Microbe-mineral interactions on the Greenland Ice Sheet: Implications for albedo and melting

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Ablation of the Greenland Ice Sheet (GrIS) is partly regulated by the presence of light absorbing impurities (LAI) on the ice sheet surface. Prominent among these LAI are pigmented ice algae[1], notably *Ancylonema nordenskiöldii* and Mesotaenium sp.[2] In order to better understand the controls on ice algal bloom development, the biogeochemical parameters of such supraglacial habitats must be constrained.

Mineralogy, aqueous geochemistry, nutrient availability, and algal biomass and community composition were characterized for surface ice samples collected ~35 km inland from the southwestern margin of the GrIS during the 2016 and 2017 melt seasons. Rietveld refinement of X-ray diffraction data indicates that the mineral dust comprises a complex composition, with rare earth element analysis indicating a primarily local provenance. Mineral dust contributes three-fold to ice sheet darkening: 1) minerals act as substrates for microbial life through cell attachment to surfaces; 2) mineral nutrient delivery closely mirrors the abundance of organic carbon (algal biomass proxy); and 3) ferromagnesian mineral phases act as LAI in their own right. These results help us better constrain what drives ice algal blooms to occur at mineral dust and glacial meltwater interfaces, and have implications for linking algal growth to ice sheet albedo and melt rate forecasting.[3,4]

[1]Williamson et al. *FEMS Microbiol. Ecol.* 94(3) (2018). [2]Lutz et al. *Microbial Genomics* 2018(4). [3]Cook et al. *J Geophys Res.* 122:434 (2017). [4]Tedstone et al. *The Cryosphere* 11:2491 (2017).