COMET HYPOTHESIS OF HYDROXYL AND WATER ORIGIN ON THE MOON ACCORDING TO THE RESULTS OF LRO AND LCROSS SPACECRAFT

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Introduction: Origin of water and hydroxyl groups on the Moon actively discussed in recent years. Now, thanks of flying space missions LP, Chandrayan-1 LRO, and others some valuable information was obtained. Analisis of these data is gradually leads us to an understanding of the complexity of the issue of origin and accumulation of $–OH/H_2O$ on the surface of the Moon [10,11]. At least two versions of the origin of water are enough arguments in favor. On the one hand $-OH/H_2O$ can be formed under the influence of solar wind protons and the other due to the fall of comets and meteoroids.

Some last experimental results: Recent laboratory experiments with irradiation like lunar samples by protons with energies of solar range showed that the formation of hydroxyl groups as a result is negligible [1,2]. In this connection, it can be assumed that contained in the surface layer of hydroxyl and water (according to the results of spectral measurements of spacecraft Cassini, Chandrayan-1,Deep Impact [3,14,15] may well have a cometary origin.

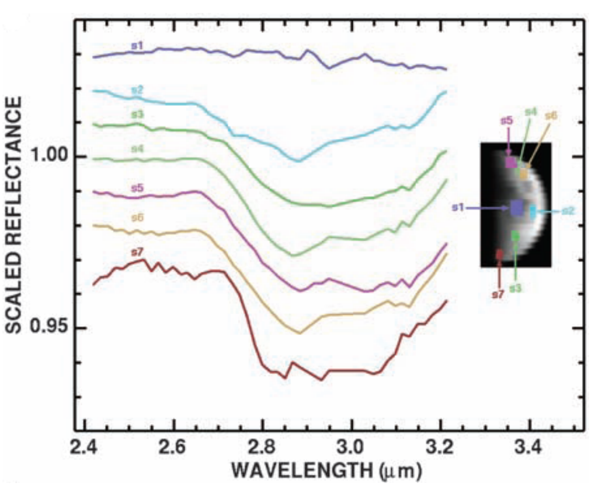

Fig.1 Data,obtained by the visual infrared spectrometer (VIMS)[3] by Cassini spacecrati to different regions of the visible side of the Moon

In the actual data obtained by Cassini [3] incorporated some doubts that the water molecule on the surface formed under the influence of the solar wind. It is seen that (Fig.1) on the part of the Mare Cognitium (the upper curve s1) is very weakly pronounced absorption lines at 2.8-3 microns, corresponding to the lines of hydroxyls and water compared to highland areas.

Our research data of the hydrogen distribution obtained by Lunar Prospector Neutron Spectrometer (LPNS) correlate with the results of Cassini. We have established a consistent trend of reduced hydrogen content in marine araes.

The Fig. 2 shows the distribution of hydrogen on the Mare Crisium west boundary. On the one hand, clearly shows that at longitudes 50 ^{0} , where the western maritime boundary is placed, there is a significant decrease in the average concentration of hydrogen in the seaward (right), reaching a minimum of 0-5 ppm. On the other hand, on a highland (to the left of the boundary), this concentration is much higher and reaches a peak above 100 ppm But marine soil is rich in iron oxide and the reaction

$$2H + FeO = Fe^0 + H_2O$$

considered an important source of water origin [5]. However, such a sharp drop hydrogen content according to Cassini and Lunar Prospector, in Mare Cognitium and Mare Crisium says just that, perhaps, the importance of this channel of water formation is negligible.

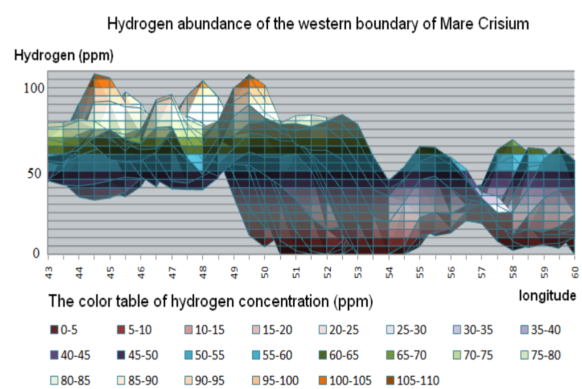

Fig. 2 The distribution of hydrogen on the west Mare Crisium boundary of according to LPNS. At the bottom, colored squares show the values of hydrogen concentration (ppm). Depth measurements of 1-2 meters below the surface.

Thus, there is reason to believe that the formation of water under the influence of the solar wind is not of paramount importance. But then it is possible to assume that –OH/H_2O, the wide dissemination of which on the surface of the Moon indicate data from space missions have a cometary origin.

LRO and LCROSS data and interpretation of the origin of cometary ice deposits: Recent spacecraft data of LRO and LCROSS experiment gave extensive information about the contents of volatiles and in particular the hydroxyl and water ice near the South Pole[4,7,12,13]. Highly volatile components (sulfur dioxide, carbon dioxide, formaldehyde, ammonia, and methanol.), found in the LCROSS plume, strictly prove a impact delivery and accumulation of volatiles got from the primitive bodies that came from outside Solar System [4].

It's an intriguing conclusion opens a wide field for further study of comet-meteoroid hypothesis. Information about the presence of interstellar material on the lunar surface is extremely valuable for creating a detailed theory of the origin and evolution of Solar System. The fact that argues the modern theory of star formation, our Sun was formed not as a single star but a star in the local group of stars, each of which had its cometary shell. Is realistic to assume that nearby stars can share comet shells [8]. In addition, it is possible that in the cometary cloud penetrate some free comets themselves rotating around the Galactic center.

Thus the comet from outside our Solar System may fall into the Oort Cloud. How could such comets penetrate to the inner planets in an amount sufficient to create visible deposits on the surface of the earth satellit? This requires the perturbation of the cometary cloud, which would enable a significant number of comets to change its orbit (comet showers). A possible reason for such a periodic perturbation is the passage of the Solar System through the seal of the interstellar medium in galactic arms in the rotation around the Galactic center.

The surprise in the results of neutron capture device LEND LRO spacecraft was that the ice deposits are by no means follows the contours of cold traps and in addition, are also on the illuminated areas under a layer of regolith thickness of several centimeters [12]. Given that the rate of regolith approximately 1-2mm. per million years, we can calculate that the layer of sediment on the ice surface could be formed for the period 20-40 million years. It is quite possible that the comet shower that,perhaps, takes place in this period, brought on the lunar surface material for ice deposits at the South pole, which was placed there because of the migration process [5,6].

Conclusions:

Due to some difficulties in the confirmation process of origin hydroxyl and water on the surface under the influence of the solar wind, comet hypothesis can be decisive in explaining the processes of accumulation of volatiles on the lunar surface. In addition, the discovery of the lunar surface material that is relevant to the interstellar medium makes the polar deposits very important subjects for broader astronomical research. Some results from space missions, LRO and LCROSS can be a starting point in a new direction of research related to studying the origin and composition of comets coming from beyond the solar system. Collection and study of this kind of information is very important for proper understanding of the origin and evolution of the Solar System.

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