Reuse and recycling: Resource allocation by *Cyanobacteria* in microbial mats

RHONA K. STUART[1*], X. MAYALI[1], J. Z. LEE[34], R. C. EVERROAD[4], M. LIPTON[2], A. BOARO[2], B. M. BEBOUT[3], J. PETT-RIDGE[1], P. K. WEBER[1] AND M. THELEN[1].

[1]LLNL, Livermore, CA, (stuart25@llnl.gov)
[2]PNNL, Richland, WA
[3]NASA Ames Research Center, Moffett Field, CA
[4]Bay Area Environmental Research Institute, Sonoma, CA

Cyanobacterial carbon excretion is crucial to carbon cycling in many microbial communities, but the nature and bioavailability of the carbon excreted is dependent on physiological function, which is often unknown. *Cyanobacteria* are the dominant primary producers in hypersaline mats and there is large reservoir of carbon in the extracellular matrix, but the nature and flux is understudied. We examined the macromolecular composition of the matrix of microbial mats from Elkhorn Slough in Monterey Bay, California. Metaproteomics revealed extracellular proteins of cyanobacterial origin that suggested cyanobacterial degradation of extracellular polymeric substances (EPS). In a cyanobacterial isolate from Elkhorn Slough (ESFC-1), we found further evidence for active, light-regulated degradation of EPS. We next used high-resolution imaging mass spectrometry (NanoSIMS) and found active uptake of EPS-carbon and EPS-nitrogen by this mat primary producer, ESFC-1. Based on these findings, we propose that mat *Cyanobacteria* store and recycle organic material from the mat extracellular matrix. *Cyanobacteria* are such a large percentage of the biomass in the mats, that their re-uptake of organic C and N has the potential to re-define carbon availability and turnover in these systems. This work has implications for cyanobacterial adaptation to dynamic environments like microbial mats, where uptake of carbon in variable forms may be necessary to persist.

Work at LLNL was performed under the auspices of the U.S. Department of Energy at Lawrence Livermore National Laboratory under contract DE-AC52-07NA27344.