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The Proposed Science Objectives for Mars Sample Return

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IMEWG (the International Mars Exploration Working Group) has been evaluating the degree of international interest in MSR science by means of a working group referred to as iMOST (the International MSR Objectives and Samples Team). A primary purpose of iMOST was to establish international consensus positions related to the potential value of returning the samples to be collected by the Mars 2020 rover. We have concluded that the analysis in Earth laboratories of the samples that could be returned from Mars is of extremely high interest to the international Mars exploration community.

The iMOST Study: The International MSR Objectives and Samples Team was comprised of a team of 71 members representing 15 different countries and a broad range of scientific disciplines.The group was chartered in November 2017 and completed their report in August 2018 [1].

Proposed Objectives: The iMOST Report has proposed a taxonomy of seven primary scientific objectives for Mars Sample Return, some of which have been broken down further into sub-objectives. The shorthand for these seven objectives is as follows 1) Geology, 2) Life, 3) Geochronology, 4) Volatiles, 5) Planetary Evolution, 6) Understand/Reduce the Risks for Humans to Mars, 7) In-Situ Resource Utilization (ISRU).

Objective 1-Geology: The first objective is to interpret the primary geologic processes and history that formed the martian geologic record, with an em-phasis on the role of water. This objective has been further divided into 5 sub-objectives reflecting specific geologic environments which may be present on Mars: sedimentary systems, ancient hydrothermal environments, deep subsurface groundwater, subaerial environments and igneous terrane.

Objective 2-Life: Assess and interpret the poten-tial biological history of Mars, including assaying returned samples for the evidence of life. This objective has been broken down into 3 sub-objectives: 1) Assess and characterize carbon, including possible organic and pre-biotic chemistry; 2) Assay for the presence of biosignatures of past life at sites that hosted habitable environments and could have preserved any biosignatures; 3) Assess the possibility that any life forms detected are alive, or were recently alive.

Objective 3-Geochronology: Quantitatively determine the evolutionary timeline of Mars.

Objective 4-Volatiles: Constrain the inventory of martian volatiles as a function of geologic time and determine the ways in which these volatiles have interacted with Mars as a geologic system.

Objective 5-Planetary Evolution: Reconstruct the processes that have affected the origin and modification of the interior, including the crust, mantle, core and the evolution of the martian dynamo.

Objective 6-Understand the Risks for Humans to Mars: Understand and quantify the potential martian environmental hazards to future human exploration and the terrestrial biosphere.

Objective 7-Prepare for In-Situ Resource Utilization: Evaluate the type and distribution of in-situ resources to support potential future Mars exploration.

References:
[1] iMOST (2018), The Potential Science and Engineering Value of Samples Deliv-ered to Earth by Mars Sample

Return. Meteoritics & Planetary Science. https://doi.org/ 10.1111/maps.13232