THE CRATERS SHOEMAKER AND FAUSTINI AS COLD TRAPS FOR VOLATILES

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Introduction: In 1994, the “Clementine” spacecraft launched by NASA explored the Moon for 70 days. As a result, a radar experiment made it possible to discover areas with anomalous radar properties (Nozette et al., 1996). The “Lunar Prospector” spacecraft, launched by NASA toward the Moon in 1998, was equipped with a neutron spectrometer for detecting possible deposits of volatiles in the polar areas of the Moon. In the region of the south pole of the Moon, the maximum hydrogen content was found in the areas coinciding with such craters as Faustini (87.2° S, 75.8° E, D = 45 km) – 160.3 ppm and Shoemaker (88° S, 38° E, D = 56 km) - 146 ppm. The average level of the contents of hydrogen makes 59 % from all area of a crater [3]. The diagram of distribution of the maximal temperatures in a crater shows, that in northern part of a crater there is an area where the temperature never exceeds 70 K. The average temperature of this area – 40 K Thus, this part of crater Shoemaker can be “a cold trap “ for water ice or NH3. In the central part of a crater the maximal temperatures reach at northern slope 100 K, and 140 K at southern. Average temperatures in this area do not exceed 50 K and 70 K accordingly. In such conditions in this part of a crater open deposits of water ice or deposit of water ice under a layer of regolith, and as connections of sulfur can be kept. The maximal temperatures in area of a southern slope of a crater exceed 180 K.

On images of area of South Pole of the Moon, received by observatory Goldstone [6] (fig. 1) as possible “cold trap”, we have allocated crater Faustini (87.2° S, 75.8° E, D = 45 km). The maximal temperatures in northern part of a crater does not exceed 87 K, the average temperatures in this area change from 47 K up to 57 K. This area can be a cold trap for the deposits of the water ice which has been not covered with a layer of regolith. The maximal temperatures in a significant part of northern half of crater do not exceed 100_ and can contain open deposits of water ice. The maximal temperatures inside south part of the crater Faustini do not exceed 200 K so connections of sulfur can contain in any part of a crater.

We found that craters Shoemaker and Faustini containing permanently shadowed areas in which the temperature allows volatiles to remain stable for a long time coincide with the areas of high hydrogen content according to the “Lunar Prospector” data and can be “cold trap” for volatiles, including water ice.

References:

Figure 1. The radar image of lunar south pole region obtained with the 3.5 centimeter wavelength Goldstone Solar System.