EVIDENCE FOR LAHARS FROM FLOW DURATION AT THE ELYSIUM VOLCANOES, MARS. J. W. Nussbaumer, Johannes Gutenberg University, Mainz, Germany.

Introduction: Elysium is Mars' second big volcanic region, after Tharsis; it is on the southeast edge of Utopia Planitia, a probable ancient impact basin. Utopia forms part of the vast northern lowlands of Mars, a depression that may have been filled with an ocean or large lakes during one or more stages in the planet's history. The water that eroded the channels burst from pits and grooves partway up the flank of Elysium. As the volcano grew, it pressurized the slopes, forcing meltwater out of the ground through faults. Water was essential in carving these channels, which are situated on the western side of Mars' Elysium Mons. But volcanic heat was the key to making the water flow, and lava has put its fingerprints on the scene as well. Outflow channels at the Elysium volcanoes are thoroughly investigated (1, 2, 3, 4, 5, 6, 7). In the case of Granicus Valles (fig. 3), several hypotheses are existing. One hypothesis states, that the outflow channels emerged below an ice sheet (1). That hypothesis is supported by elongated ridges following islands. A fluvial genesis during a relatively long time span under different climatic conditions is stated by (2), which is supported by anastomosing, meandering forms of the channels and terraces within the channels. A hypothesis describing a genesis resulting from lahars is stated by (3, 4, 5, 6). The flows must have contained a mixture of water and volcanic debris, making a mudflow or lahar. On Earth, lahars are usually highly destructive, burying villages and towns.

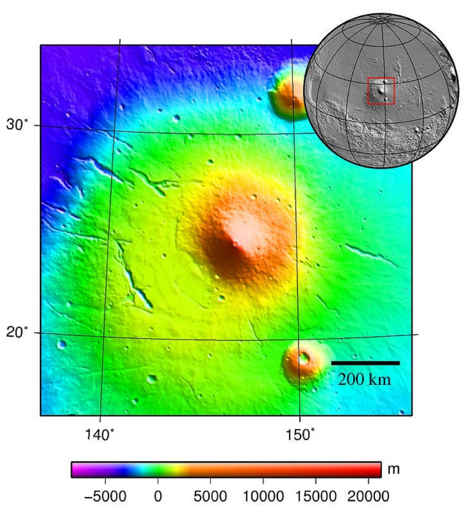

Fig. 1 Image of the Elysium Volcanoes and their place on planet Mars. (Mars orbiter laser altimeter digital elevation model)

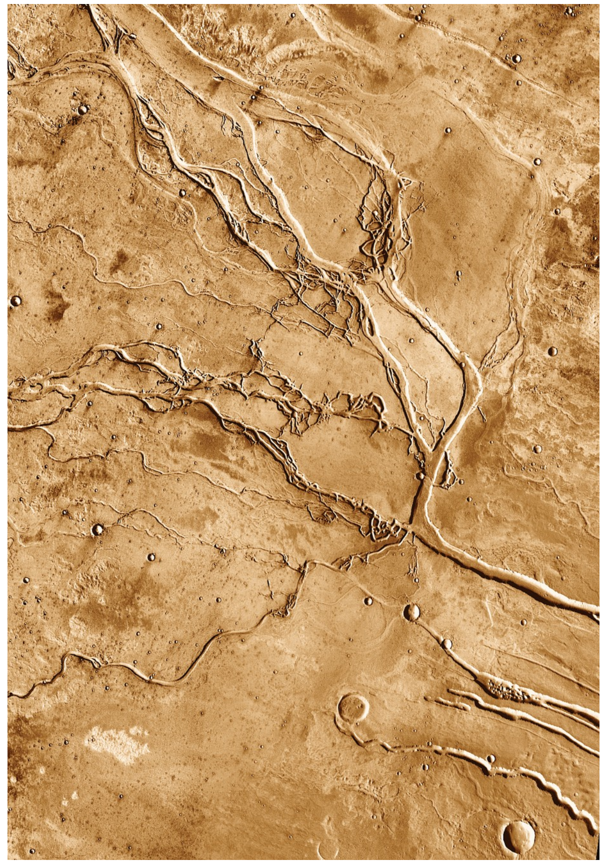

Fig. 2 Themis daytime IR-mosaic of Granicus Valles

Paleohydrology: With Chezy-based calculations, the flow velocity, the amount amount of water per time, and the flow duration has been calculated in Fig. 3.

$$v = C\sqrt{Rs} \qquad C = \frac{1}{n}(R)^{\frac{1}{6}} \qquad T = \frac{V}{KQ}$$

$$V = \int_T Q(t)dt = KQ_{max}T \qquad Q=vA$$

C=64,46 (constant), R=70m (hydraulic radius), K=0,5 (constant), Results: water quantity Q=2295830 qm/s, flow velocity v=12,24 m/s, flow duration T= 8711s or 145 minutes. Lahars on earth have flow durations of 50 -90 minutes (8).

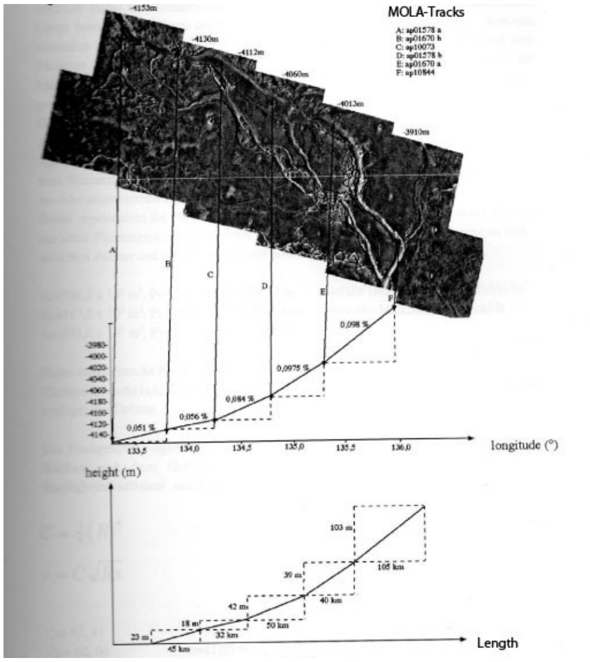

Fig. 3: Viking Orbit 541A. How fast these martian lahars flowed was calculated (145 Min flow duration). The broad channel shown in the image is almost 8 kilometers (5 miles) wide and 150 meters (500 feet) deep.

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