EVIDENCE FOR AN AEOLIAN CONCENTRATION OF CRYSTALLINE HEMATITE DEPOSITS OBSERVED WITHIN SINUS MERIDIANI. S. E. Pitiss[1], and V. L. Sharpton[1], [1]Geophysical Institute, University of Alaska Fairbanks, 903 Koyukuk Drive, P.O. Box 757320, Fairbanks, AK 99775-7320

Introduction: Results of our previous work [1] indicate that aeolian infilling has strongly affected the area within the hematite signature in Sinus Meridiani (SM) covered by MOC NA image m0704322 (hereafter, Image 1) and that two distinct surface units exist within this image. We expand upon this work by comparing this area with the results of a detailed examination of image m1801300 (hereafter, Image 2) located just outside the hematite region (Fig. 1). The objective of this study is to gain a better understanding of the processes that have produced the hematite enrichment and how they differ from other surface processes in the SM region.

Approach: Impact crater size-frequency (D-n) statistics were compiled for small (<1 km diameter) craters in both narrow angle, high resolution MOC images for comparison. These statistics were used in conjunction with other observational evidence in an effort to shed light on the origin of the hematite. Image 1 (1.45 m/pixel) covers a very flat 10 km^2 swath within the northeastern portion of the hematite region [2] and Image 2 (5.82 m/pixel) covers 114 km^2 outside of the hematite region to the northeast.

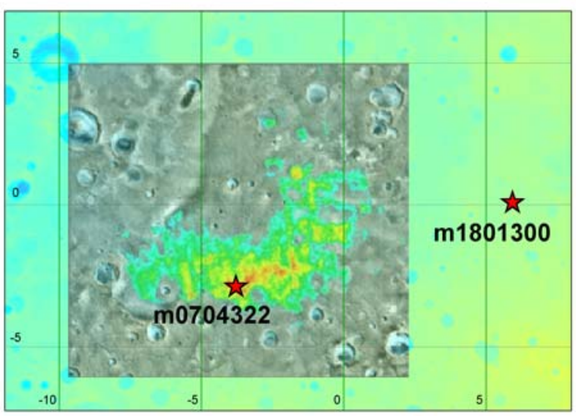

Figure 1: Location of images measured for study. Hematite image adapted from [3].

Image 1 Results. Visual inspection of Image 1 revealed the presence of two distinct regional surface units (Units 1 and 2), each with its own distinct population of craters. An additional crater population consisting of essentially buried 'stealth' craters at smaller (>80 m) diameters grading to heavily degraded craters at larger (<150 m) diameters represent inliers of an older heavily cratered surface that is almost completely covered by the younger units. Crater statistics suggest that this unit (Unit 0) is an ancient ejecta blanket deposit that has experienced continual but modest resurfacing by aeolian activity over the last few billion years (Unit 1).

More recently, aeolian sediments that have encroached from the W or SW have partially buried Unit 1 forming the youngest unit, Unit 2. These units are not regionally continuous but do form zones where either Unit 1 or Unit 2 is dominant. In the Unit 2-rich area, Unit 1 surfaces have been almost completely covered by younger and darker aeolian deposits of Unit 2. In the area of Unit 1, higher albedo material is only partially covered by Unit 2 material.

Figure 2: Portion of MOC Image 2 within the portion of SM that does not exhibit a spectral signature consistent with crystalline hematite.

Image 2 Results: The D-n plot for Image 2 shows a relatively straight line across the range 20<D<250 m.

The slope of this line is much shallower than the isochrons and roughly parallels the saturation equilibrium line (Fig. 3). We interpret this to indicate the action of some extended process, probably aeolian infilling, removing craters of all diameters. This is distinct from the total crater population statistics we derived from Image 1. However, the D-n graphs for Image 2 and Unit 2 of Image 1 are strikingly similar (Figs. 3 and 4). Furthermore, there is an abundance of very old craters with very degraded rims and infilled cavities, similar to the indications of a Unit 0 in Image 1. Both areas also are very similar in appearance and share similar geomorphic qualities.

Conclusions: Our study indicates that the portion of SM covered by Image 2 contains geological units similar in characteristics to Unit 0 and Unit 2 of Image 1. There is no surface unit in Image 2 that corresponds with Unit 1of Image 1. As Image 2 is outside the hematite zone, this suggests that Unit 1 is responsible for the hematite signature in Image 1. Morphological contraints and crater statistics indicate that Unit 1 is a relatively old aeolian deposit that has been partially covered by Unit 2, itself a younger aeolian deposit. Consequently, we suggest that the hematite-rich areas within SM may not be the source areas of crystalline hematite formation at all. Instead, these areas may be regional sinks where hematite-rich sediments collected or were concentrated through density sorting similar to placer formation and then fossilized prior to the emplacement of Unit 2.

References: [1] Chappelow, J. E. et al. (2002) *LPSC XXXIII,* Abstract #1798. [2] Lane, M. D. et al. (1999) *LPSC XXX*, Abstract #1469. [3] Christensen, P., et al. (2000) JGR 105, p.9623.

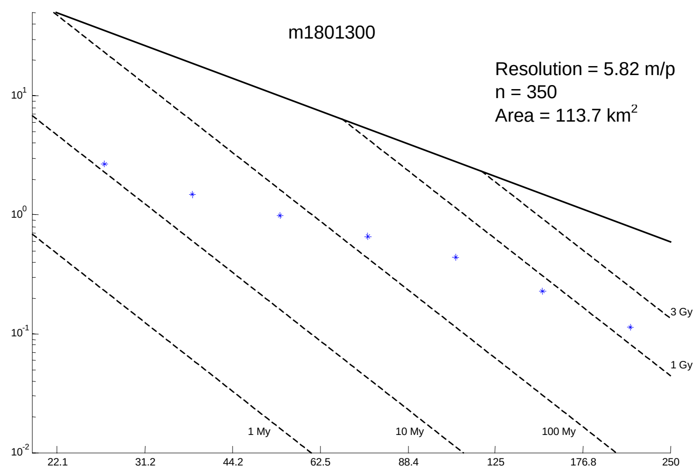

Figure 3: D-n graph for MOC Image 2. Error bars ($N^{0.5}$/area) are minute due to the large image area.

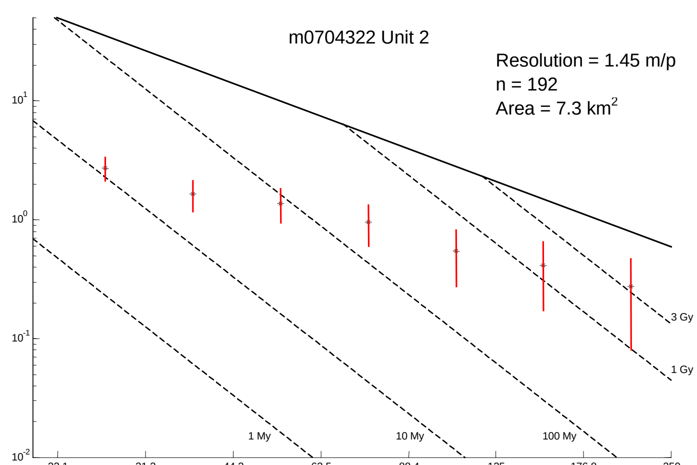

Figure 4: D-n graph for Unit 2 of MOC Image 1. Error bars shown in red.