

Subglacial carbon and nutrient fluxes fertilize the Southern Ocean under the Ross Ice Shelf

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Active subglacial water systems beneath the Antarctic Ice Sheet (AIS) ultimately drain into the Southern Ocean forming a conduit between subglacial and marine carbon and nutrient pools, and connecting continental and oceanic biogeochemical processes. The recent discovery of high concentrations of organic C (221 μM) and an active microbial ecosystem beneath the AIS in Subglacial Lake Whillans (SLW) allows us to include subglacial C and nutrient concentrations and the activities of subglacial microorganisms in estimates of subglacial-to-ocean C and nutrient fluxes. We show that subglacial organic matter contributes substantially to the dark ocean waters beneath the Ross Ice Shelf (RIS), where the availability of organic matter may limit rates of bacterial C mineralization. We demonstrate that fluxes of biologically relevant solutes from subglacial aquatic environments are sufficient to drive heterotrophic microbial activity locally (at the grounded margin of the West Antarctic Ice Sheet), and perhaps regionally (in the RIS subglacial cavity). We conclude that microbial activity in subglacial aquatic environments plays a key role in the fixation and mobilization of organic matter from beneath the AIS to the Southern Ocean.