

THE MODIFICATION OF MARS FLUVIAL SURFACES.

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Introduction: Understanding the past distribution of surface water is essential to model potential ground water stores. Fundamental to this task is the accurate identification of patterns of transport and accumulation of water on the surface inferred from fluvial landforms. These landforms have been modified by a series of secondary geological processes that have served to partially and in some cases totally obliterate the flood deposits. To date there is no published data which address the specific issue of the style and extent to which flood deposits have been modified.

Modification of surfaces: In the context of this paper, *modification* is a secondary geologic process that reconfigures the original deposit surface primarily by remobilising sediment into secondary landforms. This study will focus on two modifying agents - fluvial and aeolian. Recent high-resolution images from the Mars Orbital Camera have dramatically documented the nearly ubiquitous presence of modifying dunes across Mars [1], as well as provided detailed views of past water flow across the Martian surface [2]. In addition to aeolian [3], and fluvial modification [4], other modifying mechanisms include lava flows [5], impact craters, ejecta and mass wasting [6]. Degrees of modification vary; at one end of the spectrum are the hypothesized buried channels in the Tharsis region which have no surface expression and are indicated only by linear gravity anomalies [5]. At the other end are surfaces that appear relatively pristine. Between, lie features that have varying degrees of modification, from the winnowed and ejecta-mantled Pathfinder landing site to the deep aeolian mantles on the floor of Nandi Vallis [2].

Although it is clear that depositional surfaces on Mars have been modified, there is no data available and only a few studies have looked at this question on Earth. We intend to document the attributes of these secondary geologic processes and landforms associated with outflow channels on Mars, using remote sensing characteristics and available lander data.

Earth Analogs: Preliminary observations in eastern Washington and central Australia indicate that the surface of unconfined flood deposits have been modified by secondary geomorphic processes (fluvial, aeolian and lacustrine). Similar to Mars, the degree of modification varies from that of surface winnowing to complete obliteration of the primary landforms.

Characteristics of buried surfaces: A study of Earth analogs will facilitate a clearer understanding of the evolution of surface landforms and provide a subset of geomorphic signatures that has the potential to determine the characteristics of buried surfaces (e.g., the original extent of the deposit). Preliminary findings in central Australia show that variability in the characteristics of the superimposed landforms (e.g., aeolian dune spacing) is related to characteristics of the underlying surface (e.g., sediment size, topography).

Past changes in dry and wet episodes: In the proposed Australian analog, flood deposits (that represent a humid pulse) that inundate pre-existing dune fields (that represent a prior arid phase) are subsequently re-buried by dunes (a second arid phase). Therefore hydrological extremes in an arid climate have a distinctive geomorphic signature at the landform scale. The detection of similar landform relationships on Mars will allow relative dating of landforms and may indicate variations in the hydrologic cycle.

Figure 1. MOC example of dune modification of outflow channel. Dunes on the floor of Kasei Valles. Portion of MOC image fha01618 showing an area 1.2 km wide near ~26.60, 56.95 W, ~1.44 m/pixel, obtained from the PDS MOC Web site. Location marked as white bar on Viking context image (a).

Figure 2. Oblique aerial view of the terminal floodout of the Hale River in the Northern Simpson Desert.

Figure 3. Oblique aerial view of vegetated parabolic dunes flooded by a reservoir near Moses Lake, Washington. Water fills interdune areas in the top half of the picture.

Figure 4. Modification of fluvial surface in Central Australia a) modified dunes, b) pre-flood Pleistocene age dunes, c) playas marking flood deposit boundary, d) thinning point in modifying dune marking flood deposit boundary, e) Dissipating channel, f) Flood-bevelled dunes

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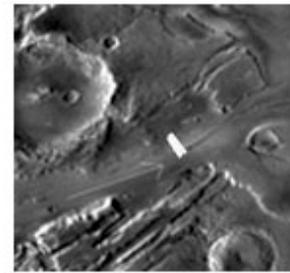
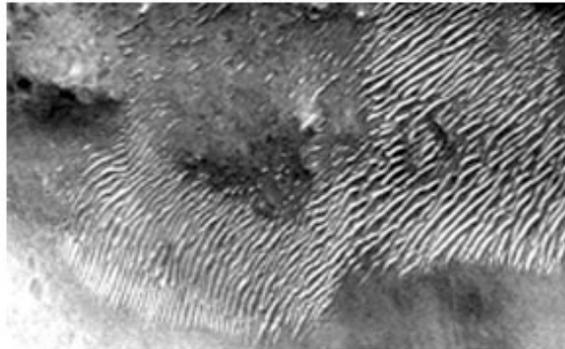


Figure 1



Figure 2

Figure 3

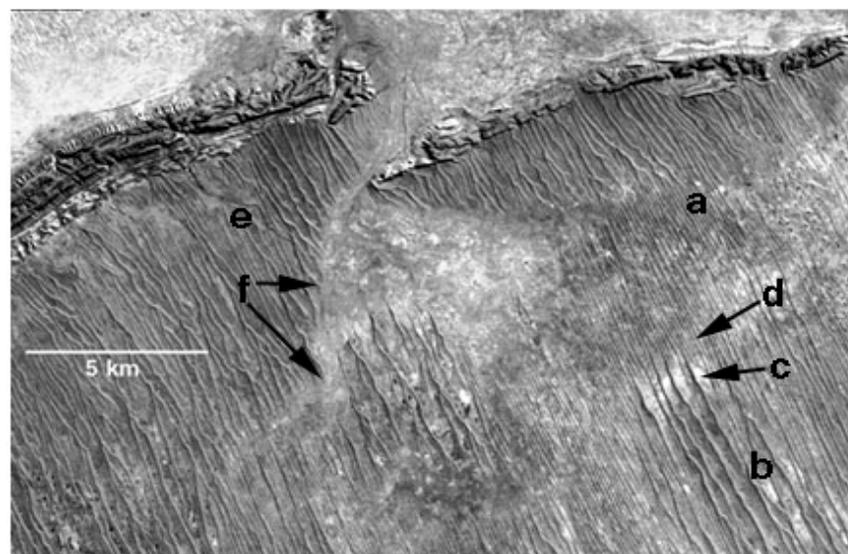


Figure 4

(Figure captions are on previous page)