Australian acid brine lake as a Mars analog: An analysis of preserved lipids in shore & lake sediments
upwelling groundwater was neutral to alkaline and capable of forming a stable phyllosilicate assemblage. The long aquifer flow paths would also promote dissolution of Fe-bearing volcanic glasses and silicates, thereby enriching the water in Fe$^{2+}$ ions. As observed in Australia, Fe$^{2+}$ transported in solution would eventually oxidize and precipitate Fe$^{3+}$ phyllosilicates and/or oxides, while generating acidity in the upward flowing waters. Near the surface, atmospheric sulfuric acid contributions [Banin et al., 1997], as well as photolytically produced oxidants [Hunten, 1979], may have generated additional acidity via Fe-oxide precipitation, shifting the stability field away from phyllosilicates and...
McArthur et al., Geochimica et Cosmochimica Acta, 1991

(dissolution of Fe-bearing rocks)

(increasing pH, salinity)

(smectite precipitation)

(decreasing pH, Increase H⁺)

(dense, saline alkaline, waters)

Ca, Mg Sulfates

Kaolinites, oxides

Weathered Basement
two replicates, and averaged only 1–2% for most species. The species analyzed was
NANOpure water system was used. Standard deviation for all specialized to resistivity of >17.8 MΩ·cm produced using a Barnstead X-ray fluorescence was also employed on non-diluted solutions.

For example, many instruments use silica glassware, thus excluding Si as an analytical target. Many instruments, such as ICs and ICP-MS, are notoriously difficult to measure by traditional chemical analyses. For example, many instruments use silica glassware, thus excluding Si as an analytical target. Many instruments, such as ICs and ICP-MS, are notoriously difficult to measure by traditional chemical analyses.
Lake Gilmore

Mid-lake core & near-shore “lunette” core
Lipid Analysis
Methanotrophs in a Mars analog?

Mid Lake

Bottom (21cm)

Near Shore

Top (0cm)

Bottom (35cm)

Nguyen, A.; Baldridge, A.; Thomson, B.; AGU 2014
δ13C values for different organisms:

- C3 plants
- CAM plants
- C4 plants
- algae
- cyanobacteria
- chromatiaceae
- rhodospirillaceae
- chlorobiaceae
- methanogens
- methanotrophs

The diagram shows a range of δ13C values from -50 to 0.
Vegetation survey
Methanotrophs at depth
Scant gypsum
TOC < 0.1%

Bacteria in upper column
> 25% gypsum
0.1 - 0.35% TOC
no archaeol
no GDGTs
some fatty acids
at depth

Alkanes
$\text{nC}_{24}-\text{nC}_{33}$

Pristane/phytane
Hopanoids
Fatty acids
at surface
δ¹³C

-85

-50 -40 -30 -20 -10 0

δ¹³C

C₄ plants
CAM plants
C₃ plants
algae
cyanobacteria
cromatiaceae
rhodospirillaceae
chlorobiaceae
methanogens
methanotrophs
No evidence for methanogens (archaeol)
No evidence for methanogens (archaeol)

No new evidence of methanotrophs ($\delta^{13}C$)
No evidence for methanogens (archaeol)

No new evidence of methanotrophs ($\delta^{13}C$)

$\delta^{13}C$ indicates sulfur bacteria input...
No evidence for methanogens (archaeol)

No new evidence of methanotrophs (δ^{13}C)

δ^{13}C indicates sulfur bacteria input...

Since lipid data indicates C_{3} plants
Sample size consideration

Derivitization agent choice

Lake Gilmore, Western Australia

sol 809, MAHLI

5 mm
Sample size consideration
Derivitization agent choice
Sulfur removal?
Contamination control
Questions?

Many thanks to Beatriz Saldana and Sara Lincoln