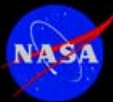




The Colorful Moon: Science Discoveries from the Moon Mineralogy Mapper on Chandrayaan-1

R. L. Klima, C. M. Pieters and the M³ Science Team

LEAG Meeting, September 14-16, 2010
Washington, D. C.



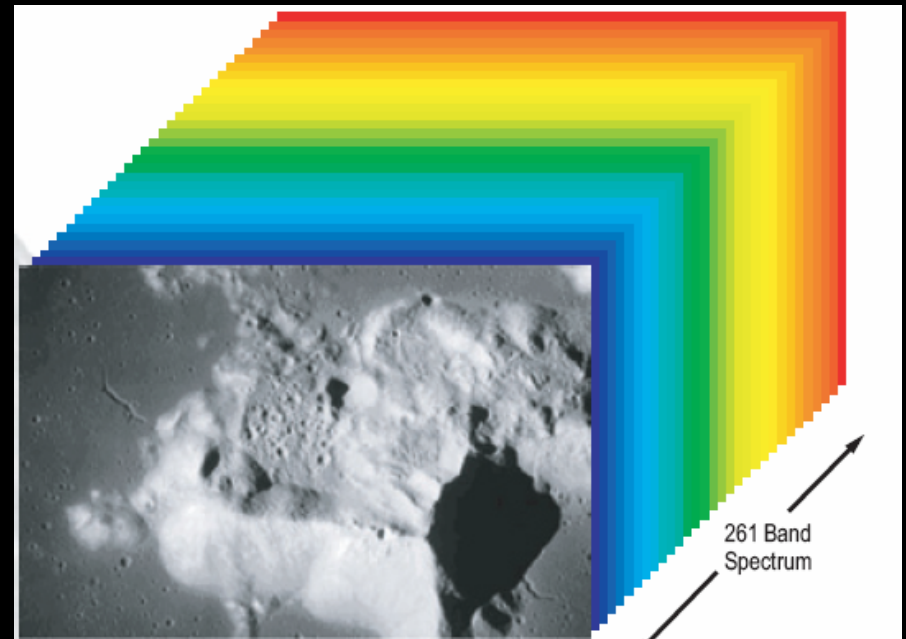


The Moon Mineralogy Mapper (M³)

Vis-NIR Imaging Spectrometer

Global Mode:

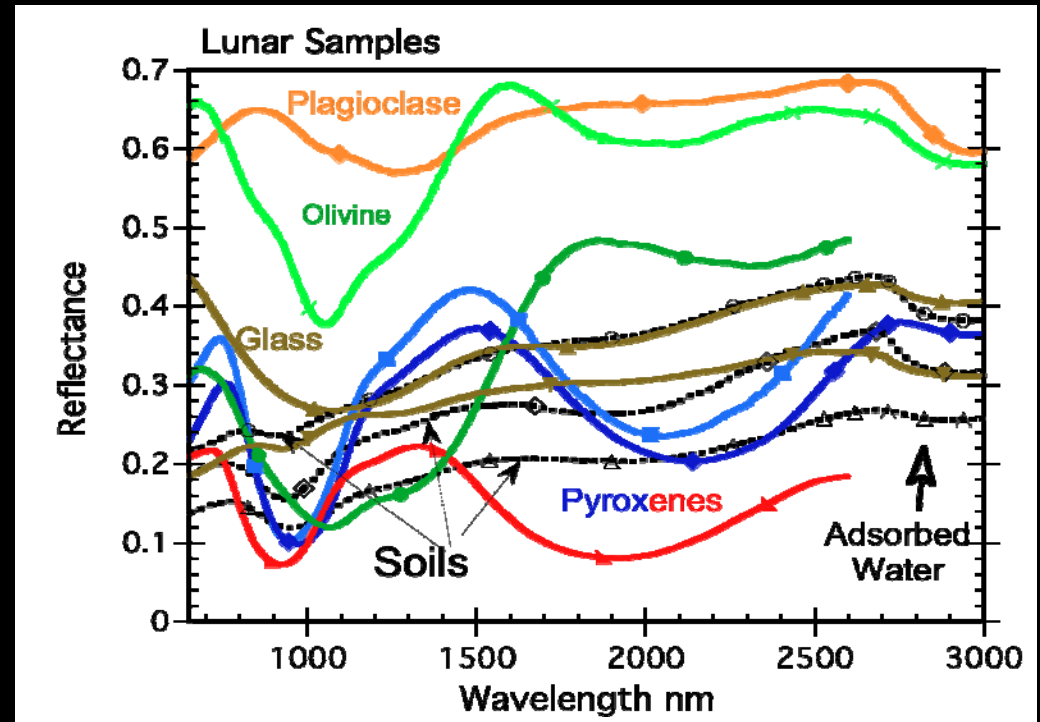
- 85 bands
- 20-40 nm spectral sampling
- 140 m/pixel & 280 m/pixel
- 0.4-3 μm





The Moon Mineralogy Mapper (M³)

- Vis-NIR ideal for detecting and characterizing the mineralogy of Fe²⁺ bearing silicates
- Water and OH⁻ also absorption in the NIR at 2.8-3 um
- Transition metals are key!





International Collaboration

M3 was a NASA Discovery Mission of Opportunity flown on ISRO's mission Chandrayaan-1

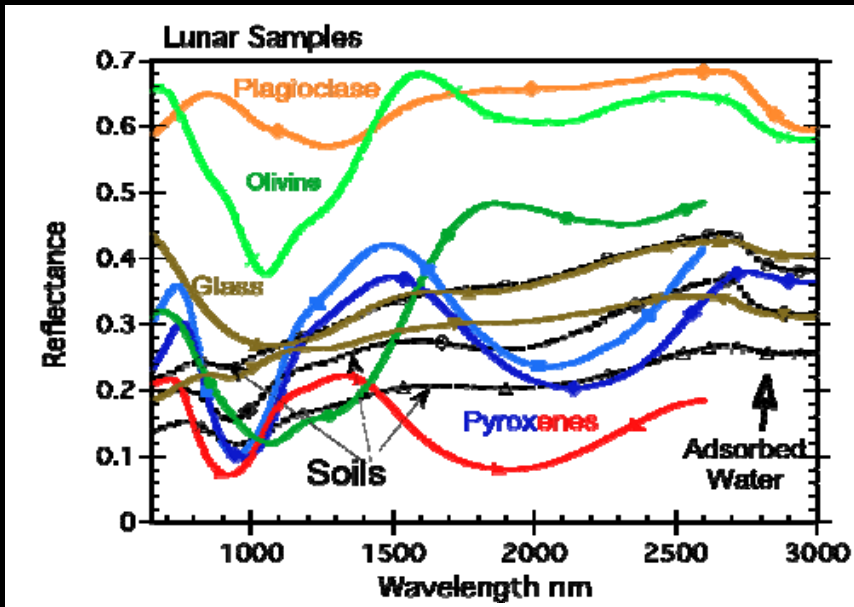
Science Goals:

- Characterize the lunar highland rocks
- Map diversity of lunar volcanism
- Identify and map hydrous phases
- Identify fresh craters, impact flux
- Identify rare or unseen lunar minerals

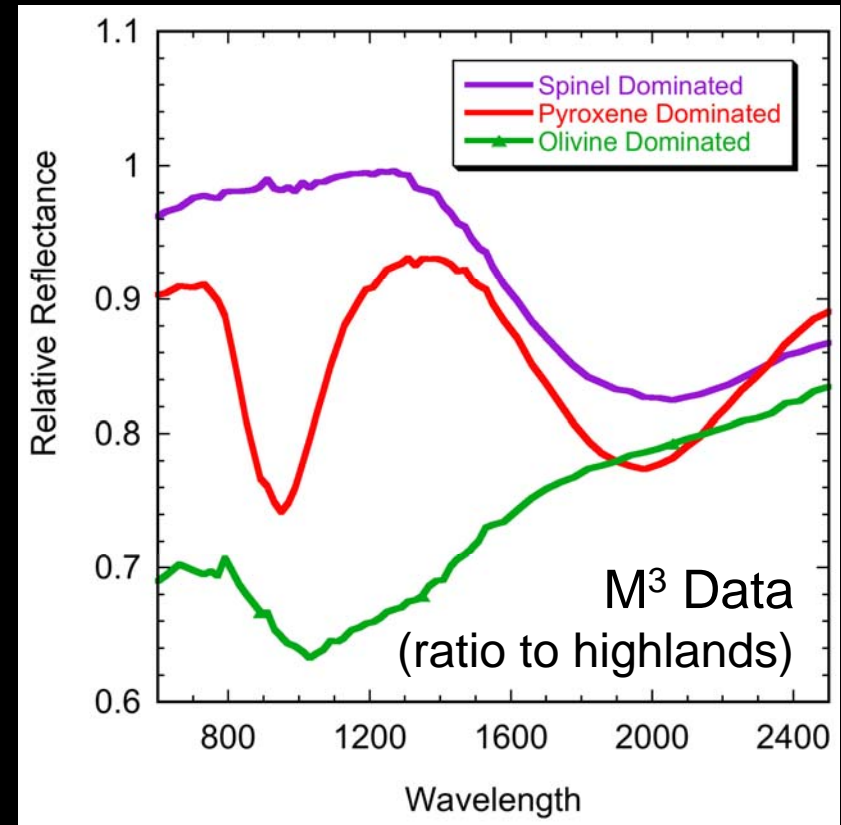




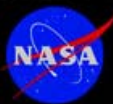
Immediate Discoveries: A New Rock Type?



In the first data strip obtained at nominal operating temperatures, anomalous spectra were detected. The only mineral group that exhibits a strong 2 um band and no 1 um band is spinel

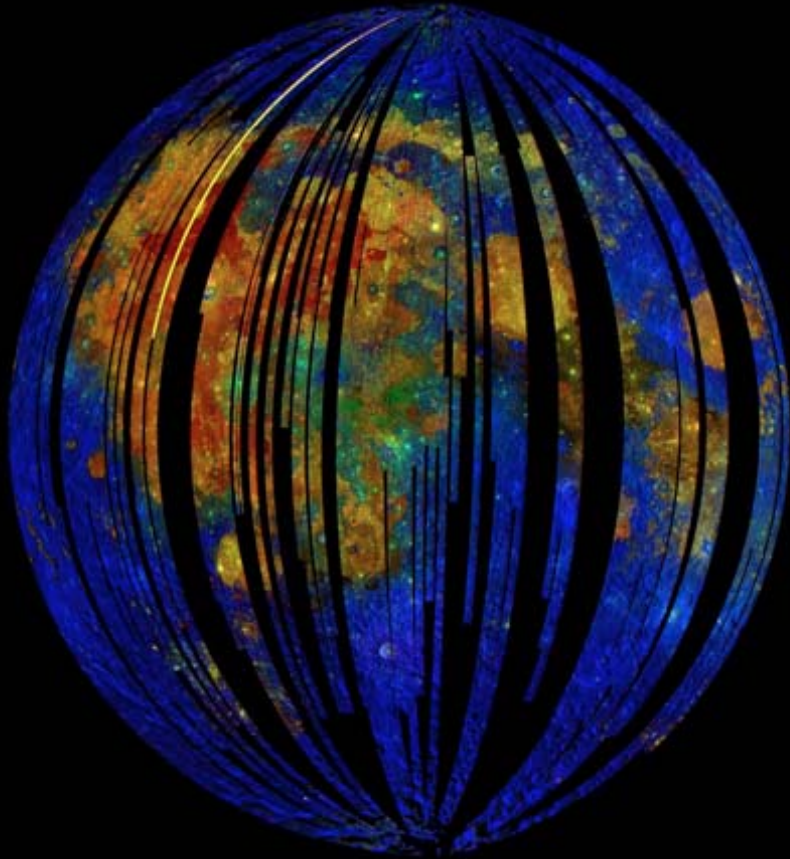


Pieters et al., 2010, submitted to JGR.

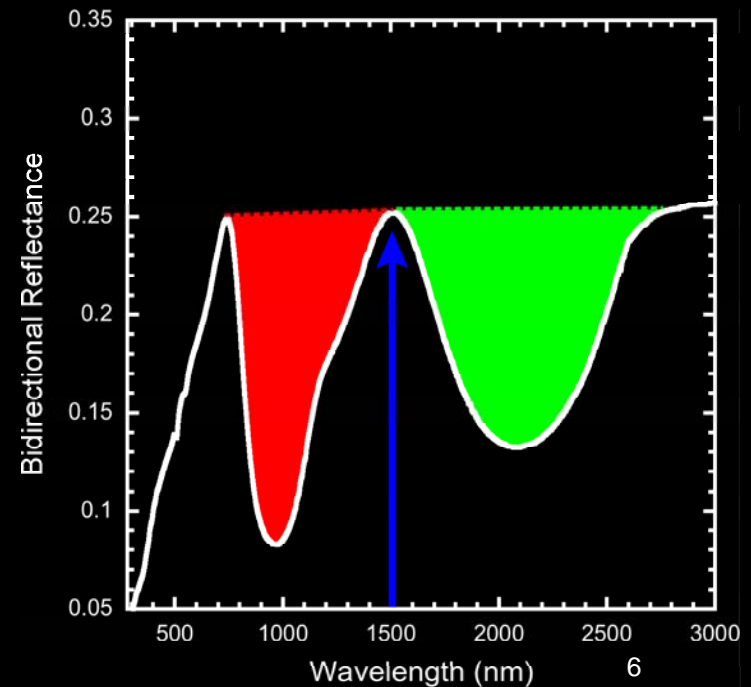




A Global View: Optical Period 1

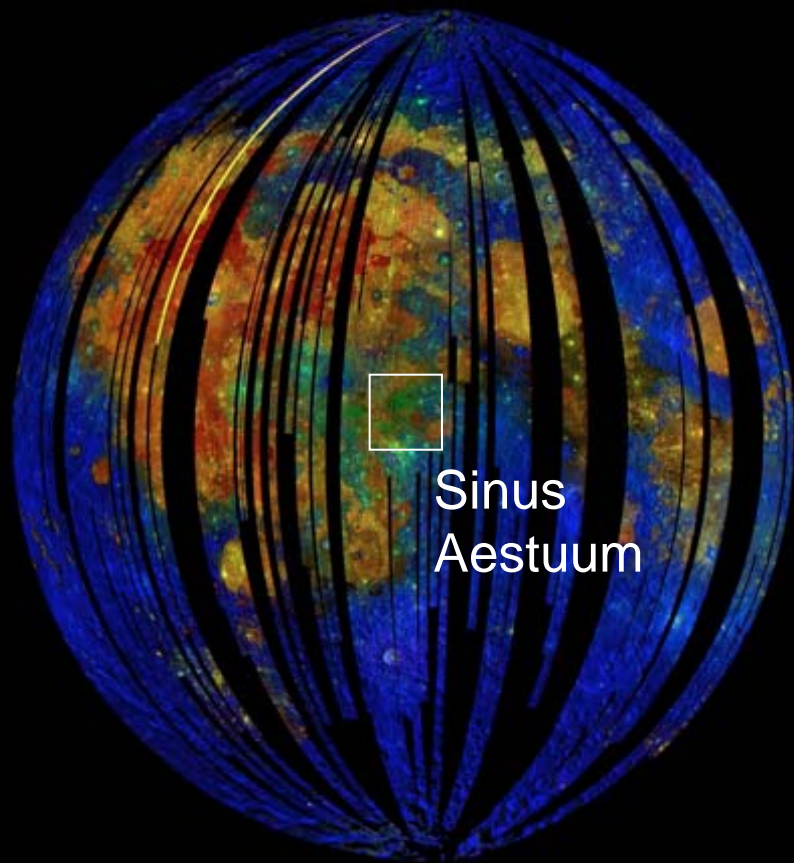


R: 1 μm integrated band depth
G: 2 μm integrated band depth
B: Reflectance at 1500 nm

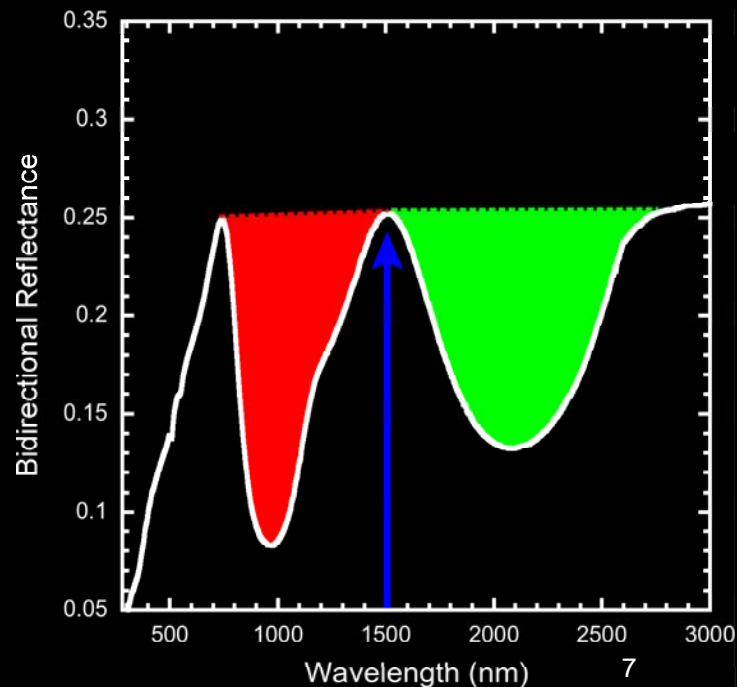




A Global View: Optical Period 1

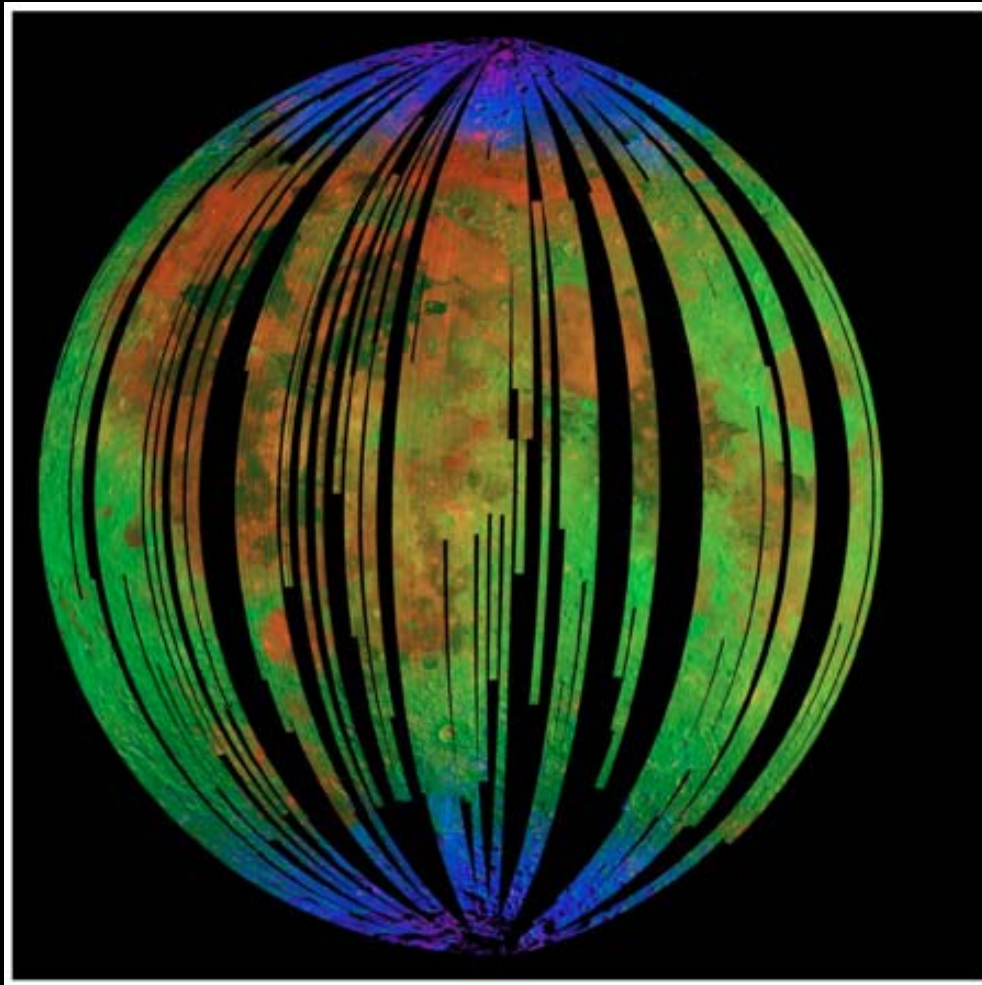


R: 1 μm integrated band depth
G: 2 μm integrated band depth
B: Reflectance at 1500 nm





Water and OH⁻ on the Lunar Surface



R: Pyroxenes

G: OH⁻

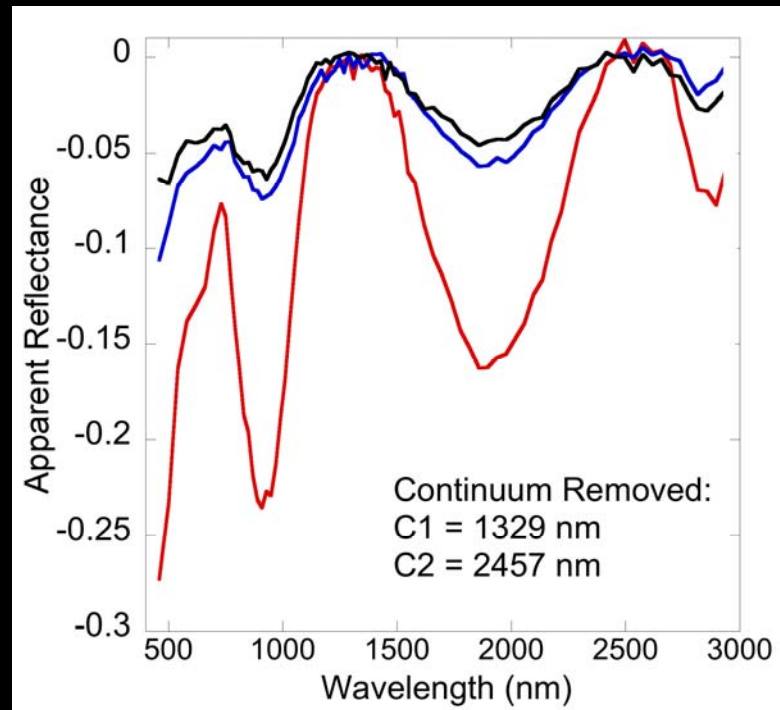
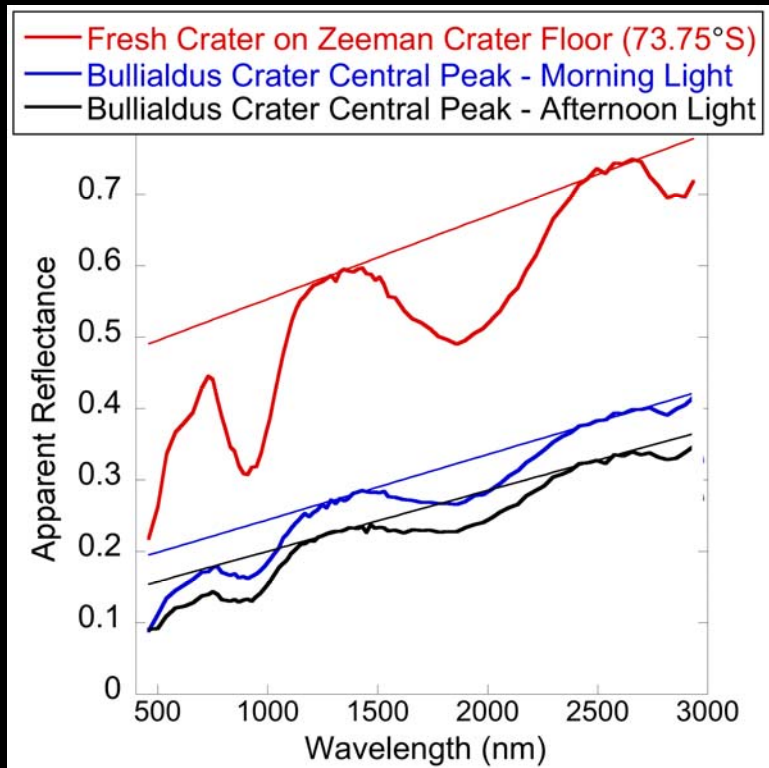
B: Water

As reported in Pieters et al., 2009, Science

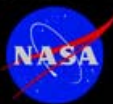
OH⁻ and/or water absorptions were detected. Though the signal is strongest at the poles is is not completely absent from low latitudes



Variability of OH⁻ Absorptions

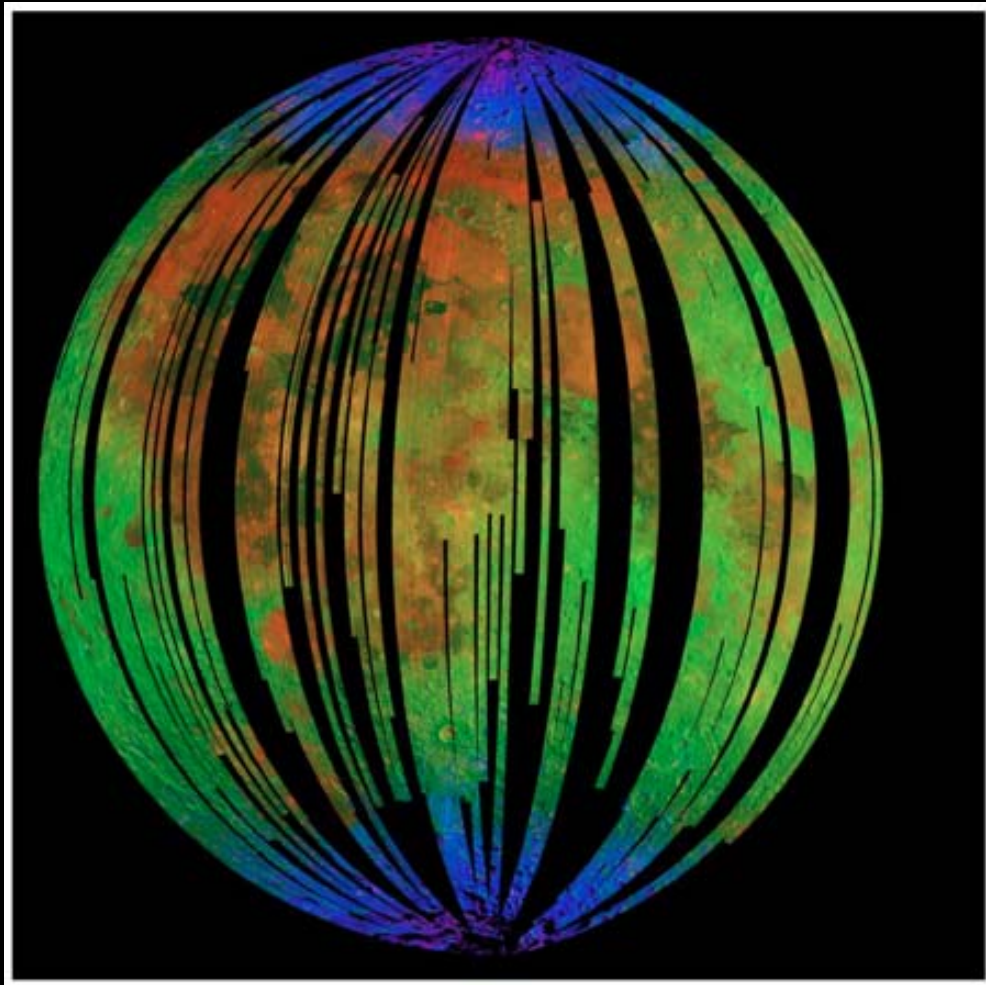


- For the same mineralogy, there is clear variability between a polar crater and mid-latitude (Bullialdus Crater, ~21°S) crater.
- Some variation is seen for the same crater observed at different times of the day





Water and OH⁻ on the Lunar Surface



What is the nature of this water/OH⁻?

Endogenic?

Exogenic?

Produced in-situ?



M³ Science Goals Revisited

- Characterize the lunar highland rocks
- Map diversity of lunar volcanism
- Identify and map hydrous phases
- Identify fresh craters, impact flux
- Identify rare or unseen lunar minerals

The data obtained (>95% of the Moon at 85 bands) can address all of these questions and more, and we're eager to study them all

BUT now...



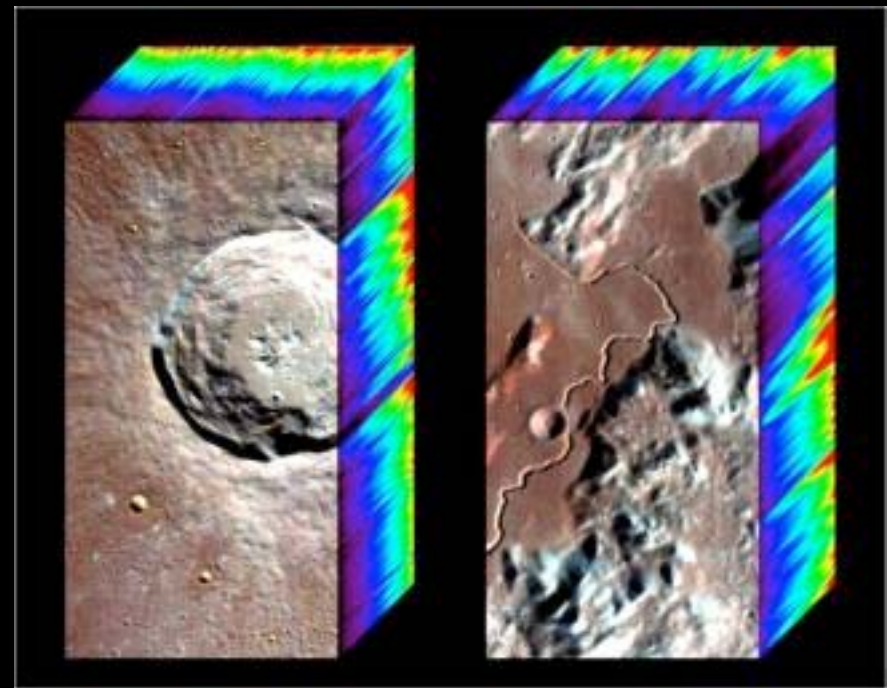


We happily invite the community to join us!

The first M³ PDS release is live now at:
<http://pds-imaging.jpl.nasa.gov/>

The data release includes level 1b (radiance data) from optical period 1

There will be a workshop at the Fall AGU meeting to introduce the data and answer questions





What follows is a bonus slide of shameless self promotion

M3 / Chandrayaan-1
Overview





Pyroxenes in South Pole-Aitken Basin

