RECENT OBSERVATIONS BY CURIOSITY'S MARS HAND LENS IMAGER (MAHLI) OF ROCK STRATA AND EOLIAN SEDIMENT ON THE LOWER NORTH SLOPE OF AEOLIS MONS, GALE CRATER, MARS.

K. S. Edgett[1], R. A. Yingst[2], L. A. Edgar[3], P. J. Gasda[4], S. G. Banham[5], J. P. Grotzinger[6], H. E. Newsom[7], N. T. Bridges[8], J. A. Watkins[6], K. E. Herkenhoff[3], M. E. Minitti[2], M. R. Kennedy[1], G. M. Krezoski[1], D. M. Fey[1], I. Belgacem[7,9], S. Gupta[5], L. C. Kah[10], K. W. Lewis[11], M. J. McBride[1,12], J. Schieber[13], K. M. Stack[14], R. M. E. Williams[2], [1]Malin Space Science Systems, San Diego CA USA, [2]Planetary Science Institute, Tucson, AZ USA, [3]U.S. Geological Survey, Flagstaff, AZ USA, [4]Los Alamos National Laboratory, Los Alamos, NM USA, [5]Imperial College, London, UK, [6]California Institute of Technology, Pasadena, CA USA, [7]University of New Mexico, Albuquerque, NM USA, [8]Johns Hopkins University/Applied Physics Laboratory, Laurel, MD USA, [9]Institut Recherche Astrophysique Planétologie, Toulouse, France, [10]University of Tennessee, Knoxville, TN USA, [11]Johns Hopkins University, Baltimore, MD USA, [12]Purdue University, West Lafayette, IN USA, [13]Indiana University, Bloomington, IN USA, [14]California Institute of Technology/Jet Propulsion Laboratory, Pasadena CA USA.

Introduction: This is a summary of Mars Science Laboratory (MSL) Mars Hand Lens Imager (MAHLI) observations of geologic materials encountered by the Curiosity rover from May 2015 to early January 2016. Informal place, target, and unit names are in *italics*. The rover's traverse during this period is illustrated in **Fig 1**. The rocks studied included **(1)** a section of the *Murray formation* stratigraphically above the *Murray* rocks examined earlier at *Pahrump Hills* (**Fig 2** and [1, 2]) and **(2)** sandstones of the *Stimson formation*. The team also began to study **(3)** the *Bagnold* dune field.

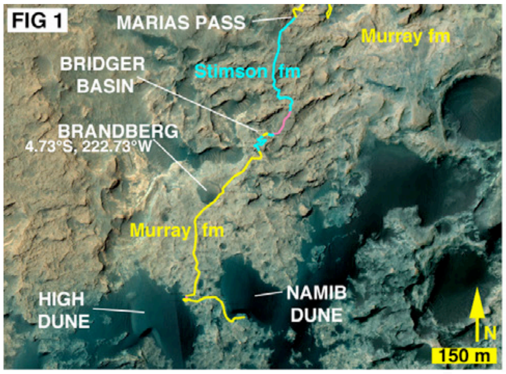
***Murray formation*:** The lower ~300 m of north Aeolis Mons strata are dominated by the recessive, slope-forming *Murray formation* [1]. Where examined, these rocks are finely-laminated, fine-grained (generally < 62.5 μm) clastic rocks interpreted to be mudstones, with occasional concretion-bearing intervals, inhomogeneities accentuated by differential wind erosion, and interbedded sandstones [1]. *Murray* outcrops examined by MAHLI during this period are along the portions of the traverse colored yellow in **Fig 1**. In some areas, fine laminae of ~500–800 μm thickness are well preserved (**Fig 3**), particularly in the vicinity of mudstones just east of *Marias Pass* with elevated Si contents relative to other *Murray* mudstones [3]. Higher in the section (**Fig 2**), *Murray* rocks exhibit a purplish hue which contrasts with the lighter grays of mudstones lower in the section (**Fig 4**).

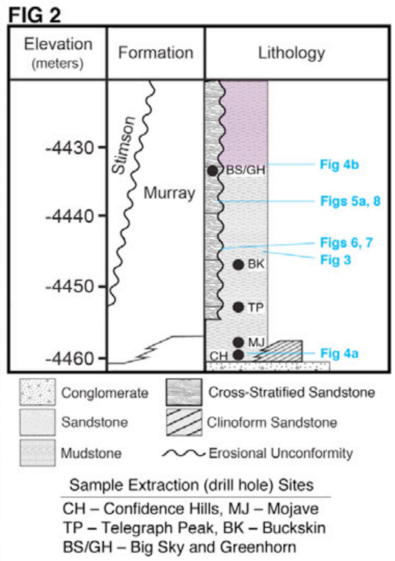
***Stimson formation*:** The *Murray formation* is unconformably overlain by the *Stimson formation* [2, 4]. The erosional paleosurface sloped down toward the north, cutting across *Murray* strata [2]. The majority of the *Stimson* rocks encountered along the traverse (in blue in **Fig 1**) are interpreted as eolian cross-bedded sandstones [6]; MAHLI images in some cases show well-rounded sand grains, including some which are interpreted as basalt lithics containing small, light gray phenocrysts (**Fig 5**). Details at the unconformity were examined by MAHLI at the *Marias Pass* site (**Fig 6**); the outcrop includes weathered clasts interpreted to be pieces of *Murray formation* mudstone incorporated into *Stimson* sands; pieces of vein-filling material from the *Murray* might also be present (**Figs 6, 7**); other white and light gray materials in the outcrop include well-rounded siliciclastic grains (mineral or lithic fragments) and pore-filling cement (**Fig 7**) [5].

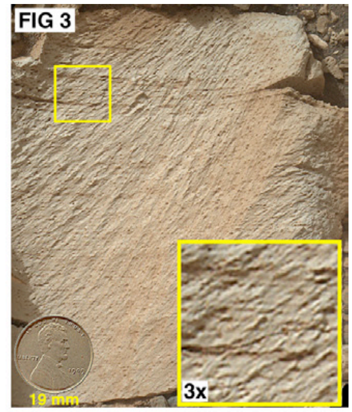
Diagenetic halos: *Stimson* sandstones are cut by fractures that have associated "halos" wherein the rock was lightened from dark to lighter gray, usually parallel to the fractures [3]; MAHLI examined examples of these (**Fig 8**). The *Murray* mudstones in *Bridger Basin* (**Fig 1**) also exhibit diagenetic halos (which MAHLI examined at *Cody* [7]). These diagenetic halos might be related to the same fluid flow event(s), post-dating *Stimson* sand burial and lithification [3, 7].

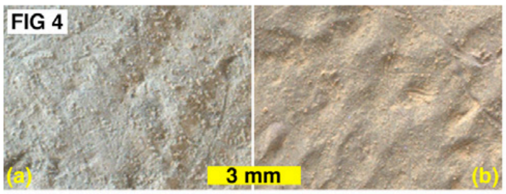
Eolian dunes: Superimposed on the *Murray* and *Stimson* bedrock in the field area (**Fig 1**) are the active [8] *Bagnold* eolian dunes [9]. The first MAHLI imaging of these sediments, on (Sol 1184) and adjacent to (Sol 1182) the east stoss margin of *High Dune*, occurred in December 2015. The bedforms examined on Sol 1182 had a surface lag of medium to coarse mafic sand overlying a body of very fine to fine sand (**Fig 9**). The coarser sands include dark gray basalt lithics and brown, yellow, and green translucent crystal fragments interpreted as possible olivine sand; other grains vary from dark gray to brown to red to white to colorless translucent; some white grains might be pieces of locally-derived (from *Murray* rocks) vein fill material; others are likely feldspars.

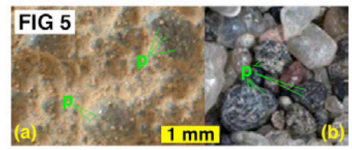
References: [1] Grotzinger *et al.* (2015) *Science, 350,* doi:10.1126/science.aac7575. [2] J. Watkins *et al.* (2016) *LPSC 47* (this volume). [3] Frydenvang *et al.* (2016) *LPSC 47* (this volume). [4] K. Lewis *et al.* (2015) *2015 AGU Fall Mtg*., P43B-2117. [5] Newsom *et al.* (2016) *LPSC 47* (this volume). [6] Banham *et al.* (2016) *LPSC 47* (this volume). [7] Gasda *et al.* (2016) *LPSC 47* (this volume). [8] Silvestro *et al.* (2013) *Geology 41*, doi:10.1130/G34162.1. [9] N. Bridges *et al.* (2016) *LPSC 47* (this volume).

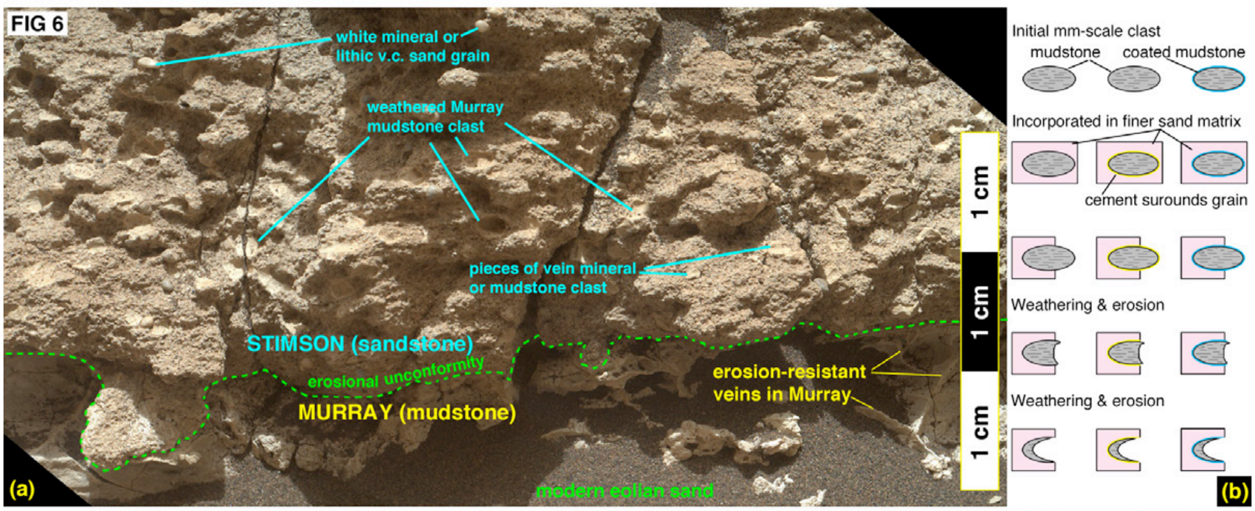


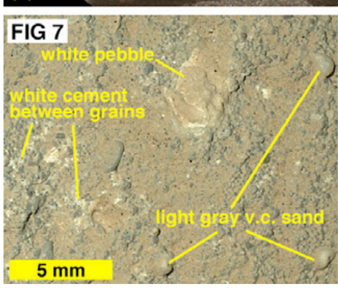












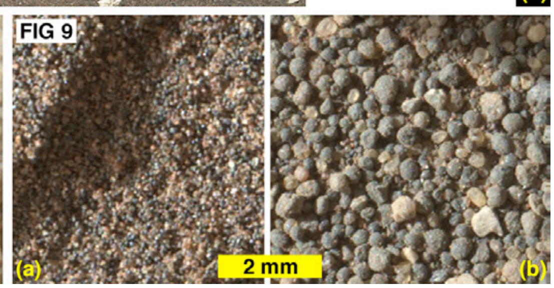


Fig 1. Curiosity's May–Dec. 2015 traverse between *Marias Pass* and *Namib Dune*. Base map is from NASA/JPL (http://mars.jpl.nasa.gov/msl/mission/whereistherovernow/). **Fig 2.** Stratigraphic column for *Murray/Stimson* section investigated Sept. 2014 – Dec. 2015. Stratigraphic position of MAHLI images in **Figs 3–8** are indicated. **Fig 3.** Fine laminae in *Murray* target *Lamoose*, MAHLI 1041MH0001900010400213C00. **Fig 4.** Qualitative mudstone color comparison in Dust Removal Tool (DRT) brushed spots; **(a)** light gray mudstone at *Topanga*; MAHLI 0815MH0003690000301483R00; **(b)** purple-hued mudstone at *Augusta*, MAHLI 1157MH0002270000402460R00. **Fig 5. (a)** Lithic fragment sand grains with phenocrysts (p) in *Stimson formation* eolian sandstone *Ledger*, portion of MAHLI image 1092MH0003350020401017C00; **(b)** For comparison at same scale, phenocrysts in basalt eolian sand from Christmas Lake Valley, Oregon. **Fig 6. (a)** MAHLI Sol 1032 mosaic at *Stimson-Murray* contact at site named *Clark*. **(b)** Clasts composed of *Murray* mudstone were incorporated into the lower *Stimson* sands at this site; sketch shows 3 working hypotheses for nature of the mudstone clasts. **Fig 7.** Night view of white clasts and cements in *Stimson* sandstone at *Big Arm*; MAHLI 1028MH0004450030204885C00. **Fig 8.** *Stimson* sandstone *Ivanhoe* within fracture-associated diagenetic halo; MAHLI 1092MH0001700000401028R00. **Fig 9.** Eolian sands of the *Bagnold* dune field near *High Dune* on Sol 1182; **(a)** The bulk sediment is very fine to fine sand overlain by **(b)** a ~1-grain-thick lag of medium to coarse sand. Grain color, shape, luster, etc., attest that a variety of mineral and lithic fragments are present.