FLUVIAL CHANNEL RESULTED IN ALLUVIAL FAN FORMATION IN ICARIA PLANUM, MARS.

J. Korteniemi[1], J. Raitala[1], M. Aittola[1], V.-P. Kostama[1], E. Hauber[2], P. Kronberg[3], G. Neukum[4] and the HRSC Co-Investigator Team. [1]Astronomy, Univ. of Oulu, Finland, (jarmo.korteniemi@oulu.fi, jouko.raitala@oulu.fi), [2]DLR, Berlin, Germany, [3]TU, Clausthal-Zellerfeld, Germany, [4]Freie Universität, Berlin, Germany.

Introduction: The Claritas-Thaumasia region is highly modified by tectonic forces. It has several indications of previous water activity phases (Fig. 1, 39°S, 258°E; Raitala et al., 2005). The Mars Express HRSC data were used in finding additional details of its fluvial history.

The Regional Background: Volatiles were transported from the peaks (1 in Fig. 1) into the basins like the one studied here, found in southern Claritas Fossae. Water filled the paleolake (2 in Fig. 1) up to the level of the lowest valley, breached through the saddle valley and formed a channel (3 in Fig. 1) from the paleolake to the west.

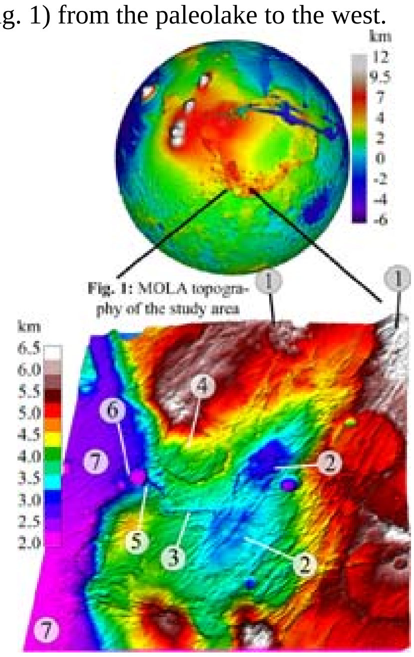

Fig. 1: MOLA topography of the study area

Along the channel, sapping from an old impact crater in the north (4 in Fig. 1) provided additional water. Close to Icaria Planum, the channel broke into an impact crater (5 in Fig. 1) and formed a temporary lake with a delta at the channel mouth. The flow breached further through the western crater rim (6 in Fig. 1). The crater floor is lower than this channel neck indicating a paleolake phase. Water spread onto the Icaria Planum lowlands (7 in Fig. 1) and formed an alluvial fan. The structures and alluvial fan units in Icaria Planum, visible in the MEX-HRSC data, were studied using the color HRSC images.

The Channel-Related Features: At some point when the wide basin in the southern Claritas area ("paleolake" in Fig. 1) was filled, the water broke through the western saddle valley forming a channel from the paleolake into Icaria Planum (Figs. 2,3). The basin depression in the south was subsequently drained into the direction of Icaria Planum.

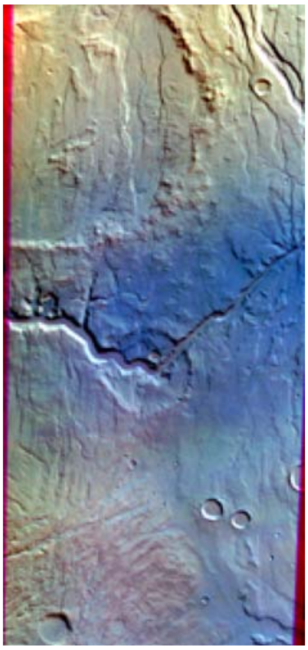

Fig. 2. The RGB combination of the three visible HRSC channels of the MEX orbit 357 over the area where the channel breached through the saddle valley into the west.

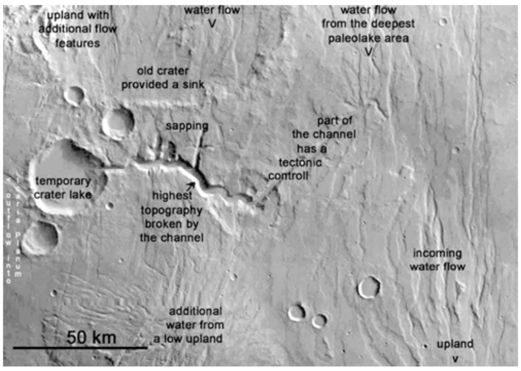

Fig. 3. The units identified along the course of the channel.

The flow channel begins from within the middle basin area (upper right part in the HRSC red channel image; Fig.3). It broke the paleolake rim at its lowest area (image center in Fig.3) and drained the lake through an impact crater (left in Fig.3) and further into northern Icaria Planum. Additional sapping channels were formed by the water flowing from the direction of the large crater (top in Fig.3).

Alluvial formations: The channel ends into the 30-km wide impact crater that was, at least partially, filled by water (Fig. 4). A temporary paleolake phase is indicated by the morphological features in the crater: A) The delta within the crater at the mouth of the channel was formed in a standing body of water. B) The crater rim has terraces and its floor was smoothened by sedimentary deposits. C) The neck of the outflow from the crater further into the west is higher than the floor of the crater.

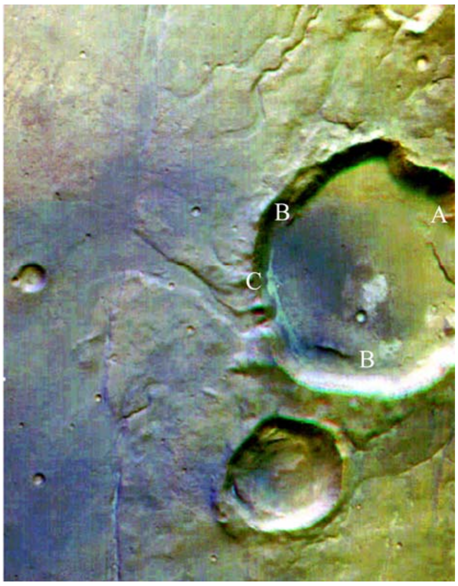

Fig. 4. The HRSC RGB image from the Mans Express orbit 068 indicates the flooded impact crater and the related formations.

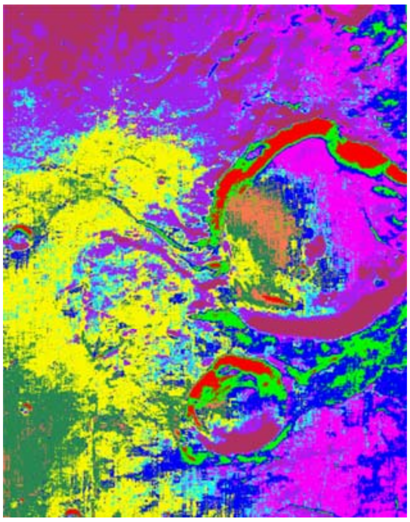

Fig. 5. The four-channel MEX-HRSC classification shows shadows with red, higher grounds with purple tones and alluvial deposits with brown, yellow and dark green.

The four-channel HRSC data set allows to map materials, units & formations: During the period of lacustrine environment in the crater its western rim breached and part of the water was led out onto the Icaria Planum lowlands. The water-carried particles were spread as sedimentary flood deposits onto Icaria Planum in front of the short channel out from the crater. These alluvial deposits are made visible by the unsupervised four-channel MEX-HRSC image classification (right: red = shadows; purple shades = higher grounds; brown & yellow & dark green = identified deposits).

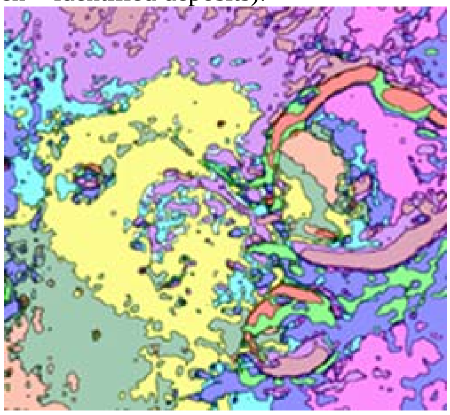

Fig. 6. The HRSC-based map of the alluvial fan in northern Icaria Planum, Mars.

Conclusion. The region is ideal in studying the fluvial channel formation tied to climate changes, hydrothermal activity and local geology. Melting of snow and ice from the peaks surrounding the major basin was the most probably responsible for the formation of the paleolake and the adjoining channel. The resulted alluvial structures reflect the amount of water available, topography and regional slopes along the course of the channel. The hi-resolution multi-channel MEX HRSC data give advanced views into the alluvial structures, erosion and sedimentation in the channel formation processes as well as into other geologic features of the area. Advanced remote sensing approaches will facilitate further mapping of the characteristic phases in development of faulting, volcanism, morphology and other geology within the Claritas-Thaumasia area.

References: Raitala, J., Aittola, M., Korteniemi, J., Kostama, V.-P., Hauber, E., Kronberg, P., Neukum, G. and the HRSC Co-Investigator Team, 2005. Claritas paleolake studied from the MEX HRSC data. LPS XXXVI, #1307.