CORRELATION OF LOW-ALBEDO DEPOSITS ON THE FLOORS OF OUDEMANS CRATER AND SOUTHEAST NOCTIS LABYRINTHUS. S.C. Mest[1,2], C.M. Weitz[1], and L.L. Tornabene[3], [1]Planetary Science Institute, 1700 E. Ft. Lowell, Suite 106, Tucson, AZ 85719-2395 (mest@psi.edu); [2]Planetary Geodynamics Laboratory, Code 698, NASA GSFC, Greenbelt, MD 20771; [3]Center for Earth and Planetary Studies, Smithsonian Institution, PO Box 37012, National Air and Space Museum, MRC 315, Washington, D.C. 20013-7012.

Introduction: HiRISE and CTX images provide detailed views of the Martian surface allowing geologic materials to be characterized with regard to meter-scale morphologies and textures. Such images reveal unprecedented detail of unique deposits within the canyon of eastern Noctis Labyrinthus (NL) that may be related to the Oudemans impact [e.g., 1-7]. Dark rugged materials, mantled by eolian sediments, are observed to extend from the floor of Oudemans into NL. Further northwest of Oudemans, the floor of NL contains deposits that display complex morphologies consisting of flow-like structures, and in some cases complexly folded and rugged massifs, some of which contain light-toned materials. These deposits are unique to this part of NL or Valles Marineris to the east. Here we use HiRISE and CTX images to investigate the probable origins of these deposits as they relate directly or indirectly to Oudemans, including (1) Oudemans ejecta, impact melt and/or impact breccia, or (2) landslide deposits generated by Oudemans impact-induced quakes.

Observations: Here we morphologically characterize the deposits within Oudemans and NL to the north (Fig. 1), and map their spatial distributions in order to evaluate their relationship to the crater.

Oudemans Crater: Oudemans (D~120 km; 9.8°S, 268.2°E) appears to be a well-preserved crater, estimated at Late Hesperian to Early Amazonian in age [8], and displays well-preserved continuous ejecta, crater rim, terraced walls, and central peak. There is a large gap in the northern section of the crater wall where it intersects the canyon. This is likely the result of the intersection of the "displaced zone" with deep portions of the valley system to the north (i.e., Oudemans postdates the formation of the valley system), or the wall was subsequently removed as the canyon formed or the canyon enlarged. Oudemans ejecta is not "layered" – atypical of Martian craters of this size [9] – instead, the ejecta appears to be hummocky and more "ballistic" in nature. The ejecta is also asymmetric in planform, being broader to the east and west, narrower to the south, and indistinct from NL floor deposits to the north. The lack of a wall and apparent lack of ejecta to the north of Oudemans, and the asymmetric ejecta pattern suggest an oblique impact may be possible and account for some of Oudemans' appearance.

The central peak of Oudemans displays Light-Toned Layered Deposits (LTLDs) that exhibit alternating light- and dark-toned strata cut by fractures and are tilted near vertical [3,7], which is also common in other smaller complex craters to the southeast [10]. The occurrence of these deposits in the central peak indicates they may have originated at a depth of ~7-11 km; this excavation depth is based on a transient crater diameter of 70 to 110 km [11,12] and a theoretical sampling depth of approximately one-tenth the apparent crater diameter [13,14]. Although similar in appearance, these depths are at the maximum or greater for LTLDs exposed on the floors of NL and VM. However, the exposure of these materials in the outer portion of the central structural uplift suggests that may originate from shallower depths than estimated here.

The floor of Oudemans is covered primarily by a mottled (in THEMIS day IR) deposit that extends across the entire crater floor, through the breach in the northern rim, and into NL as far as ~50-75 km northwest of the crater. These materials appear to embay the Noachian-aged plateau materials. These areas consist of materials previously mapped as Amazonian-aged *smooth floor material* (believed to be alluvial and eolian in nature) and *slide material* (derived from NL wall materials) [8]. In THEMIS day IR images, the *slide material* shows flow-like morphology suggesting possible emplacement via mass movements. However, HiRISE and CTX images of these deposits, as well as upslope, display no landforms that resemble landslides or other mass movement mechanisms. Furthermore, examination of the plateau and canyon floor reveal no channels or features that could have provided a conduit for alluvium to be transported and deposited in this part of NL. The overall morphology of these deposits is also inconsistent with eolian deposition. Here, high-resolution images reveal mottling is due to dark- and light-toned areas that exhibit distinct surface morphologies (Figs. 2 and 3). Dark areas consist of rugged massifs that contain a combination of small knobs (especially in its southern extent) and shallow pits and degraded small-diameter impact craters. Light-toned areas, especially in the eastern and northwestern parts of this deposit, coincide with dune-forming sediments that fill low-lying areas among the darker massifs. Intermediate-toned areas consist of dark rugged materials covered by a thin mantle of brighter materials, possibly consisting of dune-forming sediments. The morphology of this dark material in high-resolution images suggests this deposit could be Oudemans impact-melt-bearing material emplaced in NL, and is currently being buried by eolian sediments.

Noctis Labyrinthus: The floor of NL northwest of Oudemans was previously mapped as Amazonian-aged *rough floor material*, interpreted to be debris eroded from NL canyon walls and/or landslide material man-

tled by eolian deposits [8]. However, in addition to being chaotic in appearance (Fig. 4), this deposit exhibits scattered knobs, clusters of light-toned blocks within a darker matrix, scarp-bounded smooth moderate- and low-albedo mesas, and pits with elongated and irregular shapes. Massifs within this deposit, which are likely remnants of the Noachian basement, appear to be mantled by the low-albedo mesa-forming material and in some cases this mantle is being removed from the massifs, but remains along the lower massif slopes. Materials exhibiting this surface morphology are only found in this location in NL, proximal to Oudemans, and suggests that they could be related to the Oudemans impact-forming event.

Discussion: This is an ongoing investigation into the nature of deposits within Oudemans crater and a unique series of deposits to the north within NL. Previous Viking-based studies suggested these deposits are comprised of Amazonian-aged alluvial and/or eolian sediments, or materials emplaced via landslides from plateau wall materials. However, analysis of recent high-resolution HiRISE and CTX images suggests that these deposits may be directly related to the Oudemans impact, consisting of impact-melt-bearing material released from the crater via the breached northern wall and turbulently emplaced ejecta confined within the canyon of NL. Future work will involve continued mapping and evaluation of this relationship, and the timing of the emplacement of these deposits relative tothe formation of Oudemans (such as by crater size-frequency distribution statistics).

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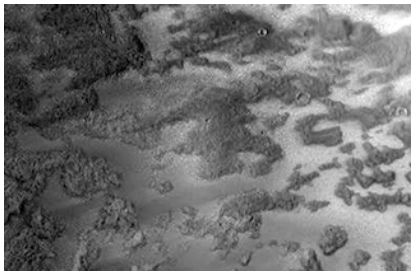

Figure 2. Rugged dark material on floor of Oudemans and Noctis Labyrinthus to north. CTX P05_003079_1714.

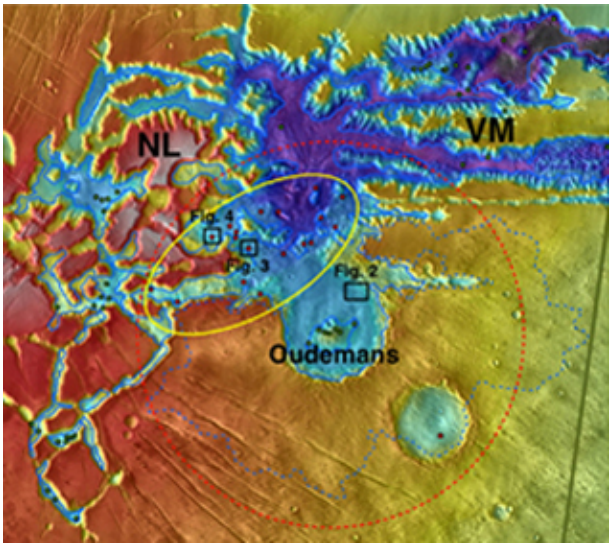

Figure 1. MOLA DEM over THEMIS day IR mosaic (100 m/pixel) showing locations of Oudemans, Noctis Labyrinthus (NL) and Valles Marineris (VM). Red circle represents approximate extent of continuous ejecta from Oudemans (~1½ times Oudemans diameter). Blue lines represent THEMIS-derived contacts. Dots represent HiRISE images displaying LTLDs found within the expected Oudemans ejecta (red) and beyond the ejecta (blue). Yellow oval shows location of possible Oudemans-related features found within NL.

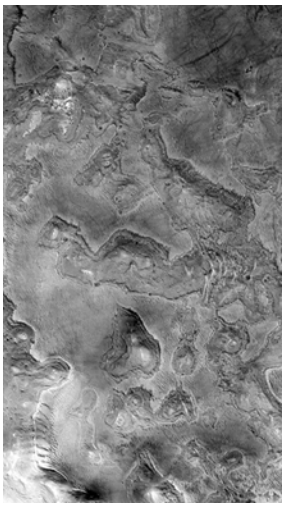

Figure 3. Rugged massifs surrounded by smooth materials on floor of Noctis Labyrinthus just north of Oudemans. HiRISE image PSP_005624_1715.

Figure 4. Chaotic terrain on floor of NL, northwest of Oudemans. HiRISE image ESP_018190_1720.