DUST COVERAGES ON HORIZONTAL ROCK TARGETS IN GALE CRATER: INFLUENCES OF SEASONAL WINDS, ELEVATION, AND PROXIMITY TO ACTIVE DUNE FIELDS. T.L.J. Henley[1], M.E. Schmidt[1], S.L. Bray[2], J.J. Zheng[3], I.K. Marincic[4], D. Patel[5], R. Lee[6], N. Bradley[7], K.W. Turner[8]. Earth Sci, Brock Univ, St. Catharines, ON L2S 3A1, Canada, th18is@brocku.ca

Introduction: With an estimated exchange of $2.9x10^{12}$ kg/yr of dust between the Martian surface and atmosphere [1], dust activity is one of the most dynamic and prevalent geological processes of present day Mars. Despite its prevalence, the overall mechanisms which facilitate dust suspension and movement are not well quantified [2]. Previous studies have estimated atmospheric dust abundances using orbital measurements of atmospheric opacity [e.g. 3] and ground-based sun-brightness measurements [e.g. 4] however there are a limited number of studies that have sought to quantify the abundance of airfall dust on the Martian surface.

To address this, we use Mars Hand Lens Imager (MAHLI) images to estimate dust coverages covering horizontal rock targets along the traverse of the Mars Science Laboratory (MSL) Curiosity rover in Gale crater. We here present the dust coverage results taken throughout MSL to Sol 3344 and discuss the effects seasonal winds, elevation and proximity to aeolian dune deposits have on surface dust deposits.

Methodology: To measure the abundance of airfall dust, this study uses MAHLI images that are co-registered with Alpha Particle X-Ray spectrometer (APXS) data. For Method 1, focus merge images are opened in ImageJ, changed to 8-bit greyscale and the *Threshold* tool is used select and measure dusty pixels. Method 2 uses an enhanced focus merge MAHLI image that been edited using the online photo-editing website *BeFunky.com*. The edited image is then imported into ImageJ and the dust pixels are selected and measured using the *Threshold* tool. Method 3 uses the enhanced focus merge MAHLI image from Method 2 but further editing is performed in Adobe Photoshop. The *Replace Colour* tool is used to select and change all dust pixels to green while bedrock and other non-dust materials are changed to black. This binary image is then exported, opened in ImageJ and the *Threshold* tool is used to measure abundance of dust pixels. In each method a 1.7 cm-diameter is centered on the MAHLI image to represent the APXS field of view and to minimize vignetting around the edges of the image. These methods are further detailed in [5].

Results: Dust coverages from 387 undisturbed horizontal dust coverages encountered during MSL (up to 3344) were used to understand dust behavior. Dust coverages have ranged from 0.3% (sol 1571 Valley Cove) to 79.1% (sol 1386 Trekkopje) with the median value of 37.4% (Fig. 1.).

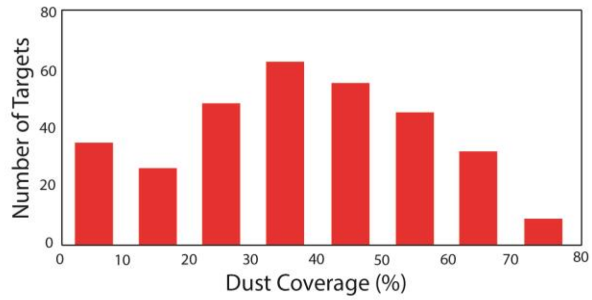

Fig. 1. Distribution of all As Is rock targets from MSL.

Dust Coverage Variations: Previous dust studies demonstrate how dust particles are most mobile during the summer period and least mobile during the winter period [4]. The results from this study have supported these observations (Fig. 2.). While maximum dust coverages increase around each Mars new year indicating deposition, they begin to decrease shortly thereafter indicating remobilization.

As Curiosity has climbed Mt. Sharp, the large central mound of Gale Crater, dust coverages were found to gradually decrease with increasing elevation (Fig. 2.). This observation is consistent with katabatic winds flowing down the slopes of Mt. Sharp [6] mobilizing surficial dust at high elevations, and leading to higher overall dust abundance along the crater floor.

Proximity to Aeolian Dune Deposits: The MSL traverse has approached two large aeolian dune deposits and in both instances dust coverages on surrounding rocks were found to decrease significantly (Fig. 3). The southern summer traverse of Bagnold Dunes returned the lowest sequence of dust coverages recorded throughout MSL (Fig. 3B.). Traversing the Sands of Forvie near the start of MY36 saw dust coverages seasonally increase (Fig. 2.), however, the proximity to aeolian dune deposits resulted in another sequence of low dust coverage targets (Fig. 3D.)

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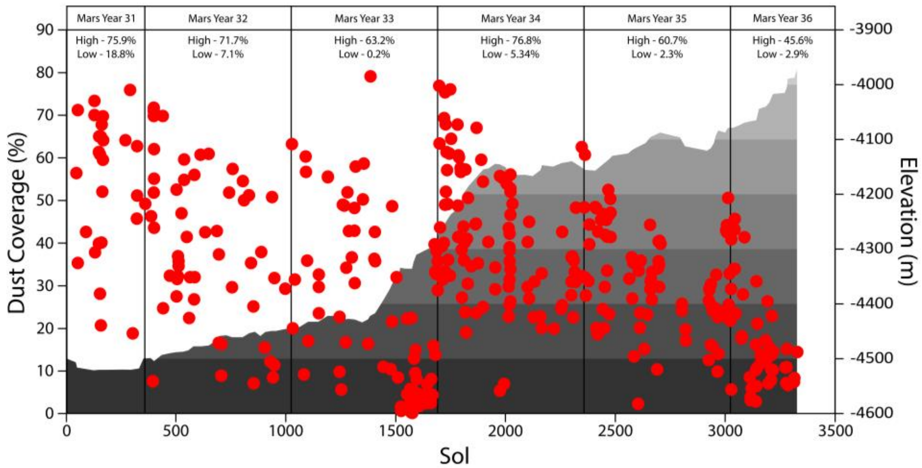

Fig. 2. Distribution of dust coverages recorded throughout MSL separated into individual Mars years, and plotted above the MSL traverse elevation. The highest and lowest dust coverages for each Mars years are displayed in their correspond panel.

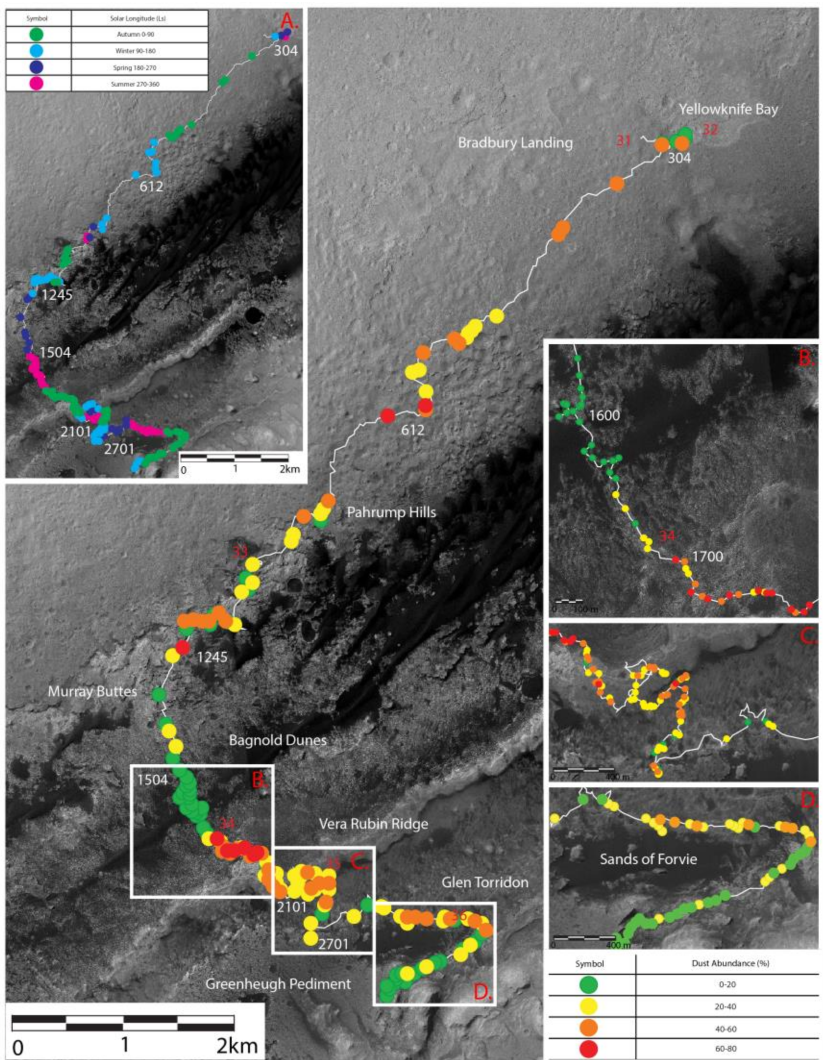

Fig. 3. Map of in situ rock targets examined by Curiosity in Gale Crater. Dust coverage (%) is indicated by color. Sols and stratigraphic members are labelled in white with the first target of each Mars new year (MY#) labelled in red. White boxes indicate locations of inset maps: (A.) Bagnold Dunes traverse, (B.) Vera Rubin Ridge, (C.) Sands of Forvie. Dust coverages during Phase 2 of the Bagnold Dunes traverse (sol 1603-1659) ranged from 1.7% to 6.9%. Excluding the sol 3192 Champeaux and sol 3212 Camster Cairns which had dust coverages of 26.3% and 22.9% respectively, the dust range during the southern traverse of the Sands of Forvie ranged from 6.6% to 17.1%