REGIONAL GEOLOGY AND ROCK DISTRIBUTIONS OF THE MARS PHOENIX LANDING SITE. T. Heet[1], R.E. Arvidson[1], M. Mellon[2], and The Phoenix Science Team, [1]Earth and Planetary Sciences, Washington University in Saint Louis, Saint Louis, MO 63130, [2] Laboratory for Atmospheric and Space Physics, University of Colorado, Boulder, 80309

Introduction: In May 2008 the Phoenix Lander descended into the north polar region of Mars. It landed at 68.22 N, 234.25 E in a shallow valley about 20 km west of a 10 km crater named Heimdall. Phoenix imaged local geomorphology, determined local ice table depth and analyzed 19 soil samples from within a ~15 m^2 work volume. Important to interpreting these locally derived results and extrapolating these results to other areas is an understanding of the regional geology of the landing site, specifically the origin and alteration of sampled material.

Regional Geology: The regional geology of the Mars Phoenix landing site was mapped using a combination of Mars Odyssey's Thermal Emission Imaging System visible data (THEMIS-VIS) together with Mars Reconnaissance Orbiter's (MRO) Context Camera (CTX) and High Resolution Imaging Science Experiment (HiRISE) images. The completed map has a resolution of 5 meters (Fig. 1), improving the fidelity of maps previously produced by Seelos 2008 [4]. The mapped area extends from 67.5 to 68.83N and from 231.5 to 236.5 E. Regionally, Phoenix is located in a shallow valley corresponding to the Scandia Formation [5]. The surrounding highlands correspond to the Vastitas Borealis Marginal unit as mapped by Tanaka 2005 [3]. Locally, the Lander sits on a differentially eroded outcrop of outer, discontinuous ejecta from nearby 10 km wide Heimdall impact crater. Heimdall ejecta deposits appear dark in CTX and THEMIS-VIS images and are characterized by large scale (15 m) and small scale (5 m) polygons superposed on one another [3]. Heimdall ejecta deposits are also slightly (~1m) elevated above the surrounding terrain as indicated by shadowing in CTX images.

Crater size-frequency: The size-frequency distribution of craters in each mapped geologic unit was determined using CTX images. Dates were derived using Hartmann and Neukum production functions modified to include possible deposition/crater infill over time [1,2]. Dates derived from the Hartmann and Neukum production functions where similar, so only Hartmann production function derived dates are quoted here.

The size-frequency distribution of craters superposed on the inner, continuous Heimdall crater ejecta indicate that the Heimdall impact occurred ~500 million years ago. The valley material and highlands material both date to early Amazonian, with the highlands material (3.5 Gy) appearing slightly older than the lowlands material (3.3 Gy). This result agrees well with crater dating done previously by Tanaka 2005 [5] for the Vastitas Borealis Marginal unit and the Scandia Formation.

Within the valley the number of craters decreases close to Heimdall, indicating that the valley material was altered during Heimdall ejecta emplacement and with alteration more extensive near the point of impact. Therefore, the valley material is mapped as two units: the Lowlands Dark Unit corresponds to unaltered lowlands deposits and the Lowlands Bright Unit corresponds to altered lowlands deposits [3]. The modification surface (i.e. Lowlands Bright Unit) is distinguished by higher albedo in THEMIS and CTX images.

Rock Size-Frequency: Rock size-frequency distributions for rocks larger than 1.5 m were characterized using a combination of automatic and hand counts of rock shadow widths in HiRISE images. The distribution of rocks smaller than 1.5 m was determined using Phoenix surface images. The Phoenix landing site is depleted in rocks of all sizes relative to other landing sites, but enriched in rocks smaller than 0.1 m relative to what simple crushing models predict.

Phoenix surface images show that small rocks, invisible in HiRISE images, tend to concentrate in polygon troughs. In HiRISE images, rocks within the Lowlands Dark Unit are seen to cluster into rubble piles. These rubble piles could represent trough deposits of extremely processed polygons. The Lowlands Bright Unit lacks distinct rubble piles consistent with a more recently modified surface.

Rock density is positively correlated with crater density. Both rocks and craters are concentrated in the Lowlands Dark Unit and on the tops of mesas which compose the Blocks/Mesas unit. Rock density is least on Heimdall crater ejecta and the Lowlands Bright Unit. This supports the hypothesis that the depletion of rocks at the Phoenix Landing site is due to surface modification during the emplacement of Heimdall ejecta.

References: [1] Phillips R.J. and Malin M.C. (1980) *Science*, *210*, *185-188.* [2] Plaut et. al. (1998) *Icarus*, *76*, *357-377*. [3] Mellon et. al. (2008) *submitted*. [4] Seelos K.D. et al. (2008) *JGR*, *113*, *E00A13*. [5] Tanaka, K.L. and Hare T.M. (2005) *USGS Scientific Investigations Map 2888*.

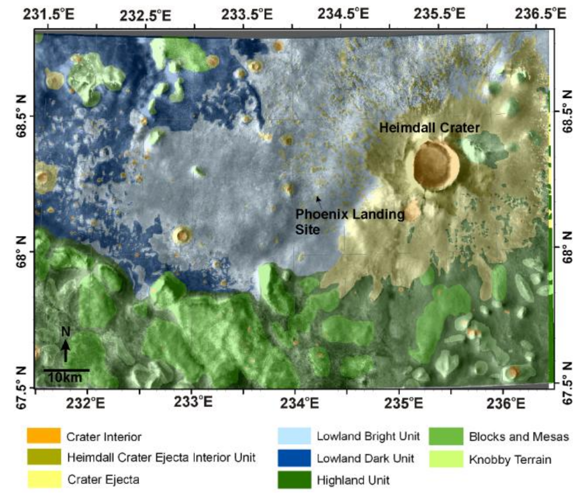

Fig. 1 Geologic Map of the region surrounding the Phoenix Landing Site. Phoenix resides in a shallow valley with about 300 meters of relief. The Lowlands Dark and Lowlands Bright units constitute valley materials, whereas higher elevation materials are mapped as Blocks and Mesas and Highlands Unit.