HIRISE IMAGES OF LAYERED DEPOSITS IN WEST CANDOR CHASMA, MARS (I): WALL ROCK RELATIONS, ENIGMATIC RIDGES, AND POSSIBLE DIKES. B. K. Lucchitta, U. S. Geological Survey, 2255 N. Gemini Dr., Flagstaff, AZ 86001. blucchitta@usgs.gov

Introduction: West Candor Chasma contains a thick stack of interior layered deposits (ILDs), which form Ceti Mensa and surrounding lowlands (Fig. 1). Their origin is still debated. They may be lacustrine [1], volcanic [2,3], eolian [4], or the result of fluvial activity [5]. Also, the idea of exhumation from the trough walls has recently been revived by Malin and Edgett [6]. High Resolution Imaging Science Experiment (HiRISE) images of the Global Reconnaissance Orbiter (MRO) mission were examined to help clarify some of these unresolved questions. To this end, I examined the relations of the layered deposits with trough walls and looked at structures within Ceti Mensa.

ILD and wall rock relations: The western lowlands of west Candor Chasma are covered by sequences of fairly uniform, light-toned, fine-grained, layered deposits with interspersed coarser and darker material. This material occurs as individual beds and more commonly as lenses within beds. The coarser materials are more resistant to erosion and usually stand in relief, many forming knobs. The origin of the coarser material could be depositional or diagenetic. If depositional, the lenses could be facies changes within beds. If diagenetic, the coarser beds and lenses could be preferentially cemented by percolating fluids [7]. The layered materials are in contact with the surrounding trough walls. The contact is shown in a stereo HiRISE image, in which light-toned layers clearly rest on top of a dark-toned wall rock spur (Fig. 2). Here, the light toned layers are NOT exhumed from the walls but are superposed, confirming the long-held view that the light layered deposits are indeed interior to the troughs.

Levees, composed of benches in the wall, locally occur on the south and west walls of the trough. They occur near the 1500-m contour line, even though some are as much as 100 km apart. The nearby trough floors are 400-1000 m lower. Above the levees talus piles up, underneath light-toned layers appear (Fig.3). The layers, where identifiable, parallel the slope or are disrupted. These observations also support that the light layers are not exhumed from the walls but are interior to the troughs. Apparently, the layered deposits once reached a much higher level in this area of west Candor Chasma. The near uniform elevation of the levees supports that the layers were deposited in a lake whose surface stood at the 1500-m level. The current floor level, which varies in elevation, could have settled differentially and perhaps draped over the preexisting floor. Settling may also have contributed to the disruption of layers at the base of the wall. Conspicuous anticlines and synclines on the floor may be due to diapiric deformation [8,9], but settling may have contributed to their formation. Differential settling, perhaps combined with dehydration, may have caused open cracks seen in places. The layers on the western floor of west Candor Chasma may be lacustrine, as suggested by the apparent shoreline and other observations by Lucchitta [10].

Enigmatic ridges and possible dikes: Circulating fluids may also have affected the top of Ceti Mensa. Okubo and McEwen [7] noted that the Ceti edifice is pervasively cut by veins standing in relief and paralleled by haloes. They suggested that aqueous fluids along joints or faults cemented the rock so it became more resistant than the country rock. Most of these veins are light colored and the relief is small. However, at the western top of Ceti Mensa, conspicuous ridges trending roughly NS are kilometers long, up to 500 m wide, and on the order of 100 m high. Several have light bases and very dark crests, shedding dark talus. HiRISE images show that the ridges are locally flanked by upturned bedding or by parallel joints (Fig. 4). These observations suggest structural control, and the dark color may indicate that the ridges contain basalt and may be dikes. Color images are not available in this area, but dark rocks on a similar ridge near the eastern base of Ceti Mensa are brownish on enhanced color images (Fig. 5). If the rock were basalt, it should have a bluish tint, as seen on basaltic landforms elsewhere. Another dike-like dark feature is seen at the southern base of Ceti Mensa. It is about 200 m wide, stands in relief, and cuts adjacent beds (Fig. 6). It also displays the brownish tint, and a CRISM (Compact Reconnaissance Imaging Spectrometers for Mars) image appears to show the signature of kieserite for this feature [11]. If the ridges are indeed volcanic and contained basalt, the rock had to be altered, probably by diagenetic fluids. Okubo (personal communication) proposes that these ridges could be cemented massive veins or breccia zones, but this view does not explain the dark color. In either case, the observation supports that the Ceti edifice has been diagenetically changed. If the dark ridges and possible dikes used to be basaltic, it would make a volcanic origin for Ceti Mensa more plausible.

Conclusion: Light-toned layers on the western floor of west Candor Chasma clearly show that the layered deposits are superposed on the walls and not exhumed. Levees on the walls at near equal elevations could be shorelines and suggest the former presence of a lake. The layers on the floor have some characteristics that may be due to diagenetic alteration. Dark ridges and possible dikes in the adjacent Ceti edifice also appear to have undergone alteration. They do not have the color of basaltic dikes but could have been derived from basalts. If so, a volcanic origin for Ceti Mensa would be plausible.

I thank the HiRISE team for making the images available.

References: [1] McCauley J. F. et al. (1972) *Icarus 17*, 289-327. [2] Lucchitta B. K. (1990) *Icarus, 86*, 476-509. [3] Chapman M. G. and Tanaka, K. L. (2001) *JGR 106(E5)*, 10,087-10,100. [4] Nedell S. S. et al. (1987*), Icarus 70*, 409-441. [5] Quantin C. et al. (2005) *JGR 110*, E12S19, doi:10.1029/2005JE002440. [6] Malin M.C. and Edgett K.S. (2000) *Science 290*, 1927-1937. [7] Okubo C. H. and McEwen A. S. (2007) *Science 315*, 983-985. [8] Beyer R. A. et al. (2000) *LPS XXXI*, Abstract #2022. [9] Milliken R. E. et al. (2007) *7th Int. Conf. Conf. Mars*, Abstract #3383. [10]

Lucchitta B. K. (2007), *LPS* Abstract # 2093. [11] Murchie, S. et al. (2007) *7th. Int. Conf. Mars*, Abstract #3238.

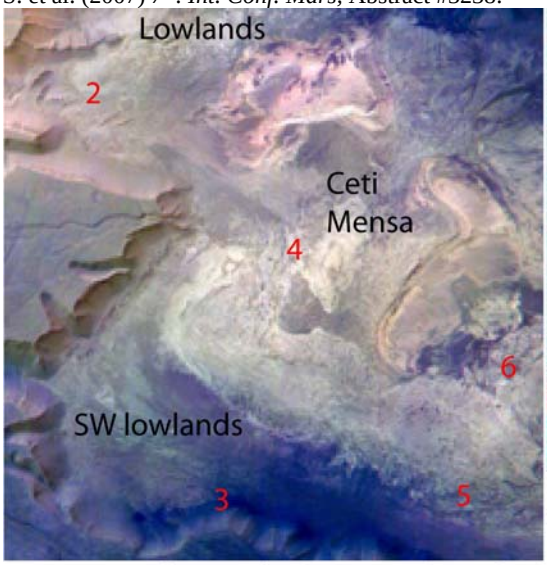

Fig. 1. SW part of west Candor Chasma. Numbers indicate location of figures.

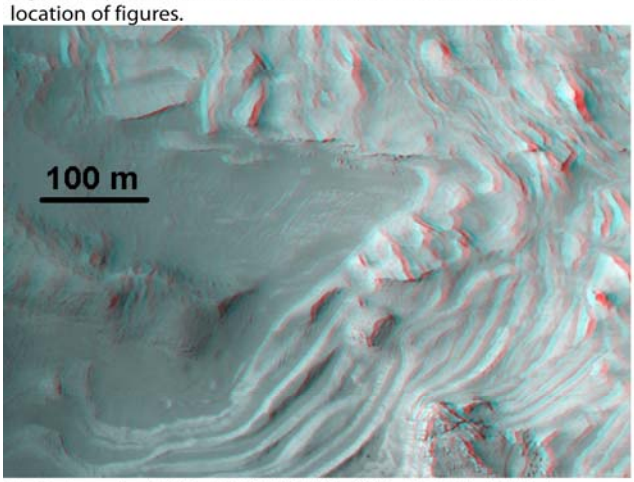

Fig. 2. Anaglyph PSP_002195_1745_PSP_002406_1745. Layers on wall rock.

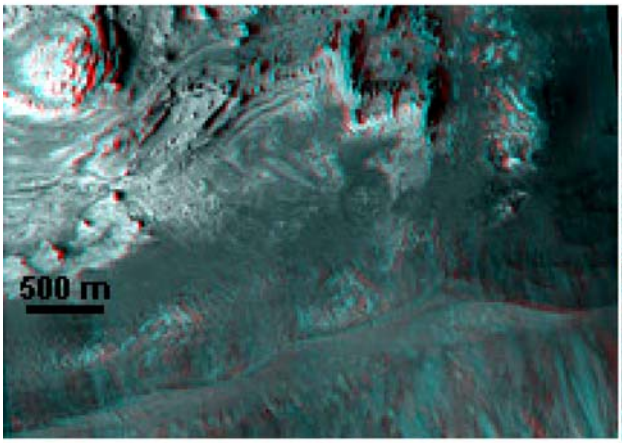

Fig. 3. Anaglyph PSP_003540_1735_PSP_003474_1735. Bench in wall traversing bottom part of image.

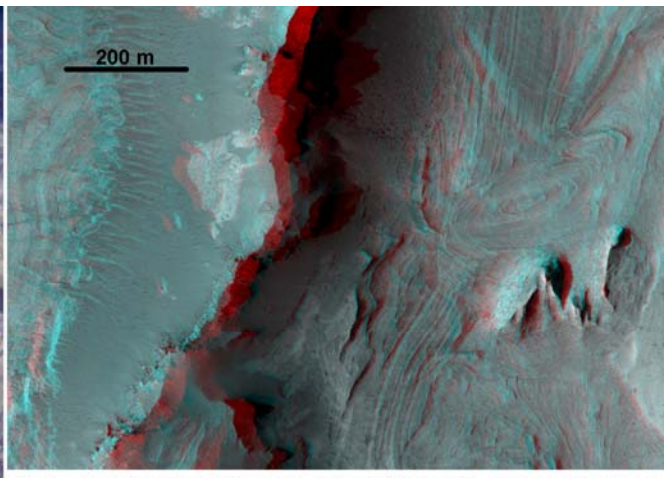

Fig. 4. Anaglyph PSP_2841_1740_PSP_003896_1740. Dike-like dark ridge traversing left-center of image.

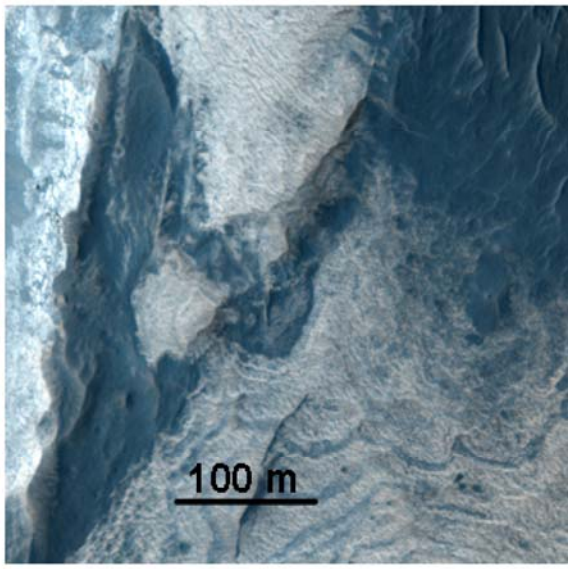

Fig. 5. PSP_002129_1735. RGB enhanced color. Dark ridge having brownish tint.

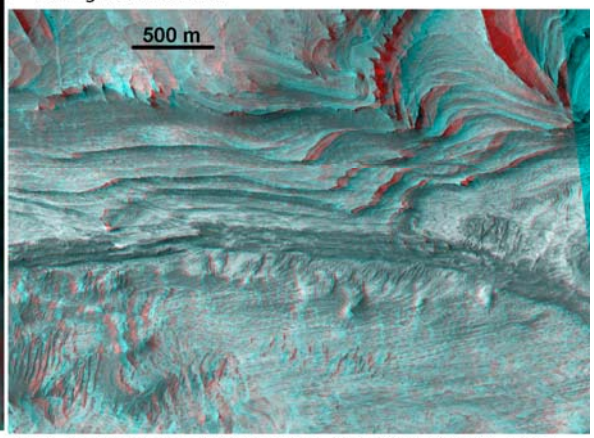

Fig. 6. Anaglyph PSP_001641_1735_PSP_002063_1735. Dark, dike-like band traverses center of image.