PETROGRAPHIC ANALYSIS OF THE MANDANNA MEMBER (LEWES RIVER GROUP) AT 14-MH-001 AND THE PROXIMAL LABERGE GROUP AT 14-MH-010 14-MH-013 14-MH-016 15-MH-97/63 15-MH-94/37

Prepared for

YUKON GEOLOGICAL SURVEY

Job No. 52135-15-3566

CONFIDENTIAL

Core Laboratories Canada Ltd.

Petroleum Services

2810 12th Street NE
Calgary, Alberta T2E 7P7

March 2016

TABLE OF CONTENTS

PETROGRAPHIC ANALYSIS OF TWENTY SANDSTONE SAMPLES FROM 14-MH-001 WITHIN THE MANDANNA MEMBER (LEWES RIVER GROUP) AND 14-MH-010/14-MH-013/14-MH-016/15-MH-97/63 AND 15-MH-94/37 WITHIN THE PROXIMAL LABERGE GROUP

PETROGRAPHIC ANALYSIS

14-MH-001

From examination of one outcrop study sample, the Mandanna Member (Lewes River Group) is a thinly laminated, moderately sorted litharenite with subangular to rounded grains and point-long grain contacts. This sample has an average grain size in the lower fine sand range.

Silt to fine grained, subangular to rounded monocrystalline quartz grains are a common framework grain component (19%). White colour, most frequently seen in plane polarized light (PPL) while first order greys showing undulose extinction is common under cross polarized light (XPL). Polycrystalline quartz (4%) is present in minor quantities, displaying under PPL translucent moderate to high relief grains, with distinct polyphase extinction under XPL.

Subangular to subrounded chert is a minor to common framework grain (4%) showing first order greys, undulose extinction and a microcrystalline texture in XPL and brown and grey in plane-polarized light (PPL).

Plagioclase feldspar is present in moderate quantities (4%), distinguished from potassium feldspar by the polysynthetic twinning under XPL, while in PPL white colour is most common. Silt sized potassium feldspar is found in minor quantities (3%) showing a yellow colour under PPL, provided by the sodium cobaltinitrite stain.

Volcanic lithoclasts are the most common framework grain component, found in abundant quantities (26%), characterized by an aphanitic and microcrystalline texture.

Mica (1%) is present in minor abundance appearing as very-fine acicular grains and primarily aligned sub-parallel to depositional surfaces along laminations and exhibiting faint pleochroism in PPL with high third order colours in XPL.

Pyroxene is a minor accessory framework grain (4%) and appears grey/green in PPL with a distinct cleavage, while low third order interference colours are common in XPL.

Clay content in this sample is abundant (22%) and appears to coat grains, masking grain contacts and occluding the pore system. Due to the size of these minerals precise identification is difficult.

Thin laminations in these samples are a result of clays concentrating along depositional surfaces. Matrix clay shows a dark colour due to the presence of hematite, as indicated by a characteristic red colour visible under reflected light.

Minor calcite cement (3%) is identified as localized concentrations, cementing framework grains.

Authigenic pyrite/goethite is a moderate diagenetic phase (10%), typically forming as small framboids throughout the sample, often intermixed with matrix clays. It is also common to see pyrite partially replacing grains. Pyrite may affect the resistivity logs by creating an anomalously low resistivity response and an anomalously high density.

This sample contains no visible macroporosity in thin section. Core-analysis porosity is reported as 0.4%. Overall this sample is very tight, showing a poorly connected pore system (permeability of 0.006mD).

14-MH-010

Sample 1 (3.70m)

From examination of the one study sample (3.70m), the Proximal Laberge Group is a massive, moderately sorted litharenite with subangular to subrounded grains and point-short grain contacts. The sample has an average grain size in the upper very fine sand range.

Framework grain mineralogy consists of common monocrystalline quartz (14%) and volcanic rock fragments (11%), moderate carbonaceous material (5%) and phosphate grains (5%) and minor polycrystalline quartz (4%), chert (3%), sedimentary lithoclasts (3%), plagioclase feldspar (3%), chert (3%) and potassium feldspar (2%) and trace zircon (<1%) and glauconite (<1%). Phosphate grains are characterized by light brown colour in PPL while appearing isotropic in XPL. Glauconite is characterized by labile grains with distinct green colour in PPL and a microcrystalline, composite texture. This framework grain is an indicator of a marine influence on the depositional environment.

Detrital clay content is of minor abundance (2%) and appears to thinly coat grains and partially fill intergranular pore spaces.

Abundant ferroan dolomite cement (35%) is identified, pervasively cementing framework grains and destroying depositional porosity. Ferroan dolomite is also visible replacing framework grains.

Ferroan dolomite indicates the potential for the precipitation of iron hydroxide gels in the presence of spending treatment acid. Also, the use of hydrofluoric acid could result in the precipitation of insoluble calcium- and magnesium-fluoride scales.

Siderite (3%) appears as localized, microcrystalline agglomerations, larger in size than adjacent framework grains.

Authigenic pyrite/goethite is a minor diagenetic phase (4%), typically forming as small concentrations and partially replacing framework grains (carbonaceous material).

This sample contains no visible macroporosity. Microporosity constitutes 100% of the core-analysis value, as reflected by the difference between the core (total) porosity and thin section (effective) porosity values, a result of no visible macroporosity. SEM images show a microporosity component, with pore spaces appearing less than 1 micron in diameter. Overall this sample shows a poorly connected pore system (permeability of 0.012mD), showing abundant cement that can occlude pore spaces and reduce poor connectivity.

Samples 2 – 3 (5.00 – 7.50m)

From examination of the two study samples (5.00 – 7.50m), the Proximal Laberge Group is a massive, poorly to well sorted sublitharenite with subangular to subrounded grains and point-long/concavo convex grain contacts. The samples have an average grain size in the lower medium to lower coarse sand range.

Framework grain mineralogy consists of abundant monocrystalline quartz (34 – 38%), minor to common polycrystalline quartz (4 – 18%), moderate volcanic rock fragments (5 – 6%), minor plagioclase feldspar (3 – 5%), potassium feldspar (2 – 3%), chert (1%), carbonaceous material (1%) and trace mica (<1%) and phosphate (<1%).

Detrital matrix clay content in these samples is of minor to moderate abundance (4 – 7%) and appears to thinly coat grains and partially fill intergranular pore spaces.

Authigenic kaolinite accounts for 3 – 9% of the rock volume, and has precipitated within the pore system as an alteration product of feldspars. In places this clay is contained by adjacent grains with little to no access to the pore system. Kaolinite in SEM appears densely packed, lacking a visible associated microporosity component.

Authigenic chlorite is found in minor to moderate quantities (2 – 8%), coating framework grains and precipitating within the intergranular pore spaces; at times appearing as discrete fibrous laths exhibiting faint pleochroism. Chlorite at times is intermixed with kaolinite.

Ferroan calcite is the most common cement phase (4 – 16%), with lesser ferroan dolomite (5%) in Sample 3 (7.50m), appearing as localized, pore-filling concentrations, and at times partially replacing feldspar grains and volcanic rock fragments. Ferroan calcite in Sample 3 (7.50m) is visible healing fractures, resulting in no effect on porosity or permeability.

Authigenic syntaxial quartz overgrowths are a minor to moderate component (3 – 6%), precipitating on detrital monocrystalline quartz grains, slightly occluding the pore system and reducing pore connectivity. These are identified by defined 'dust rims', distinguishing the detrital grain from the euhedral overgrowth.

Authigenic pyrite is a trace to minor diagenetic phase, accounting for up to 2% of the rock volume, a product of grain-replacement.

Thin section (effective) porosity is trace to minor in abundance, Sample 2 (5.00m) contains predominantly secondary solutional porosity (3%), after partial grain dissolution of unstable grains (feldspars/volcanic rock fragments), resulting in small, isolated pore spaces. Note Sample 2 (5.00m) also contains trace microfracture porosity. Sample 3 (7.50m) contains entirely trace secondary fracture porosity (<1%). Overall these samples show a poorly connected pore system (permeability falls within a range of 0.073 – 0.26mD) due to common detrital/authigenic clays and carbonate cement, significantly occluding the pore system.

14-MH-013

From examination of one study sample (41.50m), the Proximal Laberge Group is a massive, poorly sorted feldspathic litharenite with subangular to subrounded grains and point-short grain contacts. This sample has an average grain size in the lower fine sand range.

Framework grain mineralogy consists of abundant volcanic rock fragments (20%), common monocrystalline quartz (13%) and plagioclase feldspar (10%), moderate potassium feldspar (5%) and polycrystalline quartz (5%) and minor pyroxene (4%), hornblende (3%) and chert (3%). Pyroxene is a minor accessory framework grain and appears yellow/green in PPL with a distinct cleavage, while low third order interference colours are common in XPL. Hornblende is characterized by green colour in PPL with a slight pleochroism and distinct visible cleavage.

Clay content in this sample is abundant (30%) and appears to coat grains, masking grain contacts and occluding the pore system. Due to the size of these minerals precise identification is difficult. Matrix clay is intermixed with common hematite, showing a dark colour in PPL and a characteristic red colour visible under reflected light.

Calcite is a minor diagenetic phase (2%), appearing as small localized concentrations, cementing framework grains and occluding the pore system.

Authigenic pyrite is a minor diagenetic phase, accounting for 3% of the rock volume, occurring as very fine concentrations intermixed with matrix clays and as inclusions within framework grains.

Thin section contains no visible macroporosity. Microporosity constitutes 100% of the core-analysis value, as reflected by the difference between the core (total) porosity and thin section (effective) porosity values, a result of no visible thin section macroporosity. SEM analysis shows minor microfractures, contributing to the secondary porosity component. Overall this sample shows a poorly connected pore system (permeability of 0.05mD) due to abundant matrix clays/hematite significantly occluding the pore system.

14-MH-016

From examination of the two study samples (51.00 – 58.00m), the Proximal Laberge Group is a massive, poorly sorted feldspathic litharenite with subangular to subrounded grains and point/short to point-long/concavo convex grain contacts. The samples have an average grain size in the upper fine to lower coarse sand range.

Framework grain mineralogy consists of abundant monocrystalline quartz (21 – 26%) and volcanic rock fragments (22 – 24%), common potassium feldspar (12%), minor to common polycrystalline quartz (2 – 10%), minor plagioclase feldspar (3 – 5%) and trace mica (<1%).

Detrital matrix clay accounts for up to 4% of the rock volume in Sample 2 (58.00m), distributed as a thin grain-coating component, partially occluding the intergranular pore system.

Authigenic clays are a minor component in Sample 1 (51.00m), chlorite (1%) occurs within the intergranular pore spaces as discrete fibrous laths exhibiting faint pleochroism. Trace kaolinite (<1%) is a result of partial feldspar replacement.

Carbonate cement is abundant throughout both samples, Sample 1 (51.00m) contains ferroan calcite (22%) and Sample 2 (58.00m) contains ferroan dolomite (21%),

pervasively cementing framework grains and destroying depositional porosity. Ferroan calcite and ferroan dolomite are visible, replacing framework grains and healing microfractures. Note Sample 2 (58.00m) has a ferroan dolomite healed fracture, approximately 1mm in diameter that propagates through the entire thin section.

Authigenic syntaxial quartz overgrowths are a minor component (2%) in Sample 2 (58.00m), precipitating on detrital monocrystalline quartz grains, slightly occluding the pore system and reducing pore connectivity.

Pyrite (2 – 6%) is a minor to moderate diagenetic product, commonly replacing framework grains and carbonate cements, and in lesser quantities as small inclusions within framework grains.

Thin section porosity in Sample 1 (51.00m) is trace in abundance (<1%), entirely secondary solutional porosity after feldspar and rock fragments leaching, resulting in very small, isolated pores within coarse framework grains. SEM analysis highlights these pore spaces at approximately 1 micron in diameter. Core analysis porosity is reported at 0.9% and core permeability at 0.019mD, showing a poorly connected pore system with abundant ferroan calcite cement, occluding the intergranular pore system and secondary fracture porosity. Sample 2 (58.00m) contains minor porosity (2%; based on point count analysis) and is a mixture of secondary solutional porosity, from partially leached framework grains and microfractures. Note partial dissolution of the large ferroan dolomite healed fracture also contributes to the secondary solutional porosity component. Microporosity constitutes 45% of the core-analysis value, as reflected by the difference between the core (total) porosity and thin section (effective) porosity values. Overall this sample shows a poorly connected pore system (core permeability of 0.029mD) due to abundant ferroan dolomite cement, resulting in small, isolated secondary pore spaces.

15-MH-97/63

From examination of eight study samples (77.10 – 265.40m), the Proximal Laberge Group is a massive to discontinuously laminated, poorly to moderately sorted arkose/subarkose with subangular to subrounded grains and point-long/concavo convex grain contacts. The samples have an average grain size in the upper fine to lower very coarse sand range.

Framework grain mineralogy consists of abundant monocrystalline quartz (26 – 43%), common to abundant potassium feldspar (10 – 31%), moderate to common polycrystalline quartz (6 – 19%), minor to common carbonaceous material (1 – 19%), minor to moderate volcanic rock fragments (2 – 8%), minor plagioclase feldspar (2 – 4%) and chert (1 – 4%) and trace to minor mica (up to 2%). Carbonaceous material is often

intermixed with matrix clays and characterized by a dark red colour under reflected light, while in PPL dark brown to black colour is seen most frequently.

Detrital clay content is minor in abundance (1 – 4%) across the majority of the sample batch (Samples 2, 3, 4, 5, 6 and 8), showing thin coatings, and partially filling intergranular pore spaces. Sample 1 (77.10m) differs, containing common matrix clay (11%), coating grains, masking grain contacts and occluding the pore system. These clays are commonly intermixed with carbonaceous material and silt sized quartz grains. Sample 7 (245.25m) contains abundant matrix clay, filling the intergranular pore system, possibly and infiltrated clay. At times, clays in Sample 7 (245.25m) concentrate laterally along depositional surfaces, creating thin, discontinuous laminations.

Authigenic kaolinite accounts for 2 - 14% of the rock volume and has precipitated within the pore system as an alteration product of feldspars. In places this clay is contained by adjacent grains with little to no access to the pore system, however, if exposed to open pore spaces it could become migratable. The kaolinite platelets in SEM appear 5 microns or less in diameter and are very tightly packed, showing little to no associated microporosity.

Authigenic chlorite is found in minor quantities (<3%) in Samples 5 (217.53m) and 7 (245.25m), precipitated within the intergranular pore spaces; appearing as discrete fibrous laths exhibiting faint pleochroism.

Ferroan dolomite is the most common cement phase (1 – 10%), appearing in five samples (2, 3, 4, 5 and 7) as a localized, pore-filling cement, and at times, partially replaces feldspars and volcanic rock fragments. Ferroan calcite is present in moderate quantities (6%) in Sample 7 (245.25m), with lesser ferroan dolomite (2%). Ferroan calcite is a trace component in Sample 2 (114.00m).

Siderite is present in minor to moderate (1 – 9%) quantities in Samples 2 – 6 (114.00 – 226.74m) and occurs as both micro to very fine agglomerations, larger in size than adjacent framework grains and as individual crystals distributed throughout the sample, lining pores and coating framework grains.

Authigenic syntaxial quartz overgrowths are a minor to common cement component (1 – 10%), precipitating on detrital monocrystalline quartz grains, occluding the pore system and reducing pore connectivity. These are identified by ‘dust rims’, distinguishing the detrital grain from the overgrowth. These overgrowths are result of compaction as evidence from concavo convex grain contacts.

Pyrite (1 – 2%) is a minor diagenetic product, appearing in Samples 1 (77.10m), 3 (142.10m), 4 (205.00m), 6 (226.74m) and 7 (245.25m), occurring as small inclusions within framework grains.

Thin section (effective) porosity is present in six of the eight samples (Samples 1, 2, 3, 4, 5 and 8) in trace to minor abundance, accounting for 0.4 – 4.8% of the rock volume, based on point count analysis. Samples 2 (114.00m), 3 (142.10m) and 5 (217.53m), the pore system consists of entirely secondary solutional porosity, a result of unstable grain dissolution (feldspar and volcanic rock fragments). Samples 1 (77.10m), 4 (205.00m) and 8 (265.40m) are predominantly microfracture porosity. Samples 6 (226.74m) and 7 (245.25m) show no visible macroporosity in thin section.

Core-analysis porosity is higher than thin section (effective) porosity by approximately 0.5 to 5%. Microporosity constitutes 33 – 100% of the core-analysis value, as reflected by the difference between the core (total) porosity and thin section (effective) porosity values. Samples 6 and 7 have significant microporosity components (100%), a result of no visible thin section macroporosity.

Overall these samples show a poorly connected pore system (permeability of <0.01 – 0.42mD), showing abundant pore-filling authigenic/detrital clays and carbonate cements that can occlude pore spaces and reduce poor connectivity.

15-MH-94/37

From examination of five study samples (125.35 – 198.54m), the Proximal Laberge Group is a massive, poorly to moderately sorted arkose/lithic arkose/feldspathic litharenite with subangular to subrounded grains and point-long/concavo convex grain contacts. The samples have an average grain size in the upper fine to upper medium grained sand range.

Framework grain mineralogy consists of abundant monocrystalline quartz (23 – 31%), moderate to common potassium feldspar (7 – 20%) and volcanic rock fragments (6 – 18%), minor to common polycrystalline quartz (2 – 12%), minor to moderate plagioclase feldspar (5 – 9%), minor mica (1 – 2%) and chert (4%) and trace to minor carbonaceous material (1%).

Detrital matrix clay accounts for 1 – 4% of the rock volume, distributed as a thin, grain-coating component.

Kaolinite, present in all five samples, is a minor to abundant authigenic clay (3 – 28%), most common in Sample 1 (28%) and Sample 3 (10%), and has precipitated within the pore system as an alteration product of feldspars. This clay is contained by adjacent grains with little to no access to the pore system, however, if exposed to open pore spaces it could become migratable. The kaolinite platelets in SEM are very tightly packed, showing little to no associated microporosity. Kaolinite in Sample 1 (125.35m) shows a wide variation in platelet size, ranging from 10 to 1500 microns in diameter.

Chlorite (3 – 12% based on point count analysis) is a minor to common clay present in four of five samples (Samples 2 - 5), as both a thin, well-formed grain-coating component and as larger, localized pore-filling concentrations. SEM analysis often shows chlorite as a grain-coating/pore-lining clay, at times as well-formed, individual platelets approximately 1 - 2 microns in diameter.

Ferroan calcite is the most common cement phase (1 – 17%), appearing in all five samples, with lesser quantities of ferroan dolomite (3%) present in Sample 2 (153.00m) and Sample 3 (159.01m), and calcite (<2%) in Sample 2 (153.00m), Sample 4 (188.21m) and Sample 5 (198.54m). These cements occur primarily as localized, pore-filling concentrations, with grain-replacement being less common (feldspars and volcanic rock fragments). Note Sample 2 (153.00m) has a ferroan calcite healed fracture, approximately 1mm in diameter that propagates through the entire thin section. Note the ferroan calcite healed fracture shows partial ferroan dolomite replacement in small areas.

Siderite is present in minor to moderate quantities (1 – 8%) and occurs in Sample 2 (153.00m) and Sample 3 (159.01m) as both small, microcrystalline agglomerations and as individual crystals distributed throughout the sample, lining pores spaces, coating framework grains, and occluding the pore system. Siderite is Sample 1 (125.35m) appears as very fine crystalline, localized concentrations, cementing framework grains.

Authigenic syntaxial quartz overgrowths are a minor cement component (2 – 5%), precipitating on detrital monocrystalline quartz grains, occluding the pore system and reducing pore connectivity. These overgrowths are result of compaction as evidence from concavo convex grain contacts.

Authigenic pyrite is a minor diagenetic phase (2 – 5%), occurring primarily as inclusions within framework grains and as very fine, localized grain-replacing concentrations.

Thin section (effective) porosity is present in all five samples in trace to minor abundance, accounting for 0.8 – 3.2% of the rock volume, based on point count analysis. Secondary solutional porosity is the most dominant porosity type in Samples 1 (125.35m) and 5 (198.54m), a result of unstable grain dissolution (feldspars and volcanic rock fragments). Samples 2 (153.00m) and 3 (159.01m) consist entirely of minor microfracture porosity. Sample 4 (188.21m) differs, with the pore system being predominantly primary intergranular in variety, with only trace secondary solutional from the dissolution of unstable grains.

Core-analysis porosity is higher than thin section porosity by approximately 0.8 to 3.5%. Microporosity constitutes 39 – 74% of the core-analysis value, as reflected by the difference between the core (total) porosity and thin section (effective) porosity values.

Overall these samples show a poorly connected pore system (permeability of 0.028 – 0.18mD), showing abundant pore-filling authigenic clays and cements that can occlude pore spaces and reduce poor connectivity.

ANALYTICAL PROCEDURES

Thin Section Preparation and Analysis

This report presents petrographic data from twenty samples from 14-MH-001 within the Mandanna Member (Lewes River Group) and 14-MH-010/14-MH-013/14-MH-016/15-MH-97/63/15-MH-94/37 within the Proximal Leberge Group and is based on examination of thin sections of twenty core samples taken from outcrop – 265.40m (Table 1). The thin sections were prepared by first impregnating the samples with epoxy to augment cohesion and to prevent loss of material during grinding. Blue dye was added to the epoxy to highlight the pore spaces.

The thinly sliced samples were mounted on a glass slide and cut and ground in water to an approximate thickness of 30 microns. The thin sections were stained with Alizarin Red-S to differentiate calcite (stains red) from dolomite, and potassium ferrocyanide (stains blue or purple) to distinguish ferroan varieties. Additionally, thin sections were stained with sodium cobaltinitrite which stains potassium feldspar yellow. The thin sections were analyzed using standard petrographic techniques.

A point-count analysis (based on 250 points) was conducted, in order to determine semi-quantitative (statistical) mineral and porosity abundances. Folk's (1980) classification has been used to categorize the dominant mineralogical composition of these sandstones. Additionally, the sample was stained with sodium cobaltinitrite which stains potassium feldspar yellow. Reservoir quality analysis has been based on thin-section mineralogical and textural characteristic.

Texture, mineralogy and the pore system for each sample are illustrated with three thin section/SEM photomicrographs, included after the text.

SEM Analysis

The SEM sample is obtained by gently breaking the rock or core plug with a small rock-chopper across the surface to be examined. Optimal size for the final sample is generally around 5 by 10 mm. Any fine debris on the surface can usually be dislodged with a duster. The cut sample is attached to a SEM specimen stub with epoxy or carbon tape.

The sample is then coated a thin layer with a conductive metal, such as gold in either a sputter or evaporative coater. After coating, the sample is ready for SEM analysis. The coated SEM sample is then placed in the sample chamber and evacuated to high vacuum.

The SEM image is formed by an internally generated electron beam. The beam is created by heating a tungsten filament in the electron gun. The electrons are accelerated through the column by 15KV accelerating voltage. It is the interaction of the primary electron beam with the sample which produces various forms of radiation, such as secondary electrons, characteristic X-rays, backscatter electrons. The three-dimensional topographic image (SEM micrograph) is formed by collecting the secondary electrons generated by the primary beam.

REFERENCES

Folk, R.L. (1980) Petrology of Sedimentary Rocks. Hemphill Publishing Company, Austin, Texas, 184p.

Deer, W.A., Howie, R.A., Zussman, J. (1992) An Introduction to the Rock-Forming Minerals (Second Edition). Prentice Hall. Pearson Education Limited

Prepared by:

James Simpson, P. Geol.
Geologist
Reservoir Geology
Core Laboratories Canada Ltd.
2810 – 12th St. NE
Calgary, Alberta T2E 7P7
Phone: (403) 250-4066

Core Lab
RESERVOIR OPTIMIZATION

Table 1. Sample Data

Suite	Formation	Sample #	Depth (m)	TS	Thin Section Porosity (%)	Core Analysis Porosity (%)	Microporosity (% of Core Porosity)	Core Permeability (mD)
14-MH-001	Mandanna Member (Lewes River Group)	1	-	*	0.0	0.4	100.00	0.006

Core Lab
RESERVOIR OPTIMIZATION

Company: Yukon Geological Survey
Suite: 14-MH-001

C.L. File No. 52135-15-3566
Date: March, 2016
Geologist: James Simpson

Table 2. Petrographic Summary / Point Count

SAMPLE	1
DEPTH (m)	-
FORMATION	Mandanna Member (Lewes River Group)
ROCK TYPE	Sandstone
Classification (Folk, '80)	Litharenite

FRAMEWORK GRAINS

Quartz	Monocrystalline	19.2
	Polycrystalline	4.0
Rock Fragments	Chert (Non Porous)	4.0
	Chert (Porous)	-
	Detrital dolomite	-
	Sedimentary	-
	Volcanic	26.4
Feldspars	Potassic feldspar	2.8
	Plagioclase feldspar	4.0
Accessory Minerals	Glauconite	-
	Carbonaceous material	-
	Shell fragments	-
	Phosphatic intraclasts	-
	Pyroxene	4.0
	Zircon	-
	Micas	1.2
	Heavy minerals	-

MATRIX

Matrix	Detrital clays	22.0*

AUTHIGENIC MINERALS

Clays	Kaolinite	-
	Chlorite	-
Non-Clay Cements	Calcite	2.8
	Ferroan calcite	-
	Dolomite	-
	Ferroan dolomite	-
	Siderite	-
	Quartz overgrowth	-
	Anhydrite/Gypsum	-
	Pyrite/Hematite/Goethite	9.6
	Bitumen	-

POROSITY

Primary - intergranular	-
Secondary - Solutional	-
Total Thin Section Porosity	**0.0**

TEXTURE

Grain Size Classification	fL
Sorting	Moderate
Roundness	Sa-R
Grain Contacts	Point - Long

*** - Intermixed with Hematite**

Company: Yukon Geological Survey
Suite: 14-MH-001
Mandanna Member (Lewes River Group)
Sample 1 - Sandstone
Depth (m): -

Plate 1A (x32): Low magnification overview of a massive/thinly laminated, moderately sorted, fine grained sandstone. Framework grain mineralogy consists of abundant volcanic rock fragments, common monocrystalline quartz and minor polycrystalline quartz, chert, plagioclase feldspar, pyroxene, potassium feldspar and mica. Note abundant matrix clays at times concentrate along depositional surfaces creating thin laminations (red arrows).

Plate 1B (x125): This field of view is taken under reflected light to highlight abundant clay matrix intermixed with hematite, showing a characteristic red colour.

Plate 1C (x125): Magnification of pore-filling clays (yellow arrows) intermixed with hematite, showing a dark appearance. Note the presence of a detrital pyroxene grain (green arrow).

Plate 1A

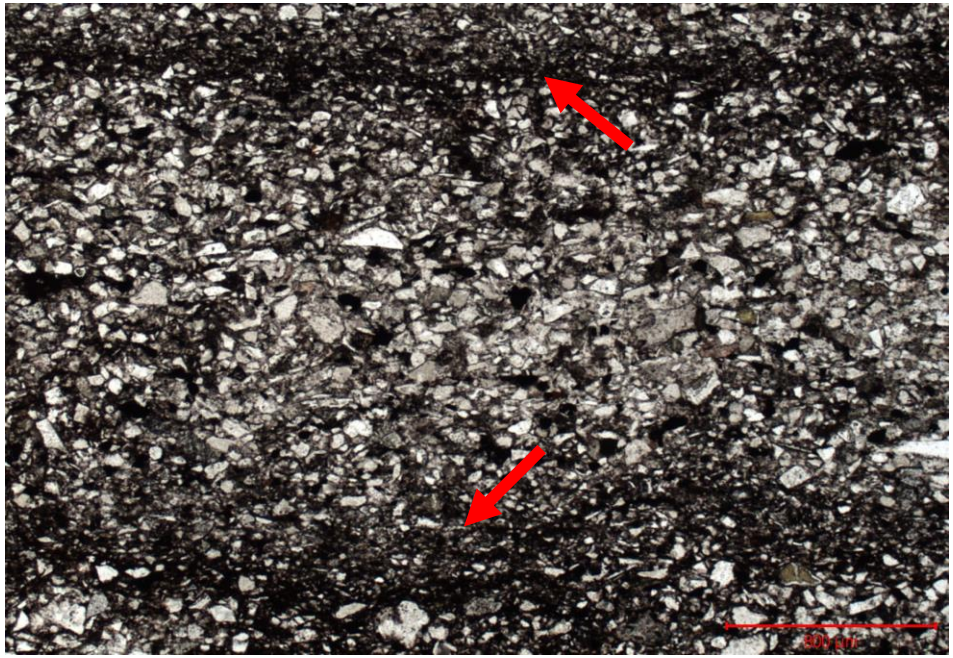


Plate 1B

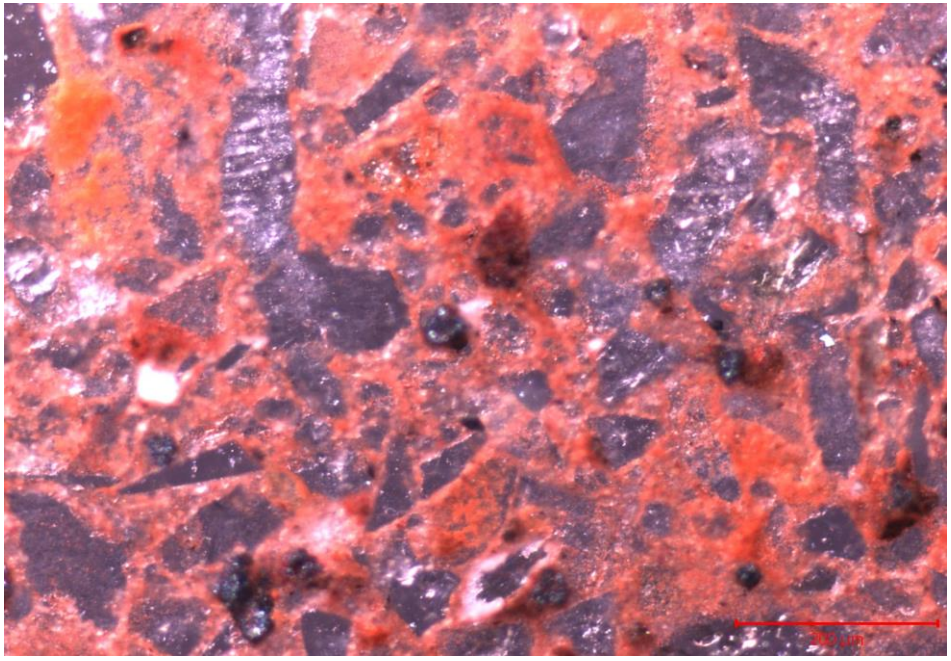


Plate 1C

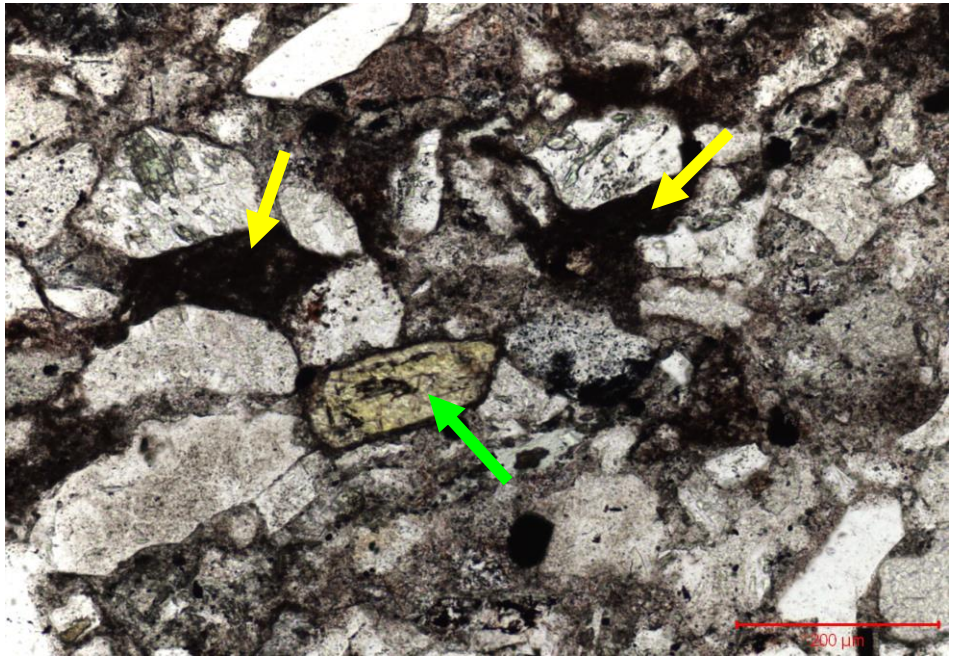


Table 1. Sample Data

Suite	Formation	TS	SEM	Thin Section Porosity (%)	Core Analysis Porosity (%)	Microporosity (% of Core Porosity)	Core Permeability (mD)
14-MH-010	Proximal Laberge Group	*	*	0.0	3.5	100.00	0.012
		*		3.2	5.5	41.82	0.26
		*	*	0.8	4.7	82.98	0.073

Core Lab
RESERVOIR OPTIMIZATION

Company: Yukon Geological Survey
Suite: 14-MH-010

C.L. File No. 52135-15-3566
Date: March, 2016
Geologist: James Simpson

Table 2. Petrographic Summary / Point Count

SAMPLE		1	2	3
DEPTH (m)		3.70	5.00	7.50
FORMATION		Proximal Laberge Group	Proximal Laberge Group	Proximal Laberge Group
ROCK TYPE		Sandstone	Sandstone	Sandstone
Classification (Folk, '80)		Litharenite	Sublitharenite	Sublitharenite
FRAMEWORK GRAINS				
Quartz	Monocrystalline	14.0	34.0	38.0
	Polycrystalline	4.0	18.4	4.4
Rock Fragments	Chert (Non Porous)	3.2	1.2	1.2
	Chert (Porous)	-	-	-
	Detrital dolomite	-	-	-
	Sedimentary	3.2	2.8	-
	Volcanic	11.2	5.2	6.4
Feldspars	Potassic feldspar	2.4	2.8	1.6
	Plagioclase feldspar	2.8	2.8	4.8
Accessory Minerals	Glauconite	0.8		-
	Carbonaceous material	5.2		1.2
	Shell fragments			-
	Phosphate clasts	5.2	0.4	0.8
	Tourmaline	-		-
	Zircon	0.8		-
	Micas	2.8		0.8
	Heavy minerals	-		-
MATRIX				
Matrix	Detrital clays	2.4	3.6	7.2
AUTHIGENIC MINERALS				
Clays	Kaolinite	-	9.2	3.2
	Chlorite	-	7.6	2.0
Non-Clay Cements	Calcite	-	-	-
	Ferroan calcite	-	4.0	15.6
	Dolomite	-	-	-
	Ferroan dolomite	34.8	-	4.8
	Siderite	3.2	-	-
	Quartz overgrowth	-	2.8	6.4
	Anhydrite/Gypsum	-	-	-
	Pyrite/Hematite/Goethite	4.0	2.0	0.8
	Bitumen		-	-
POROSITY				
Primary - intergranular		-	-	-
Secondary - Solutional		-	3.2	0.8
Total Thin Section Porosity		**0.0**	**3.2**	**0.8**
TEXTURE				
Grain Size Classification		vfU	cL	mL
Sorting		Moderate	Poor	Well
Roundness		Sa-Sr	Sa-Sr	Sa-Sr
Grain Contacts		Point - Short	Point - Long/Concavo Convex	Point - Long/Concavo Convex

Company: Yukon Geological Survey
Suite: 14-MH-010
Proximal Laberge Group
Sample 1 - Sandstone
Depth (m): 3.70

Plate 1A (x32): This sample is a massive, well cemented, moderately sorted, very fine grained sandstone comprised of common monocrystalline quartz, volcanic rock fragments, moderate carbonaceous material and phosphate grains and minor polycrystalline quartz, chert, sedimentary lithoclasts, plagioclase feldspar, mica and potassium feldspar.

Plates 1B and 1C (x125/x125): These two fields of view highlight abundant ferroan dolomite (green arrows), pervasively cementing framework grains and significantly occluding the intergranular pore system. Ferroan dolomite is also visible partially replacing framework grains (yellow arrows) such as volcanic rock fragments and carbonaceous material. This sample contains no visible macroporosity. Note the presence of phosphate grains (orange arrows).

Plate 1A

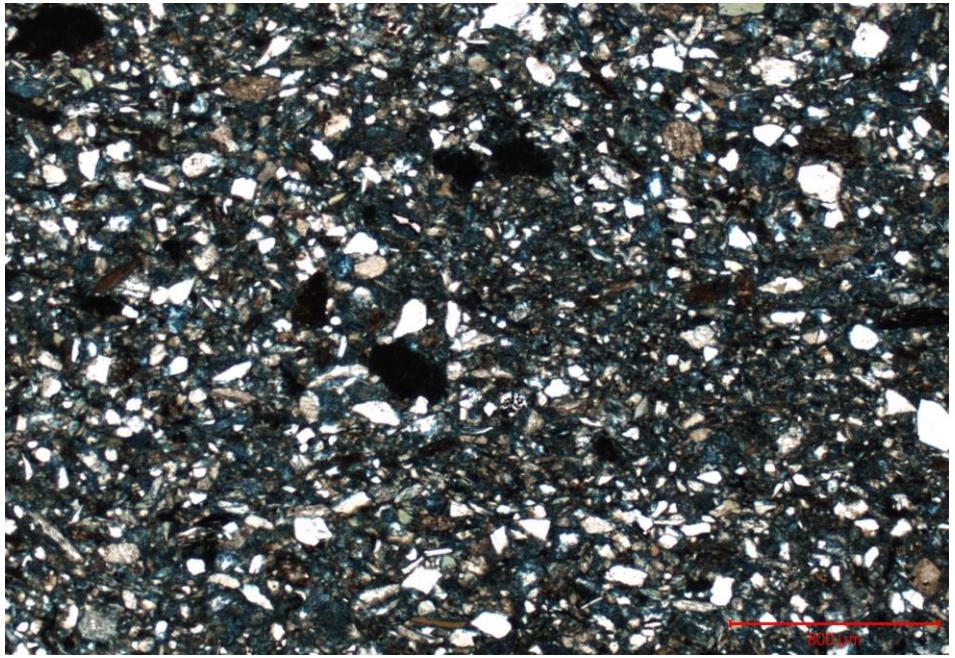


Plate 1B

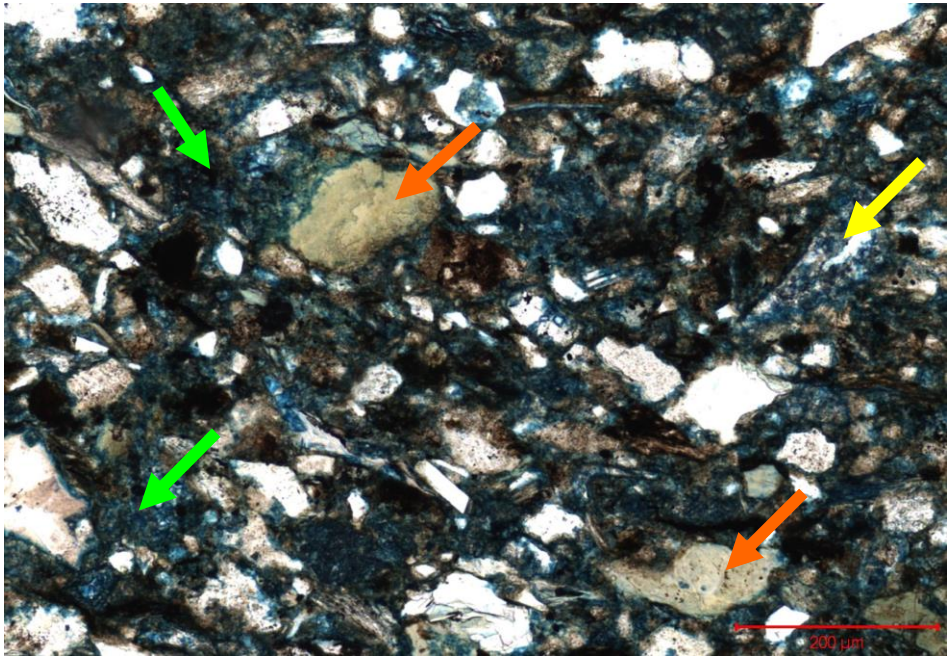
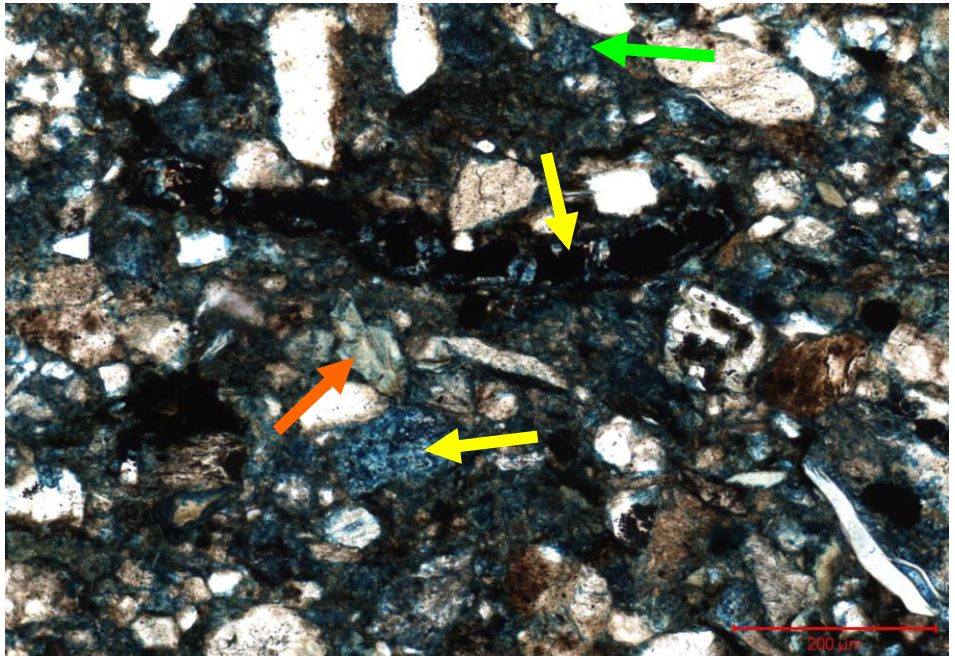


Plate 1C



Company: Yukon Geological Survey
Suite: 14-MH-010
Proximal Laberge Group
Sample 1 - Sandstone
Depth (m): 3.70

Plate 1D (x400): Close-up view of a well cemented, moderately sorted, very fine grained sandstone showing carbonaceous material (blue arrows), partially replaced by goethite (FeO; orange circle).

Plate 1E (x600): This field of view displays moderate quantities of carbonaceous material (blue arrows) cemented by very fine crystalline ferroan dolomite (green arrows).

Plate 1F (x2500): Magnification highlights a concentration of very fine crystalline ferroan dolomite (green arrow), occluding the pore system. Microporosity is visible (red arrows), with pore spaces appearing less than 1 micron in diameter. Note the presence of minor grain-coating clay (yellow arrows).

Plate 1D

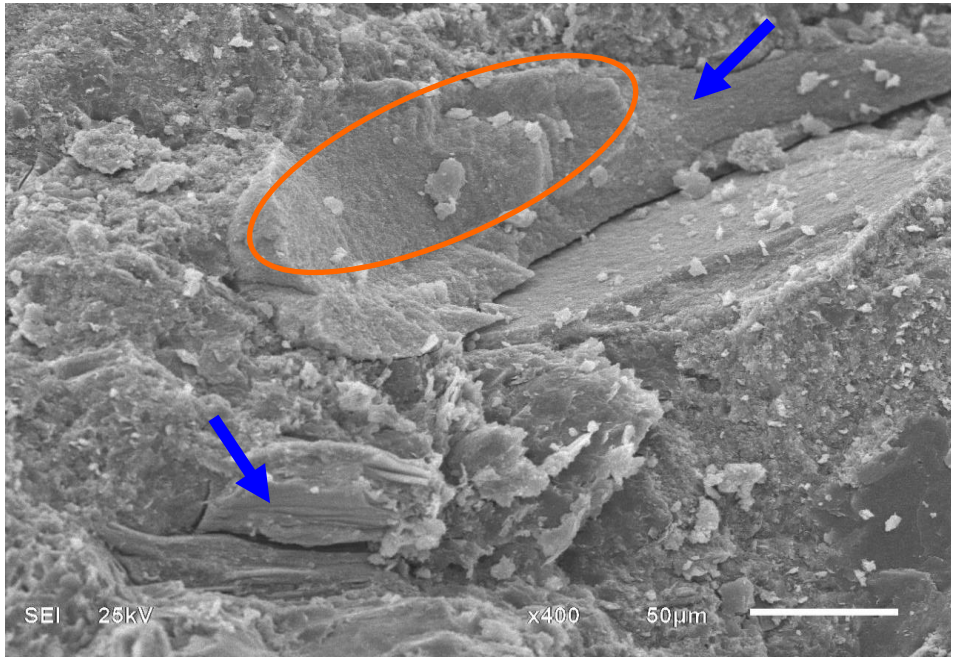


Plate 1E

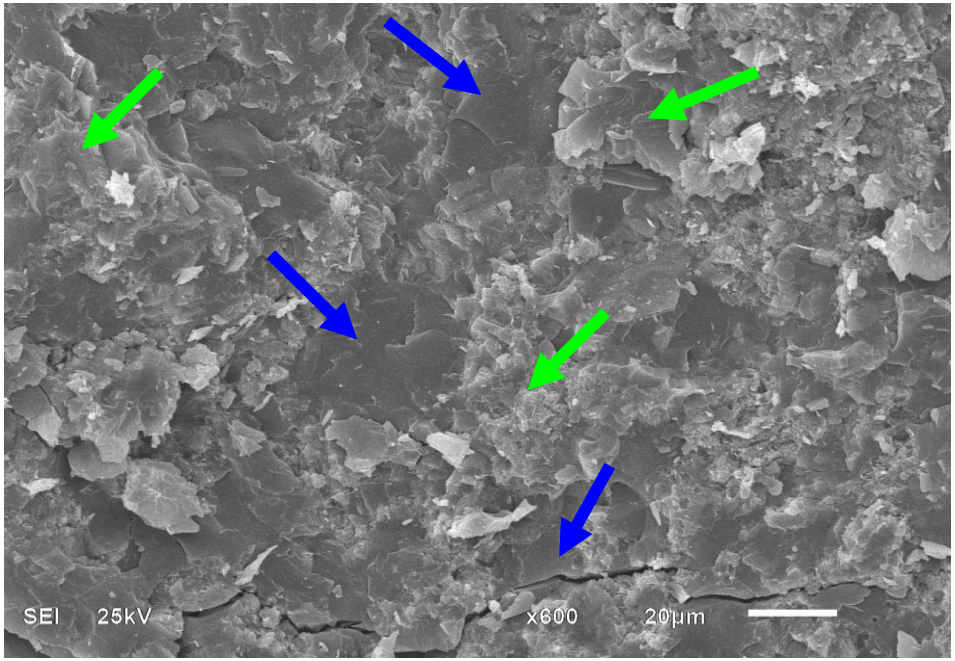
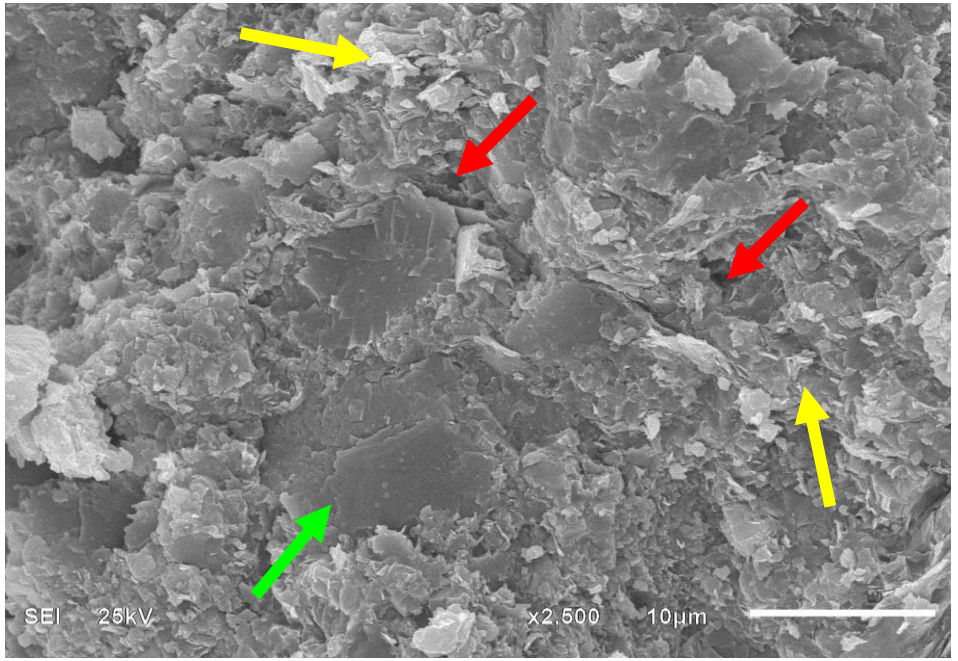


Plate 1F



Company: Yukon Geological Survey
Suite: 14-MH-010
Proximal Laberge Group
Sample 2 - Sandstone
Depth (m): 5.00

Plate 2A (x32): Low magnification overview of a massive, poorly sorted, coarse grained sandstone. Framework grain mineralogy consists of abundant monocrystalline quartz, common polycrystalline quartz, moderate volcanic rock fragments and minor sedimentary lithoclasts, potassium feldspar, plagioclase feldspar and chert. Note a minor detrital clay concentration (yellow arrow).

Plate 2B (x63): Close-up view shows minor secondary solutional porosity (red arrows) within potassium feldspar grains, a result of partial grain dissolution. Ferroan calcite (green arrows) is a minor component, cementing grains and partially replacing framework grains.

Plate 2C (x125): This field of view shows moderate quantities of grain-replacing authigenic kaolinite (yellow circle) and chlorite (yellow arrows). Note the presence of authigenic quartz overgrowths (orange arrow).

Plate 2A

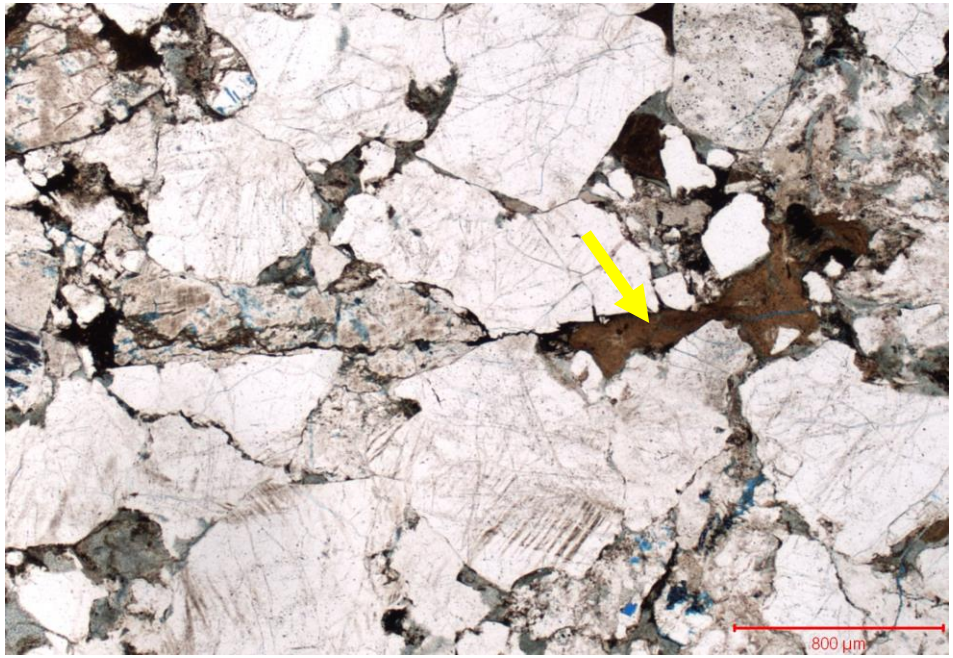


Plate 2B

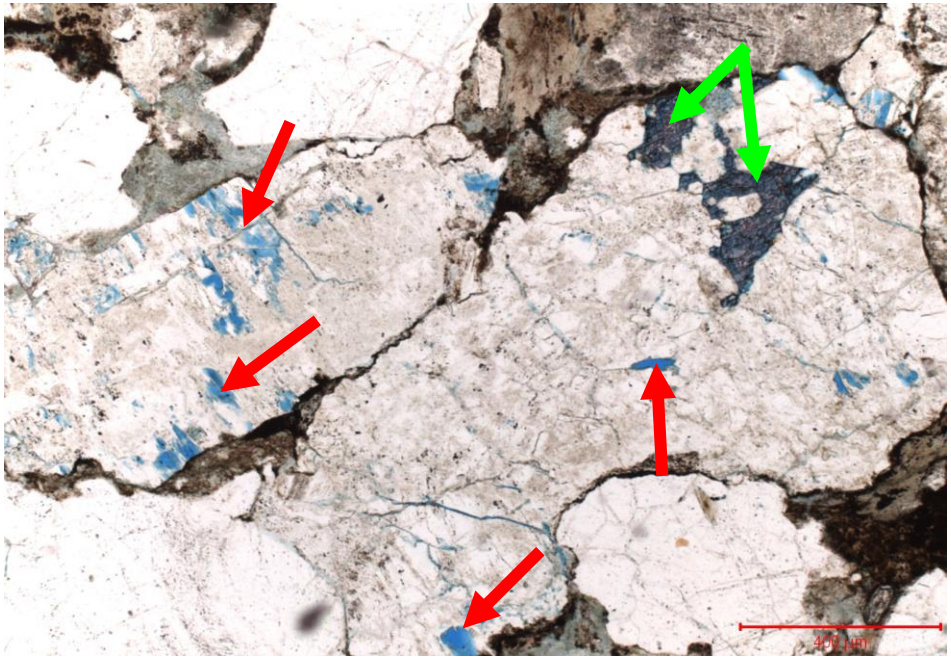
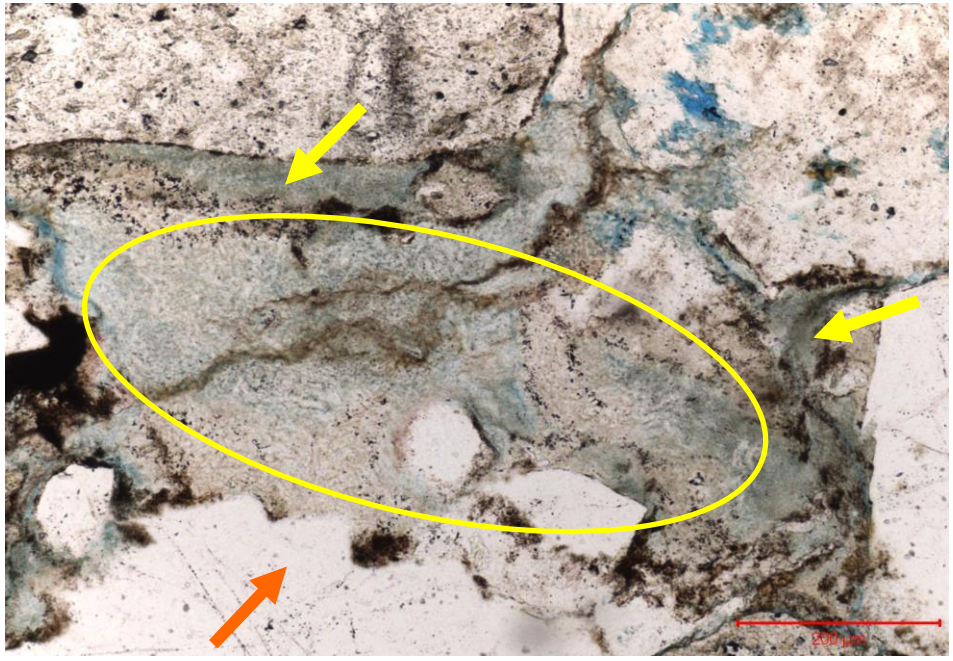


Plate 2C



Company: Yukon Geological Survey
Suite: 14-MH-010
Proximal Laberge Group
Sample 3 - Sandstone
Depth (m): 7.50

Plate 3A (x32): This sample is a massive, well sorted, medium grained sandstone comprised of abundant monocrystalline quartz, moderate volcanic rock fragments and minor plagioclase feldspar, polycrystalline quartz, potassium feldspar, chert and carbonaceous material. Note ferroan calcite healed fractures (green arrows).

Plate 3B (x63): Carbonate cement is abundant throughout the sample, common ferroan calcite , with minor ferroan dolomite, cementing framework grains and occluding the pore system (green arrows). Ferroan calcite is also visible partially replacing framework grains (blue arrows).

Plate 3C (x125): Authigenic kaolinite (yellow arrows) is a minor pore-filling/grain-replacing clay. Note ferroan calcite cement (green arrow).

Plate 3A

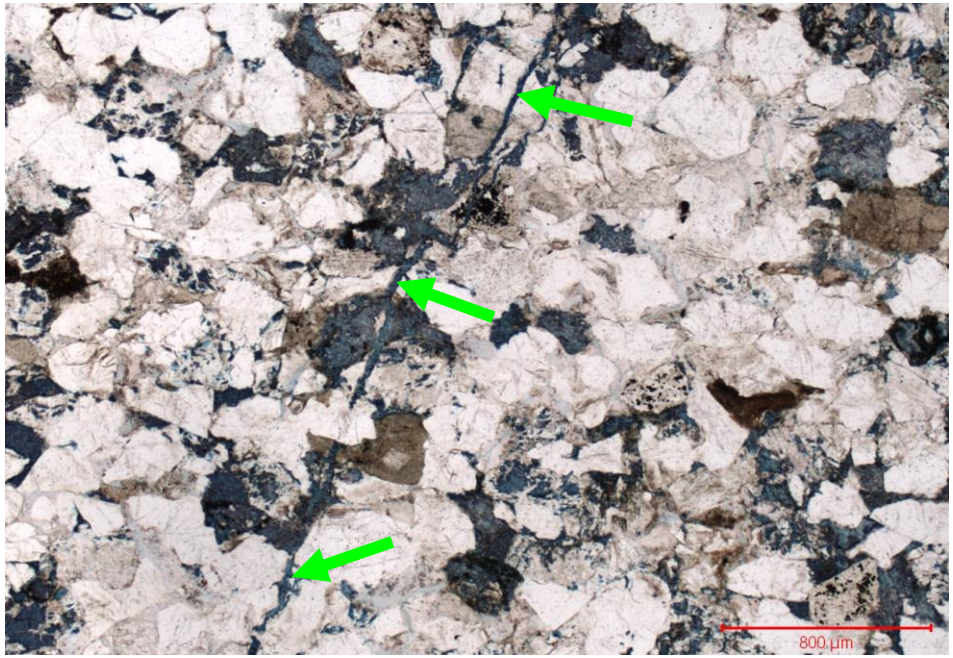


Plate 3B

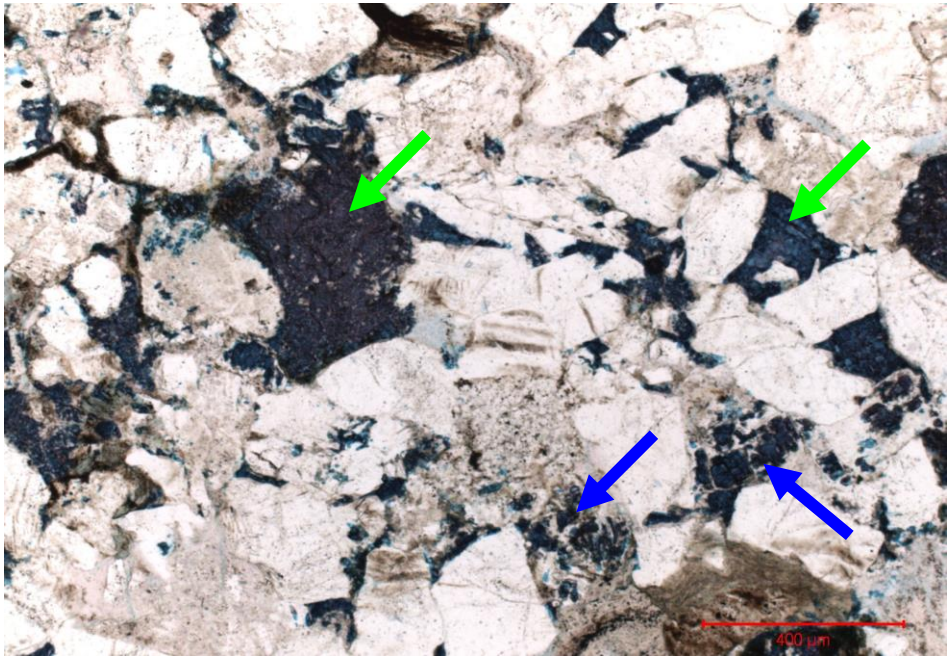
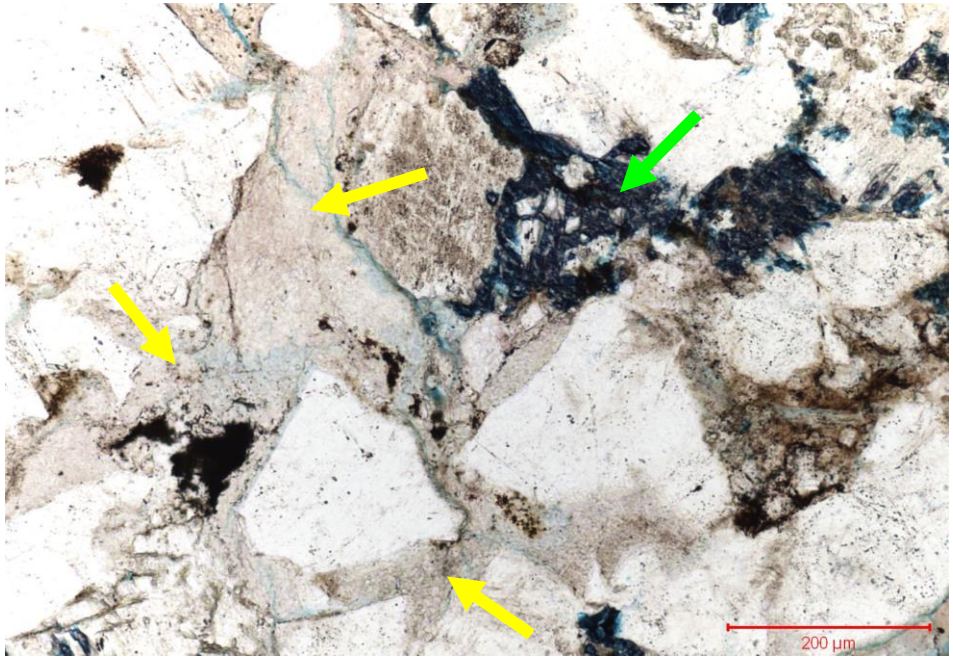


Plate 3C



Company: Yukon Geological Survey
Suite: 14-MH-010
Proximal Laberge Group
Sample 3 - Sandstone
Depth (m): 7.50

Plate 3D (x150): Overview of a massive, well sorted, medium grained sandstone showing a localized concentration of ferroan calcite cement, occluding intergranular porosity (green circle).

Plate 3E (x250): Close-up view of densely packed, pore-filling authigenic kaolinite platelets (yellow circle). EDS analysis confirms abundant Al and Si.

Plate 3F (x250): This field of view highlights secondary solutional porosity, a result of partial grain dissolution within a feldspar grain (red arrow).

Plate 3D

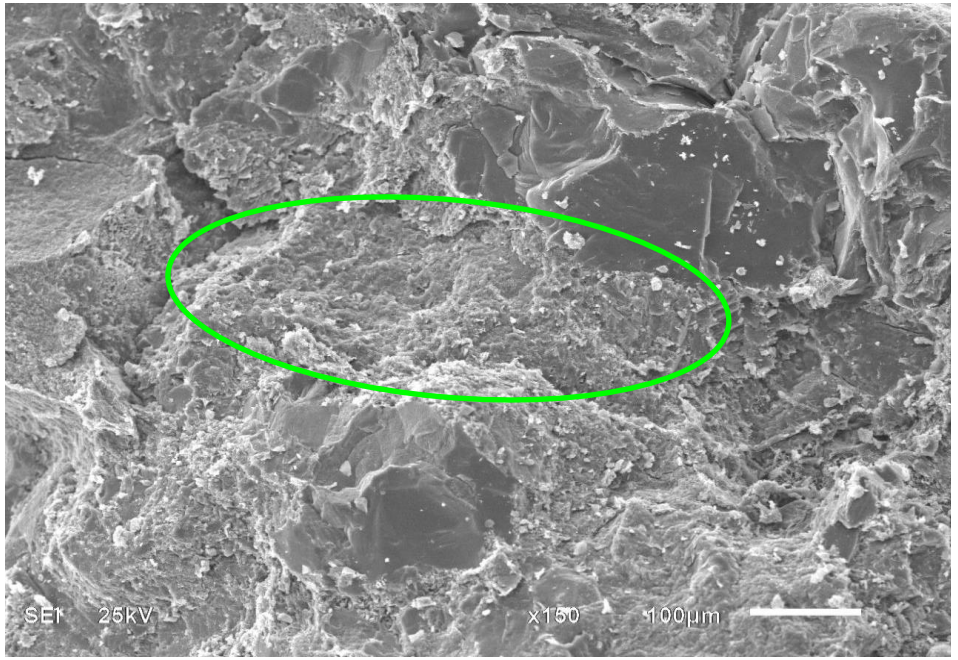


Plate 3E

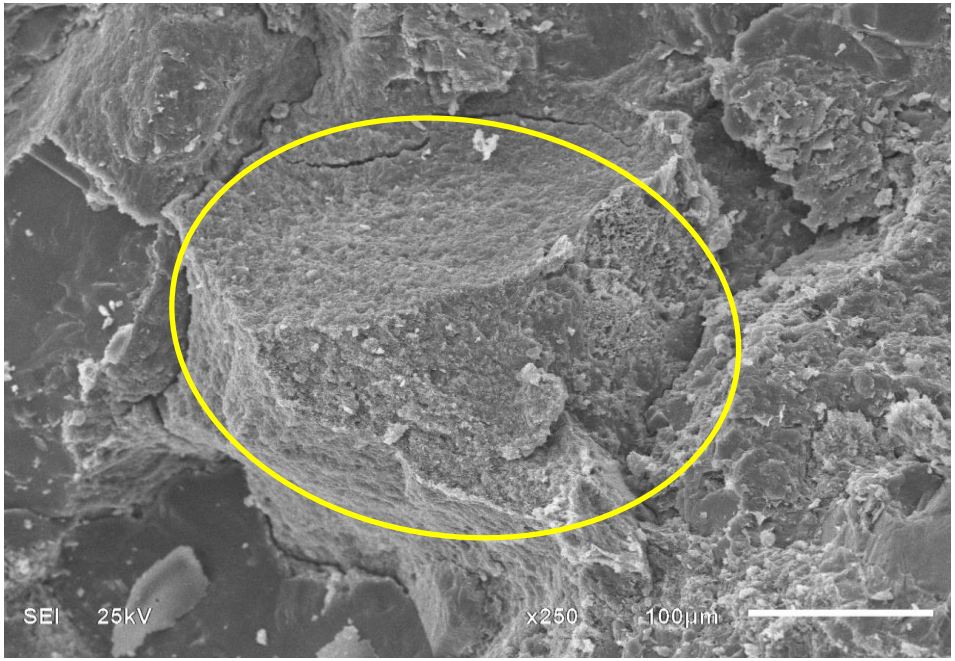


Plate 3F

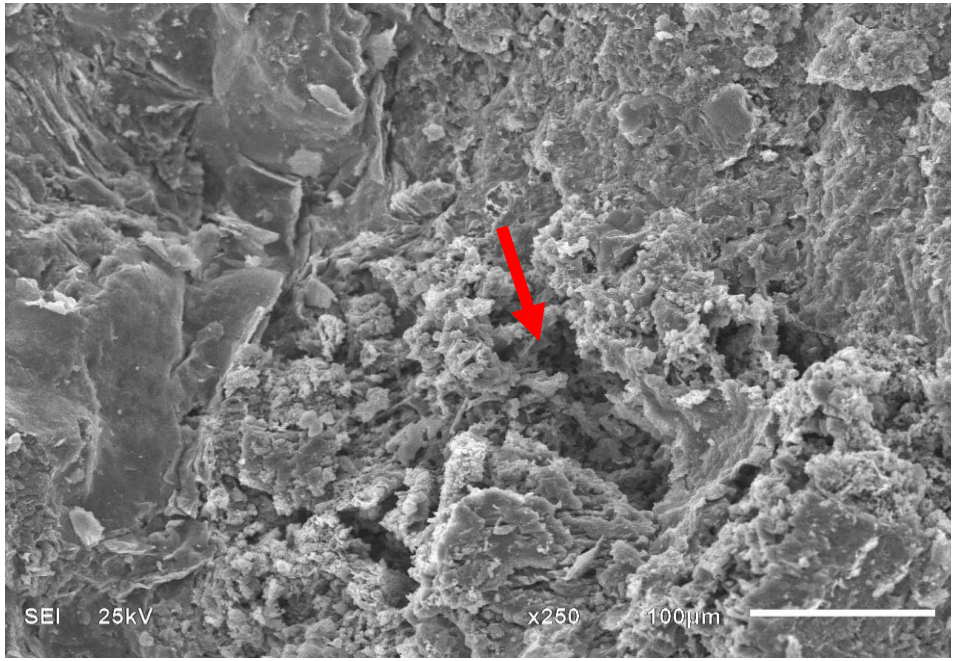


Table 1. Sample Data

Suite	Formation	TS	SEM	Thin Section Porosity (%)	Core Analysis Porosity (%)	Microporosity (% of Core Porosity)	Core Permeability (mD)
14-MH-013	Proximal Laberge Group	*	*	0.0	2.8	100.00	0.05

Core Lab
RESERVOIR OPTIMIZATION

Company: Yukon Geological Survey
Suite: 14-MH-013

C.L. File No. 52135-15-3566
Date: March, 2016
Geologist: James Simpson

Table 2. Petrographic Summary / Point Count

SAMPLE	1
DEPTH (m)	41.50
FORMATION	Proximal Laberge Group
ROCK TYPE	Sandstone
Classification (Folk, '80)	Feldspathic Litharenite

FRAMEWORK GRAINS

Quartz	Monocrystalline	13.2
	Polycrystalline	5.2
Rock Fragments	Chert (Non Porous)	3.2
	Chert (Porous)	-
	Detrital dolomite	-
	Sedimentary	-
	Volcanic	20.4
Feldspars	Potassic feldspar	6.0
	Plagioclase feldspar	10.4
Accessory Minerals	Glauconite	-
	Carbonaceous material	-
	Shell fragments	-
	Phosphatic intraclasts	-
	Hornblende	3.2
	Pyroxene	3.6
	Micas	-
	Heavy minerals	-

MATRIX

Matrix	Detrital clays	30.0*

AUTHIGENIC MINERALS

Clays	Kaolinite	-
	Chlorite	-
Non-Clay Cements	Calcite	2.0
	Ferroan calcite	-
	Dolomite	-
	Ferroan dolomite	-
	Siderite	-
	Quartz overgrowth	-
	Anhydrite/Gypsum	-
	Pyrite/Hematite/Goethite	2.8
	Bitumen	-

POROSITY

Primary - intergranular	-
Secondary - Solutional	-
Total Thin Section Porosity	**0.0**

TEXTURE

Grain Size Classification	fL
Sorting	Poor
Roundness	Sa-Sr
Grain Contacts	Point - Short

*** - Intermixed with Hematite**

Company: Yukon Geological Survey
Suite: 14-MH-013
Proximal Laberge Group
Sample 1 - Sandstone
Depth (m): 41.50

Plate 1A (x32): Low magnification overview of a massive, poorly sorted, fine grained sandstone. Framework grain mineralogy consists of abundant volcanic rock fragments, common monocrystalline quartz and plagioclase feldspar, moderate potassium feldspar and polycrystalline quartz and minor chert, hornblende and pyroxene.

Plate 1B (x125): Close-up view displays abundant matrix clays, occluding primary intergranular porosity. Calcite (green arrow) is a minor cementing phase, present in minor localized concentrations. Note the presence of minor detrital hornblende grains (blue arrows).

Plate 1C (x125): This field of view taken under reflected light to highlight the abundance of hematite intermixed with clay, showing the characteristic red colour. Note this sample shows no visible macroporosity.

Plate 1A

Plate 1B

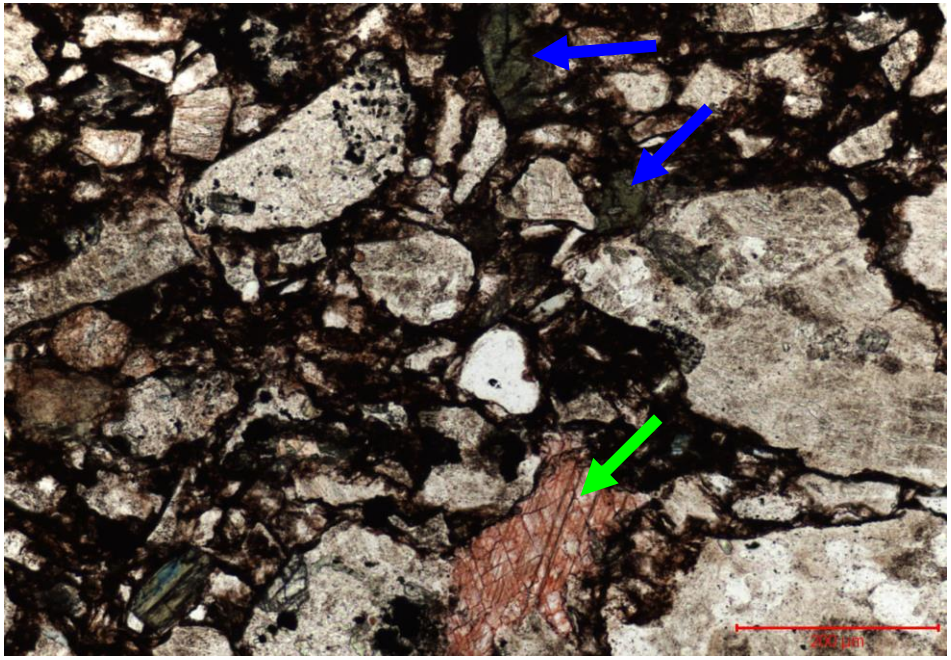
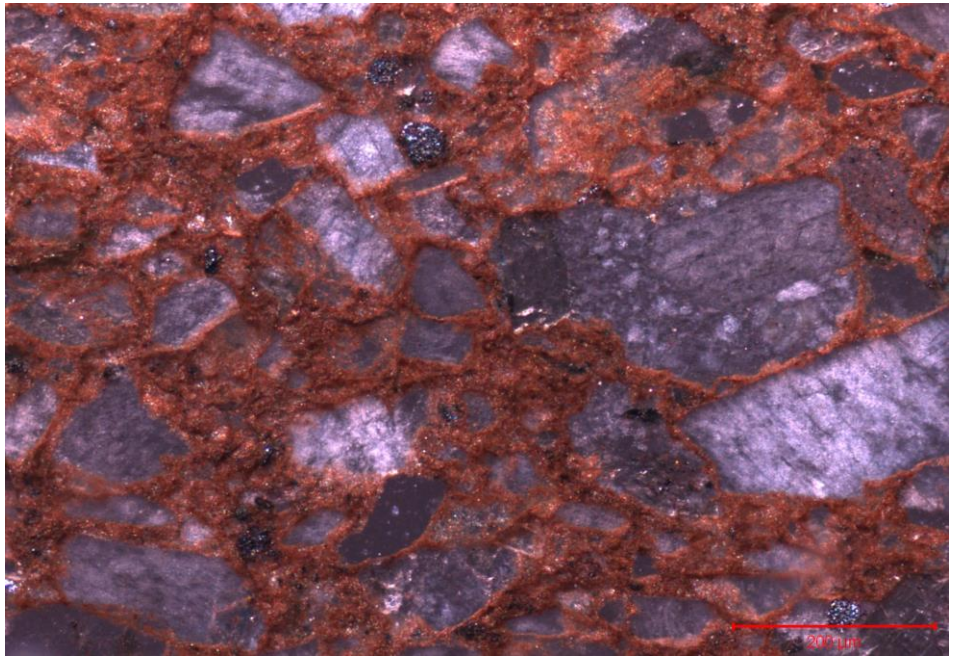


Plate 1C



Company: Yukon Geological Survey
Suite: 14-MH-013
Proximal Laberge Group
Sample 1 - Sandstone
Depth (m): 41.50

Plate 1D (x350): This close-up view of a poorly sorted, fine grained sandstone shows a pore-filling matrix clay (yellow circles), intermixed with abundant Fe and O (identified by EDS analysis).

Plate 1E (x350): This field of view displays an open fracture that contributes to secondary fracture porosity (red arrows). The fracture appears approximately 5 to 10 microns in width.

Plate 1F (x1000): Close-up view highlights a grain coated hornblende grain (orange arrow), identified by EDS analysis reporting common Ca, Mg, Al and Si.

Plate 1D

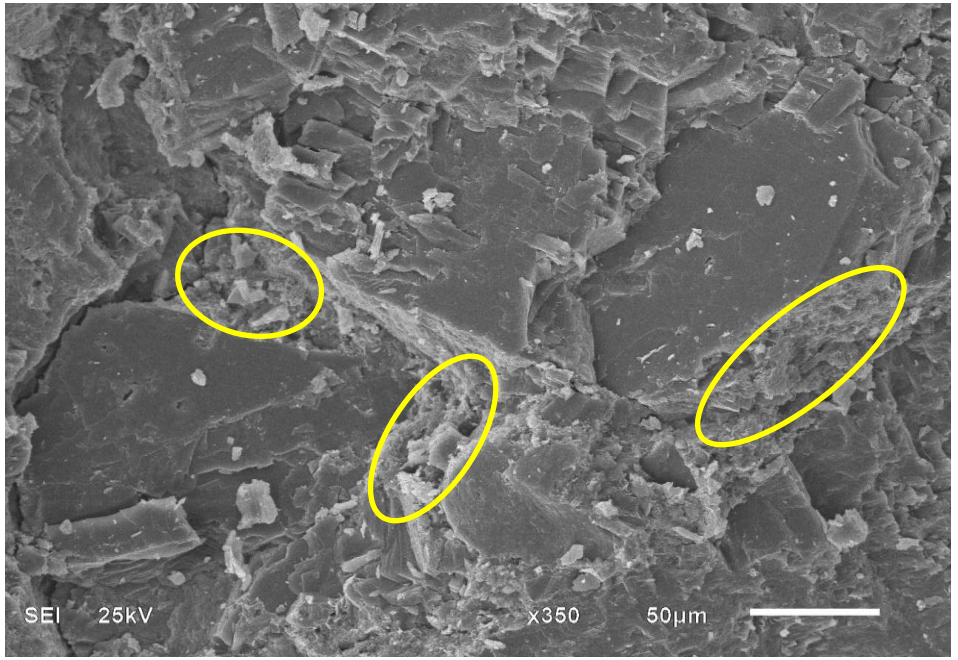


Plate 1E

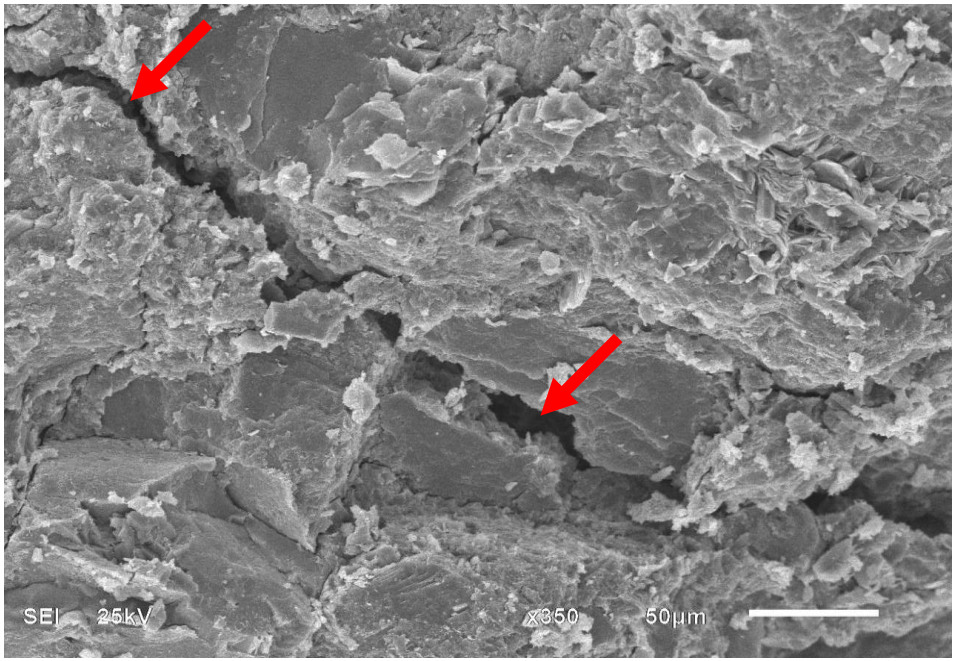


Plate 1F

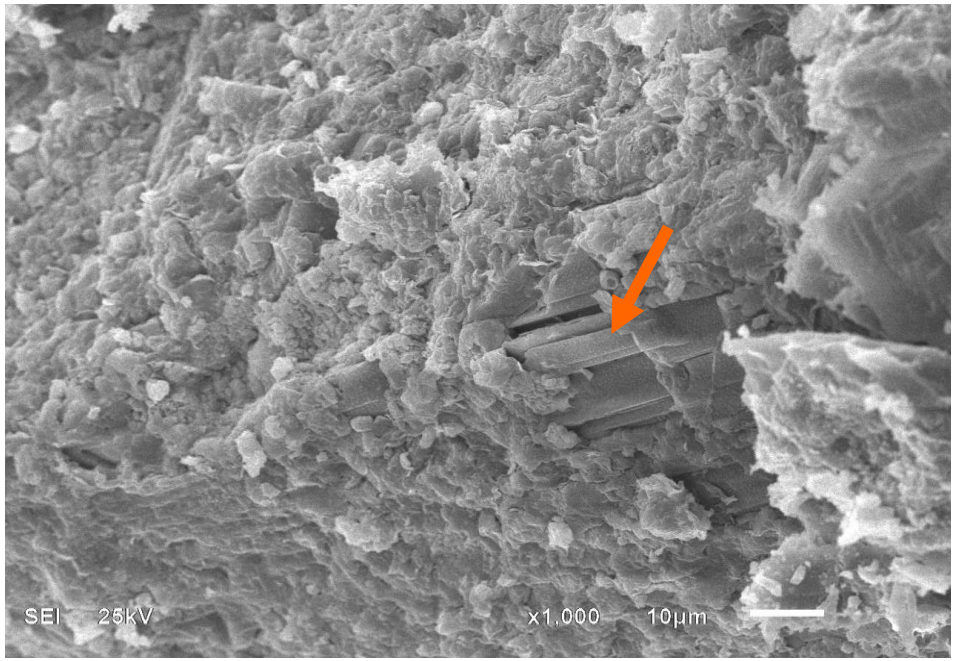


Table 1. Sample Data

Suite	Formation	TS	SEM	Thin Section Porosity (%)	Core Analysis Porosity (%)	Microporosity (% of Core Porosity)	Core Permeability (mD)
14-MH-016	Proximal Laberge Group	*	*	0.8	0.9	13.33	0.019
		*		2.4	4.4	45.45	0.029

Core Lab
RESERVOIR OPTIMIZATION

Company: Yukon Geological Survey
Suite: 14-MH-016

C.L. File No. 52135-15-3566
Date: March, 2016
Geologist: James Simpson

Table 2. Petrographic Summary / Point Count

SAMPLE		1	2
DEPTH (m)		51.00	58.00
FORMATION		Proximal Laberge Group	Proximal Laberge Group
ROCK TYPE		Sandstone	Sandstone
Classification (Folk, '80)		Feldspathic Litharenite	Feldspathic Litharenite
FRAMEWORK GRAINS			
Quartz	Monocrystalline	25.6	21.2
	Polycrystalline	10.4	2.4
Rock Fragments	Chert (Non Porous)	-	-
	Chert (Porous)	-	-
	Detrital dolomite	-	-
	Sedimentary	-	-
	Volcanic	22.0	24.4
Feldspars	Potassic feldspar	12.4	11.6
	Plagioclase feldspar	3.2	4.8
Accessory Minerals	Glauconite	-	-
	Carbonaceous material	-	-
	Shell fragments	-	-
	Phosphatic intraclasts	-	-
	Tourmaline	-	-
	Zircon	-	-
	Micas	-	0.4
	Heavy minerals	-	-
MATRIX			
Matrix	Detrital clays	-	3.6
AUTHIGENIC MINERALS			
Clays	Kaolinite	0.4	-
	Chlorite	1.2	-
Non-Clay Cements	Calcite	-	-
	Ferroan calcite	22.0	-
	Dolomite	-	-
	Ferroan dolomite	-	20.8
	Siderite	-	-
	Quartz overgrowth	-	2.4
	Anhydrite/Gypsum	-	-
	Pyrite/Hematite/Goethite	2.0	6.0
	Bitumen	-	-
POROSITY			
Primary - intergranular		-	-
Secondary - Solutional		0.8	2.4
Total Thin Section Porosity		**0.8**	**2.4**
TEXTURE			
Grain Size Classification		cL	fU
Sorting		Poor	Poor
Roundness		Sa-Sr	Sa-Sr
Grain Contacts		Point - Short	Point - Long/Concavo Convex

Company: Yukon Geological Survey
Suite: 14-MH-016
Proximal Laberge Group
Sample 1 - Sandstone
Depth (m): 51.00

Plate 1A (x63): Low magnification overview of a massive, poorly sorted, coarse grained sandstone. Framework grain mineralogy consists of abundant monocrystalline quartz and volcanic rock fragments, common potassium feldspar and polycrystalline quartz and minor plagioclase feldspar. Note the presence of chlorite visible within a volcanic rock fragment (yellow arrow).

Plate 1B (x63): This sample is pervasively cemented by ferroan calcite (green arrows), occluding the primary intergranular pore system. Secondary solutional porosity (red arrows) is a trace component, created from partial dissolution of unstable framework grains such as feldspars and volcanic rock fragments.

Plate 1C (x125): Magnification displays abundant ferroan calcite, at times replacing framework grains (green arrow).

Plate 1A

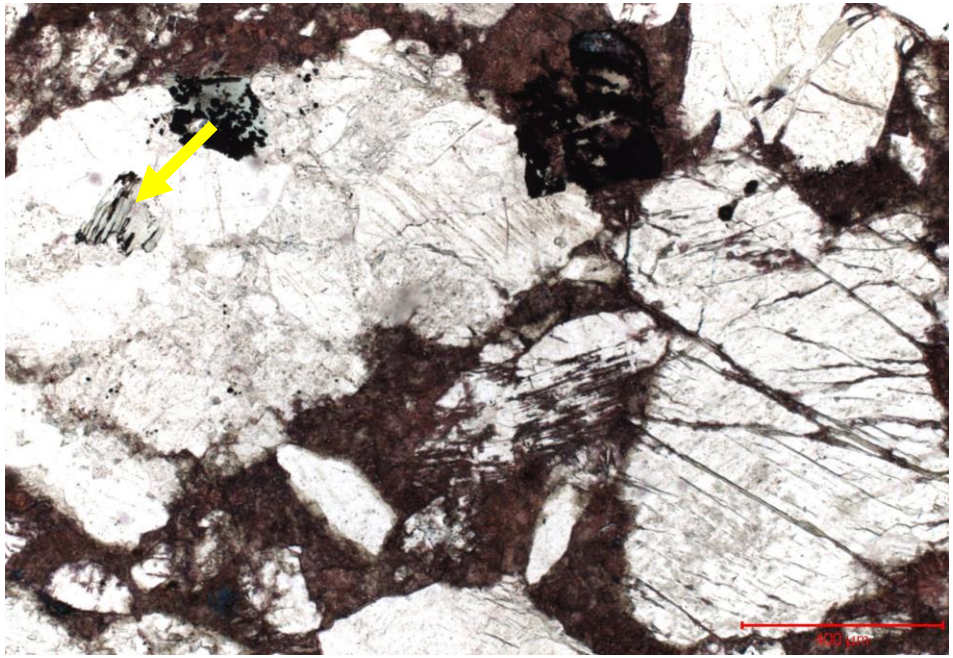


Plate 1B

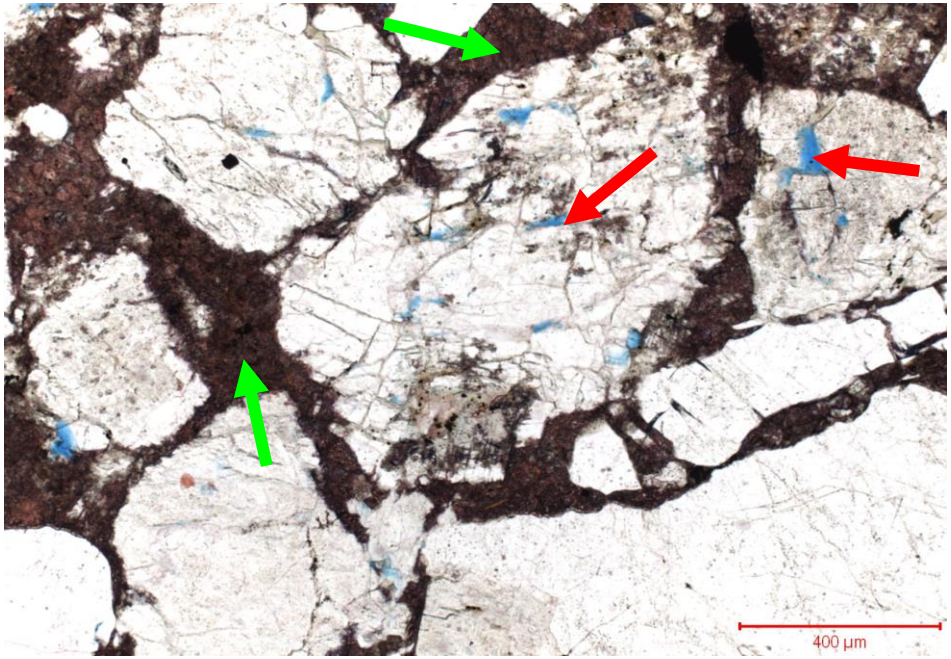
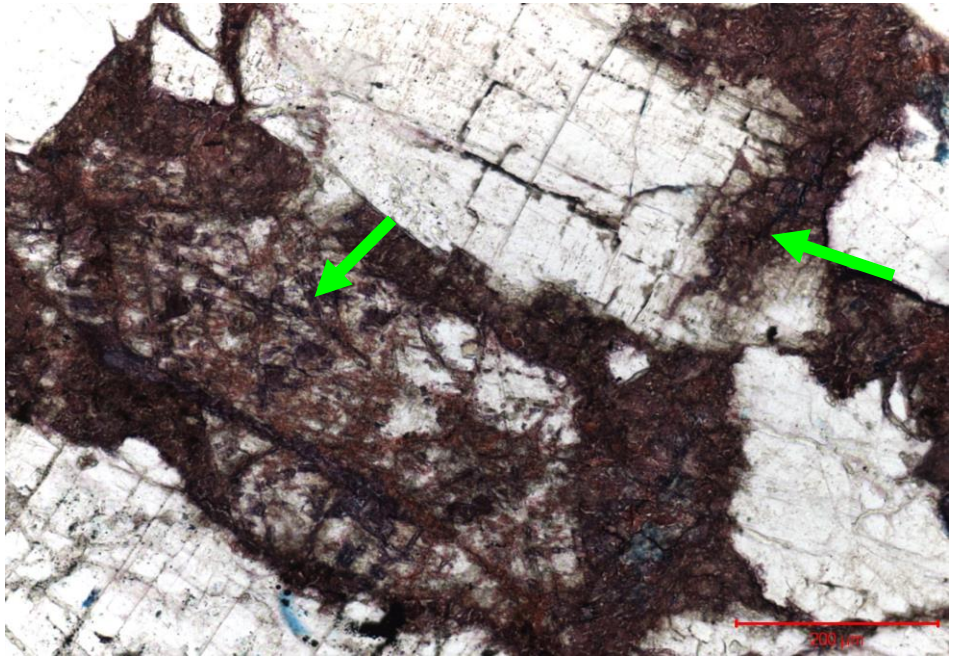


Plate 1C



Company: Yukon Geological Survey
Suite: 14-MH-016
Proximal Laberge Group
Sample 1 - Sandstone
Depth (m): 51.00

Plates 1D and 1E (x100/x150): Overviews of a massive, well cemented, poorly sorted, coarse grained sandstone showing abundant pore-filling ferroan calcite cement (green circles/green arrows).

Plate 1F (x1500): Magnification of a feldspar grain shows very small secondary solutional pore spaces (red arrows), approximately 1 micron in diameter. Note the presence of minor grain-coating chlorite (yellow arrows).

Plate 1D

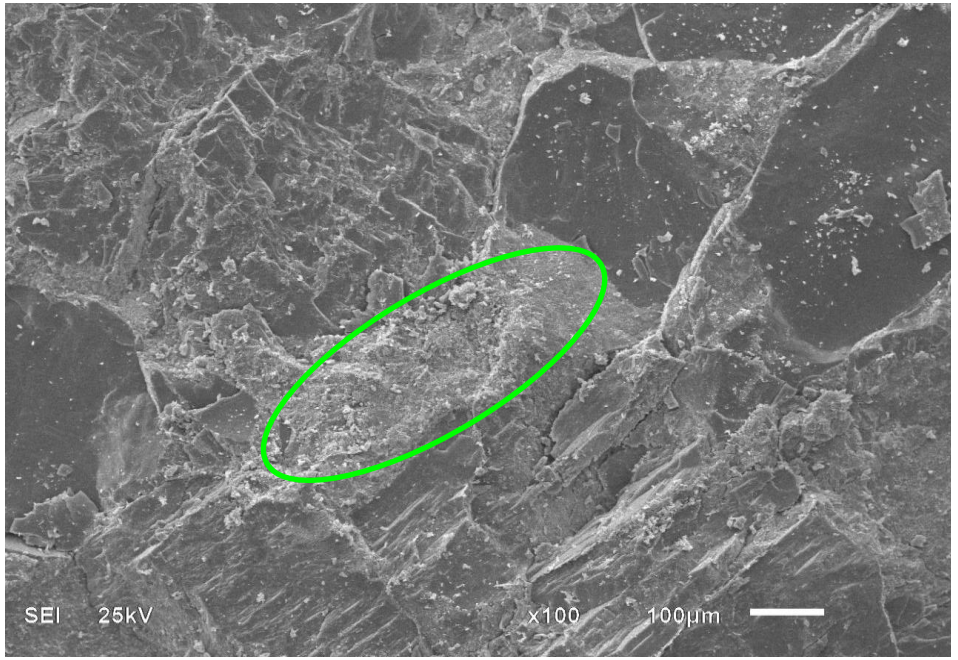


Plate 1E

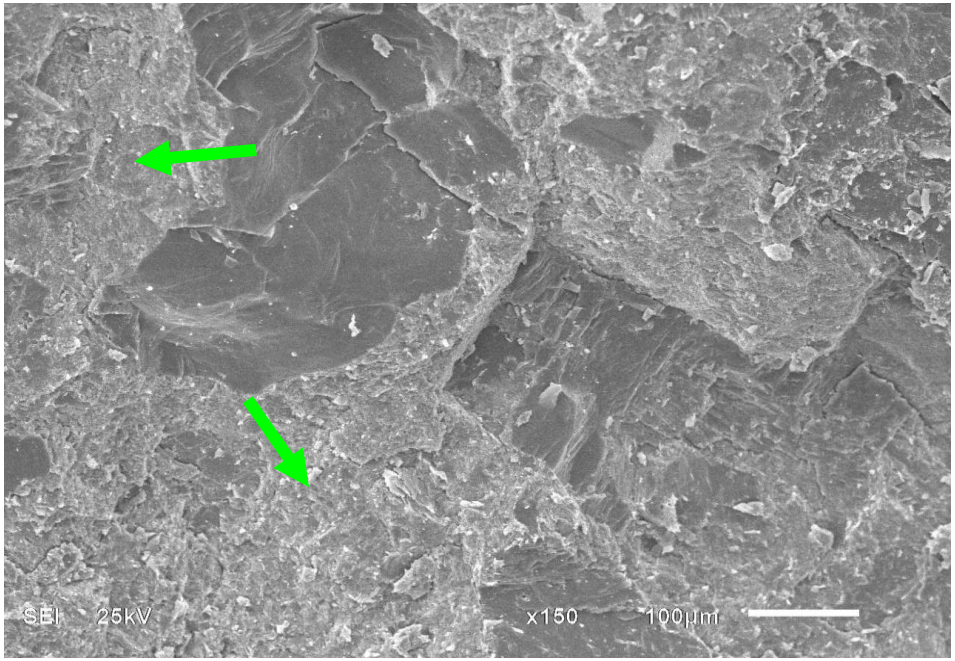
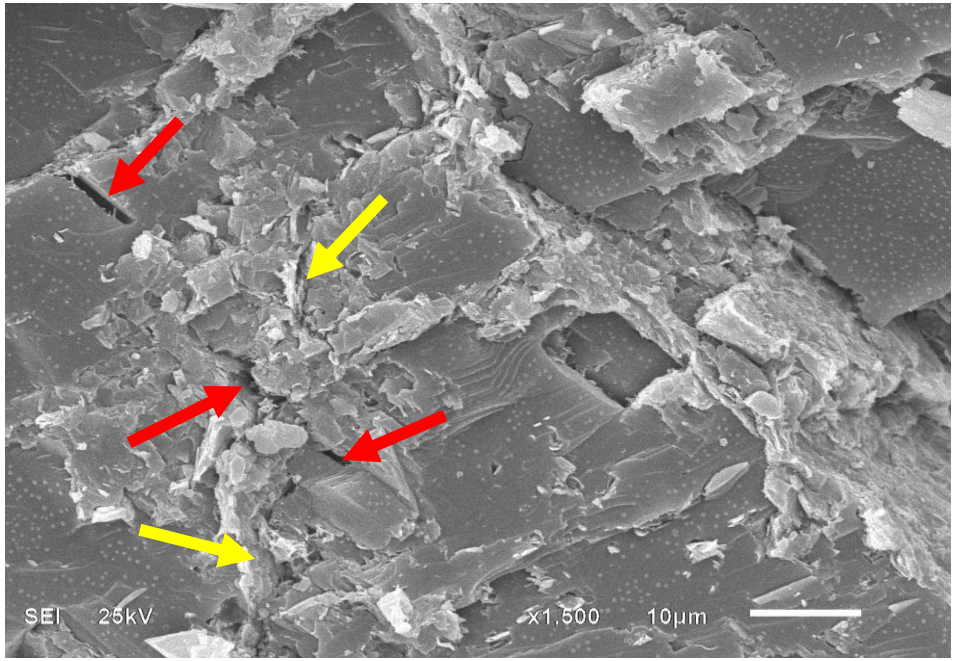


Plate 1F



Company: Yukon Geological Survey
Suite: 14-MH-016
Proximal Laberge Group
Sample 2 - Sandstone
Depth (m): 58.00

Plate 2A (x32): This sample is a massive, poorly sorted, fine grained sandstone comprised of abundant volcanic rock fragments and monocrystalline quartz, common potassium feldspar and minor plagioclase feldspar and polycrystalline quartz. Note the presence of a ferroan dolomite healed fracture (green arrow), containing minor silica replacement (orange arrow) and partial dissolution (red arrow).

Plates 2B and 2C (x125/x125): These two fields of view display abundant ferroan dolomite cement (green arrows), occluding the intergranular pore system. Detrital matrix clays (yellow arrows) are present in minor quantities, visible as a grain-coating/pore-filling component. Moderate pyrite/goethite (orange arrows) is present as small, localized concentrations. Porosity is a minor component, consisting entirely of the secondary solutional variety (red arrow), created from partial feldspar/volcanic rock fragment dissolution.

Plate 2A

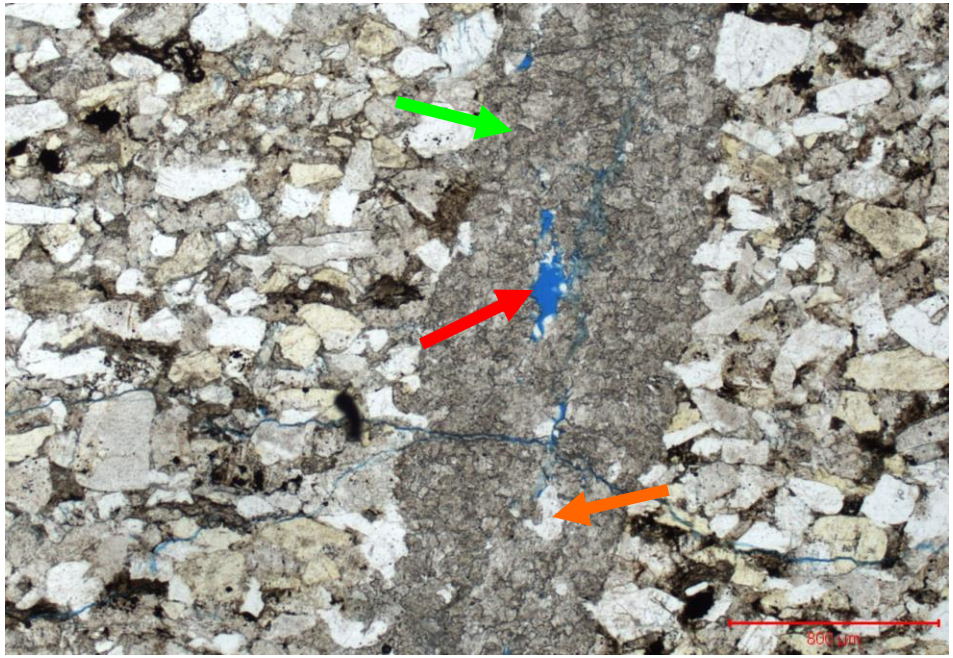


Plate 2B

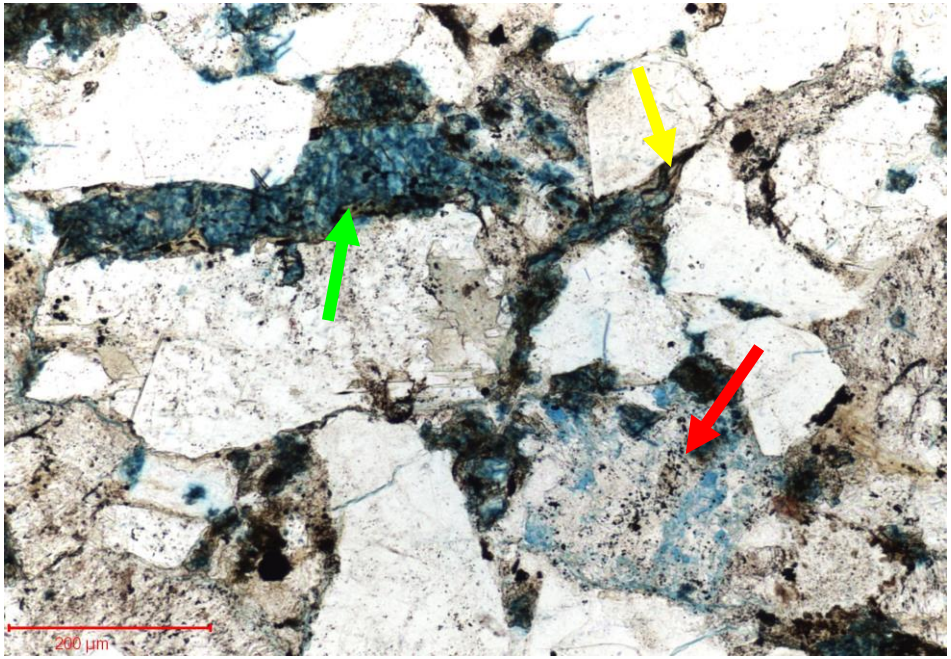


Plate 2C

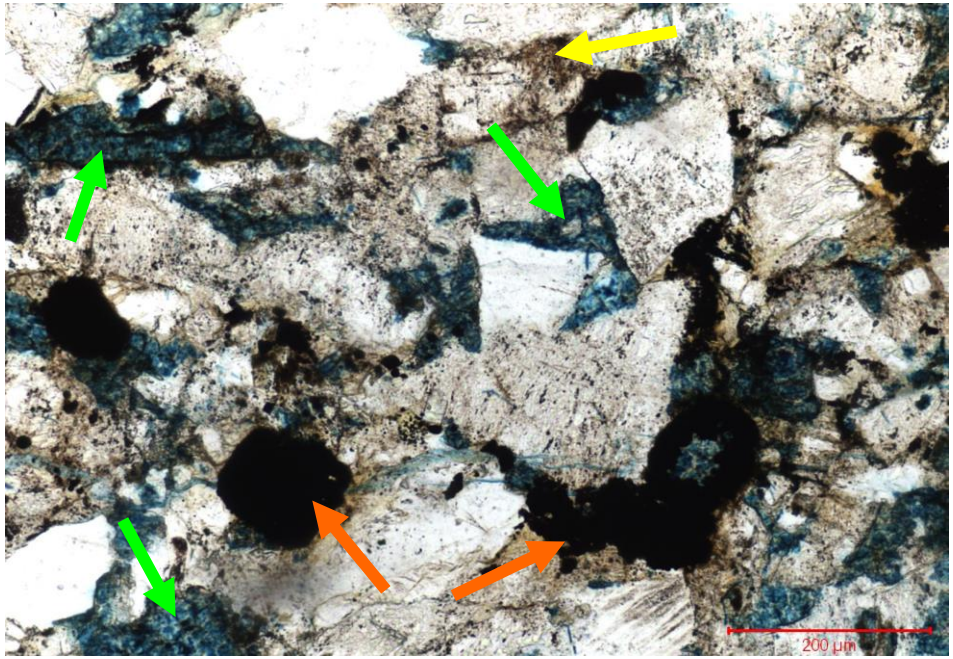


Table 1. Sample Data

Well	Formation	TS	SEM	Thin Section Porosity (%)	Core Analysis Porosity (%)	Microporosity (% of Core Porosity)	Core Permeability (mD)
15-MH-94/37	Proximal Laberge Group	*	*	0.8	1.6	50.00	0.06
		*		1.2	4.1	70.73	0.038
		*	*	1.2	4.7	74.47	0.059
		*		3.2	6.6	51.52	0.282
		*	*	3.6	5.9	38.98	0.18

Core Lab
RESERVOIR OPTIMIZATION

Company: Yukon Geological Survey
Well: 15-MH-94/37

C.L. File No. 52135-15-3566
Date: March, 2016
Geologist: James Simpson

Table 2. Petrographic Summary / Point Count

SAMPLE		1	2	3	4	5
DEPTH (m)		125.35	153.00	159.01	188.21	198.54
FORMATION		Proximal Laberge Group	Proximal Laberge Group	Proximal Laberge Group	Proximal Laberge Group	Proximal Laberge Group
ROCK TYPE		Sandstone	Sandstone	Sandstone	Sandstone	Sandstone
Classification (Folk, '80)		Feldspathic litharenite	Arkose	Arkose	Lithic Arkose	Lithic Arkose
FRAMEWORK GRAINS						
Quartz	Monocrystalline	24.4	26.4	24.4	31.2	23.2
	Polycrystalline	11.6	1.6	3.2	3.6	7.2
Rock Fragments	Chert (Non Porous)	3.6	-	-	-	-
	Chert (Porous)	-	-	-	-	-
	Detrital dolomite	-	-	-	-	-
	Sedimentary	-	-	-	-	-
	Volcanic	7.6	6.4	6.4	10.8	18.0
Feldspars	Potassic feldspar	6.8	17.6	18.0	15.2	19.6
	Plagioclase feldspar	-	5.2	4.8	8.8	6.8
Accessory Minerals	Glauconite	-	-	-	-	-
	Carbonaceous material	1.2	-	-	0.8	-
	Shell fragments	-	-	-	-	-
	Phosphatic intraclasts	-	-	-	-	-
	Tourmaline	-	-	-	-	-
	Zircon	-	-	-	-	-
	Micas	1.2	2.4	0.8	2.0	2.0
	Heavy minerals	-	-	-	-	-
MATRIX						
Matrix	Detrital clays	4.0	-	1.2	1.2	1.6
AUTHIGENIC MINERALS						
Clays	Kaolinite	28.0	4.0	10.4	3.2	3.2
	Chlorite	-	4.0	2.8	11.2	5.2
Non-Clay Cements	Calcite	-	1.2	-	0.8	0.8
	Ferroan calcite	1.2	12.0	17.2	0.8	2.4
	Dolomite	-	-	-	-	-
	Ferroan dolomite	-	2.8	3.2	-	-
	Siderite	2.8	8.4	1.2	-	-
	Quartz overgrowth	4.8	2.4	1.6	2.4	3.6
	Anhydrite/Gypsum	-	-	-	-	-
	Pyrite/Hematite/Goethite	2.0	4.4	3.6	4.8	2.8
	Bitumen	-	-	-	-	-
POROSITY						
Primary - intergranular		-	-	-	2.4	0.4
Secondary - Solutional		0.8	1.2	1.2	0.8	3.2
Total Thin Section Porosity		**0.8**	**1.2**	**1.2**	**3.2**	**3.6**
TEXTURE						
Grain Size Classification		mL	fU	fU	fU	mU
Sorting		Poor	Moderate	Moderate	Moderate	Poor
Roundness		Sa-Sr	Sa-Sr	Sa-Sr	Sa-Sr	Sa-Sr
Grain Contacts		Point - Long/Concavo convex	Point - Long/Concavo convex	Point - Long/Concavo convex	Point - Long/Concavo convex	Point - Long/Concavo convex

Company: Yukon Geological Survey
Well: 15-MH-94/37
Proximal Laberge Group
Sample 1 - Sandstone
Depth (m): 125.35

Plate 1A (x32): Low magnification overview of a massive, poorly sorted, medium grained sandstone. Framework grain mineralogy consists of abundant monocrystalline quartz, common polycrystalline quartz, moderate volcanic rock fragments and potassium feldspar and minor chert, carbonaceous material and mica.

Plate 1B (x125): This field of view display abundant pore-filling/grain-replacing kaolinite (yellow arrows), appearing as densely packed platelets occluding the pore system.

Plate 1C (x125): Magnification highlights minor ferroan calcite (green arrows) replacing volcanic rock fragments. Grain-coating matrix clays are a minor component (blue arrows). Note this sample contains only trace secondary porosity from partial grain dissolution.

Plate 1A

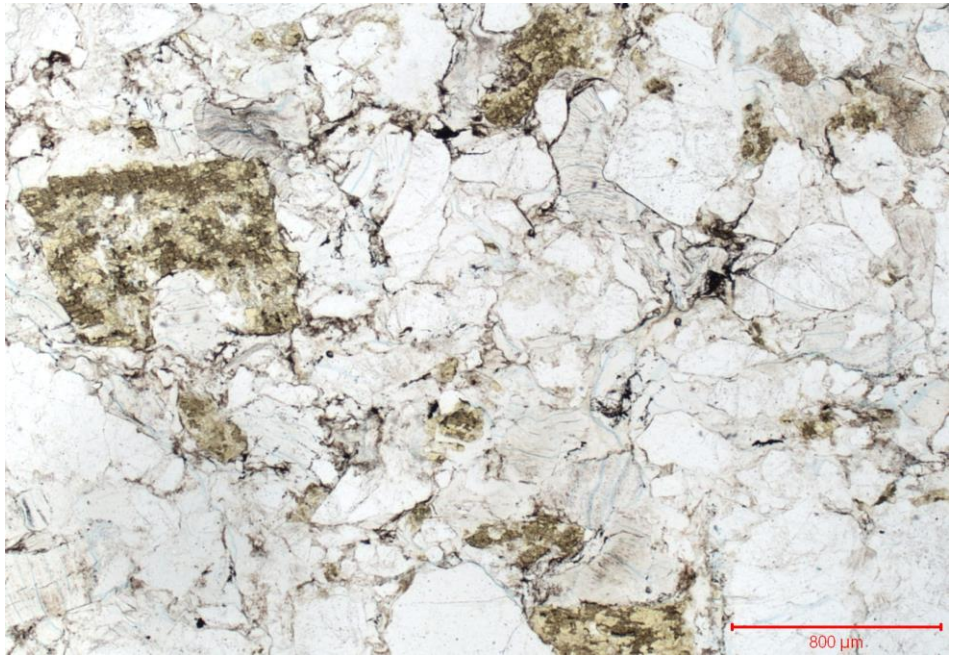


Plate 1B

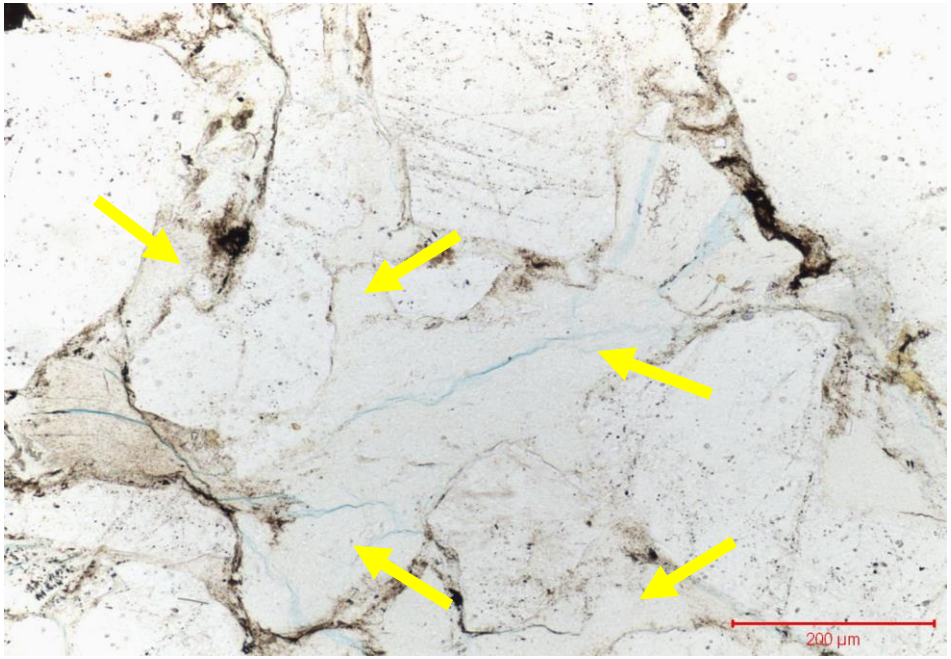
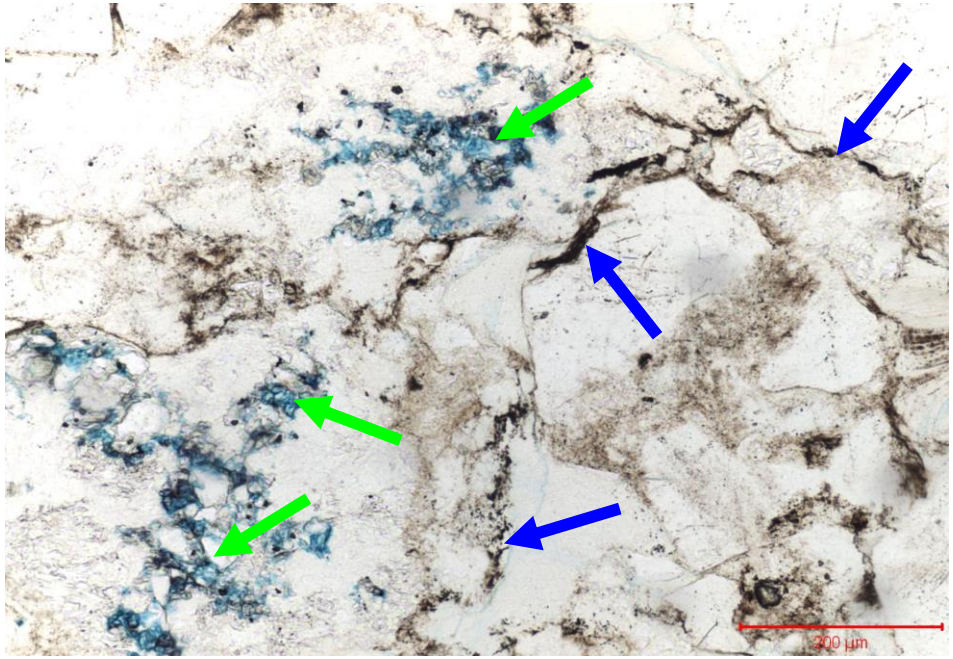


Plate 1C



Company: Yukon Geological Survey
Well: 15-MH-94/37
Proximal Laberge Group
Sample 1 - Sandstone
Depth (m): 125.35

Plate 1D (x40): Overview of massive, poorly sorted, medium grained sandstone comprised of abundant grain-replacing kaolinite (yellow circle), with platelets appearing up to 1500 microns in diameter. EDS analysis reports abundant Si and Al.

Plate 1E (x150): Close-up highlights densely packed, pore-filling kaolinite (yellow arrows), occluding the intergranular pore system.

Plate 1F (x350): Magnification displays pore-filling authigenic kaolinite (yellow arrows), appearing as very thin crystals stacked into booklets.

Plate 1D

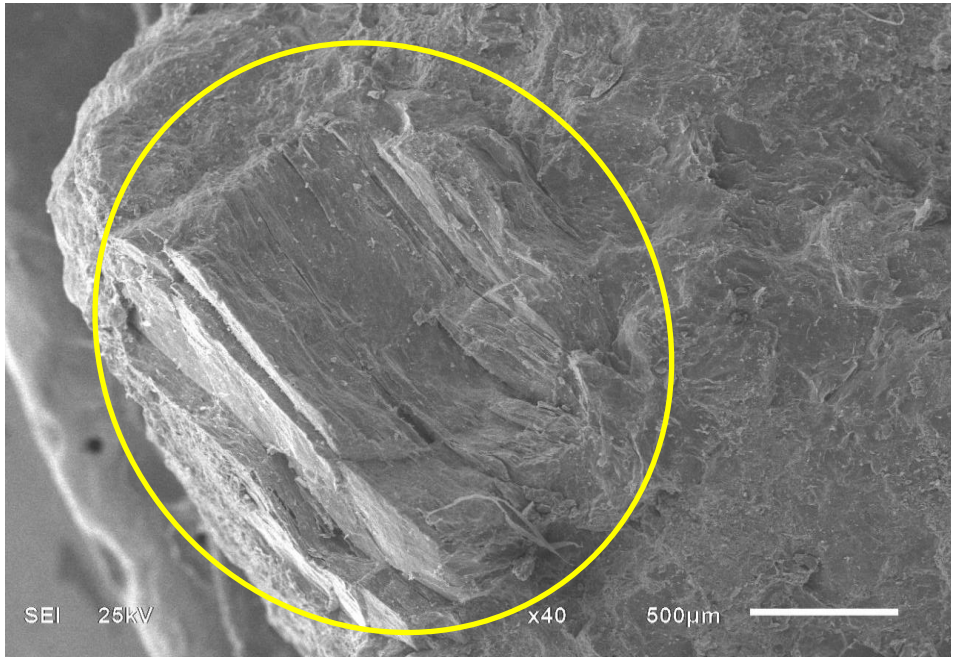


Plate 1E

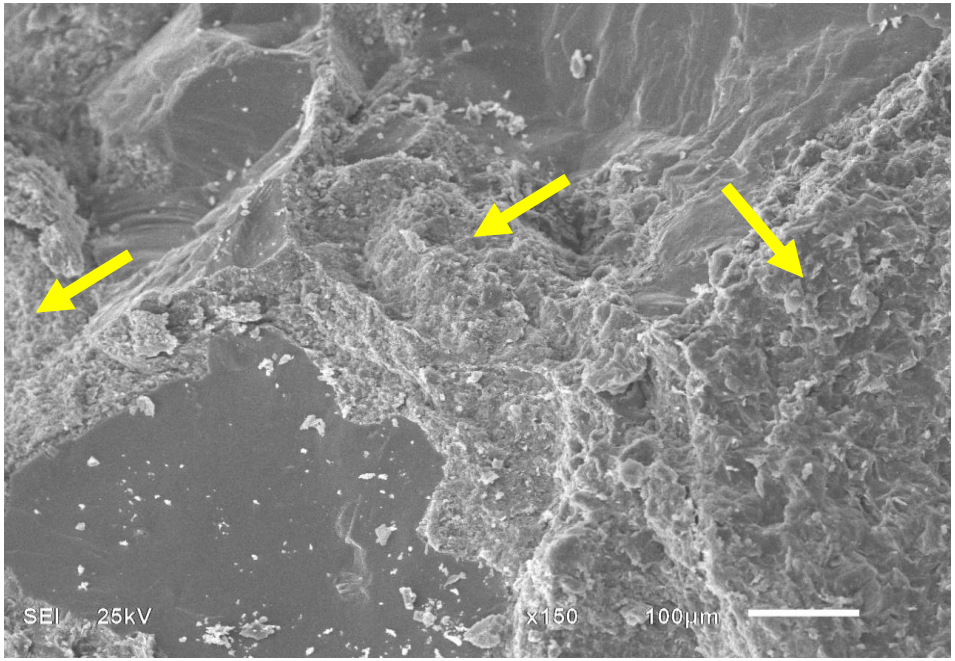
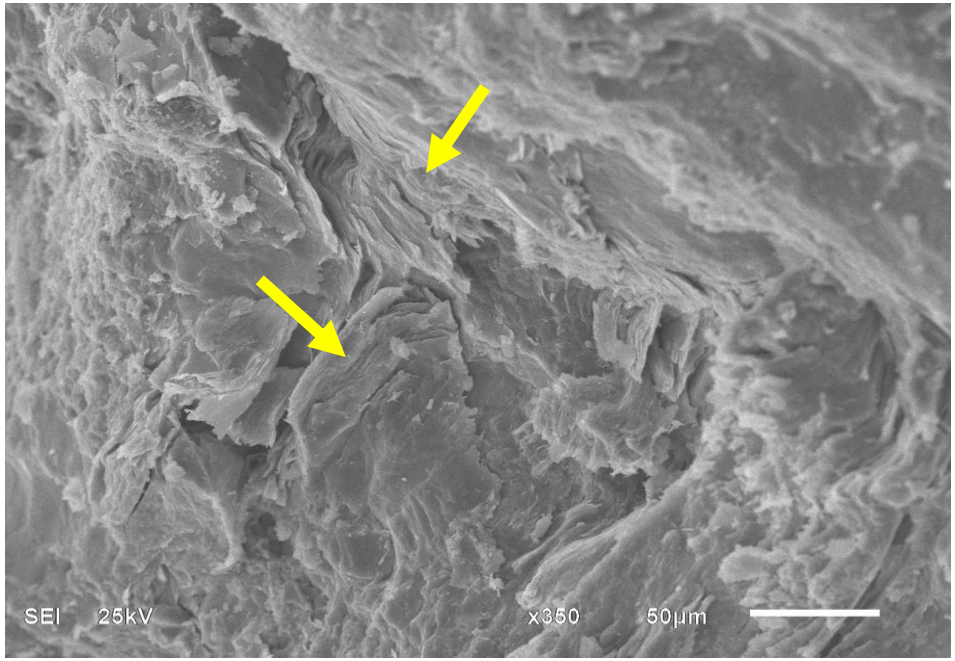


Plate 1F



Company: Yukon Geological Survey
Well: 15-MH-94/37
Proximal Laberge Group
Sample 2 - Sandstone
Depth (m): 153.00

Plate 2A (x32): This sample is a massive, moderately sorted, fine grained sandstone comprised of abundant monocrystalline quartz, common potassium feldspar, moderate volcanic rock fragments and plagioclase feldspar and minor mica and polycrystalline quartz. A ferroan calcite healed fracture (green arrow) runs through the sample and in places shows ferroan dolomite replacement (blue arrows).

Plate 2B (x125): This field of view shows a fracture, contributing to secondary porosity (red arrows). Note the presence of a ferroan calcite healed fracture (green arrows).

Plate 2C (x250): Magnification displays pore-filling, fibrous chlorite (yellow arrows). Ferroan calcite (green arrows) is a common pore-filling cement with moderate siderite (blue arrows). Note minor authigenic quartz overgrowths (orange arrows), cementing grains and partially occluding the pore system.

Plate 2A

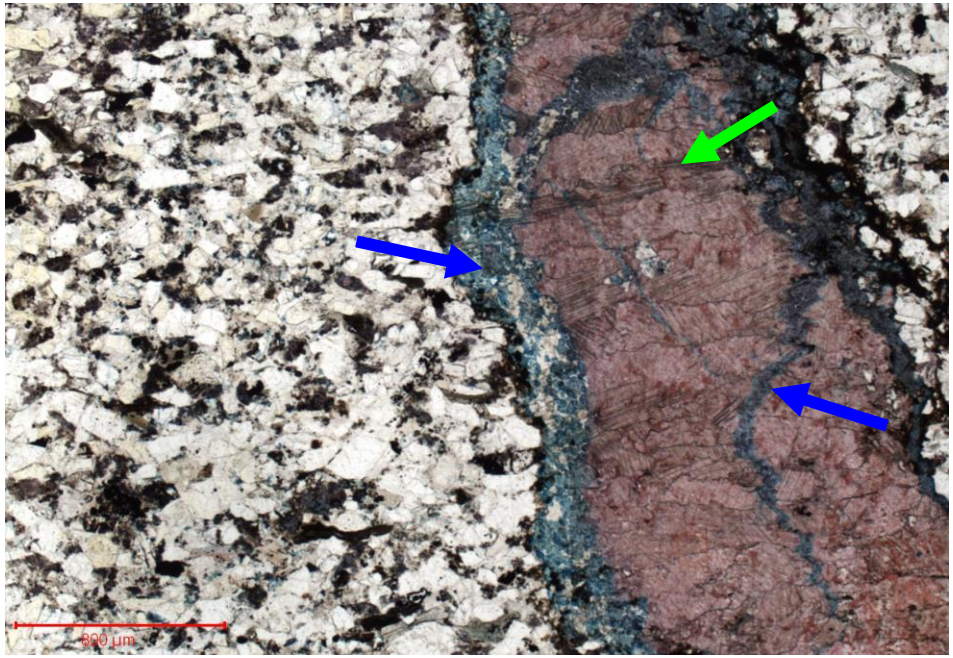


Plate 2B

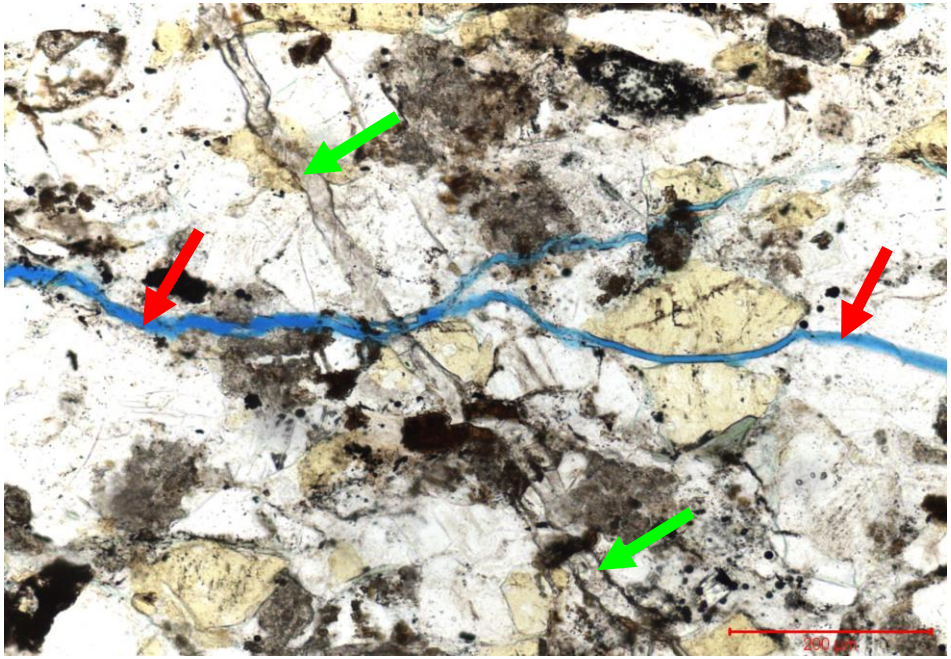
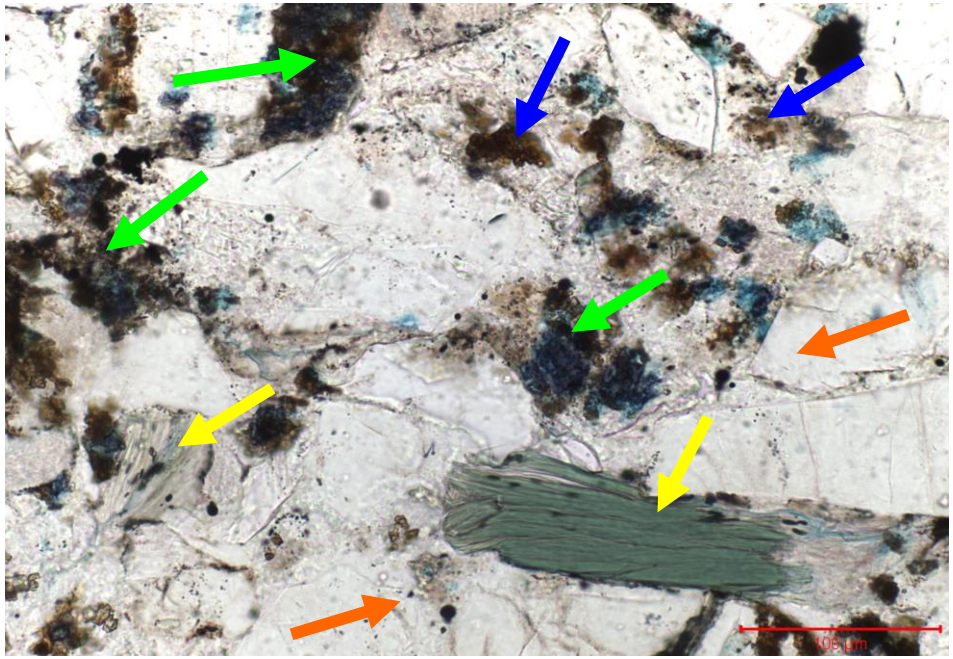


Plate 2C



Company: Yukon Geological Survey
Well: 15-MH-94/37
Proximal Laberge Group
Sample 3 - Sandstone
Depth (m): 159.01

Plate 3A (x32): Low magnification overview of a massive, moderately sorted, fine grained sandstone. Framework grain mineralogy consists of abundant monocrystalline quartz, common potassium feldspar, moderate volcanic rock fragments and minor plagioclase feldspar and polycrystalline quartz. Note a ferroan calcite healed fracture (green arrow).

Plate 3B (x125): Pore-filling kaolinite (yellow arrows) is a common clay, occluding the primary intergranular pore system. Porosity is minor component, comprised of secondary microfracture porosity (red arrows).

Plate 3C (x125): Close-up view highlights common ferroan calcite (green arrows), cementing framework grains, occluding pore spaces and partially replacing framework grains.

Plate 3A

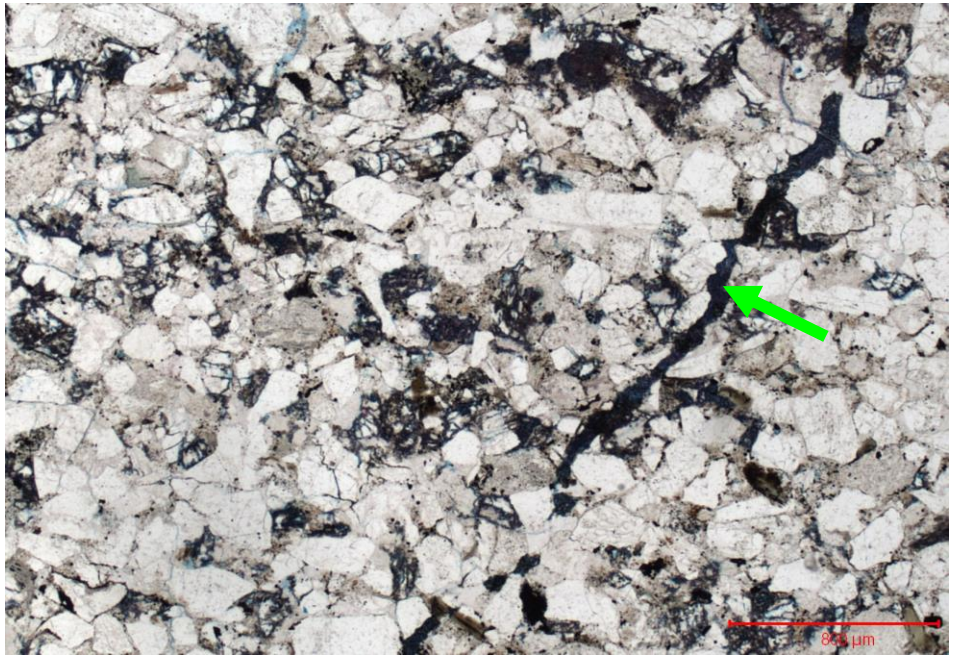


Plate 3B

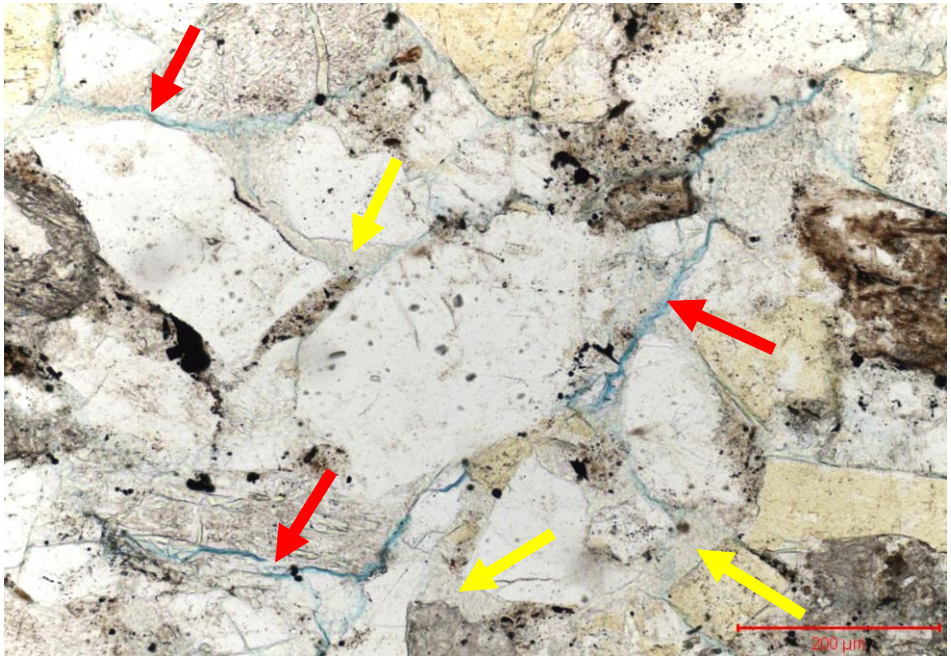
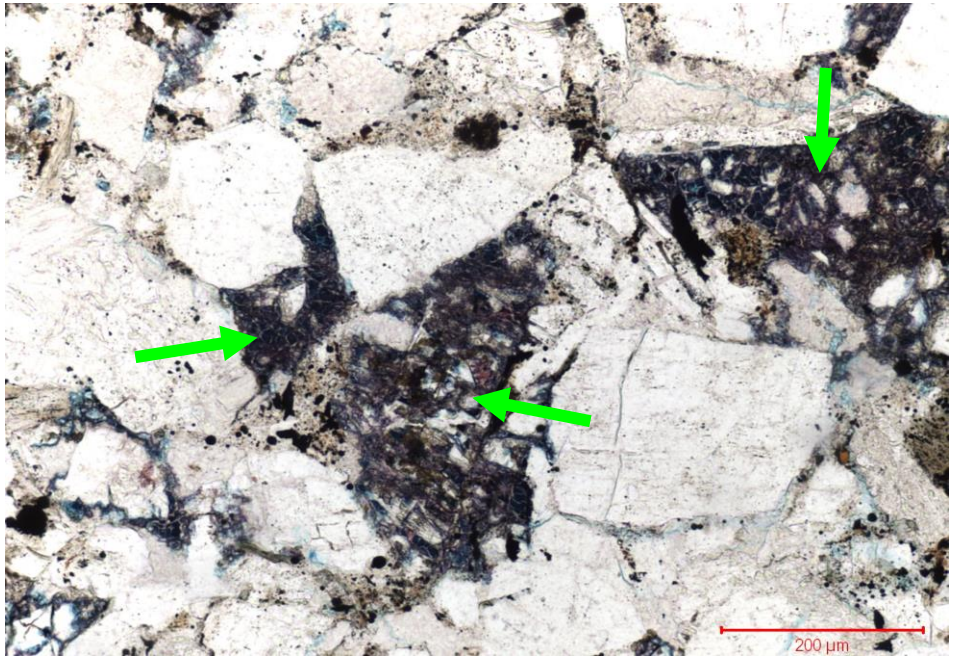


Plate 3C



Company: Yukon Geological Survey
Well: 15-MH-94/37
Proximal Laberge Group
Sample 3 - Sandstone
Depth (m): 159.01

Plate 3D (x200): Overview of a moderately sorted, fine grained sandstone showing common pore-filling kaolinite (yellow arrows) and localized concentrations of ferroan calcite cement (green circle).

Plate 3E (x400): This field of view highlights an open fracture (red arrows) that contributes to the secondary pore system.

Plate 3F (x800): Magnification displays densely packed, pore-filling authigenic kaolinite platelets (yellow circle). Kaolinite platelets are approximately 5 microns in diameter and lack an associated microporosity component.

Plate 3D

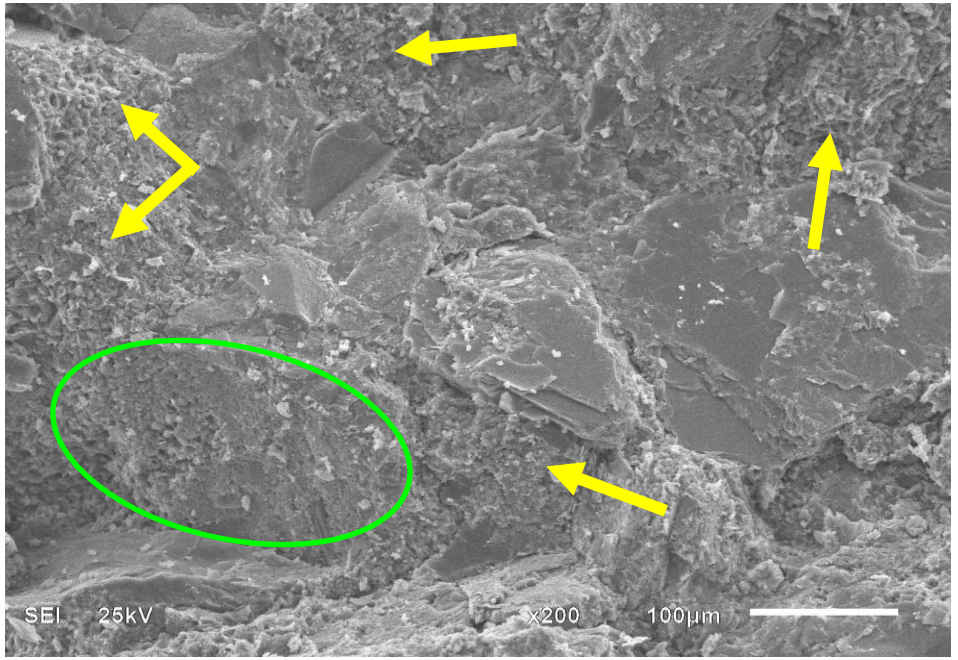


Plate 3E

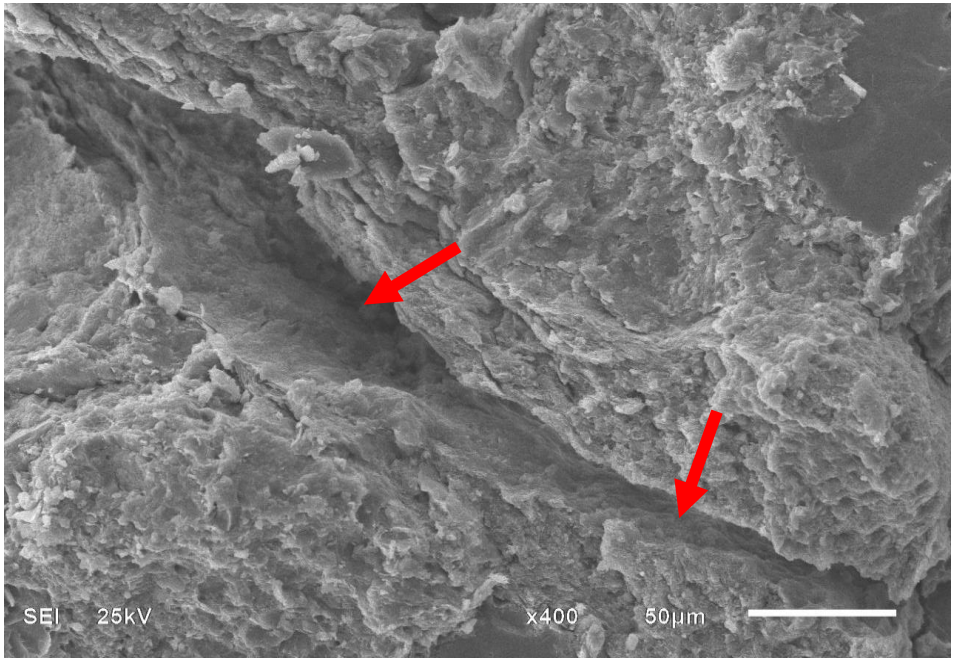
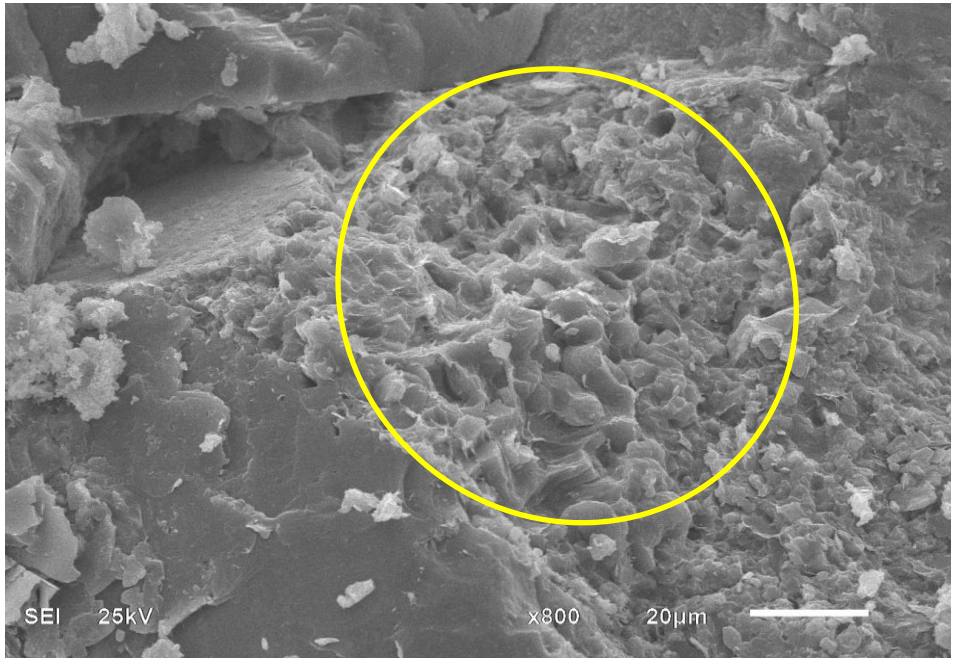


Plate 3F



Company: Yukon Geological Survey
Well: 15-MH-94/37
Proximal Laberge Group
Sample 4 - Sandstone
Depth (m): 188.21

Plate 4A (x32): This sample is a massive, moderately sorted, fine grained sandstone composed of abundant monocrystalline quartz, common potassium feldspar and volcanic rock fragments, moderate plagioclase feldspar and minor polycrystalline quartz and mica.

Plate 4B (x125): Localized concentrations of pore-filling calcite (green arrow)/ferroan calcite cement are present in minor quantities. Porosity is a minor component, primary intergranular is the most common variety (red arrows), with trace secondary solutional porosity. Authigenic chlorite (yellow arrow) is common throughout the sample, lining pore spaces and occluding intergranular porosity. Note grain-replacing pyrite (orange arrow).

Plate 4C (x250): Close-up view of intergranular porosity (red arrows) displays well formed, thin, pore-lining chlorite (yellow arrows). Note minor authigenic quartz overgrowths (orange arrows).

Plate 4A

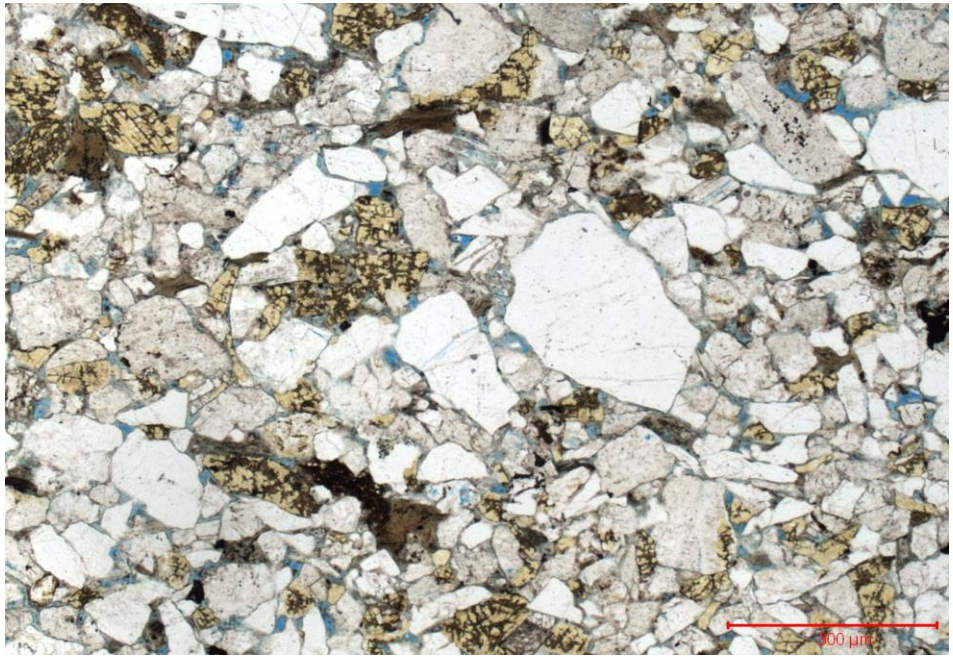


Plate 4B

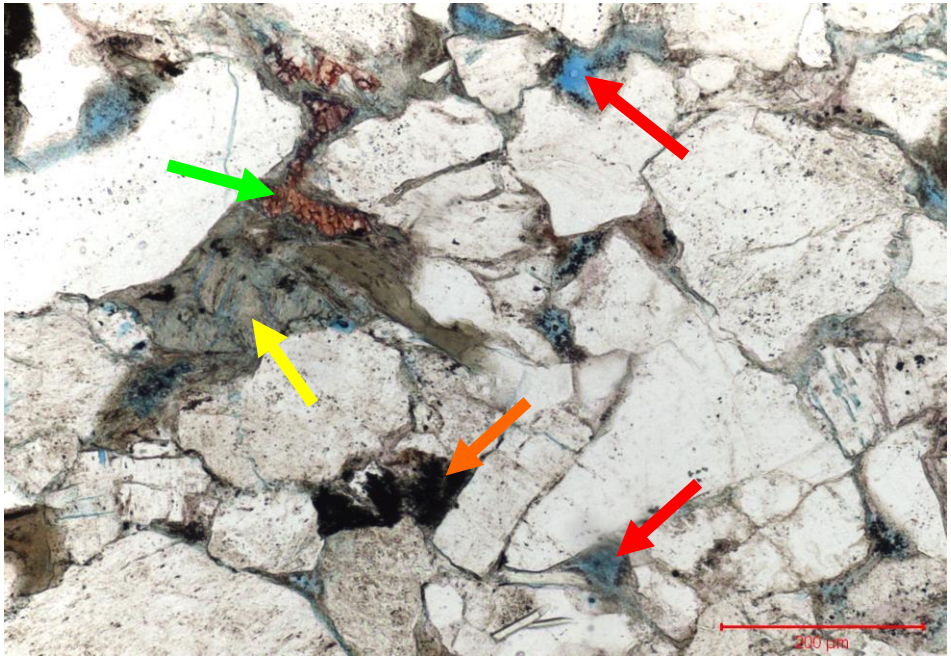
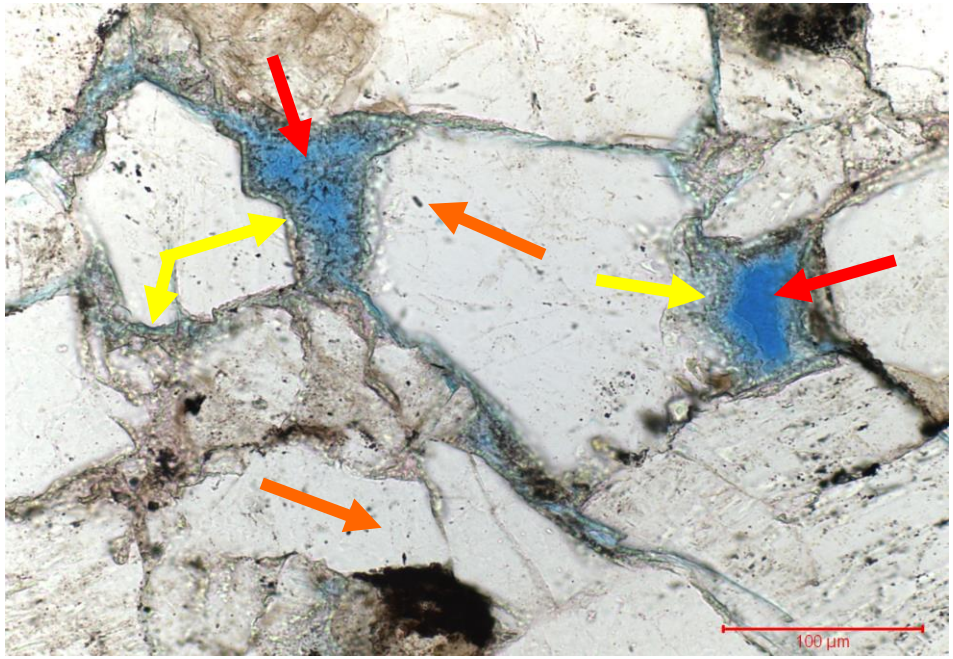


Plate 4C



Company: Yukon Geological Survey
Well: 15-MH-94/37
Proximal Laberge Group
Sample 5 - Sandstone
Depth (m): 198.54

Plate 5A (x32): Low magnification overview of a massive, poorly sorted, medium grained sandstone. Framework grain mineralogy consists of abundant monocrystalline quartz, common potassium feldspar and volcanic rock fragments, moderate polycrystalline quartz and plagioclase feldspar and minor mica.

Plate 5B (x125): Grain-replacing ferroan calcite (green arrows) is present in minor quantities. The majority of the intergranular pore system appears occluded by authigenic kaolinite/chlorite (yellow arrows).

Plate 5C (x250): Magnification of an intergranular pore space shows well-formed, thin, pore-lining authigenic chlorite (blue arrow) with pore-filling kaolinite (yellow arrows). Porosity in this sample is predominantly secondary solutional in variety, a result of feldspar/volcanic rock fragments dissolution (red arrows).

Plate 5A

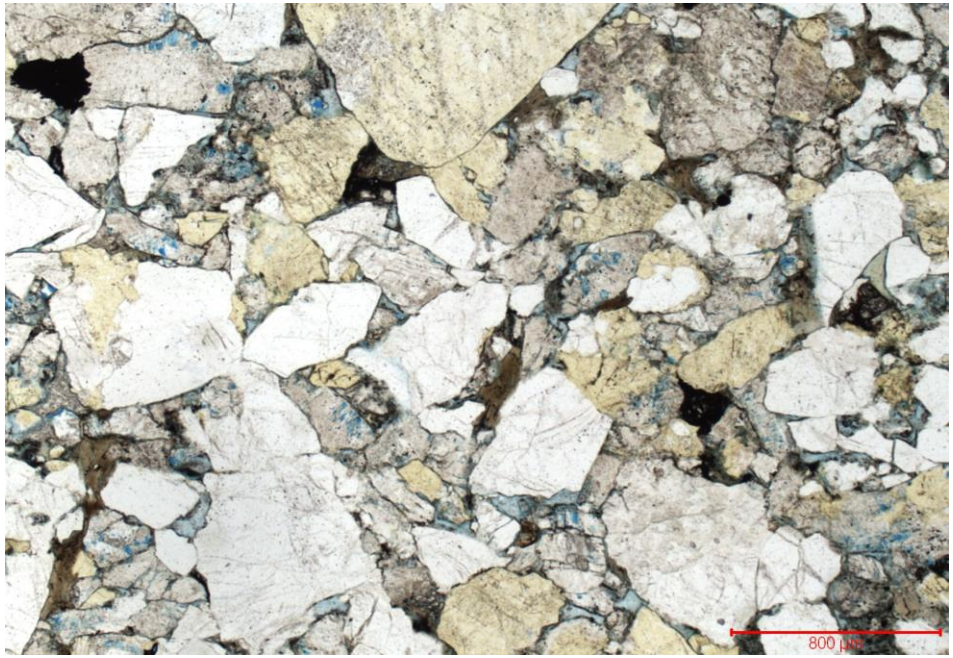


Plate 5B

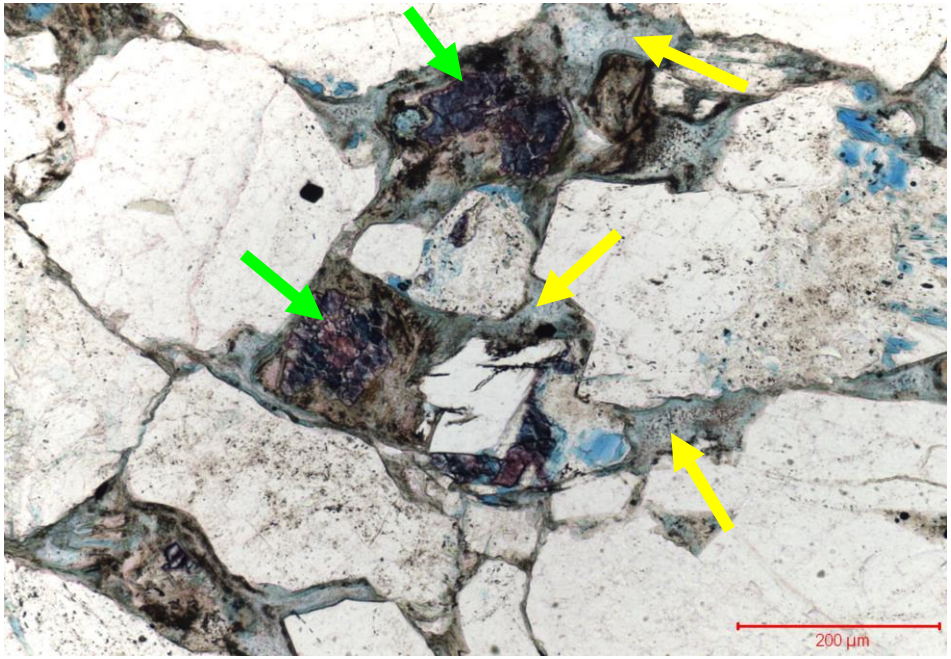
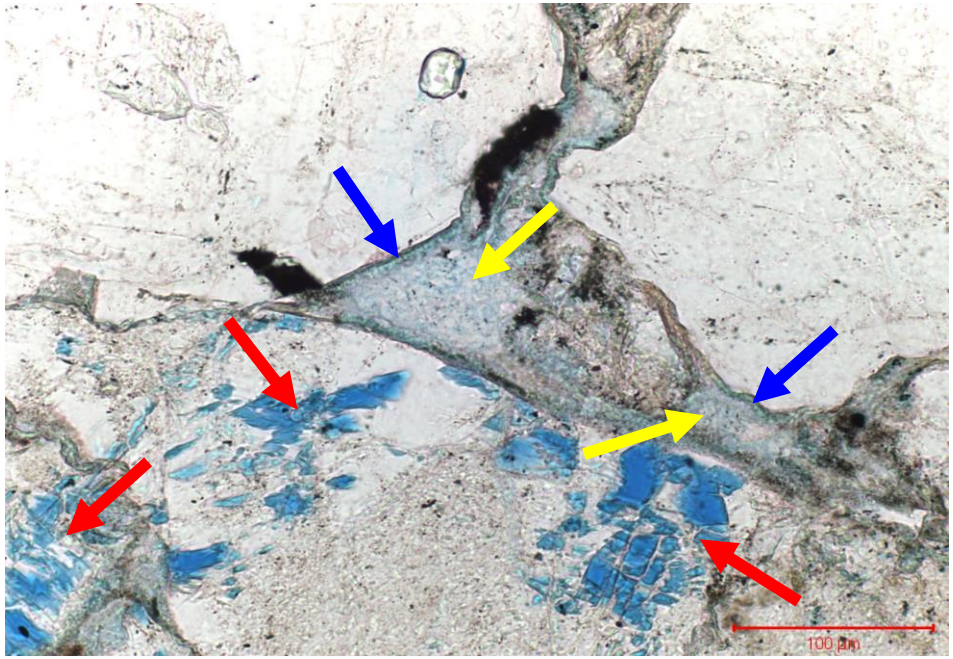


Plate 5C



Company: Yukon Geological Survey
Well: 15-MH-94/37
Proximal Laberge Group
Sample 5 - Sandstone
Depth (m): 198.54

Plate 5D (x400): Overview of a massive, poorly sorted, medium grained sandstone displays secondary solutional porosity (red arrows) within a partially leached potassium feldspar grain.

Plates 5E and 5F (x1500/2500): These two fields of view outline minor pore-filling authigenic kaolinite (yellow arrow) and thin, pore-lining authigenic chlorite (blue arrows), with the chlorite crystals appearing approximately 1 micron in diameter.

Plate 5D

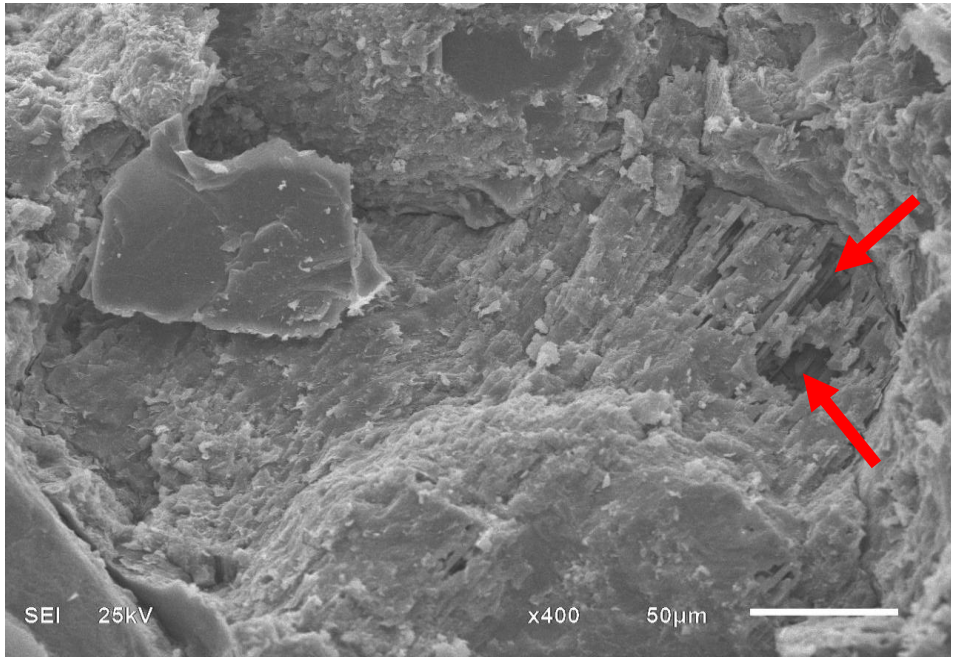


Plate 5E

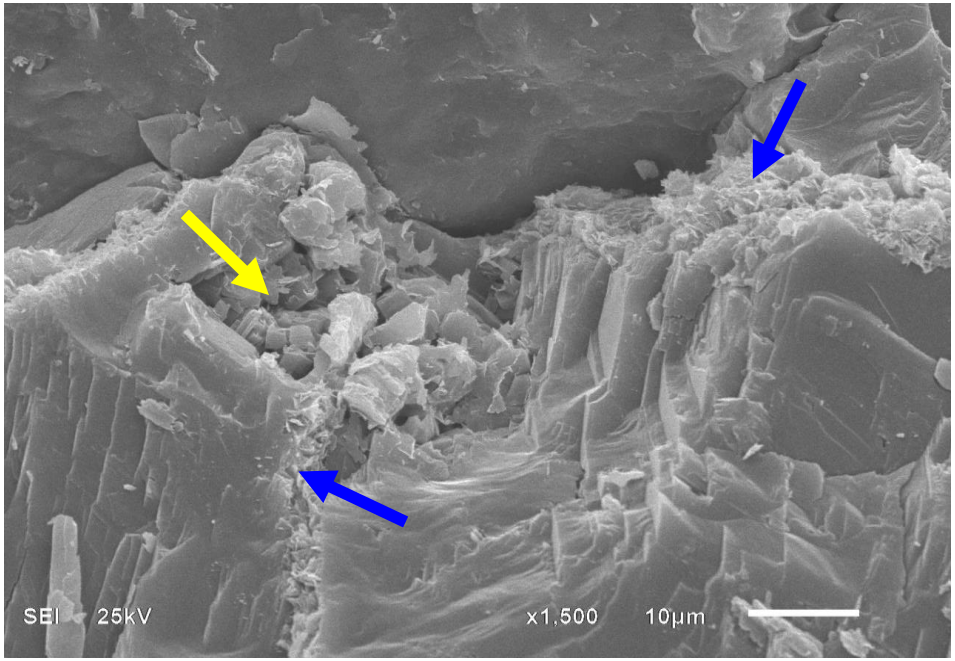
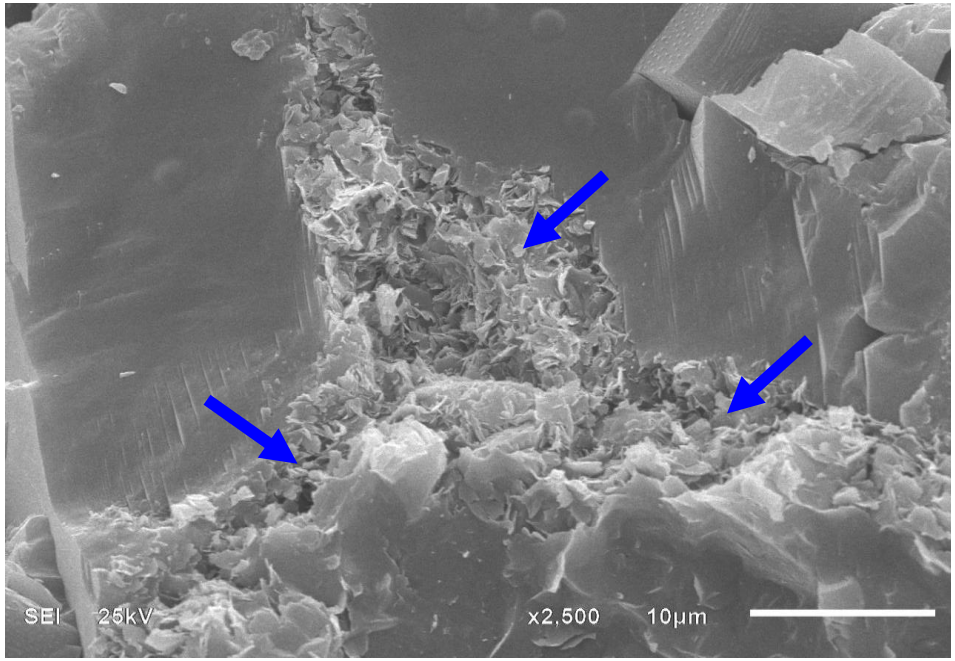


Plate 5F



Core Lab
RESERVOIR OPTIMIZATION

Table 1. Sample Data

Well	Formation	TS	SEM	Thin Section Porosity (%)	Core Analysis Porosity (%)	Microporosity (% of Core Porosity)	Core Permeability (mD)
15-MH-97/63	Proximal Laberge Group	*	*	0.8	5.8	86.21	0.42
		*		4.8	7.2	33.33	0.33
		*		1.2	3.5	65.71	0.05
		*		0.4	1.7	76.47	<0.01
		*	*	3.2	5.7	43.86	0.08
		*	*	0.0	0.5	100.00	0.13
		*		0.0	3.7	100.00	0.072
		*		0.8	3.5	77.14	0.42

Core Lab
RESERVOIR OPTIMIZATION

Company: Yukon Geological Survey
Well: 15-MH-97/63

C.L. File No. 52135-15-3566
Date: March, 2016
Geologist: James Simpson

Table 2. Petrographic Summary / Point Count

SAMPLE		1	2	3	4	5	6	7	8
DEPTH (m)		77.10	114.00	142.10	205.00	217.53	226.74	245.25	265.40
FORMATION		Proximal Laberge Group	Proximal Laberge Group	Proximal Laberge Group	Proximal Laberge Group	Proximal Laberge Group	Proximal Laberge Group	Proximal Laberge Group	Proximal Laberge Group
ROCK TYPE		Sandstone	Sandstone	Sandstone	Sandstone	Sandstone	Sandstone	Sandstone	Sandstone
Classification (Folk, '80)		Arkose	Subarkose	Arkose	Arkose	Arkose	Arkose	Arkose	Subarkose
FRAMEWORK GRAINS									
Quartz	Monocrystalline	37.6	41.2	26.8	30.0	43.2	25.6	26.0	36.0
	Polycrystalline	16.4	13.6	6.4	7.2	8.4	6.8	6.8	18.8
Rock Fragments	Chert (Non Porous)	3.2	-	1.2	1.2	-	-	1.2	4.4
	Chert (Porous)	-	-	-	-	-	-	-	-
	Detrital dolomite	-	-	-	-	-	-	-	-
	Sedimentary	-	-	-	-	-	-	-	-
	Volcanic	2.4	2.8	3.2	2.8	-	7.6	3.6	1.6
Feldspars	Potassic feldspar	18.0	10.4	31.2	16.0	18.4	20.0	19.6	10.8
	Plagioclase feldspar	-	1.6	2.0	3.6	2.0	3.2	-	-
Accessory Minerals	Glauconite	-	-	-	-	-	-	-	-
	Carbonaceous material	4.0	-	1.2	5.2	-	5.2	4.0	19.2
	Shell fragments	-	-	-	-	-	-	-	-
	Phosphatic intraclasts	-	-	-	-	-	-	-	-
	Tourmaline	-	-	-	-	-	-	-	-
	Zircon	-	-	-	-	-	-	-	-
	Micas	1.2	-	-	0.8	-	2.0	-	-
	Heavy minerals	-	-	-	-	-	-	-	-
MATRIX									
Matrix	Detrital clays	10.8	2.0	3.2	1.2	1.6	2.8	20.0	4.0
AUTHIGENIC MINERALS									
Clays	Kaolinite	2.4	6.0	8.4	12.0	12.0	14.4	5.6	2.0
	Chlorite	-	-	-	-	2.0	-	2.4	-
Non-Clay Cements	Calcite	-	-	-	-	-	-	-	-
	Ferroan calcite	-	0.8	-	-	-	-	5.6	-
	Dolomite	-	-	-	-	-	-	-	-
	Ferroan dolomite	-	5.2	0.8	10.0	4.8	-	2.0	-
	Siderite	-	7.6	9.2	4.4	1.2	9.2	-	-
	Quartz overgrowth	2.0	4.0	4.0	3.6	3.2	2.0	1.6	2.4
	Anhydrite/Gypsum	-	-	-	-	-	-	-	-
	Pyrite/Hematite/Goethite	1.2	-	1.2	1.6	-	1.2	1.6	-
	Bitumen	-	-	-	-	-	-	-	-
POROSITY									
Primary - intergranular		-	-	-	-	-	-		-
Secondary - Solutional		0.8	4.8	1.2	0.4	3.2	-		0.8
Total Thin Section Porosity		**0.8**	**4.8**	**1.2**	**0.4**	**3.2**	**0.0**	**0.0**	**0.8**
TEXTURE									
Grain Size Classification		vcL	cU	mU	mL	cL	fU	mL	cU
Sorting		Poor	Poor	Poor	Moderate	Poor	Poor	Poor	Poor
Roundness		Sa-Sr	Sa-Sr	Sa-Sr	Sa-Sr	Sa-Sr	Sa-Sr	Sa-Sr	Sa-Sr
Grain Contacts		Point-Long/Concavo convex	Point-Long/Concavo convex	Point-Long/Concavo convex	Point-Long/Concavo convex	Point-Long/Concavo convex	Point-Long/Concavo convex	Point-Long/Concavo convex	Point-Long/Concavo convex

Company: Yukon Geological Survey
Well: 15-MH-97/63
Proximal Laberge Group
Sample 1 - Sandstone
Depth (m): 77.10

Plate 1A (x32): Low magnification overview of a massive, poorly sorted, very coarse sandstone. Framework grain mineralogy consists of abundant monocrystalline quartz, common potassium feldspar and polycrystalline quartz and minor carbonaceous material (orange arrow), chert, volcanic rock fragments and mica.

Plate 1B (x125): Pore-filling detrital matrix clay is common, intermixed with very fine quartz grains (blue arrows) and carbonaceous material (orange arrows).

Plate 1C (x125): Visible porosity in this sample is of trace abundance showing only fracture porosity propagating across quartz framework grains (red arrows).

Plate 1A

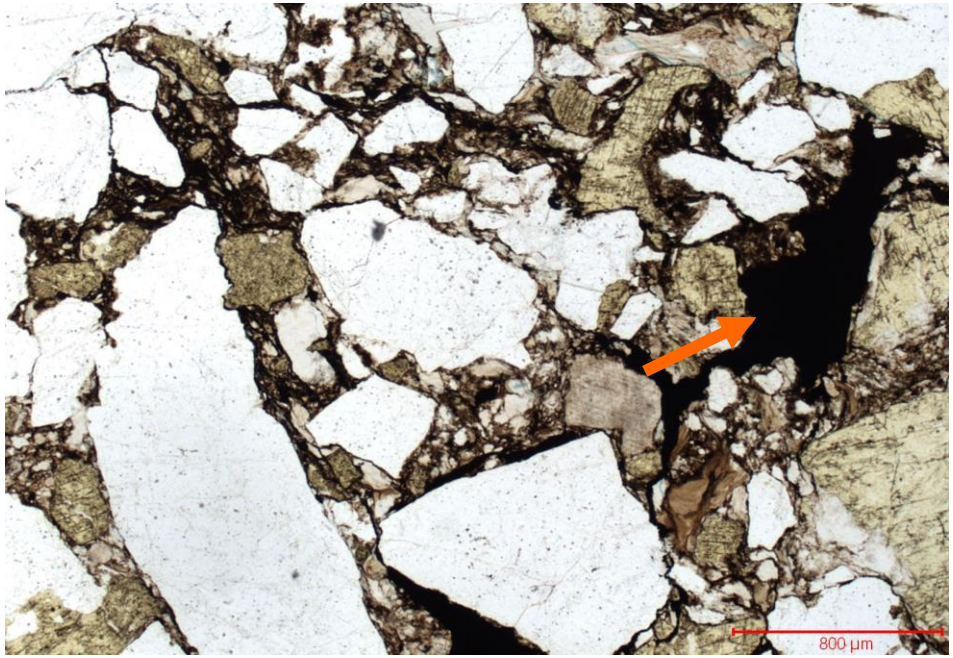


Plate 1B

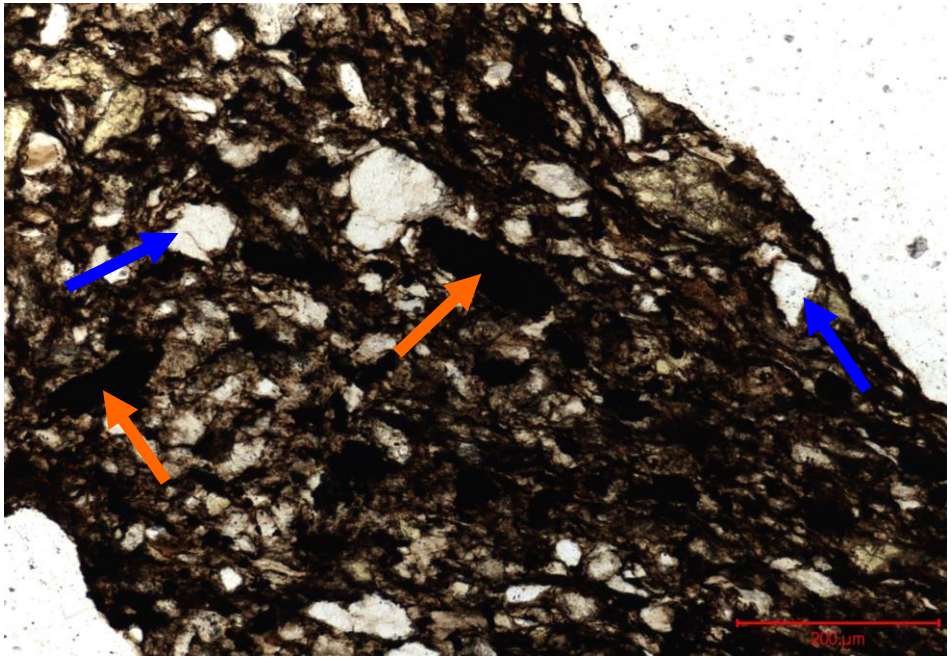
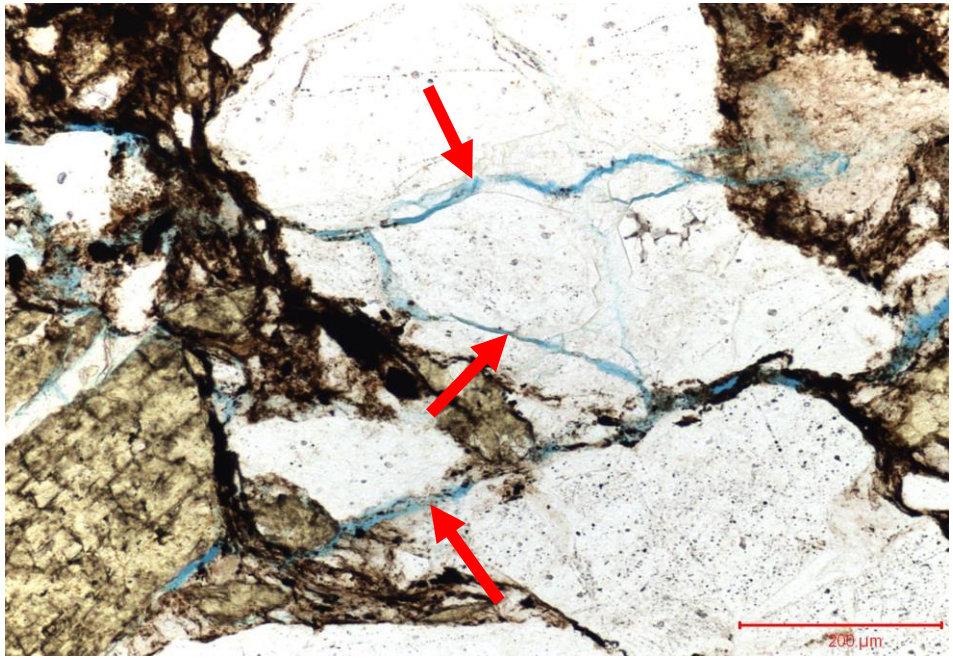


Plate 1C



Company: Yukon Geological Survey
Well: 15-MH-97/63
Proximal Laberge Group
Sample 1 - Sandstone
Depth (m): 77.10

Plate 1D (x150): Overview of a massive, poorly sorted, very coarse grained sandstone showing a fracture running through detrital matrix clay, contributing to secondary porosity (red arrows).

Plate 1E (x250): Close-up view of well-developed authigenic quartz overgrowths (orange arrows), cementing framework grains and occluding the intergranular pore system.

Plate 1F (x800): Magnification of a pore space occluded by densely packed authigenic kaolinite (yellow circle). Kaolinite platelets are approximately 5 microns in diameter.

Plate 1D

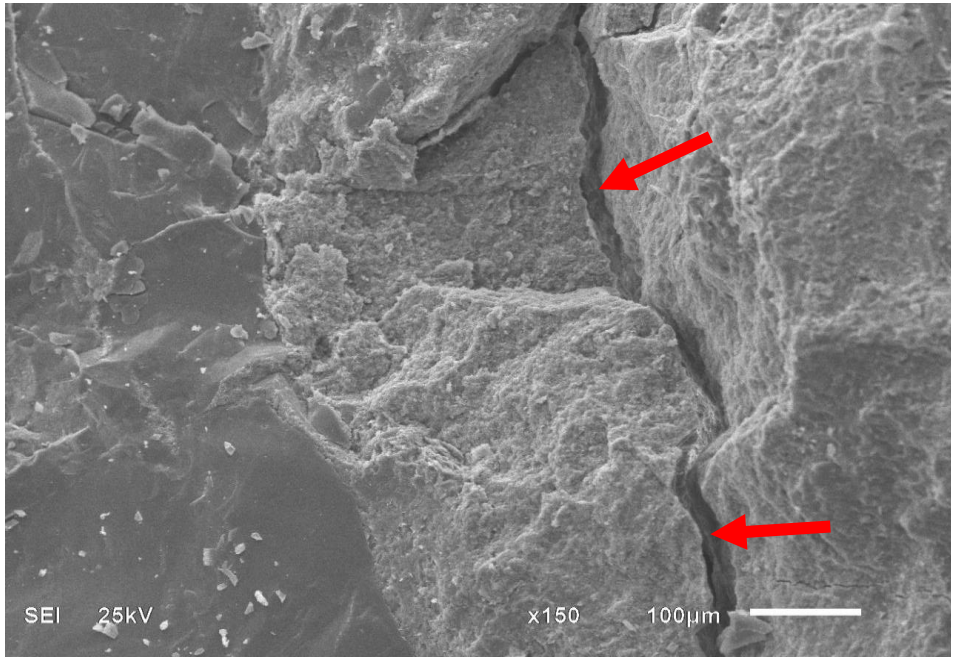


Plate 1E

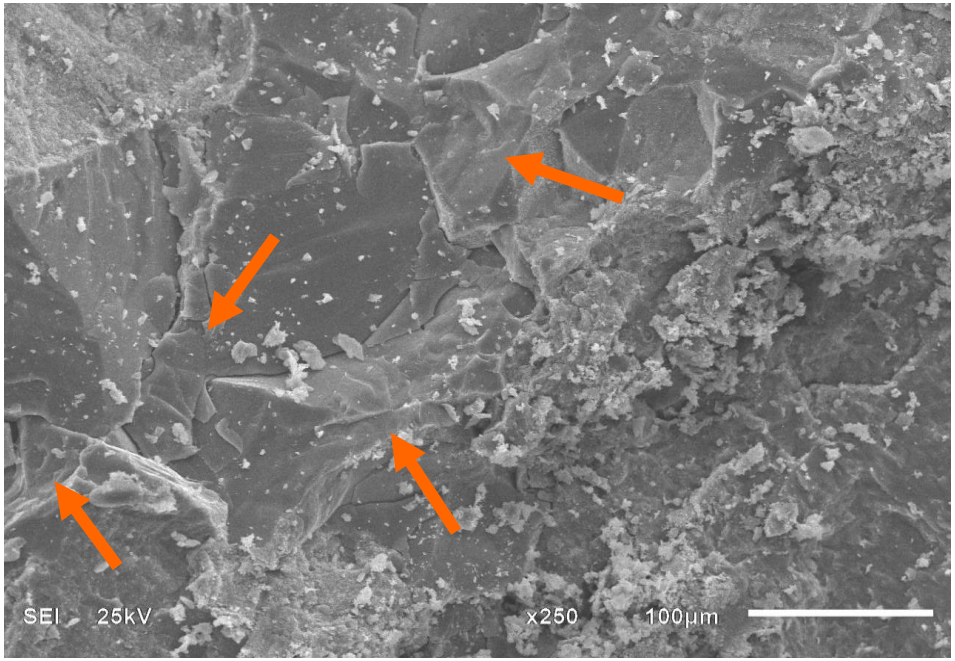
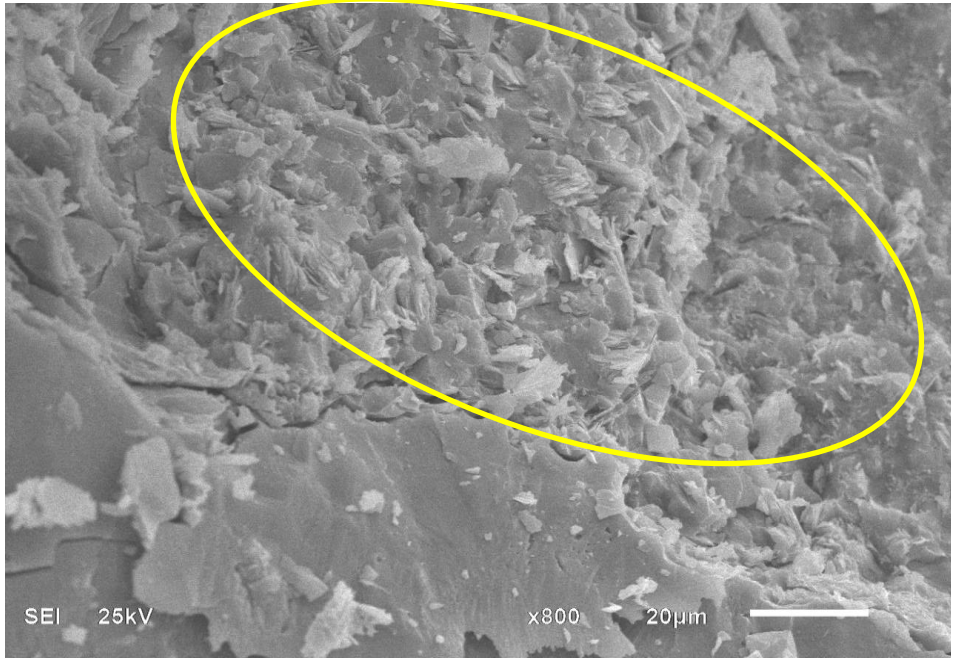


Plate 1F



Company: Yukon Geological Survey
Well: 15-MH-97/63
Proximal Laberge Group
Sample 2 - Sandstone
Depth (m): 114.00

Plate 2A (x32): This sample is a massive, poorly sorted, coarse grained sandstone comprised of abundant monocrystalline quartz, common polycrystalline quartz and potassium feldspar and minor volcanic rock fragments and plagioclase feldspar. Note the presence of siderite concentrations (blue arrows).

Plates 2B and 2C (x63/x63): These two fields of view display moderate pore-filling ferroan dolomite cement (green arrows), occluding primary intergranular porosity. Siderite is visible as both large localized concentrations and isolated, very fine crystals (blue arrows). Kaolinite platelets (yellow circles) are present in moderate quantities, a product of grain-replacement. Secondary solutional porosity (red arrows) is a minor component, a result of partial feldspar/volcanic rock fragment dissolution. Note the presence of minor authigenic quartz overgrowths (orange arrows).

Plate 2A

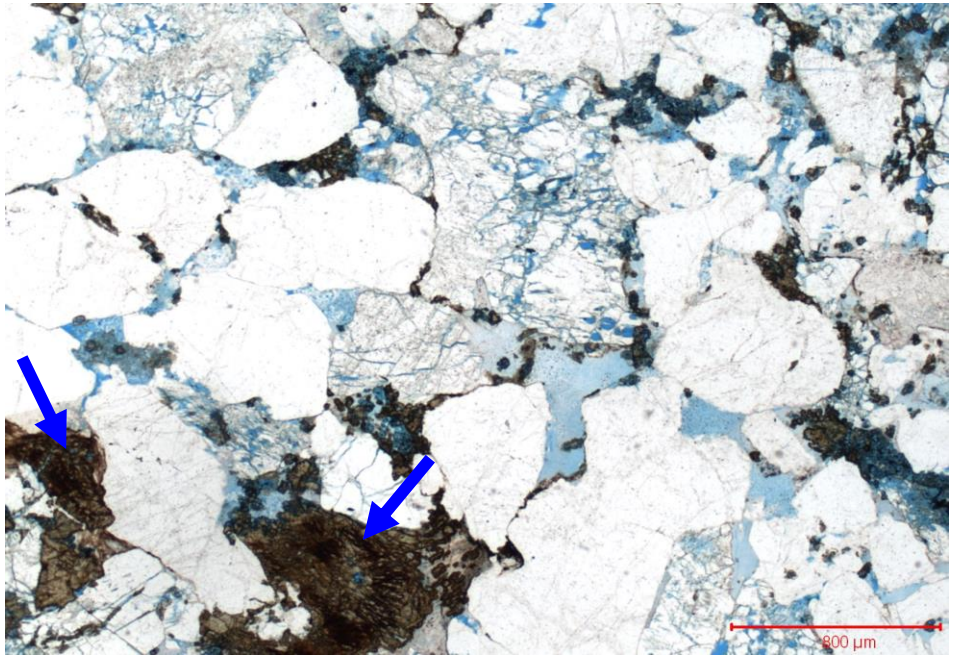


Plate 2B

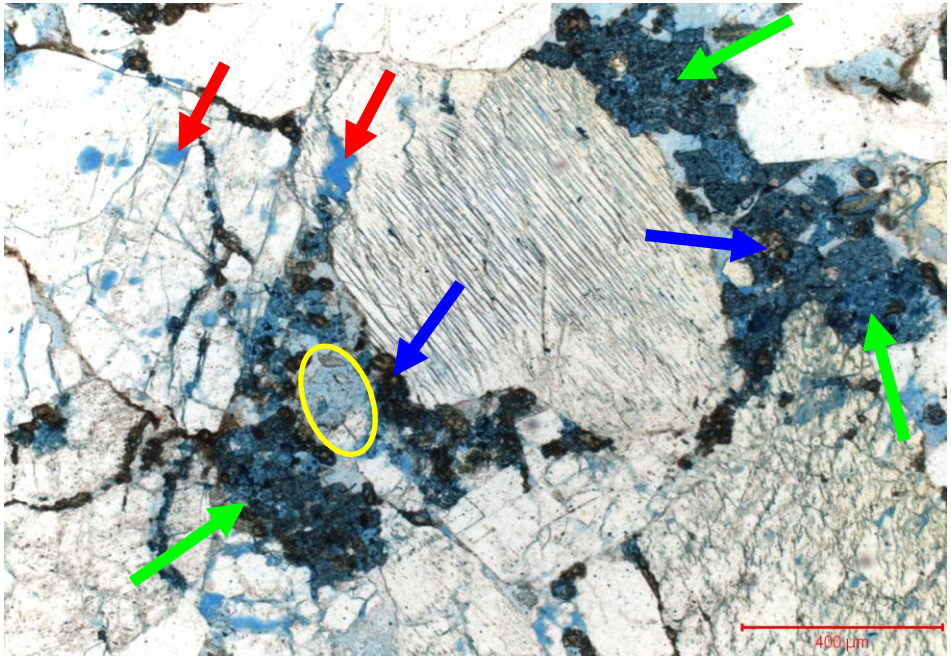
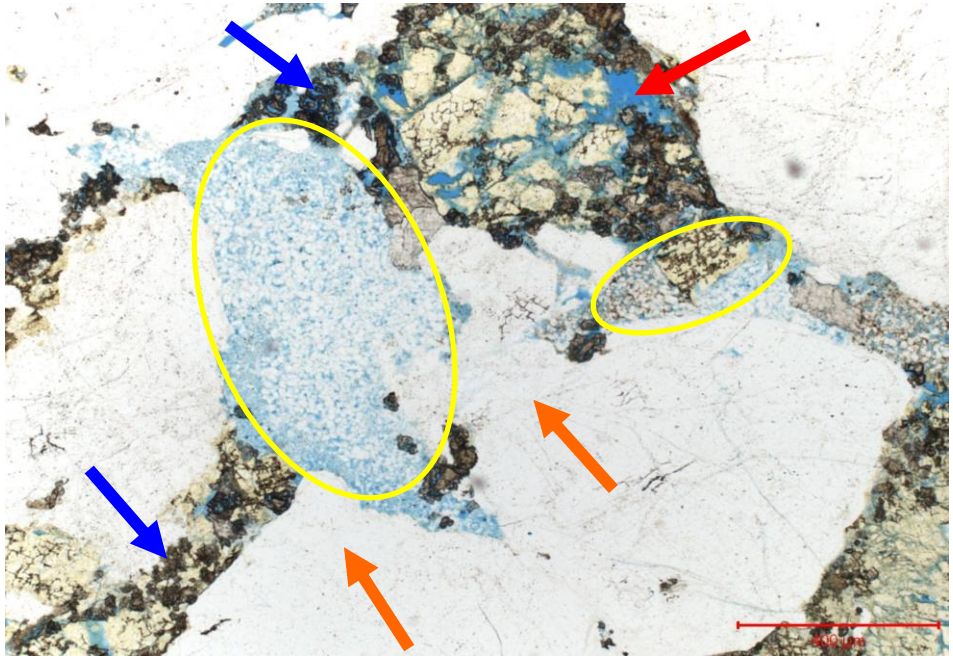


Plate 2C



Company: Yukon Geological Survey
Well: 15-MH-97/63
Proximal Laberge Group
Sample 3 - Sandstone
Depth (m): 142.10

Plate 3A (x32): Low magnification overview of a massive, poorly sorted, medium grained sandstone. Framework grain mineralogy consists of abundant potassium feldspar and monocrystalline quartz, moderate polycrystalline quartz and minor volcanic rock fragments, plagioclase feldspar, chert and carbonaceous material. Note the presence of large, very fine crystalline siderite agglomerations (blue arrows).

Plate 3B (x125): Magnification highlights secondary solutional porosity created from the dissolution of plagioclase feldspar (red arrow). Grain-coating/pore-filling siderite crystals (blue arrows) are a moderate component throughout the sample.

Plate 3C (x125): Authigenic kaolinite (yellow arrows) is a moderate component, a product of grain-replacement and appears densely packed with very little associated microporosity.

Plate 3A

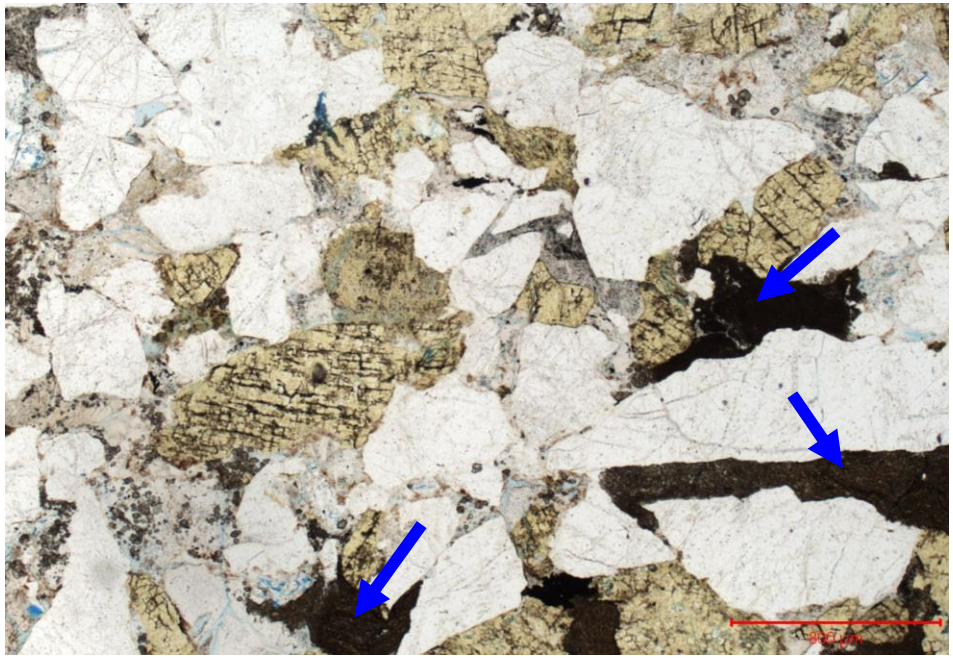


Plate 3B

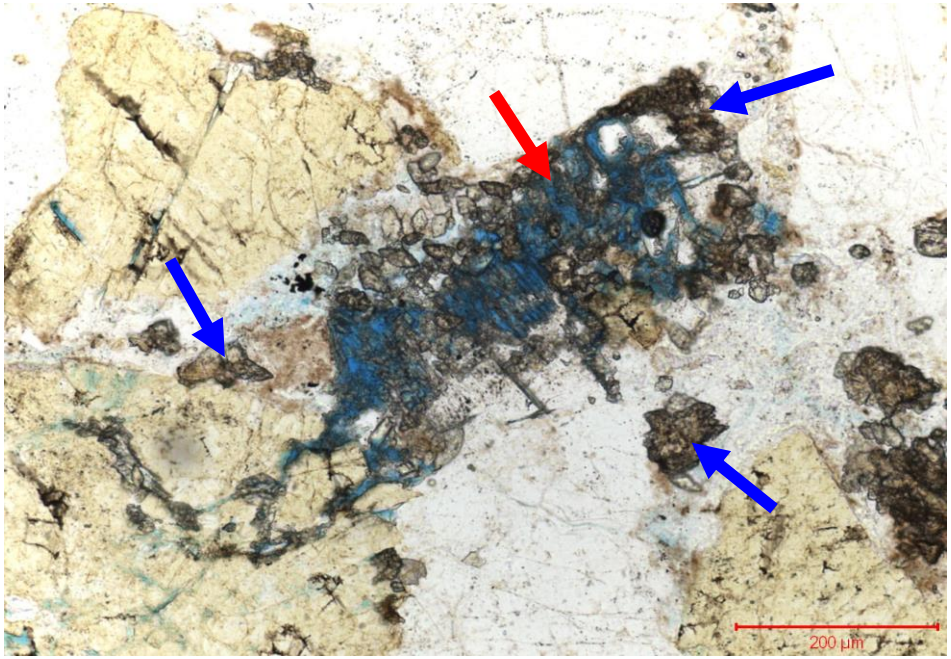
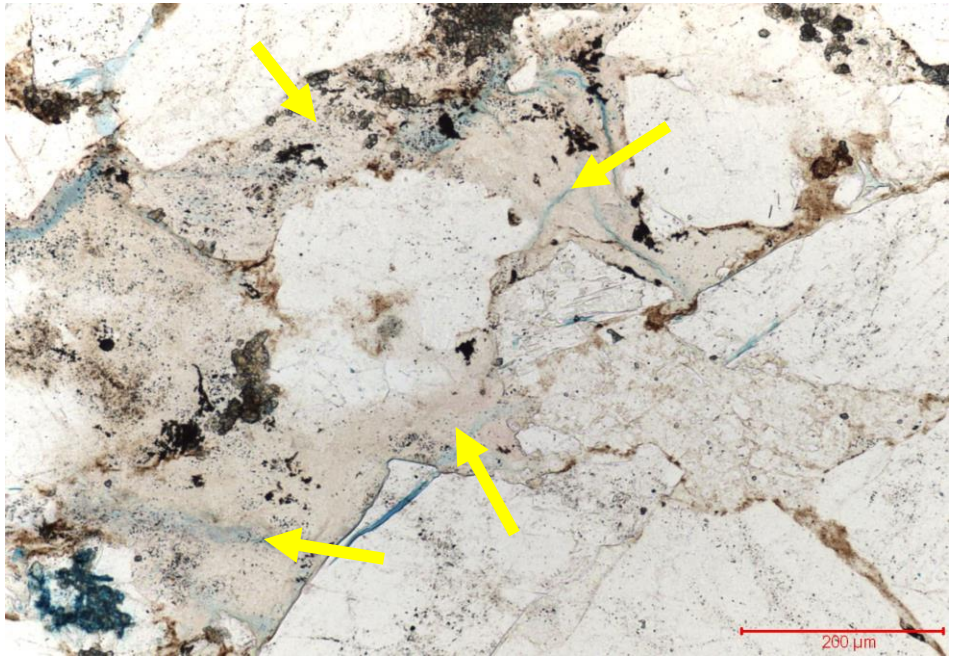


Plate 3C



Company: Yukon Geological Survey
Well: 15-MH-97/63
Proximal Laberge Group
Sample 4 - Sandstone
Depth (m): 205.00

Plate 4A (x32): This sample is massive to thinly laminated, moderately sorted, medium grained sandstone comprised of abundant monocrystalline quartz, common potassium feldspar, moderate polycrystalline quartz, carbonaceous material and minor plagioclase feldspar, volcanic rock fragments and chert. Carbonaceous material (blue arrows) most commonly concentrates along dispositional surfaces, creating thin laminations.

Plate 4B (x125): This field of view displays common, densely packed pore-filling kaolinite platelets (yellow arrows). Authigenic quartz overgrowths (orange arrows) are a minor component, partially occluding the pore system.

Plate 4C (x125): Magnification highlights common ferroan dolomite (green arrows), occluding the intergranular pore system and partially replacing framework grains. Pore-filling chlorite is present in minor quantities (red arrows). Note the presence of pore-filling kaolinite (yellow arrow).

Plate 4A

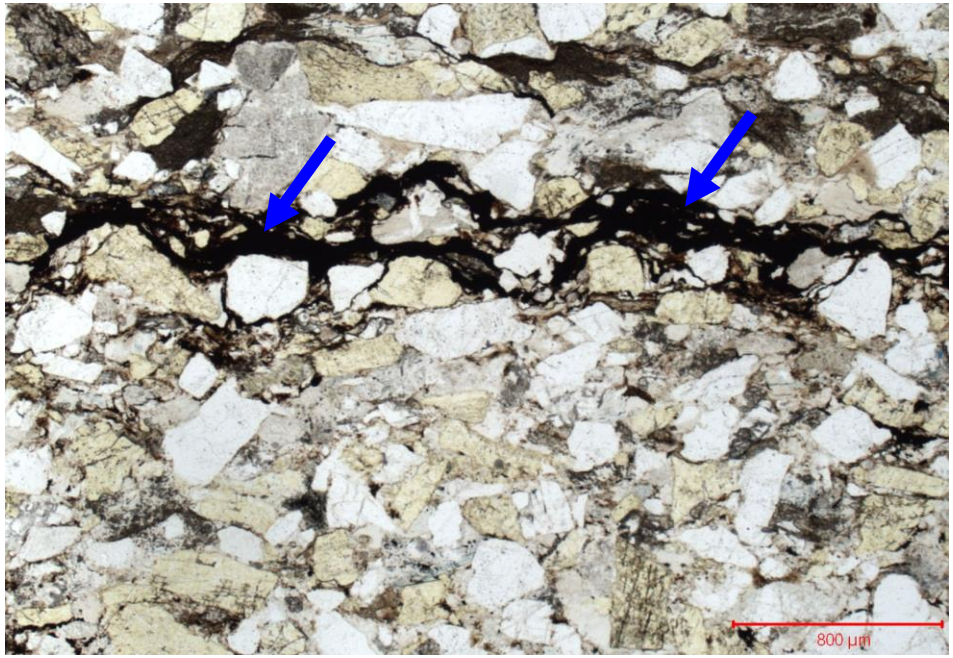


Plate 4B

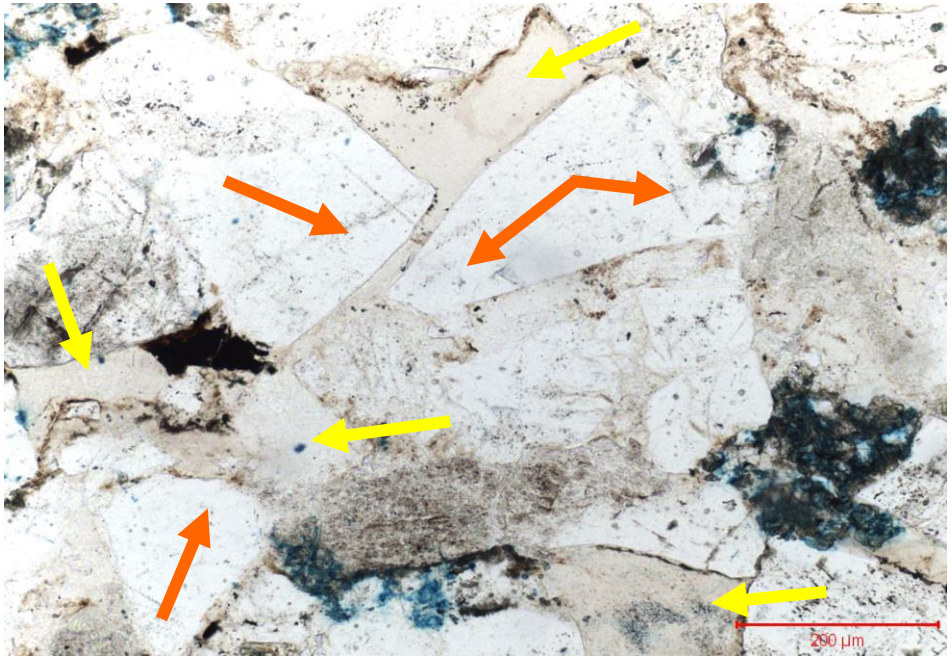
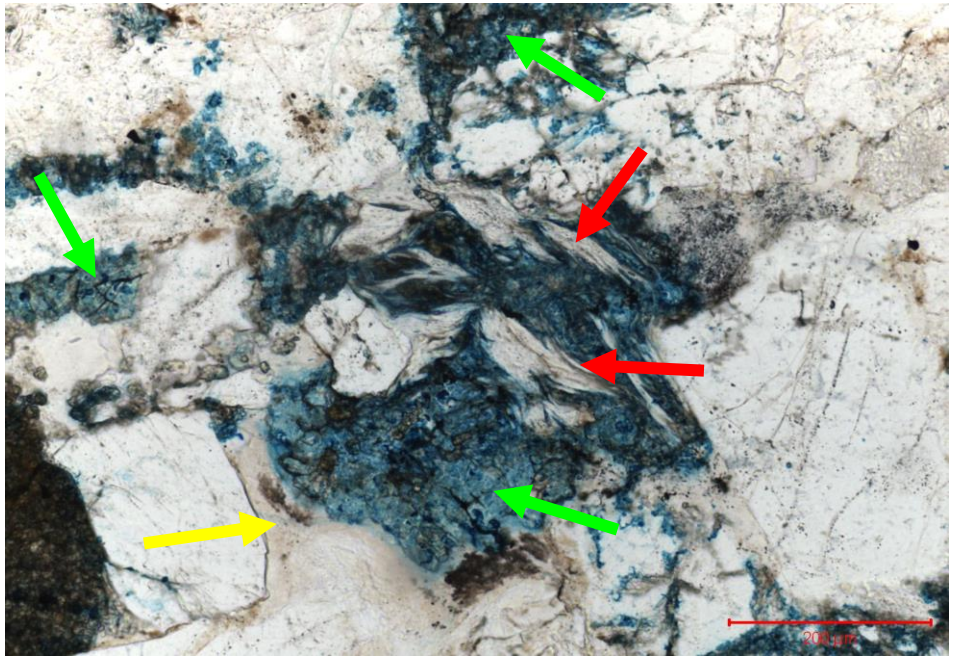


Plate 4C



Company: Yukon Geological Survey
Well: 15-MH-97/63
Proximal Laberge Group
Sample 5 - Sandstone
Depth (m): 217.53

Plate 5A (x32): Low magnification overview of a massive, poorly sorted, coarse grained sandstone. Framework grain mineralogy consists of abundant monocrystalline quartz, common potassium feldspar, moderate polycrystalline quartz and minor plagioclase feldspar.

Plate 5B (x125): Close-up view of authigenic chlorite (yellow circle), occluding intergranular porosity and intermixed with very fine crystalline siderite (blue arrows).

Plate 5C (x125): Magnification shows minor ferroan dolomite (green arrows), occluding pore spaces and partially replacing framework grains. Authigenic kaolinite platelets (yellow circles) are a minor pore-filling clay component. Porosity in this sample is minor, consisting entirely of the secondary solutional variety (red arrows), a result of partial feldspar dissolution. Note minor authigenic quartz overgrowths (orange arrows).

Plate 5A

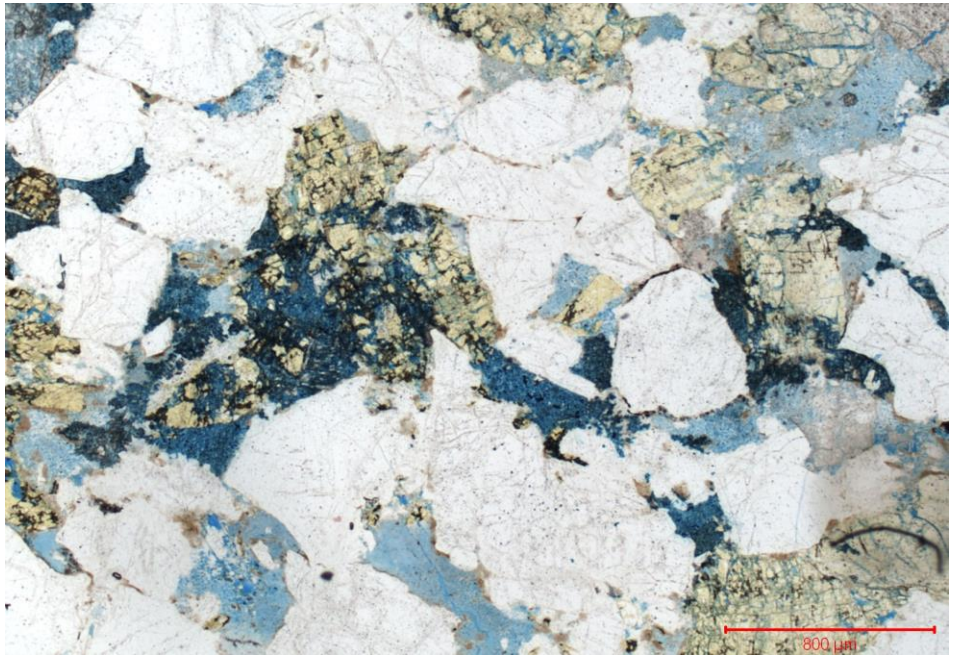


Plate 5B

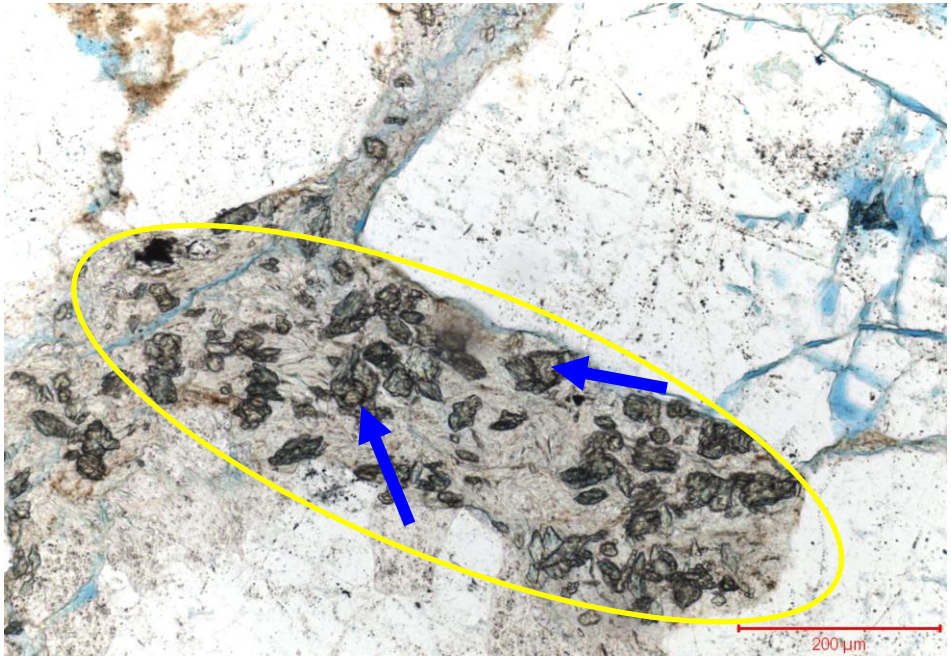
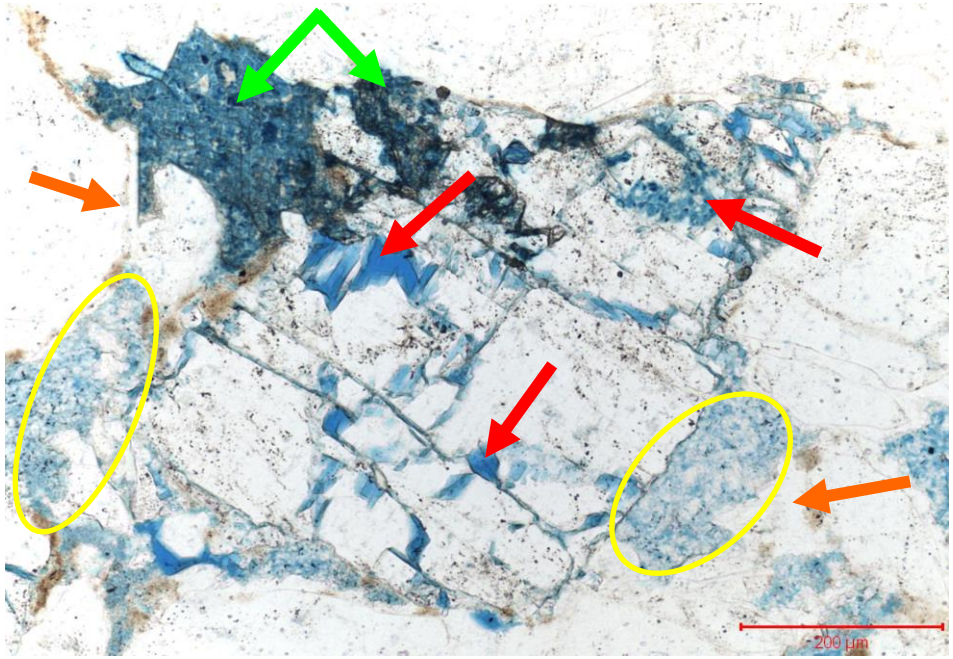


Plate 5C



Company: Yukon Geological Survey
Well: 15-MH-97/63
Proximal Laberge Group
Sample 5 - Sandstone
Depth (m): 217.53

Plate 5D (x250): Overview of a massive, poorly sorted, coarse grained sandstone showing common, pore-filling concentrations of authigenic kaolinite (yellow circles).

Plate 5E (x300): Close-up view of ferroan dolomite (green circle), cementing framework grains and occluding intergranular porosity. Note a feldspar grain showing partial dissolution (blue arrow).

Plate 5F (x1200): High magnification of a pore space containing well-crystallized kaolinite platelets (yellow arrows), approximately 10 to microns in diameter, intermixed with authigenic quartz (orange arrows). Note the clay associated microporosity (red arrows).

Plate 5D

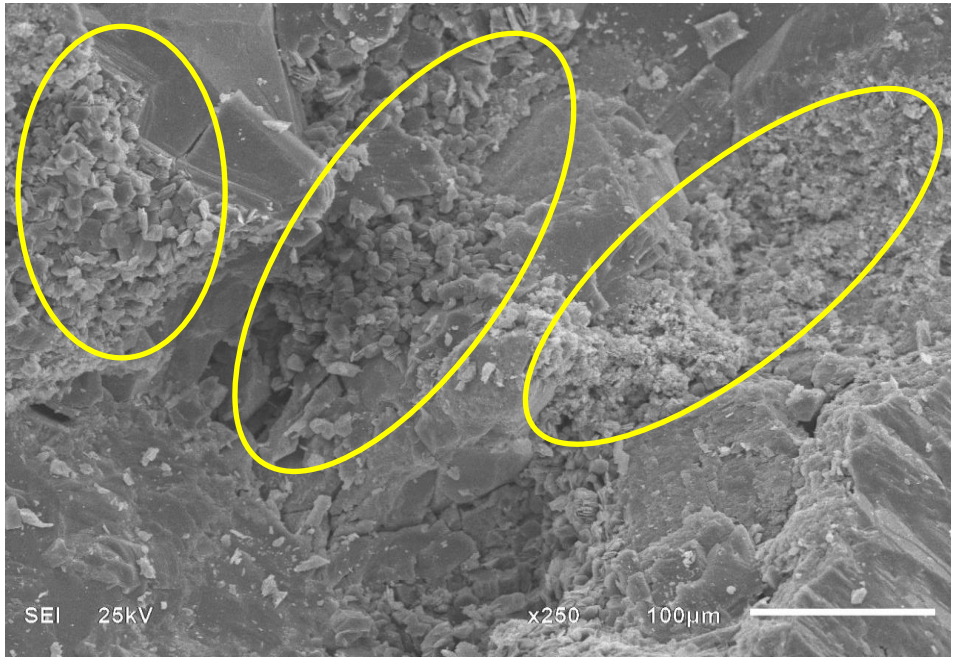


Plate 5E

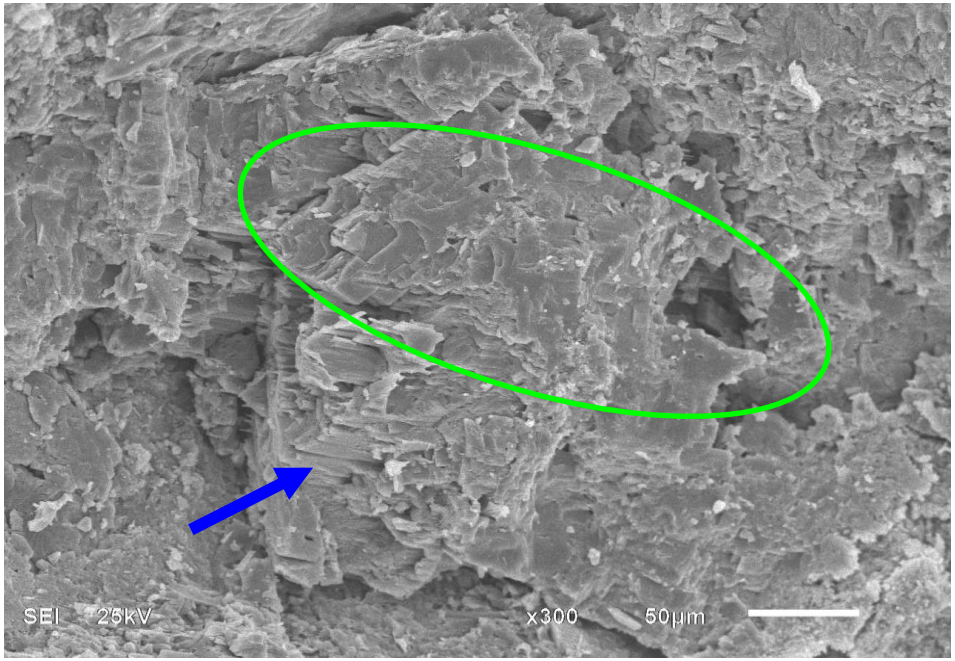
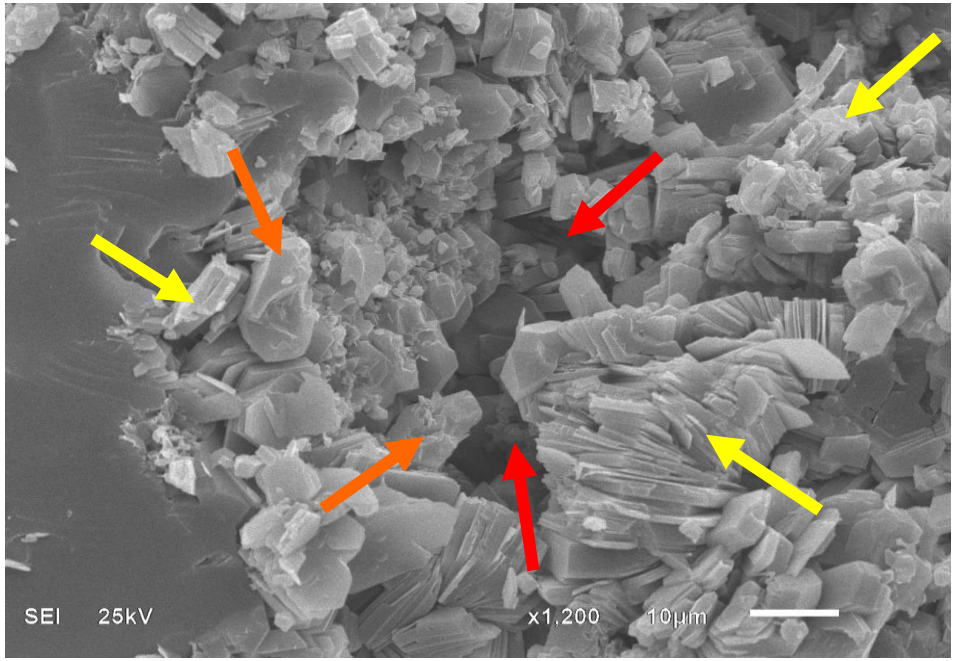


Plate 5F



Company: Yukon Geological Survey
Well: 15-MH-97/63
Proximal Laberge Group
Sample 6 - Sandstone
Depth (m): 226.74

Plate 6A (x32): This sample is a massive, poorly sorted, fine grained sandstone comprised of abundant monocrystalline quartz and potassium feldspar, moderate volcanic rock fragments, polycrystalline quartz and carbonaceous material and minor plagioclase feldspar and mica. Note the presence of minor carbonaceous material (orange arrows).

Plates 6B and 6C (x125/x125): These two fields of view highlight abundant pore-filling/grain-replacing authigenic kaolinite (yellow arrows). Microcrystalline siderite agglomerations (blue arrows) are a moderate component. This sample shows no visible macroporosity.

Plate 6A

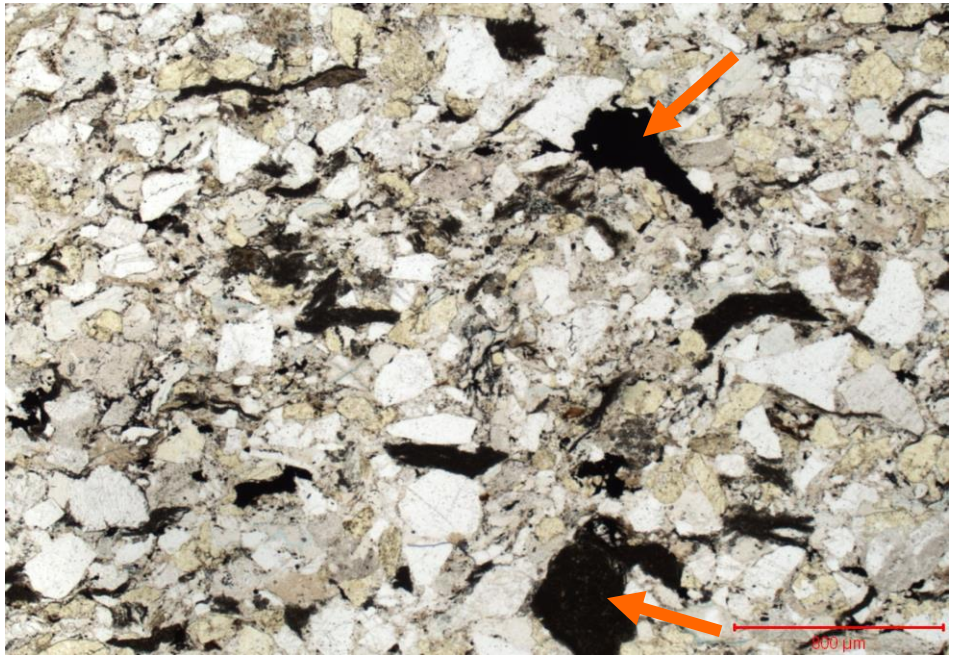


Plate 6B

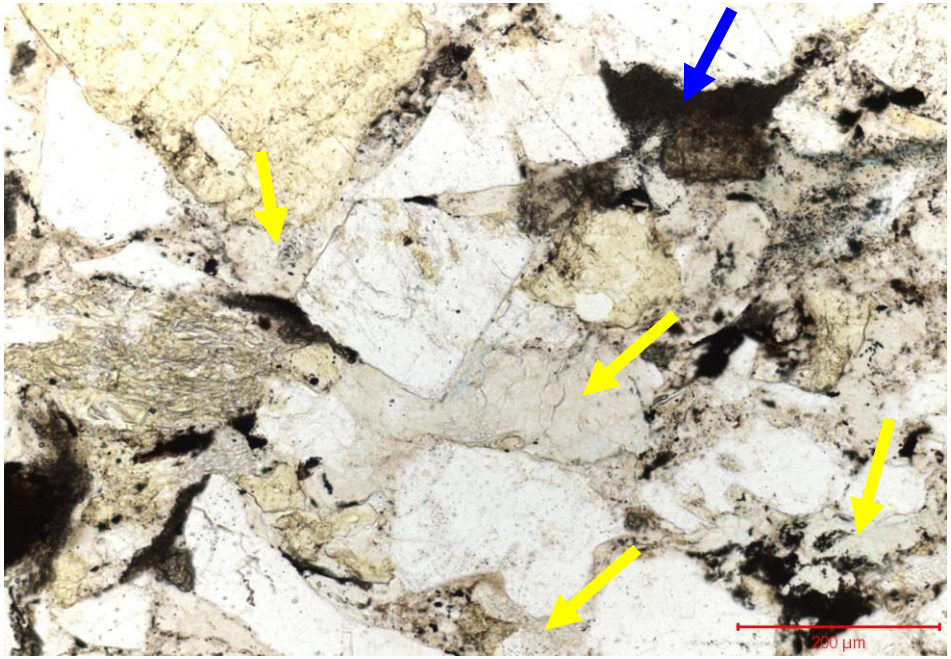
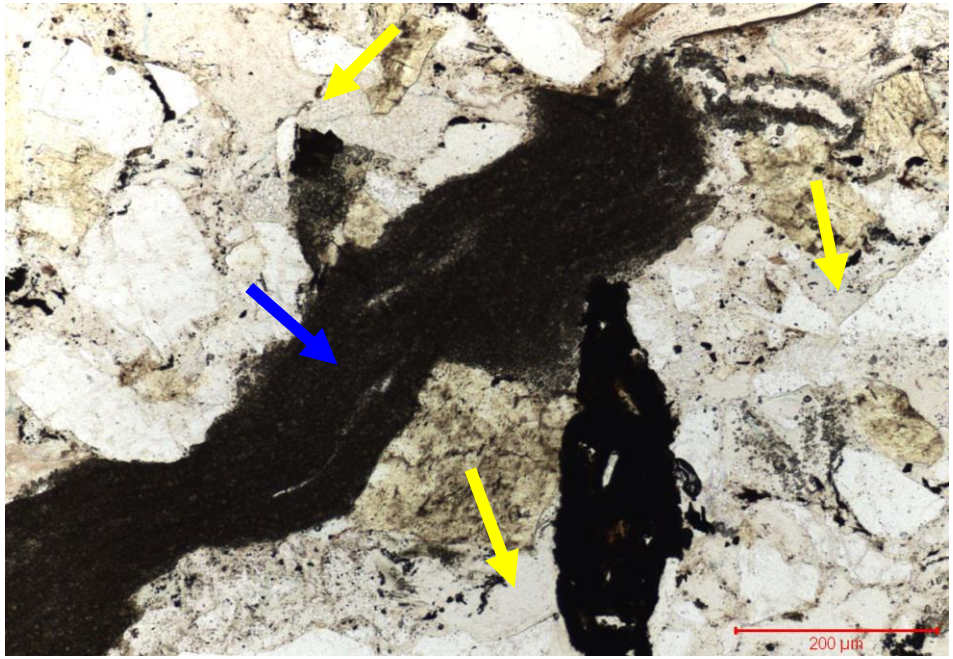


Plate 6C



Company: Yukon Geological Survey
Well: 15-MH-97/63
Proximal Laberge Group
Sample 6 - Sandstone
Depth (m): 226.74

Plate 6D (x180): Overview of a tight, poorly sorted, fine grained sandstone showing throughout the samples, common, densely packed kaolinite (yellow circles).

Plate 6E (x350): Close-up view of a pore space partially occluded by kaolinite booklets (yellow arrow) and grain-coating siderite (blue arrow) thinly coated in clay.

Plate 6F (x2500): Magnification displays pore-filling authigenic kaolinite (yellow circle) intermixed with illite.

Plate 6D

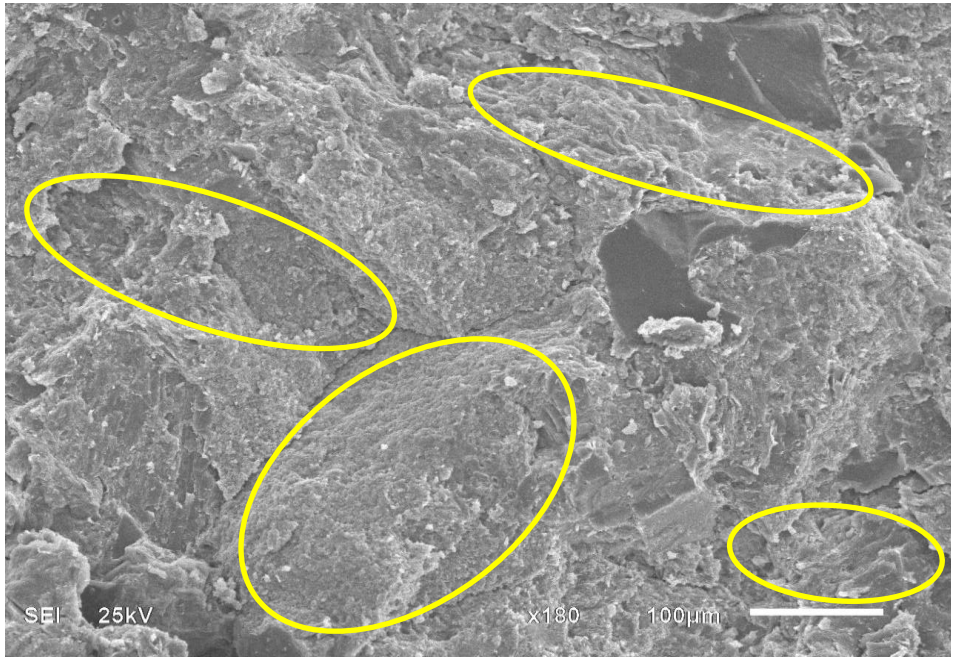


Plate 6E

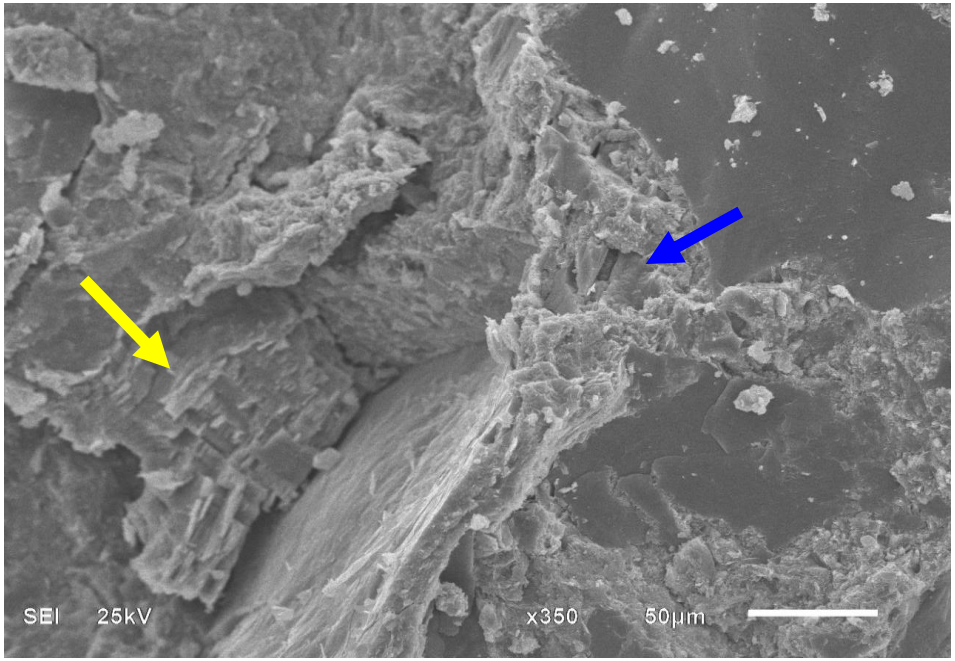
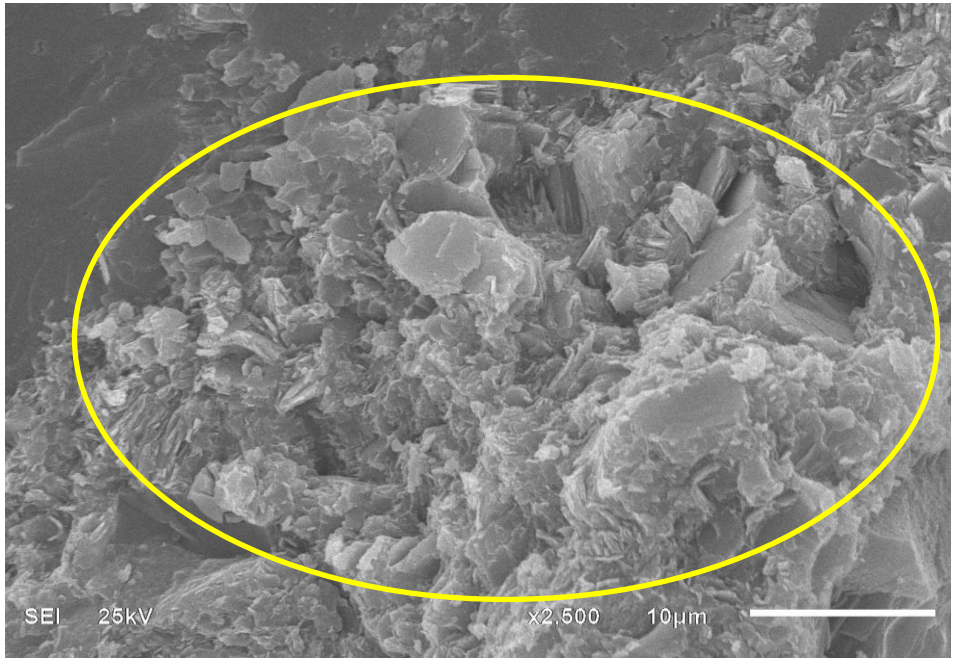


Plate 6F



Company: Yukon Geological Survey
Well: 15-MH-97/63
Proximal Laberge Group
Sample 7 - Sandstone
Depth (m): 245.25

Plate 7A (x32): Low magnification overview of a thin, discontinuously laminated, poorly sorted, medium grained sandstone. Framework grain mineralogy consists of abundant monocrystalline quartz, common potassium feldspar, moderate volcanic rock fragments and minor carbonaceous material, volcanic rock fragments and chert. Carbonaceous material (blue arrow) concentrating along depositional surfaces creates thin, discontinuous laminations.

Plate 7B (x125): Pore-filling clay (yellow arrows) is abundant throughout the sample, possibly an infiltrated clay and appears as a mixture of kaolinite and chlorite.

Plate 7C (x125): Close-up view of a concentration of carbonate cement consisting of both ferroan calcite (green arrow) and ferroan dolomite (red arrow). Authigenic quartz overgrowths (orange arrows) are a minor component, cementing quartz framework grains and occluding the pore system.

Plate 7A

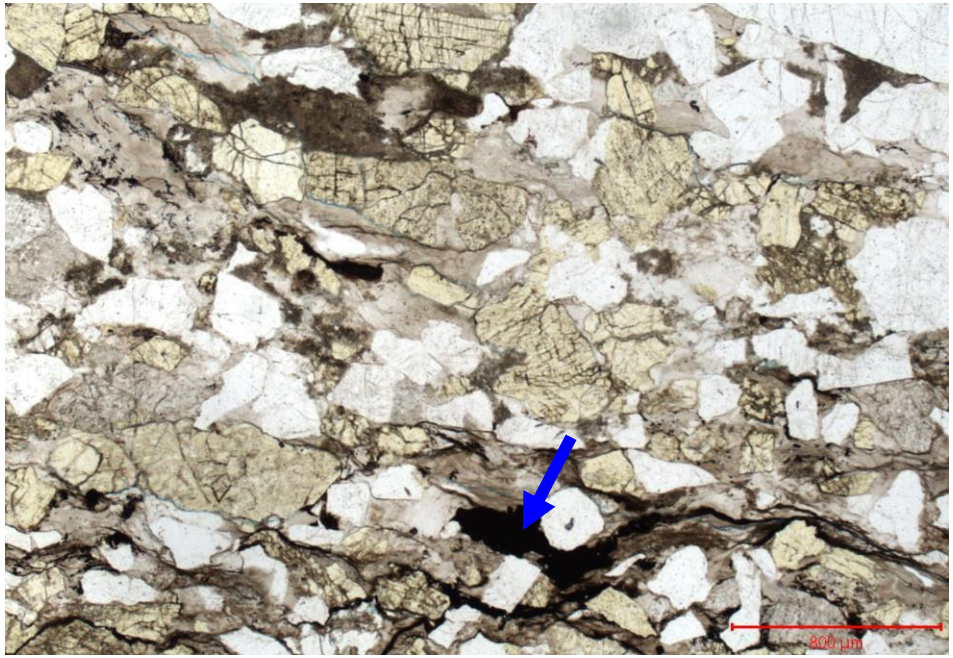


Plate 7B

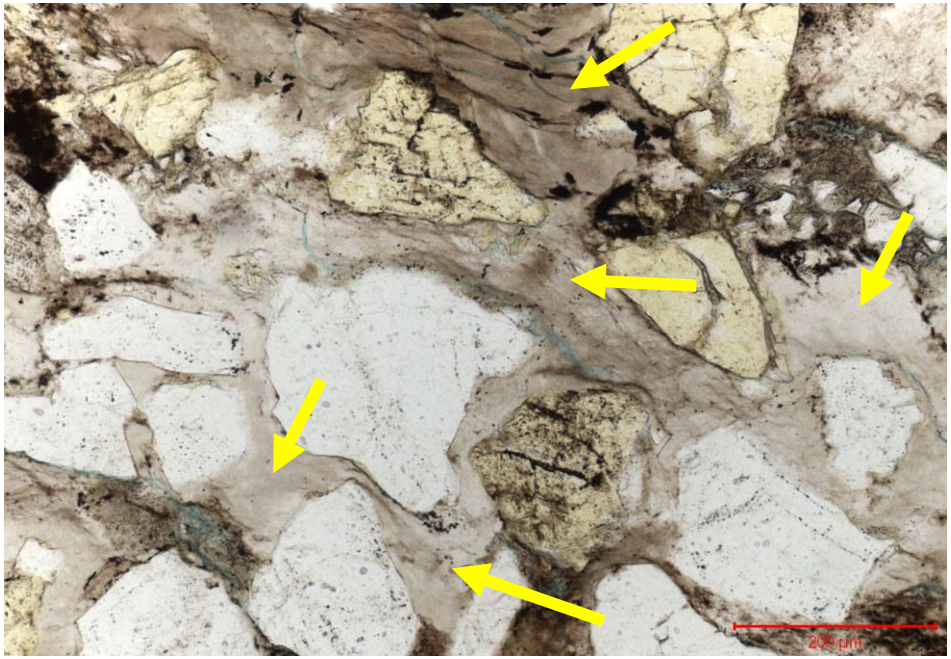
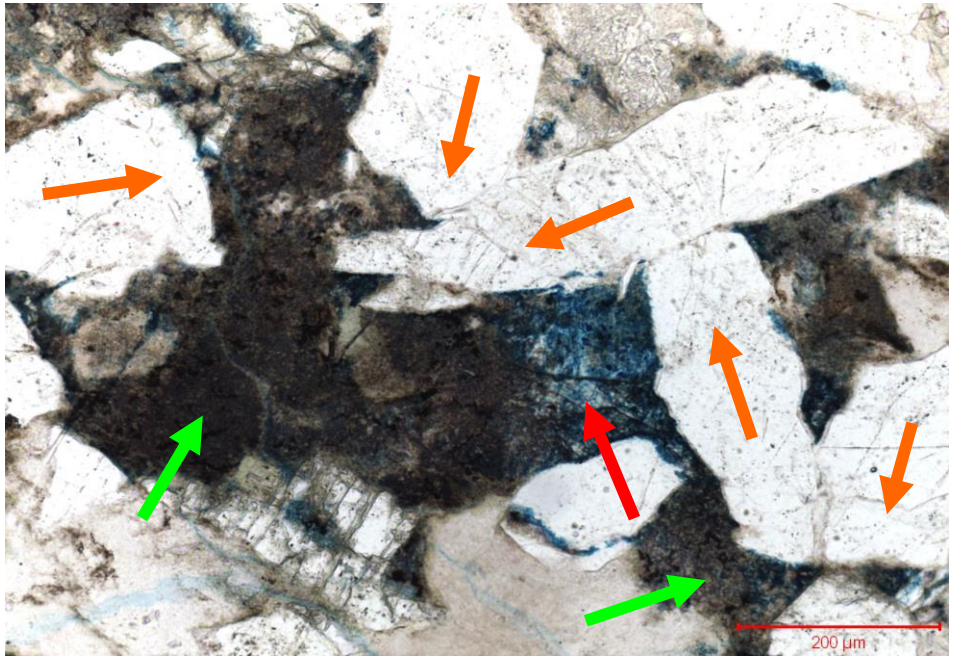


Plate 7C



Company: Yukon Geological Survey
Well: 15-MH-97/63
Proximal Laberge Group
Sample 8 - Sandstone
Depth (m): 265.40

Plate 8A (x32): This sample is a massive, poorly sorted, coarse grained sandstone comprised of abundant monocrystalline quartz, common carbonaceous material, polycrystalline quartz and potassium feldspar and minor chert and volcanic rock fragments. Note the presence of carbonaceous material (blue arrows) often intermixed with detrital matrix clays.

Plate 8B (x125): Close-up view of minor pore-filling/grain-replacing kaolinite (yellow circles).

Plate 8C (x125): Porosity is a trace component, consisting of secondary fracture porosity (red arrows) within quartz framework grains.

Plate 8A

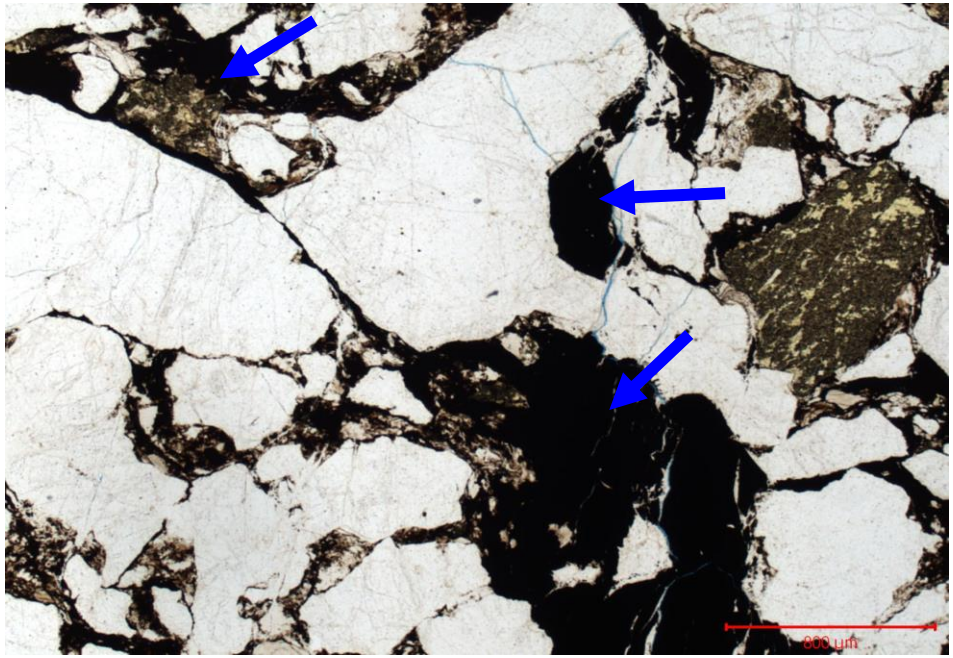


Plate 8B

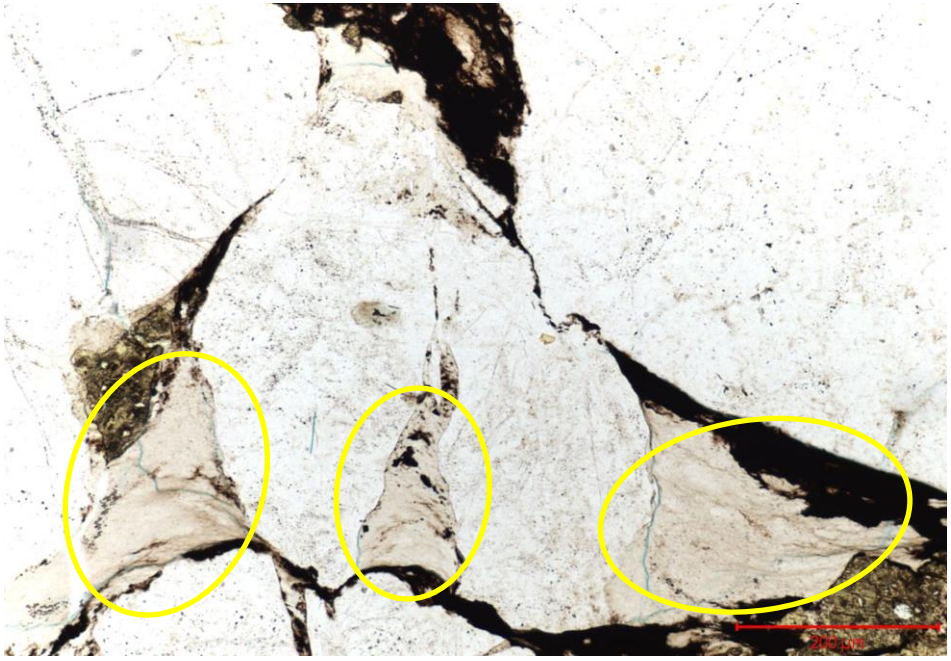


Plate 8C