Three Teams

Incubators

GEOPIG

Teachers
Despite bison, we managed
Incubator’s Research

1. Rates of N cycle processes
2. Microbial community response to nutrient addition
3. One-carbon metabolism
Incubation Locations

- Alkaline hot springs
  - Bison Pool
  - Mound
  - Rabbit Creek
- Acidic hot springs
  - Greater Obsidian Pool Area
  - Washburn (high in ammonium and organic C)
- Chemosynthetic (high T) and photosynthetic (low T) microbial communities
N Cycling in Hot Springs

Dinitrogen ($N_2$) fixation
Denitrification
Nitrification
Anaerobic ammonium oxidation (ANAMMOX)
$^{15}$N Tracer Addition Studies

- **Nitrification**
- **DNRA**
- **Remineralization**
- **NH$_4^+$ Assimilation**
- **Anammox**
- **Denitrification**

- **$\text{NO}_3^-$ Assimilation**
- **$\text{NO}_2^-$**
- **$\text{Org-N}$**
- **$\text{NH}_4^+$**
- **$\text{N}_2$**
- **$\text{N}_2\text{O}$**
N Cycling in Hot Springs

- Comparison of photosynthetic and chemosynthetic zones
- Comparison of geochemically similar hot springs with different processes (Bison Pool & Mound)
- N cycle with denitrification, but no nitrification (Skippy’s Bathtub in the Obsidian Pool Area)
Nutrient Amendment

Are microbial communities in YNP hot springs nutrient limited?

Phosphorus
Ammonium Nitrate
Iron
Expectations

Multiple Copy Gene (16S rRNA) to Single Copy Gene (rpoB) Ratio

Microbial Community Growth

Nutrient Limited Community

P, N, or Fe Addition

Non-Limited Community
One-Carbon Metabolism

- Methylotrophic organisms
- Addition of $^{13}$C-methanol to sediments/microbial mat
- Immediate goal – $^{13}$C in biomass and CO$_2$
- Long-term goal – Isolation of methylotrophs and Stable isotope probing (SIP)
One-Carbon Metabolism

- SIP – label DNA with $^{13}\text{C}$ from methanol

Molecular techniques -
Metagenome construction

$\rightarrow$ PCR amplification of ribosomal RNA and/or functional genes