

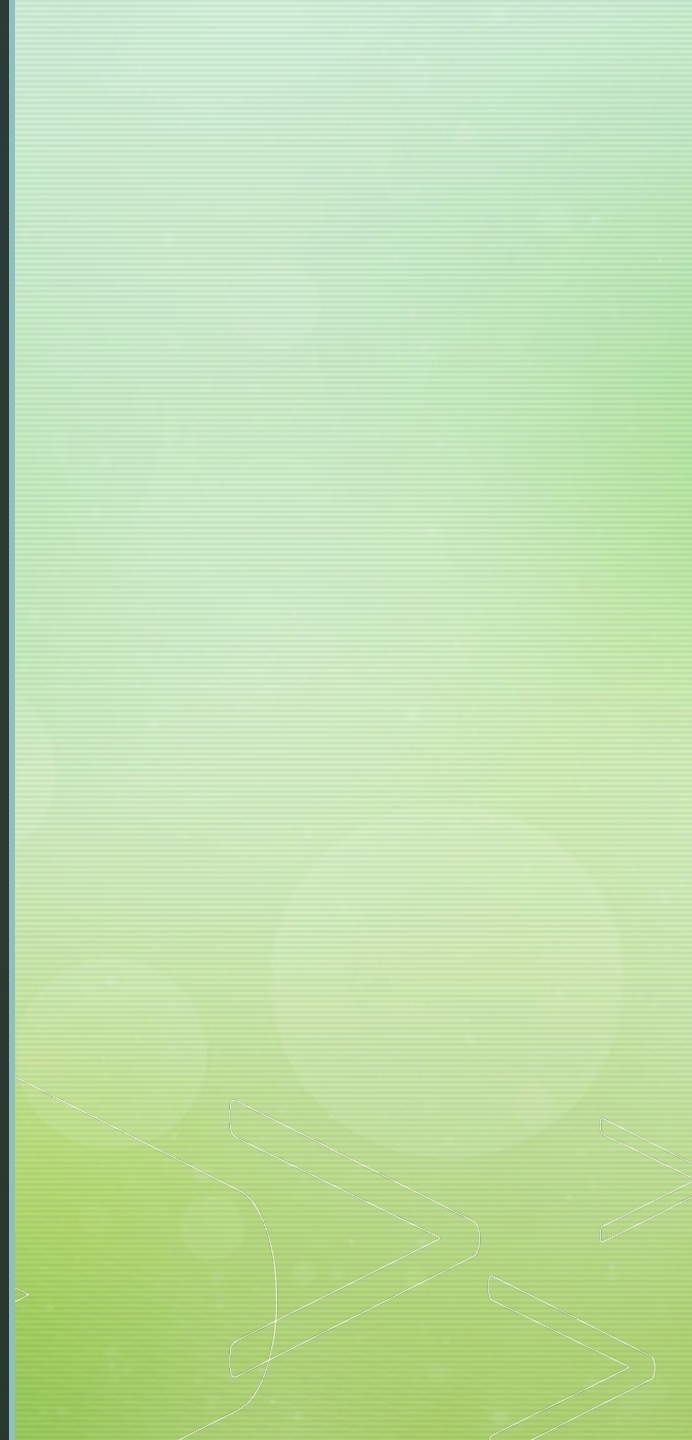
The Green in Greenstone

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Petrology 422

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Why Greenstone?



A photograph of a dark, layered rock specimen, possibly a sedimentary rock like shale or siltstone, resting on a white surface. A red ruler is placed horizontally in the foreground for scale, showing centimeter markings from 1 to 12. The rock is roughly rectangular and shows distinct horizontal layering. The background is slightly blurred, showing a white container and a red and white patterned object. The word "Background" is overlaid in white text on the rock.

Background

What is a Greenstone/Green Schist?

- Low grade metamorphic rock
- Typically contains chlorite, actinolite, epidote, albite
- Green Schist is Foliated
- Greenstone is Non-Foliated

- Winter



Greenstone

The Ely Greenstones

- $47^{\circ} 54' 41.358''$ N $91^{\circ} 48' 59.280''$ W
- Pillow Basalts
- ~2.7 Billion years old





The Research

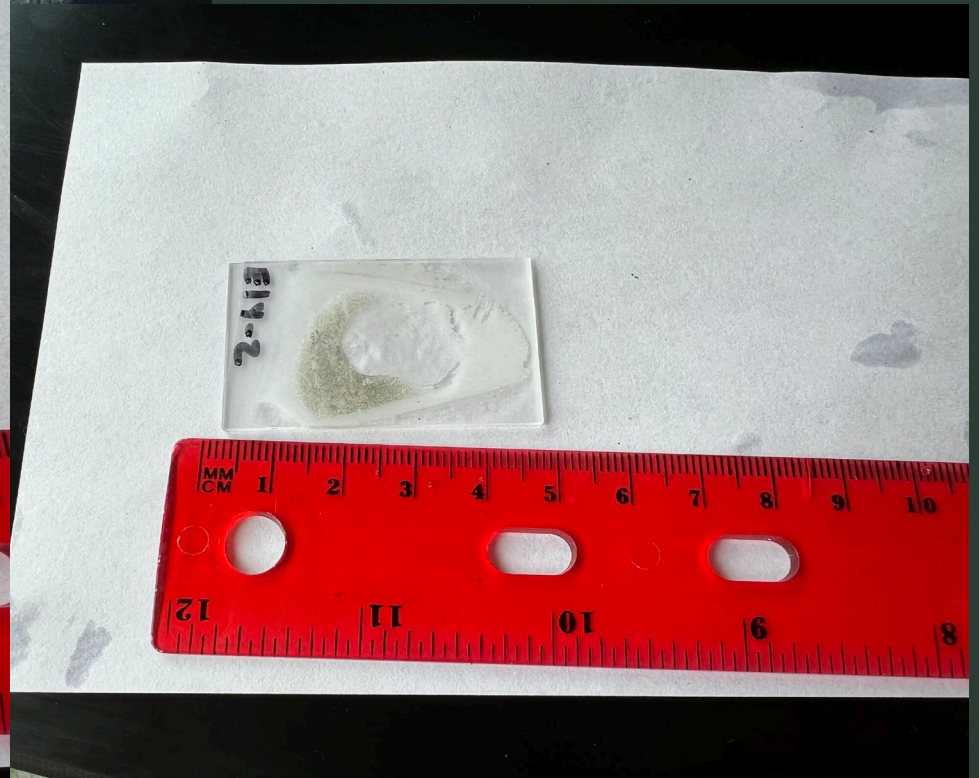




Guiding Question

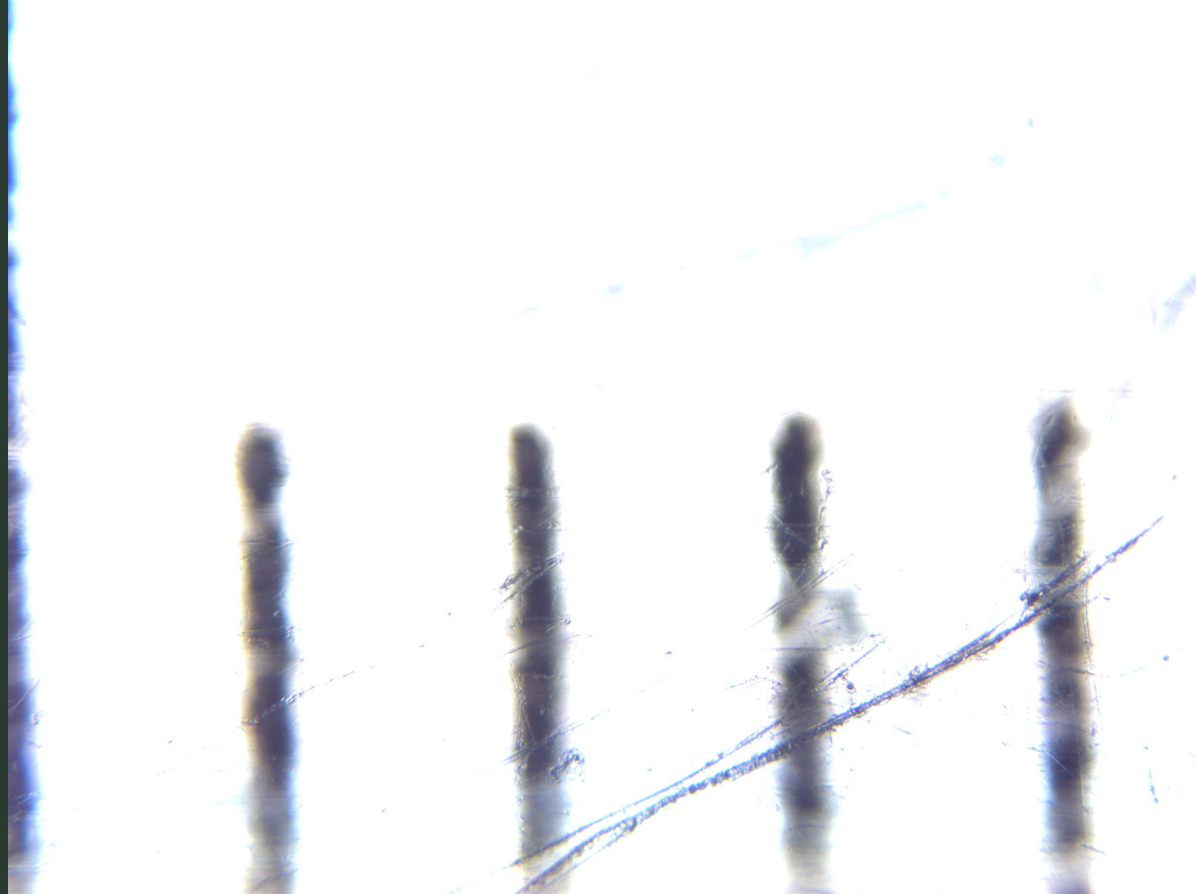
- What is the composition of the Ely Greenstone?
- What is in the Vein I found?

Making Thin Sections



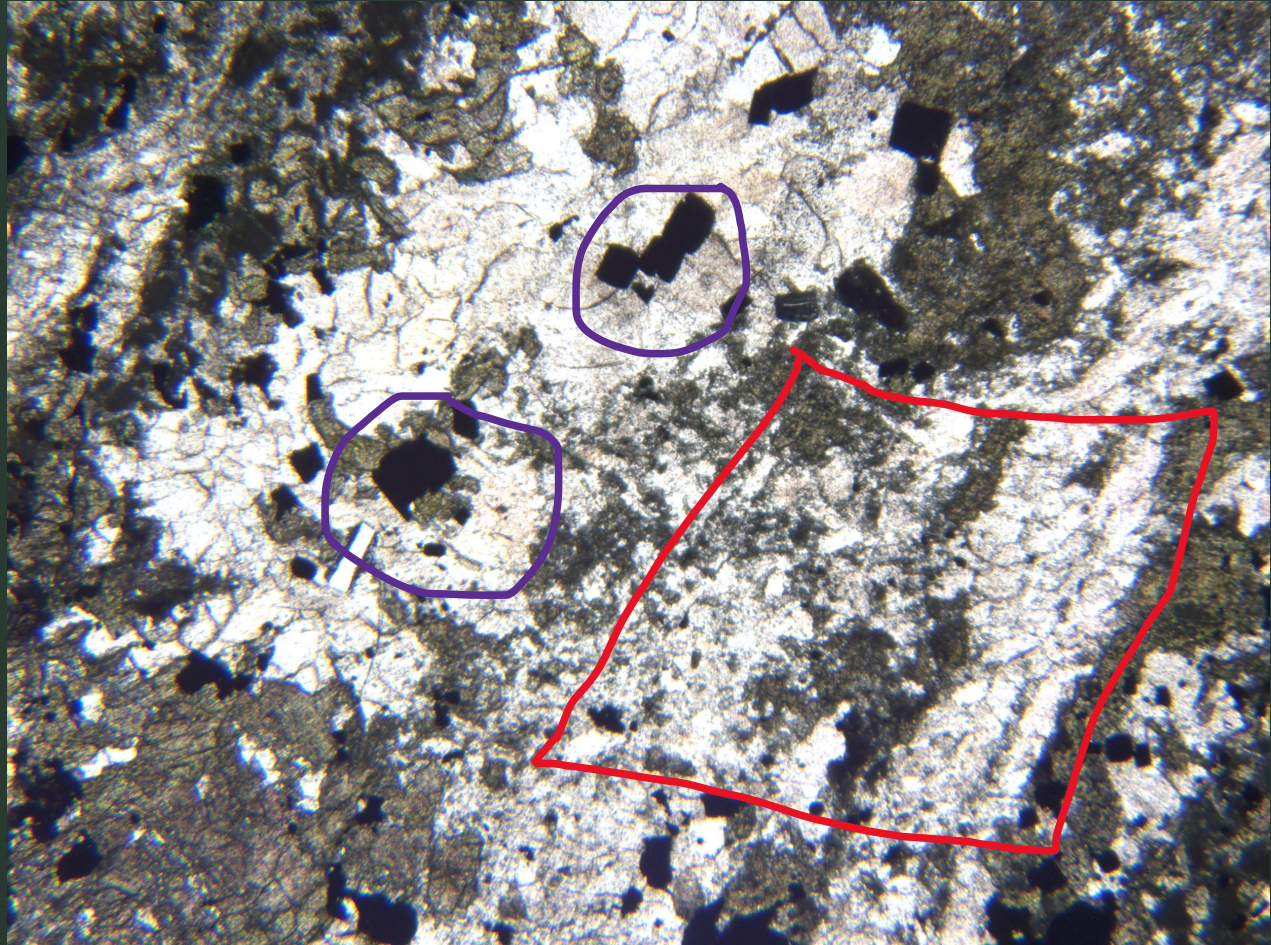
Transmitted Light Microscopy - Field of View

- ~4.8mm



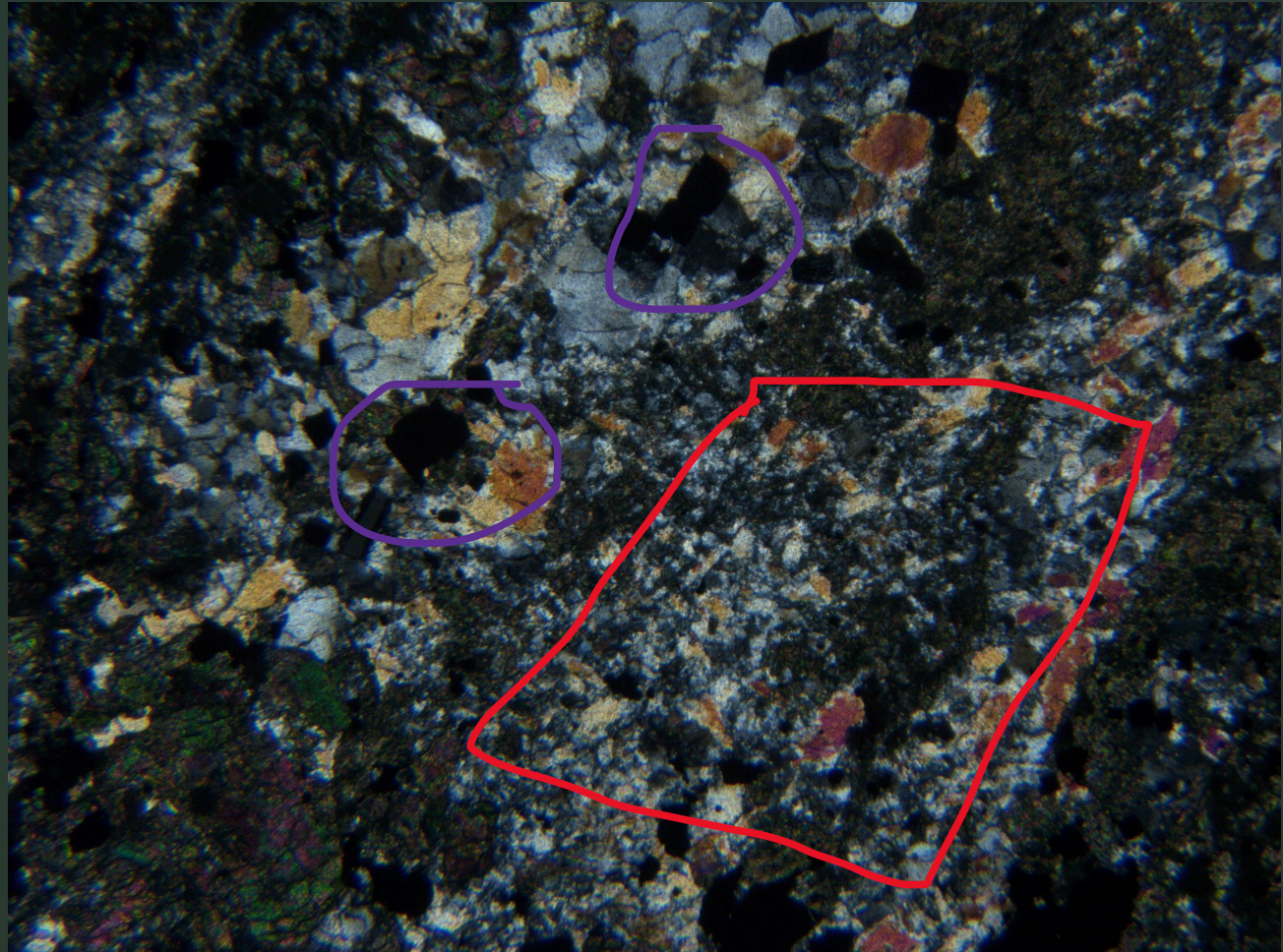
Transmitted Light Microscopy

- Ely-1 PPL



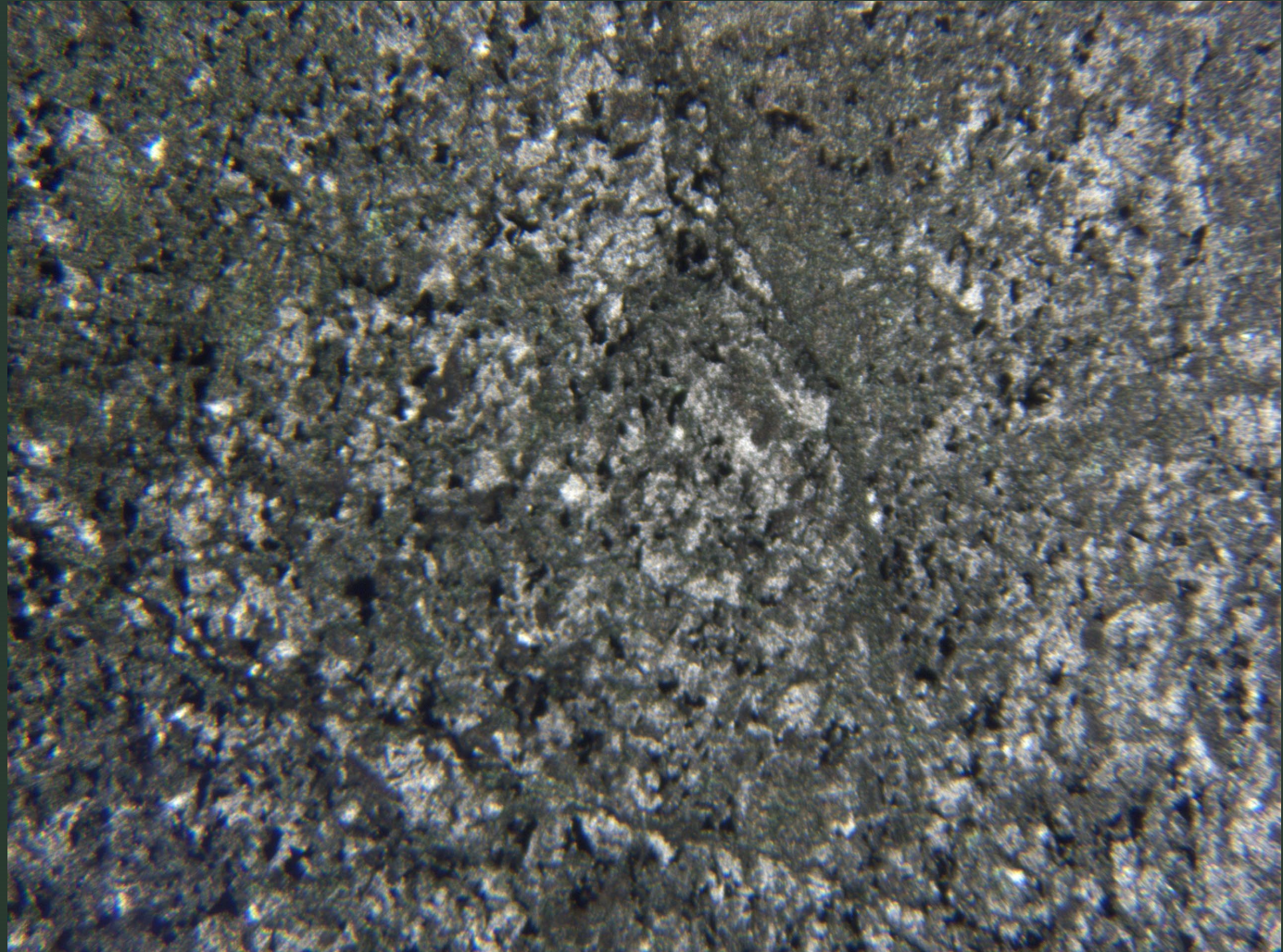
Transmitted Light Microscopy

- Ely-1 XPL



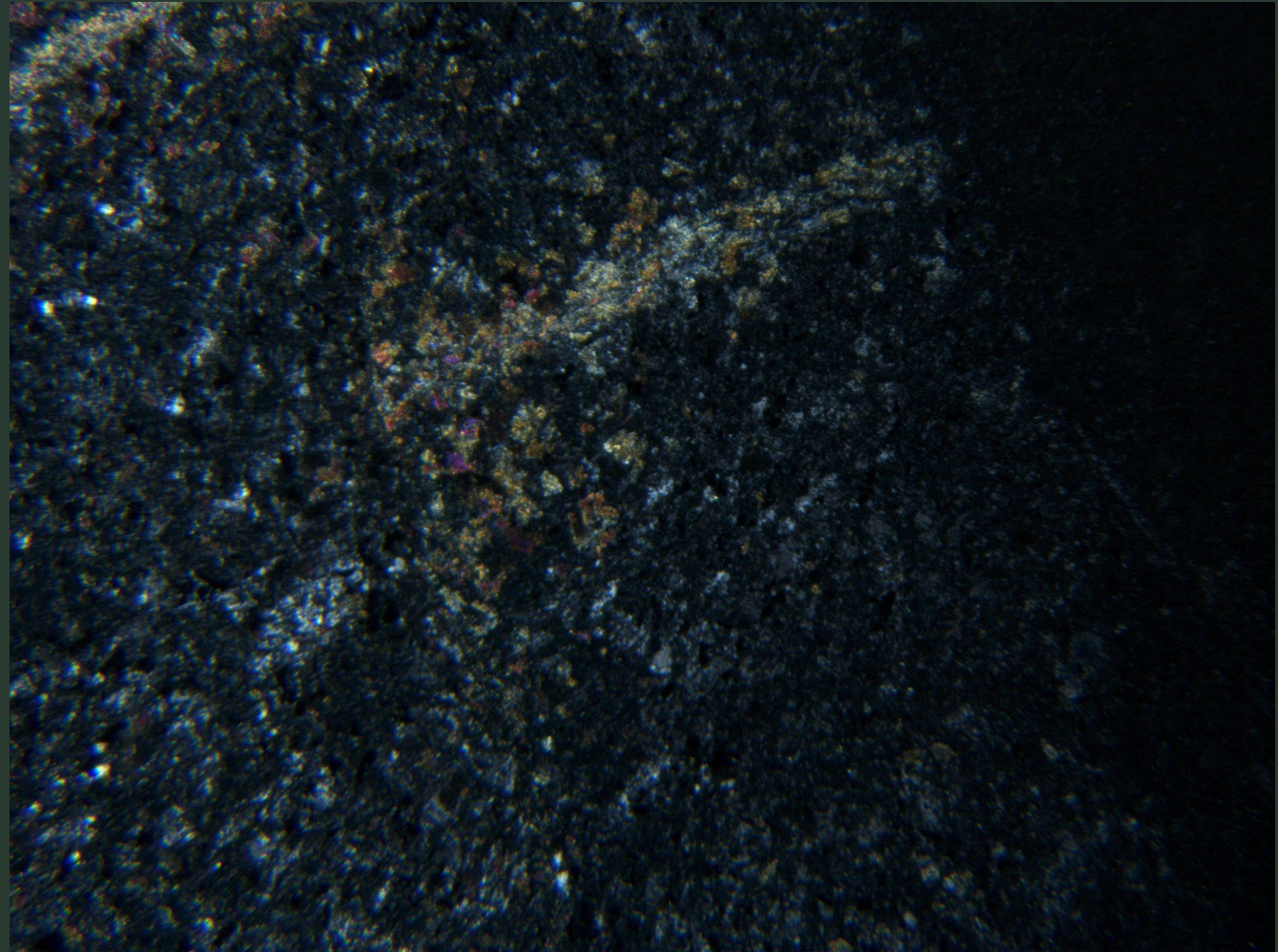
Transmitted Light Microscopy

- Ely-1 PPL



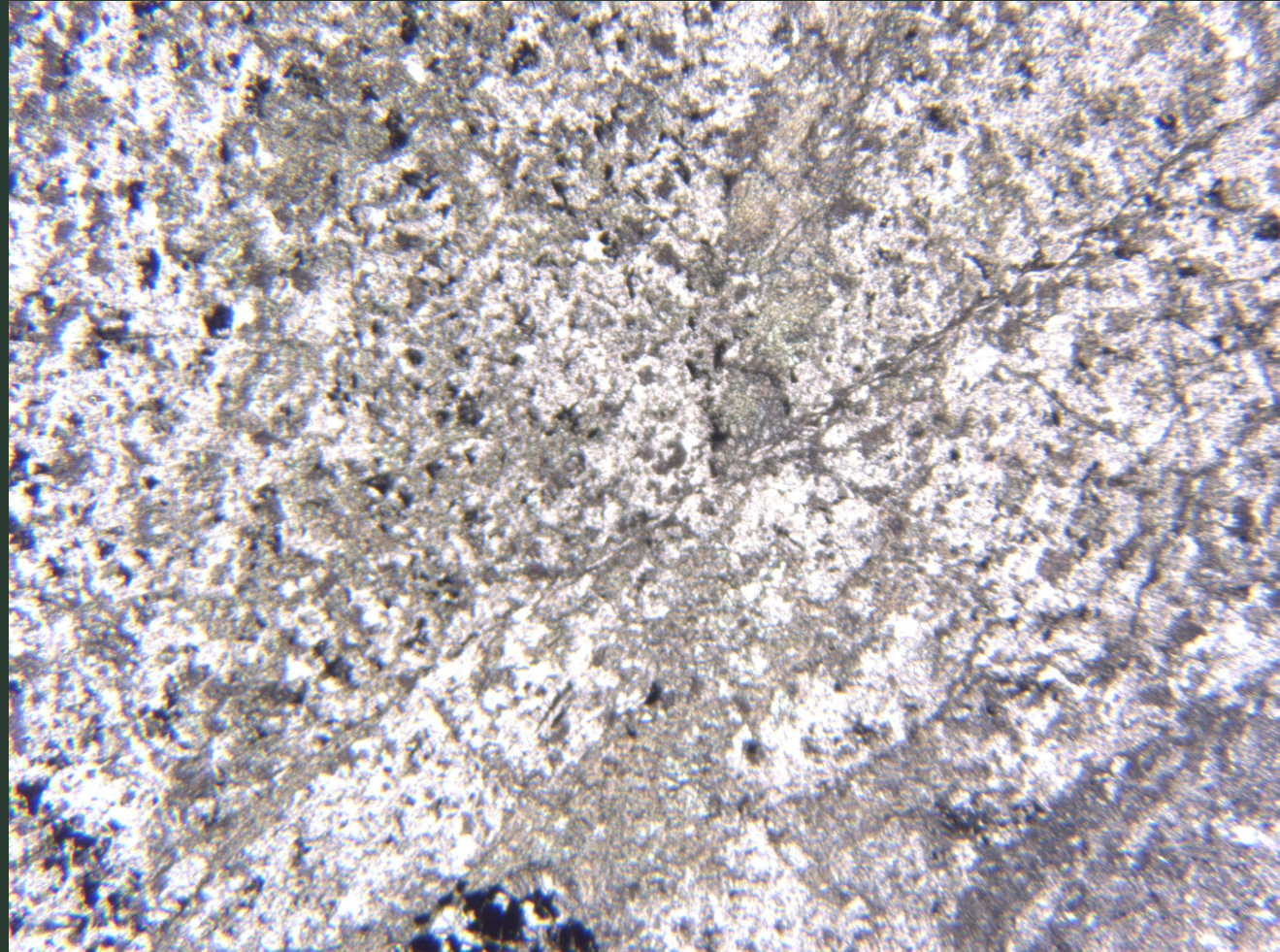
Transmitted Light Microscopy

- Ely-1 XPL



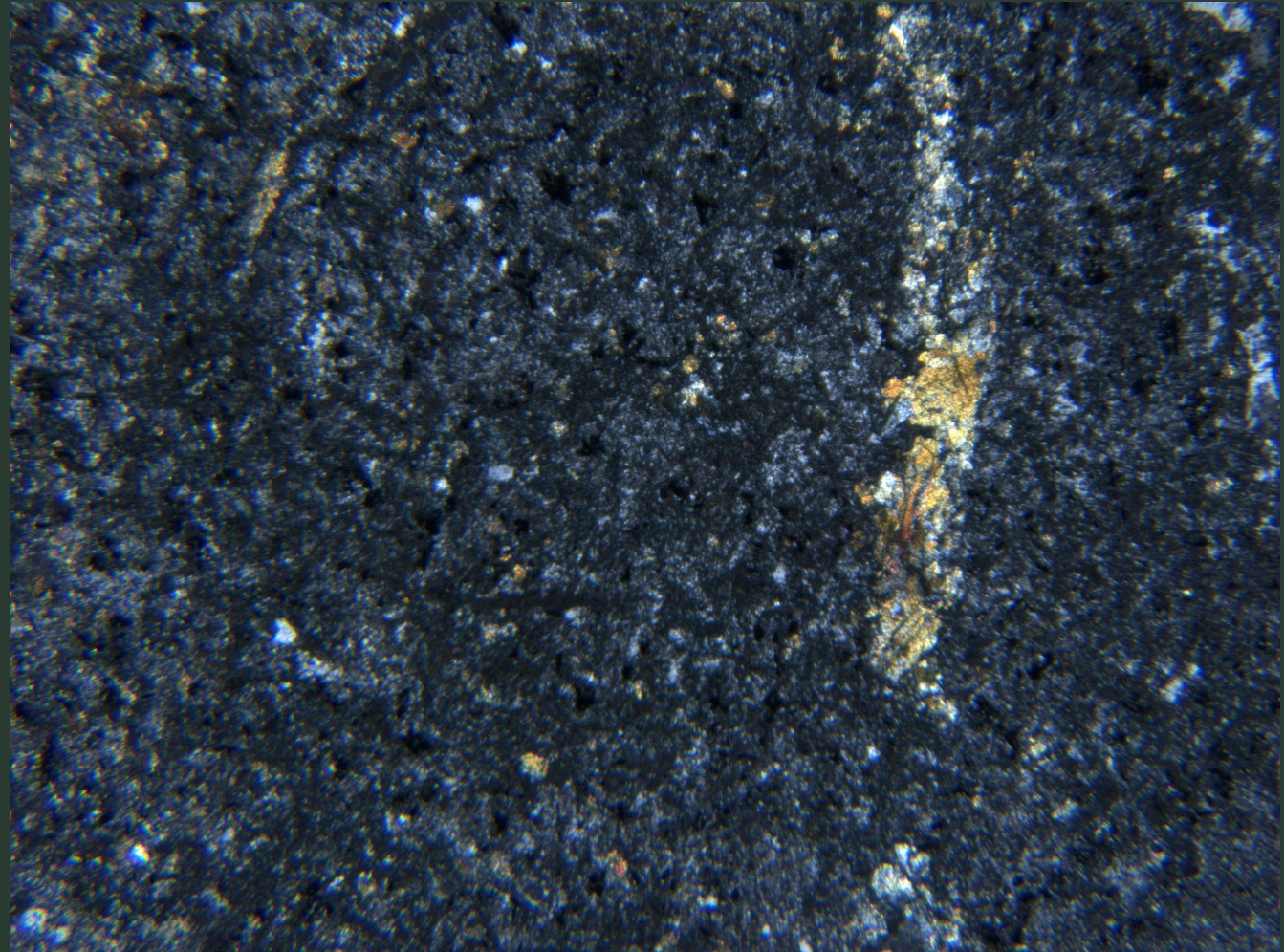
Transmitted Light Microscopy

- Ely-2 PPL

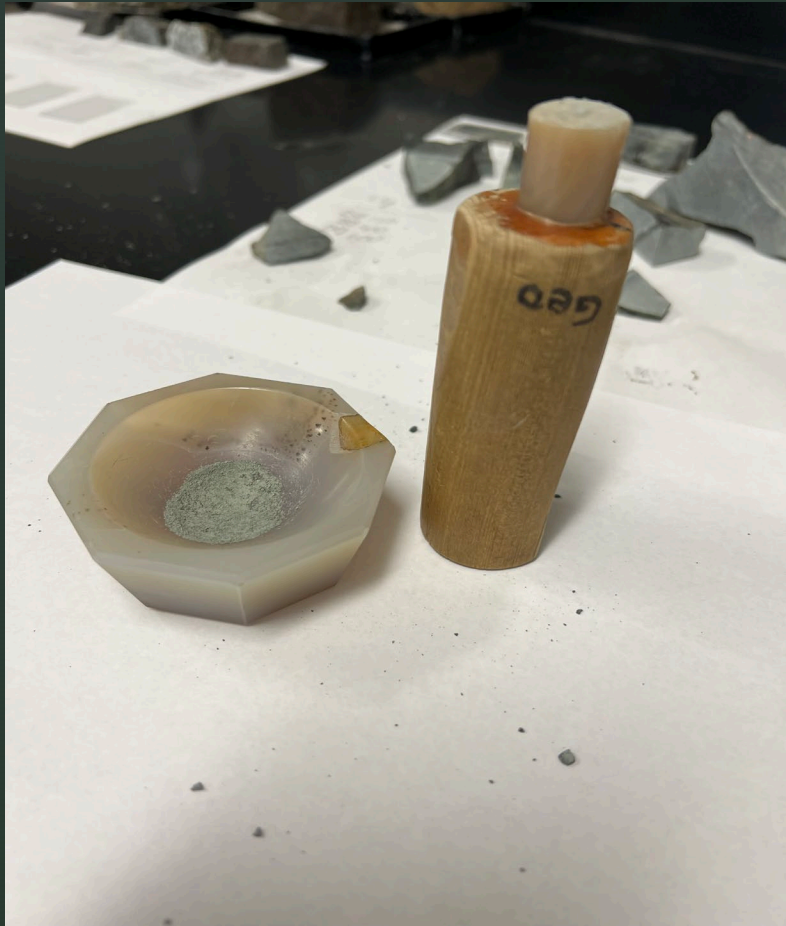


Transmitted Light Microscopy

- Ely-2 XPL



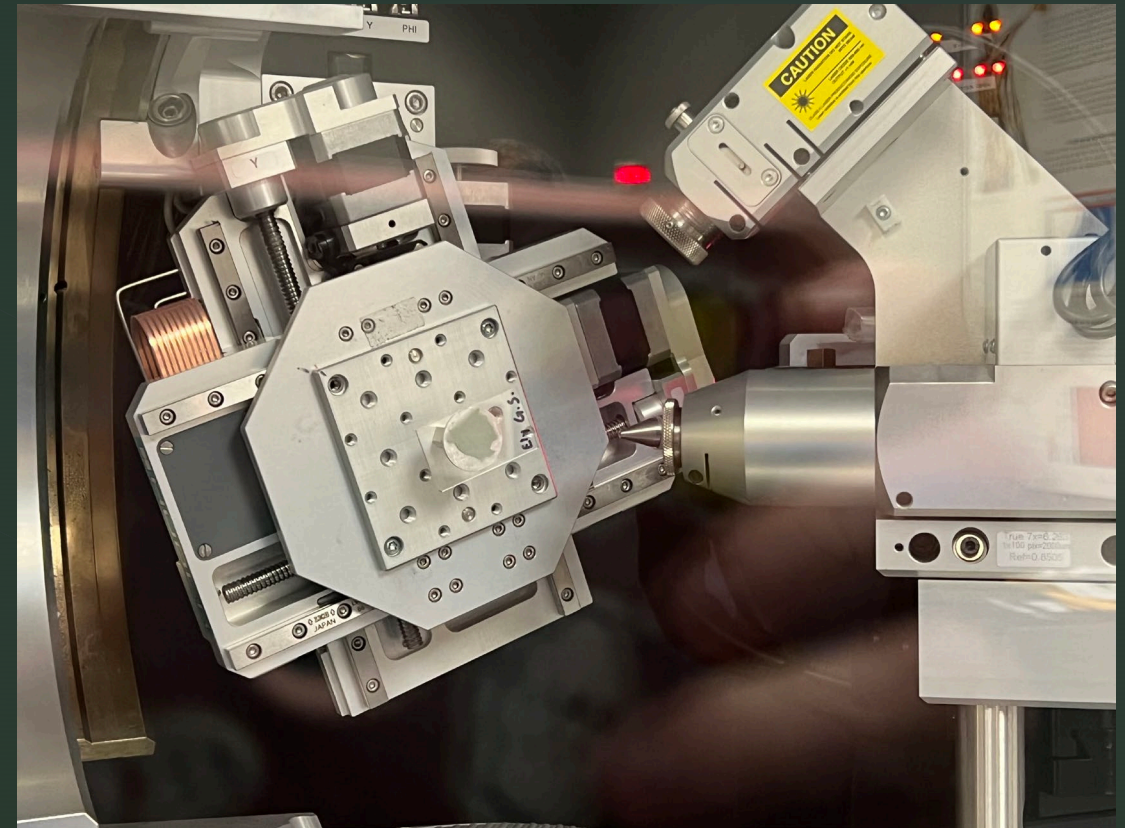
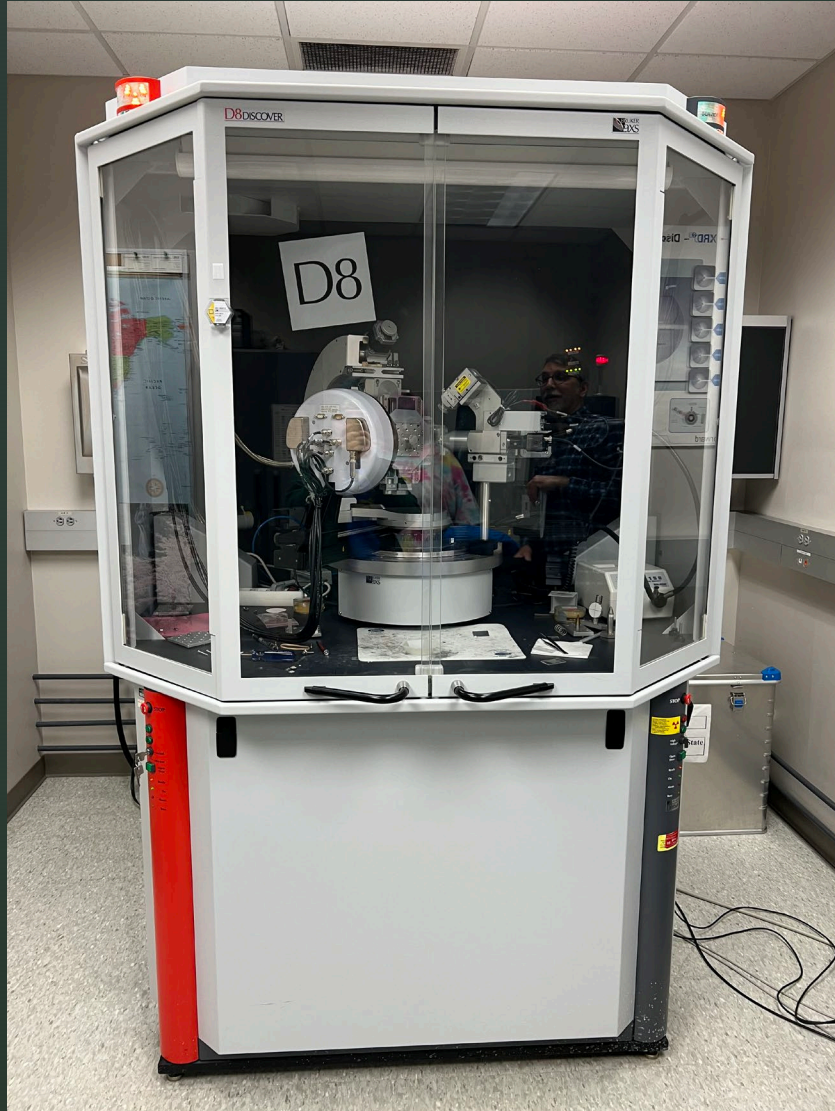
X-Ray Diffraction (XRD)



X-Ray Diffraction (XRD)

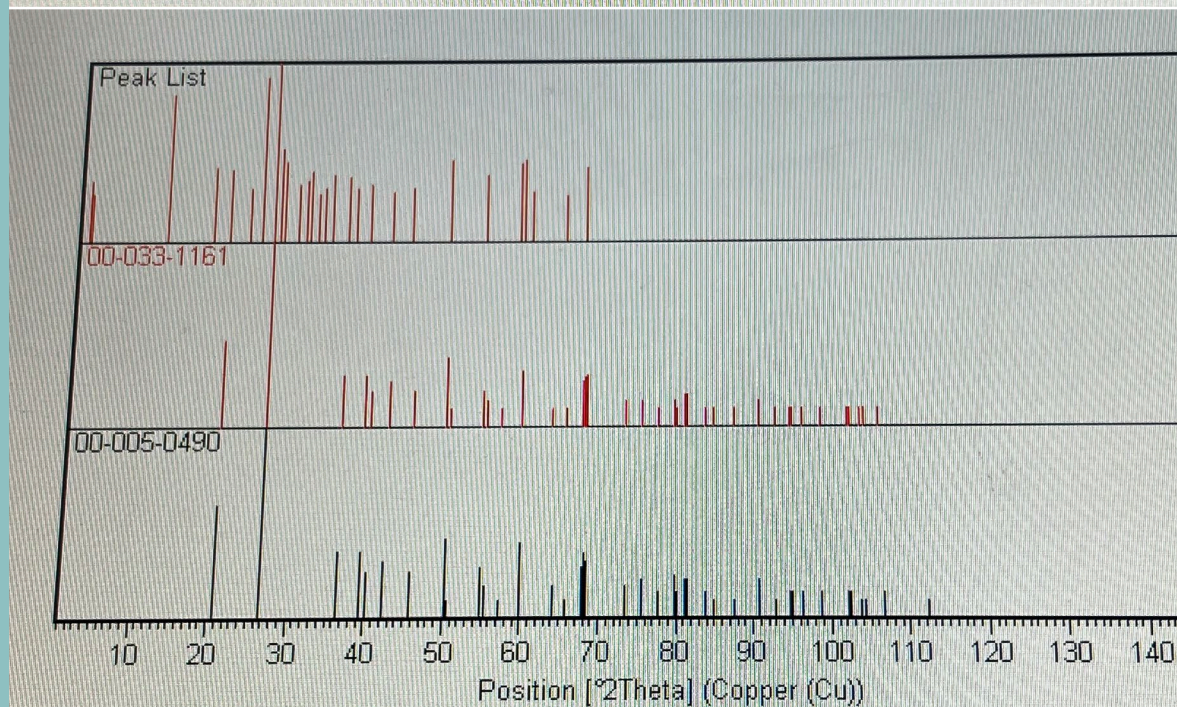
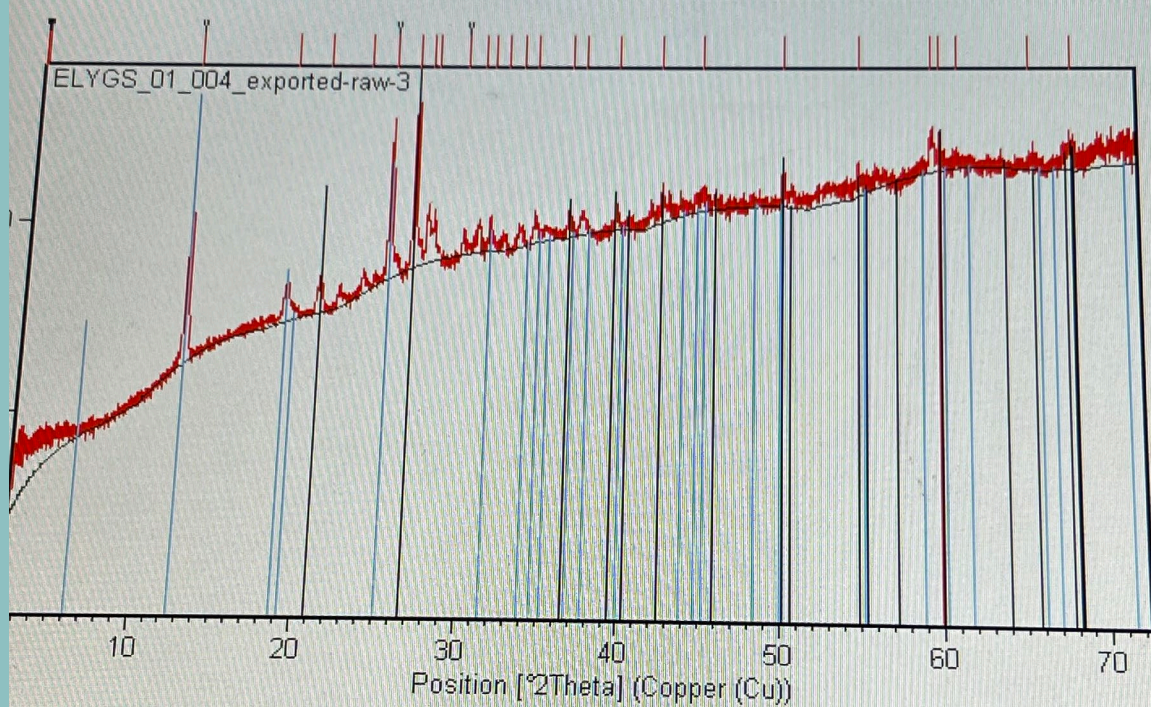


X-Ray Diffraction (XRD)



X-Ray Diffraction (XRD) - Ely G.S.

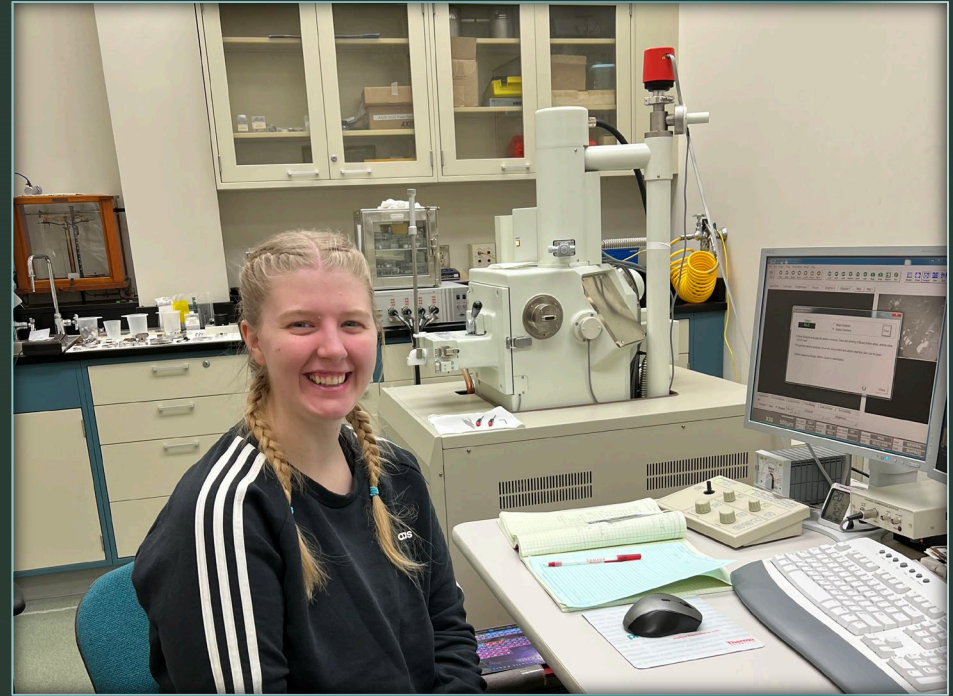
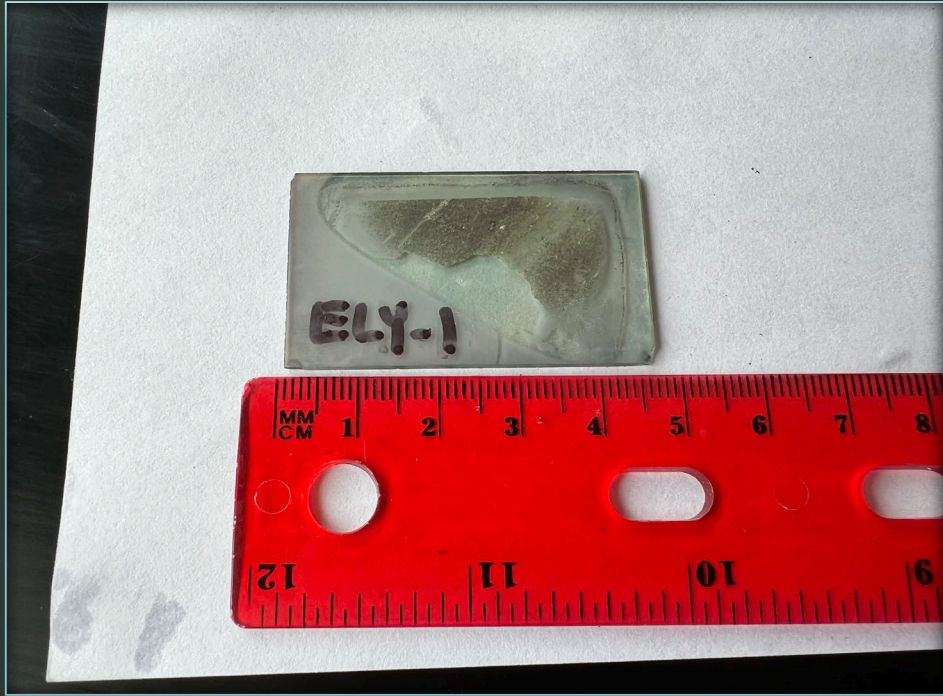
- Black – Quartz
- Red - Silica
- Regular Greenstone matched to Quartz and Silica – predicted
- Matches MNDNR data that Greenstone is predominantly Quartz



X-Ray Diffraction (XRD) - Ely G.S. Vein

- Red – Silica
- Black & Blue - Pyrite
- Dominate in Quartz and Pyrite –
Predicted
- MNDNR Data suggests that
Pyrite is a common mineral in the
Ely Greenstones





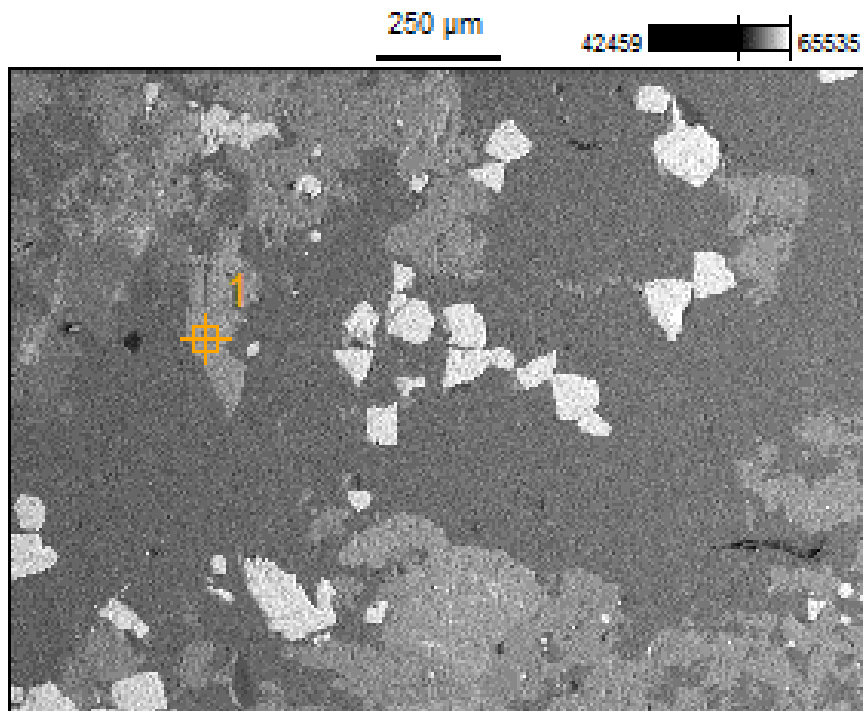
Scanning Electron Microscopy (SEM)

Goals of Scanning Electron Microscopy (SEM)

- Find out the minerals in the Vein
 - Prove XRD Results for the Vein

Scanning Electron Microscopy (SEM)

220598 ELY-1(1)



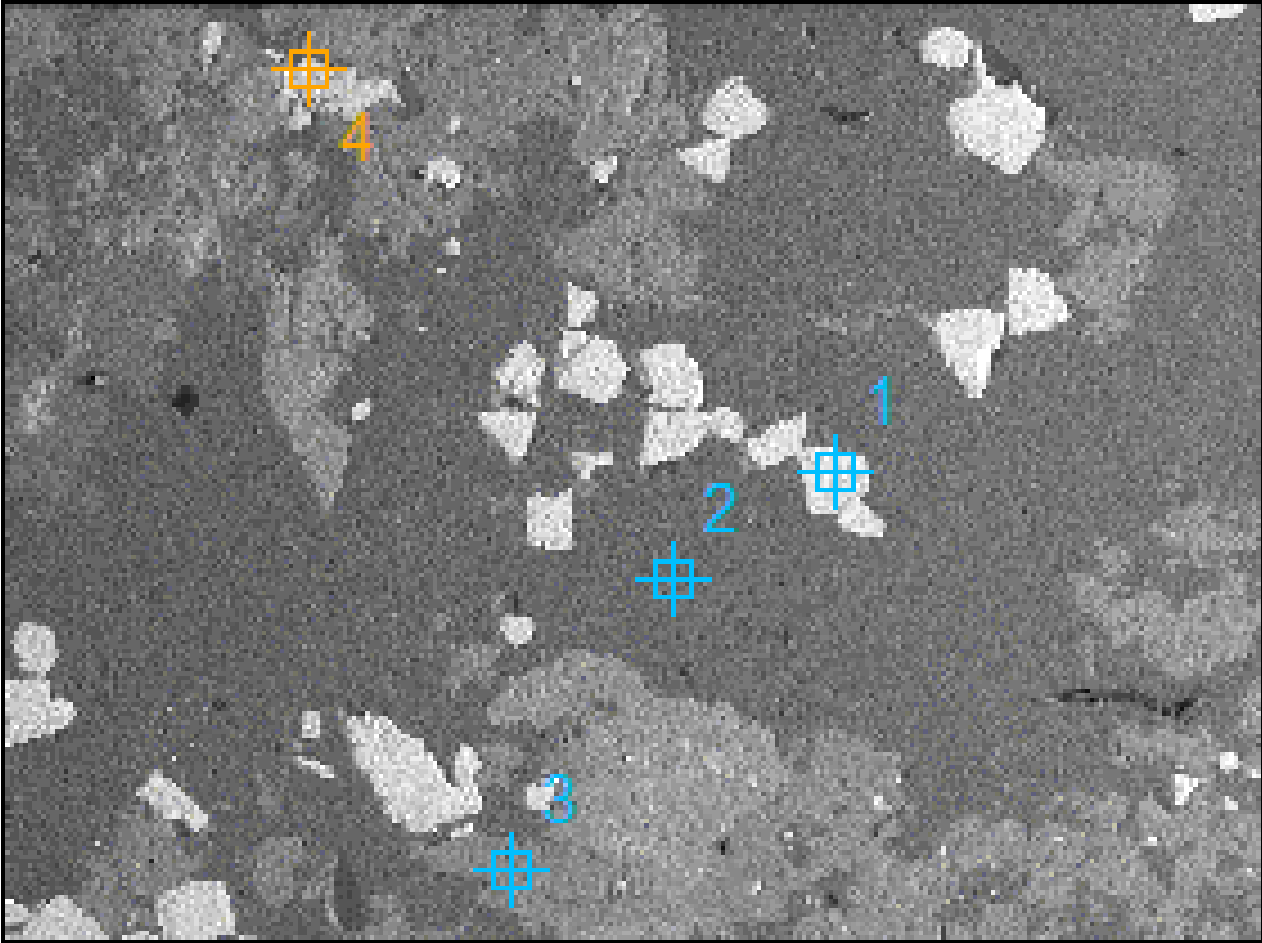
- Point 1
 - 0.46% Na₂O & 4% Al₂O₃ & 72% SiO₂ & 8% SO₃ & 0.43% K₂O & 5% CaO & 3% TiO₂ & 7% FeO
 - Quartz (SiO₂) (potentially with Epidote and maybe Augite)

220598 ELY-1(2)

250 μm

42559

65535



■ Po

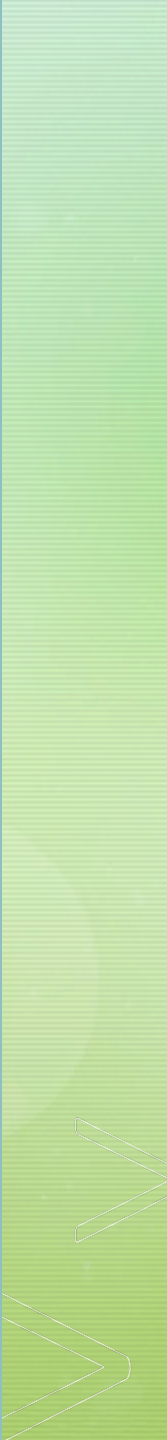
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EM)

2

0

013Si

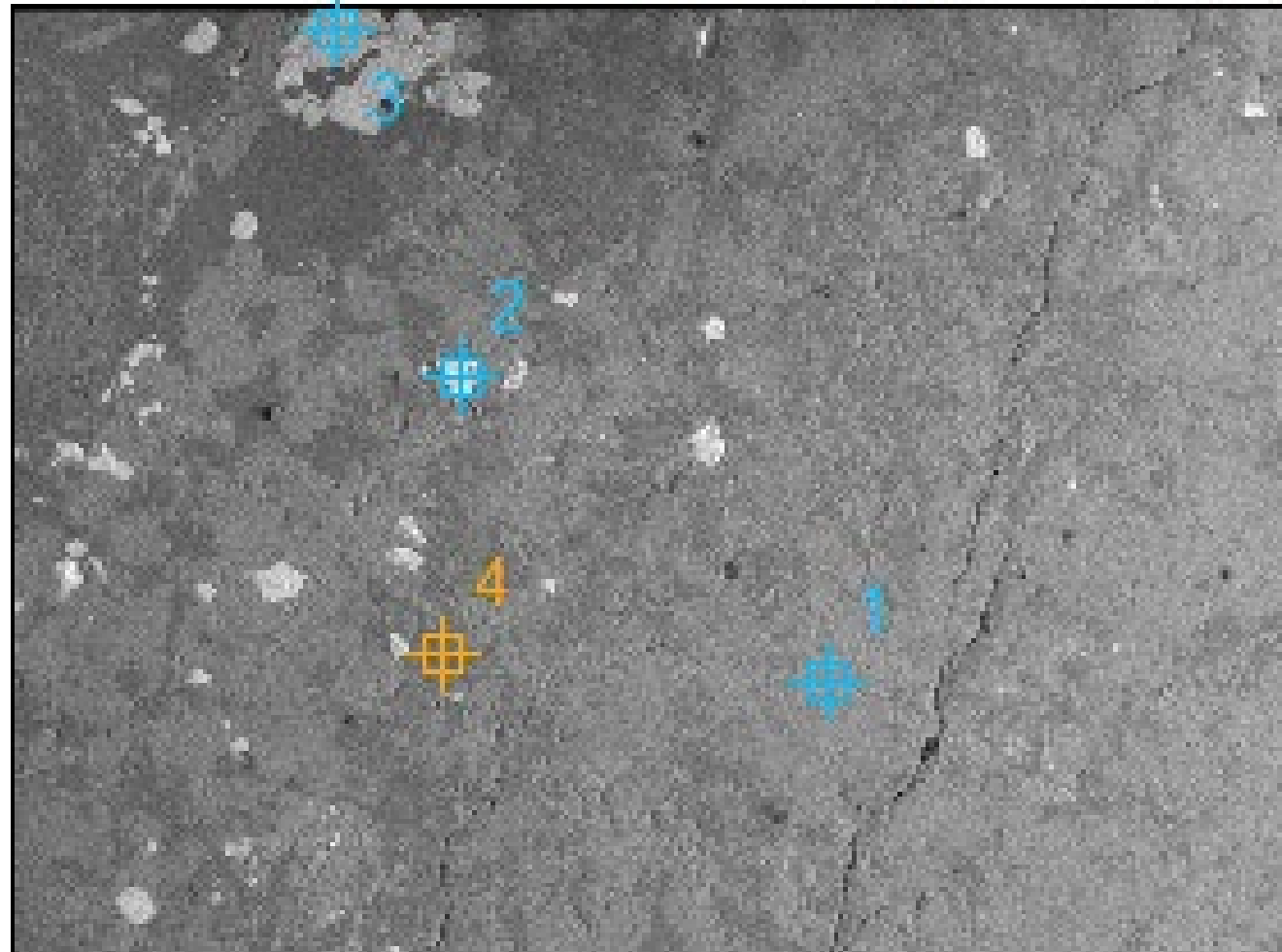


220598 ELY-1(3)

500 μm

40873

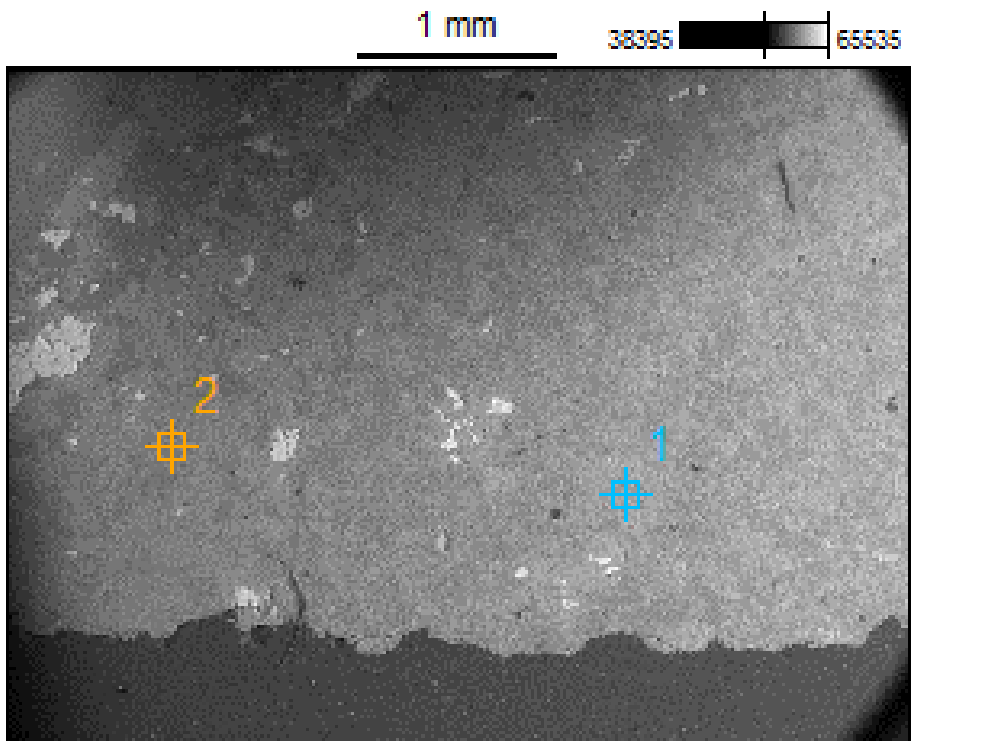
65533



M)

Scanning Electron Microscopy (SEM)

220598 ELY-1(4)



- Point 1
 - 12% MgO & 19% Al₂O₃ & 30% SiO₂ & 0.85% MnO & 38% FeO
 - Augite
(Potentially) [(Ca,Na)(Mg,Fe,Al,Ti)(Si,Al)₂O₆]
 - No text support
- Point 2
 - 7% Al₂O₃ & 84% SiO₂ & 2% K₂O & 5% CaO & 3% FeO
 - Quartz (SiO₂) with inclusions (Epidote?)



Results



What is the Composition of the Ely Greenstone?

What I Thought

- Quartz
- Epidote

What was Real

- Quartz
- Silica
- Epidote
- Augite (in results?)

What is in the Vein I found?

What I Thought

- Quartz
- Epidote
- Pyrite
- Cubanite

What was Real

- Quartz
- Silica
- Epidote
- Augite (in results?)

Literature Says

MNDNR (2014)

- Did not Mention Epidote or Augite
- Said there is Quartz and Pyrite

Journal of Geology (1924)

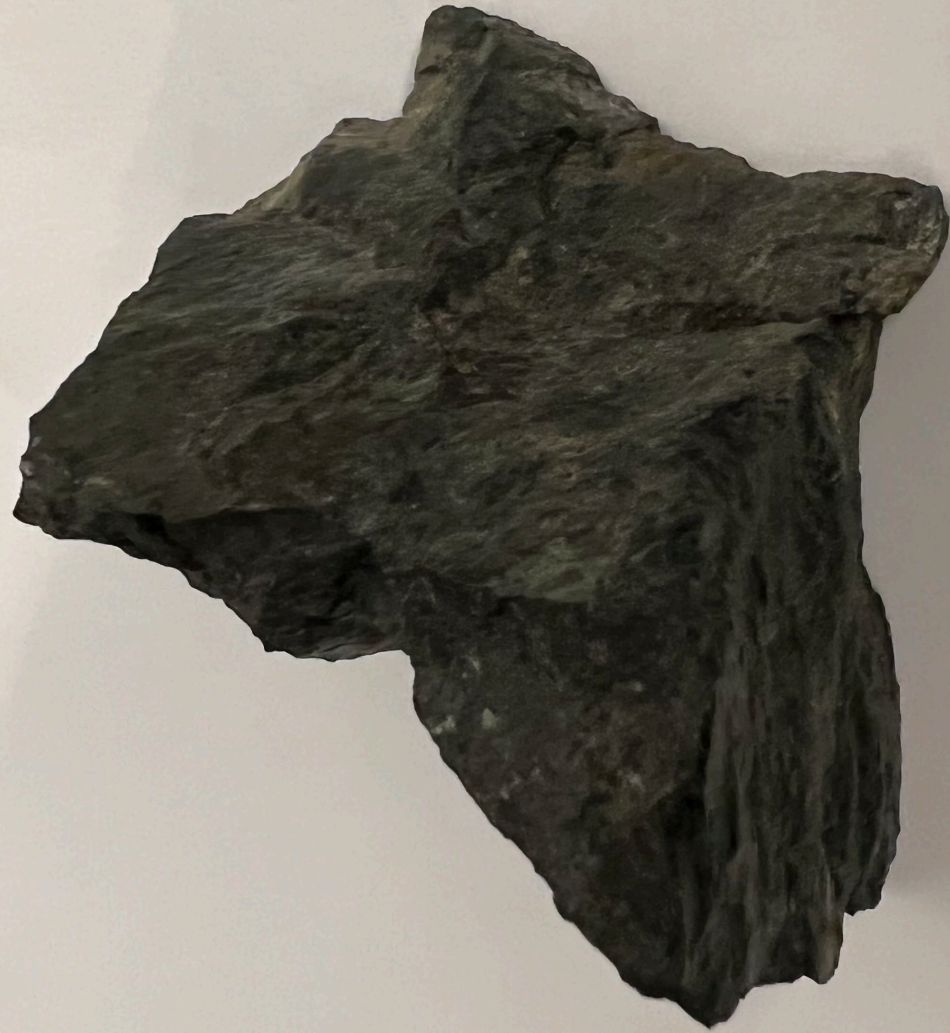
- Said there is Quartz, Pyrite, Epidote growth and Augite growth

My Data (2022)

- Says there is Epidote, Quartz, Pyrite, and potentially Augite

UND (1985)

- Said there is Epidote, Quartz, minor Pyrite, and no mention of Augite



Questions?

Works Cited

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