Martian Simulants

What is a Martian simulant?

Previous Martian simulants were designed 10-20 years ago based on a rudimentary understanding of Martian surface materials and are no longer available outside of NASA (e.g. JSC Mars-1, Mars-1A). Leveraging advances in the scientific understanding of the Martian surface, CLASS Exolith Lab has developed an open standard for regolith simulants with high fidelity in mineral, chemical, volatile, andspectral properties compared to an appropriate reference material (e.g. Rocknest site, Jezero Crater, etc.). Our approach is in contrast to that used for previous simulants, many of which are based on terrestrial geology. By replicating Martian mineralogy, Exolith simulants recreate bulk chemistry, volatile content, and spectral properties of the intended regolith. Unlike previous simulants sourced from landscaping material, our simulants are assembled ab initio from individual components to provide an accurate match to the mineralogy of the Martian regolith of your chosing. We carefully document simulant development and test the mineral constituents and final products to maintain quality and accuracy (Cannon et al., 2019).

What are the differences between our simulants?

Figure 1a: Sample of MGS-1 Simulant Credit: Matthew Villegas

MGS-1 Mars Global Simulant

Our MGS-1 simulant is the mineralogical standard for basaltic soils on Mars, developed based on quantitative mineralogy from x-ray diffraction analyses for the crystalline portion of the Rocknest soilGale Crater taken by NASA's Curiosity Rover. It is designed to replicate the windblown soil that is chemically similar to other basaltic soils at disparate landing sites.

Suggested Uses: Ideal for educational purposes, as well as plant growth studies, astrobiology studies, human health assessments, bulk simulant water extraction, and testing flight hardware.

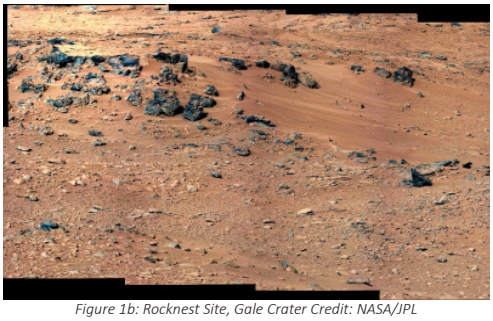

Figure 1b: Rocknest Site, Gale Crater Credit: NASA/JPL

Figure 2a: MGS-1C (left) & MGS-1S (right) Credit: Matthew Villegas

MGS-1C Clay and MGS-1S Sulfate

MGS-1C and MGS-1S are modified versions of MGS-1 specifically designed for water extraction applications. These represent reference cases identified by the NASA Mars Water In-Situ Resource Utilization Planning (M-WIP) Study. Spectral data from the Mars Reconnaissance Orbiter (MRO) was used to create mineralogically accurate variations of our MGS-1 simulant that are enriched in the hydrated clay mineral smectite (MGS-1C) and in the polyhydrated sulfate gypsum (MGS-1S).

Suggested Uses: Water-extraction studies, ISRU and ISRU technology development.

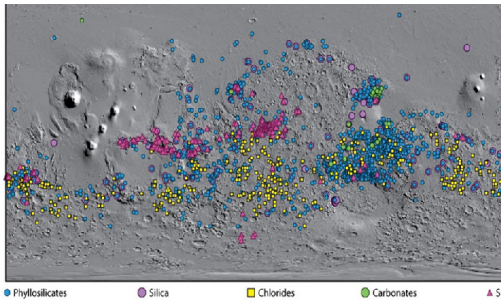

Figure 2b: Mineral detections at Gypsum Dunes Credit: NASA/JPL

Figure 3a: Sample of JEZ-1 Simulant Credit: Matthew Villegas

JEZ-1 Jezero

Dervied from analysis of imaging spectrometers onboard the MRO at one of oldest Martian landscapes, Jezero Crater, which that will be investigated by the NASA Mars 2020 Perseverance rover. The simulant is a mixture of MGS-1 mineralogy with smectite clay, Mg-carbonate, and additional olivine that have all been detected from orbital remote sensing in the Jezero delta deposits. JEZ-1 represents unconsolidated material, but can be compacted into a more cohesive solid.

Suggested Uses: Studies in anticipation of Mars 2020 samples.

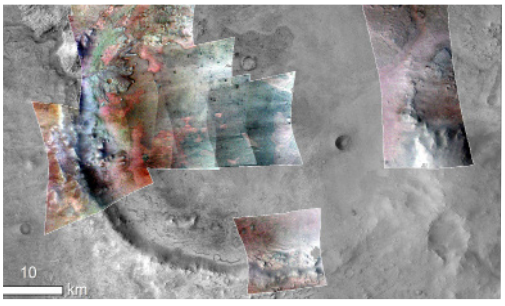

Figure 3b: Jezero Crater, MRO Imaging Spectrometer Credit: NASA/JPL

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exolithlab@ucf.edu

sciences.ucf.edu/class/exolithlab