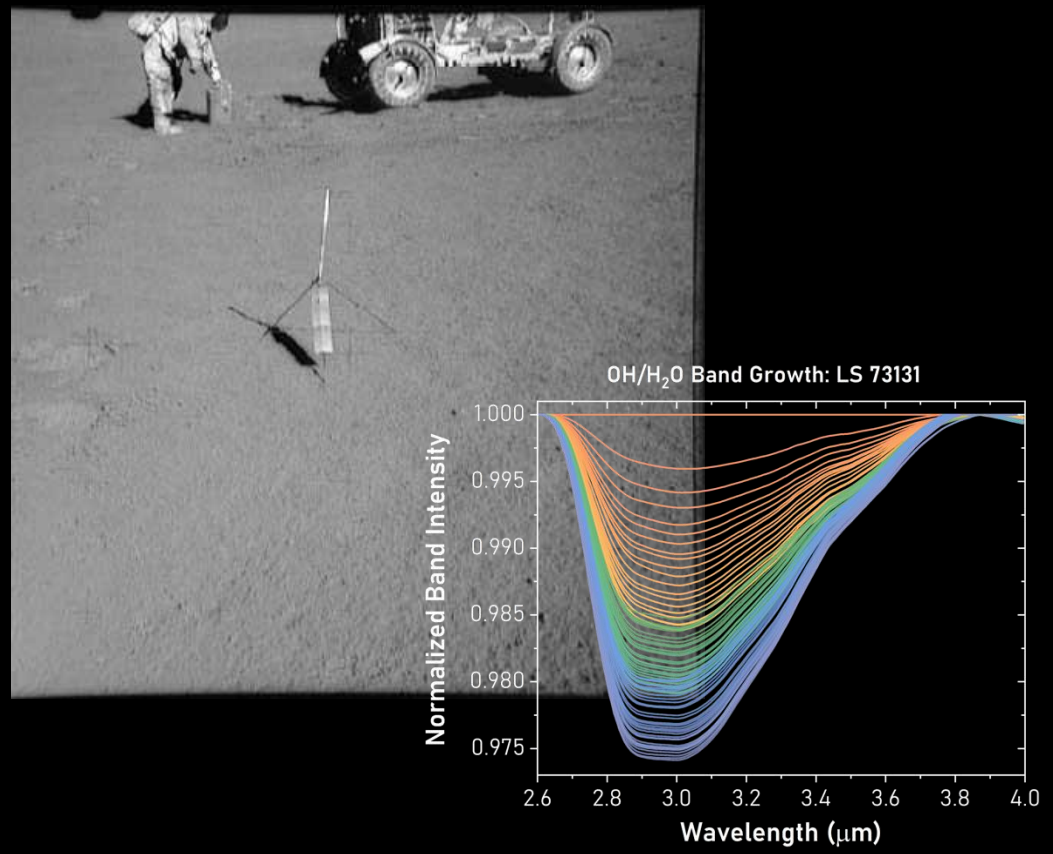
Signatures of Water Produced in Apollo-17 Samples Exposed to Laboratory Solar Wind

An infrared spectral fingerprint of water (H_2O), or a component of water called the hydroxyl radical (OH), has been detected across the Lunar surface. Despite its ubiquitous presence, the origin of the OH/H_2O signature in Lunar materials is uncertain. One theory suggests that the energetic hydrogen plasma of the solar wind can interact with the oxygen in Lunar soil to form OH/H_2O.

This theory was tested in the laboratory by scientists at Goddard by exposing Apollo 17 samples of the Lunar regolith to protons with energies similar to those in the Solar wind. The production of OH/H_2O was observed in the Lunar samples using infrared spectroscopy.

The growth of the infrared signature of OH/H_2O in vacuum as the irradiation took place eliminated confusion due to any contamination from terrestrial water and shed light on the production and diffusion rates of OH/H_2O in Lunar materials.

These results are a significant step in understanding the production and life cycle of water and its components on the Moon, where hydrated minerals and water are a crucial source of life support and fuel. Understanding how OH/H_2O forms and moves about on the Moon is important for exploration and Lunar prospecting.



Top left: Lunar sample 78421 being collected during the Apollo 17 mission. Bottom right: Infrared spectra showing the growth (from red to violet) of the spectral absorption due to OH/H_2O in Apollo sample 73131 during proton irradiation in the laboratory. Credits: NASA/Yeo et al., 2025

Yeo, L. H. (695/UMBC) , Georgiou, A., Morrissey, L., Farrell, W., & McLain, J. (695), 2025. Hydroxylation and hydrogen diffusion in lunar samples: Spectral measurements during proton irradiation. Journal of Geophysical Research: Planets, 130, e2024JE008334. https://doi.org/10.1029/2024JE008334

Press release: https://science.nasa.gov/solar-system/moon/can-solar-wind-make-water-on-moon/