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Mars Express HRSC -study of a paleolake chain in Northern Promethei Terra,

Mars.

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Introduction: The Hellas Basin in the southern hemisphere of Mars, with diameter of $\sim$2000 km [1]) and depth of $\sim$9 km is undoubtedly one of the largest impact features of our Solar System. In addition to impact related features of the basin itself and the younger craters, the area has other prominent features, such as the outflow channels Dao, Niger, Harmakhis and Reull Vallis, which cut the Hellas eastern rim. Besides these larger channels, both sides of Hellas exhibit a high number of smaller ones. In many cases these channels and valleys are associated with depressions, which can be considered probable paleolakes [e.g. 2-4]. Sometimes, more than one crater or basin is connected and a lake chain is formed [5]. The paleolakes and the chains of them against the background of local geology and evolution give us information on the local and areal hydrology.

Datasets and methods: The Hellas Basin and its complimentary regions have been one of the target sites for the HRSC-camera (High Resolution Stereo Color) [6] of the European Mars Express mission (MEX). The camera is the first to have images of both high resolution and wide spatial extent taken in color-stereo channels. In our study we use the HRSC images with complementing MOC (Mars Orbiter Camera), MOLA (Mars Orbiter Laser Altimeter) and THEMIS (Thermal Emission Imaging System) data sets. However, the possible lacustrine and/or fluvial environments (and their types) are recognized and studied more easily from the MEX-HRSC -data than

from any of the previous data sets consequent to mentioned qualities.

Case study of Martian lake chain: The lake chain described in this study is located in the eastern Hellas Basin rim area in the Northern Promethei Terra (38˚S, 102˚E). The studied chain has been part of a significantly large water system which characterizes the entire eastern part of Hellas Basin region. Chain is composed from notably different parts. The origin of the channel and lake formations was multifaceted, indicating that there has been more than one active phase in which water has flown into this chain. The water came into this channel-lake system from different sources, including underground water reservoirs, melt water from ice and snow on the nearby mountains, as well as from a flow on volcanic plains without a distinct starting point. Most of the flow types, excluding the outflow of melted ground water, run gently on the surface with no noteworthy erosion and thus making it difficult to determine their relative ages.

From the plains the water entered to the largest and northernmost crater in the chain and passed through it without forming any prominent lakes. This is indicated by similar crater densities from both in- and outside of the crater basin. After going through, the stream broke through the crater's southern rim and entered into a smaller basin. There the water probably stayed for a notable time, resulting in dark sediments which trapped the water and are still clearly seen on the HRSC red and nadir channel images. The water flowed mostly below the surface towards the lowest part of the sedimentary basin and broke out in sapping outlets. Next the water entered into another crater, which it filled forming a lake and depositing a layer of dark sediments on the NW part of the crater. Afterwards an outlet was formed on the western rim of the crater, and the lake chain system merged with other flows in the area and finally joined with Reull Vallis in the South-West.

Conclusions and discussion: The studied lake chain is a small part of a vast network of channels and lakes on the eastern rim of the Hellas Basin. Together all of them form the main sediment and volatile transportation system from Hesperia Planum down to Hellas Basin. Network has significant areal reach and impact, alone the channel system connected to the chain has total length least $\sim$400 - 500 km. Thus, the chain is evidence of highly active fluvial processes in the area during Late Hesperian/ Early Amazonian era.

Martian paleo-hydrology has still many mysteries to unveil. It's yet to uncover how much there actually was water flowing on the surface of Mars. How and in which proportion did other natural phenomena such as volcanic activity and changes in orbit parameters control the water cycle?

However, water history is already proven to be important part of Martian geological

past. Thus detailed knowledge of ancient lakes helps us to understand more deeply the intricate prosesses which made Mars the planet we see today.

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