

Newly Detected Impact Basins within South-Pole-Aitken Basin

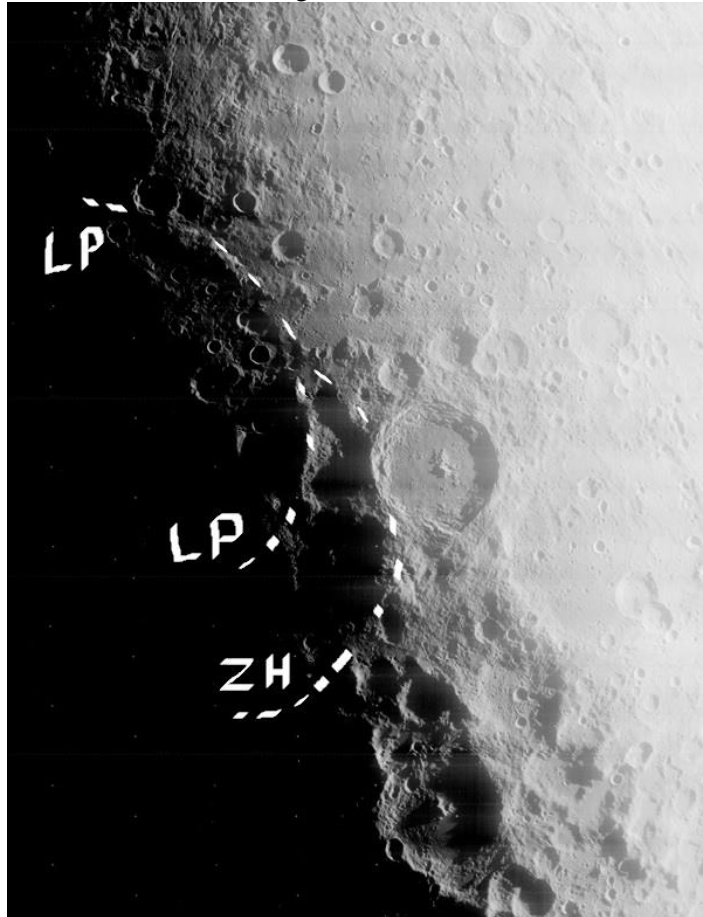
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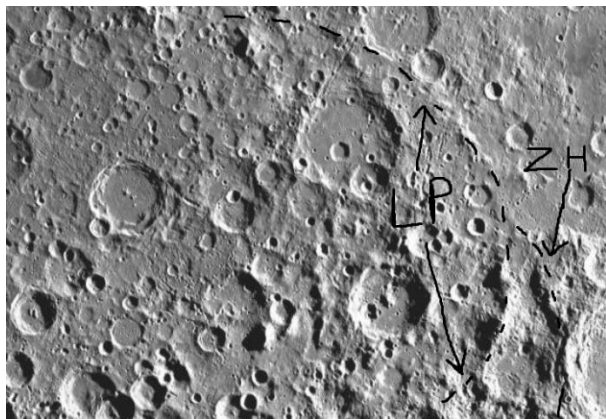
Imaging data from Lunar Orbiter 4 has led to the discovery of two impact basins located in the southeast corner of the larger South-Pole Aitken impact feature. Other images and altimetry data from the LRO has confirmed these discoveries. The first impact structure will be referred to as the Lippmann-Petzval (LP) basin. It lies to the southwest of the Orientale basin and to the east of the Mendel-Ryberg basin (which it resembles in size). The radius of the LP basin is approximately 500 kilometers, putting it in the same size category as the Apollo basin, also situated entirely within the SPA impact structure. The center of the LP basin is located at 250E, 55S (110 W, 55S), to the southwest of Orientale and directly west of the Mendel-Ryberg basin.

The eastern rim of the Lippmann-Petzval basin is indicated in this image from Lunar Orbiter 4 (photograph LO4-4193; credit LOIRP)

This sector of the southern highlands is complex, with another partial rim arc lying just to the south of the LP basin. It is proposed that this is a topographic signature of an even older basin discovered by means of Lunar Orbiter 4 imagery, here referred to as the Zeeman-Hausen (ZH) basin. The center of the LP basin is located at 240E, 70S (120 W, 70S). The ZH rim is also indicated in the LO4-4193 image. This overlap of basins, of similar dimensions, is akin to the Schrodinger overlap of the Amundsen-Ganswindt basin. The LP and ZH basin rim segments have earlier been considered to be the remnants of the rim of the South-Pole-Aitken (SPA) basin. However, the radius of curvature of these segments does not fit the dimensions of the SPA impact structure, thought to be 2,500 km in diameter. This demonstrates the difficulty of discerning such structures through the “haze” of multiple, large impact events.

This is more apparent from an LRO WAC mosaic of this region.





The radius of the LP and ZH basins is each approximately 500 km. The eastern rim of the LP basin is evident in data from the LOLA instrument aboard the Lunar Reconnaissance Orbiter. The SPA basin's massive gravity anomaly dominates a wide swath of the Far Side's southern hemisphere, as is evident from the global GRAIL mission data set. As with the Ingenuity basin on the opposite side of the SPA basin, only partial arcs of the original rims of the LP and ZH basins have been preserved. The remaining sections have been eroded by later impacts, or foundered with ejecta deposits and lava deposits.

The existence of the LP and ZH basins is consistent with the history of this area. The impact that created the SPA basin was ancient, almost primordial. A number of later impact events created subsidiary basins within it, e.g., Apollo and Ingenuity. With the discovery of the Lippman-Petzval and Zeeman-Hausen basins, it is evident that much of the SPA basin was blanketed by later, smaller impact structures. This, in turn, helps to constrain the age of the SPA basin. Its exact age in the Pre-Nectarian abyss of time will only be determined with the return of samples to the Earth. (1)

References:

Lunar impact basins: Stratigraphy, sequence and ages from superposed impact crater populations measured from Lunar Orbiter Laser Altimeter (LOLA) data

C.I. Fassett et al 2012; JGR vol 117, issue E12

