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Author: Dr. Edward Cloutis
The University of Winnipeg, Canada

A WELL-CHARACTERIZED MARS- AND MOON-RELEVANT TERRESTRIAL GEOLOGICAL SAMPLE SUITE

Abstract

The Canadian Space Agency has embarked on the assembly of a suite of well-characterized rock and mineral samples that are representative of materials known or expected to be present on the Moon and Mars. The goal of this exercise is to have available a suite of samples that have been extensively characterized compositionally, structurally, spectrally, and petrologically, and that can be used for testing and cross-calibration of instruments being developed for future planetary landed missions.

The sample suite consists of a total of 54 samples, including naturally-occurring rocks and minerals, and a few synthetic materials. The sample suite is subdivided into suites that represent materials characteristic of the following categories: Mars sedimentary rock suite, Mars hydrothermally altered rock suite, Mars low-temperature altered rock suite, Mars igneous rock suite, lunar basaltic rock suite, lunar anorthositic rock suite, and geological products of large impacts, including melts and shock metamorphosed target rocks. The project is designed to produce samples in a variety of configurations, including a hand sample, a thin section, and powders with grain sizes of <45 and 45-1000 microns.

Analysis of the samples is intended to provide comprehensive characterization that will allow for activities such as calibration of scientific instruments, testing of detection limits, and effects of physical properties on instrument performance. The samples are being characterized using the following techniques: • Macro- and micro-scale digital imaging of hand samples; • Reflectance spectroscopy of hand samples and powders: 0.2 to 5.0 microns; • Thermal emittance spectroscopy: 5-25 microns; • Raman spectra (532 nm) from 4000 to 175 cm-1; • Optical microscopy for end member identification and abundances; • UV- (365 nm) induced fluorescence spectra (400-1000 nm); • Compositional determination using X-ray fluorescence and wet chemistry (for ferrous/ferric ratios); • XRF-XRD characterization using commercial version of the Mars Curiosity rover's ChemMin instrument; • Laser-induced breakdown spectroscopy (LIBS); • Powder XRD for Rietveld-level analysis; • High-resolution 3-D laser imaging of selected weathered surfaces.

This sample suite will serve as a wide-ranging set of reference materials that will be applicable to testing of instruments destined for use on the Moon and Mars.