



Red River Valley Sample #23

By: Jake Bjerke and Nathan Trio










NDSU Petrology 2024

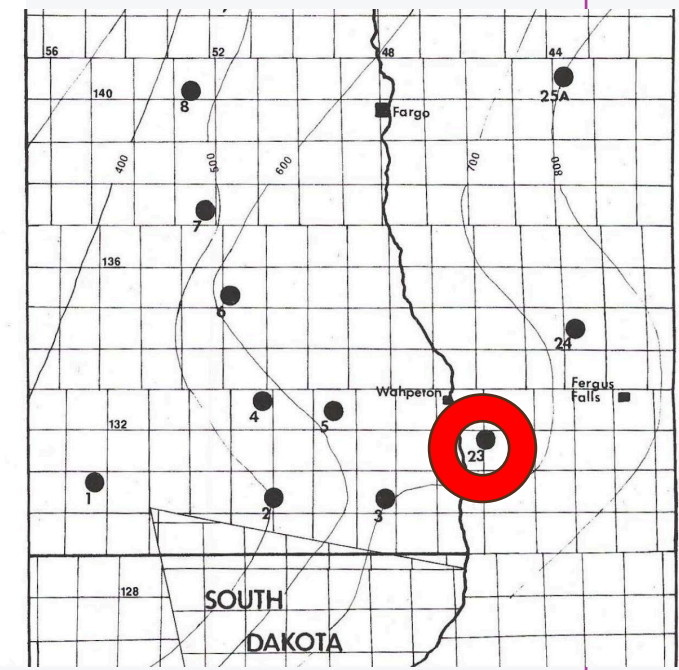
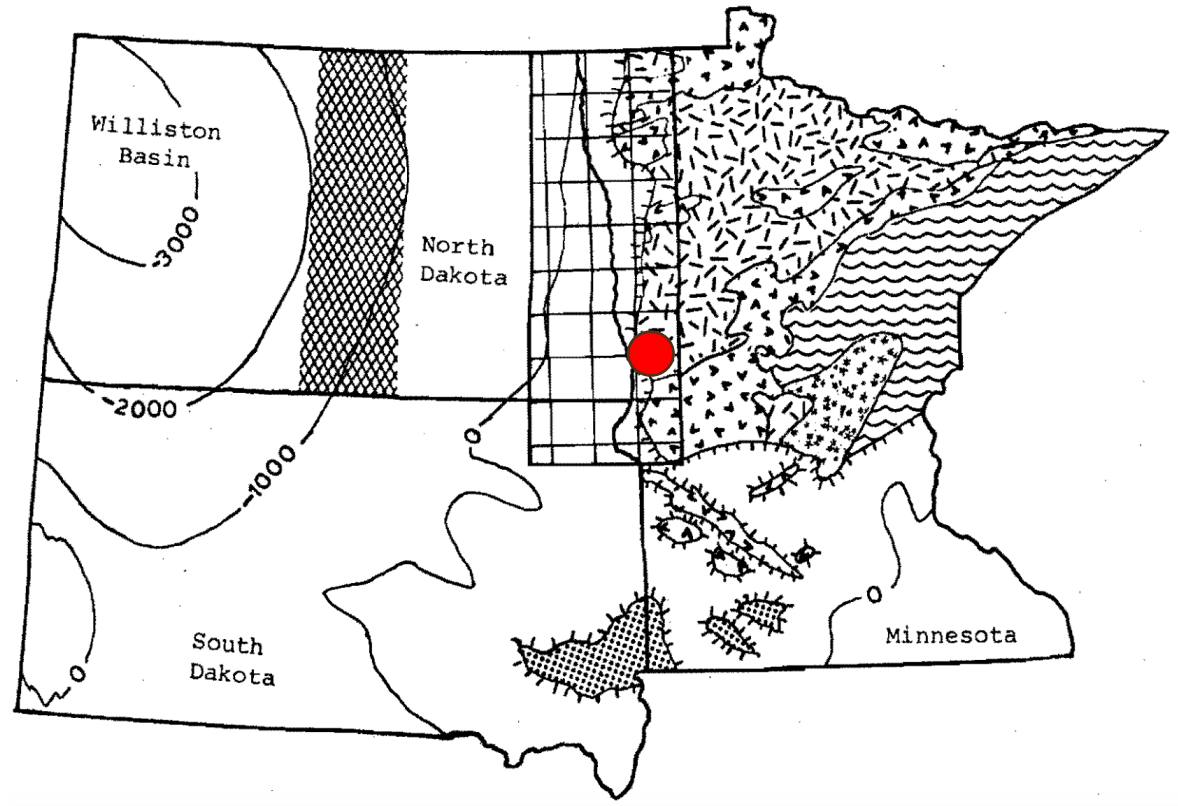
Location and Description of Samples

- Location: T 131 N, R 46 W, Section 6 NE ¼ - Wilkin, MN
- Elevation: 970 ft
- Total Depth of Drill Core: 418 ft
- Cores: 398' to 418' - Precambrian
- Description of Samples:
 - Light blueish gray Granodiorite, medium grained, hypidiomorphic granular
 - Biotite partially altered to chlorite, feldspars altered to iron oxide and Kaolinite

(Moore, 1978)

Geographic Location

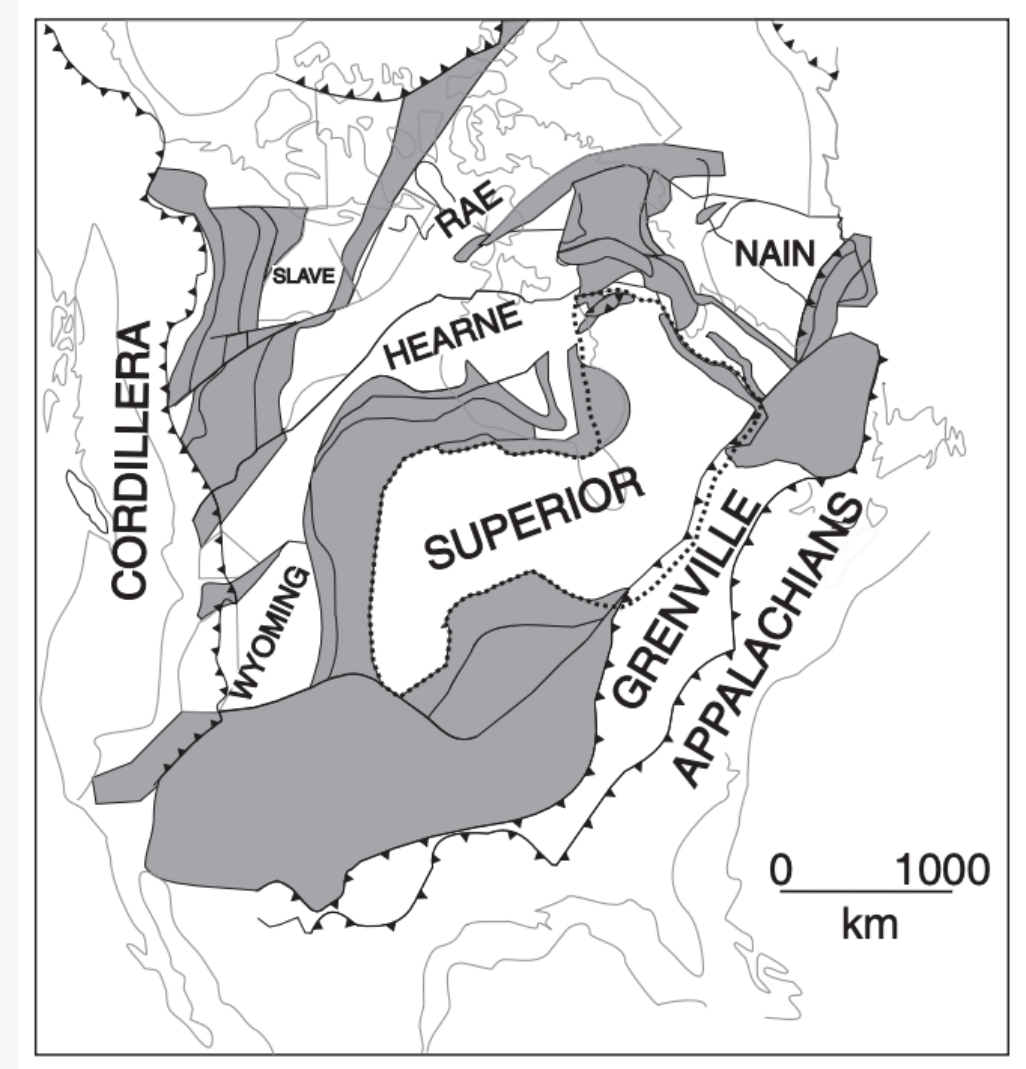
-  Study Area
-  Edge of Phanerozoic rocks
-  Structure contours on top of Precambrian. C.I.= 1000 m.
-  Boundary of Superior (east) and Churchill (west) Precambrian tectonic provinces.
-  Proterozoic quartzite (Sioux)
-  Proterozoic granite and gneiss
-  Proterozoic metamorphosed volcanic, volcaniclastic, and sedimentary rocks.
-  Archaean granites and gneisses
-  Archaean metamorphosed volcanic, volcaniclastic and sedimentary rocks.



(Kelly, 1980)

Metamorphism

- The Western Wawa-Abitibi terrane is the Precambrian rock unit that core sample 23 comes from ageing back 2.745 Ga.
- A terrane is a unit of rock not related to the surrounding rocks and separated from the surrounding rock by faults
- The terrane is a part of the larger superior province of North America, made up of igneous and metamorphosed igneous rocks from the Precambrian



Metamorphism Continued

- The Western Wawa-Abitibi is believed to be autochthonous deposition through thrust stacking and involved reoccurring plume and subduction zone magmatism.
- Deformation from collisions between the Wawa-Abitibi, Pontiac, and Minnesota River Valley terrane in 2680 Ma.
- 2710 Ma tonalitic magmatism related to northward subduction of the Wawa-Abitibi plate from the south, and Uchian orogeny (2720-2700 Ma)



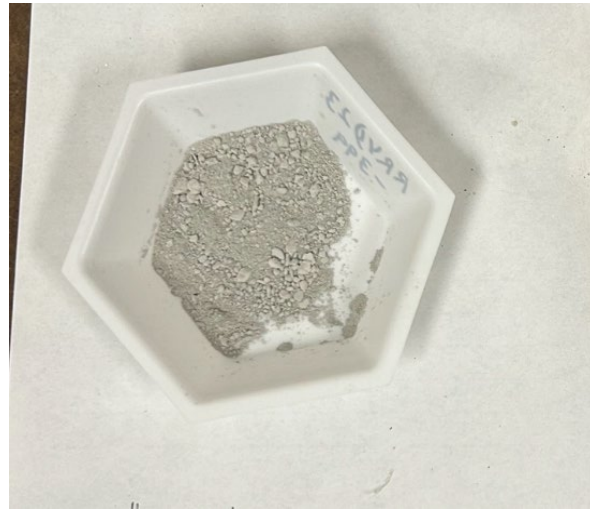
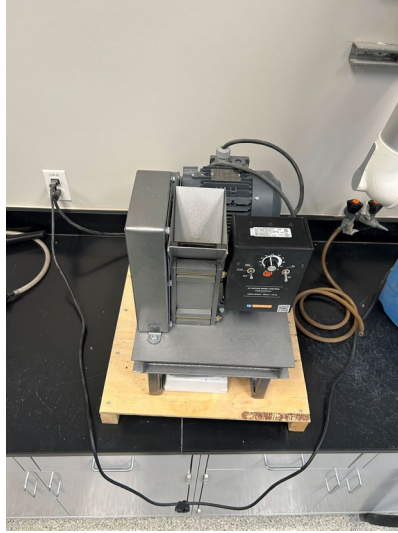
(Percival et al., 2012)

Making Thin Sections



Powder

- Crusher
- Grinder
- Powdered samples

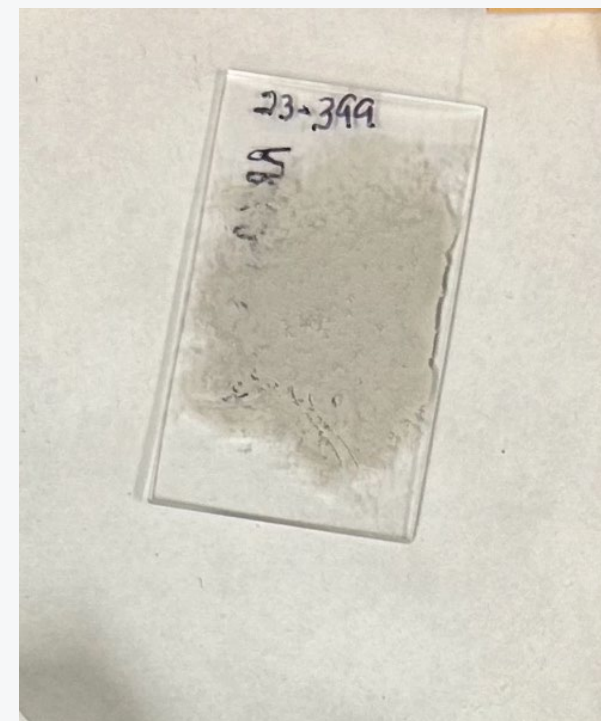
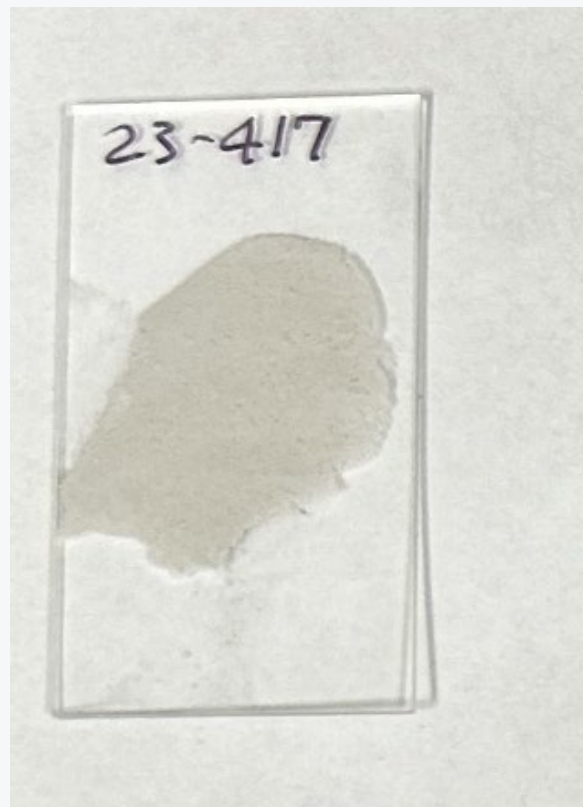


RRVD #23-399



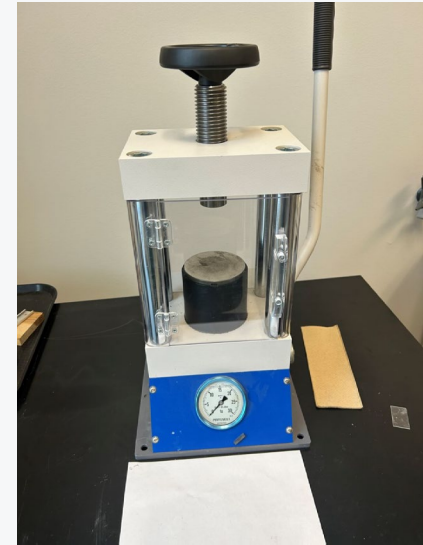
RRVD #23-417

XRD Prep



XRF Prep

- Press machine
- XRF Pellets



Hand Sample Analysis

RRVD #23-417 and RRVD #23-399

- White and Black grains
- Plagioclase and Biotite grains
- RRVD #23-417 has slightly larger grains (depth)

RRVD #23-417



RRVD #23-399



Thin Section Analysis

- RRVD #23-417

Plagioclase - 50%

Quartz - 40%

Biotite - 10%

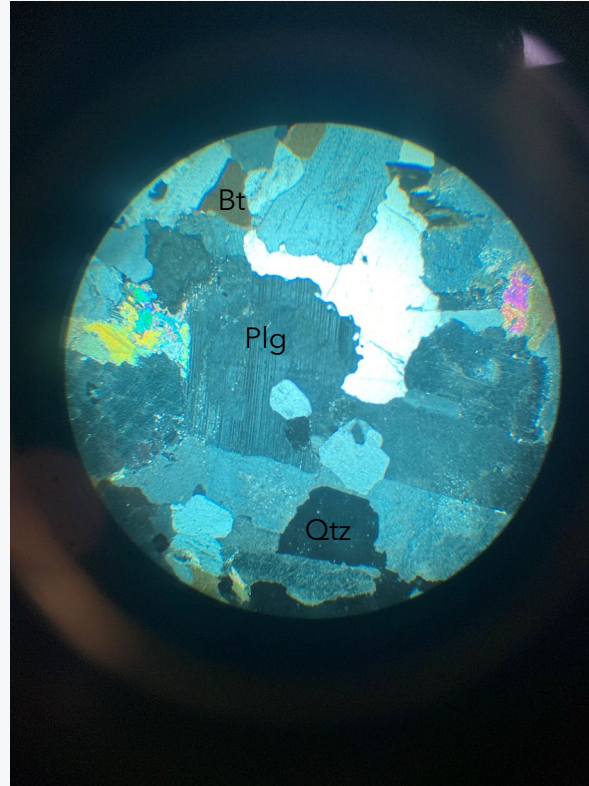
- RRVD #23-399

Plagioclase - 55%

Quartz - 40%

Biotite - 5%

RRVD #23-417

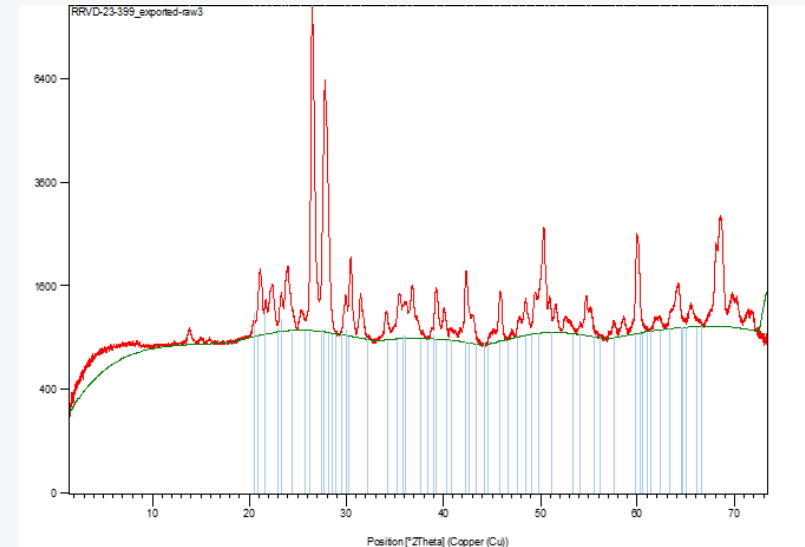


RRVD #23-399



XRD RRVD 23-399

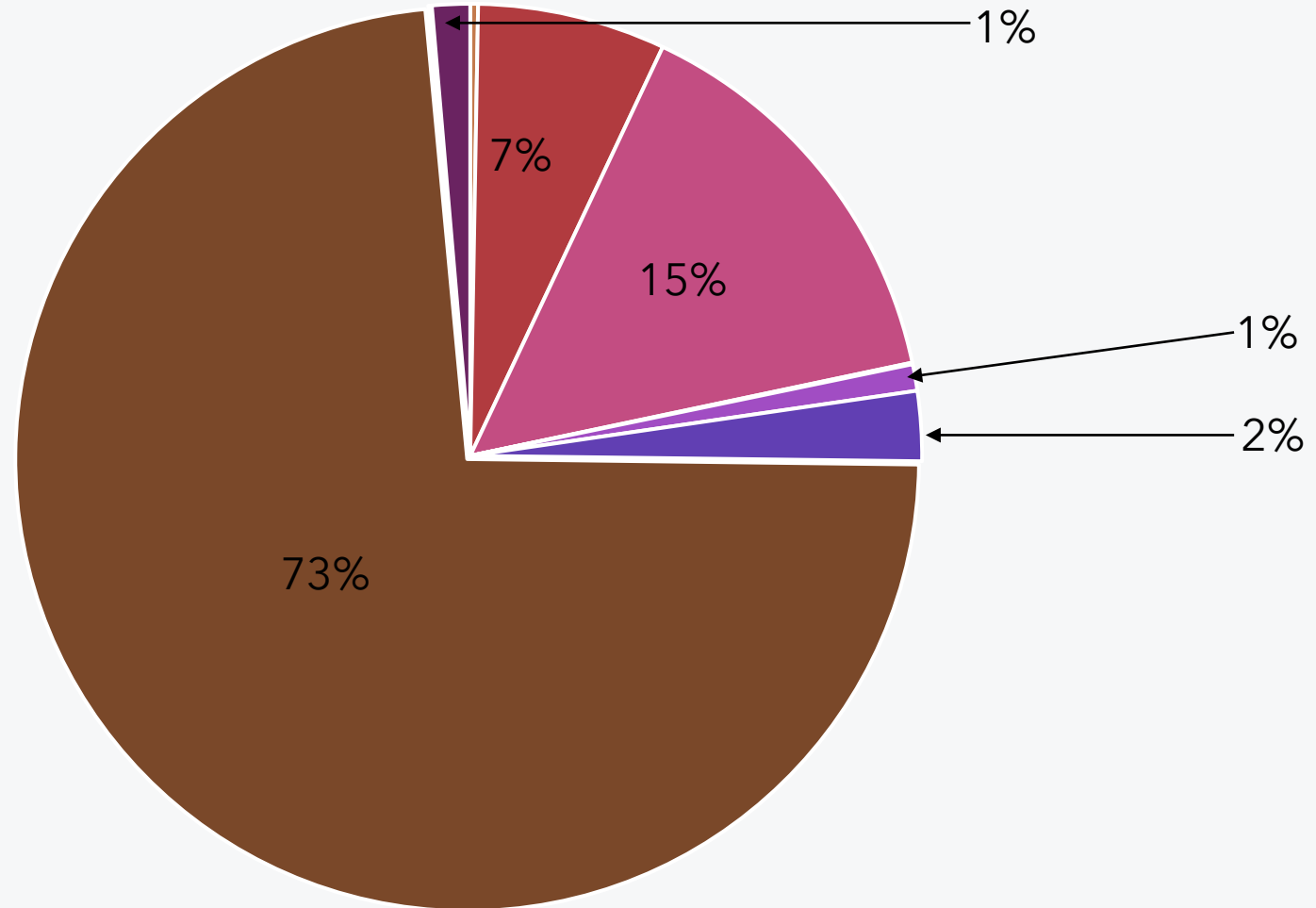
- Albite
- Silica
- Microcline
- Biotite
- Tridymite?



Visible	Ref. Code	Score	Compound Name	Displacement [°2Th.]	Scale Factor	Chemical Formula
	00-020-0548	43	Albite, calcian, ordered	0.000	0.580	(Na, Ca)(Si, Al) ₄ O ₈
	00-010-0479	27	Microcline, inter	0.000	0.266	K Al Si ₃ O ₈
	00-033-1161	34	silica	0.000	0.687	Si O ₂
	00-024-0867	19	Biotite-1\ITM\RG, syn	0.000	0.159	K Mg ₃ (Si ₃ Al) O ₁₀ (OH) ₂

XRF RRVD 23-399

- Silica - 73%
- Aluminum - 15%
- Sodium - 7%
- Iron - 1%
- Calcium - 2%
- Potassium - 1%
- Rest of minerals > 1%



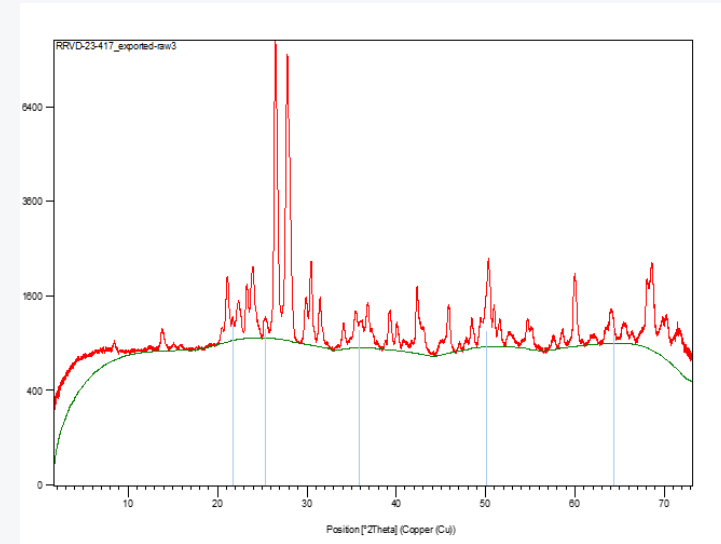
■ MgO mass% ■ Na₂O mass% ■ Al₂O₃ mass% ■ P₂O₅ mass% ■ K₂O mass%
■ CaO mass% ■ SiO₂ mass% ■ TiO₂ mass% ■ MnO mass% ■ Fe₂O₃ mass%

Results for 23~399

- The results show a percentage of Si of about 73%
- Aluminum being present indicates Albite as being present and at 15% suggests a good amount of it.
- Na at 7% and Ca at 2%

XRD RRVD 23~417

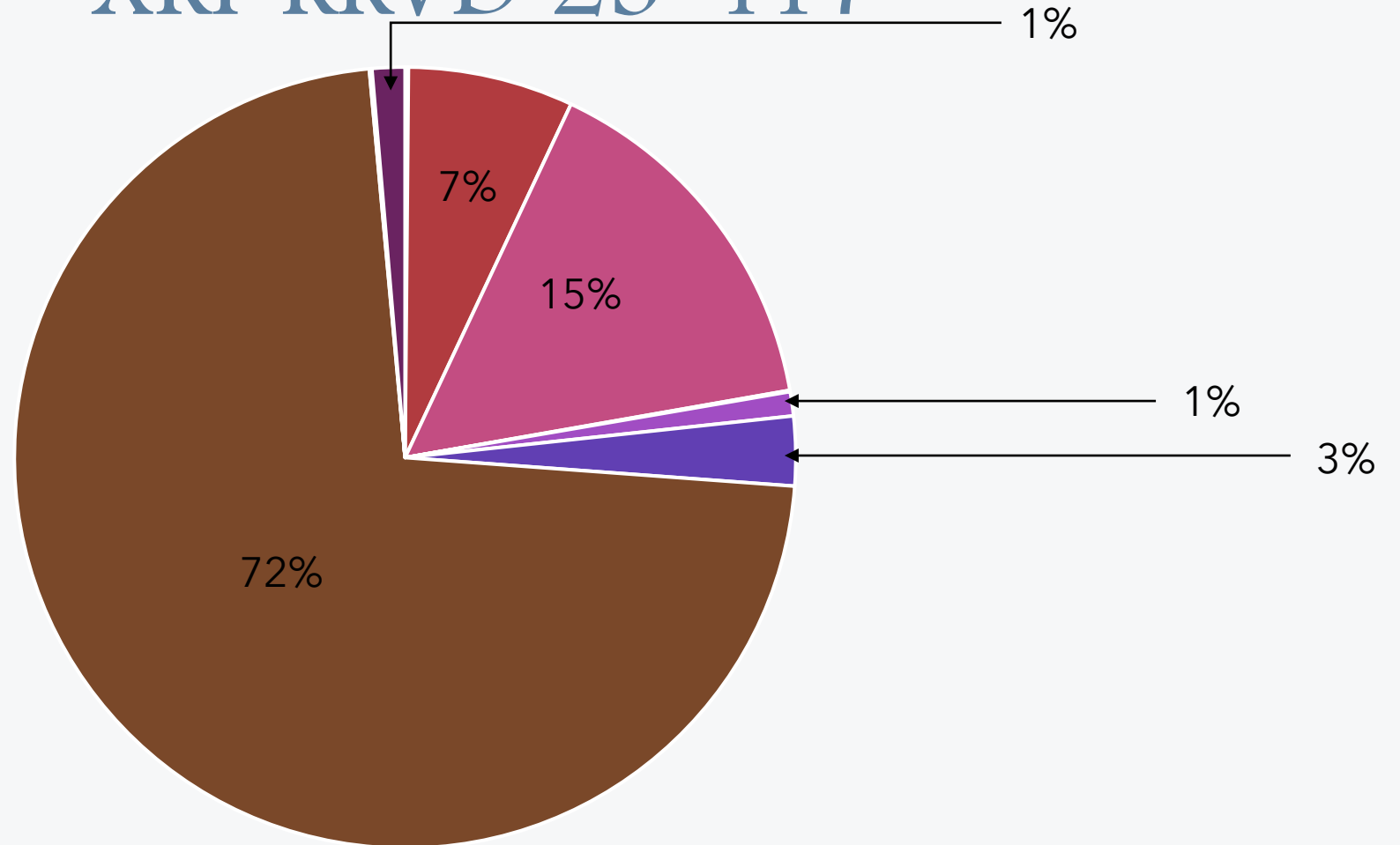
- Albite
- Silica
- Microcline



Visible	Ref. Code	Score	Compound Name	Displacement [°2Th.]	Scale Factor	Chemical Formula
	00-041-1480	64	Albite, calcian, ordered	0.000	0.824	(Na, <u>Ca</u>) Al (Si, Al) ₃ O ₈
	00-020-0554	60	Albite, ordered	0.000	0.640	Na Al Si ₃ O ₈
	00-033-1161	61	silica	0.000	0.635	Si O ₂
	00-010-0393	63	Albite, disordered	0.000	0.652	Na (Si ₃ Al) O ₈
	00-022-0675	48	Microcline, intermediate	0.000	0.191	K Al Si ₃ O ₈
	00-010-0361	52	Anorthoclase, syn	0.000	0.516	Na _{0.71} K _{0.29} Al Si ₃ O ₈

XRF RRVD 23~417

- Silica - 72%
- Aluminum - 15%
- Sodium - 7%
- Calcium - 3%
- Iron - 1%
- Potassium - 1%
- Rest of minerals > 1%



MgO mass%

Na₂O mass%

Al₂O₃ mass%

P₂O₅ mass%

K₂O mass%

CaO mass%

SiO₂ mass%

TiO₂ mass%

MnO mass%

Fe₂O₃ mass%

Results for 23~417

- The results show a percentage of Si of about 72%
- Aluminum still at 15%
- Na at 7% and Ca at 3% Slightly more Ca in the plagioclase
- More plagioclase could indicate a deeper part of the melt

Conclusion

- Data indicates a deeper melt formation
- Not a noticeable change between the two though

Thank you for being a
wonderful educator and
instructor in our learning
process



References

- Kelley, L.I., 1980. Kaolinitic weathering zone on Precambrian basement rocks, Red River Valley, eastern North Dakota, and northwestern Minnesota, University of North Dakota, p. 1-98.
- Moore, W.L., 1978. A preliminary report on the geology of the Red River Valley drilling project, eastern North Dakota and northwestern Minnesota, Bendix Field Engineering Company, p. 1-301.
- Percival, J.A., Skulski, T., Sanborn-Barrie, M., Stott, G.M., Leclair, A.D., Corkery, M.T., and Boily, M., 2012. Geology and tectonic evolution of the Superior Province, Canada, Geological Association of Canada, Special Paper 49, p. 1-58.