Phosphorus, not the limitation it was thought to be?

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Dissolved phosphorus concentrations are consistently reported as the least concentrated macronutrient in supraglacial environments and are often considered to limit microbial activity. Phosphorus is derived from rocks, and unlike nitrogen and carbon, this bioessential nutrient cannot be directly sequestered, by microorganisms, from the atmosphere. Yet, cryoconite, a substance comprised of rock-derived particles, is found in abundance in supraglacial environments. If microbes residing in supraglacial environments can mine particulate phosphorus (PP) from cryoconite, then it has the potential to supply enough phosphorus to facilitate the growth of microbes in these oligotrophic environments. To test this hypothesis, a snow microcosm experiment was conducted whereby cryoconite was added as a nutrient addition. The microcosms were sampled over four weeks. PP and DNA were extracted from the cryoconite, and meltwater was collected for dissolved nutrient analysis. PP was extracted in five fractionations, including potentially labile organic PP, to determine reactive and total phosphorus concentrations over time and to identify the most bioavailable fraction. DNA was extracted to determine the change in bacterial abundance and taxonomy associated with the cryoconite particles over time using 16S pPCR and amplicon sequencing respectively. Preliminary results suggest a remineralization of dissolved phosphorus onto the cryoconite, followed by a potential utilization of PP in the highly labile fractions. This is the only study to date to investigate potential labile organic PP in each fraction and the change in bacterial abundance and taxonomy associated with the cryoconite particles. This will help us better evaluate the nutrient limitation to microbial growth in supraglacial environments.