ABSTRACT

Life in the cold and dark: carbon cycling in ice-covered Antarctic lakes
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Photosynthetically driven carbon fixation is the primary mechanism through which organic carbon enters most ecosystems; however, carbon fixation in the absence of light (dark C-fixation) has also been observed in aquatic ecosystems, including the permanently ice-covered lakes of the Taylor Valley, Antarctica (Fryxell and Bonney). Dark C-fixation is typically considered to be negligible when compared to carbon fixation via photosynthesis, and is commonly subtracted out as background. Dark C-fixation rates were between 9 and >100% of light carbon fixation rates in the photic zone of Lake Fryxell, and between 2 and 78% of light carbon fixation rates in the Lake Bonney photic zone. A majority of the dark C-fixation occurred in the bacterial size-fraction, implying that chemolithoautotrophic microorganisms are responsible. The geochemical environment of Lake Fryxell, which includes a sulfide gradient and oxic-anoxic interface, is particularly suited to support chemolithoautotrophic bacteria. Results show that dark C-fixation in Lake Fryxell is reduced by as much as 94% by adding nitrapyrin, which blocks some chemolithoautotrophic metabolisms by inhibiting the oxidation of ammonia to nitrite. Dark C-fixation by chemolithoautotrophic microorganisms may be important in supplying organic carbon to Taylor Valley lakes during the dark Antarctic winter.