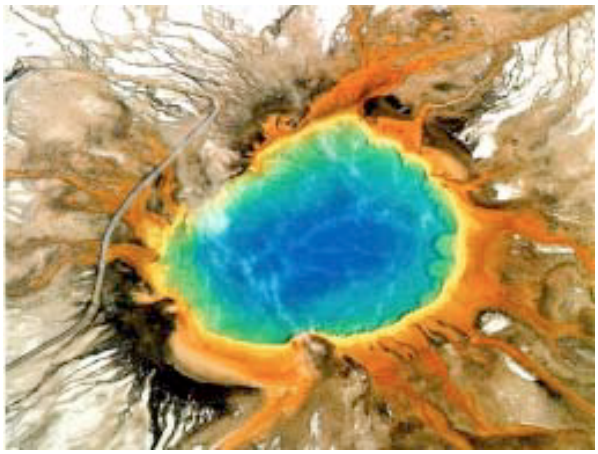
Organic Biomarker Preservation in Silica-Rich Hydrothermal Systems with Implications to Mars. L.L. Jahnke[1], M.N. Parenteau[1,2] and J.D. Farmer[3,] [1]NASA Ames Research Center, M/S 239-4, Moffett Field CA 94035 (linda.l.jahnke@nasa.gov), [2] SETI Institute, 189 Berardo Ave, Mountain View CA 94043, [3]School of Earth and Space Exploration, Arizona State University, Tempe AZ 85287.

The microbial community structure and preservation of organic matter in siliceous hydrothermal environments is a critical issue in astrobiology, given the discovery of potentially hydrothermal vents and silica on Mars. We have studied several silica-depositing hydrothermal ecosystems in Yellowstone National Park to characterize the extent of lipid biomarker biosynthesis within these microbial communities and its potential for preservation. The degradation/alteration products of organic biomarkers representative of microorganisms similar to those in Yellowstone are preserved within the sedimentary record of early Earth. The lipid carbon skeletons associated with hydrothermal microorganisms derive from membrane lipids. These hydrophobic molecules can be considered broadly characteristic of all aqueous-based life, extending potentially to an early wet Mars. By identifying phylogenetic diversity and establishing lipid biosignatures for extant microbial ecosystems, the diagenetic overprint associated with various depositional environments may be assessed and provide support for biological interpretation of organic matter preserved in ancient rocks on Earth and, perhaps also, on Mars.

Here we are interested in the microbial communities supported by the outflows of Clepsydra Geyser and Grand Prismatic Spring within the silica-depositing Lower and Midway Geyser Basins. A range of thermal outflow waters supports vast areas of diverse cyanobacterial primary productivity.



Grand Prismatic Spring: *Synechococcus* dominate production of smooth-mat in the higher temperature regions of outflow while below 55°C Oscillatoria-type '*Phormidium*' mats display a variety of morphological structure (e.g. streamers, tuffs). In the coolest distal margins of vent outflows, *Calothrix* form sheet-flow biofilm mats. Primary production supports highly diverse secondary community structure, which transforms organic input and lead to a 'secondary-alteration' biosignature.

Results: The *Phormidium* and *Calothrix* mats analyzed throughout this region are rich in cyanobacterial lipid biomarkers. Hopanoids are present primarily as bacteriohopanepolyols (BHP), which have C31 and C32 structures as both desmethyl and 2-methyl forms. Major alkanes include normal chain *n*-16 to *n*-19, mid-chain branched methylalkane (e.g. 5-, 6-, 7-methyl-heptadecane and 7,11-dimethylheptadecane), and a series of unsaturated C17-C19 (e.g. *n*-18:1, *n*-19:1, *n*-19:2). Analysis of pure cultures of *Phormidium* and *Calothrix* indicate that a variety of hopanoid structures are distributed in both genera, however, for alkane, the methylalkanes have only been detected in *Phormidium* cultures and unsaturated alkanes in *Calothrix* cultures.

Examination of several types of sinter mats including 1) surface silicified tuffed-*Phormidium*, 2) underlying/subsurface silicified tuffed-*Phormidium*, 3) flow-sheet *Calothrix* sinter over depth, and 4) downslope transects of both *Phormidium* and *Calothrix* flow-sheet sinter indicate a relatively good preservation of alkane and hopanoid biomarkers and of other cellular lipid components with exception of the subsurface sample (2).

The surface of *Phormidium* mat in the mid-terrace ponds of Clepsydra continually silicifies as vent channels migrate resulting in a topographic range from fully submerged tuffs to heavily silicified. The surface/entombed *Phormidium* cells exhibit excellent initial preservation potential. However, the organics within underlaying mat are rapidly degraded. On the more distal sheet flows, the *Calothrix* mats continually form and are buried by constant silica-deposition. The organic biomarkers present are representative of *Calothrix* but indicate the presence of *Phormidium* as well. Analysis of this mat over a 6 cm depth indicates excellent organic preservation during this burial. Variable biomarker composition was also noted. At Grand Prismatic, the *Calothrix* transect contained higher amounts of alkane relative to BHP, while those of *Phormidium* had higher BHP relative to alkane. Variations at each transect site were noted with depth. These and other results will be expanded and discussed within our presentation.