METAGENOMIC ANALYSIS OF ALGAL COMMUNITIES INHABITING THE NEAR SURFACE AQUIFER OF AN ALASKAN GLACIER

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Phototrophs in supraglacial algal blooms have been studied extensively due to their role in new carbon production and darkening ice, which accelerates further melting. To date, algal blooms on ice surfaces have received the most attention; however, surficial environments represent only a portion of the liquid habitat on glaciers and ice sheets. For instance, solar radiation absorbed by ice in the ablation zone of glaciers generates internal meltwater, creating a near-surface aquifer that stores meltwater during summer months. According to previous studies, the flux of photosynthetically active radiation through several meters of ice is sufficient to support photosynthetic activity. In this study, I used metagenomic sequence data collected from samples of the Matanuska Glacier's (Alaska) near-surface aquifer in 2014 and 2015 to conduct a taxonomic and functional analysis of microbial communities of the weathering crust aquifer. Using small subunit ribosomal RNA genes, I show that phototrophs were highly abundant in near surface ice. Phylogenetic analysis showed that the two most abundant taxa are closely related to *Ancylonema nordenskioeldii* (93.14-100% identity), a species of green algae commonly associated with ice algal blooms, and *Ochromonas* CCMP 1899 (95.15-99.85% identity), a mixotrophic genus of golden algae isolated from Antarctic Sea ice. A functional analysis based on gene content showed the samples contained genes for photosynthesis, light harvesting, and carbon fixation, confirming the potential for light-based autotrophy in this ecosystem. When considered with other biogeochemical data collected in parallel with these samples, these results indicate that the habitat for glacier algae is not restricted to ice surfaces and extends several meters into the underlying porous ice. Future studies that measure rates of photosynthetic activity and rates of carbon remineralization in these ecosystems are important for constraining carbon fluxes from large ice masses and their downstream impacts to subglacial and proglacial watersheds.

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