HISTORY OF WATER IN A MARTIAN CRATER IN NORTHERN ARABIA TERRA. H. Lahtela[1], J. Korteniemi[1], D. Baratoux[2], J. Vaucher[2], J. Raitala[1], [1]Div. of Astronomy, Dep. of Phys. Sciences, P.O. BOX 3000, FI-90014 University of Oulu, Finland (hlahtela@student.oulu.fi), [2]Observatoire Midi-Pyrénées, Laboratoire Dynamique Terrestre et Planétaire, Toulouse, France.

Introduction: The focus of the study is a highly modified crater in Arabia Terra, Mars (36,0ºN/351,8ºE) [1-3]. This ~25km diameter crater has undergone complex post formation evolution. The crater and its surroundings (Figs. 1-4) show a multitude of evidence of water-rich processes.

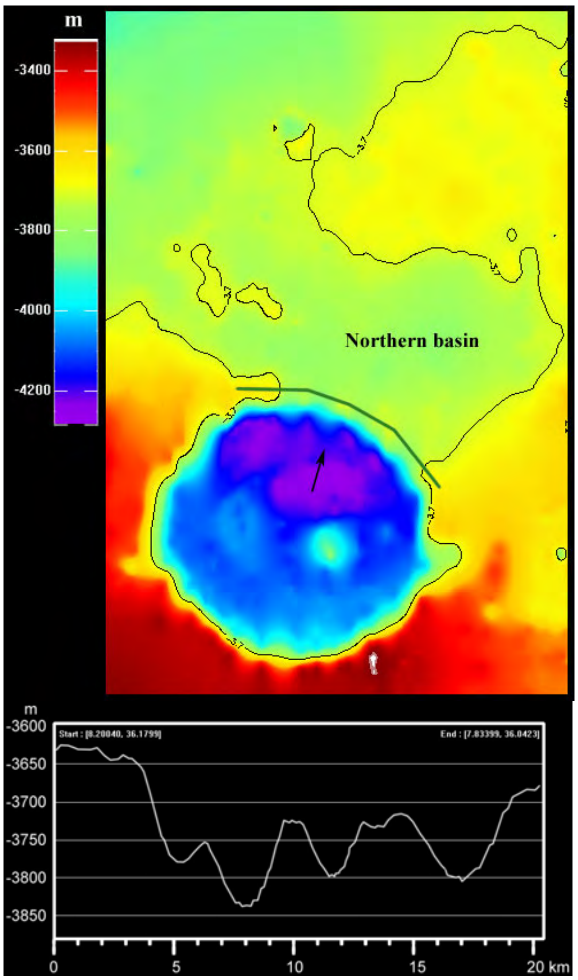

Fig. 1: Topography of the studied area with MOLA data. The black line marks the proposed '*Arabia contact*' –shoreline (-3707 m). The profile shows the four channels entering the crater from the northern basin (green arc in map). Black arrow points to elevated region below the channel mouths.

Arabia contact; shoreline of the northern ocean: The crater is intersected by one of the putative shorelines of the northern ocean (*Arabia contact*, -3707m ±21m) [e.g. 4-5]. The existence of shorelines caused by the northern ocean was originally proposed by Parker et al. [4]. The topic has since been a subject for several studies [e.g. 6]. In the "Geologic Map of the Northern Plains of Mars" by Tanaka et al. [7] the unit near the Arabia contact has been interpreted as the early Amazonian aged Vastitas Borealis marginal unit. They presume it to be composed at least partly of sediments from outflow channels and other sources along the highland margin.

Northern basin. A basin forming a "bay" along the Arabia contact is located N of the crater (Fig. 1). A mesa with clear terraces along its wall is located at the mouth of this basin (Figs. 1-2, 4a).

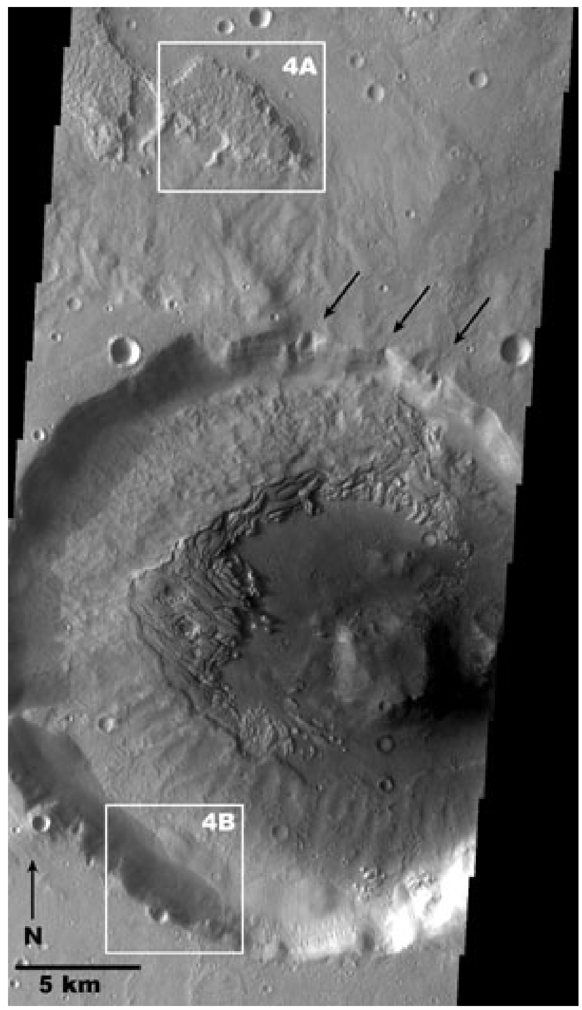

Fig. 2: The flow marks from the north are clearly visible. The black arrows show the points where three of the four channels (Fig. 1) enter the crater. The central parts of the crater exhibit eroded and cracked terrain probably of sedimentary origin. White boxes indicate locations of Figs. 4a-b. (Themis V13930008).

The crater. A section of >15 km of the northern crater rim has been eroded away (Fig. 1). Only this section is now under the Arabia contact elevation level. Four sub-channels has been formed inside this section indicating that the later stage water level was water level was lower than Arabia contact elevation for a significant period of time. The topography shows a southward dipping higher region within the crater floor next to the eroded northern rim. This indicates larger sedimentary deposits in that area.

There is no evidence of catastrophical flooding inside the crater. This indicates that the flow rate to the crater was moderate, which would be the result of a gentle rise of the water level in the northern basin.

The floor of the crater is composed of several separate units. The fractured terrain seen in Fig. 2 has a layered structure. Its slabs have sharp edges indicating to rigid but relatively brittle material. The unit has also high thermal inertia (Fig. 3). All of these features are in conformity with lithified sediments. On the other hand, IR-dark regions might indicate presence of near sub-surface ice.

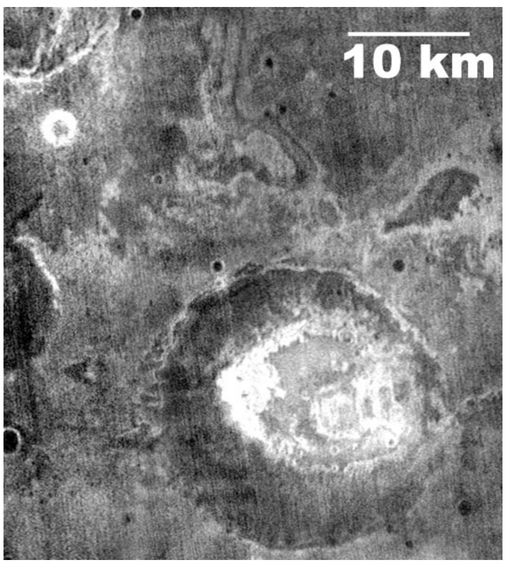

Fig. 3: The THEMIS night IR mosaic shows the variations in thermal inertia in the studied region.

Inflow channels: Two channels enter the crater, one from the east and the other from the west. There are no traces of deltas at the mouth of these inlets. They are relatively small-scale features (lengths ~4 km) and their short and stubby appearance indicates formation by sapping.

Gullies: Distinct layering is seen along the crater wall. In places, two or more separate layers are detected, but only one layer can be followed around the rim. This particular layer is darker than the under- and overlying layers, and it is the source of numerous gullies (examples in Fig. 4b). Gullies are located on the southern rim, which is in agreement with the observed gully orientations in the latitude vicinity (30- 40°N) [8].

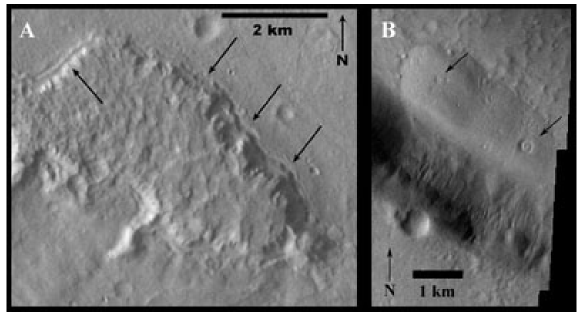

Fig. 4: a) A mesa was formed when water entered the basin north of the crater. A distinct set of terraces (black arrows) tells of the gradually lowering water level. (Themis V13930008). B) Lobate depris aprons formed from the southern rim of the crater. Gullies are located adjacent to them originating from the dark layer on the crater wall. (Themis V19159010)

Lobate debris aprons: Prominent mass-wasting deposits occur on the southern part of the crater floor (Fig. 4c). Their appearance is similar to e.g. rocky glaciers in Deutoronilus Mensae [9]. Small craters on the top of the mass-wasting debris apron formation are similar to the few relaxed impact craters observed at Deuteronilus; they suggest target material been ice-rich sediment.

Conclusions: Water-related processes have affected the rim and cavity topography and surface texture of the crater floor in many ways. A large amount of water has entered the studied crater overflooding the N rim transporting notable amount of sediments inside. Additionally, a possible creeping rock-ice glacier together with gullies has formed on the S rim of the crater.

Acknowledgements: We thank the HRSC Experiment Teams at DLR Berlin and Freie Universitaet Berlin as well as the Mars Express Project Teams at ESTEC and ESOC for their successful planning and acquisition of data as well as for making the processed data available to the HRSC Team. We acknowledge the effort of the HRSC Co-Investigator Team members and their associates who have contributed to this investigation in the preparatory phase and in scientific discussions within the Team.

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