Methane Oxidation in Serpentinization-Hosted Ecosystems

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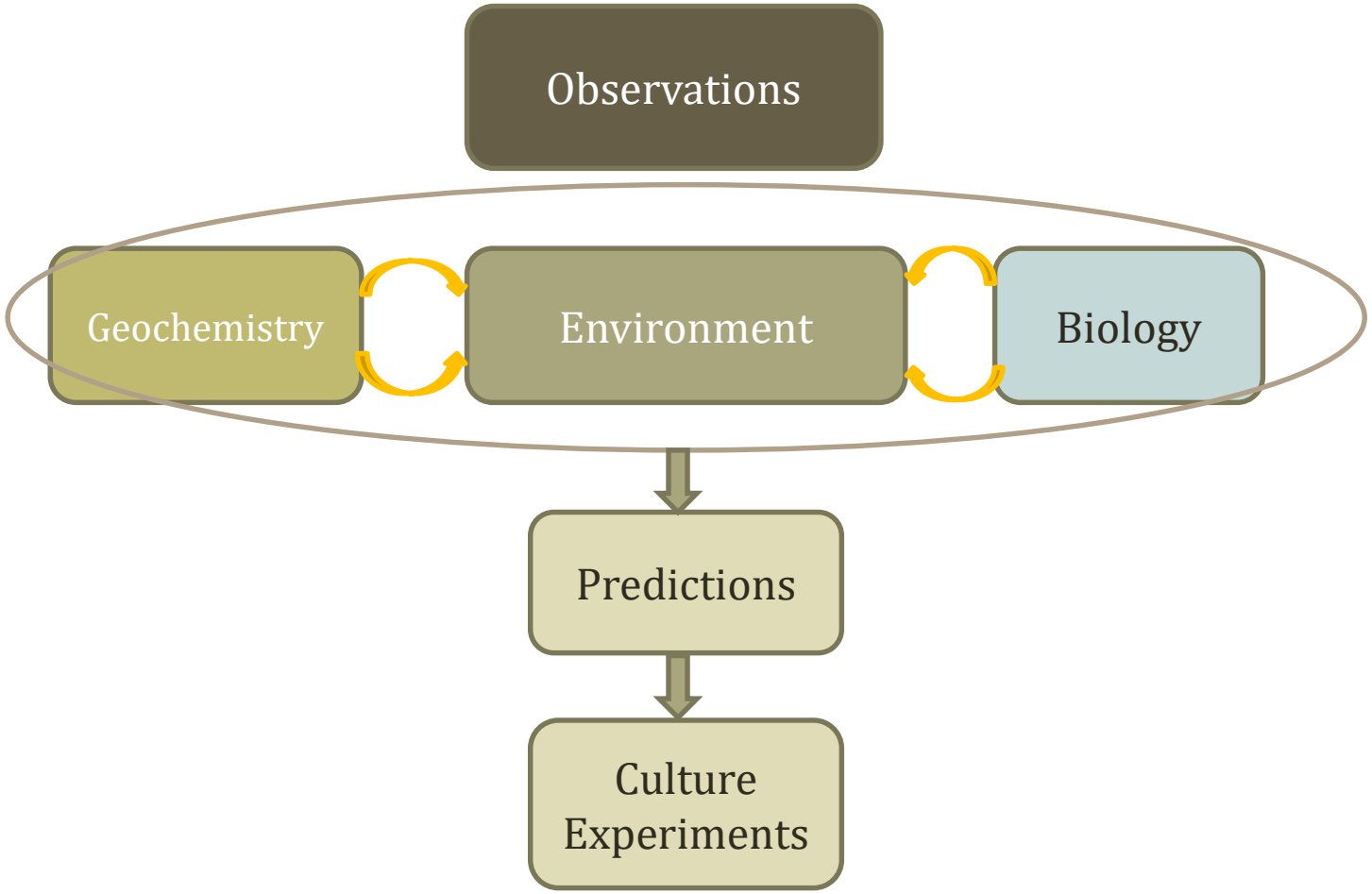
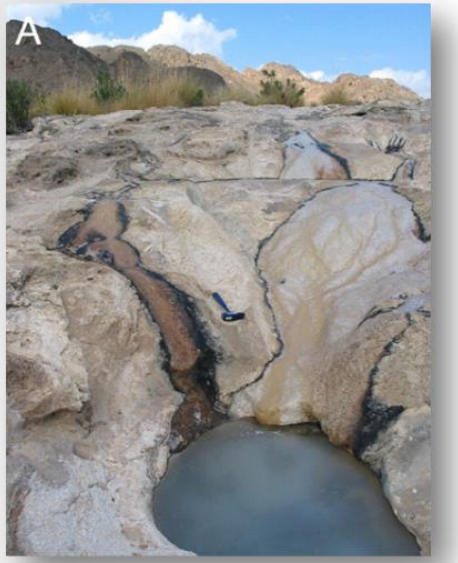
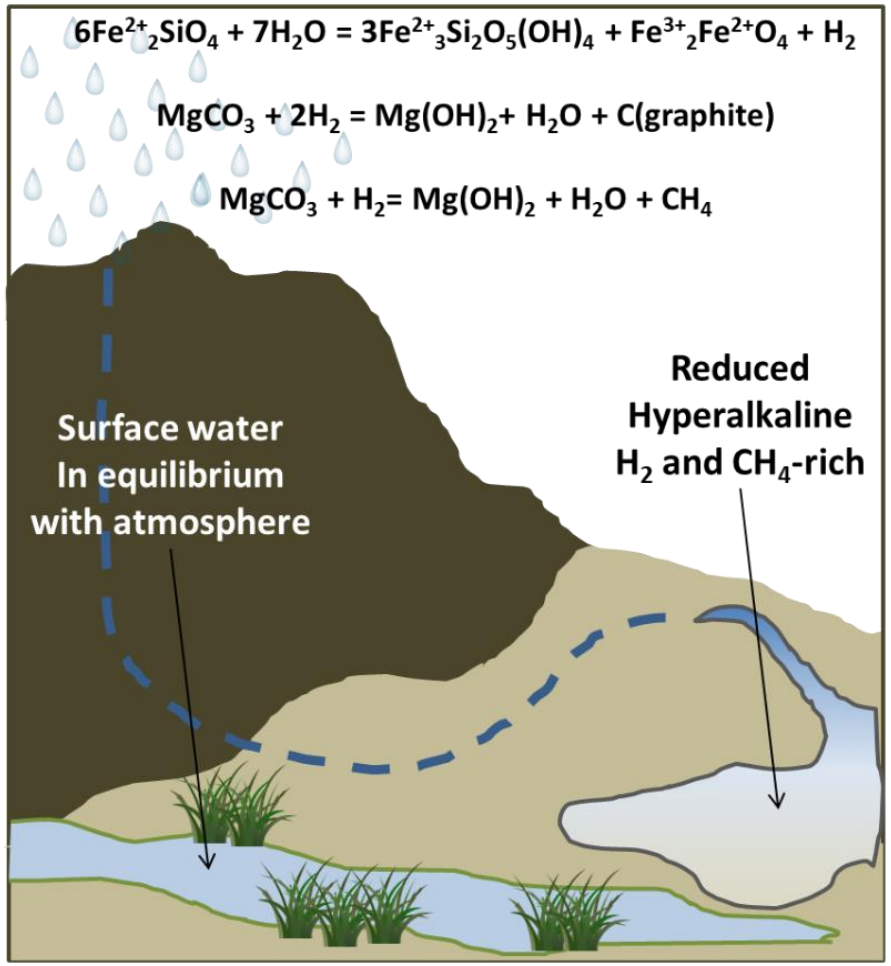
Culture Dependent Approach: Test Predictions from Environmental Observations



Serpentinization in the Oman Samail Ophiolite





Mixing = Disequilibrium

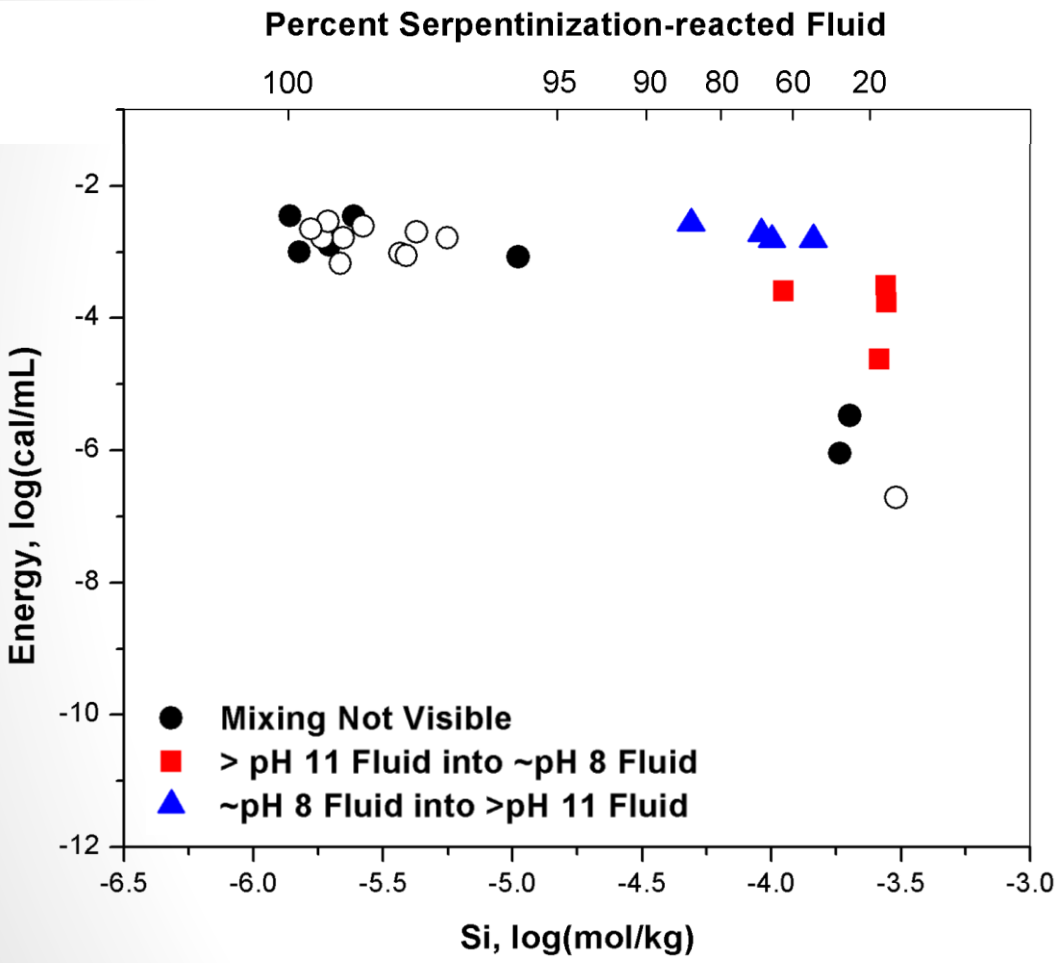
Energy for…

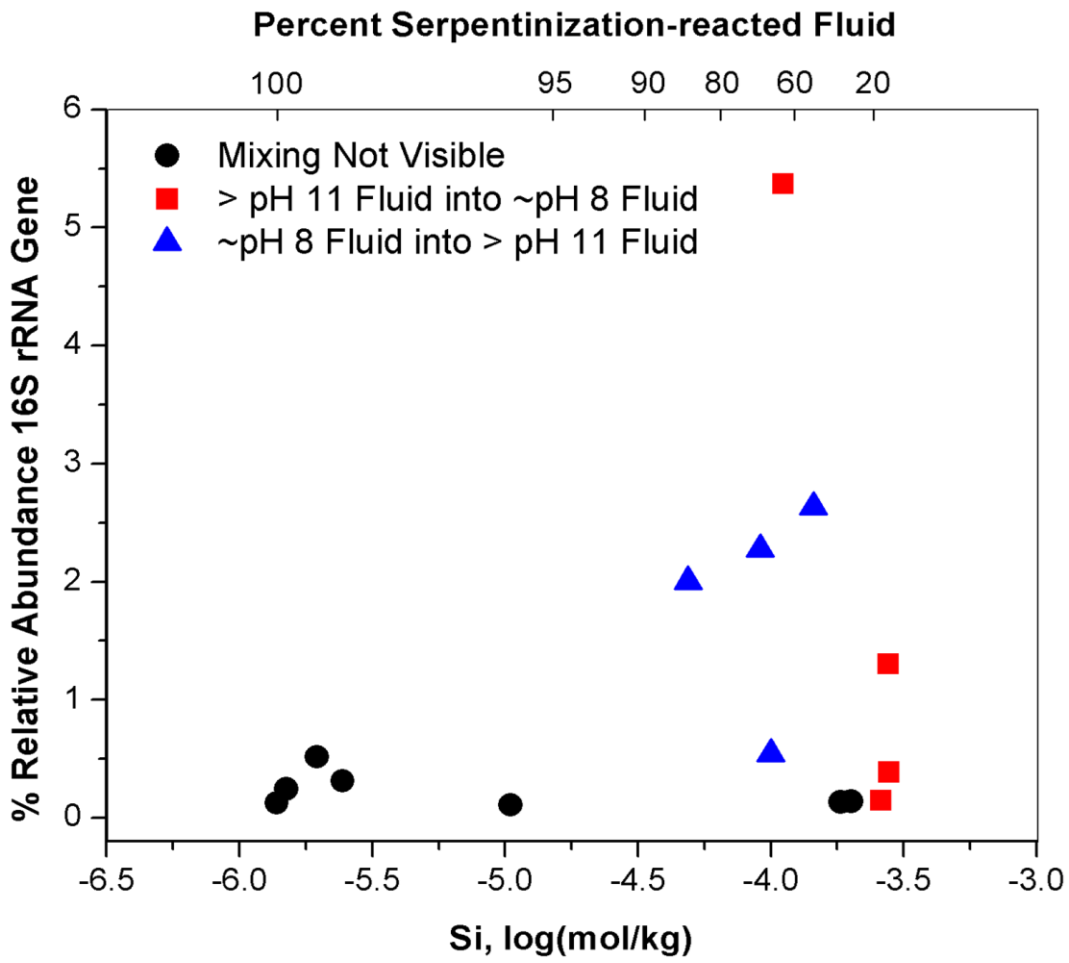
$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$
Aerobic Methane Oxidation (Methanotrophs)

Energy available, are methanotrophs present?

16S rRNA Gene Analysis

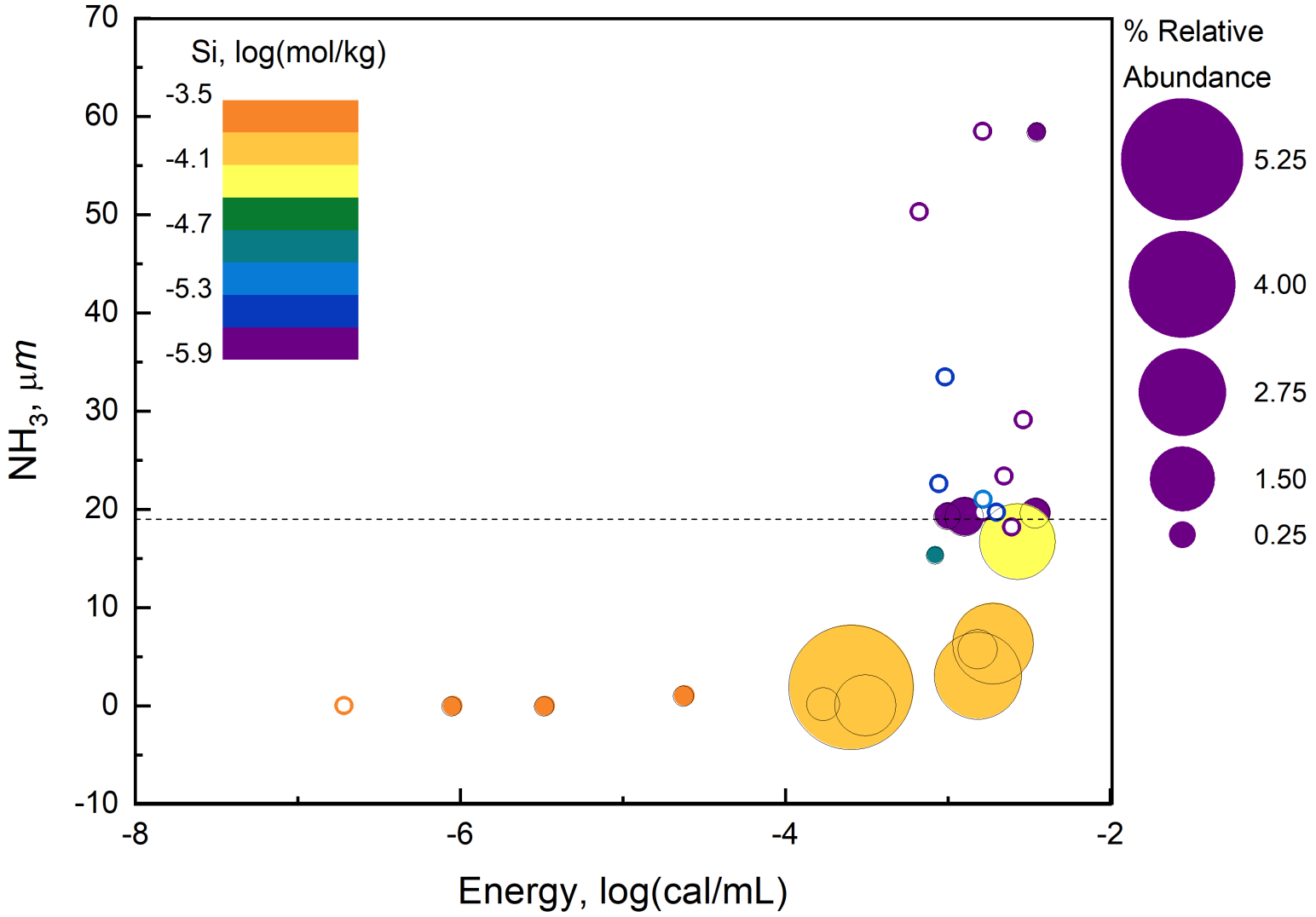
$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$$





Geochemical Drivers on Distribution of Methanotrophs

Our Prediction, Competitive Inhibition by NH_3



Presence/absence plot of 16S rRNA genes. ○, 16S rRNA gene is not present. ●, 16S rRNA gene present.

Culture Dependent Approach

To Test Hypothesis

Inoculate media designed from environmental geochemistry, ~20% O_2, ~5% CH_4 headspace, pH 11.4, 34˚C

- Vary [NH_3]
  - Environmental concentration
  - NH_3 replete
  - NH_3 deplete

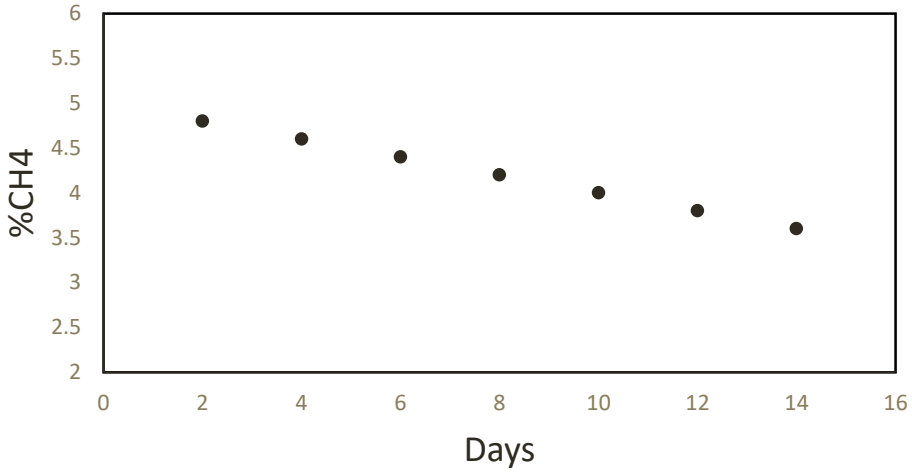
Evaluate growth of methanotrophs

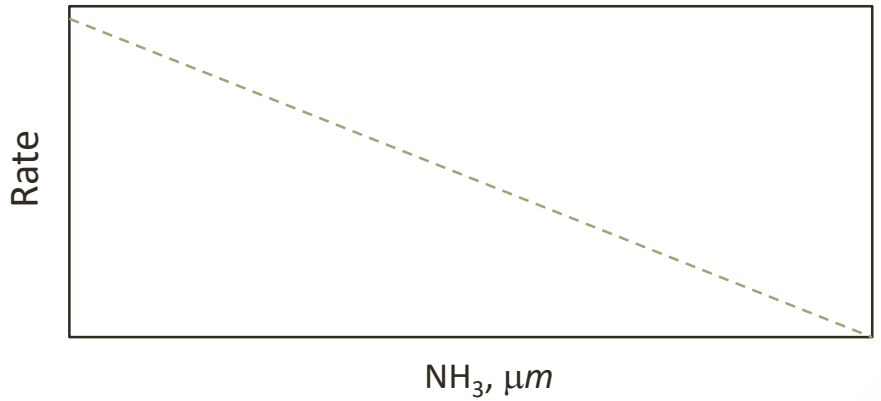
- CH_4 consumption
- 16S rRNA gene analysis

Calculate methane oxidation rate

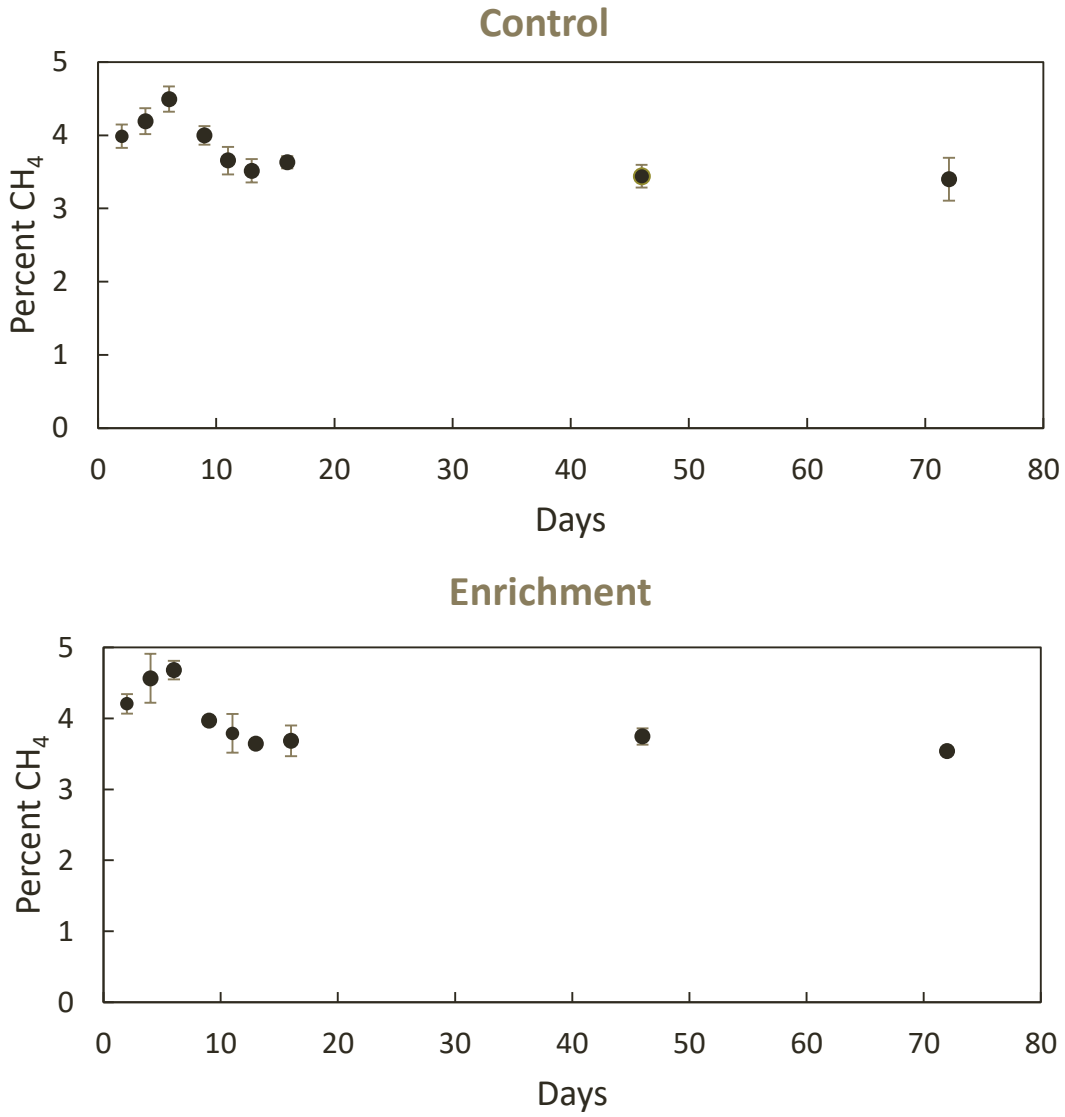
Test hypothesis: Compare rate to [NH_3]

Growth





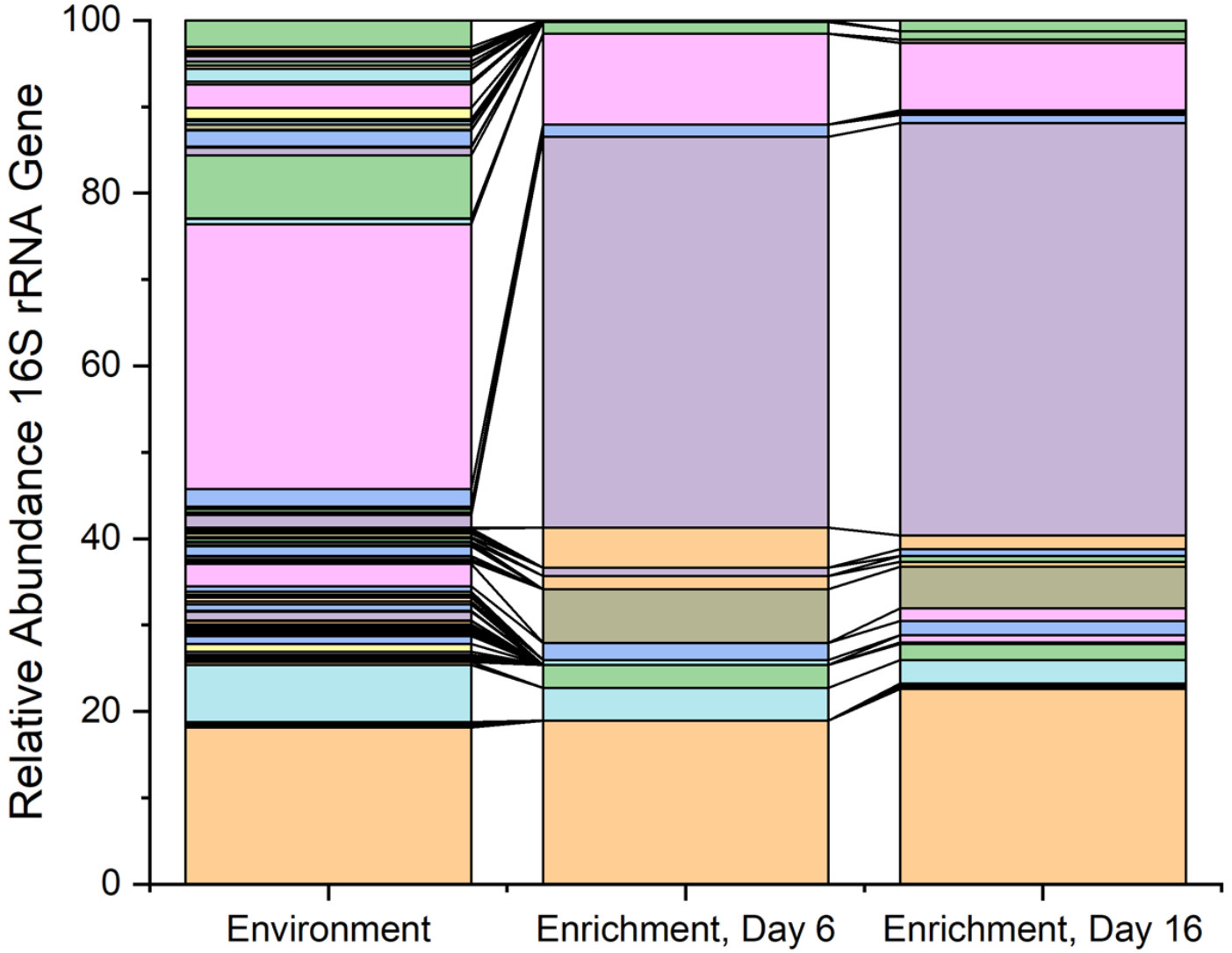
Results from Environmental [NH_3] Experiment



No significant decrease in methane over 72 days

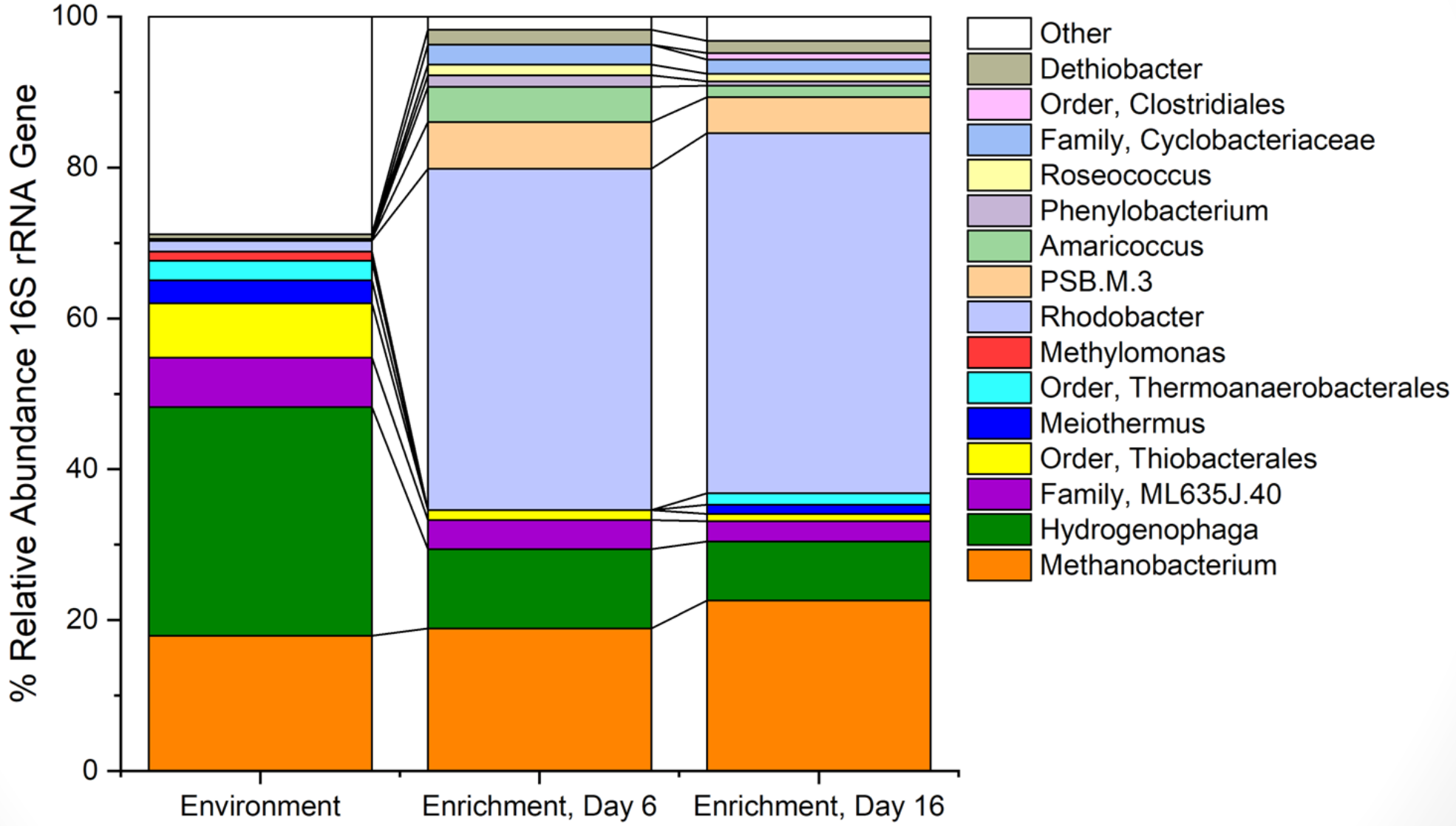
Environment to Enrichment Community Change

16S rRNA Gene Sequencing



Populations Selected for and Against

Environment to Culture



Early conclusions and future work

- Influence of NH_3 methanotroph growth
  - From these preliminary results, environmental [NH_3] inhibits growth of methanotrophs in culture
    - Alternatively, methanotrophs could be slow growers, and longer observation is required
- Community response
  - Diversity changes
  - Rhodobacter, as photo-heterotroph greatly enriched
  - Methanogens still present in the culture
- Next steps
  - Continue monitoring community growth of environment [NH_3] experiment
    - Continue CH_4 measurements
    - 16S rRNA gene sequencing on all time points
  - Run replete/deplete NH_3 experiments

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  - Alta Howells, Michelle Santana, Everett shock

- Rock Powered Life