

Using Mineralogy of the Bagnold Dune Field in Gale Crater to Interpret Eolian Sediment Sorting on the Martian Surface

E. B. Rampe¹, M. Lapotre², T. F. Bristow³, R. E. Arvidson⁴, R. V. Morris¹, C. N. Achilles⁵, C. Weitz⁶, D. F. Blake³, D. W. Ming¹, S. M. Morrison⁷, D. T. Vaniman⁶, S. J. Chipera⁸, R. T. Downs⁵, K. Edgett, J. P. Grotzinger⁹, R. M. Hazen⁷, T. S. Peretyazhko¹⁰, B. Sutter¹⁰, V. Tu¹⁰, A. S. Yen¹¹, B. Horgan¹², N. Castle¹³, P. I. Craig⁶, S. Czarnecki, D. J. Des Marais³, J. Farmer¹⁴, T. Gabriel, R. Gellert¹⁵, C. Hardgrove, A. C. McAdam¹⁶, J. M. Morookian¹¹, P. C. Sarrazin¹⁷, and A. H. Treiman¹³

¹Astromaterials Research and Exploration Science Division, NASA Johnson Space Center, Houston, Texas USA, ²Department of Earth and Planetary Sciences, Harvard University, Cambridge, Massachusetts, USA, ³NASA Ames Research Center, Moffett Field, California, USA, ⁴Department of Earth and Planetary Sciences, Washington University in St. Louis, St. Louis, Missouri, USA, ⁵Department of Geosciences, University of Arizona, Tucson, Arizona, USA, ⁶Planetary Science Institute, Tucson, Arizona, USA, ⁷Geophysical Laboratory, Carnegie Institution for Science, Washington, D. C., USA, ⁸Chesapeake Energy, Oklahoma City, Oklahoma, USA, ⁹Division of Geological and Planetary Sciences, California Institute of Technology, Pasadena, California, USA, ¹⁰Jacobs at NASA Johnson Space Center, Houston, Texas, USA, ¹¹Jet Propulsion Laboratory, California Institute of Technology, Pasadena, California, USA, ¹²Department of Earth, Atmospheric, and Planetary Sciences, Purdue University, West Lafayette, Indiana, USA, ¹³Lunar and Planetary Institute, Houston, Texas, USA, ¹⁴School of Earth and Space Exploration, Arizona State University, Tempe, Arizona, USA, ¹⁵Department of Physics, University of Guelph, Guelph, Ontario, Canada, ¹⁶Goddard Space Flight Center, Greenbelt, Maryland, USA, ¹⁷SETI Institute, Mountain View, California, USA.

The Mars Science Laboratory *Curiosity* rover landed in Gale crater in August 2012 to characterize modern and ancient surface environments. *Curiosity* executed a two-phase campaign to study the morphology, activity, physical properties, and chemical and mineralogical composition of the Bagnold Dune Field, an active eolian dune field on the lower slopes of Aeolis Mons (Mount Sharp). Detectable aspects of dune sand mineralogy have been examined from orbit with the visible/short-wave infrared spectrometer CRISM and the thermal-infrared spectrometers THEMIS and TES. CRISM data demonstrate variations in plagioclase, pyroxene, and olivine abundances across the dune field. *Curiosity* analyzed sediments from two locations in the dune field to evaluate the causes of the mineralogical differences observed from orbit. The Gobabeb sample was collected from Namib Dune, a barchanoidal dune on the upwind margin of the dune field, and the Ogunquit Beach sample was collected from the Mount Desert Island sand patch located downwind from Namib. These samples were sieved to <150 μm and delivered to the CheMin X-ray diffraction instrument for quantitative mineralogical analysis. CRISM-derived mineralogy of the Namib Dune and Mount Desert Island and CheMin-derived mineralogy of the Gobabeb and Ogunquit Beach samples can be used in a value-added manner to interpret grain segregation at the bedform to dune-field scale and evaluate contributions from local sediment sources. Models of CRISM data demonstrate that Mount Desert Island is more enriched in olivine and less enriched in plagioclase than Namib dune, suggesting that fine-grained mafic sediments are preferentially mobilized downwind. *Curiosity* data indicate olivine also forms a coarse lag on the lee sides of barchanoidal dunes. Minor abundances of hematite, quartz, and anhydrite and small differences in

the crystal chemistry of plagioclase and pyroxene derived from CheMin data suggest that sediments from the underlying lacustrine rocks also contribute to the Bagnold sands.

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Session description: Quantitative models for surface processes have been derived for Earth systems. When applied to other planetary bodies, these Earth-based models can provide critical insights into the geologic history of the Solar System. In return, planetary surfaces across the Solar System offer a unique opportunity to test these models under conditions often unachievable on Earth. We invite a range of contributions in the field of planetary surface processes with an emphasis on fluid and granular flows (fluvial, eolian, glacial, mass wasting, coastal, etc.) and that use planetary analogs, laboratory experiments, theoretical and numerical modeling, and planetary-exploration data from orbiters, landers, and rovers. This session's goal is to explore the interplay between quantitative models for planetary surface processes and new planetary exploration data that often challenge these models. We intend this session to foster more collaboration between members of the PS and EPSP sections.