A LARGE PRE-HELLAS IMPACT BASIN IN THE SOUTHERN HEMISPHERE OF MARS Herbert Frey, Geodynamics Branch, Goddard Space Flight Center, Greenbelt, MD 20771; Richard A. Schultz, Mackay School of Mines, University of Nevada, Reno, NV 89557; Anne-Marie Reidy and Harry Wolfe, Astronomy Program, University of Maryland, College Park, MD 20742.

A recent search for large impact basins in the southern hemisphere of Mars reveals several candidates [1], one of which appears to be both large (D~2400 km?) and older than the Hellas Basin. Below we present evidence for this feature and discuss its importance in possibly explaining the distribution of Hesperian volcanic flows in the region SW of Hellas.

Geologic Setting, Concentric Structures

The region 285-340°W, 55-70°S is dominated by ridged plains [units *Hr* (Malea Planum) and *Nplr*] concentrically distributed around the SW quadrant of Hellas [2]. This area is nearly devoid of craters larger than 150 km, perhaps due to burial by Hellas ejecta or by ridged plains. But the depopulated region extends much further from Hellas than the ridged plains. Noachian plains 1500-2000 km SW of Hellas are also missing large craters, even though such craters do exist SE at comparable distances. The absence of large craters must be due to more than just Hellas. It is also difficult to explain ridged plains in only one Hellas Basin quadrant.

Some ridges in *Hr* and *Nplr* are clearly concentric to Hellas; others appear related to South Polar Basin. But many cannot be easily associated with either of these basins. Scarps downthrown to the east at 340-345°W, 65°S and ridges to the NE and SE are all concentric about 325-330°W, 65-68°S. This point lies within an outcrop of Hesperian-age volcanics (unit *Hap*) with a complex distribution of local ridge orientations (Figure 1). *Hap* is interpreted as ridged plains extruded from volcanic centers and associated ring faults [2], that is, of a more localized origin than the *Hr* and *Nplr* ridged plains to the north and east.

Five separate distinct outcrops of modified (etched) cratered terrain (*Nple*) are grouped around the 328°W, 66°S point described above, at about 300-400 km to the NE, SE, SW, W and NW (Figure 1). They have much the appearance of large massifs found in some impact basins. At 600 km SSE two additional outcrops of *Nple* occur at 315°W and 325°W, 75°S. In a SW and W direction at the same distance, four prominant "mountains" (part of Sisyphi Montes, unit *M*: high, rugged feature of uncertain origin [2]) lie along an arc-like extension of a major boundary between cratered terrain (*Npl1*) and ridged plains (*Nplr*). Due north at the same 600 km distance from the above-described center, an isolated outcrop of *Npl1* stands emergent through the ridged plains (*Nplr*).

Large arc-like outcrops of knobby terrain (*HNu*) occur at 850-900 km SW of the center of the ring of massifs. Along the same arc but NW of the center are numerous *M* structures in both *Npl1* and younger plains (*Hdl*). This arc also crosses two exposures of old basement comparable to Hellas rim material (*Nplh*) SSE of the ring of massifs, lies along an asymmetric section of the south Polar Basin rim and a major Noachian/Hesperian contact, and runs through Peneus and Amphitrites Paterae on the southern flank of Hellas. At 1100-1200 km from the center, a major boundary between Noachian and Hesperian units, outcrops of *Npl1* inside and outside South Polar Basin, knobby terrain, an isolated outcrop of *Nple*, and ridges buried beneath polar units (*Apl*) define a possible outer ring.

Topography [3] is complicated because this region lies within the Hellas impact area. The old cratered terrain well away from the grouped massifs (and some of the massifs themselves) lie at elevations of 4000-5000m. The center of the localized *Hap* unit lies at 2000-3000m, lowest in the direction of Hellas.

Interpretation: An Ancient Impact Basin?

An impact basin located at 328°W, 66°S could explain the distribution of features described above (Figure 1). At least four rings seem likely, with diameters of 600, 1200, 1700 and perhaps 2200-2400 km. If true, this basin is at least comparable to South Polar [4,5,6,7] and perhaps competitive in size with Hellas. The general topographic character of the region is

consistent with an old impact basin being present, allowing for Hellas-related impact structures. The number of major features concentric to the localized *Hap* volcanic unit strongly suggests but does not prove that a major impact occurred here.

Some of the features mapped as concentric about the proposed basin may also be concentric to Hellas, and lie along one or more previously unrecognized outer rings of that impact basin. Two of the larger massifs, some outcrops of knobby terrain, and a subset of the Sisyphi Montes (unit *M*) are roughly concentric to Hellas. But the ring of *Nple* outcrops surrounding the localized *Hap* volcanics near the proposed basin center is hard to ascribe to Hellas, as are many other features. We believe there are in this region structures associated with two major overlapping impact basins.

Discussion

There may be a previously unrecognized large impact basin W of Malea Planum and SW of the Hellas Basin. If true, this basin predates Hellas, and the overlap of these two may be important. It is in the overlap region where the ridged plains units (both *Nplr* and *Hr* of Malea Planum) occur. Outside the overlap region such volcanic flows are rare and far more localized (Figure 1). We have pointed out before that what often appear to be off-center volcanics associated with single impact basins (Hellas, Isidis, Utopia) are more easily understood in terms of overlap with older basins: the volcanics are generally confined to the overlap region [8]. This additional example in the southern hemisphere adds to the importance of overlap between impact basins as localizing later volcanism, and may account for the localization of the ridged plains volcanism to one quadrant of the Hellas impact region.

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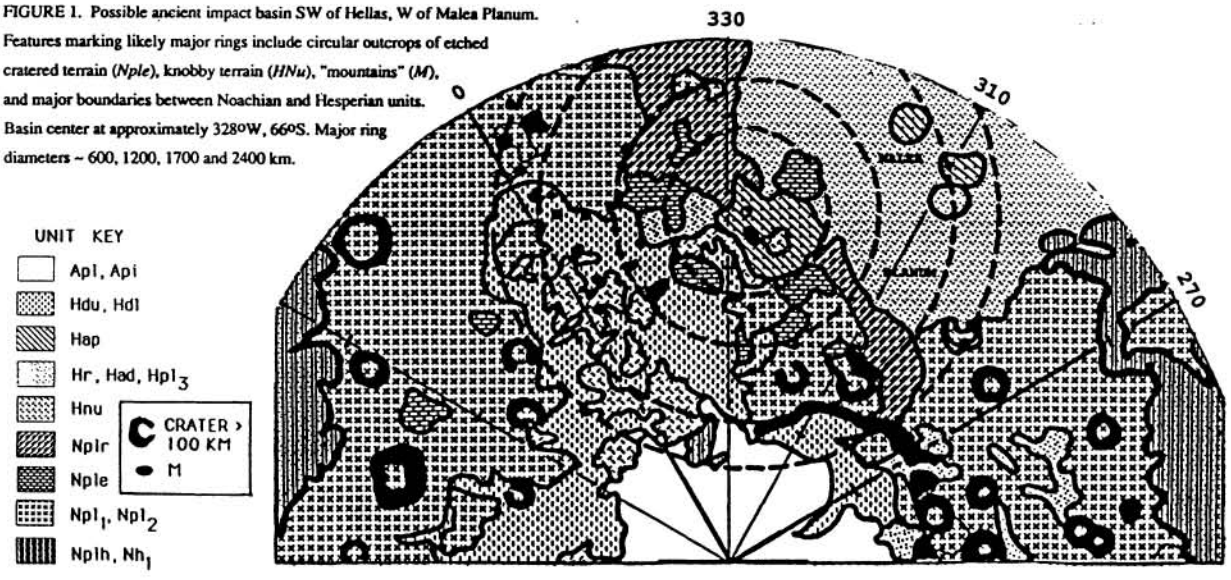

FIGURE 1. Possible ancient impact basin SW of Hellas, W of Malea Planum. Features marking likely major rings include circular outcrops of etched cratered terrain (*Nple*), knobby terrain (*HNu*), "mountains" (*M*), and major boundaries between Noachian and Hesperian units. Basin center at approximately 328°W, 66°S. Major ring diameters ~ 600, 1200, 1700 and 2400 km.