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. It is known that the bottoms of impact craters near the poles are constantly shaded and sunlight never reaches them. Such areas have turned out to be extremely cold and are a kind of cold traps for any volatile molecules that fall into them. At the same time, topographically high areas at the poles, unlike the equatorial regions, have the opportunity to be illuminated more than 50% of the time. 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 de Gerlache.

Description of the area: The site is a gentle elevation on the crater shaft, with an absolute height of about 2000 meters, the highest point of which rises above the surrounding depressions (crater bottoms) by 4000 meters (Fig. 1). At the bottom of the crater de Gerlache in the southeastern part there is an inner crater with a diameter of 15 km.

There are several shallow areas on the slope map (Fig. 2), however, the most priority for us is the area on the top of the hill, which is a subhorizontal surface measuring 1 ×10 km with a relatively small number of craters. Within its limits, it is possible to distinguish about 5 sites with the lowest slopes, reflected by shades of green, which may well act as candidates for the placement of a habitable base. Thus, surfaces less than 10 degrees occupy 28% with the main subhorizontal zone at the top of the hill.
Fig. 2. Slope map based on 5 m. The slopes are calculated from the topographic data of the LRO LOLA laser altimeter.

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, 28 NAC LROC images with a spatial resolution of about 0.5 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 55% (Fig. 4), and at individual points from 80 to 85.5% [4]. The lighting profile on the hill consists of "daytime" lighting lasting about 358 hours, followed by a series of illuminated and dark periods. The longest duration of darkness is approximately 140 hours. The total lighting time is 510 hours [3]. The maximum eclipse period is 6 days [2].

Earth visibility at the site reaches more than 50% over a quite wide area (Fig. 5).

The average winter temperature on the area ranges from -217°C in darkened areas to -148 °C on high ground. The average summer temperature ranges from -198°C to -88°C, respectively [5].

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