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Influence of iron on glacier ice algae growth, color and photophysiology

Glacier ice algae of the genus *Ancylonema* are the main primary producers on glacier ice surfaces, where they thrive under harsh conditions, including high irradiation and low nutrient availability. They produce the dark pigment purpurogallin to protect themselves from high irradiation, thereby darkening large areas of the ice surface. This leads to a reduction in ice surface albedo and an associated enhanced surface melting. The increase in surface meltwater, in turn, promotes algal growth, resulting in a positive feedback loop accelerating the melting of glaciers and ice sheets. One essential, and possibly limiting, trace metal for microalgae on the Greenland ice sheet is iron, which plays a vital role in several cellular processes including photosynthesis. In this study, we used laboratory *Ancylonema* cultures to investigate the influence of iron on glacier ice algae growth, color and photophysiology. Media supplementation with iron did not significantly influence growth rates or photophysiology of the cells but contributed to the transition of cell color from green to brown. Preliminary analyses of extracted hydrophilic pigments indicated that the glacier ice algae formed purpurogallin in culture, which will be further confirmed using mass spectrometry. Analysis is underway to evaluate if intracellular iron precipitates could also be a cause for the change in color. Furthermore, scanning electron microscopy will be used to evaluate changes in cell morphology and ultrastructure linked to variations in iron availability. The results from the laboratory study will also be compared to an iron addition experiment performed on the Greenland ice sheet with environmental samples of glacier ice algae.

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