AIRBORNE DUST EXPERIMENT (iSWEEP) ON THE PHOENIX MARS LANDER. L. Drube[1], K. Leer[1], M. B. Madsen[1], W. Goetz[2], R.V. Morris[3], M. Lemmon[4], [1] University of Copenhagen, Denmark (line@fys.ku.dk), [2] Max Planck Institute, Germany, [3]NASA Johnson Space Center, USA, [4]Texas A&M University, USA

Introduction: The Phoenix Mars Lander 2007 mission carried three identical calibration targets to verify and validate the preflight calibration of the Surface Stereo Imager (SSI) and to monitor the stability of this calibration during the mission.

These calibration targets ('iSweeps') are at least in one respect more advanced than calibration targets on earlier missions, as they contain magnets.

The iSweep is an aluminum plate with chips in six different colors and each in two sizes and with four additional experimental color chips (Fig. 2). Underneath each of the six large color chips is positioned a ring magnet. The design of each individual magnet is almost identical to that of the sweep magnets flown on MER [1]. As shown on MER, using such a sweep magnet it has been possible to maintain the center area very clean in the dusty Martian environment (fig. 1). It seems that almost any airborne particle contains at least a small amount of a strongly magnetic phase [1]. We have recognized later that the magnetic phase is predominantly magnetite [2]. This remarkable property of the Martian dust gave rise to the idea of using magnets as part of the calibration target, as they will be a lot less obscured by reddish dust accumulation during the mission.

Fig. 1: Sweep magnet on MER [1]. The dust has settled primarily where the ring magnet is positioned underneath the surface, leaving the center rather clean.

The MER heritage gave rise to the name: Improved Sweep Magnet experiments (abbreviated: iSweep experiment).

Dust settling rate on the iSweeps: Between sol 13 and sol 60 (Fig 2, 3, 4) the dust layer on the ring of the iSweep magnet got optically thicker, so the spectra for the different chips started converging towards the dust spectrum. Notice how similar the spectra are on sol 60 (Fig. 4) compared to sol 13 (Fig. 2). This convergence can also be detected from Fig. 5, where the reflectance is plotted versus sol number.

Fig. 2: iSweep no. 2 on Phoenix sol 13 and 60. Dust is settling primarily on the ring of the color chips as expected, leaving the center very clean.

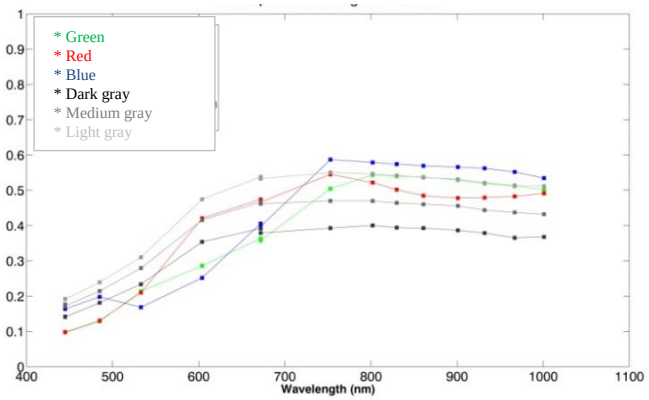

Fig. 3: The reflectance spectra of the dust ring on each of the 6 large color chips on sol 13.

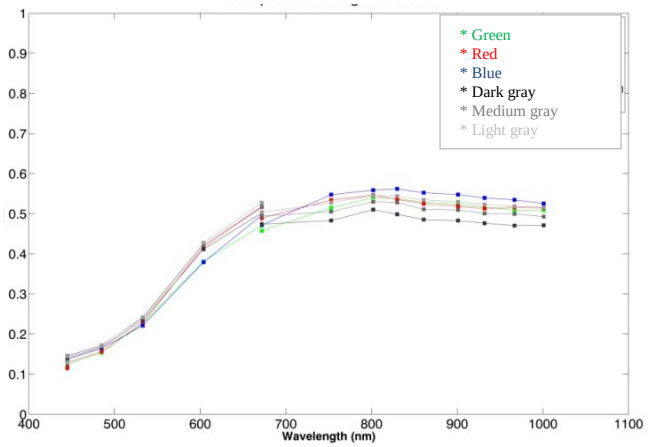

Fig. 4: The reflectance spectra of the ring on sol 60

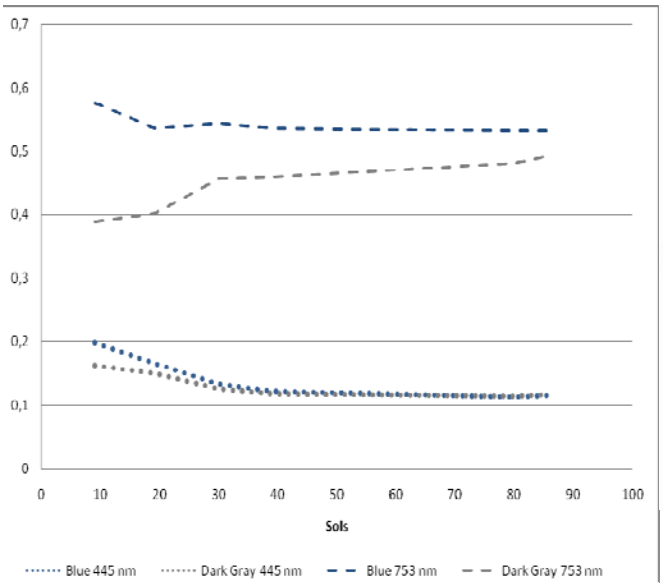

Fig. 5: Reflectance at the ring of two color chips: The dust has almost an optical thickness at 445 nm already around sol 40, but still not at 753 nm for sol 86.

The dust settling rate can be calculated by looking at the time it takes for the dust to become optically thick in different filters and then comparing them to laboratory tests performed with Mars analog dust (palagonitic dust) air-fallen onto different surfaces [3].

By looking at e.g. the ring of the Dark Gray chip in filter 445 nm the dust layer reached optical thickness around sol 40. For the laboratory air-fall test on a similar background (grey hematite) the dust became almost optically thick at a thickness around 40 µm [3]. From the results shown in fig. 5 a dust settling rate of 1 µm/sol on the magnets was calculated.

Airborne dust on a global scale: Fig. 6 shows that the spectrum of the dust on the iSweep in the northern arctic is similar to those of dust collected in similar manner in the equatorial region by MER-A..

From the small differences between the two spectra speculations can be made about how well the airborne dust is exchanged on a global scale. This discussion awaits the final calibration of SSI images.

The spectra of the dust that settled on the iSweep resemble those of the surrounding area as observed from orbit (CRISM).

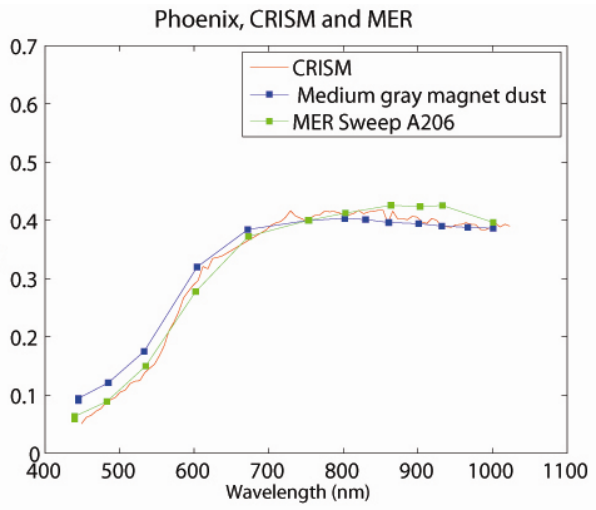

Fig. 6: Dust on the iSweep magnets compared to dust on the MER Sweep magnet and to CRISM spectra of the Phoenix local surroundings.

Conclusions: The spectra of the airborne dust collected in the Northern Arctic by Phoenix are very similar to those collected near the equator by MER but not completely so.

The dust settling rate on the iSweep magnets was of the order of 1 µm/sol during the first half of the primary mission.

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References: [1] Leer, K. et al., (2008) *JGR* 113. [2] Goetz, W. et al., (2005) *Nature* 436, 62-65. [3] Morris, R.V. et al, (2001) *32nd LPSC*, #1912.