Abstract #3621

NAVUA VALLES AND HADRIACUS MONS: DISCONTINUOUS CHANNELS, PALEOLAKES, KNOBBY TERRAINS, AND MOUND FIELDS

H. I. Hargitai[1], V. C. Gulick[2], and N. H. Glines[2]
1 NASA Ames Research Center/NPP / SETI Institute, MS 239-20, Moffett Field, CA 94035, USA, henrik.i.hargitai@nasa.gov
2 NASA Ames Research Center/ SETI Institute, MS 239-20, Moffett Field, CA 94035, USA, virginia.c.gulick@nasa.gov

The slopes of northeastern Hellas Basin are rich in a wide variety of fluvial features. This area exhibits not only the Dao–Niger–Harmakhis–Reull Valles outflow channels, but also many smaller channels and valleys, several of which includes discontinuous sections. We have mapped these channels, channel-associated depressions, and potential paleolakes, in the area from the Navua Valles in the West, through the Hadriacus Mons volcano in the center, to the Ausonia Montes to the East (Fig. 1). We identified three groups of lakes at the source regions of major drainages, and a fourth type scattered along the lower reaches of these drainages. Each group has a different character, likely determined by a different formative process: precipitation, ground-water flow at the sources, and fluvially transported water at the lower reaches (Fig. 3). Only one of these 34 basins (N10, Fig. 2) had been catalogued previously in paleolake databases [1].

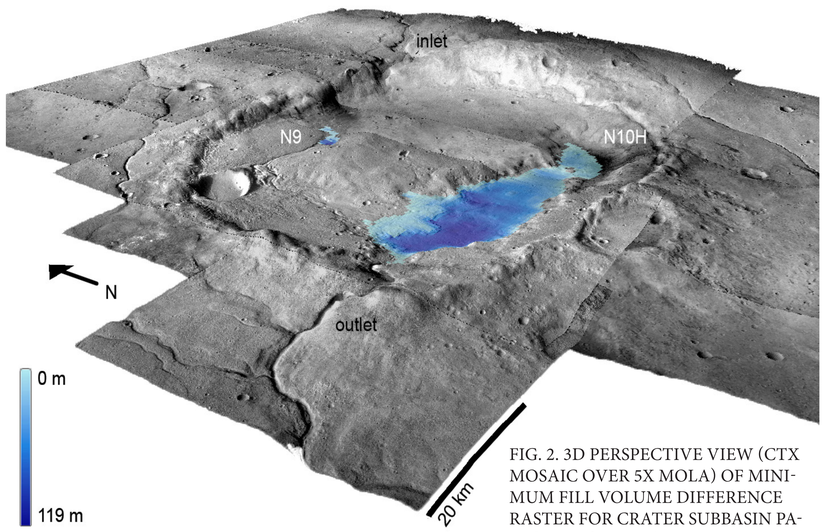


FIG. 2. 3D PERSPECTIVE VIEW (CTX MOSAIC OVER 5X MOLA) OF MINIMUM FILL VOLUME DIFFERENCE RASTER FOR CRATER SUBBASIN PALEOLAKES N10H AND N9.

Paleolake volumes range from 0.02 km³ to 1055.47 km³. The total paleolake water volume contained here in this mapping region is ~2,700 km³, nearly as great as the water volume within Lake Victoria on Earth.

The Navua Valles likely formed in a paleo-climate episodically and locally rich in liquid surface water and ground water, possibly hydrothermal, consistent with other models of persistent or repeated effects of water throughout the geologic history in Eastern Hellas [2], Reull Vallis [3] and elsewhere on Mars [4-7]. Conditions here at the eastern rim of Hellas Basin locally enabled the formation of knobby terrain and mound fields, after the active phases of the channel and lake systems. These landscapes – channels-and-lakes, knobs, mounds – were active at different times and may represent different episodes in the history of East Hellas that have provided habitable environments in the same areas.

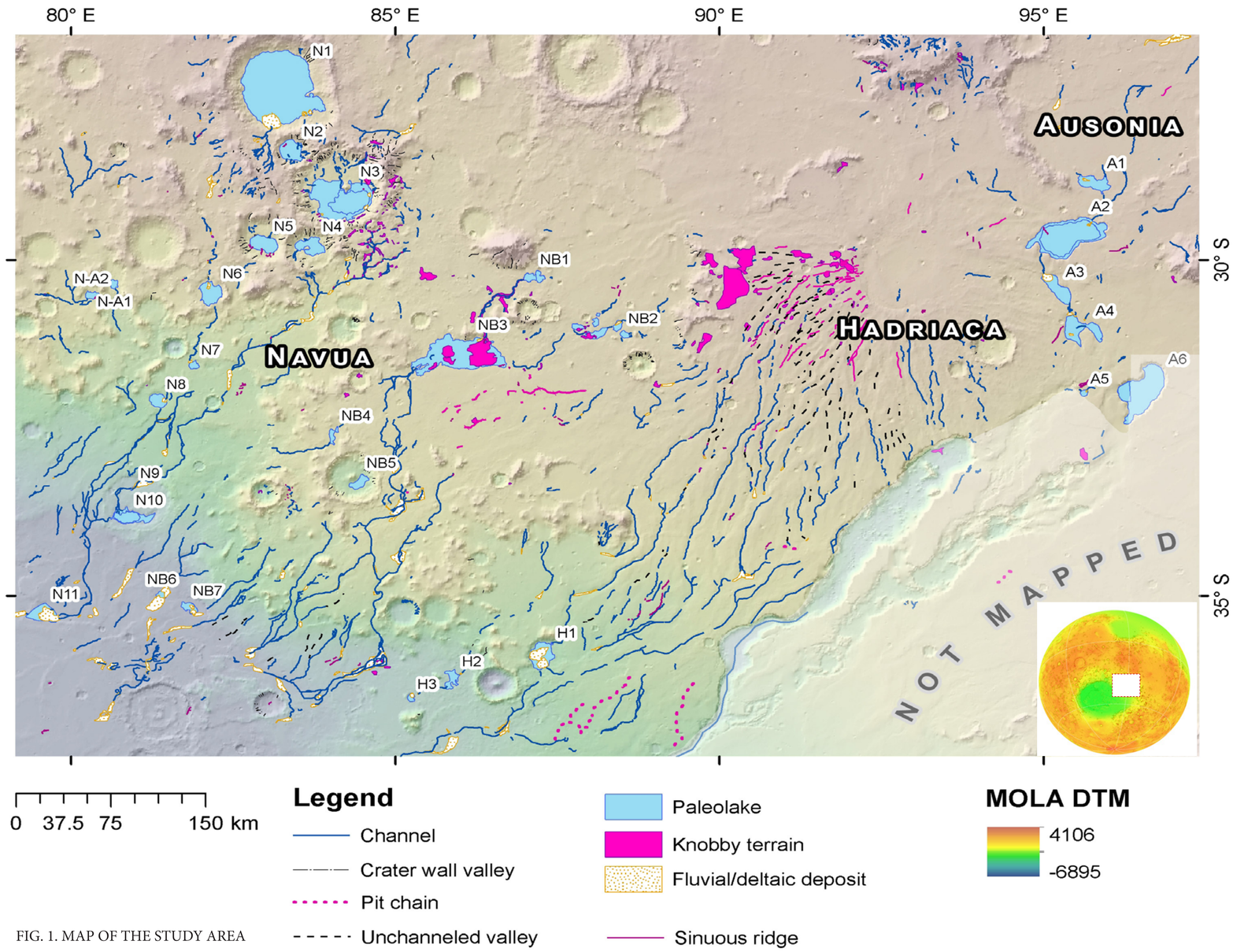
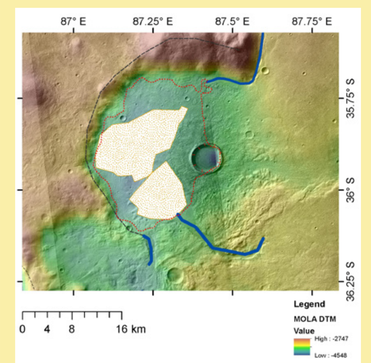


FIG. 1. MAP OF THE STUDY AREA

Type	Closed Basin Lakes		Open Basin Lakes	
	Independent	Terminal	Through-flowing	Source
Related terms	Ephemeral Lakes Isolated basins seepage lakes, wet playas	Ephemeral Lakes Valley-terminal basins dry playas	Intra-valley basins drainage lake, often parts of lake chains	Valley-head basins spring lakes, (seepage lakes), drained lakes
(dominant) Inputs	Precipitation (?) Ground water discharge (?)	Surface runoff		Ground water discharge (?)
Sediments	Terminal deposits Lacustrine Sediments Mineral precipitation (?)			
Water bal.	Underfilled		Overfilled or balanced fill	
Outputs		Evaporation (?) Ground water recharge (?)	Surface runoff	

TABLE 1. OVERVIEW OF THE POTENTIAL INPUTS AND OUTPUTS OF PALEOLAKES



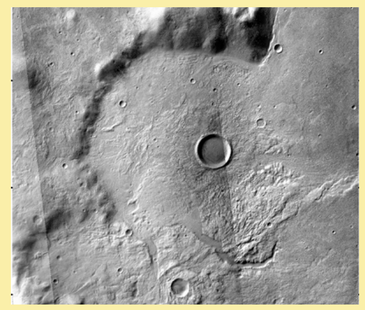


FIG. 3. THE H1 SYSTEM WITH TWO INLET CHANNELS AND TERMINAL DEPOSITS AND ONE OUTLET CHANNEL

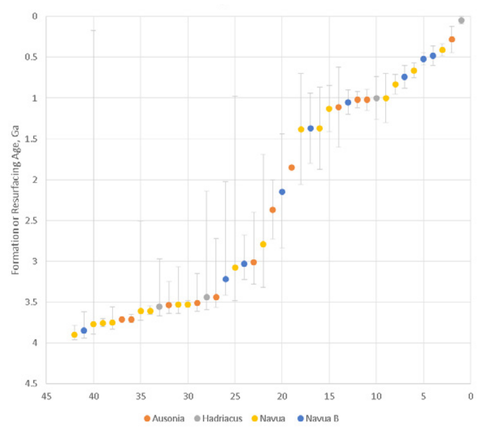


FIG. 4. CRATER RETENTION AGES OF PALEOLAKE BASINS ARRANGED IN DECREASING AGE. FLAT "SURFACES" SHOW PERIODS WHEN SEVERAL SURFACES FORMED OR RESURFACED AT THE SAME TIME.

Crater retention ages of the depressions suggest that they formed during a volcanically active period in the Hesperian when valley networks were also produced elsewhere on Mars, but they were commonly resurfaced, some formed, after volcanic activity ceased in this region, during the Amazonian.

[1] Fassett, C.I., Head, J.W. (2008) Valley network-fed, openbasin lakes on Mars: distribution and implications for Noachian surface and subsurface hydrology. Icarus 198:37–56. [2] Crown et al., (2005) J. Geophys. Res. 110, E12S22, doi:10.1029/2005JE002496. [3] Kostama et al., (2007). J. Geophys. Res., 112, E11001, doi:10.1029/2006JE002848. [4] Gulick, V. C. (2001). Geomorphology 37(4), 241–268. [5] Harrison et al., (2005). J. Geophys. Res., 110, E12S16, doi:10.1029/2005JE002455. [6] Hauber et al., (2013). J. Geophys. Res. Planets 118, 1529–1544, doi:10.1002/jgre.20107. [7] Wilson et al., (2016). J. Geophys. Res. Planets, 121, doi:10.1002/2016JE005052.

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