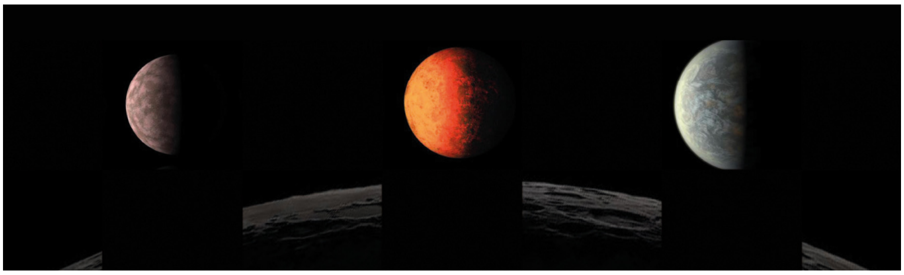

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Experimental investigation into the maturation of aeolian sands on Mars

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On Earth and Mars, aeolian (wind) transport causes sand grains to break down, which can result in mineralogic and textural changes to the sand. The nature of those changes currently represents a knowledge gap on Mars. Filling this knowledge gap could advance capabilities for provenance research that uses mineralogy to identify the sand sources of Martian dune fields. More broadly, understanding how Mars sands evolve (mature) with transport is important for understanding the geologic history and cycling of sediments, as well as dust production.

To address this knowledge gap, we are conducting laboratory experiments simulating the effects of aeolian transport on Mars-analog sediments. We developed the Sand AbrasioN Device for Aeolian Research (SANDAR), a modified air mill that uses pressurized air to circulate sand around a small abrasion chamber (Baker et al., in review). The SANDAR matches natural aeolian transport in terms of the kinetic energy of colliding sand grains as well as the microtextures produced on the surfaces of grains. These findings validate that it effectively simulates the mechanical effects of aeolian processes.

We used the SANDAR to conduct an abrasion experiment with a customized version of Mars Global Simulant-1, a synthetic compositional simulant for Mars soil made by Space Resource Technologies. We collected visible/near-infrared spectroscopy data on the sample as it was abraded and observed spectral changes consistent with a loss of Mg-sulfate (epsomite) and ferrihydrite. We are also conducting monomineralic experiments to individually compare the abrasion rates of the major mineral components of Martian sand. Thus far, we have found that Mg-sulfate (kieserite) abrades more quickly than olivine, which abrades more quickly than pyroxene (augite). These early results suggest that mature aeolian sands on Mars may be depleted in Mg-sulfate and ferrihydrite, somewhat depleted in olivine, and enriched in pyroxene.

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