A MULTI-RING IMPACT BASIN IN THAUMASIA H. V. Frey, Geodynamics Branch, Goddard Space Flight Center, Greenbelt MD 20771, 301-286-5450, J. H.. Roark, Science Systems & Applications, Inc., Lanham, MD 20706.

We suggest a previously unreported multi-ring impact basin exists in the Thausmasia area of Mars, which appears to significantly predate the formation of the fossae which dominate this region. The main ring of the basin is 570 km in diameter; there appears to be one interior and perhaps one or two exterior rings. The fractures and graben in this region appear totally unaffected by the presence of the basin, which we take to indicate complete mechanical adjustment of the impact feature prior to formation of the graben. Major compressional features of the South Tharsis Ridge Belt do change orientation from NW-SE west of the basin to SW-NE to the east of the impact. The basin is overlain by a number of large degraded and embayed craters, suggesting it may be one of the oldest relic structures on the planet.

INTRODUCTION

We previously suggested [1] the distribution of massifs, Noachian terrains and cratered/smooth plains contacts in the Daedalia region of Mars indicated the presence of three coeval impact basins rather than one very large basin as previously reported [2, 3]. We also investigated the fractured terrain of Thaumasia, a highstanding region of Noachian/Hesperian age [4] which has been interpreted as an early center of tectonisim in the development of the Tharsis region [5, 6], and which includes some of the oldest fracture systems on Mars [6, 7]. Figure 1 is a Mars MDIM image of the region with whole and partial impact craters larger than 25 km and rings of the proposed Thaumasia Basin indicated.

The main ring (diameter 570 km, centered at 93W, 36S) is defined on its western side by an arcuate scarp-like contact between older, rougher, fractured terrain (unit *Nf*) and younger fractured terrain (*Hf*), including major outcrops of Noachian basement material (*Nb*). S and SE along this arc, well-preserved craters and an elevated region of *Nb* mark a contact between *Nf* and Hesperian plains units (*Hpl3*). The topographic discontinuity extends discontinously over about 45% of a complete circle. Younger plains (*Hsl*) cover the ring on its NE side.

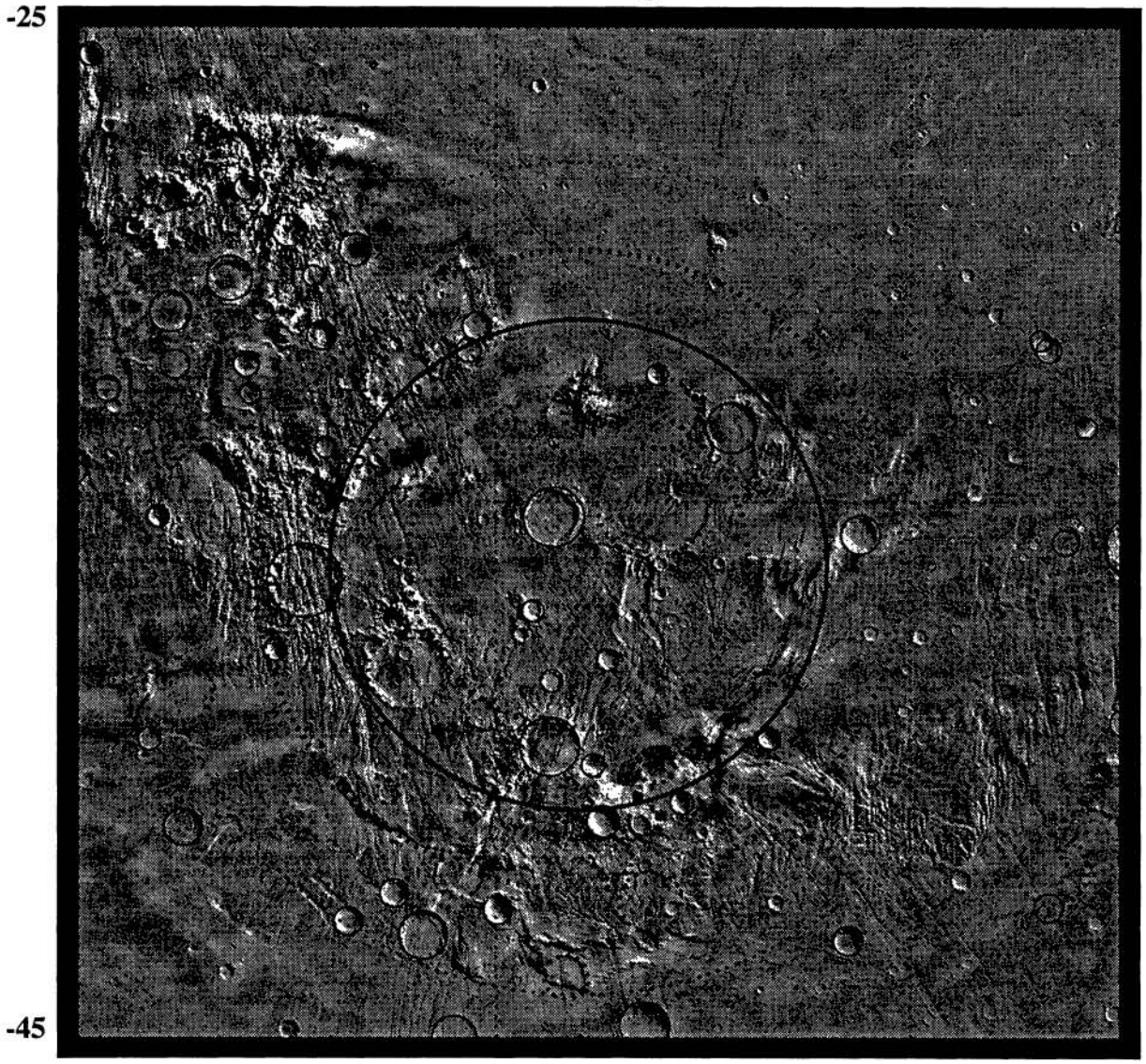
A 390 km diameter inner ring is suggested by several outcrops of basement material (*Nb*) and old fractured terrain (*Nf*). There is less evidence for outer rings: one (D = 740 km) may lie along an arcuate *Nb* outcrop on the SW side of the basin. A smaller contact between *Nb* and *Nf* may be part of a less obvious ring with diameter 960 km. On the SW side, these proposed outer rings lie along compressional features interpreted to be part of the South Tharsis Ridge Belt [8].

IMPLICATIONS

Thaumasia Basin, comparable in size to Holden, Mangala, Cassini and a basin overlapped by Shiaparelli [9], is inferred to be of Early Noachian age because: (a) The basin is extremely degraded and overlapped by features of Middle Noachian and younger age. (b) It predates a large number of superposed large impact craters, many embayed by younger plains-forming units, whose density supports the above Noachian age determination. (c) The fossae in this area appear to be totally unaffected by the presence of the basin, even where they cross the most obvious topographic barriers. This suggests the basin not only predates the formation of the fossae, but also had adjusted isostatically and was mechanically stable prior to graben formation. (d) Compressive structures thought to be part of the South Tharsis Ridge Belt and of Late Noachian/Early Hesperian age [8], appear to be influenced by the basin: orientation of the

structures changes from NW-SE west of the basin to SW-NE to the east of the impact. Thaumasia Basin may be one of the oldest structures on Mars, even pre-dating Isidis and Hellas.

FIGURE 1. Mars Viking Data



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