GRAIN SHAPE AND SIZE ANALYSIS OF SAND- AND SILT-SIZE SEDIMENT IN A TERRESTRIAL PERIGLACIAL LANDSCAPE: A POSSIBLE PROCESS ANALOG FOR SAND AND SILT IMAGED BY THE PHOENIX OPTICAL MICROSCOPE AT THE PHOENIX MARS LANDER LANDING SITE - II.

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Introduction: The Phoenix Mars Lander (PHX) landed in Vastitas Borealis, near Mars' northern polar cap, on May 25 2008, and operated until November 2, 2008. The landing site is in a valley dominated by periglacial polygonal patterned ground with 3 to 6 meter polygons, with a thin layer of basaltic sand overlying permafrost [1]. Depth to ice was 2-6 cm. A Robotic Arm (RA) dug trenches and acquired samples of dry soil and sublimation residues from water ice. The RA delivered samples to several instrument packages containing a variety of scientific instruments, including an Optical Microscope (OM). Samples for delivery to the OM were passed through a 200 µm sieve [2]. The OM was equipped with a fixed-focus, fixed-magnification optical system, two lenses, and LEDs in red, blue, green and ultraviolet for simulating color imaging. OM image spatial resolution was determined by the pixel dimension of 4 µm/pixel [2]. A variety of substrates were distributed on a rotating wheel the movement of which enabled the OM to focus and photograph each sample individually [2]. Previous research has classified grain types by color (black and brown) [3], measured particle sizes and size distributions [4], and compared grain form among different PHX grain types [5] and with several terrestrial analogs [6-7].

This presentation describes preliminary results and next steps in our effort to describe and interpret differences between grain samples imaged by the OM, based on a terrestrial, periglacial analog of those collected by Phoenix Mars Lander.

Sample and Methods: *Periglacial polygonal patterned ground landform analog.* The analog site, located in the Saginaw Lowlands, Michigan, USA., exhibits polygonal patterened ground that formed on glacial parent materials during the Wisconsinan glaciation (50,000 – 11,000 YBP).

Samples. Fine-sand size grains were studied for shape and surface-texture variation between two different depositional subenvironments (ice wedge and polygon interior). The most abundant coarse grains imaged by the OM are coarse silt (32 mm < j < 62.5 mm; >50%) and very fine sand (62.5 mm < j < 125 mm ; ~33%) [2-5]. All grains that passed a 200 mm sieve were imaged by OM [3-5]. Analog samples were split & passed through a 177 mm sieve, to examine grains most similar to OM samples.

SEM. Grains from each sample were mounted on aluminum stubs using carbon adhesive tabs, coated with carbon, and imaged using a JEOL 6610LV scanning electron microscope in secondary electron imaging mode (SSEM), with energy dispersive spectroscopy (EDS). Context images of each entire mount were acquired at the same resolution as the OM (4 µm/pixel), and 150 grains from each sample were imaged at one grain per frame to survey grain-surface textures.

Interpretation. Inventories of grain surface-features widely used in previous work [8,9] were compiled from >100 grains per sample. Grain-shape attributes were measured with ImageJ from both the context and close-up images.

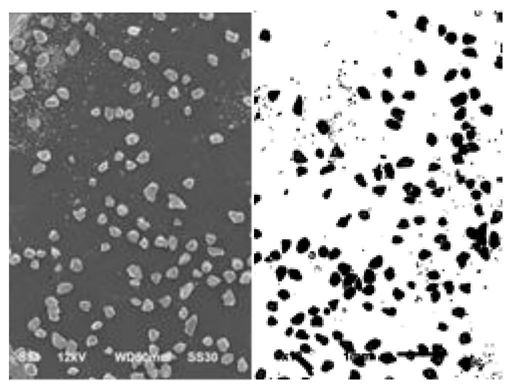

Figure 1. Grains from the trough of the terrestrial analog. Left image shows a greyscale (native) SSEM image; the right shows the processed (binary) image.

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