TO THE DISCOVERY OF THE "SOUTH POLE - AITKEN " BASIN. V. I. Chikmachev and V.V. Shevchenko, Sternberg State Astronomical Institute, Moscow University, Universitetsky 13, Moscow 119899 , Russia .

Introduction: 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 [1]. 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 [2]. 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.

Modern estimation of the basin sizes: Using of the South Pole map constructed by means of Earth-based altitude date for the lunar marginal zone and the map of the northern region of the South Pole - Aitken basin with isohypses constructed from the Zond-8 data and some Clementain data [3], we have found, that the basin is as large as the Oceanus Procellarum.

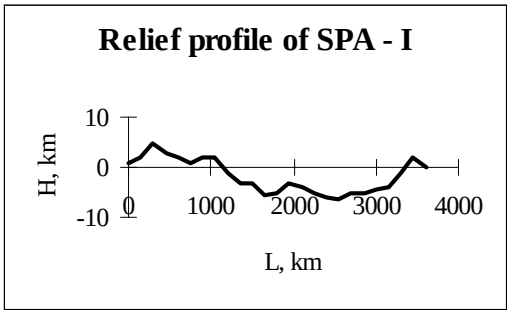

Fig. 1

Fig. 1 shows the profile of surface along meridian 180^{o} from latitude $+20^{o}$ to latitude -90^{o} and 10^{o} through the South Pole.

Fig. 2 represents the profile from west to east, from point with latitute -8^{o} and longitude $+118^{o}$ to point with lattitude -35^{o} and longitude -116^{o}.

As it is following from the profiles the outer mountain rim of the basin has diameter larger then 3150 km.

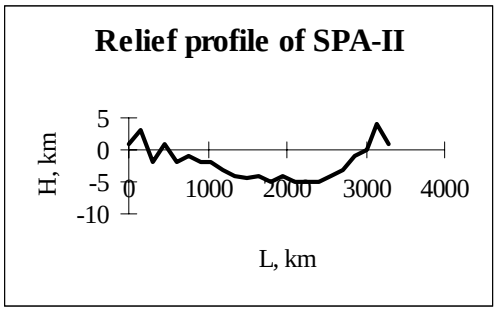

Fig. 2

Since the diameter of the ring structure observed at present reaches 1,8 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 South Pole-Aitken basin topographe is necessary for developing realistic models of the formation of this structure.

Historical observations of the basin relief: The first relief maps for the marginal zone of the Moon were constructed by Hayn [4] as early as at the begining of the current century. As a rule, altitudes were referenced to the most probable circles best describing the lunar limb at a given libration. Later, Nefed'ev [5] and Watts [6] made attempts to summarize the results of separate profiles measurements to form a unified system by using the parameters of the lunar - disk assemmetre 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.

Head [2] and Spudis [1] suggested in their reviews that the existense of the structure identified later as the South Pole - Aitken baasin was first predicted on the basis of a relief analysis of the mountain ridges observed in the libration zone be Hartman and Kuiper [7], i.e. after the first images of the lunar far-side had been obtained.

Then, Head [2] and Spudis [1] 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 then 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., [8]).

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^{o}, -50^{o} [9]. This structure was named Mare Ingenii on the map, which was produced from photographes obtained by Luna-3 in October 1959 (fig. 3).

It's interesting to compare the first pictures of the far side (Fig. 3a) with image of distribution of the iron, prepared on the base Lunar Prospector data (Fig. 3b, picture produced by NASA). We can see remarkable similarity of contours in area of estern region of South Pole-Atken basin on the south-western limb of lunar visible disk.

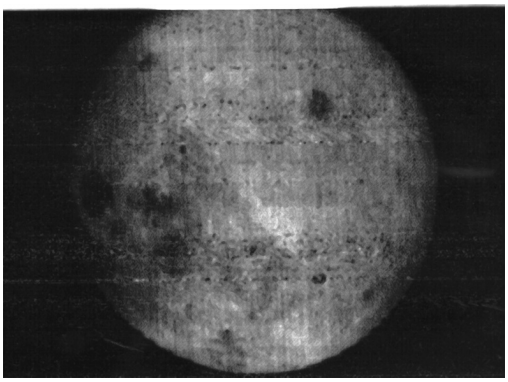

Fig. 3a

The current parameters of the basin were determined from the images returned by Galileo and from 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°, -50°.

Conclusions: Thus, the first identification of the basin by Lipsky and others 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

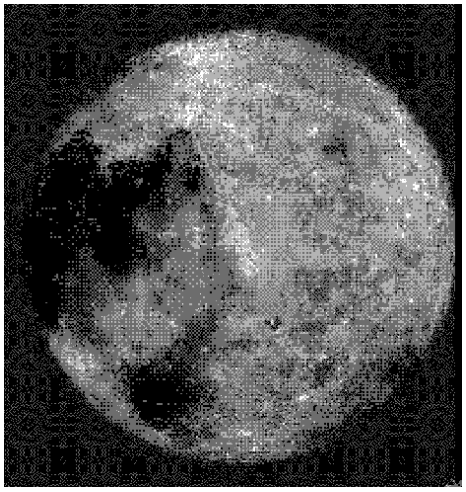

Fig. 3b

crater maria. This is confirmed by the present-day images of the South Pole - Aitken basin [2].

Interpretaters 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.

References: [1] Spudis,P.D. et al. (1994) *Science*, 266, 1848-1851. [2] Head, J.W., et al. (1993) *J.Geophys.Res.*, 98, E9, 17149-17181. [3] Chikmachev, V.I. & Shevchenko, V.V. (1999), *Astron.Vestn.*, 33, 1,18-28. [4] Hayn, F. (1914)., Selenographische Koordinaten, Abh.1V, Leipzig: Sashsische Acad. [5] Nefed'ev, A.A. (1958), Izv. Astron. Observ. im. Engelgardta, 30. [6] Watts, C.B. (1963) *Astron. Papers*, 17. [7] Hartman,W.K.and Kuiper,G.P. (1962) In:*Lunar Planet .Lab .Commun.*,Tucson: Univ.Arizona Press,51-56. [8] Rodionov, B.N. et al. (1971) *Kosm. Issled.*, 9, .3, 450-458. [9] Barabashov, N.P., Mikhailov,A.A, and Lipsky, Yu.N., Eds., (1960), *Atlas obratnoi storony Luny: Chast' 1 (Atlas of the Far-side of the Moon: Part 1)* Moscow:Acad.Nauk SSSR.