Geophysical Research Abstracts, Vol. 7, 03820, 2005
SRef-ID: 1607-7962/gra/EGU05-A-03820

Sulfur and oxygen isotope composition of gypsum minerals affected by microbial processes in evaporite deposits from Death Valley, California

B. Brunner, S. Douglas, M. Coleman

Astrobiology, Jet Propulsion Laboratory, Caltech, Pasadena, CA

Benjamin.Brunner@jpl.nasa.gov

The Mars Exploration Rover Opportunity has demonstrated the existence of Martian evaporites (Squyres et al., 2004) but the processes that formed them are unknown. Evaporite deposits from Death Valley, California show evidence of microbial activity directly affecting evaporite minerals (Douglas and Yang, 2002; Douglas, 2004). Therefore, evaporites may be an archive of past and present extraterrestrial life.

The biosignature observed by Douglas and Yang (2002) and Douglas (2004) is rosickyite, a rare form of elemental sulfur (γ-sulfur, monoclinic symmetry), which is not thermodynamically predicted to be stable at Earth surface temperatures, reverting to the more common α-sulfur form (orthorhombic symmetry). This mineral was observed within an endoevaporitic microbial community implying a biogenic role in its formation. Douglas and Yang (2002) and Douglas (2004) speculate that rosickyite is formed by a cycle of microbial dissolution of gypsum, sulfate reduction and sulfide reoxidation to elemental sulfur (rosickyite). If sulfate reduction is non-quantitative, this process is likely to cause sulfur and oxygen isotope fractionation. We hypothesize that, therefore, the sulfur and oxygen isotope composition of sulfate minerals close to the site of rosickyite formation may be different from the surrounding gypsum and that rosickyite shows a sulfur isotope composition distinct from the sulfate in the evaporite minerals. Such isotope signatures could then be used to pin down microbial activity in extraterrestrial evaporite samples.

We tested our hypothesis by sulfur and oxygen isotope analysis of sulfate minerals from evaporite samples containing rosickyite. Our preliminary data indicate that an

oxygen and sulfur isotope imprint of the microbial processes leading to the formation of rosickyite is preserved in the evaporite samples from Death Valley, CA.

References:

Douglas S. and Yang H., 2002: Mineral biosignatures in evaporites: Presence of rosickyite in an endoevaporitic microbial community from Death Valley, California. *Geology* **30** (12); 1075-1078

Douglas S., 2004: Microbial biosignatures in evaporite deposits: Evidence from Death Valley, California. *Planetary and Space Science* **52**; 223-227

Squyres S, Arvidson R. E., 2004: The Opportunity Rover's Athena Science Investigation at Meridiani Planum, Mars. *Science* **306**; 1698-1703.