NATURE AND ORIGIN OF SEDIMENTARY MATERIALS IN WESTERN ARABIA. M. A. Presley and S. W. Ruff, *Arizona State University, Dept. of Geological Sciences, Box 871404, Tempe, AZ 85287-1404*. mpresley@asu.edu and ruff@east.la.asu.edu

Introduction: Western Arabia is an intriguing geological region of Mars that has been the subject of numerous investigations [1-6]. Despite this attention, the origin and history of Western Arabian sediments remains unclear. The determination of the geologic history of this region would represent a significant improvement to our understanding of the climatic history of Mars.

Background: Western Arabia (WA) is composed of materials that are intermediate in color and albedo to the materials that comprise the classic dark and light deposits identified over the surface of Mars. The thermal inertia of WA also is intermediate between those of the classic light and dark deposits.

Thermal inertia depends on particle size [7]. The thermal inertia of the light and dark regions corresponds to that of dust and sand, respectively, which fits the geomorphology of those deposits. The materials in WA are not necessarily formed from particles that are intermediate in size between dust and sand, however. Other factors affect thermal inertia as well, including the bulk density or packing of the sediments and cementation of the materials by salts.

Geological Setting. In the north, WA is composed of relatively smooth intercrater plains. Many small and intermediate sized craters have muted topography, suggesting that the materials that make up WA have filled in older craters.

In the south, there are numerous large craters that have dark deposits on their floors, and many of these also have large dark streaks emanating from the crater and extending over very long distances towards the south or southwest [8]. Many of these craters also contain large deposits that have numerous horizontal layers exposed by extensive erosion.

WA is bordered by dark materials in both the north (Acidalia Planitia) and the south (Terra Meridiani), and light materials in both the west (Xanthe Terra) and the east (Arabia). Within Terra Meridiani there is a large deposit of crystalline hematite [9] that infers the existence of a large body of standing water within Terra Meridiani at some point in its early history.

Dunes are ubiquitous in the regions where dark deposits exist in WA. The dunes are primarily longitudinal or barchan, and both dark materials and intermediate-albedo materials form dune fields.

Geological History. While the geological history of WA remains uncertain, the infill of craters in the north clearly demonstrates that there was a period of massive deposition. Furthermore, erosional geomorphologies indicate that extensive removal of massive amounts of this deposited material also has occurred in WA.

Two hypotheses have been put forward regarding the depositional history of WA. Schultz and Lutz [4] suggested that the layered materials resemble the layered materials in the polar regions. On the basis of this similarity and the locations of the layered materials, they suggested that Mars pole has wandered throughout its history, and that these layered deposits are remnants of an ancient polar deposit.

With the increased resolution of the Mars Orbiter Camera (MOC), Malin and Edgett [10] have found the layered deposits to be nearly ubiquitous around the equatorial regions. Since these layered deposits are most visible within the larger craters, they suggested that these layered deposits were likely to be lacustrine deposits, with many large craters supporting standing water (lakes) within their basins at one time or another in early martian history.

Hynek and Phillips [6] take note of the significant amount of material that must have been removed from WA, and conclude that liquid water is the only force capable of moving that much material. They do admit, however, that WA contains very few paleo-channels, despite the extensive evidence of fluvial erosion in neighboring Xanthe.

Alternative Hypothesis: In addition to the lack of paleo-channels, the erosional morphologies in WA lack any fluvial signature such as tear-drop islands or scour marks. Conversely, evidence of eolian erosion is abundant. Fig. 1 shows some yardangs, which are ubiquitous around layered materials, particularly where nearby dune fields also exist. Yardangs are formed by eolian erosion, typically in friable materials [11]. Furthermore, since no breaches are visible in the large craters, the amount of material removed from the layered deposits within crater basins could only have been removed by wind.

Fig. 1 also illustrates that yardangs are visible within both WA materials and the layered deposits within crater basins. In regions where sand supply is sufficient, WA intercrater deposits are also being eroded [e.g., 12]. Fig. 2 illustrates that the erosional morphologies of WA material can be very similar to the morphologies evident in the crater deposits.

We propose that the materials composing WA are the same as in the deposits within crater basins. This

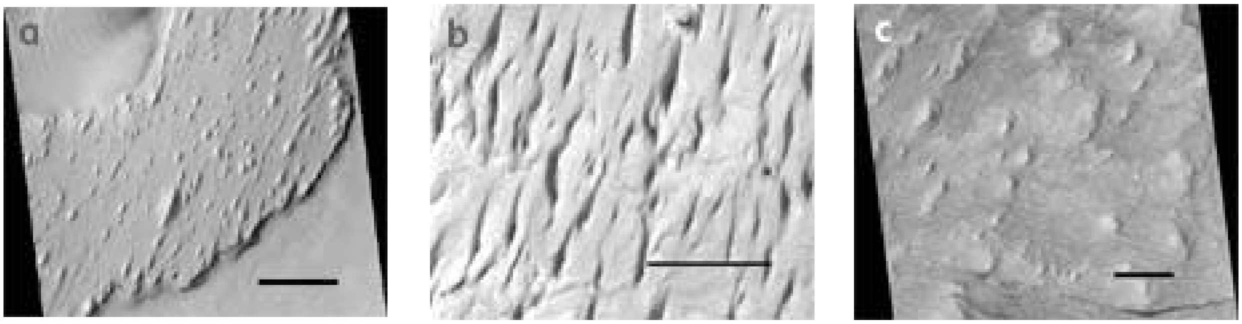

Figure 1. Geomorphology of yardangs in (a) Western Arabia, (b) Becquerel, and (c) Crommelin. Scale bar is 100 m in each figure. The images are selected segments from MOC narrow angle images (a) M02-03919, (b) M04-00124, and (c) M18-01825, respectively.

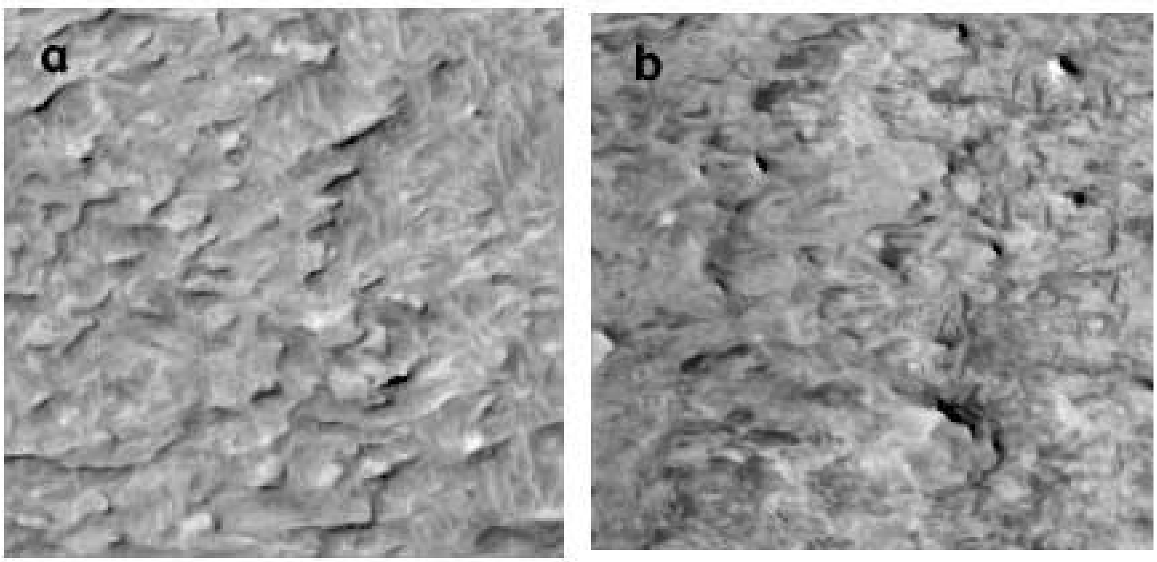

Fig. 2. Examples of erosional morphologies south of Crommelin crater. a. A portion of M2100314, showing erosion of layered deposits within a crater south of the crater south of Crommelin ~(1°N, 9.5°W). b. A portion of M0703955, showing erosion of layered deposits along the Western Arabia / Terra Meridiani border ~(0°N, 8.5°W). The resolution of both images is 4.3 m/pixel.

infers that a more regional process than individual crater lakes must have been active. This could have involved a much larger standing body of water, polar-like ice deposits, or extensive ash falls. The answer to this puzzle has obvious implications for the climatic history of Mars as a whole.

Summary: We will present further evidence that appears to link intercrater WA materials with the layered materials within crater basins. Locations of remnant layered materials outside of WA will suggest the regional extent of such a paleo-deposit.

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