

Water content and hydrogen isotope composition of lunar rocks

Greenwood, J.P.¹, Shoichi Itoh², Naoya Sakamoto², Warren, P.³, Taylor, L.⁴,
Hisayoshi Yurimoto^{2*}

¹Wesleyan University, ²Hokkaido University, ³UCLA, ⁴University of Tennessee

Water plays a critical role in the evolution of planetary bodies, and determination of the amount and sources of lunar water has profound implications for our understanding of the history of the Earth-Moon system. Here we report ion microprobe measurements of water and hydrogen isotopes in the hydrous mineral apatite, found in crystalline mare basalts and highlands rocks collected during the Apollo missions. We find a range of water content in apatite up to 6050 p.p.m., indicating that the interior of the Moon has significant water. The water content of apatite in a highlands rock reflects its involvement in the formation of the lunar highlands, and points to a role for water during all phases of the Moon's magmatic history. Variations of hydrogen isotope ratios and water contents suggest the lunar mantle, the solar wind, and comets as possible sources for water in lunar rocks, and imply a significant delivery of cometary water to the Earth-Moon system shortly after the Moon-forming impact.

Keywords: Moon, Water, hydrogen isotope, SIMS