**COMPOSITIONAL VARIANCE OF AEOLIAN DEPOSITS IN GALE CRATER, MARS.** E. L. Moreland[1] and R. E. Arvidson[1,2], [1]Department of Earth & Planetary Sciences, Washington University, Saint Louis MO (morelandellie@wustl.edu), [2]McDonnell Center for the Space Science (arvidson@wunder.wustl.edu).

**Introduction:** This abstract focuses on the comparison of Mars Reconnaissance Orbiter CRISM [1] hyperspectral observations for a portion of the Bagnold Dunes and the Sands of Forvie, a broad sand sheet located in a low region to the south of Glen Torridon (Fig. 1). Curiosity has acquired observations designed to characterize in detail the morphology, textures, mineralogy and composition of these deposits, including comparisons with CRISM-based results for the Bagnold Dunes [e.g. 2]. We add a CRISM-based analysis of both the Bagnold Dunes and Sands of Forvie to this growing set of data and interpretations for modern basaltic sand deposits in Gale Crater.

**Retrieval of Single Scattering Albedos:** Surface single scattering albedos (SSA) were retrieved from CRISM scene HRL000BABA S and L data using the WUSTL pipeline that includes explicit modeling of atmospheric gases, aerosols, and use of the Hapke photometric function [3,4]. SSA cubes were "denoised", regularized, and map projected using a log maximum likelihood approach (MLM) that retrieves the best estimate of SSA values in the presence of Poisson noise. Regions of interest (ROIs) were then delineated for the Sands of Forvie (SF, 173 36-meter pixels) and Mount Desert Island (MDI, 289 pixels) (Fig. 1). Mean spectra were extracted from each ROI for SSA data before and after application of the MLM procedures (Fig. 2). Spectral patterns for these ROIs are also evident in FRT0000B6F1, FRT0001FD99, and FRT00021C92, although for brevity we focus on HRL0000BABA in this abstract.

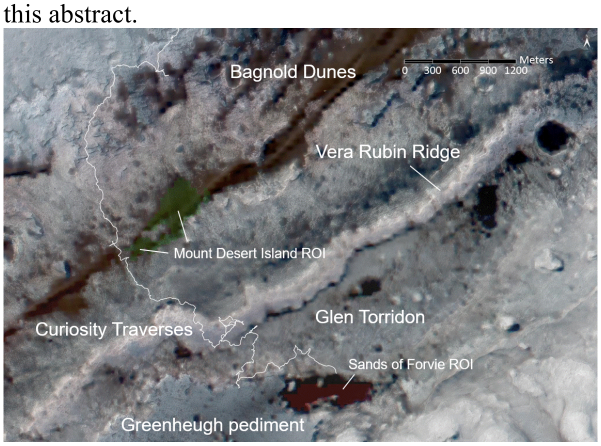


***Figure 1:*** *False-color CRISM observation (RGB = 2.5287, 1.5058, 1.0595 µm) overlain on a HiRISE mosaic. Regions of interest shown were used to obtain spectra for Sands of Forvie (red) and Mount Desert Island Bagnold Dunes site (green) (Fig. 2). Key locations are labeled, and Curiosity traverses are shown through sol 2979. Note the reddish color of the Bagnold dunes relative to the dark deposits to the southeast, including within Glen Torridon.*

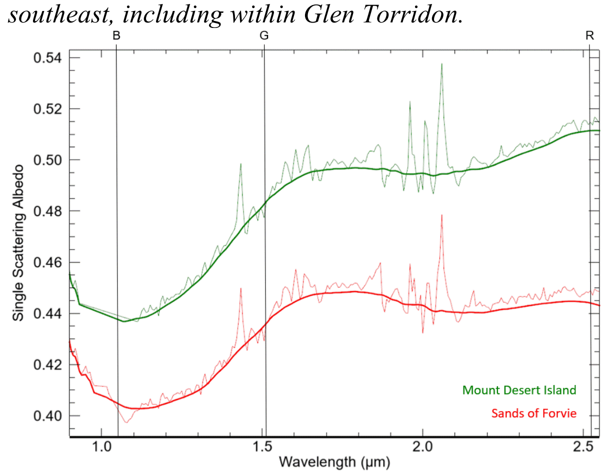


***Figure 2:*** *Plot of mean spectra from Mount Desert Island and Sands of Forvie ROIs. Thick lines represent spectra from the data processed using MLM procedures whereas thin lines include the noise associated without processing. Vertical RGB lines show the wavelengths used in generating the false color view shown in Fig. 1. The red color of the Bagnold Dunes in Fig. 1 is clearly associated with the steeper long wavelength slope associated with the MDI spectrum. Note the broad absorptions centered at ~1.07 µm for MDI and ~1.1 µm for SF.*

**Retrieval of Mineral Abundances:** We employed Markov chain Monte Carlo (MCMC) methods [5,6] to the SSA spectra to explore mineral phase abundances for each spectrum. The endmembers used for analysis included labradorite (C1DH16); basaltic glass (C1BE100); olivine Fo80 (C1DD87), Fo50 (C1DD93), and Fol0 (C1DD97); diopside (C1DL43a); pigeonite (C1DL09a); augite (C1DL68a); and hedenbergite (C1DL82a) [7]. Basaltic glass was included to model amorphous phases that may be present. Endmember spectra were taken from the RELAB Spectral Library and converted to SSA. Selection of these endmembers took advantage of previous modeling efforts for the Bagnold Dunes [2,6].

**Spectral Analysis:** Exploratory results are shown in in Figs. 3 and 4 and indicate that basaltic glass is a major component of both the Bagnold Dunes and Sands of Forvie. Both sites include labradorite, olivine, and pyroxenes. A major difference between the two sites is that the MDI fits include hedenbergite and more olivine than SF, consistent with the endmember spectral properties. This difference in endmembers accounts for the redder appearance of the dunes as shown in Figs. 1 and 2 and the shorter wavelength 1.07 µm absorption minimum associated with the MDI spectrum compared to the 1.1 µm SF absorption minimum. We note that our results are preliminary, but they do explain the short and long wavelength spectral differences between the two sand deposits. We will continue to add endmembers and model the data, extending regions of interest to additional areas within the Bagnold Dunes and sand sheets to the southeast, including within Glen Torridon.

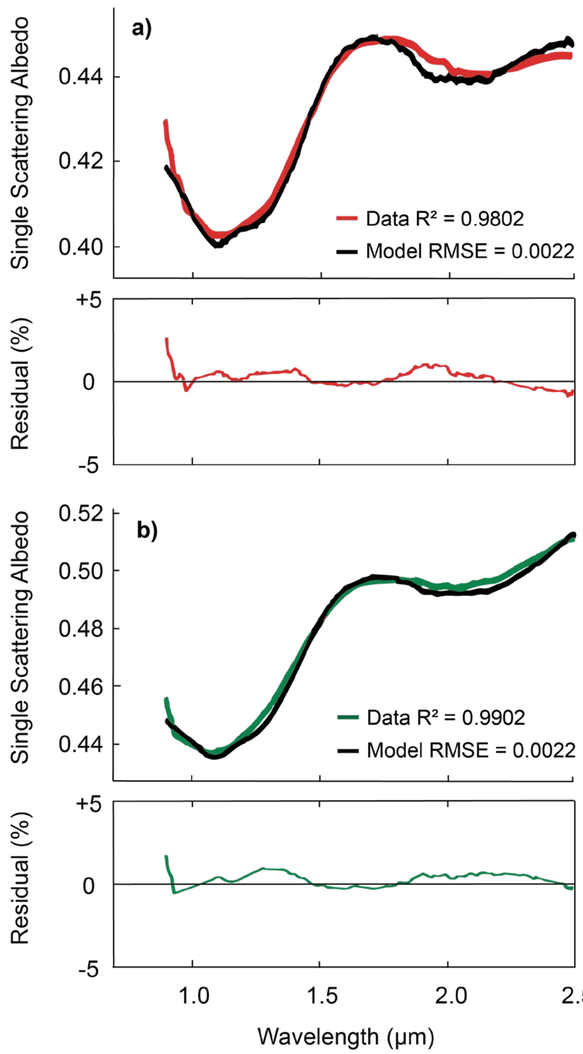


***Figure 3:*** *Model results for a) Sands of Forvie (SF) and b) Mount Desert Island (MDI) ROIs. Additional endmembers and modeling are needed to improve the long wavelength fits, although our exploratory modeling explains the long wavelength rise and shorter wavelength 1.07 µm absorption associated with the MDI ROI.*

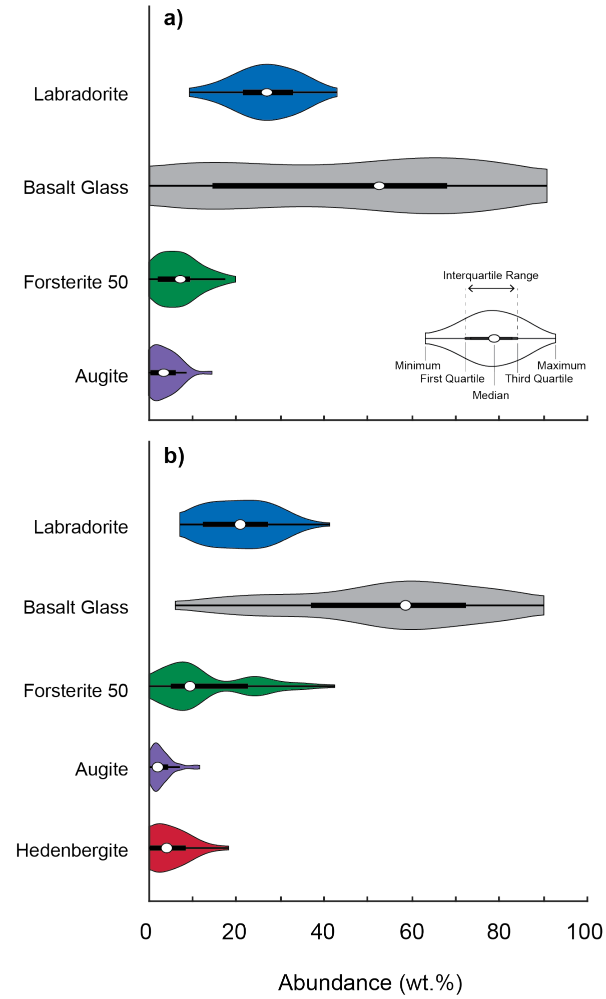


***Figure 4:*** *Probability density violin plots [8] for modeling endmembers from a) Sands of Forvie and b) Mount Desert Island. These plots consider the top 100 best fit spectra for each location. The inset of (a) shows features of each violin plot including minimum, first quartile, median, third quartile, maximum, and the interquartile range.*

**References:** [1] Murchie, S. et al. (2007) *JGR,* doi: 10.1029/2006JE002682. [2] Rampe, E. et al. (2018) GRL, doi: 10.1029/2018GL079073. [3] Kreisch, C. et al. (2016) *Icarus*, doi: 10.1016/j.icarus.2016.09.033. [4] He, L. et al. (2019) *IEEE*, doi: 10.1109/JSTARS.2019.2900644. [5] Lapotre, M. et al. (2017) *JGR: Planets*, doi: 10.1002/2016JE005248. [6] Lapotre, M. et al. (2017) *JGR: Planets*, doi: 10.1002/2016JE005133. [7] Keck/NASA RELAB Spectral Library at Brown University. [8] Hintze, J. and R. D. Nelson (1998) American Statistician, doi: 10.1080/00031305.1998.10480559.