
Sample Quality Standards for Returned Martian Samples [#6056]

Summary of sample quality standards for Mars Sample Return as defined by the Mars 2020 Returned Sample Science Board.


Introduction to the 2018 iMOST Study [#6089]

An introduction to the 2018 International Mars Sample Return Objectives and Samples Team (iMOST) study, and a preliminary report of the scientific objectives of Mars Sample Return.


Potential High Priority Subaerial Environments for Mars Sample Return [#6043]

The highest priority subaerial environments for Mars Sample Return include subaerial weathering (paleosols, periglacial/glacial, and rock coatings/rinds), wetlands (mineral precipitates, redox environments, and salt ponds), or cold spring settings.
Seeking Signs of Life on Mars: The Importance of Sedimentary Suites as Part of Mars Sample Return

Sedimentary, and especially lacustrine, depositional environments are high-priority geological/astrobiological settings for Mars Sample Return. We review the detailed investigations, measurements, and sample types required to evaluate such settings.

The Importance of Returned Martian Samples for Constraining Potential Hazards to Future Human Exploration

Thorough characterization and evaluation of returned martian regolith and airfall samples are critical to understanding the potential health and engineering system hazards during future human exploration.

High Priority Samples to Characterize the Habitability of Groundwaters and Search for Rock-Hosted Life on Mars

Discussion of the strategies required to understand the geologic context and habitability of martian groundwater aquifers and to search for evidence of life in the martian subsurface using samples.
The astrobiological community is highly interested in interrogating returned martian samples for evidence of extant life. They occur as organic compounds, stable isotope patterns, minerals, and morphologies. Each type requires particular modes of preservation and analytical measurements.

As plants could play key roles in future long-term life support systems on Mars, it is crucial to know whether in situ resources such as martian regolith are suitable for seed germination and subsequent growth of a wide variety of plant species.

Terrestrial Mars analogue sites can provide insights into rover-based biosignature detection, types of biosignatures present in different Mars-relevant terrains, biosignature preservation, and location of biosignature hot spots.

Research conducted over the past few years reveals that meteorite impact craters provide substrates and habitats for life. We propose that craters and their products should be reconsidered as high priority targets for Mars Sample Return missions.

Proposal to include in a Mars Sample Return mission an in-situ component to make sure that active life is not missed, both because of planetary protection ramifications and scientific value.

*Landing Sites for a Mars Sample Return Mission in Arabia Terra* [6033]

We are characterizing the geology of several areas in Arabia Terra as possible Mars Sample Return mission landing sites. Arabia Terra presents several interesting sites regarding the search for past traces of life on Mars.

Trigo-Rodriguez J. M. Moyano-Cambero C. E. Donoso J. A. Benito-Moreno M. I. Alonso-Azcárate J.

*Clues on Past Climatic Environments and Subsurface Flow in Mars from Aqueous Alteration Minerals Found in Nakhla and Allan Hills 84001 Meteorites* [6047]

The study of aqueous alteration minerals like Fe-Mg-Ca carbonates in Allan Hills 84001 or iddingsite and magnetite in Nakhla meteorite allow us to constrain their formation conditions and water availability at 4 and 1.3 Ga ago, respectively.


*The Planetary Terrestrial Analogues Library (PTAL)* [6060]

The Planetary Terrestrial Analogues Library project aims to build and exploit a spectral data base for the characterisation of the mineralogical and geological evolution of terrestrial planets and small solar system bodies.

Asif Iqbal Kakassery Rajesh V. J.

*Western Eos Chaos on Mars: A Potential Site for Future Landing and Returning Samples* [6065]

Introducing Eos Chaos as a potential area for collecting samples. Eos Chaos contains a number of aqueous minerals. We have detected zoisite — a least reported low-grade metamorphic mineral from this area.

Osinski G. R. Beaty D. Battler M. Caudill C. Francis R. Haltigin T. Hipkin V. Pilles E.

*The CanMars Analogue Mission: Lessons Learned for Mars Sample Return* [6068]

We present an overview and lessons learned for Mars Sample Return from CanMars — an analogue mission that simulated a Mars 2020-like cache mission. Data from 39 sols of operations conducted in the Utah desert in 2015 and 2016 are presented.


*PTAL Database and Website: Developing a Novel Information System for the Scientific Exploitation of the Planetary Terrestrial Analogues Library* [6069]

The PTAL website will store multispectral analysis of samples collected from several terrestrial analogue sites and pretend to become a cornerstone tool for the scientific community interested in deepening the knowledge on Mars geological processes.


*Plans for Selection and In-Situ Investigation of Return Samples by the Supercam Instrument Onboard the Mars 2020 Rover* [6072]

The SuperCam instrument on board Rover 2020 still provides a complementary set of analyses with IR reflectance and Raman spectroscopy for mineralogy, LIBS for chemistry, and a color imager in order to investigate in-situ samples to return.

Stevens A. H. McDonald A. Cockell C. S.

*Searching for Biosignatures in Martian Sedimentary Systems* [6076]

We present experiments designed to simulate an inhabited martian lacustrine system analogous to Gale Crater. We describe the microbes found to thrive in this simulated environment and identify issues detecting biomarkers in this context.
Walroth R. C.  Blake D. F.  Sarrazin P.  Bristow T.  Thompson K.  
*X-Ray Diffraction (XRD) and X-Ray Fluorescence (XRF) for In Situ Surface Characterization and Triage of Cached Samples* [#6077]

In situ X-ray diffraction and fluorescence instruments in development will be presented. Capabilities to elucidate provenance, inform cache/discard decisions, and document a sample’s original state in the context of sample return will be discussed.

Gellert R.  
*APXS Data from Mars and MSR Samples: How Can They Be Combined and Benefit from Each Other?* [#6080]

The APXS has returned the chemical composition of more than 1000 samples on four rover missions along the combined traverse of >70km. Combining Mars data with terrestrial lab results of martian samples will be important, but it has to be done right.

Dannenberg K.  
*Towards Mars — Stratospheric Balloons as Test-Beds for Mars Exploration* [#6083]

The abstract deals with the possibilities to use stratospheric balloons for Mars science and technology needs, especially with the opportunities offered by the new European infrastructure project HEMERA, recently selected by the European Commission.

Hoffmann V. H.  Kaliwoda M.  Hochleitner R.  Mikouchi T.  Wimmer K.  
*Combining Non–Destructive Magnetic and Raman Spectroscopic Analyses for Mars Sample Return — Powerful Tools In Situ and in Laboratory* [#6086]

Very sophisticated, high-end techniques are requested for the investigation of pristine particles from a planetary surface, such as Mars, in situ or in our laboratories, in case of martian meteorites or even returned samples from (future) missions.

*Martian Methane Cycle and Organic Compounds from Martian Regolith Breccia NWA7533 by Orbitrap Mass Spectrometry* [#6088]

We compare the organic mixture of a carbon rich martian meteorite and carbonaceous chondrites. The major difference lies in the absence of polymeric patterns in NWA7533. We interpret this as a destruction of exogenous polymers under Mars conditions.

*Spectral Characterization of H2020/PTAL Mineral Samples: Implications for In Situ Martian Exploration and Mars Sample Selection* [#6090]

We present combined analysis performed in the framework of the Planetary Terrestrial Analogues Library (H2020 project). XRD, NIR, Raman, and LIBS spectroscopies are used to characterise samples to prepare ExoMars/ESA and Mars2020/NASA observations.

*Seeking Signs of Life Preserved in Martian Silica* [#6093]

Hot spring nodular silica deposits on Earth, which resemble those discovered with the Spirit rover, preserve concentrated organics and fine-scale structures that could be searched for on Mars with the Mars 2020 rover and in returned samples.

*Downselection for Sample Return — Defining Sampling Strategies Using Lessons from Terrestrial Field Analogues [#6094]*

We detail multi-year field investigations in Icelandic Mars analogue environments that have yielded results that can help inform strategies for sample selection and downselection for Mars Sample Return.

Tait A. W.  Schröder C.  Ashley J. W.  Velbel M. A.  Boston P. J.  Carrier B. L.  Cohen B. A.  Bland P. A.  

*The Rosetta Stones of Mars — Should Meteorites be Considered as Samples of Opportunity for Mars Sample Return? [#6096]*

We summarize insights about Mars gained from investigating meteorites found on Mars. Certain types of meteorites can be considered standard probes inserted into the martian environment. Should they be considered for Mars Sample Return?


*Constraining the Source Craters of the Martian Meteorites: Implications for Prioritization of Returned Samples from Mars [#6097]*

We have made advances in constraining the potential source craters of the martian meteorites to a relatively small number. Our results have implications for Mars chronology and the prioritization of samples for Mars Sample Return.

Czaja A. D.  Osterhout J. T.  Gangidine A. J.  

*Mineralogical Control of Organic Matter Thermal Alteration: Implications for Biosignature Preservation in Returned Martian Samples [#6100]*

Raman spectroscopy, which will be used by Mars 2020, can identify organic carbon and can assess the level of thermal alteration experienced by organic fossils. This study provides evidence that lithology can also influence apparent thermal alteration.

Gonzalez I.  Pinto A.  

*Ultrasonic Sorter for Handling and Collecting Dust or Soil Particles Separated by Size/Density [#6103]*

A new device is proposed consisting of an endless screw attached to a small sorter actuated by ultrasounds where particles collect from soil or dust to be separated and collected in different reservoirs for their return to the Earth.

Adeli S.  Hauber E.  Jaumann R.  

*Hydrated Minerals and Evaporites as Key Targets for a Mars Sample Return Mission [#6111]*

Here we focus on hydrated minerals and evaporites as paleo-environment indicators with preservation capacity. Thus, samples from these materials would increase our knowledge about the past aqueous activities of Mars and its habitability potentials.

Horgan B.  Anderson R. B.  Ruff S. W.  

*The Nature, Origin, and Importance of Carbonate-Bearing Samples at the Final Three Candidate Mars 2020 Landing Sites [#6113]*

All three candidate Mars 2020 landing sites contain similar regional olivine/carbonate units, and a carbonate unit of possible lacustrine origin is also present at Jezero. Carbonates are critical for Mars Sample Return as records of climate and biosignatures.

**Advanced Analytical Methodologies Based on Raman Spectroscopy to Detect Prebiotic and Biotic Molecules: Applicability in the Study of the Martian Nakhlite NWA 6148 Meteorite [#6114]**

Advanced methodologies based on Raman spectroscopy are proposed to detect prebiotic and biotic molecules in returned samples from Mars: (a) optical microscopy with confocal micro-Raman, (b) the SCA instrument, (c) Raman Imaging. Examples for NWA 6148.

Burton A. S. Berger E. L. Locke D. R. Lewis E. K. Moore J. F.

**Examination of Laser Microprobe Vacuum Ultraviolet Ionization Mass Spectrometry with Application to Mapping Mars Returned Samples [#6115]**

Laser microprobe of surfaces utilizing a two laser setup whereby the desorption laser threshold is lowered below ionization, and the resulting neutral plume is examined using 157nm Vacuum Ultraviolet laser light for mass spec surface mapping.

Yakovlev G. A. Grokhovsky V. I.

**On Size of Meteorites from Surface of Mars for Mars Sample Return Mission [#6116]**

Couple ideas on size of meteorites from surface of Mars for Mars Sample Return mission.