**Fluvial Processes in Eastern Hellas Planitia, Mars: New Stratigraphic Insights.** W. Zuschneid[1] and S. van Gasselt[1], [1]Freie Universität Berlin, Institute of Geological Sciences, Planetary Sciences and Remote Sensing, Malteserstr. 74-100, 12249 Berlin (wilhelm.zuschneid@fu-berlin.de).

**Introduction:** We investigate the fluvial and sedimentary history of the eastern plains located within the Hellas basin using imagery acquired by currently active orbiter missions. This imagery shows that morphologic evidence for fluvial action in this region is manifold, and the history of liquid water is likely the most important aspect for understanding the post-impact history of the Hellas region.

**Data:** Large-area mapping and interpretation are conducted using MOLA gridded topography (463 m/pixel) and THEMIS infrared image mosaics (100 m/pixel) in ESRI's ArcGIS. Higher-resolution data from MRO CTX (5 m/ pixel) and HiRISE (0.25 m/pixel) are used for interpretation of small scale features and for age determinations.

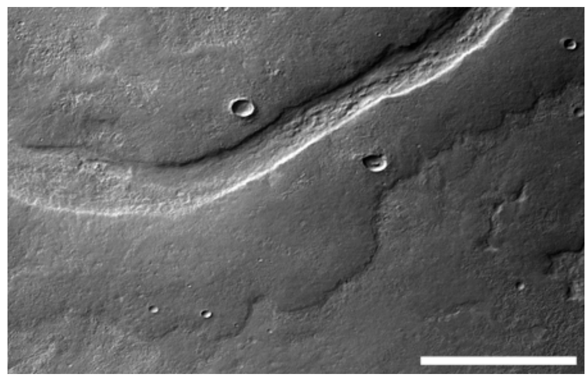
**Background:** The Hellas basin was formed by one of the last basin-forming impacts on Mars, approximately 4 Ga ago [1]. Being the major sink in the southern Martian hemisphere and an ancient structure, it has been hypothesized that the basin once held a major body of water [e.g. 2, 3]. If this was the case, it must be assumed that this water body significantly controlled the style of deposition of material within the basin.

The investigated plains units comprise the eastern floor of the basin, and abut directly against Promethei Terra (E), the Hellas-Hesperia trough (NE), and the ancient highlands of Tyrrhena Terra (N). These regions display different extents of past fluvial drainage. Most prominent are Dao and Harmakhis Valles, which indicate that Hesperia Planum and Promethei Terra both experienced major fluvial activity and erosion [4, 5]. This is also evidenced by numerous minor valleys and drainage channels, all of which display the low degree of channel system maturity typical for Mars.

**Observations:** A plethora of different fluvial systems along the eastern flank of Hellas basin can be observed, ranging in size from gullies as observed in the Dao Vallis source basin to the large channels of Dao and Harmakhis Valles, with depths exceeding 2500 m and widths of up to 40 km.

*Drainage channels:* We mapped the majority of drainage channels along the eastern rim. The highest concentration of channels can be found along the slope of the basin south of Harmakhis Vallis and west of Reull/Teviot Valles and Promethei Terra. Here, broad V-shaped shallow troughs are the marks of strong erosion which removed several hundred meters of material [5,6]. This material has been deposited in the eastern part of the Hellas impact basin.

Along an isohypse (contour line) of approx. -5800 m (one of the proposed sea levels [3]), drainage channels undergo a major change: minor and intermediate channels end abruptly and without visible fans or deltas, while the largest channels (Dao and Harmakhis) change from a distinct, valley-like morphology at the basin flank to a more subdued morphology. Channels on the basin floor are broad and filled bankful with younger deposits. In the center of the filled channel, a minor inner channel can be distinguished, which may display overbank deposits. Especially in the distal reaches of Dao Vallis, a set of streamlined islands can be seen. In sections of Harmakhis Vallis where the floor is not covered by younger deposits, basal scouring is observed.



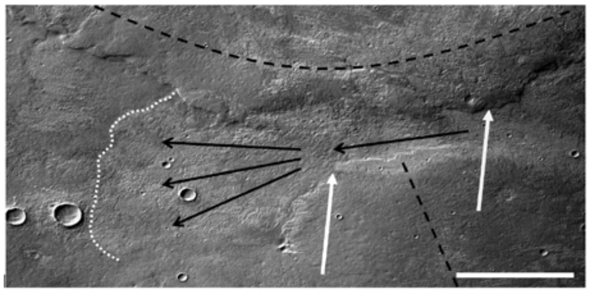
Overbank deposit at Dao Vallis in CTX image P19_008492_1423. North is up, scale bar length is 5 km, image center at 81.5 E, 39.9 S

Channels of intermediate size show distinct forms along the slope of the basin (i.e. upstream), terminating in large valleys in which plains material was deposited. Only a small fraction of the channels extend onto the plains.

*Ridges:* The eastern plains in Hellas are intersected by broad, low ridges reminiscent of wrinkle ridges. These ridges display different types of relationships to the channels: some deform the channels, effectively blocking the channel flow path, others are breached by the channels, and the third type has deformed the channel fill. Each setting indicates a different relative timing.

Along the bases of the ridges, brightness changes in THEMIS infrared and distinct scarps visible in CTX suggest compositional differences of the ridge surfaces and the interbedded plains.

*Inter-ridge plains:* The regions between the ridges are generally very smooth, but display brightness differences in thermal IR indicating different materials, as well as different small-scale surface roughness changes. More or less continuous units can be inferred originating from the mouths of intermediate channels onto the plains. These often cross ridges at lower sections or between discontinuous sections.



Connection between inter-ridge plains at a low section between ridges. Black dashed lines are ridges, white dashed line indicates possible depositional lobe, white arrows indicate scarps, black arrows supposed flow direction. Section of CTX image B19_017208_1433, north is up, scale bar length is 5 km. image center at 80.8 E, 38.8 S

**Interpretation:** The regions along the eastern rim of Hellas Planitia display numerous valleys and channels indicating widespread fluvial activity. The water which formed these channels and the eroded material must have formed major deposits within the basin. The abrupt change in channel morphology along the -5800 m-contour line supports the interpretation that the Hellas basin was partly occupied by a standing body of water [2, 3]. Ridges may have served as levees controlling sediment distribution and creating shallow lakes, which have been interconnected along ridge sections of lower elevations.

The youngest major fluvial features observed are the large channels in continuation of Dao and Harmakhis Valles, which cross the plains and cover them partly with their sediment. The channels in this regions are more reminiscent of outflow channels (according to the criteria in [7]) than the Valles along the steeper slope at the basin rim. The pattern of fluvial action (erosion and deposition), plains formation and deformation by ridging is complex and indicates that the different processes are contemporaneous, and probably closely related.

Summary of eastern Hellas activity phases:

| Age | Events | | | Units / Landforms |
|---|---|---|---|---|
| | Surface activity ceases mostly | | | Aeolian |
| | Plains degradation | | | Formation of valley fill in Dao & Harmakhis Vallis |
| | Latest channel activity | | | Inner channel development and overbank deposits |
| | Decreasing channel activity | Continuing ridge development | Flow concentrated on active channels | |
| 3.44-3.66 Ga [11] | Major drainage Channels activity peak | Compaction and ridge development | Ponding of smaller lakes | Channels on eastern plains, breaches in ridges |
| 3.8 Ga[12] | Erosion of rim and deposition in the basin | | Proposed flooding/ sea in Hellas | Eastern Hellas basin plains |
| | Basin formation | | | |

**Outlook:** We are currently mapping the fluvial features of the region for a better understanding of different processes and their temporal relationships. Crater counting will be applied to determine the timing of processes and unit formation ages. For dating small-scale features (e.g. the overbank deposits at Dao Vallis), a suitable approach making use of topographic information and cratering statistics has to be developed. Additional explanations for the distinct changes in morphology at the proposed sea-levels (-5800m, etc.) should be considered, and the general models for water release and erosion reviewed with application to the specific observations in the region [7, 8, 9, 10].

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