ANALYSIS OF THE UPPER PARTS OF REULL VALLIS AND THE MORPHEOS BASIN, MARS: PRELIMINARY RESULTS. V. -P. Kostama[1] and S. Kukkonen[1], [1]Astronomy, Dept. of Physics, University of Oulu, P.O. Box 3000, FIN-90014, Oulu, Finland, petri.kostama@oulu.fi.

Introduction: Reull Vallis, one of the larger canyons of the eastern Hellas rim region (Fig.1) has been studied in detail in earlier studies [i.e. 1, 2]. However, the new data from Mars Express (HRSC) and MRO (CTX and HiRISE) gives a possibility to add more detail to the general view of the evolution of the Reull fluvial system. We were also able to add more detailed age constraints through crater size-frequency counting using the available images of CTX, HiRISE and HRSC and compared them with the previous results from MDIM images [2].

Upper Reull Vallis and Morpheos basin: Segments 1 and 2, [1] of Reull Vallis are not connected [i.e. 1]. In the middle of the gap between the segments locates a compact, closed flat-floored topographic depression, the Morpheos basin [2,3,4]. The deepest parts of this basin are at about 450 m, about 50 m deeper than the level of the floor at the beginning of the Segment 2 of Reull Vallis [2]. The morphologically smooth floor of the basin is surrounded from the south, west, and northwest by the rugged surface of the cratered terrains.

A hypothesis of a transient reservoir of water that existed in the western portion of the Morpheos basin was suggested [2,3,4]. According to the hypothesis, the reservoir was filled by the effluents of Segment 1 and served as the source of water that later carved Segment 2. It was noted, that this reservoir may have formed quite rapidly and it may not have been a long-lived feature [2].

Later, a thorough volumetric re-analysis of the Reull Vallis system was done using MOLA DEM and GRIDVIEW [5]. Capitoli [5] determined that the proposed level of filling of the Morpheos basin at 600-650 m [2] was too high due to the limit of the volume of the Segment 1. Capitoli [5] proposed that more likely level of filling would be around the levels of 450-500 m. However, Capitoli and Mest [6] proposed that if multiple pulses of water from Segment 1 were released, a level of 550 m at the Morpheos basin could be reached.

Crater size-frequency counts: In our earlier study [2] the MDIM derived crater retention age on the Morpheos basin floor was indistinguishable from the age of the Hesperian ridged plains. This result was now tested with the availability of much more detailed images of both Morpheos and Hesperia Planum surface. Three areas were used for crater countings within the Morpheos basin, and three within Hesperia Planum in order to get comparative results. Calculations within area 1 (A1_MB) of Morpheos basin (HiRISE, ESP_016719_1425_RED, resolution of 50cm/pix) resulted in the surface age of ~3.69 Ga, which was comparable to the results from areas 1-3 of Hesperia Planum (A1_HP: CTX, B16_015928_1501_XN_29S254W, 5.13m/pix; A2_HP: CTX, P19_008280_1519_XN_28S251W, 5.1m/pix; A3_HP: HRSC, H1876_ 0000_ND3, 23.5m/pix) with the ages of ~3.66 Ga, ~3.84 Ga and ~3.68 Ga, respectively. However, the counts in the two other areas of interest within Morpheos basin (A2_MB: CTX, P04_02531_1438_XN_36S246W, 5.08m/pix; A3_MB: CTX, P20_008794_1430_XI_37S245W, 5.16m/ pix) resulted in ages of ~3.55 Ga and ~3.54 Ga, respectively. The analyzed three Morpheos basin areas differ by their altimetric locations: the areas 2 and 3 are located within the surface area confined by the contour level of 500 m and area 1 of Morpheos basin is located next to the Segment 2 channel head at around 550 m.

Conclusions: The crater size-frequency distribution calculations with the high resolution images show the difference in the previously indistinguishable [2] Hesperia Planum and Morpheos basin surface ages. The deepest parts of the basin show younger surface age.

The new crater size-frequency distribution calculations of the Morpheos basin surface supports the proposition by Capitoli [5]. It seems that the limit of the basin filling is at 500 m contour level, as the only area of calculation (A1_MB) outside this contour level of the basin gave the same age results as the Hesperia Planum areas. This seems to imply that around 3.55 Gyr ago the surface of the basin below the contour level of 500 m was modified along with the cratering record by a resurfacing event, such as by filling with water from the Segment 1.

References: [1] Mest S. C. and Crown D. A. (2001) *Icarus, 153*, 89–110, [2] Kostama V. -P. et al. (2007) *JGR, 112*, doi:10.1029/2006JE002848, [3] Kostama V. –P. et al. (2004) *Vernadsky-Brown Microsymposium XL*, [4] Ivanov M. A. et al. (2005) *JGR, 110*, doi:10.1029/2005JE002420. [5] Capitoli E. J. (2008) *Master of Science thesis*, University of Pennsylvania, [6] Capitoli E. J. and Mest S. C. (2010) *1st International Conference on Mars Sedimentology and Stratigraphy, 6017.*

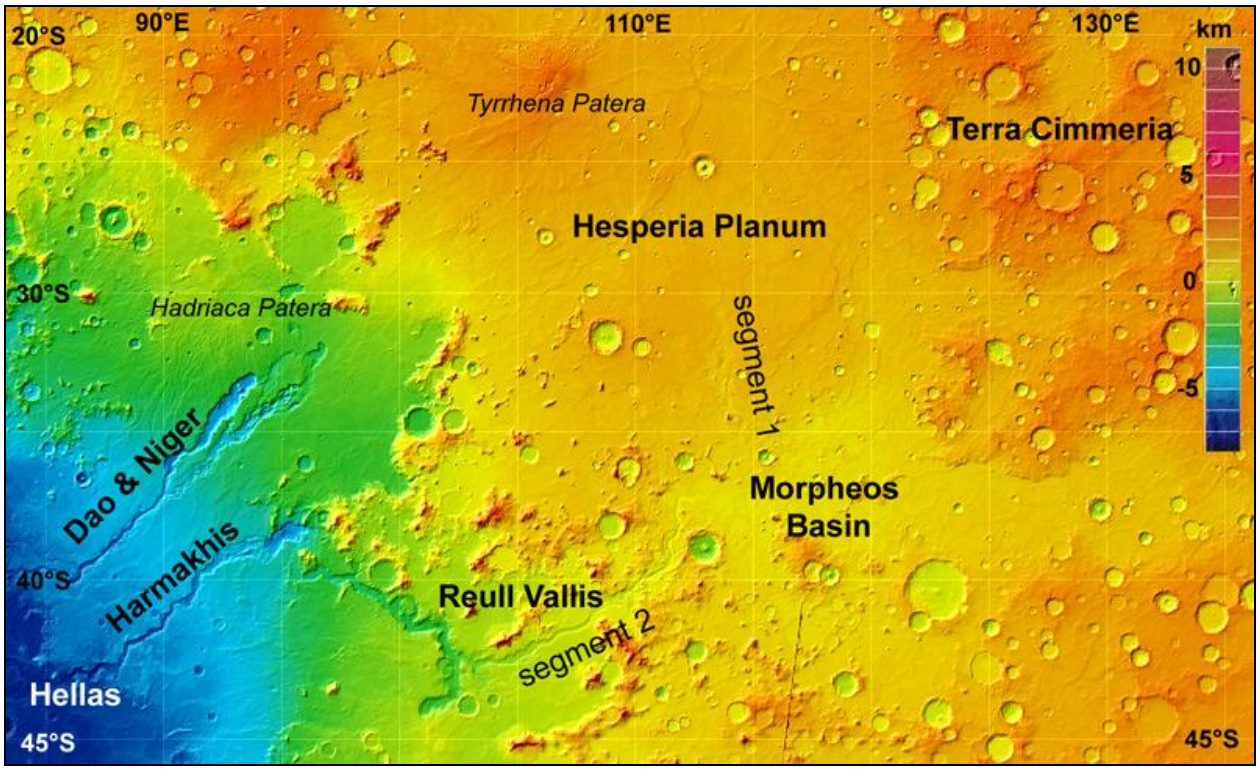

Figure 1. MOLA topographic map of the eastern Hellas rim region.