Geochemical and Population Changes in a Hypersaline Microbial Mat Maintained at Lower Salinities

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Geological evidence in late Archean and Proterozoic rocks indicate that stromatolites dominated the biosphere for a significant period of Earth's early history. Modern laminated photosynthetic microbial mats serve as analogs of these early ecosystems[1], providing a basis for interpreting ancient biosignatures as well as providing insight into microbial interactions that may have facilitated changes in past geochemical cycling- most notably the rise of atmospheric oxygen and the production of reduced gases such as H_2 and CH_4[2].

At NASA Ames Research Center we have been characterizing microbial processes and populations in laminated *Microcoleus* cyanobacterial mats from marine hypersaline ponds in Guerrero Negro, Baja California Sur, Mexico by combining field-based measurements with studies of experimentally manipulated mats maintained in a greenhouse[3]. In order to examine the effects of salinity on processes and microbial community structure, *Microcoleus* mats were maintained over a six-month period under low (20 parts per thousand), intermediate (35 ppt) and 'normal' (85 ppt) salinities and studied using complementary methods including geochemical flux measurements, stable isotope and lipid biomarker analyses, and 16S rRNA gene libraries.

The gross productivity observed for these various treatments was the same within the statistical uncertainties. However, preliminary measurements indicate that low salinity mats released nearly twice the amount of DIC at nighttime under anoxic and oxic incubations. Higher DIC rates coupled with elevated levels of ester-bound fatty acids support the notion that low salinity mats contain greater numbers of metabolically active bacteria. Methane fluxes indicated that methanogenesis was initially stimulated in low salinity mats.

References:

1 Des Marais, DJ (1995). The biogeochemistry of hypersaline microbial mats. *Advances in Microbial Ecology*, 27: 473-503.

2 Hoehler, TM et al (2001). The role of microbial mats in the production of reduced gases on the early Earth. *Nature*, 412: 324-327.

3 Bebout, BM et al (2002). Long-Term Manipulations of Intact Microbial Mat Communities in a Greenhouse Collaboratory: Simulating Earth's Present and Past Environments. *Astrobiology*, 2(4): 383-402.