THE PALAEOLAKE OF JUVENTAE CHASMA. R. Sarkar[1], P. Singh[1], A. Porwal[1], [1]Geology and Mineral Resources Group, CSRE, Indian Institute of Technology, Bombay, (ranjan.s@iitb.ac.in; ranjan888@gmail.com)

Introduction: The current idea regarding the possibility of Juventae Chasma hosting a palaeolake is that the said palaeolake overflowed multiple times, and in the process carved the Maja Vallis outflow channel [1,2,3,4]. Our observations, presented here, suggest that the formations of Maja Vallis may have happened independently, and that the palaeolake in Juventae Chasma either did not exist or never overflowed.

Datasets: The work presented here utilizes elevation data from 463m MOLA global mosaic along with visible data from HiRISE, CTX, HRSC, and MOC, and daytime infra-red data from THEMIS.

Observations and Discussions: Juventae Chasma is a merger of a chaos and a chasm. The southern portion of Juventae Chasma is elongated roughly parallel to the main chasms of Valles Marineris, while the chaotic terrain on the north is elongated roughly orthogonally (Fig. 1a). It is possible that the chaos and chasm developed independently and merged later, similar to the Ganges Chasma where an outflow channel head did not continue into the chasm (Fig. 2). An observation that might support this scenario is the presence of a sharp, east-west trending topographic step passing roughly through the centre of Juventae Chasma that might represent the line along which the chaos merged with the chasm (Fig. 1a and 1b).

There are two outflow channels that emanate from Juventae Chasma (Fig. 1a) and connect to Maja Vallis. The channel on the east wall is at an elevation of ~1300m, the one on the north is at ~1000m. However, at present the main body of Maja Vallis originates from Baetis Chaos, a separate chaos which formed later and damaged the channels originating from Juventae Chasma.

The general water-flow direction in the two channels was towards the north, dictated by the topography of the surrounding plateau. However, the present slope within Juventae Chasma is towards the south (Fig 1b), which would force any water sourced from the chaotic terrain to first pond Juventae Chasma, and then, if only the water levels inside the chasma exceeded ~1000m and/or ~1300m, would it flow through the two outflow channels. A key observation is that both the outflow channels of Juventae Chasma are faulted/broken (Figs. 3a and 3b4), mostly attributable to chaos expansion and/or chasm related faulting. Moreover, there are no signs of water flow to have taken place after the channels were faulted/broken.

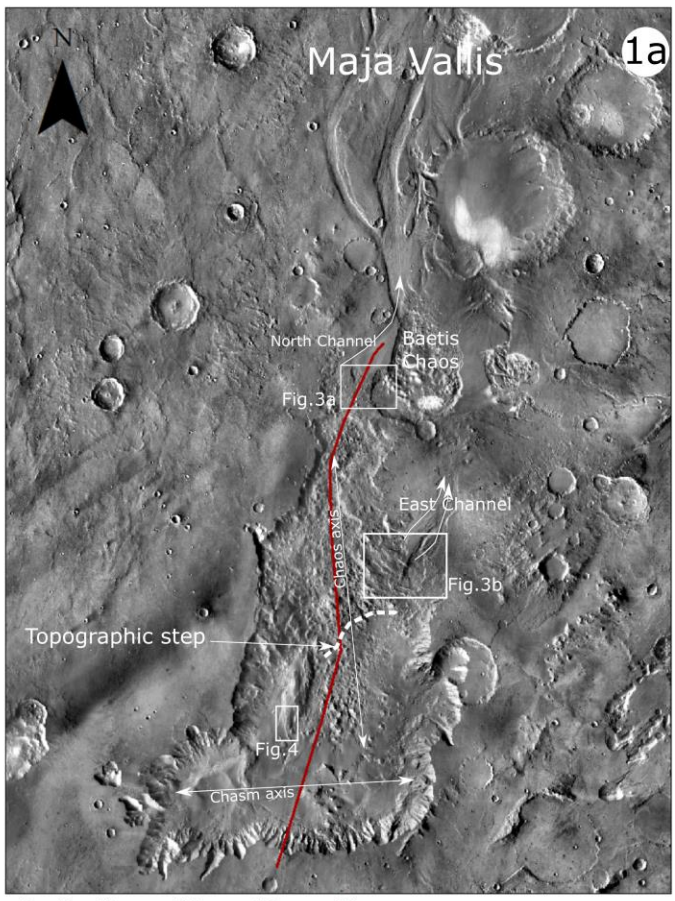
The chaotic terrain of Juventae Chasma lies within the elevation range of ~ -250 to -3200m, which is much lower than the elevation ranges of the two outflow channels. Hence, for most of the duration, water coming out of the chaotic terrain would run into Juventae Chasma. But then how and why did the two outflow channels form? These channels probably formed when the chaotic terrain was in its infancy, and not joined to Juventae Chasma. At that time, the water could flow northwards. However, after the chaotic terrain merged with Juventae Chasma, the flow direction reversed, abandoning the two outflow channels. The faulting of the two outflow channels probably happened as the chaos terrain expanded, however, the exact time is not ascertainable. But the elevations at which the channels are faulted/broken are over a kilometer higher than the present floor of the chaotic terrain, hence it must have happened quite early, when the chaotic terrain was at much higher elevation level, probably at the time when the chaotic terrain did not completely merge with Juventae Chasma.

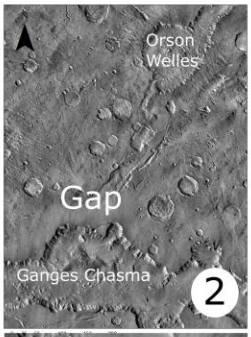
The next observation is the presence of a scarp, which occurs at a constant elevation (parallel to the -2000m contour) on the west side of the light-toned mound — Mound C (Fig. 4). The constant elevation may be consistent with the constancy of water level, and hence might represent the maximum level of the water in the palaeolake, which would be around -2000m. Otherwise, if chaos formation did not lead to release of liquid water (either because the released water sublimated or chaos formation was a dry process) no palaeolake would have formed in Juventae Chasma.

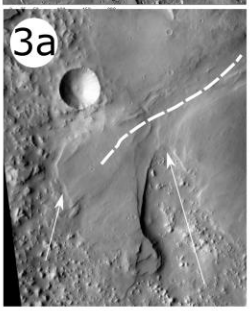
Conclusion: The two faulted/broken outflow channels present on the walls of Juventae Chasma today were active when the chaotic terrain was in its early stage. After the merging of the chaotic terrain with the chasma, the two channels were abandoned. If any water was released during chaos formation, it would ponded up Juventae Chasma, most probably up to the level shown in Fig. 5, as interpreted from the scarp on the west side of Mound C. This palaeolake never overflowed. Otherwise, if chaos formation was a dry process, there would be no palaeolake. Hence, merely the presence of two outflow channels would not necessarily suggest the presence of a palaeolake in Juventae Chasma.

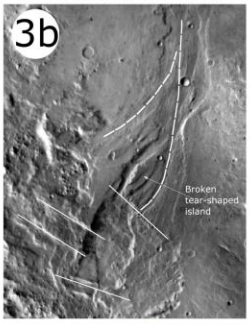
References: [1] Chapman, M. et al., (2003), JGR, 108, E10, 2-1. [2] Catling, D. C., et al. (2006), Icarus, 181, 26-51 [3] Coleman, N., & Baker, V. (2007), *LPS XXXVIII*, Abstract#1046. [4] Gross, C., et al., (2009) *LPS XL*, Abstract #1890.

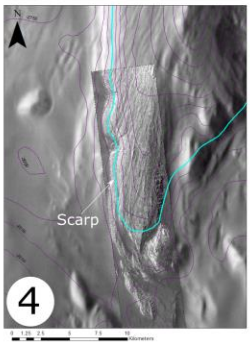
Acknowledgements: R. S. thanks CSIR New Delhis for providing his fellowship.

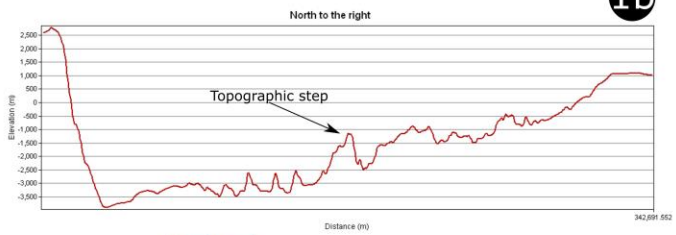












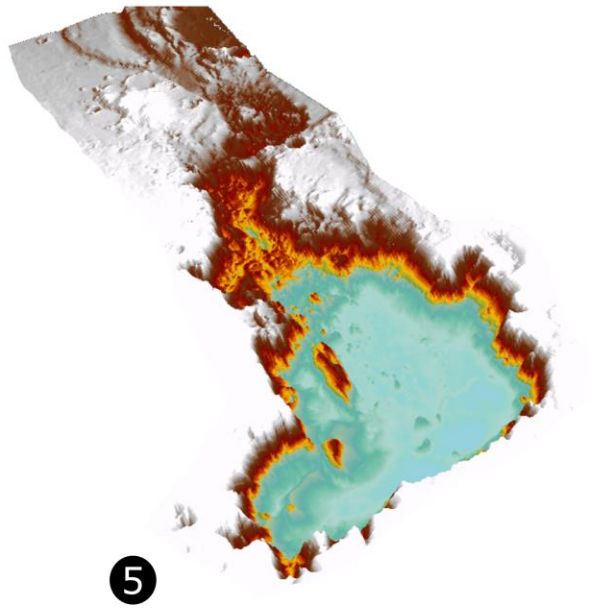


Figure 1. (a) THEMIS day IR image of Juventae Chasma showing the two channels originating from the north and east walls. White dashed line shoes a topographic step. Red line is the profile shown in Fig. 1b. (b) Elevation profile of Juventae Chasma. Note the topographic step.

Figure 2. The gap between the outflow channel and Ganges chasma.

Figure 3. (a) Broken north channel of Juventae Chasma. Note that there are no overprints of flow features after the channel broke. (b) Faulted east channel of Juventae Chasma. Note that there are no overprints of flow features after the channel was faulted. Also note the broken tear-drop shaped island.

Figure 4. Scarp on the west side of Mound C, which is parallel to the -2000m contour.

Figure 5. How Juventae Chasma would appear after being filled by a palaeolake up to -2000m elevation.