Adsorption of biologically critical trace elements onto the marine cyanobacterium *Synechococcus* sp. PCC 7002

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It has been demonstrated that microbial biomass plays an important role in marine trace element cycling. The influence of microbes may be attributed to the dominantly negative surface charge of bacteria at pH values characteristic of seawater. Recent work has begun to more fully explore how microbial biomass acts as a sink for marine trace elements in modern and ancient oceans. Currently, the role of bacterial biomass as a potential exit pathway for trace metals from the oceans into ancient systems including black shales and banded iron formations remains understudied. Such studies are of importance for understanding exit pathways of first row transition elements which play critical roles in biological systems, specifically by their incorporation into metalloenzymes. In this study, we utilize the marine cyanobacterium *Synechococcus* sp. PCC 7002 as an analogue for Precambrian biomass in order to investigate the capacity of microbial biomass to remove the trace elements Zn, Cu, Ni and Co from seawater. Metal adsorption edge experiments were conducted over a pH range encompassing the modern ocean and the best estimates for Precambrian ocean conditions. Edges were derived for single and multi-element systems to provide insight on how the presence of each metal may affect the magnitude of adsorption onto the bacteria. These experiments allow for the characterization of the magnitude by which cyanobacteria are capable of removing these biologically important transition metals from solution, and the important implications for reconstructing Precambrian seawater from banded iron formations and shale records. Our results show that microbial biomass is capable of removing appreciable quantities of trace metals from seawater, and future focus shifts to using oceanic concentrations of bacteria and trace metals, competition among microbes, and the effect iron mineral precipitates in the water column may play in the overall sequestration of trace metals.