GENERALIZED TOPOGRAPHY OF THE LUNAR SOUTH POLE – AITKEN BASIN. V.I.Chikmachev, S.G.Pugacheva and V.V.Shevchenko, Sternberg State Astronomical Institute, Moscow University, Moscow, chik@sai.msu.ru

Introduction. The nature and origin of the enormous pre-Nectarian South Pole – Aitken (SPA) basin remain the most important problems in the current lunar studies. The basin represents a geophysically, compositionally, and topographically unique lunar formation. The studying SPA is significant for principal reasons concerning earliest epoch of the bombardment rate of the Moon and possible investigations of the very deep lunar interior. Recently the SPA basin has been proposed as a high-priority target for future robotic sample return mission [1].

We revised topographical data obtained for the region to construct a generalized structure of the SPA basin as ringed formation. We have used a cartographic method to analyze properties of the system of concentric depressions inside the ring structure.

Hypsographical map of the basin area. We have compiled a variety altitude data sets to construct general hypsographic map of the lunar far side included the ring basin structure: Clementine laser altimetry results [2]; Zond catalog of the absolute heights [3]; catalog of the lunar limb heights [4, 5]. Perspective azimuthal orthographic projection was used as cartographic basis of the general hypsographic map. Because of our previous analysis of the ring structure [5, 6] we assumed the projection center coordinates as 180^{o}W and 40^{o}S. The hypsografic map shown in Fig. 1 demonstrates a hemisphere of the Moon which contains the SPA basin structure and its environs.

Size of the SPA basin. General size of the SPA basin is defined by outermost ring of the structure that has been extensively modified by post-SPA impact events. According to [7] multiple craters are superposed on the SPA basin. This process brings forward extensive destruction of the initial form of the outmost basin ring. So, we can observe a relic relief in this area now. It's reason of the large range of estimations of initial SPA basin size.

We tried to trace relic features of the possible initial outermost basin rim. Fig. 2 shows 3-D model of relief corresponding outmost basin ring. This model shares out relief, which has height more than 0 km. As usually, this level is in agreement with lunar sphere of radius equal 1738.0 km. However, the model shown in Fig. 2 is "flat", i.e. it is constructed on the plain without considering spherical effect.

We interpret that largest segment of the ancient outermost rim is placed in azimuth range from 335^{o} to 150^{o}. (The azimuth A is measured clockwise from central meridian 180^{o}). This segment looks like an extent ridge of mountain in form of huge arch with height from 2 km to 8 km (from zero level). The most width of this formation exceeded 600 km in area of the post-SPA impact Korolev basin ($A = 35^{o}$). The east part of the ridge is placed near environs of Mare Orientale basin ($A = 110^{o}$). The southern part of this arch segment is modified by the younger depression placed between craters Mendel and Rydberg ($A = 135^{o}$). This unnamed depression was shown in the sketch map published by Hiesinger and Head [7] too. Further we can see a few separate tops with heights of ~ 2 km ($A = 150^{o} – 165^{o}$), which are interpreted by us as relict details of the ancient outermost rim. South part of the supposed rim ($A = 180^{o} – 200^{o}$) encloses ridge of mountain with elevation ~ 4 km placed between craters Demonax and Boguslavsky.

In range of azimuth from 200^{o} to 265^{o} we observe an extend drop in elevation connected with Mare Australe. The next segment of the probable outermost ring extends in north - west part of the rim ($A = 265^{o} – 330^{o}$). This ridge of mountain with elevation ~ 2 ÷ 4 km includes crater Tsiolkovskij.

On the basis of our ring reconstruction we concluded that original size of the SPA basin (outermost ring diameter) is approximately 3300 km. Then we find the basin outermost ring center at roughly 180^{o} and 40^{o}S.

Inner structure of the SPA basin. As following from Fig. 1 and Fig. 2 the border of the depression with values of heights H < 0 km has form of the near right ellipse. Dimensions of the oval formation are approximately 2200 km x 1800 km. Center of the ellipse displaces from center of the outermost rim to the south on ~ 300 km. The next depression has oval form too. The elevation level of the its border is H < - 4 km. The transversal is about 1400 km, and ratio of the axes is equal to 1.2. Center of the depression displaces from center of the outermost ring to the south-east on ~ 500 km. The deepest inner depression has nearly circular form with diameter of 600 km. Its height level is H < - 6 km. Its center displaces from the basin center to the south-east on more than 700 km.

Conclusions. On the basis of our study of the generalized structure of the SPA basin we conclude that giant impact formed this basin unit was oblique or trajectory of the impactor was tangent to the surface of the lunar sphere. Because of very small value of ratio "deep – diameter" (~ 0.004) and small possibility of the long-term viscous relaxation [7] we propose that impactor had a small density of its matter, i.e. it was a giant comet body.

References. [1] Taylor G., Duke M., Pieters C. (2004) *35th COSPAR Scientific assembly.* Abstracts. A-03744. [2] Spudis P.D., Reisse R.A., Gillis J.J. (1994) *Science.* Vol. 266, p. 1848-1851. [3] Chikmachev V.I. (1986) in: *Lunar investigation problems.* Ed. Shevchenko V.V., Moscow Univ. Press. P. 42-56. [4] Nefed'ef A.A. (1958) *Izvestia of Kazan' Univ. Astronom. observ.* No. 30. [5] Chikmachev V.I., Shevchenko V.V. (1999) *Atron. Vestn.* Vol. 33, no. 1, p. 18-20. [6] Chikmachev V.I., Shevchenco V.V.(2001) *Microsymposium 34, Moscow,* MS015. [7] Hiesinger H., Head J.W. III (2003) *Microsymposium 38, Moscow,* MS107.

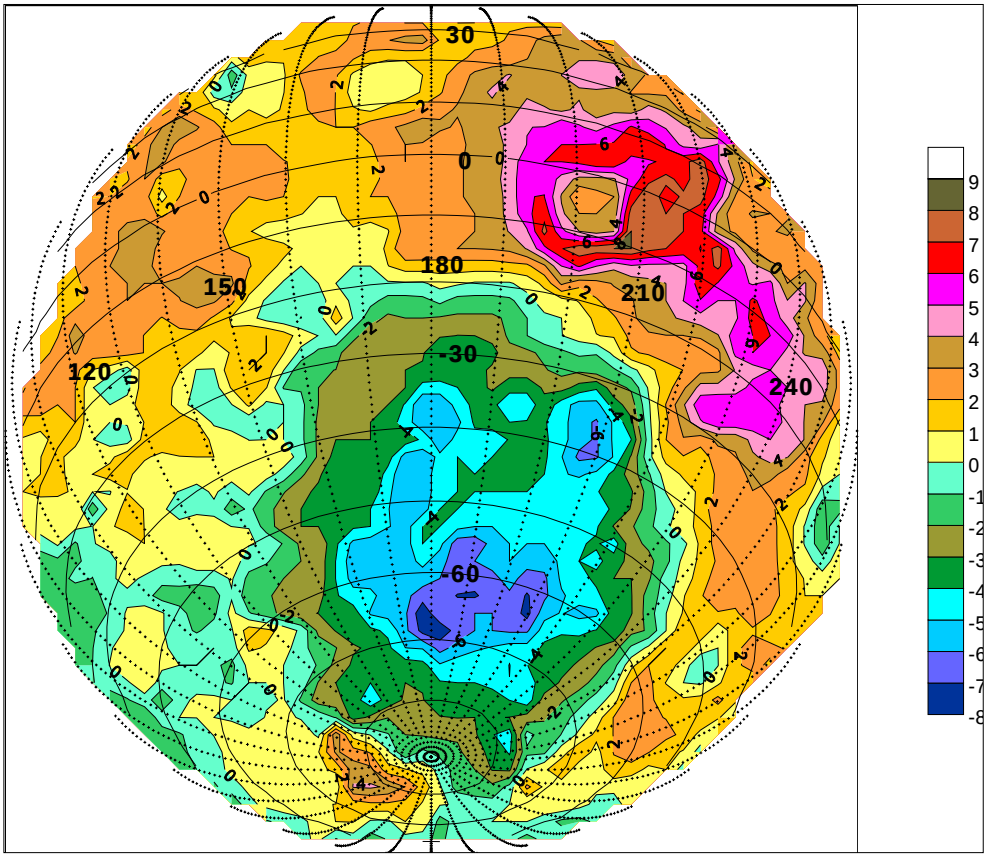

Figure 1

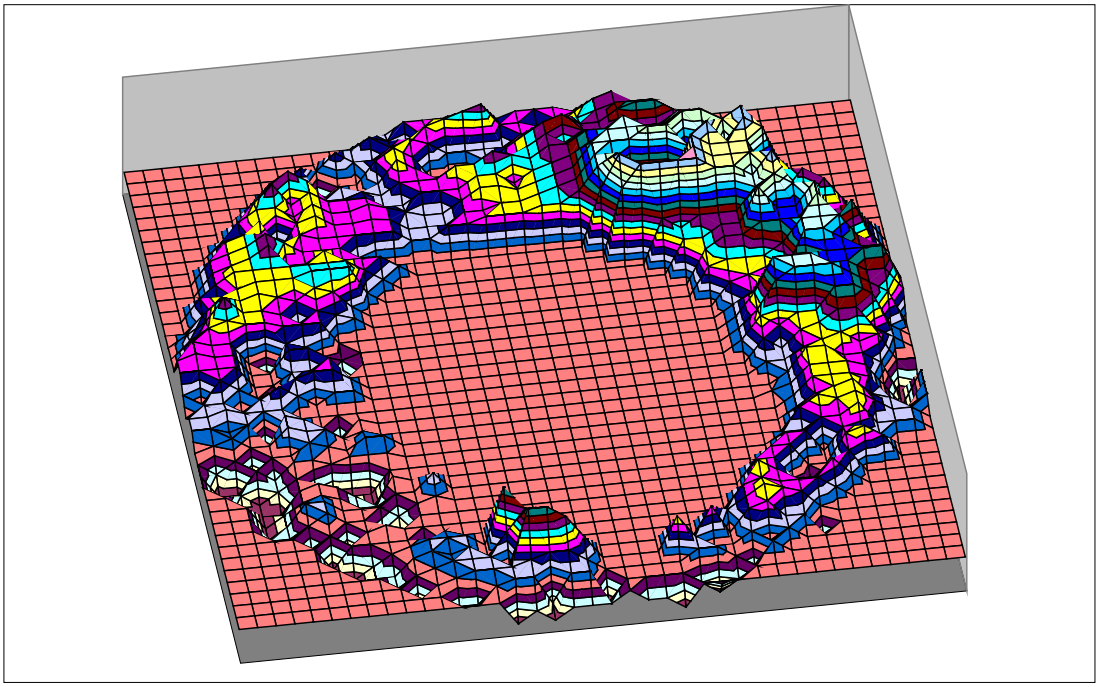

Figure 2