**ORIGIN OF MASS WASTING FEATURES IN JUVENTAE CHASMA, MARS.** R. Sarkar[1], P. Singh[1], Ganesh. I[1], A. Porwal[1], [1]Geology and Mineral Resources Group, CSRE, Indian Institute of Technology, Bombay, (ranjan.s@iitb.ac.in)

**Introduction:** This contribution reports mass-wasting features originating from the walls of Juventae Chasma. Diverse lines of evidence indicate that fluidized ice/ water within the wall rocks could be responsible for the mobilization of the debris. The presence of sub-surface ice/water activity is further evidenced by scalloped surface and craters with fluidized ejecta blankets in the Hesperian basalt plateau close to the rim of Juventae Chasma. We further argue that the sub-surface ice could have contributed to the formation of Juventae Chasma by softening and destabilizing the preexisting surface. (All images in this abstract are from Google Mars, CTX Mosaic).

**Morphological characteristics of the chasm wall:** Juventae Chasma is a box canyon, oriented oblique to the main E-W trend of the Valles Marineris canyons. The chasma wall attains its maximum height in the southern part of the chasma, and gradually decreases in height in the northernly direction. The south wall is characterized by curvilinear and rugged morphology; the absence of straight segments suggests a lack of structural/tectonic control. The south wall also displays prominent branching spurs and gullies. The spurs merge with the floor without faceted ends or any basal escarpments. The remnant of a possible scarp is preserved at a distance of about 4 kms in front of the present foot of the south-eastern chasm wall. This could indicate an early phase of structural control on the trough formation which later grew by erosion and retreat of the chasma wall. The south-western part of the chasma wall shows several amphitheater-headed tributary canyons with v-shaped profiles and curvilinear morphology in the plan view (Fig. 1). These tributary canyons do not appear to have an underlying structural controls. They originate in the chasma walls and extend into the basalt plateau. Such valleys have been interpreted to have formed by groundwater sapping [1]. Similar tributary canyons are also present in the south-eastern parts of the chasma wall but in that part they are shorter, broader, and show alignment with a plane of weakness on the plateau. On the eastern side, the wall gradually diminishes in height and after a certain distance the chasm floor merges with the surrounding basalt plateau. The east wall of the chasma is marked by curved segments and the usual spur and gully morphology along with elongate tributary canyons with blunt heads. However one part of the east wall shows a series of downfaulted blocks of plateau material, and this part of the wall is straight and free of spurs. The west wall displays the spur-and-gully morphology towards the south and relatively straighter sections towards the north. A hook-shaped tributary canyon is also present on the northern side. The geomorphological evolution of the west wall was probably controlled by both tectonics and ground water sapping.

**Mass-wasting features:** The distinctive features of mass-wasting in Juvenate Chasma are: (1) they generally lack a well-defined crown or a clear-cut section at their point of origin in the chasma wall; rather they seem to have originated from either amphitheater-headed tributary canyons and gullies (Fig. 2) or failed sections of spurs (Fig. 4); (2) no breakaway zone or slump blocks are seen, only the debris apron is preserved; (3) they generally occur in the form of overlapping clusters (Fig. 2); (4) they display a variety of surface textures ranging from fresh and grooved to degraded and chaotic (Fig. 3); (5) almost all debris aprons show rounded lobes (Fig. 4); (6) a trail of debris can be traced back upwards into the gully from which the debris apparently originated; (7) they exhibit varying sizes ranging from small lumps (~ 0.52 $m^2$) (Fig. 4) to large tongue shaped debris emerging from broad gullies (~ 80 $m^2$) (A in Fig. 2); (8) the largest ones are much smaller than the average landslides in other chasmas (see Table 1 in [5]); and (9) some debris aprons show well preserved surficial features such as grooves, digitations, flow lines, raised edges and sharp outlines that indicate recent emplacement.

**Discussion:** The apparent absence of a well-defined structural control on the present configuration of the southern wall of the chasm indicates that the wall retreat has mostly been erosion-driven in the recent time (signs of any earlier phase of tectonic activity have probably been obscured by this later phase of erosion). The presence of amphitheater-headed tributary canyons which are formed due to ground water sapping indicate that the wall-section collapse was controlled to some extent by the presence of water or ice in the walls [1,2]. The preferential occurrence of the mass wasting features at the mouths of amphitheater-headed tributary canyons along with the rounded flow fronts of the debris suggest these debris were wet at the time of emplacement [3]. The mass-wasting features in Juventae Chasma have some marked differences with the long run-out landslides found in other parts of Valles Marineris in spite of having many commonalities such as the presence of radial furrows, fan-shaped outline, overlapping aprons and overtopping of obstacles [4, 5]. The absence of well-defined crowns, breakaway zones and slump blocks, emergence from amphitheater-headed tributary canyons and the presence of trails of debris up the source gully indicate that the underlying triggering mechanism for these landslides was not structural or tectonic but rather an inherent weakness of the wall rocks imparted possibly by water or ice in the pore-spaces of the wall. Depending on the amounts of fluids involved, these mass movements may also qualify as debris flows. The presence of craters with fluidized ejecta blanket in the surrounding basalt plateau strongly supports this possibility.

**Concluding thoughts:** The role of fluids in the emplacement of the long run-out landslides in the other chasmas of Valles Marineris is still debated [for e.g., 3, 4]. The mass-wasting features in Juventae Chasma show comparatively clearer evidence that they were formed as a result of wall failure from presence of fluid in them. Further study would be to investigate in greater detail the mechanism of emplacement of these debris. Also the timing of emplacement and characterization of the water content of the wall rocks would be attempted.

**References:**

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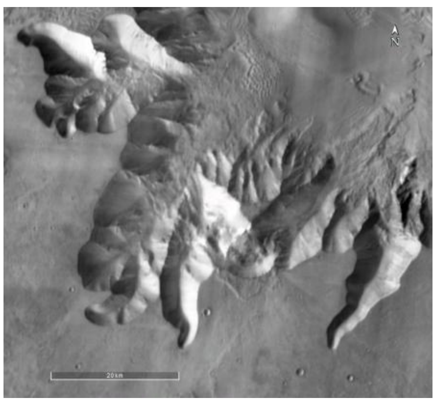


Figure 1. Tributary canyons with blunt heads in the south-western wall of Juventae Chasma.

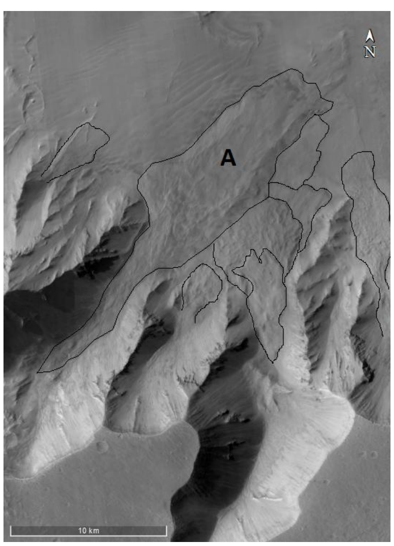


Figure 2. Tounge shaped debris issuing from an amphitheatre-headed tributary canyon (A). Overlapping lobes are outlined.

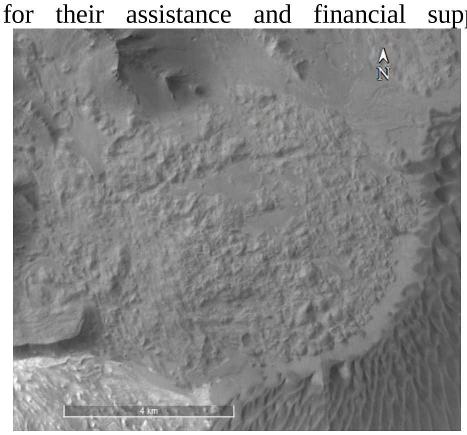


Figure 3. A degraded debris mass.


Figure 4. Small lump on the side of a spur. Rounded lobes present along front edge.