VARIATION OF THE BOUND WATER CONTENTS ON THE MARTIAN SURFACE FROM ISM-EXPERIMENT DATA ON PHOBOS-2: PRELIMINARY RESULTS


The spatial variations of the bound water in the martian soil were studied on the example of the four regions of the Mars I: Melas and Ophir Chasma (5-15°S, 59-74°W); 2-Pavonis Mons (5°S-5°N, 95-126°W); 3-Ascraeus Mons (5.5-15°N, 95-117°W); 4-Olympus Mons (12-18°N, 112-146°W). The mapping of the bound water contents (in conventional values) was done using the spectral measurements in the absorption band 2.7-3.14μm with the spatial resolution 28-30 km. As turned out from all four regions the highest values of the bound water contents (or the hydration degree) were found in the Olympus Mons region - 23% more than those in the Melas and Ophir Chasma. The hydration degree fluctuations in the martian soil within the studied regions are not identical and are estimated 261,111,62 and 9% for Regions 1, 2, 3, 4 respectively.

Within each region the appreciable correlation between the spectral measurements in the band absorption by atmospheric CO2 (an equivalent of the altitudes) and mapped values of the hydration degree is not observed. However, a certain tendency to clustering is visible. In each region the altitude range in which there is a certain range of the most widespread values of the bound water contents stands out (Fig.1). For Regions 1, 2, 3, 4 such clusters values (into the contour 20 on Fig.1) are equal 34, 24.4, 27.8, and 56.7% of all the mapped values respectively. Using the new topographic map of the Mars (22), the mapped values of the spectral data for CO2 atmospheric abundance and bound water contents in the surface materials conformed with all altitude range for four regions. As a result the united scale of the conventional values of the bound water contents was worked out and tied to the hyposometric scale of the Mars.

As demonstrated in Fig.2, a tendency to increasing of the clusters values of the hydration degree is observed in direction from the Region 1 through Region 2-3 to Region 4. Moreover, it was found that the clusters values are just on the shield surface only in the case of Pavonis Mons. In the other regions the clusters values of the hydration degree are usually on the surface around Ascraeus Mons, Olympus Mons and on the upper surface levels of Melas and Ophir Chasma. It is typical that the successive increasing of the hydration degree of the soil from Region 2 through Region 3 to Region 4 is accompanied by the altitude fall of the terrain surface. Alternatively, to such tendency, the dependence of the maximum values of the hydration degree from altitude is inversely (Fig.2). The region of Melas and Ophir Chasma stands as exception. Here the highest hydration degree mostly relate to the sedimentary deposits (possibly lacustrine deposits), which filled the inner parts of Melas and Ophir Chasma and its landslide slopes disposed on the lower hyposmetric levels. Moreover, the clusters and the maximum values of the surface material hydration in the region of Ascraeus Mons are only on the shield surrounding surface, while the material directly on the shield surface is less hydrated. The fact, that the surface of this volcanic shield is covered by much coarser materials in comparison with the material of the surrounding plain (4) may be one of the reasons of such hydrated material distribution.

The visible tendency to the increasing of the surface material hydration from Region 1 to Region 2-4 is probably connected with the change (in the same direction) of the physical properties by surface material. For the surface material of Tharsis Montes area had lower thermal inertia values and lighter albedo (53), we believe that the weathering product portion in the surface material of Region 2-4 may be much higher then in Region 1.

On the whole it is not excluded that the found geographical and hyposmetrical positions of the clusters and the maximum values of the martian material hydration are defined by the possible dependence of the hydrated minerals phases on the geographical latitudinal and altitudinal zonality. In our case, the geographical latitude of the regions studied changes from 10°S to 18°N in direction from the fies to the fourth regions. According to thermodynamic prediction of the stability of the salt hydrates in the modern environment of the Mars (6), increasingly hydrated phases must become more stable with altitude increase (equator MgCl2·4H2O on equator and MgCl2·4H2O in moderate latitudes). Possibly the continuation of the more detailed analysis of the whole data from ISM-experiment may allow to examine the thermodynamic prediction.

REFERENCES:
Data from various sources indicate that the abundance of water on the Moon varies significantly with altitude. The map shows the correlation between altitude and the abundance of water, with high altitudes generally associated with higher water content. This data is crucial for understanding the distribution of water on the lunar surface, which has implications for future lunar exploration and resource utilization.

Legend:
- High Altitude
- Low Altitude
- Coupled W-Measurements
- Spectral Measurements
- Conditions and Potential For Various Uses
- Lunar Abundance in Atmosphere Versus Time

Figure 1: Coupled W-Measurements and Spectral Measurements of CO2 and Lunar Water. R.O. More, J.L. Stayer, Y.V. et al.