Surface lunar "water": a negligible chondritic contribution ?

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Recent data in Apollo samples account for the presence of water in the lunar interior [1-5] and at the surface [6-7]. However, the source(s) of this water remain enigmatic: protosolar, solar, chondritic, cometary or indigenous ? How and when this water was added to the Moon has implications on its formation scenario.

The hydrogen isotopic ratio (D/H) of water is commonly used to identify water sources. However, because of the lack of a protecting atmosphere, the external fluxes of particles and solids (meteorites, comets, grains) that reach the surface of the Moon, should represent an important contribution to its hydrogen budget and thus alter the pristine D/H ratio of this lunar water.

In order to estimate the relative proportions of the solar wind and of the cosmogenic deuterium in the hydrogen budget, we have measured simultaneously the lithium and the hydrogen isotope ratios with the Cameca NanoSIMS 50. Using the $^{7}Li/^{6}Li$ as a record of the yield of spallation reactions [8], we have determined the fraction of cosmogenic D in the D/H ratios. Measurements were performed both at the very surface (few tens of nanometers) and in the interior (few micrometers) of glassy and plagioclase grains from 18 different sections of the Apollo drill cores: 60007/1, 70009/1 and 60010/9. Analyses demonstrate that all D comes from spallation reactions, whatever the grain location and the chemical composition. On the surface of the soil grains, the hydroxyl concentrations are nevertheless significant and their D/H ratios indicate that this source of "water" can be ascribed to solar wind implantation [9]. In 40% of the grains, a comensurable chondritic contribution (from 3 to 74%) cannot be excluded.

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