THE ROLE OF WATER/ICE IN THE RESURFACING HISTORY OF HELLAS BASIN. B. J. Thomson[1] and J. W. Head[1], [1]Brown University, Box 1846, Providence, RI, 02912.

Introduction: The Hellas impact basin is one of the most prominent topographic features in the southern hemisphere of Mars. It is comparable in magnitude to the South Pole-Aitken basin on the Moon [1-3]. The total relief of Hellas basin is over 9 km, and the floor of the basin is the lowest topographic point on the planet [4].

The MOLA global topographic data has allowed the first accurate assessment of the area drained by the Hellas Basin. The main basin rim is ~2300 km in diameter. MOLA has revealed a previously unmapped annulus of high-standing topography that surrounds the basin rim [4]. This annulus has a significant topographic signature that is evident in the surrounding terrain more than one basin diameter distant from the main rim. An analysis of the drainage divide of the basin has revealed that it is the among the largest topographic sinks on Mars, being second only to the northern lowlands in terms of areal extent and volume [4].

There are a wide variety of processes that have been interpreted to have modified the basin, including volcanic, eolian, fluvial, lacustrine, glacial, and periglacial processes [5-8]. Here we examine the role that water/ice may have played in the modification history of the basin.

Glacial History: There are a variety of distinct landforms on Mars that are interpreted to be associated with the presence of ground ice/permafrost [9-11]. Today, the only visible surface ice occurs at the permanent polar caps, although water ice is physically stable poleward of 45° N and S latitude. Some investigators have suggested that the ice cover was once more extensive, particularly in the southern hemisphere. Kargel [5] mapped the occurrence of a suite of landforms in Hellas that may have had a common glacial origin. These features, which he interpreted to be glacial scour marks, moraines, drumlins, and eskers, are shown in Figure 1.

Scour features: Occurring on the basin's southern rim, the scour features consist of north-south trending ridge and trough structures. This region of grooved terrain is found on and around the flanks of the volcanoes Amphitrites Patera and Peneus Patera and extends down to the floor of the basin (Fig. 1). As is evident in MOLA topography (Fig. 2), the orientations of these structures are strongly correlated with large-scale topography. The grooved terrain is confined to the relatively steep (average slope of 1-2°) basin wall. The grooves terminate abruptly on the basin floor (average slope of <0.5°) at about the -6000 m elevation level. The termination of scour features coincides with a sharp break in gradient, and is consistent with the hypothesis that this represents a change from an erosional glacial regime to a depositional one. It remains unclear whether the grooved terrain, if it is indeed glacial in origin, is indicative of a local, isolated glacier or whether is was part of a more extensive ice sheet in the southern hemisphere.

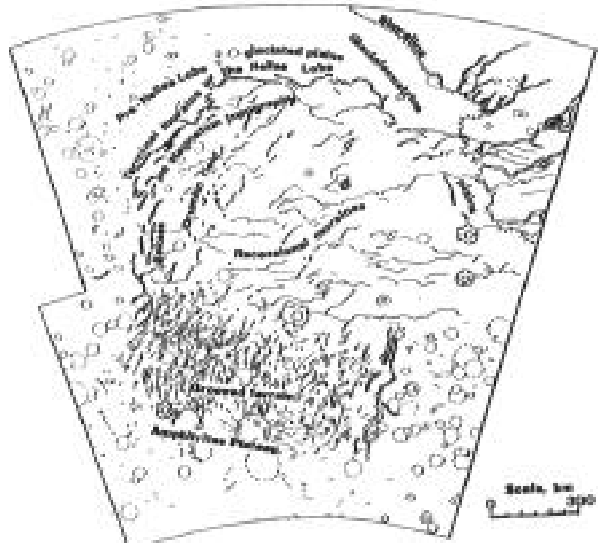

Figure 1: Glacial geomorphic map of the Hellas region after Kargel [5].

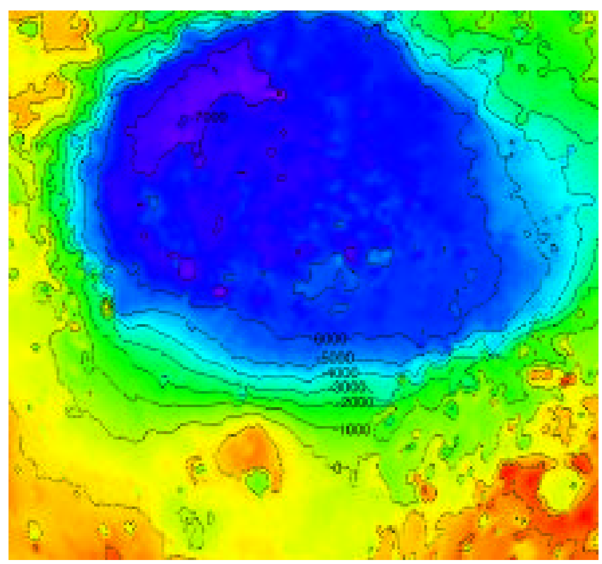

Figure 2: Quarter-degree gridded MOLA topography to reprojected to match Figure 1. Contour interval is 1000 m.

Moraines, Drumlins, and Eskers: The floor deposits, in contrast to the wall deposits, consist of features and lineations which are interpreted to be depositional in nature. In addition to a small field containing eskers and drumlins near the western edge of the basin floor, there are a large number of extended lineations which trend east-west (Fig 1.). These lineations are situated perpendicular to the proposed direction of glacial flow and have been interpreted as a moraine complex. Moving from north to south, Kargel [5] mapped features he interpreted to be a series of transverse recessional moraines. At the northern end of the field there is a terminal moraine-like feature which represents the maximum extent of glacial flow. This possible terminal moraine closely follows the southern edge of the -7000 m closed depression in the northwest portion of the basin (Figs 1,2).

Channel and Lacustrine Deposits: Northwards of the proposed area of maximum glacial extent there is a region interpreted to be influenced by glacio-lacustrine processes. Kargel [5] mapped a portion of the shoreline of a possible proglacial lake. The MOLA data reveal that this mapped shoreline lies almost entirely at the -6000 m elevation level. Possible sources of input to this lake is water derived from retreating glaciers as well as outflow channels which empty to Hellas from the east. The esker field, in which the long axis of the features in oriented north-south, may represent subglacial flow of water into a proglacial lake. The eastern channels also might have contributed to this lake. These small channels resemble other outflow channels in gross morphology, but are greatly reduced in size. Interestingly, channel cutting terminates abruptly on the basin floor in a manner that is very similar to the abrupt cessation of the circum-Chryse outflow channels. The paucity of tributaries along the length of these Hellas channels suggests a localized source region, possibly due to volcano/ground ice interactions.

Interpretation*:* The interpretation of this suite of features as glacial in origin is not widely accepted. The most comprehensive mapping of the units within Hellas to date proposes a sequence of Late Noachian lava flows, Early Hesperian fine-grained eolian infill, and possible minor lacustrine sediments [6]. This interpretation is at odds with the glacial hypothesis primarily on the basis that it appears that the formation of the grooved terrain and the formation and modification of the floor units in Hellas were non-contemporaneous. Other possible explanations for the floor deposits in Hellas include wind-created yardangs or wrinkle ridges [6,8]. We have begun to examine these features in detail to better asses their morphology, occurrence, and mode of formation. By quantifying the width, height, profile, symmetry, and spacing of these floor features with MOLA we should be able to determine how they compare to their terrestrial counterparts. In addition, we intend to quantify the roughness of the units which might have been glacially scoured and also examine areas which might have received lacustrine sediments. The new topographic data will allow us to begin to unravel the stratigraphic sequence of the units emplaced into and around the basin and determine their mode of formation.

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