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Biogas (CO₂, O₂, dimethylsulfide) dynamics in spring Antarctic fast ice

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Limnol. Oceanogr., 52(4), 2007, 1367-1379 | DOI: 10.4319/lo.2007.52.4.1367

ABSTRACT: We studied the temporal variations of CO₂, O₂, and dimethylsulfide (DMS) concentrations within three environments (sea-ice brine, platelet ice-like layer, and underlying water) in the coastal area of Adélie Land, Antarctica, during spring 1999 before ice breakup. Temporal changes were different among the three environments, while similar temporal trends were observed within each environment at all stations. The underlying water was always undersaturated in O₂ (around 85%) and oversaturated in CO₂ at the deepest stations. O₂ concentrations increased in sea-ice brine as it melted, reaching oversaturation up to 160% due to the primary production by the sea-ice algae community (chlorophyll *a* in the bottom ice reached concentrations up to 160 μg L⁻¹ of bulk ice). In parallel, DMS concentrations increased up to 60 nmol L⁻¹ within sea-ice brine and the platelet ice-like layer. High biological activity consumed O₂ and promoted the decrease of partial pressure of CO₂ (pCO₂). In addition, melting of pure ice crystals and calcium carbonate (CaCO₃) dissolution promoted the shift from a state of CO₂ oversaturation to a state of marked CO₂ undersaturation (pCO₂ < 30 dPa). On the whole, our results suggest that late spring land fast sea ice can potentially act as a sink of CO₂ and a source of DMS for the neighbouring environments, i.e., the underlying water or/and the atmosphere.

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