

Petrology of North Slope Outcrop Samples 2008: Progress Report

Alaska Department of Natural Resources
Division of Geological & Geophysical Surveys
Division of Oil & Gas

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Technical Review

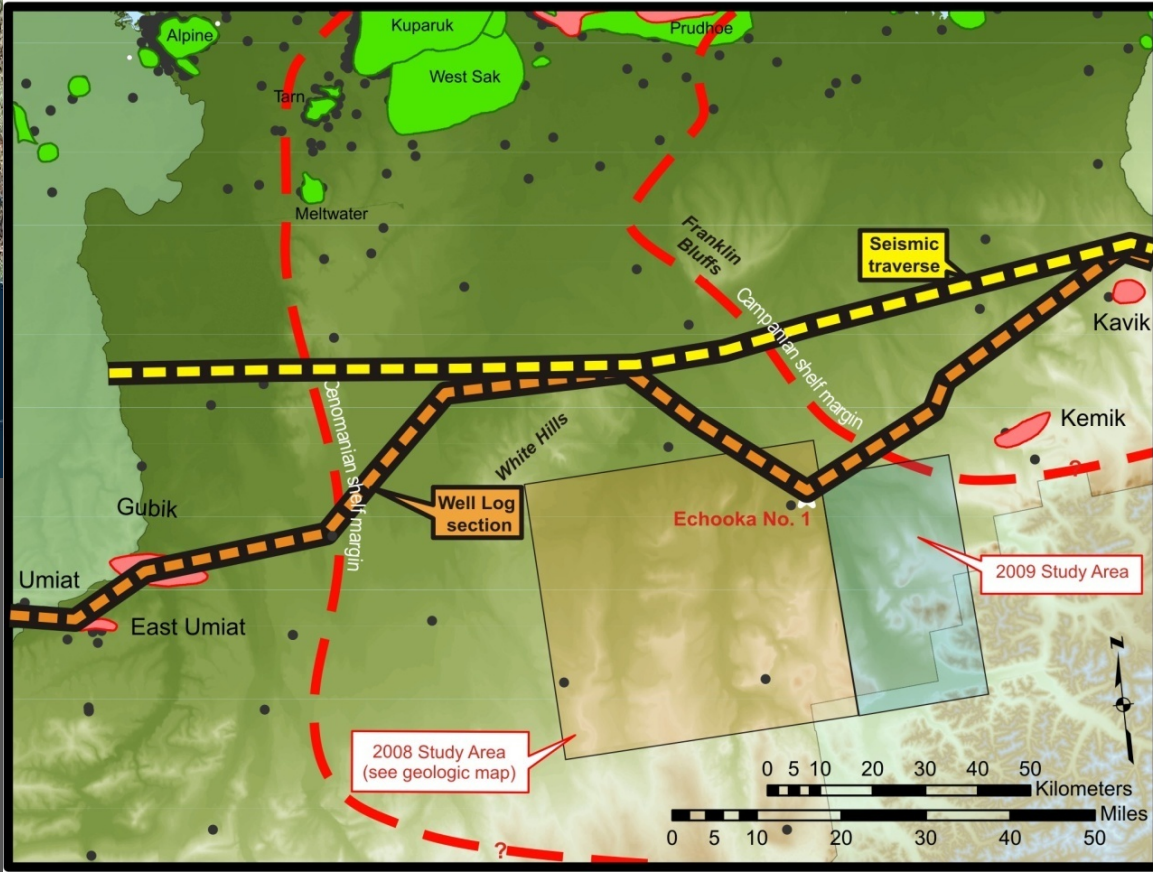
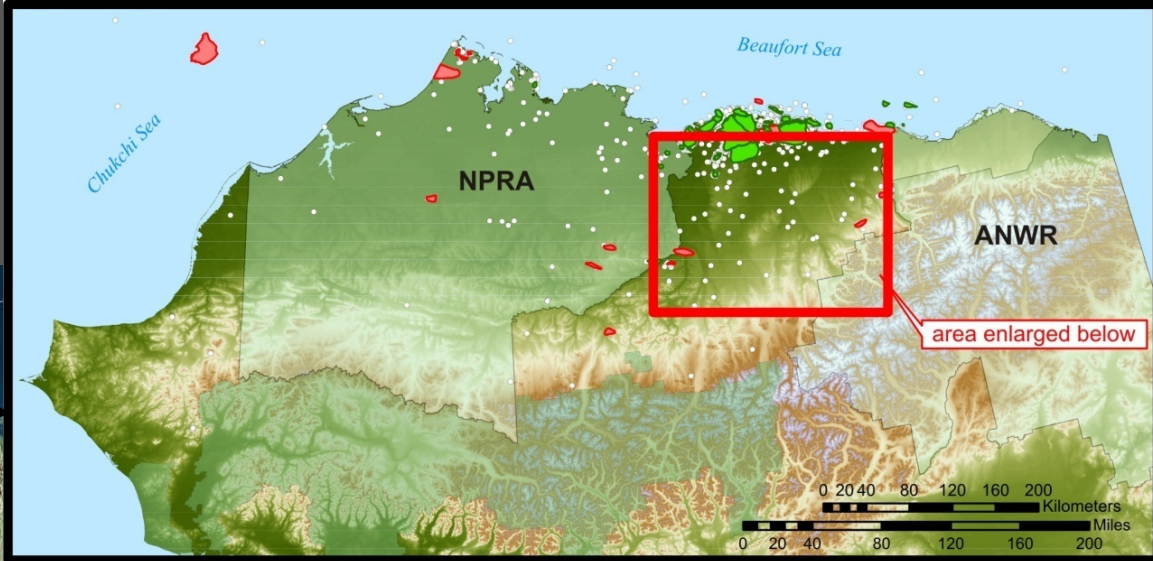
COP; ANO-259
Anchorage, AK
April 21, 2010



Outline

- **Regional overview**
- **2008 point-count data** (M. D. Wilson)
 - Compare to regional ss. compositional trends
- **2007-08 Ø-K data** (Weatherford Labs)
 - Compare to regional RQ trends
- **Representative examples**

Location of Mapping Project



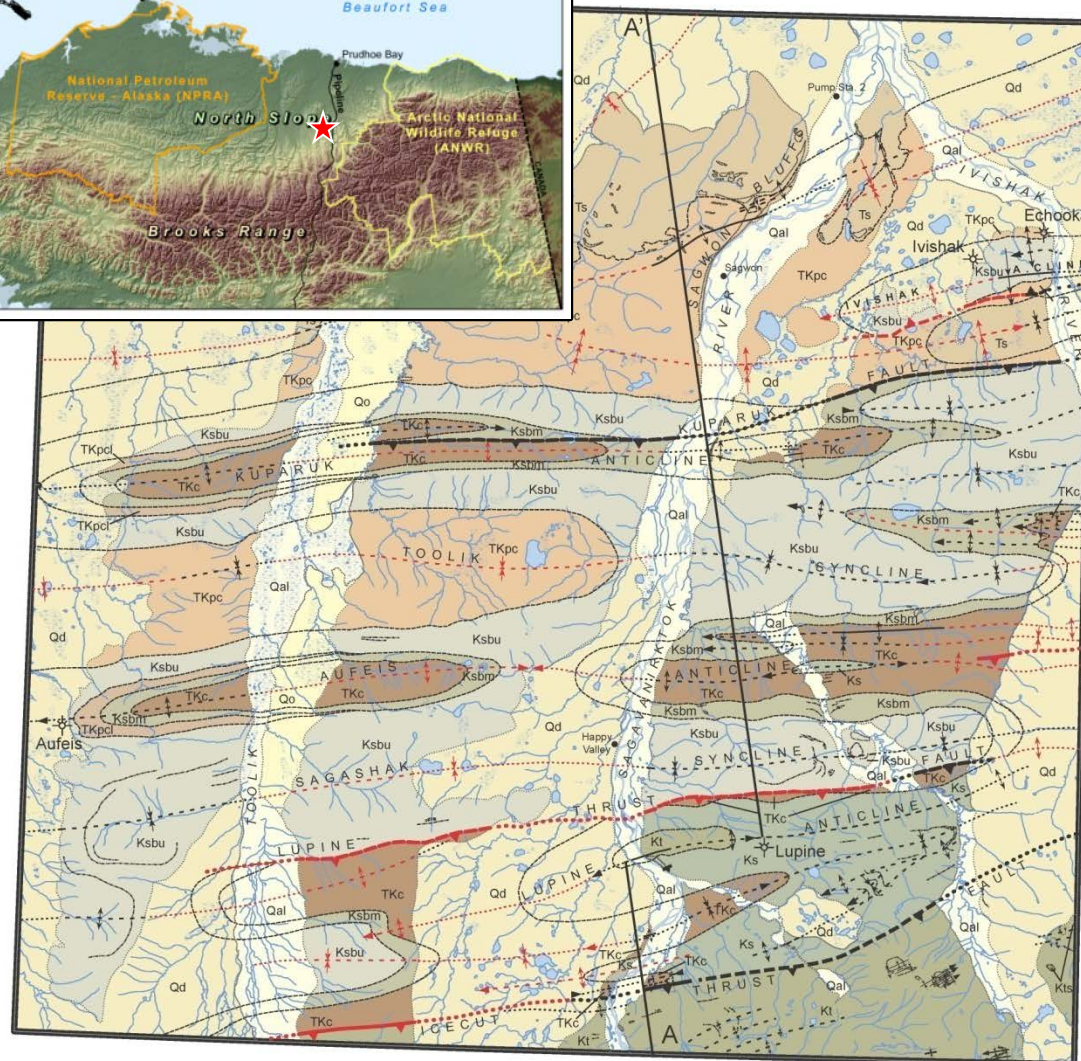
Field work conducted by:

Paul Decker, Marwan Wartes,
Dave Lepian, Bob Gillis,
Andrea Loveland, Rocky
Reifenstuhl, Wes Wallace

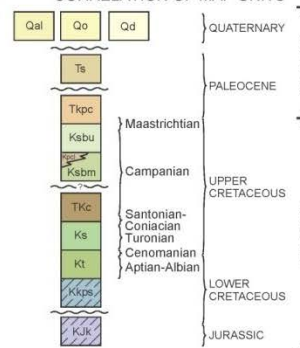
Preliminary Sagavanirktok Geologic Map



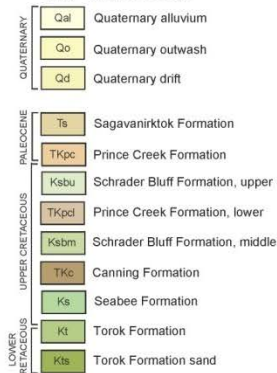
ALASKA DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS



CORRELATION OF MAP UNITS



MAP UNIT LEGEND



LEGEND OF MAP SYMBOLS

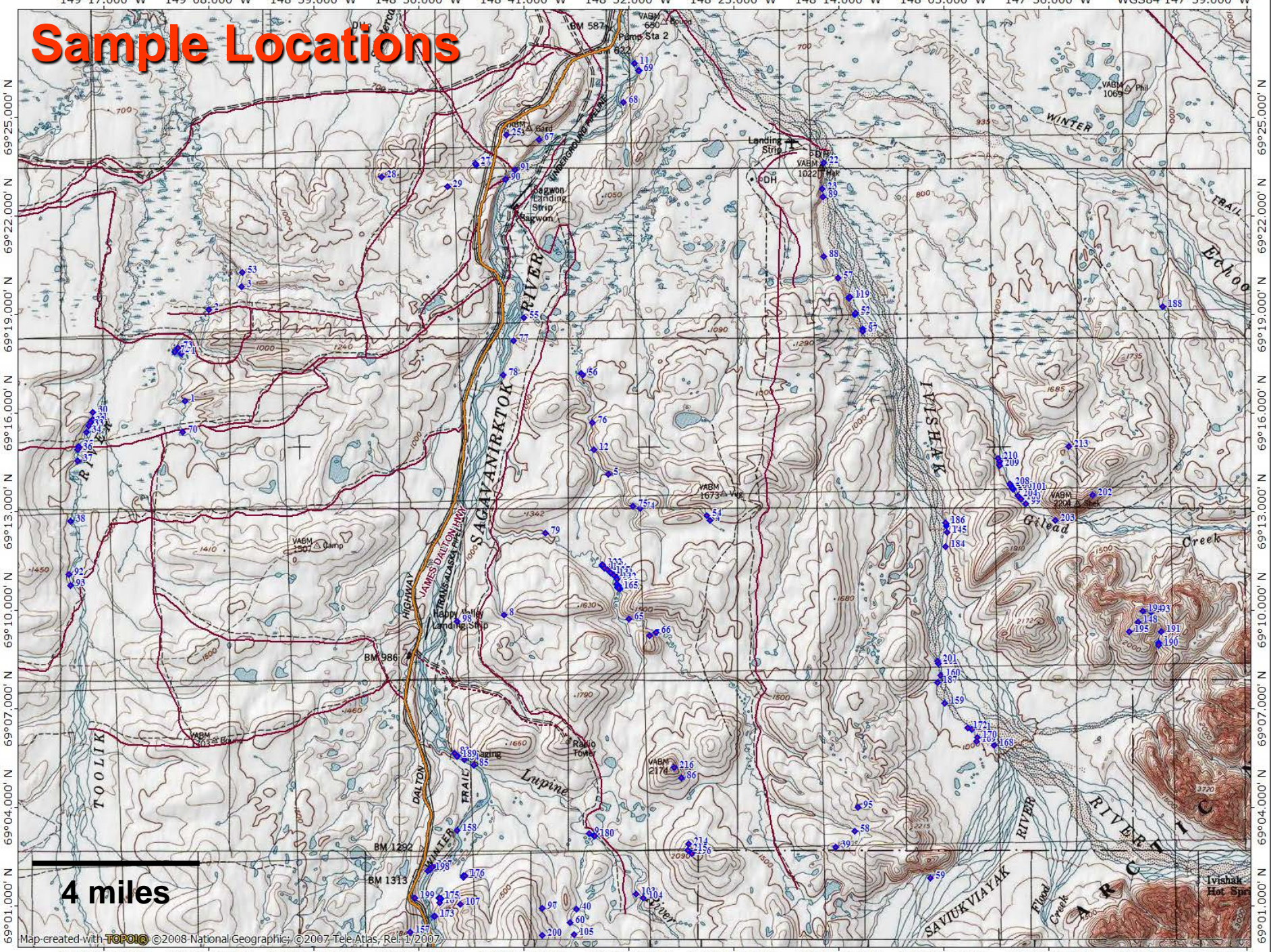
- Contacts and fold axes:
 black = constrained by surface exposures
 red = constrained by subsurface data
 dashed = approx. located
 hidden = concealed
- Thrust fault contact
 - Depositional contact
 - Rubble crop form line (from aerial photo interp.)
 - Bedrock surface exposure
 - Anticline axis w/ plunge direction
 - Syncline axis w/ plunge direction
 - Anticline axis w/ overturned limb
 - Syncline axis w/ overturned limb

Gillis et al., in press

Base vectorized from the United States Geological Survey Sagavanirktok A-3, A-4, B-3, and B-4 quadrangles (1983). Universal Transverse Mercator projection, zone 6. 1927 North American Datum

Preliminary 1:63,360-scale geologic map of southwestern and southcentral Sagavanirktok Quadrangle

Sample Locations

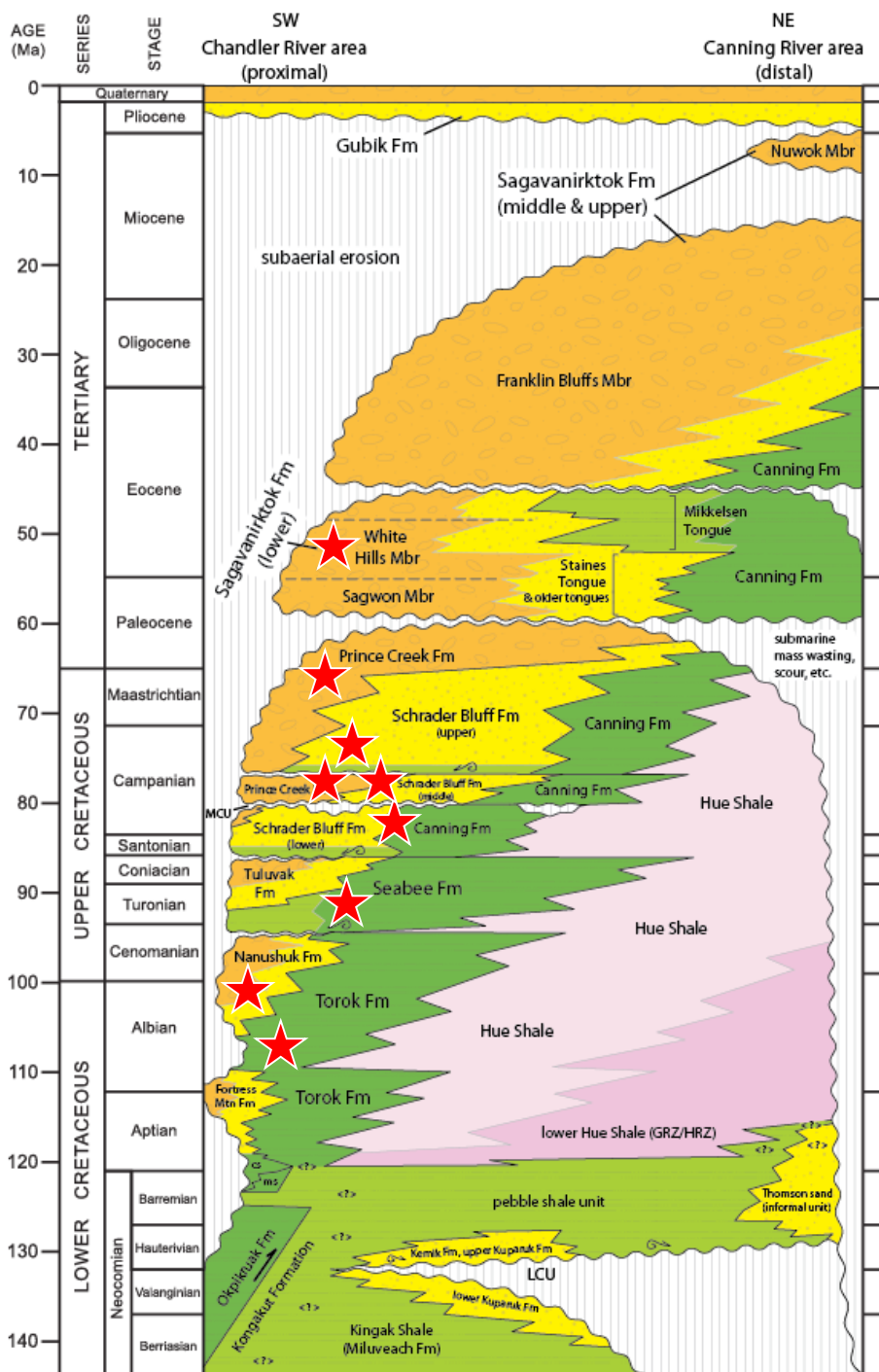


4 miles

Revised Stratigraphy of Colville Basin

2008 Sample Distribution

- 5 Sagavanirktok
- 10 Prince Creek
- 41 Schrader Bluff
- 5 Canning
- 16 Seabee
- 6 Nanushuk
- 12 Torok
- 3 Gilead



Explanation

Inferred depositional setting

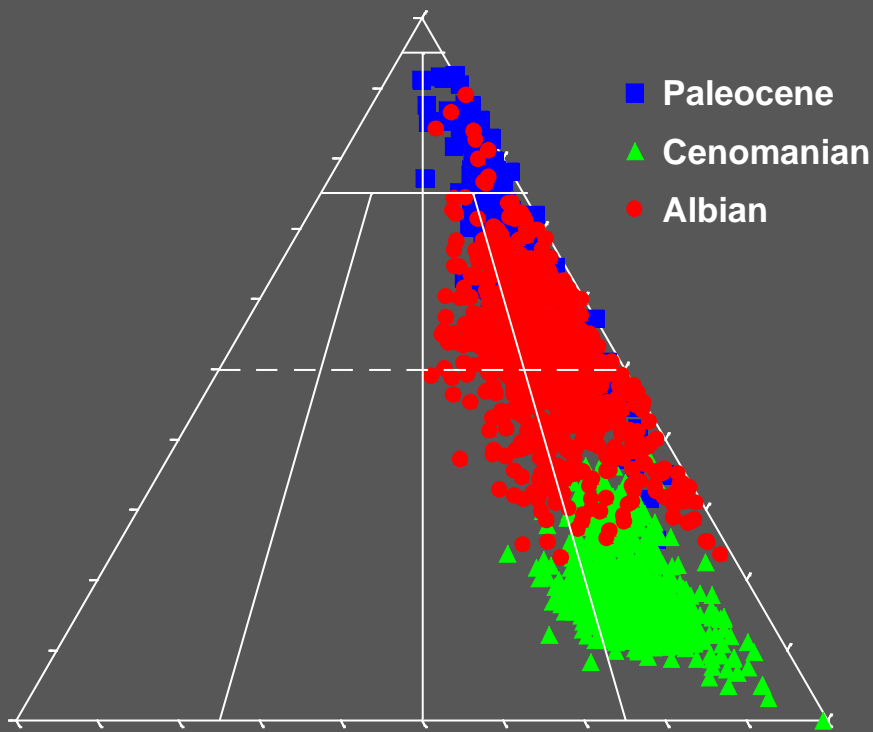
- non-marine deposits
- shallow marine deposits
- major shelfal/platform shales, siltstones
- deepwater slope & toe-of-slope deposits
- distal & condensed basinal shales

Symbols

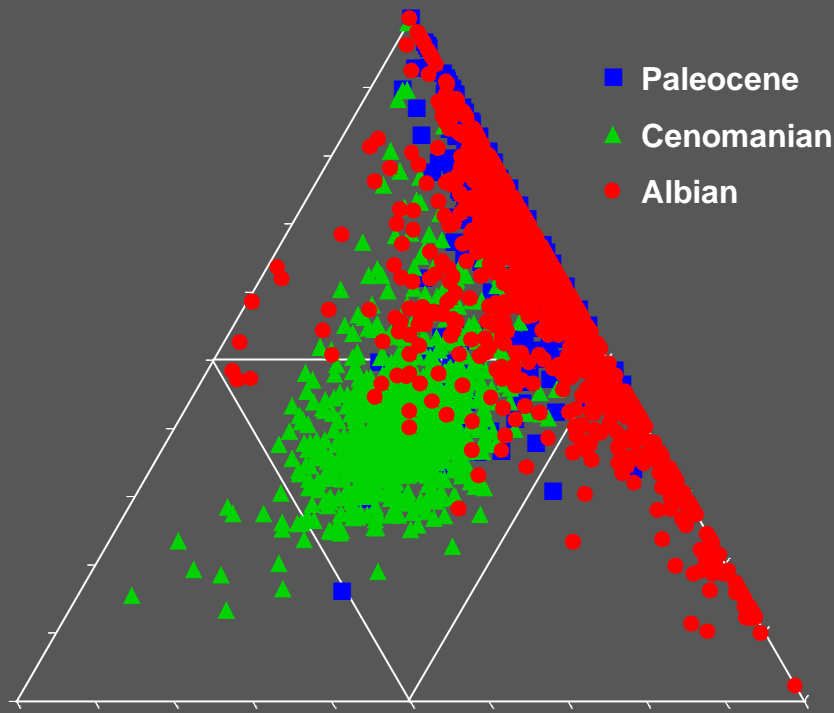
- <?> uncertain relationship
- fault contact, allochthonous unit
- transgressive flooding/ravinement surface, indicating direction of retrogradation

Regional Composition Trends

Total Quartz
(including chert)



Sedimentary Grains
(including chert)



Feldspar

Lithic Grains

Volcanic Grains

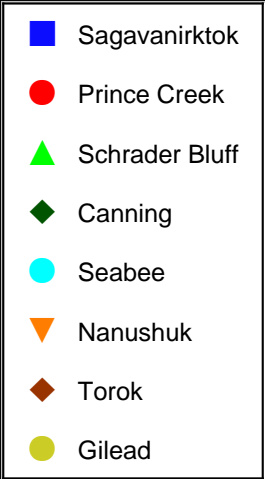
Metamorphic Grains

Paleogene ss. = chert-rich

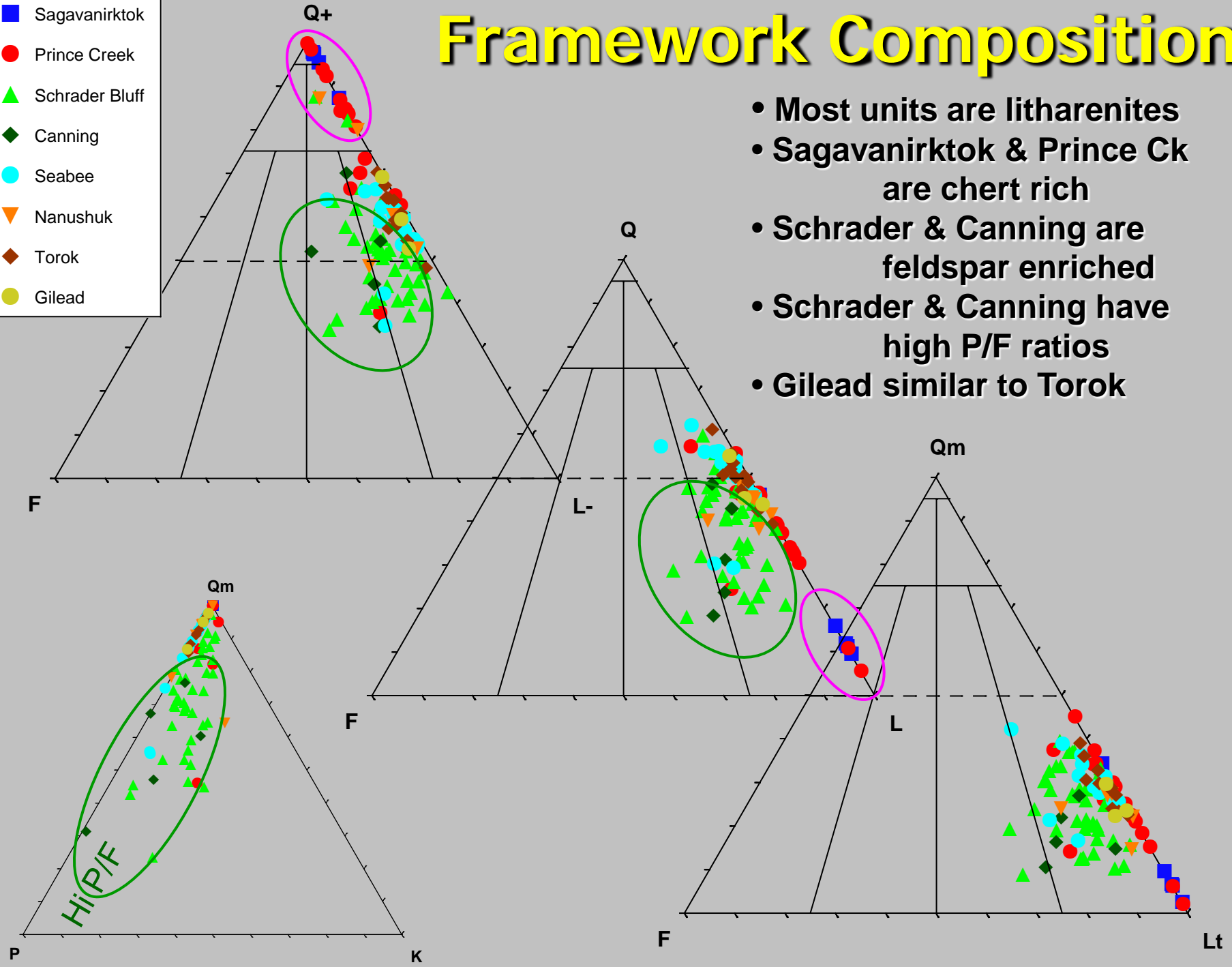
Cenomanian ss. = vitric-rich

Albian ss. = argillaceous SRF-rich

Framework Composition



- Most units are litharenites
- Sagavanirktok & Prince Ck are chert rich
- Schrader & Canning are feldspar enriched
- Schrader & Canning have high P/F ratios
- Gilead similar to Torok



Lithic Composition

- Sagavanirktok
- Prince Creek
- ▲ Schrader Bluff
- ◆ Canning
- Seabee
- ▼ Nanushuk
- ◆ Torok
- Gilead

Qp+

Sagavanirktok & Prince Creek are chert rich

Lvm

Lsm

Schrader Bluff, Canning and some Seabee are enriched in volcanic detritus

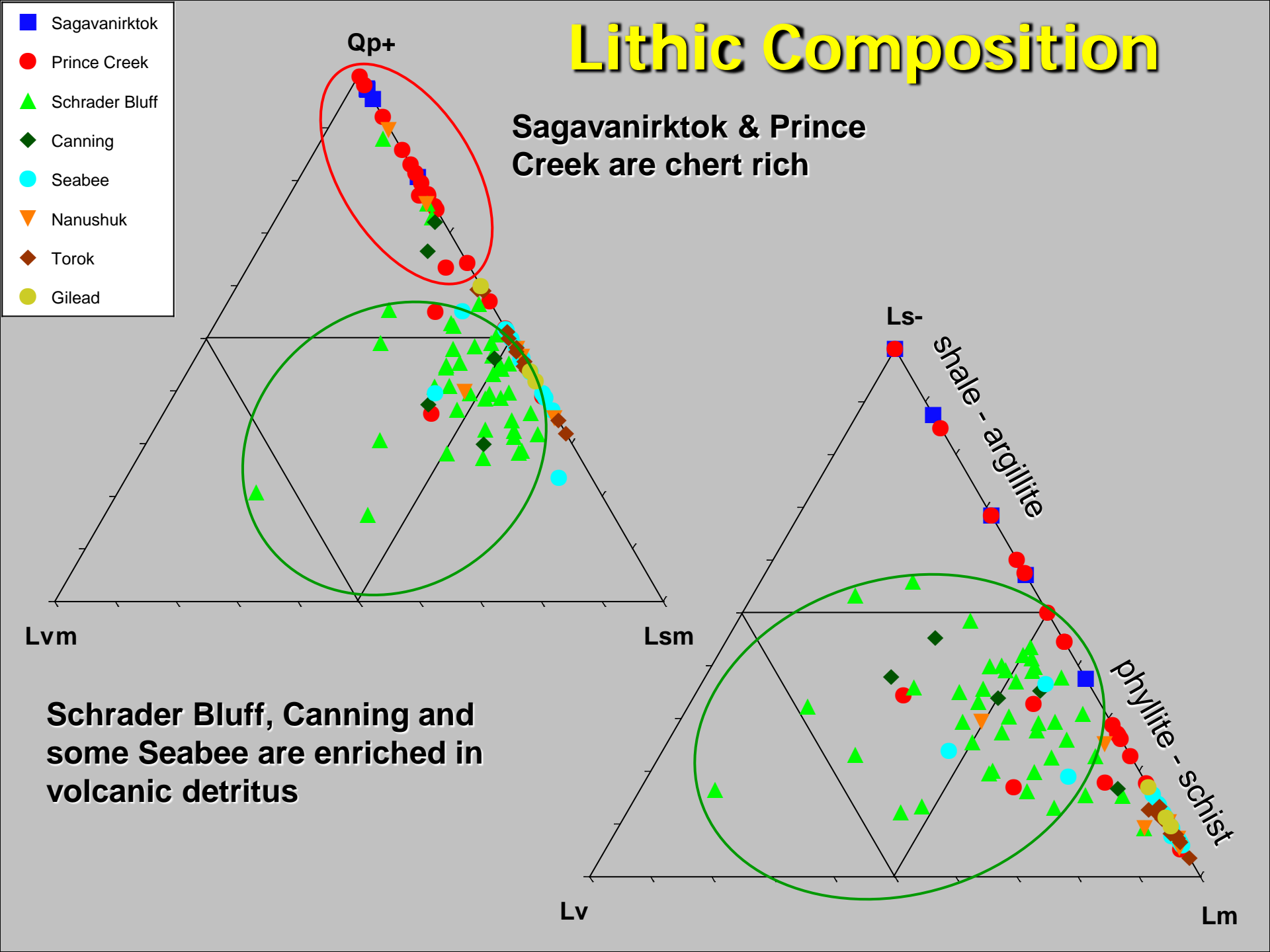
Ls-

shale - argillite

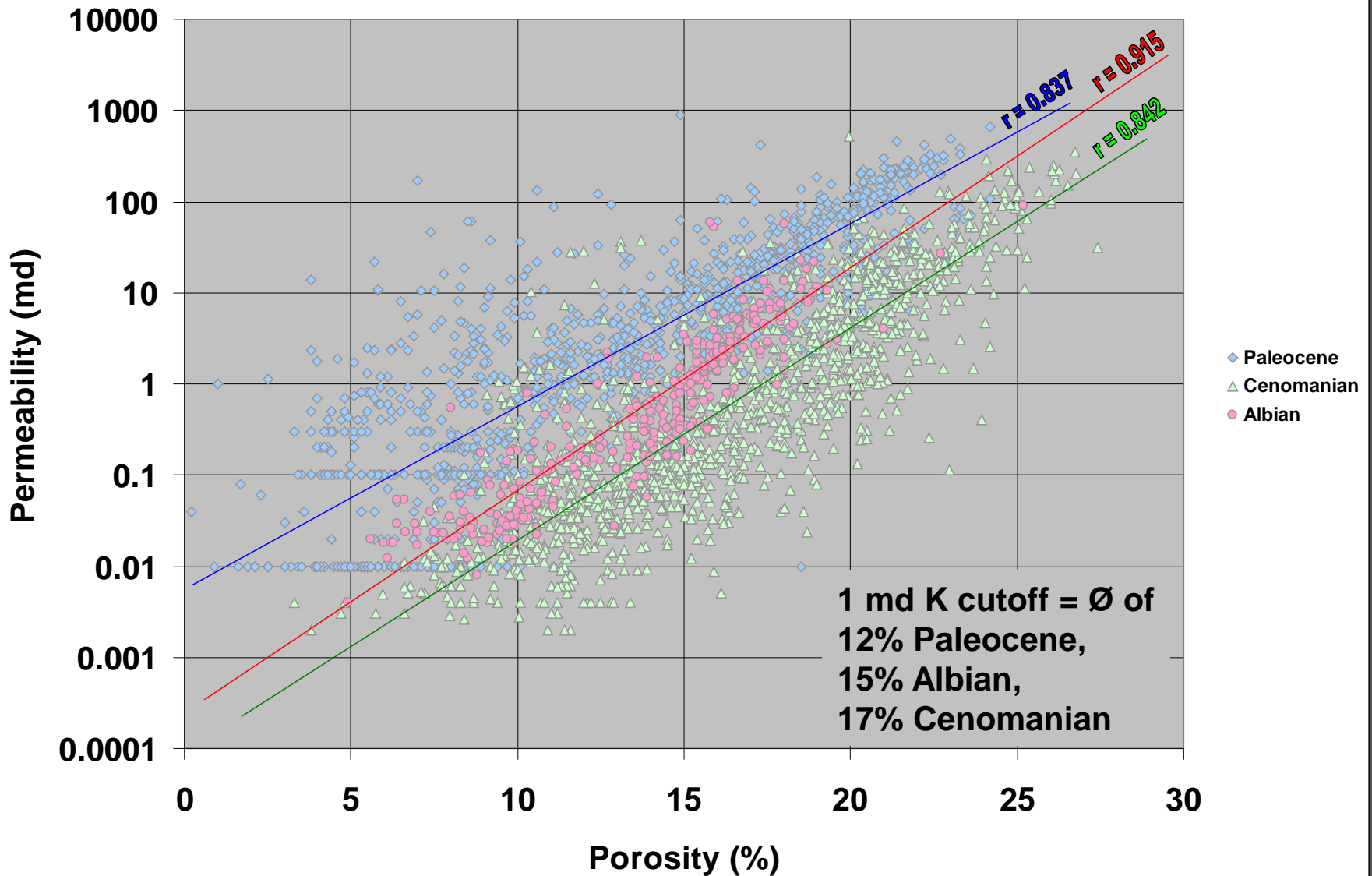
Lv

Lm

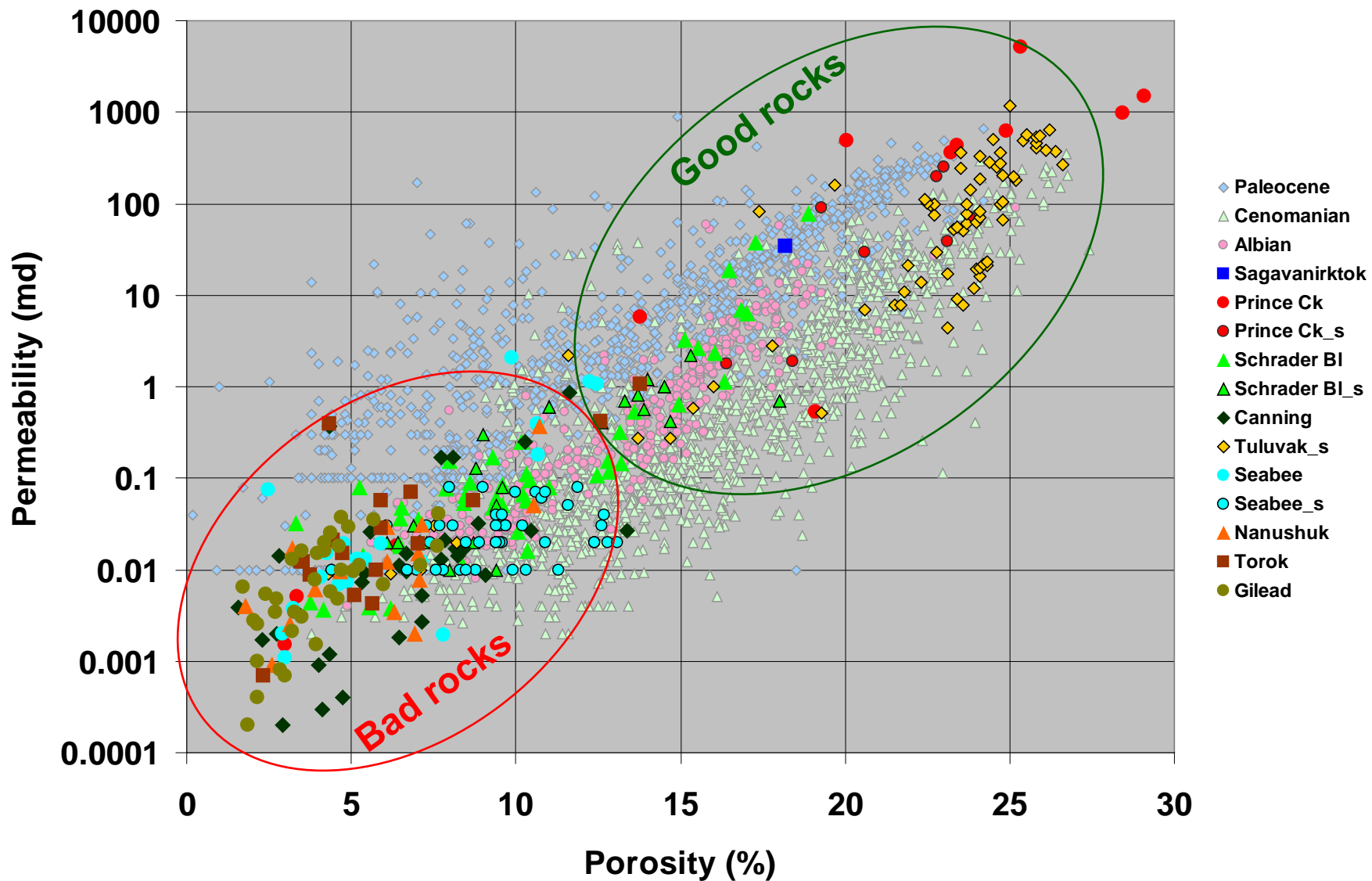
phyllite - schist



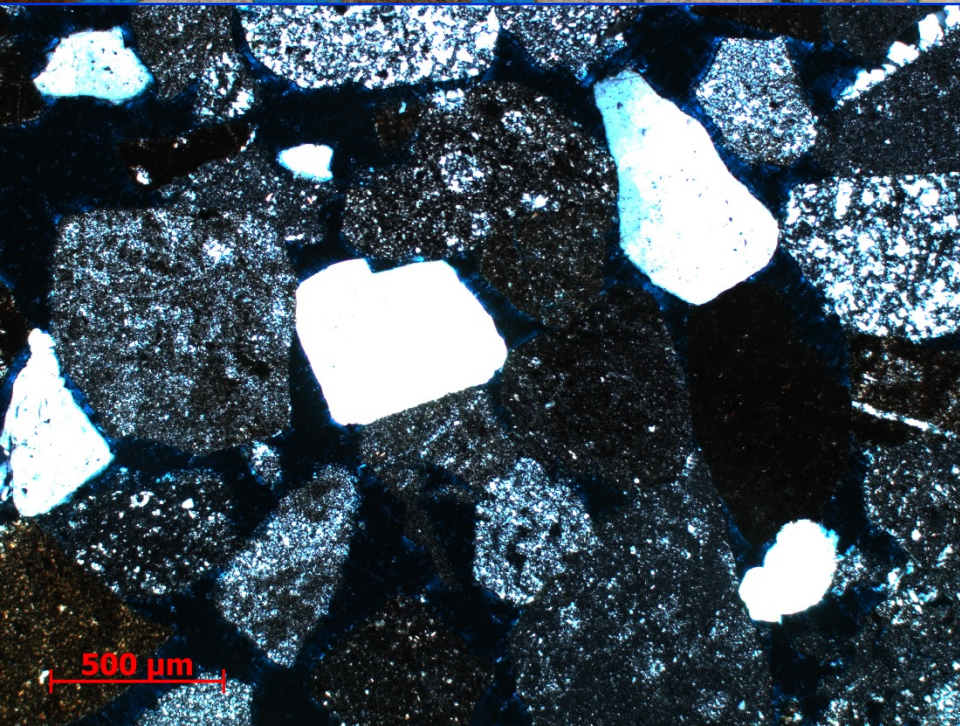
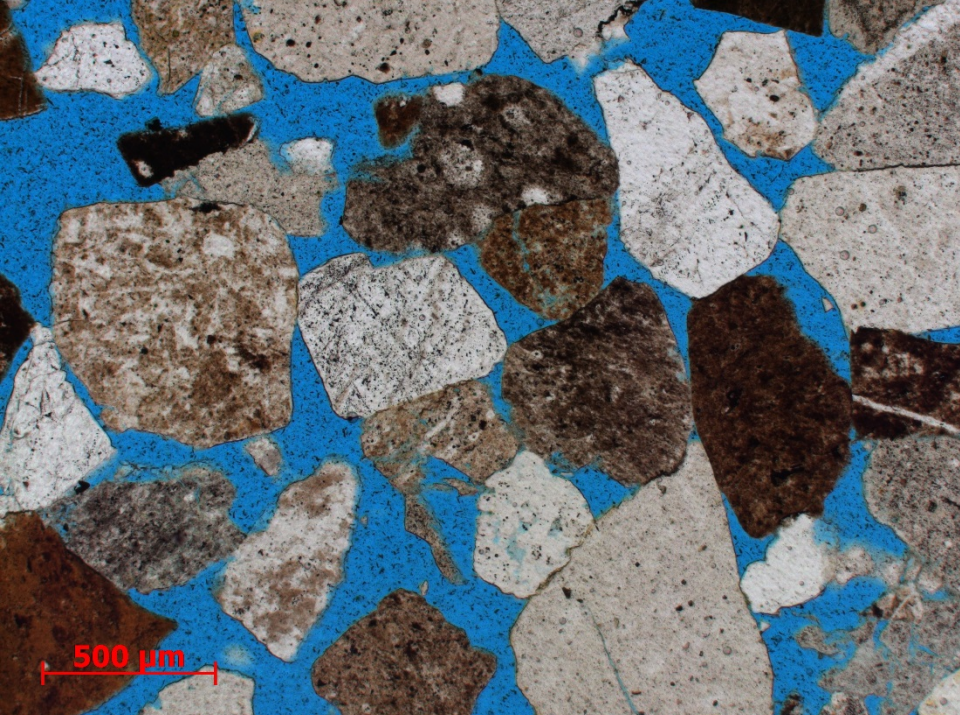
Regional RQ Trends



Reservoir Quality

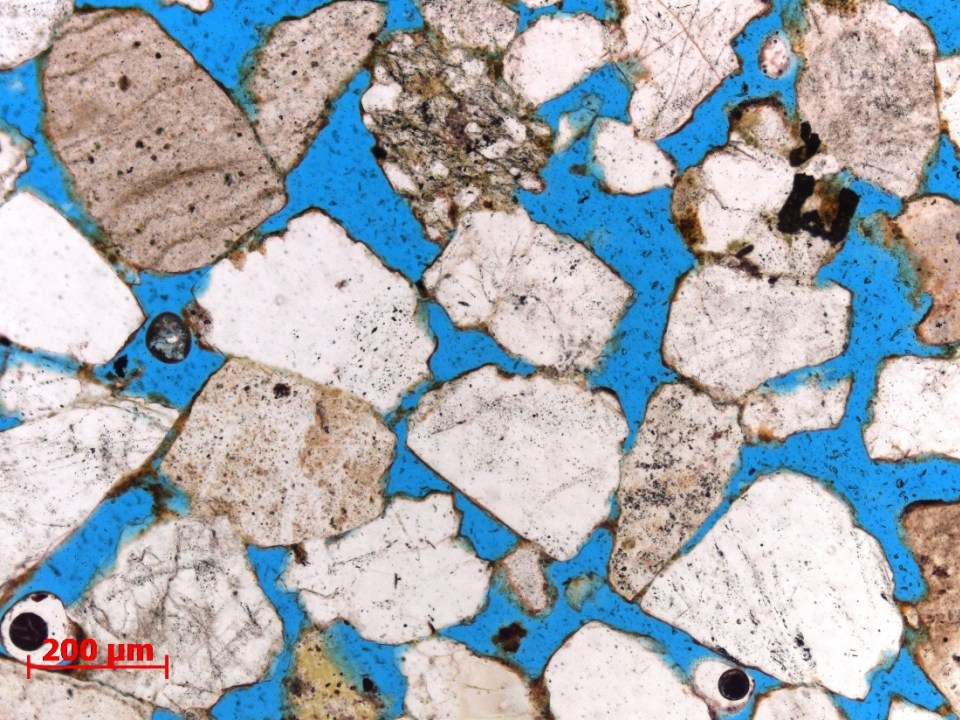


Sagavanirktok Formation

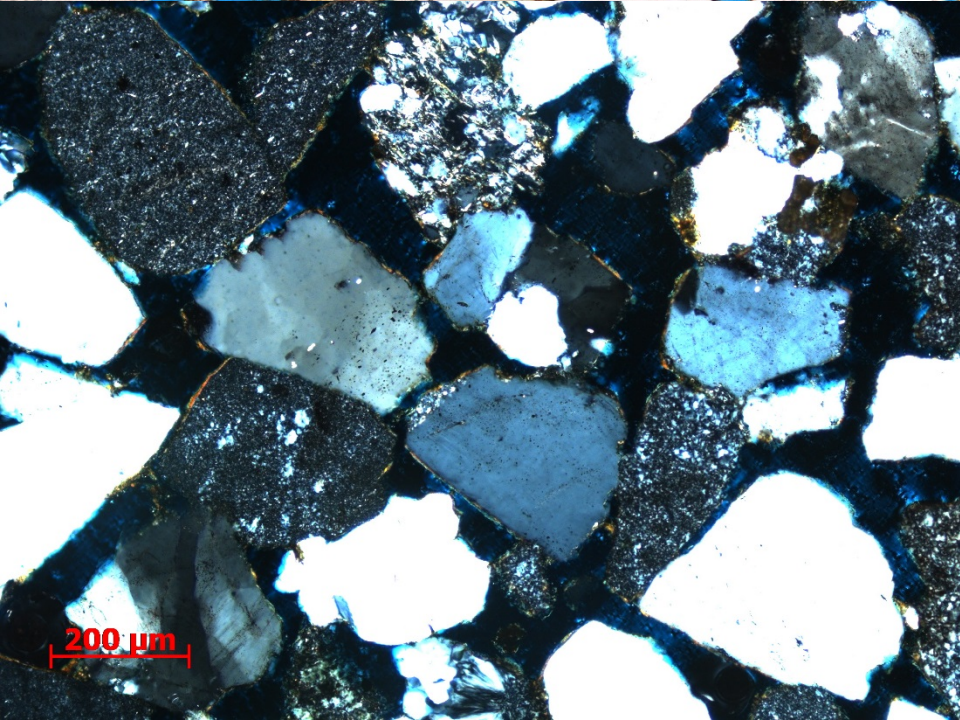


Grain Size:	0.54 mm (cL)
Sorting:	1.47 (poor)
Porosity:	21.5%
Permeability:	34.1 md (1 sample)
Intergran vol:	20.0 %
Total Clay:	6.7 %
Provenance:	chert rich
Diagenesis:	good RQ, open packing

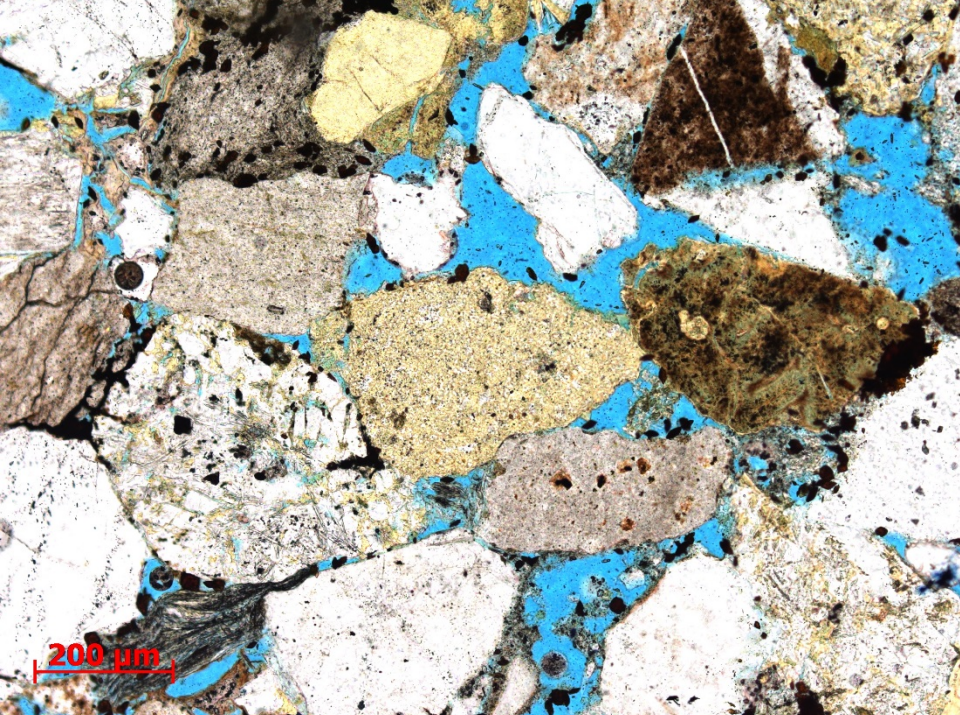
Prince Creek Formation



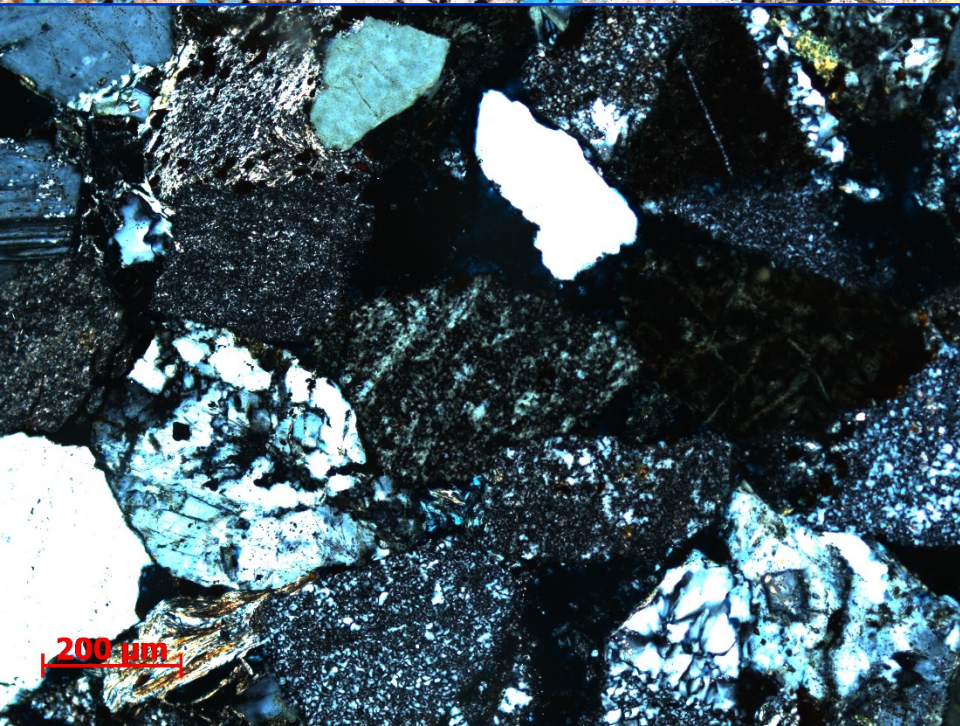
Grain Size:	0.29 mm (mL)
Sorting:	0.96 (moderate)
Porosity:	19.9 %
Permeability:	793 md
Intergran vol:	19.3 %
Total Clay:	4.1 %
Provenance:	chert rich
Diagenesis:	good RQ, open packing



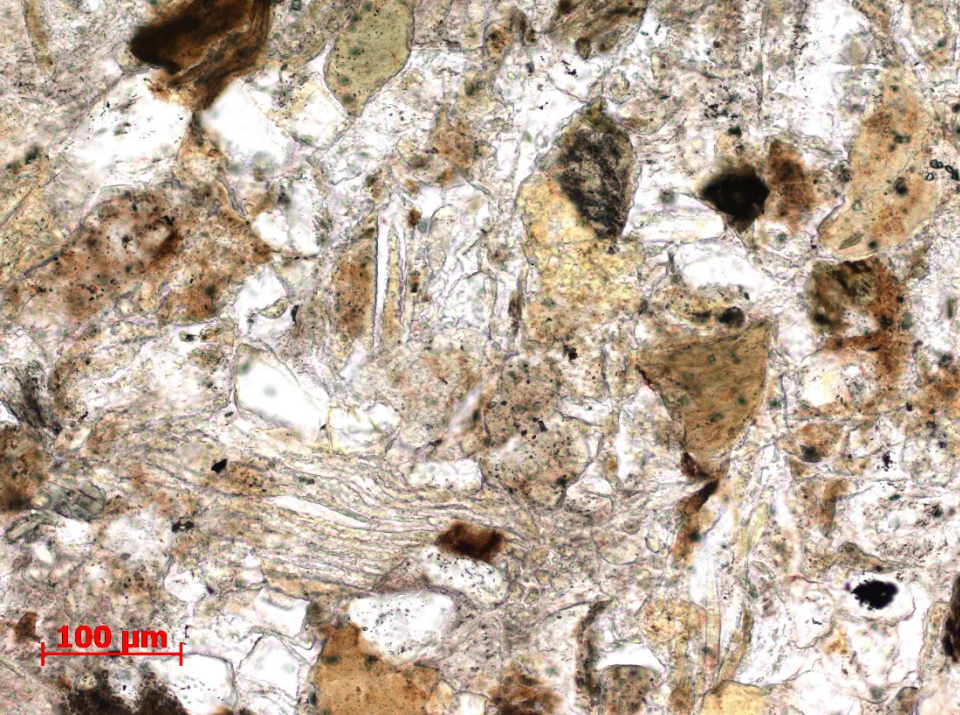
Schrader Bluff Formation (the GOOD Schrader)



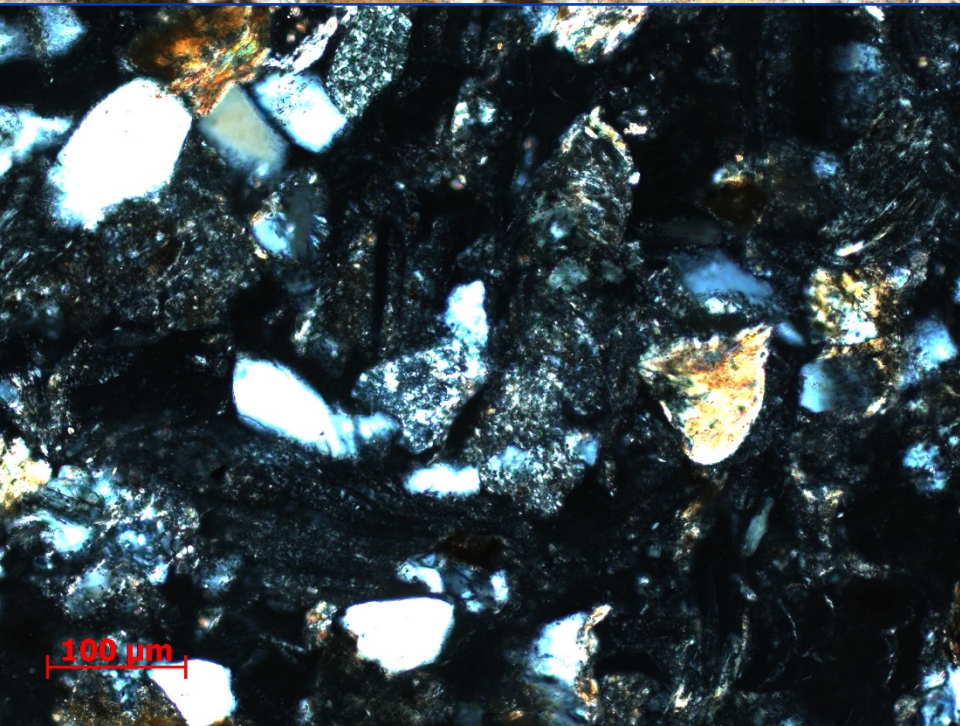
Grain Size:	0.19 mm (fU)
Sorting:	1.07 (poor)
Porosity:	16.7 %
Permeability:	19.3 md
Intergran vol:	14.7 %
Total Clay:	4.5 %
Provenance:	chert & SRF/MRF, felsic VRF, K-spar
Diagenesis:	mod. ductile grain deformation, minor hematite/siderite cement



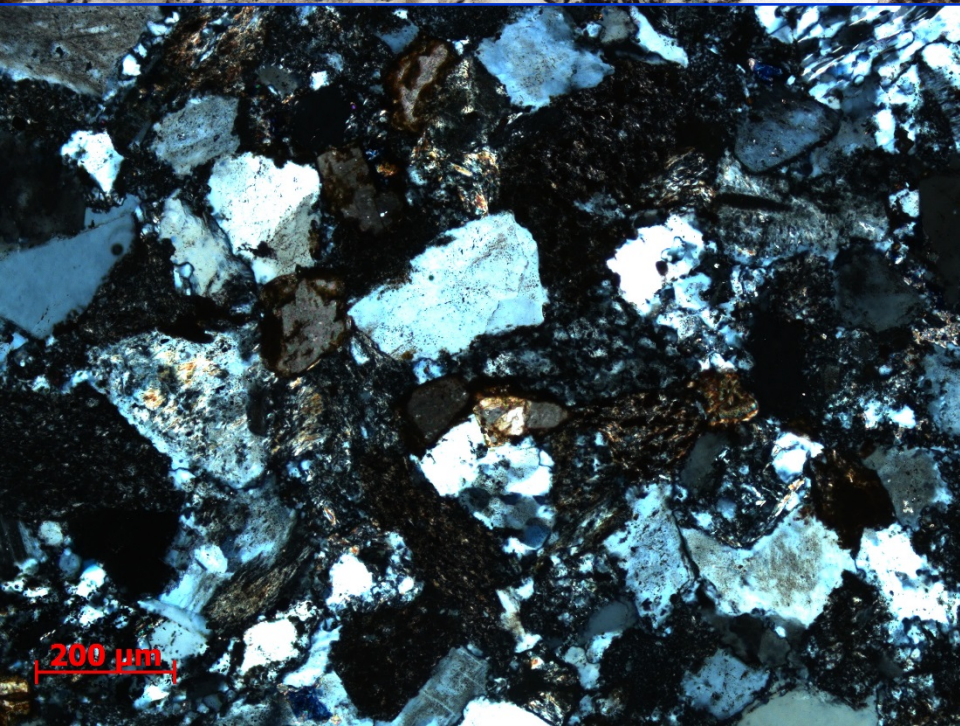
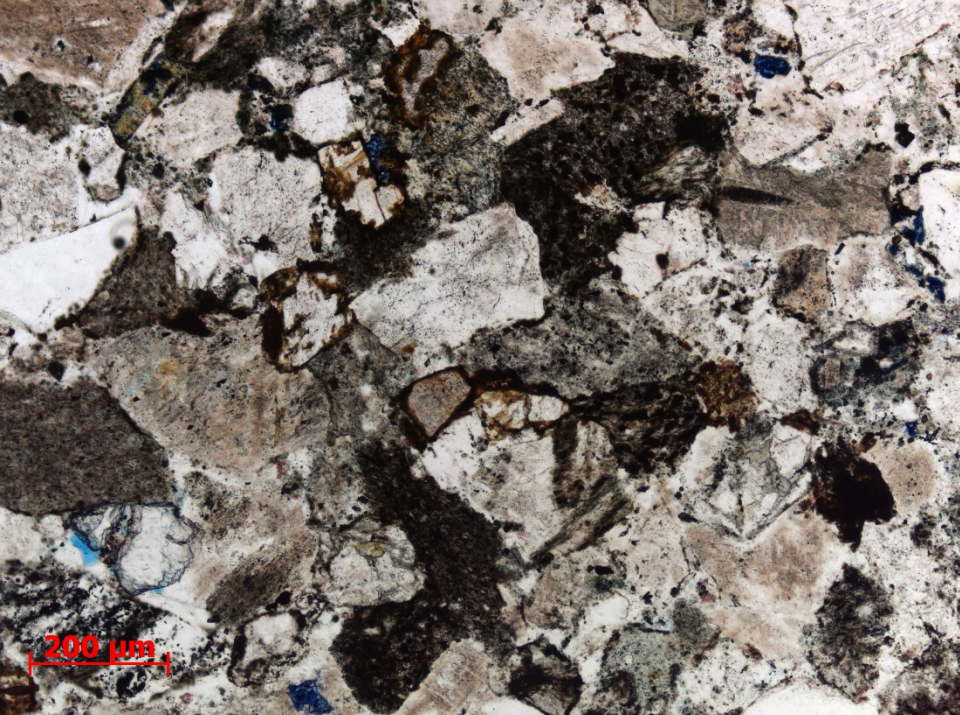
Schrader Bluff Formation (the BAD Schrader)



Grain Size:	0.08 mm (vfL)
Sorting:	1.48 (poor)
Porosity:	7.8 %
Permeability:	0.09 md
Intergran vol:	12.6 %
Total Clay:	12.5 %
Provenance:	argillaceous SRF & MRF, pyroclastic input - shards
Diagenesis:	ductile deformation and potential zeolite replacement (anaclite), minor calcite cement

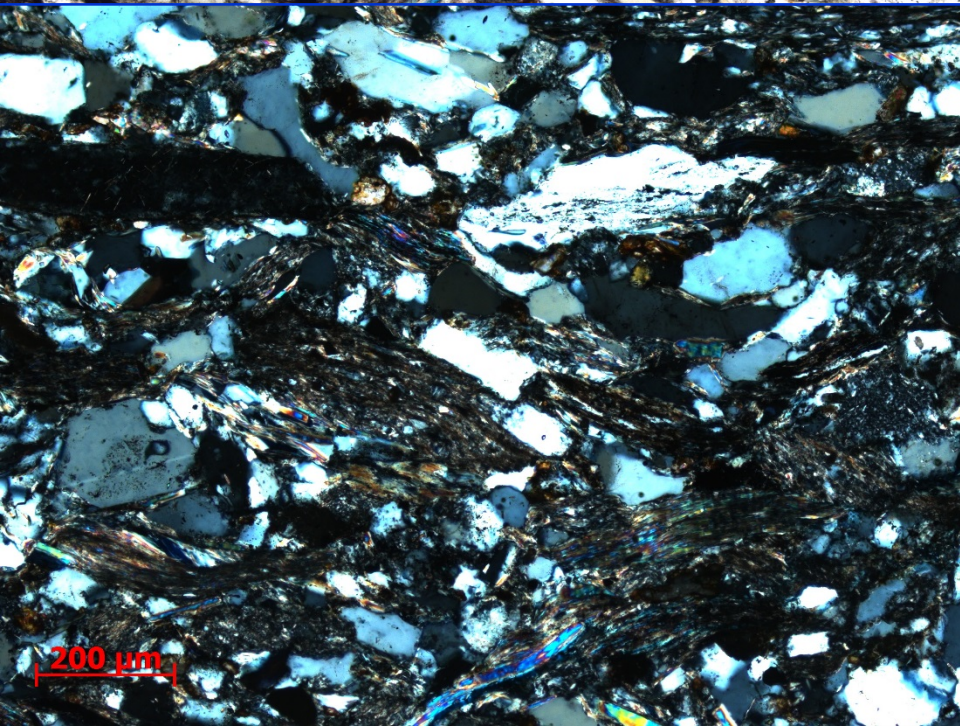


Canning Formation



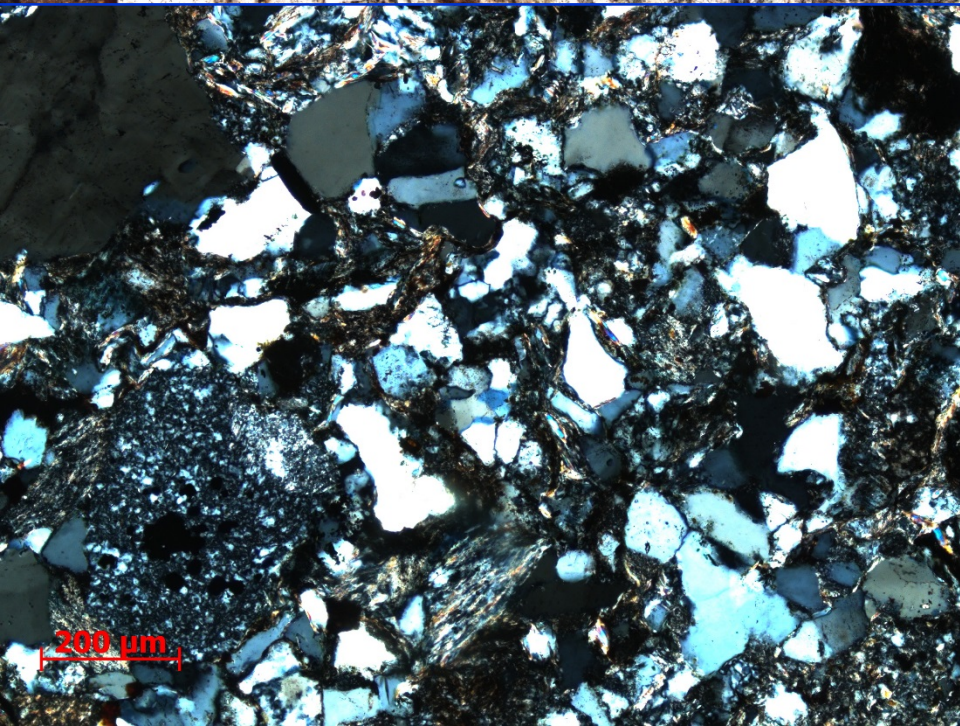
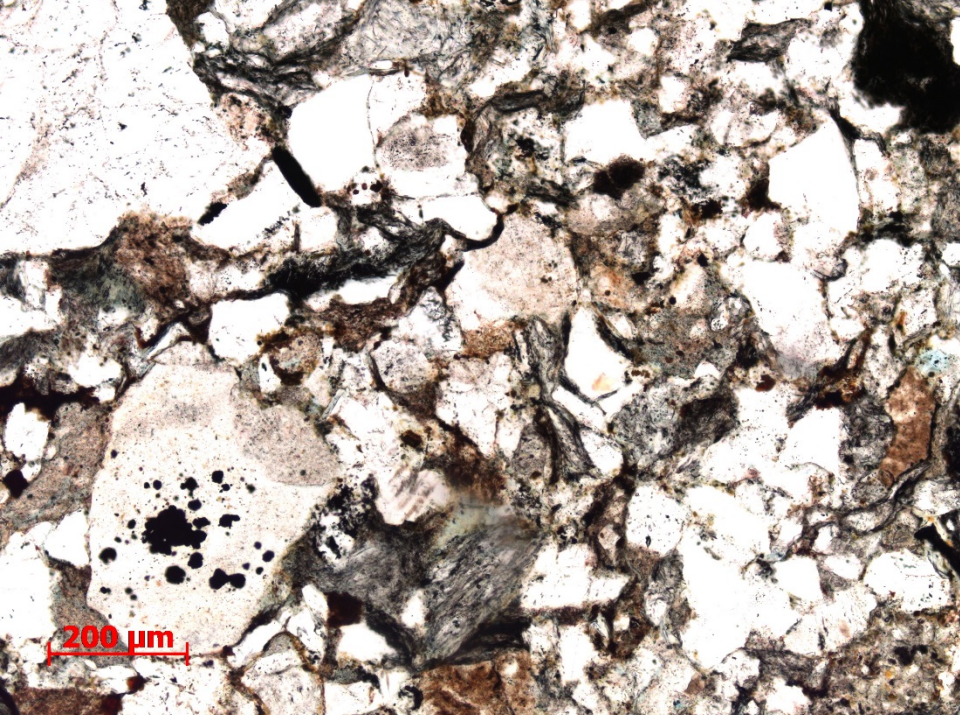
Grain Size:	0.14 mm (fL)
Sorting:	1.30 (poor)
Porosity:	5.4 %
Permeability:	0.21 md
Intergran vol:	10.3 %
Total Clay:	6.2 %
Provenance:	chert, argillaceous SRF & MRF, plagioclase
Diagenesis:	poor RQ, ductile deformation, quartz overgrowths, minor siderite cement

Seabee Formation



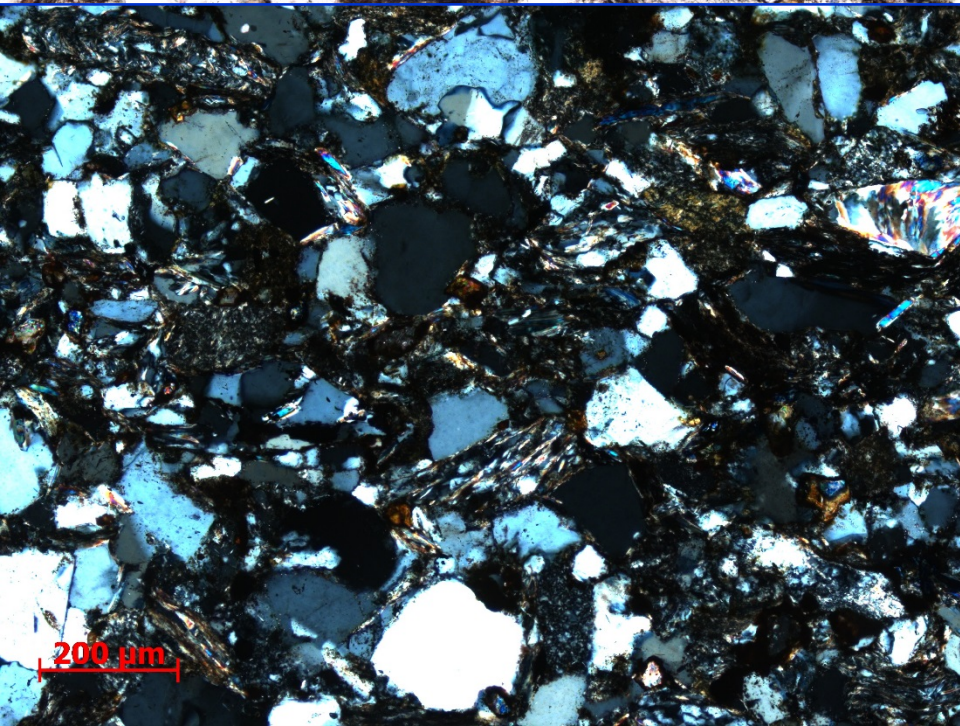
Grain Size:	0.13 mm (fL)
Sorting:	0.93 (moderate)
Porosity:	5.8 %
Permeability:	0.22 md
Intergran vol:	9.9 %
Total Clay:	3.1 %
Provenance:	argillaceous MRF (phyllite - schist) & SRF, Qp (minor chert)
Diagenesis:	mega ductile grain deformation, minor carbonate cement, poor RQ

Nanushuk Formation



Grain Size:	0.24 mm (fU)
Sorting:	1.60 (poor)
Porosity:	6.79 %
Permeability:	0.09 md
Intergran vol:	5.9 %
Total Clay:	4.2 %
Provenance:	argillaceous MRF (phyllite - schist) and SRF, Qp (minor chert)
Diagenesis:	mega ductile grain deformation; poor RQ

Torok Formation

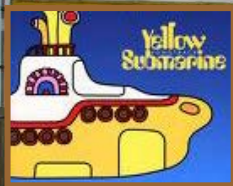


Grain Size:	0.18 mm (fU)
Sorting:	1.33 (poor)
Porosity:	5.1 %
Permeability:	0.06 md
Intergran vol:	5.2 %
Total Clay:	4.2 %
Provenance:	argillaceous MRF (phyllite - schist) and MRF, Qp (minor chert)
Diagenesis:	mega ductile grain deformation; poor RQ

Conclusions

- Recent compositional and \emptyset -K data compare well with regional trends
- Brookian ss. consist largely of argillaceous SRF & MRF – beware of ductile grain deformation
- Schrader Bluff and Canning ss. have a volcanic (pyroclastic) component
- Outcrop and subsurface \emptyset -K's are similar
- Sagavanirktok, Prince Creek and some Schrader Bluff ss. have good RQ
- Canning, Seabee, Nanushuk and Torok ss. have less oil reservoir potential

The End



Happy Trails

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Happy Valley