THE COLD TRAPS NEAR SOUTH POLE OF THE MOON.

Berezhnoy A.A., Kozlova E.A., Shevchenko V.V. Sternberg State Astronomical Institute, Moscow University, Russia, Moscow, Universitetski pr., 13, 199992. katk@sai.msu.ru

According to the data from "Lunar Prospector" [1] the areas of high hydrogen content in the lunar south pole region coincide with the areas of such craters as Faustini (87.2º S, 75.8º E), Cabeus (85.2º S, 323º E) and other crates. We have allocated a number of craters which can be considered as "cold traps " in the south pole region of the Moon (Figure 1). Some from these craters has properties similar to those of the echo coming from icy satellites of Jupiter and from the southern polar cap of Mars.

We estimate the total permanently shadowed area in the lunar northern polar region at 28 260,2 km^2. The total permanently shadowed area in the region of the south pole of the Moon is smaller than in the region of its north pole and we estimate it at 22168,5 km^2. According to our results, the total permanently shadowed area in the polar craters of the Moon is equal to 50 428,7 km^2, or 0.13% of the total area of the lunar surface [2]. The permanently shadowed area of the lunar surface estimated in this way was equal to 0,13% of the total area of the lunar surface.

Near the south pole of the Moon, such craters as Amundsen, Cabeus, Nobile, Malapert, Faustini, Shoemaker, Wiechert, Shackleton and unnamed craters (88,6º S, 220º E, D = 35,5 км), (87,7º S, 260,2º E, D = 35 км), (85,5º S, 48,1º E, D= 30 км) has contain areas in which the maximum temperature does not exceed 110 K throughout the entire 18,6-year period. The positions of these craters coincide with the locations where high hydrogen content was recorded, and, therefore, these craters are very likely to contain deposits of volatiles and water ice in particular [3].

The maximum temperature in the permanently shadowed areas of craters Shoemaker, Faustini, Amundsen, Gioja, Wiechert, and an unnamed crater (82.3º N, 120.9º E, D= 52 km) does not exceed 110 K, ruling out the possible existence of such compounds as CO_2 and NH_3, but suggest the presence of water-ice deposits not covered by a layer of regolith or sulfuric compounds [4].

Let us note that NH_3 content in the lunar regolith is relatively low, because the main N-containing compound is molecular nitrogen here [5]. The stability of SO_2 subsurface ice requires the diurnal surface temperature of less than 65 K. However, volatile species may be chemisorbed by the dust particles at the surface. In this case we can expect the existence of chemisorbed water, CO_2, and SO_2 at the content less than 0.1 wt%.

Polar rovers or penetrators with mass spectrometers can detect these species. For solving the question of the origin of lunar polar volatiles we must determine isotopic composition of these species. Adding of water ice to dry lunar regolith leads to decreasing of difference between mean diurnal temperature at the surface and at 2 cm depth. Analysis of measurements of brightness temperature at 0.1 – 1 mm at the lunar poles with high spatial resolution can check the existence of ices too.

Reference: [1] Feldman, W.C., Maurice, S., Binder, A.B., et al., *Evidence for Water Ice Near the Lunar Poles*, J. Geophys. Res., 2001, vol. 106, pp. 23231--23252. [2] Kozlova, E.A., Michael, G.G., and Shevchenko, V.V., *Permanently Shadowed Areas at the Lunar Poles*, 34-th Int. Microsymp. on Planetology, Moscow, 2001, Abstr. #MS065. [3] Vasavada, A. R. et al. (1999) *Near-Surface Temperatures on Mercury and the Moon and the Stability of Polar Ice Deposits. Icarus,* V. 141, 179-193. [4] Butler, B.J., Muhleman, D.O., and Slade, M.A., *Mercury: Full-Disk Radar Images and the Detection and Stability of Ice at the North Pole,* @J. Geophys. Res.,@ 1993, vol. 98, pp. 15003--15023. [5] Berezhnoy A.A., Hasebe N., Hiramoto T., Klumov B.A. Possibility of the presence of S, SO_2, and CO_2 at the poles of the Moon, Publications of the Astronomical Society of Japan, V. 55, p. 859-870, 2003.

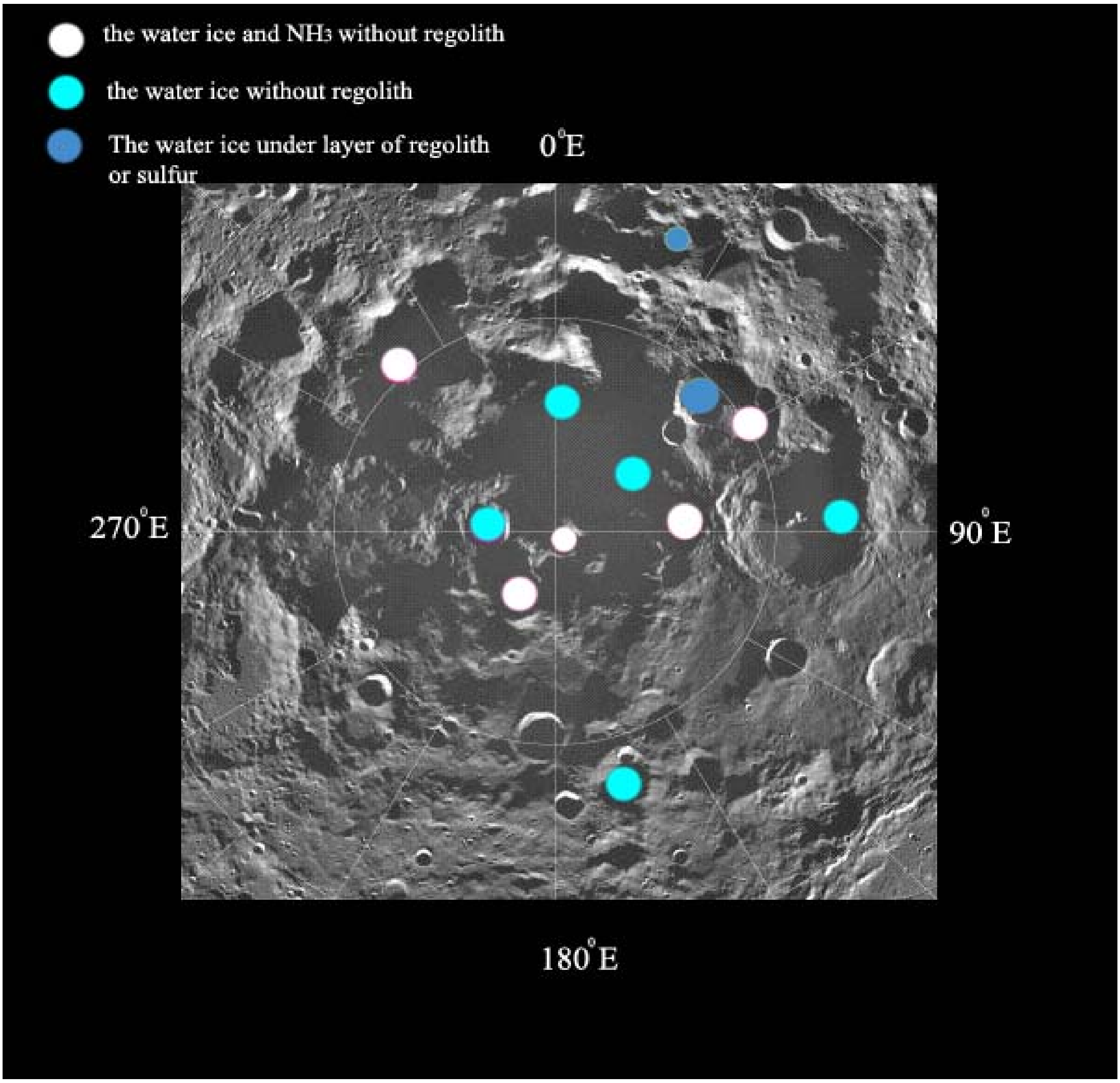

Figure 1. The distribution the possible "cold traps" in the lunar South pole region. The craters which can contain the water ice and other volatiles such as NH_3 or CO_2 without regolith are marked white. Craters which can contain only water ice without regolith are marked blue. Craters which can contain water ice only under a layer of regolith or sulfur deposits, are marked dark blue.