

# Compositional and Thermophysical Properties of Moscovиe Basin and Tsiolkovskiy Crater Revealed by Diviner

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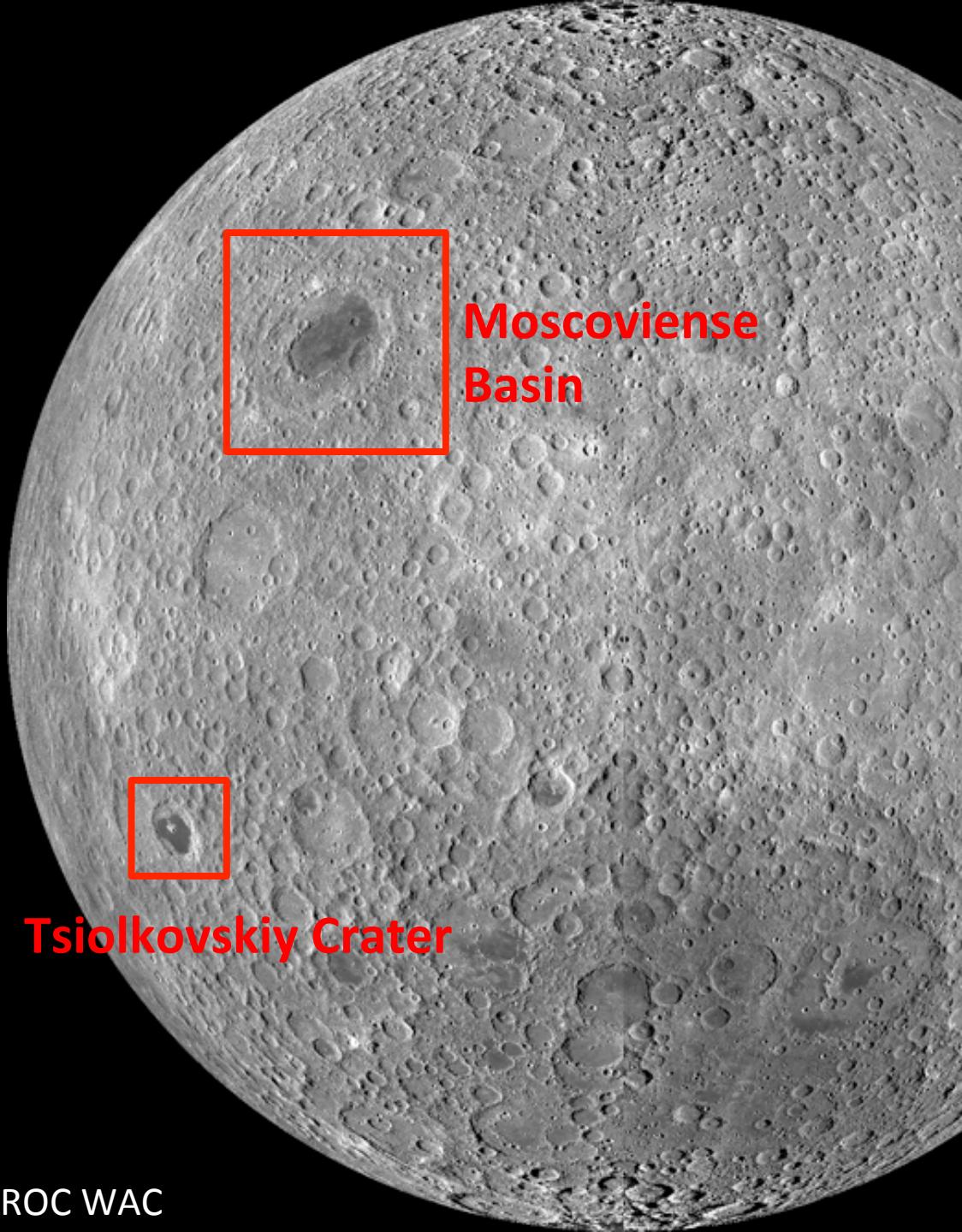
LSF 2012

07/19/12

Moffett Field, CA

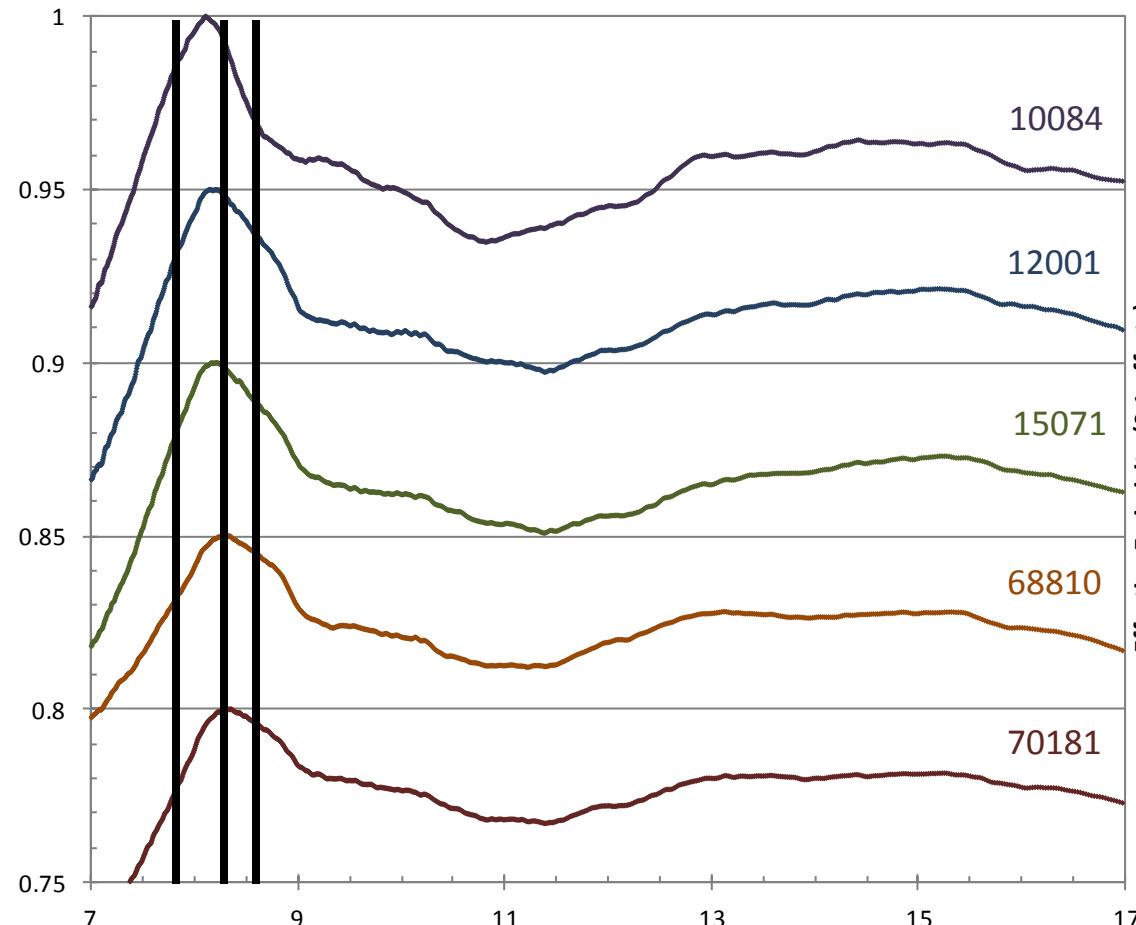
# Why focus on Moscoviense and Tsiolkovskiy?

- Moscovиense Basin is one of the most compositionally interesting sites
- Tsiolkovskiy Crater is one of the most thermophysically interesting sites

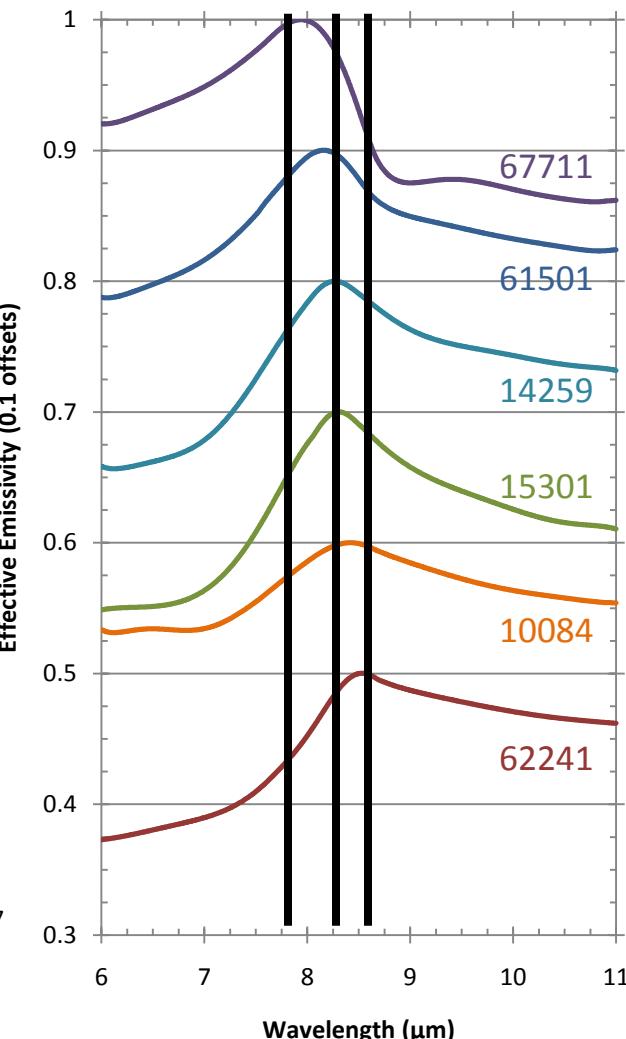


# Characterizing the Christiansen Feature

New Simulated Lunar Environment Measurements



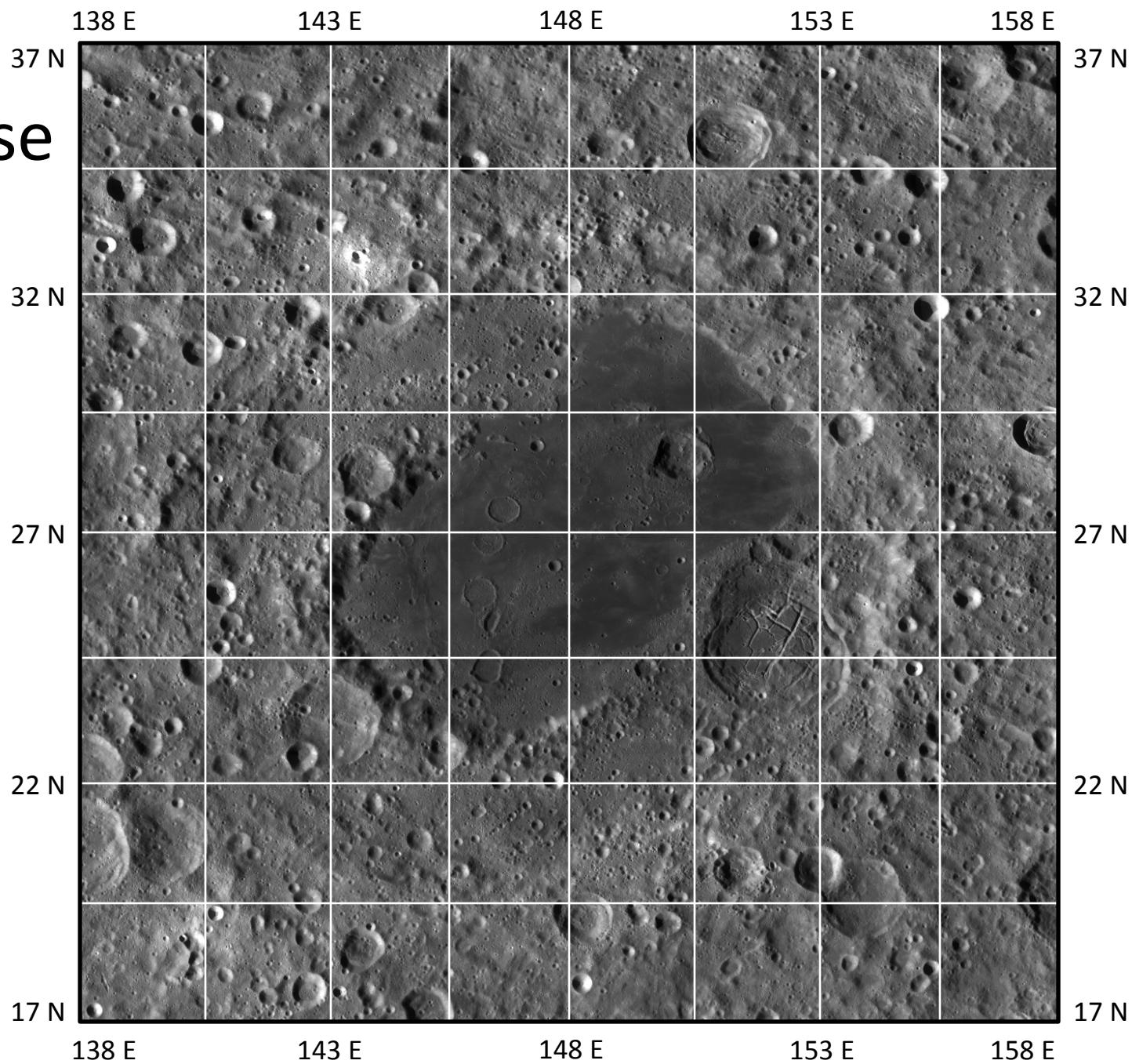
Previous SLE Measurements



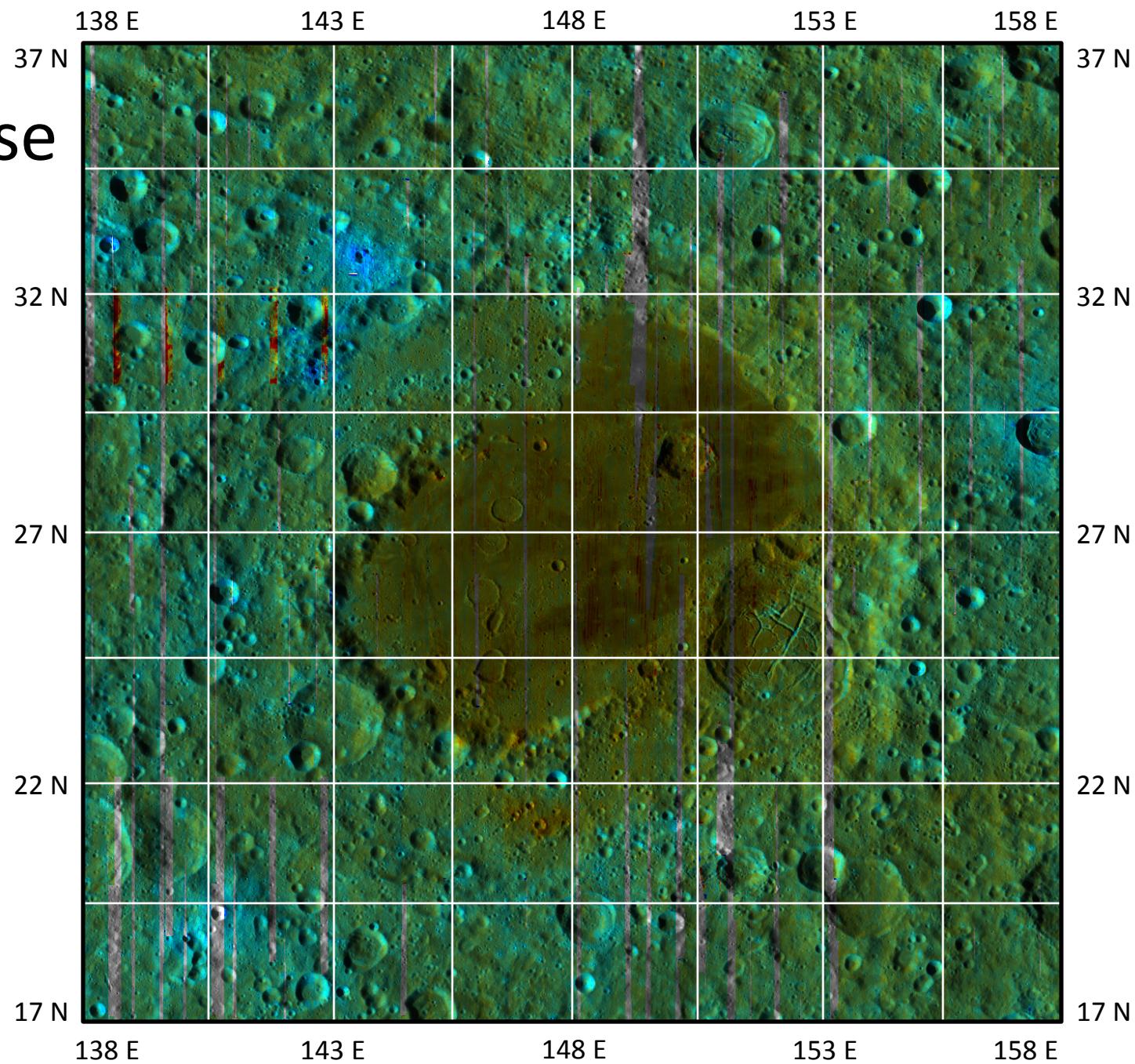
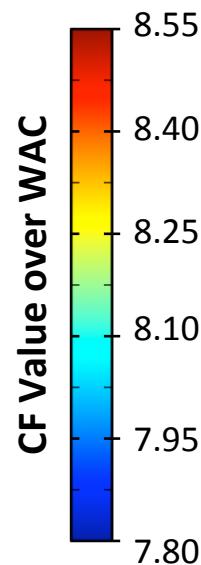
Diviner was designed to characterize the CF using three channels near 8 microns

# Moscoviense Basin

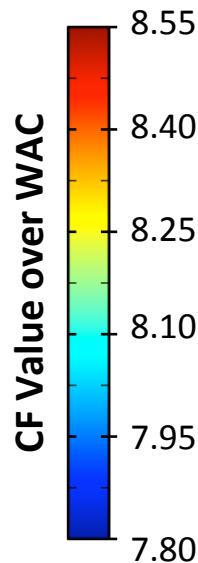
LROC WAC  
Mosaic



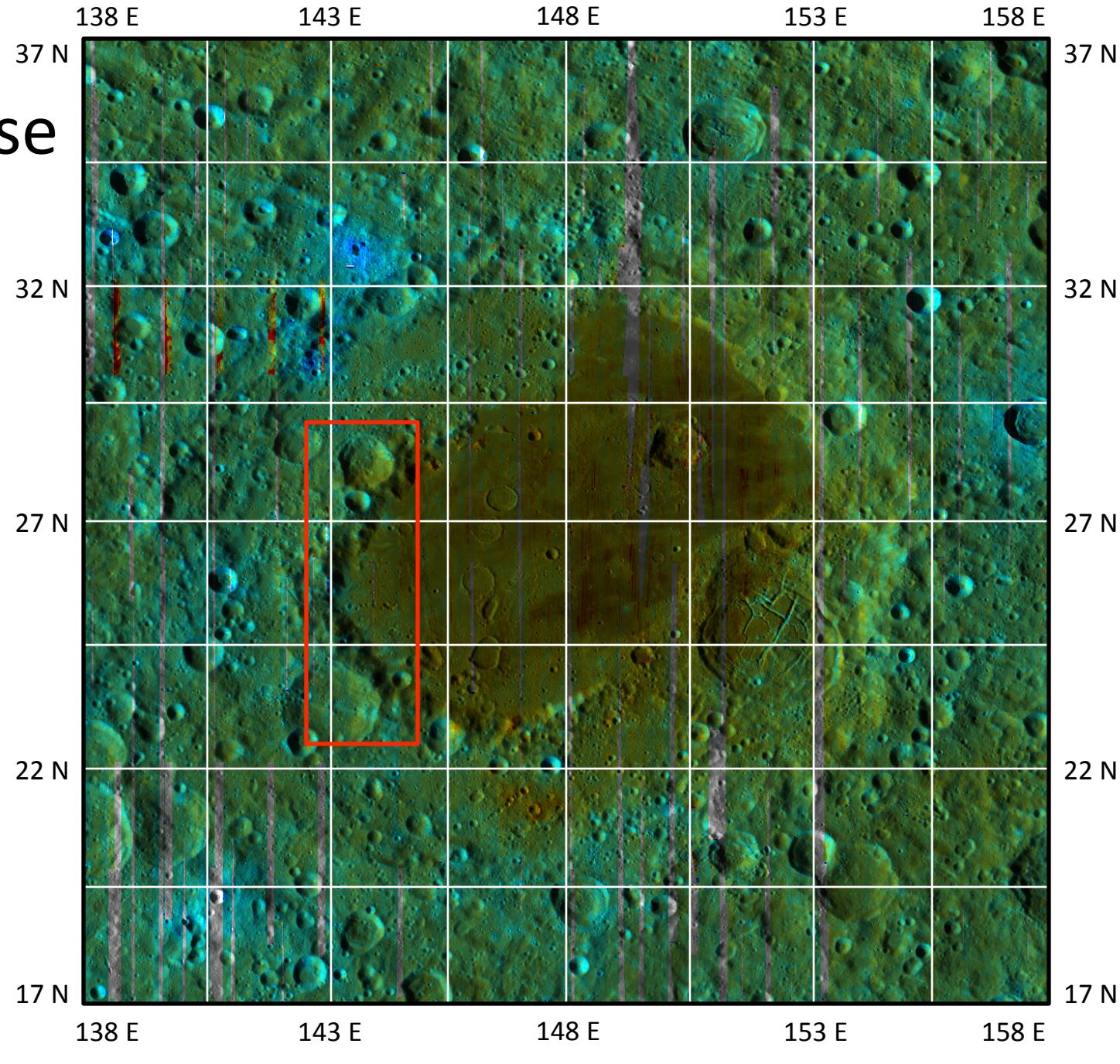
# Moscoviense Basin



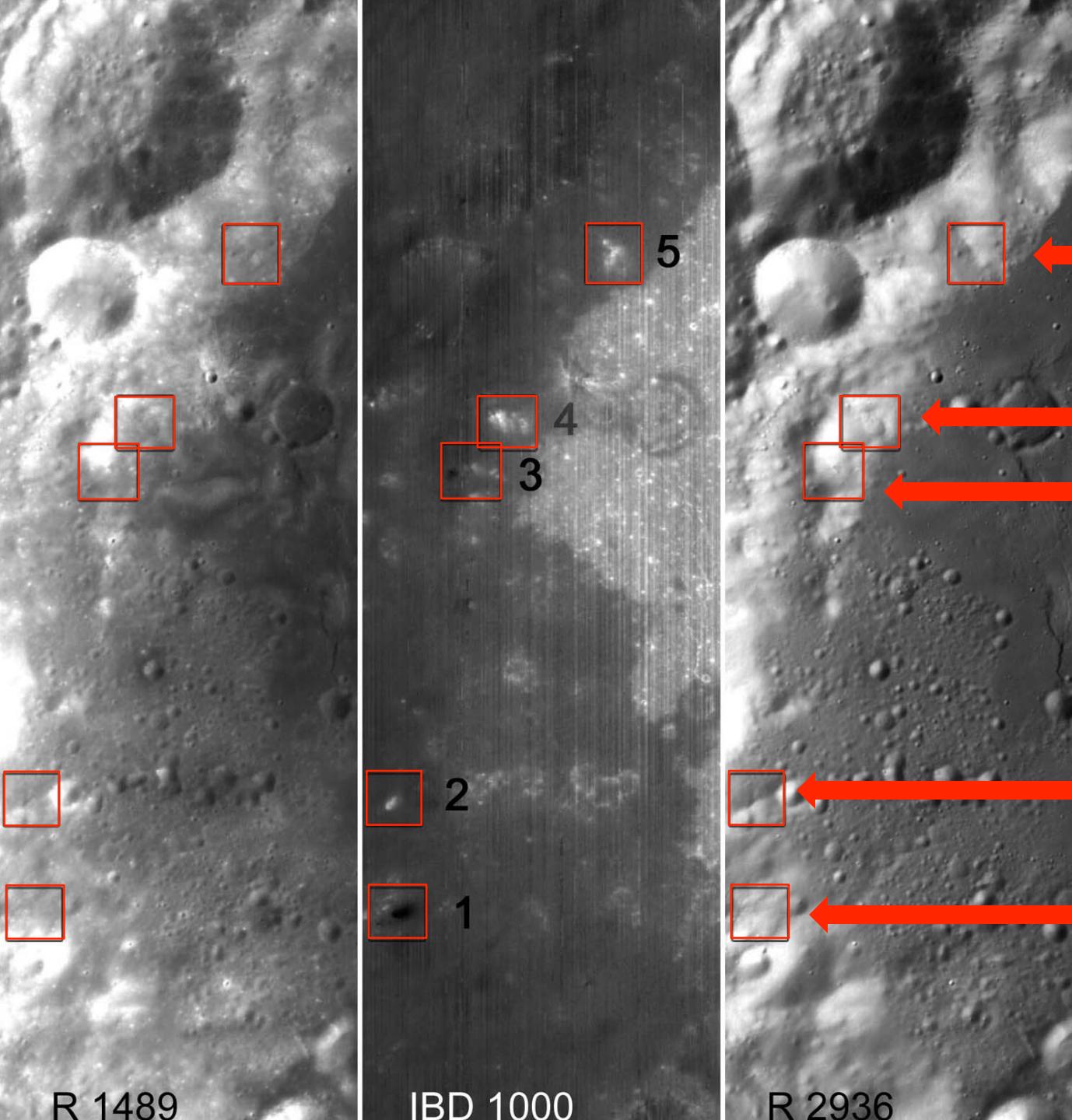
# Moscoviense Basin



Identified as location  
with three unusual  
rock types: nearly  
pure olivine,  
orthopyroxene, and  
Mg-spinel (Pieters et  
al. 2011)



# M3 Discoveries



R 1489

IBD 1000

R 2936

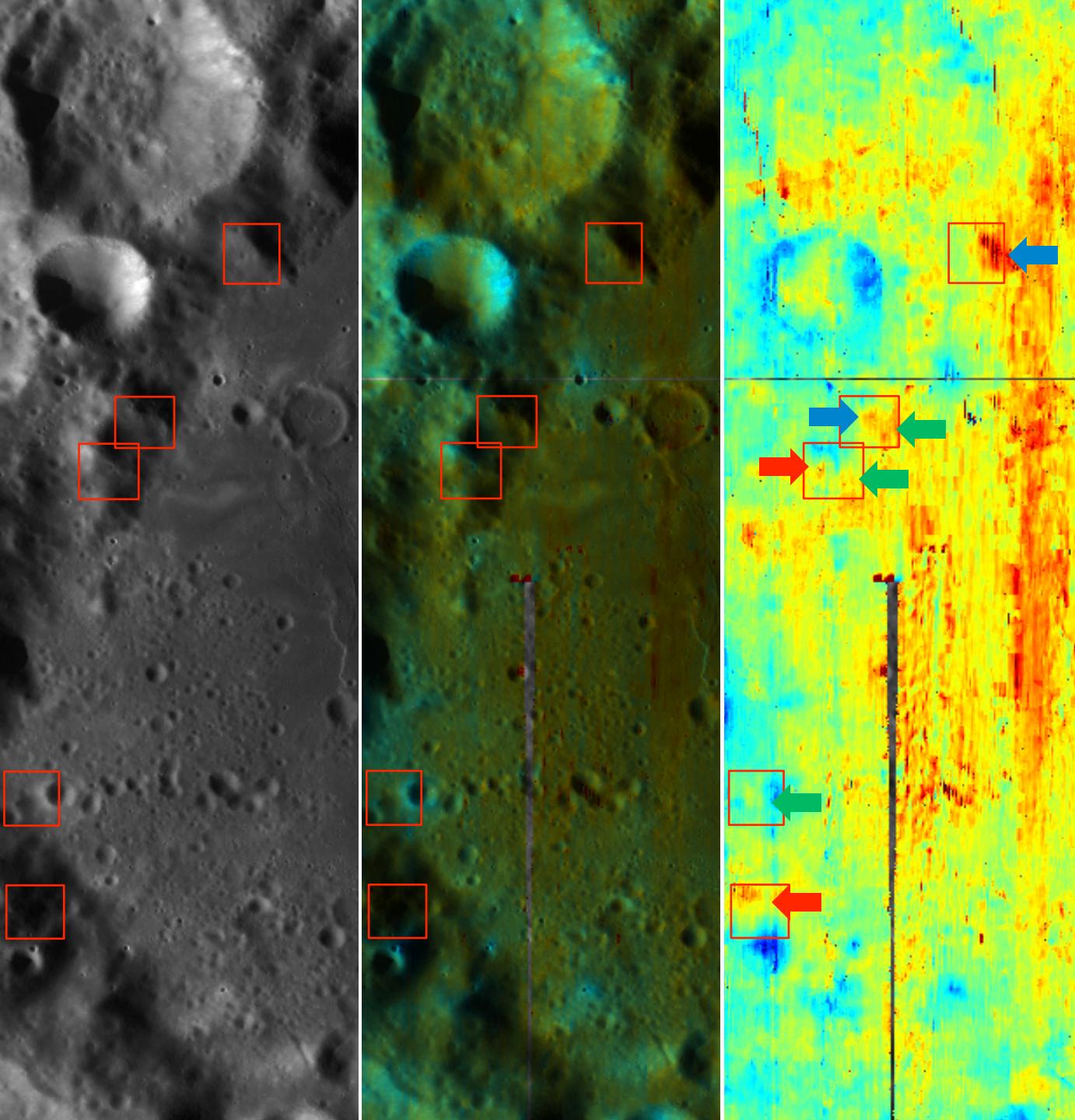
From Pieters et al., 2011

Olivine

Olivine / OPX  
Spinel / OPX

Orthopyroxene

Spinel

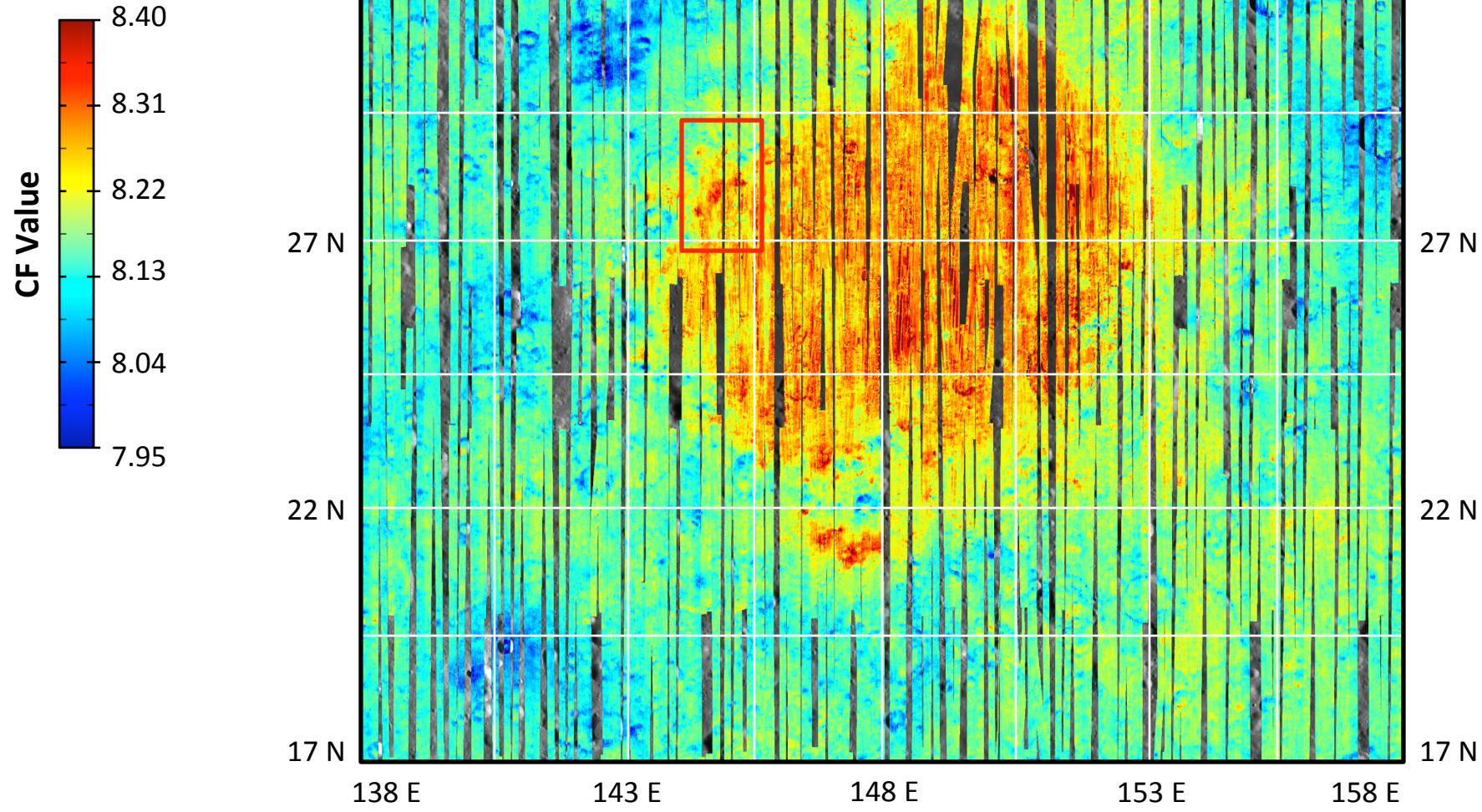


Olivine:  
Moderate-long  
to very long CF  
Values

Orthopyroxene:  
Moderate to  
moderate-long  
CF Values

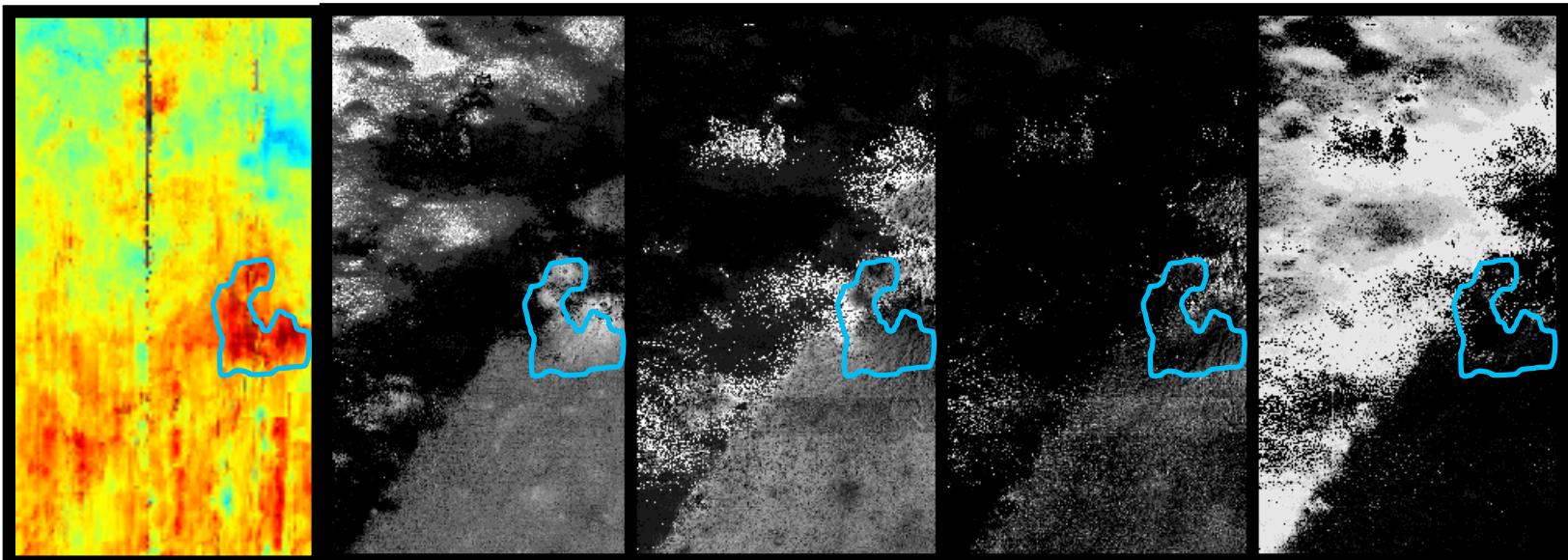
Spinel:  
Moderate-long  
CF Values

# Moscoviense Basin



# Quantitative Mineral Mapping with Diviner + Near-Infrared

Multiband Imager Alone



CF

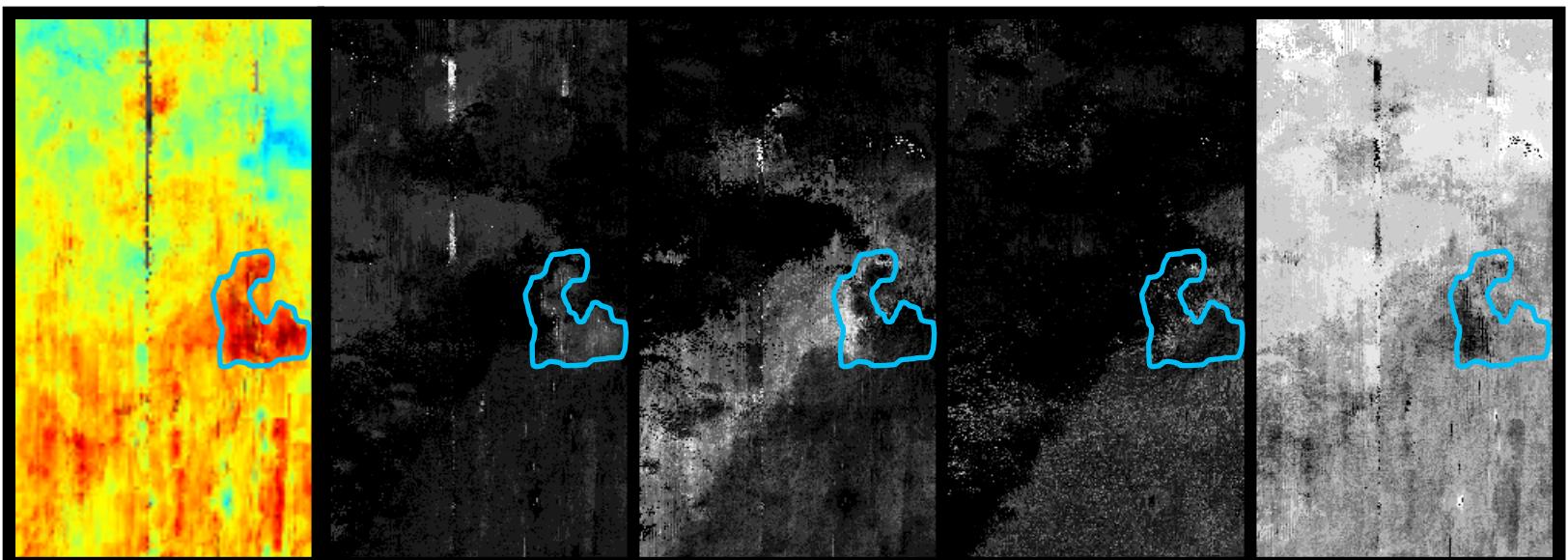
Olivine

OPX

CPX

Plagioclase

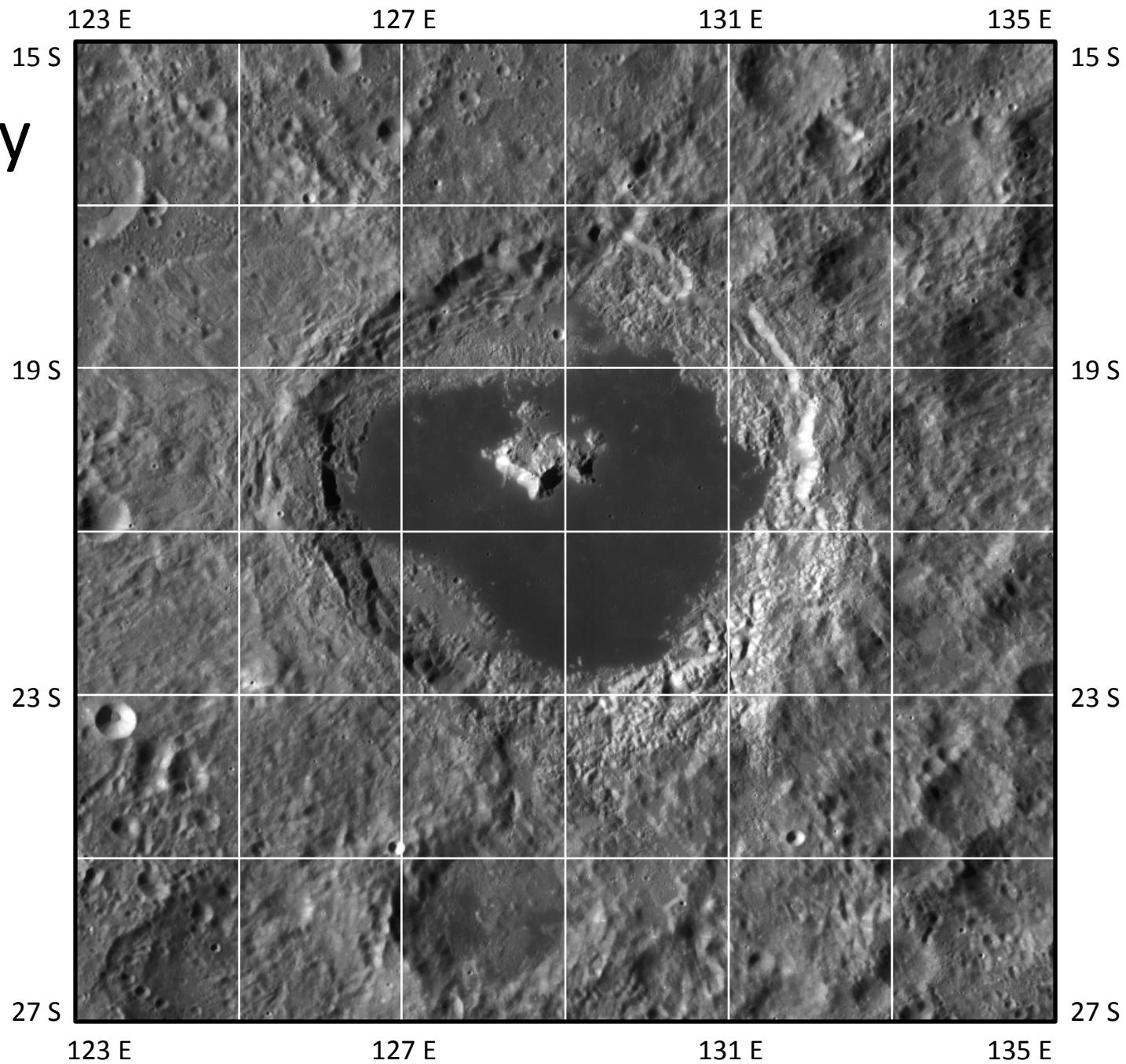
MI Imager + Diviner CF



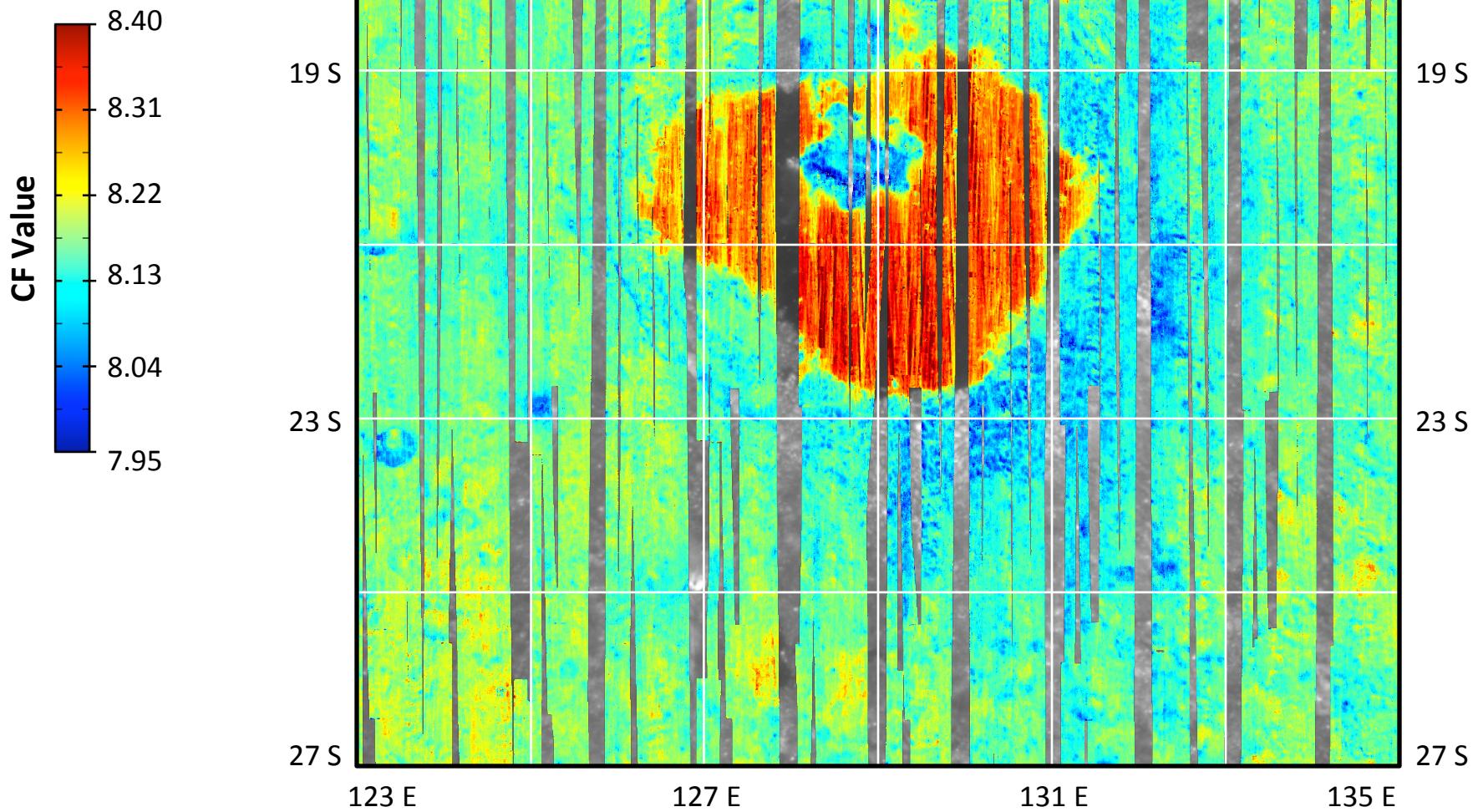
Mineral modeling technique based on Lucey, 2004; Cahill, Lucey, & Wieczorek, 2009

# Tsiolkovskiy Crater

LROC WAC  
Mosaic

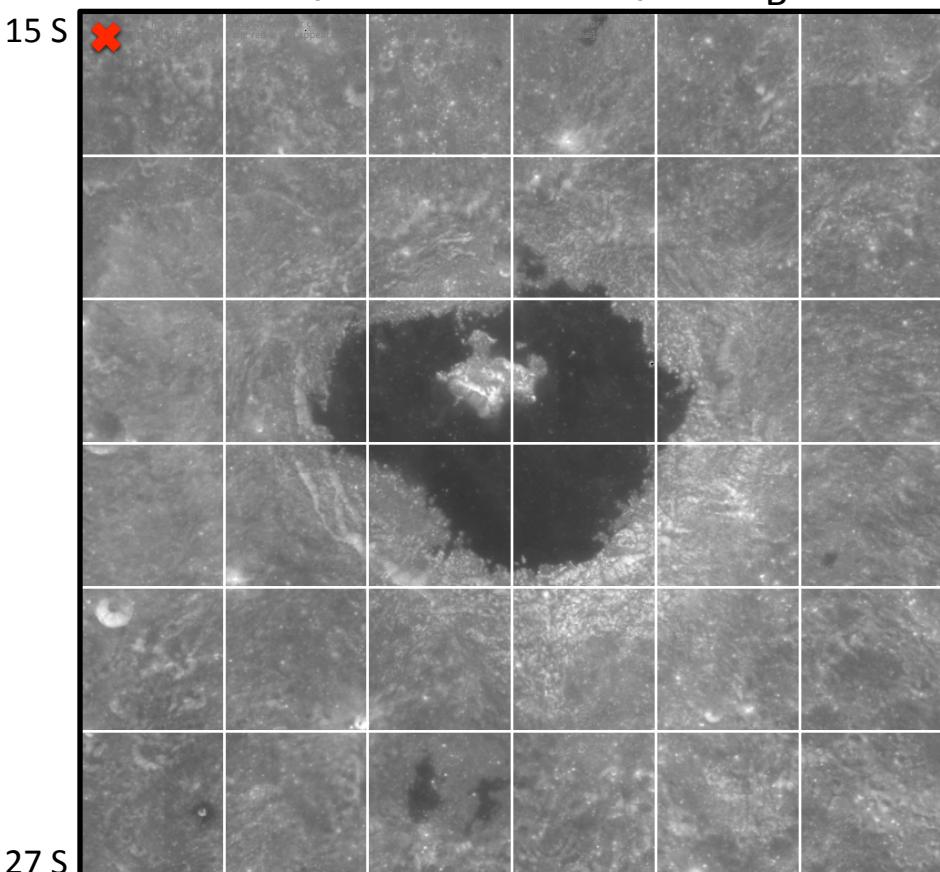


# Tsiolkovskiy Crater

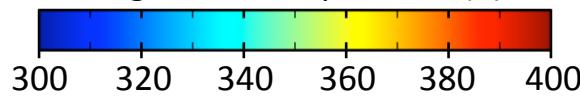


# Tsiolkovskiy Crater Day/Night Temperatures

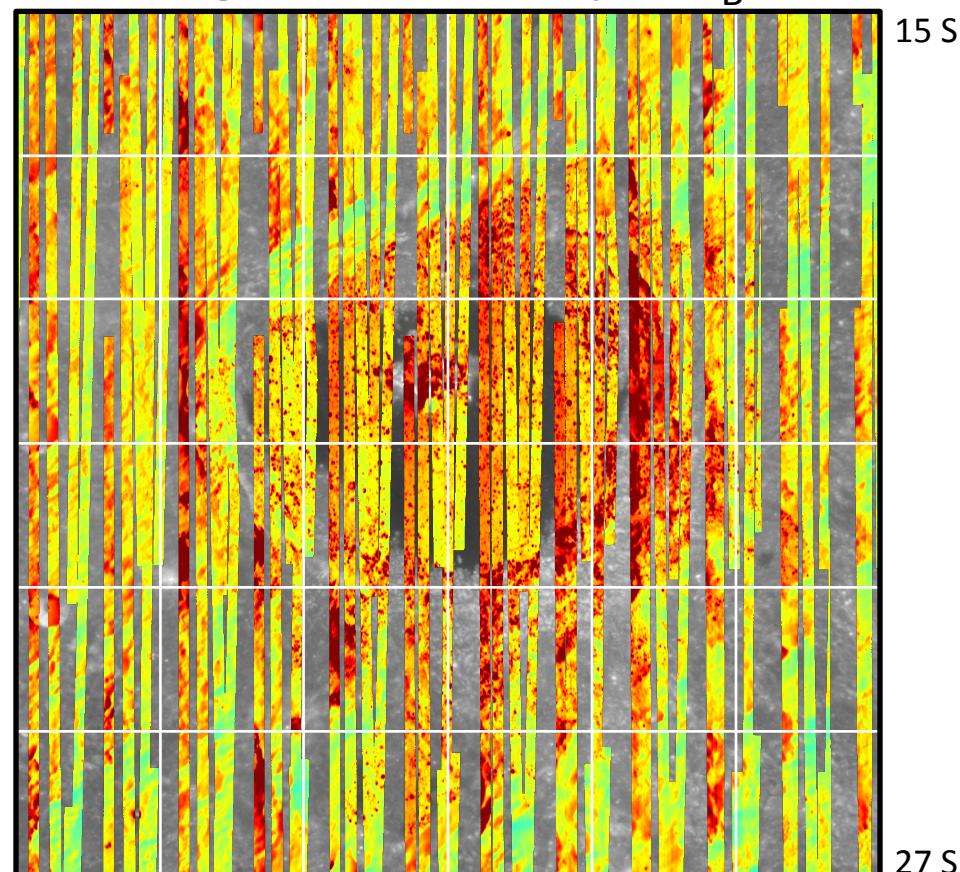
Daytime 26-41  $\mu\text{m}$   $T_B$



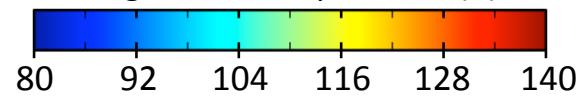
Brightness Temperature (K)



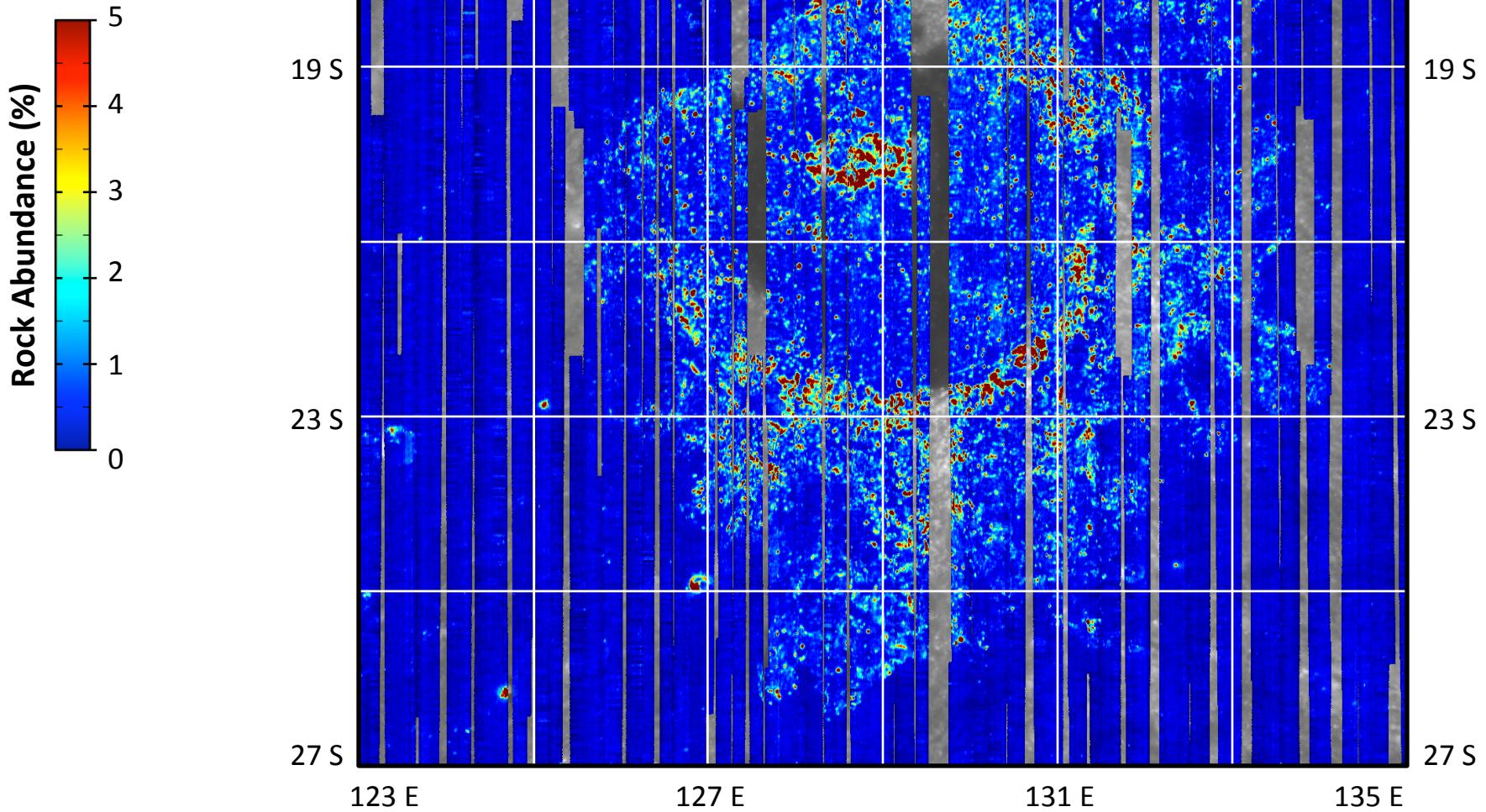
Nighttime 26-41  $\mu\text{m}$   $T_B$



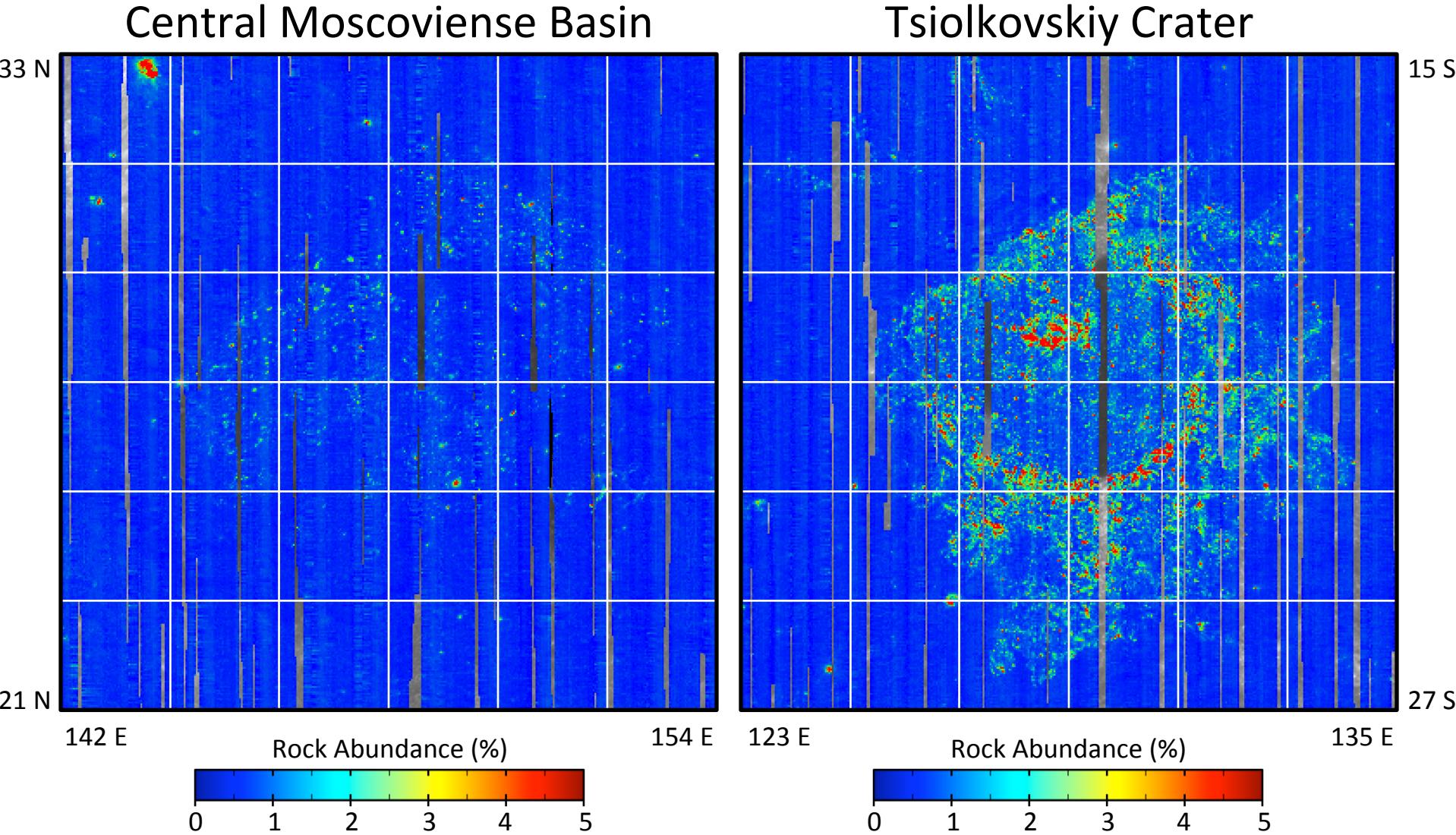
Brightness Temperature (K)



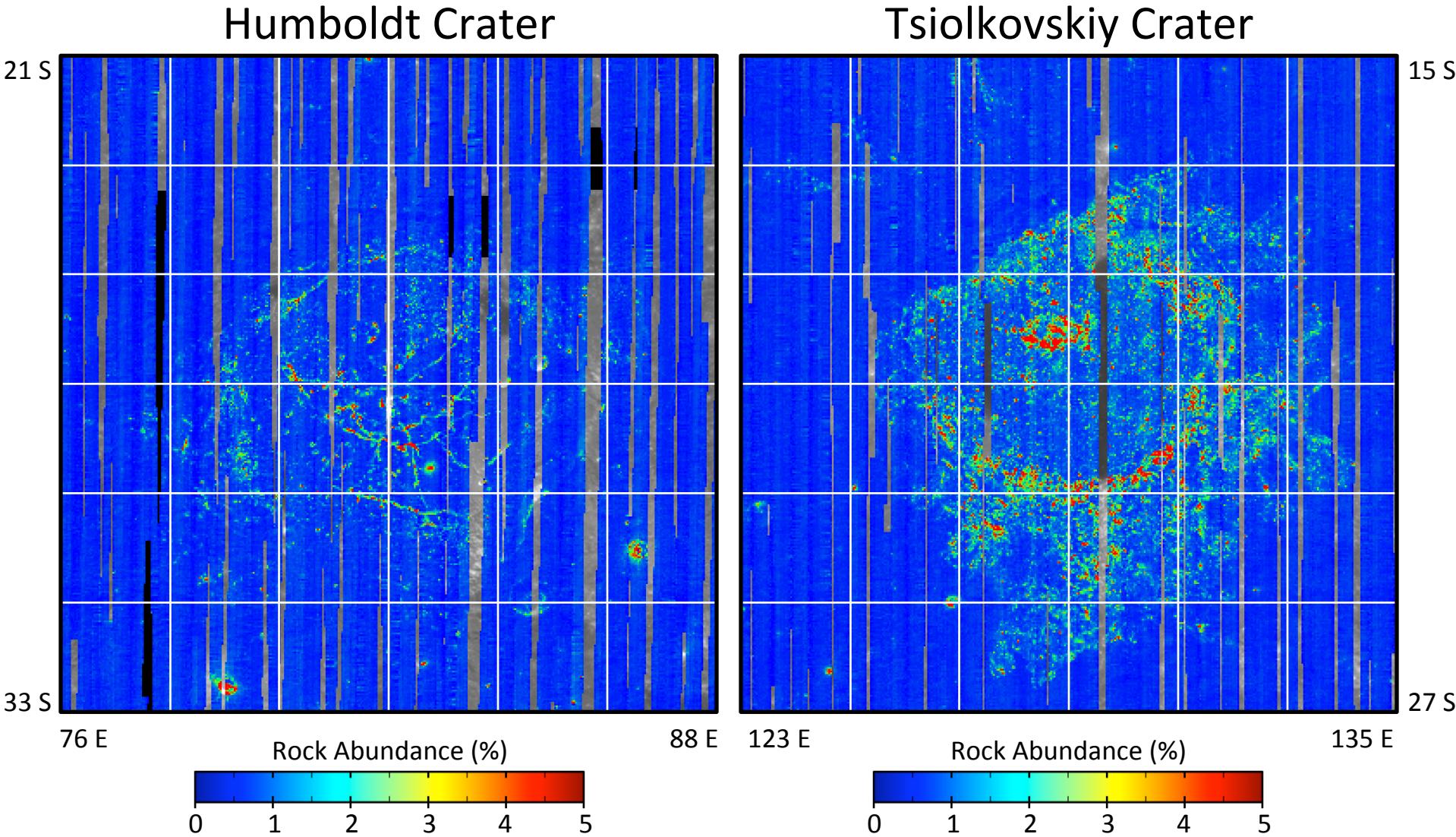
# Tsiolkovskiy Crater



# Moscoviense vs. Tsiolkovskiy Rock Abundance



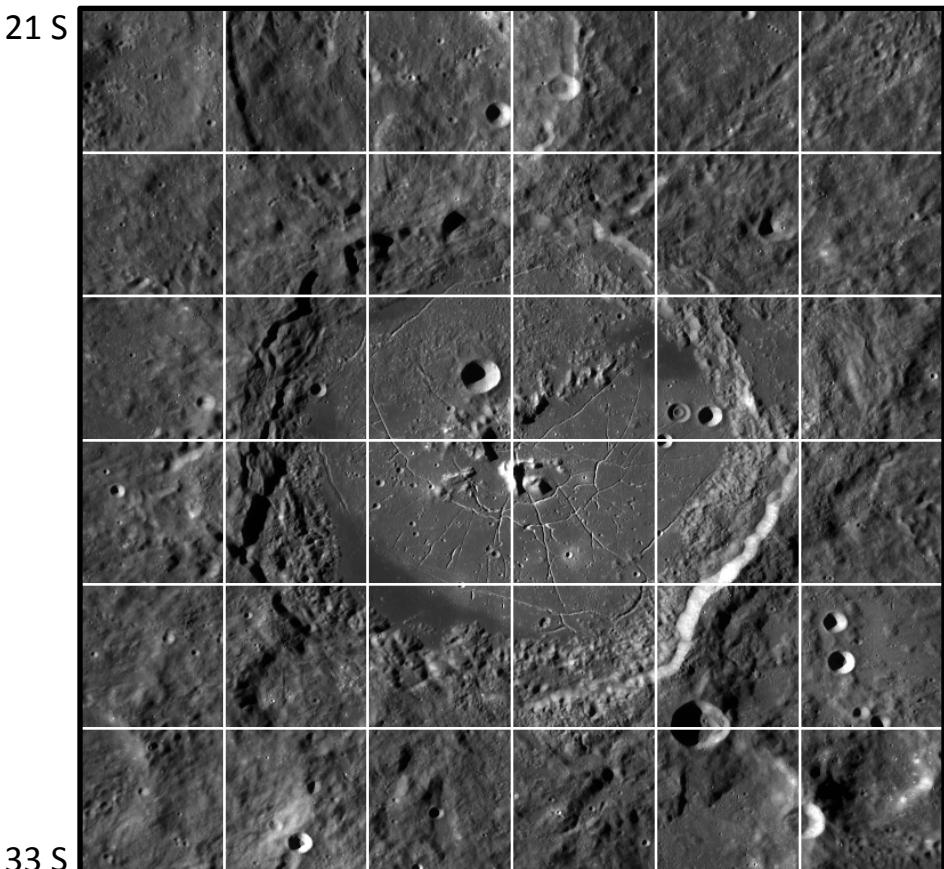
# Humboldt vs. Tsiolkovskiy Rock Abundance



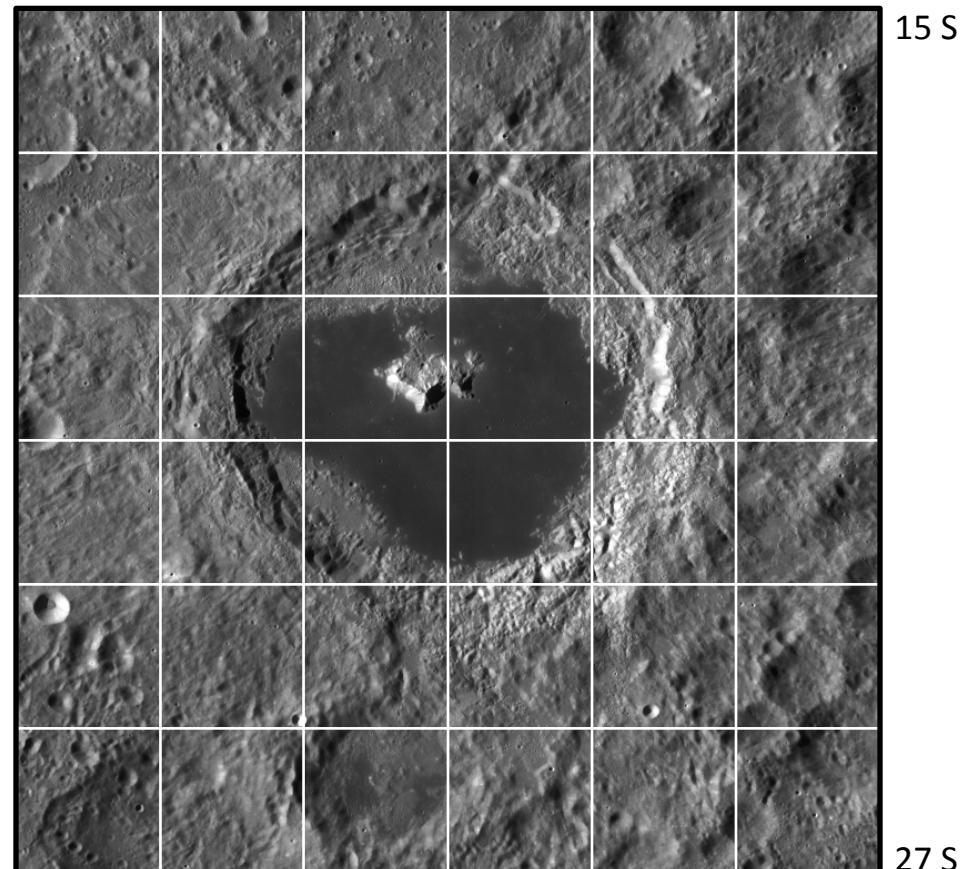
# Humboldt vs. Tsiolkovskiy

## LROC WAC Mosaic

Humboldt Crater

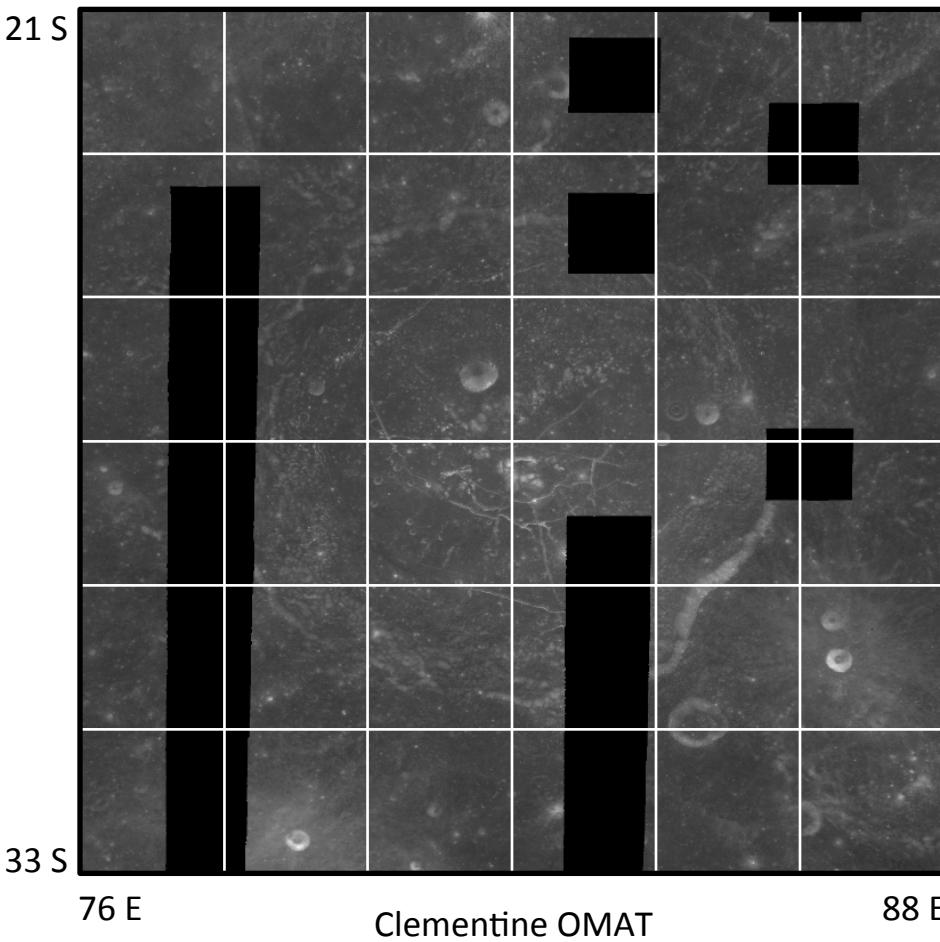


Tsiolkovskiy Crater

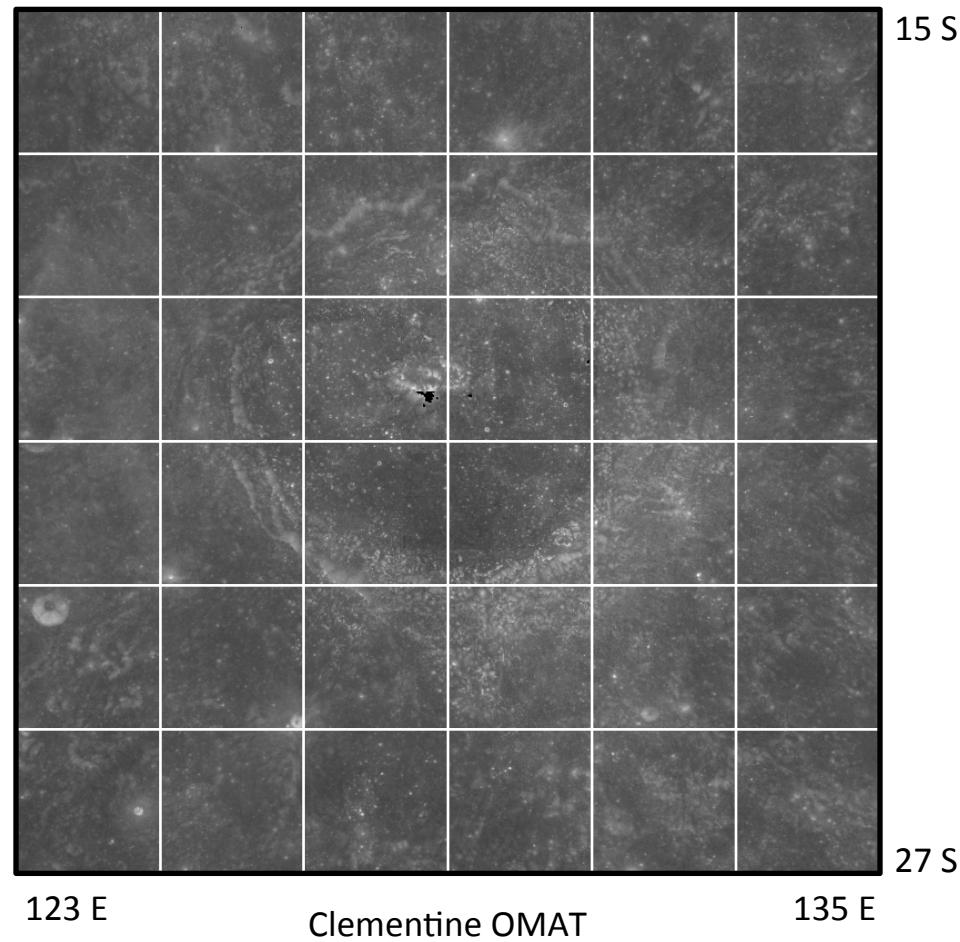


# Humboldt vs. Tsiolkovskiy Soil Maturity

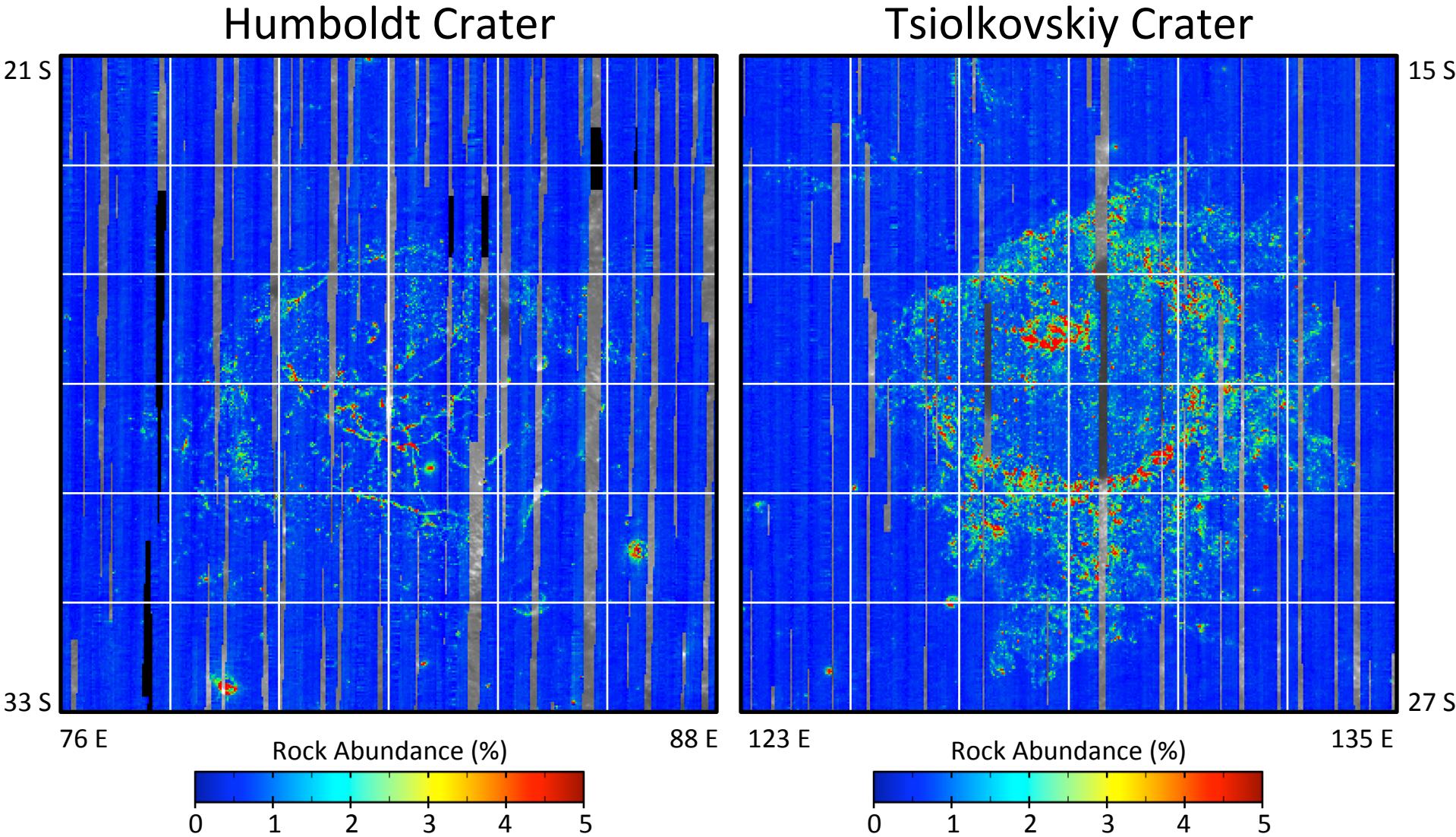
Humboldt Crater



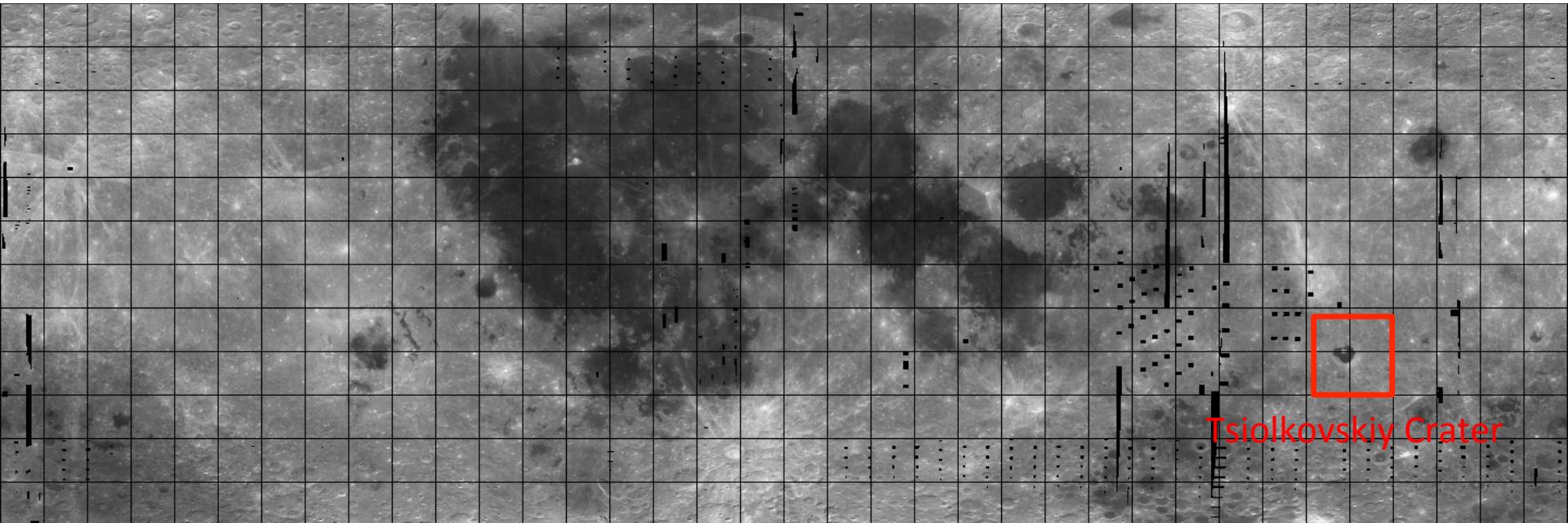
Tsiolkovskiy Crater



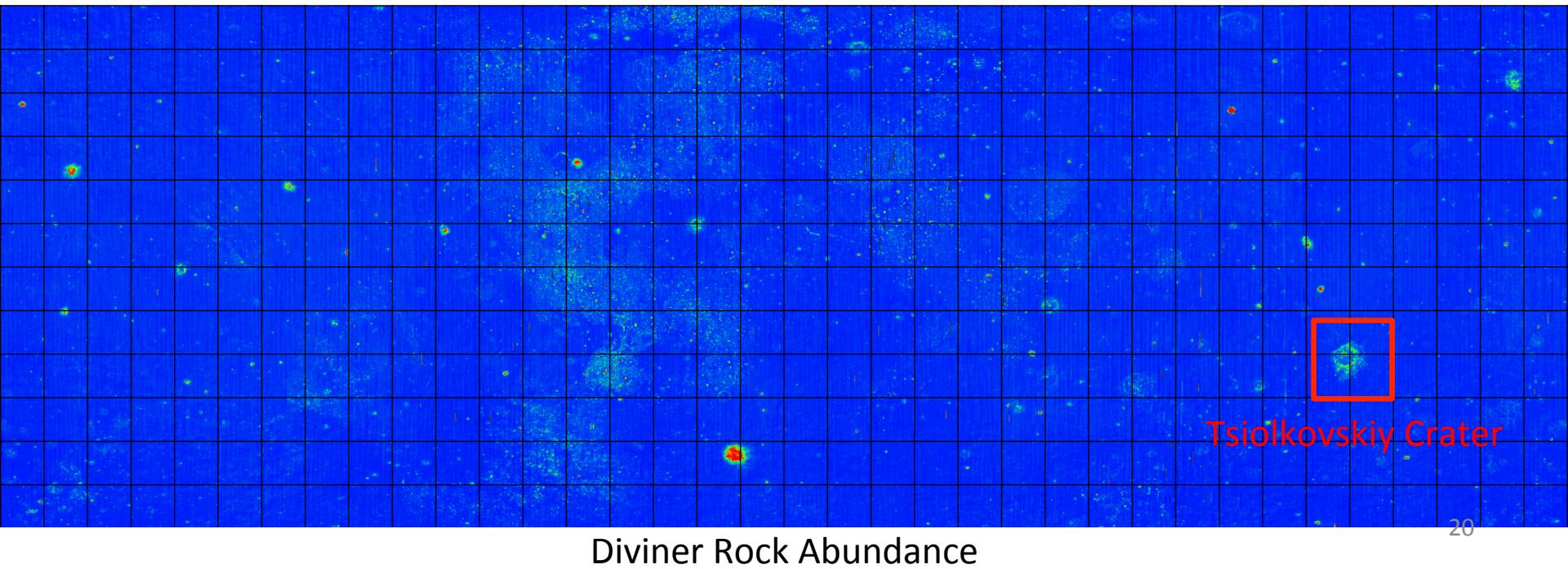
# Humboldt vs. Tsiolkovskiy Rock Abundance



# Clementine Albedo



Tsiolkovskiy Crater

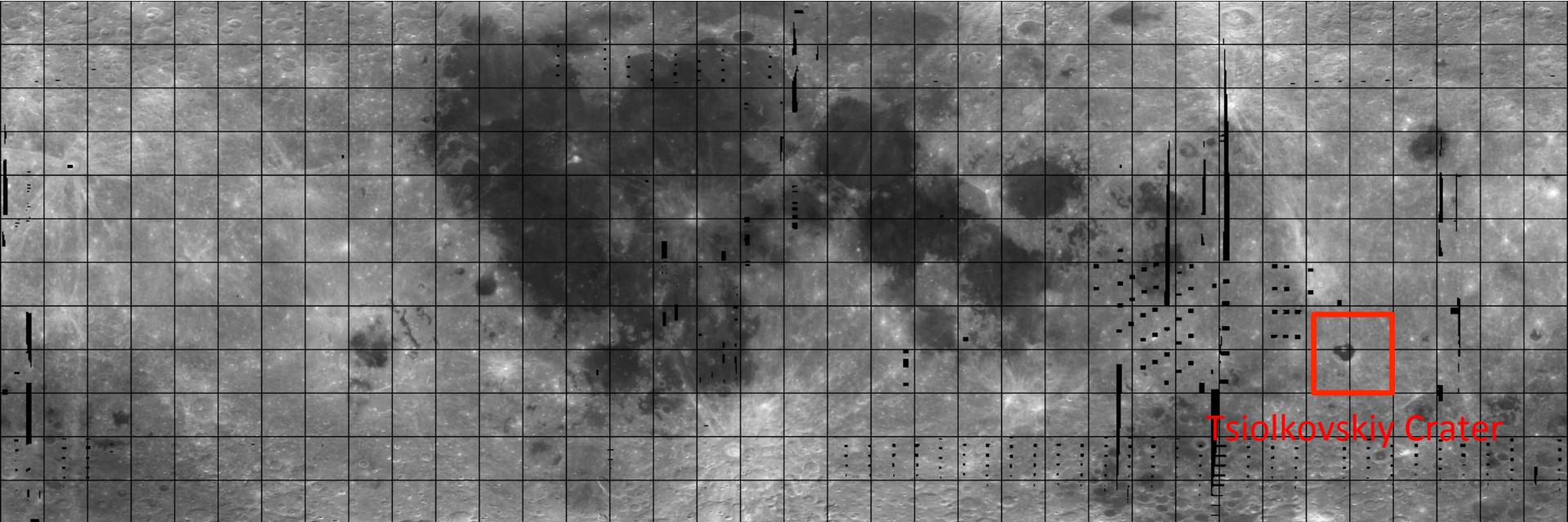


Tsiolkovskiy Crater

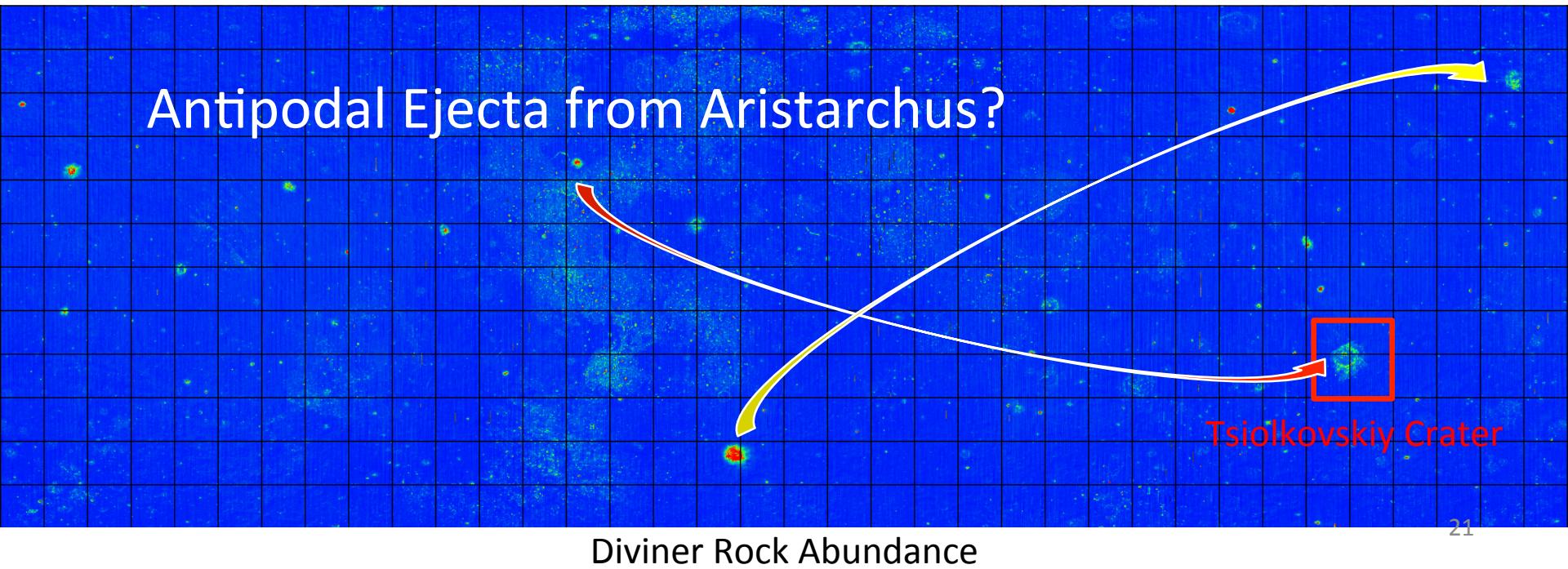
Diviner Rock Abundance

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# Clementine Albedo



Tsiolkovskiy Crater



Tsiolkovskiy Crater

Diviner Rock Abundance

# What the is going on?!

	Aristarchus Antipodal Ejecta	Massive Impact Melt Deposits	Iron-rich Impactor	Incorrectly Dated
Pro	“Blocky” material in Tsiolkovskiy ejecta blanket is antipodal to Aristarchus	Tsiolkovskiy is believed to have thick impact melt deposits	Iron-metal has high thermal conductivity	Tsiolkovskiy would “look right” if it were 1-2 Ga
Con	Aristarchus is likely too small to have produced enough ejecta	What’s exposing new blocky material?	What’s the mechanism for concentrating iron-metal	No reason to question existing crater counts

Maybe the explanation requires additional mechanism and/or some combination of proposed mechanisms

- Aristarchus ejecta exposed new blocky material (e.g. caused landslides)
- Aristarchus ejecta secondary impacts “contaminated” age estimates
- ?????

# Conclusions

- The Moon is a strange and fascinating place
- Moscoviense is compositionally unique
  - Excellent location to study a diverse range of mineralogies in close proximity (sample return!)
  - Test site for understanding feldspar-mafic ratio
- Tsiolkovskiy Crater is thermophysically unique and compositionally interesting
  - Any of the suggested formation/evolution mechanisms make a compelling case for future exploration
- The Diviner compositional and thermophysical datasets in PDS have “discovery” potential.