IMPORTANT SKGs FOR LUNAR WATER RESOURCES: TIME/SPACE VARIATIONS OF SURFICIAL OH/H2O. C. M. Pieters and R. E. Milliken[1], [1]Brown University, DEEPS, Providence, RI 02912 (Carle_Pieters@brown.edu)

Introduction: An important potential resource on the Moon is its pervasive layer of surficial OH/H_2O. The presence of this form of OH/H_2O was found to occur over widespread portions of the illuminated surface of the Moon (Pieters et al., 2009, Sunshine et al., 2009, Clark et al., 2009). It is believed this form of OH/H_2O is tied to the oxygen-rich nature of surface materials and the hydrogen-rich nature of the solar wind (e.g. Dyar et al., 2010; McCord et al. 2011; and refs. therein). Although most attention has been given to understanding possible buried volatiles in permantly shadowed regions of the lunar poles, the pervasive nature of surficial OH/H_2O makes it an attractive potential resource.

There are several Strategic Knowledge Gaps (SKGs) that need to be addressed to evaluate surficial OH/H_2O as a resource. They can be formulated as the following questions:

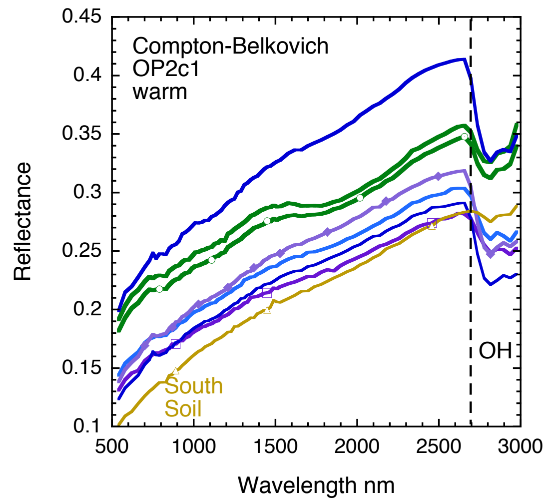
1. What is the distribution and abundance of OH/H_2O across the lunar surface?
2. What are the processes responsible for formation of surficial OH/H_2O on the Moon?
3. At what rate does surficial OH/H_2O form and what role, if any, does composition play in this rate?
4. How mobile is surficial OH/H_2O?
5. What is the resource potential of the surficial OH/H_2O and is it renewable?

Near-infrared reflectance spectra from the Moon Mineralogy Mapper (M^3) onboard Chandrayaan-1 acquired in 2008/2009 has provided a first assessment of global surficial OH/H_2O on the Moon (Pieters et al., 2009; McCord et al., 2010), although with non-ideal spectral, spatial and temporal characteristics (Boardman et al., 2011). Such spectroscopic measurements rely on fundamental absorptions of OH and H_2O between 2800 and 3000 nm. At these wavelengths, most radiation measured from the Moon is reflected solar radiation. However, thermal emission from warm lunar surfaces can also contribute a significant component to measured radiation. Identifying and removal of the thermal component (e.g. Clark et al., 2011) is essential for evaluating the character of the OH/H_2O absorption.

The basic calibration of M^3 data (Green et al., 2011) and ongoing approaches for improving the thermal removal have resulted in not only refining estimates of surficial OH/H_2O at the cool high latitudes (Li and Milliken, 2013), but also in identifying several local concentrations of OH/H_2O, linked to the inherent geologic character of deposits at Buldialdus (Klima et al. 2013), Compton-Belkovich (Bhattacharya et al., 2013; Petro et al. 2013) and several regional pyroclastic deposits (Li and Milliken, 2014).

Although progress has been made, in order to evaluate the character of the pervasive OH/H_2O associated with surface materials of the Moon and to assess the potential of surficial OH/H_2O as a *renewable* resource, focused new data are needed to close key SKGs.

Accurate measurements of the time variability of surface hydration in a geologic context is the first essential step for understanding the physics of OH/H_2O production and loss on the Moon. Data must be acquired over multiple lunar days at different local times in a clear spatial context. Distinguishing OH from H_2O requires high spectral resolution across the entire absorption feature. Although local analyses can be obtained from the surface, the critical global assessment is best accomplished from orbit.



M^3 spectra of the Compton-Belkovich region of the Moon exhibit prominent 2800+ nm absorptions due to the presence of OH/H_2O. Surrounding soil (orange spectrum) exhibits a less prominent absorption. [A few instrumental artifacts occur at shorter wavelengths.]

References:

Bhattacharya et al., 2013, *Current Science* 105, No.5.
Boardman et al., 2011, *JGR* 116, E00G14.
Clark, RN, 2009, *Science* 326, 562.
Clark et al., 2011, *JGR* 116, E00G16.
Dyar et al., 2010, *Icarus* 208, 425–437.
Green et al., 2011, *JGR*, 116, E00G19.
Klima et al., 2013, *Nature Geoscience* DOI: 10.1038/NGEO1909
Li and Milliken, 2013, LPSC44 #1337.
Li and Milliken, 2014, LPSC45 #2012
McCord et al., 2011, *JGR*, 116, E00G05.
Petro et al., 2013, LPSC44 #2688.
Pieters et al., 2009, *Science* 326, 568.
Sunshine et al., 2009, *Science* 326, 565.