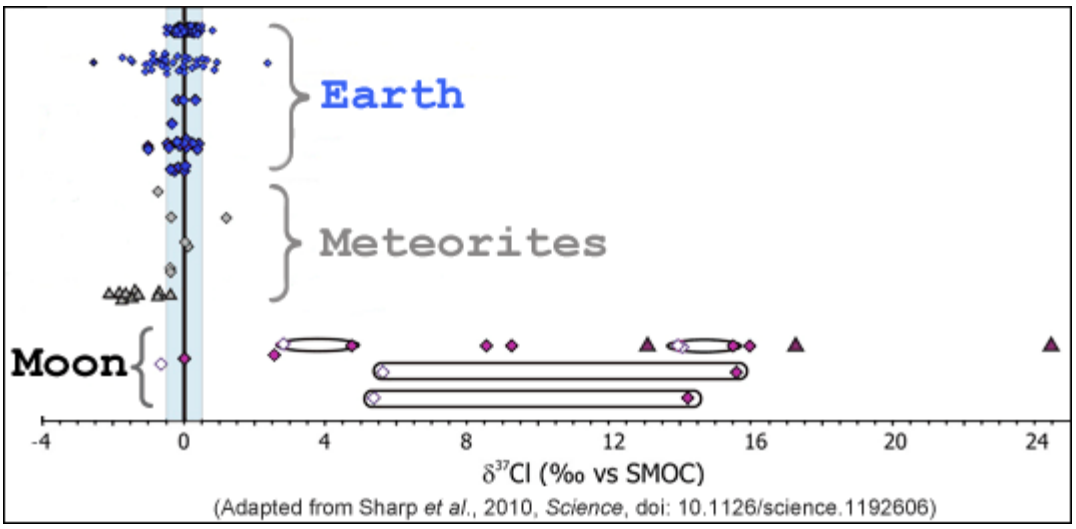
PLANETARY SCIENCE RESEARCH DISCOVERIES
CosmoSparks
Quick Views of Big Advances

Putting a Damper on the Damp Moon

Recent studies have shown that some lunar samples contain water, drastically revising a traditional view that the Moon is virtually free of water (less than about one part per billion compared to Earth's 500 parts per million). The new estimates give water contents in the lunar interior of 1 to a few tens of parts per million. This new view of the Moon has implications for how it formed and the source of water to the inner Solar System. As planetary scientists begin to consider the implications of this much damper lunar interior, Zachary Sharp and colleagues at the University of New Mexico suggest that we not throw out the old view entirely. Most of the lunar interior is as dry as we thought. Their conclusion stems from measurements of chlorine isotopes in lunar samples. The $^{37}Cl/^{35}Cl$ ratio is strikingly uniform in terrestrial samples (from both the crust and mantle) and in meteorites (see figure).



Lunar samples show a large range in the ratio. Sharp and his colleagues suggest a lack of available hydrogen in lunar magmas. On Earth, the chlorine isotopes do a balancing act. The lighter ^{35}Cl isotope is lost preferentially to a vapor phase, but the heavier ^{37}Cl isotope is incorporated preferentially into HCl gas. The result is little fractionation of the chlorine isotopes. If no water is present to provide the hydrogen to make HCl gas, the lighter isotope is preferentially lost and the rocks end up with higher ^{37}Cl, so shown by the data. Using a distillation calculation, they estimate that the lunar interior contains about 10 parts per billion, a thousand times less than the recent wetter estimates. Nevertheless, water has been detected unambiguously in lunar samples, so we know there was some, but how much? Where is it? How does its concentration vary throughout the lunar interior? How did it get to where it is? What does the variable lunar water concentration tell us about the processes operating during formation of the Moon?

See: Sharp et al. (2010) The chlorine isotope composition of the Moon and its implications for an anhydrous mantle. *Science*, doi: 10.1126/science.1192606 and the PSRD article ***Damp Moon Rising***.

Written by G. Jeffrey Taylor, Hawai'i Institute of Geophysics and Planetology, for ***PSRD***.

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http://www.psrd.hawaii.edu
psrd@higp.hawaii.edu