INTERACTIONS OF BIOGEOCHEMICAL CYCLES IN ONCOID MICROBIALITES FROM CUATRO CIÉNEGAS, MEXICO. J. R. Corman[1], V. Souza[2], and J. J. Elser[1], [1]Arizona State University, USA, (jrcorman@asu.edu), [2] National Autonomous University of Mexico (UNAM), MX

Introduction: Modern microbialite systems may provide unique opportunities to study the feedbacks that couple or uncouple multiple biogeochemical cycles. For instance, phosphorus plays an essential role in many cellular functions, particularly metabolism and replication. Therefore, its distribution can have a strong influence on primary production and the cycling of other bioessential elements. Furthermore, microbial physiology may constrain elemental uptake rates based on the stoichiometry of the organism's nutrition. However, in lithifying microbial systems, calcification may reduce microbial uptake of phosphorus by absorbing bioavailable phosphates from the environment into the mineral matrix. When phosphorus uptake is geochemical, and not biological, it is decoupled from biological stoichiometric constraints of nitrogen and carbon uptake. Thus, net fluxes of carbon, phosphorus, and nitrogen in an ecosystem may indicate whether biotic or abiotic processes are dominating ecosystem processes.

Field site and methods: Here we present results from a two-week manipulative experiment using oncoid microbialites from Cuatro Ciénegas, Mexico [Figure 1]. As a groundwater-fed, evaporitic aquatic system replenished by a carbonate aquifer, the waters of Río Mezquites are mineral rich, but extremely phosphorus poor. Ecosystem responses following treatments of high and low phosphorus or organic carbon were determined by assessing changes to primary production, microbial biomass and nutrient content, and microbial community structure.

Results and Discussion: Increases in gross primary production following experimental additions of low and high phosphorus confirmed that the oncoid microbialites are phosphorus limited. Increases in ecosystem respiration were detected in high phosphorus treatments and low phosphorus treatments supplemented with organic carbon. This suggests that, like autotrophs, heterotrophs are phosphorus limited, and that biotic feedbacks may rapidly influence biogeochemical cycling in microbialite ecosystems.

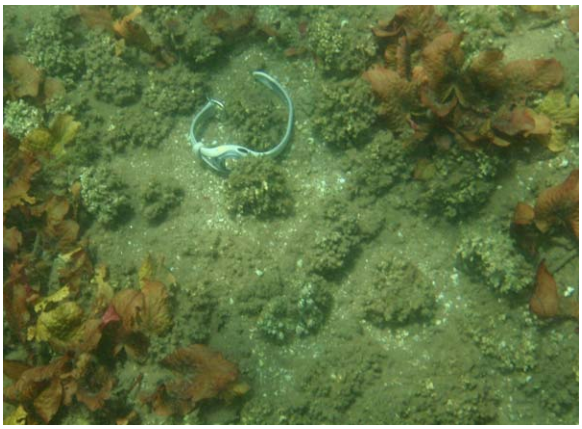

Figure 1. Oncoid stromatolites are found abundantly on the bottom of Río Mezquites, Cuatro Ciénegas, MX. Watch shown for scale. Photo by A. Corman.