

# "South Pole - Aitken" Basin on the First Images of the Lunar Far-side

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As the completion of a global topographic survey of the surface of Solar System bodies has shown, the ring structure adjacent to the southern region of the Moon is the largest crater of the Solar System in terms of absolute size - 2500 km in diameter with an average depth of 12 km (Spudis et al., 1994).

The relative size of this structure is so large that, if the traditional point of view on the process of impact cratering is adopted, the cavity originally formed in this giant structure could uncover materials to the depth of the lunar mantle (Head et al., 1993).

Even only these circumstances show that studying this multiring structure, which does not yet have an approved name (but is tentatively called the South Pole - Aitken basin), is of fundamental importance. Since the diameter of the ring structure observed at present reaches 1.4 times the radius of the Moon, the reconstruction of this impact - structure formation mechanism is undoubtedly a topical problem in the investigation of the evolution of planetary surfaces. It is obvious that detailed information on the South Pole - Aitken basin topography is necessary for developing realistic models of the formation of this structure.

Additional interest in the South Pole - Aitken basin topography arose after the results of the Clementine bistatic radar experiment and then the Lunar Prospector neutron - spectrometer results suggested the presence of lunar ice deposits in permanently shaded regions ("cold traps"), which presumably exist near the poles of the Moon (Shevchenko, 1998).

The first relief maps for the marginal zone of the Moon were constructed by Hayn (1914) as early as at the beginning of the current century. As a rule, altitudes were reference to the most probable circles best describing the lunar limb at a given libration. Later, Nefed'ev (1958) and Watts (1963) made attempts to summarize the results of separate profiles measurements to form a unified system by using the parameters of the lunar - disk asymmetry obtained from observations. From these maps it was already possible, knowing in advance of the existence of the basin, to trace a part of this gigantic ring structure (fig.1).

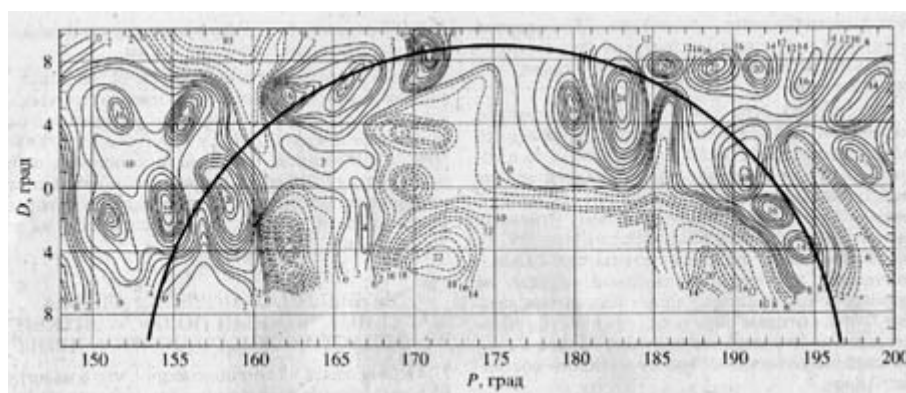


Fig.1. Map by Nefed'ev of marginal zone in the South-Pole region.  
The heavy solid line shows the giant-basin rim.

Head (1993) and Spudis (1994) suggested in their reviews that the existence of the structure identified later as the South Pole - Aitken basin was first predicted by Hartman and Kuiper (1962) on the basis of a relief analysis of the mountain ridges observed in the libration zone, i.e. after the first images of the lunar far-side had been obtained.

Then, Head (1993) and Spudis (1994) pointed out that a number of publications of the results of limb-profile measurements from the images returned by Zond-6 and Zond-8 detected a depression (more than 2000 km in diameter and up to 5-7 km deep) in the region currently known to be occupied by the South Pole-Aitken basin (for example, Rodionov et al., 1971, 1976).

However, the earliest images of this structure - the largest in the Solar System - were obtained when the lunar far-side was first photographed in 1959. The plan location of this structure, detected in four images as a darker area at the edge of the visible disk, was determined from a central darkening, 1500 km in diameter and centered at 179°E, 50°S (Barabashov et al., 1961; Lipsky, 1962; Breido et al., 1962; Lipsky, 1965). This structure was named Mare Ingenii on the map, which was produced from images obtained by Luna-3 in 7 October 1959 (fig.2).

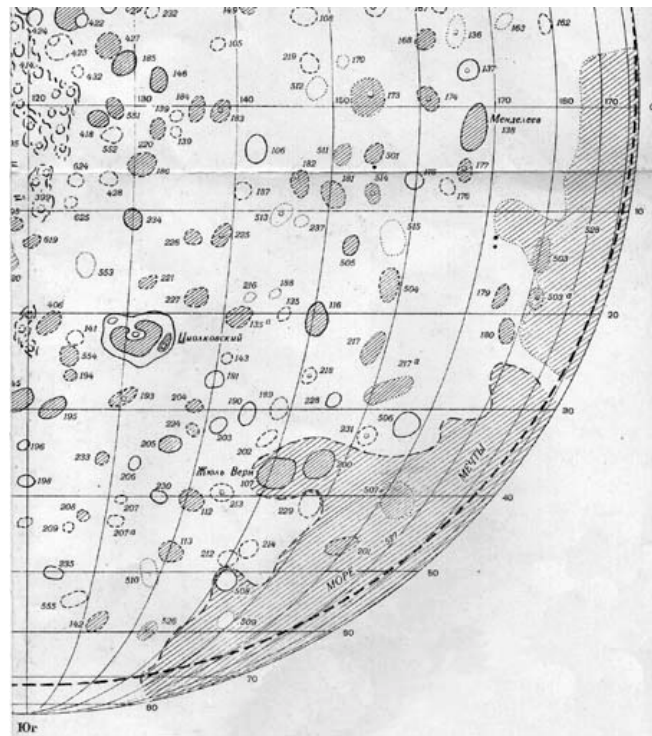


Fig.2. Part of the map produced in 1960 from the lunar far-side images obtained by Luna-3 in 1959.

The current parameters of the basin were determined from the images returned by Galileo and from the Clementine images and laser - altimetry results. According to these data, the central part of the basin is 1400 km in diameter and it is centered at 180°E, 50°S.

Thus, the first identification of the basin by Lipsky et al. in 1959 was reasonable enough. In the first descriptions of the western part of the structure, it was noted that its surface is covered by numerous craters and crater maria. This is confirmed by the present-day images of the South - Aitken basin floor [see the scheme of the secondary ring structures of the South Pole - Aitken basin (Head, 1993)].

Interpreters could not find obvious signs of the giant-basin contours in the Lunar Orbiter images obtained in the second half of the 1960s. As a result, the boundaries of the entire structure were corrected and the name Mare Ingenii was given to only a small dark structure in the north-western part of the basin, about 270 km in diameter.

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