LARGE-SCALE EOLIAN BEDFORMS AND STRATIGRAPHIC ARCHITECTURE AT VICTORIA CRATER, MERIDIANI PLANUM, MARS. L. A. Edgar[1], J. P. Grotzinger[1], A. G. Hayes[1], D. M. Rubin[2], S. W. Squyres[3], J. F. Bell III[3] . [1]Division of Geological and Planetary Sciences, California Institute of Technology, 1200 E. California Blvd., Pasadena, CA 91125, [2]USGS, Santa Cruz, CA 95060 [3]Cornell University, Ithaca, NY 14853. ledgar@caltech.edu

Abstract: The Mars Rover *Opportunity* has recently completed its observations of Victoria crater, the largest crater yet explored by the rover at Meridiani Planum. At ~750 m in diameter, Victoria crater exposes cliffs up to ~15 m high, revealing thick bedsets (3-7 m) of large scale cross-bedding, interpreted as fossil eolian dunes. *Opportunity* was able to drive into the crater at Duck Bay, located on the western margin of Victoria crater. Data from the Microscopic Imager and Panoramic Camera reveal details about the structures, textures, and depositional and diagenetic events that influenced the Victoria bedrock. Detailed stratigraphic analyses at Duck Bay, and nearby promontory Cape Verde suggest that these outcrops may be part of a larger-scale draa architecture. This insight is possible only due to the larger-scale exposures at Victoria crater, which significantly exceed the more limited exposures at previously explored Erebus, Endurance, and Eagle craters.

Stratigraphy at Duck Bay and Cape Verde: A lithostratigraphic subdivision of bedrock units was enabled by the presence of a light-toned band that lines the rim of the crater. *Opportunity's* ingress path intersects three stratigraphic units, named Lyell, Smith and Steno, in ascending stratigraphic order; Smith is the light-toned band. All three units consist of sulfate-rich cross-bedded sandstone, interpreted as fossil eolian dunes. Smith is interpreted as a diagenetic band, exhibiting a lighter tone and poor expression of lamination consistent with recrystallization. Evidence of the diagenetic unit reworked in the impact breccia indicates that Smith formed prior to the crater impact. Strike and dip measurements, calculated from Pancam stereo imagery, show that the units dip 2^{o} to the west (away from the center of the crater) likely as a result of the impact. The contact between Smith and Lyell is gradational, but the contact between Smith and Steno is erosional and dips ~10^{o} to the southeast. These units, define the "Reference Section" for Victoria crater.

After completing its observations at Duck Bay, *Opportunity* made a close approach to nearby outcrop Cape Verde, which contains a light-toned band similar in thickness to that of Smith, overprinting well-laminated sandstone with low-angle cross-bedding. The base of the Cape Verde cliff face contains a truncation surface dipping ~10^{o} to the southeast. Given that the erosional contact at the base of Steno also has a ~10^{o} dip, and the two exposures of the surface lie in the same plane, we infer that the erosional contact at the base of Steno correlates with the erosional surface at the base of Cape Verde.

Reconstruction of Eolian Bedforms: The erosional surface likely represents the migration of a dune across a larger bedform, known as a draa [1, 2]. The erosional surface indicates deposition by the same bedform on pre-existing topography, with deposition occurring close in time between locations (note that the dune would have arrived at different locations at different times). Analysis of cross-bedding geometry reveals that strata below the erosional surface dip to the W/SW, while strata below the surface dip to the SE. This suggests that the erosional surface may represent a draa-scale reactivation surface, responding to shifting wind directions. This interpretation is consistent with observations of terrestrial draas, which may contain reactivation surfaces representing the migration of dunes across a draa in opposite directions [3]. Alternatively, the opposing dip directions of the strata above and below the erosional surface may represent the migration of sinuous-crested bedforms, which can produce cross-beds that dip toward nearly all azimuths.

Conclusions: The strata exposed at Duck Bay and Cape Verde indicate deposition in an eolian dune environment, with further modifications though diagenesis. In the Reference Section, Smith is interpreted as a secondary, diagenetic unit, whose lower boundary also coincides with a primary, erosional contact, but elsewhere in the crater the diagenetic unit cross-cuts the primary stratigraphic surfaces. Correlation with Cape Verde suggests that there is an erosional surface at the base of the cliff face that likely corresponds to the erosional contact below Steno. This surface is interpreted to represent the migration of a dune across a draa. Additionally, the presence of several orders of bedforms and a complex wind regime suggest that the strata may have been part of a very large sand sea, with no evidence for aqueous deposition as observed at Eagle and Endurance. Victoria crater not only reveals the regional extent of processes seen elsewhere in Meridiani Planum, but the greater size of its outcrop exposures reveals the building of ever larger eolian bedforms.

References: [1] Brookfield, *Sedimentology* 1977; [2] Kocurek, *Sedimentology* 1981; [3] McKee, *Sedimentology* 1966