SEDIMENTARY GEOLOGY OF TROUVELOT CRATER AND DARK INTRACRATER FEATURES (OR, "SPLOTCHES") OF WESTERN ARABIA TERRA, MARS. K. S. Edgett and M. C. Malin, Malin Space Science Systems, P.O. Box 910148, San Diego, CA 92191-0148, USA.

Introduction: Western Arabia Terra has been known for 3 decades for its prominent dark intracrater "splotches" and adjacent, low albedo wind streaks [*e.g.,* 1–5]. High spatial resolution images from Mars Global Surveyor's Mars Orbiter Camera (MOC) confirm that the dark "splotches" are—in part—eolian dune fields and that the wind streaks appear to be mantles of fine-grained (*e.g.,* silt) sediment deposited from eolian suspension [6–7]. This paper focuses on one of the western Arabia craters—Trouvelot—as an example of what all of them are generally like at the meter scale. The work is divided into two topics that focus on the floor of Trouvelot Crater: (1) modern and recent eolian landforms and (2) ancient stratigraphic relationships exposed by eolian deflation.

Eolian Features: Trouvelot Crater (16°N, 13°W) is ~150 km across (Fig. 1) and is one of 25 craters with diameters ≥25 km in western Arabia that have both a low albedo surface on some part of the southern crater floor, and also a low albedo streak that emanates from the dark spot and extends more than 100 km southward across the surfaces outside the crater. Trouvelot also contains a bright, high-standing feature on its floor similar to the "White Rock" in Terra Sabaea.

An image acquired in September 1998 (SP2-53203) provides the most information about the dark surface in Trouvelot Crater; these landforms are among the most Earth-like features seen anywhere on Mars. The location of this SPO-2 image and an additional MOC picture described here (M00-01346) are shown in Fig. 1. Sub-frames of the images are shown in Fig. 2. The simplest way to describe the eolian landforms in Trouvelot is to begin at the north end of the SPO-2 image and move southward in the direction of wind transport inferred from regional wind streak orientation. In addition to the figures shown here, the reader should refer to the original SPO-2 image, as some aspects are not illustrated owing to space constraints.

About 12 km south of the top of image SP2-53203 there is a relatively large (5.3 by 2.5 km) barchan-like dune (Fig. 2a). The dune has a varied albedo, suggesting that its surface includes particles sorted by size and/or composition. The dune surface exhibits several thin, dark streaks—up to 33 m wide—that crisscross the dune. These are interpreted to result from the passage of wind vortices and/or strong, individual wind gusts. The dune is flanked by large ripples spaced ~30 m apart—they are similar to granule-rich megaripples on Earth. South of the big dune, the surface exhibits many pits and small, broad, low albedo bedforms banked against low, rounded hills. Further south, this surface grades into a field of pedestal craters (Fig. 2b) and craters with bright yardangs in them (Fig. 2c). South of the pedestal craters occurs a large "white rock" feature, a relatively bright, ridged and grooved landform that stands above the dark, pitted floor of Trouvelot (Fig. 2d). This material appears to be only weakly layered and has been scoured by wind to form yardangs. Bright rock outcrops occur at the break in slope between the wall and floor of Trouvelot, suggesting that the bright field of yardangs is but a remnant of a material that was once more extensive. Dark eolian drifts have accumulated around some obstacles at the north end and within the "white rock" unit, and similar drifts emanate from its south side (Fig. 2d). Small barchanoid dunes are found south of the bright outcrops (Fig. 2d). The dunes do not bank up against Trouvelot's south wall, and thus indicate that sand which forms dunes has not been particularly abundant in Trouvelot Crater. The south wall, rim, and adjacent upland at Trouvelot Crater are mantled by dark material in which no bedforms occur—this material drapes the local topography and is interpreted to be a mantle of low albedo fines (as elsewhere in western Arabia Terra [7]).

Eolian deflation and deposition have both occurred in Trouvelot Crater. The source of dark sediment may have been the deflated surface on which the pedestal craters occur—these form when the ejecta deposit of the crater armors an underlying material that is otherwise susceptible to deflation by wind. Dark sand (in the form of drifts and dunes) is deposited where it banks against topographic obstacles, is confined by the topography of the south crater wall, and is captured in pits among the pedestal crater-covered plains. The yardangs are not presently shedding bright sediment, as none is found to be incorporated with the dark sand—the sand is just as dark where it is leaving the field of bright yardangs as it is where it enters the yardangs. The material in which the yardangs occur must, however, be somewhat friable and susceptible to eolian deflation.

Basin Floor Stratigraphy: The bright material in which yardangs have formed was once more extensive. Outcrops in the southern wall and remnants of this material elsewhere (Fig. 2c) indicate evidence of this former extent. The bright yardang material overlies the surface in which the pedestal craters occur. This is most evident in Fig. 2e, which shows a pedestal crater emergent from beneath the bright yardang material. Figure 2e also indicates that there is an erosional unconformity that separates the bright yardang material from the surface in which the pedestal craters occur. The pedestal craters, in turn, overlie a layer of material that has been largely stripped away by eolian deflation, leaving behind the pedestal forms. A 4.1 km diameter crater at the north end of image SP2-53203 exhibits layers in its walls, indicating that the material beneath the present floor of Trouvelot is layered. Thus we infer that the surface beneath the pedestal craters is also layered. Trouvelot Crater is a large basin in which successive layers of material were once deposited, and there was at least one interval of erosion and crater formation that pre-dates the deposition of the bright material in which the yardangs formed. The fact that wind can erode these materials indicates that at least some of these layers consist of material that is easily broken-up, dislodged, and carried away by wind.

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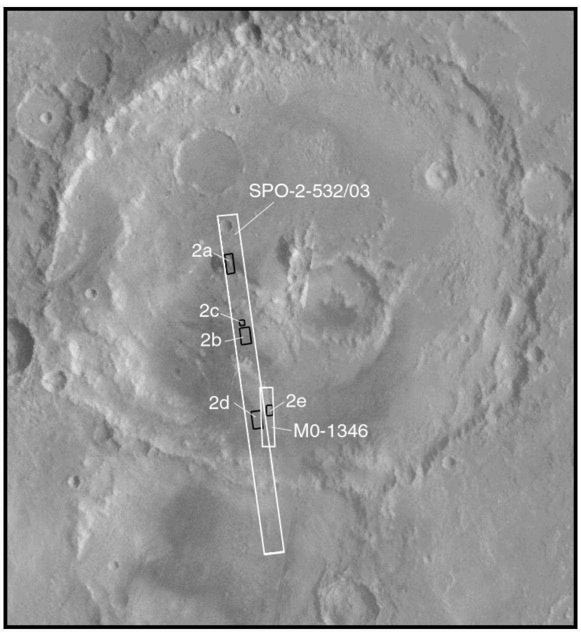

Figure 1. Trouvelot Crater (150 km wide) and context of MOC images described here. Bright feature north of the box labeled '2d' is a high-standing mass of wind-scoured, indurated or lithified material.

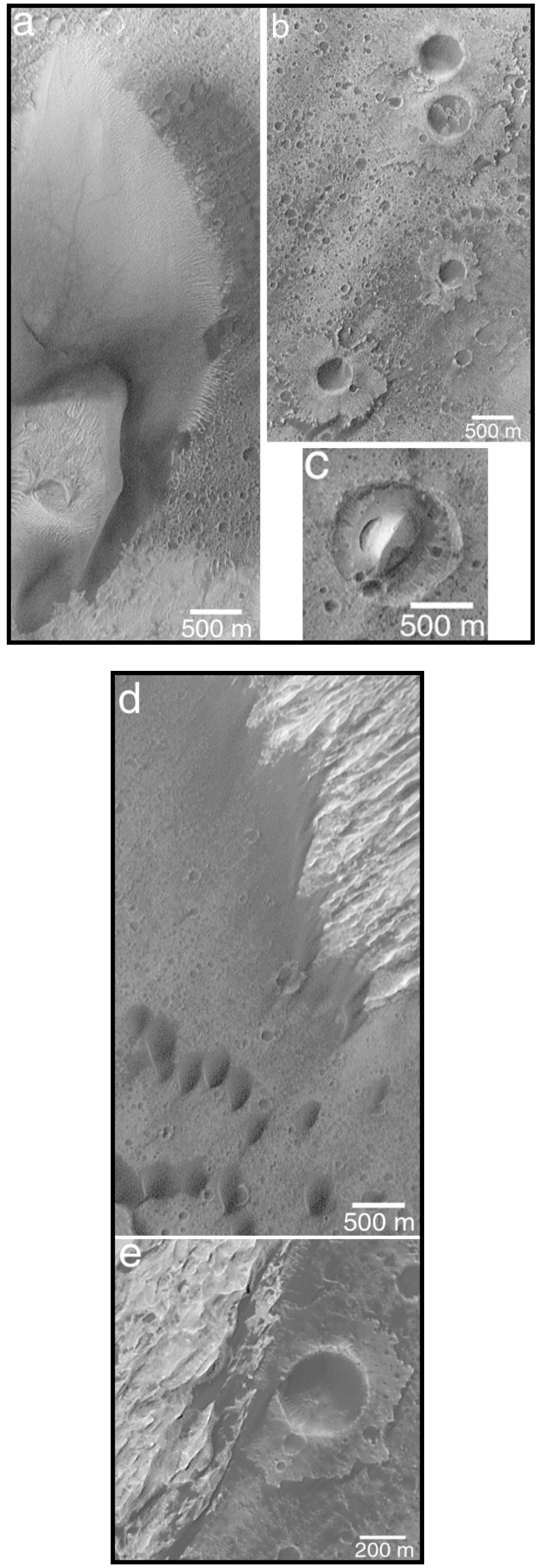

Figure 2. Pictures (a–d, right) are sub-frames of SP2-53203. Picture (e, right) is sub-frame of M00-01346. All are illuminated from the left. a) large dune; b) pedestal craters; c) bright yardang in older crater; d) "white rock" yardang material (upper right), dark drifts, and dunes (lower left); e) pedestal crater form partly exhumed from beneath the bright yardang material. Image (e) demonstrates stratigraphic relationships and occurrence of an erosional unconformity beneath the bright material.