TOPOGRAPHY OF THE SMYTHII BASIN. Priscilla Strain and Farouk El-Baz, National Air and Space Museum, Smithsonian Institution, Washington, D.C. 20560.

The Smythii Basin is a partially flooded, pre-Nectarian age (1) impact basin on the Moon's east limb (Fig. 1). Its location at the intersection of the flight paths of Apollo missions 15, 16, and 17 makes it one of the most completely photographed lunar basins. This extensive photographic coverage, often at high Sun elevation angles, made possible the construction of detailed and accurate topographic maps. These maps constitute the most comprehensive topographic coverage of any lunar basin, and along with the fact of Smythii's sparse mare fill, provide a good source for the study of basin morphology and structure. The maps used in this study include 30 Lunar Topographic Orthophotomaps (LTO's) at 1:250,000 scale with a 100-m contour interval, and a 1:1,000,000 scale map of the basin with a 500-m contour interval. The latter was specially produced by the Defense Mapping Agency/Topographic Center and covers the central part of the basin from 80° to 100°E and 8°N to 12°S.

Remnants of three Smythii rings are visible on Lunar Orbiter and Apollo photographs. The inner ring (about 370 km in diameter) is most prominently displayed in a straight segment on the west side of the basin. Here the ring ranges in height from about 1700 m to more than 3400 m above the basin floor. Profiles show an eastward slope that is about 12-15° at the base and becomes more gentle towards the crest. The second Smythii ring is very degraded and exhibits little relief. The third ring is most prominent in the southeast and is similar in profile to the first ring, but exhibits gentler slopes. Base slopes are about 10°. In profile, both the first and third rings resemble crater rims, which, while not ruling out other mechanisms, may suggest formation in a manner consistent with a nested-crater model (2) where both outer and inner rims form by cratering processes, not mere slumping. The third ring reaches heights of up to 3800 m above the surrounding terra and more than 8 km above the lowest points on the basin floor. These heights are comparable to those estimated from limb profiles, Lunar Orbiter photographs, and laser altimeter data, by Howard et al. (5) for the Cordillera ring around Orientale, a basin roughly similar in size but much younger than Smythii.

The basin floor (the area within the first ring) is only partially flooded by mare basalts primarily concentrated in the northeast. The floor exhibits little relief on the 1:1,000,000 scale map. Therefore, in order to study it in more detail, a sketch map with a 100-m contour interval was constructed by reducing and combining 16 LTO's (Fig. 2).

The sketch map indicates that the lowest areas of the basin floor correlate well with the occurrence of mare basalts, as was noted by Stewart et al. (3). The range of elevations in the mare is from 3400 m to more than 3800 m above an arbitrary lunar radius of 1730 km. Mare ridges are associated with the lowest points in the mare which may indicate faulting or subsidence along ridges. In particular Dorsa Dana and Dorsa Cloos bound a graben (?) more than 100 m deep. The highest Smythii ridge (located near Pirandello) is more than 200 m high.

Numerous multi-ringed craters are found on Smythii's floor. They range from about 30-70 km in diameter and exhibit maximum floor to rim heights of from 500-900 m. Despite variations in size, the lowest points of 60% of these craters are at the same elevation, within the limits of the 100-m contour "resolution" (Fig. 2). The remaining multi-ringed craters reach depths of up to 200 m lower. Schultz (4) pointed out the similarity between the

floor elevations of these craters and the surrounding mare, and suggested that this was due to a "magmastatic" adjustment in craters affected by volcanic modifications.

The circularity of the basin floor is broken in the northeast by a low region which extends north toward Mare Marginis. Within this low is a "trough" consisting of a string of irregular, breached depressions (Fig. 1). The straight and parallel segments of the rims and the similarly oriented lineations in the surrounding terrain indicate faulting along the "trough" and suggest that the origin of the low may be in part structural.

In summary, topographic data have been used to study the morphology of the Smythii Basin. In the absence of good low to medium Sun angle photography the topographic base becomes an especially important tool. Profiles have shown that despite their great age and degraded appearance, some segments of the Smythii rings exhibit considerable relief, rising more than 8 km above the basin floor. The basin floor is flooded in the northeast by mare materials. Lows associated with mare ridges suggest post-mare structural adjustments. The location of mare basalts coincides with the lowest areas of the basin floor. This suggests a pre-mare low into which the basalts flowed (3). One possible origin of such a low might be a large post-basin impact. Multi-ringed craters in Smythii's interior form a rough arc which might delineate the impact. Such craters elsewhere on the Moon are often associated with basin edges (4).

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References

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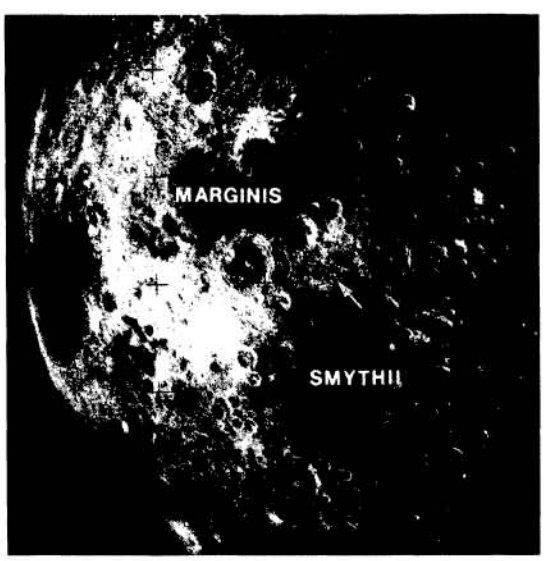

Figure 1. Apollo 14 view of the Smythii Basin. Arrows show "trough" north of the mare. (AS14-75-10304)

SMYTHII TOPOGRAPHY

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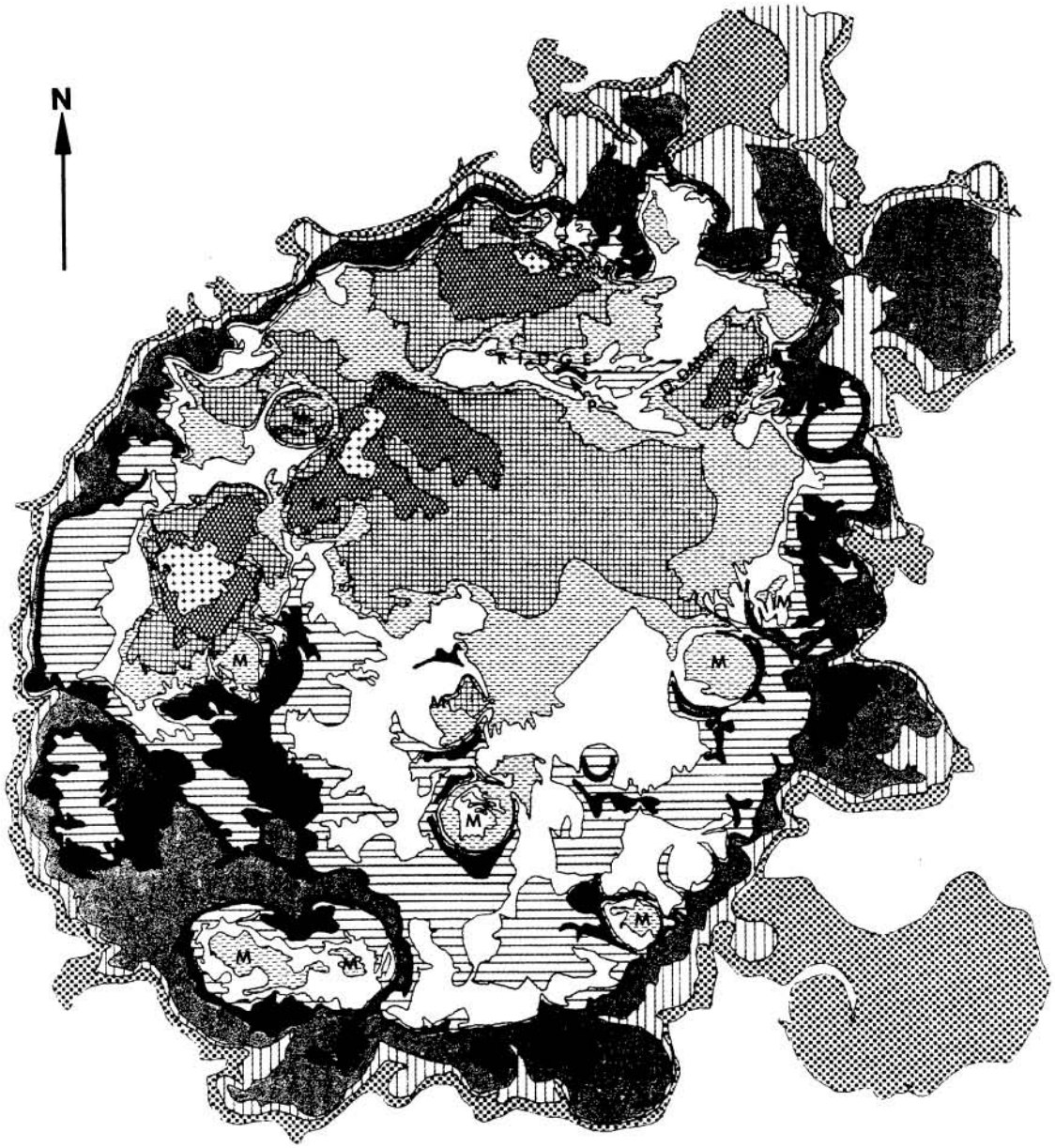

Approximate scale- 1:3,000,000

< 3400m | 3500-3600 | 3700-3800 | 3900-4000 | 4500-5000
3400-3500 | 3600-3700 | 3800-3900 | 4000-4500 | 5000-5500

Figure 2. Sketch map of Smythii topography constructed by reducing 16 LTO's. Small distortions of the data were introduced by the reduction process. Note relation of mare ridges to lows in the mare. M designates examples of multi-ringed craters. P marks the crater Pirandello. Note that last 3 contours represent 500-m intervals.