# Using HISH-nanoSIMS to probe trophic interactions in cryoconite sediments from the McMurdo Dry Valleys, Antarctica

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Icy systems are dominated by bacterial life; and yet little is known about the direct role of individual microorganisms in biogeochemical cycling from these environments and the effect on downstream aquatic ecosystems. Nutrient transfer from cryoconite is important, as glacial surface melt volumes will increase as a response to climate warming. Here we present a detailed investigation of microbial diversity, granule structure, and metabolic activity including single cell activity in cryoconite samples collected from the McMurdo Dry Valleys, Antarctica. Granules were analyzed by powder x-ray diffraction, step-wise thermogravimetric analysis, and reflection confocal laser scanning microscopy (CLSM). CLSM in combination with specific fluorescent stains enumerated and confirmed the association of microbial populations with sediment surfaces and the presence of biofilm. Carbon fixation and ammonia assimilation rates were determined at the single-cell level for *Oscillatoriales* and *Bacteroidetes* populations using Halogen In Situ Hybridization-Secondary Ion Mass Spectroscopy (HISH-nanoSIMS). $^{13}C$ fixation and $^{15}N$ uptake rates were calculated, and the successive uptake of released fixed carbon compounds by heterotrophic *Bacteroidetes* sp. was quantified. Collectively, these data indicate that cryoconite sediments are important reservoirs of organic carbon and nutrients for microbial activity and nutrient cycling on glacial surfaces.