

Revising the stratigraphy at Mollies Nipple, Kane County, Utah, USA to better understand the origin of jarosite and alunite cements.

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<u>COMPLEX STRATIGRAPHY</u>

- Mollies Nipple butte, southern Utah, USA
- Jarosite/alunite early diagenetic cements
- Mapped as Navajo Sandstone
 - Other possibilities:
 - Page Ss
 - Carmel Fm
 - Temple Cap Fm
- Questions:
 - What is the overlying formation(s)?
 - J1 or J2?
- Expected Results:
 - Revision of paleogeography
 - Depositional environment
- Relevance:
 - Better understanding of origin of jarosite/ alunite cements
 - Mars analog site



East Pine Valley

Mtns Section

Mount Carmel

Highway Section

Judd Hollow

Section

Lake Powell

Composite Section

Gunlock

Composite Section

JAROSITE AND ALUNITE CEMENTS

- Alunite group minerals jarosite [KFe₃(SO₄)₂(OH)₆] and alunite [Al₃H₆KO₁₄S₂] have been identified on Mars and Mollies Nipple.
- These minerals commonly form in wet, oxidizing surface environments at low pH (<1 to ~4), *i.e.*, acid mine drainages, volcanic fumaroles, acidic lakes, and soils.
- Uncommon in ancient terrestrial rocks.
 - Fluid-rock interactions do not preserve thermodynamically unstable alunite group minerals.
- Grains completely encased in jarosite cement (A) suggests early diagenesis.



JAROSITE AND ALUNITE CEMENTS





DEPOSITIONAL ENVIRONMENT

- Cap rock is difficult to interpret.
 - The immediate surrounding area is eroded.
- Regional stratigraphy is complex.
 - Potential formations are the Temple Cap Formation, Carmel Formation, Page Sandstone.
- Presences of peloids suggest an environment adjacent to a marine environment.
- A sabkha depositional environment is likely.



METHODS

Field

- Measured sections
- Paleowind directions

Laboratory

- XRD
- QEMSCAN

	Upper Caprock	Name	Lower Caprock	Upper Caprock	
		Grain Size	Fine- to medium- grained sand	Very fine to medium grained sand	Silt
	Capiock	Sorting	Moderate	Moderate	Well- sorted
aprock		Roundness	Sub-rounded	Sub-rounded to rounded	Subangular
	Lower Caprock	Sedimentary Structures	~3-4 m thick crossbed sets	Crossbedding, ~1 mm thick silt wind ripple lamination intercalcated with ~ 3mm thick medium sand grain flow lamina	Planar Lamination
		Color	not specified	not specified	not specified
Navajo Sandstone		Cement	Alunite, illite, and amorphous aluminosilicat es	Jarosite, alunite, iron oxide, kaolinite, silica	
		Composition	Quartz Arenite; ~1% feldspar ~15 m	Quartz is common with minor amounts of feldspar, volcanic clasts, and rare mica and green, glauconitic peloids. Chert is common.	Siltstone

EXPECTED RESULTS

- Accurate stratigraphic column of Mollies Nipple.
- A more confident interpretation of the caprock depositional environment
- Paleogeographic revision of south-central Utah.
- Lab estimates on alunite group mineral formation used to interpret diagenetic and depositional environments are not observed in nature.
- Better understanding of how alunite group mineral cements were deposited at Mollies Nipple.

