Further Evidence for Multiple Flooding Events at Juventae Chasma and Maja Valles, Mars. C. Gross, L. Wendt, A. Dumke and G. Neukum. Institute of Geosciences, Planetology and Remote Sensing, Freie Universität Berlin, Malteser Str. 74-100, 12249 Berlin, Germany. Christoph.gross@fu-berlin.de

Introduction: In this study we investigate the age relationship of Juventae Chasma to the adjacent Maja Valles in order to gain a feasible explanation for the formation and evolution of rhythmic light-toned layered deposits (LLD). In this first step, we use impact crater size-frequency distributions for dating the planetary surface in the regions of interest.

Juventae Chasma is located at the northern side of the Valles Marineris and stretches for approximately 150 km east-west and 250 km north-south. The basin floor shows a depth of 5 km and more below the surrounding surface. To the north lies the adjacent Maja Valles, a 50 km to 150 km wide channel extending for 1600 km northward and discharging into the Chryse Planitia plains.

Various investigations of several authors have been carried out on this subject in the past, but the formation of the LLD in Juventae Chasma is still poorly understood. The formation theories range from a volcanic origin [1], lake deposits, delta-deposits [2] to spring deposits [3]. A very different hypothesis for the formation of the sulfates is deposition from airfall. This could happen as dry deposition from the atmosphere or in co-precipitation with icy materials such as snow crystals or dust particles. This phenomenon is observed at the poles of Mars, where rhythmic layerings occur showing high similarities to the sulfate deposits in Juventae Chasma. The light-toned materials in the chasma show a spectral signature indicative of kieserite in the outcrops A, C and D and in the lower part of B, whereas the upper part of B was described as gypsum [4]. Wendt et al. [5] identified different mineral assemblages in the cap-rock of mount B, using the CRISM instrument and the Multiple-Endmember Linear Spectral Unmixing Model (MELSUM).

HRSC DTM: The Digital Terrain Model (DTM) mosaic (see Fig. 1) was derived from 11 HRSC orbits at approximately -7° S to 8° N and 295° to 301° E with a ground resolution of 100 m per pixel and an ortho-image mosaic with a ground resolution of 12.5 m per pixel. The main processing tasks for the DTM derivation are first a pre-rectification of image data using the global MOLA- based DTM, then a least-squares area-based matching between nadir and the other channels (stereo and photometry) in a pyramidal approach and finally, DTM raster generation. Improved orientation data are necessary for high-resolution digital terrain models and ortho-image mosaics. For this purpose, new exterior and interior orientation data, based on tie-

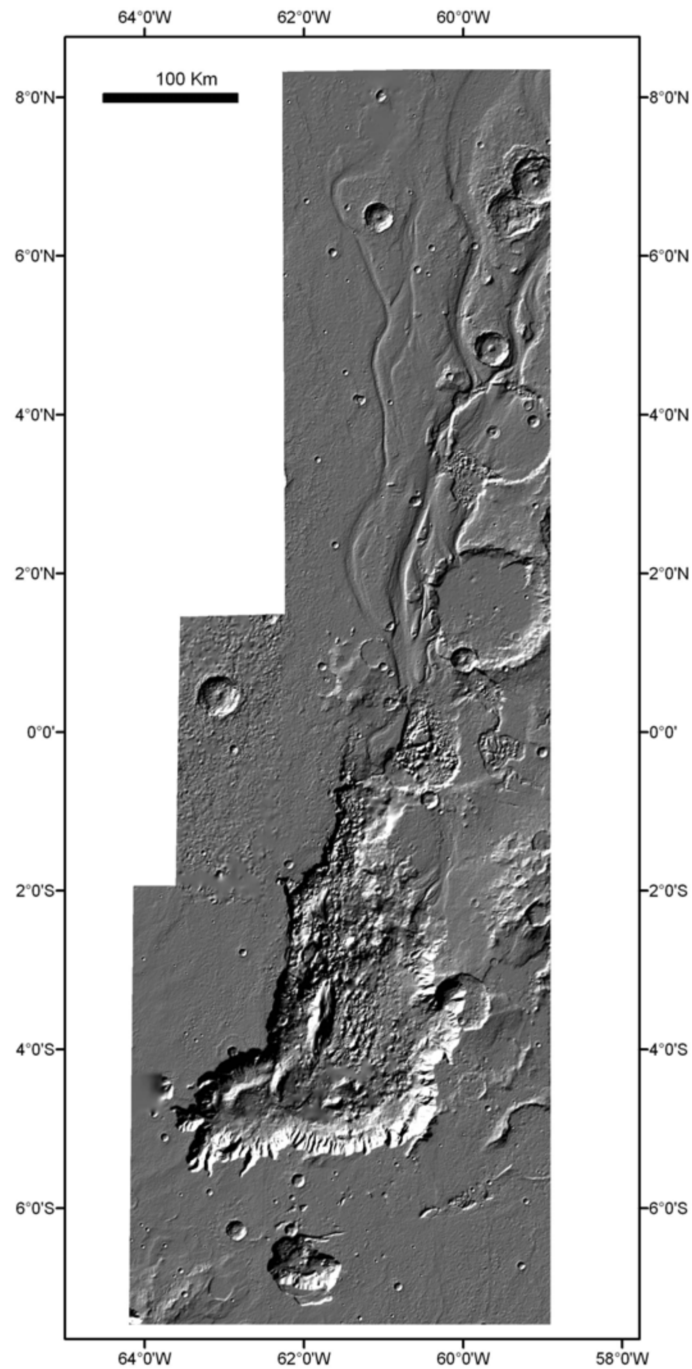

Figure 1: Shaded relief HRSC DTM MOSAIC of Juventae Chasma and the Maja Valles outflow channel.

point matching have been used. The bundle adjustment approach for photogrammetric point determination with a three-line camera is a least squares adjustment based on the well known collinearity equations [6].

The construction of the HRSC-DTM is the basis for further investigation of the masses and volumes, transported from Juventae Chasma through Maja Valles. We use HRSC and OMEGA (Mars Express), as well as HiRise and CRISM (Mars Reconnaissance Orbiter) Data for generally mapping the target area. Crater counting is carried out using CTX and HRSC images.

Results: The results of the first determinations of the impact crater size-frequency distributions are presented in Fig. 2 and 3 and show an age of 1.22 Ga (+/-0.16 Ga) for the western part of the Maja Valles channel. The southeastern channel (close to the streamlined island) shows older ages of 3.68 Ga (+0.08/-0.17 Ga) and 2.18 Ga (+/- 0.31 Ga). This clearly indicates, that multiple flooding events took place in the area. The first results for Juventae Chasma age determinations indicate an age of 3.33 Ga.

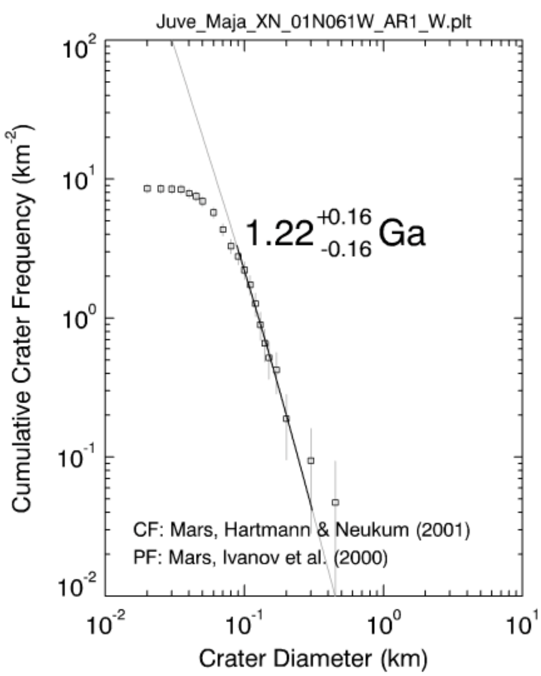

Figure 2: Impact crater size-frequency distributions of the western channel bed of Maja Valles.

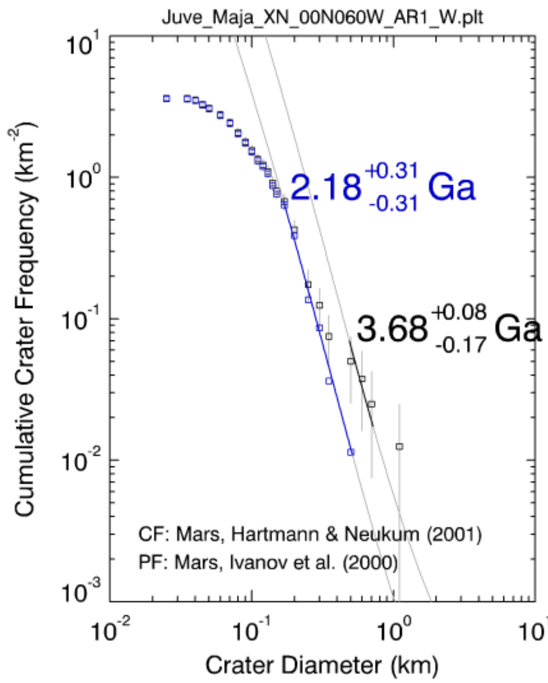

Figure 3: Impact crater size-frequency distributions of south-eastern channel of Maja Valles.

Conclusions: The HRSC-DTM enables us to examine the study area most accurately. We dated the formation of the Juventae Chasma with an age of at least 3.33 Ga. The investigated sites at Maja Valles clearly show evidences for multiple outflow events. Some of these events took place before the formation of the sulfate deposits in Juventae Chasma. Further age determinations and mapping will be carried out in this area to obtain a chronology of events of this highly interesting area in the equatorial regions of Mars.

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References:

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