-lived calving bay reentrants, where varved sediments with massive concentrations of Chaetoceros resting spores document meltwater stabilized surface waters with algal blooms potentially fertilized by iron, sourced from melting glacial ice. Finally, sub-marine exposure and post-glacial isostatic rebound of land previously covered by grounded ice may serve as an iron source, explaining early- to mid- Holocene blooms in the Antarctic Peninsula, comprised of a morphotype of Eucampia antarctica observed today in regions of natural iron fertilization associated with ocean island settings.