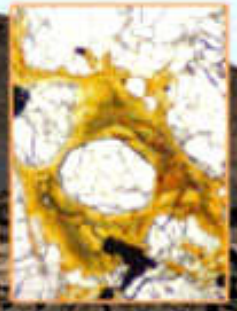
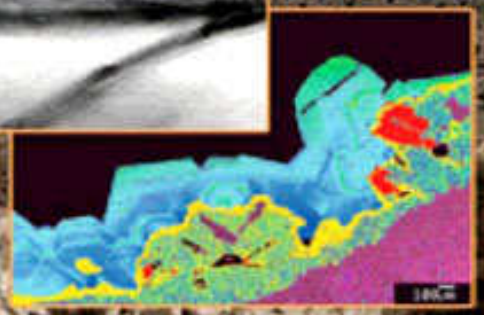
Ground Truth from Mars: Science Payoff from a Sample Return Mission





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April 21–23, 2008 ✧ Albuquerque, New Mexico

Conveners

Charles (Chip) Shearer, University of New Mexico
Carl Agee, University of New Mexico
David Beaty, Jet Propulsion Laboratory

www.lpi.usra.edu/meetings/msr2008

MSR Workshop

Purpose:

- Involve planetary and terrestrial sample science communities in discussions of MSR.
- Discuss synergies between MSR and other areas of Mars exploration (orbital and surface science).
- Explore science that can be accomplished within a variety of styles of MSR missions.
- Discuss linkages among samples, sample science, surface operations, planetary protection, and sample handling-curation.

MSR Workshop

Sponsors:

NASA, CAPTEM, Lunar and Planetary Institute, MEPAG, and Institute of Meteoritics

Scientific organizing committee:

David Bish (*University of Indiana)*
James Farquhar *(University of Maryland)*
John Grotzinger *(California Institute of Technology)*
Virgil Lueth, *(New Mexico School of Technology)*
Chris McKay *(NASA Ames)*
Glenn MacPherson (*Smithsonian)*
Doug Ming *(Johnson Space Center)*
Dimitri Papanastassiou *(Jet Propulsion Laboratory)*
James J. Papike, *(University of New Mexico)*
Dawn Y. Sumner (*University of California Davis)*
Allan Treiman (*Lunar and Planetary Institute)*
David Vaniman *(Los Alamos National Laboratory)*

MSR Workshop

Summary

•105 participants and 62 presentations.

•The 2.5 day workshop consisted of 6 sessions.

•Abstracts for each presentation, selected presentations, and workshop report may be viewed at http://www.lpi.usra.edu/captem.

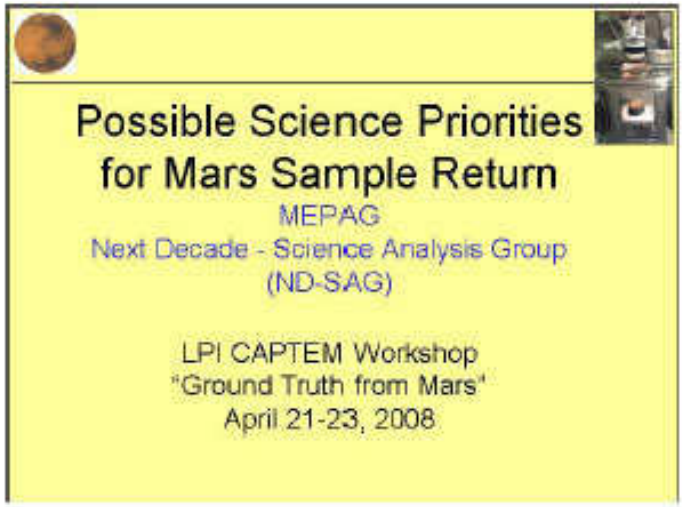
MSR Workshop

The Workshop Sessions:

- ENABLING SAMPLE RETURN: PRIORITIES, MISSIONS, AND STRATEGIES.
- SAMPLE REQUIREMENTS FROM THE ASTROBIOLOGY POINT OF VIEW.
- SULFATES AS RECORDERS OF MARS NEAR SURFACE PROCESSES AND THE MER SITES AS FIRST SAMPLE RETURN LOCALITIES.
- UNDERSTANDING THE EVOLUTION OF MARS' CORE, MANTLE, CRUST, SURFACE, ATMOSPHERE.
- HYDROUS MINERALS AS RECORDERS OF FLUID-ATMOSPHERIC EVOLUTION AND SECONDARY ALTERATION.
- POSTER SESSION.

MSR Workshop

ENABLING SAMPLE RETURN: PRIORITIES, MISSIONS, AND STRATEGIES:

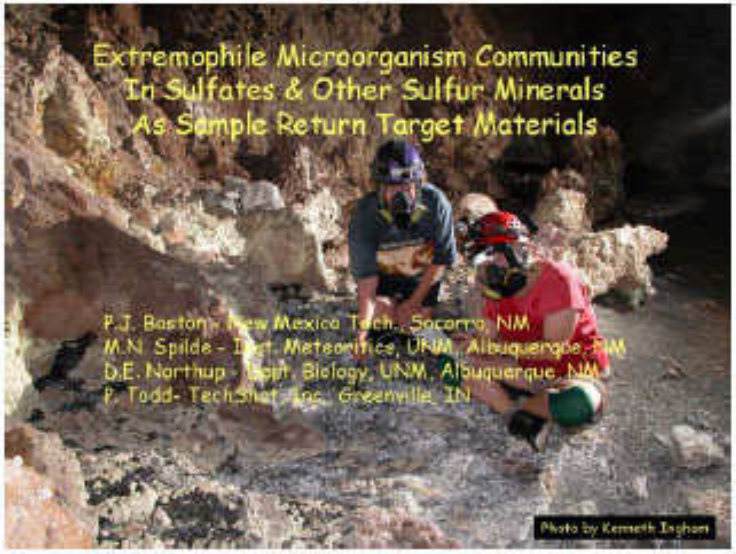


CAPTEM

Curation and Analysis Planning Team for Extraterrestrial Materials

MSR Workshop

SAMPLE REQUIREMENTS FROM THE ASTROBIOLOGY POINT OF VIEW.



The Open University

Identification (or otherwise) of Martian carbon in Martian meteorites

Monica Grady, V. K. Pearson, I. Gilmour, M. A. Gilmour, A. B. Verchovsky, J. Watson and I. P. Wright

Planetary and Space Science Research Institute

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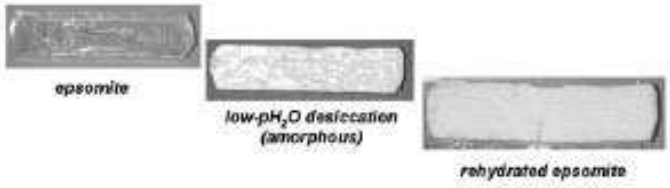
SULFATES AS RECORDERS OF MARS NEAR SURFACE PROCESSES AND THE MER SITES AS FIRST SAMPLE RETURN LOCALITIES.

Encoding of Water-Rock-Atmosphere Interactions in Jarosite: Implications for Mars

SALT-HYDRATE STABILITIES AND MARS SAMPLE RETURN MISSIONS

David Vaniman (Los Alamos National Laboratory)
David Bish (Indiana University)
Steve Chipera (Chesapeake Energy Corp.)



FE-SULFATES ON MARS: Considerations for Martian Environmental Conditions, Mars Sample Return & Hazards

P. L. King[1,2], M. D. Lane[3], B. C. Hyde[2], M. D. Dyar[4], & J. L. Bishop[5]
[1]Inst. Meteoritics, Univ. New Mexico, Albuquerque, NM USA
[2]Dept. Earth Science, Univ. Western Ontario, London, ON Canada
[3]Planetary Science Institute, Tucson, AZ USA
[4]Mount Holyoke College, South Hadley, MA USA
[5]SETI Institute/NASA-Ames Res. Cen., Mountain View, CA USA

WHAT CAN YOU DO WITH A RETURNED SAMPLE OF MARTIAN *DUST*? *and* WHAT *CAN'T* YOU DO?

Mike Zolensky and Keiko Nakamura-Messenger;
NASA Johnson Space Center

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UNDERSTANDING THE EVOLUTION OF MARS' CORE, MANTLE, CRUST, SURFACE, ATMOSPHERE:

TWO GENERATIONS OF CARBONATE IN ALH84001: THREE OXYGEN ISOTOPES AND OH

John W. Valley

Taka Ushikubo, Noriko Kita

University of Wisconsin- Madison

WISCONSIN Astrobiology Research Consortium

UNIVERSITY OF MARYLAND

Stable isotope targets with return samples

James Farquhar

Department of Geology and ESSIC
University of Maryland, College Park

Acknowledge support of NASA (EXB, NAI, COG), NSF EAR, and ACSPRF

Magnetic Studies of Returned Samples from Mars

Benjamin P. Weiss (MIT)

Ian Garrick-Bethell (MIT)
Joseph L. Kirschvink (Caltech)

Fundamental Importance of Returned Samples to Understanding the Martian Interior

David S. Draper and Carl B. Agee
Institute of Meteoritics
Department of Earth and Planetary Sciences
University of New Mexico

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MSR Workshop

HYDROUS MINERALS AS RECORDERS OF FLUID-ATMOSPHERIC EVOLUTION AND SECONDARY ALTERATION.

CLAY MINERALOGY AS A GUIDE TO ALTERATION ENVIRONMENTS ON MARS

David Bish and David Vaniman

Indiana University
Los Alamos National Laboratory

CLAY MINERALS IN RETURNED SAMPLES AND ALTERATION CONDITIONS ON MARS
or
What do we know about what clay minerals can tell us about alteration conditions on Mars?

Michael A. Velbel

MICHIGAN STATE UNIVERSITY

Clay Minerals Formation in Impact Induced Hydrothermal Systems: Source of Hydrous Phases on Mars

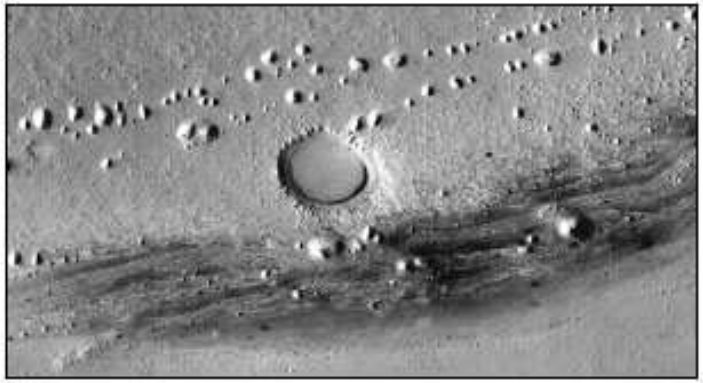
Nele Muttik, Kalle Kirsimäe & Peeter Somelar
Department of Geology, University of Tartu, Estonia

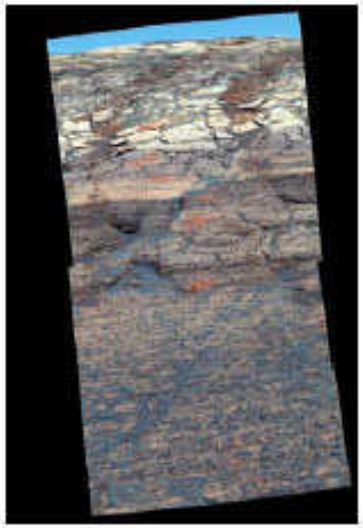
Transition between altered and non-altered minerals in Mawrth Vallis and Arabia Terra.

E. Z. Noe Dobrea
(yes, I did cut my hair)
J.L. Bishop, N.K. McKeown, G. Swayze, J.R. Michalski, F. Poulet, J.-P. Bibring, J.F. Mustard, B.L. Ehlmann, R. Arvidson, R.V. Morris, S. Murchie, A.S. McEwen, E. Malaret, C. Hash, and the CRISM Team.

MSR Workshop

Summary of the conference discussions by the conveners I





The presentations at the workshop showed that a wonderful variety of compelling scientific objectives would be possible via MSR.

In many cases, the different possible sample-related scientific objectives discussed at the conference would require different kinds of samples, and/or samples from different geologic setting. Thus, for the first MSR mission it would be imperative to consider carefully: (1)The choice of the landing site (2) The nature of the sample selection and the surface operations capabilities.

MSR Workshop

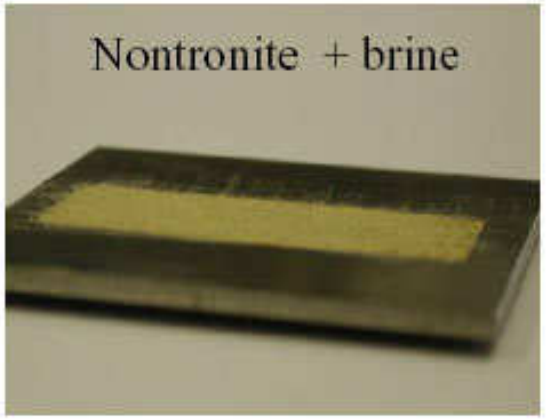
Summary of the conference discussions by the conveners II

There is a large untapped reservoir of sample scientists with a wide range in background that are poised to participate in and contribute to MSR.

Within the sample analysis community, the use of analytical technology to extract more information from samples continues to improve.

Summary of the conference discussions by the conveners III

There was an increased realization that important samples from the surface of Mars might be both fragile and reactive. The strategy for sample collection, storage, preservation, curation, and allocation must be deliberated in exacting detail.



Increase in relative humidity →

At high relative humidity ferric sulfates do not solidify but forms a viscous, amorphous syrup

MSR Workshop

Summary of the conference discussions by the conveners IV

Conference participants discussed a spectrum of possible MSR missions ranging from options that would be relatively simple (focused and limited set of science goals) to relatively complex (broader set of science goals).

There were no presentations at the Conference relating to mission cost or potential budget availability. However, there was quite a bit of unconstrained discussion about how to strike the right balance between relatively simple and relatively complex versions of MSR.