Ore Mineralogy of the Red Dog Mine, Alaska

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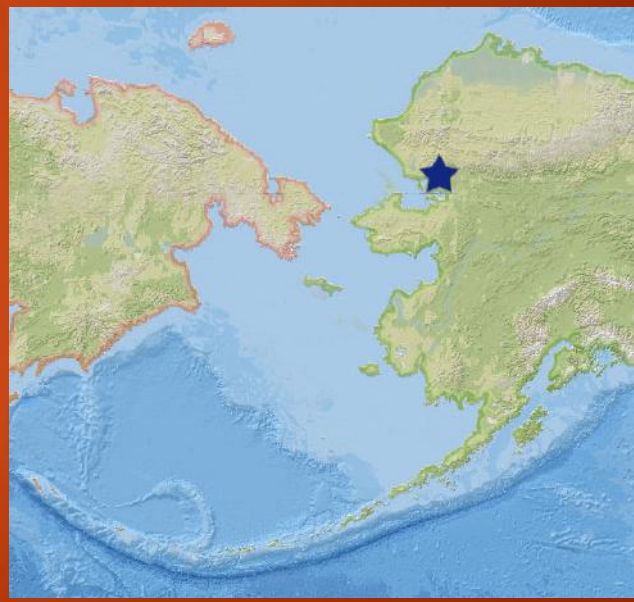
NDSU Petrology 2016

ocation

- Located in the Brooks Mountain Range in Northwestern Alaska
- Named after the overlying Red Dog Creek
- Open-pit mining since construction began in 1987

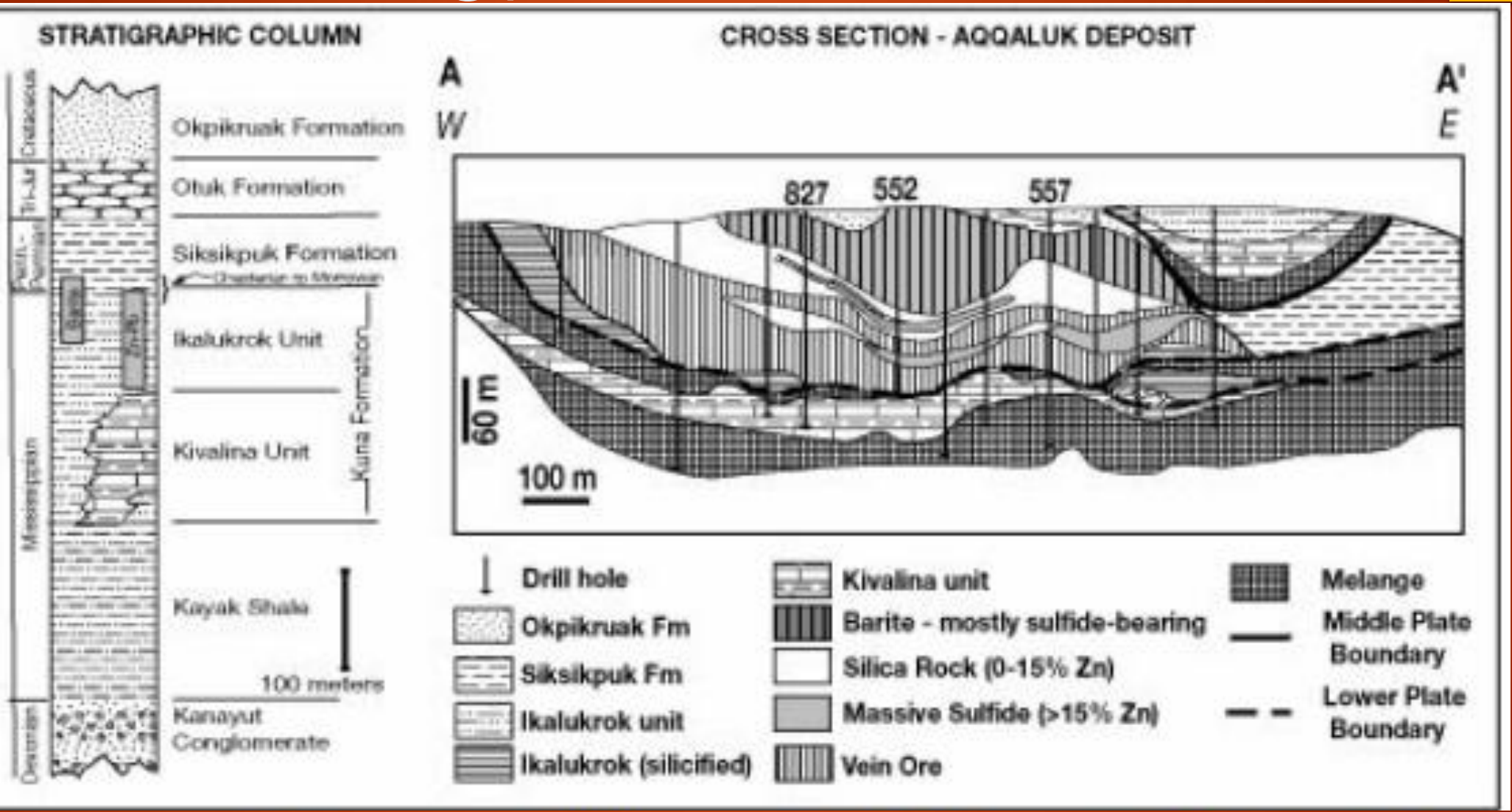
http://m.ammoth.us/blog/2010/04/a-preliminary-atlas-of-gizmo-landscapes/



http://dec.alaska.gov/spar/csp/sites/reddog.htm

Mowatt et al., 1991)

ocal Geology



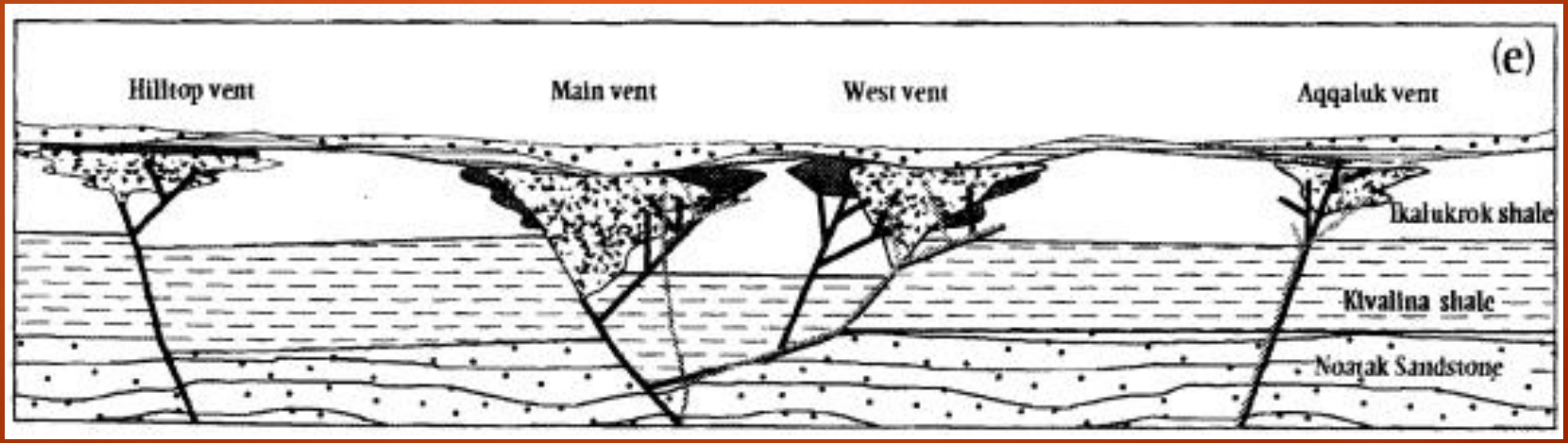
(elley et al., 2004)

Guiding Questions

- How did this orebody form?
- What is the mineralogy of this sample?
  - More specifically the ore-bearing minerals

ow did this orebody form?

- Hydrothermal vent field 2400m X 400m
- Four main vents: Hilltop, Main, West, Aqqaluk
- The Main and West vents were the main source of fluid discharge
- Mineral-rich fluid precipitated ores of Zn, Pb, and Ag
- Host rock of black shale and mudstone



et al., 2004)
et al., 2004)
on, 1997)

Why is this deposit important?

- World's largest source of zinc
- Orebody contains reserves of ~150 metric tons
- 16.2% zinc
- 4.4% lead
- 110 grams/ton silver
- Other locations with similar mineralogy are being discovered in northwestern Alaska
  - Possible increase in mining activity in the near future

erton, 1997)

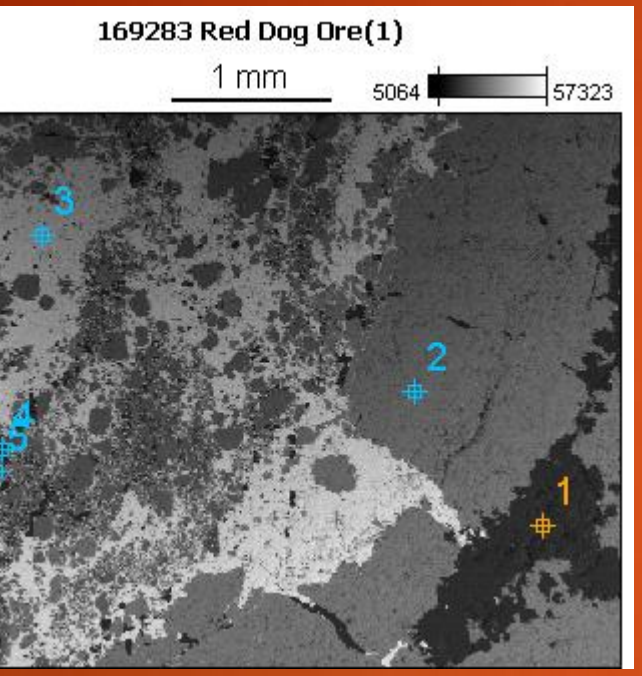
Determining Ore Mineralogy

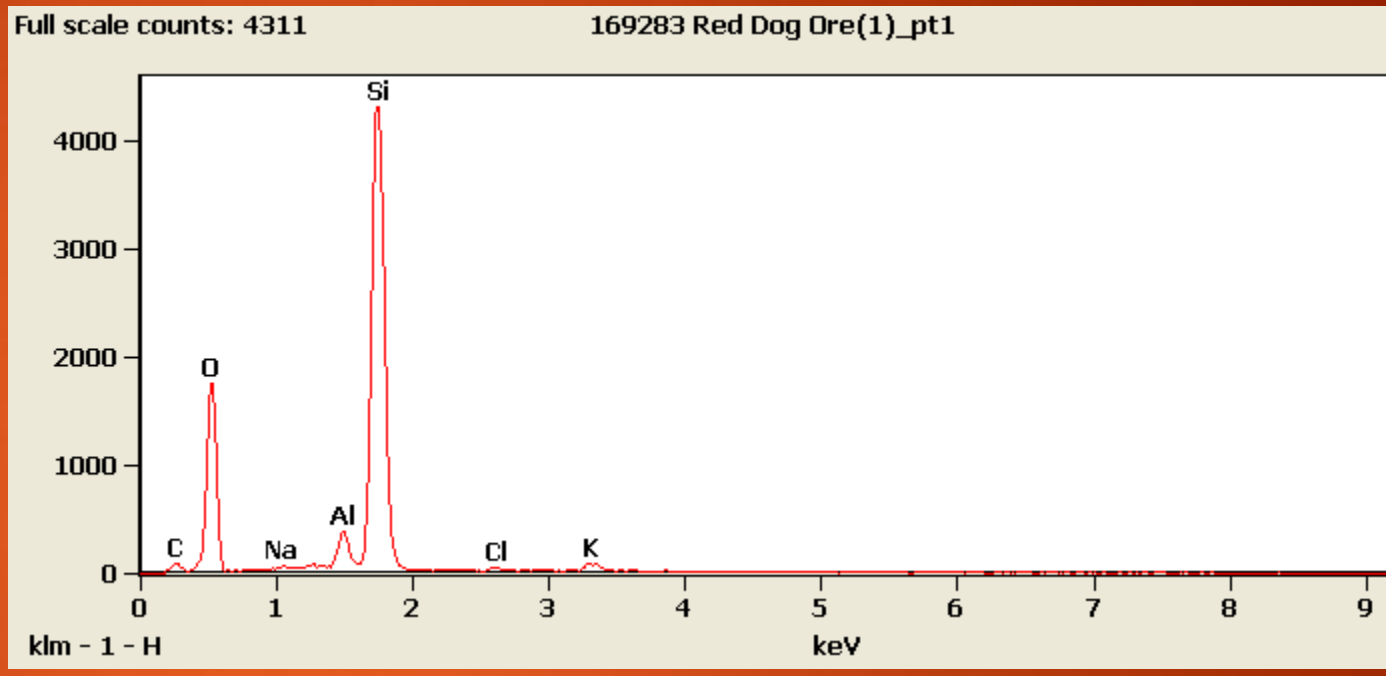
- SEM Analysis
  - 2 separate magnifications
  - Part 1: 3 sample points from a magnification of 30
  - Part 2: 4 sample points from a magnification of 1300
- The back-scattered electron detector (BSE) was used to determine the elements present in the sample. Electron detectors above the sample determine composition while detectors on the side determine topography
- Elements with low atomic mass will appear darker than heavier elements
- Note: thin sections for ore minerals cannot be used on normal optical microscopes due to their opaque properties

EM Results Part 1

- Magnification at only 30

EM Results Part 1





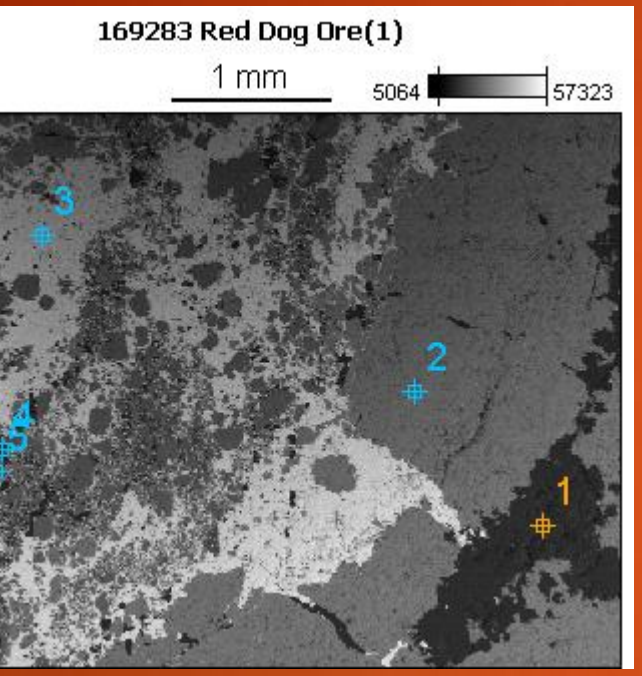
ame: 169283 Red Dog Ore(1)
rage: 15.0 kV
ation: 30

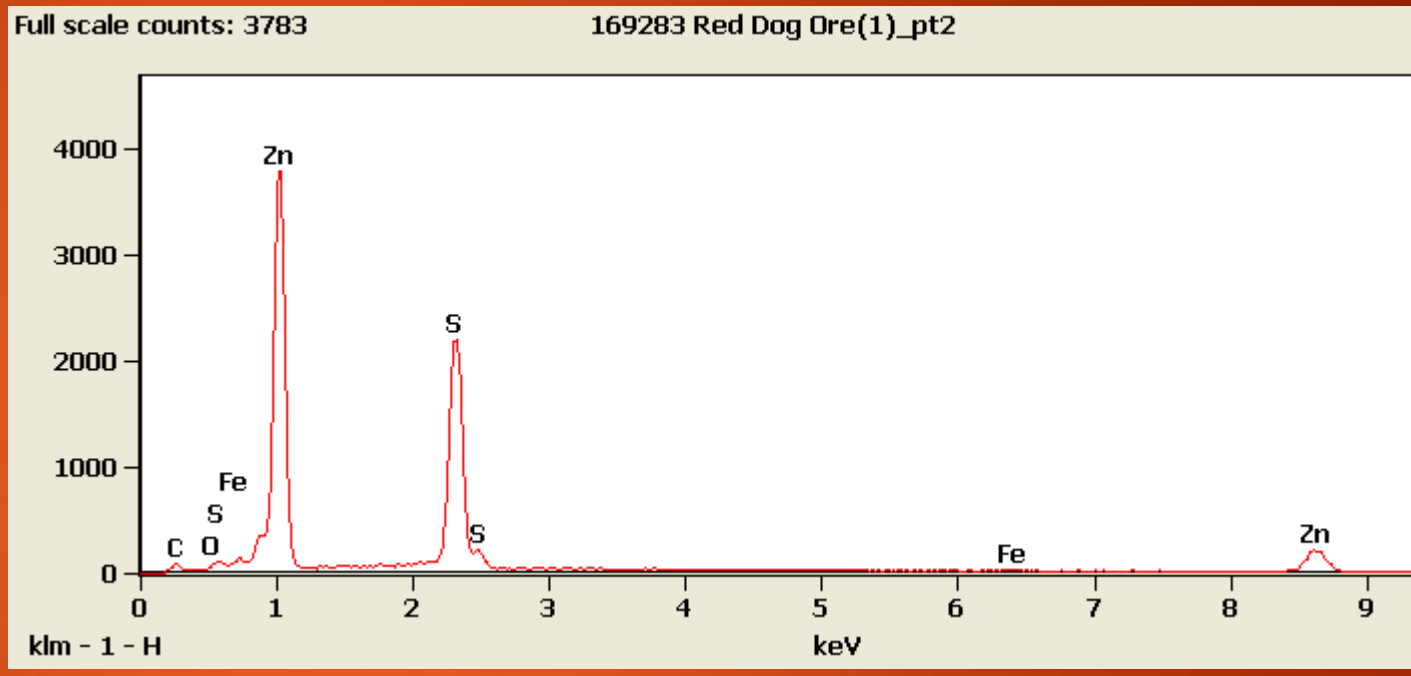
Conclusion: Quartz SiO_2

Weight %

	Na-K	Al-K	Si-K	S-K	Cl-K	K-K	Fe-K	Zn-K
169283 Red Dog Ore(1)_pt1	0.72	4.35	90.37		1.20	3.36		
169283 Red Dog Ore(1)_pt2				35.57			1.76	62.67
169283 Red Dog Ore(1)_pt3				13.07				
169283 Red Dog Ore(1)_pt4			12.24	54.80		0.67	32.29	
169283 Red Dog Ore(1)_pt5				37.78				62.22

EM Results Part 1





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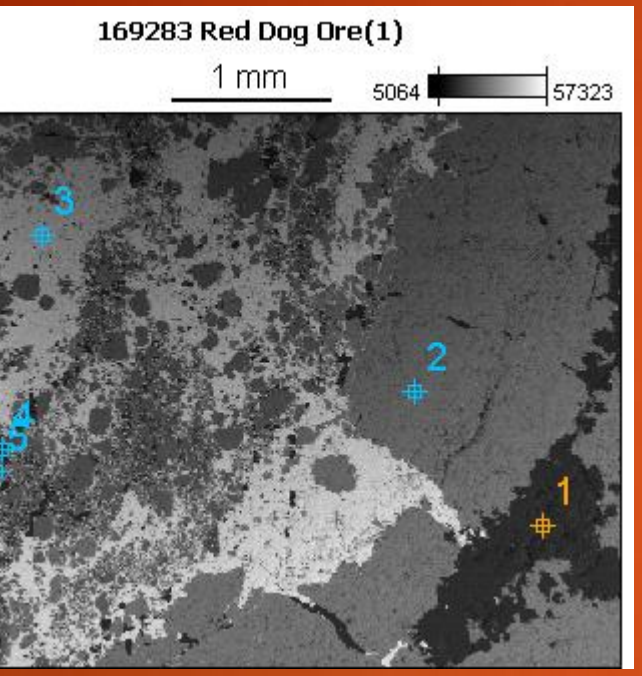

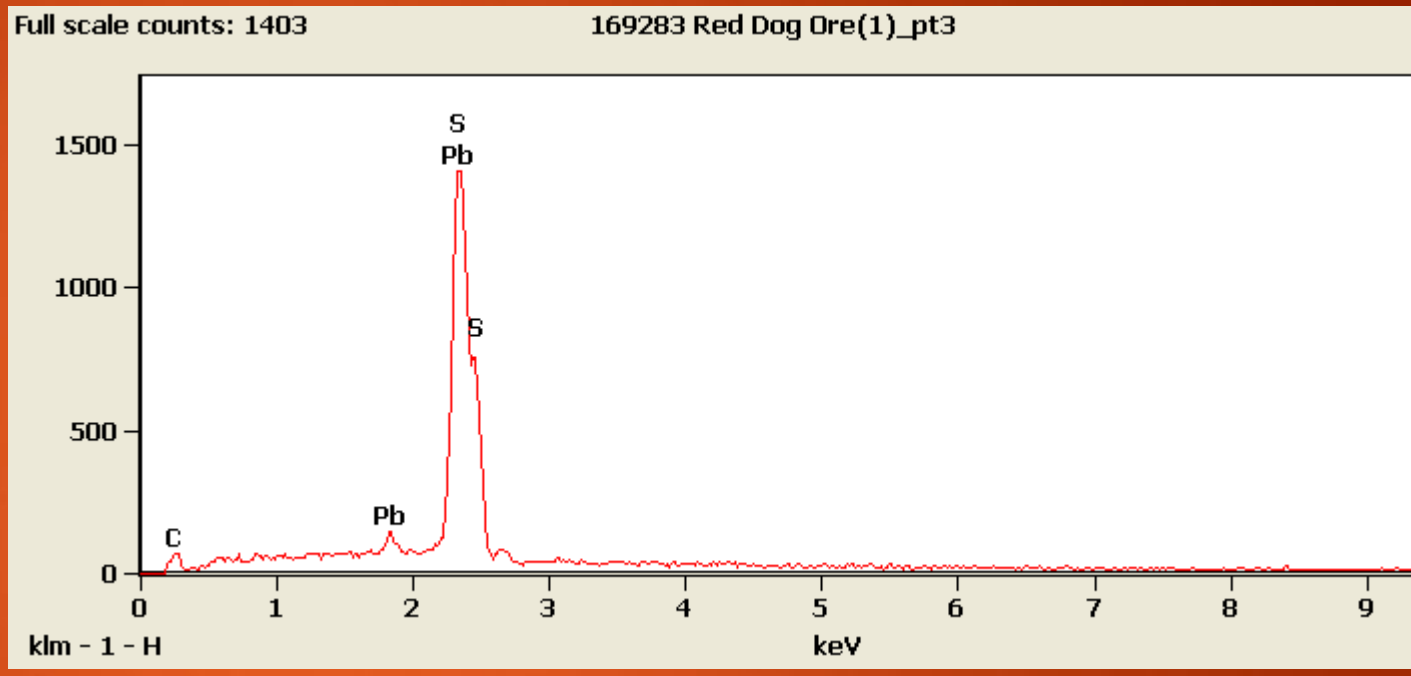

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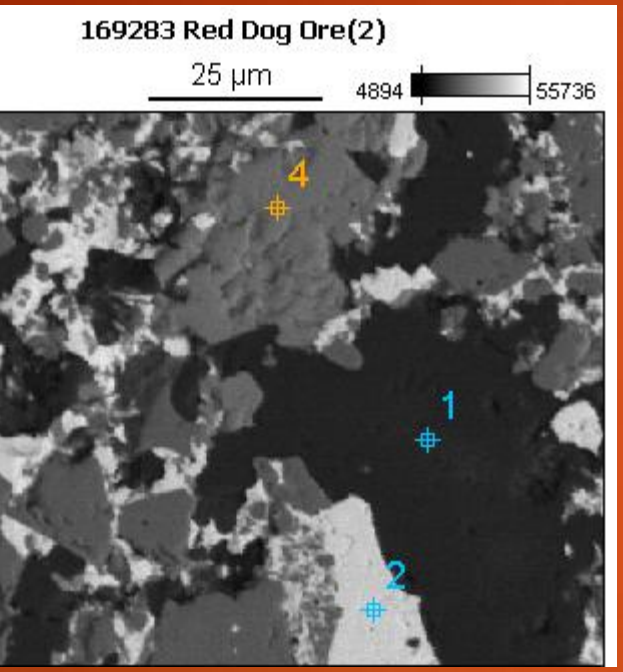
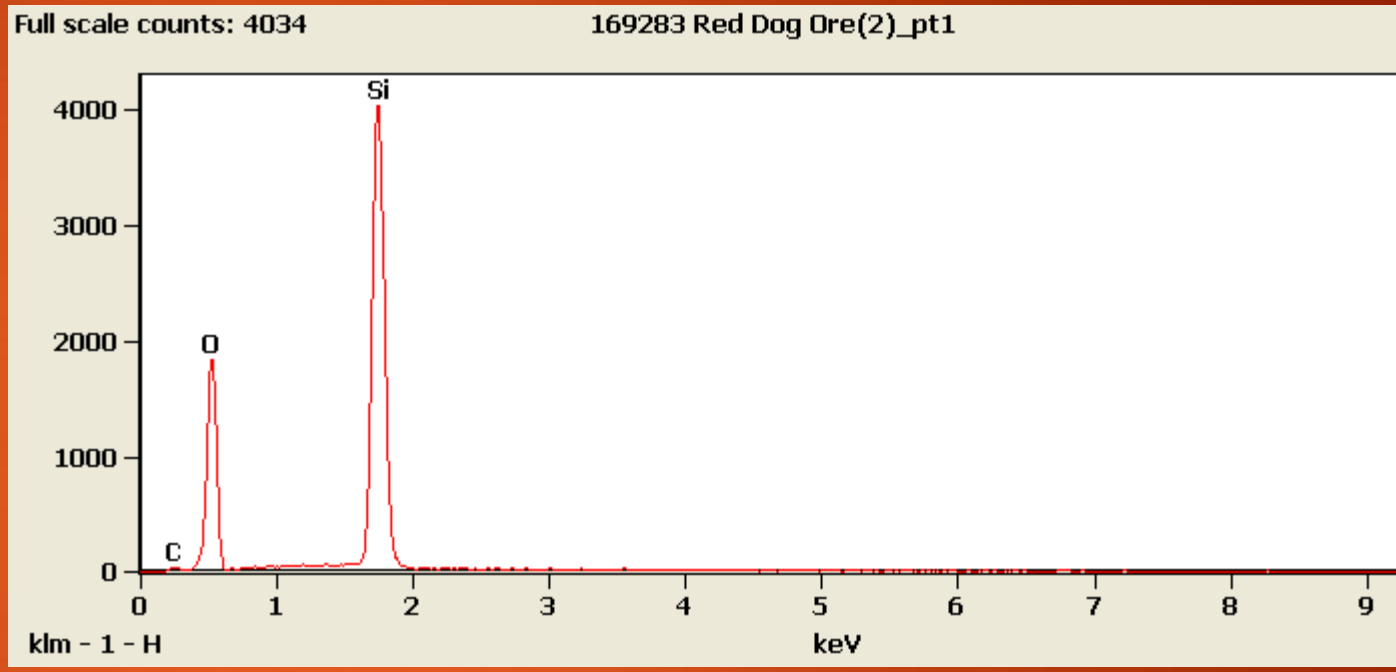
EM Results Part 2

- Magnification increased to 1300

EM Results Part 2





e Name: 169283 Red Dog Ore(2)
Voltage: 15.0 kV
ification: 1300

Conclusion: Quartz SiO_2

Weight %

	C-K	O-K	Si-K	S-K	Fe-K	Zn-K
169283 Red Dog Ore(2)_pt1	5.14	50.52S	44.34			
169283 Red Dog Ore(2)_pt2				14.02		
169283 Red Dog Ore(2)_pt3				55.84	44.16	
169283 Red Dog Ore(2)_pt4				34.93	2.23	62.84

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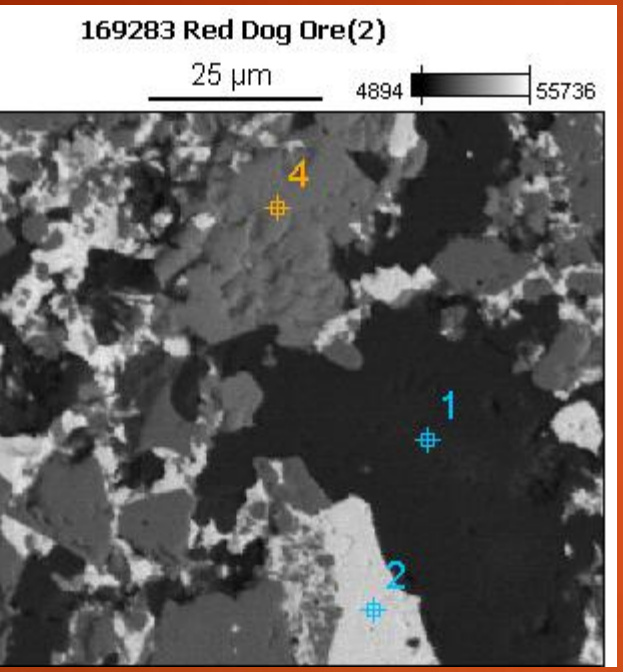

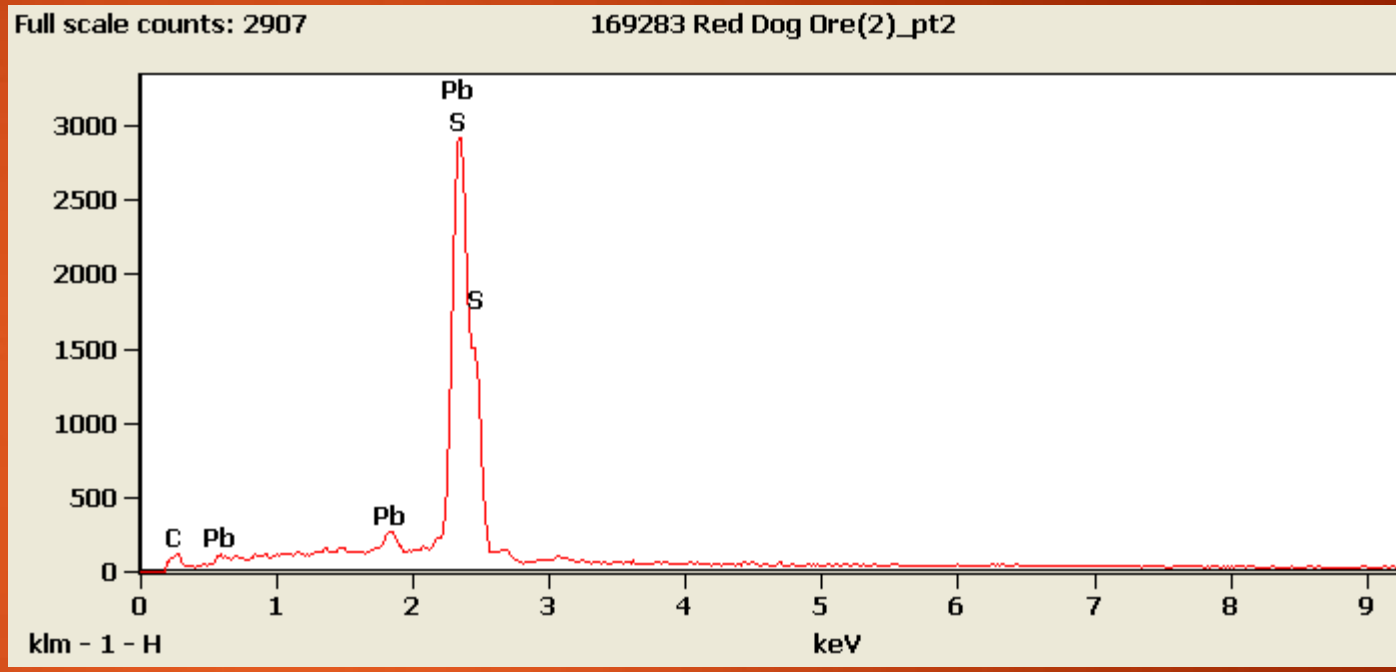

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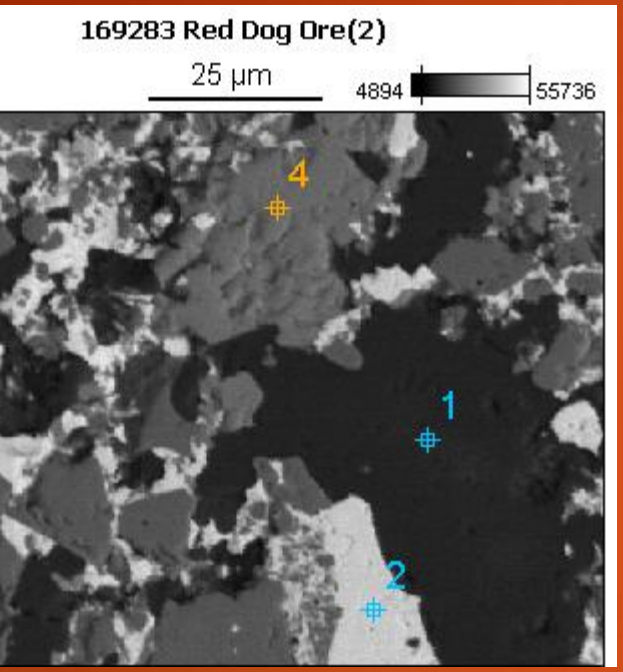

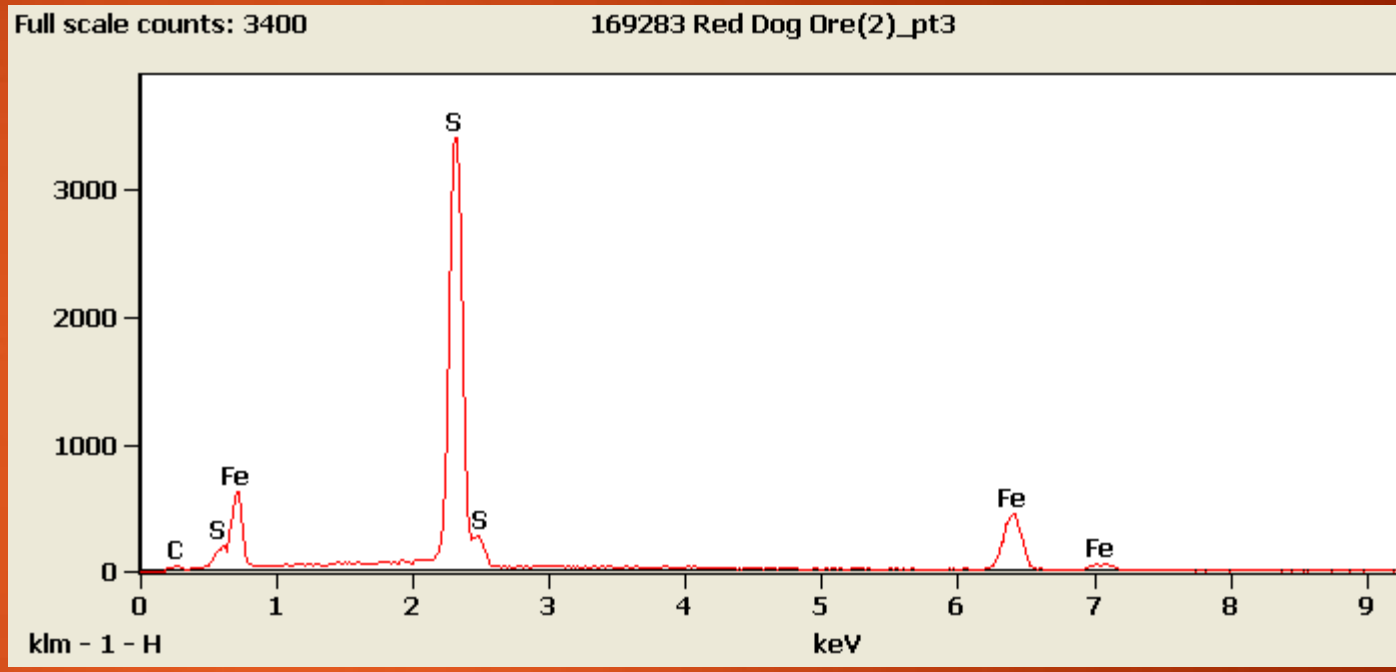

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Conclusion: Pyrite FeS_2
Not pyrrhotite $Fe_{1-x}S$

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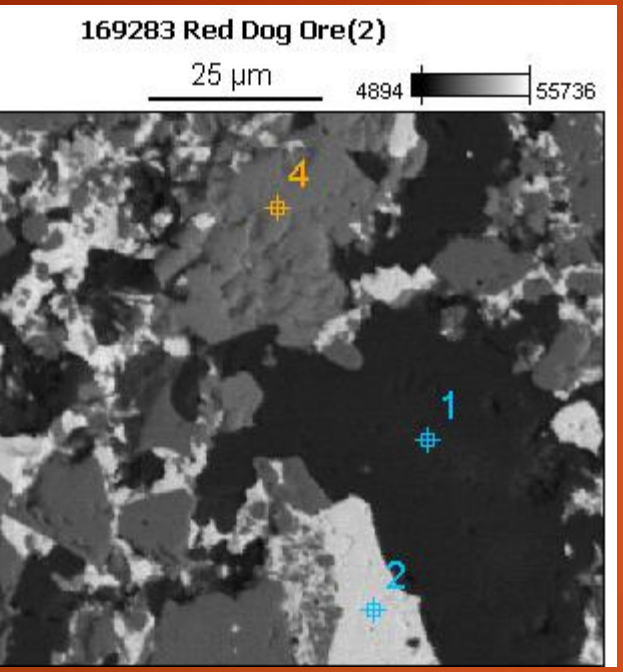

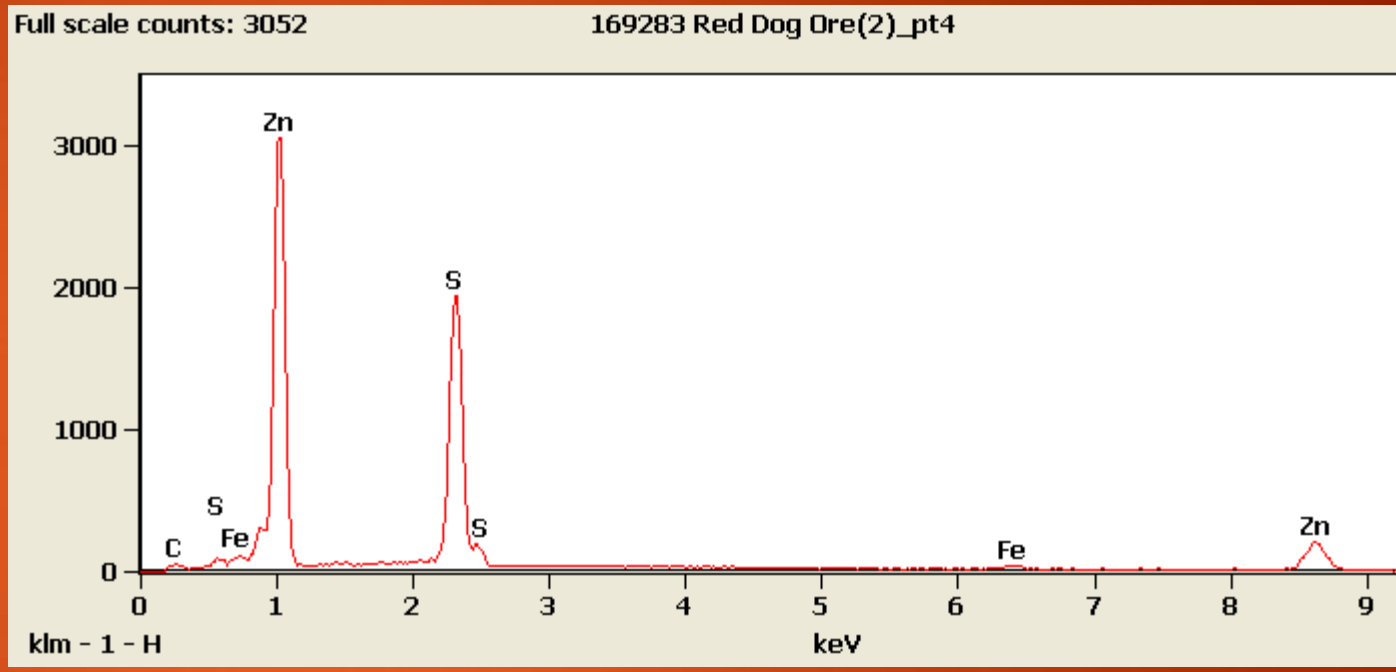

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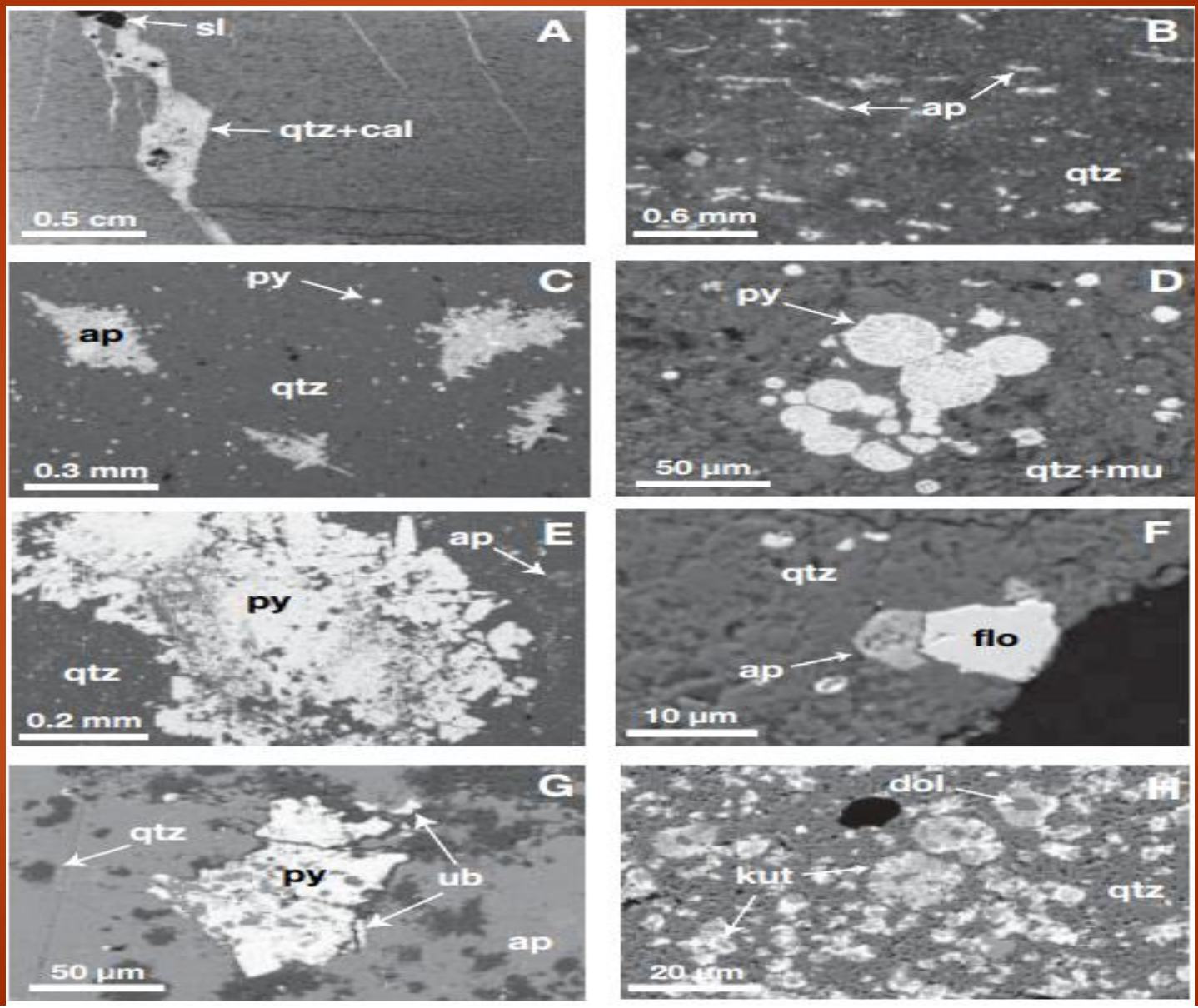
EM Results for Slack et al.



Conclusions

- How did this orebody form?
  - Hyrdothermal vents precipitated sulfide minerals into the Kuna Formation
  - Black shale and mudstone of Mississippian age
- What is the mineralogy of this sample?
  - Analysis through SEM shows major ore-bearing minerals:
    - Sphalerite: zinc
    - Galena: lead
    - Pyrite: iron
    - Quartz: accessory mineral

y et al., 2004)

eferences

- Edgerton, D. 1997. Reconstruction of the Red Dog Zn-Pb-Ba orebody, Alaska: implications for the vent environment during the mineralizing event. Canadian Journal of Earth Sciences, 34, 1581-1602.
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- Slack, J., Kelley, K., Anderson, M., Clark, J., Ayuso, R. 2004. Multistage Hydrothermal Silicification and Fe-Tl-As-Sb-Ge-REE Enrichment in the Red Dog Z Pb-Ag District, Northern Alaska: Geochemistry, Origin, and Exploration Applications. Economic Geology, 99, 1481-1508.

Acknowledgements

- Dr. Bernhardt Saini-Eidukat for his help and guidance with my project
- The staff at the SEM lab for their help with the composition analysis

Thank You