DUCTILE AND BRITTLE DEFORMATIONAL FEATURES WITHIN THE LIGHT TONED MOUNDS OF JUVENTAE CHASMA, MARS R. Sarkar[1] , P. Singh[1] , A. Porwal[1] , [1]Geology and Mineral Resources Group, CSRE, Indian Institute of Technology, Bombay , 124313001@iitb.ac.in

Introduction: Ductile and brittle deformational features are identified from the light toned mounds of Juventae Chasma using HiRISE [1] images. The ductile features include antiformal-synformal folds, sheath folds and interference patterns. Brittle deformation is exhibited through parallel and sometimes curved fracture planes, brecciation of light toned material into angular blocks and occasional pulverization of the same material. The location of the mounds and the corresponding images are shown in Fig. 1.

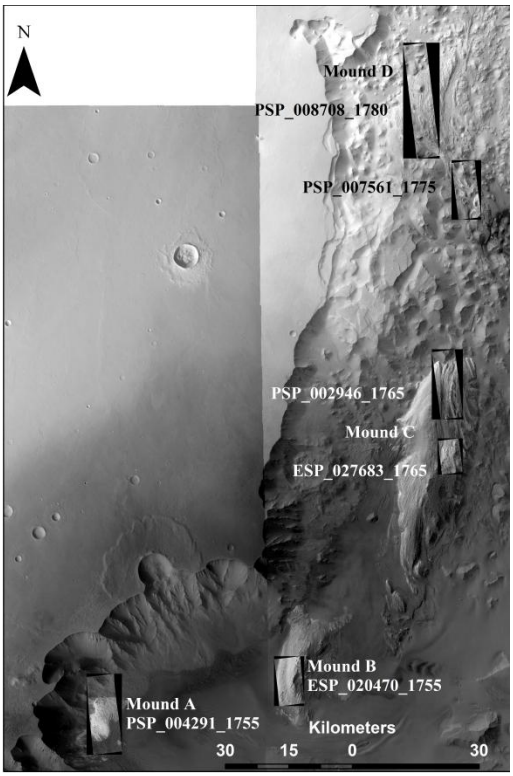

Figure 1. Mosaic of HRSC images H1070_0001 and H1973_0000 showing the location of the four mounds in Juventae Chasma and the corresponding HiRISE image IDs in which the deformational features are observable.

Datasets: Ductile and brittle deformational structures are described from the ILDs of Juventae Chasma using HiRISE [1] imagery. Contour lines are included to help conceptualize the nature of the terrain. These contour lines have been obtained from HiRISE (available at http://www.uahirise.org/dtm by NASA/JPL/University of Arizona) and HRSC [2],[3] (available at HRSCview, http://hrscview.fu-berlin.de/) DTMs which are: DTEEC_004291_1755_003790_1755_U01 and H1070_0001_DT4 respectively.

Description of structures: Mound A (Fig. 1) is located close to the chasma wall with some part of it apparently emerges out of the wall [4]. Different styles of folding are observed in the layer stacks for example, elliptical outcrop pattern (location A); sickle shaped fold (location B and C) and box fold (location D) (Fig. 2a). Brecciation and fracturing, with curvilinear fracture planes (location a), and some amount of slipping of the fracture-bound material along the curved fracture planes (location b) can be seen in Figure 2b. Mound B (Fig. 1) is located close to the chasma wall near its northwestern tip where exposures of possibly exhuming ILD material are in its proximity [4]. Ductile deformation is not found in this mound; however the signatures of brittle deformations are ubiquitous and are characterized by brecciation of the light toned material, parallel fractures and joint planes. In Mound C (Fig. 1), there are numerous exposures of folded layers ranging from moderately inclined synformal to superposed folds. Figure 2c displays the hinge of an eroded recumbent fold. Brittle deformation manifests itself as curved and parallel fracture planes, interspaced by angular blocks and with a matrix of pulverized light toned materials. Mound D (Fig. 1), located within the chaotic terrain at the Northern end of the chasma with its base at the highest elevation within the chasma floor, shows evidences of exhumation of light toned material at multiple places [4]. Ductile deformation is recognized at almost all locations in Mound D, and include eroded inclined and plunging synformal folds (Fig. 2d), Type III interference fold closing towards the south-west that could actually be a synformal fold with a refolded axial plane (Fig. 2e) etc. Brittle deformation is also observed at multiple locations for example as shown in Figure 2f.

Discussion: Within a salt diaper, irregular and constrictional flow of salt from a source layer to the rising stock can give rise to sheath folds and curtain folds within the salt mass and variations in the flow pattern can cause refolding of the earlier generation of folds to produce interference pattern [5,6]. Although theories regarding the origin of the sulphate mounds in Juventae Chasma suggest direct precipitation from a body of water [7], our observations suggest that these mounds may have evolved though a diapiric uprise of some pre-existing sulphate layers through an overburden. It follows that the source salt layers may predate at least some of the Hesperian plateau basalts.

References: [1] McEwen, A. S. et al. (2007) *JGR*, 112, doi: 10.1029/2005JE002605 [2] Neukum, G. et al. (2004) *ESA, Noordwijk, The Netherlands*, 17-35. [3] Jaumann, R. et al. (2007) *PSS*, 55, 928-952. [4] Catling, D. C., et al. (2006) *Icarus*, 181, 26-51. [5] Twiss, R. J., & Moores, E. M. (1992), *W. H. Freeman*. [6] Park, R. G. (2013), *Routledge*. [7] Bishop, J. L. et al. (2009) *JGR: Planets* (1991–2012) 114.E2.

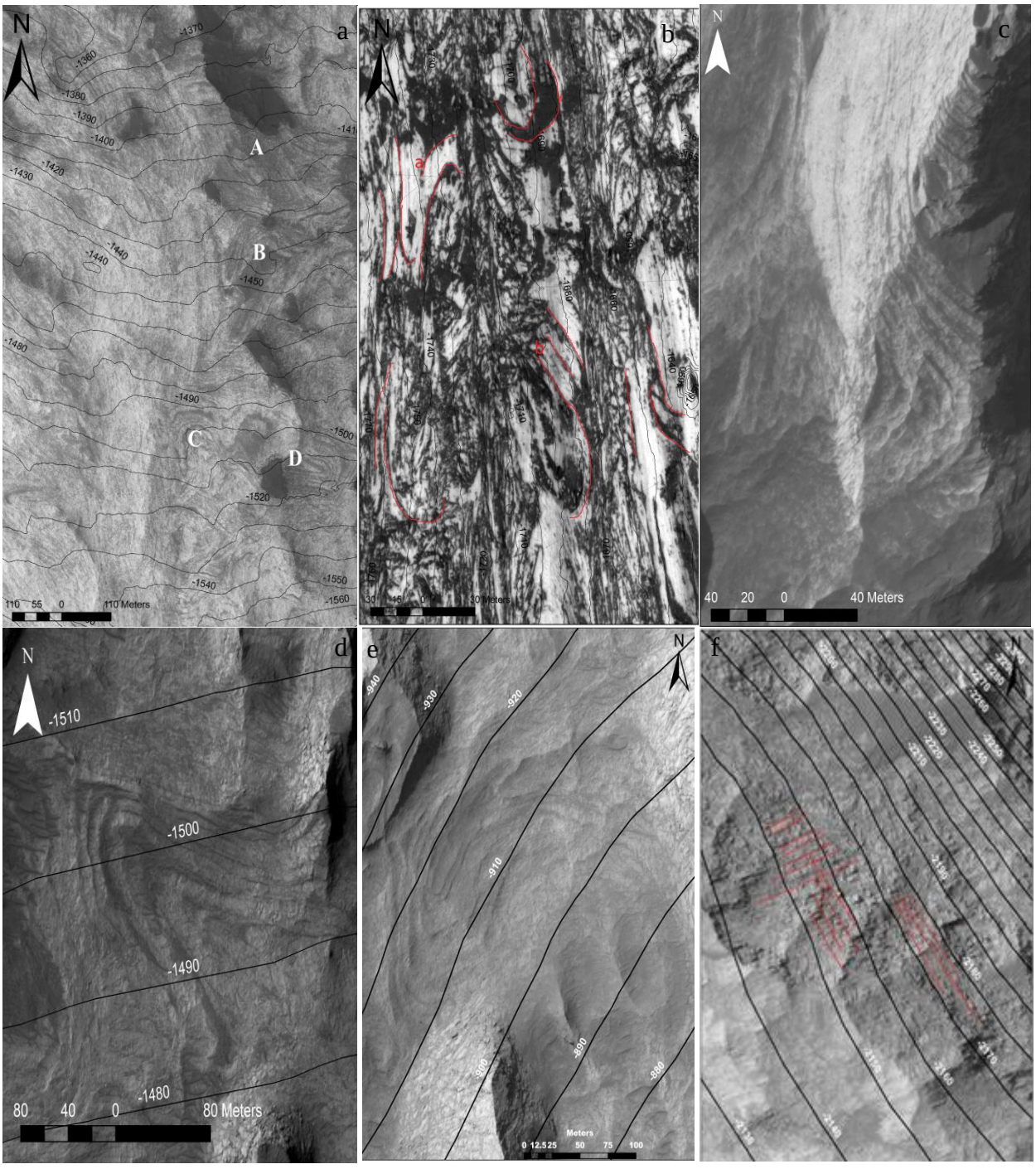

Figure 2: (a) Ductile features in Mound A; (b) Brittle features in Mound A, red lines highlight the features; (c) Hinge of recumbent fold in Mound C; (d) Inclined and plunging synformal fold in Mound D; (e) Type III interference fold, 'hook shaped' in Mound D; (f) Brittle fracturing in Mound D, red lines highlight the fracture planes.