

Deglacial biogenic opal peaks revealing enhanced Southern Ocean upwelling

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Abstract

The Southern Ocean upwelling around Antarctica controls the exchange of carbon dioxide (CO₂) between the deep ocean reservoirs and the atmosphere, as well as the dissolved silicon communicate with the euphotic zone of the Southern Ocean. The silicon supply could limit the high-latitude Southern Ocean diatom opal productivity and the subsequent burial of biogenic opal in underlying sediments. Here we report two records of biogenic opal export off Prydz Bay, and thus upwelling, show pronounced enhancing during the past seven glacial terminations. In all seven cases, opal peaks are consistent with a classic Northern Hemisphere summer insolation intensity trigger for the retreat of northern ice sheets. Fresh water and icebergs entering the North Atlantic could change oceanic and atmosphere circulation and associated heat and carbon fluxes, causing in stronger upwelling, higher atmospheric CO₂ concentration and Antarctic temperatures that drive the termination in the Southern Ocean. Enhanced upwelling would have introduced the Si-rich signature to low-latitude surface waters via Antarctic Intermediate Water (AAIW) and Subantarctic Mode Water (SAMW), leading to subtropical North Atlantic deglacial opal peaks in similar age covering.

Keywords: Southern Ocean; ventilation; biogenic opal peaks; glacial termination.