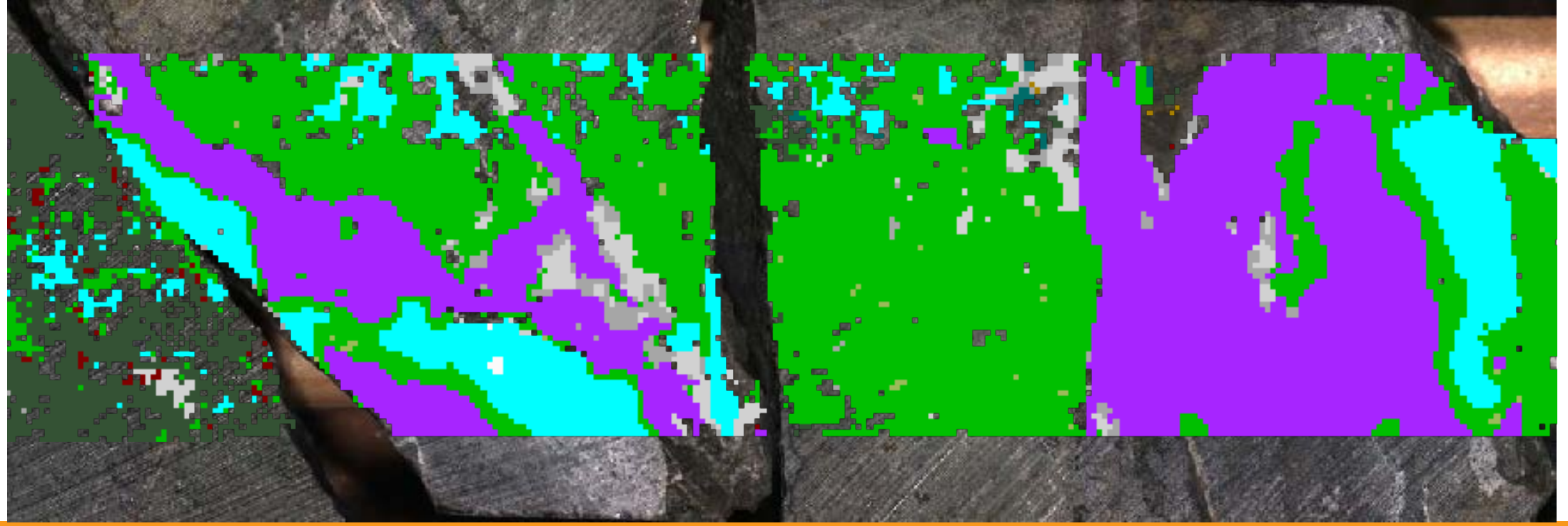

Introduction to Hyperspectral Core Imaging

Britt Bluemel, MSc | Principal Geochemist, Corescan

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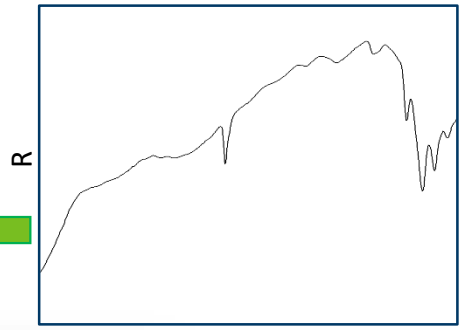
Who is Corescan?

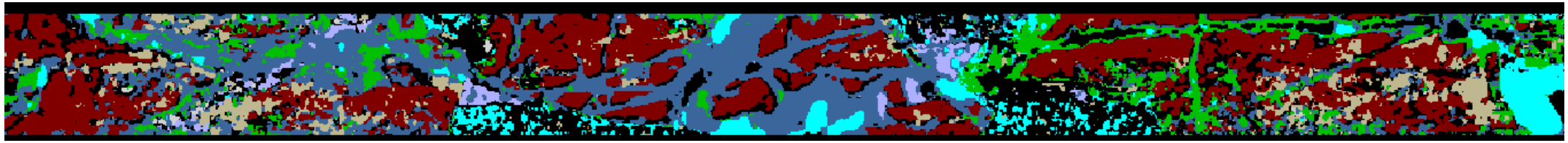
Ops Team

Spectral Geologists



Processing software

Phlogopite | Sericite | Chlorite | Montmorillinite | Kaolinite | Calcite | Tourmaline



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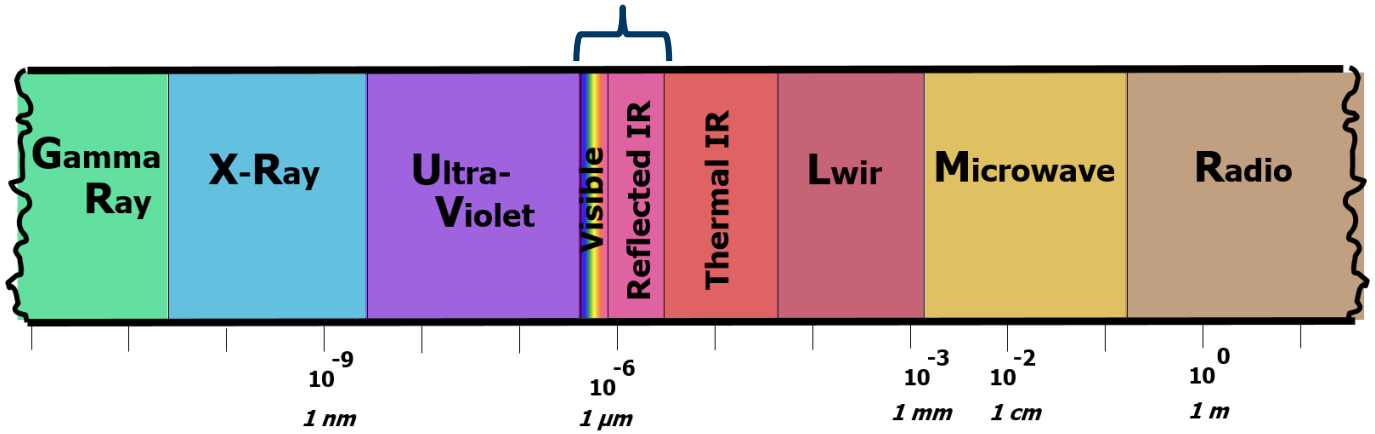
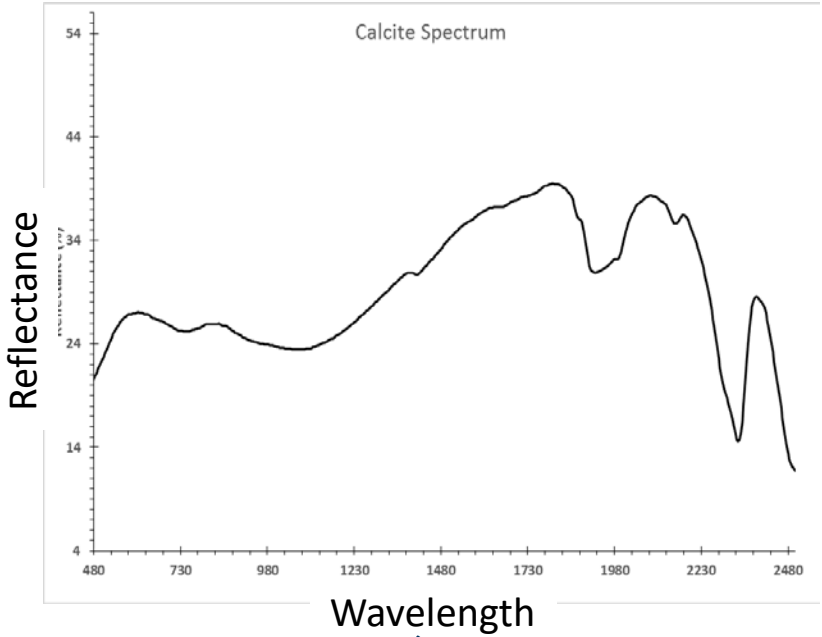
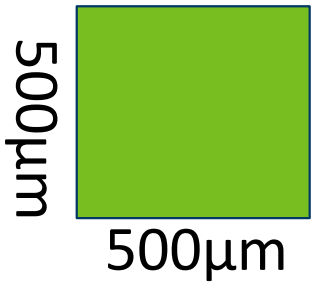
What is hyperspectral imaging?

- The imaging of earth materials in hundreds of contiguous, narrow bands across the electromagnetic spectrum from 450-2500nm





The surface of the core is imaged in ~200,000 pixels per meter; each 500 µm x 500 µm pixel has a single extracted spectral signature

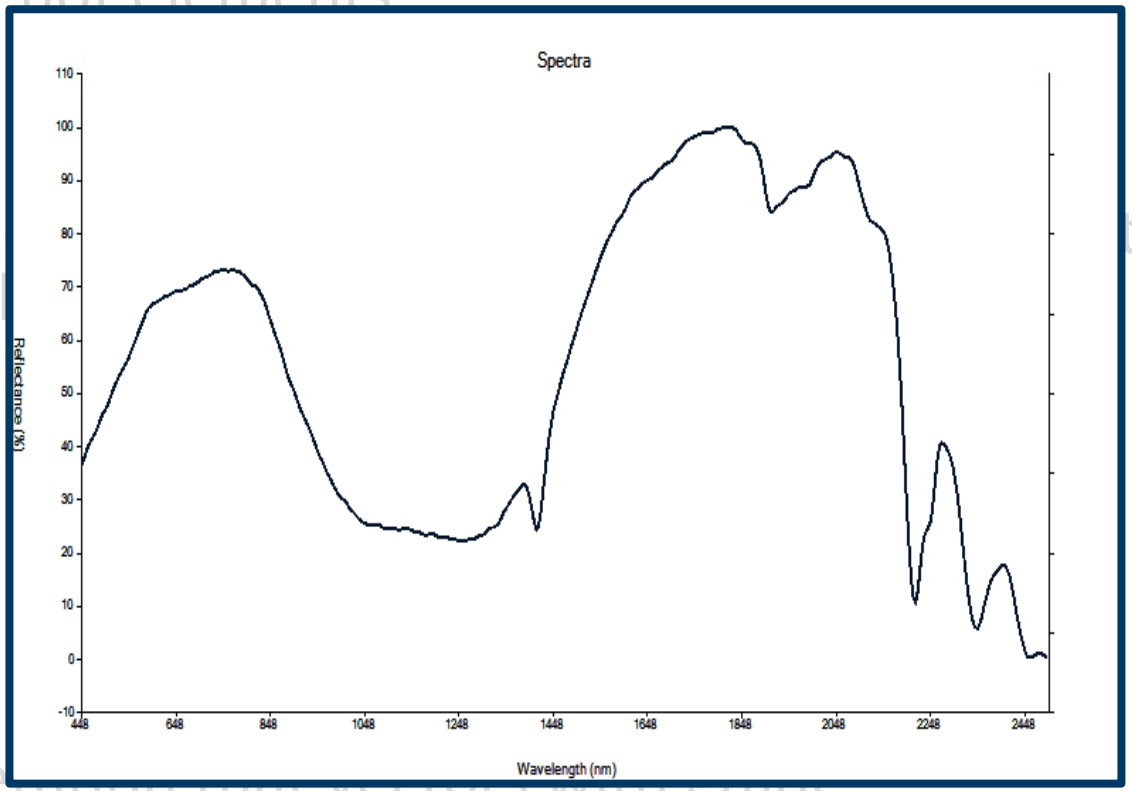


Absolute Mineral Identification

- We mine minerals, not elements
- The value of the metal in the rock is directly influenced by the other minerals in that rock
- Quantifying ‘Value Modifiers’
- Identifying the alteration as vectors to grade

Absolute Mineral Identification

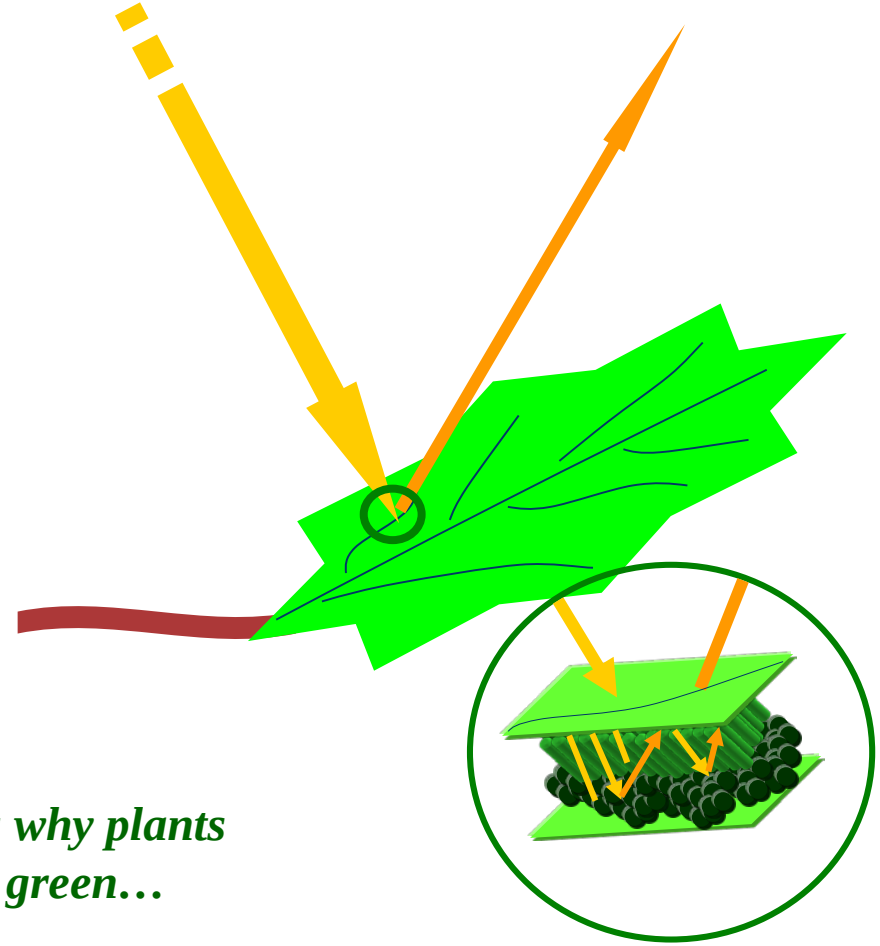
- We mine minerals, not elements
- The value of the m… the other minerals in t…
- Quantifying ‘Value…
- Identifying the alte… with grade



What is ‘true’ rock character?

IR Spectroscopy : Reflectance and Absorption

- When radiation interacts with a material, it can absorb (and possibly transmit) and it can partly scatter and/or reflect



This is why plants are green…

Reflectivity (r)

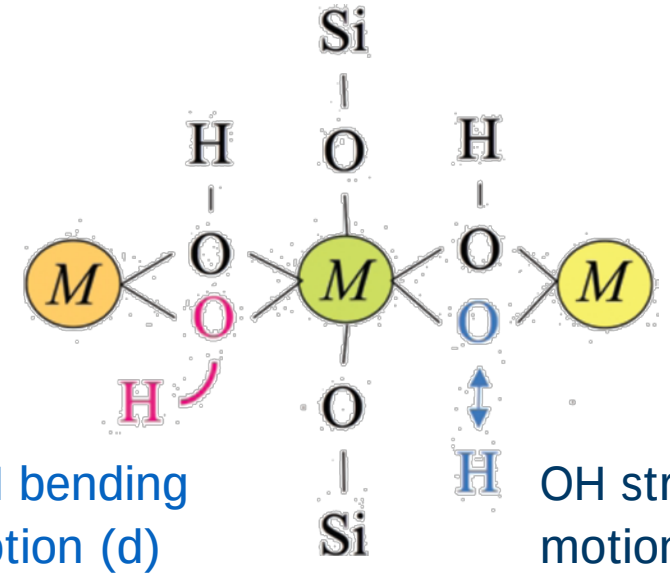
- A function of how much energy is reflected vs. how much energy was incident

So what happens during absorption?

- Incident energy interacts with a material (*in this example, a leaf*)
- Some energy is reflected right back out (*such as the light shown reflecting off of the spongy dark green cells in the leaf at right; the green and infrared wavelengths*)
- Other energy is absorbed by the material (*shown occurring in the lighter green palisade cells and dark green spongy cells; the blue and the red wavelengths*)

Vibrational Processes

- Vibrational energies of these motions depend on which cations occupy the octahedral sites (M)
- Also coordination of the crystal influences OH vibration (i.e. dioctahedral = 2 M-sites filled vs. trioctahedral = all M-sites filled).



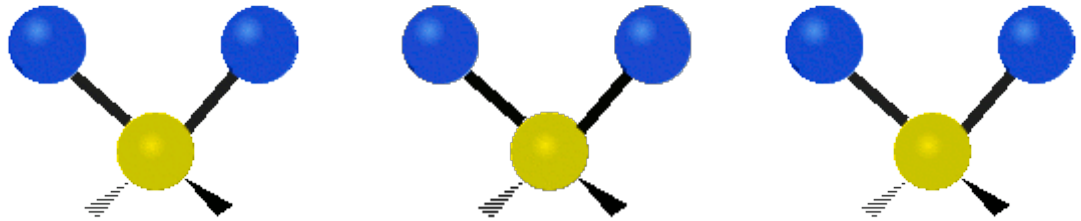
OH bending motion (d)

OH stretching motion (n)

Asymmetrical stretch

Symmetrical stretch

Bending



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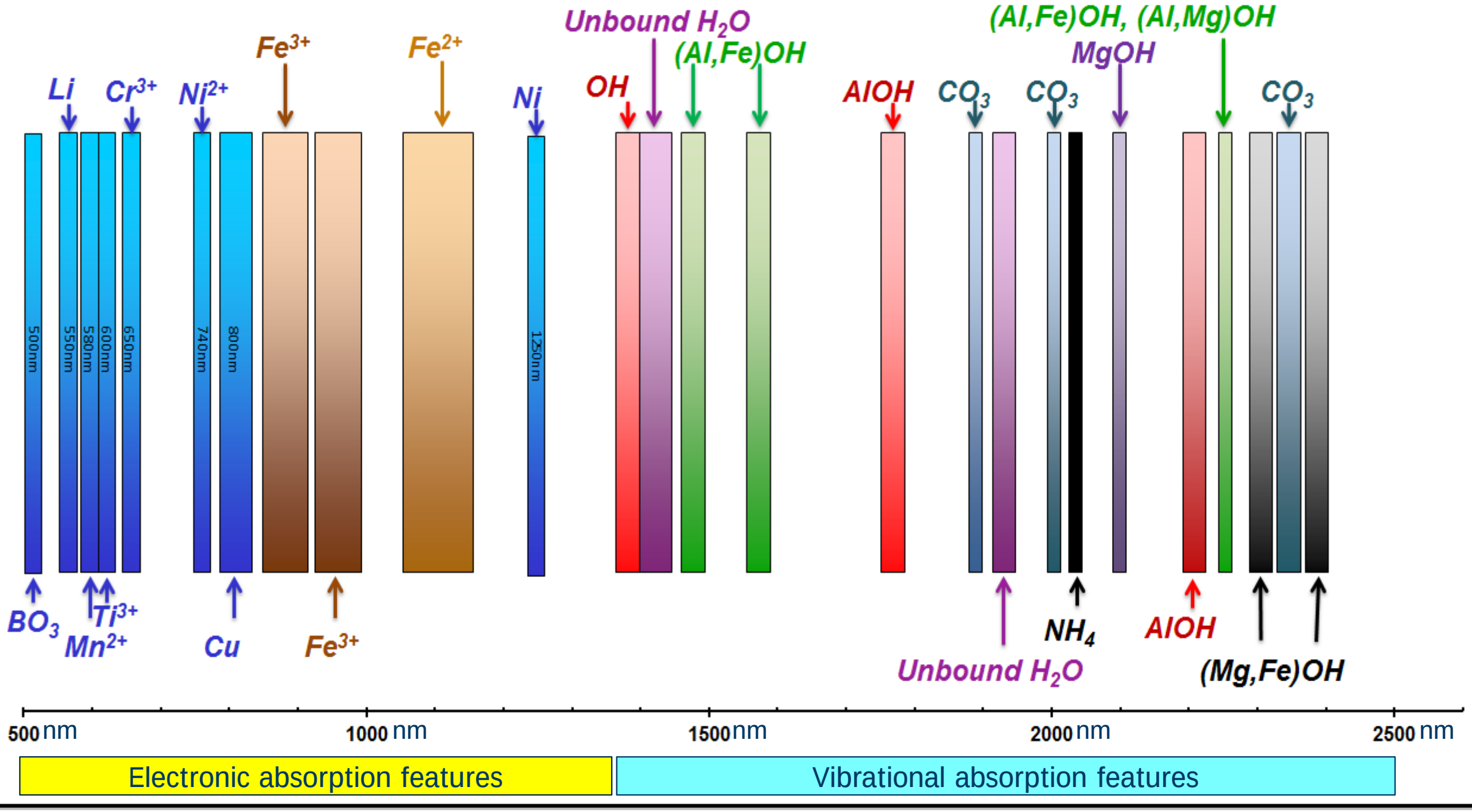
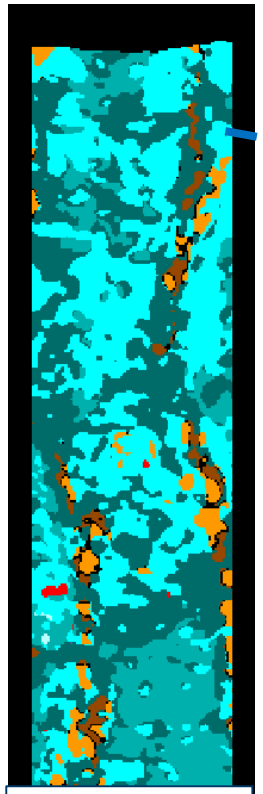

Li
Cr3+
Ni2+
Fe3+
Fe2+
Ni
Unbound H2O
OH
(Al,Fe)OH
AlOH
CO3
CO3
MgOH
(Al,Fe)OH, (Al,Mg)OH
CO3
500nm
550nm
580nm
600nm
650nm
740nm
800nm
1250nm
BO3
Mn2+
Ti3+
Cu
Fe3+
Unbound H2O
NH4
AlOH
(Mg,Fe)OH
500 nm
1000 nm
1500 nm
2000 nm
2500 nm
Electronic absorption features
Vibrational absorption features

Hyperspectral Imaging *or* Imaging Spectroscopy

50µ Core Photo

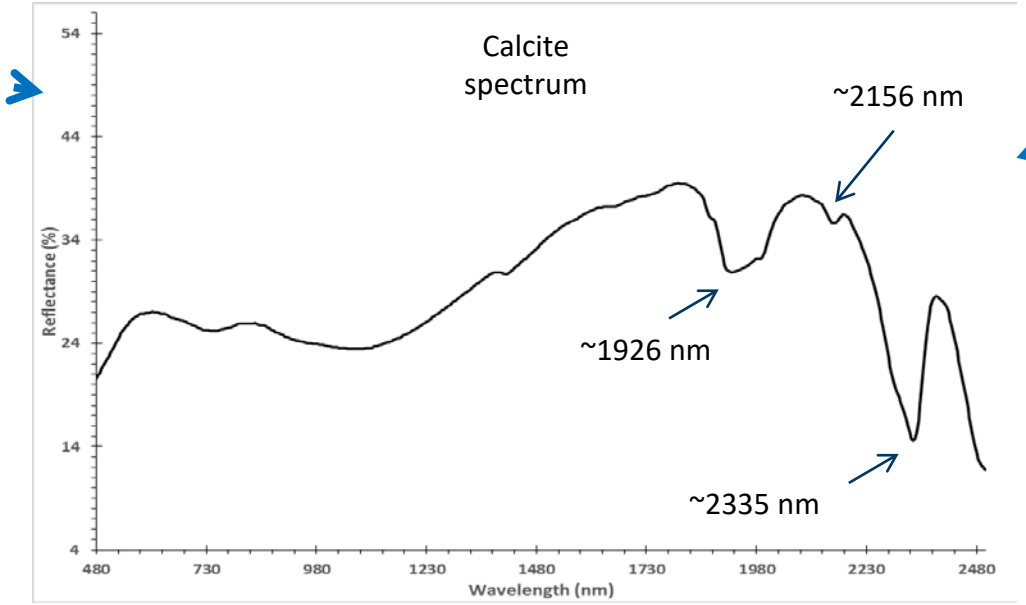
50 mm

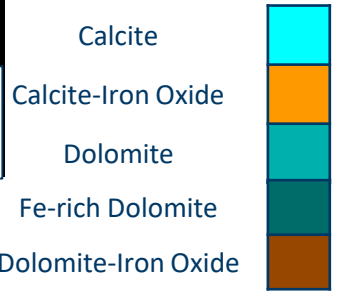
Mineral Class Map



50 mm

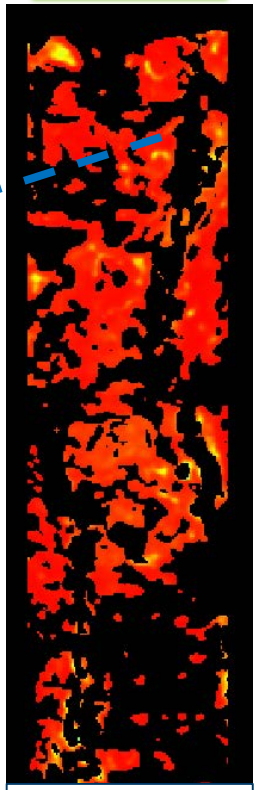
- Each single spectral signature contains 'absorption features', 'shoulders' and 'slopes' that quantifiably and uniquely identify specific minerals



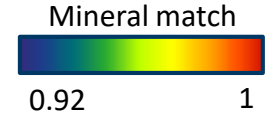


- The spectral features that identify calcite are like fingerprints; hyperspectral is absolute identification of mineralogy

Calcite Match



50 mm



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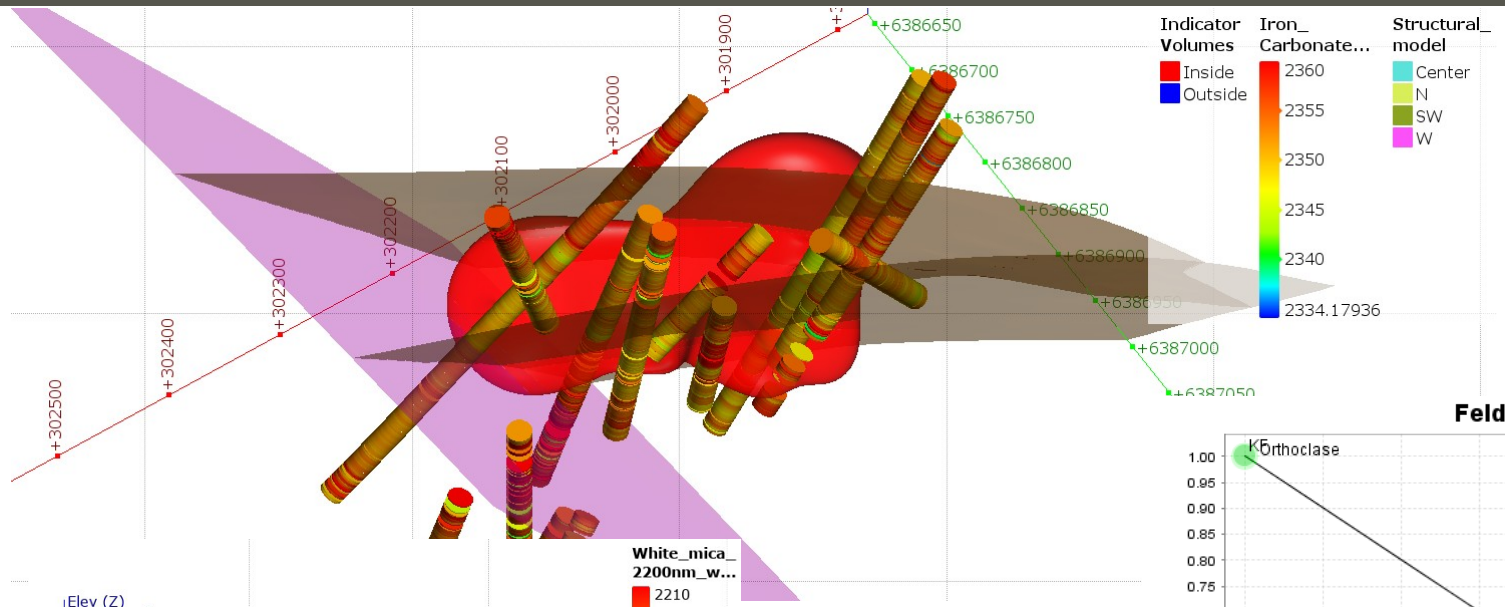
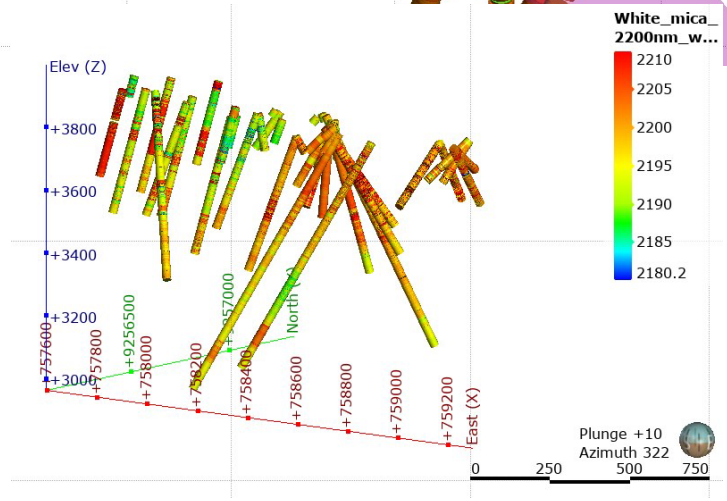
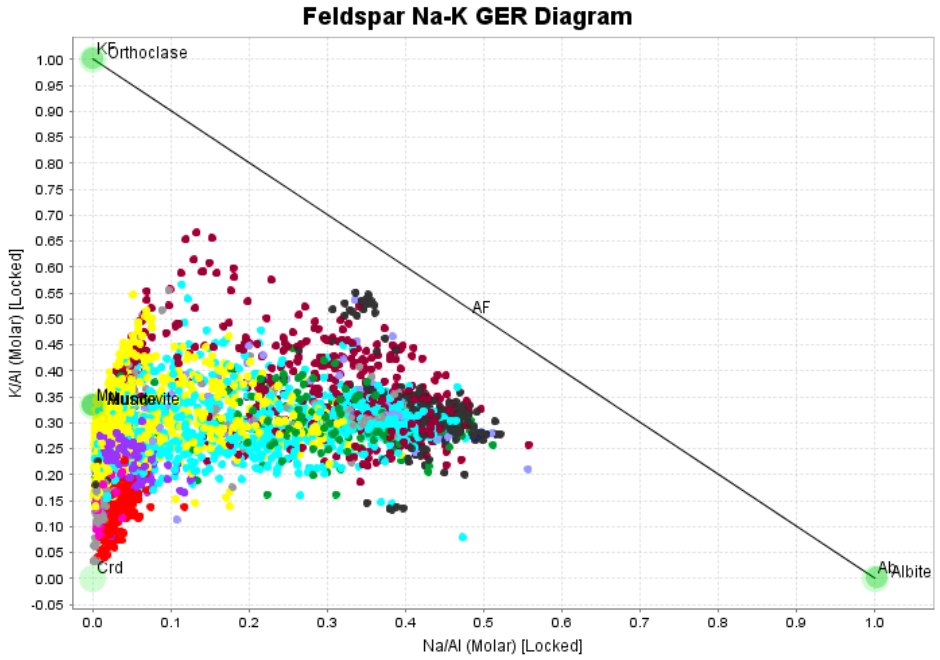
Where to next?







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Thank you!

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