

Assessment of spectral properties of Apollo 12 landing site

Project talk

B.Sc. Planetary Sciences with Astronomy
4th Year



1 Preamble

- Location/timelines
- Objectives
- Cross-section

2 Chandrayaan-1 M³

- Craters location map
- Craters hyperspectral signal

3 Methods

• FeO Mapping

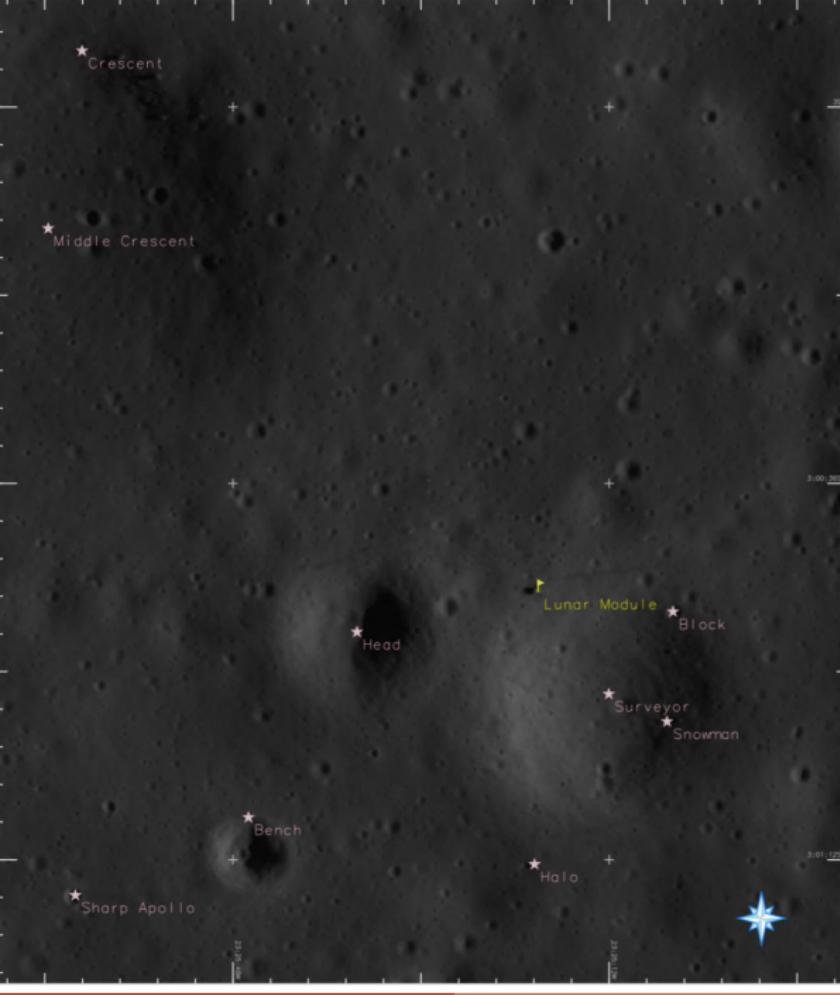
- Object-based classification
- Manual seek and compare

4 Results

- FeO Mapping
- Relative Age Mapping
- Manual seek: 12063,79NT

5 Conclusions

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Location/timelines

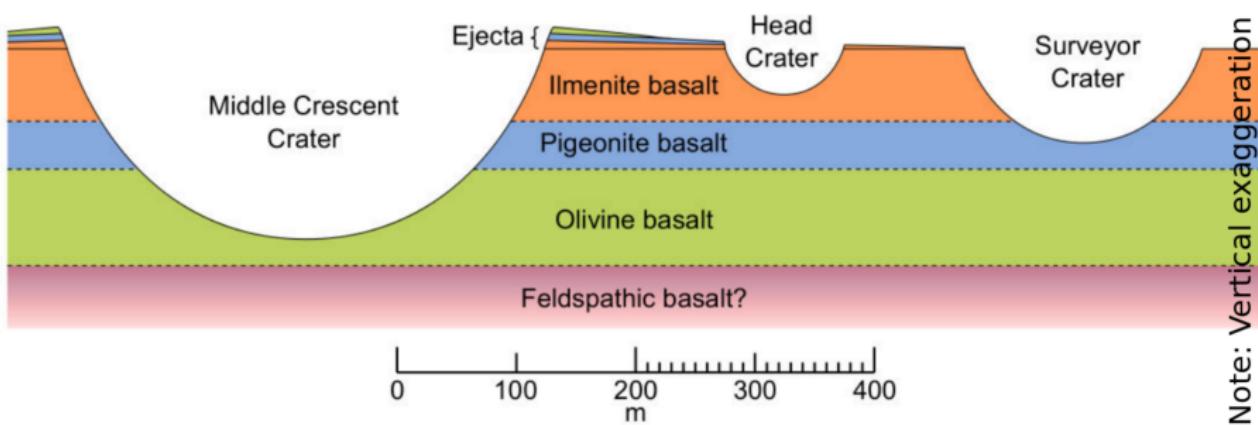
- 3.2S 336.62E
 - Surveyor: 19 April 1967
 - Apollo 12: 19 November 1969
 - Chan-1: 2 October, 2008
 - Chan-1: 312 days

Objectives

- Initially designed to complement Alexander [2015]
- Different scale and point of view from remote sensing
- Keeping the scale at the landing site level
- Using the Moon Multispectral Mapper (M^3) @150m/pixel

- Hyperspectral signatures from lunar samples
- Hyperspectral response curves from M^3
- Can we say something from those about the A12 landing site?

Cross-section



Apollo 12 Landing site mineralogical cross-section [Snape et al., 2013]

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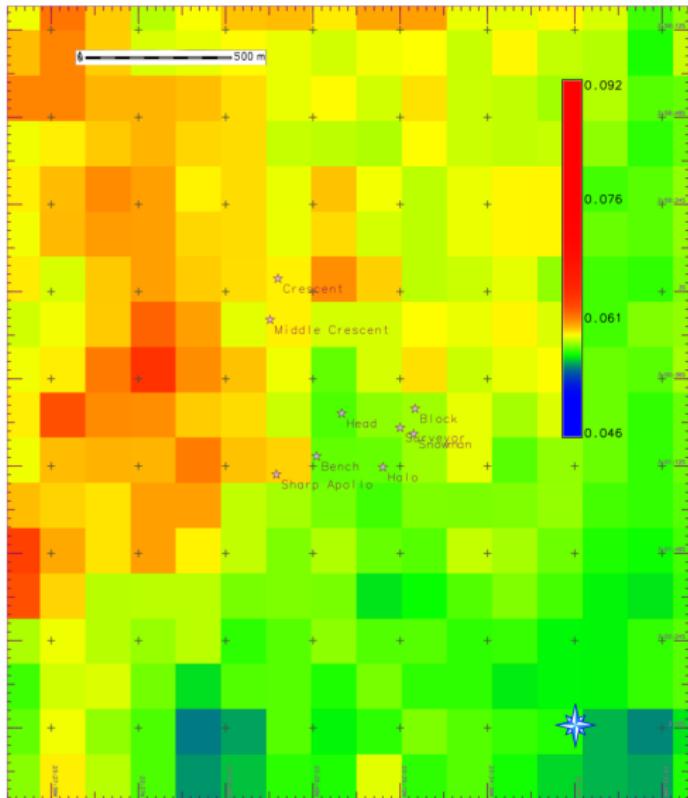
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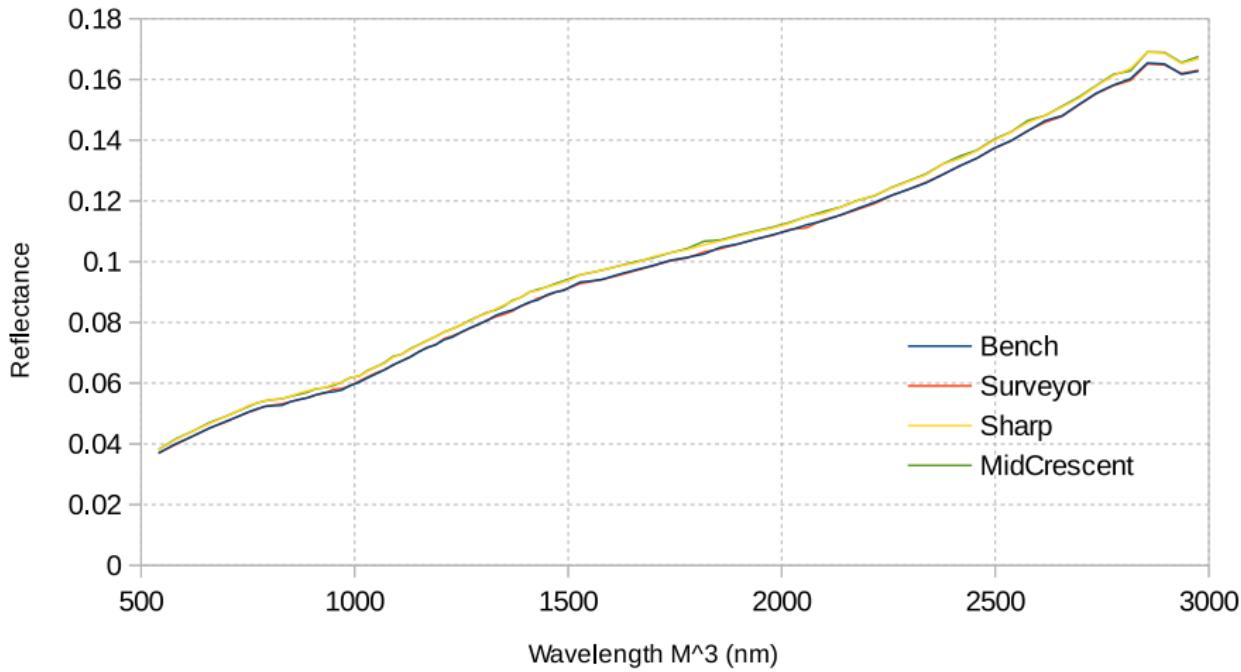
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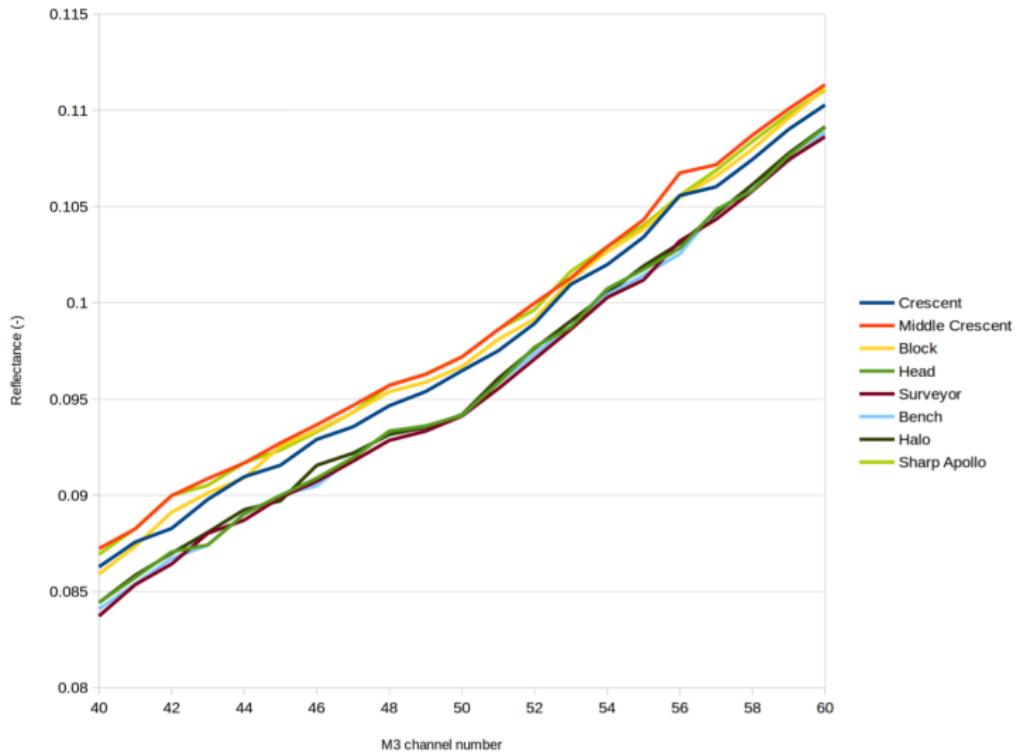
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Crater location map (M³ band 19, reflectance @ 950nm)



A12 Craters hyperspectral signal



A12 Craters hyperspectral signal Zoom

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FeO equation

- Derived from Clementine work and type of equation
- Performs well regionally
- Zhang and Bowles [2013]

$$\theta_{Fe}[\text{wt\%}] = -\arctan \left[\frac{\frac{R_{950}}{R_{750}} - 1.26}{R_{750} - 0.01} \right] \quad (1)$$

Object-based classification

- Classification based on both spectral and region growth statistics
- Removed M³ band 1 & 2 as empty
- Configured to simplify large regions instead of small units
- Trying to exploit the reflectance gap in craters signal
- Momsen and Metz [2012]

Manual seek and compare

- Compare each Relab signal from Apollo 12 to M³
- Removed M³ band 1 & 2 as empty
- Closest found are half glass half rock (12063,79NT)
- M³ signal too linear

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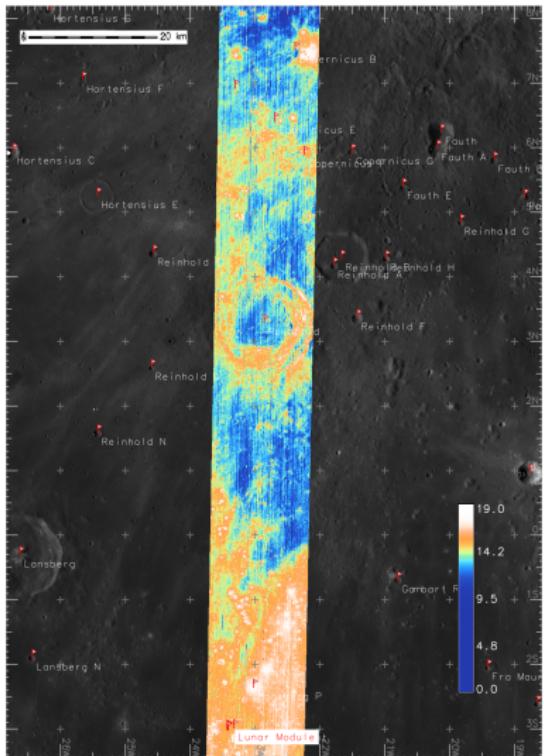
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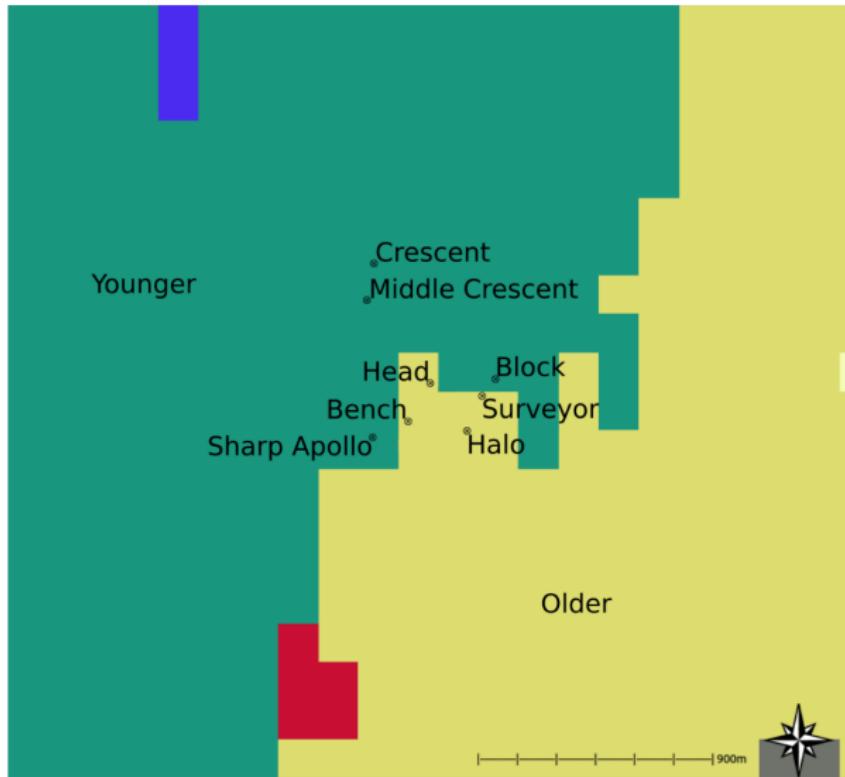
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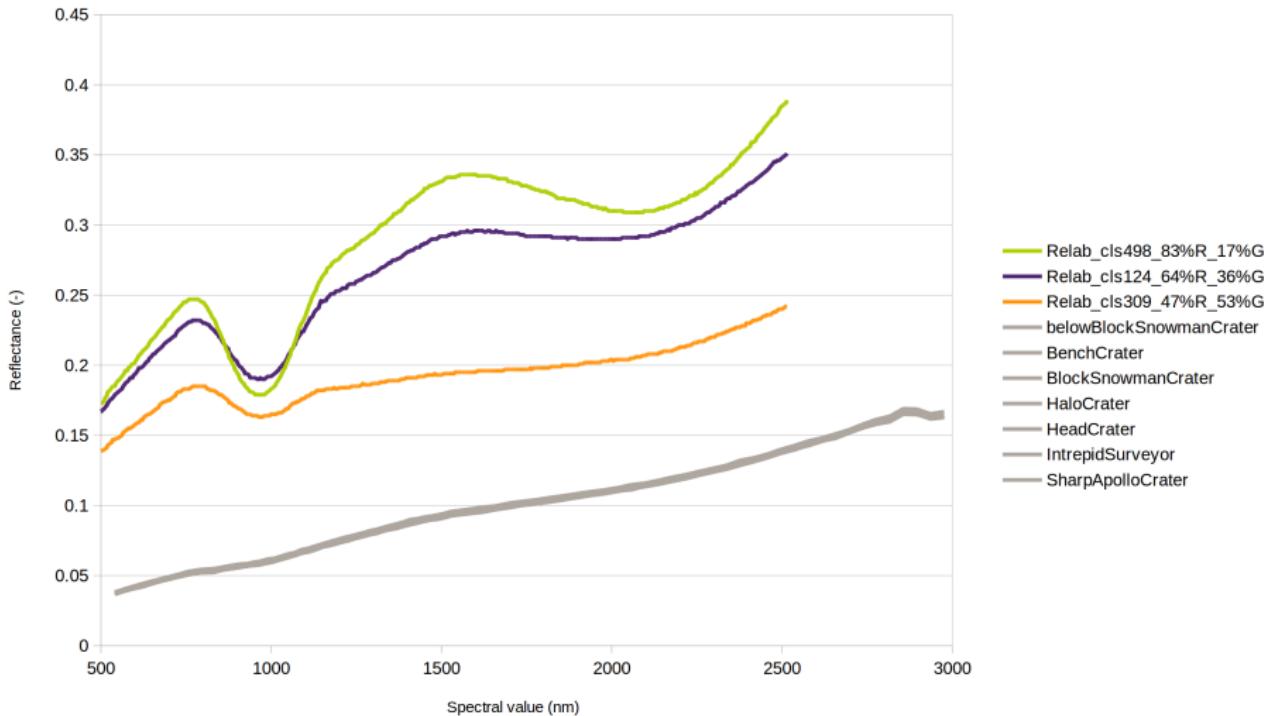
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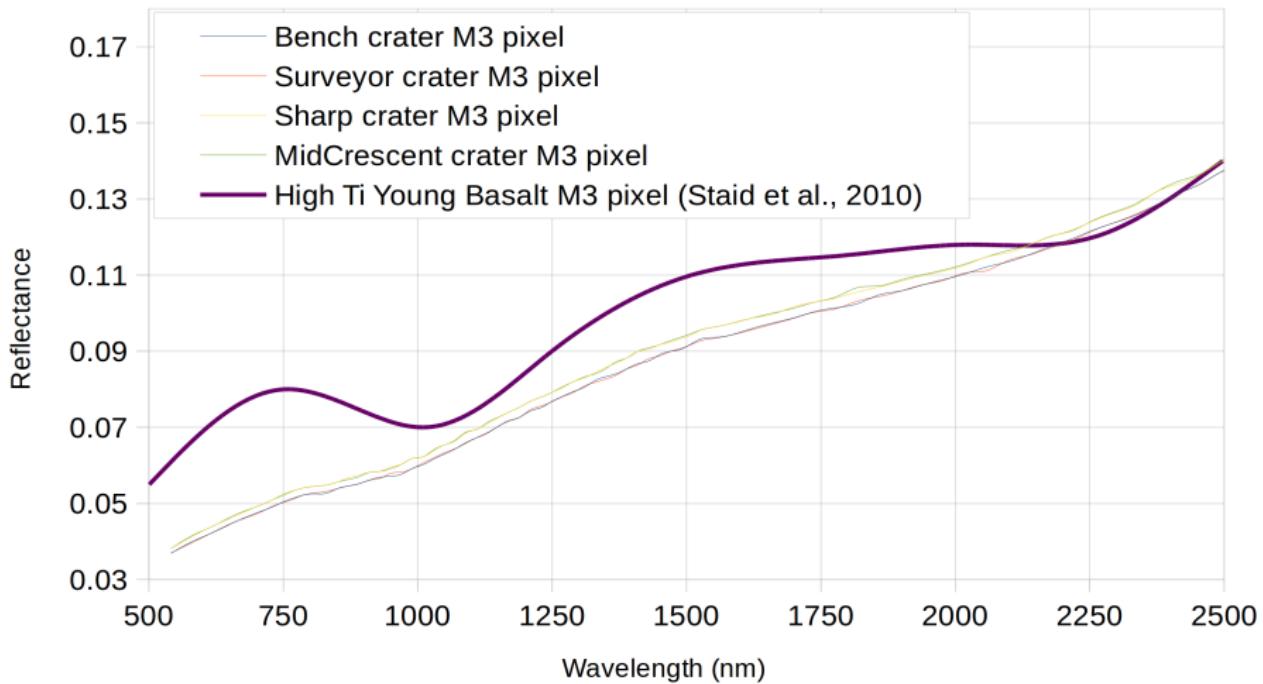
Zhang et al [2013] FeO[wt%]



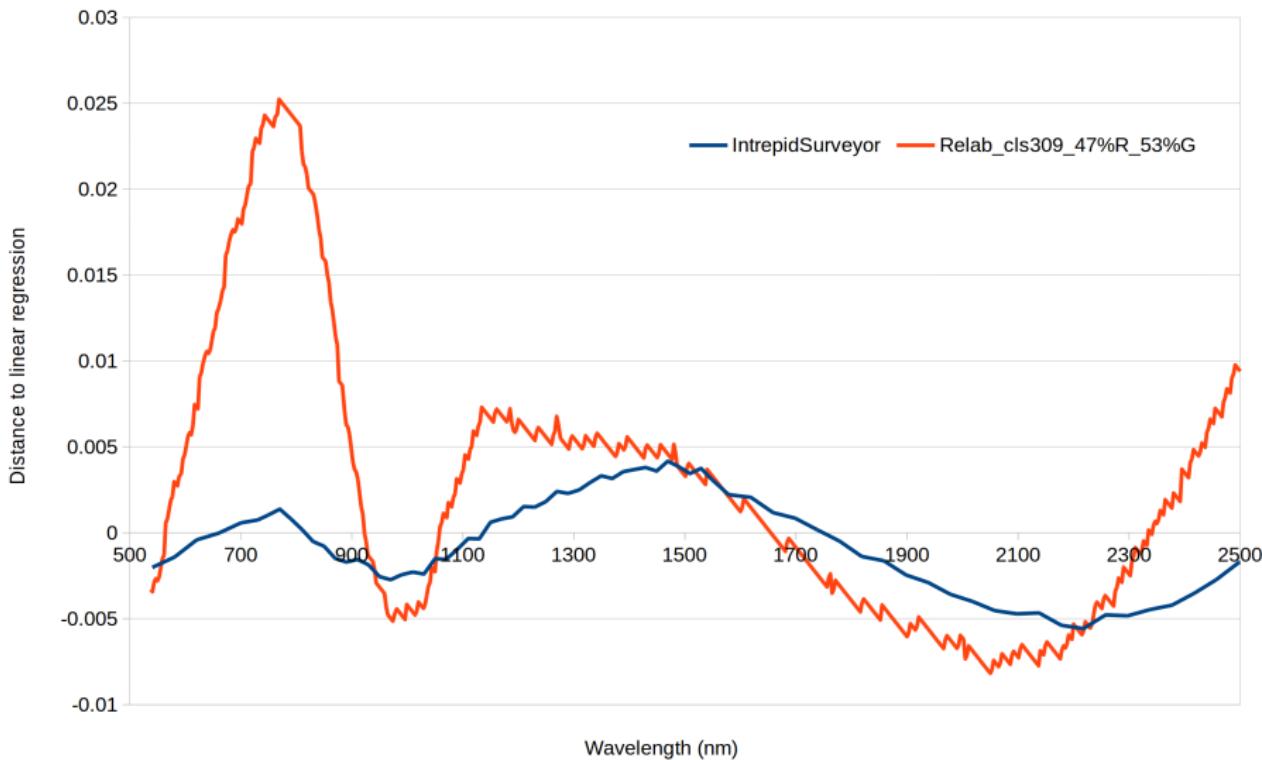
Object-based classification



Manual seek: 12063,79NT (Relab cls309)

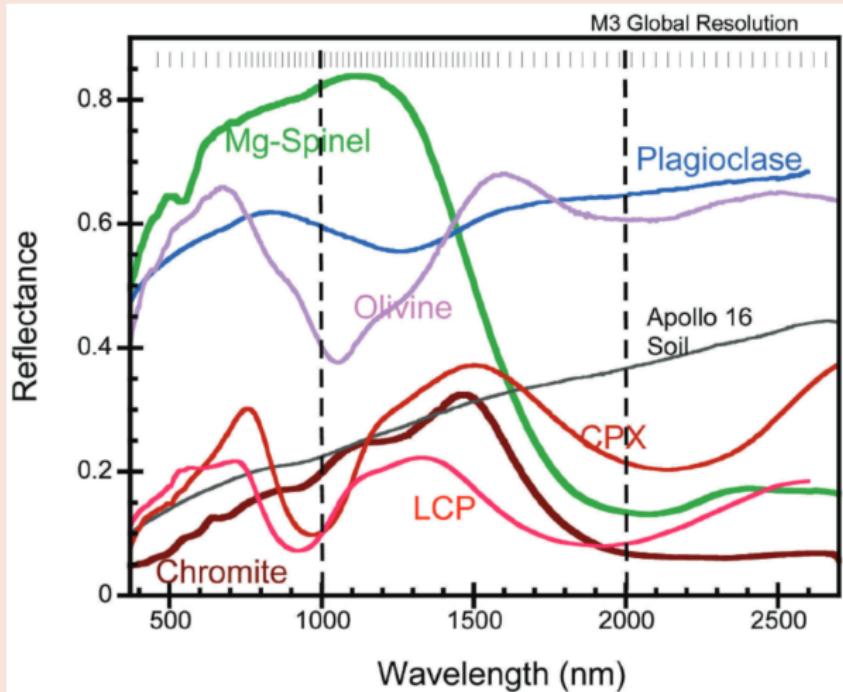


Manual seek: 12063,79NT compare Staid et al. [2011] Mare Basalt



Manual seek: 12063,79NT compare Relab cls309 (detrended)

Finding: CPX



Graph from Pieters et al. [2014]

Finding: CPX

- **Pre-copernican**

Augite/pigeonite leaning towards Hedenbergite ($\text{CaFeSi}_2\text{O}_6$)

- **Copernican**

Augite/pigeonite leaning towards Endiopside/Diopside ($\text{CaMgSi}_2\text{O}_6$)

- Layer within 5000m in Copernicus crater

- Aging going out of the ray, increase $\text{FeO}[\text{wt}\%]$

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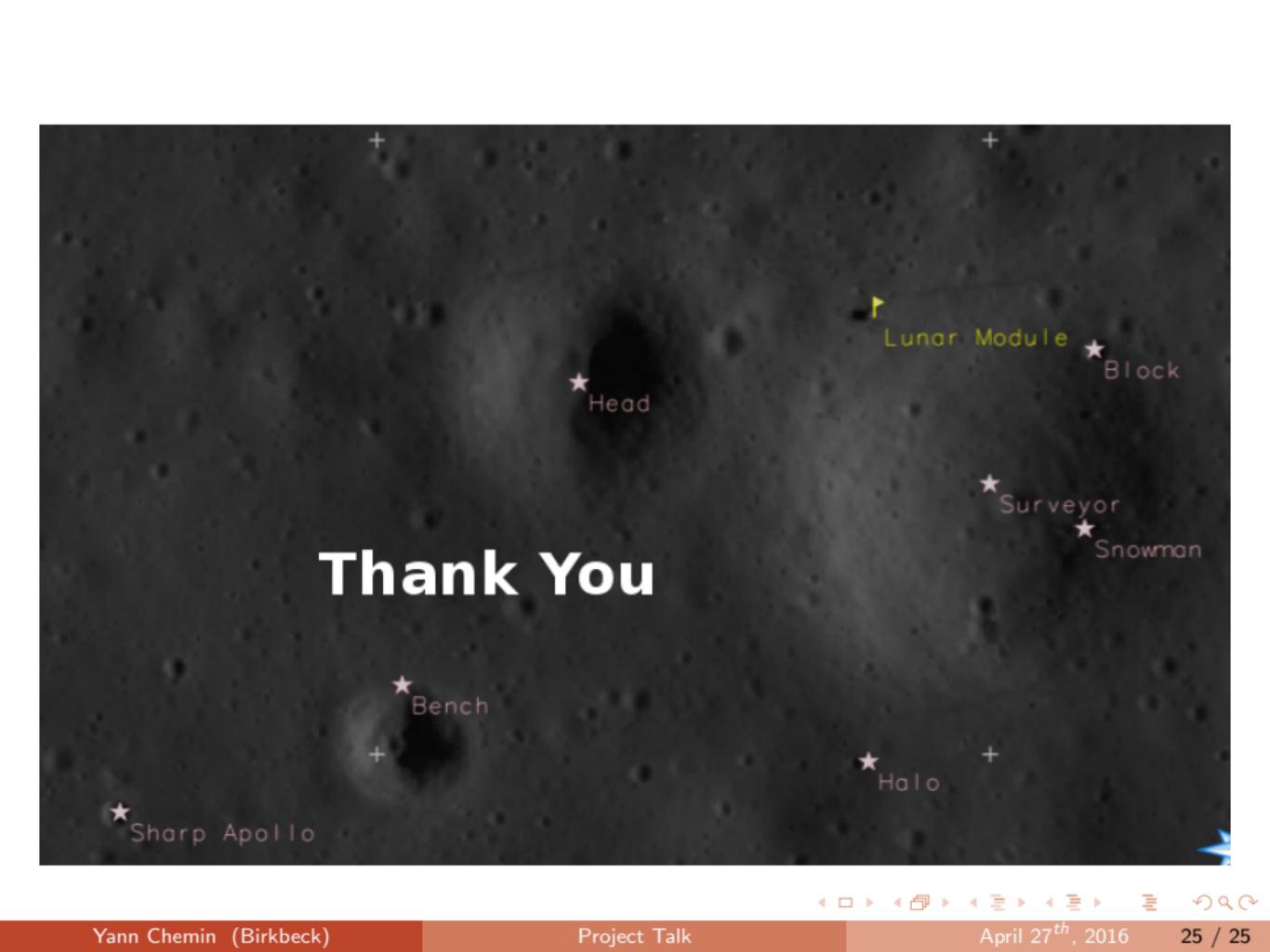
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This study

- Found some Copernican and pre-Copernican CPX
- with FeO differences

Future

- 2018: Imaging IR Spectrometer on Chandrayaan-2 (600-2500nm)
- Will enhance this work, and add mineralogical identification power
- I should be involved, somehow, to bridge Lunar samples to RS data



Thank You

★ Sharp Apollo

★ Bench

★ Head

Lunar Module

★ Block

★ Surveyor

★ Snowman

★ Halo