

**-FINAL REPORT-
PETROGRAPHIC STUDY
FOR
QGC-A BG GROUP BUSINESS
MAGNETIC-1 WELL
BOWEN BASIN
UPPER TINOWON SANDSTONE,
LORELLE SANDSTONE, PS46 TRS,
AND BASEMENT FORMATIONS
QUEENSLAND, AUSTRALIA**

WFT FILE NO.: AB-76967



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LABORATORIES

February 24, 2016

Ms. Heidi Sutton
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Level 25, 275 George Street
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SUBJECT: *Final Report - Petrographic Study*
Magnetic 1 Well
Bowen Basin
Upper Tinowon Sandstone, Lorelle Sandstone, PS46 TRS, and Basement
Formations
Queensland, Australia
WFT File No.: AB-76967

Dear Ms. Sutton:

A total of thirty-nine (39) samples including twelve (12) rotary sidewall core samples and twenty-seven (27) conventional core samples from the above referenced well were submitted for X-ray diffraction (XRD) analysis, twenty-eight (28) for detailed thin section analysis, and eleven (11) samples were analyzed using general thin section analytical techniques. Lastly, seven (7) samples were selected for scanning electron microscopy (SEM) analysis. This report provides all data and photomicrographs associated with these analyses. One (1) copy of this report is provided; additional copies can be prepared upon request.

It has been a pleasure to provide this study for QGC – A BG Group Business. Please feel free to contact us if you have any questions concerning this report or if we can be of further service.

Sincerely,
WEATHERFORD LABORATORIES



Angela Schwartz
Manager, Petrology Group



Jamie Mills
Project Geologist

INTRODUCTION

Twelve (12) rotary sidewall core samples and twenty-seven (27) conventional core samples from the Magnetic-1 well located within the Bowen Basin of Queensland, Australia were submitted for X-ray diffraction (XRD) analysis. Twelve (12) rotary sidewall core samples and twenty-seven (27) conventional core samples were chosen for thin section preparation, thin section photography, and quantitative thin section analysis. Based on lithology, twenty-eight (28) samples were considered suitable for quantitative modal analysis while the remaining eleven (11) were analyzed utilizing qualitative techniques. Seven (7) samples from the Magnetic-1 well were selected for scanning electron microscopy (SEM) analysis.

The primary objectives of this study are to:

1. document the mineral composition, fabric, grain size, and texture of the samples
2. determine controls on porosity and permeability and to interpret reservoir quality as it relates to compaction and cementation
3. examine mineralogical effects on well log response
4. address formation sensitivity concerns

Three formations are represented in this sample suite the Upper Tinowon Sandstone (2792.7-2818.6m), Lorelle Sandstone (2931.4-2980.09m), the PS46 TRS (2982.04-3020.5m), and the basement (3036.0m). Table 1 provides the sample depths and the analyses performed.

TABLE 1
SAMPLE DEPTHS AND ANALYSIS PERFORMED

Sample Number	Sample Depth (m)	Sample Type	Formation	Thin Section Preparation & Photography	Detailed Thin Section Analysis	General Thin Section Analysis	Scanning Electron Microscopy	X-Ray Diffraction
SWC25	2792.7	RSWC	Upper Tinowon Ss	X		X		X
SWC24	2794.1	RSWC	Upper Tinowon Ss	X	X			X
SWC23	2800.2	RSWC	Upper Tinowon Ss	X	X			X
SWC21	2808.2	RSWC	Upper Tinowon Ss	X	X			X
SWC20	2818.6	RSWC	Upper Tinowon Ss	X	X			X
SWC12	2931.4	RSWC	Lorelle Ss	X	X			X
SWC11	2933.8	RSWC	Lorelle Ss	X	X			X
1-1P DS	2936.06	CC	Lorelle Ss	X	X		X	X
1-3P DS	2938.06	CC	Lorelle Ss	X	X			X
1-5P DS	2940.05	CC	Lorelle Ss	X	X			X
1-8P DS	2942.06	CC	Lorelle Ss	X	X			X
1-10P DS	2944.10	CC	Lorelle Ss	X	X			X
1-12P DS	2946.05	CC	Lorelle Ss	X	X			X
1-15P DS	2948.06	CC	Lorelle Ss	X	X		X	X
1-17P DS	2950.09	CC	Lorelle Ss	X	X			X
1-19P DS	2952.06	CC	Lorelle Ss	X	X			X
1-22P DS	2954.05	CC	Lorelle Ss	X	X		X	X
1-24P DS	2956.05	CC	Lorelle Ss	X	X			X
1-26P DS	2958.05	CC	Lorelle Ss	X	X			X
1-28P DS	2960.17	CC	Lorelle Ss	X	X			X
1-30P DS	2962.05	CC	Lorelle Ss	X	X			X
1-33P DS	2965.05	CC	Lorelle Ss	X	X			X
1-36P DS	2968.12	CC	Lorelle Ss	X	X		X	X
1-38P DS	2970.05	CC	Lorelle Ss	X	X			X
1-40P DS	2972.10	CC	Lorelle Ss	X	X		X	X
2-44P DS	2974.13	CC	Lorelle Ss	X	X		X	X
2-46P DS	2976.05	CC	Lorelle Ss	X	X		X	X
2-48P DS	2978.07	CC	Lorelle Ss	X	X			X
2-50P DS	2980.09	CC	Lorelle Ss	X	X			X
2-52P DS	2982.04	CC	Lorelle Ss	X		X		X
2-57P DS	2987.05	CC	PS46 TRS	X		X		X
SWC8	2994.7	RSWC	PS46 TRS	X		X		X
2-65P DS	2995.05	CC	PS46 TRS	X		X		X
2-73P DS	3002.05	CC	PS46 TRS	X		X		X
2-80P DS	3008.05	CC	PS46 TRS	X		X		X
SWC7	3011.3	RSWC	PS46 TRS	X		X		X
SWC5	3017.3	RSWC	PS46 TRS	X		X		X
SWC4	3020.5	RSWC	PS46 TRS	X		X		X
SWC2	3036.0	RSWC	Basement	X		X		X

PETROGRAPHIC RESULTS

The following sections characterize the intervals with respect to sedimentary fabric and texture, framework grain composition, authigenic minerals, clay mineralogy, reservoir quality, the effects of mineralogy on log response, formation sensitivity, and diagenesis. Specific information on individual samples is included in Appendices A through E.

Of the thirty-nine (39) samples provided from this well, twenty-eight (28) were analyzed utilizing quantitative techniques, while the remaining eleven (11) were analyzed utilizing qualitative techniques. Detailed petrographic analysis is required to quantify the amounts of the different types of grains, cements, and porosity types present in these samples in order to accurately characterize the rock lithology (e.g., using the Folk, 1980 classification scheme). The values presented in the following sections reflect data acquired on the samples that underwent modal analysis. General petrographic assessment of the remaining thin sections are available in the appendix.

❖ Upper Tinowon Sandstone Formation (5 samples; 2792.7m-2818.6m)

Sedimentary Fabric and Texture

Five (5) samples were provided from the Upper Tinowon Formation, and range in depth from 2792.7m to 2818.6m. Four (4) samples were selected for detailed point count analysis and one (1) was determined to be unsuitable for detailed point count analysis, a general description was performed instead. X-ray diffraction (XRD) analyses was performed on all five (5) samples. One sample (2792.7m) was classified as an conglomerate and argillaceous silty limestone, three (3) as feldspathic litharenite, and one (1) as a lithic arkose. The average particle size ranges from <0.01mm (clay) to 19.57mm (pebble). Compaction ranges from low to high in these samples.

Framework Grain Mineralogy

These five (5) samples representing the Upper Tinowon Formation are predominantly composed of lithic rock fragments (16.00%-31.50%, by volume per modal analysis), plagioclase feldspar (7.25%-33.50%, by volume), monocrystalline quartz (9.50%-18.50%, by volume), and with lesser amounts of potassium feldspar (trace-0.25%, by volume). Lithic fragments include chert (7.50%-17.00%, by volume), mudstone fragments (0.50%-1.75%, by volume), tuffaceous volcanic fragments (0.25%-1.50%, by volume), and siltstone fragments (0.75%-1.50%, by volume). Feldspar varieties are identified based on optical characteristics (i.e., twinning) and with the aid of chemical staining: sodium cobaltinitrite for potassium feldspar (stains yellow) and rhodamine B for plagioclase (stains red/pink). Some lithic fragments and feldspars are slightly altered and some are partially dissolved.

Accessory grain types include carbonaceous plant material (0.00%-8.50%; by volume), muscovite mica (0.50%-1.50%), biotite mica (0.00%-1.75%), chamosite (0.00%-0.25%), fossil fragments (0.00%-0.75%), glauconite (0.00%-trace), and heavy minerals (trace-0.25%). Heavy mineral varieties include tourmaline, and zircon.

Cement/Replacement

Authigenic minerals occur in common to abundant amounts in the Upper Tinowon Formation. Calcite is the dominant authigenic mineral in sample 2794.10, occurring as both cement and replacement of unstable lithic fragments (20.50%; total calcite by volume). Illite (1.75%-6.75%, by volume) occurs as pore-filling and replacement of altered grains. Microcrystalline quartz (0.00%-5.75%, by volume) occurs as cement and replacement of unstable material. Calcite varies in abundance and in iron content throughout the entire well and is differentiated based on thin section staining; calcite is stained red while iron-rich calcite is purple.

Other minerals occurring in lesser amounts include, Fe-oxide (0.00%-0.25%, by volume), and pyrite (0.00%-1.75%, by volume). Iron oxide and pyrite mainly occur as a replacement of unstable particles, such as detrital matrix clays and organics, and is present as a rare grain-coating cement.

Clay Mineralogy

Clays in the Upper Tinowon Formation represent a combination of both detrital (depositional) and authigenic (secondary) origins, which can be difficult to distinguish in these thin sections. Both detrital and authigenic clays occur in moderate amounts as grain-coating and pore-filling material. Detrital clays range from 2.00% to 33.50% (by volume). Authigenic illite occurs as thin grain coatings on the surfaces of detrital grains, as minor pore-filling (0.00%-4.25%, by volume per modal analysis), and as an alteration product of partially dissolved unstable grains (2.25%-4.75%, by volume).

X-ray diffraction (XRD) analysis was used to determine individual clay types. XRD utilizes an energy dispersive spectrometer (EDS) that is essential in determining the elemental differences between clay varieties, especially when considering detrital matrix clays. The identification of authigenic clays in thin section can be extremely difficult because of the physical limitations of petrographic techniques.

X-ray diffraction (XRD) analysis (Appendix B) reveals that mixed-layer illite/smectite (19%-34%, by weight) and illite/mica (1-3%, by weight) are the dominant clay types, followed by lesser amounts of chlorite (trace-1%, by weight), and trace amounts of kaolinite. The mixed-layer illite/smectite consists of ordered interstratified layers that are 15%-25% expandable.

Reservoir Quality

Porosity and permeability measurements were obtained for these rotary sidewall core samples, this data is also provided in the appendix (see Appendix E). Measurements obtained during routine core analysis reveal the porosity values range from 2.9% (2792.7m) to 5.0% (2808.2m), with a permeability values (to air) that range from 0.0015mD (2818.6m) to 0.037mD (2792.7m). Modal analysis (by volume) indicates the micropores (2.25%-4.00%) are the dominant pore type, followed by intragranular/moldic pores (0.00%-3.75%), primary intergranular pores (0.00%-3.50%), and then grain fracture pores (0.00%-trace). Sample 2818.60 contains the lowest permeability value and has the highest amount of clay; the only form of porosity in this sample are micropores associated with these clays.

TABLE 2

SUMMARY OF PETROGRAPHIC RESULTS THE UPPER TINOWON FORMATION

Sample Number	Sample Depth (m)	Grain Size Avg. (mm)	Visual Sorting	Fabric	Total Matrix (vol. %)	Cement/ Replacement Minerals (vol. %)	Total Porosity (vol. %)	Porosity/Perm (RCA)
SWC25	2792.7	19.57/0.04	Very Poor	Laminated; Disturbed	N/A	N/A	N/A	2.9%/0.037mD
SWC24	2794.1	0.25	Moderately Well	Massive	2.00	29.25	3.50	4.1%/0.005mD
SWC23	2800.2	0.40	Moderate	Massive; Burrowed	3.00	14.00	9.25	3.3%/0.025mD
SWC21	2808.2	0.18	Poor	Laminated; Bioturbated	18.25	16.25	4.00	5.0%/0.0035mD
SWC20	2818.6	0.30/0.04	Mod. to Mod. Well	Massive to Laminated	33.50	18.25	2.50	3.7%/0.0015mD

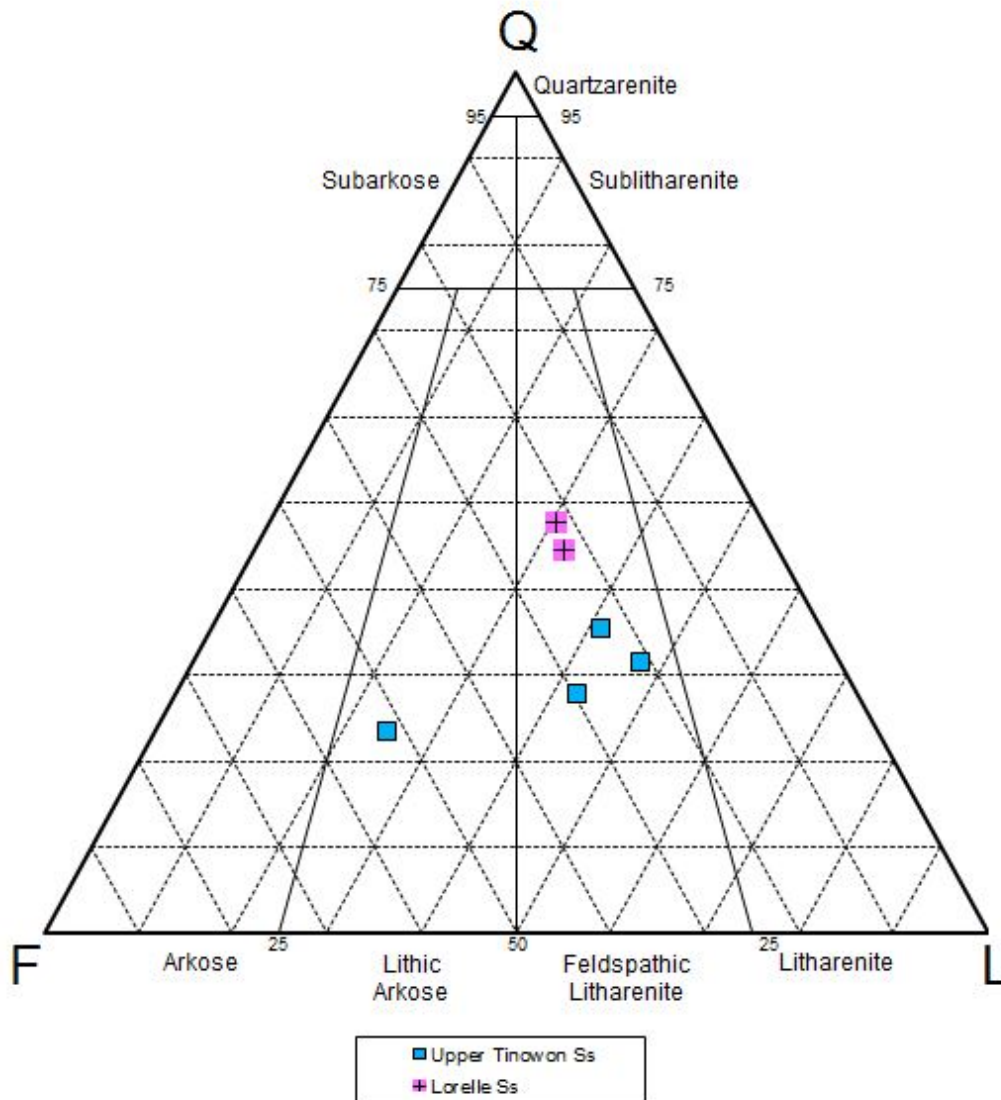
=Fine-grained
 =Medium-grained
 =Pebble-grained

❖ **Lorelle Sandstone Formation (25 samples; 2389.5m to 2982.04m)**

Sedimentary Fabric and Texture

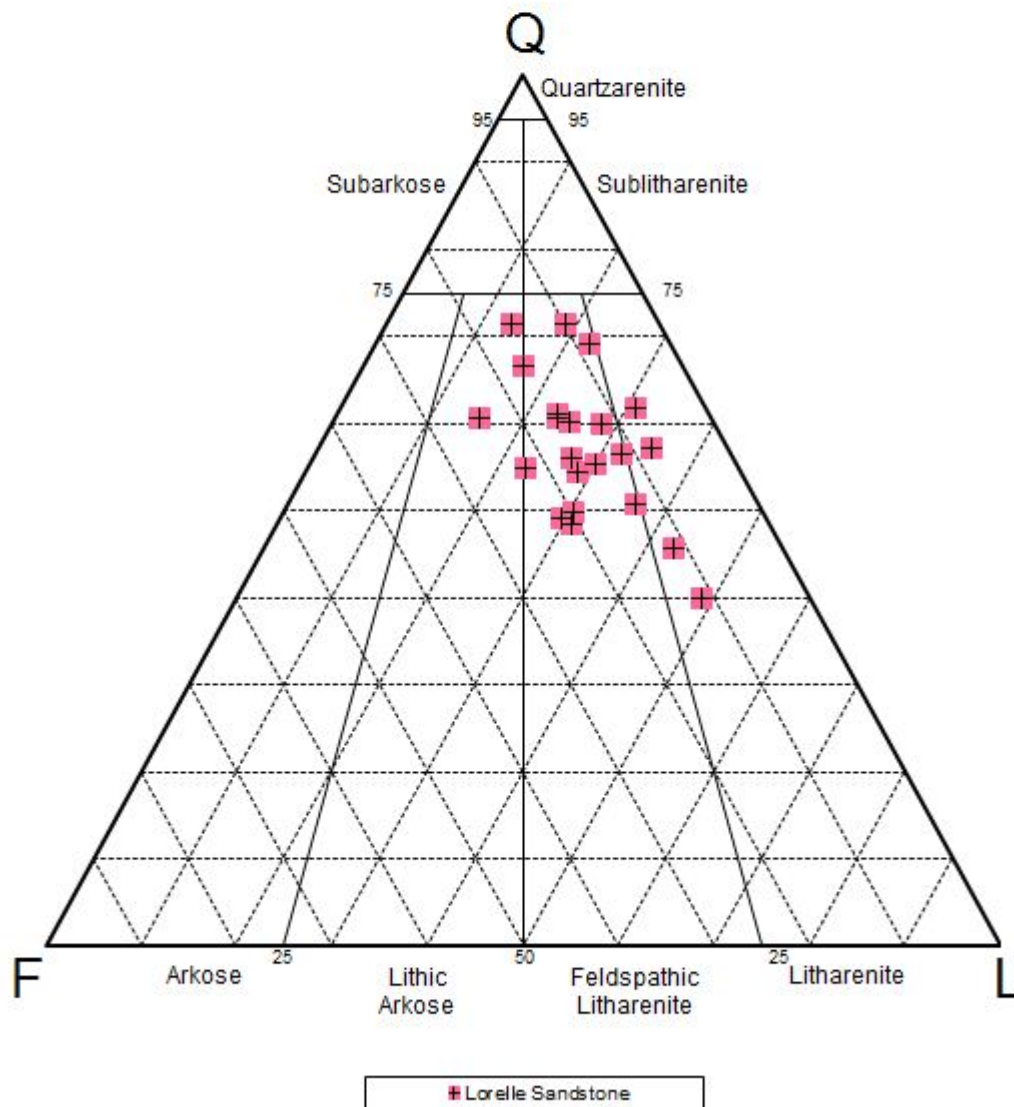
Twenty-five (25) of the samples analyzed from this well represent the Lorelle Sandstone Formation and range in depth from 2389.5m to 2982.04. One (1) sample was determined unsuitable for point count analysis (2982.04m) based on lithology, therefore a general thin section analysis was performed. The remaining twenty-four (24) samples were selected for detailed point count analysis. All twenty-five (25) samples were submitted for X-ray diffraction (XRD). Seven (7) samples were submitted for scanning electron microscopy (SEM) analysis. Based on visual estimates of thin section derived grain size analysis, the samples are classified as one (1) tuffaceous agglomerate, one (1) lithic arkose to feldspathic litharenite, two (2) lithic arkose, three (3) sandy conglomerate, one (1) slightly sandy conglomerate, three (3) litharenite, and fourteen (14) feldspathic litharenite. Average grain sizes range from 0.34mm (medium sand) to 9.31mm (pebble). Sample fabrics vary from massive to laminated/bioturbated and are very poorly to moderately sorted. Detrital grains range in shape from subangular to subrounded with most grains being subrounded. Compaction ranges from low to very high.

Figure 1
Sandstone Composition (Folk, 1980)
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Magnetic-1
Bowen Basin
Queensland, Australia
WFT File No.: AB-76967



QFL diagram for rotary sidewall core samples

Figure 2
Sandstone Composition (Folk, 1980)
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Magnetic-1
Bowen Basin
Queensland, Australia
WFT File No.: AB-76967



QFL diagram for conventional core samples

Framework Grain Mineralogy

The Lorelle Sandstone Formation samples consist of moderate to abundant amounts of lithic fragments (11.50%-79.00%; total lithics) and quartz (8.00%-53.00%; total quartz). Plus minor to common amounts of plagioclase and potassium feldspars (1.50%-12.50%, by volume; total feldspar). Lithic varieties occurring in lesser amounts include, by volume, chert (2.00%-13.00%), siltstone fragments (trace-8.50%), mudstone fragments (0.00%-1.25%), tuffaceous/glass volcanic fragments (0.00%-2.75%), mafic volcanic fragments (0.00%-4.50%), and felsic volcanic fragments (0.00%-2.00%).

Accessory grain types include carbonaceous plant material (0.00%-4.75%; by volume), muscovite mica (trace-5.00%), biotite mica (0.00%-1.50%), metamorphic chlorite (0.00%-0.50%), and heavy minerals (0.00%-0.50%). Heavy mineral varieties include pyroxene, sphalerite, garnet, rutile, sphene, epidote, tourmaline, and zircon.

Cements and Replacements

Authigenic minerals occurring in these samples are rare to common. Please note that the sample at depth 2982.04mm was classified as a tuffaceous agglomerate and was not analyzed using quantitative techniques and therefore the values present here only reflect the samples that were suitable for modal point count analysis. The dominant authigenic minerals are illite/smectite occurring as replacement of less stable material. Minor amounts of siderite and ankerite occur as a replacement of unstable grains. Other authigenic minerals occurring in lesser amounts (by volume) include quartz overgrowths (0.00%-10.75%), microquartz (0.00%-1.5%), feldspar overgrowths (0.00%-0.50%), Ti-oxide (0.00%-0.25%), Fe-oxide (0.00%-0.25%), and ferroan calcite (0.00%-2.75%). Pyrite is rare and occurs as both microcrystalline masses and framboids within intergranular pores (trace-1.50%) and as a partial replacement of labile grains (trace-1.50%).

Clay Mineralogy

Clay observed in the Lorelle Sandstone Formation represent a combination of both detrital (depositional) and authigenic (secondary) origins. Detrital clays are abundant in two (2) of the Lorelle Sandstone samples, 2931.4m (27.25%; by volume) and 2933.8m (30.00%, by volume). Trace to minor amounts of detrital clays occur in the remaining twenty-three (23) of these samples. Detrital clays occur in these samples as distinct laminations, as minor pore-filling material, and as infiltrated clay that is erratically dispersed throughout the samples. Authigenic clays include mainly illite/smectite and trace amounts of kaolinite.

In scanning electron microscopy (SEM) analysis authigenic clay types were identified both visually and using elemental dispersive spectroscopy (EDS). Web-like to fibrous grain-coating and grain-replacing illite and chlorite which is differentiated by a face-to-edge morphology of blade-like crystals occurring as grain-replacement was observed. Illite and chlorite occur as both a patchy pore-filling clay within intergranular areas and

as an *in situ* replacement of susceptible grains. Micropores are associated with these clays.

Clay types detected during XRD analysis of the twenty-five (25) samples representing the Lorelle Sandstone Formation include mixed-layer illite/smectite (6%-29%, by weight), kaolinite (trace-1%, by weight), illite/mica (trace-28%, by weight), and chlorite (trace-5%, by weight). These samples contain mixed-layer illite/smectite consisting of ordered interstratified layers that are 15%-20% expandable.

Reservoir Quality

Routine core analyses was performed on all twenty-five (25) samples from the Lorelle Sandstone Formation. Measured porosity values for these samples range from 2.0% to 11.8%. Permeability measurements (to air) range from 0.0025mD to 2.14mD. Intergranular pores are occluded due to the detrital and authigenic clays as well as authigenic cements. Micropores are associated with the clays, but are considered ineffective to the overall porosity and permeability. Sample 2974.13 contains less pore-filling clays and minor amounts of authigenic cement resulting in higher permeability values. Moderate to high compaction also contributes to the pore size and connectivity reduction. Secondary intragranular and grain-moldic pores (trace-7.5%, by volume) occurring within partially to completely dissolved detrital grains contribute minor amounts of porosity to the overall pore system. Primary intergranular pores (0.00%-2.00%, by volume) are less common and grain fracture pores are rare (0.00%-0.25%, by volume). Susceptible grains include feldspars and feldspar-bearing lithic fragments, such as volcanic or metamorphic fragments. Thin section results are summarized in Table 3 (next page).

TABLE 3

SUMMARY OF PETROGRAPHIC RESULTS THE LORELLE SANDSTONE FORMATION

Sample Number	Sample Depth (m)	Grain Size Avg. (mm)	Visual Sorting	Fabric	Total Matrix (vol. %)	Cement/ Replacement Minerals (vol. %)	Total Porosity (vol. %)	Poro./Perm. (RCA)
SWC12	2931.4	0.42	Very Poor	Laminated; Disturbed	27.25	10.25	1.50	2.0%/0.0025mD
SWC11	2933.8	0.34	Poor	Laminated; Disturbed	30.00	6.50	0.50	11.4%/0.18mD
1-1P DS	2936.06	1.52	Very Poor	Massive	0.25	12.25	10.25	10.7%/0.37mD
1-3P DS	2938.06	0.99	Poor	Massive	0.25	12.00	8.50	11.4%/ 0.85mD
1-5P DS	2940.05	0.58	Moderate	Massive	0.25	18.25	7.00	8.2%/0.094mD
1-8P DS	2942.06	0.78	Poor	Massive	0.50	11.75	8.50	12.2%/0.59mD
1-10P DS	2944.10	0.86	Poor	Massive	0.50	13.75	7.25	9.5%/0.26mD
1-12P DS	2946.05	0.36	Poor	Laminated	11.25	8.25	2.75	3.2%/0.014mD
1-15P DS	2948.06	0.51	Mod. to Poor	Massive	1.00	15.00	6.50	11.8%/0.34mD
1-17P DS	2950.09	0.73	Poor	Laminated; Burrowed	11.75	7.00	4.75	5.3%/0.12mD
1-19P DS	2952.06	0.62	Poor	Massive	0.25	16.50	7.50	9.9%/0.19mD
1-22P DS	2954.05	0.56	Poor	Massive	0.25	13.75	10.00	11.8%/0.39mD
1-24P DS	2956.05	0.44	Poor	Laminated; Bioturbated	15.50	9.50	3.00	3.4%/0.029mD
1-26P DS	2958.05	0.51	Poor	Massive; Disturbed	15.00	8.25	4.50	4.9%/0.078mD
1-28P DS	2960.17	1.16	Very Poor	Massive	0.75	14.50	8.00	8.3%/0.89mD
1-30P DS	2962.05	0.96	Very Poor	Massive	0.75	14.75	6.75	8.5%/0.48mD
1-33P DS	2965.05	1.31	Very Poor	Massive	4.25	7.25	6.00	7.2%/0.23mD
1-36P DS	2968.12	0.28/2.56	Mod. to Very Poor	Massive to Laminated	trace	14.00	4.25	7.4%/1.62mD
1-38P DS	2970.05	0.89	Very Poor	Massive; Bioturbated	1.25	14.00	3.25	5.3%/0.40mD
1-40P DS	2972.10	4.64	Very Poor	Massive; Microstylolites	0.75	5.25	4.75	9.0%/0.588mD
2-44P DS	2974.13	7.15	Very Poor	Massive	Trace	9.50	4.25	6.3%/2.14mD
2-46P DS	2976.05	9.31	Very Poor	Laminated	0.50	7.75	3.75	4.0%/0.83mD
2-48P DS	2978.07	0.49	Very Poor	Massive	4.50	11.00	5.25	5.8%/0.45mD
2-50P DS	2980.09	6.79	Very Poor	Massive to Laminated	2.75	10.00	1.00	3.9%/0.063mD
2-52P DS	2982.04	N/A	Very Poor	Massive	N/A	N/A	N/A	6.6%/0.007mD

=Medium-grained
 =Coarse-grained
 =Very Coarse-grained
 =Pebble-grained
 =Tuff

❖ PS46 TRS Formation (8 samples; 2987.05m-3020.5m)

Sedimentary Fabric and Texture

Eight (8) samples analyzed from this well represent the PS46 TRS Formation and range in depth from 2987.05m to 3020.5m. All of these samples were unsuitable for point count analysis based on lithology, therefore a general thin section analysis was performed. All eight (8) samples were selected for X-ray diffraction (XRD) analysis. All eight (8) samples are classified as tuffaceous agglomerate, composed of abundant welded tuffaceous matrix material. Sorting ranges from very poor to poor and sample fabrics are massive. These sandstones have undergone low sedimentary compaction based on thin section analysis.

Framework Grain Mineralogy

General thin section analysis reveals that framework grains in these tuffaceous agglomerate samples from the PS46 TRS Formation consist predominantly of altered volcanic glass. Less common grains include andesitic volcanic fragments, siltstone fragments, chert, metamorphic rock fragments, monocrystalline quartz, polycrystalline quartz, plagioclase feldspar, plutonic rock fragments, and tuffaceous volcanic rock fragments.

Accessory grain types include muscovite mica, biotite mica, undifferentiated calcareous fossil fragments, organic fragments, sphalerite, chamosite, tourmaline, and zircon.

Cement/Replacement

Common authigenic illitic clay occurs as a pore-filling material and as replacement of altered grains. Rare pyrite occurs as a replacement of detrital clays and as scattered framboids attached loosely to detrital grains. Ferroan calcite and Ti-oxide occur as a rare replacement of partially dissolved grains. Microquartz and calcite also occur as replacement of less stable material. Minor amounts of chlorite replaces unstable feldspar and lithic grains.

Clay Mineralogy

Clays observed in these samples from the PS46 TRS Formation are highly altered. X-ray diffraction (XRD) analysis (Appendix B) of the eight (8) samples representing the PS46 TRS Formation reveals that mixed-layer illite/smectite (7%-37%, by weight) is the predominant clay type, followed by lesser amounts of illite/mica (trace-11%, by weight), chlorite (2%-5%, by weight), and trace amounts of kaolinite (trace-1%, by weight).

Reservoir Quality

Routine core analysis was performed on the samples from the PS46 TRS Formation and are provided in Appendix E as a reference. Measured porosity values range from 4.7% to 9.0%. Permeability values (to air) range from 0.0022mD to 0.055mD. Note that permeability results were not obtained from sample 3020.5m. Primary intergranular pores are reduced by the common detrital and authigenic clays and authigenic cement. Micropores, associated with detrital clay, authigenic clay, and leached detrital feldspar and lithic grains, are the dominant pore type present within these samples. Secondary intragranular pores associated with partially to completely dissolved lithic fragments and feldspars are rare. Rare examples of intragranular fracture porosity occurs within the more rigid quartz or feldspar grains. Petrographic thin section results are summarized below in Table 4.

TABLE 4

SUMMARY OF PETROGRAPHIC RESULTS OF THE PS46 TRS FORMATION

Sample Number	Sample Depth (m)	Grain Size Avg. (mm)	Visual Sorting	Fabric	Total Matrix (vol. %)	Cement/ Replacement Minerals (vol. %)	Total Porosity (vol. %)	Porosity/Perm. (RCA)
2-57P DS	2987.05	N/A	Very Poor	Massive	N/A	N/A	N/A	5.8%/0.055mD
SWC8	2994.7	N/A	Poor	Massive	N/A	N/A	N/A	4.7%/0.0037mD
2-65P DS	2995.05	N/A	Very Poor	Massive	N/A	N/A	N/A	6.3%/ 0.027mD
2-73P DS	3002.05	N/A	Very Poor	Massive	N/A	N/A	N/A	7.5%/0.013mD
2-80P DS	3008.05	N/A	Poor	Massive	N/A	N/A	N/A	8.5%/0.014mD
SWC7	3011.3	N/A	Very Poor	Massive	N/A	N/A	N/A	5.4%/0.0046mD
SWC5	3017.3	N/A	Poor	Massive	N/A	N/A	N/A	9.0%/0.0022mD
SWC4	3020.5	N/A	Poor	Massive	N/A	N/A	N/A	7.3%/N/A

Color coding not applicable due to lithology characterization

Basement Formation (1 sample; 3036.0m)

Sedimentary Fabric and Texture

Only one (1) sample was provided from the Basement Formation, and was determined to be unsuitable for detailed point count analysis, a general description was performed instead. X-ray diffraction (XRD) analysis was also performed on this sample. This sample (3036.0m) was classified as a porphyritic trachyte, consisting of a welded tuffaceous material and altered clay minerals. The average particle size ranges from <0.01mm (clay) to 2.89mm (gravel). Intact silt-sized crystals of quartz, metamorphic fragments, and volcanic glass suggest low compaction.

Framework Grain Mineralogy

The one sample representing the Basement Formation is predominantly composed of altered volcanic glass fragments and quartz, with lesser amounts of volcanic and metamorphic rock fragments. Common amounts of potassium feldspar (15%; XRD by weight) were also observed. Feldspar varieties are identified based on optical characteristics (i.e., twinning) and with the aid of chemical staining: sodium cobaltinitrite for potassium feldspar (stains yellow) and rhodamine B for plagioclase (stains red/pink). Some lithic fragments and feldspars are slightly altered (seriticized or recrystallized) and partially dissolved.

Cement/Replacement

Authigenic minerals are common in this porphyritic trachyte. Illitic clay occurs as pore-filling and replacement of altered grains. Pyrite mainly occurs as a replacement of unstable particles, such as detrital matrix clays and organics, and is present as a rare grain-coating cement. Calcite and Ti-oxide occur as replacements of dissolved lithic fragments and unstable feldspar grains. Calcite varies in iron content throughout the entire well and is differentiated based on thin section staining; calcite is stained red while iron-rich calcite is purple. Other minerals occurring in lesser amounts include siderite, dolomite, and chlorite. Minor amounts of altered authigenic clays occur as pore-filling material and as replacement of susceptible grains.

Clay Mineralogy

Clays occurring in this Back Alley Shale sample represent a combination of both detrital (depositional) and authigenic (secondary) origins, which are difficult to distinguish in this thin section. Both detrital and authigenic clays occur as grain-coating and pore-filling material. Authigenic clays, such as kaolinite, occur as replacements of altered grains.

X-ray diffraction (XRD) analysis represents the best way to determine individual clay types. This analysis utilizes an energy dispersive spectrometer (EDS) that is essential in determining the elemental differences between clay varieties, especially when considering detrital matrix clays. The identification of authigenic clays in thin section can be extremely difficult because of the physical limitations of petrographic techniques.

X-ray diffraction (XRD) analysis (Appendix B) reveals that mixed-layer illite/smectite (17%, by weight) is the predominant clay type, followed by lesser amounts of chlorite (4%), and trace amounts of kaolinite and illite/mica. The mixed-layer illite/smectite consists of ordered interstratified layers that are 15%-25% expandable.

Reservoir Quality

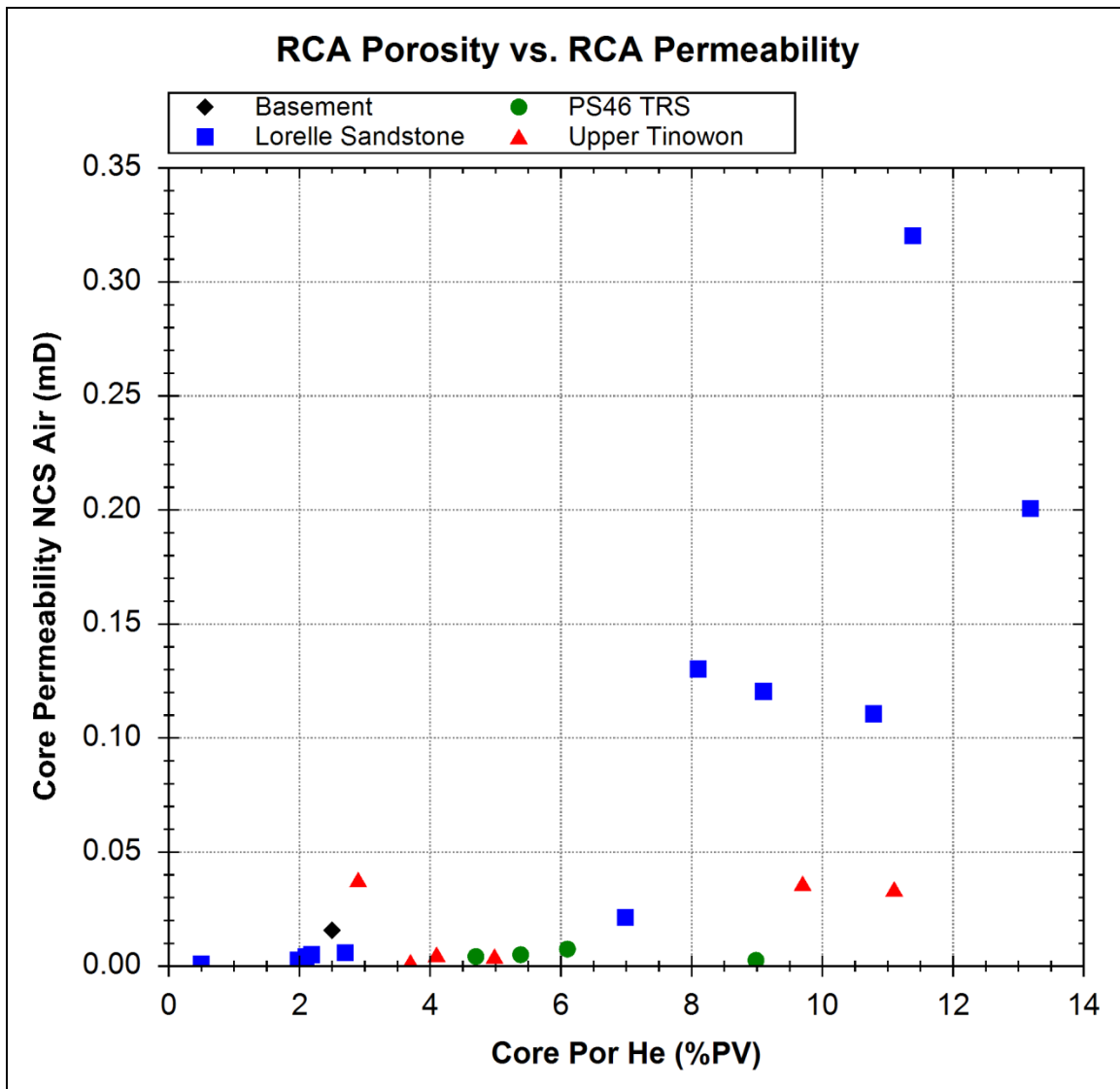
Porosity and permeability measurements were obtained for this rotary sidewall core sample and is provided in the appendix (see Appendix E). Measurements obtained during core analysis reveal the porosity value of 2.5%, with a permeability value (to air) of 0.015mD. The porosity of this sample is likely due to the microporosity associated with detrital clay, authigenic clay, and leached/altered detrital feldspar and lithic grains. Intergranular pores are occluded with cement and detrital matrix, no open primary pores were observed in thin section analysis using standard petrographic techniques. Thin section results are summarized below in Table 5.

TABLE 5

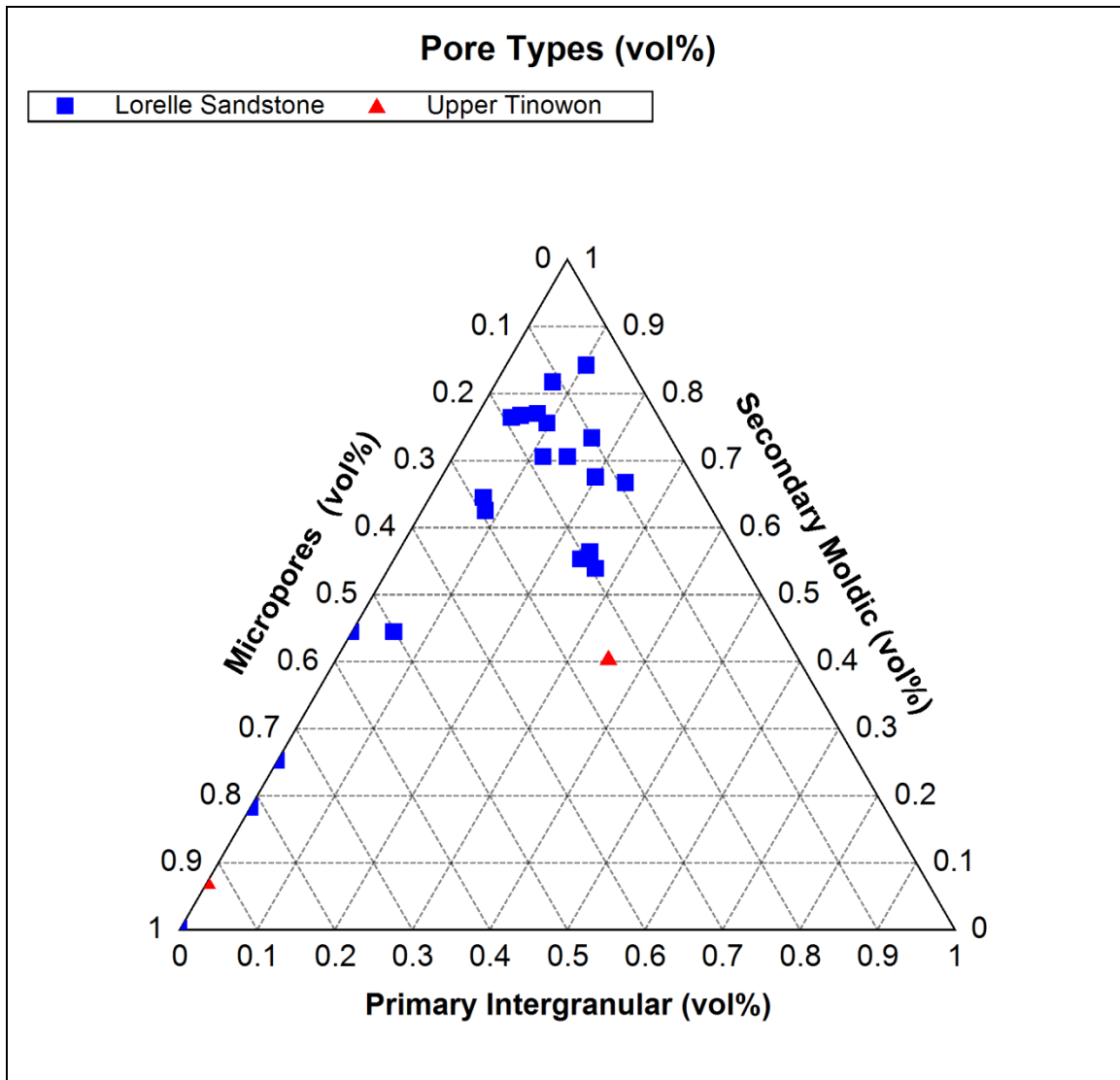
SUMMARY OF PETROGRAPHIC RESULTS THE BASEMENT FORMATION

Sample Number	Sample Depth (m)	Grain Size Avg. (mm)	Visual Sorting	Fabric	Total Matrix (vol. %)	Cement/ Replacement Minerals (vol. %)	Total Porosity (vol. %)	Poro./Perm (RCA)
SWC2	3036.0	N/A	N/A	Massive	N/A	N/A	N/A	2.5%/0.015mD

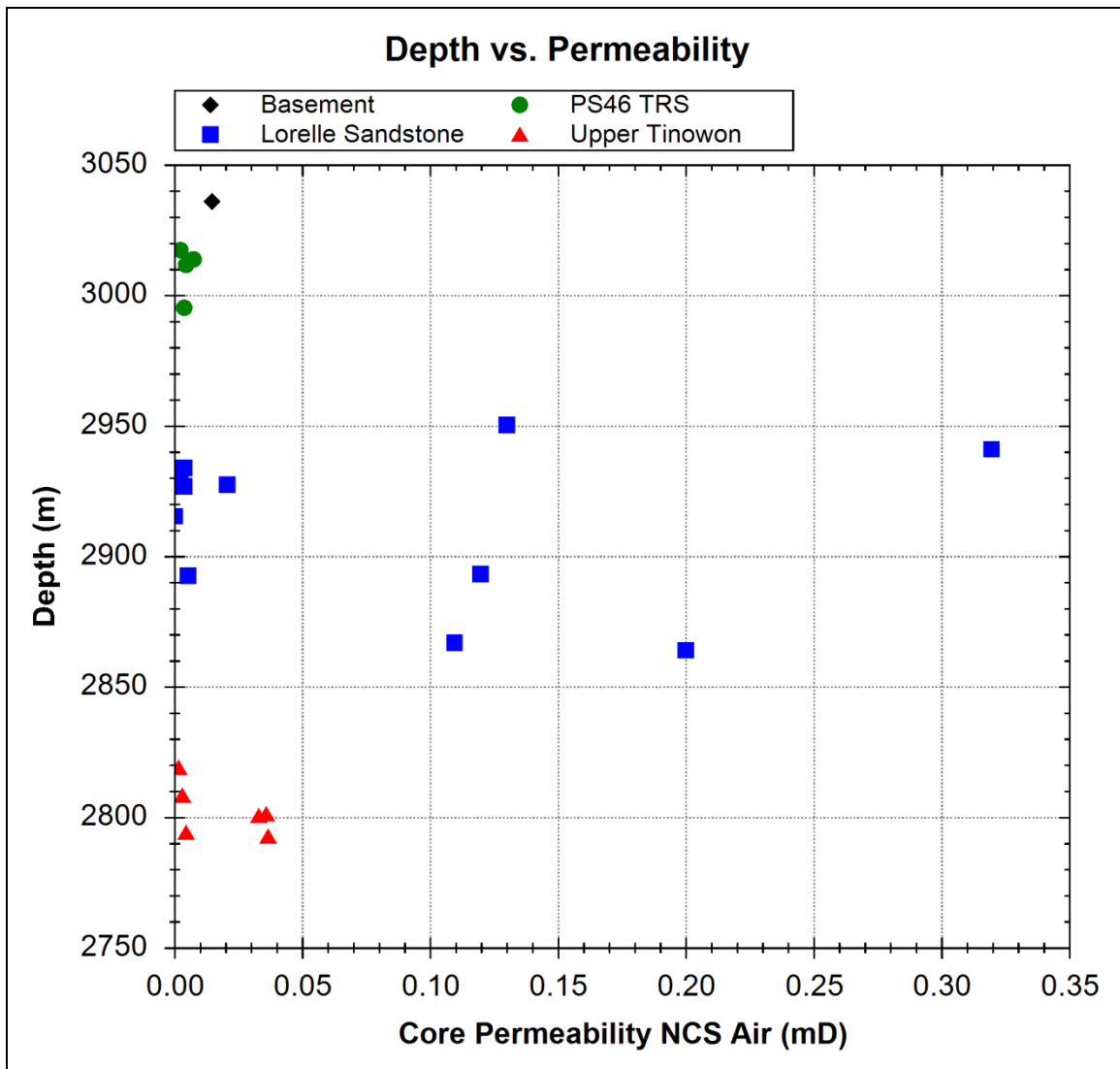
Color coding not applicable due to lithology characterization



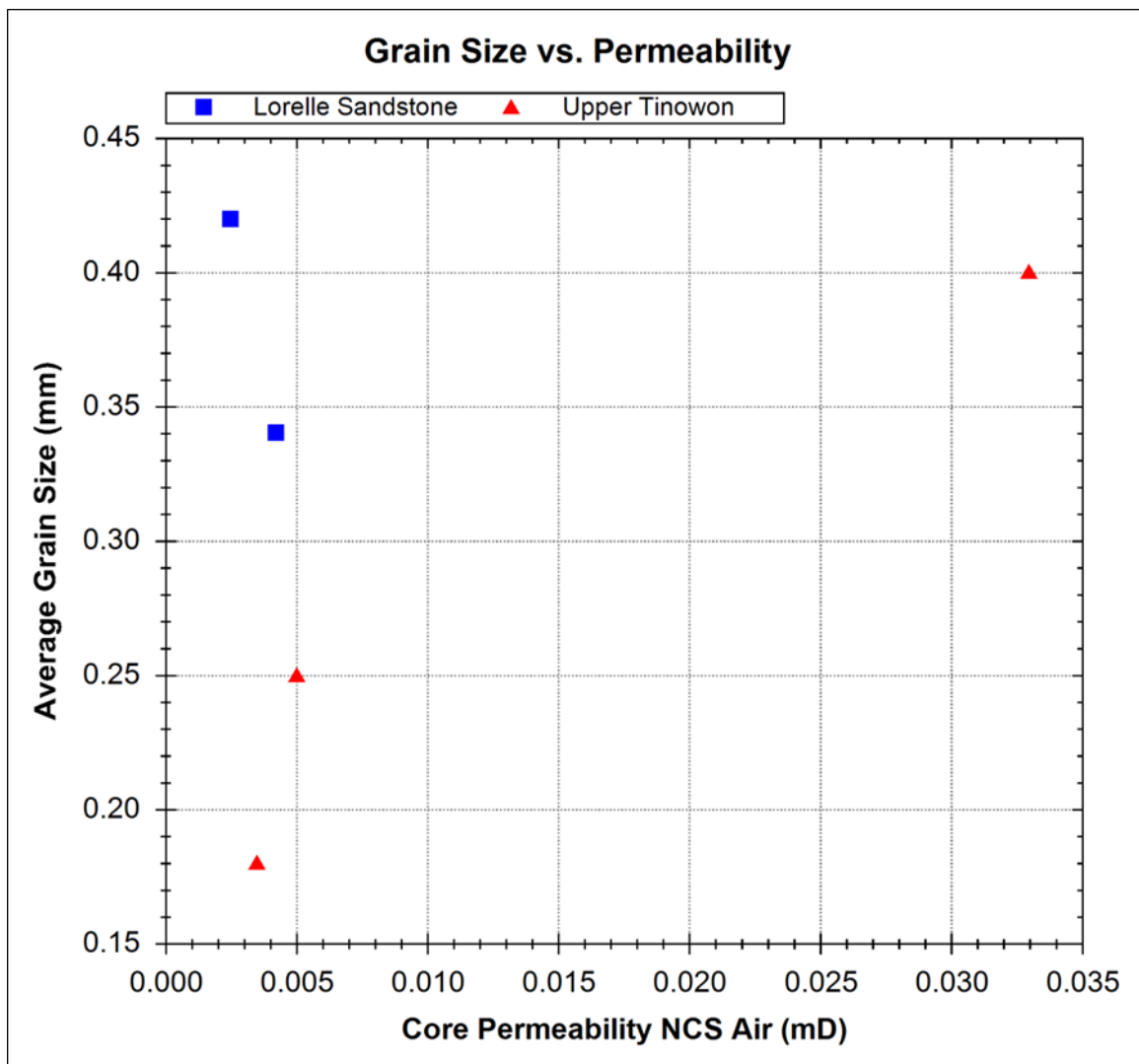
Porosity types occurring in this well are identified according to thin section analysis. Effective porosity consists of primary intergranular pores (0.00%-3.50%, by volume; per modal analysis), secondary intragranular pores (0.00%-7.50%, by volume), micropores (0.50%-8.25%, by volume), and pores occurring within fractured grains (2.25%-4.00%, by volume). Porosity percentages vary throughout the well, ranging from common porosity in the Lorelle Sandstone Formation to rare porosity in the PS46 TRS and Basement Formations. Factors contributing to the reduction of effective porosity include pore-filling cements, authigenic and detrital clays, volcanic matrix, and sedimentary compaction. This plot shows no correlation between porosity and permeability within these samples.



The following plot provides a ternary diagram of distribution of the pore types for each formation. This diagram illustrates that the majority of porosity occurs as micropores associated with clays and secondary pores associated with partial to complete grain dissolution. This plot was based on modal analysis, which was not applicable to the PS46 TRS and Basement formation, therefore only the Upper Tinowon and Lorelle Sandstone formations are represented.



Permeability is also controlled by pore types, cement volume, and compaction. Data sets were plotted with permeability to assess their effect on different formations. The plot above illustrates that permeability is higher in the Lorelle Sandstone formation where there is lower amounts of pore occluding clays and cements. In the Upper Tinowon, PS46 TRS, and the Basement formations there is higher compaction and common amounts of cement/clays resulting in lower permeability.



This plot depicts permeability versus average grain size, indicating that grain size is not a significant factor contributing to permeability changes. Average grain sizes were not taken for the PS46 TRS and the Basement samples since they were unsuitable for modal analysis and therefore they are not represented in this plot.

Mineralogic Influences On Log Response

The following section discusses the effects on log response of the mineralogy and associated pore types occurring in these samples.

Resistivity Logs: The main factors that may suppress resistivity in the samples from this well are grain-coating/pore-filling authigenic illitic and chloritic clay, laminar to grain-supporting concentrations of detrital clay, microporous partially dissolved and clay-altered grains (i.e., potassium feldspar and volcanic lithic fragments), localized pore-filling calcite, and microcrystalline pyrite. Resistivity suppression can result from conductive minerals and from the immovable water bound in microporous clay minerals. High resistivity suppression is expected in the intervals containing higher amounts of detrital clay or pore-filling calcite; however, low to minor resistivity suppression is expected in the cleaner samples with less clay minerals.

Density Logs: The samples analyzed typically contain minor amounts of the high density minerals pyrite, siderite, Ti-oxides, Fe-oxides, and/or calcite. These samples also often contain minor to abundant amounts of lower density minerals, such as feldspars, feldspar-bearing lithic fragments, and matrix clays. There are a few samples that do contain high amounts of calcite (i.e., 2792.7m). According to core analysis results, the samples selected for petrographic analysis range in density from 2.63g/cm³ to 2.80g/cm³.

Gamma-Ray Log: Gamma-ray logs respond to radioactive isotopes. The clay mineral chlorite will not be detected by gamma-ray logs due to the absence of potassium. Conversely, the mineral potassium feldspar will be detected by the gamma-ray logs due to the presence of potassium, and may be interpreted as “clay” in a Vclay calculation based on gamma-ray response. In addition, thin section analysis reveals the abundant presence of volcanic fragments (tuffaceous and andestic) and organic-debris. These components will slightly increase the gamma-ray response due to the presence of potassium or other radioactive minerals. The net result of these components would be that the gamma-ray log response could over-estimate the total clay volume in the samples.

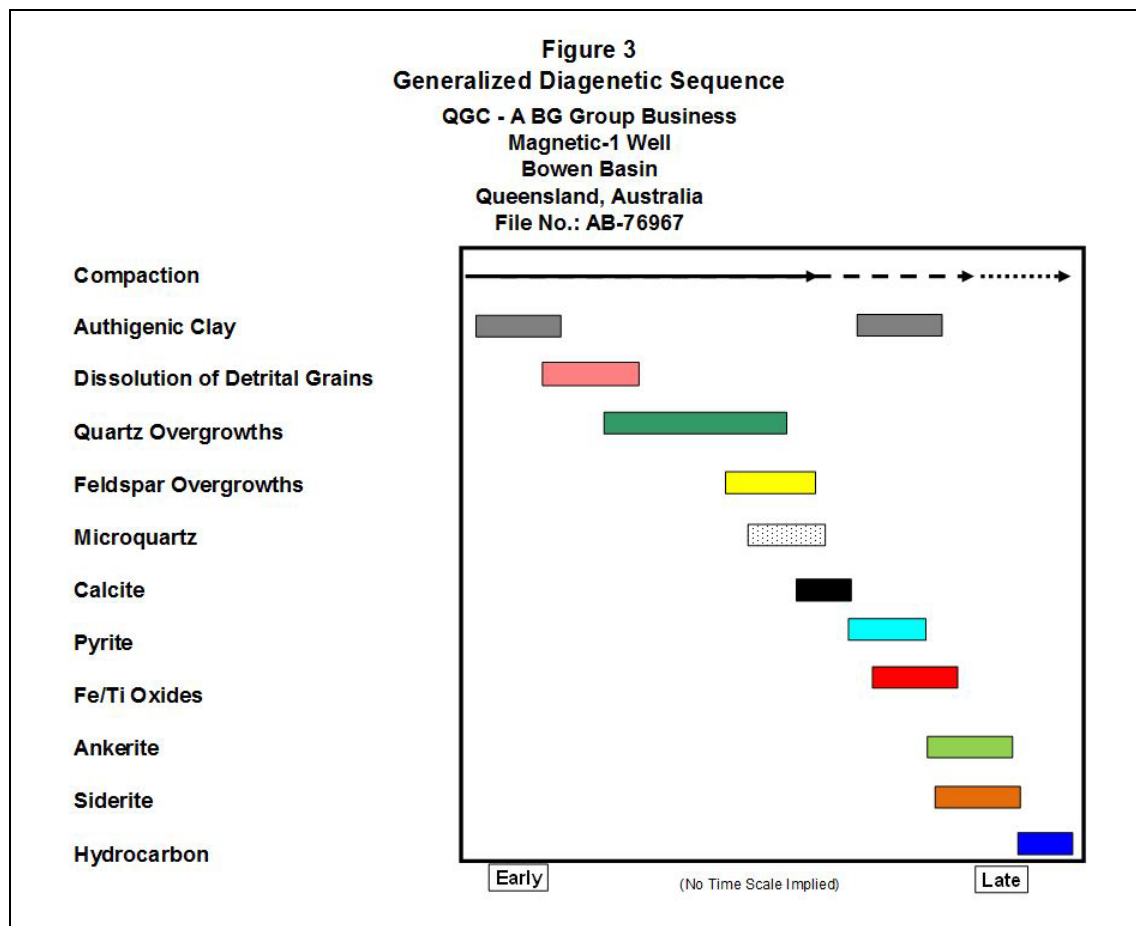
FORMATION SENSITIVITY

The presence of microporous mixed-layer illite/smectite clay in many samples is a concern. Significant amounts of these clays were detected using X-ray diffraction (XRD) analysis. The use of benign completion fluids such as KCl fluid is recommended to prevent any clay swelling/interaction. It is suggested that any fluid used in completion be tested with the formation water (if available) to assess the potential for fluid interaction and potential solids precipitation.

Petrographic analysis reveals that these samples are mainly quartz-rich, feldspar-rich and lithic-rich sandstones. The carbonate minerals calcite and siderite occur in variable amounts (rare to common) as pore-filling cement, as a replacement of partially to completely dissolved labile grains, and as detrital grains. Carbonate minerals are not compatible with HF acid systems, and an acid treatment is not recommended. However, if acid is needed, HCl acid coupled with an iron chelating agent can be used. If mud acid is used, be sure to pump enough HCl ahead to remove carbonate minerals, before pumping HF acid. Otherwise an inert damaging precipitate (CaF_2) may form.

DIAGENESIS

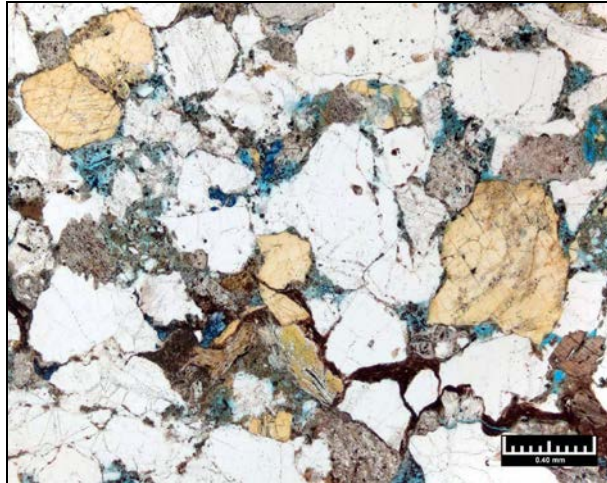
The diagenetic sequence was developed by examining the relative occurrences of the various diagenetic processes and products. Depositional features that originated prior to burial may no longer exist because of compaction, dissolution, and replacement. Based on the results of thin section petrography, point count data, X-ray diffraction (XRD) analysis, and scanning electron microscopy (SEM) examination, a generalized diagenetic sequence is provided, and a discussion of the major diagenetic elements follows. Figure 3 provides a generalized diagenetic sequence for the Magnetic-1 well.



Three (3) main diagenetic sequences are observed, and include initial sediment compaction, secondary dissolution, and cementation. Initial sediment compaction is observed by grain-contact relationships and compaction/deformation of less stable components, such as organic material and micas. Mechanical compaction is less pronounced in the samples containing smaller quantities of detrital clay and was largely limited to grain rotation and rearrangement. The presence of rigid cements, such as quartz overgrowths, microquartz, and calcite inhibited additional burial compaction. As a result, major mechanical compaction was largely impeded after these cements were developed. Descriptions of each authigenic mineral occurrence, with example photomicrographs are provided on the following pages.

Compaction

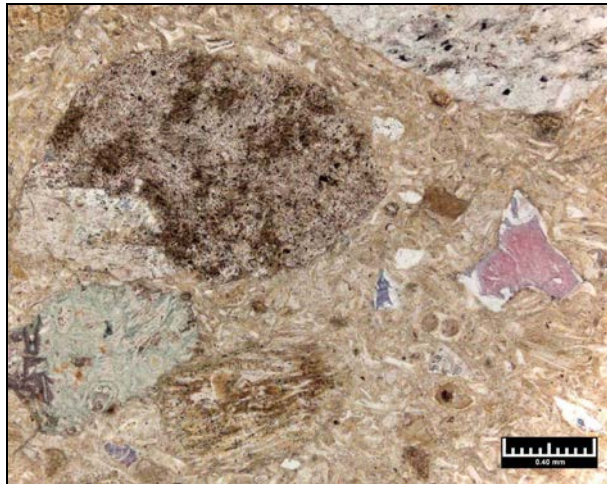
Compaction was generally greater in the samples from shallower depths, this is due to rapid cementation which inhibited further compaction by providing a rigid framework. The thin section photograph below illustrates high compaction; the detrital grains are mildly sutured. Another indication of high to very high compaction are microstylolites (pictured below).



2948.06m 50X Magnification (thin section photo)

Authigenic Clay

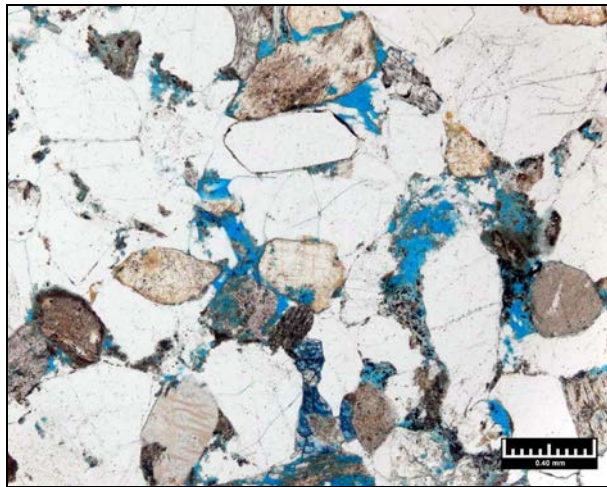
The amount and distribution of authigenic grain-coating and grain-replacing clay ranges from rare to common in these samples. Petrographic analysis indicates that authigenic clays consist of chlorite, mixed-layer illite/smectite, and illite. These clays occur on the surfaces of detrital grains, as pore-filling material, and as an alteration product of labile grains. Grain surfaces containing continuous clay rims will inhibit the precipitation of secondary quartz cements, which preserves the intergranular pore space. Illitic clays, both illite and mixed-layer illite/smectite, occur as crenulated to web-like crystals; however, minor occurrences of fibrous illite are also present. The thin section photomicrograph below illustrates authigenic chlorite (green) occurring as replacement of an unstable feldspar or lithic fragment (bottom left of photo).



2995.05m 50X Magnification (thin section photo)

Quartz Overgrowths

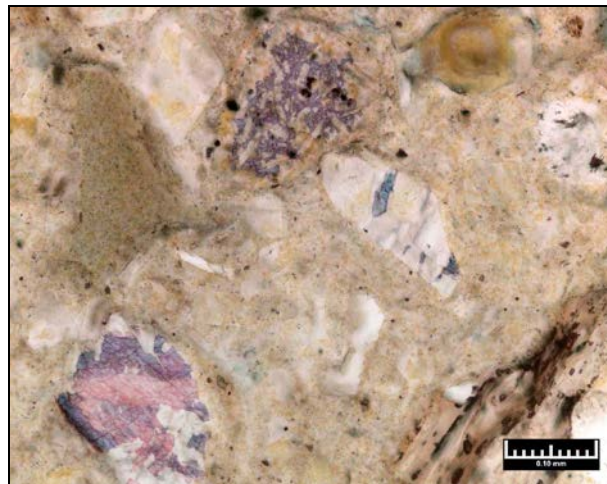
Quartz overgrowth cement precipitated early in the diagenetic history of these samples. Quartz cement is rigid and is resistant to dissolution and compaction. The thin section photomicrograph below illustrates the pore-filling characteristic of quartz overgrowth cement. The thin section photo below provides an example of well developed, grain-binding quartz overgrowths.



2952.06.8m 50X Magnification (thin section photo)

Microquartz

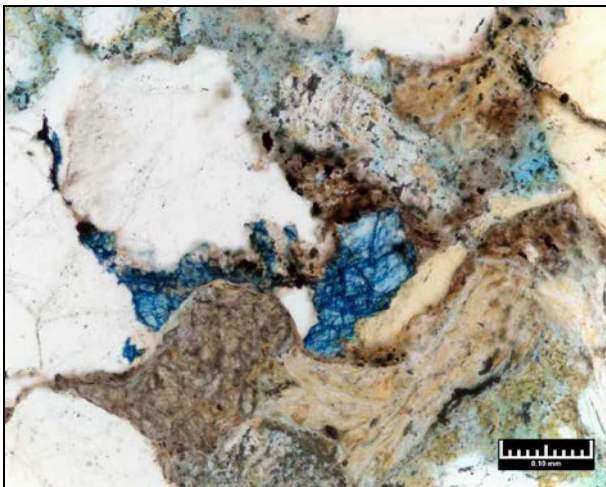
Rare to minor amounts of authigenic microquartz cement fills primary intergranular areas, significantly reducing porosity and permeability. This rigid cement prevents grains from being deformed during compaction. The thin section image below illustrates authigenic microquartz (white; lower middle of photo) surrounded by volcanic matrix material.



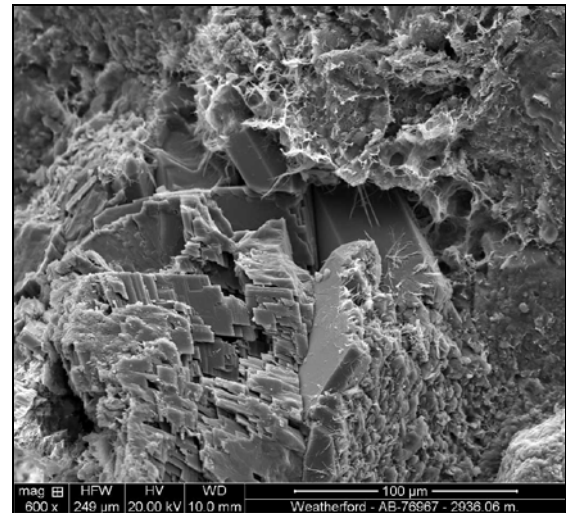
3002.05m 200X Magnification (thin section photo)

Carbonate Cements

The carbonate cements include calcite, Fe-calcite, ankerite, and siderite. These cements occur in various amounts (rare to common) in these samples. Calcite and ankerite occurs as blocky/patchy pore fillings and occurs as replacement of unstable or partially dissolved detrital grains. Rare amounts of Fe-calcite also occurs within these samples. The infilling of secondary pores indicate a relatively late precipitation, at least after the initial dissolution phase of the diagenetic process. In the thin section photomicrograph siderite (lower left of photo) occurs as replacement of a lithic fragment and ankerite (stained blue) occurs as a pore-filling cement. The SEM photo illustrates authigenic ankerite occurring as possible replacement of susceptible material.



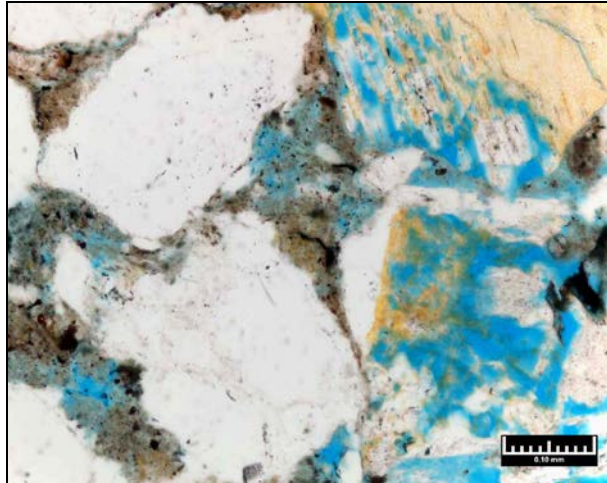
2948.06m 200X Magnification (thin section photo)



2936.06m 600X Magnification (SEM photo)

Feldspar Overgrowths

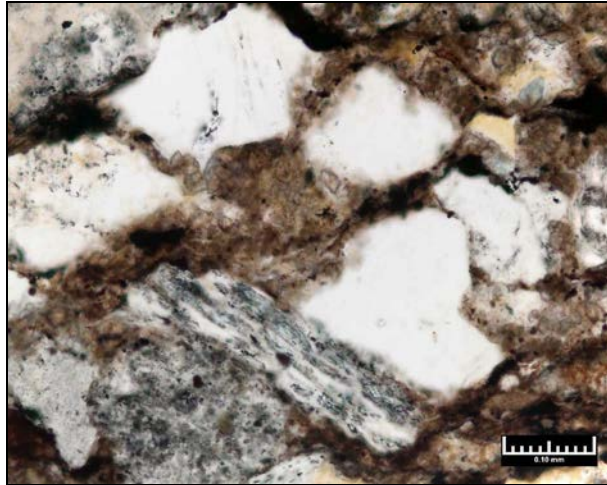
Minor amounts of feldspar overgrowths precipitate on host detrital grains, and partially occlude adjacent intergranular pores. Thin section analysis reveals that feldspar overgrowths occurred prior to dissolution of detrital feldspar grains. Below is a thin section photomicrograph illustrating a euhedral plagioclase feldspar overgrowths that preserve the outline of a dissolved feldspar grain (middle right in photo).



2942.06m 200X Magnification (thin section photo)

Pyrite

Pyrite occurs as a replacement of organic material, as intergranular pore-filling cement, and as microcrystalline framboidal masses attached to the surfaces of detrital grains. The thin section photomicrograph below depicts pyrite (black) replacing organic material.



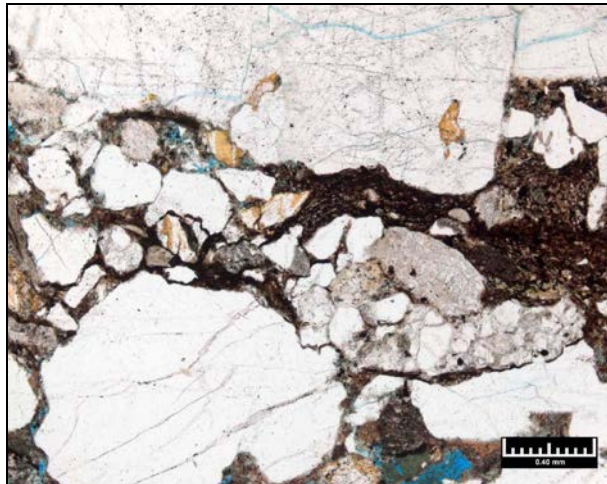
2956.05m 200X Magnification (thin section photo)

Fe/Ti-Oxides

Iron and titanium oxides occur as replacements of less stable material. These oxide minerals are generally absent to rare in occurrence. Thin section analysis indicates that iron and titanium oxide crystallized after overgrowth development. Titanium oxide was also observed in scanning electron microscopy (SEM) analysis.

Hydrocarbon

Hydrocarbon is observed in all four formations. This organic material occurs in association with authigenic clay minerals. The presence of hydrocarbons is rare to minor, ranging from 0.00% to 8.50% (by volume, per modal analysis). The emplacement of this organic-based material is extremely late, and is considered the last stage of authigenic mineralization observed. The image below is a thin section photo illustrating an organic filled microstylolite.



2965.05m 50X Magnification (thin section photo)

REFERENCES

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

APPENDIX A

PETROGRAPHIC ANALYTICAL PROCEDURES

Sample Preparation

A representative portion (6 grams minimum, preferably 10 grams) of each sample is selected for XRD analysis. Samples are disaggregated using mortar and pestle and portioned out for bulk and clay analyses.

Bulk/Whole Rock Analysis

The bulk portion is ground into a slurry using a McCrone Micronizing Mill. The slurry is transferred to an air brush assembly and spray dried using a James Hutton Institute Spray Drying Oven. Randomly oriented spherical aggregates are then loaded into stainless steel sample holders. This method eliminates preferred orientation of minerals and allows for improved reproducibility of the bulk XRD patterns. [Sp. Ed. Bish, D. L. and Post, J. E. (1989); Hillier, S (2002b)].

These bulk sample mounts are scanned with a Bruker AXS D4 Endeavor X-ray diffractometer using copper K-alpha radiation. To eliminate K-beta peaks and reduce background noise, nickel filter slits and air scatter screens are utilized, respectively. The scanning parameters for a bulk scan are from 5° 2 θ to 70° 2 θ . The step size is 0.020°, and the dwell time at each step is 0.5 seconds. Full scanning parameters are defined below (for both bulk and clay):

- Operating voltage: 50Kv
- Operating amperage: 40mA
- Axial soller slit is in place
- Goniometer diameter: 400mm
- Lynx Eye High speed detector with a 2 θ scanning range of 4°
- A nickel filter for K beta peaks
- An air scatter screen to reduce fluorescence
- Variable divergent slit at 0.3mm for bulk and 0.5mm for clay

Bulk Mineral Quantification

MDI Jade™ 9+ software and ICDD PDF 4+ 2013 database, with over 790,000 known compounds, are used to identify mineral phases present in the bulk diffractograms. Reference Intensity Ratio (RIR) method is used to quantify the whole rock. The RIRs (e.g., Mineral Intensity Factors (MIF)) are generated for each diffractometer using pure mineral standards mixed with quartz in a 50:50 weight percent ratio. When pure mineral standards are not available, Jade™ intensity ratios are applied. The primary peaks of the minerals present are measured using the area under the curve to one standard deviation (subtracting the background).

X-ray diffraction *cannot* identify non-crystalline (amorphous) material, such as organic material and volcanic glass. However, samples containing amorphous material show an anomalous “hump” in the XRD pattern. If further evaluations are required, Bruker AXS TOPAS v4.2 software is used to provide an estimate of the amount of amorphous material. Scans undergo full-pattern-fitting and Rietveld refinement using structure phase files previously identified by Jade and ICDD software (see above).

Clay Sample Preparation

An oriented clay fraction mount is prepared for each sample from hand ground powder. The samples are treated with a small amount of sodium hexa-meta-phosphate as a deflocculant mixed with distilled water. The samples are then physically dispersed using a Fisher Scientific Ultra Sonifier to bring the clays into suspension. The samples are sized fractionated by centrifuging. After centrifuging, the supernatant containing the less than 2 micron clay fraction is vacuumed through a filter membrane glass tube that collects the solids on to a millipore filter.

These oriented solids are mounted on glass slides, loaded into desiccant bowls containing 99.9% ethylene glycol for an extended period of time at a temperature of 110°C. The samples are loaded directly from the desiccant bowl to ensure maximum sample glycolation. The glycolated clays are also scanned in a Bruker AXS diffractometer using the following scan parameters: 2° 2θ to 30° 2θ at a step size of 0.025° per step and a dwell time of 0.26 seconds at each step.

After the glycolated slide is scanned, the slides are heat-treated in a furnace at 375°C for one hour and rescanned at the same clay parameters stated above. This process aids in identifying the expandable, water-sensitive minerals.

When samples contain high levels of carbonates combined with low clay quantities, we may need to return to the sample and remove the carbonates to obtain a better clay scan for accurate identification and quantification.

Clay Mineral Identification and Quantification

Mixed-layer clays, particularly illite/smectite (I/S) are identified following the multiple peak method of Moore and Reynolds (1997). This entails measuring the 001/002 and 002/003 peaks of the illite/smectite. NEWMOD clay mineral generation program is used to create theoretical clay patterns, clay mixtures, and illite crystallinity. Identification of the amount of smectite (percent expandability) is also verified using the heat treated diffractogram overlain on the glycolated diffractogram in MDI Jade.

Kaolinite and chlorite are identified by the relative proportions of the peaks at 3.59 Å (kaolinite 002) and 3.54 Å (chlorite 004).

Clay mineral quantification includes: (1) the actual amount of discrete clay mineral species in the sample, and (2) the “expandability” or amount of smectite in mixed-layer clays, if present. Illite/Smectite (I/S) is the most common mixed-layer clay, but there are also chlorite/smectite (corrensite) and kaolinite/smectite. There are several tables in Moore and Reynolds (1997) that list 2θ positions and their correlative percent smectite in I/S (Table 8.3, p.273) or C/S (Table 8.4, p.281).

The Mineral Intensity Factor (MIF) method of Moore and Reynolds (1997) is applied to quantify the clay species. Weatherford has calculated MIFs for most clay minerals encountered. The area of the specific mineral peak being used is divided by the MIF in the quantification process. The clay species is normalized to the total clay value derived from the bulk analysis.

References

- Bish D.L. and Reynolds R.C. Jr. (1989) Sample preparation for X-ray diffraction. Pp. 73-99 in: Modern Powder Diffraction (D.L. Bish and J.E. Post, editors) Reviews in Mineralogy, Volume 20, Mineralogical Society of America, USA.
- Hillier S. (2002b) Spray drying for X-ray powder diffraction specimen preparation. IUCR Commission on Powder Diffraction Newsletter No. 27. June 2002.
- Moore, D.M. and Reynolds, R.C. (1997) X-ray Diffraction and the Identification and Analysis of Clay Minerals, 2nd edition. Oxford University Press, Oxford, 332 pp.

Thin Section Preparation and Analyses

Samples selected for thin section analysis were prepared by first vacuum impregnating with blue-dyed epoxy. The samples were then mounted on an optical glass slide and cut and lapped in water to a thickness of 0.03 mm (30 microns). The samples were stained for potassium (K-) feldspar using the method described by Bailey and Stevens in 1960, and by Laniz in 1964. First, hydrofluoric acid (HF) is used to etch the surface. Then sodium cobaltinitrite is used to stain any K-feldspar on that surface a yellow color. Then the samples are re-etched and submerged in rhodamine B to stain plagioclase feldspar a reddish/pink color. Next, the sections were stained using Alizarin Red S for calcite, and potassium ferricyanide for ferroan dolomite/calcite. When present, dolomite will appear clear, ankerite will appear turquoise blue, calcite will appear red, and ferroan calcite will appear purple. The prepared sections were then covered with index oil and temporary cover slips, and then analyzed using standard petrographic techniques.

Standard point count analysis was utilized to obtain the composition of framework grains, as well as abundance of diagenetic, and pore system components. A modal analysis consisting of 400 point counts was completed for each thin section using magnifications ranging from 100X to 400X. Reflected light microscopy was utilized in the determination of opaque minerals, such as iron/titanium oxides and pyrite. The modal analyses include a detailed evaluation of secondary pores and micropores; i.e., specifically counting the grain type or other rock components in which these pore types occur.

Scanning Electron Microscopy (SEM) Analysis

Samples selected for scanning electron microscopy analysis are first broken, or split, to expose fresh surfaces. The samples are then mounted on sample holders with a conductive carbon paste and coated with gold in a "cool" SPI module sputter coater to prevent heat damage to sensitive clay minerals or friable samples. The samples are analyzed with a FEI Model Quanta 200 Digital Scanning Electron Microscope (SEM) and Oxford INCA Energy Dispersive Spectrometer (EDS). Standard secondary electron images are typically generated using an Everhart-Thornly Detector (ET detector) under high vacuum conditions. Elemental identification within the Oxford INCA EDS software is calibrated against a copper standard.

Acquiring simultaneous EDS data during SEM image analysis requires a beam accelerating voltage between 15kV to 30kV and a set working distance (WD) of 10mm. Typical magnifications (at a working distance of 10mm) range from 40X, with a horizontal field width (HFW) of 3.73mm, up to approximately 6,000X, with a HFW of 24.9µm.

The Quanta 200 model SEM is also capable of running in low vacuum mode. Low vacuum mode is typically only used while looking at dirty and/or un-cleaned samples

where it is necessary to dissipate charging to achieve a quality image. In low vacuum mode, water vapor from a reservoir of de-ionized water is pumped into the chamber to help dissipate any charging effects. A large field detector (LFD) is used to generate secondary electron images while running in low vacuum mode.

References

Welton, Joann E., 1984, SEM Petrology Atlas, AAPG

APPENDIX B

X-RAY DIFFRACTION DATA

WEATHERFORD LABORATORIES
X-RAY DIFFRACTION
(WEIGHT %)

Client: QGC - A BG Group business
Well: Magnetic-1
Area: Queensland, Australia
Sample Type: Conventional Core

File No: AB-76967
Date: 08/12/15
Analyst: G. Torrez

Barcode Number	Sample Number	Sample Depth (m)	CLAYS				CARBONATES				OTHER MINERALS						TOTALS		
			Chlorite	Kaolinite	Illite/Mica	Mx I/S*	Calcite	Dolomite	Dolomite(Fe/Ca) ^{1,2}	Siderite	Quartz	K-spar	Plag.	Pyrite	Apatite	Barite	Clays	Carb.	Other
6122537878	1_1P	2936.06	Tr	Tr	10	8	2	Tr	Tr	1	67	6	6	Tr	Tr	0	18	3	79
6122537880	1_3P	2938.06	Tr	Tr	8	6	2	Tr	Tr	1	70	6	7	Tr	Tr	0	14	3	83
6122537882	1_5P	2940.05	1	Tr	11	12	1	1	1	1	54	10	8	Tr	Tr	0	24	4	72
6122537884	1_8P	2942.06	1	Tr	5	7	1	Tr	1	Tr	71	7	7	Tr	Tr	0	13	2	85
6122537886	1_10P	2944.10	1	Tr	7	8	1	Tr	1	1	68	7	6	Tr	Tr	0	16	3	81
6122537888	1_12P	2946.05	1	Tr	28	6	1	Tr	1	1	47	8	6	1	Tr	0	35	3	62
6122537890	1_15P	2948.06	1	Tr	8	7	1	Tr	1	1	67	7	7	Tr	Tr	0	16	3	81
6122537892	1_17P	2950.09	1	Tr	12	10	1	0	Tr	Tr	64	6	5	1	Tr	0	23	1	76
6122537894	1_19P	2952.06	1	Tr	8	8	1	Tr	1	Tr	69	6	6	Tr	Tr	0	17	2	81
6122537896	1_22P	2954.05	1	Tr	6	4	1	Tr	1	Tr	74	6	7	Tr	Tr	Tr	11	2	87
6122537898	1_24P	2956.05	1	Tr	18	12	Tr	Tr	Tr	5	50	6	7	1	Tr	0	31	5	64
6122537900	1_26P	2958.05	1	Tr	12	13	Tr	Tr	1	5	56	6	5	1	Tr	Tr	26	6	68
6122537902	1_28P	2960.17	1	Tr	6	6	1	0	Tr	0	71	6	9	Tr	Tr	Tr	13	1	86
6122537904	1_30P	2962.05	1	Tr	8	6	Tr	0	1	0	63	8	13	Tr	Tr	Tr	15	1	84
6122537906	1_33P	2965.05	1	Tr	8	7	Tr	Tr	1	Tr	67	8	8	Tr	Tr	Tr	16	1	83
6122523678	1_36P	2968.12	1	Tr	10	7	2	Tr	Tr	1	66	6	7	Tr	Tr	0	18	3	79
6122537908	1_38P	2970.05	1	Tr	8	7	Tr	0	Tr	4	67	6	7	Tr	Tr	0	16	4	80
6122537910	1_40P	2972.10	Tr	Tr	11	6	Tr	Tr	1	Tr	70	5	7	Tr	Tr	0	17	1	82
6122523684	2_44P	2974.13	2	Tr	8	7	1	0	Tr	0	70	6	6	Tr	Tr	0	17	1	82
6122523686	2_46P	2976.05	Tr	Tr	9	6	Tr	Tr	Tr	1	73	5	6	Tr	Tr	0	15	1	84
6122537912	2_48P	2978.07	Tr	Tr	9	9	3	Tr	1	Tr	58	9	10	1	Tr	0	18	4	78
6122537914	2_50P	2980.09	1	Tr	12	7	1	Tr	1	Tr	54	11	12	1	Tr	0	20	2	78
6122537916	2_52P	2982.04	2	Tr	10	21	1	Tr	1	Tr	43	10	12	Tr	Tr	0	33	2	65
6122537918	2_57P	2987.05	3	Tr	7	14	8	Tr	1	0	39	10	18	Tr	Tr	0	24	9	67
6122537920	2_65P	2995.05	2	1	10	14	6	Tr	1	0	37	7	22	Tr	Tr	0	27	7	66
6122537922	2_73P	3002.05	3	Tr	11	24	5	0	Tr	0	36	7	14	Tr	Tr	0	38	5	57
6122537924	2_80P	3008.05	3	Tr	2	37	5	0	1	Tr	36	8	8	Tr	Tr	0	42	6	52
		Average	1	Tr	10	10	2	Tr	Tr	1	60	7	9	Tr	Tr	Tr	21	3	76

* Ordered interstratified mixed-layer illite/smectite; with approximately 15-20% expandable interlayers.

¹ Dolomite species interpretation based on the d-spacing of the highest intensity peak of dolomite group minerals; other dolomite species may be present.

² Dolomite species interpretation based on the d-spacing of the highest intensity peak of dolomite group minerals (which increases with calcium in excess of 50:50 Ca:Mg or substitution of Fe for Mg).

**WEATHERFORD LABORATORIES
X-RAY DIFFRACTION
(WEIGHT %)**

Client: QGC - A BG Group business
Well: Magnetic-1
Area: Queensland, Australia
Sample Type: Rotary Sidewall Core

File No: AB-76967
Date: 08/12/15
Analyst: G. Torrez

Barcode Number	Sample Number	Sample Depth (ft)	CLAYS				CARBONATES				OTHER MINERALS						TOTALS		
			Chlorite	Kaolinite	Illite/Mica	Mx I/S*	Calcite	Dolomite ¹	Dolomite(Fe/Ca) ²	Siderite	Quartz	K-spar	Plag.	Pyrite	Apatite	Barite	Clays	Carb.	Other
6122525420	25 SWC	2792.7	1	Tr	3	24	37	0	Tr	2	19	3	9	2	Tr	0	28	39	33
6122525418	24 SWC	2794.1	Tr	Tr	1	20	19	0	Tr	0	20	Tr	40	Tr	Tr	0	21	19	60
6122525416	23 SWC	2800.2	1	Tr	1	19	5	0	Tr	Tr	39	Tr	35	Tr	Tr	0	21	5	74
6122525412	21 SWC	2808.2	1	Tr	2	34	3	0	Tr	0	26	3	18	Tr	13	0	37	3	60
6122525410	20 SWC	2818.6	Tr	Tr	2	27	3	0	Tr	2	50	Tr	14	2	Tr	0	29	5	66
6122525394	12 SWC	2931.4	2	Tr	17	11	Tr	0	Tr	2	48	7	10	3	Tr	0	30	2	68
6122525392	11 SWC	2933.8	2	Tr	18	13	Tr	0	1	1	48	7	9	1	Tr	0	33	2	65
6122525386	8 SWC	2994.7	3	Tr	6	18	10	Tr	Tr	0	33	6	24	Tr	0	0	27	10	63
6122525384	7 SWC	3011.3	4	1	Tr	29	5	Tr	1	0	41	6	13	Tr	0	0	34	6	60
6122525380	5 SWC	3017.3	4	Tr	4	7	4	0	1	0	41	6	33	Tr	0	0	15	5	80
6122525378	4 SWC	3020.5	5	Tr	6	9	1	0	1	0	43	6	29	Tr	Tr	0	20	2	78
6122525374	2 SWC	3036.0	4	Tr	Tr	17	2	Tr	2	0	42	15	18	Tr	Tr	0	21	4	75
		AVERAGE	2	Tr	5	19	7	Tr	1	1	37	5	21	1	1	0	26	9	65

* Ordered interstratified mixed-layer illite/smectite; with approximately 15-25% expandable interlayers.

¹ Dolomite species interpretation based on the d-spacing of the highest intensity peak of dolomite group minerals; other dolomite species may be present.

² Dolomite species interpretation based on the d-spacing of the highest intensity peak of dolomite group minerals (which increases with calcium in excess of 50:50 Ca:Mg or substitution of Fe for Mg).

APPENDIX C

THIN SECTION MODAL ANALYSIS AND PHOTOMICROGRAPHS WITH DESCRIPTIONS

QGC- A BG Group Business
Magnetic-1
Upper Tinowon Sandstone
Queensland, Australia
Rotary Sidewall Core

Weatherford Labs File No.: AB-76967

THIN SECTION DESCRIPTION
SAMPLE DEPTH: 2792.7 METERS
SAMPLE NUMBER: SWC25

PLATE 1

Lithology*: Conglomerate and argillaceous, silty limestone to argillaceous, brachiopodal siltstone

Sedimentary Fabric: Laminated; disturbed; bimodal

Particle Size Range: <0.01mm-19.57mm

Average Grain Size: 19.57mm and 0.04mm

Visual Sorting: Very poor

Compaction: High

Framework Grains:

Major: Conglomerate fragment and brachiopod fragments and spines

Minor: Monocrystalline quartz, chert, organic fragments, plagioclase feldspar, metamorphic schistose fragments, polycrystalline quartz, mudstone fragments, and potassium feldspar

Accessory: Muscovite, biotite, and glauconite

Matrix: The matrix consists of abundant amounts of laminar clay minerals (visual est. 25%, by volume); XRD analysis indicates that clay minerals account for 28% (by weight), with measured clays types mainly including mixed-layer illite/smectite (24%), with lesser amounts of illite/mica (3%), and rare chlorite (1%), and kaolinite (trace).

Cement/Replacement: Common authigenic illitic clay occurs as a pore-filling and replacement of altered grains; rare pyrite occurs as scattered framboids attached to detrital grains and as a replacement of detrital clays; rare replacement of dissolved grains by calcite, Fe-calcite and ankerite

Porosity Types: Minor to rare micropores associated with detrital clay matrix and partially dissolved grains represent the only form of visible porosity

Porosity (RCA): 2.9%

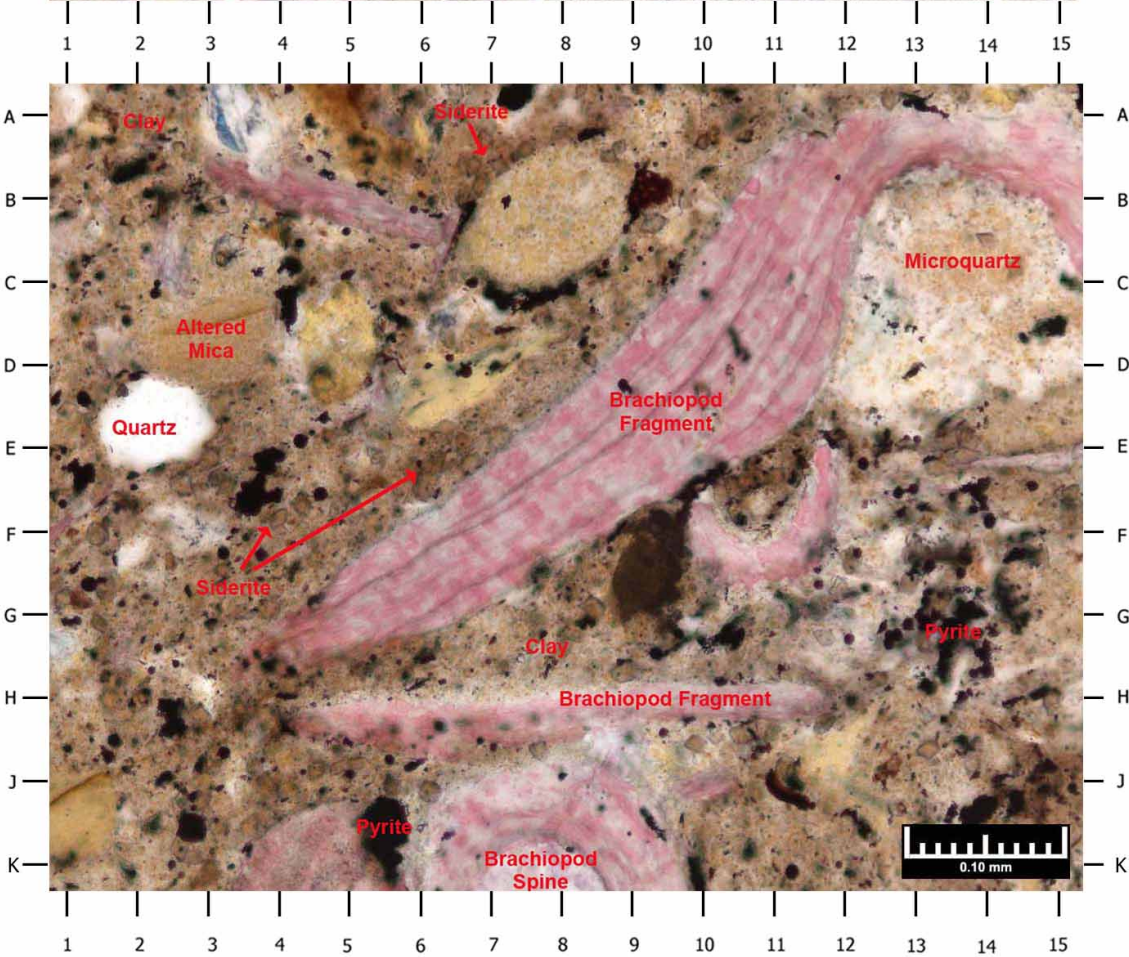
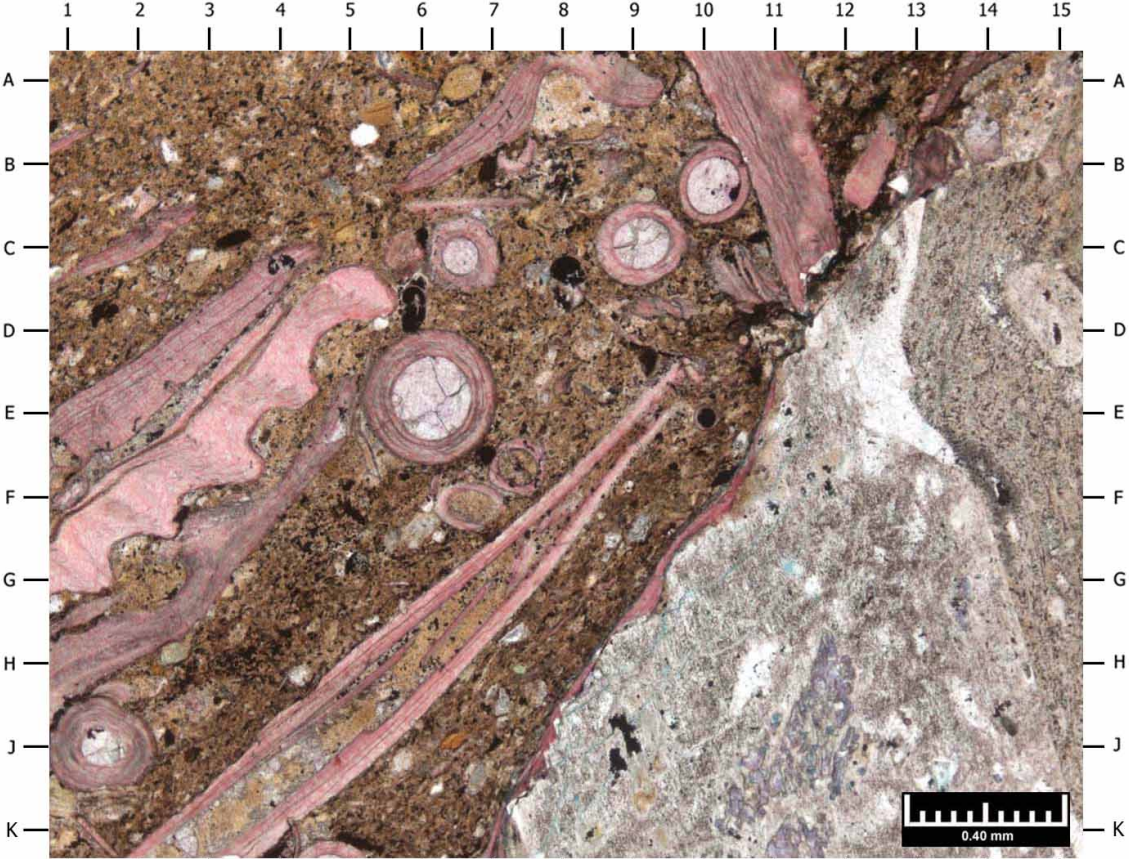
Permeability (RCA): 0.037mD

Grain Density (RCA): 2.67gm/cc

*Folk (1962) classification based on visual estimate of sample constituents

Magnification: A: 50X B: 200X

- A) Survey photomicrograph A provides a general overview of this sample. Part of a large conglomerate fragment occurs at A15-K8. Calcareous brachiopod spines (CD6, B10, C9, E6, J1.2) and fragments (AB11, EF3, AB7) are surrounded by a volcanically derived clay matrix (A1-C5, A12, E9-K6).
- B) This photomicrograph provides a magnified view of the area near BC6.5 in Photo A. Pyrite (black specks; CD15, G13.5, JK2.9, JK5.5) and siderite (B7, CD8.5, EF5.9) occur as replacement of less stable material. Monocrystalline quartz (E2) and microquartz (C13.5) are observed.



QGC- A BG Group Business
Magnetic-1
Upper Tinowon Sandstone
Queensland, Australia
Rotary Sidewall Core

Weatherford Labs File No.: AB-76967

THIN SECTION DESCRIPTION
SAMPLE DEPTH: 2794.1 METERS
SAMPLE NUMBER: SWC24

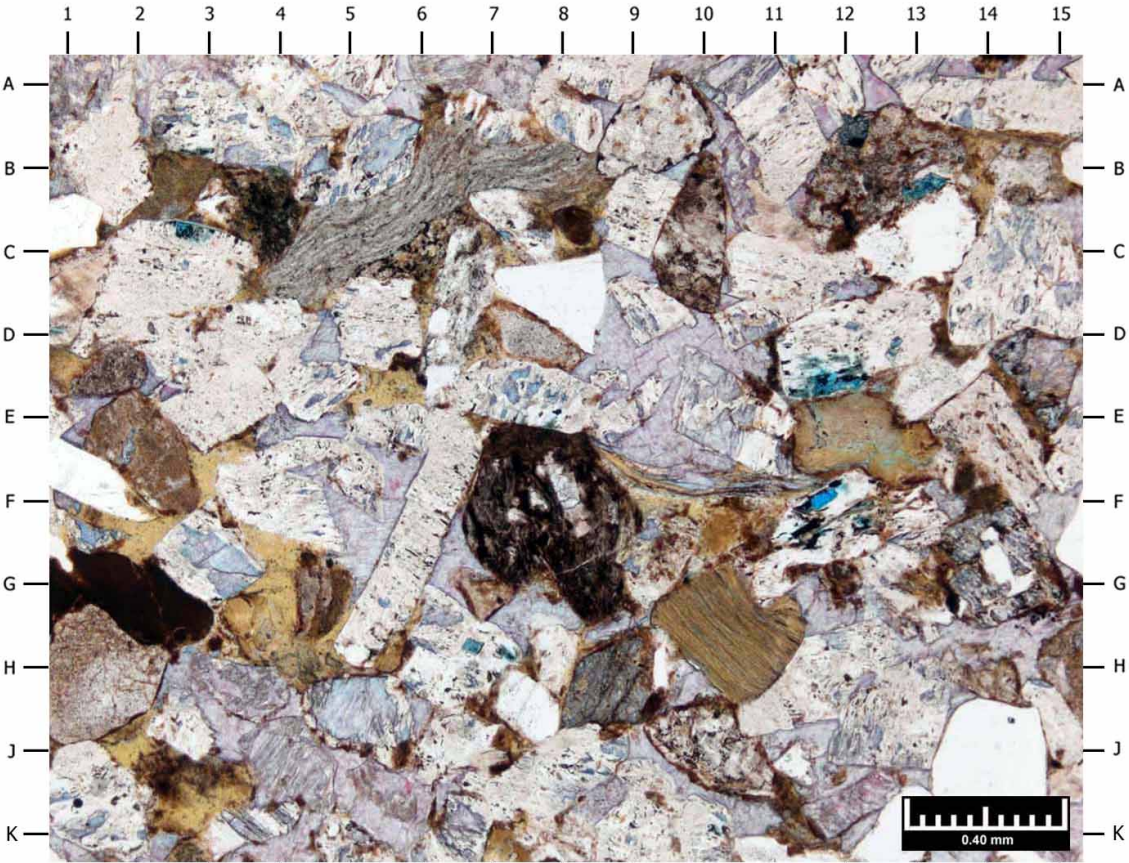
PLATE 2

Lithology*:	Lithic arkose
Sedimentary Fabric:	Massive
Grain Size Range:	<0.01mm -0.97mm
Average Grain Size:	0.25mm
Compaction:	Moderate
Sorting:	Moderately well
Framework Grains:	
Major:	Plagioclase feldspar and monocrystalline quartz
Minor:	Chert, siltstone/sandstone fragments, mudstone fragments, volcanic rock fragments, potassium feldspar, polycrystalline quartz, and metamorphic rock fragments
Accessory:	Muscovite mica, glauconite, chamosite, and heavy minerals
Clay Content:	
Detrital Matrix:	Minor amounts of pore-filling detrital clays
Authigenic Clay:	Minor amounts of illite and smectite clay
Cement/Replacement:	Common amounts of calcite as replacement of unstable grains and minor amounts of calcite cement; rare amounts of feldspar overgrowths; and trace pyrite, siderite, and ankerite replacement
Porosity Types:	Minor amounts of micropores associated with clays, rare intragranular/moldic pores, and trace amounts of grain fracture pores
Porosity (RCA):	4.1%
Permeability (RCA):	0.005mD
Grain Density (RCA):	2.65gm/cc

*Folk classification based on visual estimate of sample constituents

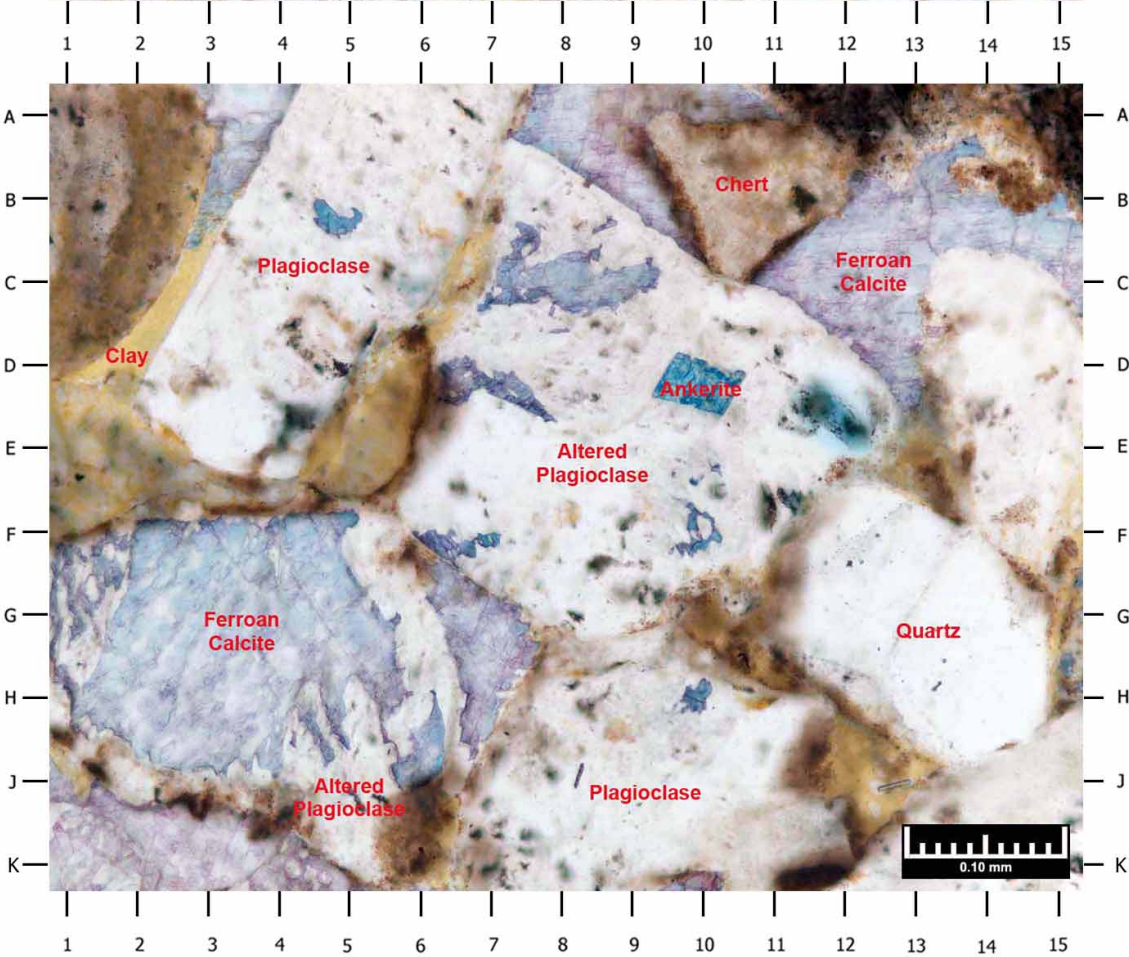
Magnification: A: 50X B: 200X

- A) Survey photomicrograph A depicts the massive fabric of this lithic arkose. Secondary intragranular pores (blue epoxy; DE12, F11.2) are associated with dissolution of unstable feldspar grains. Plagioclase feldspar (A8, CD14, HJ12.5) and monocrystalline quartz (BC13, CD8, J14) grains compose the majority of the detrital constituents.
- B) This photomicrograph provides a magnified view of the area near HJ6 in Photo A, highlighting partially Fe-calcite-replaced plagioclase (stained purple) feldspar grains (C5, E8, J5, J9). Possible smectite clay (yellow) occurs at D2. Authigenic ferroan calcite also occurs as grain-binding cement (BC11-15).



A

50X



B

200X

QGC- A BG Group Business
Magnetic-1
Upper Tinowon Sandstone
Queensland, Australia
Rotary Sidewall Core

Weatherford Labs File No.: AB-76967

THIN SECTION DESCRIPTION
SAMPLE DEPTH: 2800.2 METERS
SAMPLE NUMBER: SWC23

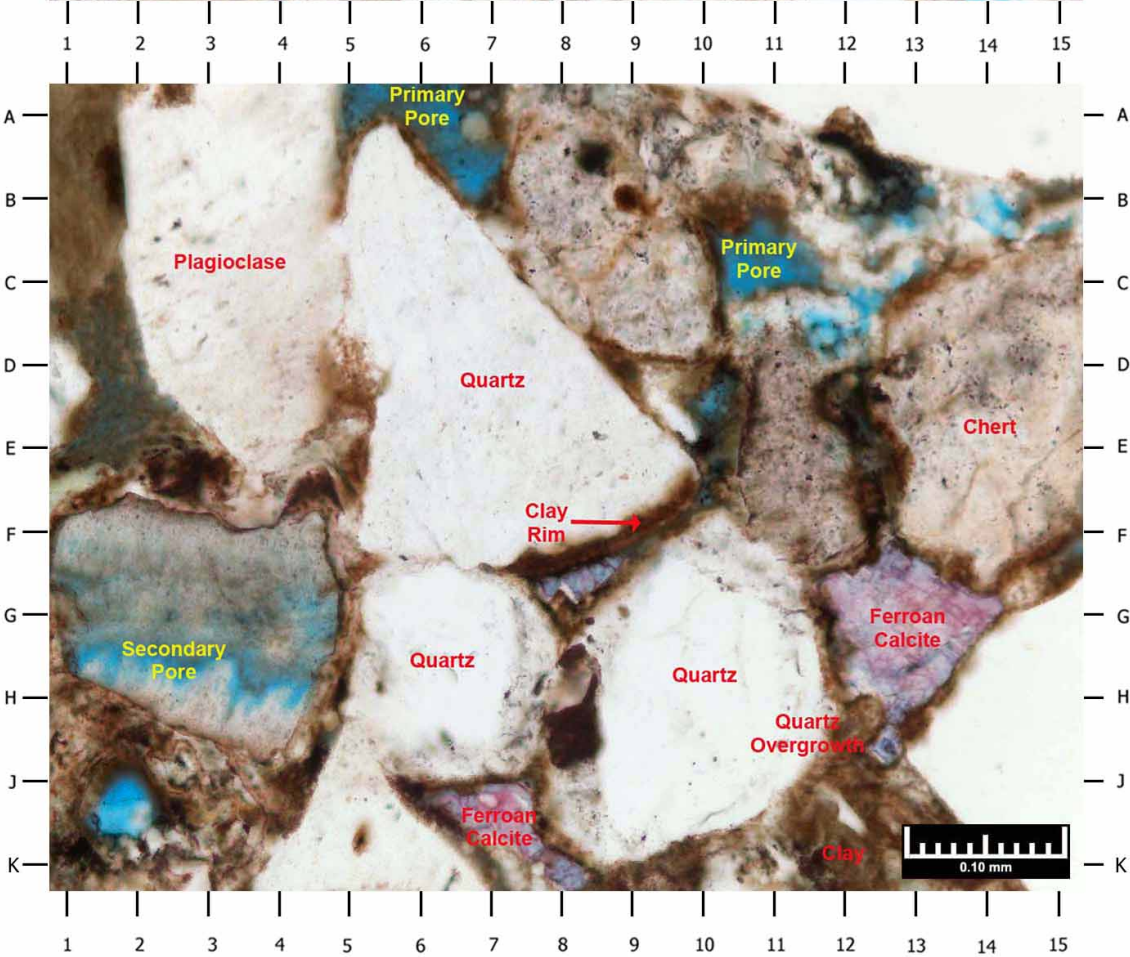
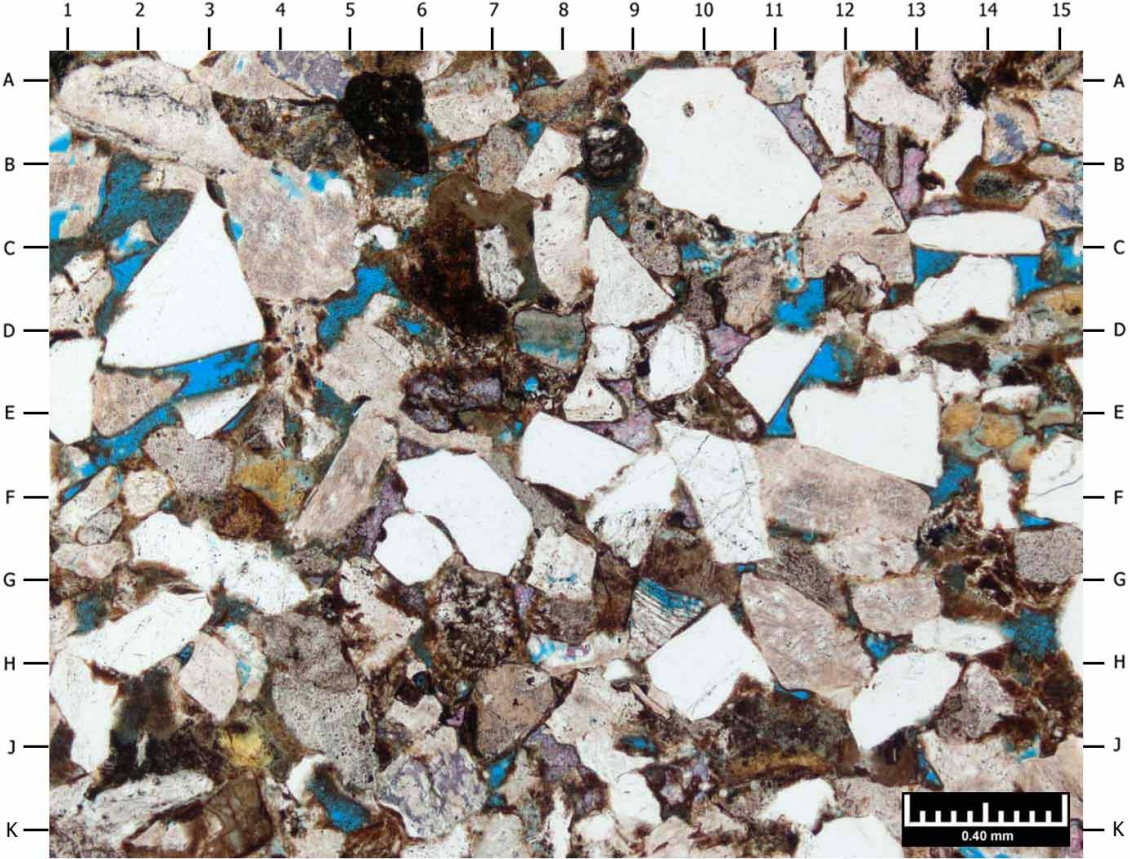
PLATE 3

Lithology*:	Feldspathic litharenite
Sedimentary Fabric:	Massive; burrowed
Grain Size Range:	<0.01mm-0.80mm
Average Grain Size:	0.40mm
Compaction:	Low to moderate
Sorting:	Moderate
Framework Grains:	
Major:	Monocrystalline quartz and plagioclase feldspar
Minor:	Chert, mudstone fragments, potassium feldspar, polycrystalline quartz, volcanic rock fragments, siltstone fragments, and metamorphic rock fragments
Accessory:	Muscovite mica, biotite mica, chamosite, organic material, and tourmaline
Clay Content:	
Detrital Matrix:	Minor amounts of detrital clays
Authigenic Clay:	Minor to trace amounts of illite and smectite clay
Cement/Replacement:	Minor amounts of quartz overgrowths; minor amounts of feldspar overgrowths; rare amounts of microquartz, siderite, Fe-calcite, and pyrite replacement
Porosity Types:	Intergranular pores occurring between detrital grains, intragranular pores associated with partially dissolved grains, micropores associated with clays and trace amounts of fracture pores
Porosity (RCA):	11.1%
Permeability (RCA):	0.033mD
Grain Density (RCA):	2.64gm/cc

*Folk classification based on visual estimate of sample constituents

Magnification: A: 50X B: 200X

- A) The detrital constituents in this cross-laminated, feldspathic litharenite include monocrystalline quartz grains (B10, CD2, H10) and plagioclase feldspar (C7.9, F4.5). Organic material (dark brown) lightly coats detrital grains. Primary intergranular pores (DE2.5, CD14.2, DE11.5) and secondary intragranular pores (BC4, G9.5, JK5) are observed.
- B) This photomicrograph provides a magnified view of the area near CD9 in Photo A. Ferroan calcite (stained purple; G12.5, FG8, JK7) cement and detrital clays (A-CD1.5, JK12) locally fills intergranular areas. Secondary pores (G3) are a result of partial dissolution of unstable grains.



QGC- A BG Group Business
Magnetic-1
Upper Tinowon Sandstone
Queensland, Australia
Rotary Sidewall Core

Weatherford Labs File No.: AB-76967

THIN SECTION DESCRIPTION
SAMPLE DEPTH: 2808.2 METERS
SAMPLE NUMBER: SWC21

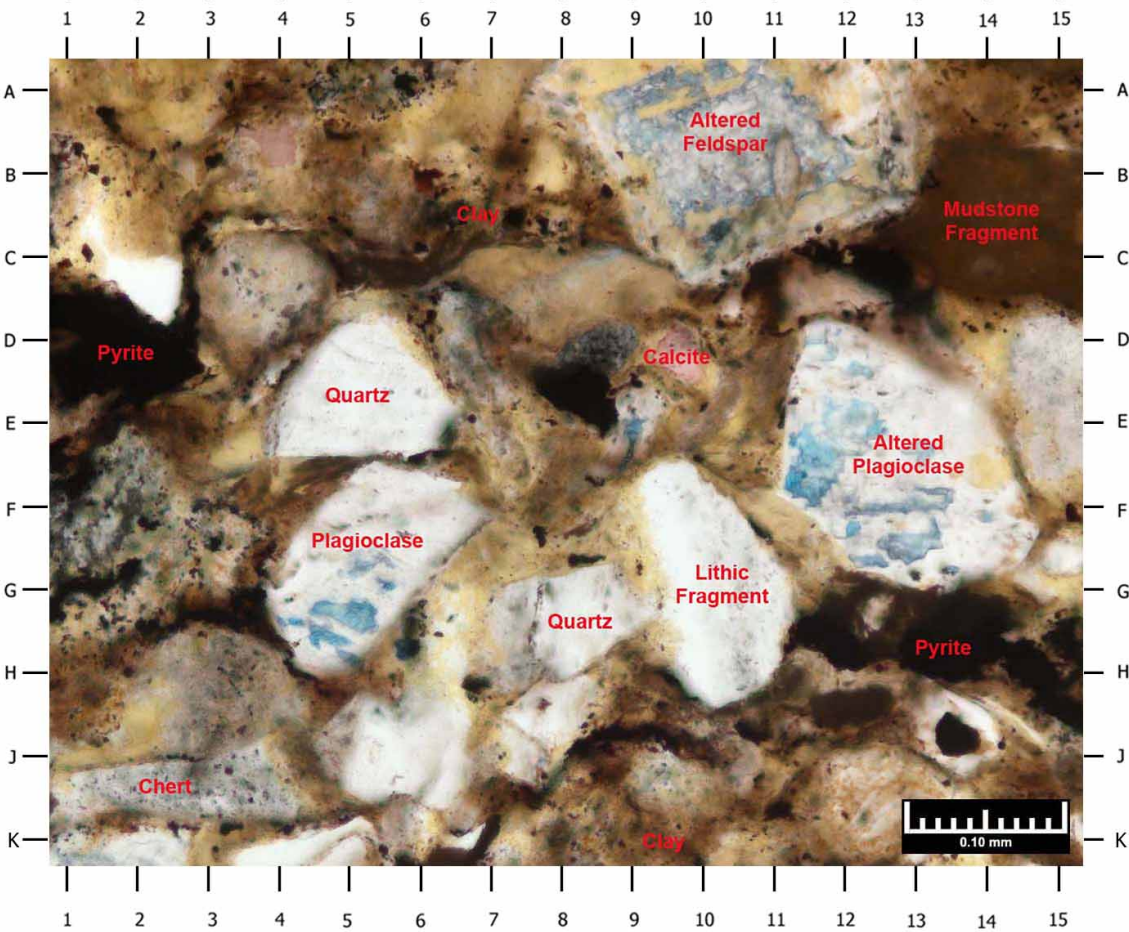
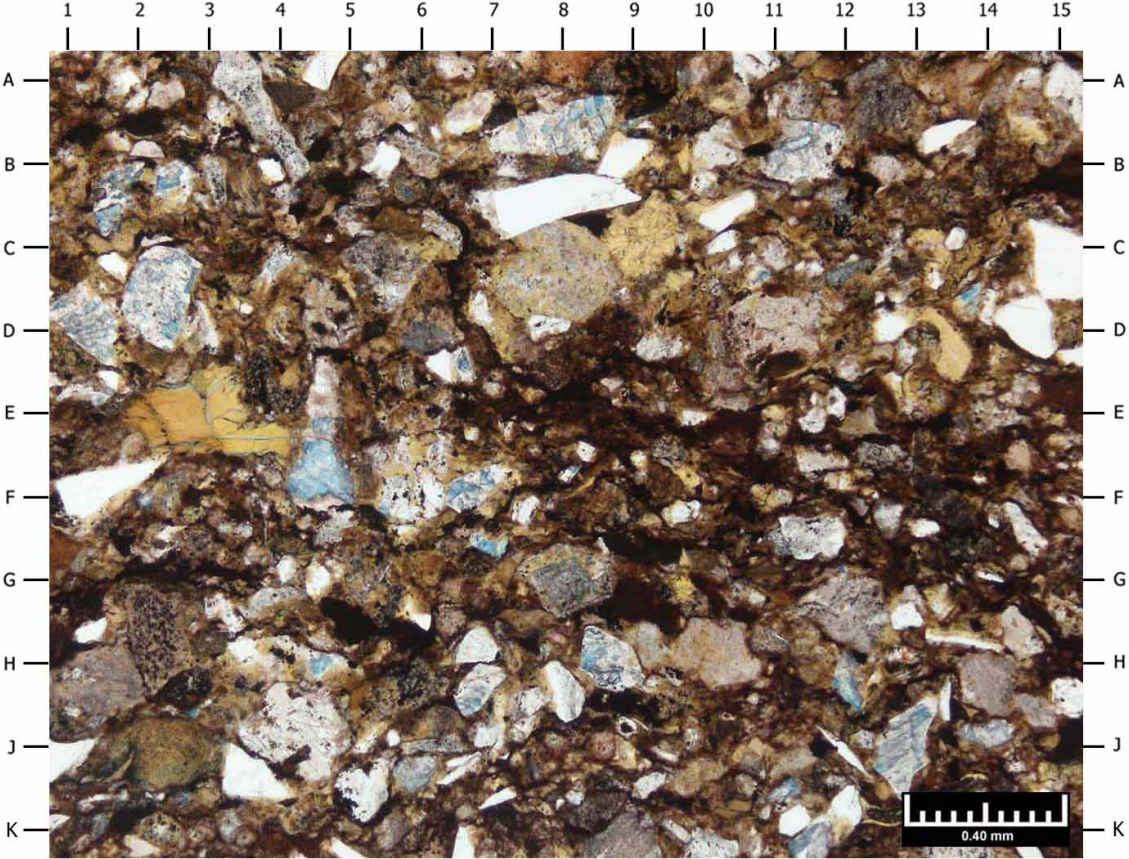
PLATE 4

Lithology*:	Feldspathic litharenite
Sedimentary Fabric:	Laminated; bioturbated
Grain Size Range:	<0.01mm-0.29mm
Average Grain Size:	0.18mm
Compaction:	Moderate to high
Sorting:	Poor
Framework Grains:	
Major:	Monocrystalline quartz and plagioclase feldspar
Minor:	Volcanic fragments, chert, metamorphic rock fragments, mudstone rock fragments, siltstone fragments, and polycrystalline quartz
Accessory:	Muscovite mica, biotite mica, organic material, fossil fragments, and heavy minerals
Clay Content:	
Detrital Matrix:	Common amounts of detrital clays
Authigenic Clay:	Minor amounts of chlorite clay
Cement/Replacement:	Minor amounts of calcite, Fe-calcite, chlorite, Fe-oxide, pyrite, and quartz overgrowths; rare siderite and kaolinite replacement; trace amounts of microquartz, Fe-dolomite, and feldspar overgrowths
Porosity Types:	Minor amounts of micropores associated with clays
Porosity (RCA):	5.0%
Permeability (RCA):	0.0035mD
Grain Density (RCA):	2.68gm/cc

*Folk classification based on visual estimate of sample constituents

Magnification: A: 50X B: 200X

- A) General photomicrograph A displays detrital quartz grains (BC7.5, C15, JK3.5), plagioclase feldspar (D1, J12.9, GH9), and altered volcanic fragments (AB14.5, CD4). Common amounts of detrital clays surround detrital grains, organic material is locally intermixed with the clays (black; CD6-GH15).
- B) This photomicrograph provides a magnified view of the area near H7.5 in Photo A, highlighting the pore-filling clay. Fe-dolomite (stained blue; AB10, GH5, EF12) partially replaces unstable plagioclase grains. Pyrite (black; D1.5, D7.5, CD12.5, GH13) occurs as replacement of probable organic material.



QGC- A BG Group Business
Magnetic-1
Upper Tinowon Sandstone
Queensland, Australia
Rotary Sidewall Core

Weatherford Labs File No.: AB-76967

THIN SECTION DESCRIPTION
SAMPLE DEPTH: 2818.6 METERS
SAMPLE NUMBER: SWC20

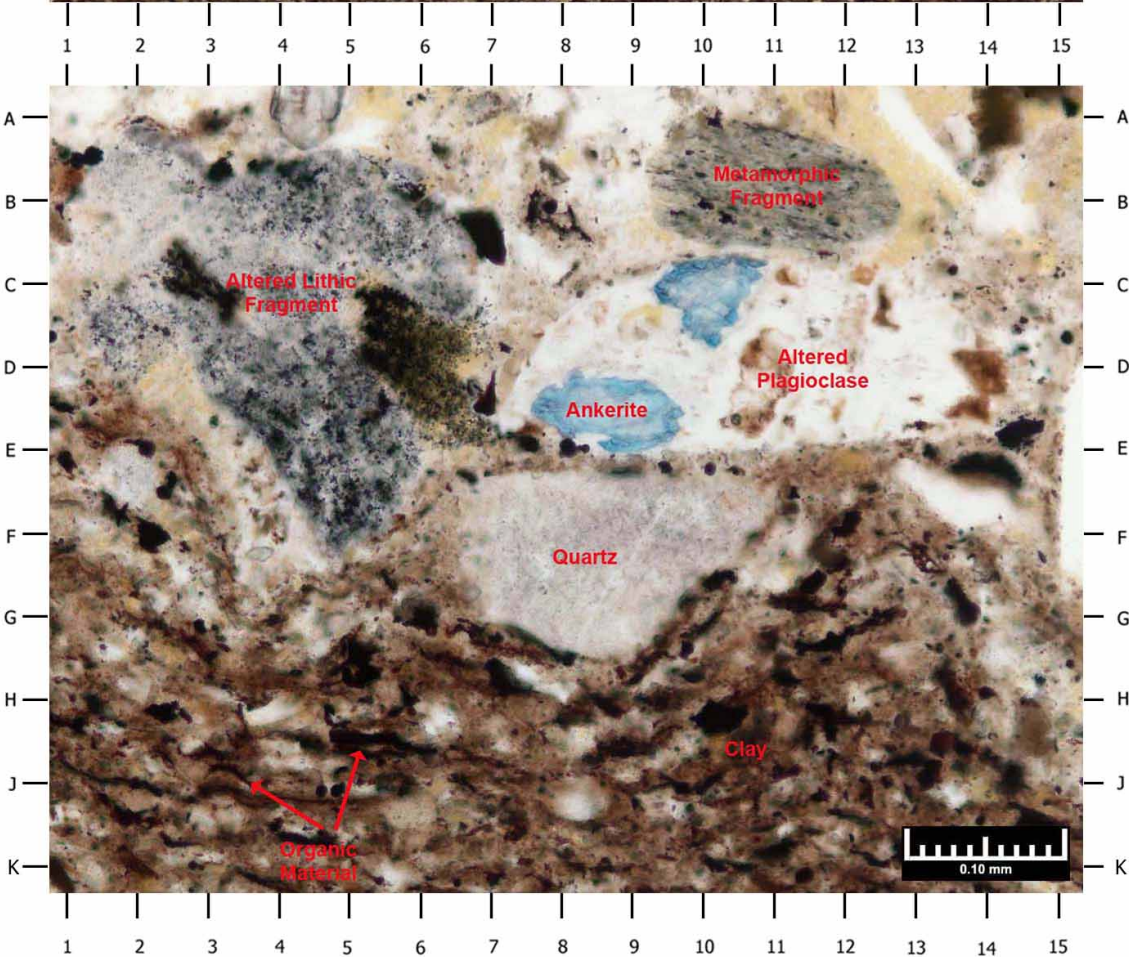
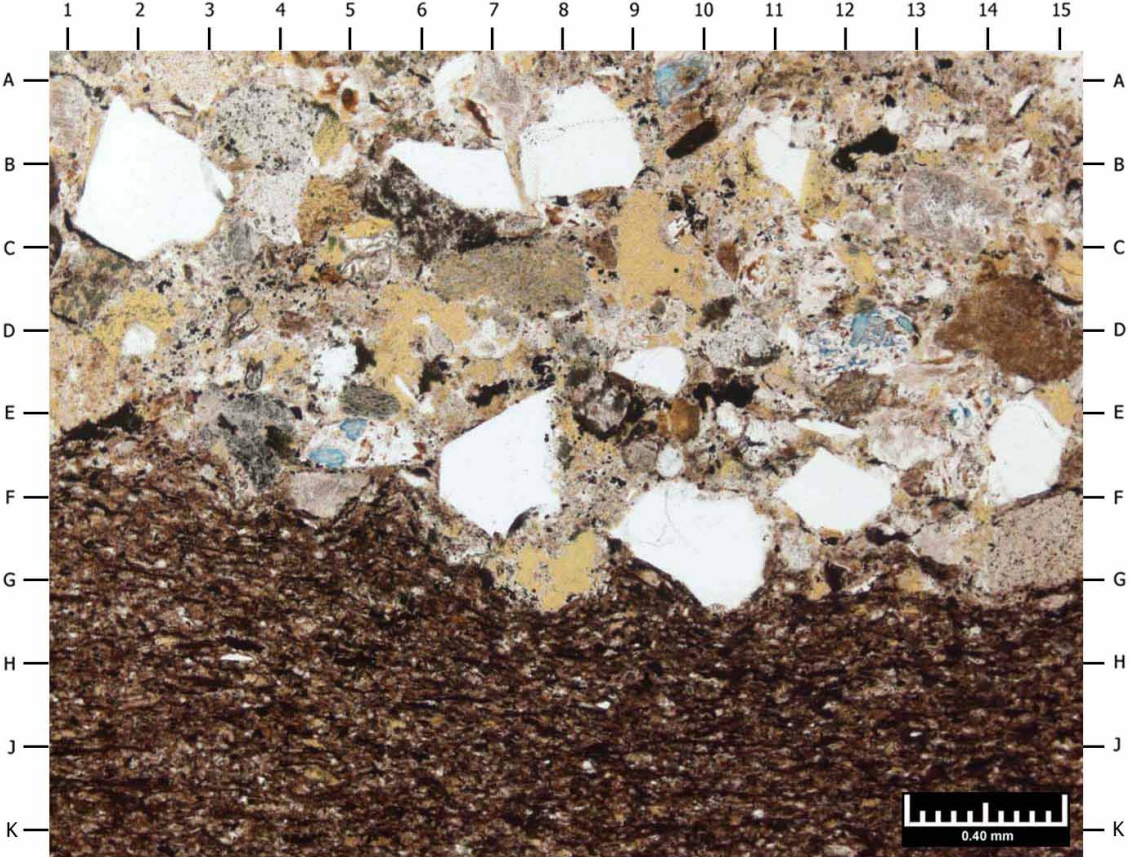
PLATE 5

Lithology*:	Feldspathic litharenite and organic argillaceous siltstone
Sedimentary Fabric:	Massive to laminated
Grain Size Range:	<0.01mm-0.72mm
Average Grain Size:	0.30mm/0.04mm
Compaction:	Moderate to high
Sorting:	Moderate to moderately well
Framework Grains:	
Major:	Monocrystalline quartz
Minor:	Chert, plagioclase feldspar, potassium feldspar, polycrystalline quartz, volcanic fragments, metamorphic rock fragments, siltstone fragments, organic material, and mudstone rock fragments
Accessory:	Muscovite mica, biotite mica, and zircon
Clay Content:	
Detrital Matrix:	Abundant amounts of detrital clays occur within the siltstone lithology
Authigenic Clay:	Minor amounts of illite/smectite and chlorite
Cement/Replacement:	Minor amounts of illite replacement; minor amounts of microquartz as cement and replacement, minor to rare amounts of calcite, Fe-calcite, pyrite and siderite replacement; trace amounts of calcite, quartz overgrowths, feldspar overgrowths, and pyrite
Porosity Types:	Micropores associated with clays are the only visible pore type present
Porosity (RCA):	3.7%
Permeability (RCA):	0.0015mD
Grain Density (RCA):	2.63gm/cc

*Folk classification based on visual estimate of sample constituents

Magnification: A: 50X B: 200X

- A) This low magnification photomicrograph provides a view of the contact between the feldspathic litharenite (AE1-AG15) and organic argillaceous siltstone (FK1-GK15). Angular, sand-sized grains of quartz (BC2, C8, EF7, FG9.5) occur within the feldspathic litharenite lithology, and very fine silt-sized grains of quartz occur within the siltstone lithology.
- B) This photomicrograph provides a magnified view of the area near FG4.5 in Photo A. Ferroan dolomite (ankerite; stained blue; C10, DE8.5) partially replaces an unstable plagioclase feldspar grain. Organic material and silt grains occur within clay-rich matrix in the siltstone portion.



QGC- A BG Group Business
Magnetic-1
Lorelle Sandstone
Queensland, Australia
Rotary Sidewall Core

Weatherford Labs File No.: AB-76967

THIN SECTION DESCRIPTION
SAMPLE DEPTH: 2931.4 METERS
SAMPLE NUMBER: SWC12

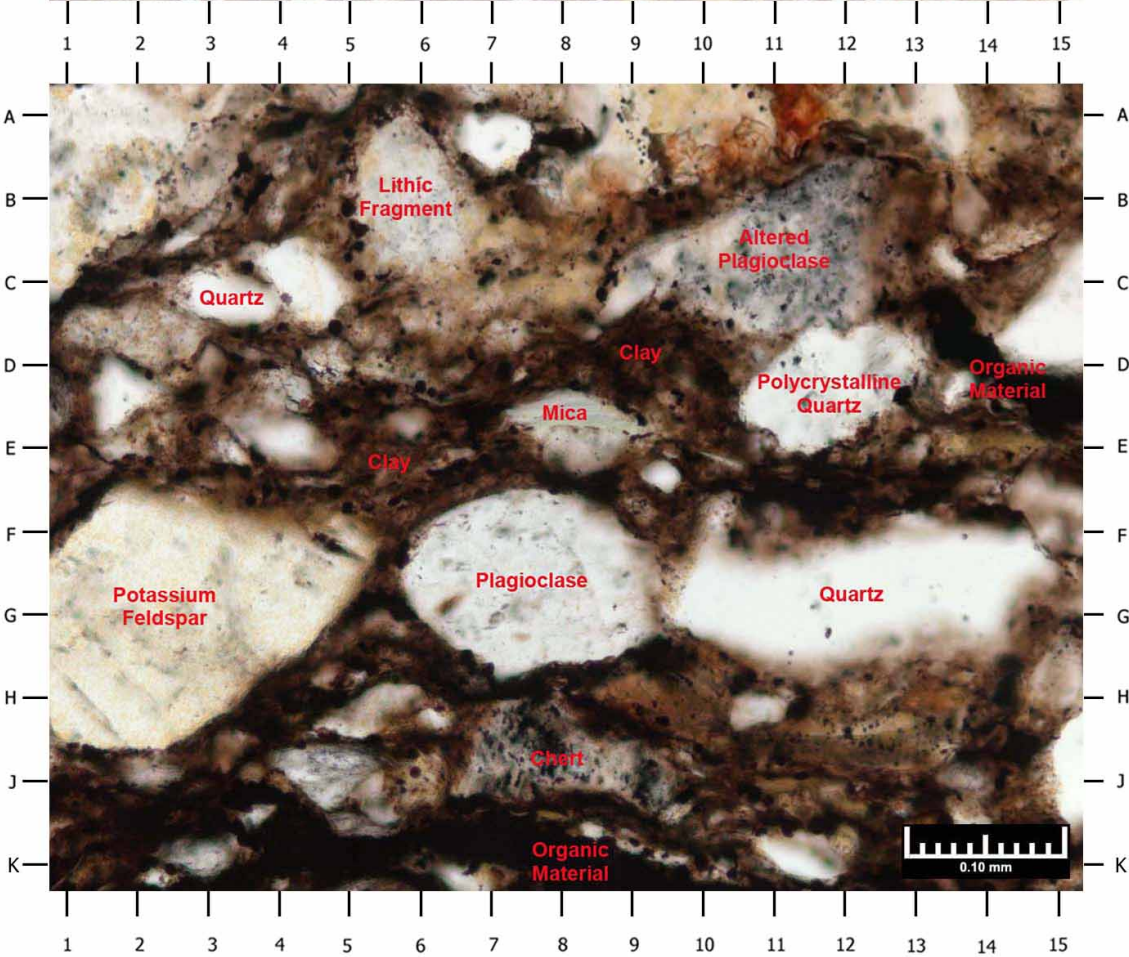
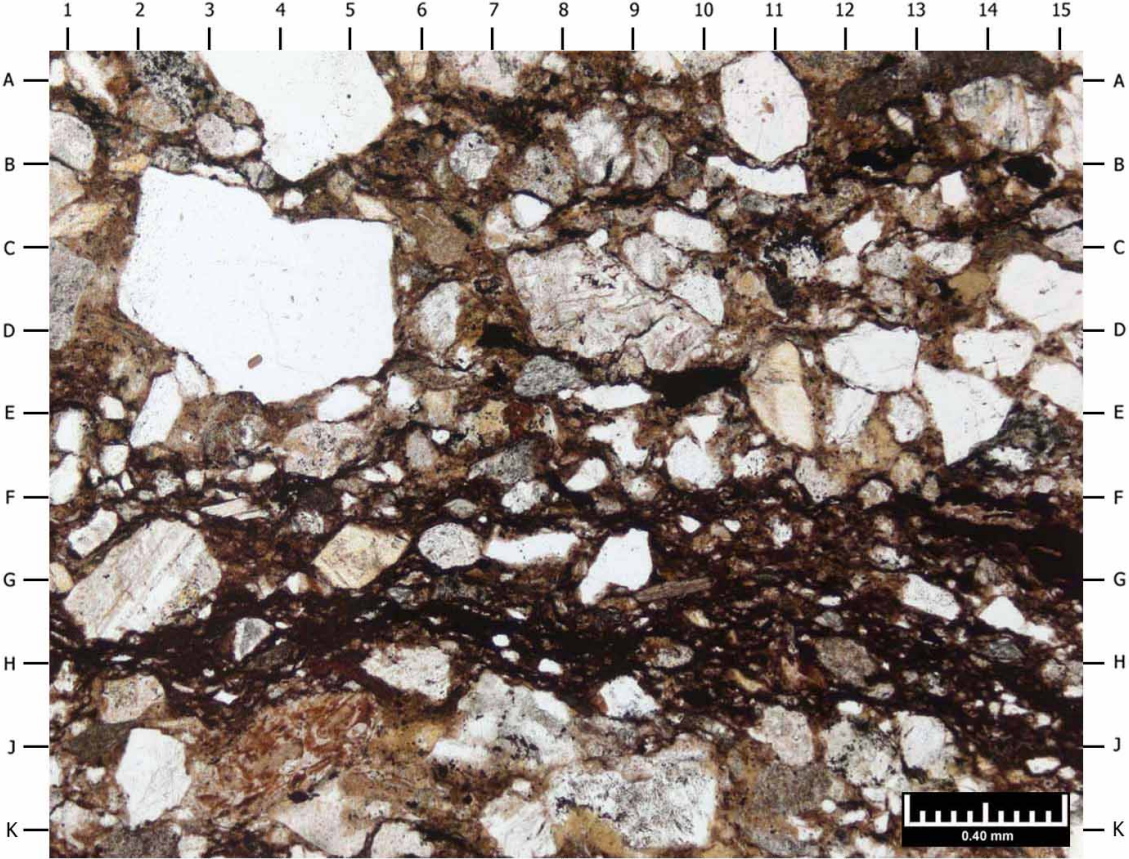
PLATE 6

Lithology*:	Feldspathic litharenite
Sedimentary Fabric:	Laminated; disturbed
Grain Size Range:	<0.01mm-4.02mm
Average Grain Size:	0.42mm
Compaction:	Moderate
Sorting:	Very poor
Framework Grains:	
Major:	Monocrystalline quartz
Minor:	Polycrystalline quartz, plagioclase feldspar, chert, volcanic rock fragments, metaquartzite, potassium feldspar, plutonic rock fragments, mudstone rock fragments, siltstone fragments, and metamorphic rock fragments
Accessory:	Muscovite mica, biotite mica, metamorphic chlorite, organic material, and tourmaline
Clay Content:	
Detrital Matrix:	Abundant amounts of detrital clays
Authigenic Clay:	Minor amounts of illite/smectite
Cement/Replacement:	Minor amounts of quartz overgrowths, calcite, Fe-dolomite, siderite, and microquartz; trace amounts of pyrite, Fe-oxides, bitumen, and feldspar overgrowths
Porosity Types:	Micropores associated with clays are dominant; trace amounts of intragranular pores associated with dissolved grains
Porosity (RCA):	2.0%
Permeability (RCA):	0.0025mD
Grain Density (RCA):	2.68gm/cc

*Folk classification based on visual estimate of sample constituents

Magnification: A: 50X B: 200X

- A) This laminated sublitharenite contains abundant amounts of detrital quartz grains (A4, JK2, CD14.5), with lesser amounts of plagioclase feldspar (G1.5, HJ11) and volcanic fragments (AB2, H12, J4). Laminations rich in organic material are observed (black; GH1-15).
- B) This photomicrograph provides a magnified view of the area near FG6.5 in Photo A. Detrital quartz (CD2.5, C15, FG12), altered plagioclase (BC10, FG7) and potassium feldspar grains (F2) are surrounded by detrital clays intermixed with organic material. Pyrite (black specks) occurs as replacement of organic material.



QGC- A BG Group Business
Magnetic-1
Lorelle Sandstone
Queensland, Australia
Rotary Sidewall Core

Weatherford Labs File No.: AB-76967

THIN SECTION DESCRIPTION
SAMPLE DEPTH: 2933.8 METERS
SAMPLE NUMBER: SWC11

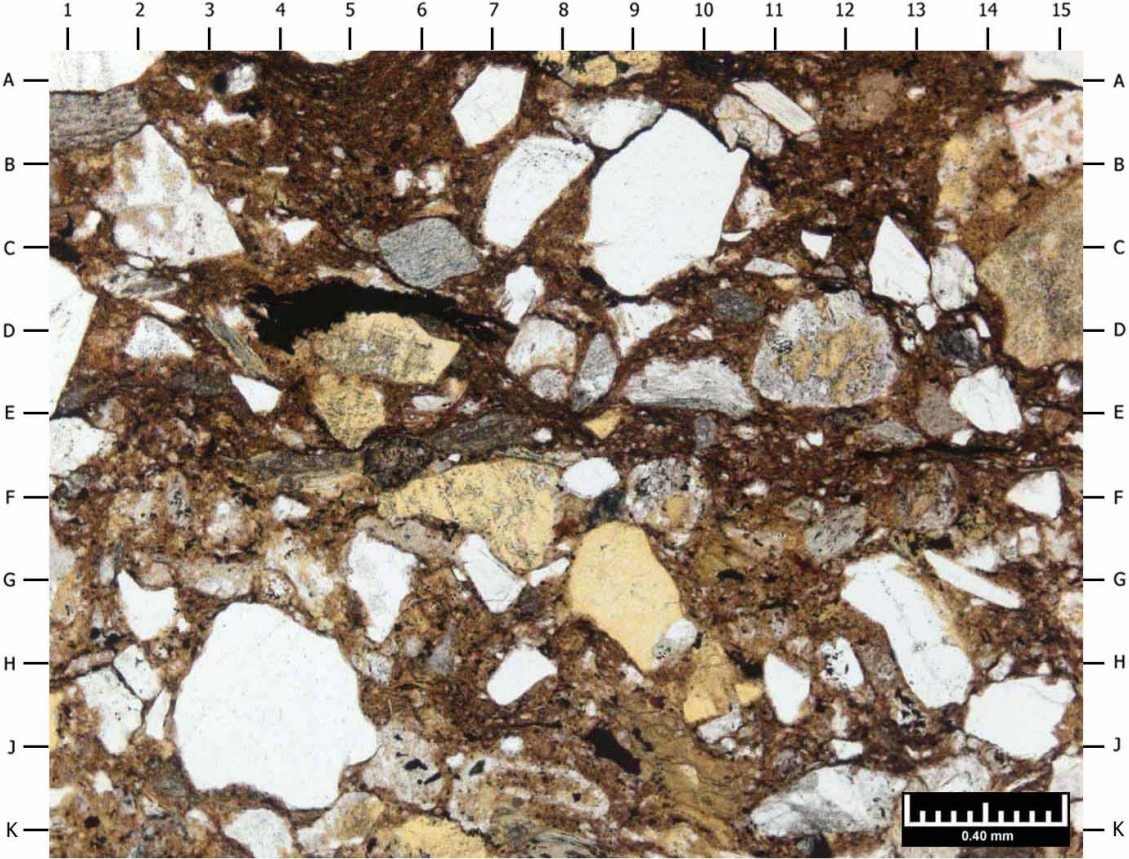
PLATE 7

Lithology*:	Feldspathic litharenite
Sedimentary Fabric:	Laminated; disturbed
Grain Size Range:	<0.01mm-3.91mm
Average Grain Size:	0.34mm
Compaction:	Moderate
Sorting:	Poor
Framework Grains:	
Major:	Monocrystalline quartz
Minor:	Mudstone fragments, polycrystalline quartz, chert, plagioclase feldspar, volcanic fragments, metamorphic rock fragments, and siltstone fragments
Accessory:	Muscovite mica, biotite mica, chamosite, metamorphic chlorite, organic material, and intrabasinal clasts
Clay Content:	
Detrital Matrix:	Rare amounts of detrital clays
Authigenic Clay:	Minor amounts of chlorite clay
Cement/Replacement:	Minor amounts of quartz overgrowths, calcite, chlorite; rare to trace amounts of feldspar overgrowths, Fe-oxide, and pyrite
Porosity Types:	Micropores associated with clays, secondary intragranular pores associated with leached grains, and primary intergranular pores
Porosity (RCA):	11.4%
Permeability (RCA):	0.18mD
Grain Density (RCA):	2.74gm/cc

*Folk classification based on visual estimate of sample constituents

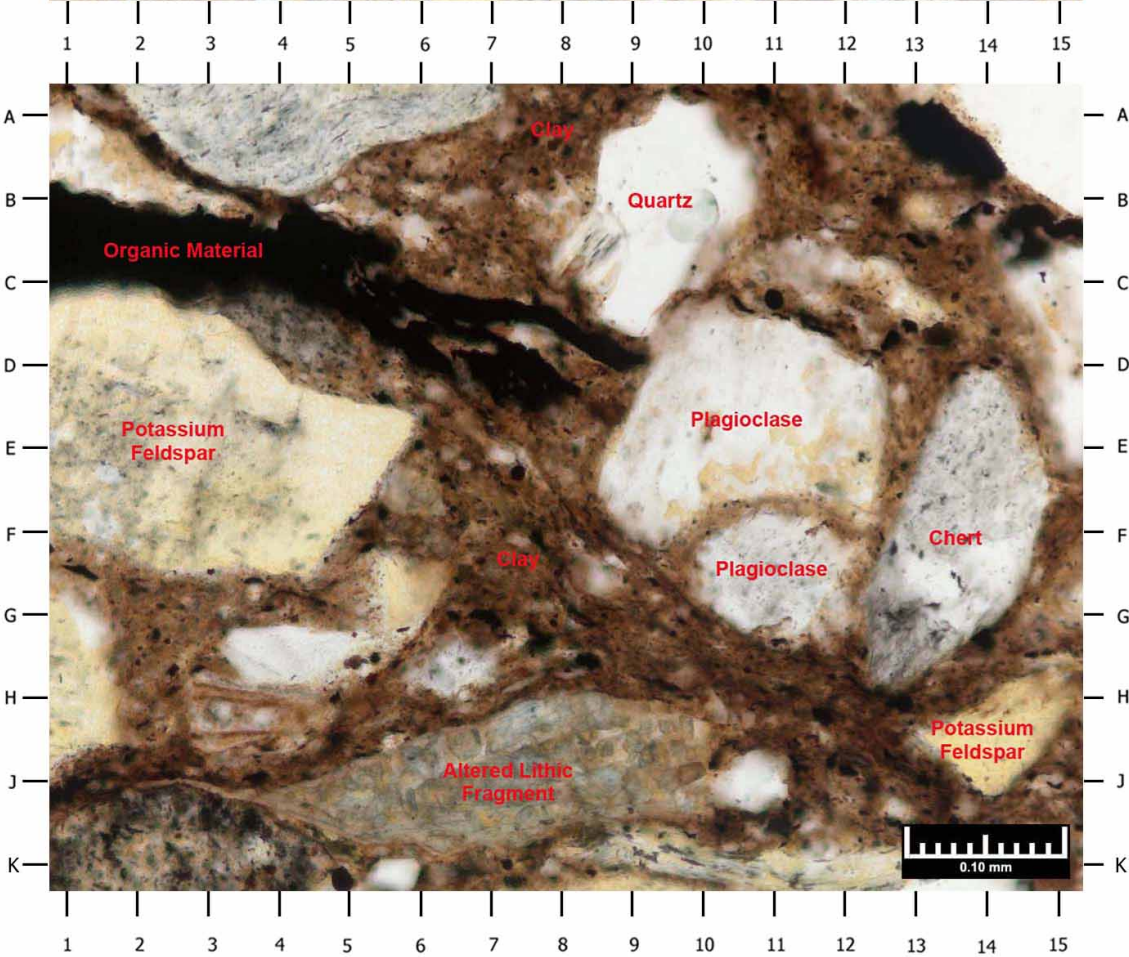
Magnification: A: 50X B: 200X

- A) This low magnification photomicrograph illustrates a general overview of this moderately sorted litharenite. Volcanic rock fragments (C12, DE1.2, J10), mudstone fragments (AB1.2, H8), and monocrystalline quartz (B2, DE5.5) are the main detrital grain types observed. Quartz overgrowths (BC1.8, H5, H6.1) precipitate on host detrital grains. Secondary intragranular pores (blue epoxy; CD12, G7, J12.9), associated with dissolution, and primary intergranular pores (A13, GH8) are present.
- B) This photomicrograph provides a magnified view of the area near D7.2 in Photo A. Pyrite replaces unstable material (black; AB11-13). Intergranular pores are locally filled with chlorite/illite clays; however, these clays do contain micropores.



A

50X



B

200X

QGC- A BG Group Business
Magnetic-1
Lorelle Sandstone Formation
Queensland, Australia
Conventional Core

Weatherford Labs File No.: AB-76967

THIN SECTION DESCRIPTION
SAMPLE DEPTH: 2936.06 METERS
SAMPLE NUMBER: 1-1P DS

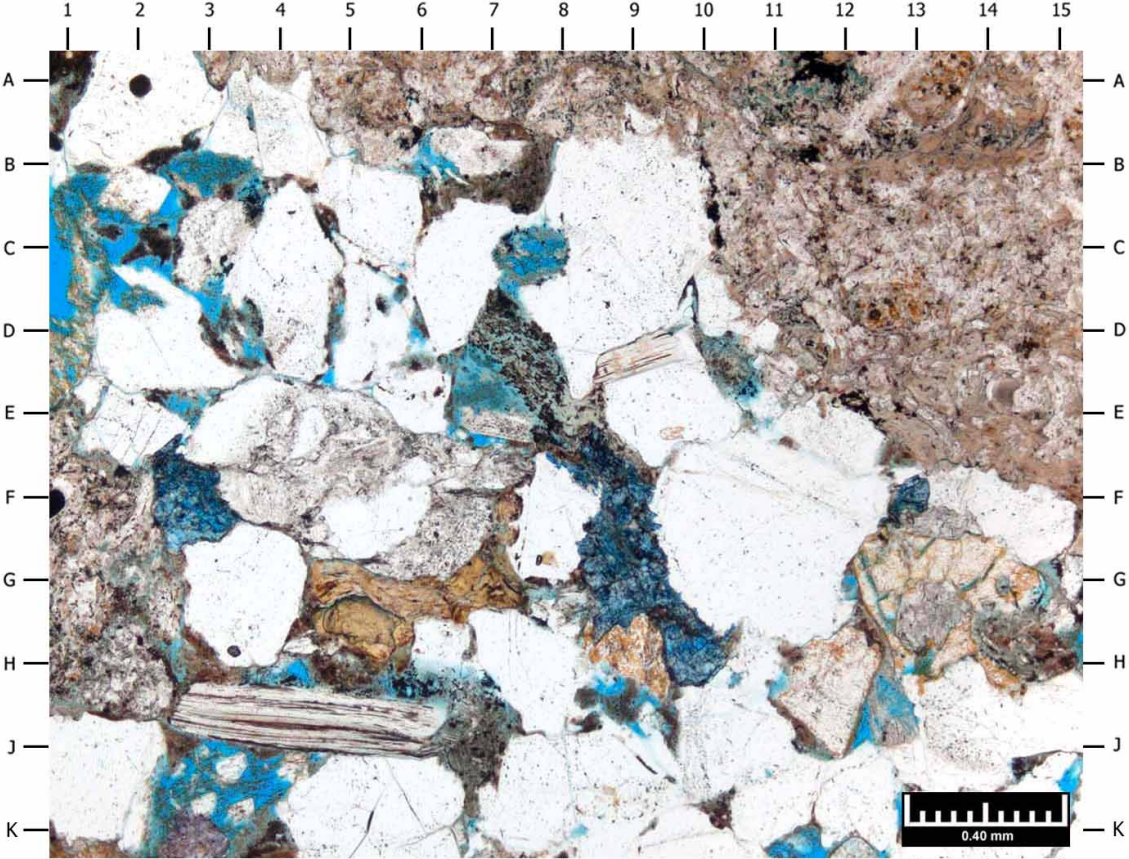
PLATE 8

Lithology*:	Litharenite
Sedimentary Fabric:	Massive
Grain Size Range:	<0.01mm-8.78mm
Average Grain Size:	1.52mm
Compaction:	Low
Sorting:	Very poor
Framework Grains:	
Major:	Monocrystalline quartz
Minor:	Chert, metamorphic rock fragments, conglomerate rock fragments, polycrystalline quartz, potassium feldspar, mudstone fragments, volcanic fragments, plagioclase feldspar, siltstone fragments, and metaquartzite
Accessory:	Muscovite mica, biotite mica, metamorphic chlorite and tourmaline
Clay Content:	
Detrital Matrix:	Rare amounts of pore-filling detrital clays
Authigenic Clay:	Rare amounts of illite/smectite
Cement/Replacement:	Minor amounts of quartz overgrowths, chlorite, microquartz, Ti-oxide, rare to trace amounts of feldspar overgrowths, siderite, ankerite, and pyrite
Porosity Types:	Secondary intragranular pores associated with leached grains, micropores associated with clays and leached grains, and rare primary intergranular pores
Porosity (RCA):	10.7%
Permeability (RCA):	0.37mD
Grain Density (RCA):	2.68gm/cc

*Folk classification based on visual estimate of sample constituents

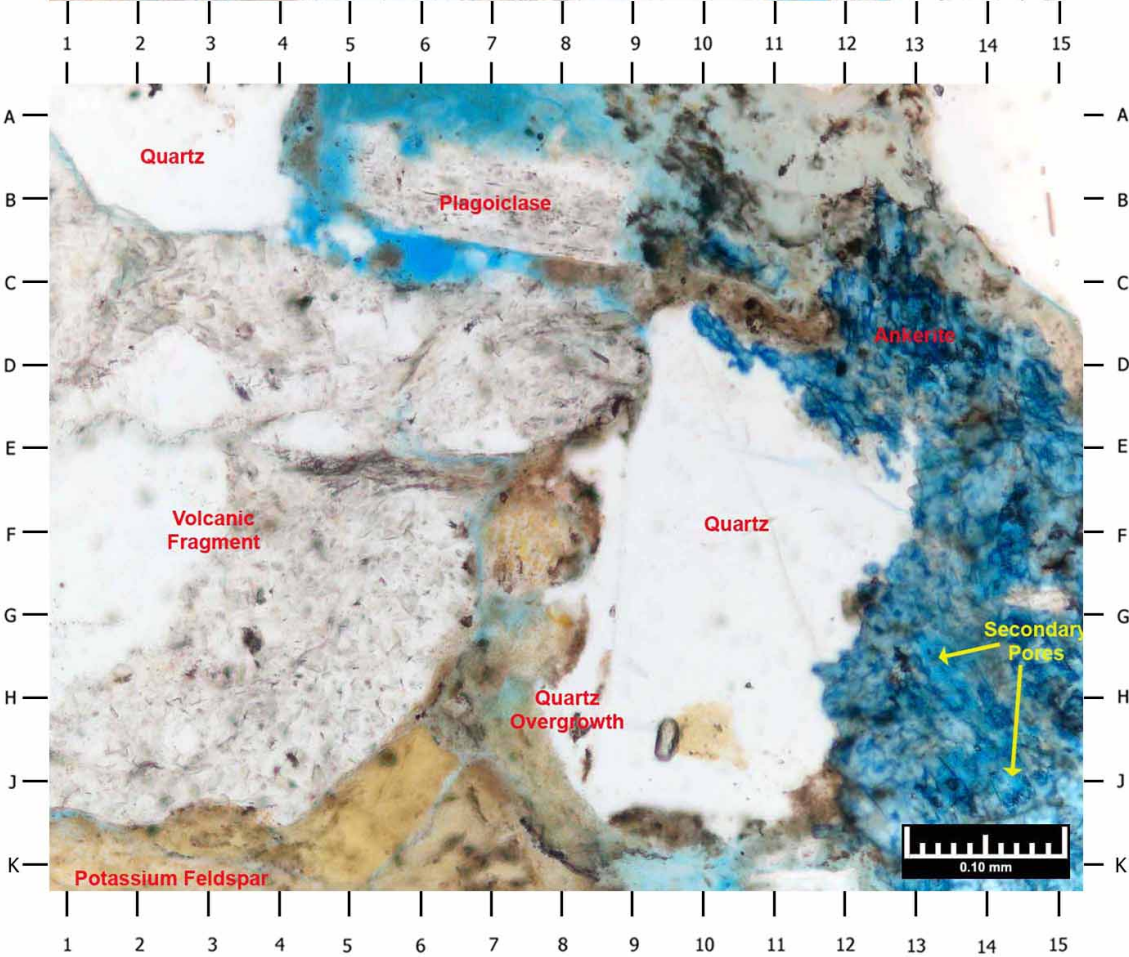
Magnification: A: 50X B: 200X

- A) This photomicrograph provides a general overview of this massive litharenite. Monocrystalline quartz (D2, CD6.5) is abundant, with common amounts of chert (JK1.5, HJ13.1). Muscovite mica (HJ2.5-6) and a large lithic fragment (A3-F5) are observed. Secondary intragranular pores (blue epoxy; BC2.9, JK3, HJ12.5) occur within partially dissolved grains. Primary pores (DE4.1, H4.2) occurring between detrital grains are also present.
- B) This photomicrograph provides a magnified view of the area near F7 in Photo A. Authigenic quartz overgrowth cement (E8-J8.2) precipitates on host detrital grains. Ankerite (stained blue; B12.5-K13) occurs as replacement of less stable material. A volcanic rock fragment occurs at F3.



A

50X



B

200X

QGC- A BG Group Business
Magnetic-1
Lorelle Sandstone Formation
Queensland, Australia
Conventional Core

Weatherford Labs File No.: AB-76967

THIN SECTION DESCRIPTION
SAMPLE DEPTH: 2938.06 METERS
SAMPLE NUMBER: 1-3P DS

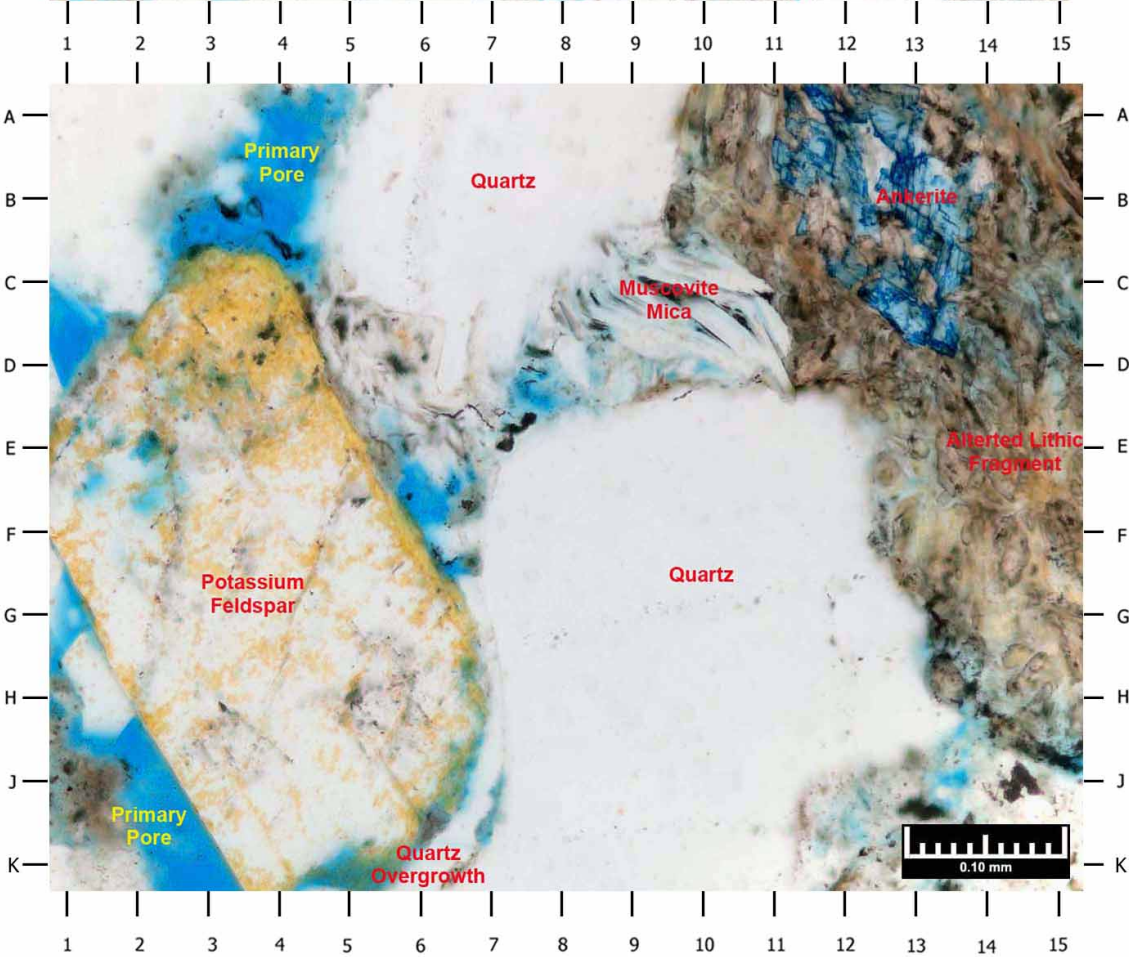
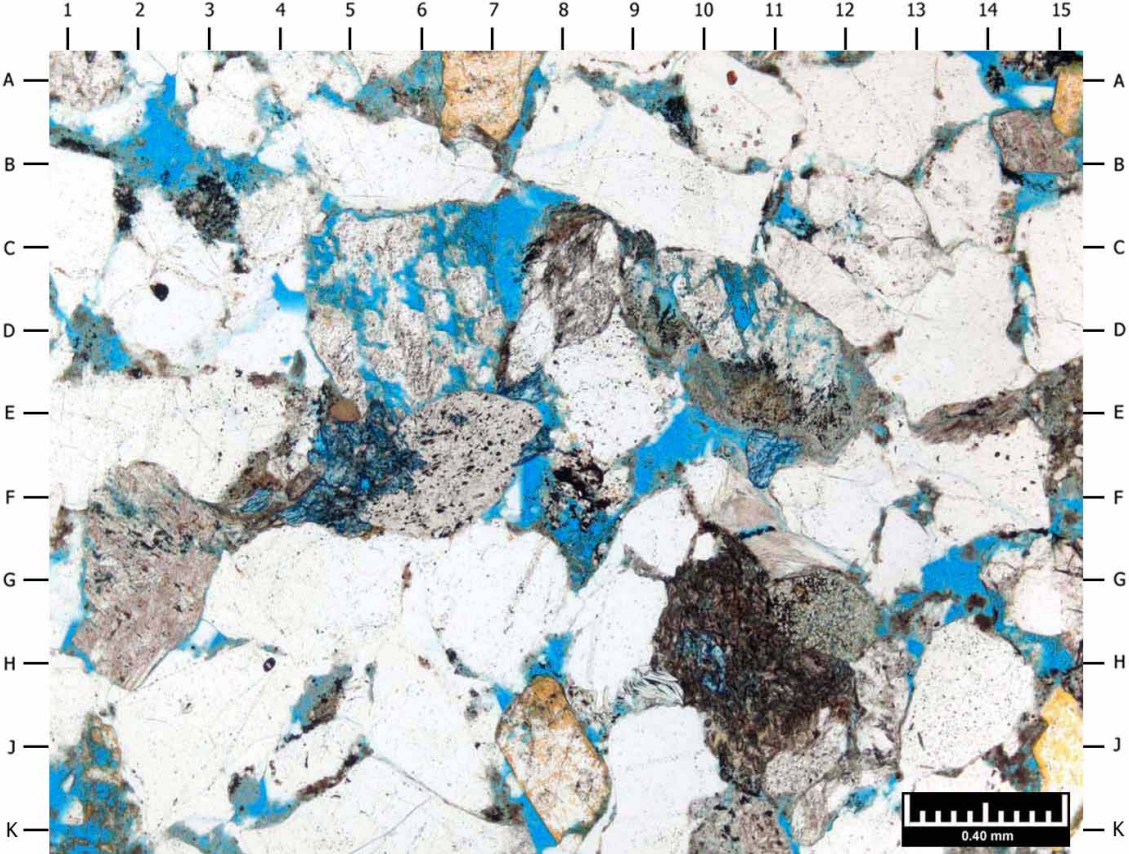
PLATE 9

Lithology*: Lithic arkose to feldspathic litharenite
Sedimentary Fabric: Massive
Particle Size Range: <0.01mm-2.93mm
Average Grain Size: 0.99
Visual Sorting: Poor
Compaction: Low to moderate
Detrital Grains / Allochems:
 Major: Monocrystalline quartz
 Minor: Polycrystalline quartz, potassium feldspar, plagioclase feldspar, volcanic rock fragments, metamorphic rock fragments, chert, and siltstone fragments
 Accessory: Muscovite mica, biotite mica, metaquartzite, tourmaline, and zircon
Matrix: Trace amounts of pore-filling matrix material
Cement / Replacement: Minor amounts of quartz overgrowth cement; Minor amounts of feldspar replacement; trace amounts of pyrite and Ti-oxide occur as a replacement of detrital clays; rare authigenic illitic and chloritic clay replaces dissolved grains and matrix material; and rare replacement of partially dissolved grains by Fe-calcite
Porosity Types: Secondary intragranular pores associated with leached grains, micropores associated with clays and leached grains, minor primary intergranular pores, and trace grain fracture pores
Porosity (RCA): 11.4%
Permeability (RCA): 0.85mD
Grain Density (RCA): 2.66gm/cc

*Folk classification based on visual estimate of sample constituents

Magnification: A: 50X B: 200X

- A) This photomicrograph provides a general overview of this massive lithic arkose to feldspathic litharenite. Detrital quartz grains (BC1, GH4, D13) are abundant with lesser amounts of volcanic lithic fragments (G2, H11). Authigenic quartz overgrowths (H2.5, K8) precipitate on host detrital grains. Primary intergranular pores (blue epoxy; B2.1, G13.5, JK7.5), and secondary dissolution pores (blue epoxy; CD5.5, CD10.1) are readily observed.
- C) This photomicrograph provides a detailed view of the area near J9 in Photo A. Ankerite occurs as replacement of an unstable lithic fragment (stained blue; B12.5). Muscovite mica (CD9.5) is slightly deformed between two quartz grains. A potassium feldspar grain (stained yellow; F3) is observed.



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Lorelle Sandstone Formation
Queensland, Australia
Conventional Core

Weatherford Labs File No.: AB-76967

THIN SECTION DESCRIPTION
SAMPLE DEPTH: 2940.05 METERS
SAMPLE NUMBER: 1-5P DS

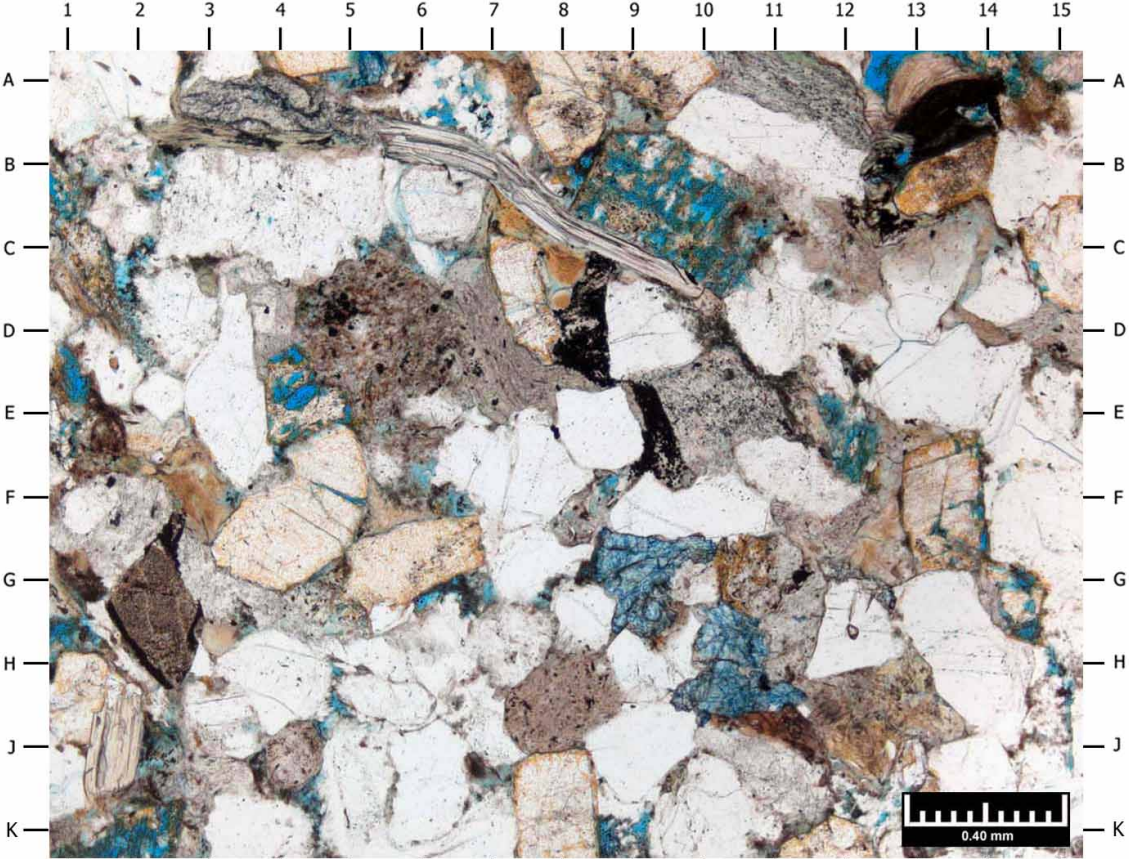
PLATE 10

Lithology*:	Feldspathic litharenite
Sedimentary Fabric:	Massive
Grain Size Range:	<0.01mm-2.62mm
Average Grain Size:	0.58mm
Compaction:	Moderate
Sorting:	Moderate
Framework Grains:	
Major:	Monocrystalline quartz
Minor:	Potassium feldspar, chert, plagioclase feldspar, volcanic fragments, metamorphic rock fragments, mudstone rock fragments, siltstone fragments, and polycrystalline quartz
Accessory:	Muscovite mica, biotite mica, metaquartzite, metamorphic chlorite, zircon, and carbonaceous (organic) material
Clay Content:	
Detrital Matrix:	Rare amounts of detrital clays
Authigenic Clay:	Minor amounts of illite/smectite clays
Cement/Replacement:	Minor amounts of illite/smectite replacement and cement; minor amounts of quartz and feldspar overgrowths; rare amounts of microquartz, Ti-oxide, ankerite, and siderite; and trace amounts of Ti-oxide, and pyrite
Porosity Types:	Secondary intragranular pores associated with leached grains, micropores associated with clays and leached grains, minor primary intergranular pores, and trace grain fracture pores
Porosity (RCA):	8.2%
Permeability (RCA):	0.094mD
Grain Density (RCA):	2.69gm/cc

*Folk classification based on visual estimate of sample constituents

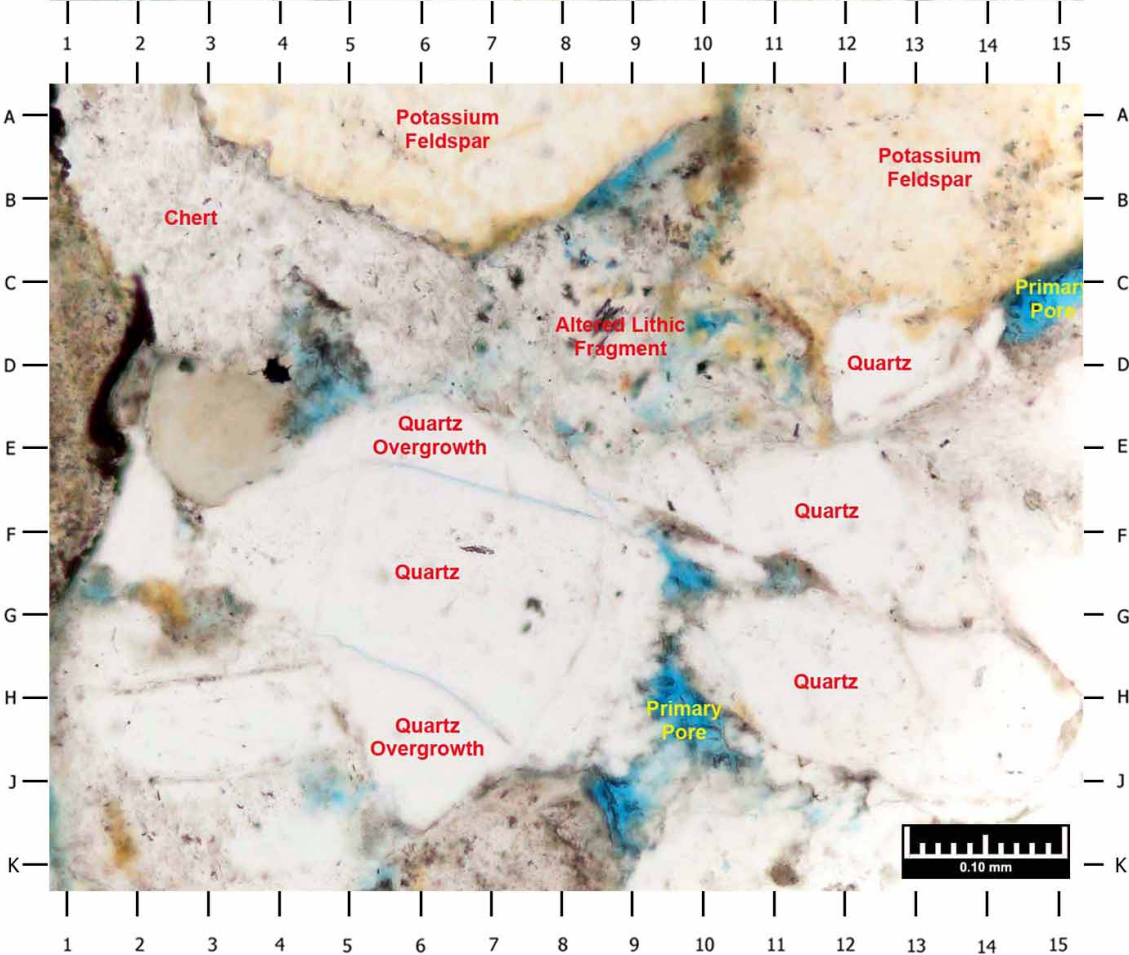
Magnification: A: 50X B: 200X

- A) This general photomicrograph illustrates the moderately sorted, massive fabric of this feldspathic litharenite. Quartz (E3, F9.5, HJ9) and potassium feldspar (stained yellow; FG4, FG6, JK8) are the most common detrital constituents. Other detrital grains include muscovite mica (B5-CD10), altered lithic fragments (BC9, D5, HJ12.5), organic fragments (black; AB13.5), and Fe-dolomite replaced lithic fragments (stained blue; G9, H10).
- B) This photomicrograph provides a magnified view of the area near H4.5 in Photo A. Well-developed quartz overgrowth cement locally fills intergranular areas (DE6, FG1.2, HJ6). Secondary dissolution pores (blue epoxy) are associated with an altered lithic fragment (C10).



A

50X



B

200X

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Lorelle Sandstone Formation
Queensland, Australia
Conventional Core

Weatherford Labs File No.: AB-76967

THIN SECTION DESCRIPTION
SAMPLE DEPTH: 2942.06 METERS
SAMPLE NUMBER: 1-8P DS

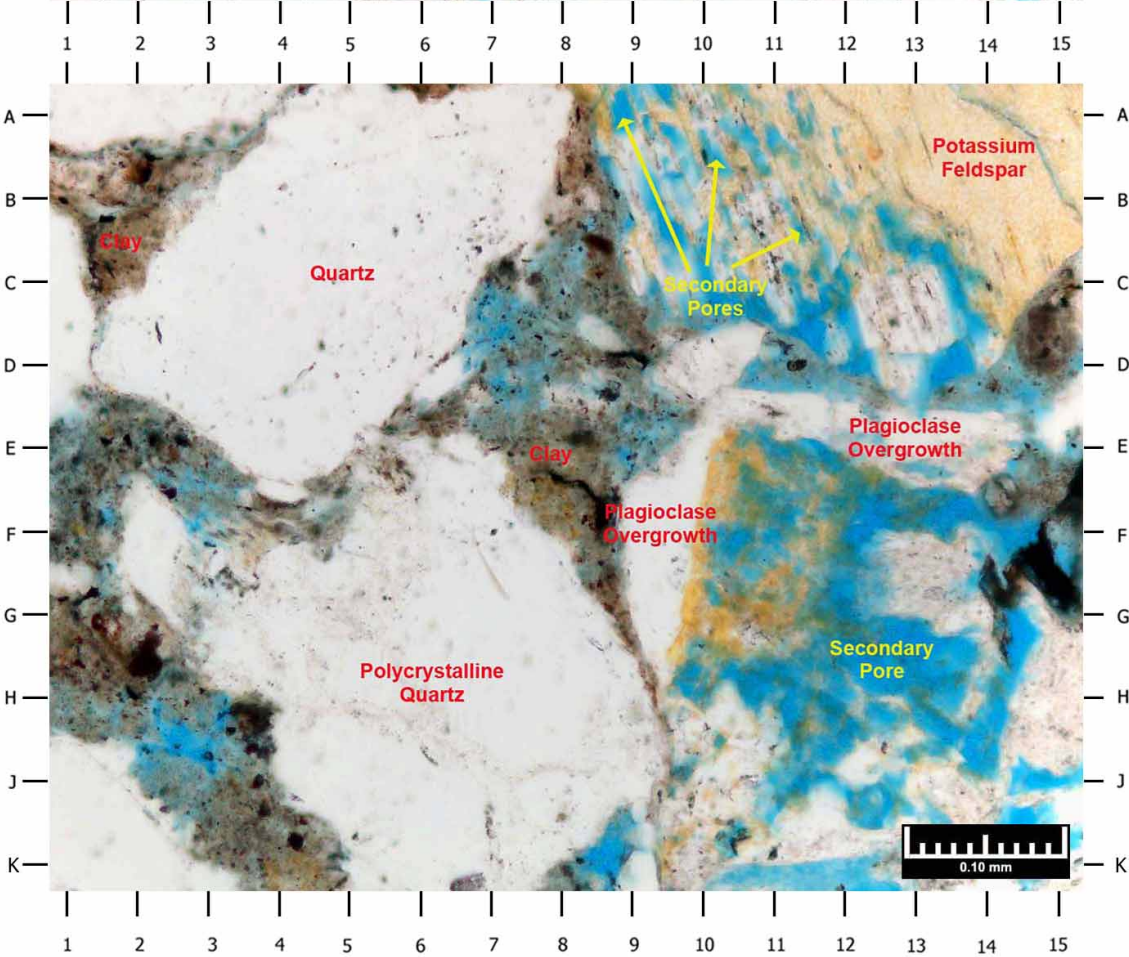
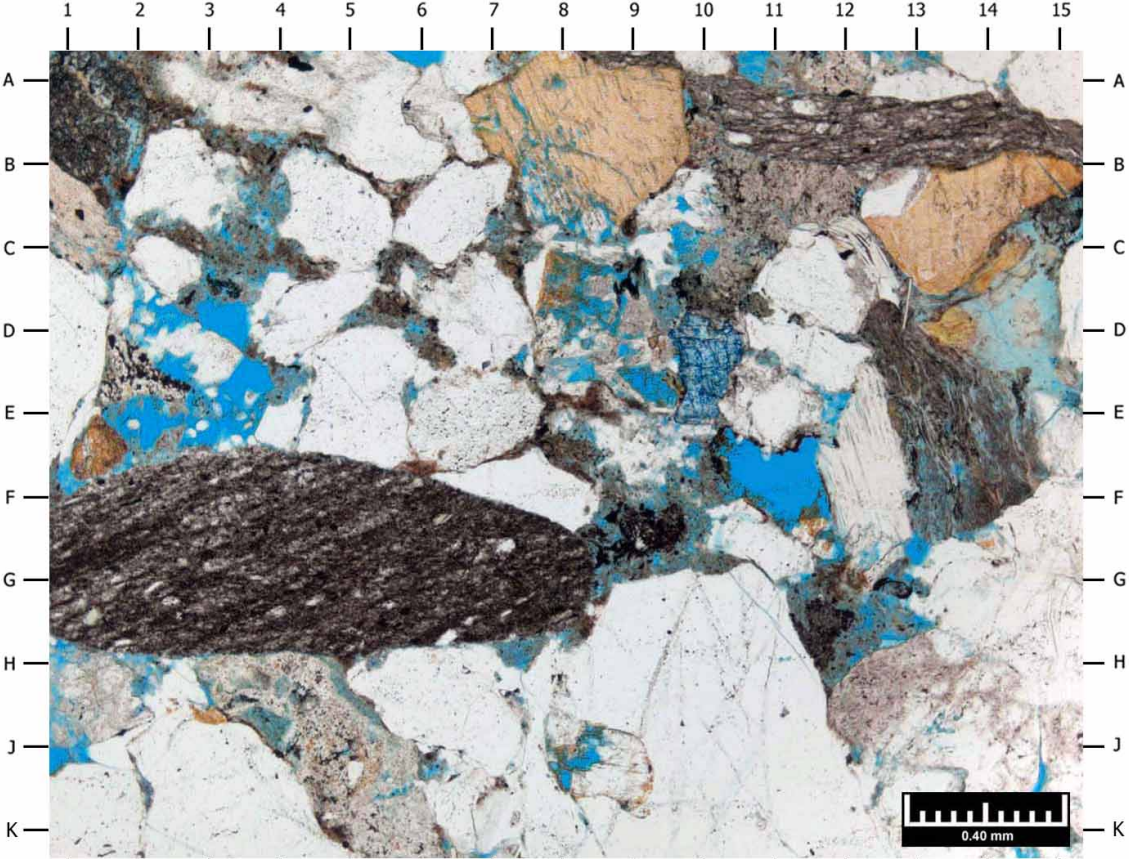
PLATE 11

Lithology*:	Feldspathic litharenite
Sedimentary Fabric:	Massive
Grain Size Range:	<0.01mm-2.85mm
Average Grain Size:	0.78mm
Compaction:	Moderate
Sorting:	Poor
Framework Grains:	
Major:	Monocrystalline quartz
Minor:	Potassium feldspar, plagioclase feldspar, chert, volcanic fragments, metamorphic rock fragments, mudstone rock fragments, siltstone fragments, and polycrystalline quartz
Accessory:	Muscovite mica, biotite mica, metamorphic chlorite, and tourmaline
Clay Content:	
Detrital Matrix:	Rare amounts of pore-filling detrital clays
Authigenic Clay:	Minor to trace amounts of illite/smectite clays
Cement/Replacement:	Minor amounts of illite/smectite replacement; minor to rare amounts of feldspar overgrowths, quartz overgrowths, calcite, Fe-calcite, ankerite, siderite, Ti-oxide, and pyrite
Porosity Types:	Secondary intragranular pores associated with leached grains, micropores associated with clays and leached grains, and minor primary intergranular pores
Porosity (RCA):	12.2%
Permeability (RCA):	0.59mD
Grain Density (RCA):	2.66gm/cc

*Folk classification based on visual estimate of sample constituents

Magnification: A: 50X B: 200X

- A) Survey photomicrograph A depicts the massive fabric of this feldspathic litharenite. Quartz (E5, J10) represents the dominant detrital grain type with lesser amounts of plagioclase feldspar (EF12), potassium feldspar (stained yellow; B8, BC13.5), and mudstone fragments (G1-8). Ferroan dolomite (stained blue; D10) occurs as replacement of unstable material.
- B) This detailed view of the area near C7 in Photo A illustrates the common amounts of secondary pores (blue epoxy) occurring within partially leached feldspar grains (B9-13, F13, GH12.5). Plagioclase feldspar overgrowths (DE13, F9) have preserved the outline of a partially dissolved composite feldspar grain.



THIN SECTION DESCRIPTION
SAMPLE DEPTH: 2944.10 METERS
SAMPLE NUMBER: 1-10P DS

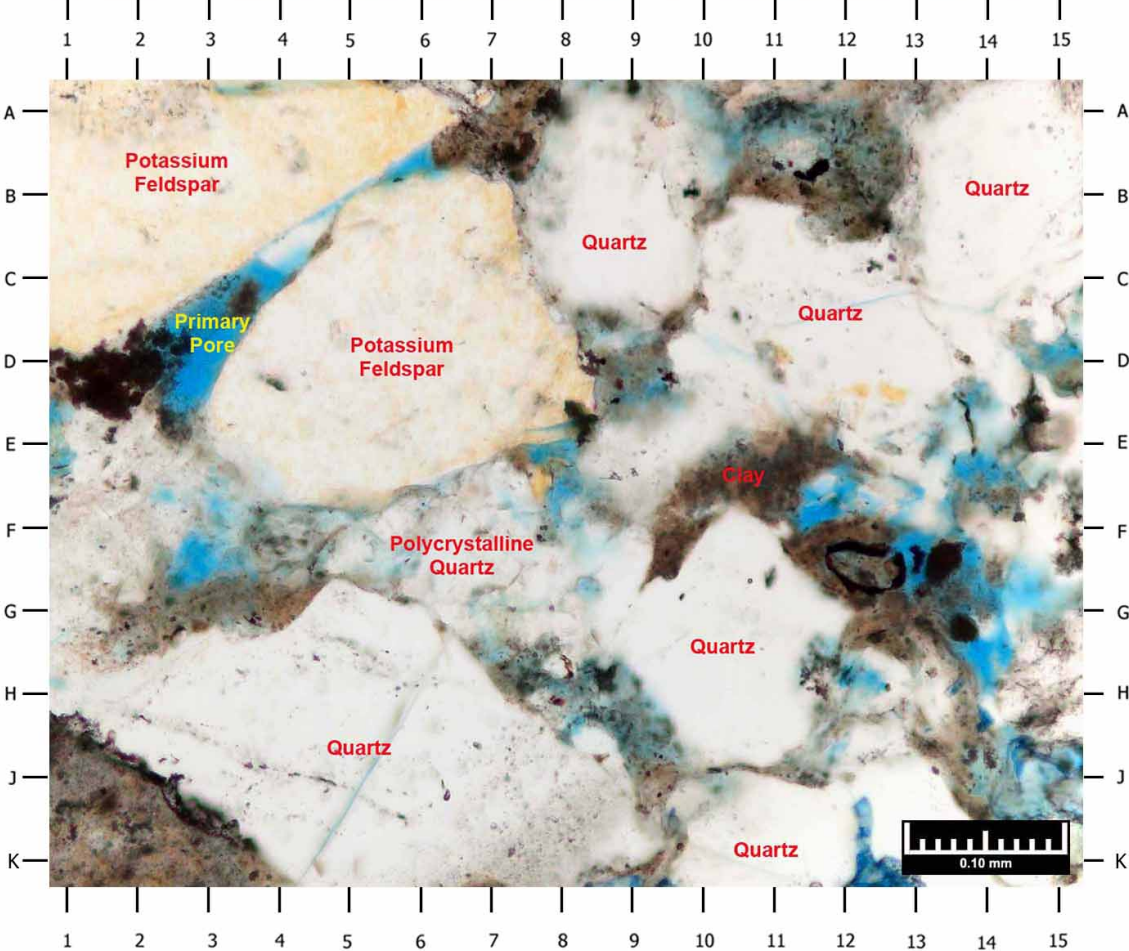
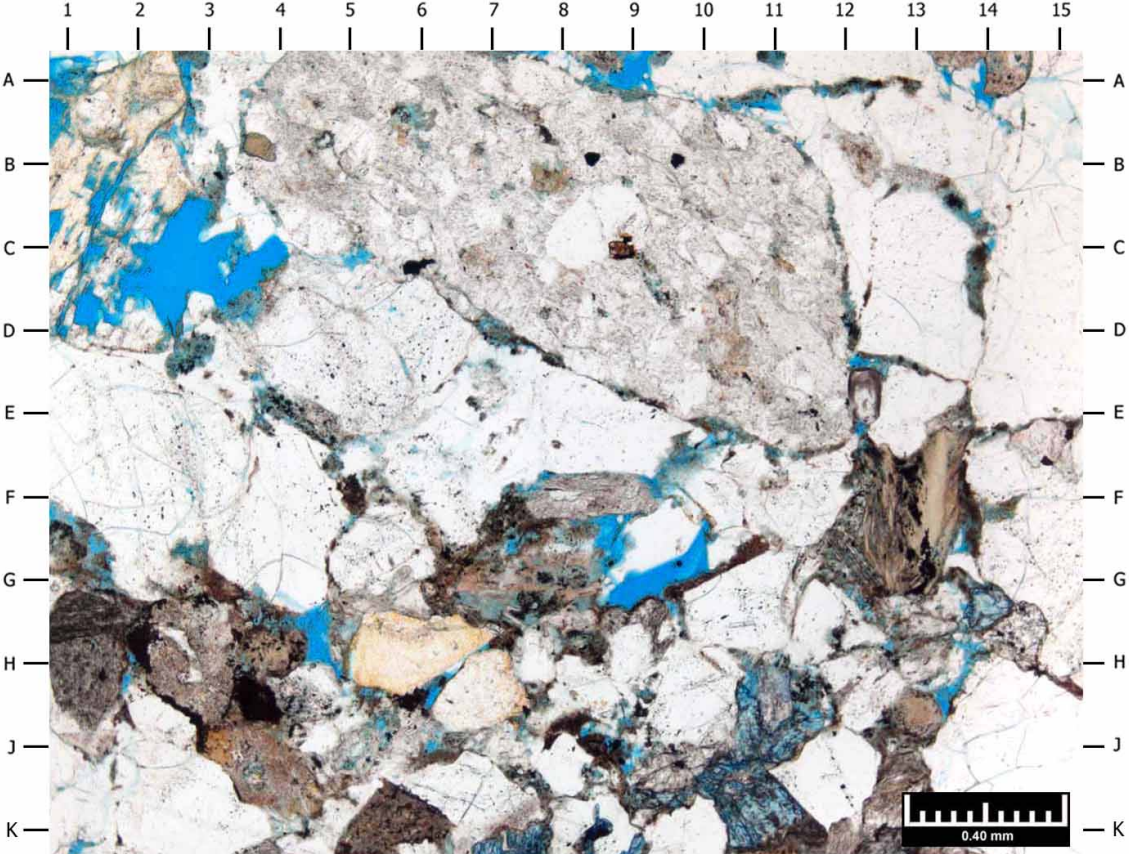
PLATE 12

Lithology*:	Feldspathic litharenite
Sedimentary Fabric:	Massive
Particle Size Range:	<0.01mm-3.75mm
Average Grain Size:	0.86
Visual Sorting:	Poor
Compaction:	Low to moderate
Detrital Grains / Allochems:	
Major:	Monocrystalline quartz
Minor:	Potassium feldspar, polycrystalline quartz, plagioclase feldspar, chert, volcanic fragments, mudstone fragments, siltstone fragments, metaquartzite, and metamorphic schistose fragments
Accessory:	Muscovite, biotite, carbonaceous (organic) material, and tourmaline
Matrix:	The matrix consists of trace amounts of pore-filling clays
Cement / Replacement:	Pyrite occurs as scattered framboids attached to detrital grains and as a replacement of detrital clays and organics; rare replacement of labile grains by siderite and ankerite; authigenic illite/smectite clay replaces dissolved grains and matrix material; rare quartz overgrowth cement; and rare replacement of partially dissolved grains by Fe-calcite
Porosity Types:	Secondary intragranular pores associated with leached grains, micropores associated with clays and leached grains, and minor primary intergranular pores
Porosity (RCA):	9.5%
Permeability (RCA):	0.26mD
Grain Density (RCA):	2.67gm/cc

*Folk classification based on visual estimate of sample constituents

Magnification: A: 50X B: 200X

- A) Detrital quartz (E1.5, J14.5, JK12) and potassium feldspar (stained yellow; H6) dominate the grain fraction of this feldspathic litharenite. A large lithic fragment occurs at B4-E11. Authigenic quartz cement (B12) locally fills intergranular areas. Secondary pores (blue epoxy; CD2.5, FG9) associated with partial dissolution of unstable feldspar grains and lithic fragments represent the dominant pore type.
- B) This high magnification photomicrograph details the area near J7.5 in Photo A. Pyrite (black; D1.5) occurs as replacement of susceptible material. Clays, mainly detrital, locally fill intergranular areas (AB12, AB7, EF11). A secondary quartz overgrowth is noted (CD14).



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Conventional Core

Weatherford Labs File No.: AB-76967

THIN SECTION DESCRIPTION
SAMPLE DEPTH: 2946.05 METERS
SAMPLE NUMBER: 1-12P DS

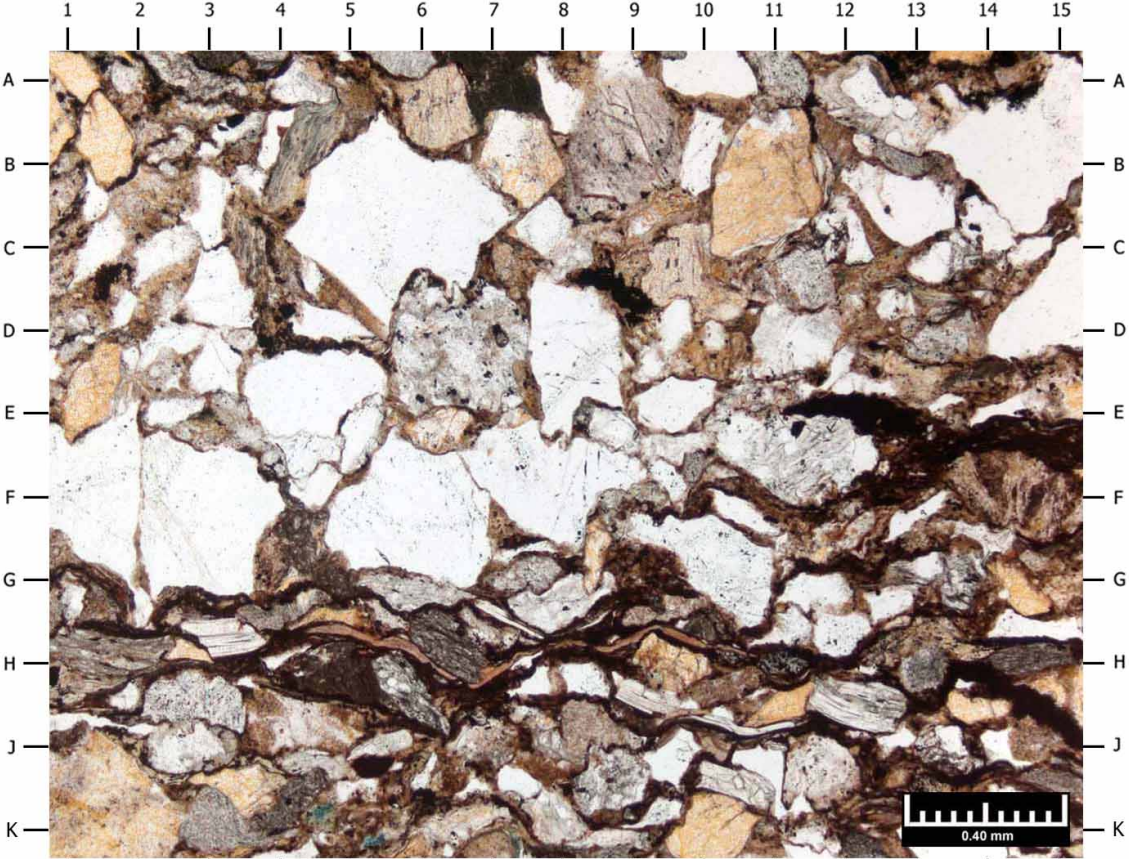
PLATE 13

Lithology*:	Feldspathic litharenite
Sedimentary Fabric:	Laminated
Grain Size Range:	<0.01mm-7.79mm
Average Grain Size:	0.36mm
Compaction:	Moderate to high
Sorting:	Poor
Framework Grains:	
Major:	Monocrystalline quartz
Minor:	Potassium feldspar, volcanic fragments, chert, mudstone fragments, plagioclase feldspar, metamorphic rock fragments, siltstone fragments, metaquartzite, and polycrystalline quartz
Accessory:	Biotite mica, muscovite mica, metamorphic chlorite, organic material, and tourmaline
Clay Content:	
Detrital Matrix:	Common amounts of detrital clays
Authigenic Clay:	Minor amounts of illite/smectite clays
Cement/Replacement:	Minor amounts of quartz overgrowths, feldspar overgrowths, microquartz, and siderite; pyrite occurs as replacement of less stable material and as cement; and trace amounts of Ti-oxide
Porosity Types:	Minor amounts of micropores associated with clays and leached grains; and rare amounts of secondary intragranular pores associated with leached grains
Porosity (RCA):	3.2%
Permeability (RCA):	0.014mD
Grain Density (RCA):	2.70gm/cc

*Folk classification based on visual estimate of sample constituents

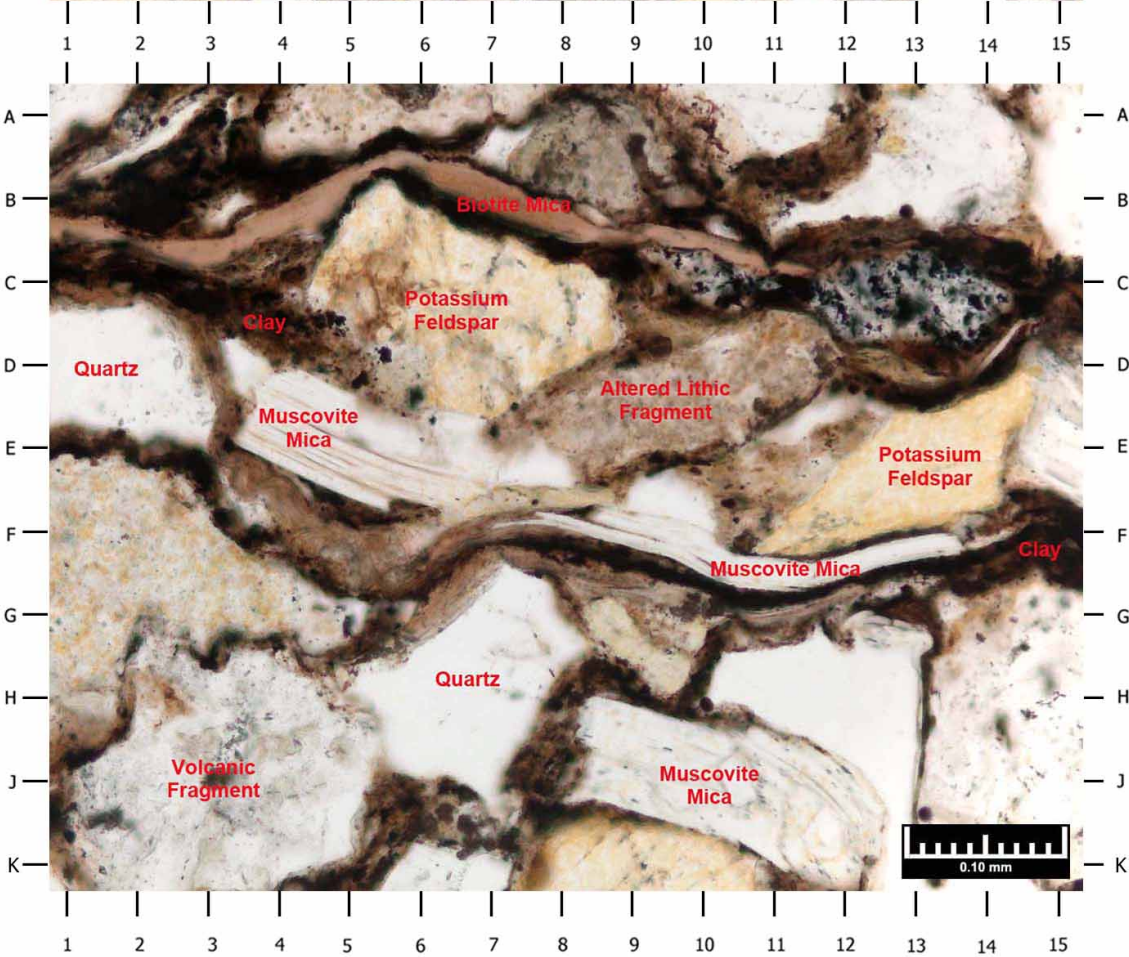
Magnification: A: 50X B: 200X

- A) General photomicrograph A displays the laminated fabric of this feldspathic litharenite. Quartz grains are abundant (C5.5, F1, CD15) with lesser amounts of altered feldspar/lithic grains (B4.2, H13, DE6), and potassium feldspar (stained yellow; B11, E1, K1, K10). Pyrite (black; CD1.2) replaces unstable material. Authigenic quartz occurs as cement (GH14.5, J11) and replacement (AB12.1).
- B) This photomicrograph provides a magnified view of the area near J9.5 in Photo A. Muscovite mica (EF5, F7-13) and biotite mica (BC1-11) display ductile grain deformation after subjection to moderate to high mechanical compaction. There are no visible pores in this photomicrograph.



A

50X



B

200X

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Magnetic-1
Lorelle Sandstone Formation
Queensland, Australia
Conventional Core

Weatherford Labs File No.: AB-76967

THIN SECTION DESCRIPTION
SAMPLE DEPTH: 2948.06 METERS
SAMPLE NUMBER: 1-15P DS

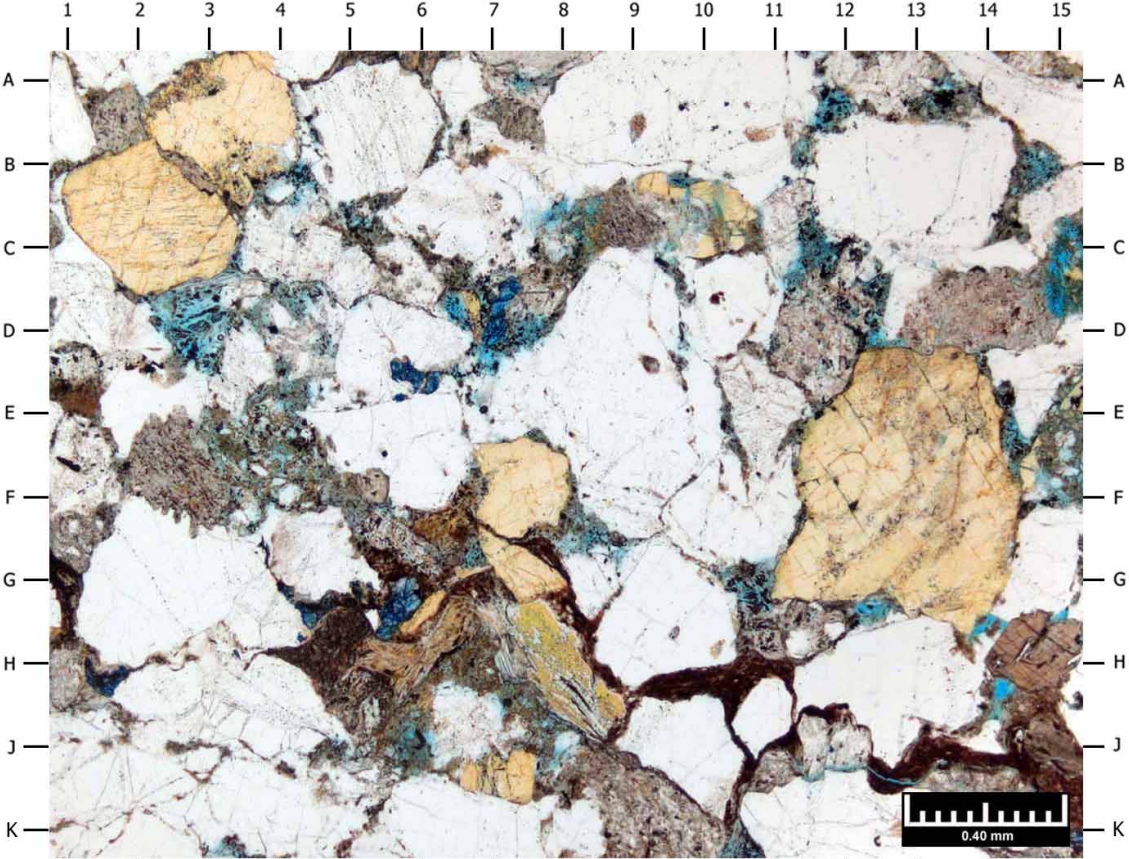
PLATE 14

Lithology*:	Feldspathic litharenite
Sedimentary Fabric:	Massive; microstylolites
Grain Size Range:	<0.01mm-3.57mm
Average Grain Size:	0.51mm
Compaction:	Moderate
Sorting:	Moderate to poor
Framework Grains:	
Major:	Monocrystalline quartz
Minor:	Chert, potassium feldspar, polycrystalline quartz, plagioclase feldspar, volcanic fragments, metamorphic rock fragments, mudstone rock fragments, siltstone fragments, metaquartzite,
Accessory:	Muscovite mica, biotite mica, metamorphic chlorite, organic material, and zircon
Clay Content:	
Detrital Matrix:	Minor amounts of detrital clays
Authigenic Clay:	Minor amounts of illite/smectite clays
Cement/Replacement:	Minor amounts of quartz overgrowth cement, ankerite as replacement and as cement, and siderite replacement; trace amounts of pyrite and Ti-oxide replacement
Porosity Types:	Secondary intragranular pores associated with leached grains, micropores associated with clays and leached grains, minor primary intergranular pores, and trace grain fracture pores
Porosity (RCA):	11.8%
Permeability (RCA):	0.34mD
Grain Density (RCA):	2.67gm/cc

*Folk classification based on visual estimate of sample constituents

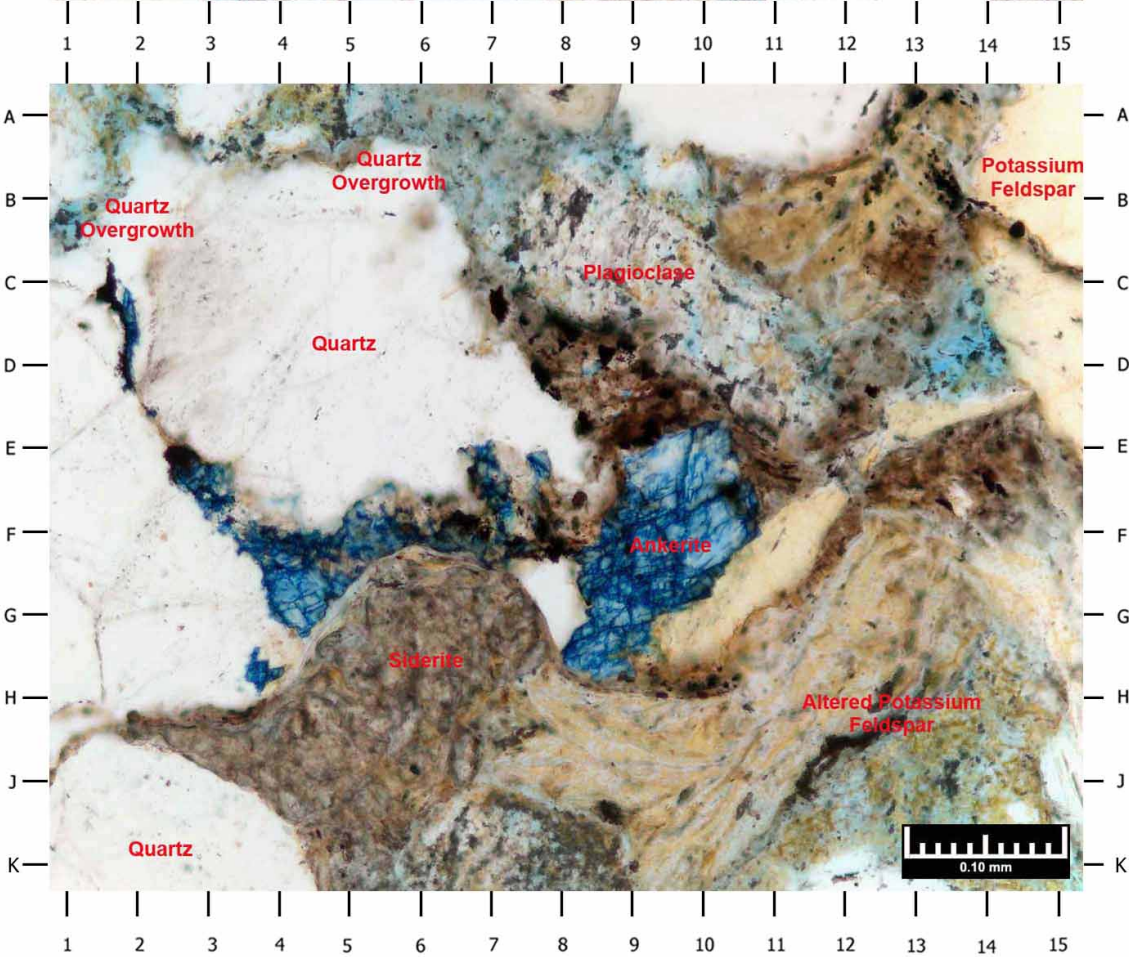
Magnification: A: 50X B: 200X

- A) This general overview represents the massive fabric of this feldspathic litharenite. Quartz (AB1, G2, GH9, K12), chert (D11.5), potassium feldspar (stained yellow; C2, F12.5, EF7), and altered lithic fragments (D3.5K9) are the dominant detrital constituents. A microstylolite is observed at G7-JK14. Secondary dissolution pores (blue epoxy; CD15, C8) represent the dominant pore type.
- B) This photomicrograph provides a detailed view of the area near G5.5 in Photo A. Siderite (H6) and ankerite (stained blue; FG4, F9.5) occur as replacements of less stable material. Authigenic quartz overgrowths (BC1.8, B5.5) precipitate on host detrital grains.



A

50X



B

200X

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Magnetic-1
Lorelle Sandstone Formation
Queensland, Australia
Conventional Core

Weatherford Labs File No.: AB-76967

THIN SECTION DESCRIPTION
SAMPLE DEPTH: 2950.09 METERS
SAMPLE NUMBER: 1-17P DS

PLATE 15

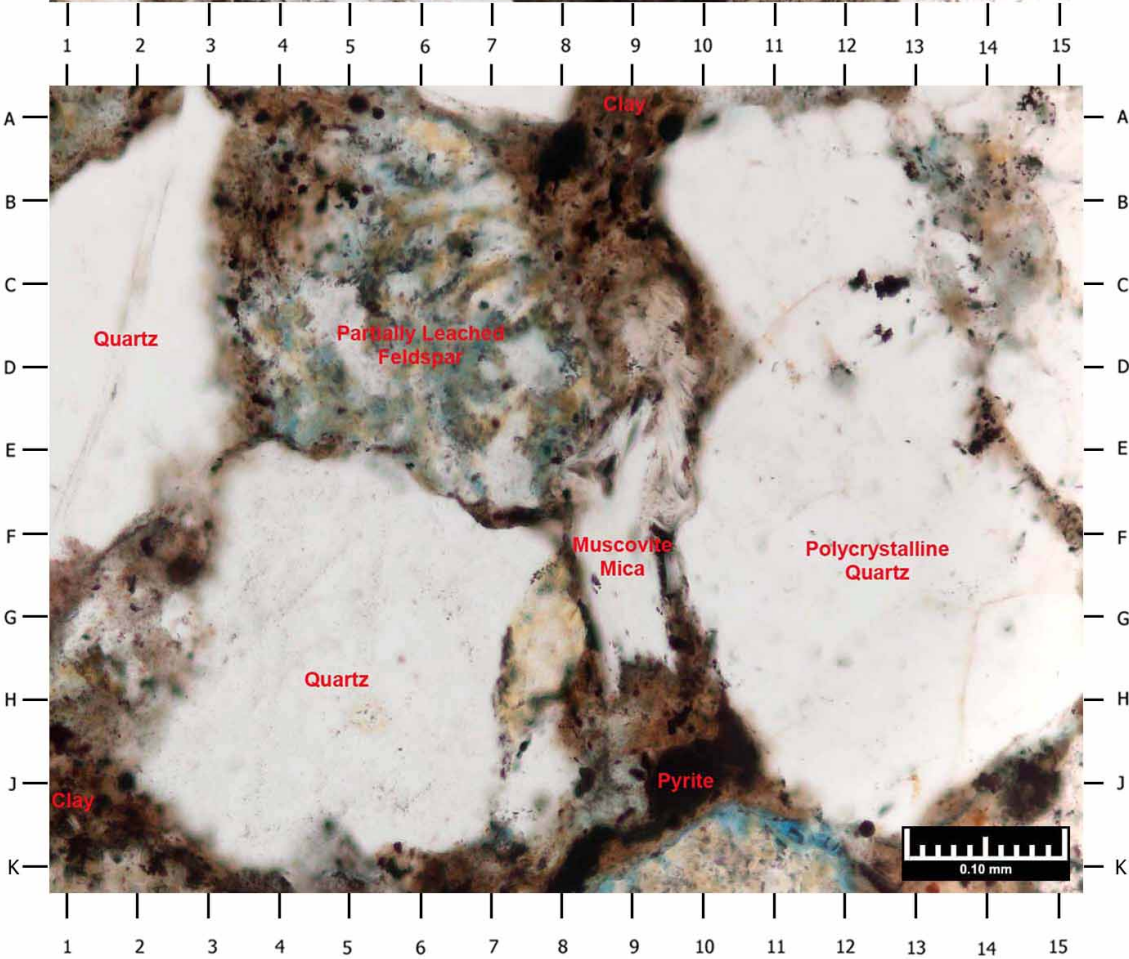
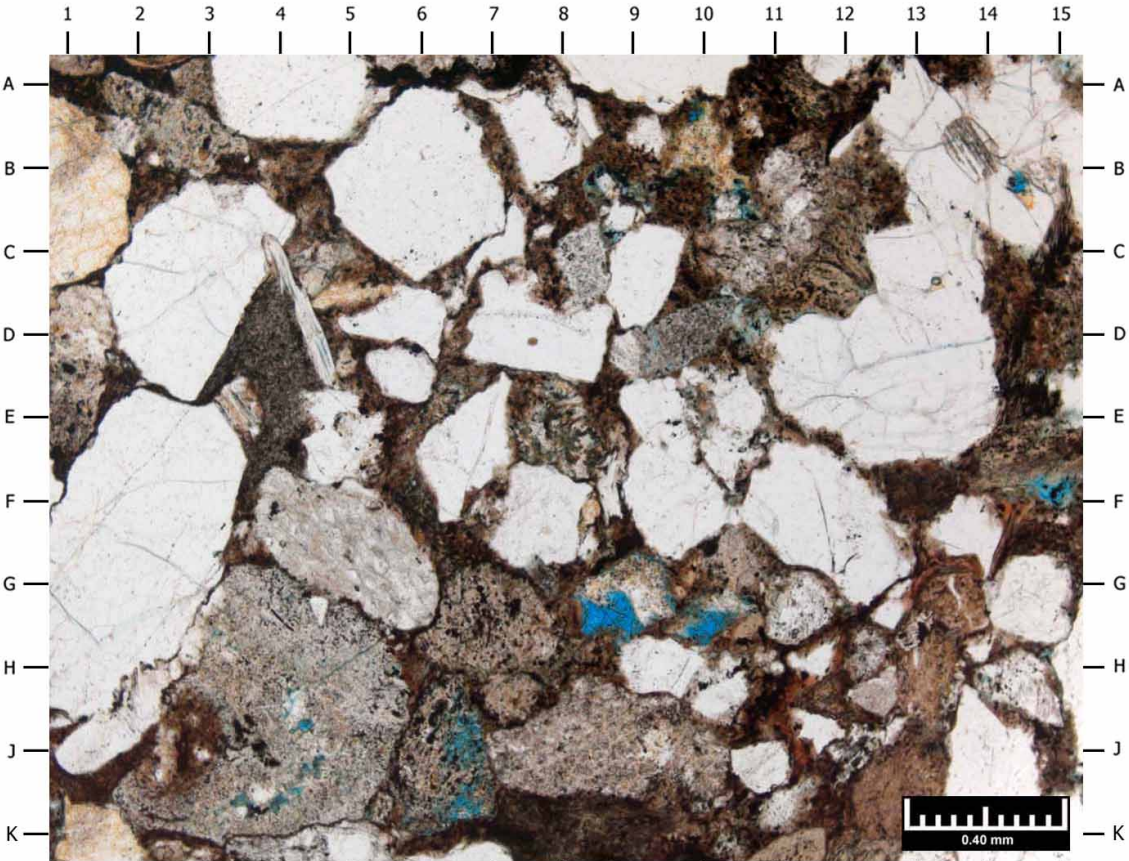
Lithology*: Feldspathic litharenite
Sedimentary Fabric: Laminated; burrowed
Particle Size Range: <0.01mm-4.94mm
Average Grain Size: 0.73
Visual Sorting: Poor
Compaction: Moderate
Framework Grains:
 Major: Monocrystalline quartz
 Minor: Potassium feldspar, plagioclase feldspar, metamorphic fragments, chert, tuffaceous volcanic fragments, mudstone fragments, conglomerate fragments, polycrystalline quartz, and metaquartzite
 Accessory: Biotite mica, muscovite mica, carbonaceous (organic) material and tourmaline
Clay Content:
 Detrital Matrix: The matrix consists of common amount of detrital clays
Cement/Replacement: Minor amounts of siderite occurs as a rare replacement mineral of detrital matrix clays and argillaceous fragments; minor pyrite occurs as partial replacement of unstable material; minor illitic clay replaces dissolved grains and matrix material; and trace amounts of authigenic calcite as a replacement
Porosity Types: Secondary intragranular pores associated with leached grains, micropores associated with clays and leached grains, minor primary intergranular pores and grain fracture pores
Porosity (RCA): 5.3%
Permeability (RCA): 0.12mD
Grain Density (RCA): 2.69gm/cc

*Folk classification based on visual estimate of sample constituents

Magnification: A: 50X

B: 200X

- A) Survey photomicrograph A provides a general overview of this feldspathic litharenite. Detrital grains are predominantly composed of quartz (B6, D13, F12), altered lithic fragments, and potassium feldspar grains (BC1). Secondary pores (blue epoxy; GH8.5, GH10, J6.8) are associated with partially dissolved labile grains.
- B) This photomicrograph provides a magnified view of the area near EF8 in Photo A. Detrital clays (A9, J1) commonly fill intergranular areas. Pyrite (black; AB8, J10) occurs as replacement of less stable material.



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THIN SECTION DESCRIPTION
SAMPLE DEPTH: 2952.06 METERS
SAMPLE NUMBER: 1-19P DS

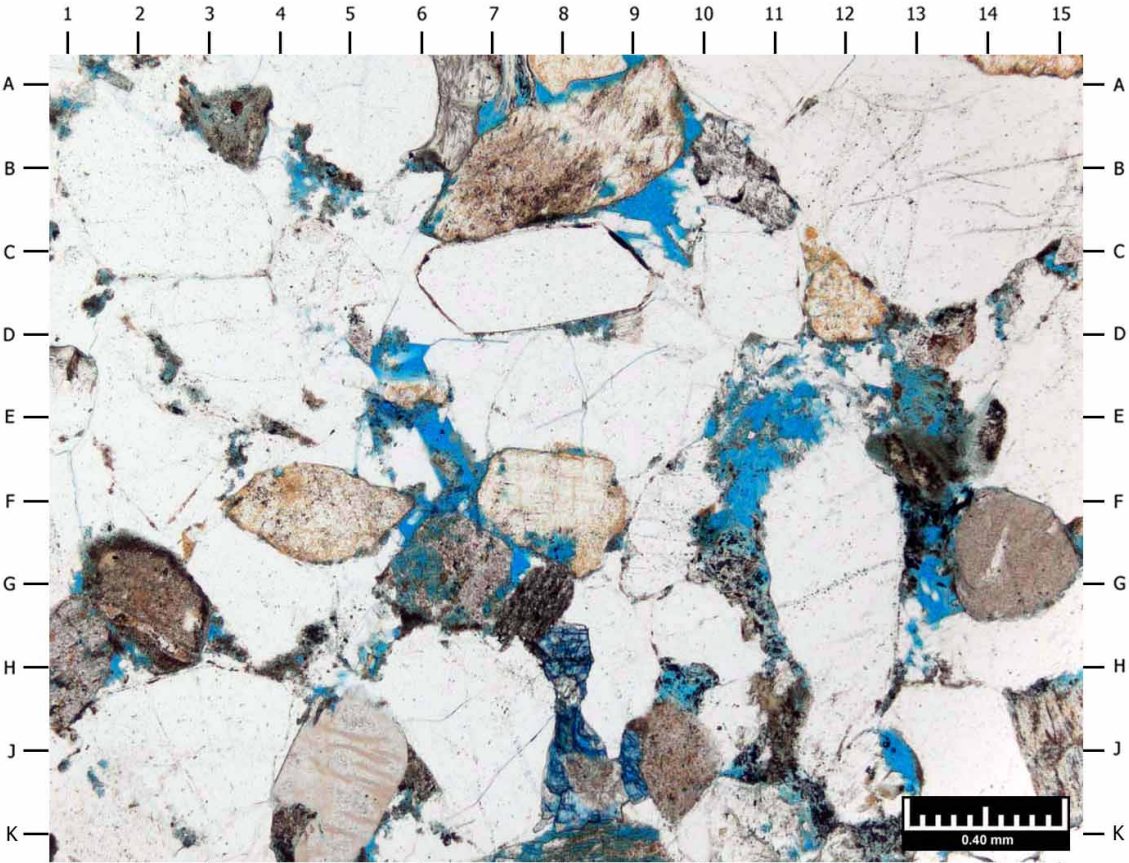
PLATE 16

Lithology*:	Lithic arkose
Sedimentary Fabric:	Massive
Grain Size Range:	<0.01mm -6.76mm
Average Grain Size:	0.62mm
Compaction:	Low to moderate
Sorting:	Poor
Framework Grains:	
Major:	Monocrystalline quartz
Minor:	Chert, polycrystalline quartz, volcanic rock fragments, plagioclase feldspar, tuffaceous volcanic fragments, potassium feldspar, metamorphic rock fragments, mudstone fragments, conglomerate fragments, and siltstone fragments
Accessory:	Muscovite mica, biotite mica, metamorphic chlorite, and tourmaline
Clay Content:	
Detrital Matrix:	The matrix consists of rare amounts of detrital clays
Cement/Replacement:	Quartz and feldspar overgrowth cement; trace amounts of Ti-oxide and ankerite cement; and trace amounts of pyrite replacement
Porosity Types:	Minor intragranular pores associated with partially dissolved grains; minor amounts of intragranular pores; rare amounts of micropores associated with clays; and trace amounts of grain fracture pores
Porosity (RCA):	9.9%
Permeability (RCA):	0.19mD
Grain Density (RCA):	2.67gm/cc

*Folk classification based on visual estimate of sample constituents

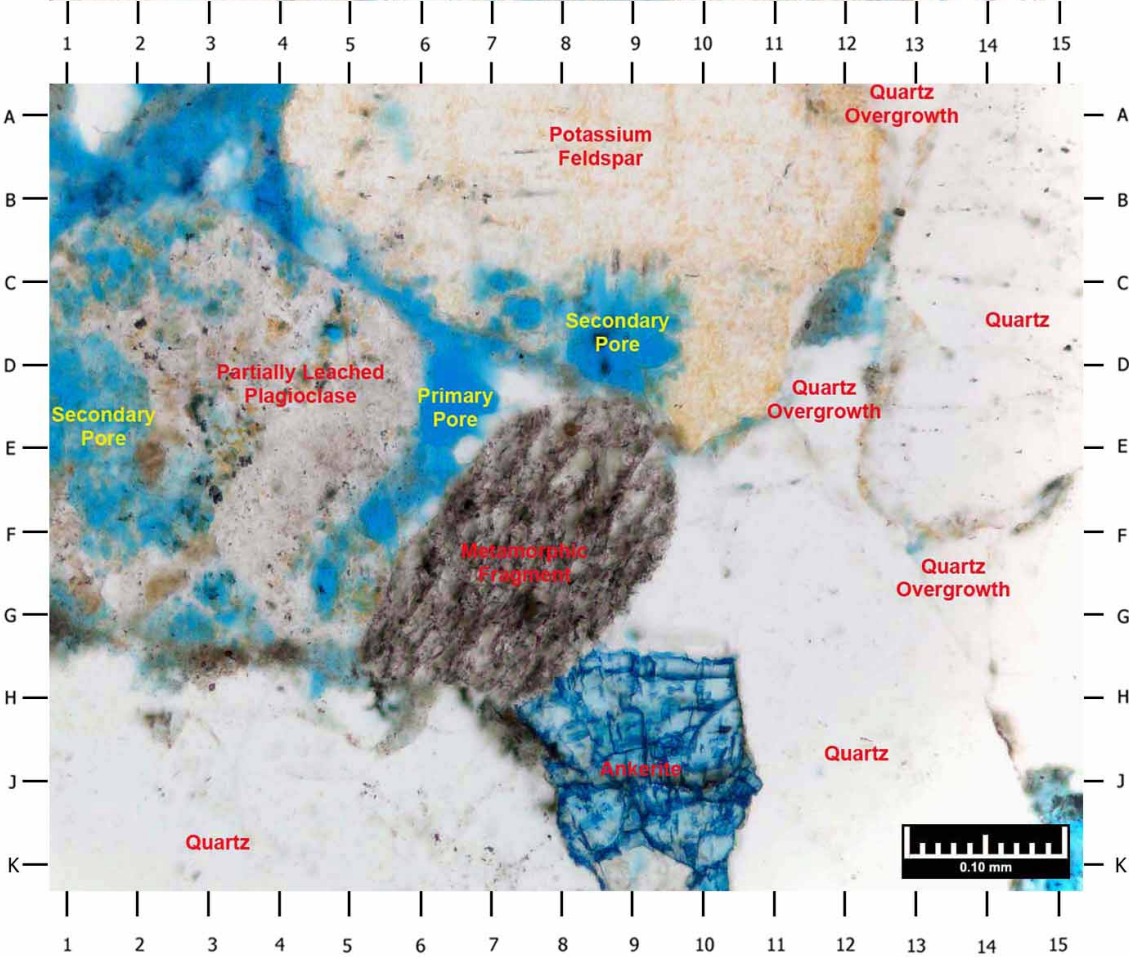
Magnification: A: 50X B: 200X

- A) Survey photomicrograph A depicts the massive fabric of this lithic arkose. Well-developed authigenic quartz overgrowths occlude primary pores (C6, FG2, DE6.5). Quartz (A5, B13, CD7, J7) compose the majority of the detrital constituents, with lesser amounts of altered lithic fragments (B8, H1, FG14.5) and potassium feldspar grains (stained yellow; CD12, F8). Ankerite (stained blue; H7-K8) occurs as replacement of less stable material.
- B) This photomicrograph provides a magnified view of the area near G8 in Photo A, highlighting the grain-binding quartz overgrowth cement (DE12, F9.5, FG14). Secondary dissolution pores (blue epoxy; DE1, D8.5) and primary intergranular pores (blue epoxy; AB2, E6) are present.



A

50X



B

200X

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Queensland, Australia
Conventional Core

Weatherford Labs File No.: AB-76967

THIN SECTION DESCRIPTION
SAMPLE DEPTH: 2954.05 METERS
SAMPLE NUMBER: 1-22P DS

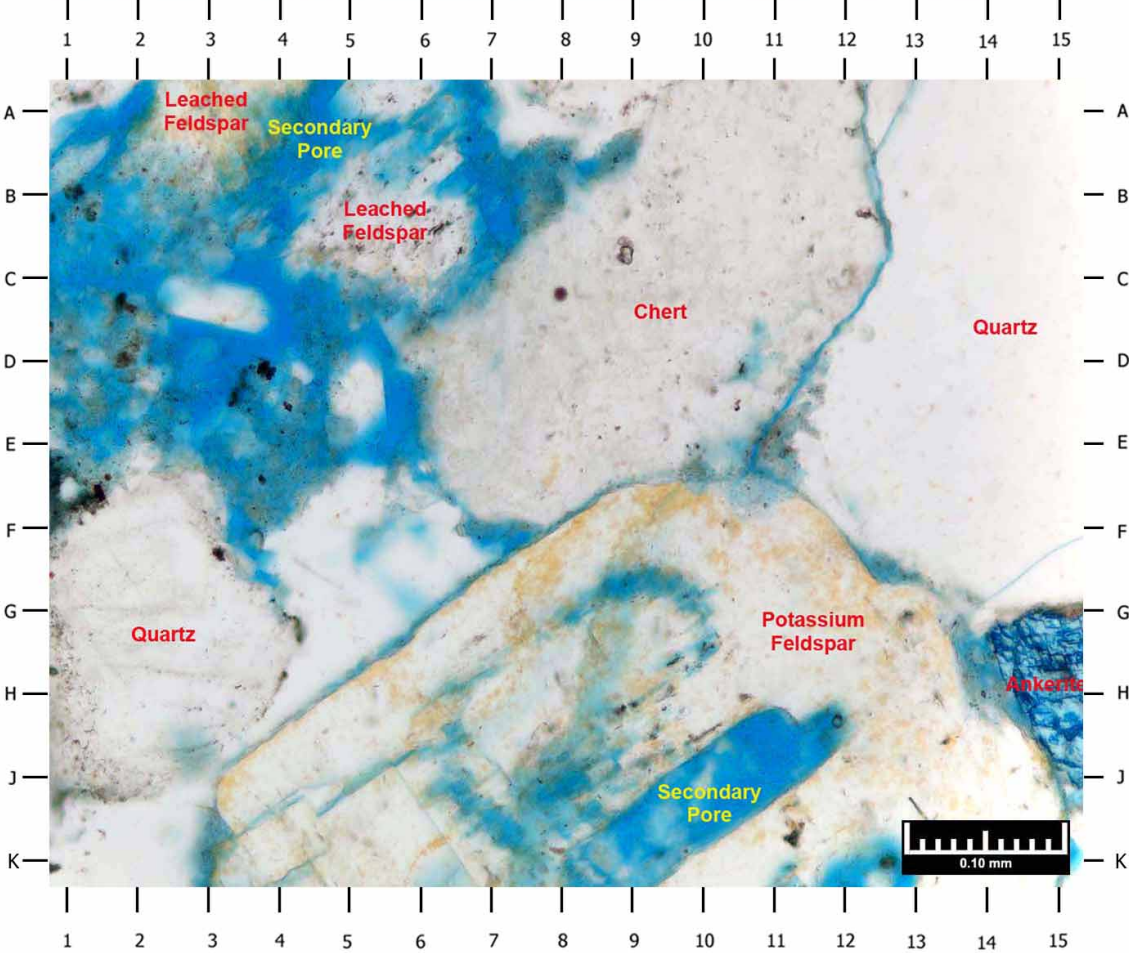
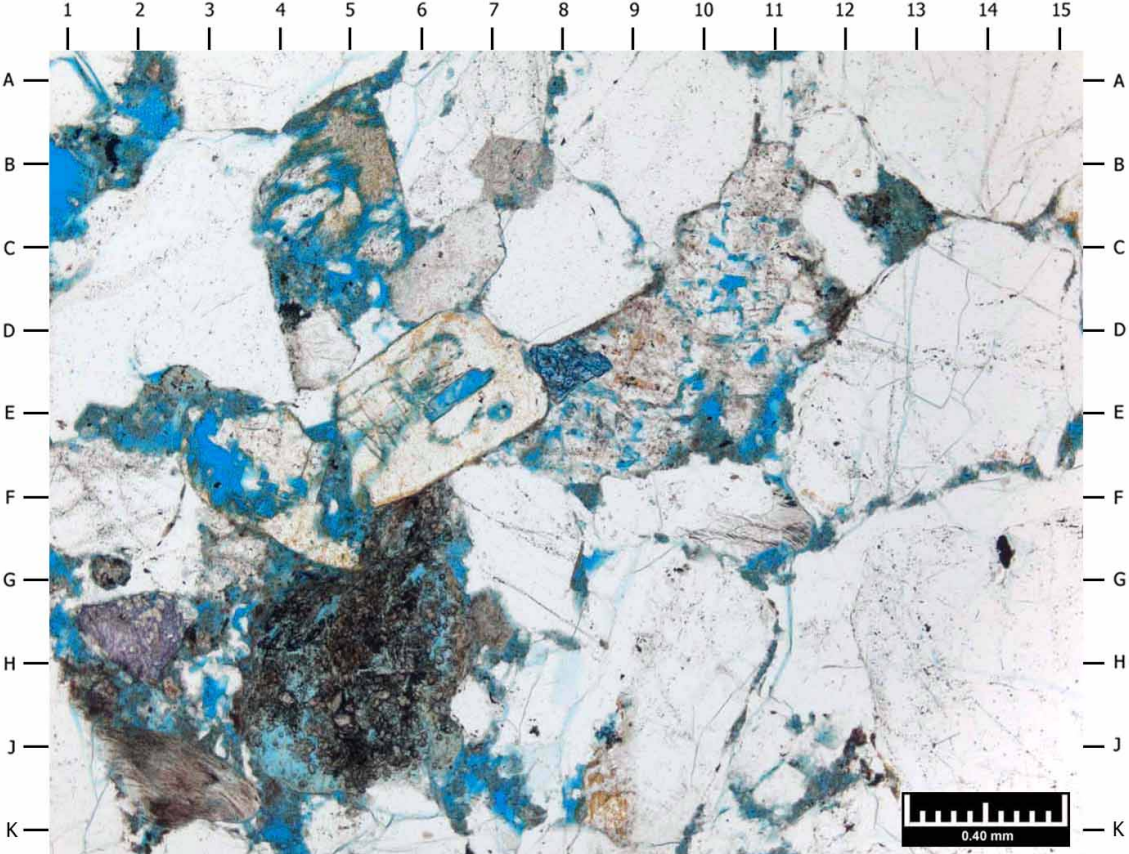
PLATE 17

Lithology*:	Lithic arkose
Sedimentary Fabric:	Massive
Grain Size Range:	0.03mm-2.51mm
Average Grain Size:	0.56mm
Compaction:	Low to moderate
Sorting:	Poor
Framework Grains:	
Major:	Monocrystalline quartz
Minor:	Chert, polycrystalline quartz, volcanic rock fragments, plagioclase feldspar, tuffaceous volcanic fragments, potassium feldspar, metamorphic rock fragments, mudstone fragments, conglomerate fragments, and siltstone fragments
Accessory:	Muscovite mica, biotite mica, metamorphic chlorite, and tourmaline
Clay Content:	
Detrital Matrix:	The matrix consists of rare amounts of detrital clays
Cement/Replacement:	Quartz and feldspar overgrowth cement; trace amounts of Ti-oxide and ankerite cement; and trace amounts of pyrite, ankerite, and Fe-calcite replacement
Porosity Types:	Minor intragranular pores associated with partially dissolved grains; minor amounts of intragranular pores; rare amounts of micropores associated with clays; and trace amounts of grain fracture pores
Porosity (RCA):	11.8%
Permeability (RCA):	0.39mD
Grain Density (RCA):	2.67gm/cc

*Folk classification based on visual estimate of sample constituents

Magnification: A: 50X B: 200X

- A) The low magnification view provided by photomicrograph A depicts the generally massive fabric of this litharenite. Detrital grains include quartz (CD2.5, CD8, DE13, H13), potassium feldspar (stained yellow; E6), altered lithic fragments (C4.5, D10, J3) and mudstone fragments (H5). Ankerite (stained blue; D7.5) and ferroan calcite (stained purple; GH2) occur as replacement of less stable material. Intragranular dissolution pores (blue epoxy; B2, CD4.5, E10, HJ3) are the dominant pore type represented in this photomicrograph.
- B) This photomicrograph provides a magnified view of the area near D6 in Photo A. Secondary moldic pores are the result of a partial dissolution (blue epoxy; C1.5, AB7, J10). Authigenic quartz cement (FG5.5, K2) locally fills intergranular areas. Secondary ankerite (stained blue; GH15) occurs as a cement and as replacement.



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Magnetic-1
Lorelle Sandstone Formation
Queensland, Australia
Conventional Core

Weatherford Labs File No.: AB-76967

THIN SECTION DESCRIPTION
SAMPLE DEPTH: 2956.05 METERS
SAMPLE NUMBER: 1-24P DS

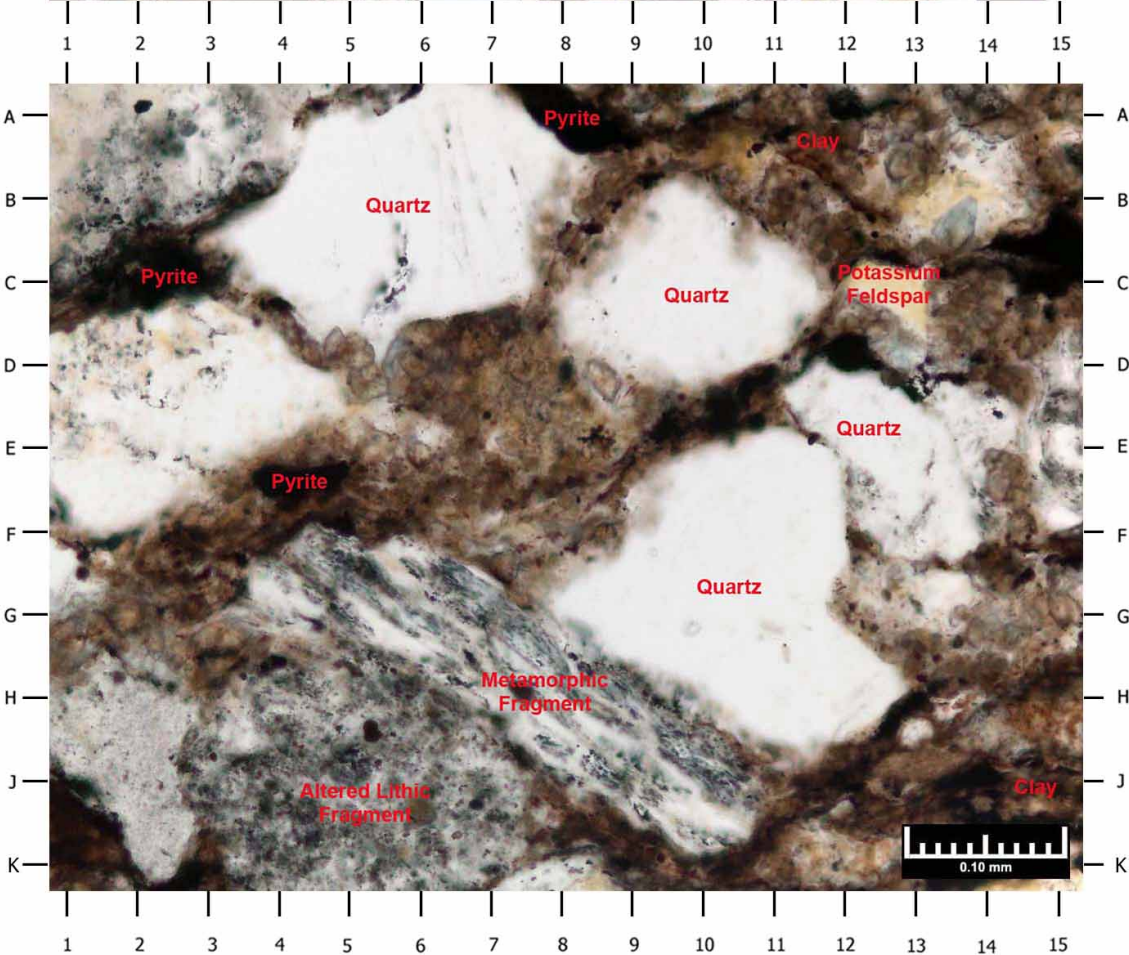
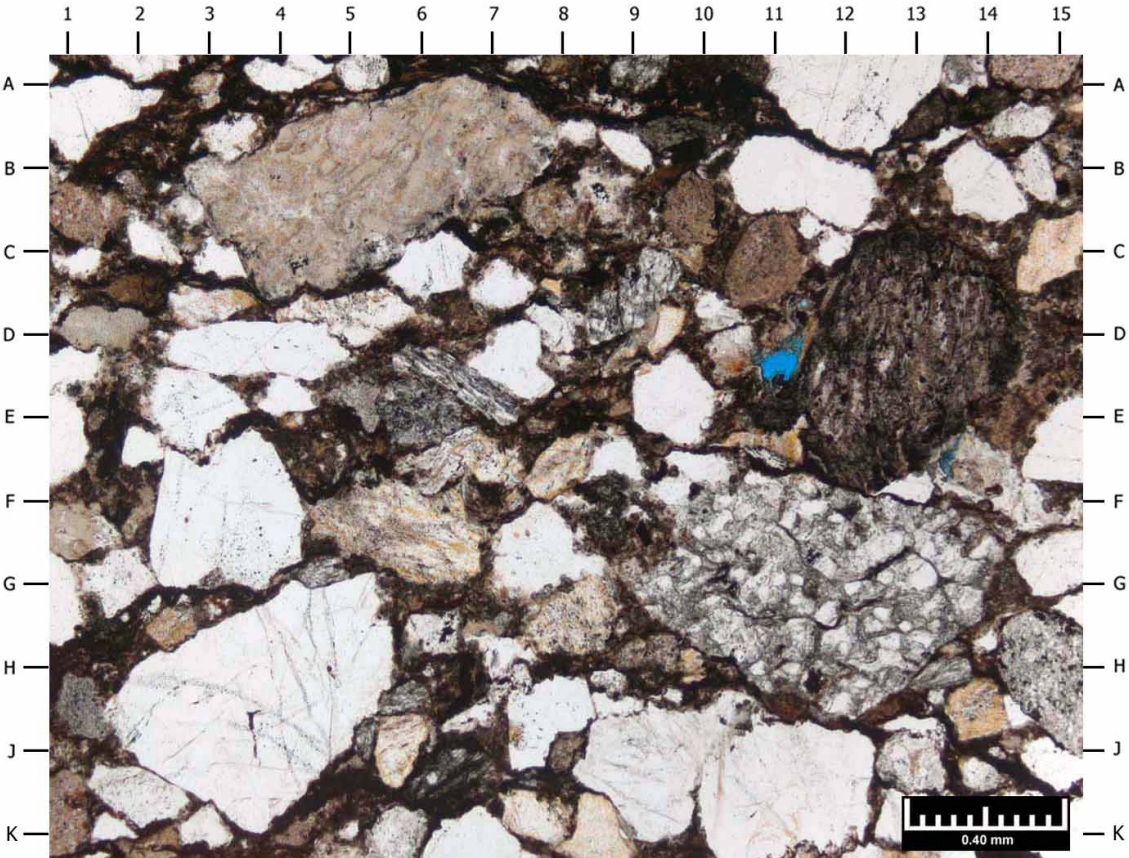
PLATE 18

Lithology*:	Feldspathic litharenite
Sedimentary Fabric:	Laminated; bioturbated
Grain Size Range:	0.03mm-3.72mm
Average Grain Size:	0.44mm
Compaction:	High
Sorting:	Poor
Framework Grains:	
Major:	Monocrystalline quartz
Minor:	Metamorphic fragments, potassium feldspar, volcanic fragments, plagioclase feldspar, chert, mudstone rock fragments, siltstone fragments, metaquartzite, volcanic glass fragments, and polycrystalline quartz
Accessory:	Muscovite mica, biotite mica, carbonaceous (organic) material, glauconite, metamorphic chlorite, zircon, and tourmaline
Clay Content:	
Detrital Matrix:	Common amounts of detrital clays
Authigenic Clay:	Trace amounts of illite/smectite clays
Cement/Replacement:	Quartz overgrowths, pyrite and siderite occur as cement; minor amounts of siderite, pyrite, and illite/smectite occurring as replacement; trace amounts of chlorite, ankerite, and quartz replacements
Porosity Types:	Micropores associated with clays and leached grains are the dominant pore type present; trace amounts of secondary intragranular pores associated with leached grains and grain fracture pores
Porosity (RCA):	3.4%
Permeability (RCA):	0.029mD
Grain Density (RCA):	2.80gm/cc

*Folk classification based on visual estimate of sample constituents

Magnification: A: 50X B: 200X

- A) The low magnification view provided by photomicrograph A depicts the generally massive fabric of this feldspathic litharenite. Abundant amounts of quartz (FG3, JK5.3, GH13.5) and metamorphic fragments (D13, DE6) compose the majority of the detrital grains. Micropores are likely associated with the clays; however, are not visible at this magnification. A rare moldic pore (blue epoxy) occurs at DE11.
- B) This photomicrograph provides a magnified view of the area near D7 in Photo A. Pyrite (black; C2, AB8, CD12) occurs as an alteration product of unstable material, probable organics. Rare ferroan dolomite (stained blue; BC13.5) partially replaced a potassium feldspar grain.



QGC- A BG Group Business
Magnetic-1
Lorelle Sandstone Formation
Queensland, Australia
Conventional Core

Weatherford Labs File No.: AB-76967

THIN SECTION DESCRIPTION
SAMPLE DEPTH: 2958.05 METERS
SAMPLE NUMBER: 1-26P DS

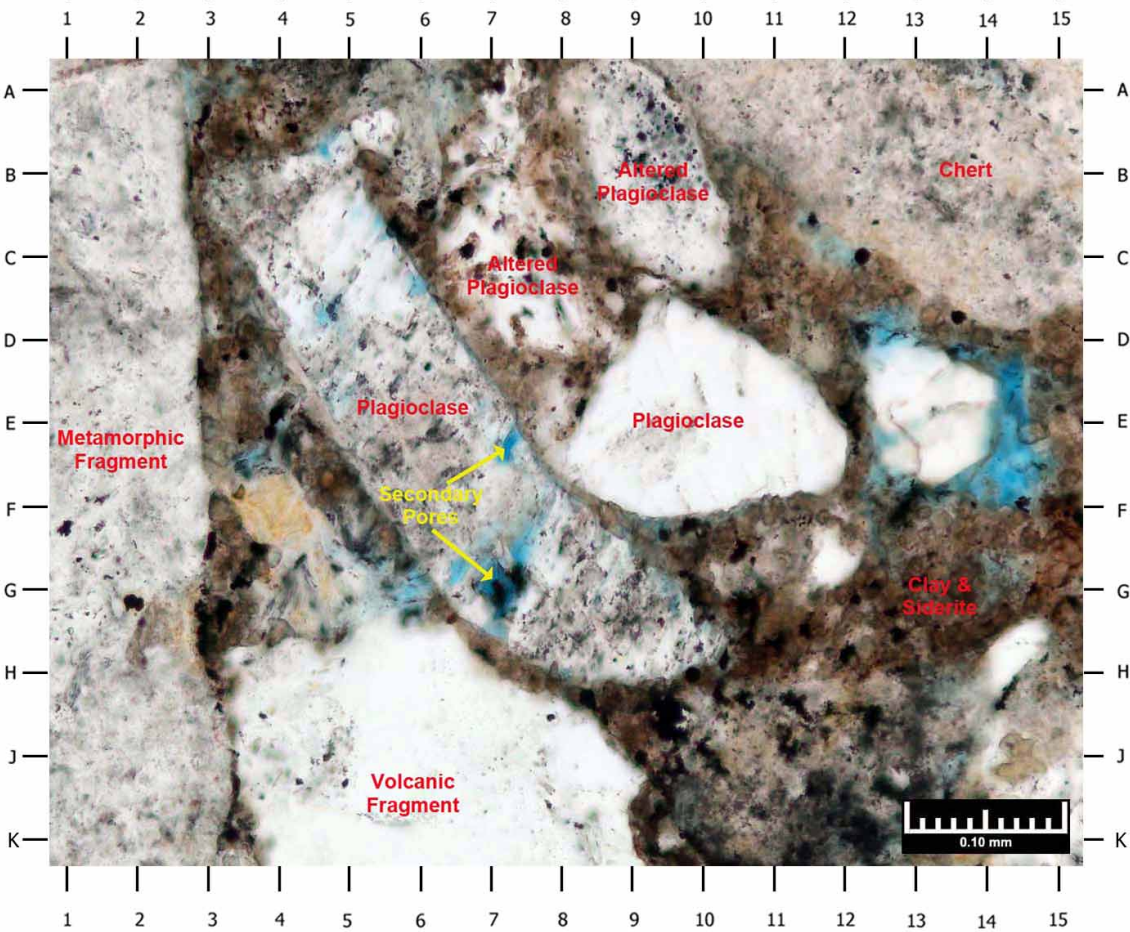
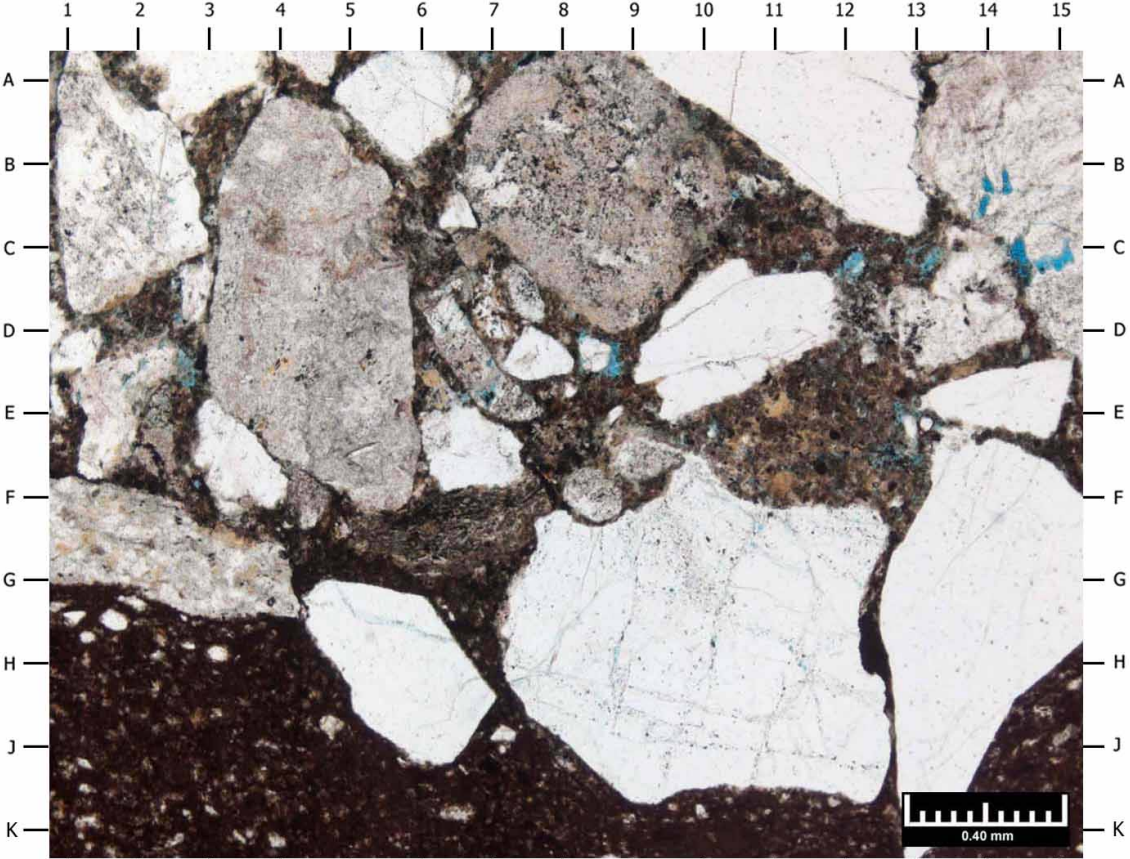
PLATE 19

Lithology*:	Feldspathic litharenite
Sedimentary Fabric:	Massive; disturbed
Particle Size Range:	<0.01mm-9.27mm
Average Grain Size:	0.51
Visual Sorting:	Poor
Compaction:	Moderate to high
Framework Grains:	
Major:	Monocrystalline quartz
Minor:	Metamorphic fragments, siltstone fragments, conglomerate fragments, potassium feldspar, volcanic fragments, plagioclase feldspar, chert, mudstone rock fragments, metaquartzite, volcanic glass fragments, and polycrystalline quartz
Accessory:	Muscovite mica, biotite mica, organic material, zircon, and tourmaline
Clay Content:	
Detrital Matrix:	Common amounts of detrital clays
Authigenic Clay:	Rare amounts of illite/smectite clays
Cement/Replacement:	Quartz overgrowths, feldspar overgrowths, and Ti-oxide occur as cement; minor amounts of siderite, quartz and illite/smectite occurring as replacement; trace amounts of feldspar, calcite and Ti-oxide as replacement of less stable material
Porosity Types:	Micropores associated with clays and leached grains are the dominant pore type present; minor amounts of secondary intragranular pores associated with leached grains and trace amounts of grain fracture pores
Porosity (RCA):	4.9%
Permeability (RCA):	0.078mD
Grain Density (RCA):	2.70gm/cc

*Dunham (1962) classification based on visual estimate of sample constituents

Magnification: A: 50X B: 200X

- A) This photomicrograph represents a massive feldspathic litharenite, of which the lower area of this photo represents a clay-filled burrow (G1-H15). Detrital constituents include monocrystalline quartz grains (AB12, H6, GH14), polycrystalline quartz (H10), chert (B8), and metamorphic rock fragments (BC1.5, D4, FG2).
- B) This photomicrograph provides a magnified view of the area near DE7 in Photo A highlighting the secondary pores (blue epoxy; D4, GH6.5) and the possible primary pore (blue epoxy; EF14). Pyrite (black; HJ9.5) occurs as replacement of susceptible material.



QGC- A BG Group Business
Magnetic-1
Lorelle Sandstone Formation
Queensland, Australia
Conventional Core

Weatherford Labs File No.: AB-76967

THIN SECTION DESCRIPTION
SAMPLE DEPTH: 2960.17 METERS
SAMPLE NUMBER: 1-28P DS

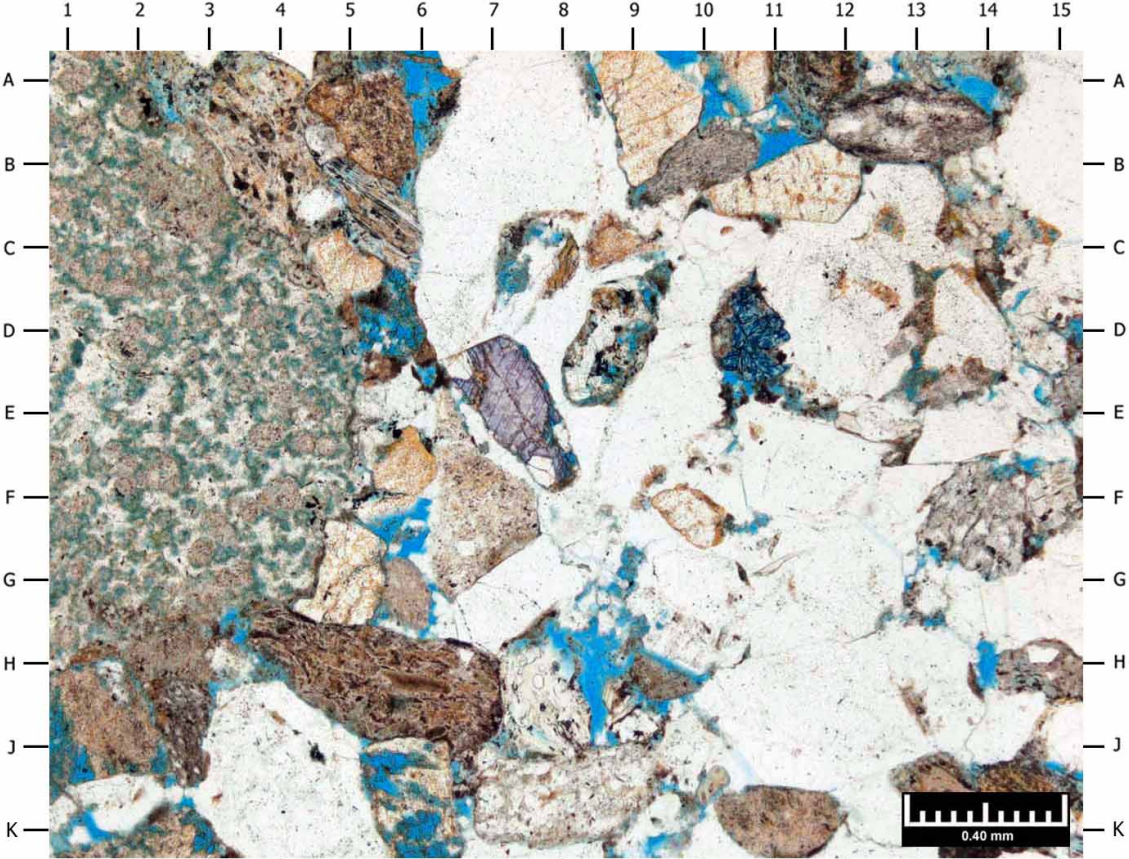
PLATE 20

Lithology*:	Feldspathic litharenite
Sedimentary Fabric:	Massive
Grain Size Range:	<0.01mm-9.12mm
Average Grain Size:	1.16mm
Compaction:	Low to moderate
Sorting:	Very poor
Framework Grains:	
Major:	Monocrystalline quartz
Minor:	Conglomerate fragments, metamorphic fragments, siltstone fragments, potassium feldspar, volcanic fragments, plagioclase feldspar, chert, mudstone rock fragments, metaquartzite, volcanic glass fragments, and polycrystalline quartz
Accessory:	Muscovite mica, biotite mica, chamosite, zircon, and tourmaline
Clay Content:	
Detrital Matrix:	Rare amounts of detrital clays
Authigenic Clay:	Rare amounts of illite/smectite clays
Cement/Replacement:	Quartz overgrowths, feldspar overgrowths, pyrite and laumontite occur as cement; minor amounts of Fe-calcite, ankerite, siderite, microquartz and illite/smectite occurring as replacement; trace amounts of laumontite, chlorite, pyrite, and Ti-oxide as replacement of less stable material
Porosity Types:	Intragranular pores associated with leached grains are the dominant pore type present; minor amounts of primary intergranular pores and micropores associated with clays and leached grains; and trace amounts of grain fracture pores
Porosity (RCA):	8.3%
Permeability (RCA):	0.89mD
Grain Density (RCA):	2.68gm/cc

*Folk classification based on visual estimate of sample constituents

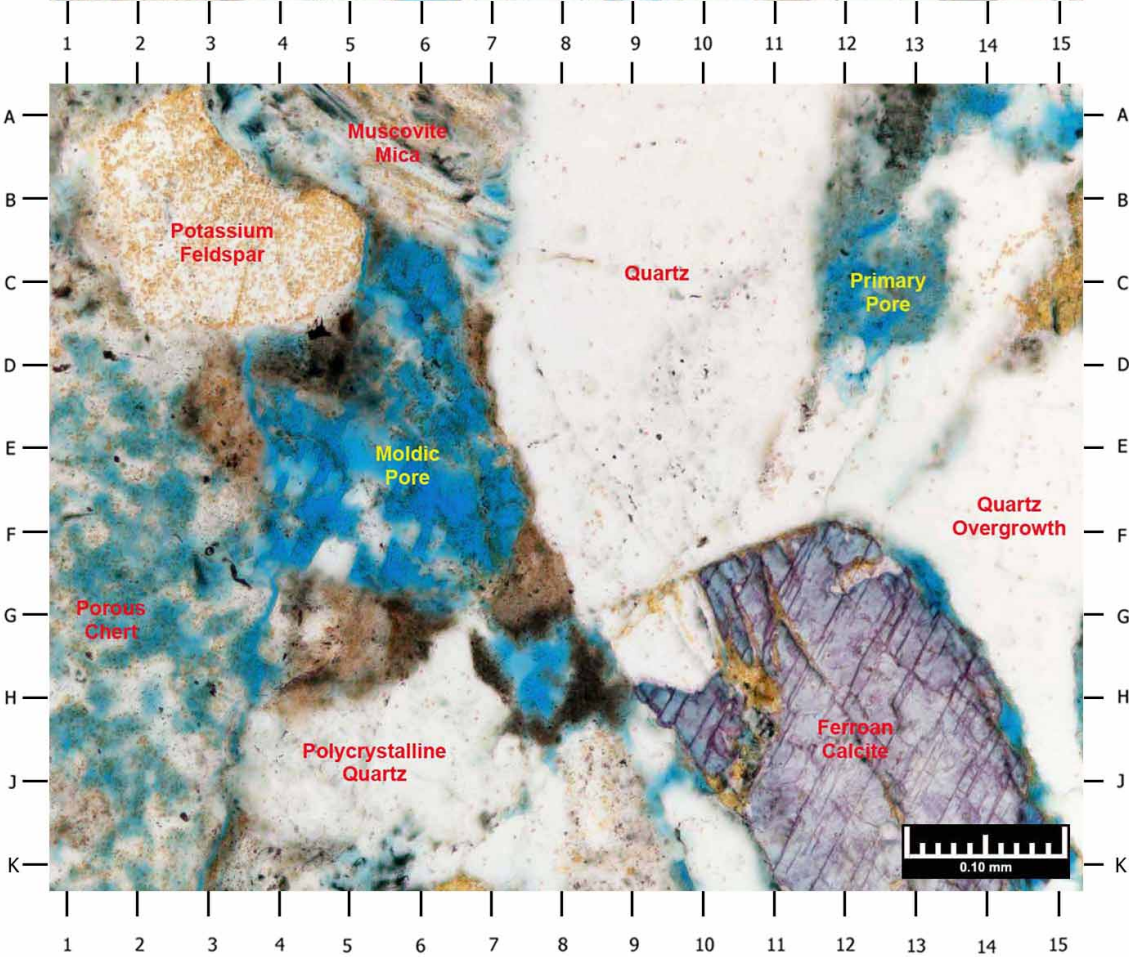
Magnification: A: 50X B: 200X

- A) General photomicrograph A depicts massive fabric of this litharenite. Detrital grains consist predominantly of quartz (B7, B15, J4), conglomerate fragments (F14), and chert (A1-G4). Secondary dissolution pores represent the dominant pore type (blue epoxy; AB6, AB14, K1, JK6).
- B) The area near D5.5 in Photo A is provided in this high magnification photomicrograph. Rare ferroan calcite (stained purple; H12) occurs as replacement of an unstable grain. Authigenic quartz overgrowth cement occludes primary pores (F14.5).



A

50X



B

200X

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Magnetic-1
Lorelle Sandstone Formation
Queensland, Australia
Conventional Core

Weatherford Labs File No.: AB-76967

THIN SECTION DESCRIPTION
SAMPLE DEPTH: 2962.05 METERS
SAMPLE NUMBER: 1-30P DS

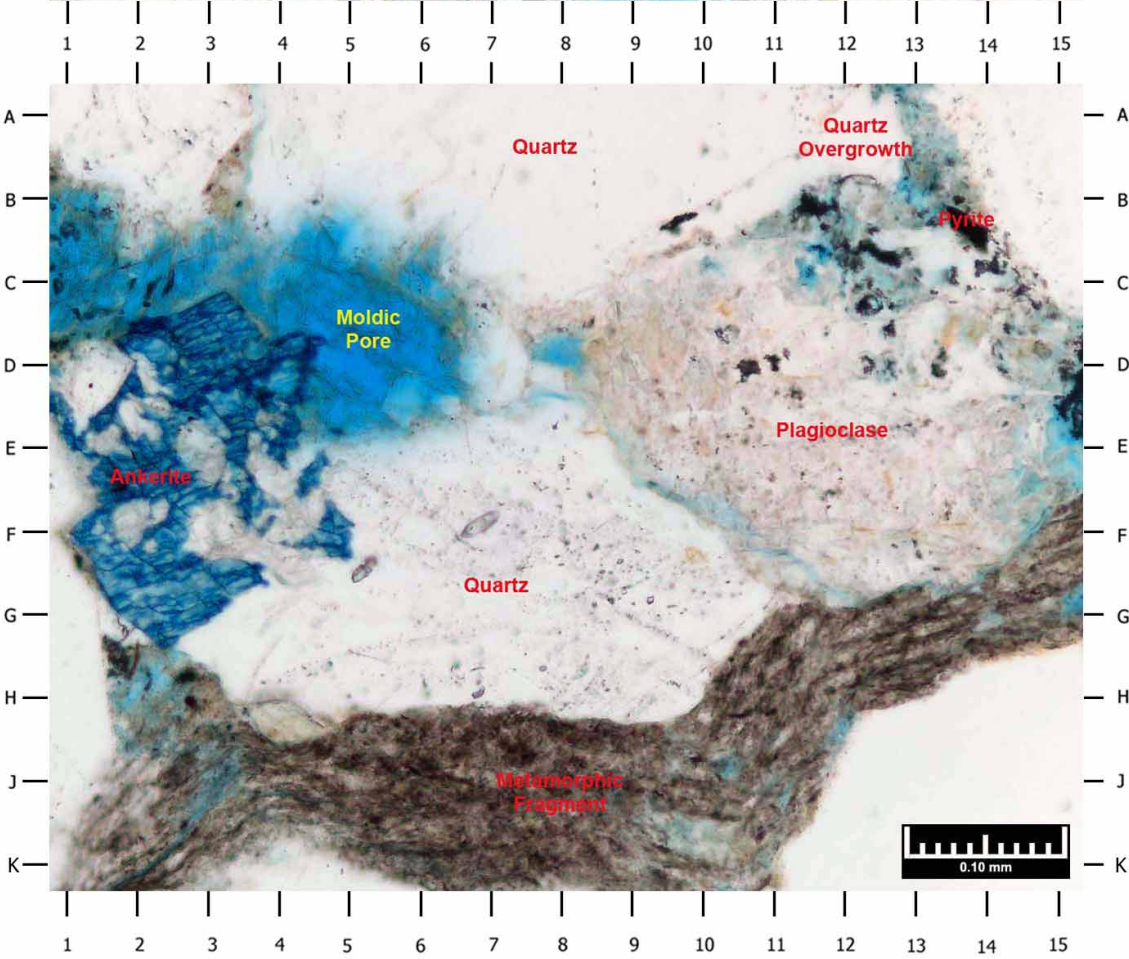
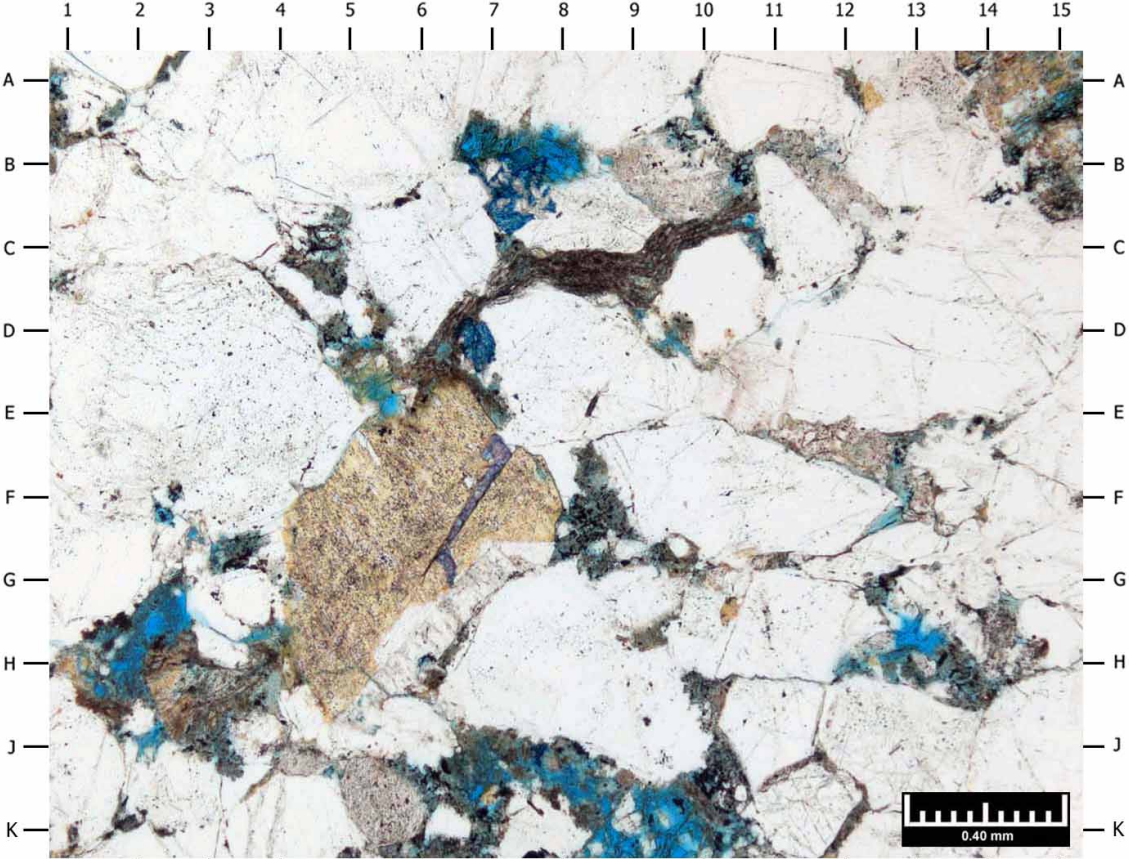
PLATE 21

Lithology*:	Litharenite
Sedimentary Fabric:	Massive
Grain Size Range:	<0.01mm-8.21mm
Average Grain Size:	0.96mm
Compaction:	Moderate to high
Sorting:	Very poor
Framework Grains:	
Major:	Monocrystalline quartz
Minor:	Chert, conglomerate fragments, metamorphic fragments, siltstone fragments, potassium feldspar, volcanic fragments, plagioclase feldspar, metaquartzite, volcanic glass fragments, and polycrystalline quartz
Accessory:	Muscovite mica, biotite mica, carbonaceous (organic) material and zircon
Clay Content:	
Detrital Matrix:	Rare amounts of detrital clays
Authigenic Clay:	Minor amounts of illite/smectite clays
Cement/Replacement:	Quartz overgrowths, feldspar overgrowths, illite/smectite, microquartz, Fe-calcite, and pyrite occur as cement; minor amounts of bitumen, microquartz, ankerite, and quartz occurring as replacement; trace amounts of feldspar, calcite, and pyrite occur as replacement of less stable material
Porosity Types:	Intragranular pores associated with leached grains are the dominant pore type present; minor amounts of micropores associated with clays and leached grains and primary intergranular pores; and trace amounts of grain fracture pores
Porosity (RCA):	8.5%
Permeability (RCA):	0.48mD
Grain Density (RCA):	2.67gm/cc

*Folk classification based on visual estimate of sample constituents

Magnification: A: 50X B: 200X

- A) The detrital constituents in this massive, litharenite include mainly monocrystalline quartz grains (AB5, D13, H8) and lesser amounts of plagioclase feldspars (B9.5, JK5.5) and potassium feldspars (stained yellow; F5). A highly compacted metamorphic fragment occurs at CD9.
- B) This photomicrograph provides a magnified view of the area near BC8 in Photo A. Ankerite (stained blue; FG2) and pyrite (black; BC12, BC13) occur as replacements of less stable material.



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Lorelle Sandstone Formation
Queensland, Australia
Conventional Core

Weatherford Labs File No.: AB-76967

THIN SECTION DESCRIPTION
SAMPLE DEPTH: 2965.05 METERS
SAMPLE NUMBER: 1-33P DS

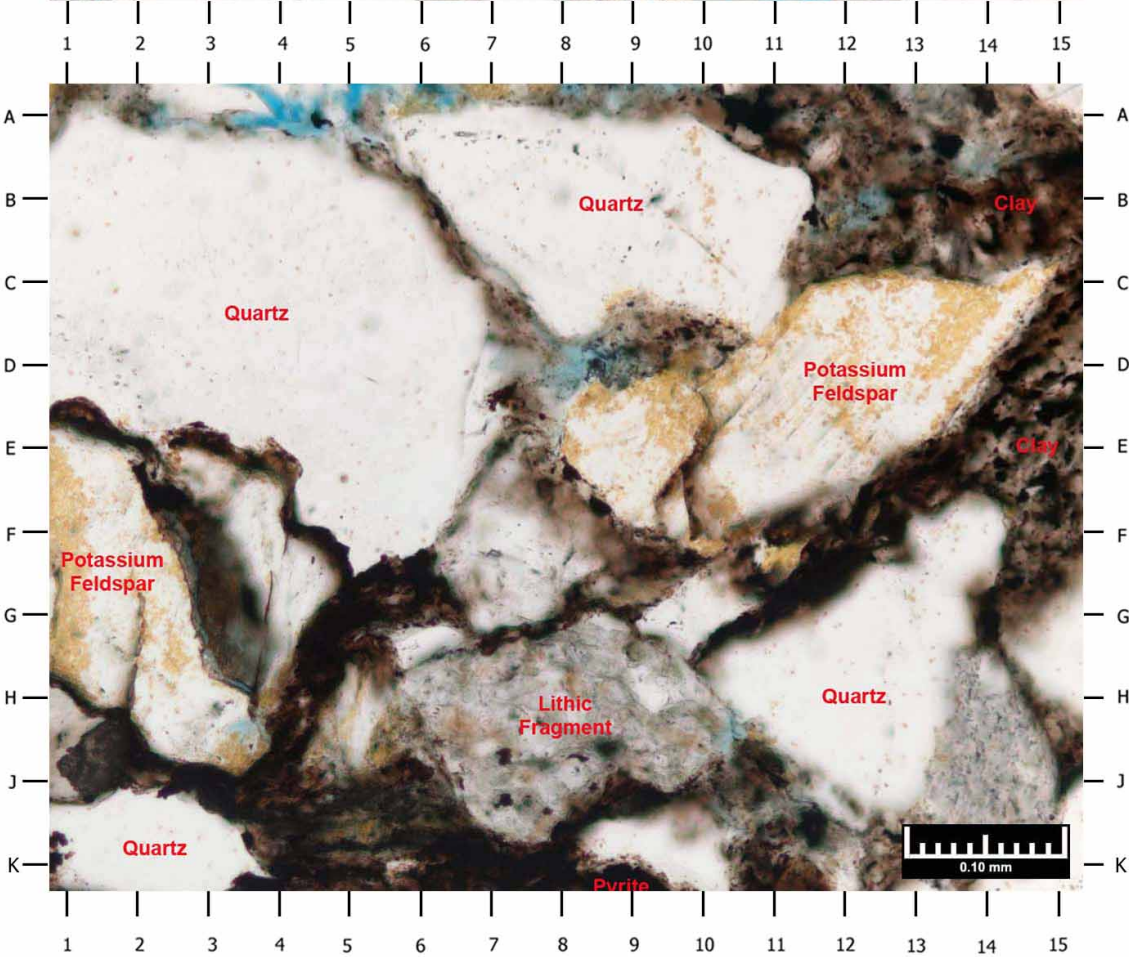
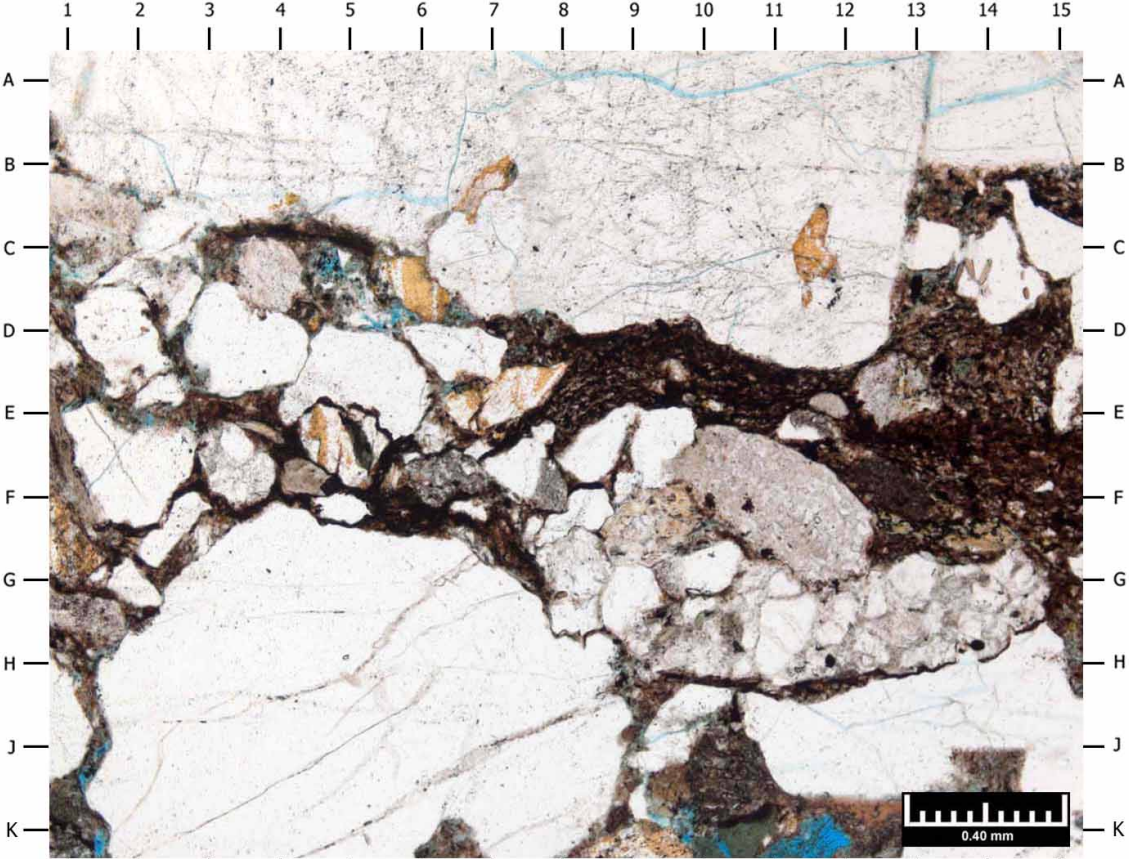
PLATE 22

Lithology*:	Litharenite
Sedimentary Fabric:	Massive; microstylolites
Grain Size Range:	<0.01mm-12.16mm
Average Grain Size:	1.31mm
Compaction:	High
Sorting:	Very poor
Framework Grains:	
Major:	Monocrystalline quartz and conglomerate fragments
Minor:	Chert, metamorphic fragments, siltstone fragments, potassium feldspar, volcanic fragments, plagioclase feldspar, metaquartzite, volcanic glass fragments, and polycrystalline quartz
Accessory:	Muscovite mica, biotite mica, carbonaceous (organic) material and zircon
Clay Content:	
Detrital Matrix:	Rare amounts of detrital clays
Authigenic Clay:	Minor amounts of illite/smectite clays
Cement/Replacement:	Quartz overgrowths, illite/smectite, siderite, and pyrite occur as cement; minor amounts of feldspar, calcite, siderite and pyrite occurring as replacement; trace amounts of chlorite, quartz, microquartz, bitumen, and pyrite occur as replacement of less stable material
Porosity Types:	Intragranular pores associated with leached grains are the dominant pore type present; minor amounts of micropores associated with clays and leached grains and primary intergranular pores; and trace amounts of grain fracture pores
Porosity (RCA):	7.2%
Permeability (RCA):	0.23mD
Grain Density (RCA):	2.67gm/cc

*Folk classification based on visual estimate of sample constituents

Magnification: A: 50X B: 200X

- A) Survey photomicrograph A depicts the laminated fabric of this litharenite. Incipient microstylolites are observed (FG3-15). Thin grain fracture pores (A7-13, AB13-5) are observed within a detrital quartz grain. Clays (DE7-15) commonly occlude intergranular areas.
- B) This photomicrograph provides a magnified view of the area near EF6 in Photo A. Detrital quartz grains (C4, B9, H12), potassium feldspar grains (stained yellow; D12, FG2), and lithic fragments (H8, J14) are observed. Secondary dissolution pores (blue epoxy; A4, D8) are rare.



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Weatherford Labs File No.: AB-76967

THIN SECTION DESCRIPTION
SAMPLE DEPTH: 2968.12 METERS
SAMPLE NUMBER: 1-36P DS

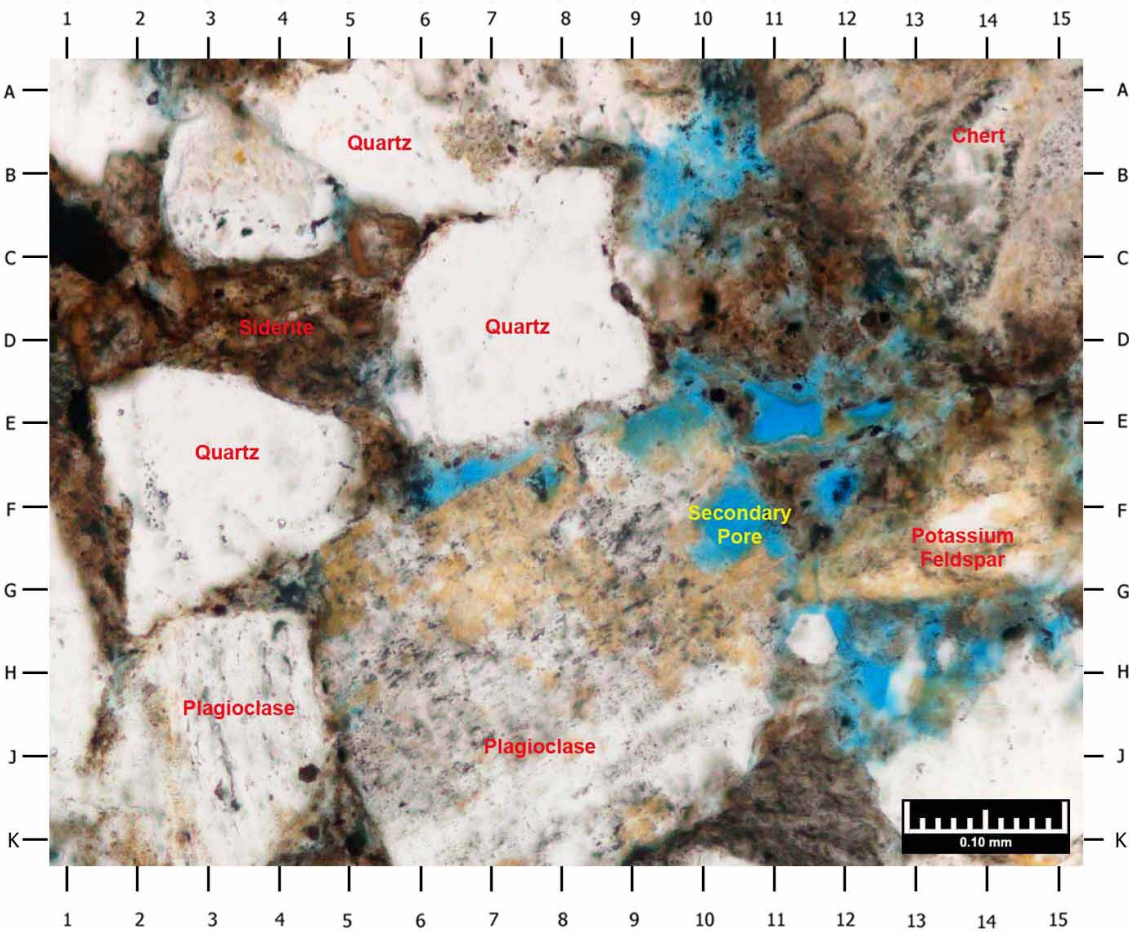
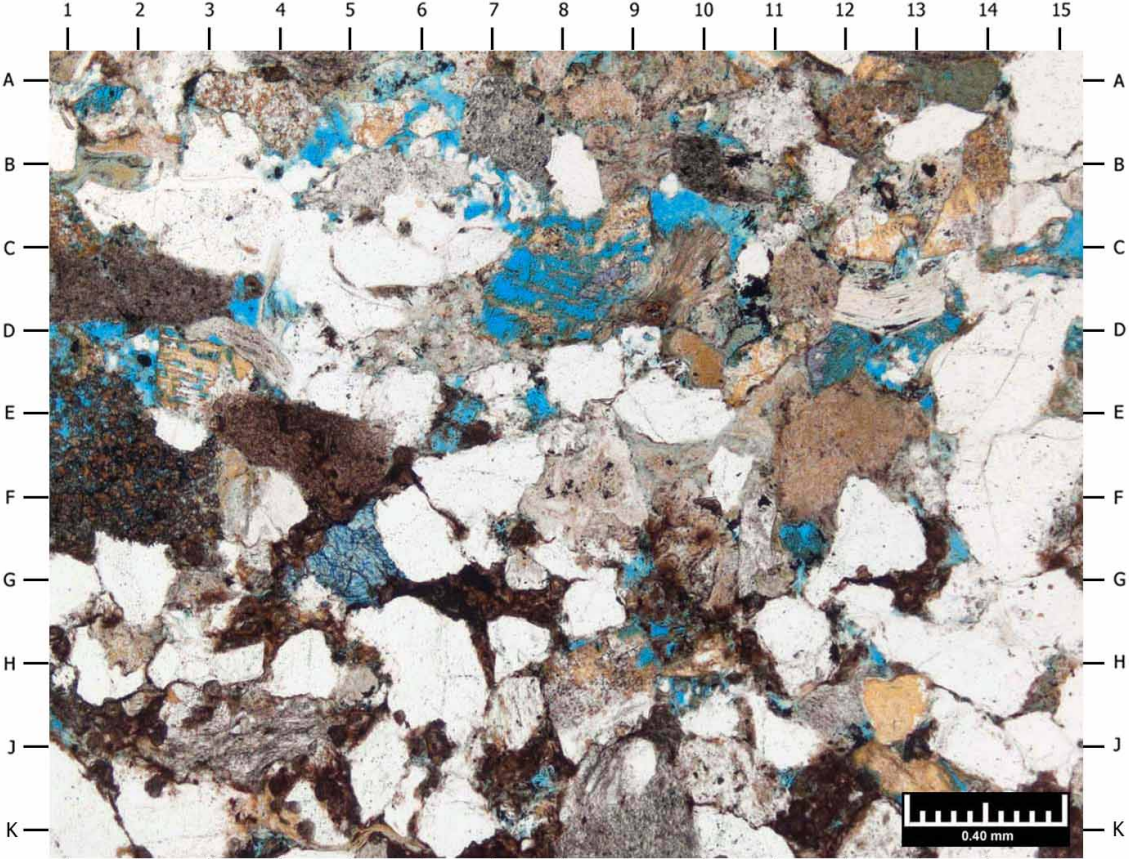
PLATE 23

Lithology*:	Feldspathic litharenite
Sedimentary Fabric:	Massive to laminated; bimodal
Grain Size Range:	0.02mm-10.26mm
Average Grain Size:	0.28mm/2.56mm
Compaction:	Moderate
Sorting:	Moderate to very poor
Framework Grains:	
Major:	Monocrystalline quartz and conglomerate fragments
Minor:	Chert, metamorphic fragments, siltstone fragments, potassium feldspar, volcanic fragments, plagioclase feldspar, metaquartzite, volcanic glass fragments, and polycrystalline quartz
Accessory:	Muscovite mica, carbonaceous (organic) material and zircon
Clay Content:	
Detrital Matrix:	Trace amounts of detrital clays
Authigenic Clay:	Rare amounts of illite/smectite clays
Cement/Replacement:	Quartz overgrowths, illite/smectite, siderite, ankerite, microquartz, and pyrite occur as cement; minor amounts of illite/smectite, quartz, feldspar, microquartz, calcite, siderite and pyrite occurring as replacement; trace amounts of Fe-calcite occurs as replacement of less stable material
Porosity Types:	Intragranular pores associated with leached grains are the dominant pore type present; minor amounts of micropores associated with clays and leached grains and primary intergranular pores; and trace amounts of grain fracture pores
Porosity (RCA):	7.4%
Permeability (RCA):	1.62mD
Grain Density (RCA):	2.67gm/cc

*Folk classification based on visual estimate of sample constituents

Magnification: A: 50X B: 200X

- A) General photomicrograph A displays quartz (A15, G2, H6), plagioclase feldspar (H8.5), potassium feldspar (stained yellow; A12.2, HJ12.5, DE2.5), mudstone fragments (EF4), and altered lithic fragments (G10, J4). Authigenic ankerite cement (stained blue; G5) locally fills intergranular areas.
- B) This photomicrograph provides a magnified view of the area near H8.5 in Photo A. Siderite (CD4) replaces unstable material. Secondary pores (blue epoxy; EF6, F10.5) are associated with partial dissolution of unstable feldspar and lithic grains. Micropores associated with clays are also observed (blue epoxy; AB10, DE11.5).



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Lorelle Sandstone Formation
Queensland, Australia
Conventional Core

Weatherford Labs File No.: AB-76967

THIN SECTION DESCRIPTION
SAMPLE DEPTH: 2970.05 METERS
SAMPLE NUMBER: 1-38P DS

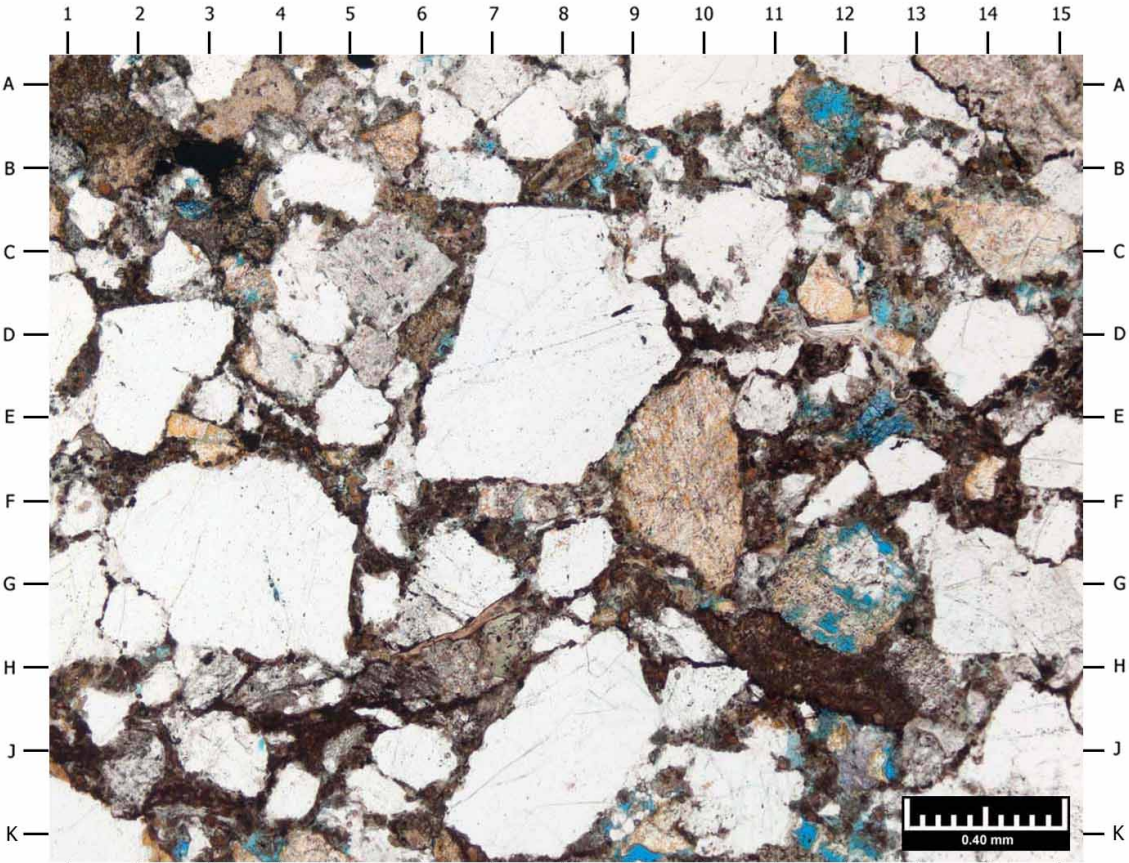
PLATE 24

Lithology*:	Feldspathic litharenite
Sedimentary Fabric:	Massive; bioturbated
Grain Size Range:	0.05mm-11.25mm
Average Grain Size:	0.89mm
Compaction:	High
Sorting:	Very poor
Framework Grains:	
Major:	Monocrystalline quartz and conglomerate fragments
Minor:	Chert, metamorphic fragments, siltstone fragments, potassium feldspar, volcanic fragments, plagioclase feldspar, metaquartzite, and polycrystalline quartz
Accessory:	Muscovite mica, biotite mica, metamorphic chlorite, carbonaceous (organic) material, tourmaline, and zircon
Clay Content:	
Detrital Matrix:	Minor amounts of detrital clays
Authigenic Clay:	Rare amounts of illite/smectite clays
Cement/Replacement:	Quartz overgrowths, feldspar overgrowths, illite/smectite, siderite, and bitumen occur as cement; minor amounts of illite/smectite, chlorite, quartz, Fe-calcite, bitumen, siderite and pyrite occurring as replacement; trace amounts of feldspar and microquartz occurs as replacement of less stable material
Porosity Types:	Intragranular pores associated with leached grains are the dominant pore type present; and minor amounts of micropores associated with clays and leached grains and primary intergranular pores
Porosity (RCA):	5.3%
Permeability (RCA):	0.40mD
Grain Density (RCA):	2.70gm/cc

*Folk classification based on visual estimate of sample constituents

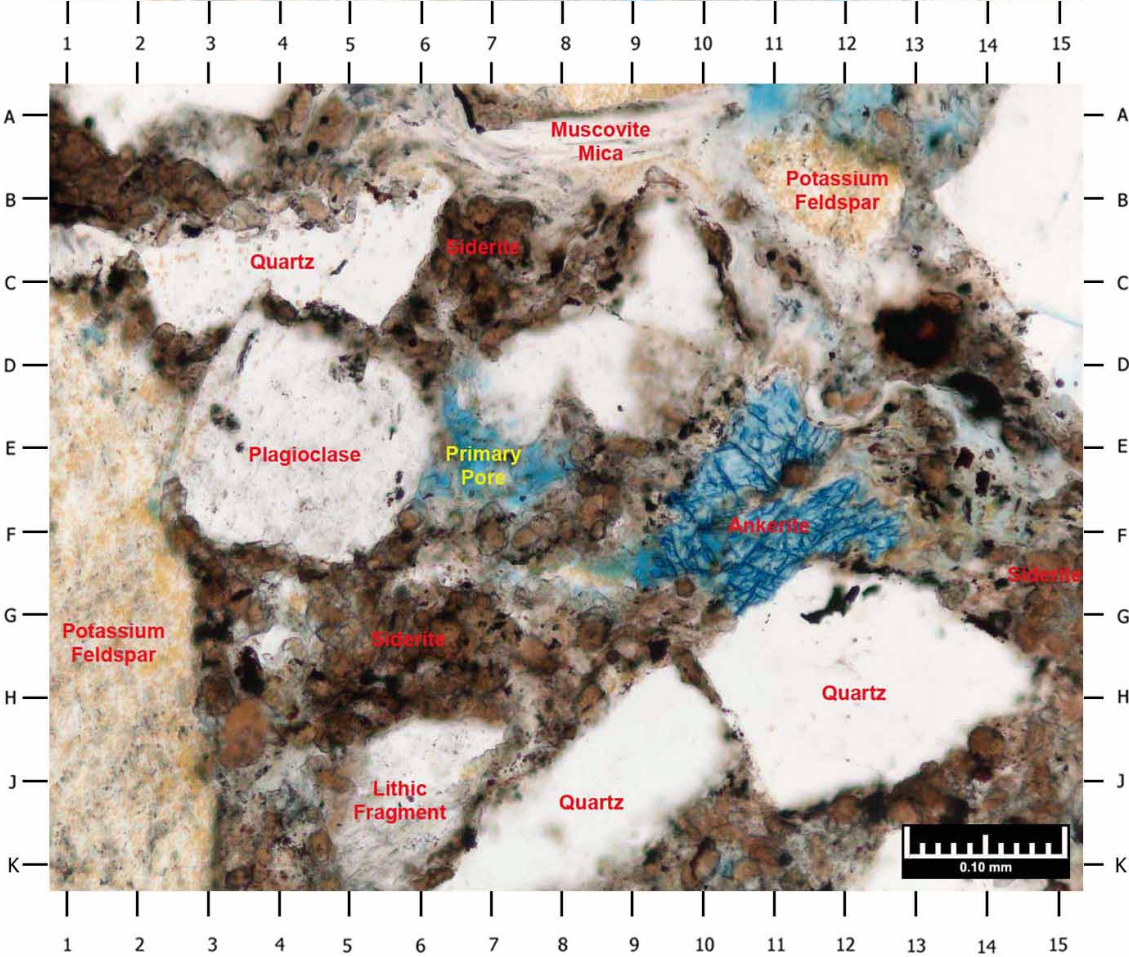
Magnification: A: 50X B: 200X

- A) Survey photomicrograph A depicts the massive fabric of this litharenite. Quartz (A10, D8, G3.5, J8) are the dominant detrital grain type with lesser amounts of potassium feldspar (stained yellow; C14, EF9, EF2.5) and plagioclase feldspar grains (A15, CD5). Secondary dissolution pores (blue epoxy; AB11.5, G12, K12) represent the dominant pore type.
- B) This detailed view of the area near E11.5 in Photo A provides an enhanced view of siderite (AB1-5, C7, GH5, FG15, JK11) occurring as replacement and cement. Ankerite (stained blue; EF11) also occurs as replacement. A rare primary interparticle pore is observed at E6.5.



A

50X



B

200X

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Magnetic-1
Lorelle Sandstone Formation
Queensland, Australia
Conventional Core

Weatherford Labs File No.: AB-76967

THIN SECTION DESCRIPTION
SAMPLE DEPTH: 2972.10 METERS
SAMPLE NUMBER: 1-40P DS

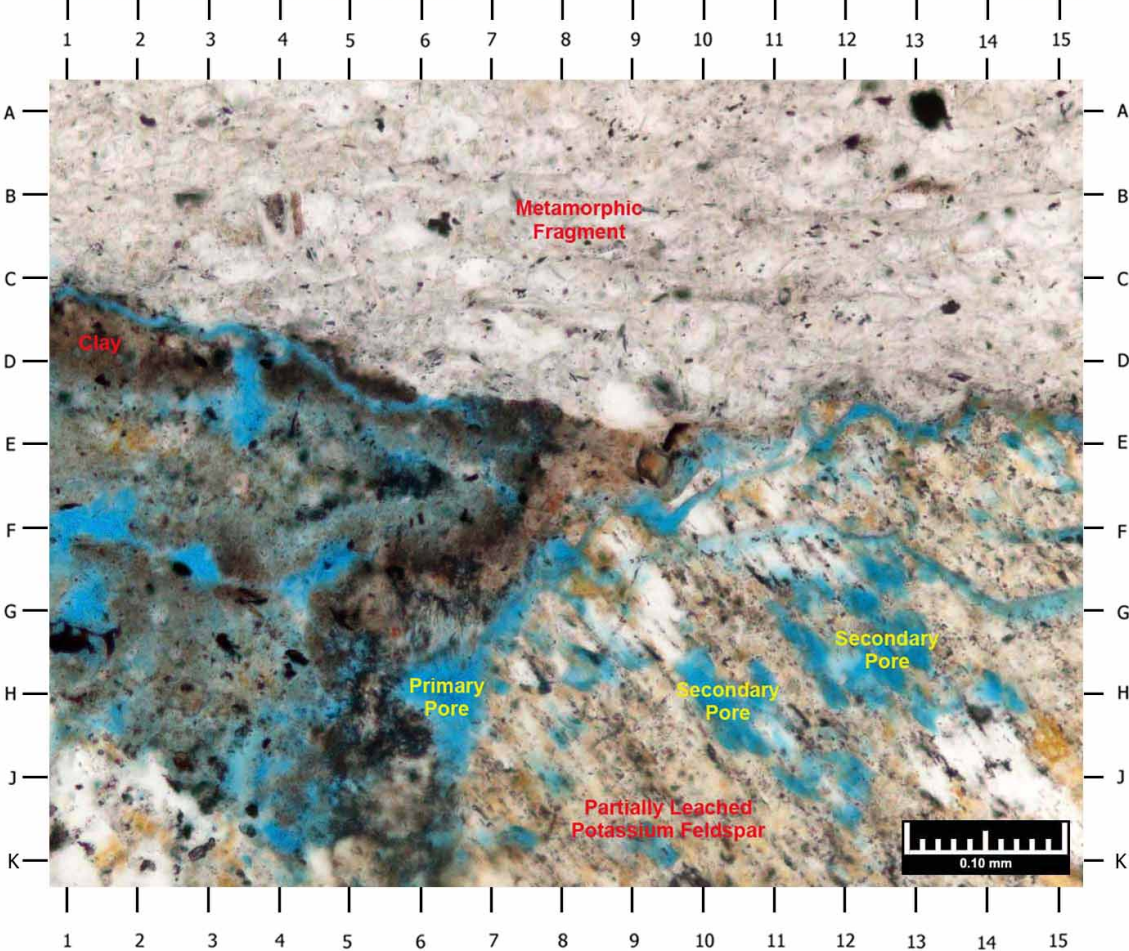
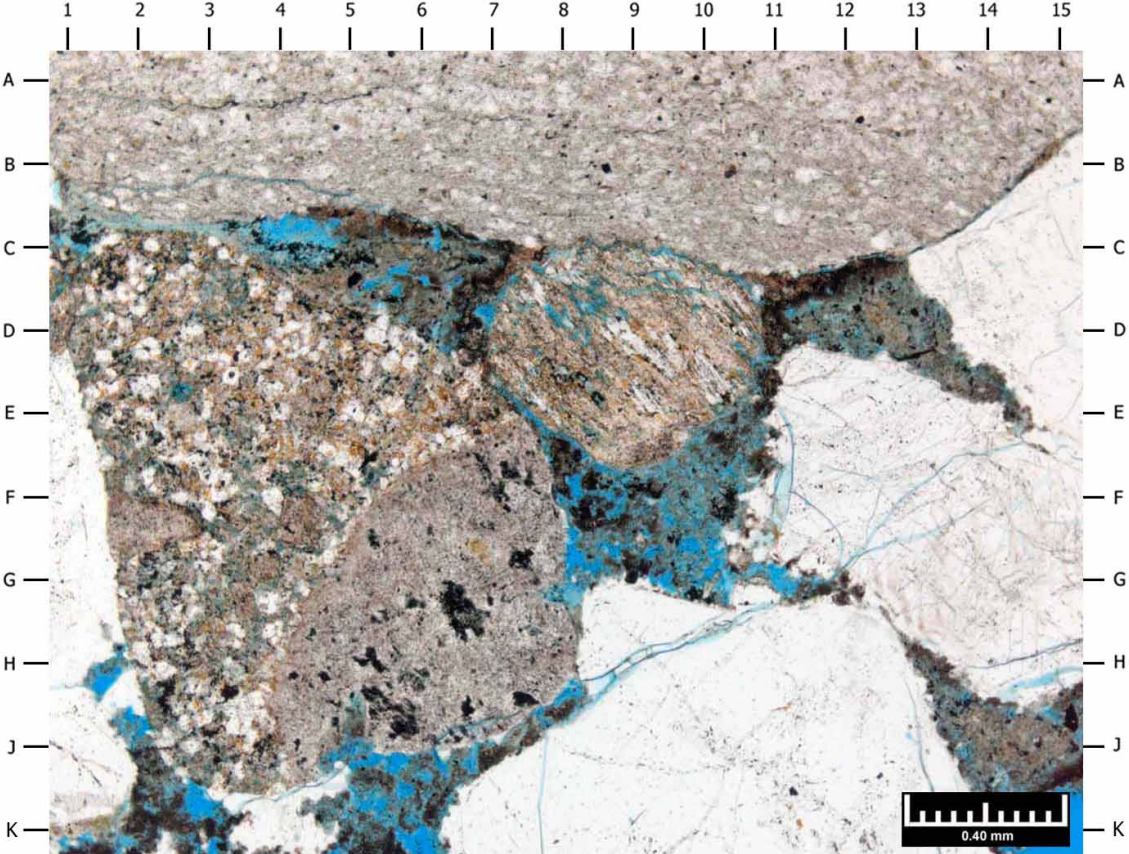
PLATE 25

Lithology*:	Sandy conglomerate
Sedimentary Fabric:	Massive; microstylolites
Grain Size Range:	0.02mm-23.00mm
Average Grain Size:	4.64mm
Compaction:	Very high
Sorting:	Very poor
Framework Grains:	
Major:	Conglomerate fragments
Minor:	Monocrystalline quartz, chert, metamorphic fragments, siltstone fragments, potassium feldspar, volcanic fragments, plagioclase feldspar, metaquartzite, and polycrystalline quartz
Accessory:	Muscovite mica, carbonaceous (organic) material, and zircon
Clay Content:	
Detrital Matrix:	Rare amounts of detrital clays
Authigenic Clay:	Minor amounts of illite/smectite clays
Cement/Replacement:	Quartz overgrowths, illite/smectite, and siderite occur as cement; minor amounts of illite/smectite, microquartz, quartz, Ti-oxide, and pyrite occurring as replacement; trace amounts of feldspar, calcite, Fe-calcite, ankerite and siderite occurs as replacement of less stable material
Porosity Types:	Intragranular pores associated with leached grains are the dominant pore type present; and minor amounts of micropores associated with clays and leached grains; rare primary intergranular pores; and trace grain fracture pores
Porosity (RCA):	9.0%
Permeability (RCA):	0.588mD
Grain Density (RCA):	2.67gm/cc

*Folk classification based on visual estimate of sample constituents

Magnification: A: 50X B: 200X

- A) A conglomerate fragment (F4), metamorphic fragment (AB1-15) dominate the field of view in this photomicrograph. Lesser amounts of quartz (C15, F13, EK1, J10) and a potassium feldspar grain (D9) are also observed. Clays (CD6, D12, F9, JK2.5, J14) partially occlude primary intergranular pores.
- B) This high magnification photomicrograph details the area near CD7.5 in Photo A. Secondary pores (blue epoxy; GH10, GH12) are a result of partial dissolution of an unstable potassium feldspar grain. Despite very high compaction minor primary pores (H6.5) are preserved.



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Magnetic-1
Lorelle Sandstone Formation
Queensland, Australia
Conventional Core

Weatherford Labs File No.: AB-76967

THIN SECTION DESCRIPTION
SAMPLE DEPTH: 2974.13 METERS
SAMPLE NUMBER: 2-44P DS

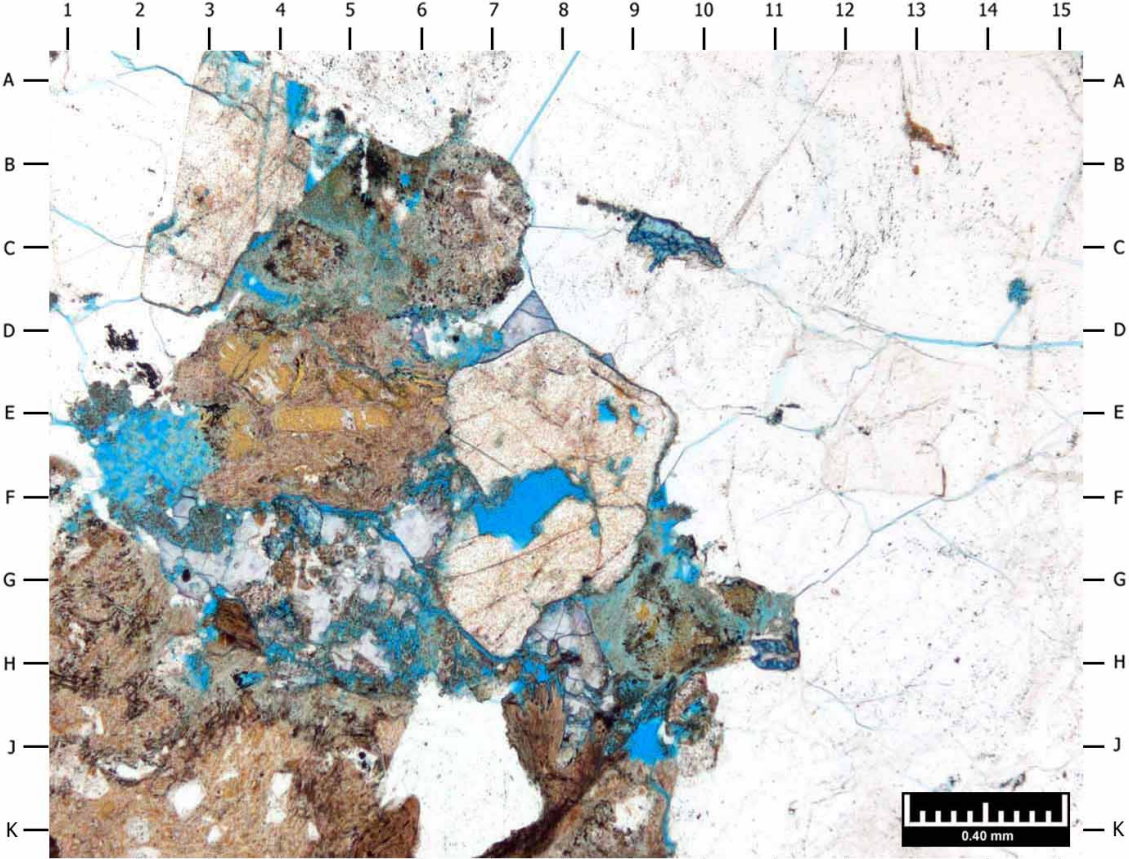
PLATE 26

Lithology*:	Sandy conglomerate
Sedimentary Fabric:	Massive
Grain Size Range:	<0.01mm-16.56mm
Average Grain Size:	7.15mm
Compaction:	Moderate
Sorting:	Very poor
Framework Grains:	
Major:	Conglomerate fragments
Minor:	Monocrystalline quartz, chert, metamorphic fragments, siltstone fragments, potassium feldspar, volcanic fragments, plagioclase feldspar, metaquartzite, and polycrystalline quartz
Accessory:	Muscovite mica, biotite mica, and zircon
Clay Content:	
Detrital Matrix:	Trace amounts of detrital clays
Authigenic Clay:	Trace amounts of illite/smectite clays
Cement/Replacement:	Quartz overgrowths, illite/smectite, microquartz, calcite, Fe-calcite, ankerite and pyrite occur as cement; minor amounts of illite/smectite, chlorite, quartz, and pyrite occurring as replacement; trace amounts of feldspar, calcite, and ankerite occurs as replacement of less stable material
Porosity Types:	Intragranular pores associated with leached grains are the dominant pore type present; and minor amounts of micropores associated with clays and leached grains; rare primary intergranular pores; and trace grain fracture pores
Porosity (RCA):	6.3%
Permeability (RCA):	2.14mD
Grain Density (RCA):	2.68gm/cc

*Folk classification based on visual estimate of sample constituents

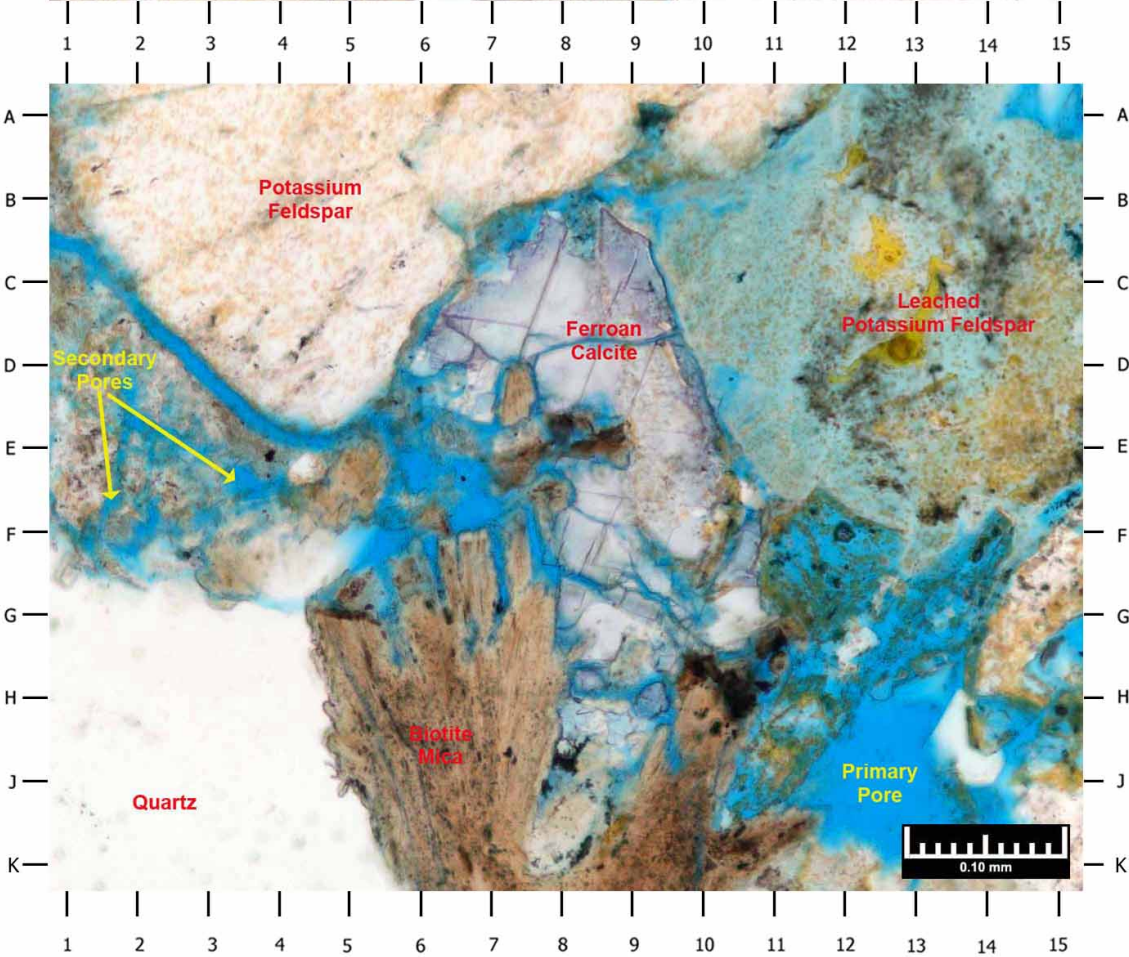
Magnification: A: 50X B: 200X

- A) This low magnification photomicrograph provides a general overview of this massive sandy conglomerate. Conglomerate fragments (EF5, GH1, K4) represent the dominant detrital grain type. Authigenic quartz cement (B2, A8-K10) (B2, A8-K10) and minor ferroan calcite cement (D7.5) fills intergranular areas.
- B) This photomicrograph provides a magnified view of the area near HJ8 in Photo A. Ferroan calcite occurs as authigenic replacement (stained purple; D8.5). Secondary pores (blue epoxy, F1, EF3) are associated with partially dissolved labile grains (blue epoxy; J12.5). Primary intergranular pores are also observed.



A

50X



B

200X

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Lorelle Sandstone Formation
Queensland, Australia
Conventional Core

Weatherford Labs File No.: AB-76967

THIN SECTION DESCRIPTION
SAMPLE DEPTH: 2976.05 METERS
SAMPLE NUMBER: 2-46P DS

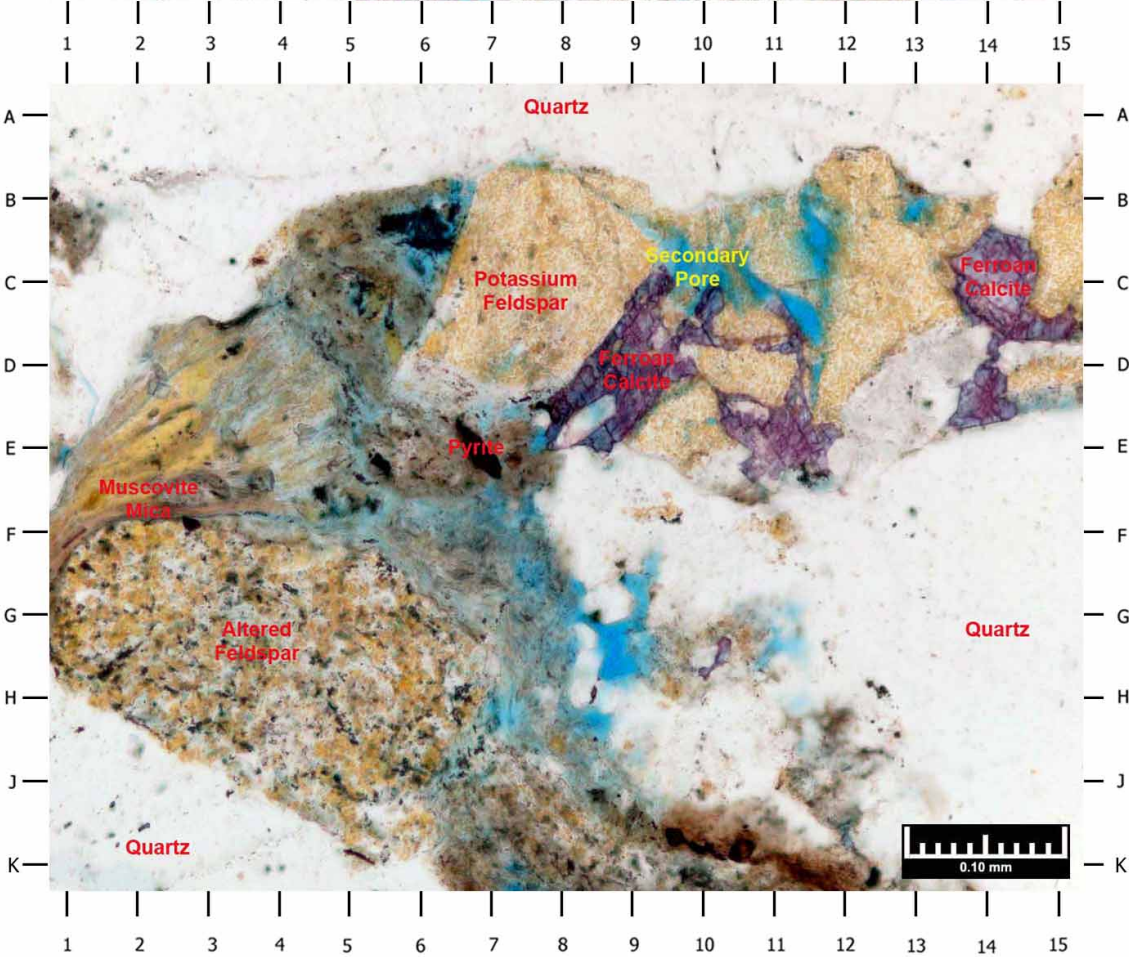
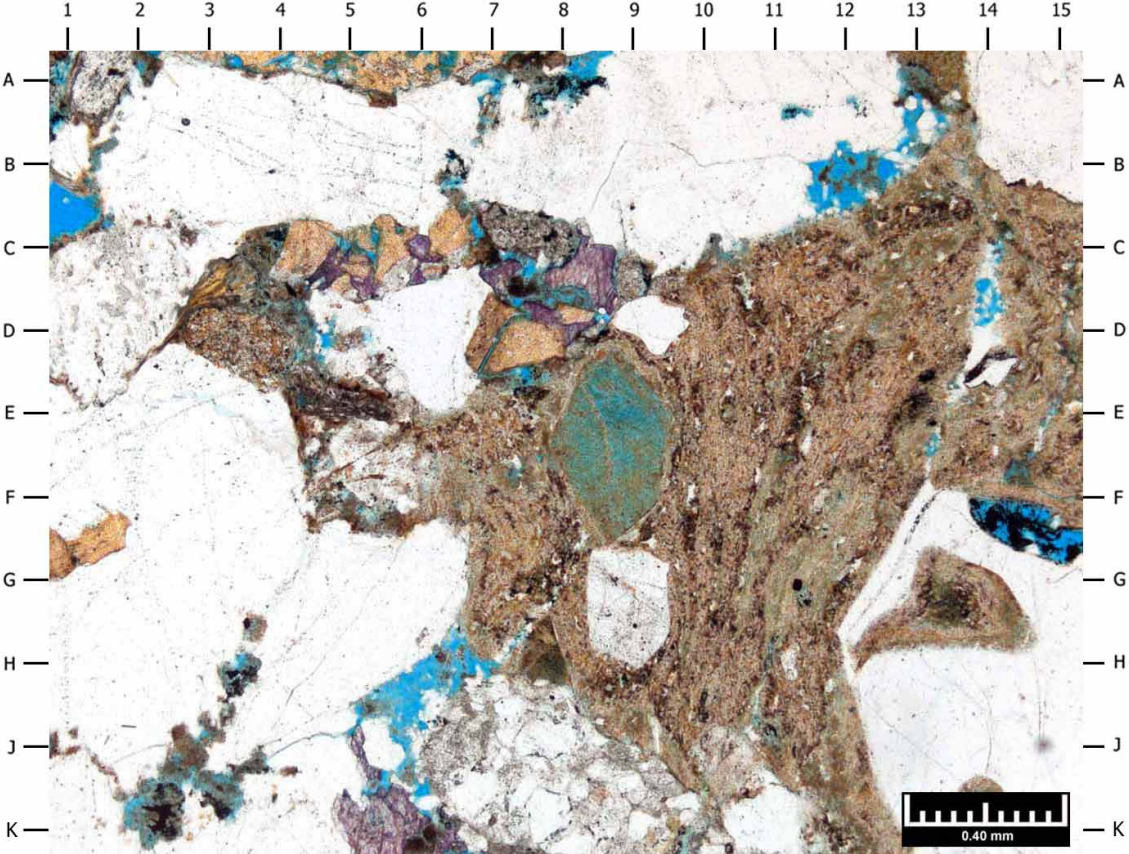
PLATE 27

Lithology*:	Slightly sandy conglomerate
Sedimentary Fabric:	Laminated
Grain Size Range:	<0.01mm-20.14mm
Average Grain Size:	9.31mm
Compaction:	Moderate
Sorting:	Very poor
Framework Grains:	
Major:	Conglomerate fragments
Minor:	Monocrystalline quartz, chert, metamorphic fragments, siltstone fragments, potassium feldspar, volcanic fragments, and polycrystalline quartz
Accessory:	Muscovite mica, biotite mica, and carbonaceous (organic) material
Clay Content:	
Detrital Matrix:	Rare amounts of detrital clays
Authigenic Clay:	Trace amounts of illite/smectite clays
Cement/Replacement:	Quartz overgrowths, microquartz, and pyrite occur as cement; minor amounts of illite/smectite, chlorite, quartz, Fe-calcite and pyrite occurring as replacement; and a trace amount of ankerite occurs as replacement of less stable material
Porosity Types:	Intragranular pores associated with leached grains are the dominant pore type present; and minor amounts of micropores associated with clays and leached grains; and trace primary intergranular pores and trace grain fracture pores
Porosity (RCA):	4.0%
Permeability (RCA):	0.83mD
Grain Density (RCA):	2.67gm/cc

*Folk classification based on visual estimate of sample constituents

Magnification: A: 50X B: 200X

- A) This general overview provides a low magnification view of this slightly sandy conglomerate. Conglomerate fragments (JK8) and quartz (B4, B10, J14, G3) are the dominant detrital constituents. Clays locally fill primary intergranular areas (BC13-K12).
- B) This photomicrograph provides a detailed view of the area near DE4.5 in Photo A. A partially dissolved potassium feldspar (stained yellow; CD6-15) contains secondary pores (blue epoxy; BC10, BC11.5), some of these pores are filled by ferroan calcite (stained purple; D9, E11, CD14). Pyrite (black; EF6.5) occurs as replacement of susceptible material.



QGC- A BG Group Business
Magnetic-1
Lorelle Sandstone Formation
Queensland, Australia
Conventional Core

Weatherford Labs File No.: AB-76967

THIN SECTION DESCRIPTION
SAMPLE DEPTH: 2978.07 METERS
SAMPLE NUMBER: 2-48P DS

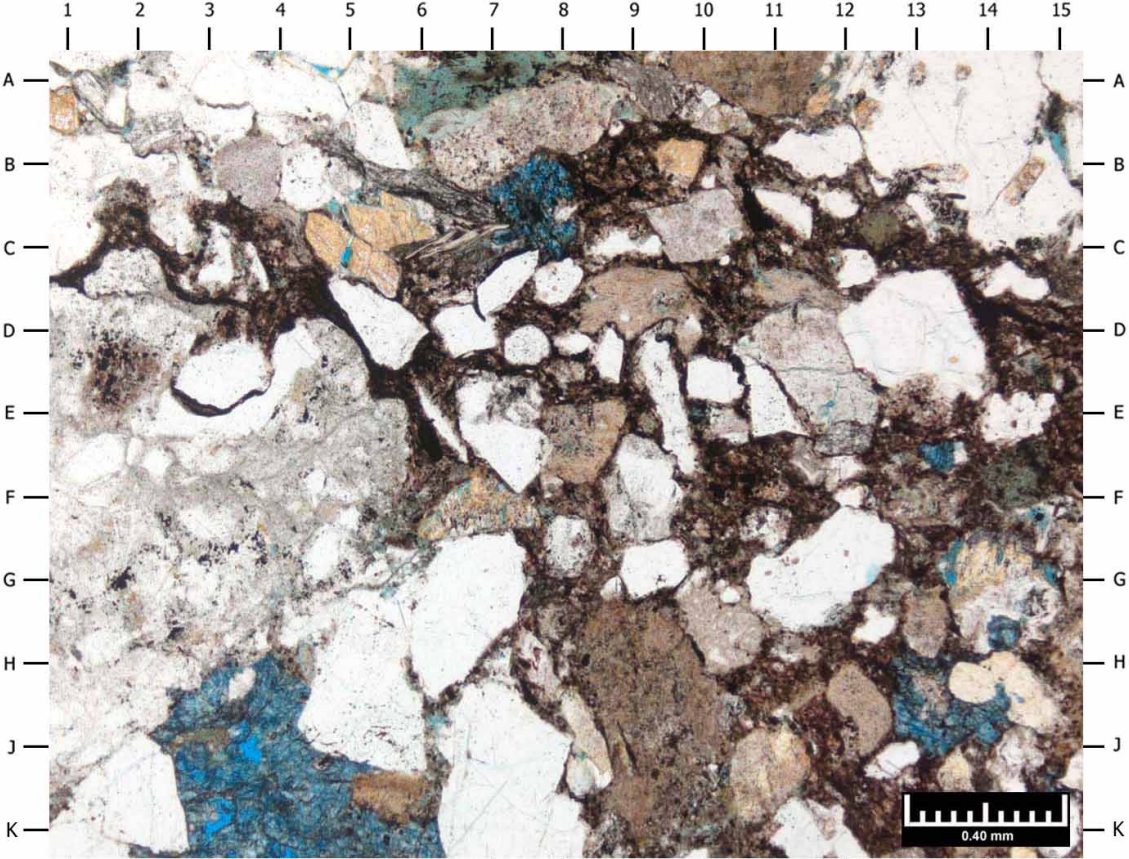
PLATE 28

Lithology*:	Feldspathic litharenite
Sedimentary Fabric:	Massive; microstylolites
Grain Size Range:	0.03mm-2.16mm
Average Grain Size:	0.49mm
Compaction:	High
Sorting:	Very poor
Framework Grains:	
Major:	Conglomerate fragments and monocrystalline quartz
Minor:	Chert, volcanic rock fragments, plagioclase feldspar mudstone fragments, polycrystalline quartz, tuffaceous, metamorphic rock fragments, potassium feldspar, metaquartzite, and siltstone fragments
Accessory:	Muscovite mica, biotite mica, carbonaceous (organic) material, metamorphic chlorite, and zircon
Clay Content:	
Detrital Matrix:	Minor amounts of detrital clays
Authigenic Clay:	Minor amounts of illite and smectite
Cement/Replacement:	Minor amounts of quartz overgrowths, ankerite, siderite, calcite, Fe-calcite, lamontite, microquartz, and bitumen cement; minor amounts of illite/smectite, quartz, feldspar, ankerite, Fe-calcite, siderite, sericite, microquartz, lamontite, and pyrite occurring as replacement of susceptible material
Porosity Types:	Intragranular pores associated with leached grains are the dominant pore type present; and minor amounts of micropores associated with clays and leached grains; and trace primary intergranular pores and trace grain fracture pores
Porosity (RCA):	5.8%
Permeability (RCA):	0.45mD
Grain Density (RCA):	2.69gm/cc

*Folk classification based on visual estimate of sample constituents

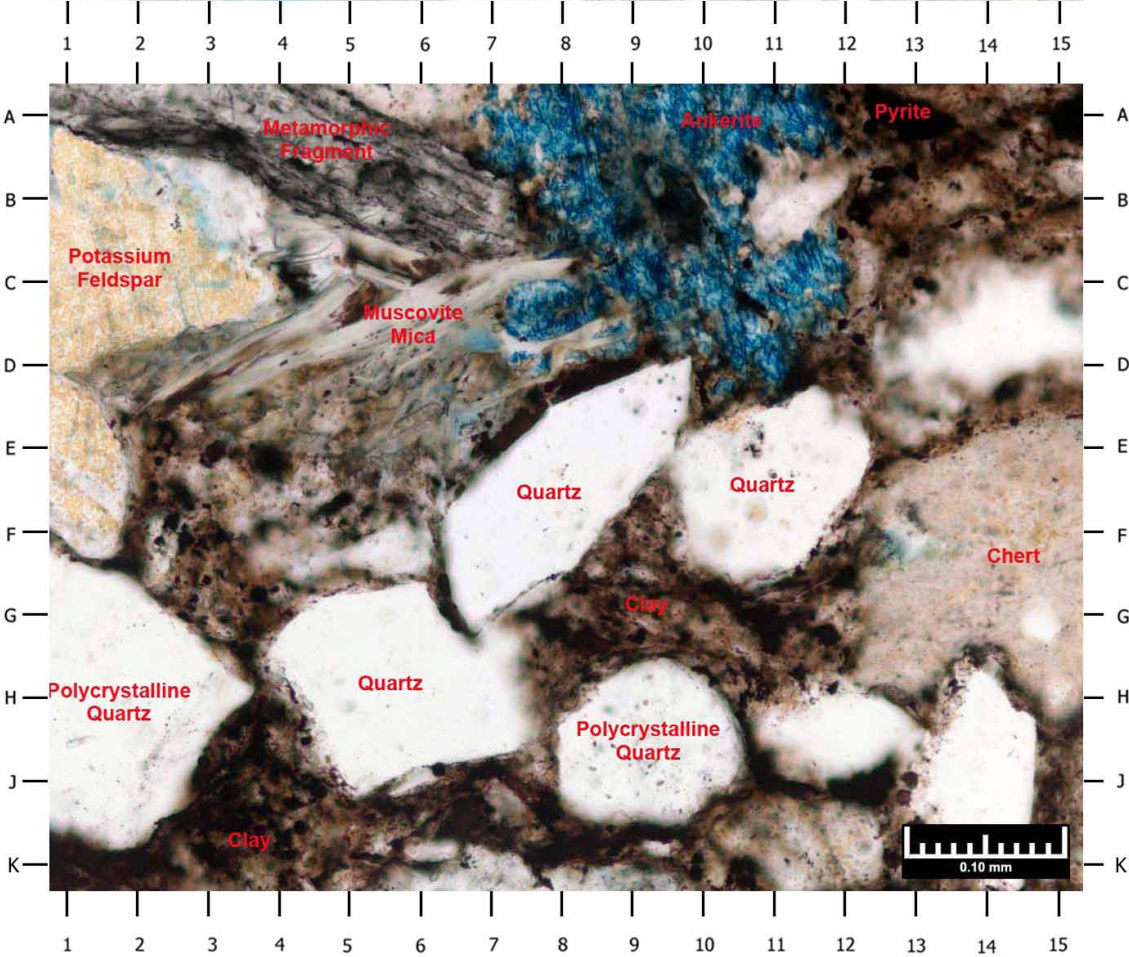
Magnification: A: 50X B: 200X

- A) This photomicrograph depicts the massive fabric of this feldspathic litharenite. Detrital grains include conglomerate fragments (FG2), quartz (D13, JK7), plagioclase feldspar (B7, CD8.5), and potassium feldspar (stained yellow; C5, B9.5, G14). Ankerite occurs as replacement of unstable grains (stained blue; BC7.5). Incipient microstylolites (CD1-15) indicate high compaction.
- B) This photomicrograph provides a magnified view of the area near CD7 in Photo A. Clays fill the intergranular areas within this photo. Authigenic quartz overgrowths precipitate on host detrital grains (D9.5).



A

50X



B

200X

QGC- A BG Group Business
Magnetic-1
Lorelle Sandstone Formation
Queensland, Australia
Conventional Core

Weatherford Labs File No.: AB-76967

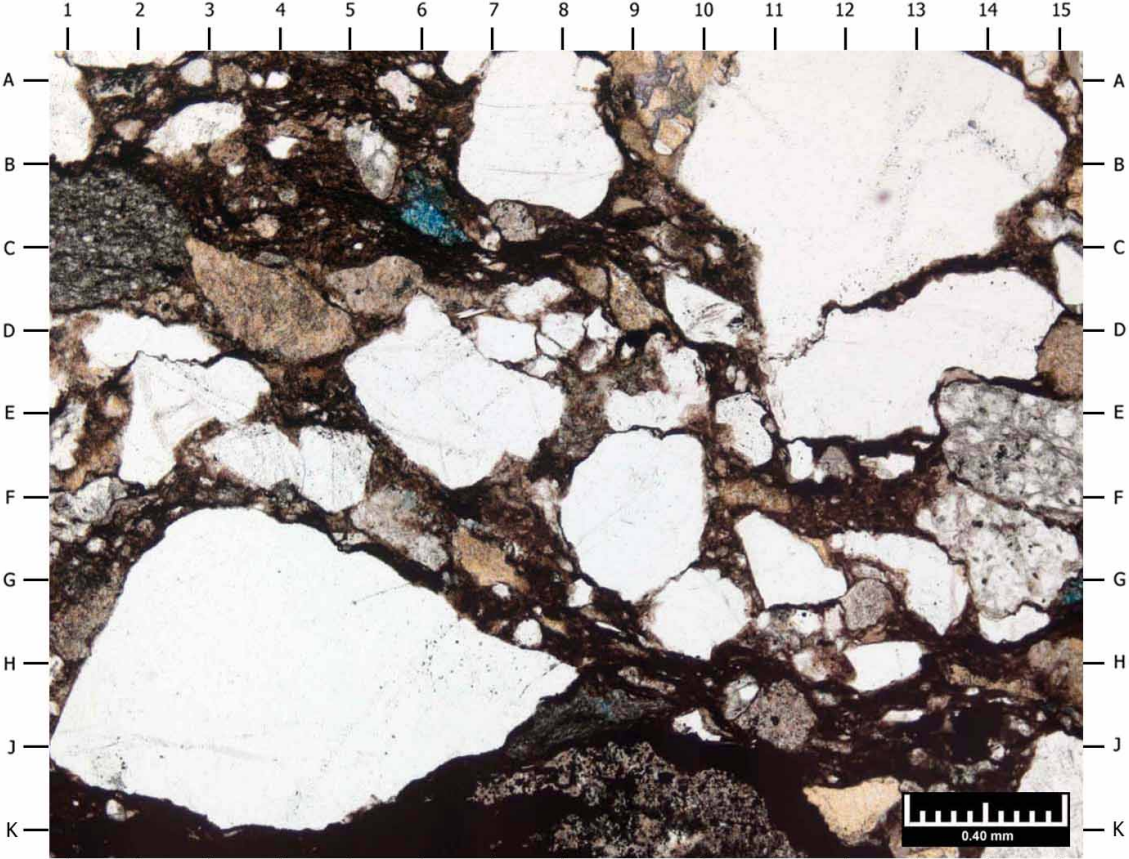
THIN SECTION DESCRIPTION
SAMPLE DEPTH: 2980.09 METERS
SAMPLE NUMBER: 2-50P DS

PLATE 29

Lithology*: Sandy conglomerate
Sedimentary Fabric: Massive to laminated; microstylolites
Grain Size Range: 0.01mm-15.01mm
Average Grain Size: 6.79mm
Compaction: High
Sorting: Very poor
Framework Grains:
 Major: Conglomerate fragments
 Minor: Monocrystalline quartz, chert, metamorphic fragments, siltstone fragments, potassium feldspar, volcanic fragments, plagioclase feldspar, metaquartzite, and polycrystalline quartz
 Accessory: Muscovite mica, biotite mica, carbonaceous (organic) material, tourmaline, and zircon
Clay Content:
 Detrital Matrix: Minor amounts of detrital clays
 Authigenic Clay: Rare amounts of illite/smectite clays
Cement/Replacement: Quartz overgrowths, calcite, Fe-calcite, ankerite and pyrite occur as cement; minor amounts of illite/smectite, quartz, calcite, Fe-calcite, ankerite, and pyrite occurring as replacement of less stable material
Porosity Types: Minor amounts of micropores associated with clays and leached grains; minor amounts of intragranular pores associated with leached grains; and trace grain fracture pores
Porosity (RCA): 3.9%
Permeability (RCA): 0.063mD
Grain Density (RCA): 2.69gm/cc

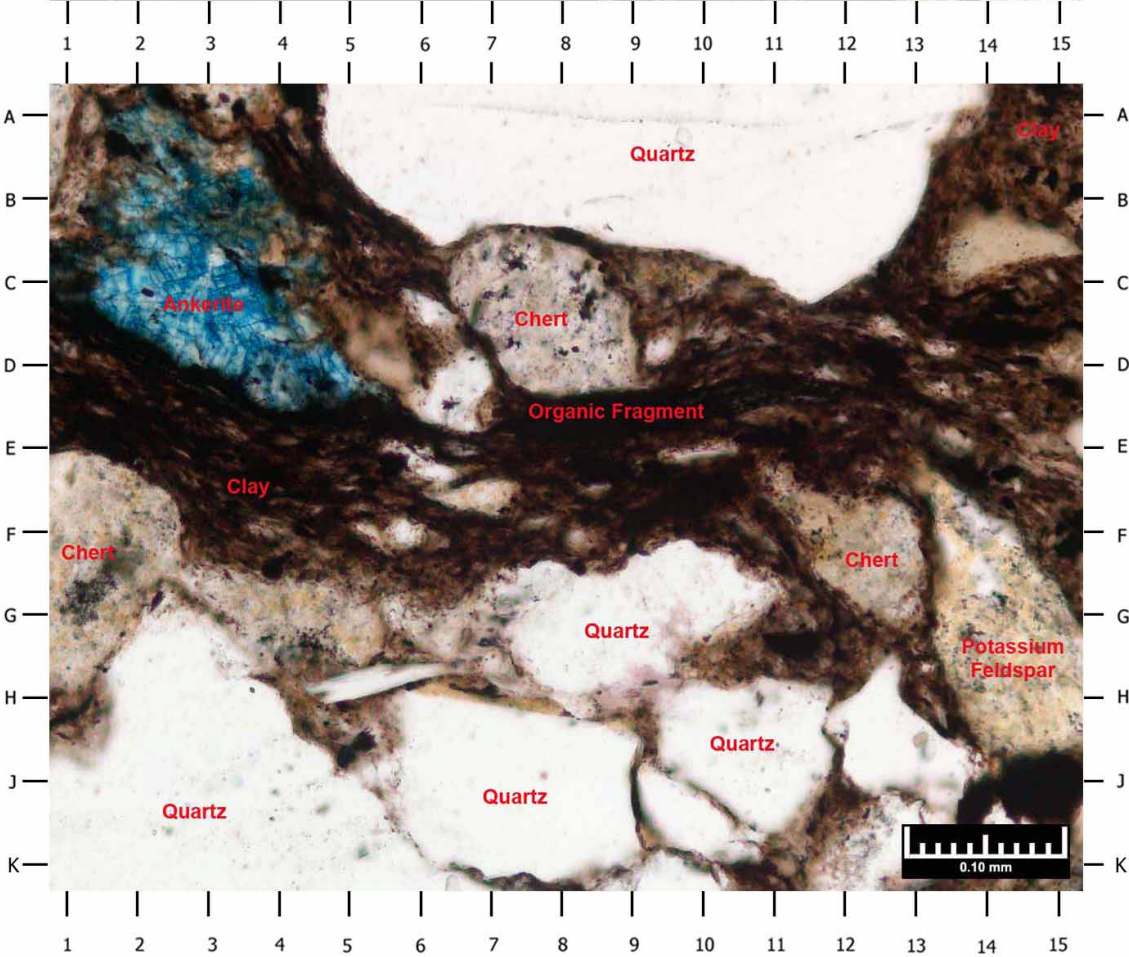
Magnification: A: 50X B: 200X

- A) Survey photomicrograph A depicts the massive fabric of this sandy conglomerate. Sand-sized grains of quartz (B7.5, B12, E6, H4), conglomerate fragments (EF14.5), metamorphic rock fragments (C1.5), plagioclase feldspar (CD4), and potassium feldspar (stained yellow; A9.5, JK12) compose the majority of the detrital constituents.
- B) This photomicrograph provides a magnified view of the area near CD7.5 in Photo A. Ankerite (stained blue; C2.5) occurs as replacement of unstable material, probable organic material. A compacted organic fragment occurs at DE8.



A

50X



B

200X

QGC- A BG Group Business
Magnetic-1
Lorelle Sandstone
Queensland, Australia
Conventional Core

Weatherford Labs File No.: AB-76967

THIN SECTION DESCRIPTION
SAMPLE DEPTH: 2982.04 METERS
SAMPLE NUMBER: 2-52P DS

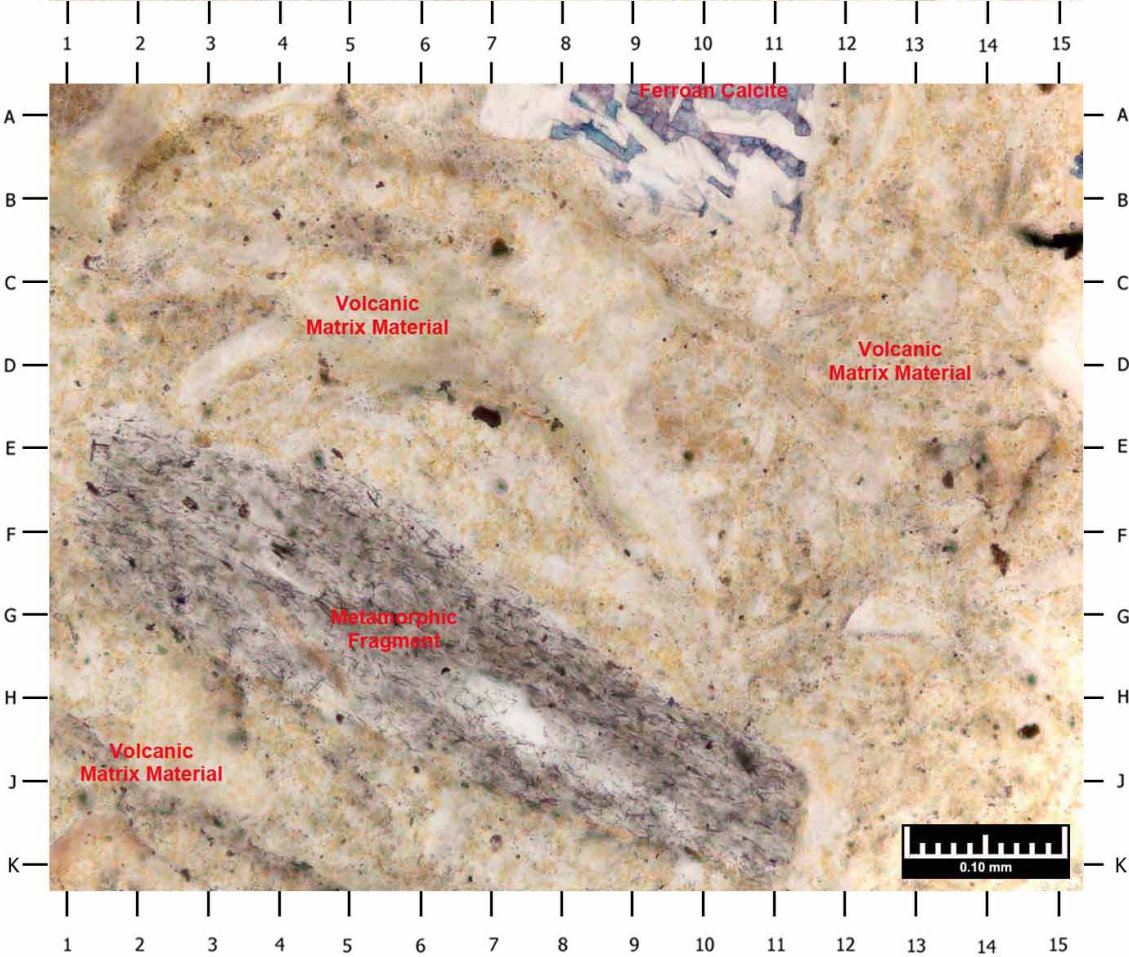
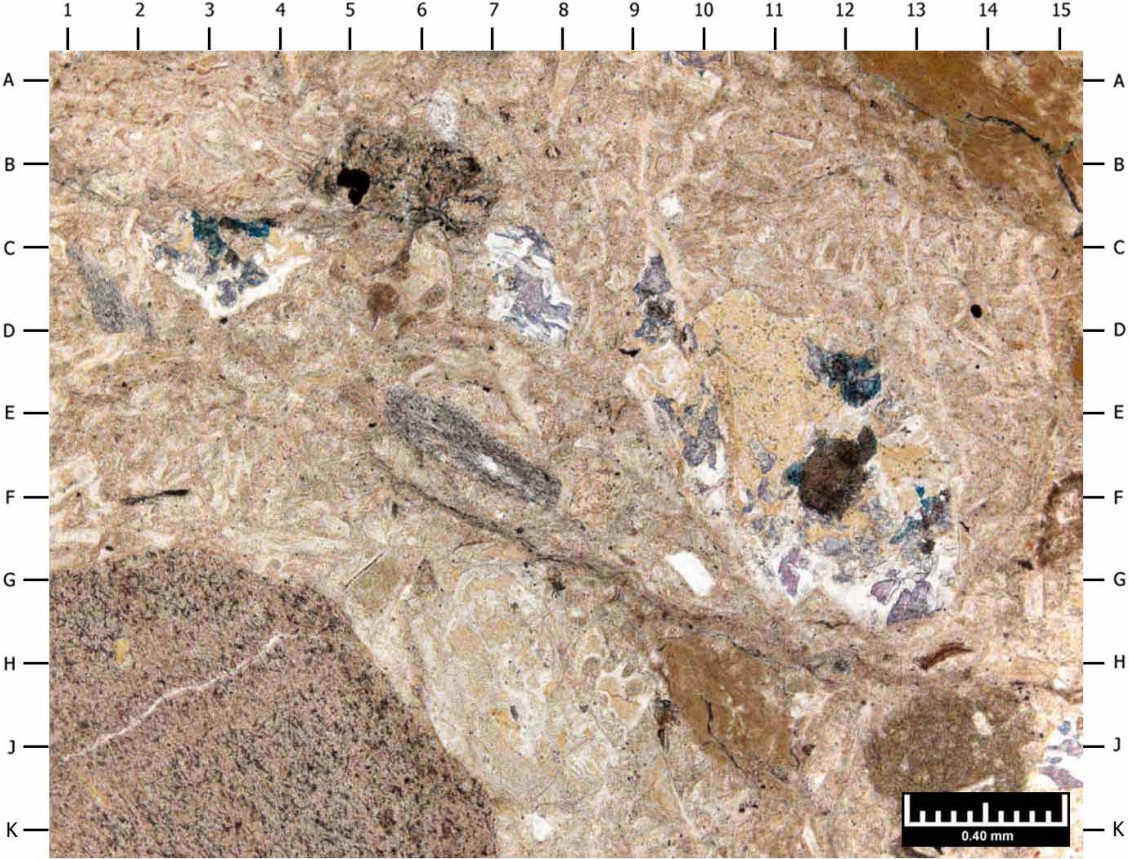
PLATE 30

Lithology*: Tuffaceous agglomerate
Sedimentary Fabric: Clay-altered tuffaceous deposit with massive configuration
Particle Size Range: <0.01mm-8.36mm
Average Grain Size: N/A
Visual Sorting: Very poor
Compaction: Low
Detrital Grains / Allochems:
 Major: Altered volcanic glass
 Minor: Chert, tuffaceous volcanic fragments, andesitic volcanic fragments, plagioclase feldspar, siltstone fragments, and metamorphic schistose fragments

 Accessory: Muscovite, biotite, chamosite, sphalerite and tourmaline
Matrix: The matrix consists of welded tuffaceous material and abundant amounts of alteration clay minerals (visual est. 30%, by volume); XRD analysis indicates that clay minerals account for 33% (by weight), with measured clays types mainly including mixed-layer illite/smectite (21%), with lesser amounts of illite/mica (10%), and rare chlorite (2%), and kaolinite (trace).
Cement / Replacement: Common authigenic illitic clay occurs as a pore-filling and replacement of altered grains; minor chlorite replacing labile grains; rare pyrite occurs as scattered framboids attached to detrital grains and as a replacement of detrital clays; rare replacement of dissolved grains by microquartz
Porosity Types: Minor micropores associated with detrital clay matrix and partially dissolved grains and rare secondary intragranular pores within partially dissolved grains
Porosity (RCA): 6.6%
Permeability (RCA): 0.007mD
Grain Density (RCA): 2.70gm/cc

Magnification: A: 50X B: 200X

- A) This photomicrograph provides a general overview of this tuffaceous agglomerate. Welded tuffaceous matrix material composes most of this field of view. A volcanic fragment occurs at J3. Authigenic quartz (CD3, D7, E9-G13) and ferroan calcite (stained purple; CD7.2, EF10, G12.5) is observed.
- B) A detailed view of the area near E7 in Photo A is represented in this photomicrograph. A metamorphic rock fragment occurs at F1-K11 and is surrounded by volcanic matrix material. Ferroan calcite (A9.5) replaces a feldspar grain.



QGC- A BG Group Business
Magnetic-1
PS46 TRS
Queensland, Australia
Conventional Core

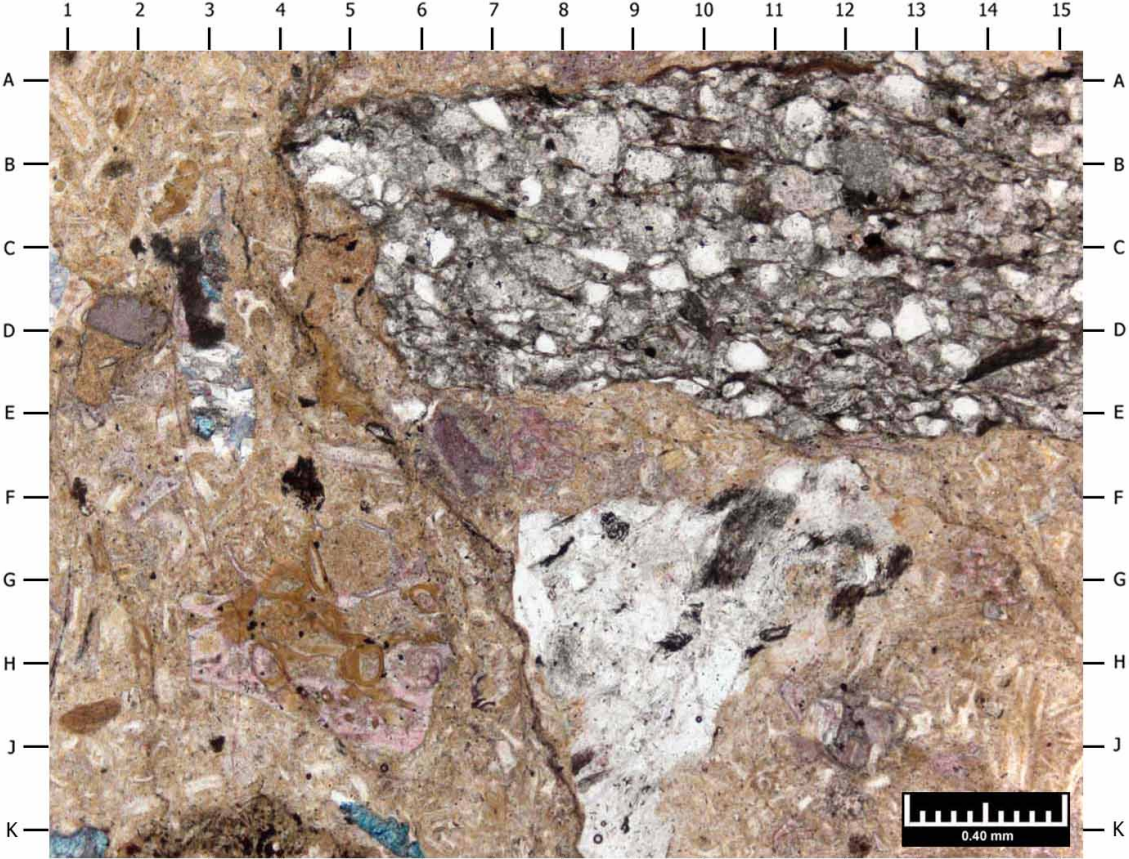
Weatherford Labs File No.: AB-76967

THIN SECTION DESCRIPTION
SAMPLE DEPTH: 2987.05 METERS
SAMPLE NUMBER: 2-57P DS

PLATE 31

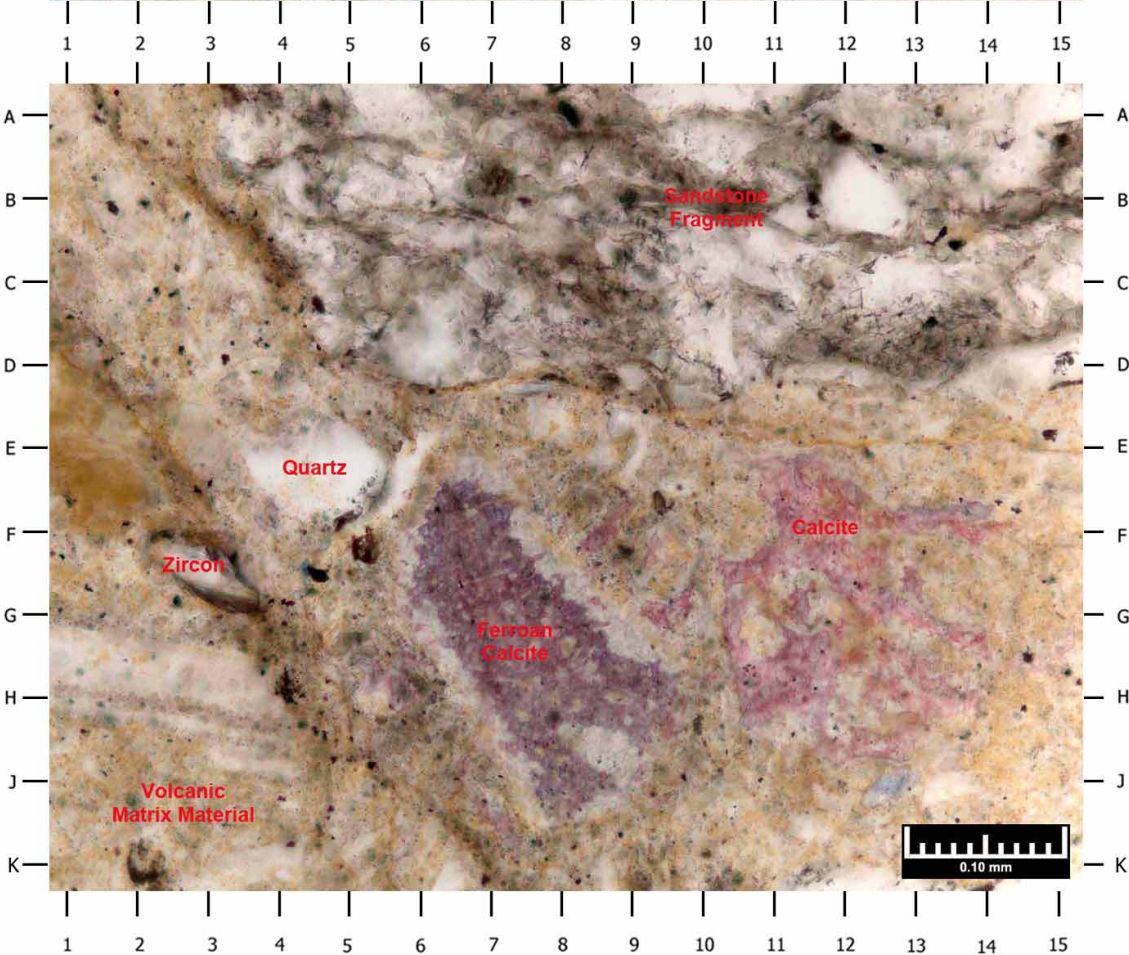
Lithology*: Tuffaceous agglomerate
Sedimentary Fabric: Clay-altered tuffaceous deposit with massive configuration
Particle Size Range: <0.01mm-14.44mm
Average Grain Size: N/A
Visual Sorting: Very poor
Compaction: Low
Detrital Grains / Allochems:
 Major: Altered volcanic glass
 Minor: Tuffaceous volcanic fragments, andesitic volcanic fragments, potassium feldspar, monocrystalline quartz, siltstone/sandstone fragments, mudstone fragments, and metamorphic schistose fragments
Accessory: Heavy minerals (tourmaline)
Matrix: The matrix consists of welded tuffaceous material and abundant amounts of alteration clay minerals (visual est. 25%, by volume); XRD analysis indicates that clay minerals account for 24% (by weight), with measured clays types mainly including mixed-layer illite/smectite (14%), with lesser amounts of illite/mica (7%), and rare chlorite (3%), and kaolinite (trace).
Cement / Replacement: Common authigenic illitic clay occurs as a pore-filling and replacement of altered grains; minor chlorite replacing labile grains; rare pyrite occurs as scattered framboids attached to detrital grains and as a replacement of detrital clays; rare replacement of dissolved grains by microquartz, ankerite, calcite, and Fe-calcite
Porosity Types: Minor micropores associated with detrital clay matrix and partially dissolved grains and rare grain fracture pores
Porosity (RCA): 5.8%
Permeability (RCA): 0.055mD
Grain Density (RCA): 2.69gm/cc
Magnification: A: 50X B: 200X

- A) A probable sandstone fragment (C5-15) and volcanic fragment (GH9) are surrounded by welded tuffaceous matrix material. Ankerite (stained blue; K1, K5.5) and calcite (stained red; HJ5.5) occur as replacement of less stable material.
- B) This high magnification photomicrograph details the area near EF6 in Photo A. Intergranular areas are filled with volcanic clay. The heavy mineral zircon occurs at FG2.5. Ferroan calcite (stained purple; GH8) occurs as possible replacement of susceptible material.



A

50X



B

200X

THIN SECTION DESCRIPTION
SAMPLE DEPTH: 2994.7 METERS
SAMPLE NUMBER: SWC8

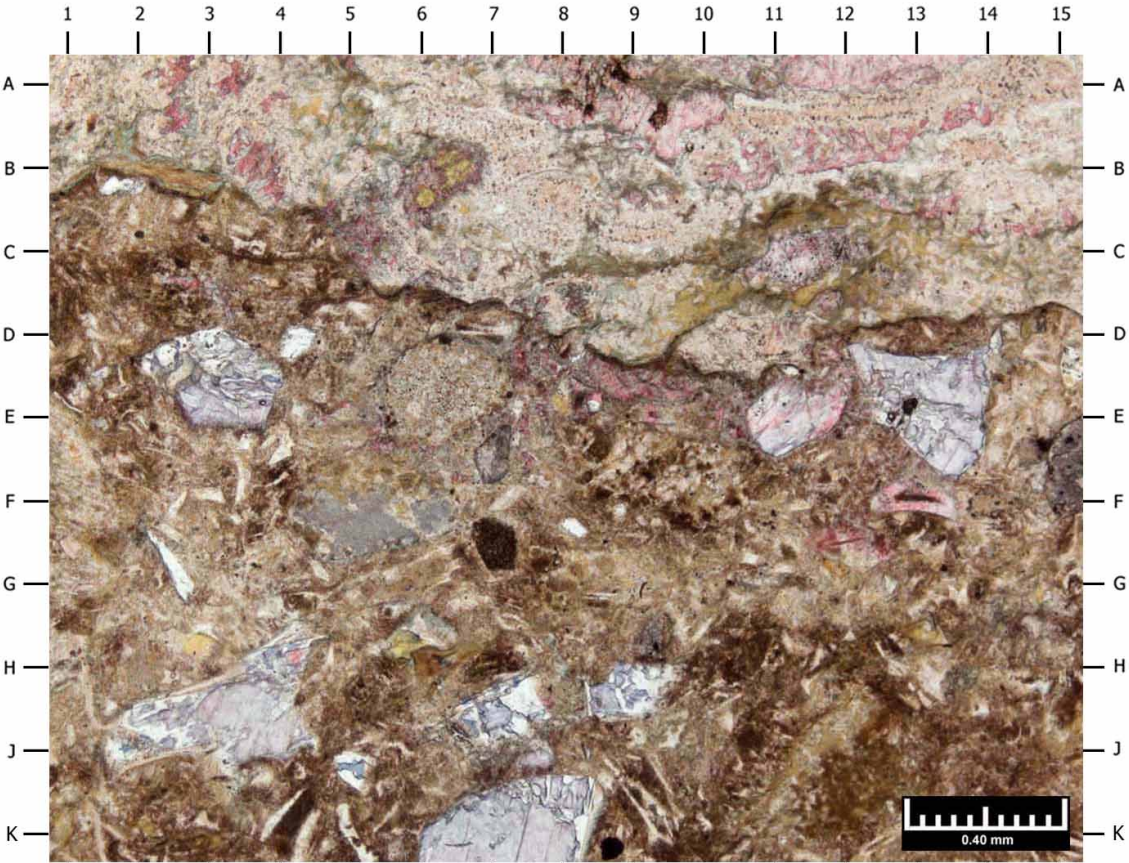
PLATE 32

Lithology*:	Tuffaceous agglomerate
Sedimentary Fabric:	Clay-altered tuffaceous deposit with massive configuration
Particle Size Range:	<0.01mm-11.55mm
Average Grain Size:	N/A
Visual Sorting:	Poor
Compaction:	Low
Detrital Grains / Allochems:	
Major:	Altered volcanic glass
Minor:	Tuffaceous volcanic fragments, andesitic volcanic fragments, plagioclase feldspar, monocrystalline quartz, polycrystalline quartz, plutonic fragments, and metamorphic schistose fragments
Accessory:	Muscovite mica, biotite mica, organic fragments, undifferentiated calcareous fossil fragments, and heavy minerals (tourmaline and zircon)
Matrix:	The matrix consists of welded tuffaceous material and abundant alteration clay minerals (visual est. 15%, by volume); XRD analysis indicates that clay minerals account for 27% (by weight), with clay types mainly including mixed-layer illite/smectite (18%), with lesser amounts of illite/mica (6%), chlorite (3%), and kaolinite (trace).
Cement / Replacement:	Common authigenic illitic clay occurs as a pore-filling and replacement of altered grains; moderate replacement of dissolved grains by microquartz; rare pyrite occurs as scattered framboids attached to detrital grains and as a replacement of detrital clays; minor to replacement of dissolved grains by calcite, Fe-calcite, siderite, and Ti-oxides
Porosity Types:	Rare micropores associated with detrital clay matrix and partially dissolved grains and rare grain fracture pores
Porosity (RCA):	4.7% (at 4000psi)
Permeability (RCA):	0.0037mD (at 4000psi)
Grain Density (RCA):	2.66gm/cc

*Folk (1962) classification based on visual estimate of sample constituents

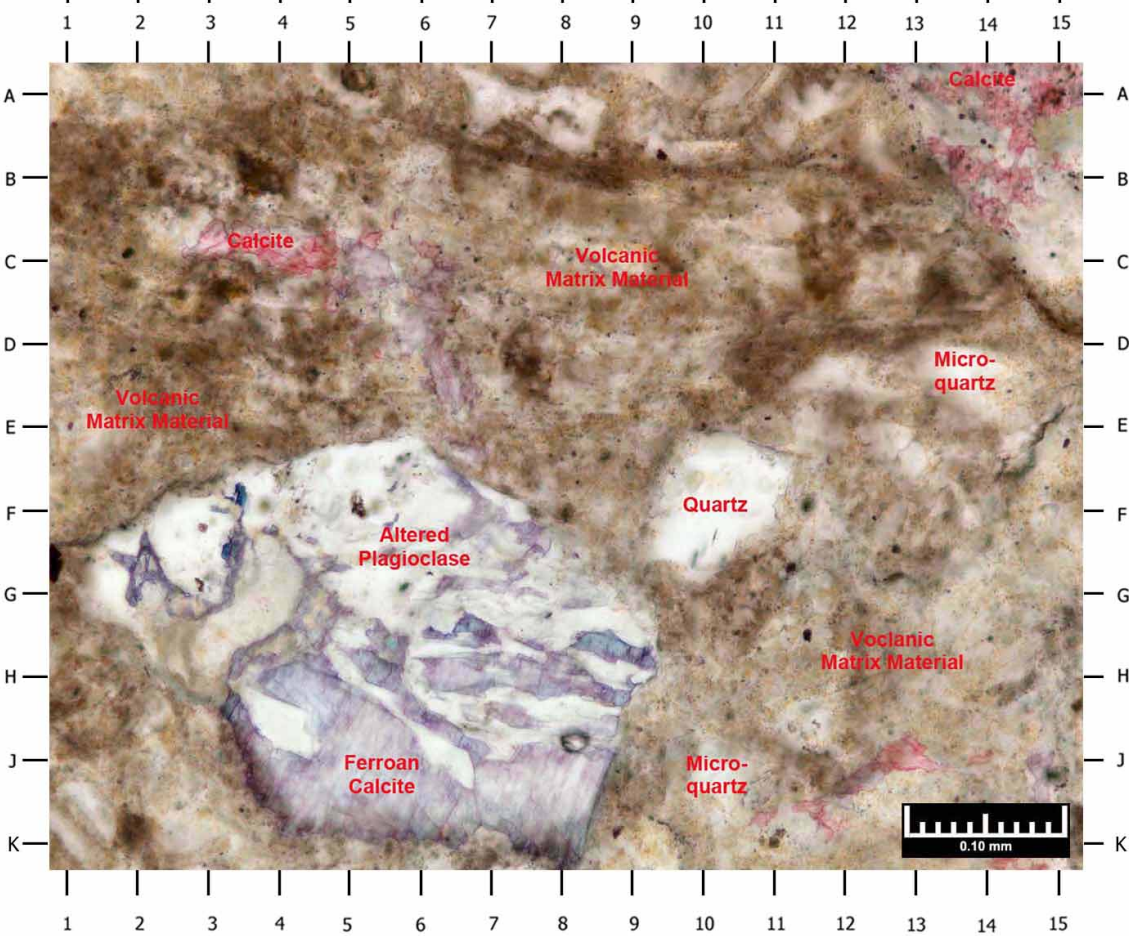
Magnification: A: 50X B: 200X

- A) This massive tuffaceous agglomerate contains abundant amounts of altered volcanic rock fragments (DE3, FG5, H13) surrounded by welded tuffaceous matrix material. Calcite (stained red), Fe-calcite (stained purple), and pyrite (black) occur as replacements. Organic material occurs at BC1-CD15.
- B) This photomicrograph provides a magnified view of the area near D3.5 in Photo A, highlighting the volcanic matrix material. Ferroan calcite (J6) partially replaces an unstable plagioclase feldspar grain.



A

50X



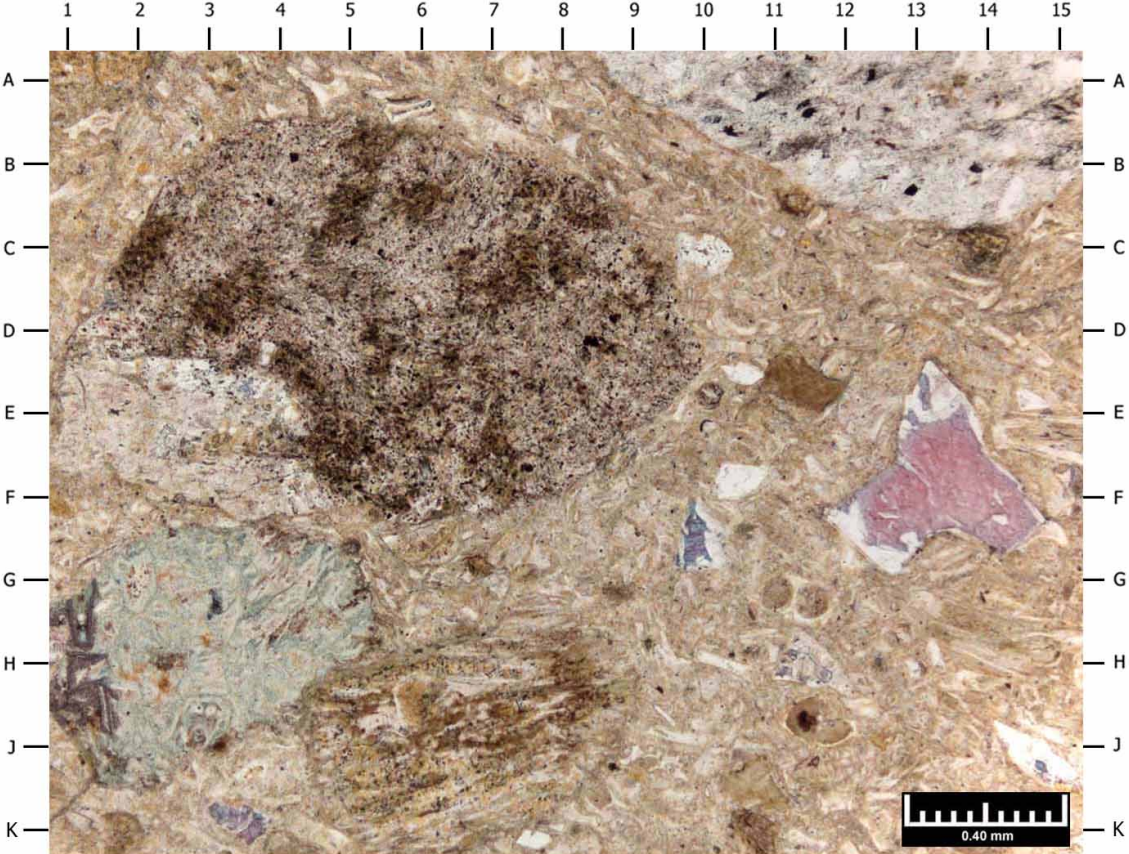
B

200X

THIN SECTION DESCRIPTION
SAMPLE DEPTH: 2995.05 METERS
SAMPLE NUMBER: 2-65P DS

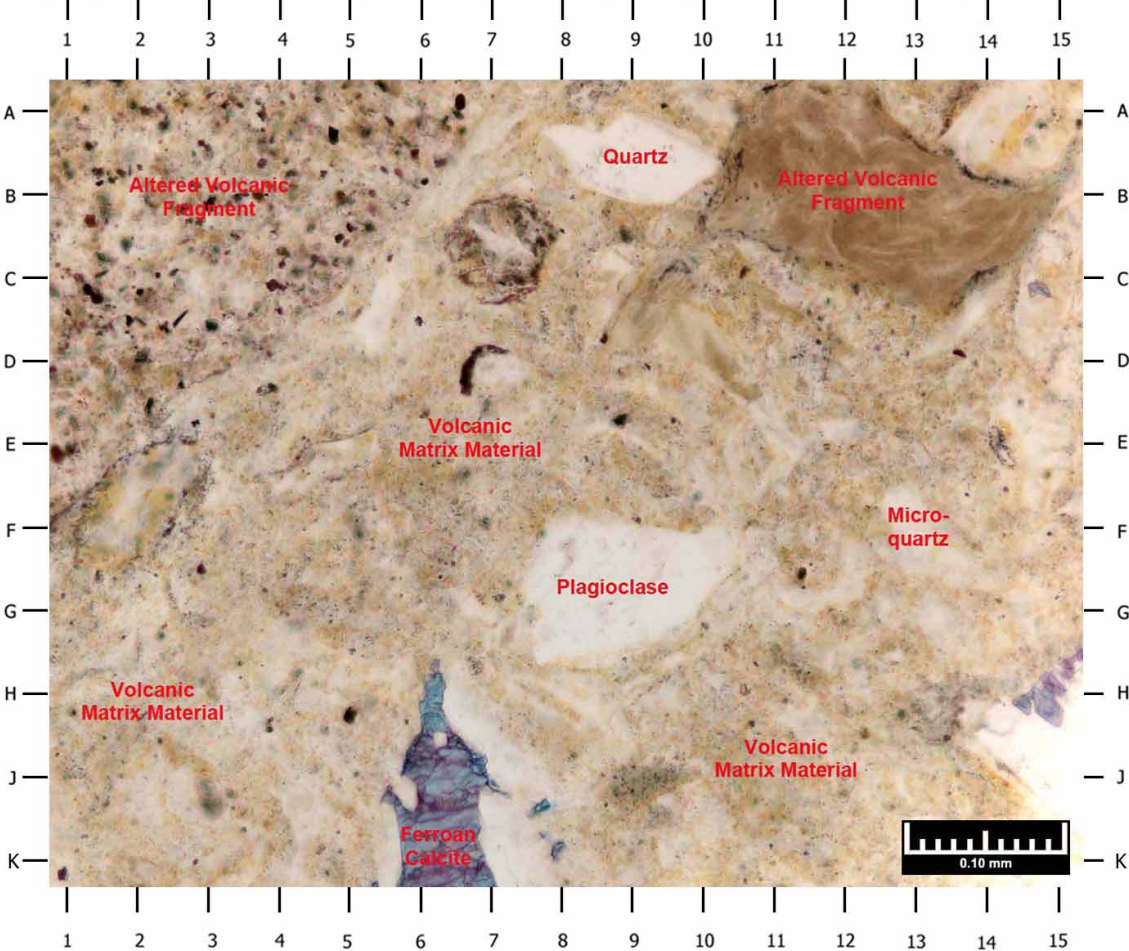
PLATE 33

Lithology*:	Tuffaceous agglomerate
Sedimentary Fabric:	Clay-altered tuffaceous deposit with massive configuration
Particle Size Range:	<0.01mm-5.97mm
Average Grain Size:	N/A
Visual Sorting:	Very poor
Compaction:	Low
Detrital Grains / Allochems:	
Major:	Altered volcanic glass
Minor:	Chert, tuffaceous volcanic fragments, andesitic volcanic fragments, plagioclase feldspar, monocrystalline quartz, siltstone fragments, and metamorphic schistose fragments
Accessory:	Muscovite and heavy minerals (tourmaline and zircon)
Matrix:	The matrix consists of welded tuffaceous material and abundant amounts of alteration clay minerals (visual est. 25%, by volume); XRD analysis indicates that clay minerals account for 27% (by weight), with measured clays types mainly including mixed-layer illite/smectite (14%) and illite/mica (10%), with lesser to rare amounts of chlorite (2%), and kaolinite (1%).
Cement / Replacement:	Common authigenic illitic clay occurs as a pore-filling and replacement of altered grains; minor chlorite replacing labile grains; rare pyrite occurs as scattered framboids attached to detrital grains and as a replacement of detrital clays; rare replacement of dissolved grains by microquartz, calcite, Fe-calcite, Ti-oxide, and Fe-oxide
Porosity Types:	Minor micropores associated with detrital clay matrix and partially dissolved grains; rare secondary intragranular pores within partially dissolved grains; and rare fracture pores
Porosity (RCA):	6.3%
Permeability (RCA):	0.027mD
Grain Density (RCA):	2.69gm/cc
Magnification:	A: 50X B: 200X
A)	This massive tuffaceous agglomerate contains abundant amounts of altered volcanic rock fragments (AB13, CD6, H3, JK7) surrounded by welded tuffaceous matrix material. Calcite (stained red; F13), Fe-calcite (stained purple; FG10, JK3.2), and chlorite (green; H3) occur as replacements of unstable grains.
B)	This photomicrograph provides a magnified view of the area near EF10 in Photo A. Ferroan calcite (JK6-7) partially replaces an unstable plagioclase feldspar grain.



A

50X



B

200X

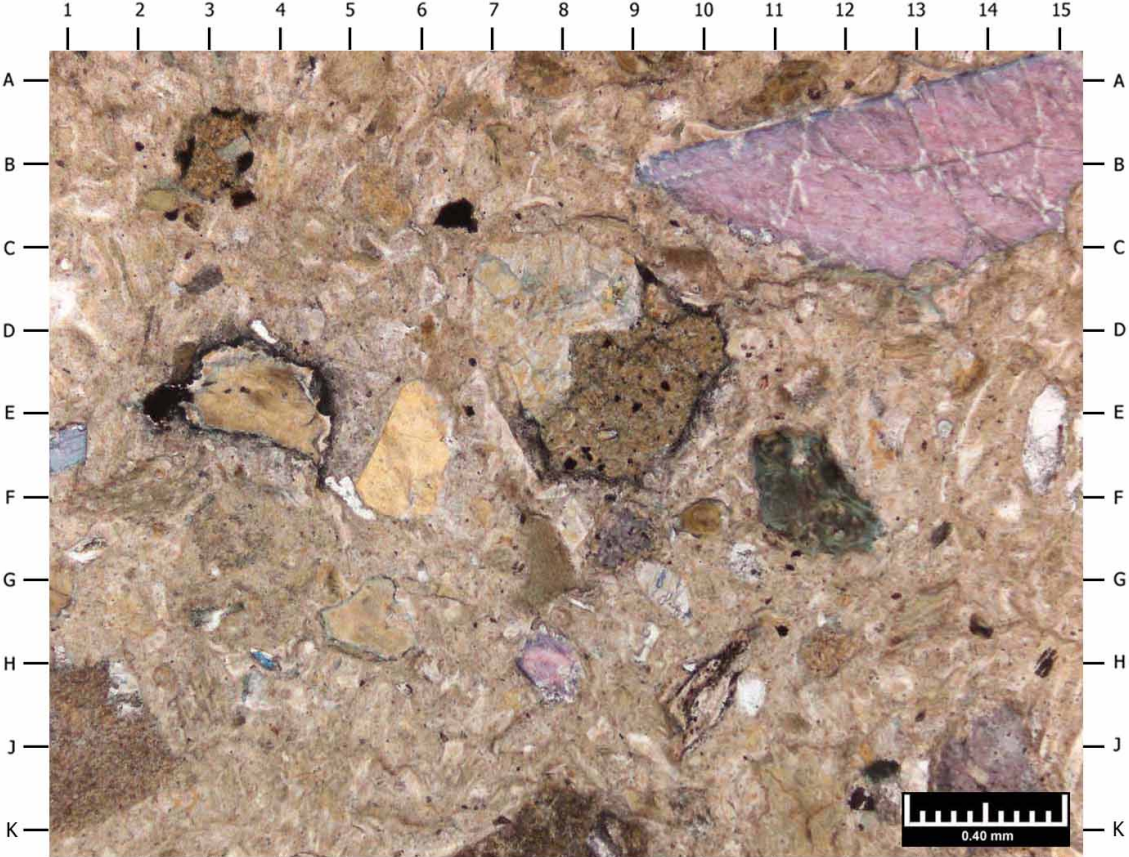
THIN SECTION DESCRIPTION
SAMPLE DEPTH: 3002.05 METERS
SAMPLE NUMBER: 2-73P DS

PLATE 34

Lithology*: Tuffaceous agglomerate
Sedimentary Fabric: Clay-altered tuffaceous deposit with massive configuration
Particle Size Range: <0.01mm-9.39mm
Average Grain Size: N/A
Visual Sorting: Very poor
Compaction: Low
Detrital Grains / Allochems:
 Major: Altered volcanic glass
 Minor: Tuffaceous volcanic fragments, andesitic volcanic fragments, plagioclase feldspar, monocrystalline quartz, siltstone fragments, and metamorphic schistose fragments
Accessory: None
Matrix: The matrix consists of welded tuffaceous material and abundant amounts of alteration clay minerals (visual est. 30%, by volume); XRD analysis indicates that clay minerals account for 38% (by weight), with measured clays types mainly including mixed-layer illite/smectite (24%) and illite/mica (11%), with lesser to rare amounts of chlorite (3%), and kaolinite (trace).
Cement / Replacement: Common authigenic illitic clay occurs as a pore-filling and replacement of altered grains; minor chlorite replacing labile grains; rare pyrite occurs as scattered framboids attached to detrital grains and as a replacement of detrital clays; rare replacement of detrital grains by Fe-oxide and Ti-oxide; rare replacement of dissolved grains by microquartz, calcite, and Fe-calcite
Porosity Types: Minor micropores associated with detrital clay matrix and partially dissolved grains; rare secondary intragranular pores within partially dissolved grains; and rare grain fracture pores
Porosity (RCA): 7.5%
Permeability (RCA): 0.013mD
Grain Density (RCA): 2.70gm/cc

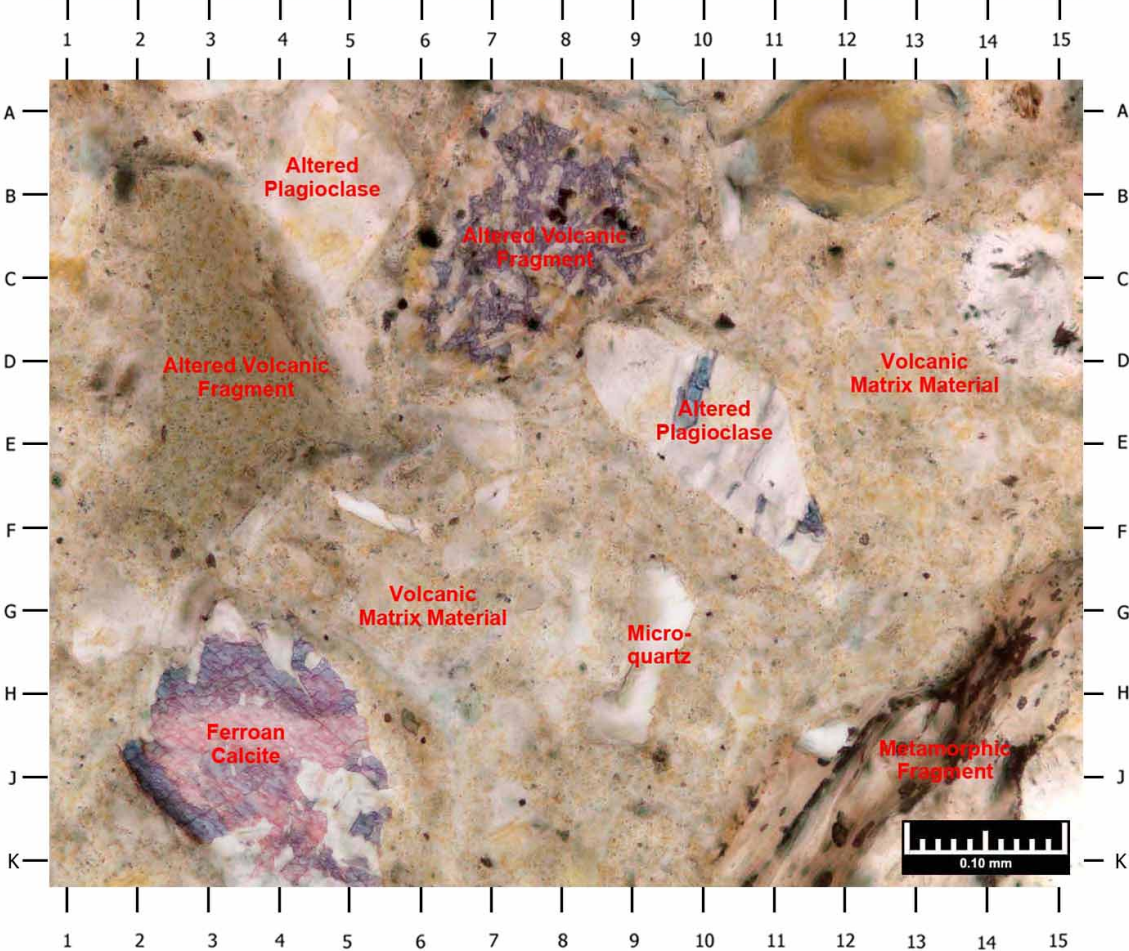
Magnification: A: 50X B: 200X

- A) This photomicrograph depicts a general overview of a tuffaceous agglomerate. Ferroan calcite replaced grains (stained purple; B13, H8), potassium feldspar grains (stained yellow; EF5.5), and altered volcanic fragments (B3, E9, F11.5, K8) are surrounded by the welded tuffaceous matrix material. Ankerite (stained blue; EF1) and chlorite (green; F11.5) replace labile grains.
- B) This high magnification photomicrograph details the area near HJ9 in Photo A, highlighting the abundant volcanic matrix material. Altered volcanic (D3), altered feldspar grains (B4.5, E10), and metamorphic fragments (G15-K11) are observed.



A

50X



B

200X

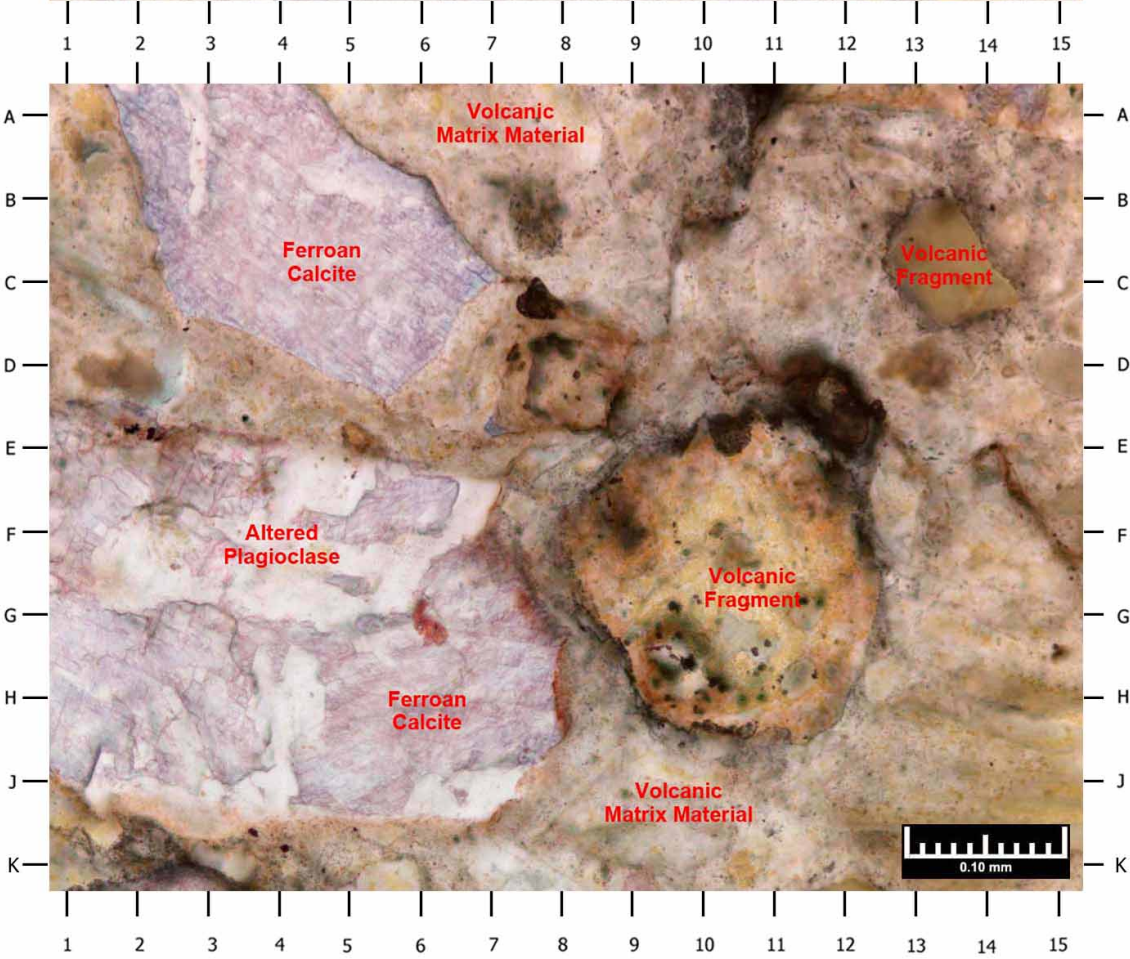
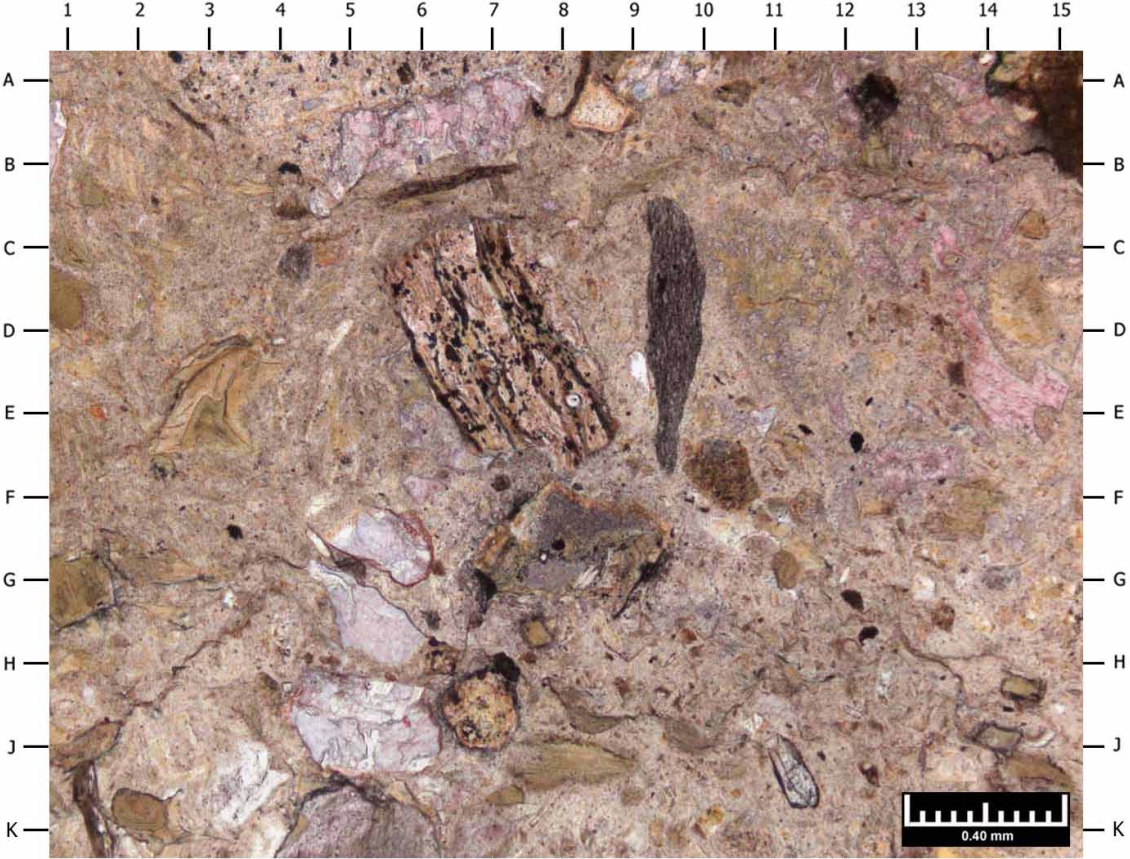
THIN SECTION DESCRIPTION
SAMPLE DEPTH: 3008.05 METERS
SAMPLE NUMBER: 2-80P DS

PLATE 35

Lithology*: Tuffaceous agglomerate
Sedimentary Fabric: Clay-altered tuffaceous deposit with massive configuration
Particle Size Range: <0.01mm-4.06mm
Average Grain Size: N/A
Visual Sorting: Very poor
Compaction: Low
Detrital Grains / Allochems:
 Major: Altered volcanic glass
 Minor: Tuffaceous volcanic fragments, andesitic volcanic fragments, plagioclase feldspar, monocrystalline quartz, siltstone fragments, and metamorphic schistose fragments
 Accessory: Muscovite, biotite, chamosite, and the heavy mineral tourmaline
Matrix: The matrix consists of welded tuffaceous material and abundant amounts of alteration clay minerals (visual est. 45%, by volume); XRD analysis indicates that clay minerals account for 42% (by weight), with measured clays types mainly including mixed-layer illite/smectite (37%), with minor to rare amounts of illite/mica (2%), chlorite (3%), and kaolinite (trace).
Cement / Replacement: Common authigenic illitic clay occurs as a pore-filling and replacement of altered grains; minor chlorite replacing labile grains; rare pyrite occurs as scattered framboids attached to detrital grains and as a replacement of detrital clays; rare replacement of labile grains by Fe-oxide and T-oxides; rare replacement of dissolved grains by microquartz, calcite, and Fe-calcite
Porosity Types: Minor micropores associated with detrital clay matrix and partially dissolved grains and rare grain fracture pores
Porosity (RCA): 8.5%
Permeability (RCA): 0.014mD
Grain Density (RCA): 2.71gm/cc

Magnification: A: 50X B: 200X

- A) This photomicrograph depicts a generally massive tuffaceous agglomerate containing abundant amounts of volcanic matrix material. A metamorphic rock fragment occurs at E6.5. Calcite (stained red; B6, DE14) replaces susceptible grains and some matrix material.
- B) This photomicrograph provides a magnified view of the area near HJ6 in Photo A. Ferroan calcite (stained purple; BC4, GH2, H6) partially replaces unstable plagioclase feldspar grains. Pyrite (black; CD7.2) occurs as replacement of matrix material.



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Queensland, Australia
Rotary Sidewall Core

Weatherford Labs File No.: AB-76967

THIN SECTION DESCRIPTION
SAMPLE DEPTH: 3011.3 METERS
SAMPLE NUMBER: SWC7

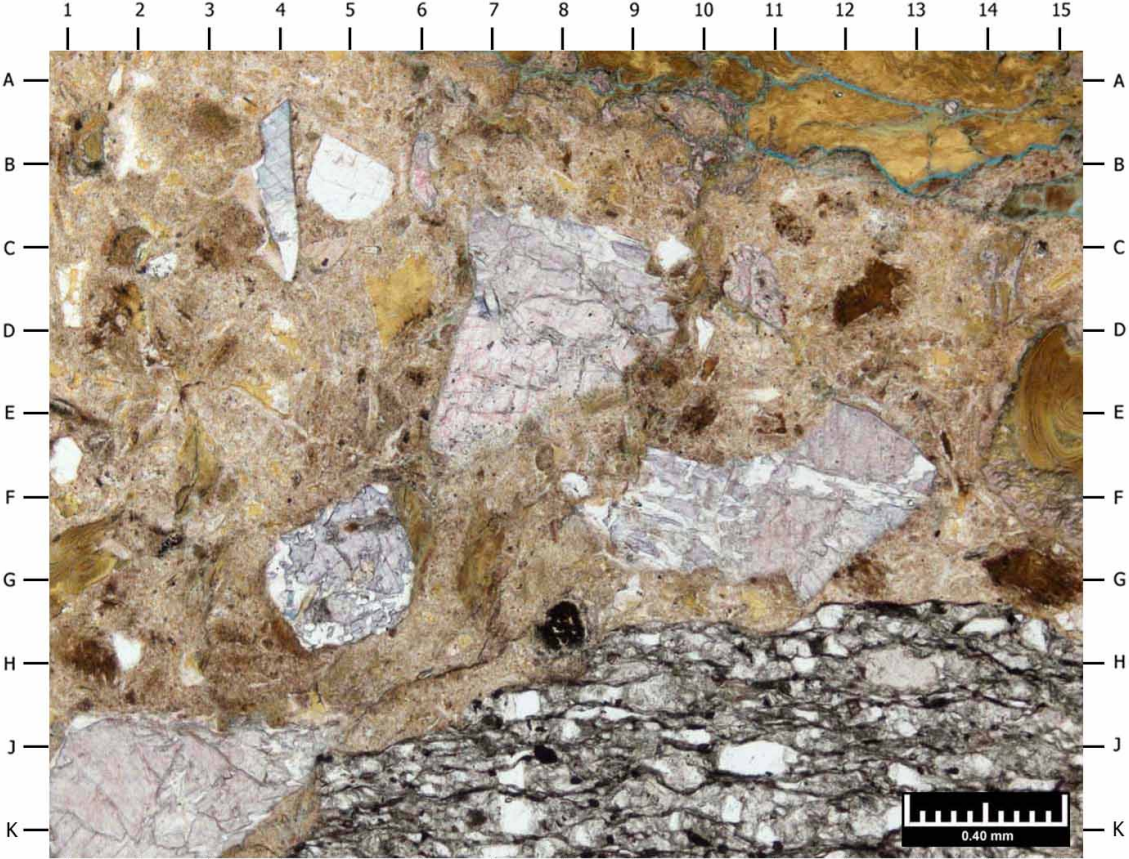
PLATE 36

Lithology*: Tuffaceous agglomerate
Sedimentary Fabric: Clay-altered tuffaceous deposit with massive configuration
Particle Size Range: <0.01mm-3.92mm
Average Grain Size: N/A
Visual Sorting: Very poor
Compaction: Low
Detrital Grains / Allochems:
 Major: Altered volcanic glass
 Minor: Chert, andesitic volcanic fragments, plagioclase feldspar, plutonic fragments, monocrystalline quartz, siltstone fragments, polycrystalline quartz, mudstone fragments, and metamorphic schistose fragments
 Accessory: Muscovite, biotite, metamorphic chlorite, organic fragments, and the heavy mineral zircon
Matrix: The matrix consists of welded tuffaceous material and abundant amounts of alteration clay minerals (visual est. 25%, by volume); XRD analysis indicates that clay minerals account for 34% (by weight), with measured clays types mainly including mixed-layer illite/smectite (29%) and illite/mica (trace), with lesser to rare amounts of chlorite (4%), and kaolinite (1%).
Cement / Replacement: Common authigenic illitic clay occurs as a pore-filling and replacement of altered grains; rare pyrite occurs as a replacement of detrital clays; rare replacement of dissolved grains by calcite and Fe-calcite
Porosity Types: Minor micropores associated with detrital clay matrix and partially dissolved grains represent the only form of visible porosity
Porosity (RCA): 5.4% (at 4000psi)
Permeability (RCA): 0.0046mD (at 4000psi)
Grain Density (RCA): 2.66gm/cc

*Folk (1962) classification based on visual estimate of sample constituents

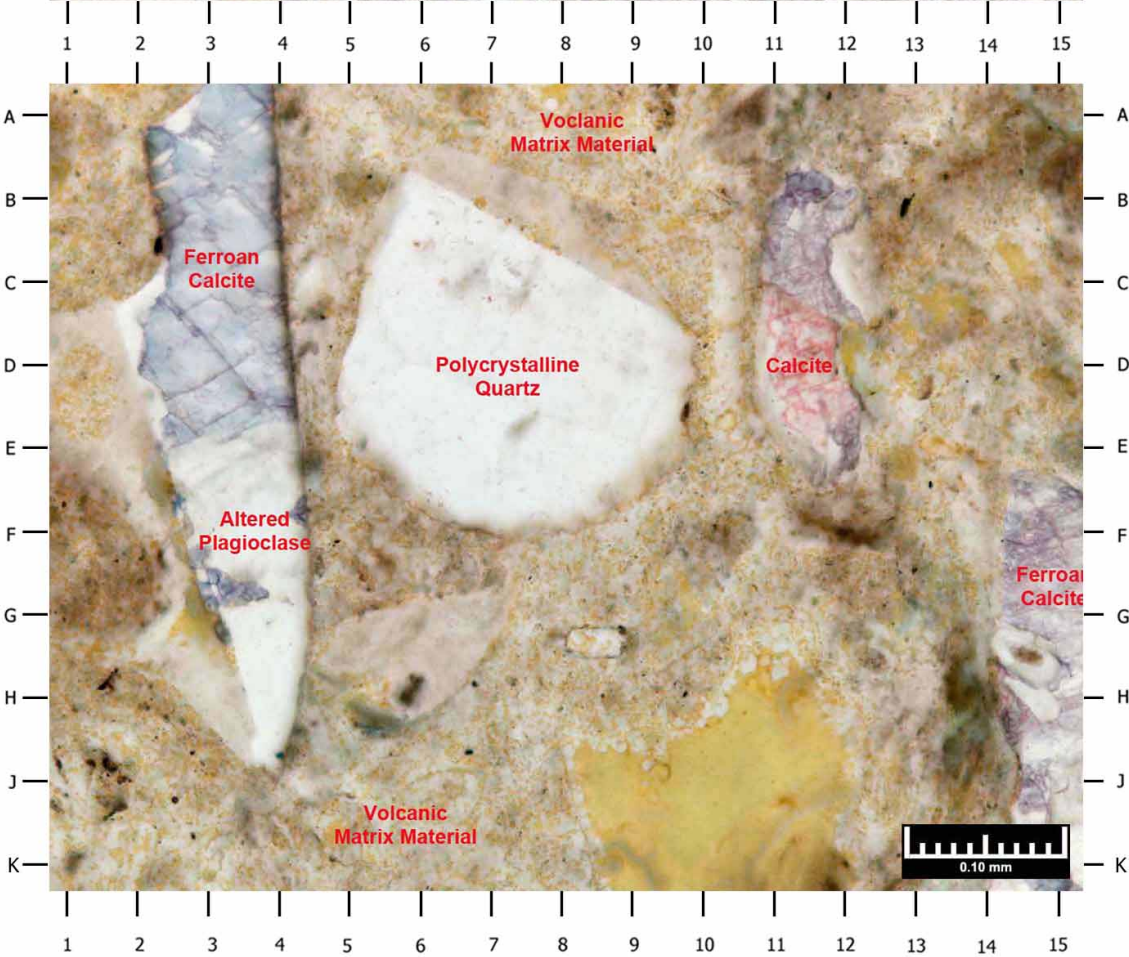
Magnification: A: 50X B: 200X

- A) This massive tuffaceous agglomerate contains abundant amounts of volcanic rock fragments (D8, F10), with lesser amounts of polycrystalline quartz (BC5). Part of a large rock fragment occurs at K4-GH15.
- B) This photomicrograph provides a magnified view of the area near C5 in Photo A. Calcite cement (stained red/pink; CD11.2) and ferroan calcite (stained purple; C3, FG15) occur as replacement of less stable grains.



A

50X



B

200X

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Queensland, Australia
Rotary Sidewall Core

Weatherford Labs File No.: AB-76967

THIN SECTION DESCRIPTION
SAMPLE DEPTH: 3017.3 METERS
SAMPLE NUMBER: SWC5

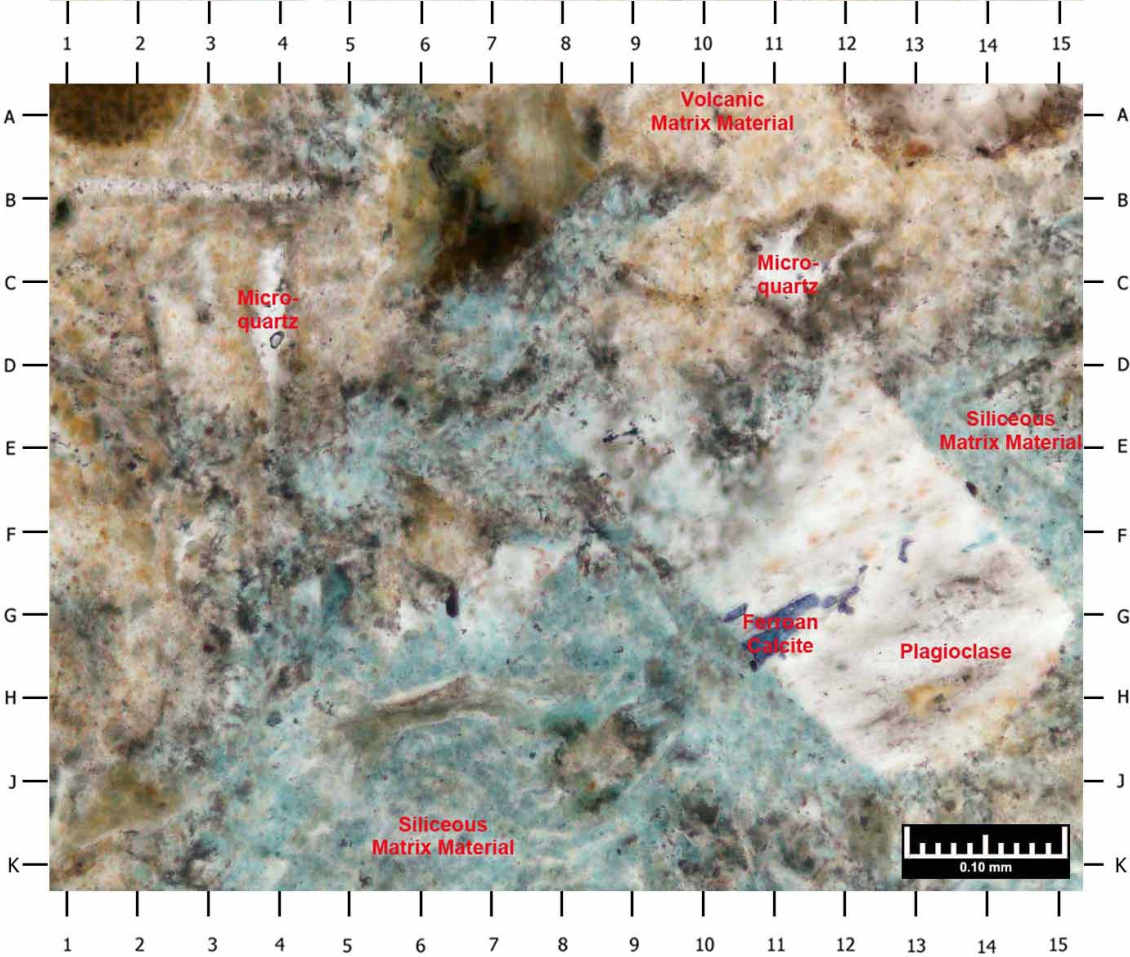
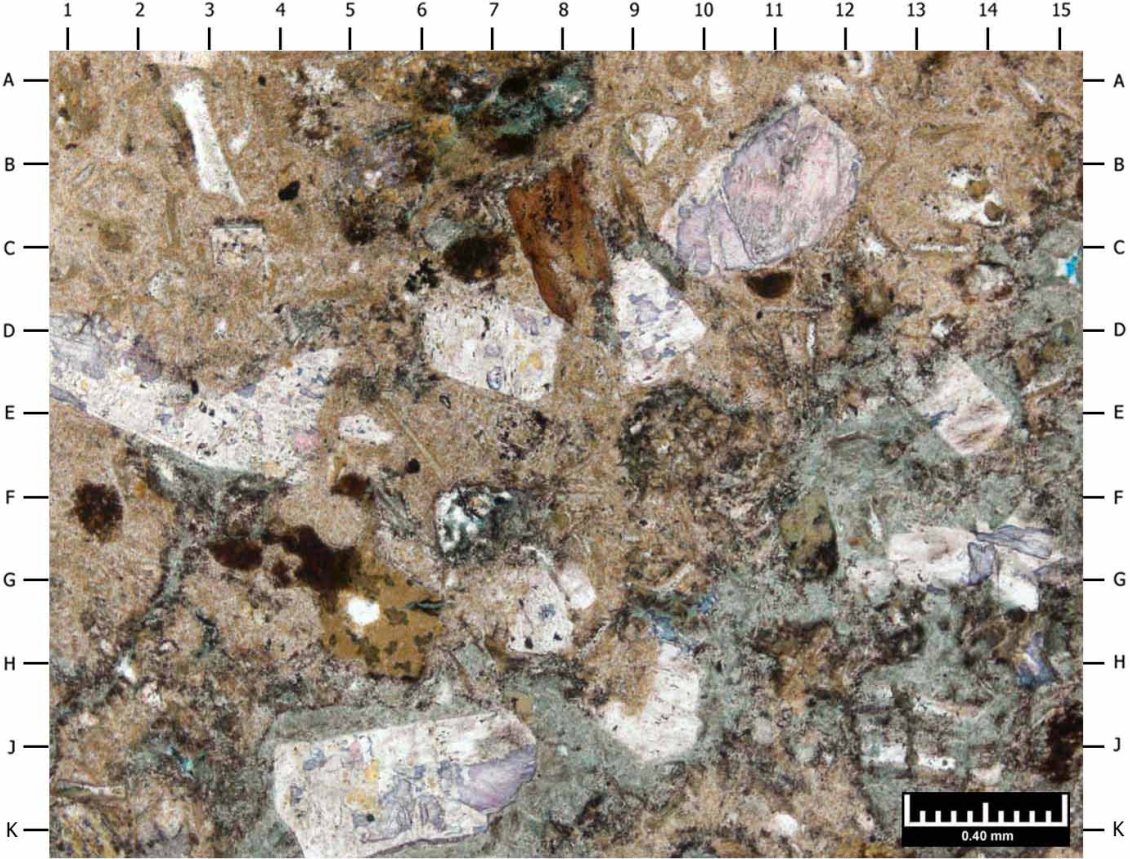
PLATE 37

Lithology*: Tuffaceous agglomerate
Sedimentary Fabric: Clay-altered tuffaceous deposit with massive configuration
Particle Size Range: 0.02mm-4.18mm
Average Grain Size: N/A
Visual Sorting: Poor
Compaction: Low
Detrital Grains / Allochems:
 Major: Altered volcanic glass
 Minor: Andesitic volcanic fragments, plagioclase feldspar, monocrystalline quartz, mudstone fragments, polycrystalline quartz, chert, and metamorphic schistose fragments
 Accessory: Muscovite, biotite, organic fragments, and the heavy mineral tourmaline
Matrix: The matrix consists of welded tuffaceous material and alteration clay minerals (visual est. 10%, by volume); XRD analysis indicates that clay minerals account for 15% (by weight), with clays types including mixed-layer illite/smectite (7%) and illite/mica (4%), with lesser to rare amounts of chlorite (4%), and kaolinite (trace). Cryptocrystalline quartz matrix material is also present
Cement / Replacement: Common authigenic illitic clay occurs as a pore-filling and replacement of altered grains; minor chlorite replacement; rare pyrite occurs as scattered framboids attached to detrital grains and as a replacement of detrital clays; rare replacement of detrital grains by Ti-oxide; rare replacement of dissolved grains by microquartz, calcite, and Fe-calcite
Porosity Types: Minor micropores associated with detrital clay matrix and partially dissolved grains; rare secondary intragranular pores within partially dissolved grains; and rare grain fracture pores
Porosity (RCA): 9.0% (at 4000psi)
Permeability (RCA): 0.0022mD (at 4000psi)
Grain Density (RCA): 2.65gm/cc

*Folk (1962) classification based on visual estimate of sample constituents

Magnification: A: 50X B: 200X

- A) This massive tuffaceous agglomerate contains abundant amounts of volcanic rock fragments (AB13.5, BC8, J9.5). Two different matrices are present; one is composed of welded tuffaceous material (A1-K15) and the other is composed of cryptocrystalline quartz (C15-K3).
- B) This photomicrograph provides a magnified view of the area near DE12 in Photo A illustrating the contact of the two different matrix materials.



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PS46 TRS
Queensland, Australia
Rotary Sidewall Core

Weatherford Labs File No.: AB-76967

THIN SECTION DESCRIPTION
SAMPLE DEPTH: 3020.5 METERS
SAMPLE NUMBER: SWC4

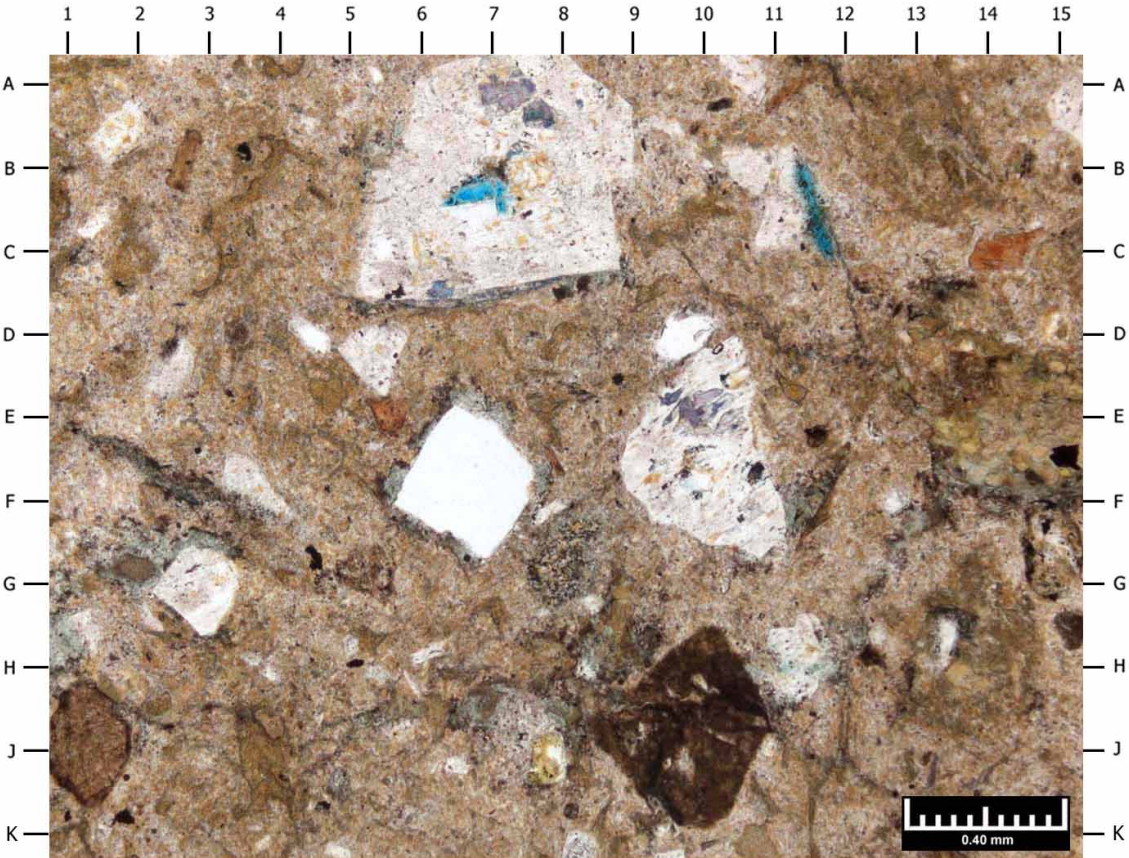
PLATE 38

Lithology*: Tuffaceous agglomerate
Sedimentary Fabric: Clay-altered tuffaceous deposit with massive configuration
Particle Size Range: <0.01mm-4.86mm
Average Grain Size: N/A
Visual Sorting: Poor
Compaction: Low
Detrital Grains / Allochems:
 Major: Altered volcanic glass
 Minor: Tuffaceous volcanic fragments, andesitic volcanic fragments, plagioclase feldspar, monocrystalline quartz, polycrystalline quartz, siltstone fragments, mudstone fragments, chert, and metamorphic schistose fragments
 Accessory: Muscovite, biotite, organic fragments, and heavy minerals (tourmaline and zircon)
Matrix: The matrix consists of welded tuffaceous material and moderate amounts of alteration clay minerals (visual est. 10%, by volume); XRD analysis indicates that clay minerals account for 20% (by weight), with measured clays types mainly including mixed-layer illite/smectite (9%), with minor to rare amounts of illite/mica (6%), chlorite (5%), and kaolinite (trace).
Cement / Replacement: Common authigenic illitic clay occurs as a pore-filling and replacement of altered grains; minor chlorite replacing labile grains; rare pyrite occurs as scattered framboids attached to detrital grains and as a replacement of detrital clays; rare replacement of dissolved grains by microquartz, calcite, and Fe-calcite
Porosity Types: Minor micropores associated with detrital clay matrix and partially dissolved grains; rare secondary intragranular pores within partially dissolved grains; and rare grain fracture pores
Porosity (RCA): 7.3% (at 4000psi)
Permeability (RCA): N/A
Grain Density (RCA): 2.66gm/cc

*Folk (1962) classification based on visual estimate of sample constituents

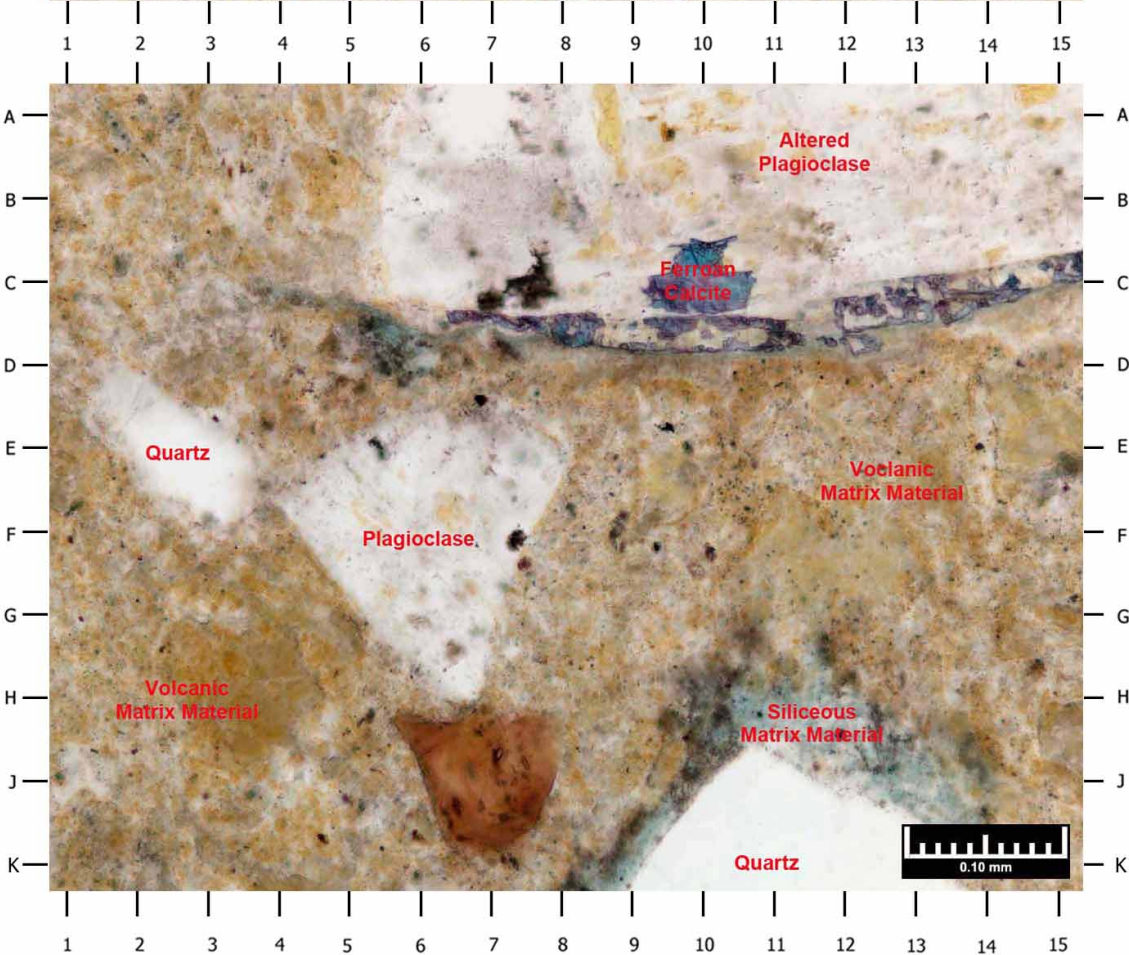
Magnification: A: 50X B: 200X

- A) This photomicrograph depicts a massive tuffaceous agglomerate containing abundant amounts of volcanic matrix material. Secondary dissolution pores are observed (blue epoxy; C6.8, B11.5).
- B) This photomicrograph provides a magnified view of the area near D5.5 in Photo A. Ferroan calcite (stained purple; C10) partially replaces an unstable plagioclase feldspar grain.



A

50X



B

200X

QGC- A BG Group Business
Magnetic-1
Basement
Queensland, Australia
Rotary Sidewall Core

Weatherford Labs File No.: AB-76967

THIN SECTION DESCRIPTION
SAMPLE DEPTH: 3036.0 METERS
SAMPLE NUMBER: SWC2

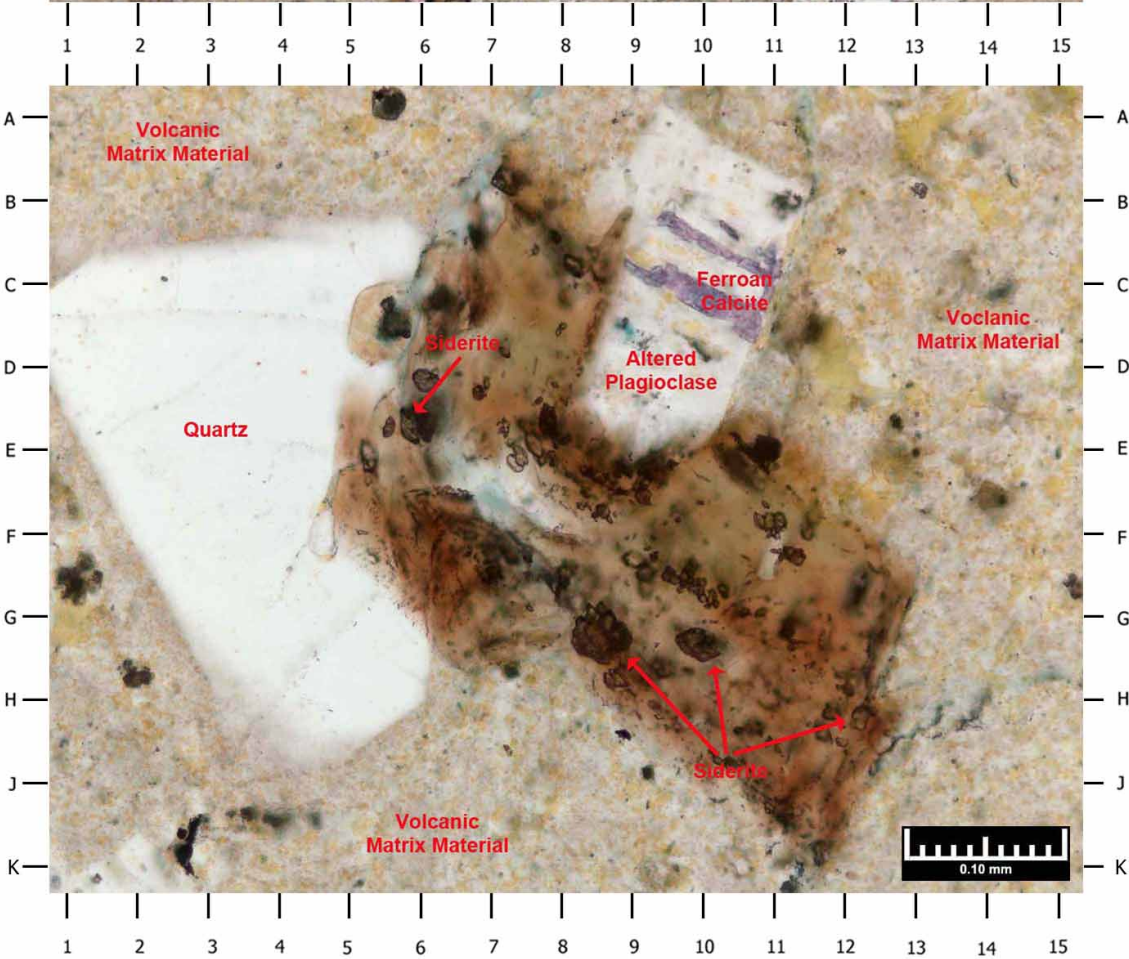
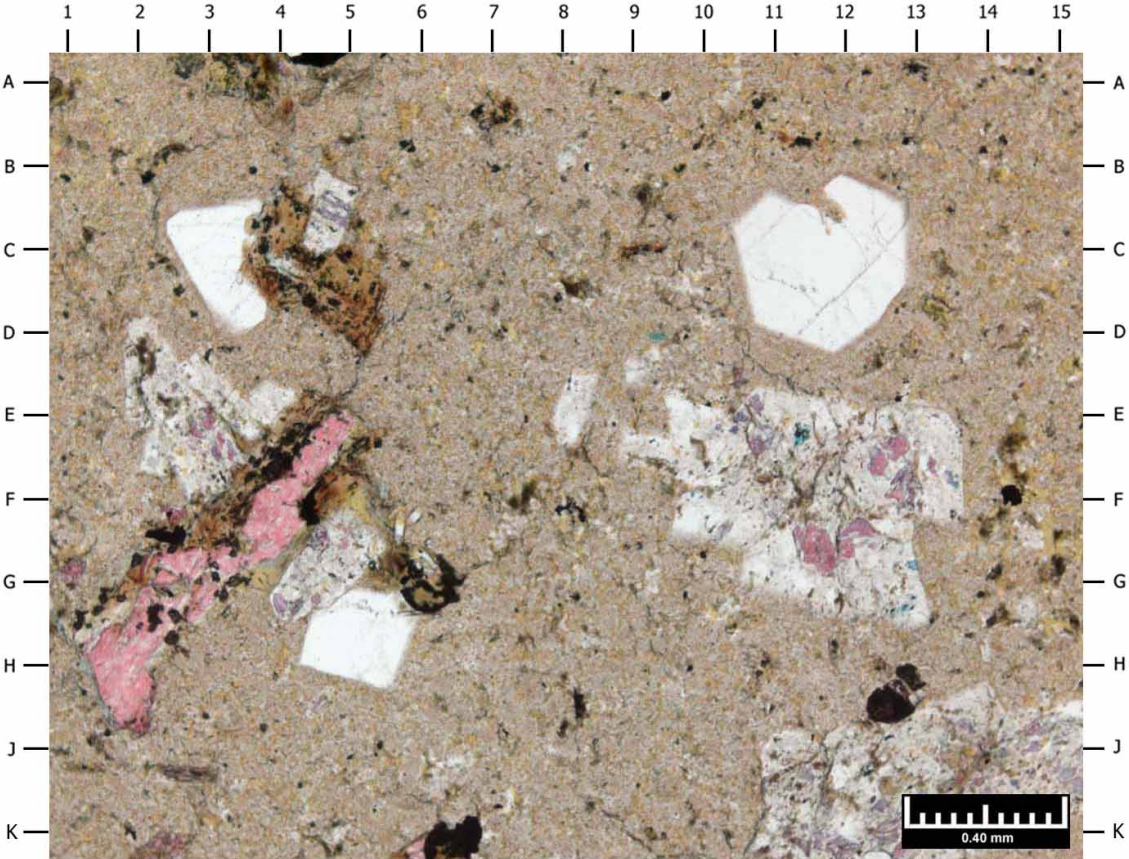
PLATE 39

Lithology*:	Porphyritic trachyte
Sedimentary Fabric:	Clay-altered deposit with massive configuration
Particle Size Range:	<0.01mm-2.89mm
Average Grain Size:	N/A
Visual Sorting:	N/A
Compaction:	Low
Detrital Grains / Allochems:	
Major:	Altered volcanic glass
Minor:	Andesitic volcanic fragments, plutonic fragments, potassium feldspar, monocrystalline quartz, and metamorphic schistose fragments
Accessory:	Biotite, organic fragments, and heavy minerals (tourmaline and zircon)
Matrix:	The matrix consists of welded tuffaceous material and moderate amounts of alteration clay minerals (visual est. 15%, by volume); XRD analysis indicates that clay minerals account for 21% (by weight), with measured clays types mainly including mixed-layer illite/smectite (17%), with lesser amounts of illite/mica (trace), and rare chlorite (4%), and kaolinite (trace).
Cement / Replacement:	Common authigenic illitic clay occurs as a pore-filling and replacement of altered grains; rare pyrite occurs as a replacement of detrital clays; rare replacement of dissolved grains by Fe-calcite and Ti-oxide
Porosity Types:	Minor micropores associated with detrital clay matrix and partially dissolved grains; rare secondary intragranular pores within partially dissolved grains; and rare grain fracture pores
Porosity (RCA):	2.5% (at 4000psi)
Permeability (RCA):	0.015mD (at 4000psi)
Grain Density (RCA):	2.64gm/cc

*Folk (1962) classification based on visual estimate of sample constituents

Magnification: A: 50X B: 200X

- A) This photomicrograph provides a general overview of this massive porphyritic trachyte. Quartz fragments (CD3, C11.5, GH5) are surrounded by abundant welded tuffaceous matrix material.
- B) This photomicrograph provides a magnified view of the area near CD4 in Photo A. Siderite (CD5.1, GH8.1, GH10) and ferroan calcite (stained purple; CD10) occurs as replacement of less stable material.



THIN SECTION MODAL ANALYSIS

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Magnetic -1

Bowen Basin

Queensland, Australia

Weatherford Labs File No.: AB-76967

Sample Type: Conventional / Analyst: A. Schwartz

DEPTH: (Meters)	2936.06	2938.06	2940.05	2942.06
SAMPLE NUMBER:	1-1P DS	1-3P DS	1-5P DS	1-8P DS
Formation:	Lorelle Ss	Lorelle Ss	Lorelle Ss	Lorelle Ss
Grain Size Avg. (mm):	1.52	0.99	0.58	0.78
Grain Size Range (mm):	<0.01-8.78	<0.01-2.93	<0.01-2.62	<0.01-2.85
Sorting:	Very Poor	Poor	Moderate	Poor
Fabric:	Massive	Massive	Massive	Massive
Rock Name (Folk):	Litharenite	Lithic Ark./Felds. Lith.	Felds. Litharenite	Felds. Litharenite
FRAMEWORK GRAINS				
Quartz	41.00	51.75	34.00	43.25
Monocrystalline	34.50	47.00	30.75	38.75
Polycrystalline	6.25	4.75	2.50	4.25
Meta-Quartzite	0.25	tr	0.75	0.25
Feldspar	5.00	8.00	12.25	10.50
K-Feldspar	0.75	4.50	10.75	9.00
Plagioclase	4.25	3.50	1.50	1.50
Lithic Fragments	29.50	18.00	22.00	23.50
Plutonic-Granitic	1.75	5.00	1.25	2.50
Volcanic-Tuff/Glass	0.50	1.50	2.75	2.00
Volcanic-Felsic	0.00	0.00	0.75	0.50
Volcanic-Interm./Mafic	2.25	0.25	2.00	0.25
Metamorphic-Schist	7.25	4.75	6.25	8.00
Metamorphic-Phyllite/Slate	0.00	0.50	2.25	0.25
Chert	13.00	4.75	5.50	7.75
Mudstone	0.50	tr	0.50	1.25
Carbonate	0.00	0.00	0.00	0.00
Siltstone/Sandstone	1.50	1.25	0.75	1.00
Conglomerate	2.75	0.00	0.00	0.00
Accessory Grains	1.75	1.50	6.00	2.25
Muscovite	1.00	1.25	5.00	1.75
Biotite	0.50	0.25	0.75	tr
Metamorphic Chlorite	tr	0.00	tr	tr
Heavy Minerals*	0.25	tr	0.25	0.50
ENVIRON. INDICATORS	0.00	0.00	0.25	0.00
Plant Fragments/Organics	0.00	0.00	0.25	0.00
Glauconite	0.00	0.00	0.00	0.00
Chamosite	0.00	0.00	0.00	0.00
Intrabasinal Clasts	0.00	0.00	0.00	0.00
Phosphatic Grains	0.00	0.00	0.00	0.00
DETRITAL MATRIX	0.25	0.25	0.25	0.50
Clay Matrix-Laminar	0.00	0.00	0.00	0.25
Clay Matrix-Pore filling	0.00	0.00	0.00	0.00
Clay Matrix-Pore lining	0.25	0.25	0.25	0.25
Volcanic	0.00	0.00	0.00	0.00
AUTHIGENIC CEMENTS	6.00	7.00	9.25	7.25
Illite, I/S-Pore lining	0.75	0.75	0.50	tr
Illite, I/S-Pore filling	0.00	0.50	1.00	0.25
Chlorite-Pore lining	0.00	0.00	0.00	0.00
Chlorite-Pore filling	0.00	0.00	0.00	0.00
Kaolinite	0.00	0.00	0.00	0.00
Quartz Overgrowths	4.75	5.75	6.25	7.00
Feldspar Overgrowths	0.25	tr	0.25	0.00
Microquartz	0.00	tr	0.75	0.00
Calcite	0.00	0.00	0.00	0.00
Fe-Calcite	tr	tr	0.00	0.00
Dolomite	0.00	0.00	0.00	0.00
Ankerite	tr	0.00	0.25	0.00
Siderite	tr	0.00	0.00	0.00
Pyrite	tr	tr	tr	tr
Ti-Oxides	0.25	0.00	0.25	0.00
Fe-Oxides	0.00	0.00	0.00	0.00
Bitumen		0.00	0.00	0.00
Zeolite	0.00	0.00	0.00	0.00
REPLACEMENTS	6.25	5.00	9.00	4.50
Illite, I/S, Sericite	2.75	2.00	4.25	1.75
Chlorite	0.00	0.00	0.00	0.00
Kaolinite	0.00	0.00	0.00	0.00
Quartz	0.50	tr	0.50	0.25
Feldspar	0.75	1.25	0.50	1.25
Microquartz	0.50	0.00	0.25	0.00
Calcite	0.00	0.00	0.00	0.00
Fe-Calcite	1.00	1.00	0.00	0.50
Dolomite	0.00	0.00	0.00	0.00
Ankerite	0.25	0.25	1.75	tr
Siderite	0.50	0.50	1.75	0.50
Pyrite	tr	tr	tr	tr
Ti-Oxides	tr	tr	tr	0.25
Fe-Oxides	0.00	0.00	0.00	0.00
Bitumen	0.00	0.00	0.00	0.00
Zeolite	0.00	0.00	0.00	0.00
POROSITY	10.25	8.50	7.00	8.25
Intergranular	1.00	1.25	0.50	2.00
Intragranular/Moldic	7.75	6.00	4.50	5.50
Microscopic	1.50	1.25	2.00	0.75
Transgranular/Grain Fracture	0.00	tr	tr	0.00
TOTAL:	100.00	100.00	100.00	100.00
Q (quartz + metaquartzite)	57.14	66.56	49.82	55.99
F (feldspar + granite fragment)	8.01	16.72	19.78	16.83
R (rock fragments)	34.84	16.72	30.40	27.18

* Pyroxene, Sphalerite, Tourmaline, and Zircon

THIN SECTION MODAL ANALYSIS

QGC - A BG Group Business

Magnetic -1

Bowen Basin

Queensland, Australia

Weatherford Labs File No.: AB-76967

Sample Type: Conventional / Analyst: A. Schwartz

DEPTH: (Meters)	2944.10	2946.05	2948.06	2950.09
SAMPLE NUMBER:	1-10P DS	1-12P DS	1-15P DS	1-17P DS
Formation:	Lorelle Ss	Lorelle Ss	Lorelle Ss	Lorelle Ss
Grain Size Avg. (mm):	0.86	0.36	0.51	0.73
Grain Size Range (mm):	<0.01-3.76	<0.01-7.79	<0.01-3.57	<0.01-4.94
Sorting:	Poor	Poor	Moderate to Poor	Poor
Fabric:	Massive	Laminated	Massive	Laminated; Burrowed
Rock Name (Folk):	Felds. Litharenite	Felds. Litharenite	Felds. Litharenite	Felds. Litharenite
FRAMEWORK GRAINS				
Quartz	46.75	32.50	45.50	38.50
Monocrystalline	41.50	24.50	39.00	32.00
Polycrystalline	5.25	6.50	6.00	3.25
Meta-Quartzite	tr	1.50	0.50	3.25
Feldspar	10.00	5.75	11.00	8.50
K-Feldspar	6.25	3.75	7.25	7.00
Plagioclase	3.75	2.00	3.75	1.50
Lithic Fragments	21.00	30.75	18.00	26.50
Plutonic-Granitic	1.75	2.50	0.75	7.00
Volcanic-Tuff/Glass	1.00	0.00	0.50	2.75
Volcanic-Felsic	0.00	1.00	0.50	0.25
Volcanic-Interm./Mafic	0.25	1.75	2.00	1.00
Metamorphic-Schist	7.50	7.50	3.50	4.00
Metamorphic-Phyllite/Slate	1.50	1.25	0.75	0.75
Chert	7.25	8.75	8.50	4.75
Mudstone	0.25	0.75	0.25	0.25
Carbonate	0.00	0.00	0.00	0.00
Siltstone/Sandstone	1.50	2.25	1.25	2.25
Conglomerate	0.00	5.00	0.00	3.50
Accessory Grains	0.75	5.00	3.00	1.50
Muscovite	0.50	3.00	2.75	1.00
Biotite	tr	1.50	0.25	0.50
Metamorphic Chlorite	0.00	0.25	tr	0.00
Heavy Minerals*	0.25	0.25	tr	tr
ENVIRON. INDICATORS	tr	3.75	tr	1.50
Plant Fragments/Organics	tr	3.75	tr	1.50
Glauconite	0.00	0.00	0.00	0.00
Chamosite	0.00	0.00	0.00	0.00
Fossil Fragments	0.00	0.00	0.00	0.00
Phosphatic Grains	0.00	0.00	0.00	0.00
DETRITAL MATRIX	0.50	11.25	1.00	11.75
Clay Matrix-Laminar	tr	7.50	0.00	1.25
Clay Matrix-Pore filling	tr	3.75	1.00	10.50
Clay Matrix-Pore lining	0.50	0.00	tr	0.00
Volcanic	0.00	0.00	0.00	0.00
AUTHIGENIC CEMENTS	9.00	2.50	9.75	2.75
Illite, I/S-Pore lining	1.00	tr	1.00	tr
Illite, I/S-Pore filling	0.75	1.25	0.75	0.25
Chlorite-Pore lining	0.00	0.00	0.00	0.00
Chlorite-Pore filling	0.00	0.00	0.00	0.00
Kaolinite	0.00	0.00	0.00	0.00
Quartz Overgrowths	6.75	0.25	7.00	1.75
Feldspar Overgrowths	0.25	tr	0.00	0.25
Microquartz	0.00	0.00	0.00	0.00
Calcite	0.00	0.00	0.00	0.00
Fe-Calcite	0.00	0.00	0.00	0.00
Dolomite	0.00	0.00	0.00	0.00
Ankerite	tr	0.00	1.00	0.00
Siderite	0.00	0.00	0.00	0.00
Pyrite	tr	1.00	tr	0.50
Ti-Oxides	tr	0.00	0.00	0.00
Fe-Oxides	0.00	0.00	0.00	0.00
Bitumen	0.00	0.00	0.00	0.00
Zeolites	0.25	0.00	0.00	0.00
REPLACEMENTS	4.75	5.75	5.25	4.25
Illite, I/S, Sericite	2.75	3.25	2.25	1.25
Chlorite	0.00	0.00	0.00	0.00
Kaolinite	0.00	0.00	tr	0.00
Quartz	tr	0.00	0.50	0.00
Feldspar	0.00	0.00	tr	0.50
Microquartz	0.00	0.25	0.00	0.00
Calcite	0.00	0.00	0.00	tr
Fe-Calcite	0.75	0.00	0.00	0.00
Dolomite	0.00	0.00	0.00	0.00
Ankerite	0.75	0.00	1.50	0.25
Siderite	0.50	1.25	0.75	0.75
Pyrite	tr	0.75	0.25	1.50
Ti-Oxides	0.00	0.25	tr	0.00
Fe-Oxides	0.00	0.00	0.00	0.00
Bitumen	0.00	0.00	0.00	0.00
Zeolite	0.00	0.00	0.00	0.00
POROSITY	7.25	2.75	6.50	4.75
Intergranular	1.75	0.00	1.75	0.25
Intragranular/Moldic	4.00	0.50	3.50	2.00
Microscopic	1.50	2.25	1.25	2.25
Transgranular/Grain Fracture	0.00	0.00	tr	0.25
TOTAL:	100.00	100.00	100.00	100.00
Q (quartz + metaquartzite)	60.13	50.78	61.07	55.00
F (feldspar + granite fragment)	15.11	12.89	15.77	22.14
R (rock fragments)	24.76	36.33	23.15	22.86

* Bitumen, Garnet, Epidote, Metamorphic Chlorite, Pyroxene, Rutile, Sphene, Tourmaline, and Zircon

THIN SECTION MODAL ANALYSIS

QGC - A BG Group Business

Magnetic -1

Bowen Basin

Queensland, Australia

Weatherford Labs File No.: AB-76967

Sample Type: Conventional / Analyst: A. Schwartz

DEPTH: (Meters)	2952.06	2954.05	2956.05	2958.05
SAMPLE NUMBER:	1-19P DS	1-22P DS	1-24P DS	1-26P DS
Formation:	Lorelle Ss	Lorelle Ss	Lorelle Se	Lorelle Ss
Grain Size Avg. (mm):	0.62	0.56	0.44	0.51
Grain Size Range (mm):	<0.01-6.76	<0.01-2.51	<0.01-3.72	<0.01-9.27
Sorting:	Poor	Poor	Poor	Poor
Fabric:	Massive	Massive	Laminated; Bioturbated	Massive; Disturbed
Rock Name (Folk):	Lithic Arkose	Lithic Arkose	Felds. Litharenite	Felds. Litharenite
FRAMEWORK GRAINS				
Quartz	<u>44.50</u>	<u>53.00</u>	<u>32.75</u>	<u>34.75</u>
Monocrystalline	37.50	49.25	27.50	28.50
Polycrystalline	6.50	3.75	4.75	6.00
Meta-Quartzite	0.50	0.00	0.50	0.25
Feldspar	<u>12.50</u>	<u>9.75</u>	<u>9.25</u>	<u>6.25</u>
K-Feldspar	9.75	6.50	7.75	1.75
Plagioclase	2.75	3.25	1.50	4.50
Lithic Fragments	<u>17.00</u>	<u>11.50</u>	<u>24.75</u>	<u>29.00</u>
Plutonic-Granitic	5.25	1.75	5.00	0.75
Volcanic-Tuff/Glass	0.75	0.25	1.00	0.75
Volcanic-Felsic	0.50	0.00	2.00	0.50
Volcanic-Interm./Mafic	0.25	0.25	1.25	0.75
Metamorphic-Schist	3.00	1.50	5.50	4.75
Metamorphic-Phyllite/Slate	1.50	0.25	1.00	0.50
Chert	4.75	7.00	6.75	4.00
Mudstone	tr	tr	0.25	tr
Carbonate	0.00	0.00	0.00	0.00
Siltstone/Sandstone	0.25	0.50	2.00	8.50
Conglomerate	0.75	0.00	0.00	8.50
Accessory Grains	<u>1.75</u>	<u>1.75</u>	<u>1.50</u>	<u>0.75</u>
Muscovite	1.50	1.00	1.00	0.75
Biotite	tr	0.50	0.25	tr
Metamorphic Chlorite	0.25	0.25	0.25	0.00
Heavy Minerals*	tr	0.00	tr	tr
ENVIRON. INDICATORS	<u>0.00</u>	<u>0.00</u>	<u>3.75</u>	<u>1.50</u>
Plant Fragments/Organics	0.00	0.00	3.75	1.50
Glauconite	0.00	0.00	tr	0.00
Chamosite	0.00	0.00	0.00	0.00
Fossil Fragments	0.00	0.00	0.00	0.00
Phosphatic Grains	0.00	0.00	0.00	0.00
DETRITAL MATRIX	<u>0.25</u>	<u>0.25</u>	<u>15.50</u>	<u>15.00</u>
Clay Matrix-Laminar	0.00	0.00	10.00	11.50
Clay Matrix-Pore filling	0.25	0.25	5.50	3.50
Clay Matrix-Pore lining	0.00	0.00	0.00	0.00
Volcanic	0.00	0.00	0.00	0.00
AUTHIGENIC CEMENTS	<u>12.75</u>	<u>9.00</u>	<u>2.00</u>	<u>2.50</u>
Illite, I/S-Pore lining	0.75	1.00	tr	0.00
Illite, I/S-Pore filling	1.00	0.25	0.00	0.25
Chlorite-Pore lining	0.00	0.00	0.00	0.00
Chlorite-Pore filling	0.00	0.00	0.00	0.00
Kaolinite	0.00	0.00	0.00	0.00
Quartz Overgrowths	10.75	7.50	0.50	1.50
Feldspar Overgrowths	tr	0.00	0.00	0.25
Microquartz	0.00	0.25	0.00	0.00
Calcite	0.00	tr	0.00	0.00
Fe-Calcite	0.00	0.00	0.00	0.00
Dolomite	0.00	0.00	0.00	0.00
Ankerite	0.25	tr	0.00	0.00
Siderite	0.00	0.00	0.75	0.50
Pyrite	tr	tr	0.75	0.00
Ti-Oxides	tr	0.00	0.00	tr
Fe-Oxides	0.00	0.00	0.00	0.00
Bitumen	0.00	0.00	0.00	0.00
Zeolites	0.00	0.00	0.00	0.00
REPLACEMENTS	<u>3.75</u>	<u>4.75</u>	<u>7.50</u>	<u>5.75</u>
Illite, I/S, Sericite	1.50	2.00	2.25	1.75
Chlorite	0.00	tr	tr	0.00
Kaolinite	tr	0.00	0.00	0.00
Quartz	0.50	0.50	tr	0.75
Feldspar	0.75	0.25	0.00	tr
Microquartz	0.00	0.00	0.00	0.00
Calcite	0.00	tr	0.00	tr
Fe-Calcite	0.25	0.75	0.00	0.00
Dolomite	0.00	0.00	0.00	0.00
Ankerite	0.50	0.75	0.25	0.25
Siderite	0.25	0.25	3.75	2.75
Pyrite	tr	tr	1.25	0.25
Ti-Oxides	0.00	tr	0.00	tr
Fe-Oxides	0.00	0.00	0.00	0.00
Bitumen	0.00	0.00	0.00	0.00
Zeolite	0.00	0.25	0.00	tr
POROSITY	<u>7.50</u>	<u>10.00</u>	<u>3.00</u>	<u>4.50</u>
Intergranular	1.25	2.00	0.00	0.00
Intragranular/Moldic	5.50	6.75	tr	2.00
Microscopic	0.75	1.25	3.00	2.50
Transgranular/Grain Fracture	tr	tr	0.00	tr
TOTAL:	<u>100.00</u>	<u>100.00</u>	<u>100.00</u>	<u>100.00</u>
Q (quartz + metaquartzite)	60.75	71.38	49.06	56.50
F (feldspar + granite fragment)	24.23	15.49	21.35	11.38
R (rock fragments)	15.02	13.13	29.59	32.11

* Bitumen, Garnet, Epidote, Metamorphic Chlorite, Pyroxene, Rutile, Sphene, Tourmaline, and Zircon

THIN SECTION MODAL ANALYSIS

QGC - A BG Group Business

Magnetic -1

Bowen Basin

Queensland, Australia

Weatherford Labs File No.: AB-76967

Sample Type: Conventional / Analyst: A. Schwartz

DEPTH: (Meters)	2960.17	2962.05	2965.05	2968.12
SAMPLE NUMBER:	1-28P DS	1-30P DS	1-33P DS	1-36P DS
Formation:	Lorelle Ss	Lorelle Ss	Lorelle Ss	Lorelle Ss
Grain Size Avg. (mm):	1.16	0.96	1.31	0.28 / 2.56
Grain Size Range (mm):	<0.01-9.12	<0.01-8.21	<0.01-12.16	<0.01-10.26
Sorting:	Very Poor	Very Poor	Very Poor	Moderate to Very Poor
Fabric:	Massive	Massive	Massive	Massive to Laminated
Rock Name (Folk):	Felds. Litharenite	Litharenite	Litharenite	Felds. Litharenite
FRAMEWORK GRAINS				
Quartz	35.00	42.00	26.00	33.00
Monocrystalline	27.00	35.00	19.75	28.25
Polycrystalline	7.00	6.75	5.50	4.75
Meta-Quartzite	1.00	0.25	0.75	0.00
Feldspar	3.75	3.25	3.25	3.50
K-Feldspar	3.00	2.50	2.50	2.50
Plagioclase	0.75	0.75	0.75	1.00
Lithic Fragments	37.00	31.50	52.50	44.00
Plutonic-Granitic	5.50	1.75	3.25	3.00
Volcanic-Tuff/Glass	0.00	0.00	0.25	0.50
Volcanic-Felsic	0.00	0.00	0.25	0.00
Volcanic-Interm./Mafic	1.00	1.25	4.50	1.00
Metamorphic-Schist	6.00	3.75	1.25	2.00
Metamorphic-Phyllite/Slate	1.00	0.75	0.00	tr
Chert	8.25	11.50	17.50	9.00
Mudstone	0.00	0.00	0.00	1.00
Carbonate	0.00	0.00	0.00	0.00
Siltstone/Sandstone	2.75	3.75	0.75	2.00
Conglomerate	12.50	8.75	24.75	25.50
Accessory Grains	0.75	0.75	tr	1.25
Muscovite	0.75	0.75	tr	1.25
Biotite	tr	tr	tr	0.00
Metamorphic Chlorite	0.00	0.00	0.00	0.00
Heavy Minerals*	tr	tr	tr	tr
ENVIRON. INDICATORS	0.25	0.25	0.75	tr
Plant Fragments/Organics	0.00	0.25	0.75	tr
Glauconite	0.00	0.00	0.00	0.00
Chamosite	0.25	0.00	0.00	0.00
Fossil Fragments	0.00	0.00	0.00	0.00
Phosphatic Grains	0.00	0.00	0.00	0.00
DETRITAL MATRIX	0.75	0.75	4.25	tr
Clay Matrix-Laminar	0.00	0.00	0.50	0.00
Clay Matrix-Pore filling	0.75	0.75	3.75	0.00
Clay Matrix-Pore lining	0.00	0.00	0.00	tr
Volcanic	0.00	0.00	0.00	0.00
AUTHIGENIC CEMENTS	9.00	11.00	4.25	8.50
Illite, I/S-Pore lining	0.50	1.00	0.25	0.25
Illite, I/S-Pore filling	0.50	0.75	0.50	tr
Chlorite-Pore lining	0.00	0.00	0.00	0.00
Chlorite-Pore filling	0.00	0.00	0.00	0.00
Kaolinite	0.00	0.00	0.00	0.00
Quartz Overgrowths	7.50	9.25	3.50	5.00
Feldspar Overgrowths	0.50	tr	0.00	0.00
Microquartz	0.00	tr	0.00	0.25
Calcite	0.00	0.00	0.00	2.50
Fe-Calcite	0.00	tr	0.00	tr
Dolomite	0.00	0.00	0.00	0.00
Ankerite	0.00	0.00	0.00	tr
Siderite	0.00	0.00	tr	0.50
Pyrite	tr	tr	tr	tr
Ti-Oxides	0.00	0.00	0.00	0.00
Fe-Oxides	0.00	0.00	0.00	0.00
Bitumen	0.00	tr	0.00	0.00
Zeolites	tr	0.00	0.00	0.00
REPLACEMENTS	5.50	3.75	3.00	5.50
Illite, I/S, Sericite	2.75	1.50	2.00	2.00
Chlorite	0.25	0.25	tr	0.00
Kaolinite	0.00	0.00	0.00	0.00
Quartz	0.00	1.00	tr	0.75
Feldspar	0.00	tr	0.25	0.25
Microquartz	1.00	0.25	tr	1.25
Calcite	0.00	tr	0.25	0.75
Fe-Calcite	0.50	0.00	0.00	tr
Dolomite	0.00	0.00	0.00	0.00
Ankerite	0.25	tr	0.00	0.00
Siderite	0.50	0.00	0.25	0.25
Pyrite	tr	tr	0.25	0.25
Ti-Oxides	0.25	0.00	0.00	0.00
Fe-Oxides	0.00	0.00	0.00	0.00
Bitumen	0.00	0.75	tr	0.00
Zeolite	tr	0.00	0.00	0.00
POROSITY	8.00	6.75	6.00	4.25
Intergranular	2.00	0.50	0.50	0.50
Intragranular/Moldic	4.50	5.50	3.75	3.00
Microscopic	1.50	0.75	1.75	0.75
Transgranular/Grain Fracture	tr	tr	tr	tr
TOTAL:	100.00	100.00	100.00	100.00
Q (quartz + metaquartzite)	55.34	61.76	45.61	60.00
F (feldspar + granite fragment)	14.62	7.35	11.40	11.82
R (rock fragments)	30.04	30.88	42.98	28.18

* Bitumen, Garnet, Epidote, Metamorphic Chlorite, Pyroxene, Rutile, Sphene, Tourmaline, and Zircon

THIN SECTION MODAL ANALYSIS

QGC - A BG Group Business

Magnetic -1

Bowen Basin

Queensland, Australia

Weatherford Labs File No.: AB-76967

Sample Type: Conventional / Analyst: A. Schwartz

DEPTH: (Meters)	2970.05	2972.10	2974.13	2976.05
SAMPLE NUMBER:	1-38P DS	1-40P DS	2-44P DS	2-46P DS
Formation:	Lorelle Ss	Lorelle Ss	Lorelle Ss	Lorelle Ss
Grain Size Avg. (mm):	0.89	4.64	7.15	9.31
Grain Size Range (mm):	<0.01-11.25	<0.01-23.00	<0.01-16.56	<0.01-20.14
Sorting:	Very Poor	Very Poor	Very Poor	Very Poor
Fabric:	Massive; Bioturbated	Massive; Microstylolites	Massive	Laminated
Rock Name (Folk):	Felds. Litharenite	Sandy Conglomerate	Sandy Conglomerate	Sl. Sandy Conglomerate
FRAMEWORK GRAINS				
Quartz	29.50	22.50	20.00	8.25
Monocrystalline	24.50	16.50	12.50	5.25
Polycrystalline	3.75	5.50	5.50	3.00
Meta-Quartzite	1.25	0.50	2.00	0.00
Feldspar	6.00	1.25	1.75	0.25
K-Feldspar	4.50	0.75	1.50	0.25
Plagioclase	1.50	0.50	0.25	0.00
Lithic Fragments	45.00	65.25	64.25	79.00
Plutonic-Granitic	3.25	1.50	1.00	3.25
Volcanic-Tuff/Glass	0.50	0.00	tr	0.00
Volcanic-Felsic	0.00	0.00	0.00	0.00
Volcanic-Interm./Mafic	2.25	0.75	0.00	0.00
Metamorphic-Schist	3.50	4.00	1.00	1.25
Metamorphic-Phyllite/Slate	0.25	0.25	0.25	0.00
Chert	9.00	2.00	4.00	2.25
Mudstone	0.00	0.00	0.00	tr
Carbonate	0.00	0.00	0.00	0.00
Siltstone/Sandstone	tr	0.25	tr	1.75
Conglomerate	26.25	56.50	58.00	70.50
Accessory Grains	0.50	0.25	0.25	0.50
Muscovite	0.50	tr	tr	0.25
Biotite	tr	0.00	0.25	0.25
Metamorphic Chlorite	tr	0.00	0.00	0.00
Heavy Minerals*	tr	0.25	tr	tr
ENVIRON. INDICATORS	0.50	tr	0.00	tr
Plant Fragments/Organics	0.50	tr	0.00	tr
Glauconite	0.00	0.00	0.00	0.00
Chamosite	0.00	0.00	0.00	0.00
Intrabasinal Clasts	0.00	0.00	0.00	0.00
Phosphatic Grains	0.00	0.00	0.00	0.00
DETRITAL MATRIX	1.25	0.75	tr	0.50
Clay Matrix-Laminar	tr	tr	0.00	tr
Clay Matrix-Pore filling	1.25	0.75	0.00	0.50
Clay Matrix-Pore lining	0.00	0.00	tr	0.00
Volcanic	0.00	0.00	0.00	0.00
AUTHIGENIC CEMENTS	7.50	2.00	6.50	2.00
Illite, I/S-Pore lining	0.25	0.25	tr	0.00
Illite, I/S-Pore filling	0.25	tr	0.25	0.00
Chlorite-Pore lining	0.00	0.00	0.00	0.00
Chlorite-Pore filling	0.00	0.00	0.00	0.00
Kaolinite	0.00	0.00	0.00	0.00
Quartz Overgrowths	5.50	1.75	5.75	0.75
Feldspar Overgrowths	0.25	0.00	0.00	0.00
Microquartz	0.00	0.00	0.25	1.00
Calcite	0.00	0.00	tr	tr
Fe-Calcite	0.00	0.00	0.25	0.00
Dolomite	0.00	0.00	0.00	0.00
Ankerite	0.00	0.00	tr	0.00
Siderite	1.00	0.00	0.00	0.00
Pyrite	tr	tr	tr	0.25
Ti-Oxides	tr	0.00	0.00	0.00
Fe-Oxides	0.00	0.00	0.00	0.00
Bitumen	0.25	0.00	0.00	0.00
Zeolite	0.00	0.00	0.00	0.00
REPLACEMENTS	6.50	3.25	3.00	5.75
Illite, I/S, Sericite	1.50	1.25	1.25	2.75
Chlorite	0.50	0.00	0.50	0.00
Kaolinite	0.00	0.00	0.00	0.00
Quartz	0.50	0.50	0.25	0.25
Feldspar	tr	tr	tr	0.00
Microquartz	tr	0.50	0.00	1.00
Calcite	0.00	tr	tr	0.75
Fe-Calcite	0.25	tr	0.75	tr
Dolomite	0.00	0.00	0.00	0.00
Ankerite	0.50	tr	tr	0.00
Siderite	2.00	tr	0.00	0.50
Pyrite	1.00	0.75	0.25	0.50
Ti-Oxides	0.00	0.25	0.00	0.00
Fe-Oxides	0.00	0.00	0.00	0.00
Bitumen	0.25	0.00	0.00	0.00
Zeolite	0.00	0.00	0.00	0.00
POROSITY	3.25	4.75	4.25	3.75
Intergranular	0.25	0.50	0.25	tr
Intragranular/Moldic	2.50	4.00	3.25	2.75
Microscopic	0.50	0.25	0.75	1.00
Transgranular/Grain Fracture	0.00	tr	tr	tr
TOTAL:	100.00	100.00	100.00	100.00
Q (quartz + metaquartzite)	54.38	69.23	71.43	48.53
F (feldspar + granite fragment)	17.05	8.46	9.82	20.59
R (rock fragments)	28.57	22.31	18.75	30.88

* Pyroxene, Sphalerite, Tourmaline, and Zircon

THIN SECTION MODAL ANALYSIS

QGC - A BG Group Business
Magnetic - 1
Bowen Basin
Queensland, Australia
Weatherford Labs File No.: AB-76967
Sample Type: Conventional / Analyst: A. Schwartz

DEPTH: (Meters)	2978.07	2980.09	2982.04	2987.05
SAMPLE NUMBER:	2-48P DS	2-50P DS	2-52PDS	2-57P DS
Formation:	Lorelle Ss	Lorelle Ss	Lorelle Ss	PS46 TRS
Grain Size Avg. (mm):	0.49	6.79	N/A	N/A
Grain Size Range (mm):	<0.01-2.16	<0.01-15.01	<0.01-8.36	<0.01-14.44
Sorting:	Very Poor	Very Poor	Very Poor	Very Poor
Fabric:	Massive	Massive to Laminated	Massive	Massive
Rock Name (Folk):	Felds. Litharenite	Sandy Conglomerate	Tuffaceous Anglomerate	Tuffaceous Anglomerate
FRAMEWORK GRAINS				
Quartz	33.00	8.00		
Monocrystalline	26.25	7.00		
Polycrystalline	4.75	0.75		
Meta-Quartzite	2.00	0.25		
Feldspar	5.00	1.50		
K-Feldspar	3.50	1.00		
Plagioclase	1.50	0.50		
Lithic Fragments	39.25	73.25		
Plutonic-Granitic	3.25	0.75		
Volcanic-Tuff/Glass	0.50	1.00		
Volcanic-Felsic	0.50	0.00		
Volcanic-Interm./Mafic	1.00	0.75		
Metamorphic-Schist	3.75	1.00		
Metamorphic-Phyllite/Slate	0.25	tr		
Chert	5.00	4.50		
Mudstone	0.00	0.00		
Carbonate	0.00	0.00		
Siltstone/Sandstone	1.75	2.50		
Conglomerate	23.25	62.75		
Accessory Grains	1.75	0.75		
Muscovite	1.25	0.25		
Biotite	0.50	0.25		
Metamorphic Chlorite	tr	0.00		
Heavy Minerals*	tr	0.25		
ENVIRON. INDICATORS	0.25	2.75		
Plant Fragments/Organics	0.25	2.75		
Glauconite	0.00	0.00		
Chamosite	0.00	0.00		
Intrabasinal Clasts	0.00	0.00		
Phosphatic Grains	0.00	0.00		
DETRITAL MATRIX	4.50	2.75		
Clay Matrix-Laminar	0.75	1.25		
Clay Matrix-Pore filling	3.75	1.50		
Clay Matrix-Pore lining	0.00	0.00		
Volcanic	0.00	0.00		
AUTHIGENIC CEMENTS	5.25	1.50		
Illite, I/S-Pore lining	0.00	0.00	Sample deemed unsuitable for point count analysis	Sample deemed unsuitable for point count analysis
Illite, I/S-Pore filling	0.00	0.00		
Chlorite-Pore lining	0.00	0.00		
Chlorite-Pore filling	0.00	0.00		
Kaolinite	0.00	0.00		
Quartz Overgrowths	1.75	tr		
Feldspar Overgrowths	0.00	0.00		
Microquartz	tr	0.00		
Calcite	0.50	0.25		
Fe-Calcite	0.75	tr		
Dolomite	0.00	0.00		
Ankerite	1.25	1.00		
Siderite	0.25	0.00		
Pyrite	0.50	0.25		
Ti-Oxides	0.00	0.00		
Fe-Oxides	0.00	0.00		
Bitumen	tr	0.00		
Zeolite	0.25	0.00		
REPLACEMENTS	5.75	8.50		
Illite, I/S, Sericite	1.25	1.25		
Chlorite	0.00	0.00		
Kaolinite	0.00	0.00		
Quartz	0.75	0.25		
Feldspar	0.25	0.00		
Microquartz	tr	0.00		
Calcite	0.00	1.50		
Fe-Calcite	1.00	0.75		
Dolomite	0.00	0.00		
Ankerite	1.00	2.50		
Siderite	0.75	0.00		
Pyrite	0.50	2.25		
Ti-Oxides	0.00	0.00		
Fe-Oxides	0.00	0.00		
Bitumen	0.00	0.00		
Zeolite	0.25	0.00		
POROSITY	5.25	1.00		
Intergranular	0.25	0.00		
Intragranular/Moldic	4.00	0.25		
Microscopic	1.00	0.75		
Transgranular/Grain Fracture	tr	tr		
TOTAL:	100.00	100.00		
Q (quartz + metaquartzite)	60.55	40.00		
F (feldspar + granite fragment)	16.06	11.25		
R (rock fragments)	23.39	48.75		

* Pyroxene, Sphalerite, Tourmaline, and Zircon

THIN SECTION MODAL ANALYSIS

QGC - A BG Group Business
Magnetic -1
Bowen Basin
Queensland, Australia
Weatherford Labs File No.: AB-76967
Sample Type: Conventional / Analyst: A. Schwartz

DEPTH: (Meters)	2995.05	3002.05	3008.05
SAMPLE NUMBER:	2-6SP DS	2-73P DS	2-80P DS
Formation:	PS46 TRS	PS46 TRS	PS46 TRS
Grain Size Avg. (mm):	N/A	N/A	N/A
Grain Size Range (mm):	<0.01-5.97	<0.01-9.39	<0.01-4.06
Sorting:	Very Poor	Very Poor	Poor
Fabric:	Massive	Massive	Massive
Rock Name (Folk):	Tuffaceous Anglomerate	Tuffaceous Anglomerate	Tuffaceous Anglomerate
FRAMEWORK GRAINS			
<i>Quartz</i>			
Monocrystalline			
Polycrystalline			
Meta-Quartzite			
<i>Feldspar</i>			
K-Feldspar			
Plagioclase			
<i>Lithic Fragments</i>			
Plutonic-Granitic			
Volcanic-Tuff/Glass			
Volcanic-Felsic			
Volcanic-Interm./Mafic			
Metamorphic-Schist			
Metamorphic-Phyllite/Slate			
Chert			
Mudstone			
Carbonate			
Siltstone/Sandstone			
Conglomerate			
<i>Accessory Grains</i>			
Muscovite			
Biotite			
Metamorphic Chlorite			
Heavy Minerals*			
ENVIRON. INDICATORS			
Plant Fragments/Organics			
Glauconite			
Chamosite			
Intrabasinal Clasts			
Phosphatic Grains			
DETRITAL MATRIX			
Clay Matrix-Laminar			
Clay Matrix-Pore filling			
Clay Matrix-Pore lining			
Volcanic			
AUTHIGENIC CEMENTS			
Illite, I/S-Pore lining	Sample deemed unsuitable for point count analysis	Sample deemed unsuitable for point count analysis	Sample deemed unsuitable for point count analysis
Illite, I/S-Pore filling			
Chlorite-Pore lining			
Chlorite-Pore filling			
Kaolinite			
Quartz Overgrowths			
Feldspar Overgrowths			
Microquartz			
Calcite			
Fe-Calcite			
Dolomite			
Ankerite			
Siderite			
Pyrite			
Ti-Oxides			
Fe-Oxides			
Zeolite			
REPLACEMENTS			
Illite, I/S, Sericite			
Chlorite			
Kaolinite			
Quartz			
Feldspar			
Microquartz			
Calcite			
Fe-Calcite			
Dolomite			
Ankerite			
Siderite			
Pyrite			
Ti-Oxides			
Fe-Oxides			
Bitumen			
Zeolite			
POROSITY			
Intergranular			
Intragranular/Moldic			
Microscopic			
Transgranular/Grain Fracture			
TOTAL:			
Q (quartz + metaquartzite)			
F (feldspar + granite fragment)			
R (rock fragments)			

* Pyroxene, Sphalerite, Tourmaline, and Zircon

THIN SECTION MODAL ANALYSIS

QGC - A BG Group Business

Magnetic -1

Bowen Basin

Queensland, Australia

Weatherford Labs File No.: AB-76967

Sample Type: Rotary Sidewall / Analyst: A. Schwartz

DEPTH: (Meters)	2792.70	2794.10	2800.20	2808.20
SAMPLE NUMBER:	SWC25	SWC24	SWC23	SWC21
Formation:	Upper Tinowon Ss	Upper Tinowon Ss	Upper Tinowon Ss	Upper Tinowon Ss
Grain Size Avg. (mm):	19.57 / 0.04	0.25	0.40	0.18
Grain Size Range (mm):	<0.01-19.57	<0.01-0.97	<0.01-0.80	<0.01-0.29
Sorting:	Very Poor	Moderately Well	Moderate	Poor
Fabric:	Lam.; Disturbed	Massive	Massive; Burrowed	Laminated; Bioturbated
Rock Name (Folk):	Cong. / Arg. Silt. Limestone	Lithic Arkose	Feldspathic Litharenite	Feldspathic Litharenite
FRAMEWORK GRAINS				
Quartz		15.00	20.25	18.75
Monocrystalline		12.25	18.50	13.75
Polycrystalline		2.75	1.50	5.00
Meta-Quartzite		0.00	0.25	0.00
Feldspar		33.50	21.25	12.25
K-Feldspar		tr	tr	0.00
Plagioclase		33.50	21.25	12.25
Lithic Fragments		16.00	31.50	22.00
Plutonic-Granitic		0.00	0.25	0.00
Volcanic-Tuff/Glass		1.00	1.50	0.50
Volcanic-Felsic		0.00	0.00	0.00
Volcanic-Interm./Mafic		2.50	8.50	10.25
Metamorphic-Schist		0.50	0.75	0.50
Metamorphic-Phyllite/Slate		0.75	0.25	1.00
Chert		9.50	17.00	7.50
Mudstone		0.50	1.75	1.25
Carbonate		0.00	0.00	0.00
Siltstone/Sandstone		1.25	1.50	1.00
Conglomerate		0.00	0.00	0.00
Accessory Grains		0.50	0.75	3.25
Muscovite		0.50	0.50	1.25
Biotite		0.00	0.25	1.75
Metamorphic Chlorite		0.00	0.00	0.00
Heavy Minerals*		tr	tr	0.25
ENVIRON. INDICATORS		0.25	tr	5.25
Plant Fragments/Organics		0.00	tr	4.50
Glauconite		tr	0.00	0.00
Chamosite		0.25	0.00	0.00
Intrabasinal Clasts		0.00	0.00	0.00
Fossil Fragments		0.00	0.00	0.75
DETRITAL MATRIX		2.00	3.00	18.25
Clay Matrix-Laminar		0.00	0.00	7.50
Clay Matrix-Pore filling		2.00	1.00	10.75
Clay Matrix-Pore lining		0.00	2.00	0.00
Volcanic		0.00	0.00	0.00
AUTHIGENIC CEMENTS		13.00	6.75	7.75
Illite, I/S-Pore lining		0.00	0.25	6.75
Illite, I/S-Pore filling	Sample deemed unsuitable for point count analysis	4.25	2.75	0.00
Chlorite-Pore lining		0.00	0.00	0.00
Chlorite-Pore filling		0.00	0.00	0.00
Kaolinite		0.00	0.00	0.00
Quartz Overgrowths		0.00	0.75	tr
Feldspar Overgrowths		0.75	1.50	tr
Microquartz		0.00	0.75	0.25
Calcite		8.00	0.75	0.25
Fe-Calcite		0.00	0.00	0.00
Dolomite		0.00	0.00	0.00
Ankerite		0.00	0.00	0.00
Siderite		0.00	0.00	0.00
Pyrite		tr	tr	0.50
Ti-Oxides		0.00	0.00	0.00
Fe-Oxides		0.00	0.00	0.00
Bitumen		0.00	0.00	0.00
Zeolite		0.00	0.00	0.00
REPLACEMENTS		16.25	7.25	8.50
Illite, I/S, Sericite		3.50	2.25	2.75
Chlorite		0.00	0.00	0.00
Kaolinite		0.00	0.00	0.00
Quartz		0.00	0.00	0.00
Feldspar		0.00	0.25	0.00
Microquartz		0.00	0.50	0.25
Calcite		12.50	3.00	3.25
Fe-Calcite		0.25	0.25	1.00
Dolomite		0.00	0.00	0.00
Ankerite		tr	tr	tr
Siderite		tr	1.00	0.50
Pyrite		tr	tr	0.50
Ti-Oxides		0.00	0.00	0.00
Fe-Oxides		0.00	0.00	0.25
Bitumen		0.00	0.00	0.00
Zeolite		0.00	0.00	0.00
POROSITY		3.50	9.25	4.00
Intergranular		0.00	3.25	0.00
Intragranular/Moldic		0.25	3.75	0.00
Microscopic		3.25	2.25	4.00
Transgranular/Grain Fracture		tr	tr	0.00
TOTAL:		100.00	100.00	100.00
Q (quartz + metaquartzite)		23.26	27.74	35.38
F (feldspar + granite fragment)		51.94	29.45	23.11
R (rock fragments)		24.81	42.81	41.51

* Tourmaline and Zircon

THIN SECTION MODAL ANALYSIS

QGC - A BG Group Business

Magnetic -1

Bowen Basin

Queensland, Australia

Weatherford Labs File No.: AB-76967

Sample Type: Rotary Sidewall / Analyst: A. Schwartz

DEPTH: (Meters)	2818.60	2931.40	2933.80	2994.70
SAMPLE NUMBER:	SWC20	SWC12	SWC11	SWC8
Formation:	Upper Tinowon Ss	Lorelle Sandstone	Lorelle Sandstone	PS46 TRS
Grain Size Avg. (mm):	0.30 / 0.04	0.42	0.34	N/A
Grain Size Range (mm):	<0.01-0.72	<0.01-4.02	<0.01-3.91	<0.01-11.55
Sorting:	Moderate to Mod. Well	Very Poor	Poor	Poor
Fabric:	Massive to Laminar	Laminated; Disturbed	Laminated; Disturbed	Massive
Rock Name (Folk):	Feld. Lith./Org., Arg. Silt.	Feldspathic Litharenite	Feldspathic Litharenite	
FRAMEWORK GRAINS				
Quartz	11.25	24.00	26.75	
Monocrystalline	9.50	19.00	17.25	
Polycrystalline	1.75	4.75	5.25	
Meta-Quartzite	0.00	0.25	4.25	
Feldspar	7.50	10.00	7.75	
K-Feldspar	0.25	6.00	4.00	
Plagioclase	7.25	4.00	3.75	
Lithic Fragments	17.00	20.00	21.50	
Plutonic-Granitic	0.00	2.25	4.50	
Volcanic-Tuff/Glass	0.25	0.25	0.25	
Volcanic-Felsic	0.00	1.50	1.25	
Volcanic-Interm./Mafic	4.25	2.25	2.25	
Metamorphic-Schist	0.50	6.50	4.25	
Metamorphic-Phyllite/Slate	1.25	0.75	0.75	
Chert	9.50	5.50	4.00	
Mudstone	0.50	0.25	1.00	
Carbonate	0.00	0.00	0.00	
Siltstone/Sandstone	0.75	0.75	3.25	
Conglomerate	0.00	0.00	0.00	
Accessory Grains	1.50	2.25	3.25	
Muscovite	1.50	1.00	1.75	
Biotite	tr	1.00	1.25	
Metamorphic Chlorite	0.00	tr	0.00	
Heavy Minerals*	tr	0.25	0.25	
ENVIRON. INDICATORS	8.50	4.75	3.75	
Plant Fragments/Organics	8.50	4.75	3.75	
Glauconite	0.00	0.00	0.00	
Chamosite	0.00	0.00	0.00	
Intrabasinal Clasts	0.00	0.00	0.00	
Fossil Fragments	0.00	0.00	0.00	
DETRITAL MATRIX	33.50	27.25	30.00	
Clay Matrix-Laminar	33.50	21.00	22.75	
Clay Matrix-Pore filling	0.00	6.25	7.25	
Clay Matrix-Pore lining	0.00	0.00	0.00	
Volcanic	0.00	0.00	0.00	
AUTHIGENIC CEMENTS	8.75	2.75	1.75	
Illite, I/S-Pore lining	1.75	0.75	0.25	
Illite, I/S-Pore filling	0.00	0.00	0.00	
Chlorite-Pore lining	0.00	0.00	0.00	
Chlorite-Pore filling	0.00	0.00	0.00	
Kaolinite	0.00	0.00	0.00	
Quartz Overgrowths	tr	0.25	0.00	
Feldspar Overgrowths	tr	tr	0.00	
Microquartz	5.50	0.25	0.00	
Calcite	0.00	0.00	0.00	
Fe-Calcite	1.00	0.00	0.00	
Dolomite	0.00	0.00	0.00	
Ankerite	0.00	0.00	0.00	
Siderite	0.00	0.00	0.00	
Pyrite	0.50	1.50	1.50	
Ti-Oxides	0.00	0.00	0.00	
Fe-Oxides	tr	0.00	0.00	
Bitumen	0.00	0.00	0.00	
Zeolite	0.00	0.00	0.00	
REPLACEMENTS	9.50	7.50	4.75	
Illite, I/S, Sericite	4.75	2.75	1.75	
Chlorite	0.00	0.00	0.00	
Kaolinite	0.00	0.00	0.00	
Quartz	0.00	0.00	0.00	
Feldspar	0.00	0.00	0.00	
Microquartz	0.25	0.00	tr	
Calcite	0.25	0.00	0.00	
Fe-Calcite	1.75	0.00	0.00	
Dolomite	0.00	0.00	0.00	
Ankerite	tr	0.25	tr	
Siderite	1.00	3.25	2.75	
Pyrite	1.25	1.00	0.25	
Ti-Oxides	0.00	0.00	0.00	
Fe-Oxides	0.00	0.25	0.00	
Bitumen	0.25	tr	0.00	
Zeolite	0.00	0.00	0.00	
POROSITY	2.50	1.50	0.50	
Intergranular	0.00	0.00	0.00	
Intragranular/Moldic	0.00	tr	0.00	
Microscopic	2.50	1.50	0.50	
Transgranular/Grain Fracture	0.00	0.00	0.00	
TOTAL:	100.00	100.00	100.00	
Q (quartz + metaquartzite)	31.47	44.44	47.77	
F (feldspar + granite fragment)	20.98	22.69	21.88	
R (rock fragments)	47.55	32.87	30.36	

Sample deemed unsuitable
for point count analysis

* Tourmaline and Zircon

THIN SECTION MODAL ANALYSIS

QGC - A BG Group Business
Magnetic -1
Bowen Basin
Queensland, Australia
Weatherford Labs File No.: AB-76967
Sample Type: Rotary Sidewall / Analyst: A. Schwartz

DEPTH: (Meters)	3011.30	3017.30	3020.50	3036.00
SAMPLE NUMBER:	SWC7	SWC5	SWC4	SWC2
Formation:	PS46 TRS	PS46 TRS	PS46 TRS	Basement
Grain Size Avg. (mm):	N/A	N/A	N/A	N/A
Grain Size Range (mm):	<0.01-3.92	0.02-4.18	<0.01-4.86	<0.01-2.89
Sorting:	Very Poor	Poor	Poor	N/A
Fabric:	Massive	Massive	Massive	Massive
Rock Name (Folk):	Anglomerate Tuff	Anglomerate Tuff	Anglomerate Tuff	Porphyritic Trachyte
FRAMEWORK GRAINS				
<i>Quartz</i>				
Monocrystalline				
Polycrystalline				
Meta-Quartzite				
<i>Feldspar</i>				
K-Feldspar				
Plagioclase				
<i>Lithic Fragments</i>				
Plutonic-Granitic				
Volcanic-Tuff/Glass				
Volcanic-Felsic				
Volcanic-Interm./Mafic				
Metamorphic-Schist				
Metamorphic-Phyllite/Slate				
Chert				
Mudstone				
Carbonate				
Siltstone/Sandstone				
Conglomerate				
<i>Accessory Grains</i>				
Muscovite				
Biotite				
Metamorphic Chlorite				
Heavy Minerals*				
ENVIRON. INDICATORS				
Plant Fragments/Organics				
Glauconite				
Chamosite				
Intrabasinal Clasts				
Fossil Fragments				
DETRITAL MATRIX				
Clay Matrix-Laminar				
Clay Matrix-Pore filling				
Clay Matrix-Pore lining				
Volcanic				
AUTHIGENIC CEMENTS				
Illite, I/S-Pore lining				
Illite, I/S-Pore filling				
Chlorite-Pore lining				
Chlorite-Pore filling				
Kaolinite				
Quartz Overgrowths				
Feldspar Overgrowths				
Microquartz				
Calcite				
Fe-Calcite				
Dolomite				
Ankerite				
Siderite				
Pyrite				
Ti-Oxides				
Fe-Oxides				
Bitumen				
Zeolite				
REPLACEMENTS				
Illite, I/S, Sericite				
Chlorite				
Kaolinite				
Quartz				
Feldspar				
Microquartz				
Calcite				
Fe-Calcite				
Dolomite				
Ankerite				
Siderite				
Pyrite				
Ti-Oxides				
Fe-Oxides				
Bitumen				
Zeolite				
POROSITY				
Intergranular				
Intragranular/Moldic				
Microscopic				
Transgranular/Grain Fracture				
TOTAL:				
Q (quartz + metaquartzite)				
F (feldspar + granite fragment)				
R (rock fragments)				

* Tourmaline and Zircon

APPENDIX D

SCANNING ELECTRON MICROSCOPY PHOTOMICROGRAPHS AND DESCRIPTIONS

(Note the micron bar at the basal right of each photomicrograph for scale)

QGC - A BG Group Business
Magnetic-1
Lorelle Sandstone Formation
Onshore, Australia
Conventional Core

Weatherford Labs File No.: AB-76967

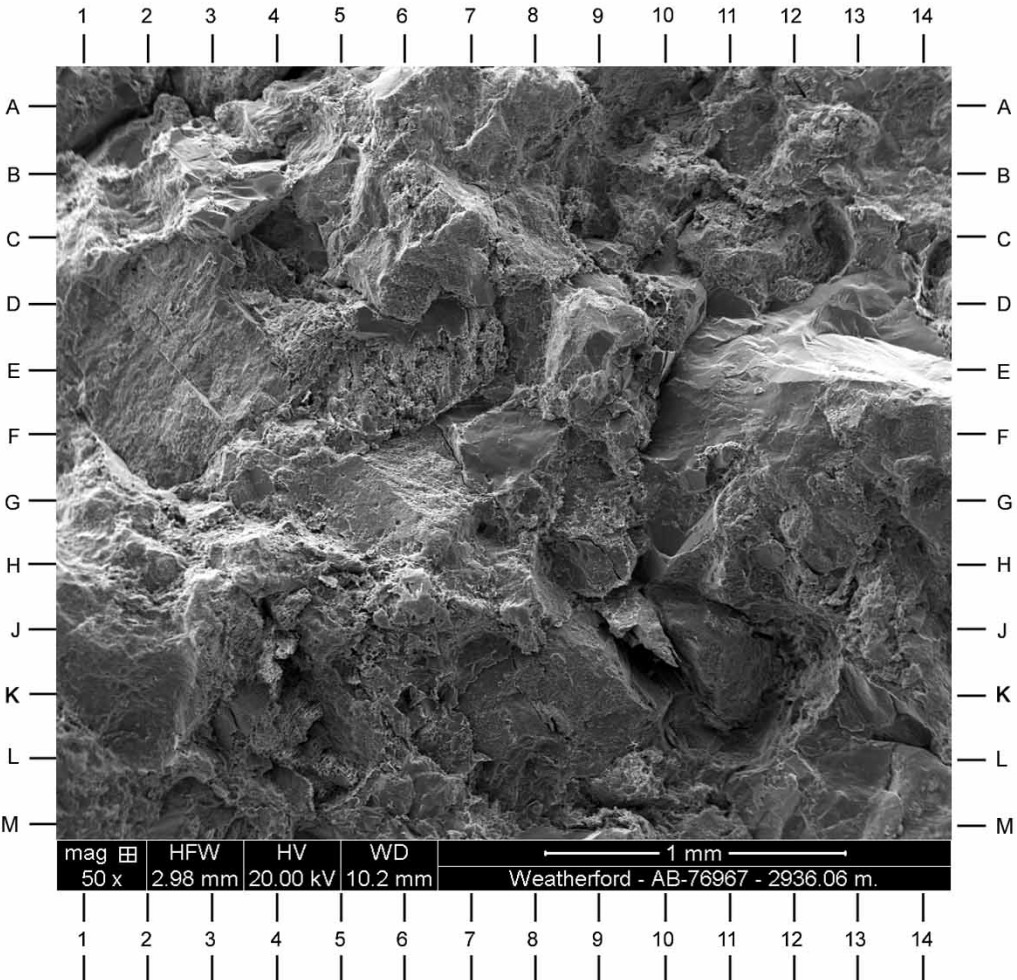
SAMPLE DEPTH: 2936.06 METERS
SAMPLE NUMBER: 1-1P DS

PLATE 1

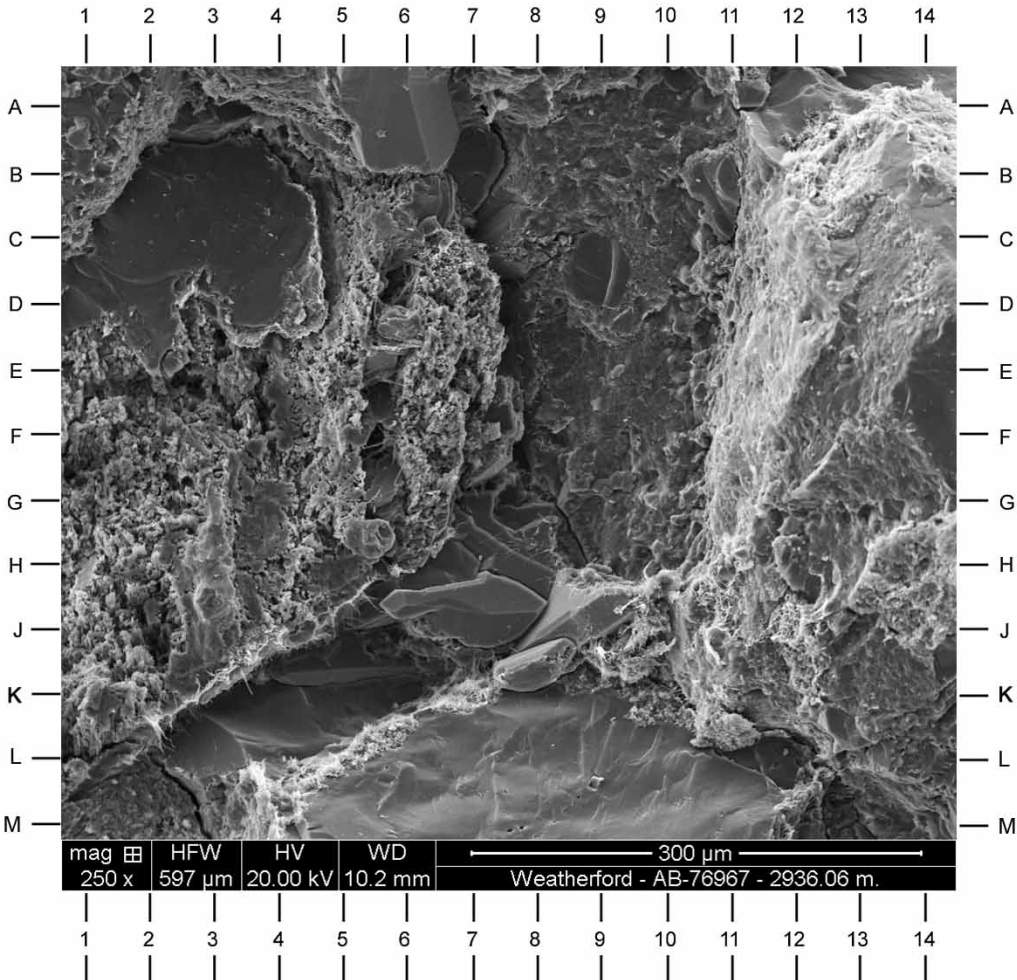
Photo A is a general overview illustrating the generally massive texture of this litharenite (based on thin section). Quartz (Photo B; C2.5, AB6, K5, LM9/ Photo C; DE6, J8/ Photo D; B12-M2) and potassium feldspar (Photo D; A2, F5) were detected using energy dispersive spectrometry (EDS). Barite occurs on the sample surface and is a probably a contaminant of drilling fluid. Quartz overgrowths precipitate on host detrital grains (Photo D; BC12). Authigenic ferroan dolomite (Photo C; F6-M7) occurs as possible replacement of unstable material. This litharenite appears to be very tight due to compaction and quartz overgrowth cement. Observed porosity is mostly secondary intragranular pores (Photo B; FG1-7) and micro/nanopores associated with the clays.

Magnification: A: 50X B: 250X C: 600X D: 1000X

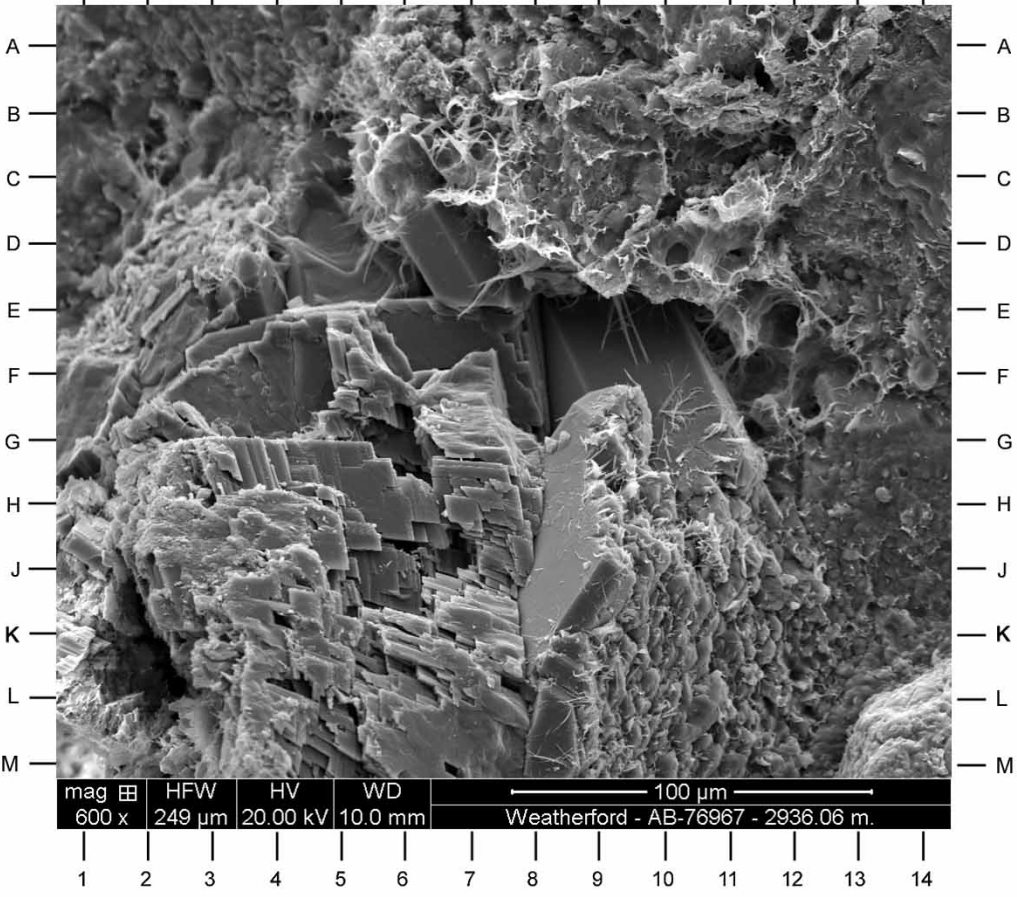
A



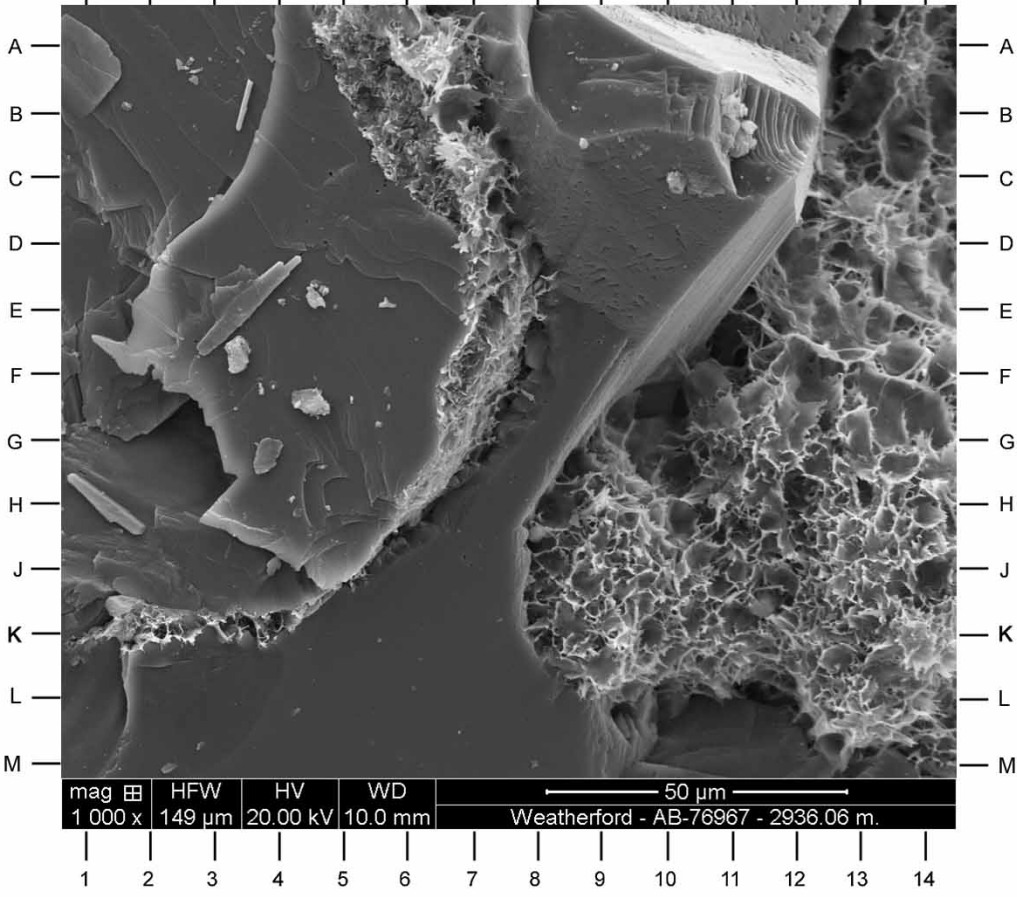
B



C



D



QGC - A BG Group Business
Magnetic-1
Lorelle Sandstone Formation
Onshore, Australia
Conventional Core

Weatherford Labs File No.: AB-76967

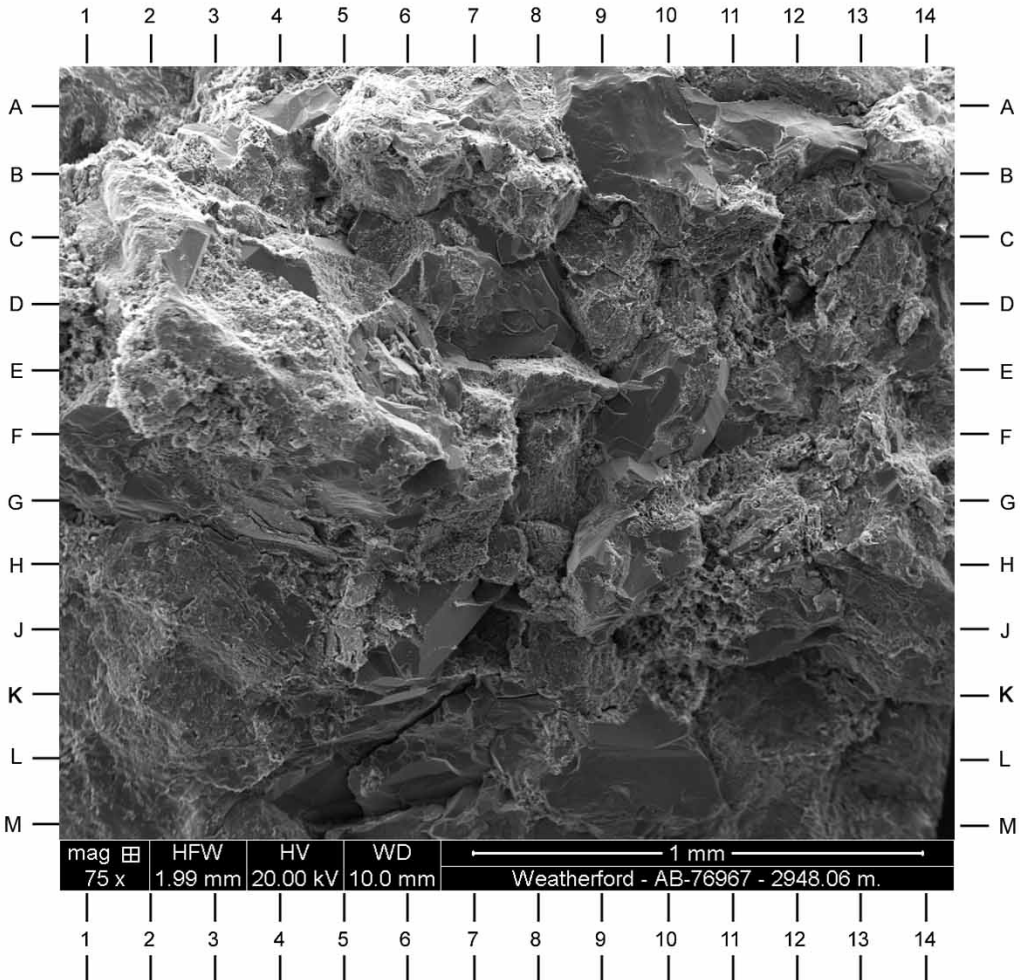
SAMPLE DEPTH: 2948.06 METERS
SAMPLE NUMBER: 1-15P-DS

PLATE 2

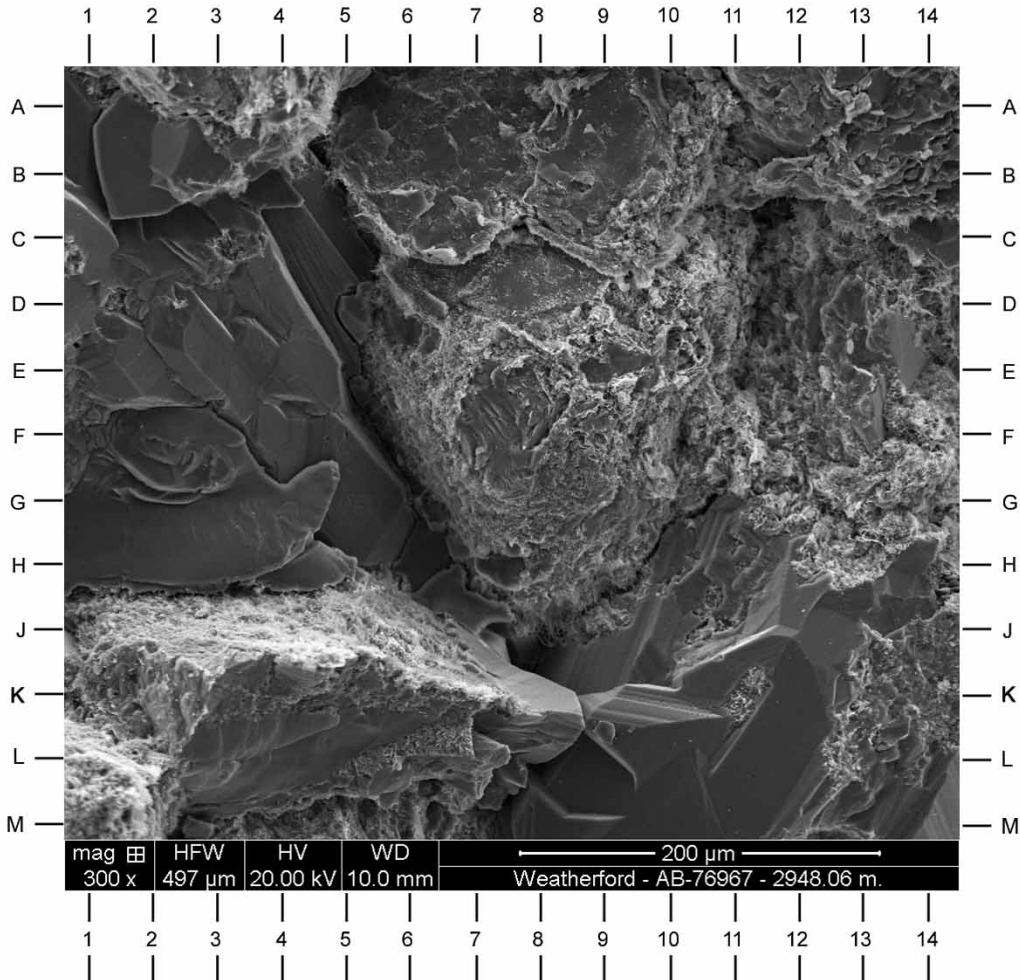
These photomicrographs illustrate a massive feldspathic litharenite (based on thin section). Photo B provides a high magnification view of the area DE9 in Photo A. Detrital grains consist predominantly of quartz (Photo B; E3, K11, K5/ Photo C; BC13, C4, J4/ Photo D; A3-M2, D14-M11) with lesser amounts of potassium feldspar (Photo B; E12/ Photo C; A9/ Photo D; BG10) and albite (Photo C; G13). Authigenic quartz (Photo B; HJ10/ Photo C; BC13) and ferroan dolomite (Photo C; K5) cement almost completely reduce the intergranular pores. Siderite (Photo B; C6) occurs as replacement of less stable material. Biotitic mica occurs at AB7 in Photo B. Illite (CD10.5/ Photo C; F7-M14/ Photo D; A8-G3) occurs as grain coating material. Secondary pores are dominant and occur within partially altered feldspar grains (Photo D; BG10). Micropores are less common and occur between illite clay particles.

Magnification: A: 75X B: 300X C: 800X D: 1200X

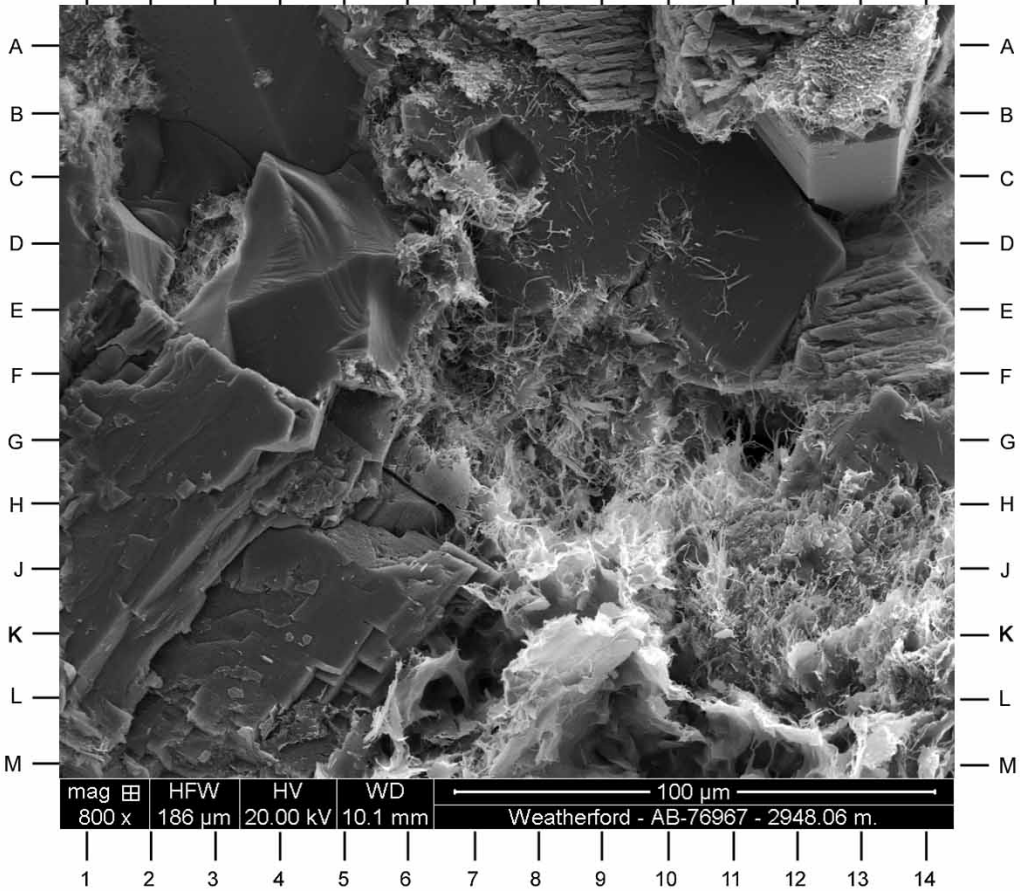
A



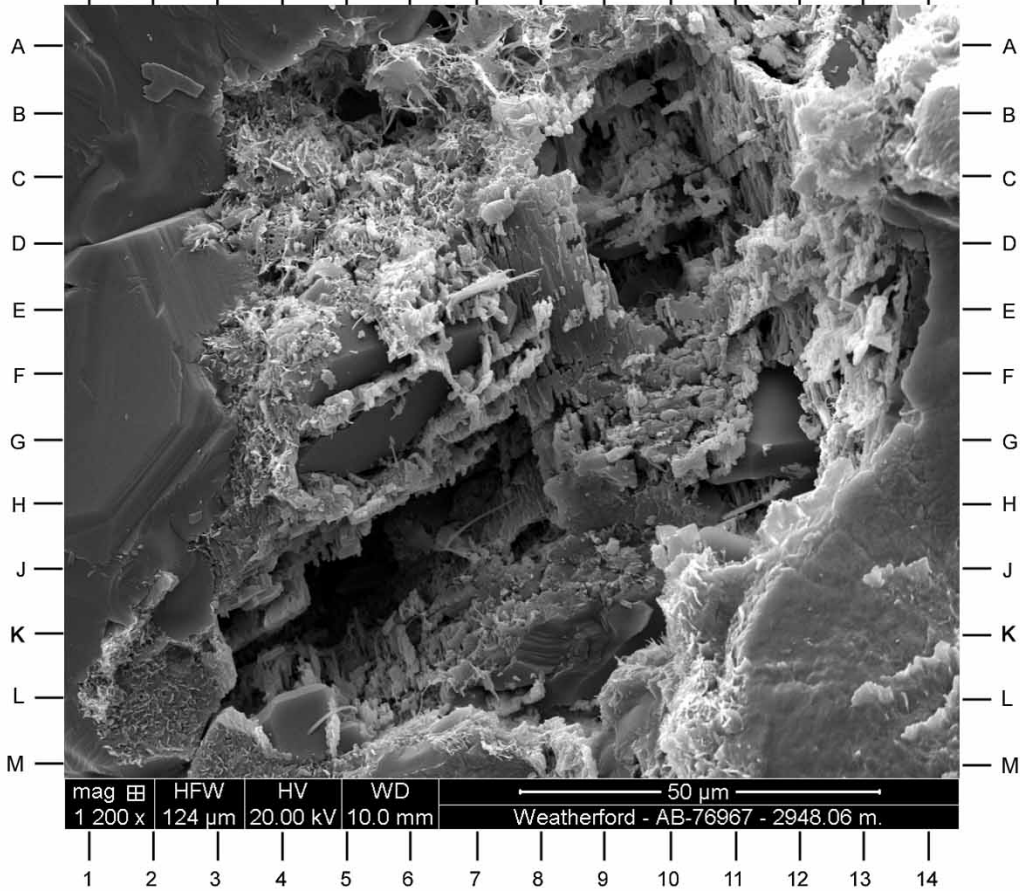
B



C



D



QGC - A BG Group Business
Magnetic-1
Lorelle Sandstone Formation
Onshore, Australia
Conventional Core

Weatherford Labs File No.: AB-76967

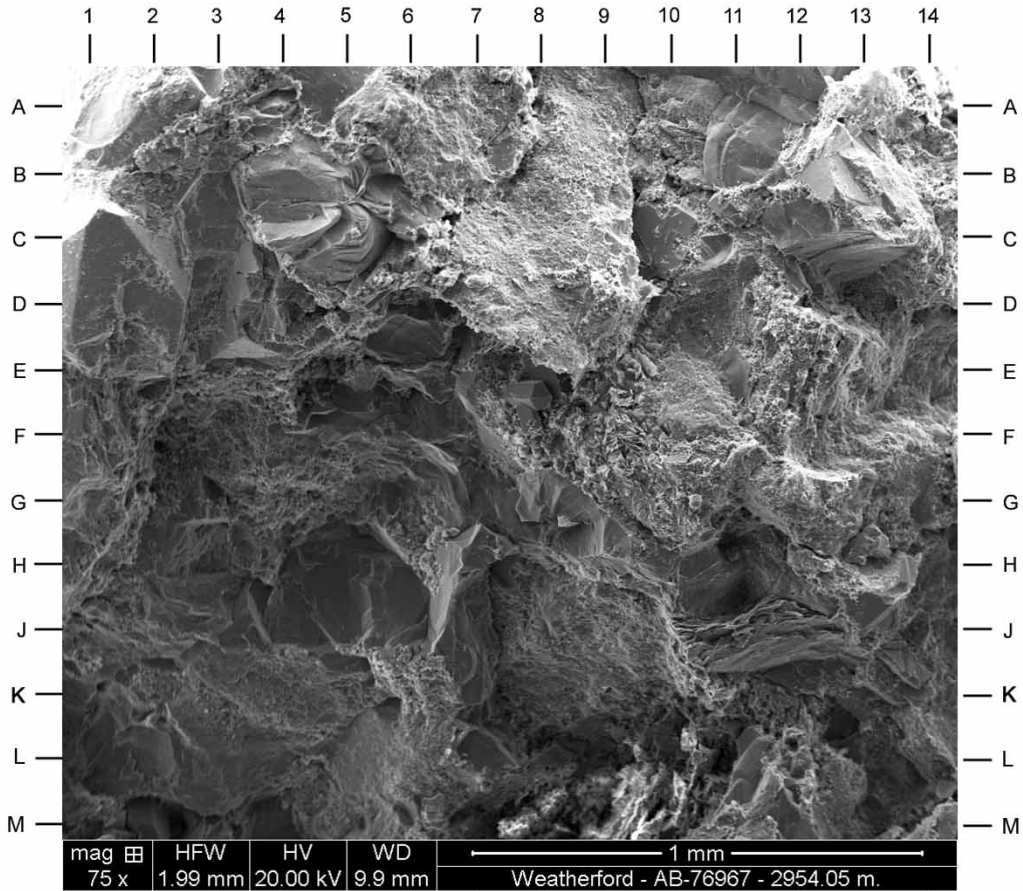
SAMPLE DEPTH: 2954.05 METERS
SAMPLE NUMBER: 1_22P-DS

PLATE 3

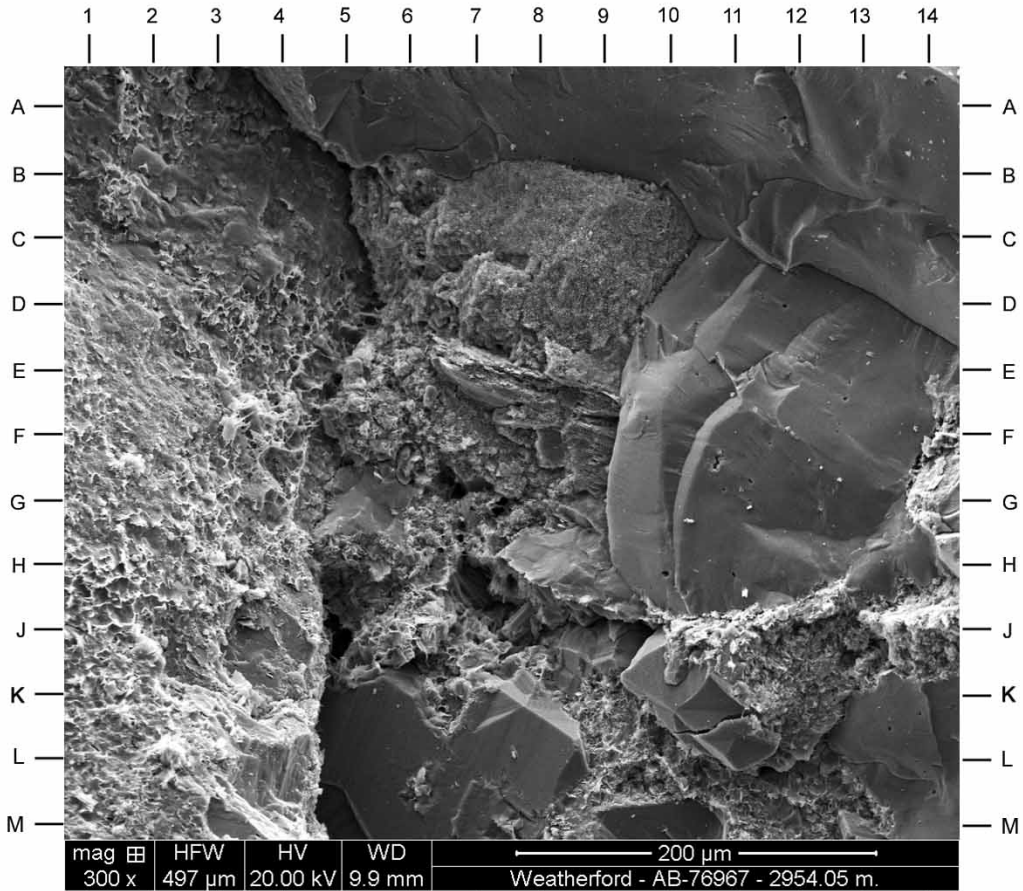
These photomicrographs depict a massive lithic arkose (based on thin section) composed of abundant amounts of detrital quartz (Photo B; B12, F11, L6) and potassium feldspar (Photo D; A1-J8). Grain-coating, fibrous illite clay (Photo B; J10-14/ Photo D; A8-M1) and pore-bridging illite/smectite clay (Photo C; F5-6, F11) is present. The illite clay rim in Photo D preserves a feldspar grain's shape even though the grain has been partially dissolved. Authigenic quartz, probable cement, is observed in Photo D (LM9-14). Well-developed, euhedral quartz crystals (Photo C; AB5, AB7/ Photo D; D7) are attached to grain surfaces, along with grain-coating mixed-layer illite/smectite and chlorite (Photo C; BC4, C5.5). Secondary dissolution/moldic pores (Photo B; C6-J5) represent the dominant pore type, with lesser amounts of micropores associated with clays.

Magnification: A: 75X B: 300X C: 600X D: 800X

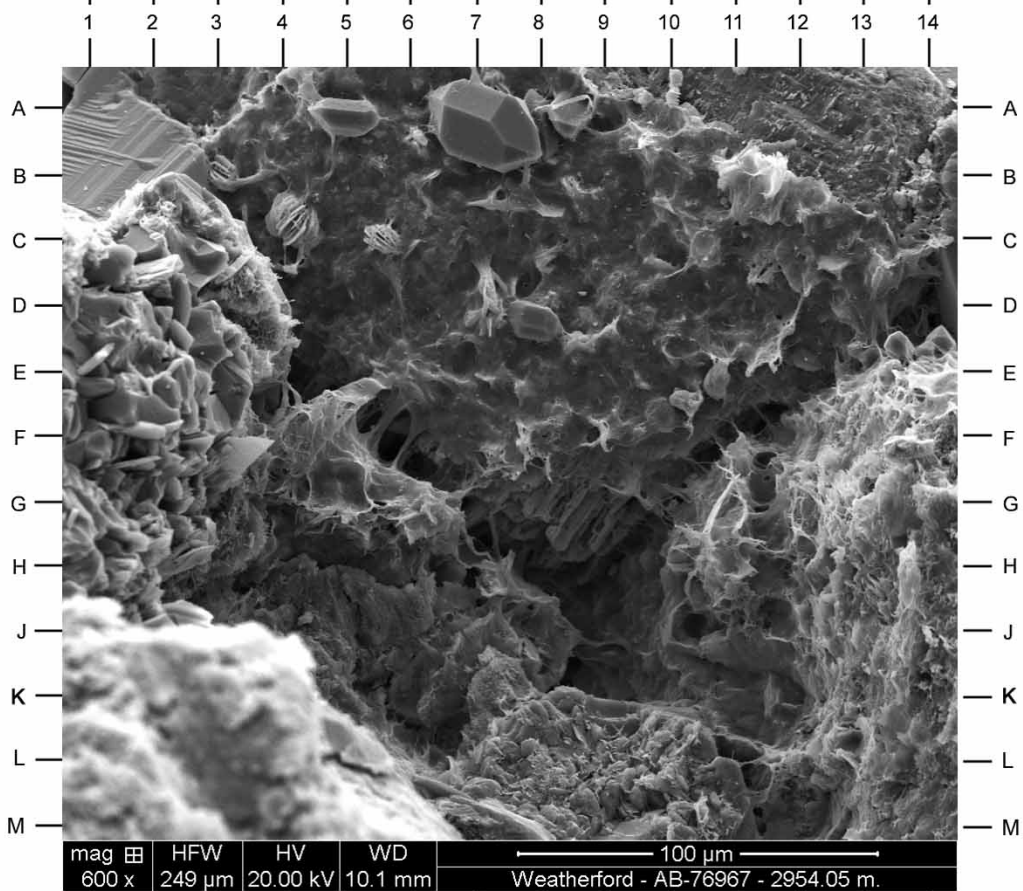
A



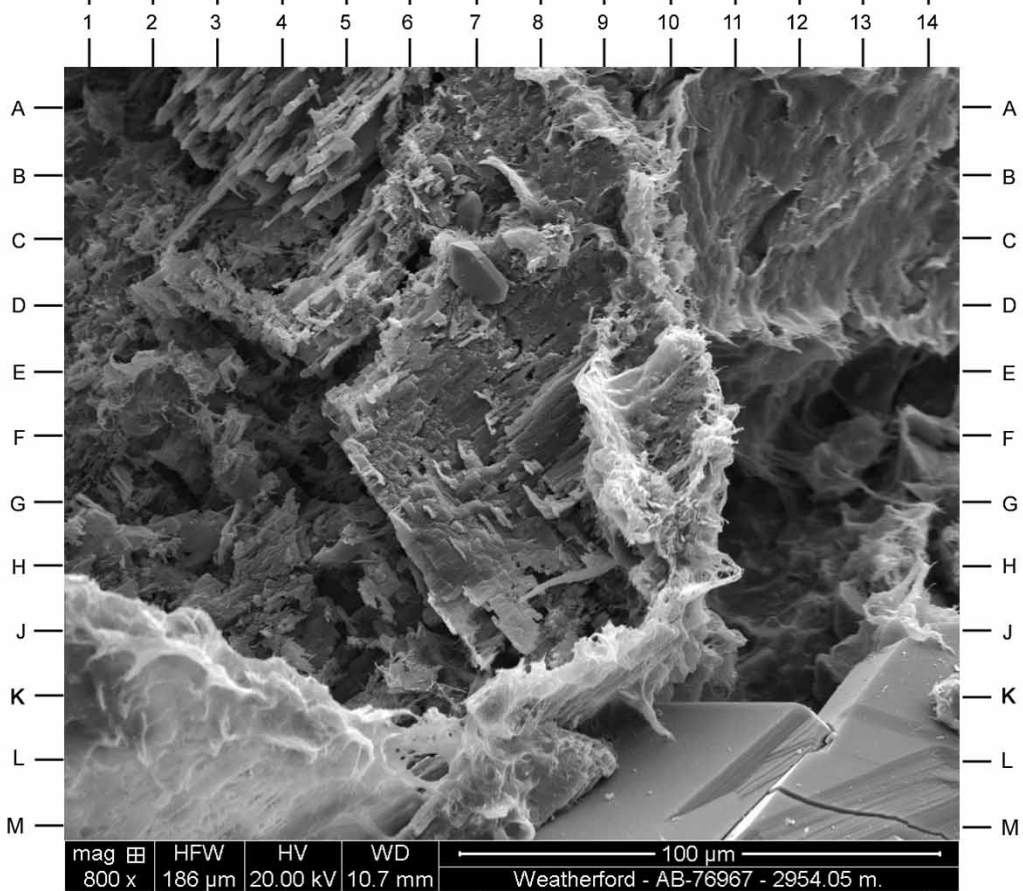
B



C



D



QGC - A BG Group Business
Magnetic-1
Lorelle Sandstone Formation
Onshore, Australia
Conventional Core

Weatherford Labs File No.: AB-76967

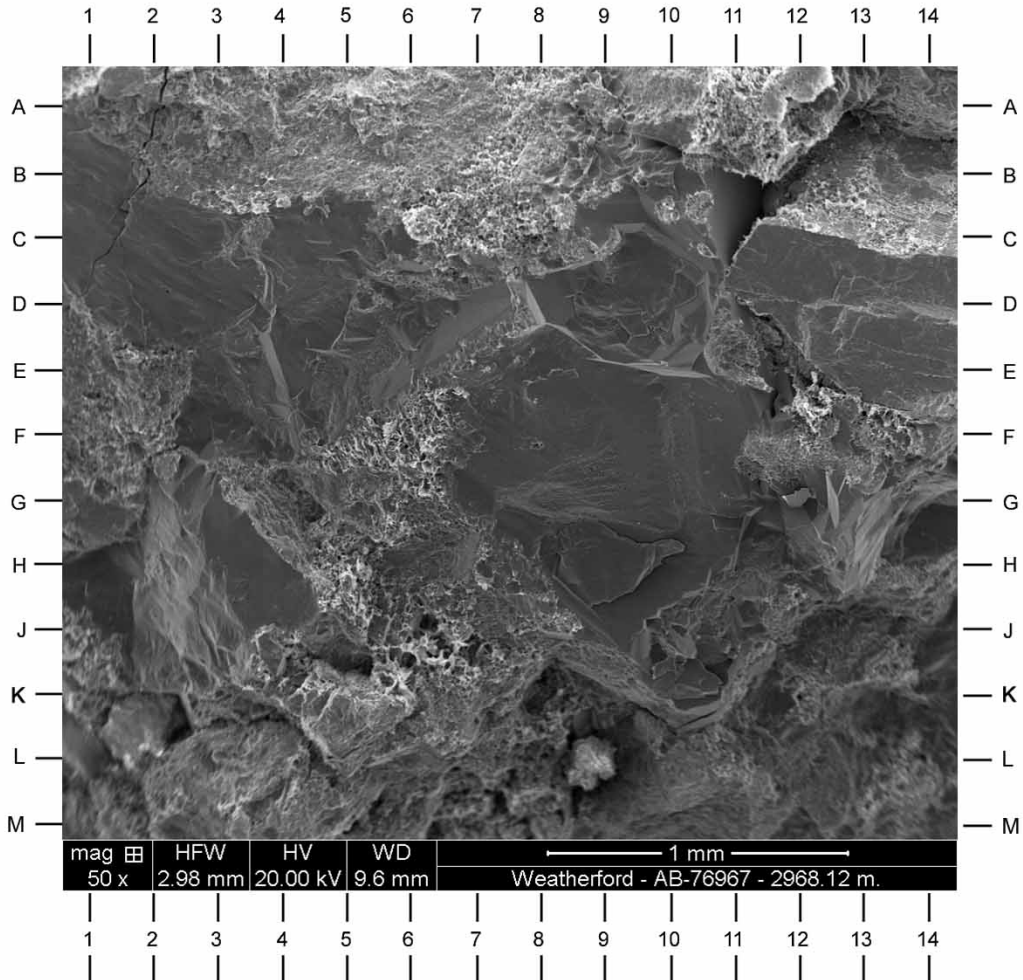
SAMPLE DEPTH: 2968.12 METERS
SAMPLE NUMBER: 2_6P-DS

PLATE 4

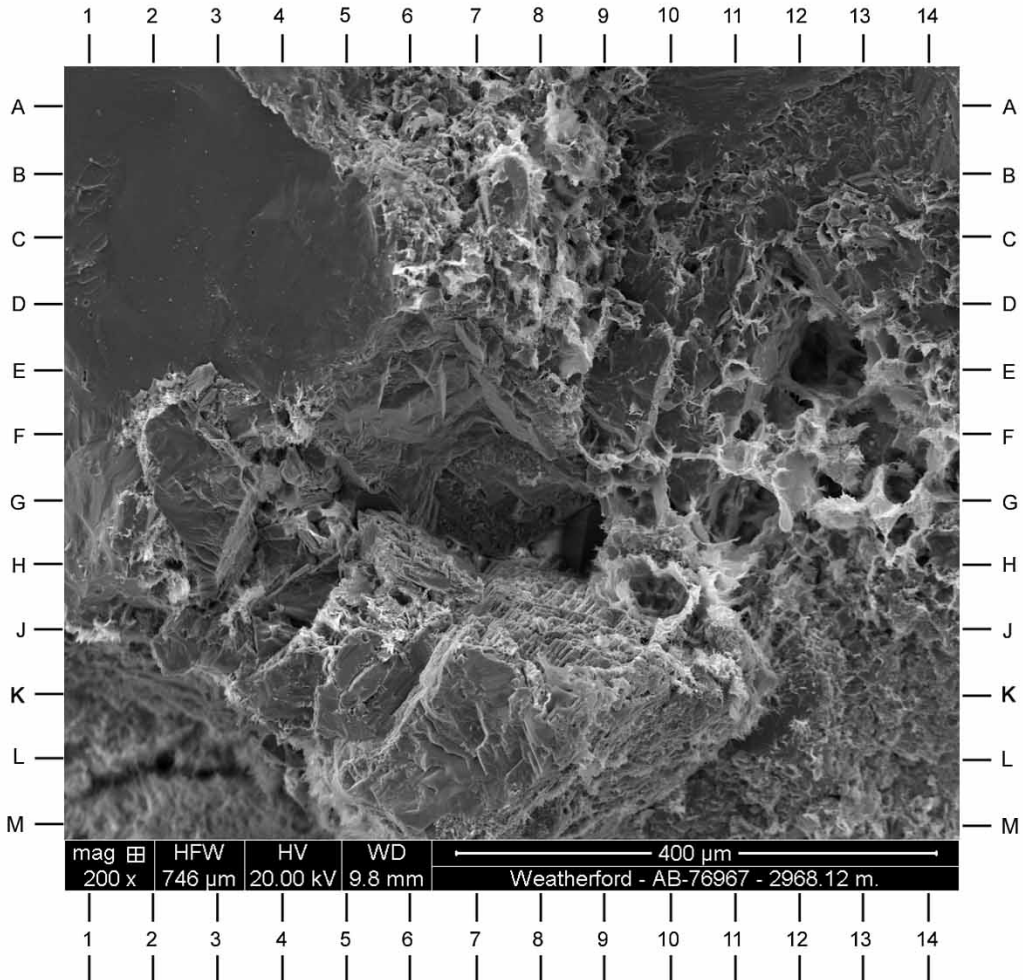
These photos illustrate a compacted feldspathic litharenite. Quartz (Photo B; C2, A11, L13/ Photo C; AB5, LM2/ Photo D; C7) and potassium feldspar (Photo B; FG2, J7/ Photo C; K11, H7.5/ Photo D; L5) represent the dominant detrital grains in these photos. Illite (fibrous: Photo B; A5-H14/ Photo D; JK1-LM14) and illite intermixed with chlorite (Photo C; E1-L4.5) coat detrital grains. Ferroan dolomite (G7) occurs as replacement or cement. Authigenic quartz cement, possible overgrowths, is observed (Photo C; DE1.5, DE4, F6). Partially leached potassium feldspar grains (Photo C; F11-LM5) contain secondary micropores. Micropores are also associated with the clays.

Magnification: A: 50X B: 200X C: 400X D: 800X

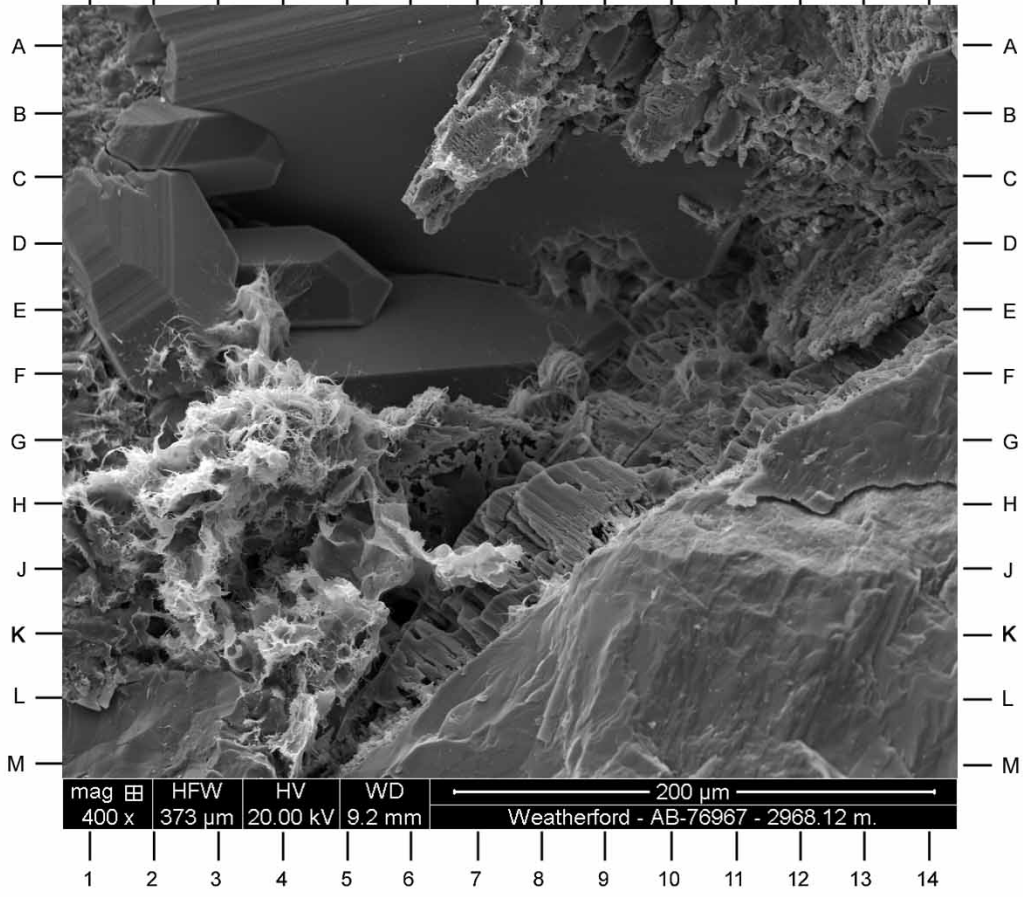
A



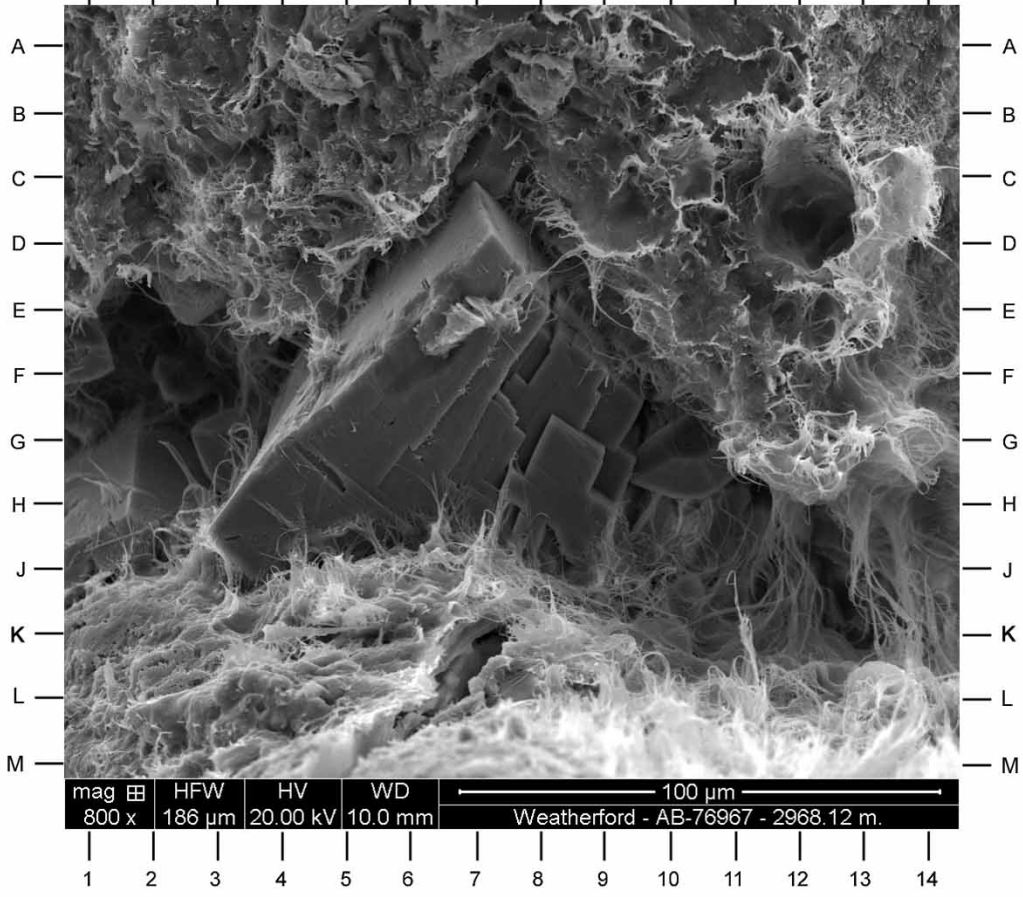
B



C



D



QGC - A BG Group Business
Magnetic-1
Lorelle Sandstone Formation
Onshore, Australia
Conventional Core

Weatherford Labs File No.: AB-76967

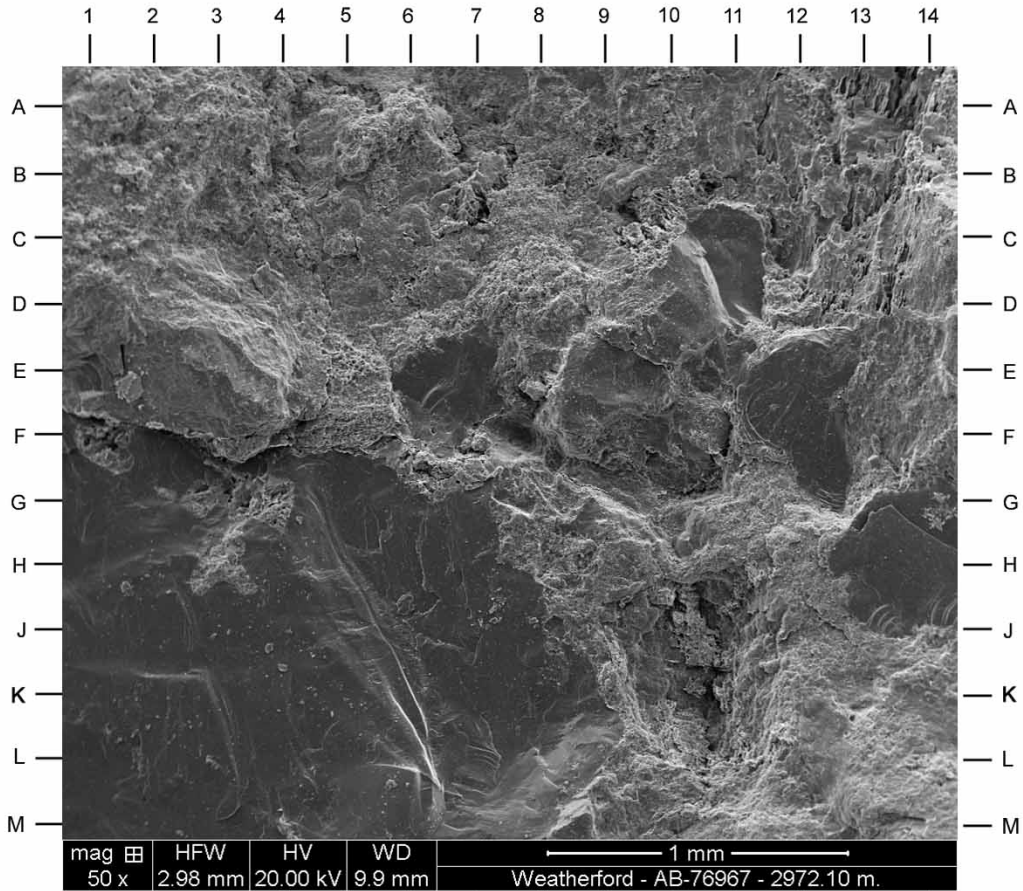
SAMPLE DEPTH: 2972.10 METERS
SAMPLE NUMBER: 1-40P DS

PLATE 5

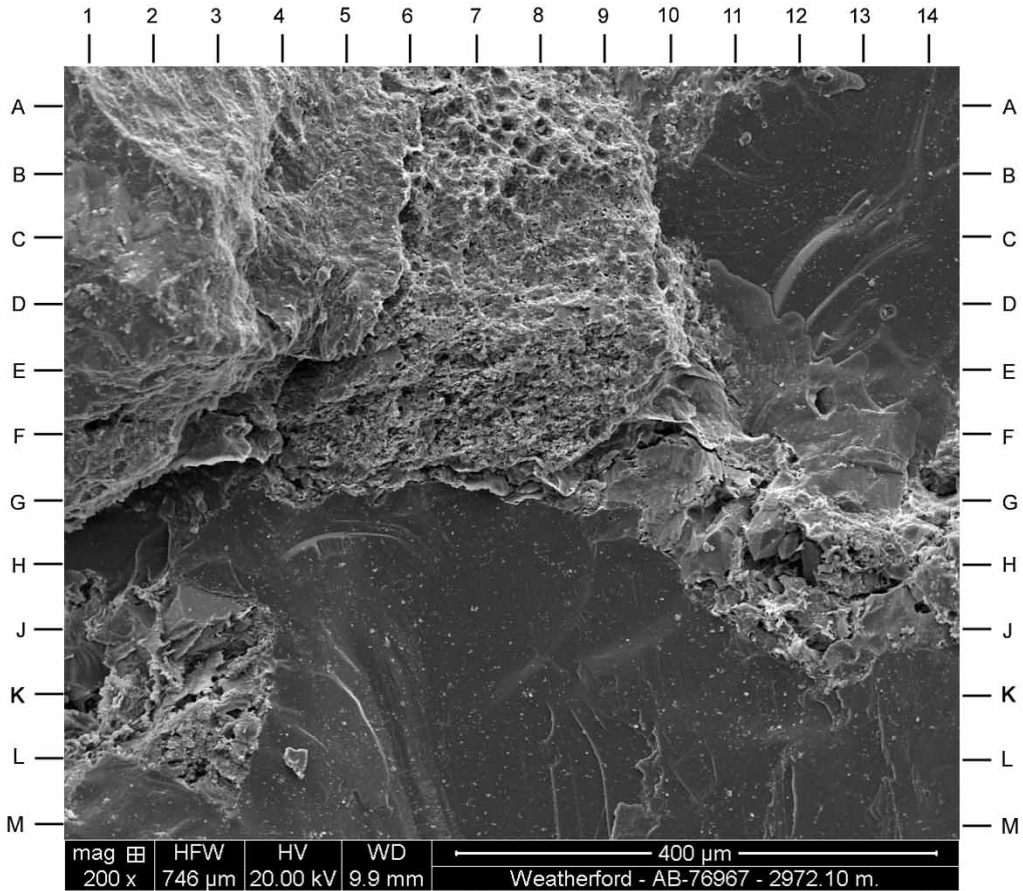
These photomicrographs illustrate a massive, sandy conglomerate (based on thin section). Photo C provides an enhanced view of a possible secondary pore area which has been partially cemented by authigenic albite (B7, E2, G7, EF13.5), quartz (A11-C12), and potassium feldspar (DE7.5). Rare Ti-oxide occurs as cement (Photo B; AE5). A muscovite mica flake occurs at A14-F1 in Photo D. Secondary dissolution pores are associated with partially dissolved feldspar grains (Photo D; A14-M1). Photo B is a high magnification view of the area centered near FG5 in Photo A.

Magnification: A: 50X B: 200X C: 800X D: 2000X

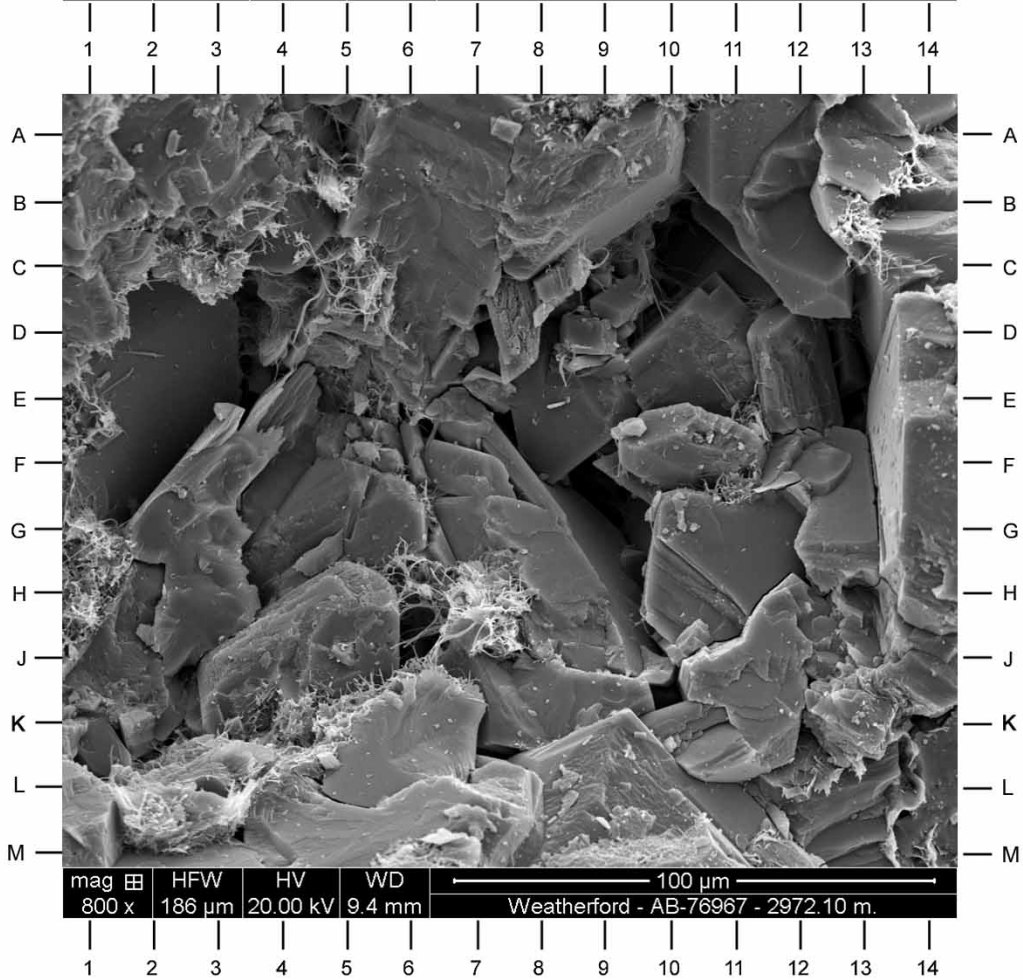
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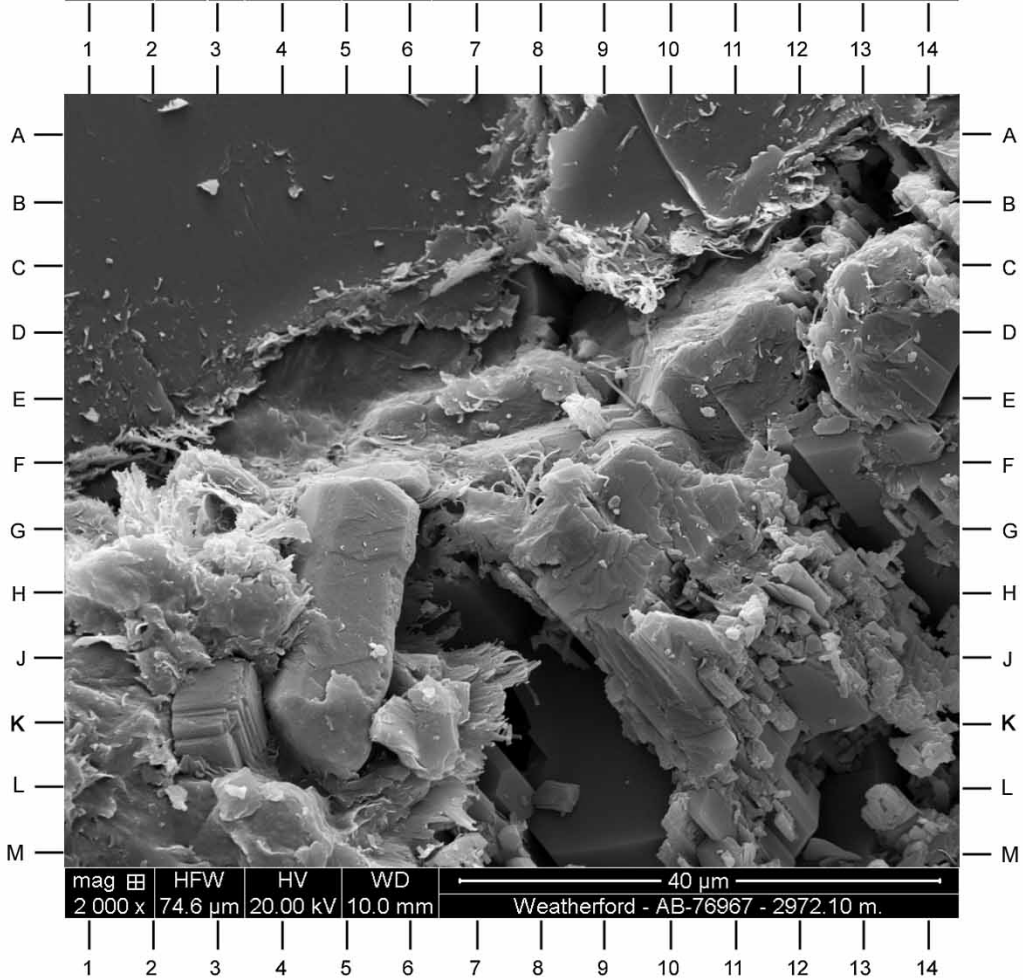
B



C



D



**QGC - A BG Group Business
Magnetic-1
Lorelle Sandstone Formation
Onshore, Australia
Conventional Core**

Weatherford Labs File No.: AB-76967

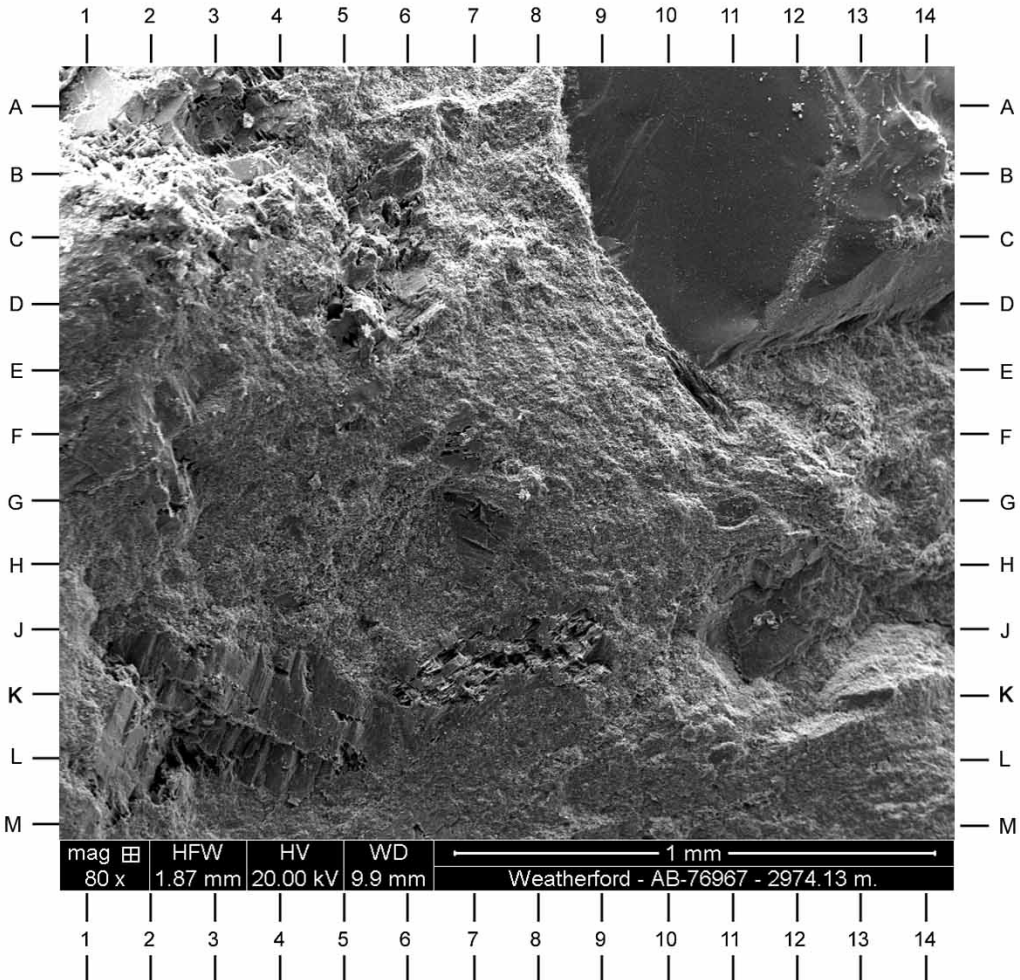
**SAMPLE DEPTH: 2974.13 METERS
SAMPLE NUMBER: 2-44P DS**

PLATE 6

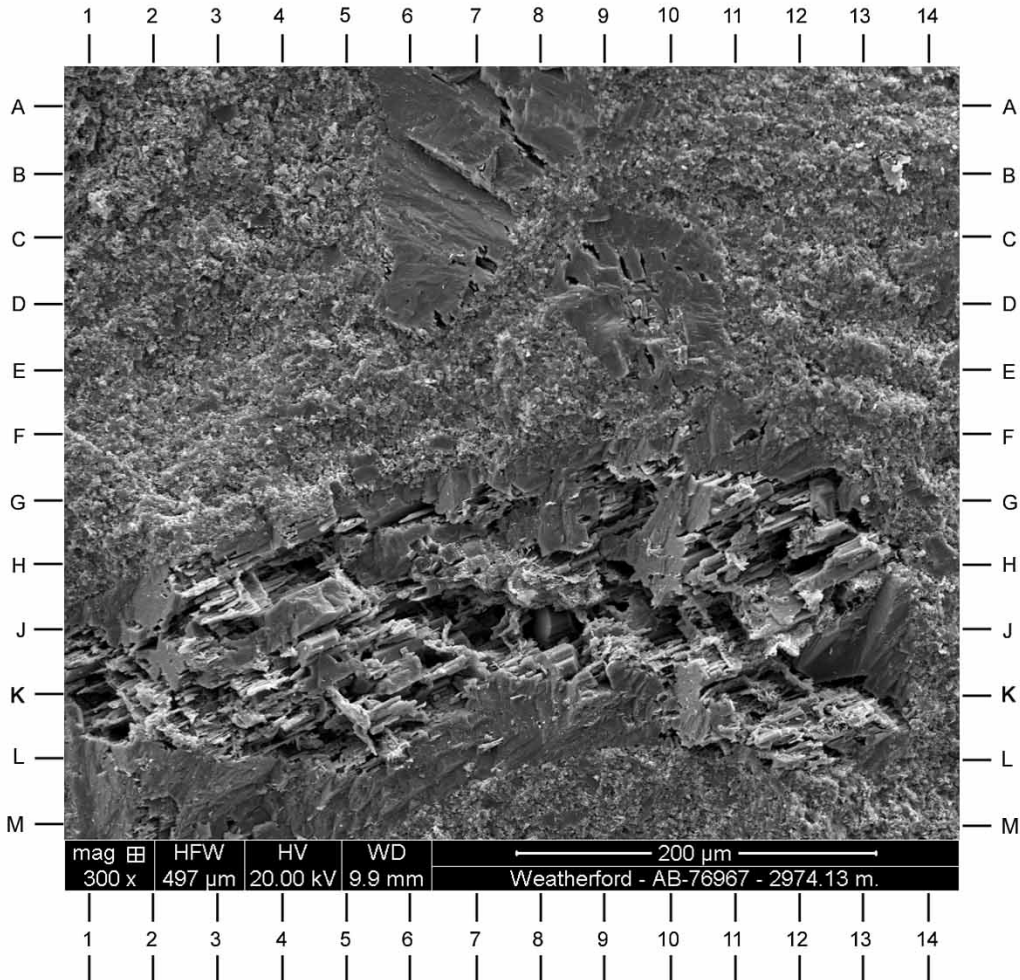
Photo A provides a general overview of this massive sandy conglomerate (based on thin section). Photo B is a magnified view of the area near J7 in Photo A. Partially dissolved albite (Photo B; K1-J12/ Photo C; D1-CD13) and potassium feldspar grains (Photo B; CD6, D9.5/ Photo D; A2-L7) yield secondary pores. Relatively large quartz grains (Photo A; B11/ Photo C; M1-J14) are observed. Possible argillaceous cherty fragments (Photo B; A1-F7, B12/ Photo C; AB1-14, FL1-EF14/ Photo D; A6-M14) are also observed.

Magnification: A: 80X B: 300X C: 1200X D: 3000X

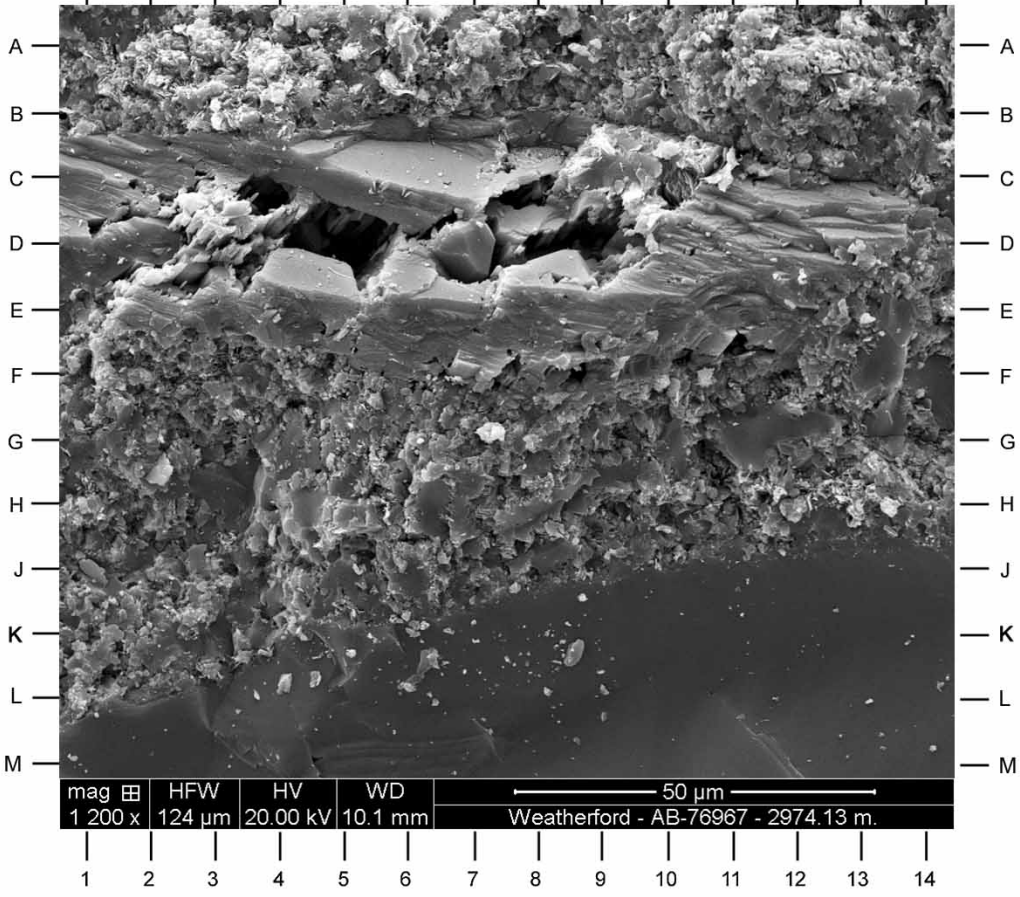
A



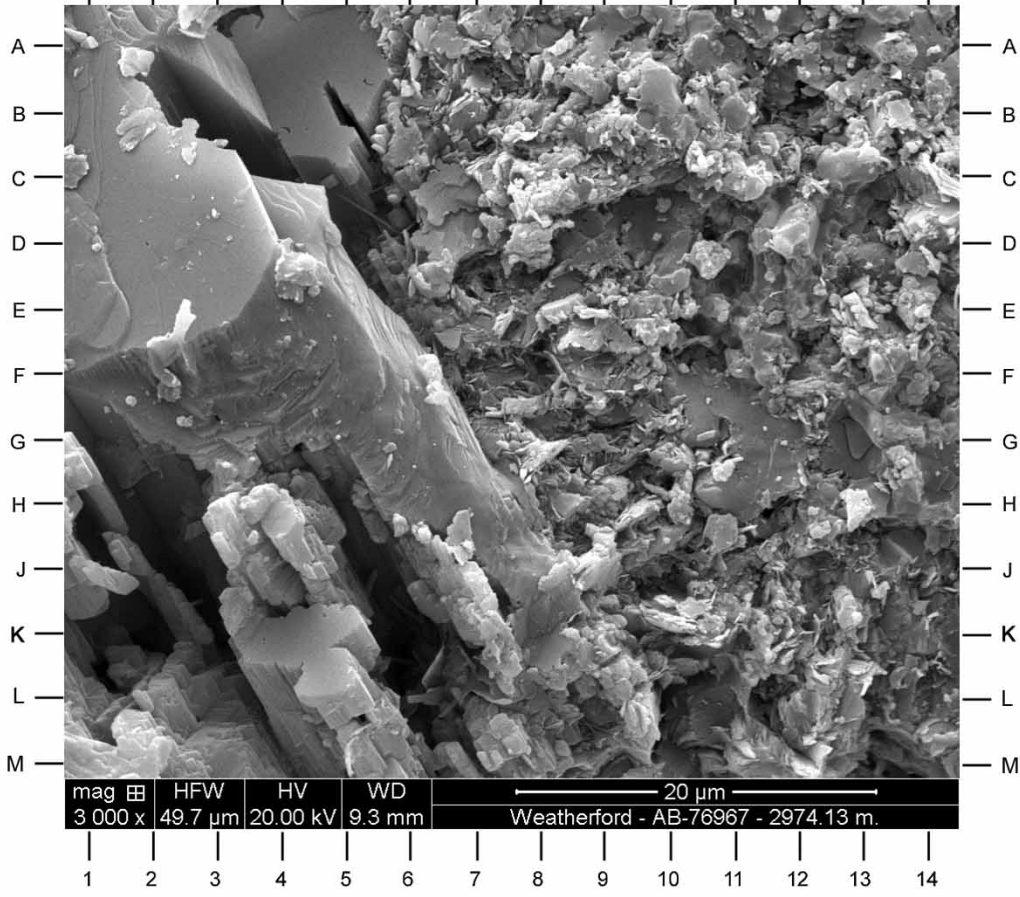
B



C



D



**QGC - A BG Group Business
Magnetic-1
Lorelle Sandstone Formation
Onshore, Australia
Conventional Core**

Weatherford Labs File No.: AB-76967

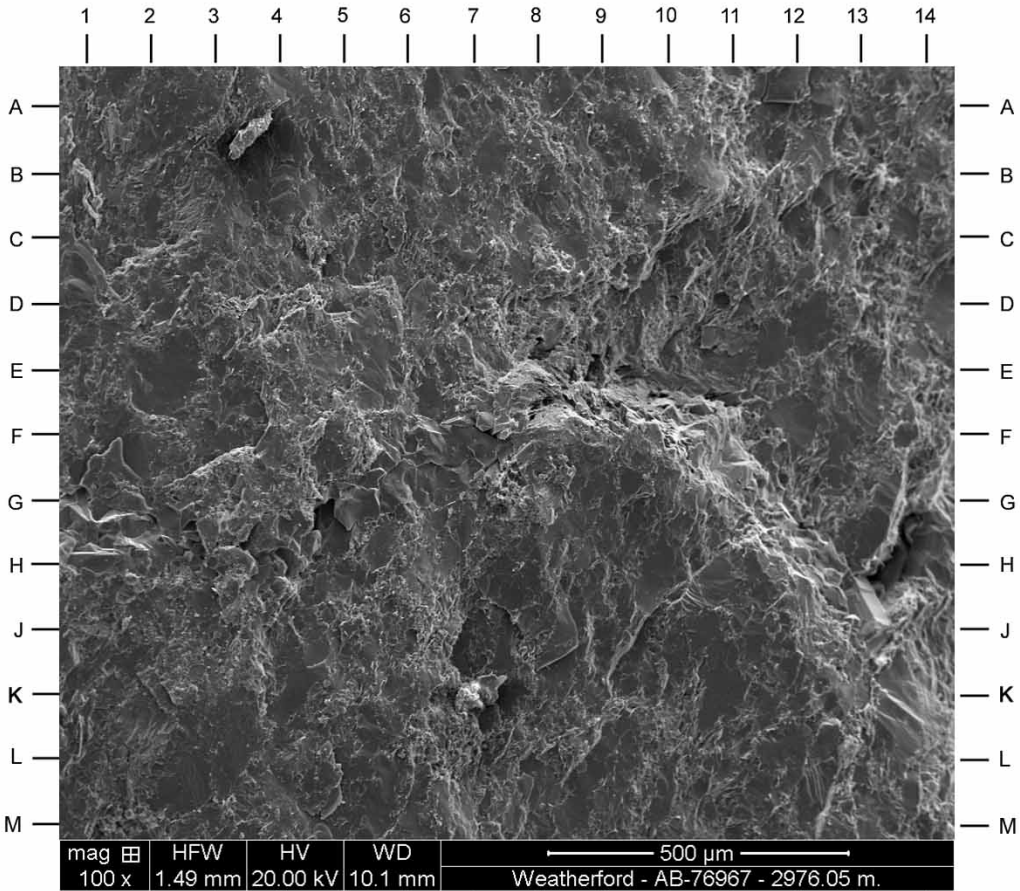
**SAMPLE DEPTH: 2976.05 METERS
SAMPLE NUMBER: 2-46P DS**

PLATE 7

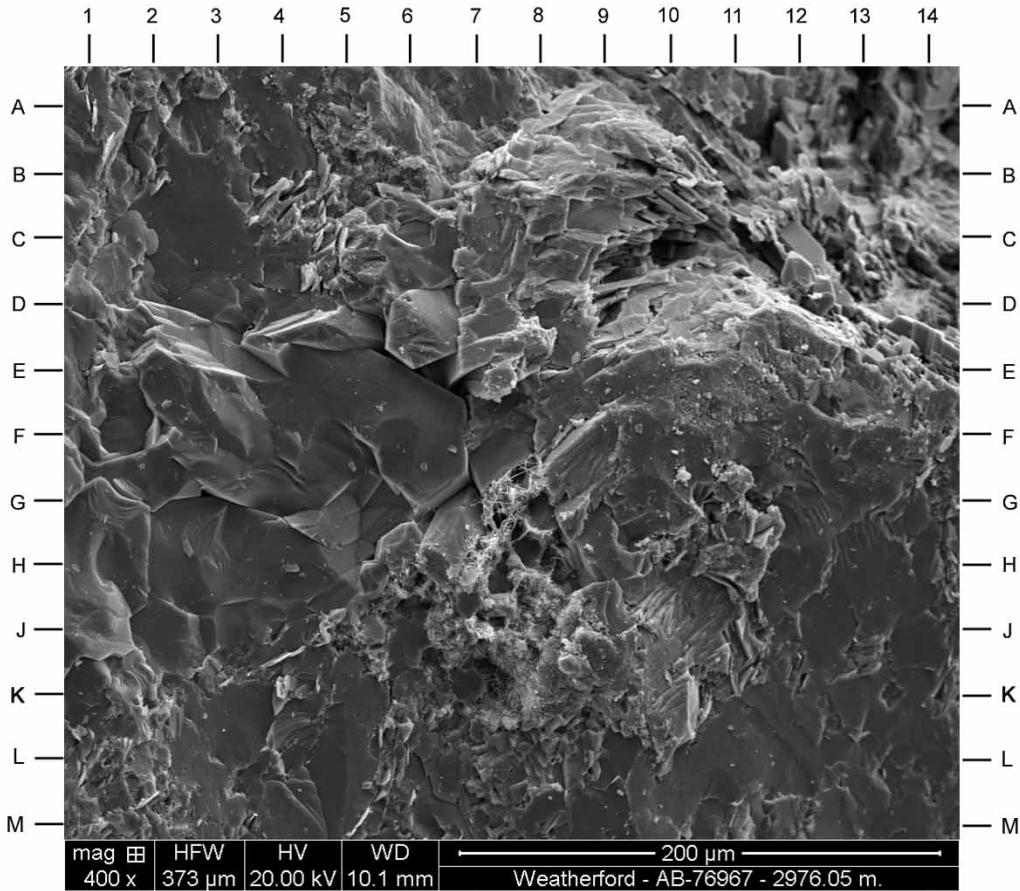
These images represent high magnification views of conglomerate fragments within a slightly sandy conglomerate (based on thin section). Photo B is a high magnification view of the area centered near FG7.5 in Photo A. Ferroan dolomite occurs as either replacement or intergranular cement (Photo B; C8). Photomicrograph C illustrates authgenic quartz (B8, AB13, K3, H7, M14) with blades of chlorite (A5, D6, F7-14, LM9) occurring between the crystals. Photo D also contains authgenic quartz (C11, A1-M14) with blades of chlorite (A6-G14) and a patch of fibrous illite (L4). Intercrystalline micropores occur along the euhedral crystal faces between adjacent cements with incomplete cementation (Photo B; DE6.5, G7/ Photo D; E5.5).

Magnification: A: 100X B: 400X C: 1050X D: 1400X

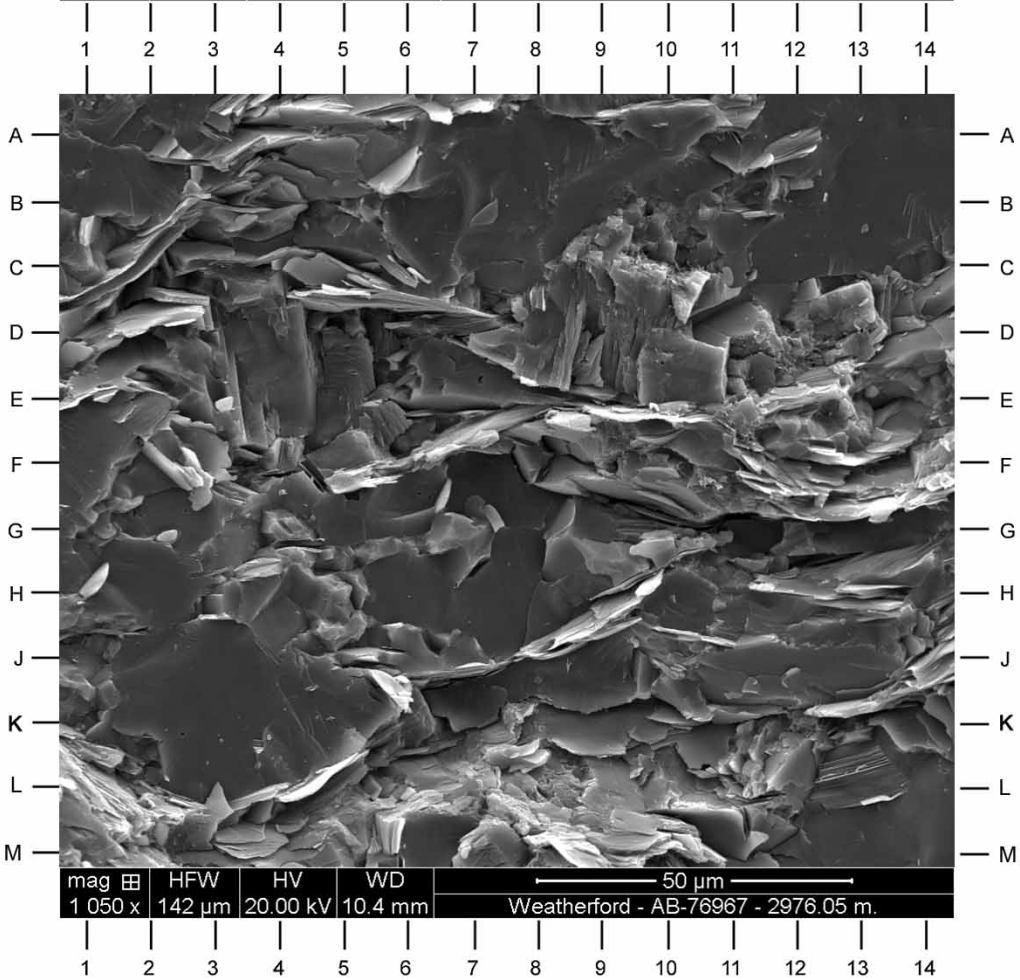
A



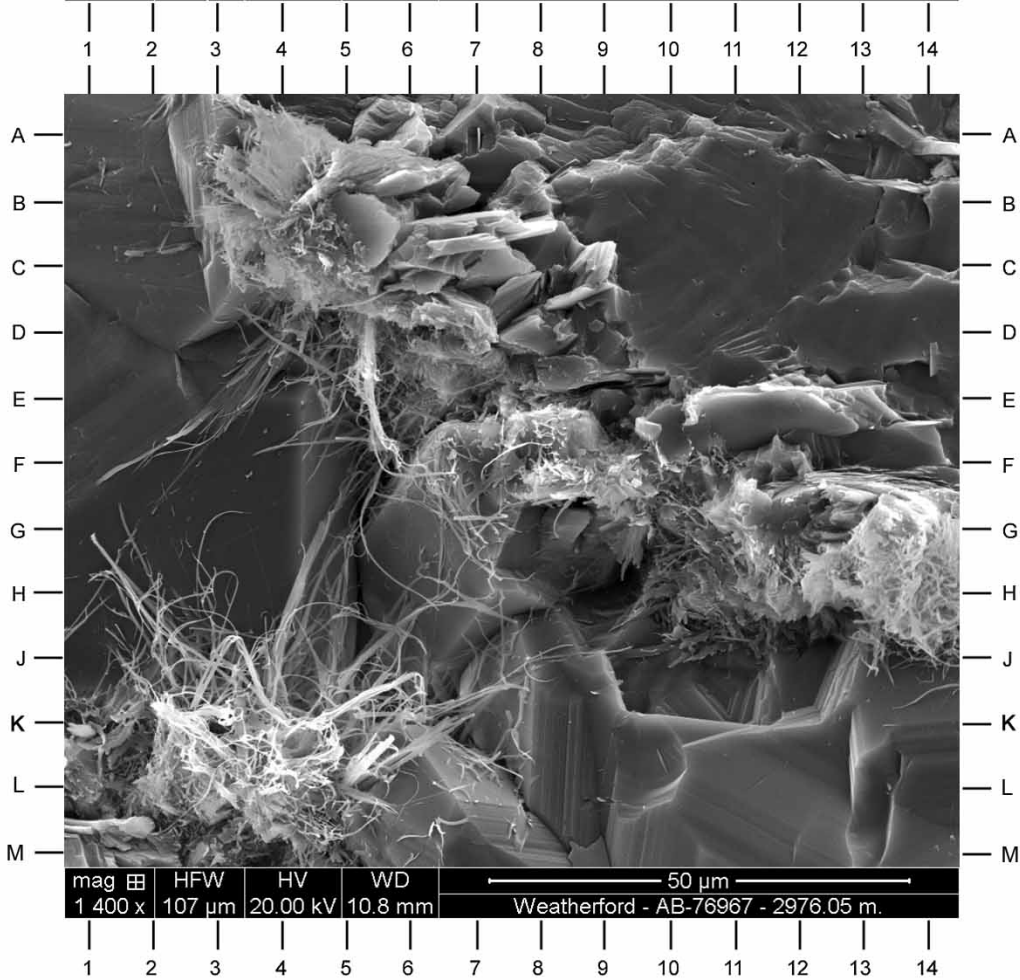
B



C



D



APPENDIX E

ROUTINE CORE ANALYSIS RESULTS

CORE ANALYSIS PRELIMINARY REPORT

Client : QGC - A BG Group Business
Well : Magnetic-1
Core Int 1 : 2936.00-2972.41m
Core Int 2 : 2972.41-3008.41m

Date : 6/16/2015
File : AB-76967
Cleaning Method : Chloro-Meth
Drying Method : Oven Dry
Baseline MUD, ppm : 153.1

Sample Number	Depth (m)	Dir	Porosity Helium (percent)	Grain Density (g/cm ³)	Permeability to Air (mD)	Fluid Saturation			Deuterium Tracer Concentration ppm	Remarks
						So (percent)	Sw (percent)	Tracer Adjusted Sw (percent)		
1_1P	2936.06	H	10.7	2.68	0.37	13.8	70.6	64.9	164.0	
1_2P	2937.06	H								
1_3P	2938.06	H	11.4	2.66	0.85	12.5	70.4	70.4	150.9	
1_4P	2939.06	H								
1_5P	2940.05	H	8.2	2.69	0.094	6.6	76.4	76.4	148.4	
1_6P	2941.06	H								
1_7P		H								N.P - not full metre
1_8P	2942.06	H	12.2	2.66	0.59	14.1	70.2	70.2	152.6	
1_9P	2943.06	H								
1_10P	2944.10	H	9.5	2.67	0.26	5.6	80.4	80.4	149.9	
1_11P	2945.05	H								
1_12P	2946.05	H	3.2	2.70	0.014	3.5	94.7	94.7	150.7	
1_13P	2947.05	H								
1_14P		H								N.P - not full metre
1_15P	2948.06	H	11.8	2.67	0.34	12.1	69.5	69.5	149.1	
1_16P	2949.06	H								
1_17P	2950.09	H	5.3	2.69	0.12	3.9	89.0	89.0	151.4	irreg
1_18P	2951.06	H								
1_19P	2952.06	H	9.9	2.67	0.19	13.7	71.5	71.5	145.5	irreg

Sample Number	Depth (m)	Dir	Porosity Helium (percent)	Grain Density (g/cm ³)	Permeability to Air (mD)	Fluid Saturation			Deuterium Tracer Concentration ppm	Remarks
						So (percent)	Sw (percent)	Tracer Adjusted Sw (percent)		
1_20P	2953.06	H								
1_21P		H								N.P - not full metre
1_22P	2954.05	H	11.8	2.67	0.39	32.3	60.3	60.3	150.0	
1_23P	2955.05	H								
1_24P	2956.05	H	3.4	2.80	0.029	53.7	43.8	43.8	147.6	
1_25P	2957.05	H								
1_26P	2958.05	H	4.9	2.70	0.078	11.8	87.7	87.7	146.6	irreg
1_27P	2959.05	H								
1_28P	2960.17	H	8.3	2.68	0.89	28.0	64.7	64.7	150.7	irreg
1_29P	2961.05	H								
1_30P	2962.05	H	8.5	2.67	0.48	24.6	64.9	64.9	152.9	irreg
1_31P	2963.05	H								
1_32P	2964.05	H								S.P
1_33P	2965.05	H	7.2	2.67	0.23	7.4	83.7	83.7	147.9	
1_34P	2966.13	H								
1_35P	2967.06	H								S.P
1_36P	2968.12	H	7.4	2.67	1.62	20.1	76.2	76.2	151.7	irreg
1_37P	2969.10	H								
1_38P	2970.05	H	5.3	2.70	0.40	19.5	72.6	71.3	155.5	
1_39P	2971.06	H								
1_40P	2972.10	H	9.0	2.67	0.588	21.8	67.7	67.7	146.7	irreg
1_41P		H								N.P - not full metre
2_42P		H								N.P - not full metre
2_43P	2973.13	H								
2_44P	2974.13	H	6.3	2.68	2.14	14.6	76.7	67.4	170.3	irreg
2_45P	2975.11	H								
2_46P	2976.05	H	4.0	2.67	0.83	9.9	87.5	83.9	159.0	irreg
2_47P	2977.04	H								
2_48P	2978.07	H	5.8	2.69	0.45	3.4	92.8	92.8	153.1	irreg

Sample Number	Depth (m)	Dir	Porosity Helium (percent)	Grain Density (g/cm ³)	Permeability to Air (mD)	Fluid Saturation			Deuterium Tracer Concentration ppm	Remarks
						So (percent)	Sw (percent)	Tracer Adjusted Sw (percent)		
2_49P	2979.05	H								
2_50P	2980.09	H	3.9	2.69	0.063	26.2	72.2	72.2	148.8	irreg S.P
2_51P	2981.11	H								
2_52P	2982.04	H	6.6	2.70	0.007	16.2	80.2	80.2	146.0	
2_53P	2983.06	H								
2_54P	2984.13	H								
2_55P	2985.05	H								
2_56P	2986.04	H								
2_57P	2987.05	H	5.8	2.69	0.055	2.2	96.3	96.3	153.0	
2_58P	2988.15	H								
2_59P		H								Fail
2_60P	2990.16	H								
2_61P	2991.05	H								
2_62P	2992.06	H								
2_63P	2993.10	H								
2_64P	2994.06	H								
2_65P	2995.05	H	6.3	2.69	0.027	14.7	82.5	82.5	145.1	
2_66P	2996.07	H								
2_67P		H								N.P - not full metre
2_68P	2997.05	H								
2_69P	2998.06	H								
2_70P	2999.05	H								
2_71P	3000.05	H								
2_72P	3001.05	H								
2_73P	3002.05	H	7.5	2.70	0.013	14.7	84.3	84.3	143.5	
2_74P		H								N.P - not full metre
2_75P	3003.04	H								
2_76P	3004.05	H								
2_77P	3005.05	H								

Sample Number	Depth (m)	Dir	Porosity Helium (percent)	Grain Density (g/cm ³)	Permeability to Air (mD)	Fluid Saturation			Deuterium Tracer Concentration ppm	Remarks
						So (percent)	Sw (percent)	Tracer Adjusted Sw (percent)		
2_78P	3006.06	H								
2_79P	3007.14	H								
2_80P	3008.05	H	8.5	2.71	0.014	16.9	82.0	82.0	142.0	
2_81P		H								N.P - not full metre

CORE ANALYSIS PRELIMINARY REPORT

Client : QGC - A BG Group Business
Well : Magnetic-1 (SWC)

Date : 6/23/2015
File : AB-76967
Cleaning Method : Chloro-Meth
Drying Method : Humidity Dry

Sample Number	Depth (m)	Dir	Porosity Helium (percent)	Grain Density (g/cm ³)	Permeability to Air (mD)	Remarks
1	3040.70	SWC	2.9	2.64	0.018	
2	3036.00	SWC	2.5	2.64	0.015	
3	3031.90	SWC	2.9	2.64	0.017	
4	3020.50	SWC	7.3	2.66		frac, irreg
5	3017.30	SWC	9.0	2.65	0.0022	
6	3013.30	SWC	6.1	2.66	0.0074	irreg
7	3011.30	SWC	5.4	2.66	0.0046	congl
8	2994.70	SWC	4.7	2.66	0.0037	
9	2950.10	SWC	8.1	2.66	0.13	
10	2940.80	SWC	11.4	2.65	0.32	
11	2933.80	SWC	2.2	2.68	0.0042	intbd
12	2931.40	SWC	2.0	2.68	0.0025	intbd
13	2927.00	SWC	7.0	2.66	0.021	
14	2926.40	SWC	2.1	2.67	0.0037	intbd
15	2914.80	SWC	0.5	2.69	0.0006	intbd
16	2892.70	SWC	9.1	2.66	0.12	congl, irreg
17	2892.20	SWC	2.7	2.69	0.0056	congl, intbd
18	2866.50	SWC	10.8	2.65	0.11	
19	2864.00	SWC	13.2	2.64	0.20	
20	2818.60	SWC	3.7	2.63	0.0015	dual lith
21	2808.20	SWC	5.0	2.68	0.0035	intbd
22	2801.30	SWC	9.7	2.64	0.036	
23	2800.20	SWC	11.1	2.64	0.033	
24	2794.10	SWC	4.1	2.65	0.005	
25	2792.70	SWC	2.9	2.67	0.037	intbd, calc shl rem
26	2790.80	SWC	3.5	2.66	0.040	intbd, calc shl rem, irreg
27	2748.00	SWC	5.5	2.59	0.0011	lam, frac?
28	2740.40	SWC				no sample recovered
29	2734.60	SWC	9.6	2.61	0.013	lam
30	2733.70	SWC				no sample recovered
31	2732.80	SWC				no sample recovered

frac	fracture
irreg	irregular
congl	conglomerate
intbd	interbedded
dual lith	dual lithology
calc shl rem	calcified shell remnants
lam	lamination