DESCRIPTION OF THE PROBABLE LOCATION OF THE VISITED LUNAR BASE ON THE SHAFT OF THE CRATER SHACKLETON. O.I. Turchinskaya[1], E. A. Grishakina[1], O.S. Tretyukhina[1], E.A. Feoktistova[2], E.N. Slyuta[1], [1]Vernadsky Institute of Geochemistry and Analytical Chemistry, Moscow, Kosygina 19, Russia, olgaturch@yandex.ru, [2]Sternberg State Astronomical Institute, M.V. Lomonosov Moscow State University, Moscow, Universitetsky prospekt 13, Russia, hrulis@yandex.ru .

Introduction: The choice of a potential location for the placement of the lunar base was carried out on the basis of requirements determined by specific scientific and practical tasks and on the basis of general requirements for the area of the habitable lunar base: comfort of the temperature regime, maximum continuous provision of solar electricity, direct connection with the Earth, availability in sufficient quantity with the necessary characteristics of lunar regolith, which should be used as a building material, the availability of local resources for life support and for use in the technological processes of extraction and enrichment of these resources, the availability of resources for the production of rocket fuel, is a set of minimum necessary requirements that should be taken into account when choosing the optimal location for the habitable lunar base. Unusual light conditions are observed in the polar regions of the Moon, which make them attractive places for future research. The possibility that places receiving long-term portions of continuous illumination are in close proximity to areas that may contain water ice [1] makes the polar regions of the Moon potentially ideal locations for future outposts.

Taking into account all the above requirements, a site was selected in the southern polar region of the Moon on the shaft of the crater Shackleton.

Description of the area: This elevation (Fig.1), which is located at a distance of about 10 km from the Shackleton crater and about 15 km from the South Pole, which is also located on the shaft of the Shackleton crater. This area is located on the far side of the Moon in the libration zone, which gives both a periodic possibility of direct radio communication with the Earth, and a periodic favorable opportunity for astrophysical research in the absence of terrestrial radiation. Installation of the repeater antenna on the visible side of the Moon on Mount Malapert will ensure continuous and stable direct radio communication of the base with the Earth.

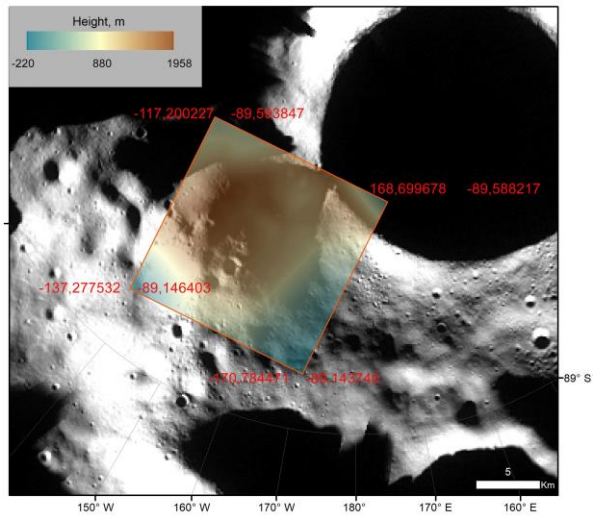

Fig.1. Image of the South Pole region of the Moon in stereographic projection according to NASA LROC data. The topographic map of the site is highlighted with an orange square measuring 15×15 km and overlaid on the LROC WAC Global Mosaic. At the bottom right is the crater Shackleton.

The site is a relatively flat and gently sloping hill measuring approximately 8x12 km, with an absolute height of almost 2000 meters, the highest point of which rises above the bottom of the Shackleton crater by almost 5000 meters, and above the surrounding plains about 2000 m.

From the slope map (Fig.2) it can be seen that the most flat is the area at the top of the hill, which is a subhorizontal surface with a relatively small number of craters.

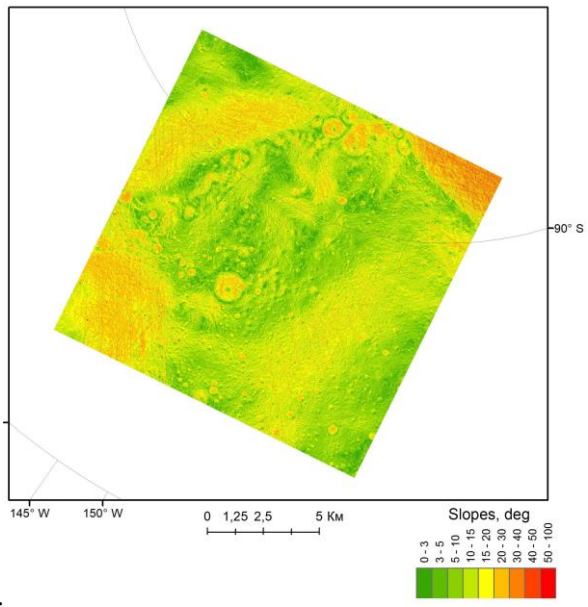

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Fig.2. Slope map based on 5 m . The slopes are calculated from the topographic data of the LRO LOLA laser altimeter.

Within its limits, it is possible to distinguish at least 8 sites with the lowest slopes which may well act as candidates for the placement of a habitable base. The map also reflects potentially dangerous places in the form of several large craters. Thus, surfaces less than 10 degrees occupy 38.5%, and it is characterized by a large area of continuous gently sloping surface.

A mosaic of images is a mandatory element in the analysis of the territory. The mosaic allows us to display the real texture of the surface. Thus, 13 NAC LROC images with a spatial resolution of about 1.6 meters were used to create the mosaic, which provided sufficient coverage of the studied area (Fig.3).

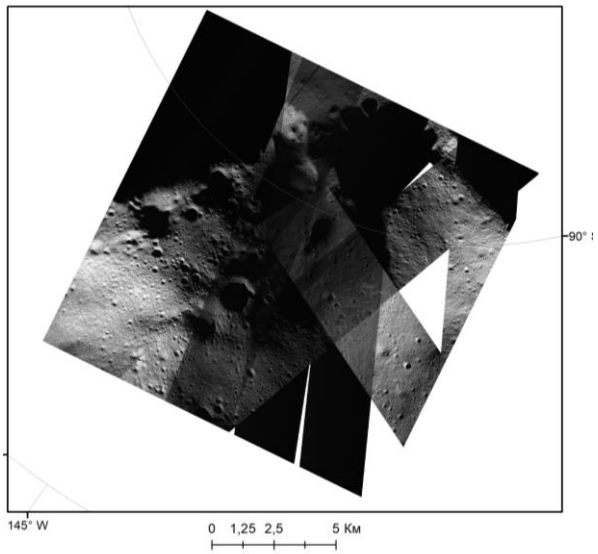

Fig.3. Final texture map.

We also calculated the illumination by the Sun and the visibility of the Earth , based on the data obtained by the LOLA altimeter of the LRO probe, on the proposed territories of the habitable lunar base.

Illumination at the top of this hill reaches more than 60%, and 89% at individual points (Fig.4). [3].

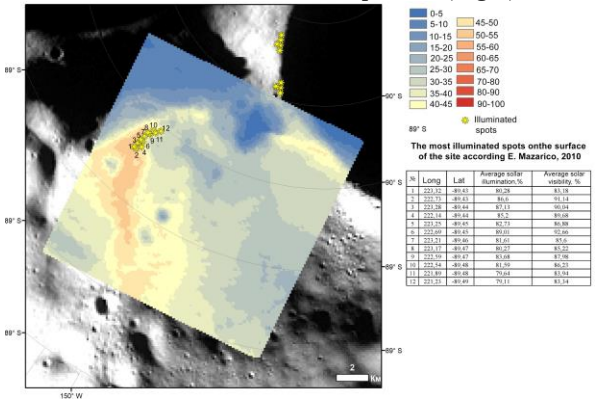

Fig.4. Visibility of the Sun (%) and the most illuminated spots.

The illumination profile on the hill is flat - a relatively short period of darkness lasting 188 hours, interrupted by a brief 10-hour "window" of illumination inclusive, is followed by one long (520 hours) period of illumination without breaks, with the exception of one interval of eclipse of the Sun by the Earth with a length of 10 hours [2].

As for the visibility of the Earth, here it reaches about 55% (Fig.5).

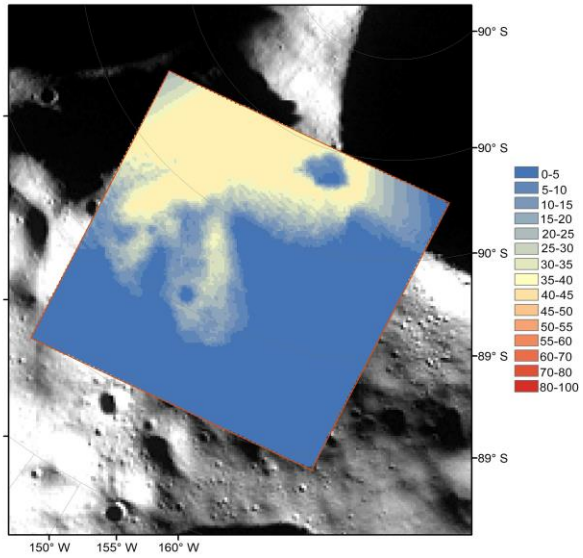

Fig.5. Visibility of the Earth (%).

The average winter temperature on the area ranges from -216°C in darkened areas to -138 ° C on high ground. The average summer temperature ranges from -199°C to -93°C, respectively [4].

References:

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[2] Bussey D. B. J., Spudis P. D., Robinson M. S. Illumination conditions at the lunar south pole // Geophys. Res. Lett. 1999. V. 9. P.1187-1190.

[3] Mazarico E., Neumann G.A., Smith D.E., Zuber M.T., Torrence M.H. Illumination conditions of the lunar polar regions using LOLA topography. Icarus. 2011.V. 211.P.1066-1081.

[4] Williams et al. Seasonal variations in south polar temperatures on the Moon, LPSC 50th, 2019. #2852