Survey of glycerol dialkyl glycerol tetraethers (GDGTs) in Nevada and California hot springs and selected thermophiles

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INTRODUCTION

Glycerol dialkyl glycerol tetraethers (GDGTs) are core membrane lipids of many Archaea and some Bacteria. They are ubiquitously found in many sediment types (Zink et al. 2010). Branching in GDGTs has been hypothesized to produce branched and isoprenoid tetraether lipids in hot spring sediments (Damsté, 2009). Weijers et al. (2009) demonstrated a niche for bGDGT-producing organisms in cooler, more acidic springs away from the hottest geothermal sources. In addition, a collection of eleven thermoacidophilic bacterial strains hypothesized to synthesize bGDGTs were tested, however, none synthesized bGDGTs under the tested conditions. Our data provides insight into the environmental conditions under which archaean and bacterial GDGTs are produced, which may improve the use of GDGTs as environmental proxies for understanding climates and conditions of the past and the future.

RESULTS

Forty sediment samples were collected from eight different hot springs.

- Sampling sites had temperatures ranging from 31 to 95°C and pH values ranging from 6.8 to 10.7, including high temperature geothermal sources, cooler samples in outflow channels, and cooler spring sources.

- Water samples were also collected at each site and analyzed for temperature, pH, Ca, Cr, Cu, Fe, K, Mg, Mn, Na, Ni, Sr, NO₂⁻, and NO₃⁻.

- Table 1: Selected Pearson’s parametric and Spearman’s nonparametric correlations between lipid types and geochemical analytes.

CONCLUSIONS

Relationships between GDGTs and pH
- Positive correlations between lipid GDGT-4 and pH
- Negative correlations between core GDGTs and pH

- Core GDGTs in hot spring sediments
  - Relationship between GDGTs and pH
  - Greenhouse gases control the distribution of archaeal tetraethers in terrestrial hot springs.

- Future work
  - More studies need to be conducted on this topic to further understand the distribution and function of GDGTs in hot spring environments.

REFERENCES


Table 1: Selected Pearson’s parametric and Spearman’s nonparametric correlations between lipid types and geochemical analytes.

Core lipids – represent “fossil” or old lipids

- The use of GDGTs as environmental proxies for understanding climates and conditions of the past and the future.

Future climate change
- Future climate change will have a significant impact on the distribution and abundance of GDGTs in hot spring environments.

ACKNOWLEDGEMENTS

This study is the most detailed biogeochemical survey investigating the distribution of GDGTs in hot springs to explore the relationships between GDGTs to environmental proxies within hot spring environments.

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