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TITLE: Biogeochemistry and microbial diversity in the marine cavity beneath the McMurdo Ice Shelf, Antarctica

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ABSTRACT:

Ice shelves surround ? 75% of Antarctica's coastline and are highly sensitive to climate change; several have recently collapsed and others are predicted to in the near future. Marine waters beneath ice shelves harbor active ecosystems, while adjacent seas can be important areas of bottom water formation. Despite their oceanographic significance, logistical constraints have resulted in few opportunities to directly sample sub-ice shelf cavities. Here, we present the first data on microbial diversity and biogeochemistry beneath the McMurdo Ice Shelf (MIS) near Ross Island, Antarctica. Physicochemical profiles obtained via a 56 m deep borehole through the MIS revealed three vertically layered water masses (Antarctic Surface Water [AASW], Ice Shelf Water [ISW], and modified High Salinity Shelf Water [mHSSW]). Metabolically active, moderately diverse (Shannon diversity from 2.06 to 5.74) microbial communities were detected in the AASW and mHSSW. Heterotrophic bacterial production and dissolved organic matter concentrations were higher (12?37% and 24%, respectively) in mHSSW relative to AASW. Chemoautotrophic production was 5.3 nmol C L?1 d?1 and 6.0 nmol C L?1 d?1 in the AASW and mHSSW, respectively. Phytoplankton cells were more abundant and larger in the mHSSW sample relative to the AASW, which indicates sinking of phytoplankton produced in surface waters and, together with southerly flowing currents (0.09?0.16 m s?1), horizontal advection of phytoplankton from McMurdo Sound. Advected phytoplankton carbon together with in situ chemoautotrophic production provide important sources of organic matter and other reduced compounds to support ecosystem processes in the dark waters in the ice shelf cavity.

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