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Preface

This Open File is one of a series on detrital and diagenetic mineralogy of the Lower Cretaceous rocks of the Scotian Basin resulting from a collaborative program initiated in 2001 between Saint Mary's University and the Geological Survey of Canada. The report provides the results of a study of the sedimentology and sedimentary petrography of Lower Cretaceous rocks in conventional core from three wells in the eastern part of the Scotian Basin. It contributes to a growing database on the provenance of the deltaic sediments in the Scotian Basin that host most of the gas reserves. An understanding of provenance is an exploration tool for major sandstone distribution and detrital minerals play an important role in influencing diagenesis and hence reservoir quality.

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ABSTRACT

Short conventional cores have been studied from the Middle Member of the Missisauga Formation from the Esperanto K-78 and South Griffin J-13 wells and from the lower Naskapi Member in Hesper I-52. Cores were described and photographs. Samples were examined by petrographic microscope and in some cases by SEM and electron microprobe. Tidal parasequences are found in cores from Esperanto K-78 and South Griffin J-13, whereas at Hesper I-52, a shoreface parasequence was sampled. The stratigraphic position of the core from Hesper I-52 was reassessed, with the aid of new biostratigraphic data; the core does not sample the top-Missisauga unconformity, as previous interpreted.

Features of the detrital petrology are similar to equivalent stratigraphic levels in Peskowesk A-99, including the low abundance of stable heavy minerals, the preponderance of K-feldspar relative to plagioclase, and the abundance of lithic clasts of microgranite and rhyolite. The new data confirms that there was a change in sediment supply in the Upper Member of the Missisauga Formation.

Diagenesis of the sandstones is characterized by low abundances of diagenetic carbonates and porosity principally cemented by clay minerals. The paragenetic sequence suggests that kaolinite, calcite, siderite and pyrite are the principal eogenetic minerals, followed by quartz overgrowths, chlorite, illite, and further silica cement. In addition, silica cement is abundant at South Griffin J-13. The occurrence of diagenetic sphalerite at South Griffin J-13 suggests hot, saline basinal fluids were present.

Collectively, these data show that the previous detailed interpretations of detrital petrology and diagenesis from the Peskowesk A-99 extend to a large area of the eastern Scotian Basin.

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A. INTRODUCTION

GENERAL SETTING AND PURPOSE

The Scotian Basin initially formed during the rifting of Pangea and the opening of the North Atlantic Ocean (Wade et al., 1995). Rifting of the Paleozoic basement caused the formation of several northeast-southwest trending half-grabens and horsts, which became the framework for a depositional system to accommodate the progradational sediments (Given, 1977). From the southwest to the northeast these structural elements include: Shelburne Subbasin, La Have Platform, Sable and Abenaki Subbasins, Banquereau Platform, Orpheus Graben and Laurentian Subbasin (Canada-Nova Scotia Offshore Petroleum Board, 2000). Several authors have suggested that Cretaceous clastic sediment was supplied by a paleo-St. Lawrence River with a large sediment load because it drained most of eastern Canada (Wade and MacLean, 1990; Grist et al., 1992; Cummings and Arnott, 2005). However, recent work (Pe-Piper and MacKay, 2005, 2006; Pe-Piper and Piper, 2011) suggests that most of the sediment was locally derived from the Appalachians, probably from steep, mountainous rivers. Early Cretaceous tectonic re-activation and uplift was a consequence of the complex opening of the North Atlantic Ocean (Pe-Piper and Piper, 2004).

The purpose of this study is to gain a better understanding of the source and diagenesis of Lower Cretaceous sediments through the logging of conventional core from three wells drilled on the eastern Scotian Shelf (Fig. 1): Esperanto K-78, Hesper I-92 and South Griffin J-13. Esperanto K-78 and Hesper I-92 lie in the Abenaki Subbasin on the southern edge of the Banquereau Platform and each has one conventional core, in the lower part of the Middle Member of the Missisauga Formation and the base of the Naskapi Member of the Logan Canyon Formation respectively. South Griffin J-13 lies farther seaward on the outer edge of the continental shelf, within the Sable Sub-basin, and has one conventional core from the middle of the Middle Member of the Missisauga Formation. Samples for polished thin sections were taken from the cores in order to study the detrital petrology and diagenesis of these wells. These data are compared with similar data from three other wells from the eastern Scotian Shelf: Peskowesk A-99 (Pe-Piper et al., 2006), Dauntless D-35 (Pe-Piper and Piper, 2009) and Louisbourg J-47 (Pe-Piper et al., 2010).

The Esperanto K-85 and South Griffin J-13 wells studied here, together with Hesper P-52, are among 21 reference wells recently re-examined for biostratigraphy and lithostratigraphy for the Play Fairway Analysis commissioned by the Province of Nova Scotia (Wilson et al., 2010).

METHODS

Conventional cores from all three wells were logged and sampled at the Canada-Nova Scotia Offshore Petroleum Board Geoscience Research Centre in Dartmouth, Nova Scotia. Sedimentary facies were identified using the classification scheme by Gould et al. (2010b). This scheme is based on work by MacRae and Jauer (2001), Cummings (2004), Cummings and Arnott (2005), Cummings et al. (2006), Gould (2007), Karim et al. (2008), Karim et al. (2010a,b), and Gould (2010a). The scheme uses lithology and both sedimentary and biogenic structures to determine depositional environment (Table A1).

Sub-samples from the cores were carefully brushed and washed to remove any remnant drilling mud and other contaminants such as minerals evaporated from residual seawater. Polished thin sections, impregnated with blue epoxy, were made for most of the sandstone samples.

The polished thin sections were analysed under a polarized transmitted-light petrographic microscope to determine the percentages of grains, matrix, cement, and porosity, as well as the mean grain size, sorting, and the roundness of the quartz grains. Grains were identified and the percentages for each mineral or rock-type represented within the grain fraction was estimated. The different types of cement and their order of formation were also determined. Photos were taken to record the different orders of cement formation and noteworthy fossils and minerals.

To confirm the identification of both detrital and diagenetic minerals that were not easily identified by petrographic microscope we also used the energy dispersive spectroscopy (EDS) system of the Scanning Electron Microscope (SEM) at the Regional Analytical Centre at Saint Mary's University. This is a LEO 1450 VP SEM with a maximum resolution up to 3.5 nm at 30 kV. Detection limit is >0.1%. The SEM uses a tungsten filament to supply electrons to produce a back-scattered electron (BSE) image of the grains on the polished thin section and return an atomic number.

Representative polished thin sections from Esperanto K-78 well were also studied at the Regional Electron Microprobe centre located at Dalhousie University to determine the composition of both detrital and diagenetic minerals. The microprobe is a JEOL-8200 electron microprobe with five wavelength spectrometers and a Noran 133 eV energy dispersive detector. The beam was operated at 15 kV and 20 nA, with an average beam diameter of 5 microns. Elements measured were Si, Al, Ti, Cr, Fe, Mn, Mg, Ca, Na, K, P, Zr and Ba.

(B) ESPERANTO K-78

INTRODUCTION

The Mobil Tetco Esperanto K-78 well was spudded in March 1971 by Mobil Oil Canada Ltd. as the operator, using the semi-submersible drilling unit Sedco H through Shell Canada Ltd. (Mobil Tetco, 1972). It was drilled in a water depth of 69 m to investigate the hydrocarbon potential of a faulted anticlinal structure on the northern edge of the Abenaki sub-basin. The Logan Canyon Formation is more than 800 m thick; the Missisauga Formation is 700 m thick, overlying >550 m of alternating sandstones and shales of the Mic Mac Formation (MacLean and Wade, 1993).

DESCRIPTION OF LITHOFACIES

The cored interval is near the base of the Middle Member of the Missisauga Formation. The base of the core sampled a featureless fine grained sandstone. It is unclear whether this is structureless because of liquefaction (facies 10g) or part of a massive delta-front turbidite of facies 9. Although there may have been some disturbance to core sections after drilling (Fig. 4d), this sandstone appears to pass up into sandstone with irregular intraclasts of mudstone similar to those found in sandstone dykes at Alma K-85 by Piper et al. (2004: their figure 10). This unit is abruptly overlain by intraclast conglomerate and coarse- to very coarse-grained cross-bedded sandstone (Fig. 4D, 5A, D). The remainder of the core is cross-bedded, fine- to medium-grained sandstone (Fig. 5B) with mud drapes (Fig. 5E), and rare phytodetritus (Fig. 5C), interpreted as tidal estuarine facies 4g.

DETRITAL PETROLOGY

Four samples were studied in detail. Three of these samples are from medium- to coarse-grained sandstones, and the fourth is from a fine-grained conglomerate (Table B1). All samples studied show poor sorting and mean grain size 400 to 600 μm.

Quartz is the main detrital mineral in all samples at about 93 to 96 % of total grains. Other common detrital minerals present include feldspars at 2 to 4% of total grains, commonly muscovite up to 2.5% of total grains, and biotite in some samples (<1%). Grain textures and mineral inclusions in monocrystalline quartz, which is the dominant quartz type present (Table B1), were used to estimate the sources, following the approach of Pe-Piper et al. (2010) for the nearby Louisbourg well. The quartz appears to be principally (60–65%) from igneous rock sources, with 30–35% from metamorphic rock sources. Mylonitized quartz is very common in these sandstones. K-feldspar is the dominant detrital feldspar, based on both petrographic observations and electron microprobe analyses (Tables B1, B2a, and B2b; Fig. 8). The detrital muscovite under the microscope looks strained and altered (e.g Fig. 4 in Appendix B1). Such textures explain why it was difficult to get good chemical analyses of muscovite. Most of such analyses have low totals (Table B2), suggesting that the muscovite is changing diagenetically to hydromuscovite and therefore cannot be used as a chemical fingerprinting tool. The very few detrital biotite grains that have been analysed have low Mg compositions and most of them are partly altered to chlorite (Table B2). The discrimination plot of Abdel-Rahmen (1994) (not shown here) for the very few analysed fresh-looking biotite grains suggests an origin from peraluminous felsic igneous rocks. Lithic clasts are also common constituents of the samples studied. Rock lithologies identified as lithic clasts include: rhyolite, microgranite and chert, together with intraclasts of sandstone and mudstone (Fig. 5A, B and D; Appendix B1).

Other detrital minerals present in the rocks studied, identified by both petrographic microscope and electron microprobe, include zircon, rutile, tourmaline, hornblende, chromite and apatite (Tables B1, B2 and Appendix B1). The number of samples studied from this well is limited, and the detrital minerals that can be used as fingerprinting indicators are also rare; thus the available electron microprobe chemical analyses of such minerals is also limited.

Minerals that can provide good chemical fingerprinting information in this study are tourmaline and chromite. For the tourmaline analyses we have used the fields of Henry and Guidotti (1985) and Kassoli-Fournaraki and Michailidis (1994) in combination with the plot suggested by Pe-Piper et al. (2010). The latter plot combines the natural clusters in chemical composition of the tourmalines that these authors analysed from the Lower Cretaceous sandstones from Scotian Basin and identifies four provenance-related type of tourmalines. The two tourmaline analyses from this well plot in the Type 1 field corresponding to Li-poor granite (Fig. 6). For chromite, we used the plot by Pearce et al. (2000). This plot distinguishes three compositional fields for all chromite and chromian spinels: boninite, ocean ridge basalt (ORB) and island-arc tholeiite (IAT). The two chromite analyses plot in the boninite field (Fig. 7).

DIAGENESIS

The diagenetic minerals identified in the samples studied include kaolinite, quartz (as overgrowths), calcite, siderite, hydromuscovite, illite, chlorite, silica and pyrite (Tables B1, B2, Appendix B1). Of the cements the most common is calcite, followed by quartz overgrowths, kaolinite, siderite, pyrite, hydromuscovite and illite, chlorite, and silica (Table B1). Based on diagnostic textural relationships the diagenetic paragenesis in this wells is as follows. In samples with no kaolinite, calcite seems to be the first cement mineral to precipitate followed by quartz overgrowths. In samples with siderite the quartz overgrowths postdate siderite. Illite and chlorite seem to precipitate after kaolinite and quartz overgrowths. The presence of silica cement is very limited and it seems to be even later. A generalised overall paragenetic sequence from early to late may be: kaolinite, calcite, siderite, quartz overgrowths, chlorite, illite, and further silica cement.

(C) HESPER I-52

INTRODUCTION

The Petro-Canada/Mobil Hesper I-52 well was spudded in May 1976 (Petro-Canada, 1976). It was drilled 27 km SE of Esperanto K-78 in a water depth of 42 m. The purpose of the well was to test a high amplitude (bright spot) anomaly as a potential stratigraphic trap for hydrocarbons at the top of the Missisauga Formation at about 2760 m depth. The well bottomed in barren Missisauga sandstone, the seismic anomaly being the result of a 20-m thick basalt near the base of the Naskapi Member of the Logan Cayon Formation. No hydrocarbon shows were encountered throughout the drilling of Hesper I-52. The Logan Canyon Formation in Hesper I-52 is almost 1 km thick (MacLean and Wade, 1993). One 10 m conventional core was cut at what was then interpreted as the top of the Missisauga Formation. Eight years later, Hesper P-52 was drilled 500 m to the NW to a TD of 5679 m in limestones of the Mic Mac Formation. Hesper P-52 is one of 21 reference wells currently being examined for the Play Fairway Analysis (Wilson et al., 2010).

STRATIGRAPHIC POSITION OF THE CONVENTIONAL CORE

The stratigraphic position of the conventional core was reported to include the top of the Upper Member of the Missisauga Formation, and the base of the Naskapi Member of the Logan Canyon Formation by MacLean and Wade (1993). Regionally, the top of the Missisauga Formation is an erosional unconformity on the Banquereau Platform (Weir-Murphy, 2004; Bowman, 2010; Pe-Piper and Piper, 2011). The top of the Naskapi Member was interpreted by Maclean and Wade (1993) at 2669 m below RT and the base at 2753 m (Fig. 9).

The nominal top of the conventional core is at 2750.8 m and the top of continuous sandstone at 2754.3 m. From the gamma log, the sandstone to shale transition is at 2752 m, suggesting that the depth of the conventional core may be offset from the log depth by +2.3 m (Fig. 10).

As discussed below, the conventional core shows a transitional contact between the shale unit and the sandstone unit, with no evidence for an unconformity. The gamma log shows a much more abrupt transition from sandstone to shale at 2760 m. Furthermore, a cuttings sample from across this transition contains a rich marine Aptian palynological assemblage (R. Fensome, pers. comm. 2010), implying that the shale interval from 2756–2760 m is part of the Naskapi Member. We re-interpret the top Missisauga unconformity to be at 2760 m.

A series of basaltic flows, from 2727–2745 m, directly overlie the top of the shale unit sampled in the conventional core. The flows include some hyaloclastite material and were interpreted by Bowman (2010) on the basis of seismic profiles to have been stopped by flow into marine water a few kilometres from the Hesper I-52 well.

DESCRIPTION OF LITHOFACIES

The base of the core samples delta-front turbidites of facies 9g, comprising medium- to thick-bedded, fine-grained sandstone (Fig. 12, bottom two trays; Fig. 13D, base). This is sharply overlain by a medium-grained sandstone, locally coarse- to very coarse-grained, with sparse horizontal mud-lined burrows including *Ophiomorpha* and very low-angle bedding (Figs 13D top, 13E). This interval is classified as shoreface facies 2o, as it lacked clear fluvial or tidal features. It is overlain by intensely bioturbated shoreface sandstone (Fig. 13F) passing up into bioturbated sandstone with interbedded mudstone and phytodetritus (Fig. 13G).

The upper half of the cored sequence consists of fissile dark shales that were highly disturbed following drilling (Fig. 12), with minor thin bedded slightly bioturbated sandstone beds and siltstone laminae of facies 0m and 0b (Fig. 13A, C). These interbed with condensed sandy intervals with intense bioturbation (Fig. 13C) and, in places, abundant thick shells (Fig. 13B) and siderite cementation (Fig. 13C).

DETRITAL PETROLOGY

Of the four samples studied from this well, three are medium-grained sandstones and one is fine-grained sandstone (Table C1). The sorting of the same samples ranges from poor to good and with mean grain size 100 to 300 μm (Table C1).

Quartz is the main detrital mineral in all samples at about 90 to 99 % of total grains. Other common detrital minerals present include feldspars at 1 to 6% of total grains; muscovite at 1 to 5.5.% of total grains (in half the samples); traces of biotite; and variable amounts of lithic, mainly igneous, clasts. Grain textures and mineral inclusions in monocrystalline quartz, which is the dominant quartz type present (Table C1), were used to estimate the sources, following the approach of Pe-Piper et al. (2010) for the nearby Louisbourg well. The quartz appears to be principally (65-75%) from igneous rock sources, with 25 to 35% from metamorphic rock sources. Mineral inclusions in the detrital quartz identified in all samples include zircon, biotite, and apatite. Inclusions seen in the detrital quartz only in some samples include titanite, muscovite, pyrite, and K-feldspar. Mylonitized quartz is observed only in two out of the four samples, and it is less common when comparing this well with the core from the Middle Missisauga Formation in the Esperanto K-78 well.

K-feldspar is by far the dominant feldspar present as both petrographic and scanning electron microscope (EDS) analyses have shown (Tables 2a and b; Appendix C1). The identified chemical composition of plagioclase is mostly oligoclase (e.g. Fig. 7 in Appendix C1b) and only very occasionally albite (e.g. Fig. 2 in Appendix C1b). Two types of albite grains can be distinguished on the basis of texture and composition: some are clearly detrital and others are products of K-feldspar albitisation during diagenesis (e.g. Fig. 7 pos. 1 in Appendix C1c – detrital and Fig. 4 pos. 9 in Appendix C1b – diagenetic). Muscovite is common only in half of the samples and many grains are partly altered to chlorite, e.g Fig. 1 in Appendix C1c. Biotite has been seen only occasionally and again tends to be partly altered to chlorite.

Of the heavy minerals, titanite has been identified only as inclusions in detrital quartz. Chromite/spinel is present in all samples but not in significant concentrations. Some chromite grains are very rounded and or porous e.g. Fig. 13 in Appendix C1c, which may be the result of repeated transport. In all samples, detrital apatite mostly occurs as inclusion in detrital quartz and only occasionally has been seen as independent grains e.g. Fig. 10 in Appendix C1c. Detrital zircon and detrital ilmenite, in various stages of alteration to pseudorutile and rutile, are both ubiquitous in all samples. Occasionally an association of xenotime, monazite and zircon has been identified (e.g. Fig. 12 in Appendix C1b) and this may indicate a source in peraluminous granite. Detrital tourmaline is rare. It has only been identified in one sample, and only in a few grains (e.g. Fig. 5 in Appendix C1c). Lithic clasts are present in all samples studied, although in variable concentration (Table C3). Lithic clasts consist of microgranite, various types of rhyolite, chert, and schist, together with intraclasts of mudstone or siltstone and some bioclasts (Fig. 4).

DIAGENESIS

The diagenetic minerals identified in the studied rocks include kaolinite, quartz overgrowths, siderite, calcite, albite, silica, chlorite, rutile, and pyrite (Table C3). The three upper sandstone samples are different from that at 2757.58 m (Table C1; Appendix C1). The dominant cements in the upper three samples is kaolinite as the first cement to form followed by quartz overgrowths. In the fourth sandstone sample, the first cement to form is early calcite followed by silica. Diagenetic albite is also common in the first group, whereas in the fourth sandstone sample calcite seems to have partly replaced both K-feldspar (Fig. 2 in Appendix C1d) and plagioclase (Fig. 4 in Appendix C1d; Table C1d). Chlorite in all samples has only been seen replacing muscovite; whether this replacement predates or postdates deposition is unclear. Chlorite is also the dominant mineral in schist lithic clasts (Fig. 15 in Appendix C1a). A titania mineral (referred to as rutile) is ubiquitous. It occurs often in close association with the altered ilmenite (e.g. Fig. 6 in Appendix C1b) or in the form of very small grains scattered in pores and mineral interstices of the sandstones, often in association with pyrite (e.g. Fig. 17 in Appendix C1a; Fig. 5 in Appendix C1c). Barite mostly occurs in very small grains in pores and between framework grains (e.g. Fig. 2 in Appendix C1a). These barite occurrences are explaned as barite being a contaminant from the use of drilling mud. However occasionally barite has also been seen as euhedral small grains in close association with pyrite (e.g. Fig. 4 in Appendix C1a). Such occurrences suggest the presence of barite as diagenetic mineral as well. Siderite has been identified in all samples, whereas glauconite has been seen only in two of the samples and it has not been very convincingly identified as such.

(D) SOUTH GRIFFIN J-13

INTRODUCTION

The Bow Valley/Husky et al. South Griffin J-13 well is located on the eastern Scotian Shelf approximately 37 km south of Hesper I-52 and Esperanto K-78 and 27 km southeast of Louisbourg J-47 (Pe-Piper et al., 2010). It was spudded in January 1984 by Bow Valley Industries Ltd in a water depth of 40 m (Bow Valley/Husky et al., 1984). The purpose of drilling this well was to test the hydrocarbon potential of the lower Cretaceous and Jurassic sequence at the northeast end of the Scotian Shelf. The well reached the Scatarie Member of the Abenaki Formation and encountered minor hydrocarbon shows. However the logs taken did not indicate significant reservoir development. The well was abandoned in August 1984 and drill-string tests were not run. A conventional core was cut in the Middle Member of the Missisauga Formation, from 4138.3 to 4142 m. The Logan Canyon Formation is just over 1 km thick; the Missisauga Formation is 1.4 km thick, overlying 1.3 km of predominantly limestones of the Mic Mac Formation (MacLean and Wade, 1993). The top of overpressure is at about 5023 m, within the MicMac Formation.

DESCRIPTION OF LITHOFACIES

South Griffin has one core from the Middle Member of the Missisauga Formation. It sampled 3 m of sandstone. Most of the sandstone is weakly bioturbated fine-grained sandstone (Fig. 17 A, B) with minor mud-drapes (Fig. 17A) and coarser beds. Sedimentary structures are commonly obscured by the pervasive silica cementation. The sandstones are interpreted as tidal estuarine facies 4o.

DETRITAL PETROLOGY

Samples studied in polished thin sections (Table D1) from this well range from fine- to coarse-grained sandstone; they show poor sorting and mean grain size 200 to 1000 μm. Quartz is the main detrital mineral in all samples at about 93 to 96% of total grains. Monocrystalline quartz is predominant, with the polycrystalline quartz 1% or less of total grains (Table D1). Other common detrital minerals present include feldspars at 1 to 4% of total grains, muscovite at 1 to 4% of total grains, and a variable amount of lithic, mainly igneous, clasts. To identify the source for the monocrystalline quartz, we have again used the mineralogy of inclusions in such grains and textures as seen under the petrographic microscope, although in the samples of this well the quartz textures were not very useful. Almost all samples studied contain detrital grains with optical properties that can be either quartz or K-feldspar, with linear features that could be either because the crystals are either perthitic K-feldspars or highly fractured quartz. Additional SEM analysis, characterising the grains by EDS analyses (Appendix D1), showed that most of the grains were highly-fractured quartz grains, although K-feldspar is also a common detrital mineral in the samples studied. Mineral inclusions in the detrital quartz identified in all samples include zircon, biotite and ilmenite. Therefore based on the type of mineral inclusions in the quartz and the textures of those quartz grains that are not highly fracture, it is suggested that there was again a major supply of detrital quartz from igneous sources at about 70%, with about 30% from metamorphic rock sources. This is in agreement with the abundance of igneous lithic clasts present in this well. Mylonitized quartz is observed in all studied samples (Table D1) and in this respect resembles Esperanto K-78, which also sampled the Middle Missisauga Formation, than to Hesper I-52, which sampled the lower Naskapi Member.

K-feldspar is by far the dominant feldspar present, based on both petrographic study and SEM-EDS analyses have shown (Appendix D1). The other feldspars present are either altered grains (e.g. Fig. 2 in Appendix D1b), or rare albite grains in association with K-feldspar (Fig. 4 in Appendix D1d). Muscovite is commonly compressed and flattened (e.g. Fig. 3 in Appendix D1a) and often shows signs of alteration to chlorite. Biotite has been seen only occasionally, and tends to be partly altered to chlorite.

Of the heavy minerals, chromite/spinel is present in most samples, but not in significant concentrations. Tourmaline is also present in all samples, but in small amounts. Detrital zircon, and detrital ilmenite, in various stages of alteration to TiO_2 minerals, are both ubiquitous. Other heavy detrital minerals seen include rutile, titanite, apatite, and allanite. Rock lithologies identified to occur as lithic clasts in these sandstone include microgranite, various types of rhyolite, chert, bioclasts and various sedimentary lithologies.

DIAGENESIS

The diagenetic minerals identified in the rocks studied include: kaolinite, quartz (as overgrowths), titania minerals, pyrite, silica, illite, chlorite, calcite and sphalerite (Table D1). In three out of 5 studied samples, kaolinite was the first cement to form, whereas in the other two samples pyrite seems to predate kaolonite. Kaolinite often occurs in well formed bundles of booklets. Pyrite occurs either in framboids (e.g. Fig. 3 in Appendix Dib) or in platy crystals associated with K-feldspar (e.g. Figs. 1 and 4 in Appendix D1e). Both kaolinite and pyrite in all samples predate the quartz overgrowths. The quartz overgrowths seem also to be predated by a mixture of illite and chlorite and postdated by silica cement. Chlorite in all samples has been seen in lithic clasts, replacing muscovite and often mixed with illite or calcite. It is thus again difficult to determine if this happened during diagenesis or during weathering and transport of the detrital host or both. The titania mineral (termed rutile) is ubiquitous. As in the other wells, it occurs often in close association with altered ilmenite, or in the form of very small grains scattered in the pores and mineral interstices of the sandstones, often in association with pyrite. In one sample, small grains of sphalerite have been identified (Fig. 5 in Appendix D1e). These grains occur in the form of a clot and they are also associated with pyrite. The straight edges of these grains suggest a diagenetic origin. Sphalerite and pyrite have been seen in other places filling pores in the same sample.

(E) DISCUSSION

Sedimentary environments

Two major facies association are recognized in the cores studied. Tidal parasequences (as defined by Gould et al., 2010b) are found in cores from Esperanto K-78 and South Griffin J-13, both from the Middle Member of the Missauga Formation. In the basal Naskapi Member at Hesper I-52, a shoreface parasequence was sampled.

The top Missisauga unconformity in Hesper I-52

We have considered the possibility that the top-Missisauga unconformity occurs between the delta-front turbidites in the bottom 70 cm of the conventional core and the abruptly overlying medium sandstone unit. On the Canso Ridge, the top of the Missisauga Formation is marked by intense kaolinization (Weir-Murphy, 2004). There is no evidence for much diagenetic kaolinite in samples from 2757.19 m and 2757.58 m and both felspars and muscovite are well preserved (Appendix C1) and abundant (Table C2). This suggests that the feldspars and muscovite were supplied from contemporary volcanism and crystalline basement rather than being reworked from tilted and weathered Upper Missisauga sands.

Sediment provenance

Sediment provenance is indicated by general optical petrography, identification of lithic clasts, and chemical composition of certain detrital minerals. The available data is much less than for the Peskowesk A-99 and Louisbourg J-47 wells, with which comparison is made. South Griffin J-13 and Esperanto K-78 sampled different stratigraphic levels in the lower part of the Middle Member of the Missisauga Formation. They have similar abundance of igneous-derived quartz (65-70%), contain significant mylonitized quartz, and have 1–4 % K-feldspar. Principal lithic clasts are chert, rhyolite and microgranite. These abundances are similar to those found in the Middle Missisauga at Peskowesk A-99. K-feldspar and metamorphic lithic clasts are less abundant compared with the Logan Canyon Formation at Peskowesk A-99. The basal Naskapi Member at Hesper I-52 resembles the Cree Member at Peskowesk A-99 in having lithic clasts that include schist, in addition to common chert, rhyolite and microgranite. K-feldspar reaches

6% abundance. Unlike Peskowesk A-99, mylonitized quartz is rare in Hesper I-52 samples.

Mineral chemistry data is available only from Esperanto K-78. The two tourmaline analyses are similar to analyses from the Cree Member at Peskowesk A-99 and also at Hermine E-94, but different from analyses in the Orpheus graben wells, Louisbourg J-47 and Dauntless D-35 (Fig. 6). The one spinel is of a type found in many other wells (Fig. 7). The range of K-feldspar compositions is small, from Or_{90} to Or_{97}, although the number of grains analysed is small. In most wells, compositions range from Or_{80} to Or_{97} (Fig. 8). North Triumph G-43 has a similar range in the Upper Missisauga Formation, but oligoclase is also common there. Orpheus graben wells have a similar range, but also common anorthoclase that may correspond to the un-analysed common microcline and perthite in Esperanto K-78. The closest match is the Missisauga and MicMac Formations of Peskowesk A-99.

Sediment provenance data thus confirms stratigraphic trends in detrital petrology previously recognised at Peskowesk A-99, that point to a significant change in supply starting in the Upper Member of the Missisauga Formation, with a greater component of metamorphic lithic detritus and also more K-feldspar. Both of these components would be favoured by hinterland uplift and more rapid erosion.

Diagenesis in the eastern Scotian Basin

Few new insights into the diagenesis have been gained from this study. Rocks studied from all three wells resemble those from the Missisauga and Logan Canyon formations at Peskowesk A-99 in having low abundances of diagenetic carbonates and porosity principally cemented by clay minerals. The paragenetic sequence suggests that kaolinite, calcite, siderite and pyrite are the principal eogenetic minerals, followed by quartz overgrowths, chlorite, illite, and further silica cement. In addition, silica cement is abundant at South Griffin J-13: it is located about 900 m above the top of overpressure and is thus probably unrelated. The occurrence of diagenetic sphalerite at South Griffin J-13 suggests hot, saline basinal fluids were present.

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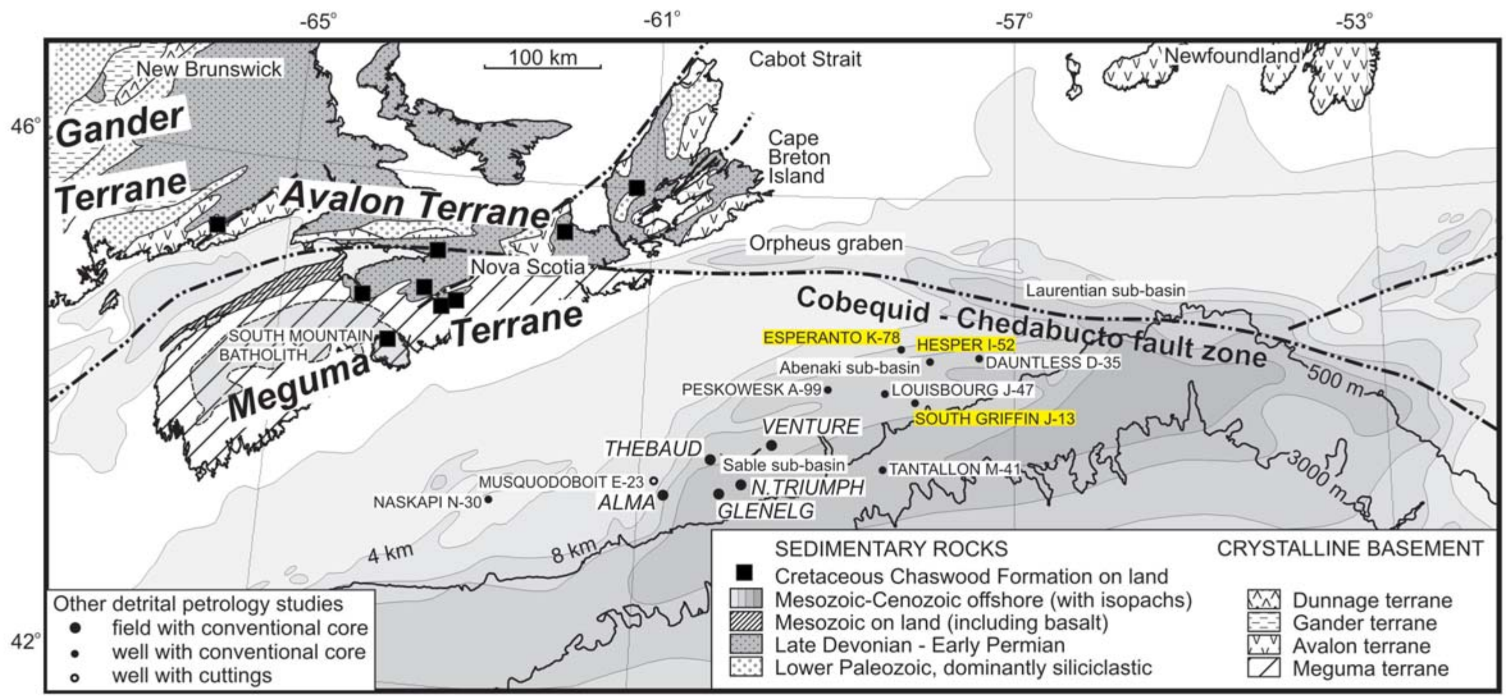


Figure 1: Location of Esperanto K-78, Hesper I-52 and South Griffin J-13, together with other wells and fields on the Scotian Shelf with detailed petrographic studies, and Chaswood Formation localities on land. Also shows isopachs of Scotian basin and generalized geology on land (modified from Williams and Grant, 1998).

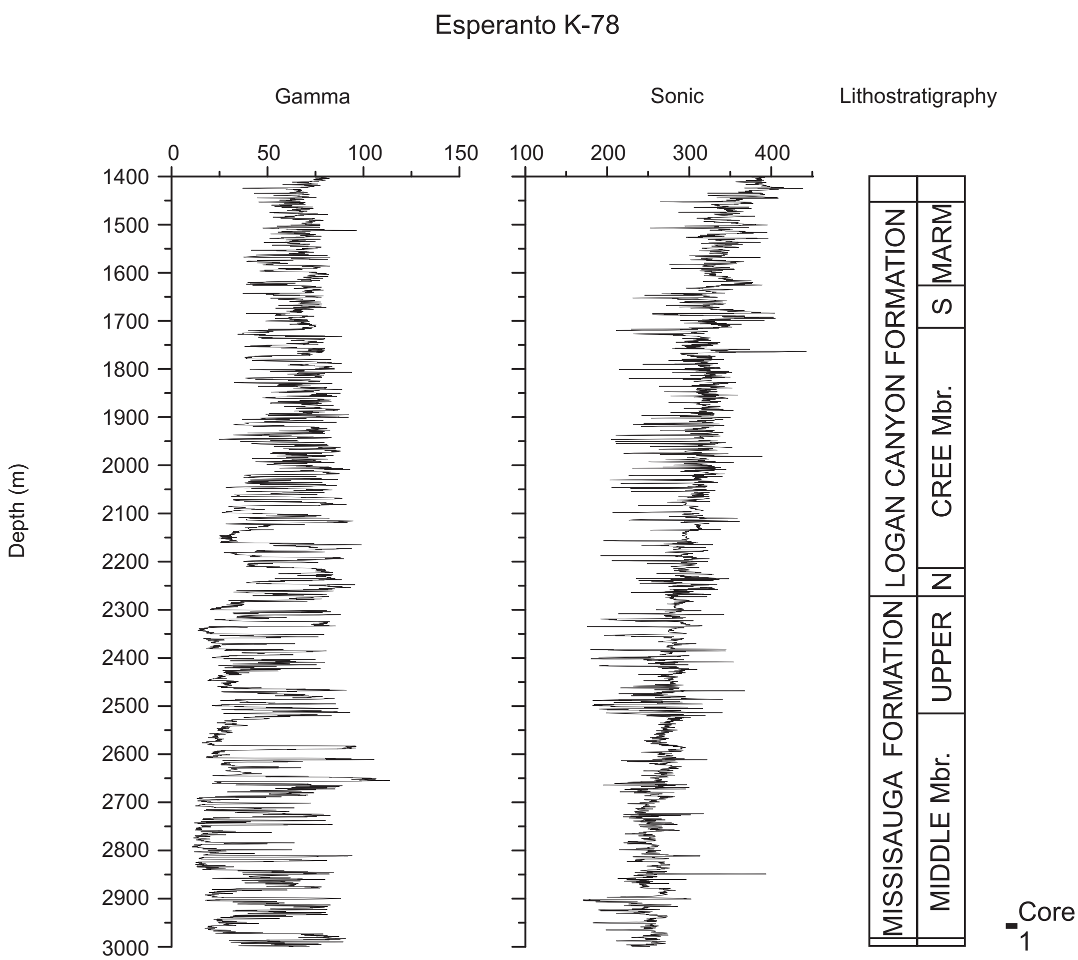


Figure 2: Summary log of the Logan Canyon and Missisauga formations at Esperanto K-78, showing location of the conventional core.

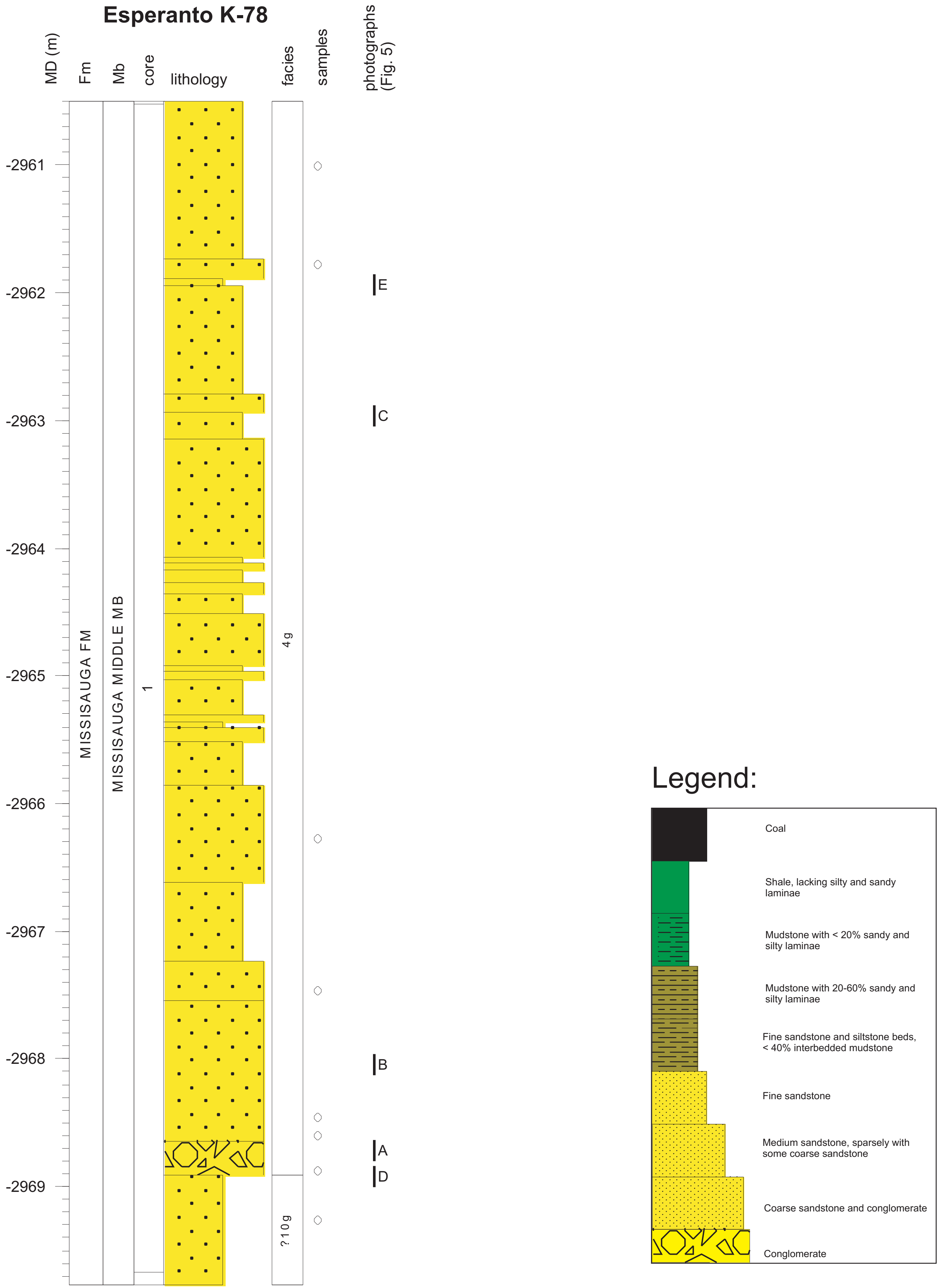


Figure 3: Detailed core log for core 1 of the Esperanto K-78 well, showing lithology, identified lithofacies, sample depths and location of illustrated photographs (Fig. 5) .

Top

Base

Figure 4: (a) Core photographs of Esperanto K-78, core 1, Missisauga Formation, 2960.50 — 2962.97 m.

Top

Base

Figure 4: (b) Core photographs of Esperanto K-78, core 1, Missisauga Formation, 2962.97 — 2965.39 m.

Top

Base

Figure 4: (c) Core photographs of Esperanto K-78, core 1, Missisauga Formation, 2965.39 — 2968.00 m.

Top

Base

Figure 4: (d) Core photographs of Esperanto K-78, core 1, Missisauga Formation, 2968.00 m- 2969.77 m.

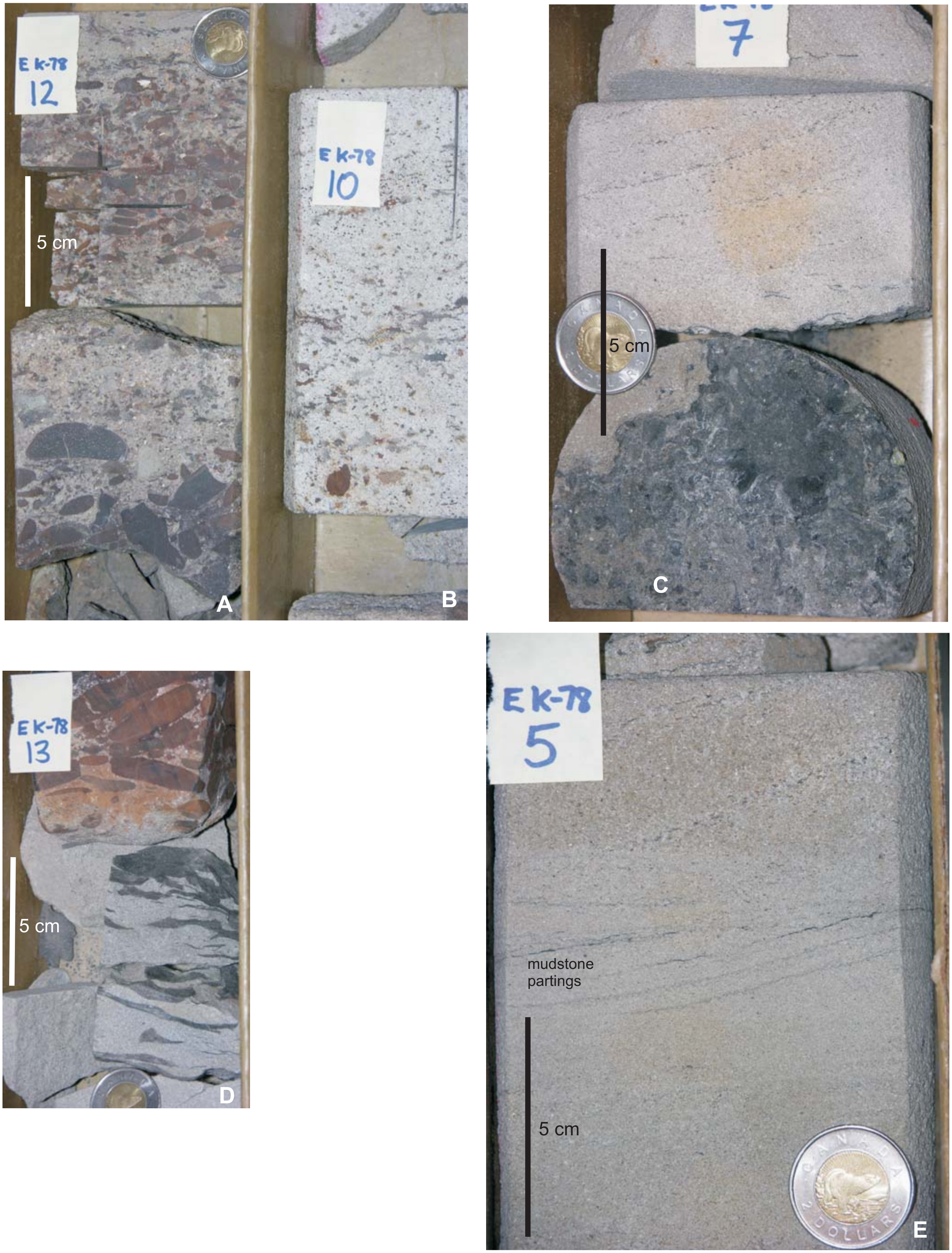


Figure 5: Details of core from Esperanto K-78. Locations in Fig. 3. (A) Very coarse grained sandstone to granule conglomerate with abundant siderite-cemented intraclasts. (B) Coarse grained sandstone with siderite-cemented intraclasts and mudstone partings. (C) Coarse-grained cross-bedded sandstone; bedding plane shows muddy parting with white mica and abundant phytodetritus. (D) Conglomerate of siderite-cemented intraclasts overlying medum grained sandstone either with mudstone intraclasts, or injected into mudstone. (E) Cross-bedded sets of fine and coarse grained sandstone, with some thin mudstone partings.

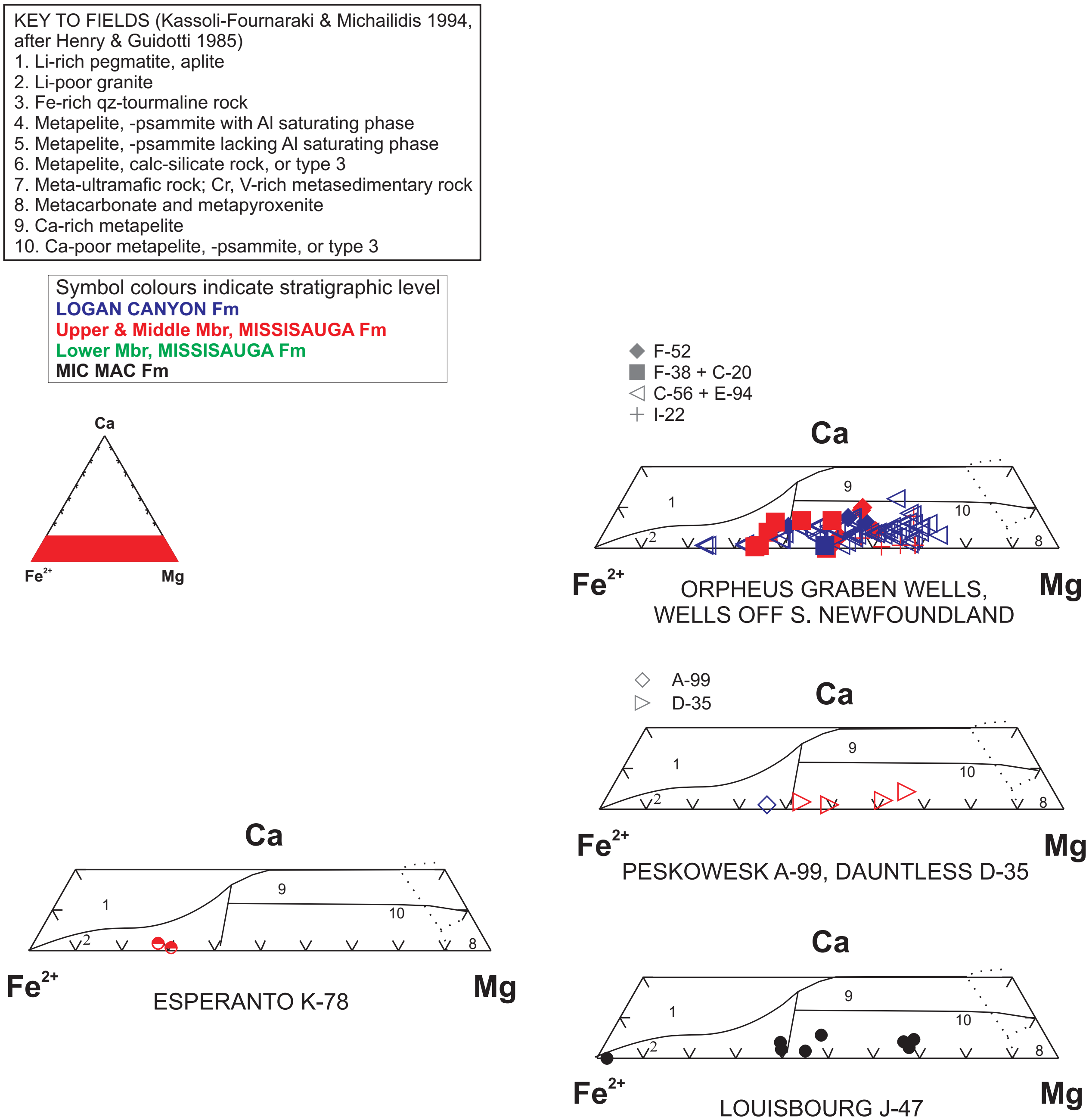


Figure 6a: Chemical variation in tourmaline from Esperanto based on Ca - Mg - Fe^{2+}. Data for other wells in the eastern Scotian Basin from Pe-Piper et al. (2009).

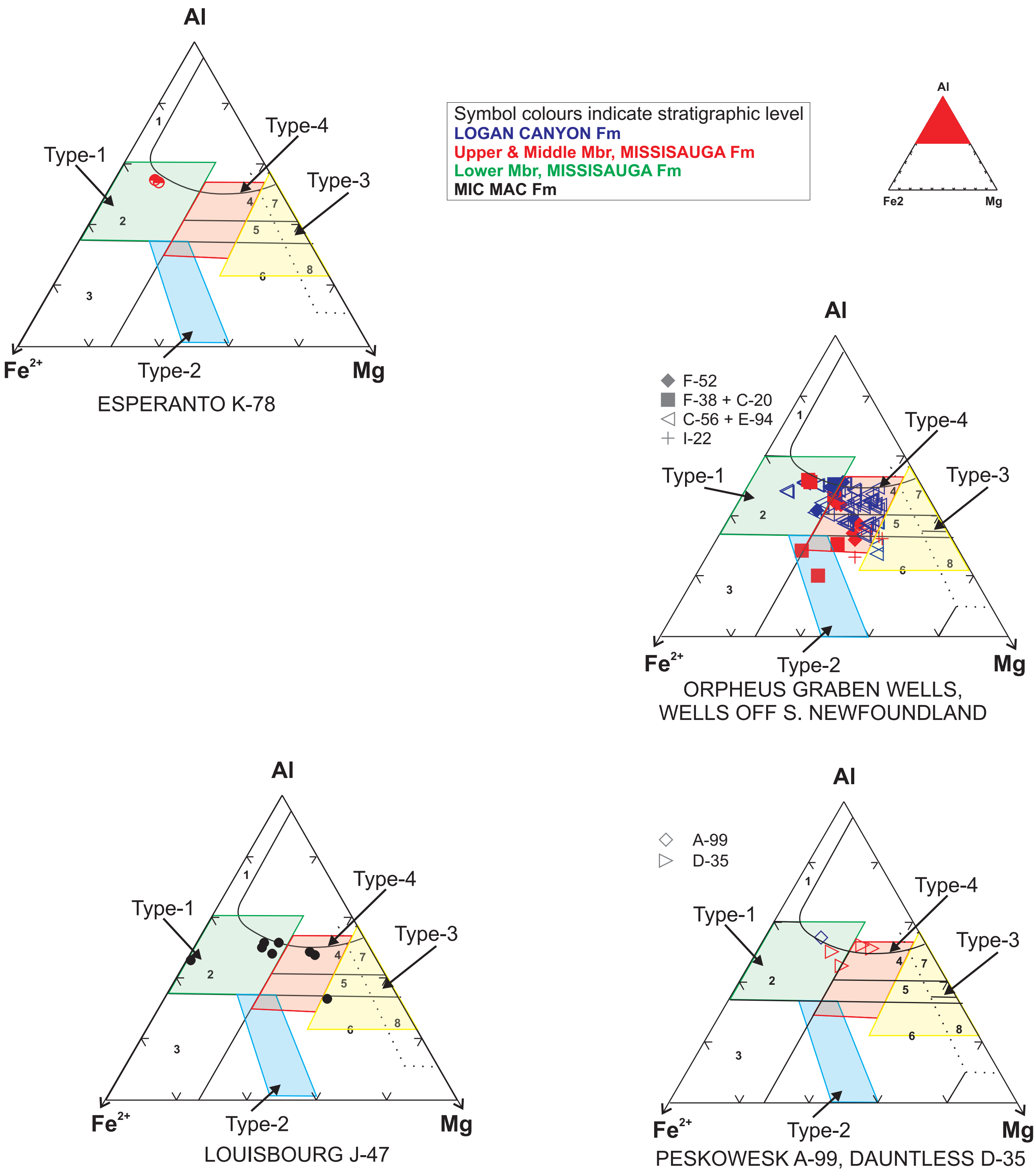


Figure 6b: Chemical variation in tourmaline from Esperanto K-78 based on Al - Mg - Fe^{2+} showing definition of types defined by Pe-Piper et al. (2009). Data from other wells in the eastern Scotian Basin from Pe-Piper et al. (2009).

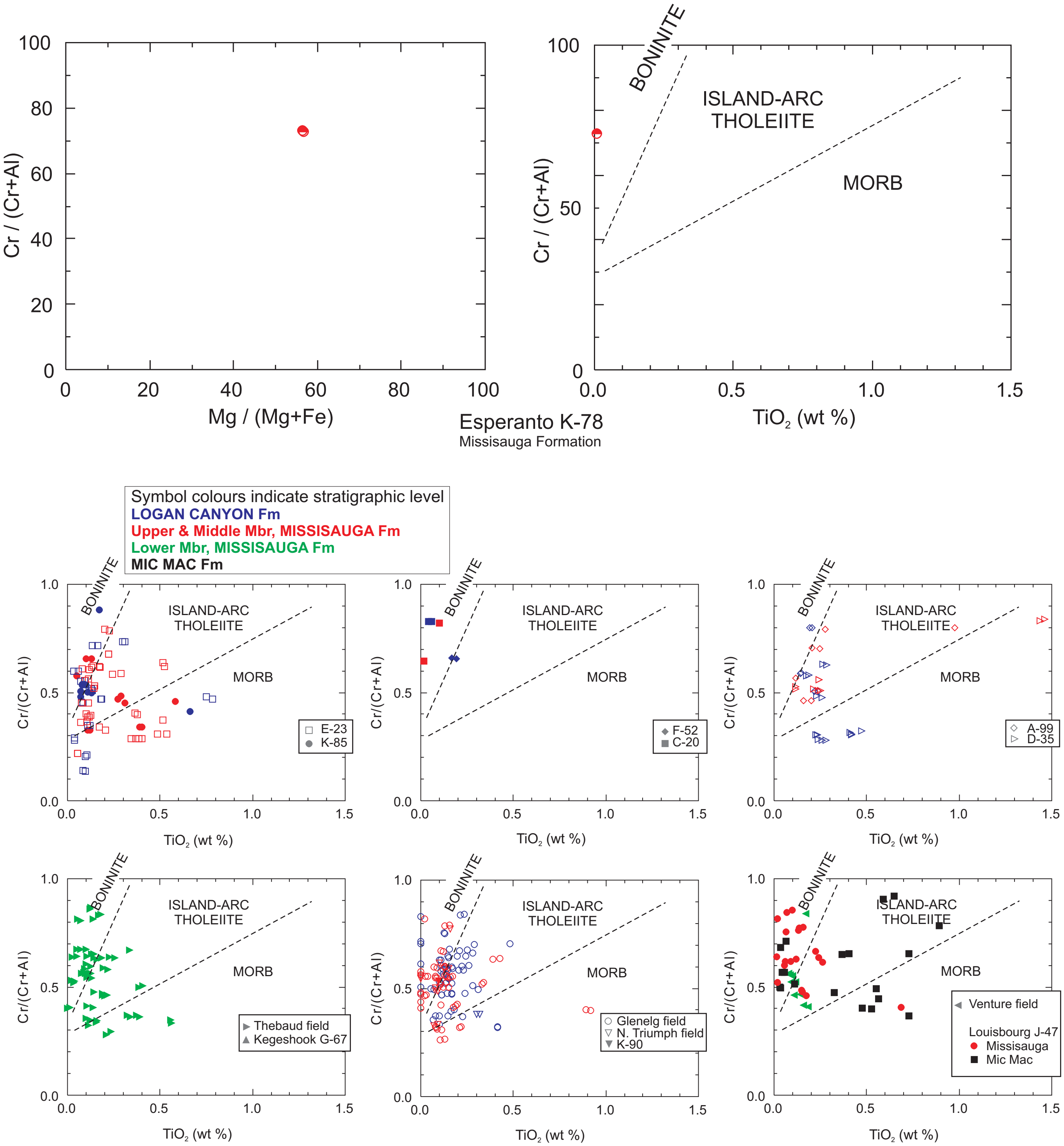


Figure 7: (*above*) Plots of spinel compositions for Esperanto K-78; (*below*) comparative data from other wells on the Scotian Shelf (from Pe-Piper et al. 2009). Fields for source rocks from Pearce et al. (2000).

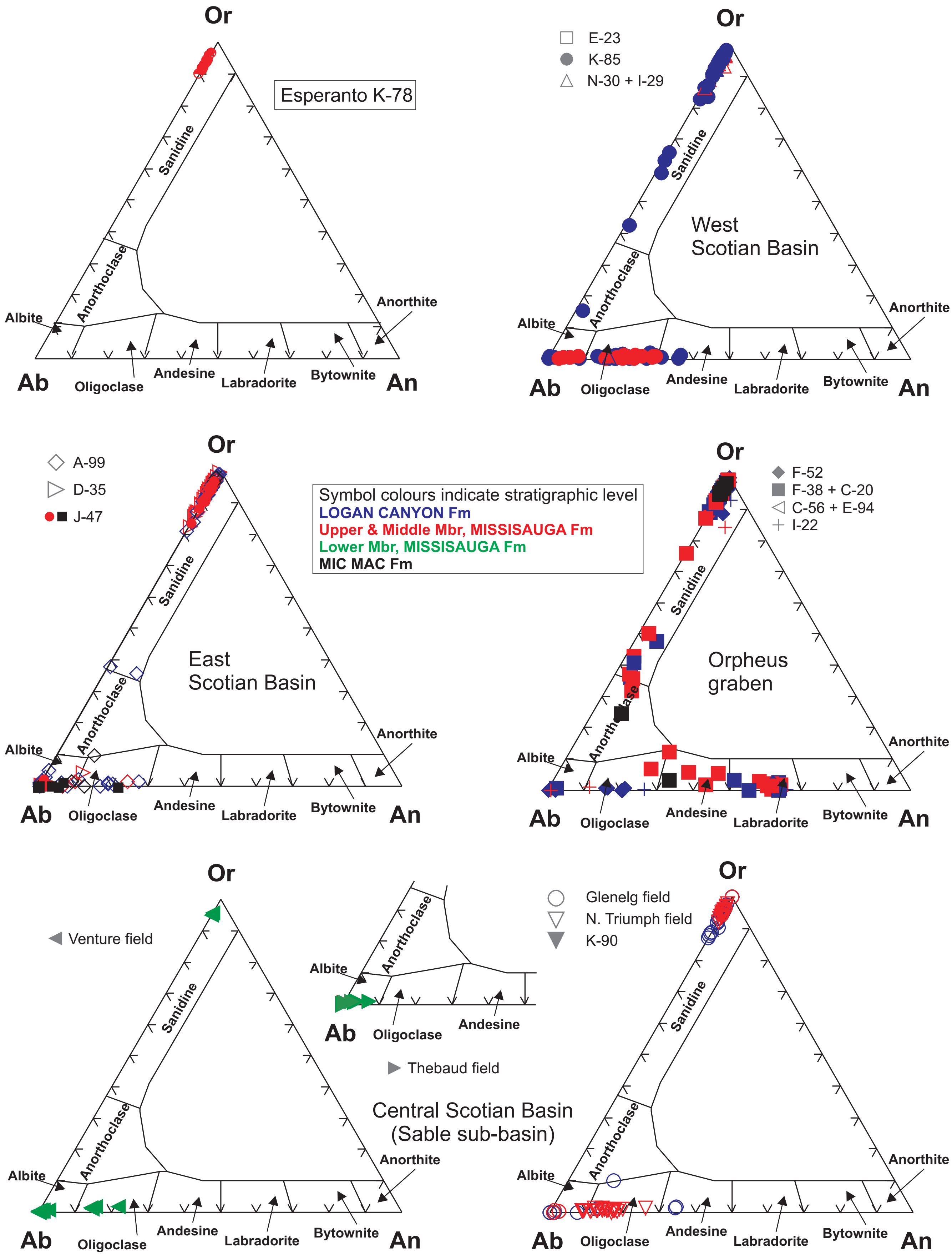


Figure 8: Chemical variation in feldspars from Esperanto K-78. Also shows analysed feldspars from other Scotian Basin wells (from Pe-Piper et al. 2009).

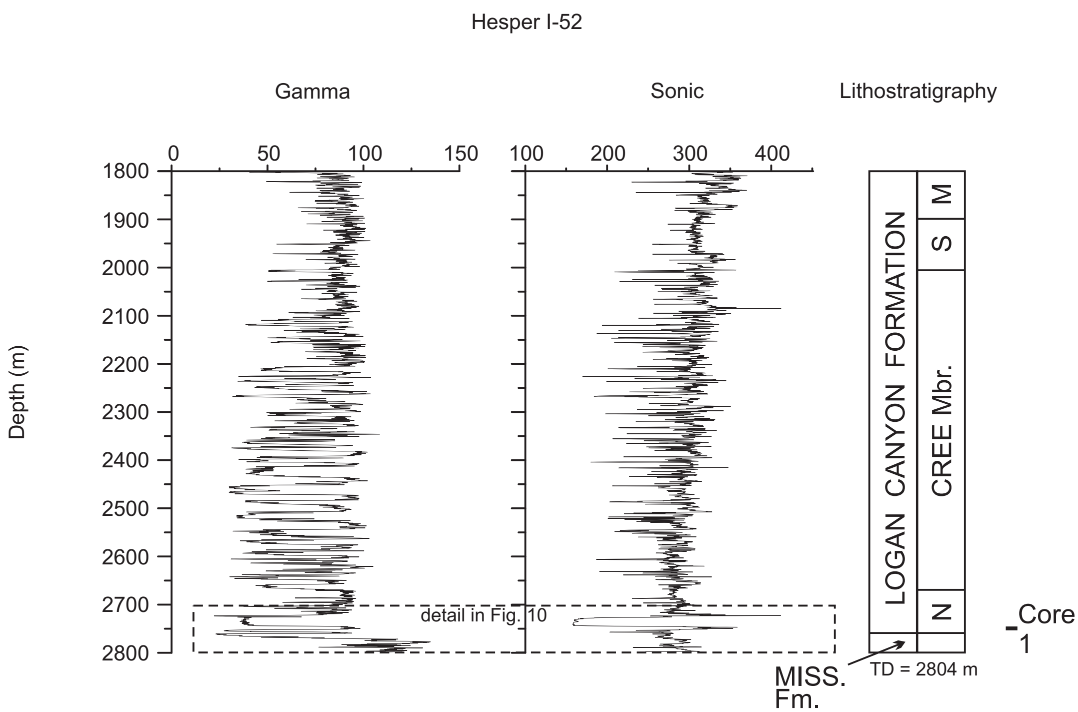
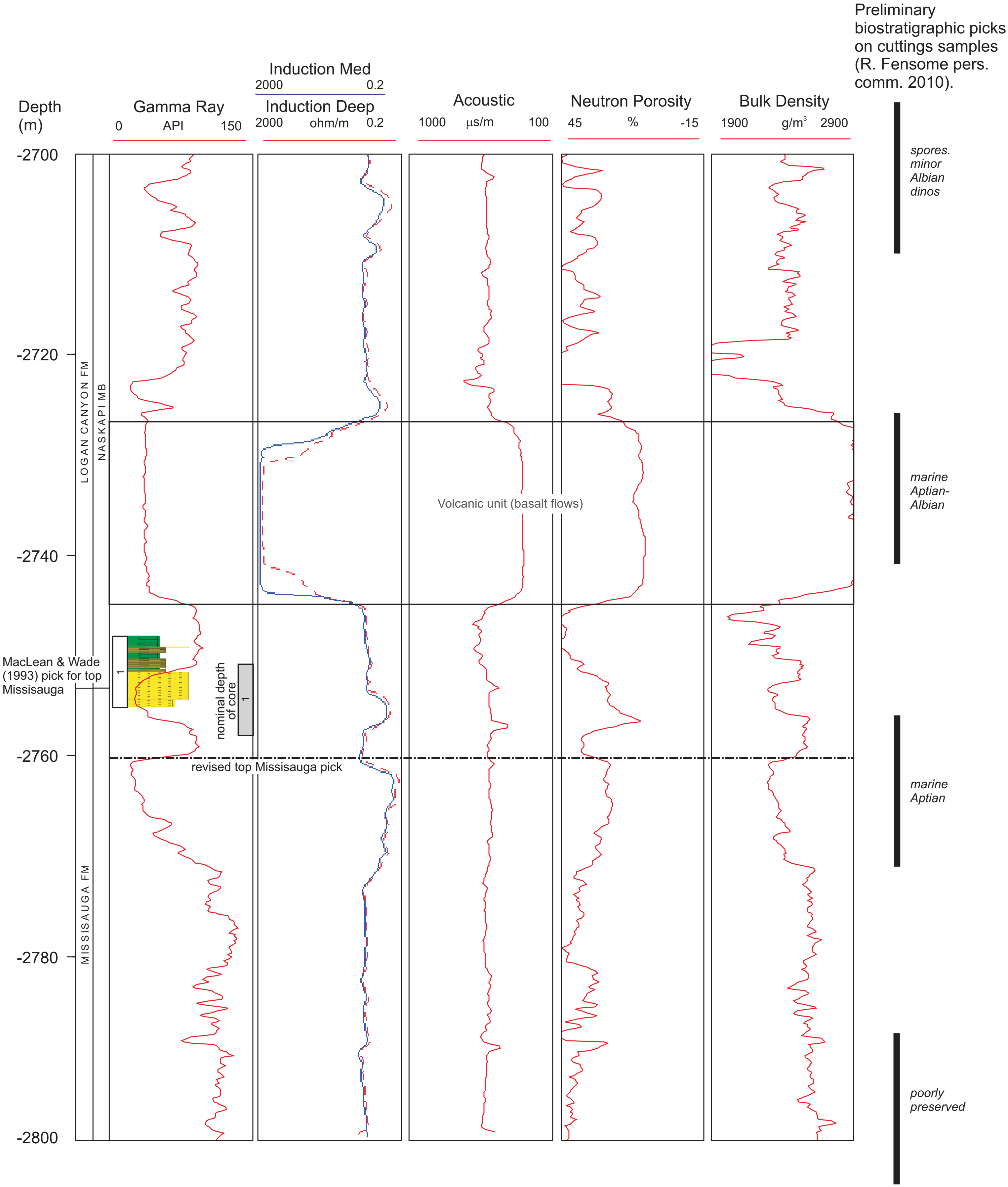


Figure 9: Summary log of the Logan Canyon and Missisauga formations at Hesper I-52, showing location of the conventional core.



Fiigure 10: Detailed setting of core 1 at Hesper. For explanation, see text.

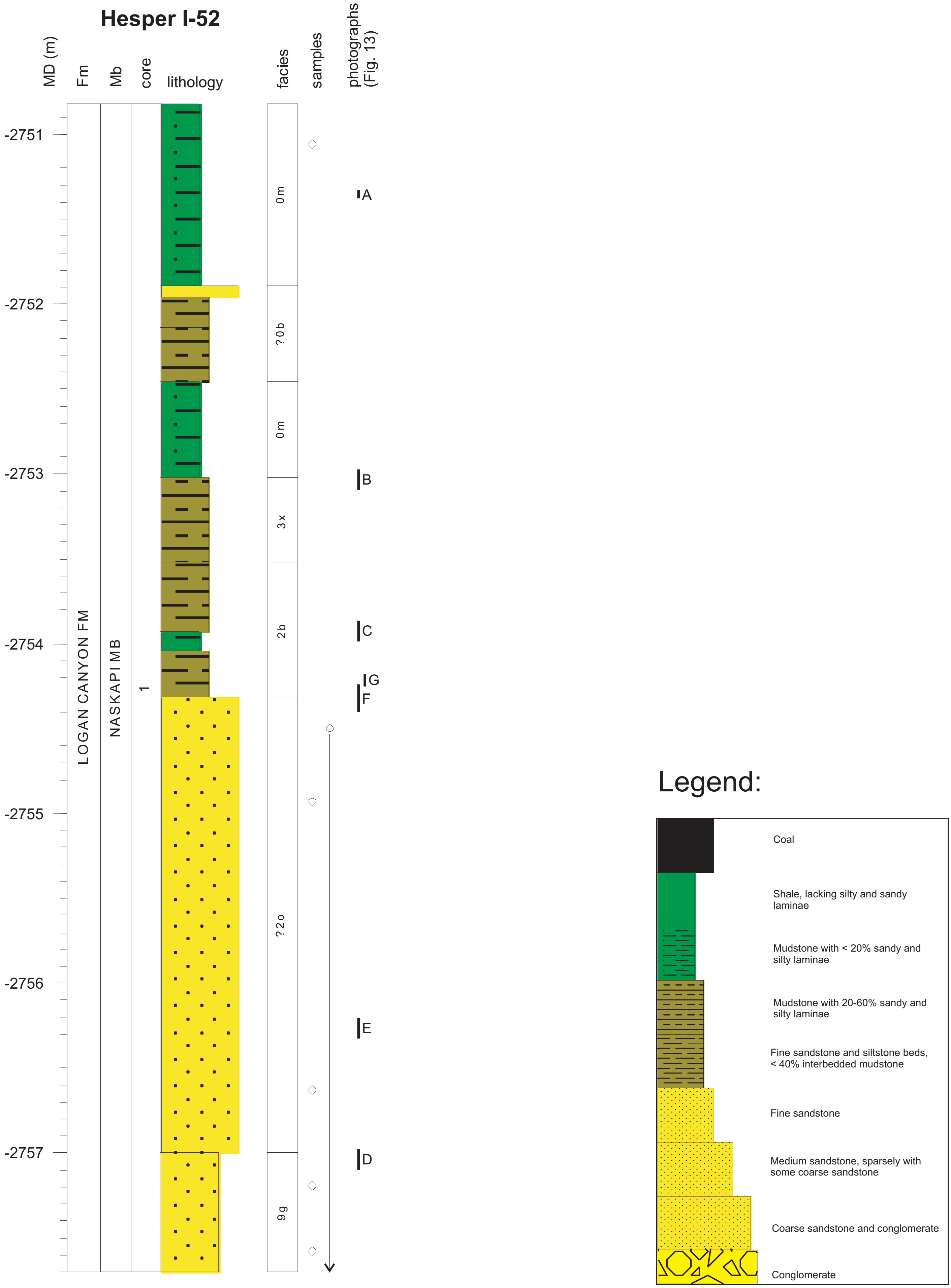


Figure 11: Detailed core log for core 1 of the Hesper I-52 well, showing lithology, identified lithofacies, sample depths and location of illustrated photographs (Fig. 13) .

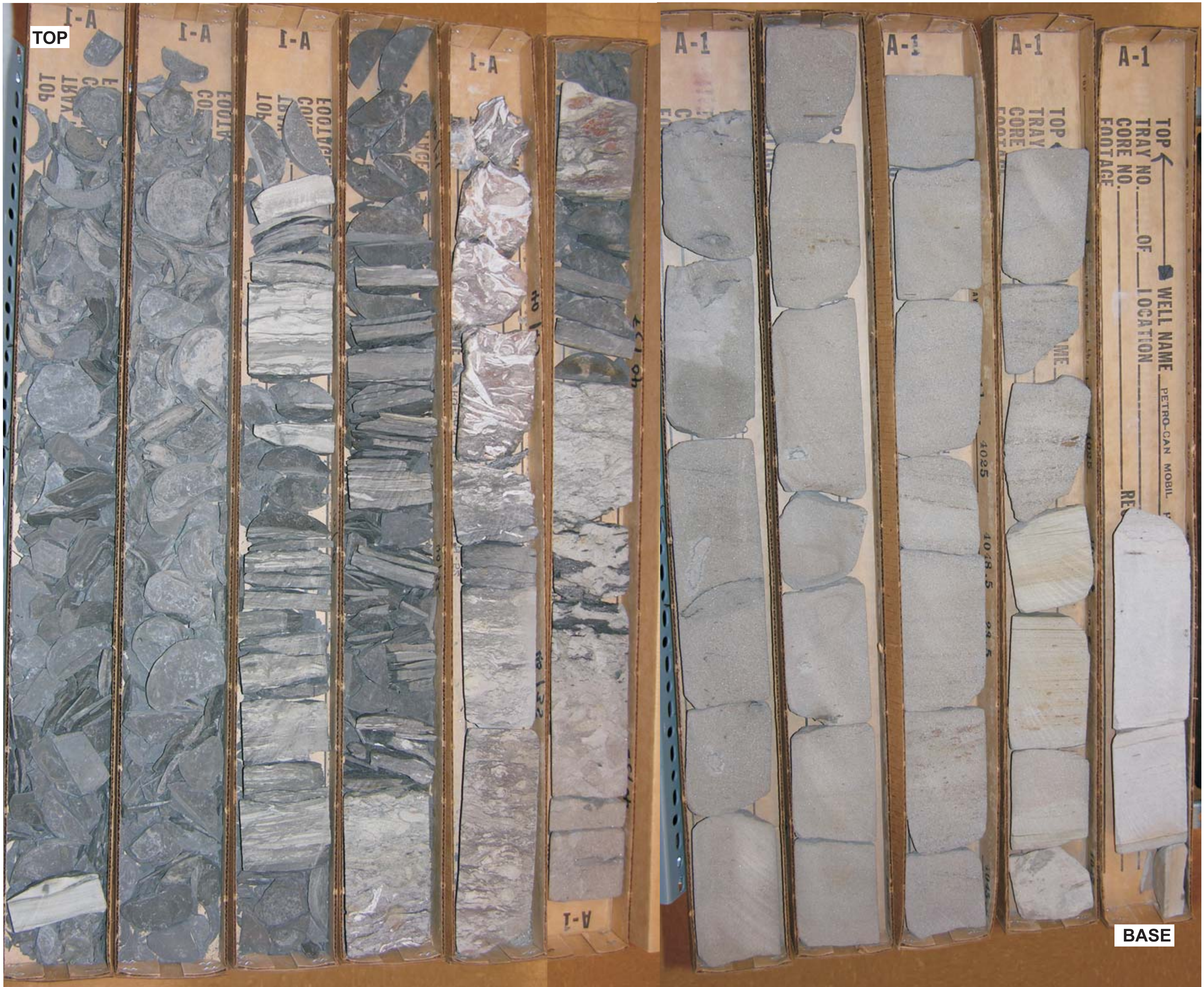


Fig. 12. Photographs of conventional core from Hesper I-52.

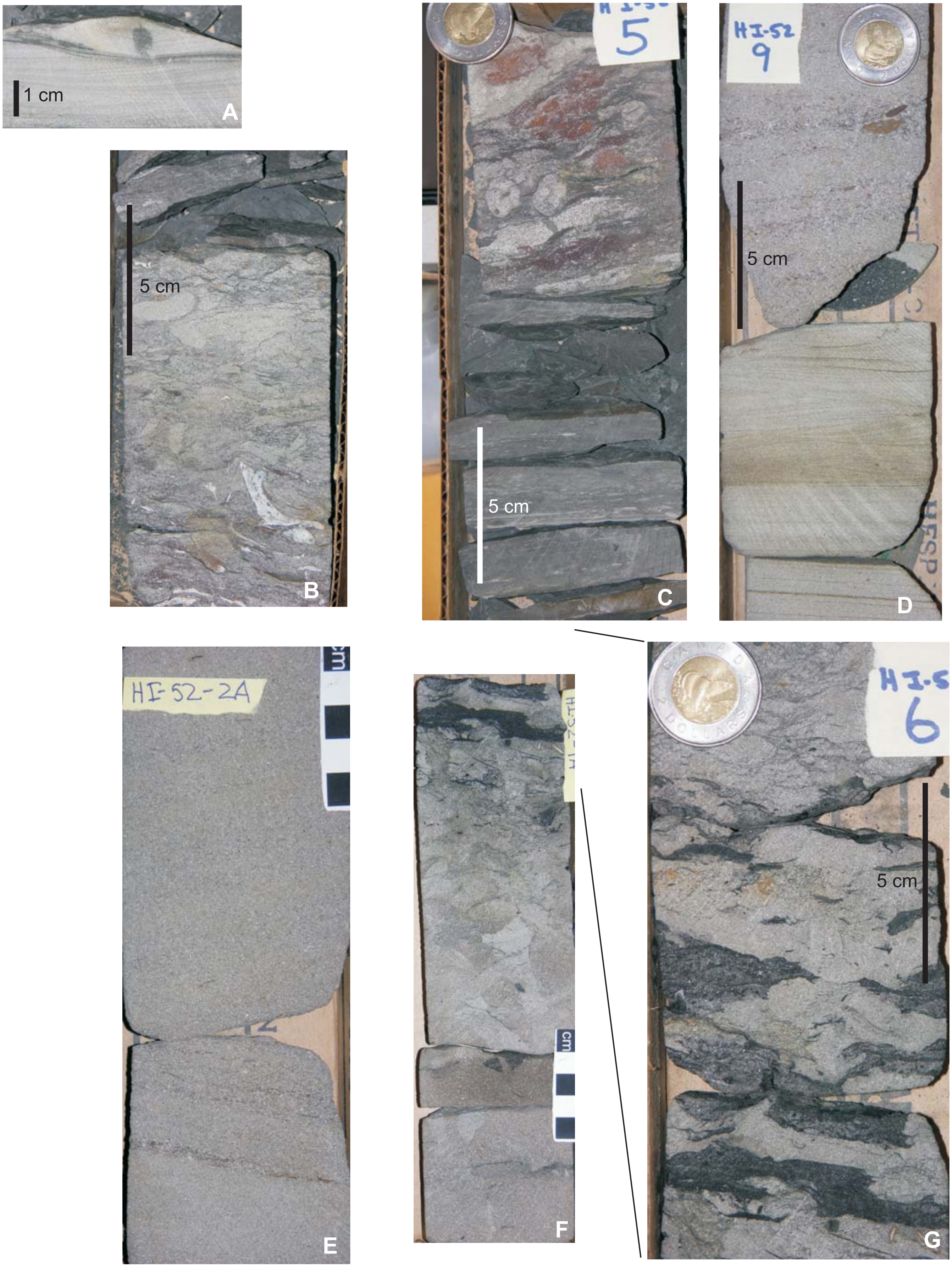


Figure 13: Details of core from Hesper I-52. Locations in Fig. 11. (A) Wave ripple at top of sandstone bed. (B) Black shale with fine siltstone laminae, abruptly overlying highly bioturbated sandstone over a conglomerate of oyster fragments. (C) Bioturbated sandstone with goethite cement, abruptly overlying dark mudstone with thin siltstone laminae. (D) Cross-bedded coarse sandstone with siderite intraclasts over laminated and cross-laminated fine sandstone. (E) Massive and cross-bedded medium to coarse grained sandstone. (F) Transition from massive or cross-bedded sandstone with sparse *Ophiomorpha* burrows, through highly bioturbated sandstone with mud-lined burrows to bioturbated sandstone with abundant mudstone and phytodetritus. (G) Detail of bioturbated sandstone unit with abundant mudstone and phytodetritus.

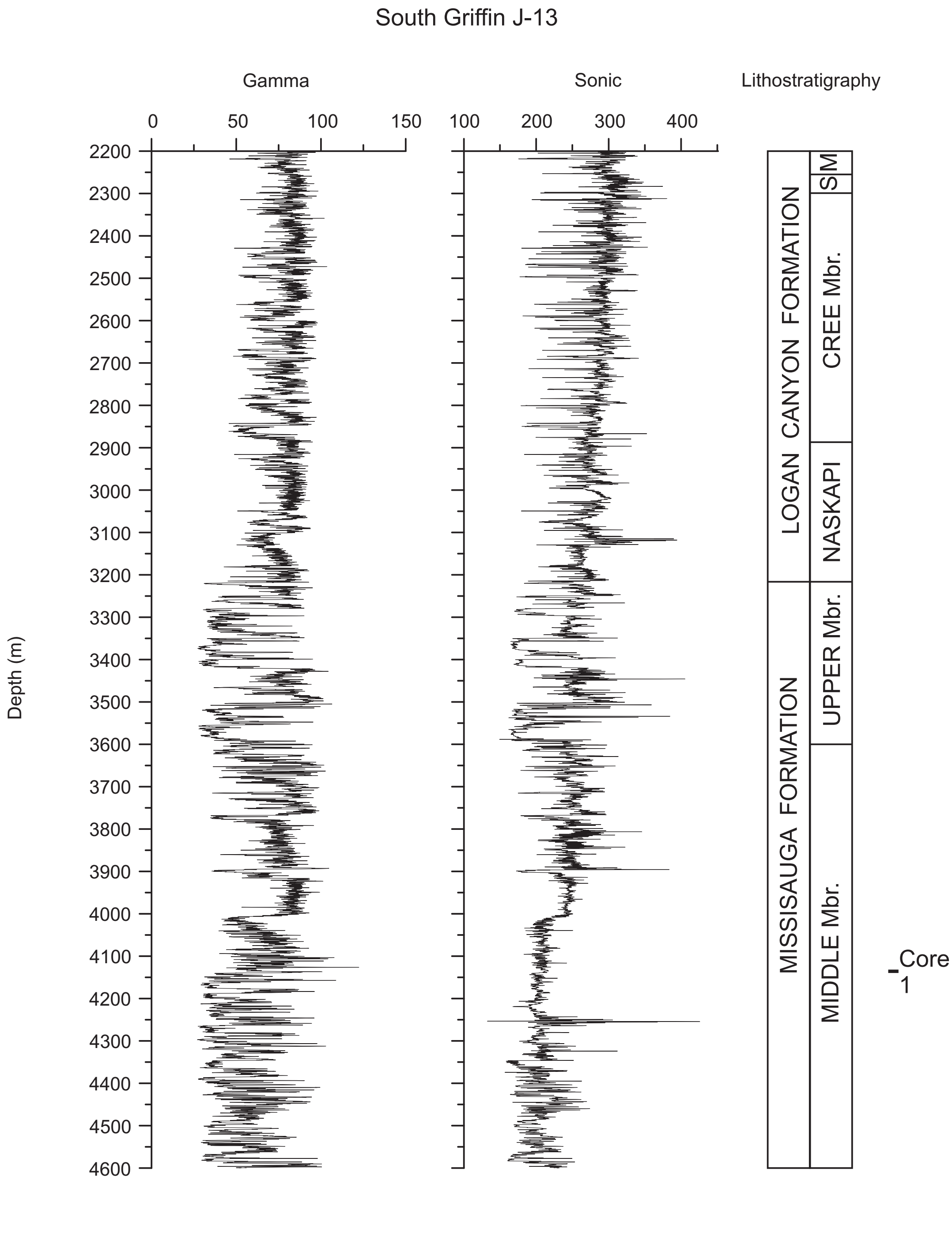


Figure 14: Summary log of the Logan Canyon and Missisauga formations at South Griffin J-13, showing location of the conventional core.

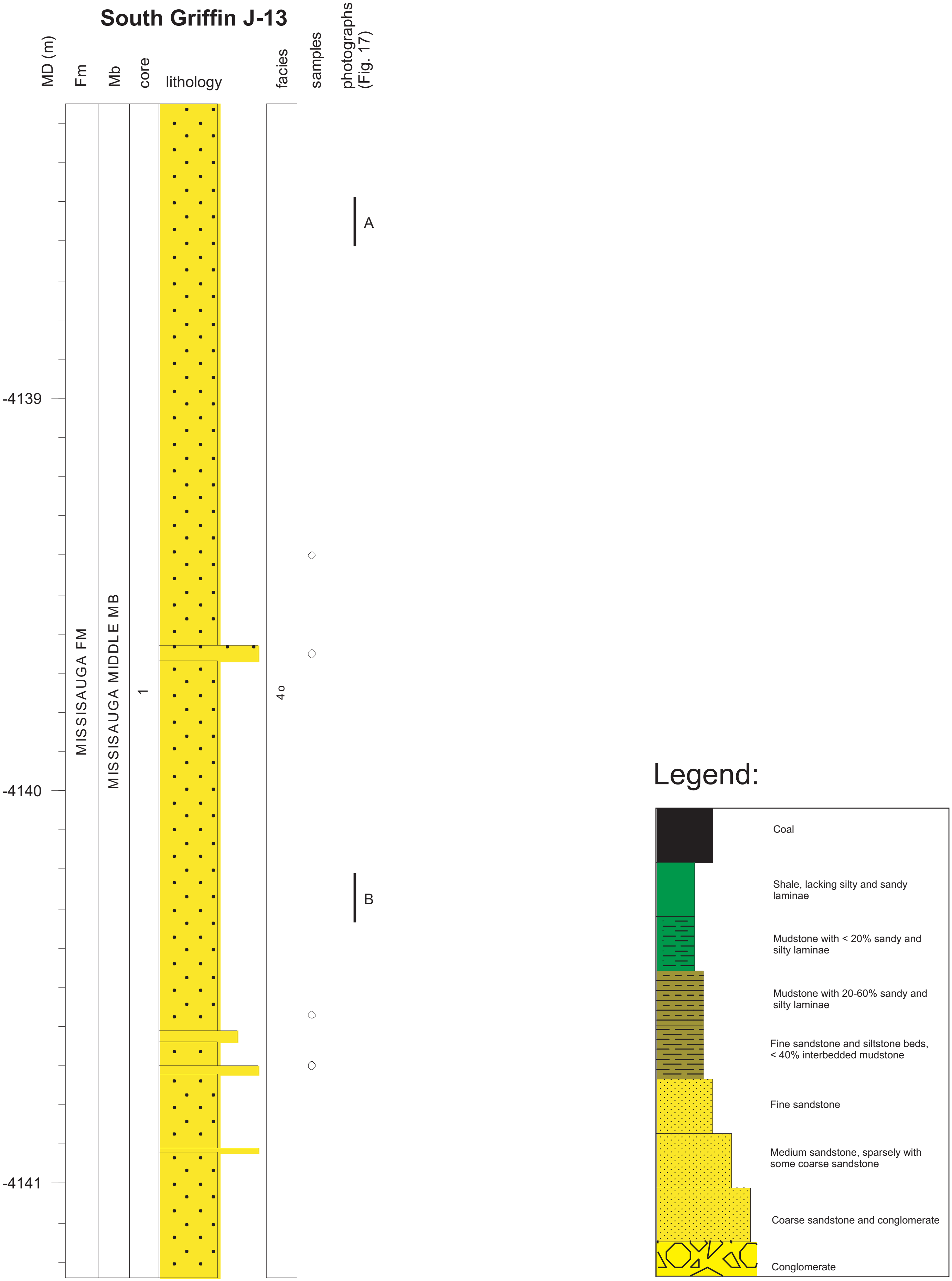


Figure 15: Detailed core log for core 1 of the South Griffin J-13 well, showing lithology, identified lithofacies, sample depths and location of illustrated photographs (Fig. 17) .

Top

Base

Figure 16: (a) Core photographs of South Griffin J-13, core 1, Missisauga Formation, 4138.25 m - 4140.64 m (Modified from Core Laboratories, 1984).

Top

Base

Figure 16: (b) Core photographs of South Griffin J-13, core 1, Missisauga Formation, 4140.64 — 4141.24 m (Modified from Core Laboratories, 1984).

Figure 17: Details of core from South Griffin J-13, showing rare mudstone drapes and mud-lined burrows including *Ophiomorpha*. Locations in Fig. 15.

Table A1: Classification scheme for lithofacies interpretation. (Gould et al. 2010b)

Facies	Subfacies	Lithology and texture	Primary sedimentary structures	Biogenic structures	General interpretation	Related facies	Notes on diagnostic criteria	Comparison with others	Characteristics
0	0g	sandstone, generally fine but may reach coarse	medium bedded; laminated or cross laminated, common erosional base; possible wave and current ripples	absent to sparse biot	River mouth to shoreface; prodeltaic turbidites	commonly overlies 1 and 2; may interbed with 9	lacks interbedded mudstone	Gould (S4); Cummings and Arnott (6)	0g: common medium bedded graded sandstone beds lacking interbedded mudstone
	0b	fine sandstone, siltstone, mudstone (sandstone > mudstone)	sharp, erosive based beds (<25 cm thick) with sltst laminae, interbedded with mst with sltst laminae; some lenticular bedding; parallel and cross laminae; variable sed structures as in Lamb et al, 2008; possible wave and current ripples	sparse to uncommon biot			sandstone:mudstone ratio	Gould (S2b); Cummings and Arnott (3) and (5); Karim, 2008 (0t), (0s) and (0l)	0t: graded sandstone beds, generally laminated to cross laminated with lesser interbedded mudstone with abundant silt laminae and some lenticular, sparse bioturbation, erosional base
	0m	mudstone, siltstone, very fine sandstone (mudstone >> sandstone)	some sltst or very fine sst laminae; parallel lam, x-lam, lenticular bedding; possible wave and current ripples	uncommon biot			sandstone:mudstone ratio; from 1 by sst; from 1 and 2b by lack of biot	Gould (M1); Cummings et al. (4); Cummings and Arnott (4)	0m: predominant mudstone, uncommon bioturbation, some silt or very fine sandstone laminae
	0a	fine and coarse sandstone, mudstone (sandstone ><mudstone)	alternation of coarse and fine sst beds with interbedded mst; parallel lam, x-lam, lenticular bedding; possible wave and current ripples	absent to sparse biot			mudstone with coarse and fine grained sst		0a: alternation of coarse and fine sandstone beds with interbedded mudstone, bioturbation absent
1		mudstone, <5% fine sandstone or siltstone	thin beds and laminae of parallel fine sst or sltst laminae	abundant to complete biot (*Chondrites* ichnofacies); uncommon thin shelled fossils - echinoderms, ammonites	Shelf	commonly overlies 3 and underlies 2 or 0	from 0 by biot; from 2b by sst; presence of marine shells		may have uncommon thin-shelled fossils
2	2b	mudstone, fine sandstone (10-60%)	destroyed by biot, possible remnants of storm beds with parallel lamination, wave ripples and wave dominated structures	generally moderate to common biot; possible shells, *Cruziana* ichnofacies; may have reworked shell frags at base of preserved beds	Shoreface	interbeds with 0; possibly grades into 3	from 0 by biot; from 1 by higher % of sand; less sst than 2c; diverse trace fossil assemblage; sst beds with possible shell hash at base, interbedded with biot sandy mst	Gould (S4)	2b: interbedded with moderate to common bioturbation, sharp base
	2c	fine sandstone (60-95%), mudstone	destroyed by biot, possible remnants of storm beds with parallel lamination, wave ripples and wave dominated structures	common to complete biot, multiple species; possible shells; *Cruziana* ichnofacies; may have reworked shell frags at base of preserved beds			from 0s by biot; from 2b by sst; diverse trace fossil assemblage; primary structures rarely preserved; reworked shells, preserved structures are wave not current dominated	Cummings and Arnott (14)	2c: common to completely bioturbated sandstone and mudstone with sandstone predominant (60 - 90 %)
	2o	fine sandstone	generally thin to thick massive beds	sparse to moderate biot, horizontal *Ophiomorpha* burrows			like 4o but mud drapes absent		
	2x	fine-rare medium sandstone	cross-bedding, mostly low angle, thin bed sets; rare mud drapes	sparse biot			from 4x because of biot, no mud drapes absent. Coal absent. Biot not *Skolithos* ichnofacies		
3	3x	sandy mudstone (10-50% sand); granules; poorly sorted; common brown staining due to early siderite	may have intraclasts	moderate to complete biot; thick shells	Condensed unit on shelf, commonly transgressive	commonly overlies 3y	mudstone	Gould (C1)	3a: sandstone matrix and mud laminae, bioturbation absent to uncommon
	3y	muddy sandstone (50-90% sand), granules; poorly sorted; common brown staining due to early siderite	may have intraclasts	moderate to complete biot; thick shells		commonly overlies 3l or an erosion surface	sandstone	Gould (M2); Cummings and Arnott (13)	3m: mud matrix predominant, moderate to common bioturbation
	3i	intraclast conglomerate; common brown staining due to early siderite	may have intraclasts	may include shells			intraclast cgl		3s: medium sandstone matrix, bioturbation absent, sharp base
	3c	lithic conglomerate; common brown staining due to early siderite	may have intraclasts	may include shells			lithic cgl; generally rare		3b: sandstone matrix, bioturbation absent, erosional base
	3f	firm ground	evidence of strong sed.; commonly associated intraclasts; erosion or incision of underlying sediment	some burrow penetrating firm ground, *Glossifungites*			evidence of firm ground; generally rare		
	3l	bioclastic limestone	parallel lam	abundant shell fragments, possibly in place			bioclastic limestone	Gould (L1); Cummings et al. (7)	3l: bioclastic limestones
	3o	oolitic limestone and sandstone	parallel lam	possible biot			oolitic limestone and sandstone		3o: oolitic limestones and sandstones

Table A1: Classification scheme for lithofacies interpretation. (Gould et al. 2010b)

Facies	Subfacies	Lithology and texture	Primary sedimentary structures	Biogenic structures	General interpretation	Related facies	Notes on diagnostic criteria	Comparison with others	Characteristics
4	4o	principally fine sandstone	thin to medium bedded, may be cross-bedded; mud drapes	sparse to common biot, *Ophiomorpha* , *Skolithos* ichnofacies	Tidal estuary to fluvial	passes up into 5 or 2	from 5-4 by *Ophiomorpha* burrows; common mud drapes;	Karim, 2008 (4o); Karim, 2008 (4u)	4o: Fine sandstone (< 25 cm), mudstone drapes, *Ophiomorpha* , cross-bedding; 4u: coarse sandstone with bioturbation, mud drapes, calcite cementation
	4g	medium to coarse sandstone; may have coarse grained lag at base of unit	typically thin-bedded, mud drapes; bedding parallel to low angle	absent to sparse biot				Gould (S1); Cummings et al. (2); Cummings and Arnott (10, 12)	4g: medium to coarse sandstone, minor mud drapes, bioturbation absent, base of sandstone may be erosional
	4x	medium to coarse sandstone; mudstone intraclasts; may have coarse grained lag at base of unit	thin to thick beds, many high angle cross-bedded	biot absent; coal intraclasts			coarser grainsize, high-angle cross-bedding	Cummings et al. (1)	4x: thick beds medium to coarse sandstone, not "graded", some cross-bedding
	4n	mudstone, siltstone, very fine sandstone (sandstone>mudstone)	"tidal bundles" of poorly sorted sand and silt; or well-sorted fine sand, rarely with ripples; mud partings 1-2 mm	biot absent or sparse			more silt and sand than 0m; differs from 0a in lack of coarse sst beds	Cumings and Arnott (2); Karim, 2008 (0n)	0n: distinctive graded silt to mud laminae interbedded with well sorted very fine sandstone laminae and lenticular beds, bioturbation absent
5	5m	>75% sandstone, predominantly fine may have medium or coarse grained beds, mudstone	thin bedded; variable mud drapes; mud, slt, and vf sst parallel & x-lam; mud on ripples	variable biot - sparse to moderate, or common to abundant, *Skolithos* ichnofacies; ?plant frags	Mixed flat - intertidal		from 6-1 by sandstone dominance; from 2 by less biot, subvertical burrows dominant, preservation of primary structures diagnostic of tidal environ.	Gould (S3); Cummings et al. (5); Cummings and Arnott (7)	with uncommon to moderate bioturbation, muddy linings to burrows
	5s	>95% sandstone, generally fine may be medium or coarse grained, minor mudstone	possible thin to med bedded; some x-bedding	sparse to mod biot; shells	Sand flat - intertidal to subtidal	may pass up into 4o	mud drapes and *Ophiomorpha* rare compared to 4o; cross- bedding diagnostic; from 2 by less biot, subvertical burrows dominant, preservation of primary structures diagnostic of tidal environ.	Karim, 2008 (4s)	4s: sandstone and siltstone commonly lenticular, mudstone drapes
	5b	20-75% sandstone, predominantly fine may have medium or coarse grained beds	destroyed	abundant to complete biot - common large and long subvertical burrows; may have shells	Mixed flat - intertidal	transitional to 2	large subvertical burrows; from 2 by less biot, subvertical burrows dominant, preservation of primary structures some diagenetic of tidal environ.		
	5c	medium sandstone	sharp based, thin beds	absent	Tidal channel - subtidal	within 5/6	thin beds within 5/6		
6	6s	subequal fine sandstone,mudstone; or 60-75% mudstone, fine sandstone; may have minor medium-coarse sandstone, e.g. in burrows	mud dominant sections with wavy or current ripples and mud on ripple lam, interbedded with prominant parallel lam sst and mst (pinstripe-shaped)	small *Skolithos* ichnofacies burrows absent to common; possible plant frags	Mixed flat- intertidal	commonly interbedded with 4, 5, 7, 8	like 0 but with *Skolithos* burrows, current ripples	Cummings et al. (3); Cummings and Arnott (11); Cummings (P4)	with root traces, tidal flat structures
	6b	>80% mudstone, minor very fine to fine sandstonemay have minor medium-coarse sandstone, e.g. in burrows	destroyed; rare preserved parallel lam, current ripples	common to complete biot; may have whole or fragments of oyster shells	Mudflat- intertidal		from 5b by mud dominance; oyster shells		
	6m	>95% mudstone, may have minor medium-coarse sandstone, e.g. in burrows; may have minor medium-coarse sandstone, e.g. in burrows	rare discontinuous sltst lam, broken by subvertical to vertical burrowing	biot absent to common, may have burrows (horizontal and subvertical) filled with m-c sst; ?oyster shells	Mudflat- intertidal		from other 5/6 by mudstone dominance	Cummings (P4)	
7		lignite or carbon-rich mud		rootlets beneath	Tidal marsh	may overlie 6	lignite or carbon-rich mud		
8		mudstone, rare siltstone	planar parallel to low angle cross siltstone lam	biot generally absent to sparse, with locally intense biot	Lagoon	interbeds with 5 & 6	1 has fossils and overlies 3, is more biot; 8 interbeds with 5 and 6	Cummings (P3)	
9	9g	very coarse to fine sandstone, some graded beds	sharp-based beds, some with erosive structures (sole marks); predominantly massive beds, generally >25cm thick, with minor parallel or cross laminae at top of some beds; possible mud intraclasts	absent to moderate biot at top of beds; plant detritus; possible reworked coastal deposits (shells, sid nodules)	River mouth to prodelta turbidite	commonly interbedded with 0, overliain by 4o	from facies 0 by bed thickness; from 9s by lack of interbedded mudstone	Gould (S2c); Cummings and Arnott (8); Karim, 2008 (4b)	9g: graded sandstone beds lacking interbedded mudstone; 4b: Fine sandstone with coarse bioclasts and ooids and/or coated grains
	9s	fine sandstone, minor mudstone, minor interbedded facies 0	sharp-based beds, some with erosive structures (sole marks); generally >25 thick, parallel lamination at base and cross lamination at top; some beds have mud intraclasts near base	moderate biot at top of beds; plant detritus; possible reworked coastal deposits (shells, sid nodules)			from facies 0 by bed thickness	Gould (S2a), Karim 2008 (9m)	9s: sharp base, parallel lamination at base and cross lamination at top. Some beds have abundant mud intraclasts generally near base; 9m: mud laminae, and intraclasts
10	10f	mudstone to muddy sandstone	destroyed by deformation; secondary structures - massive texture, horizontal foliation	-	Deformed facies	commonly interbedded with 0			10f: dark foliated mudstone to muddy sandstone, massive texture, dark color, horizontal foliation
	10g	sandstone	destroyed by deformation; secondary structures - liquified beds	-					10g: liquefied sandstone beds
	10s	sandstone, siltstone, mudstone,	mostly destroyed by deformation; secondary structures - sheared and folded beds	variable biot					10s: sheared and folded sandstone, siltstone and mudstone, making original structures difficult to recognize

Table B1- Lithofacies interpretation for Esperanto K-78 well

Well	Core #	Depth (m)	Facies	Condensed notes from logger:
Esperanto K-78	1	2960.50-2967.54	4g	Mega unit of fg-cg sst. Bed sets are generally 5-20 cm thick, and horizontal to dipping (cross-bedding). Distinct mud partings distinguish bedding. Phyto-detritus is found in some places, usually within mud partings. Some siderite concretions/ cements and possibly intraclasts. Some irregular patchy brown staining? Bed sets are sometimes distinguishable by grain size.
Esperanto K-78	1	2960.50-2960.66	4g	Mg sst, lighter than below. Different cement?
Esperanto K-78	1	2960.66-2960.88	4g	Horizontal mg sst.
Esperanto K-78	1	2960.81	4g	Irregular mud parting .
Esperanto K-78	1	2960.88-2960.92	4g	4 cm cross-bedding set. Mg sst.
Esperanto K-78	1	2960.92-2961.20	4g	Horizontal to sub-horizontal mg sst. Rubble.
Esperanto K-78	1	2961.20-2960.36	4g	Thick cross-bedded mg sst (16 cm).
Esperanto K-78	1	2961.32	4g	Dipping mud drape.
Esperanto K-78	1	2960.36-2961.48	4g	Mg sst w/ dipping mud drapes. Unsure whether connected or overlying cross bed.
Esperanto K-78	1	2961.48-2961.74	4g	Mg sst.
Esperanto K-78	1	2961.55	4g	Large wood clast.
Esperanto K-78	1	2961.74-2961.89	4g	Cg sst w/ mud drapes. Dipping cross bed at the base, possibly at top too.
Esperanto K-78	1	2961.89-2961.94	4g	Dipping fg sst with thin mud drapes.
Esperanto K-78	1	2961.94-2962.00	4g	Horizontal bed of mud (top) coarsening downward to cg sst.
Esperanto K-78	1	2962.00-2962.15	4g	Sub horizontal mg sst, cm scale sets within beds.
Esperanto K-78	1	2962.15-2962.22	4g	Mg sst w/ large siderite intraclast engulfing a mud clast. The sst is also cemented by siderite (diagenetic?).
Esperanto K-78	1	2962.22-2962.25	4g	Dipping mg sst. Cross-bedded.
Esperanto K-78	1	2962.25-2962.34	4g	Mud parting with white mica and phyto-detritus, some burrows, overlying horizontal mg sst
Esperanto K-78	1	2962.34-2962.42	4g	Mud parting w/white mica, phyto-detritus and burrows overlying mg grading down to cg horizontal sst. Another mud parting in the middle.
Esperanto K-78	1	2962.42-2962.48	4g	Dipping mg sst. Cross-bedded at base.
Esperanto K-78	1	2962.48-2962.53	4g	Rubbly mg sst. Appears to be horizontal bedding.
Esperanto K-78	1	2962.53-2962.61	4g	Slightly dipping mg sst.
Esperanto K-78	1	2962.61-2962.68	4g	Possibly massive coarsening downward mg sst. Overlying mud parting which is dipping
Esperanto K-78	1	2962.68-2962.79	4g	Horizontal? dipping? mg sst.
Esperanto K-78	1	2962.79-2962.84	4g	Dipping bed picked out by mud laminae. Cg sst.
Esperanto K-78	1	2962.84-2962.94	4g	Cg sst w/a mud parting at 2962.86m which has white micas, phyto-detritus and burrows.
Esperanto K-78	1	2962.94-2963.05	4g	Mg sst slightly dipping with a couple mud drapes picking out bedding orientation.
Esperanto K-78	1	2963.05-2963.14	4g	Dipping mg sst?
Esperanto K-78	1	2963.14-2963.17	4g	Odd contact with overlying mg sst. Cg sst. Dipping.
Esperanto K-78	1	2963.17-2963.34	4g	Coarsening downward from mg to cg sst. Bedding?
Esperanto K-78	1	2963.34-2963.36	4g	Interbedded cg and mg sst.
Esperanto K-78	1	2963.36-2963.82	4g	Dipping cg sst with occasional dipping mud and parting/drape. Mud partings have some white micas, phyto-detritus and biot.
Esperanto K-78	1	2963.82-2964.02	4g	Dipping cg sst? Rubble. Possibly cross-bed within rubble.

Table B1- Lithofacies interpretation for Esperanto K-78 well

Esperanto K-78	1	2964.02-2964.07	4g	Slightly dipping cg sst overlying mud parting.
Esperanto K-78	1	2964.07-2964.12	4g	Dipping mg sst with mud parting.
Esperanto K-78	1	2964.12-2964.17	4g	Rubbly cg sst.
Esperanto K-78	1	2964.17-2964.27	4g	Dipping mg sst?
Esperanto K-78	1	2964.27-2964-36	4g	Dipping cg sst?
Esperanto K-78	1	2964.36-2964.51	4g	Dipping mg sst.
Esperanto K-78	1	2964.51-2964.92	4g	Slightly dipping cg sst.
Esperanto K-78	1	2964.92-2964.96	4g	Dipping mg sst picked out by mud laminations.
Esperanto K-78	1	2964.96-2965.03	4g	Slightly dipping cg sst overlying dipping sst. Cross-bedded.
Esperanto K-78	1	2965.03-2965.15	4g	Dipping cross-bed of mg sst. Mud laminations.
Esperanto K-78	1	2965.15-2965.18	4g	Sub-horizontal mg sst.
Esperanto K-78	1	2965.18-2965.22	4g	Dipping mg sst.
Esperanto K-78	1	2965.22-2965.31	4g	Sub-horizontal mg sst.
Esperanto K-78	1	2965.31-2965.36	4g	Dipping cg sst.
Esperanto K-78	1	2965.36-2965.41	4g	Fg sst.
Esperanto K-78	1	2965.41-2965.46	4g	Cg sst, slight dip. Small siderite? intraclast. Lithic fragments.
Esperanto K-78	1	2965.46-2965.52	4g	Dipping cg sst cross-bed. Mud partings at base.
Esperanto K-78	1	2965.52-2965.86	4g	Slightly dipping mg sst.
Esperanto K-78	1	2965.86-2966.14	4g	Cg sst. No apparent bedding. Mud parting at top. Overlying dipping cross-bed.
Esperanto K-78	1	2966.14-2966.21	4g	Cross-bedded cg sst picked out by mud laminations and partially aligned siderite clast (<1mm).
Esperanto K-78	1	2966.21-2966.48	4g	Underlying mud parting. Cg sst. Mostly rubble. No apparent bedding orientation. Overlying dipping mud parting
Esperanto K-78	1	2966.48-2966.53	4g	Dipping cg grained cross-bed?
Esperanto K-78	1	2966.53-2966.62	4g	Slightly dipping cg sst.
Esperanto K-78	1	2966.62-2966.67	4g	5 cm of cg sst. Overlying mud laminations and mg sst.
Esperanto K-78	1	2966.67-2967.10	4g	Slightly dipping mg sst. Some darker grains scattered around.
Esperanto K-78	1	2967.10-2967.14	4g	Dipping cross-bed of mg sst.
Esperanto K-78	1	2967.14-2967.21	4g	Mg sst with granular lithic fragments.
Esperanto K-78	1	2967.21-2967.23	4g	Mg sst.
Esperanto K-78	1	2967.23-2967.28	4g	Horizontal cg sst with mud partings and large siderite intraclast.
Esperanto K-78	1	2967.28-2967.54	4g	Rubbly cg to very cg sst. Mud partings and clasts. Siderite clasts.
Esperanto K-78	1	2967.54-2968.91	4g	Mega unit of mg to very cg sst with some cross-bedding, mud partings, siderite clasts and replacement partings. coarsening downward to very cg sst and siderite intraclasts. Irregular grey partings. Possibly a channel lag at the base. Silica rich cement throughout.
Esperanto K-78	1	2967.62-2967.99	4g	Siderite intraclasts. Sub-horizontal dipping sets of mg to very cg sst, with siderite intraclasts. Vary in grain size. Mostly mg sst.
Esperanto K-78	1	2967.99-2968.08	4g	Slightly dipping cg sst. Siderite granules and mud fragments. Starting to become more silica rich.
Esperanto K-78	1	2968.08-2968.43	4g	Dipping siliceous cg sst with siderite clasts and replacement partings. Also irregular light grey (mud) partings.
Esperanto K-78	1	2968.43-2968.47	4g	Less siliceous thick (<1 cm) mud parting with burrows and phyto-detritus overlying cg sst
Esperanto K-78	1	2968.47-2968.51	4g	Low angle cross-bedding in cg sst picked out by mud partings.

Table B1- Lithofacies interpretation for Esperanto K-78 well

Esperanto K-78	1	2968.51-2968.55	4g	Cg sst overlying mud partings, possibly cross-bed.
Esperanto K-78	1	2968.55-2968.63	4g	Very cg slightly dipping sst. Siderite intraclasts.
Esperanto K-78	1	2968.63-2968.65	4g	Siliceous fg sst with very cg lithic granules. Top of lag.
Esperanto K-78	1	2968.65-2968.91	4g	Channel lag. Coarsening downward.
Esperanto K-78	1	2968.65-2968.73	4g	Very cg sst with siderite intraclasts (~1 cm). Mud intraclasts.
Esperanto K-78	1	2968.73-2968.79	4g	Very cg sst with fewer intraclasts.
Esperanto K-78	1	2968.79-2968.91	4g	Very cg sst with large 2-6 cm intraclasts of siderite. Siliceous texture.
Esperanto K-78	1	2968.85	4g	Thick 1 cm siderite/mud layer.
Esperanto K-78	1	2968.91-2969.77	10g	Mega unit of rather featureless mg-fg sst with mud clasts at the top. Mud clasts could be partings? Rip up clasts? Sst interjected into mg? Perhaps the top of a liquefied sst bed.
Esperanto K-78	1	2968.91-2969.02	10g	Mg sst with irregular mud clasts.
Esperanto K-78	1	2969.02-2969.77	10g	Featureless fg sst.

Note: Fg= fine grained; Mg= medium grained; ; Cg= coarse grained; Sst= sandstone; Sh=shale; Mst=mudstone; Biot=bioturbated; Lst= limestone; Slt= silt; w/=with.

Table B2: Petrography of representative samples from Esperanto K-78.

	(Fields marked with asterisk* add up to 100)																												
Well	**Depth (m)**	**Rock name**	**Grains***				*for each mineral or rock type, number of grains as a percentage of total grains*													**Matrix***		**Cement***	*list in chronological order where apparent*				**Porosity***	**NOTES**
			% of total rock	mean size µm	sorting (poor, fair, good)	roundness of quartz	mono quartz	poly quartz	feldspar	muscovite	biotite	igneous rock fragments	siliceous rock fragments	foliated rock fragments	carbonate rock fragments	fossils	other ferro-mag minerals	opaque minerals	light-coloured heavy minerals	NOTES: List noteworthy minerals and rock fragments, alteration of minerals.	% of total rock	description of material	% of total rock	cement 1: mineral, % (of total cement), form and any alteration	cement 2: mineral, % (of total cement), form and any alteration	cement 3: mineral, % (of total cement), form and any alteration	other cements	remaining porosity, % of total rock	include information on deformation and veins; cross reference to photomicrographs, BSEI, etc.
Esperanto K-78	2961.78	med. sst	80	400	P	SR	96	<1	4	<1										chert, fossils,Tur,my-Qtz	1	clay/mud	9	Kln (2)	Qtz.over (6)	Illite+chlorite (1)	Pyrite(1)	10	
Esperanto K-78	2968.46A*	crs sst	78	500	P	SR	95	1.3	1.3	1.3	1.3									my-Qtz, Chr, Rt, Tur, Sd, Ap, chert, Bt	1	mud	20	Early cal (20)	Sd (1)	Qtz.over (0.1)	Pyrite(1)	<1	
Esperanto K-78	2968.46B*	crs sst	78	400	P	SR	94	2.5	3.7	0.1										my-Qtz, Tur, Ksp, chert	1	clay/mud	20	Cal (17)	Sd (1)	Qtz.over (1)	Fe-oxide (1)	<1	
Esperanto K-78	2968.88	fine conglomerate	78	600	P	SR	93	1.2	2.5	2.5	1.2									Zrn, Rt, Tur, chert, Sd, my-Qtz	1	mud/clay	20	Cal (15)	Sd (2)	Silica (1)		<1	

Notes: 1) *= Polished thin sections of same sample; 2) med= medium; crs= coarse; my-qtz= mylonitic quartz; sst= sandstone; P= poor; SR= sub-rounded; over= overgrowth; all mineral abbreviations after Kretz 1983.

Table B3a: Electron microprobe chemical analyses of representative detrital minerals from the Esperanto K-78 well, sorted by depth.

Well-Esperanto	Depth	File #	Mineral	Symbol[3]	SiO_2	TiO_2	Al_2O_3	Cr_2O_3	FeO_t	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	NiO	SrO	BaO	V_2O_3	NiO	ZnO	Total	BSE[1] Image
Esperanto K78	2961.78	132	K-feldspar (LT)	Kfs	63.99	0.04	18.45	0.03	0.19	0.02	0.00	0.01	0.79	13.86	0.02	0.07	0.03	0.43	0.00	0.00	0.00	97.94	1
Esperanto K78	2961.78	133	K-feldspar (LT)	Kfs	64.03	0.02	18.23	0.02	0.12	0.03	0.00	0.01	0.74	14.17	0.00	0.05	0.00	0.31	0.00	0.00	0.00	97.72	1
Esperanto K78	2961.78	134	K-feldspar (LT)	Kfs	63.94	0.02	18.08	0.04	0.08	0.01	0.00	0.04	0.65	14.24	0.00	0.02	0.00	0.07	0.00	0.00	0.00	97.18	
Esperanto K78	2961.78	135	K-feldspar	Kfs	64.40	0.01	18.08	0.01	0.13	0.03	0.00	0.04	0.66	15.18	0.00	0.04	0.00	0.04	0.00	0.00	0.00	98.62	
Esperanto K78	2961.78	136	K-feldspar	Kfs	63.62	0.05	18.27	0.02	0.08	0.04	0.00	0.04	0.87	14.30	0.00	0.05	0.07	0.64	0.00	0.00	0.00	98.05	
Esperanto K78	2961.78	137	K-feldspar	Kfs	63.59	0.04	18.17	0.02	0.32	0.02	0.00	0.04	0.91	14.57	0.00	0.04	0.00	0.48	0.00	0.00	0.00	98.20	
Esperanto K78	2961.78	130	Tourmaline	Tur	34.51	0.50	34.44	0.00	10.63	0.13	2.26	0.20	1.85	0.05	0.08	0.01	0.10	0.00	0.00	0.00	0.00	84.78	1
Esperanto K78	2961.78	131	Tourmaline	Tur	34.42	0.57	34.27	0.00	10.57	0.13	2.26	0.19	1.86	0.05	0.06	0.00	0.13	0.00	0.00	0.00	0.00	84.52	1
Esperanto K78	2968.46	98	Amphibole		37.59	0.48	10.62	0.03	29.96	0.82	1.24	10.74	1.47	2.13	0.00	0.00	0.00	0.04	0.00	0.00	0.00	95.11	
Esperanto K78	2968.46	99	Amphibole		37.39	0.49	10.49	0.00	30.09	0.82	1.24	10.77	1.41	2.08	0.00	0.00	0.00	0.05	0.00	0.00	0.00	94.82	
Esperanto K78	2968.46	119	Kaolinite	Kln	42.71	0.40	31.22	0.00	10.31	0.03	1.55	0.26	0.13	0.78	0.00	0.00	0.13	0.00	0.00	0.00	0.00	87.51	
Esperanto K78	2968.46	120	Kaolinite (LT)[2]	Kln	40.68	0.02	31.23	0.00	5.85	0.00	0.90	0.17	0.07	0.35	0.00	0.00	0.16	0.00	0.00	0.00	0.00	79.42	
Esperanto K78	2968.46	84	K-Feldspar	Kfs	64.20	0.01	17.94	0.00	0.12	0.01	0.00	0.04	0.77	14.77	0.01	0.00	0.00	0.03	0.00	0.00	0.00	97.92	14
Esperanto K78	2968.46	85	K-Feldspar	Kfs	64.37	0.00	17.94	0.00	0.13	0.01	0.00	0.05	0.75	15.07	0.01	0.00	0.00	0.00	0.00	0.00	0.00	98.33	14
Esperanto K78	2968.46	88	K-feldspar (LT)	Kfs	63.27	0.03	18.53	0.01	0.07	0.01	0.00	0.11	0.91	14.19	0.42	0.01	0.00	0.01	0.00	0.00	0.00	97.56	
Esperanto K78	2968.46	89	K-feldspar	Kfs	64.09	0.03	18.51	0.01	0.07	0.03	0.00	0.04	0.87	14.59	0.19	0.02	0.00	0.07	0.00	0.00	0.00	98.52	
Esperanto K78	2968.46	92	K-feldspar	Kfs	63.76	0.11	18.42	0.00	0.08	0.03	0.00	0.02	0.63	14.74	0.01	0.05	0.00	1.10	0.00	0.00	0.00	98.94	
Esperanto K78	2968.46	93	K-feldspar	Kfs	63.73	0.12	18.51	0.01	0.08	0.04	0.00	0.01	0.48	14.67	0.00	0.01	0.00	1.26	0.00	0.00	0.00	98.92	
Esperanto K78	2968.46	113	K-feldspar (LT)	Kfs	64.07	0.00	18.12	0.00	0.02	0.00	0.00	0.02	1.05	13.84	0.00	0.00	0.00	0.07	0.00	0.00	0.00	97.19	
Esperanto K78	2968.46	114	K-feldspar (LT)	Kfs	63.83	0.00	17.99	0.00	0.03	0.00	0.00	0.03	0.70	14.36	0.01	0.00	0.00	0.22	0.00	0.00	0.00	97.16	
Esperanto K78	2968.46	115	K-feldspar (LT)	Kfs	62.68	0.00	17.98	0.00	0.03	0.00	0.00	0.04	0.61	15.05	0.00	0.00	0.00	0.40	0.00	0.00	0.00	96.79	
Esperanto K78	2968.46	116	K-feldspar (LT)	Kfs	62.14	0.00	17.91	0.00	1.41	0.00	0.00	0.05	0.35	14.06	0.02	0.00	0.00	0.51	0.00	0.00	0.00	96.45	
Esperanto K78	2968.46	117	K-feldspar (LT)	Kfs	63.36	0.00	18.05	0.00	0.00	0.00	0.00	0.02	0.63	15.04	0.00	0.00	0.00	0.26	0.00	0.00	0.00	97.37	
Esperanto K78	2968.46	118	K-feldspar (LT)	Kfs	63.22	0.00	18.07	0.00	0.00	0.00	0.00	0.01	0.61	14.53	0.00	0.00	0.00	0.24	0.00	0.00	0.00	96.67	
Esperanto K78	2968.46	81	Quartz	Qtz	92.27	0.02	2.16	0.00	2.20	0.03	0.89	0.07	0.00	0.19	0.03	0.01	0.52	0.04	0.00	0.00	0.00	98.43	4
Esperanto K78	2968.46	82	Quartz	Qtz	95.87	0.00	0.50	0.00	0.21	0.00	0.00	0.04	0.01	0.04	0.01	0.00	0.57	0.00	0.00	0.00	0.00	97.25	5
Esperanto K78	2968.46	83	Chlorite (LT)	Chl	21.42	0.06	18.43	0.08	27.77	0.05	4.53	0.48	0.03	0.13	0.05	0.03	0.00	0.10	0.00	0.00	0.00	73.15	6
Esperanto K78	2968.46	127	Chlorite	Chl	29.25	0.00	18.26	0.02	18.54	0.27	16.82	0.20	0.12	0.12	0.00	0.04	0.02	0.03	0.00	0.00	0.00	83.69	
Esperanto K78	2968.46	128	Chlorite	Chl	28.33	0.01	17.33	0.00	18.81	0.30	16.63	0.24	0.18	0.12	0.00	0.06	0.02	0.05	0.00	0.00	0.00	82.07	
Esperanto K78	2968.46	129	Chlorite	Chl	28.15	0.00	17.62	0.00	19.05	0.27	16.76	0.23	0.18	0.07	0.02	0.02	0.10	0.01	0.00	0.00	0.00	82.50	
Esperanto K78	2968.46	112	Biotite	Bt	33.15	3.52	19.72	0.02	22.22	0.25	5.52	0.15	0.13	7.91	0.01	0.03	0.00	0.05	0.00	0.00	0.00	92.67	
Esperanto K78	2968.46	123	Bt alt to Chl	Bt/chl	30.88	1.41	18.90	0.11	26.83	0.14	4.43	0.25	0.21	3.08	0.01	0.08	0.00	0.17	0.00	0.00	0.00	86.50	
Esperanto K78	2968.46	124	Bt alt to Chl	Bt/chl	31.69	1.44	19.16	0.09	27.59	0.12	4.64	0.25	0.29	3.26	0.00	0.08	0.02	0.16	0.00	0.00	0.00	88.80	
Esperanto K78	2968.46	86	Hydro-muscovite		45.63	0.27	34.94	0.00	1.06	0.02	0.38	0.02	0.24	7.84	0.04	0.00	0.00	0.00	0.00	0.00	0.00	90.45	
Esperanto K78	2968.46	87	Hydro-muscovite		45.85	0.12	34.84	0.00	1.15	0.02	0.43	0.01	0.22	7.38	0.00	0.00	0.00	0.04	0.00	0.00	0.00	90.08	
Esperanto K78	2968.46	90	Hydro-muscovite		45.04	0.89	33.85	0.00	1.13	0.02	0.60	0.10	0.63	7.55	0.03	0.00	0.00	0.18	0.00	0.00	0.00	90.02	14
Esperanto K78	2968.46	91	Hydro-muscovite		45.19	0.88	33.94	0.01	1.07	0.04	0.65	0.12	0.65	7.80	0.06	0.01	0.00	0.23	0.00	0.00	0.00	90.64	14

Table B3a: Electron microprobe chemical analyses of representative detrital minerals from the Esperanto K-78 well, sorted by depth.

Well-Esperanto	Depth	File #	Mineral	Symbol[3]	SiO_2	TiO_2	Al_2O_3	Cr_2O_3	FeO_t	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	NiO	SrO	BaO	V_2O_3	NiO	ZnO	Total	BSE[1] Image
Esperanto K78	2968.46	125	Hydro-muscovite		45.96	0.25	36.12	0.00	0.89	0.02	0.39	0.08	1.33	7.78	0.00	0.00	0.00	0.05	0.00	0.00	0.00	92.88	
Esperanto K78	2968.46	126	Hydro-muscovite		46.40	0.28	35.59	0.00	0.90	0.01	0.42	0.07	1.18	7.44	0.00	0.02	0.00	0.14	0.00	0.00	0.00	92.44	
Esperanto K78	2968.46	80	Hydro-muscovite		50.74	0.03	29.69	0.03	1.73	0.03	2.34	0.16	0.20	5.84	0.03	0.00	0.00	0.20	0.00	0.00	0.00	91.04	4
Esperanto K78	2968.46	94	Apatite	Ap	0.90	0.00	0.03	0.00	0.09	0.05	0.00	55.50	0.02	0.06	37.76	0.00	0.00	0.00	0.00	0.00	0.00	94.40	
Esperanto K78	2968.46	95	Apatite	Ap	1.06	0.00	0.02	0.00	0.14	0.07	0.00	54.82	0.02	0.05	38.44	0.00	0.00	0.00	0.00	0.00	0.00	94.62	
Esperanto K78	2968.46	96	Apatite	Ap	0.11	0.00	0.00	0.00	0.03	0.11	0.00	56.32	0.06	0.01	39.13	0.00	0.00	0.00	0.00	0.00	0.00	95.76	
Esperanto K78	2968.46	97	Apatite	Ap	0.10	0.00	0.01	0.00	0.04	0.09	0.00	56.96	0.03	0.02	39.57	0.00	0.00	0.00	0.00	0.00	0.00	96.82	
Esperanto K78	2968.46	121	Apatite	Ap	0.27	0.01	0.00	0.09	0.16	0.09	0.00	57.88	0.06	0.04	38.84	0.11	0.08	0.04	0.00	0.00	0.00	97.67	
Esperanto K78	2968.46	122	Apatite	Ap	0.31	0.03	0.01	0.10	0.57	0.11	0.00	58.05	0.06	0.05	38.68	0.10	0.07	0.06	0.00	0.00	0.00	98.21	
Esperanto K78	2968.46	138	Chromite	Chr	0.00	0.01	13.57	54.41	17.99	0.43	11.15	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0.04	0.16	98.28	
Esperanto K78	2968.46	139	Chromite	Chr	0.00	0.00	13.42	54.00	18.10	0.55	11.02	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.02	0.15	97.65	

Notes: 1= The numbers in this column refer to appendix 1; LT[2] =low total; 3= mineral symbols after Kretz1983.

Table B3b: Electron Microprobe chemical analyses of representative detrital minerals from the Esperanto K-78 well, sorted by mineral.

Well-Esperanto	Depth	File #	Mineral	Symbol[3]	SiO_2	TiO_2	Al_2O_3	Cr_2O_3	FeO_t	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	NiO	SrO	BaO	V_2O_3	NiO	ZnO	Total	BSE[1] Image
Esperanto K78	2968.46	98	Amphibole		37.59	0.48	10.62	0.03	29.96	0.82	1.24	10.74	1.47	2.13	0.00	0.00	0.00	0.04	0.00	0.00	0.00	95.11	
Esperanto K78	2968.46	99	Amphibole		37.39	0.49	10.49	0.00	30.09	0.82	1.24	10.77	1.41	2.08	0.00	0.00	0.00	0.05	0.00	0.00	0.00	94.82	
Esperanto K78	2968.46	94	Apatite	Ap	0.90	0.00	0.03	0.00	0.09	0.05	0.00	55.50	0.02	0.06	37.76	0.00	0.00	0.00	0.00	0.00	0.00	94.40	
Esperanto K78	2968.46	95	Apatite	Ap	1.06	0.00	0.02	0.00	0.14	0.07	0.00	54.82	0.02	0.05	38.44	0.00	0.00	0.00	0.00	0.00	0.00	94.62	
Esperanto K78	2968.46	96	Apatite	Ap	0.11	0.00	0.00	0.00	0.03	0.11	0.00	56.32	0.06	0.01	39.13	0.00	0.00	0.00	0.00	0.00	0.00	95.76	
Esperanto K78	2968.46	97	Apatite	Ap	0.10	0.00	0.01	0.00	0.04	0.09	0.00	56.96	0.03	0.02	39.57	0.00	0.00	0.00	0.00	0.00	0.00	96.82	
Esperanto K78	2968.46	121	Apatite	Ap	0.27	0.01	0.00	0.09	0.16	0.09	0.00	57.88	0.06	0.04	38.84	0.11	0.08	0.04	0.00	0.00	0.00	97.67	
Esperanto K78	2968.46	122	Apatite	Ap	0.31	0.03	0.01	0.10	0.57	0.11	0.00	58.05	0.06	0.05	38.68	0.10	0.07	0.06	0.00	0.00	0.00	98.21	
Esperanto K78	2968.46	112	Biotite	Bt	33.15	3.52	19.72	0.02	22.22	0.25	5.52	0.15	0.13	7.91	0.01	0.03	0.00	0.05	0.00	0.00	0.00	92.67	
Esperanto K78	2968.46	123	Bt alt to Chl	Bt/chl	30.88	1.41	18.90	0.11	26.83	0.14	4.43	0.25	0.21	3.08	0.01	0.08	0.00	0.17	0.00	0.00	0.00	86.50	
Esperanto K78	2968.46	124	Bt alt to Chl	Bt/chl	31.69	1.44	19.16	0.09	27.59	0.12	4.64	0.25	0.29	3.26	0.00	0.08	0.02	0.16	0.00	0.00	0.00	88.80	
Esperanto K78	2968.46	83	Chlorite (LT)	Chl	21.42	0.06	18.43	0.08	27.77	0.05	4.53	0.48	0.03	0.13	0.05	0.03	0.00	0.10	0.00	0.00	0.00	73.15	6
Esperanto K78	2968.46	127	Chlorite	Chl	29.25	0.00	18.26	0.02	18.54	0.27	16.82	0.20	0.12	0.12	0.00	0.04	0.02	0.03	0.00	0.00	0.00	83.69	
Esperanto K78	2968.46	128	Chlorite	Chl	28.33	0.01	17.33	0.00	18.81	0.30	16.63	0.24	0.18	0.12	0.00	0.06	0.02	0.05	0.00	0.00	0.00	82.07	
Esperanto K78	2968.46	129	Chlorite	Chl	28.15	0.00	17.62	0.00	19.05	0.27	16.76	0.23	0.18	0.07	0.02	0.02	0.10	0.01	0.00	0.00	0.00	82.50	
Esperanto K78	2968.46	138	Chromite	Chr	0.00	0.01	13.57	54.41	17.99	0.43	11.15	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0.04	0.16	98.28	
Esperanto K78	2968.46	139	Chromite	Chr	0.00	0.00	13.42	54.00	18.10	0.55	11.02	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.02	0.15	97.65	
Esperanto K78	2968.46	86	Hydro-muscovite		45.63	0.27	34.94	0.00	1.06	0.02	0.38	0.02	0.24	7.84	0.04	0.00	0.00	0.00	0.00	0.00	0.00	90.45	
Esperanto K78	2968.46	87	Hydro-muscovite		45.85	0.12	34.84	0.00	1.15	0.02	0.43	0.01	0.22	7.38	0.00	0.00	0.00	0.04	0.00	0.00	0.00	90.08	
Esperanto K78	2968.46	90	Hydro-muscovite		45.04	0.89	33.85	0.00	1.13	0.02	0.60	0.10	0.63	7.55	0.03	0.00	0.00	0.18	0.00	0.00	0.00	90.02	14
Esperanto K78	2968.46	91	Hydro-muscovite		45.19	0.88	33.94	0.01	1.07	0.04	0.65	0.12	0.65	7.80	0.06	0.01	0.00	0.23	0.00	0.00	0.00	90.64	14
Esperanto K78	2968.46	125	Hydro-muscovite		45.96	0.25	36.12	0.00	0.89	0.02	0.39	0.08	1.33	7.78	0.00	0.00	0.00	0.05	0.00	0.00	0.00	92.88	
Esperanto K78	2968.46	126	Hydro-muscovite		46.40	0.28	35.59	0.00	0.90	0.01	0.42	0.07	1.18	7.44	0.00	0.02	0.00	0.14	0.00	0.00	0.00	92.44	
Esperanto K78	2968.46	80	Hydro-muscovite		50.74	0.03	29.69	0.03	1.73	0.03	2.34	0.16	0.20	5.84	0.03	0.00	0.00	0.20	0.00	0.00	0.00	91.04	4
Esperanto K78	2968.46	119	Kaolinite	Kln	42.71	0.40	31.22	0.00	10.31	0.03	1.55	0.26	0.13	0.78	0.00	0.00	0.13	0.00	0.00	0.00	0.00	87.51	
Esperanto K78	2968.46	120	Kaolinite (LT)[2]	Kln	40.68	0.02	31.23	0.00	5.85	0.00	0.90	0.17	0.07	0.35	0.00	0.00	0.16	0.00	0.00	0.00	0.00	79.42	
Esperanto K78	2961.78	132	K-feldspar	Kfs	63.99	0.04	18.45	0.03	0.19	0.02	0.00	0.01	0.79	13.86	0.02	0.07	0.03	0.43	0.00	0.00	0.00	97.94	1
Esperanto K78	2961.78	133	K-feldspar (LT)	Kfs	64.03	0.02	18.23	0.02	0.12	0.03	0.00	0.01	0.74	14.17	0.00	0.05	0.00	0.31	0.00	0.00	0.00	97.72	1
Esperanto K78	2961.78	134	K-feldspar (LT)	Kfs	63.94	0.02	18.08	0.04	0.08	0.01	0.00	0.04	0.65	14.24	0.00	0.02	0.00	0.07	0.00	0.00	0.00	97.18	
Esperanto K78	2961.78	135	K-feldspar	Kfs	64.40	0.01	18.08	0.01	0.13	0.03	0.00	0.04	0.66	15.18	0.00	0.04	0.00	0.04	0.00	0.00	0.00	98.62	
Esperanto K78	2961.78	136	K-feldspar	Kfs	63.62	0.05	18.27	0.02	0.08	0.04	0.00	0.04	0.87	14.30	0.00	0.05	0.07	0.64	0.00	0.00	0.00	98.05	
Esperanto K78	2961.78	137	K-feldspar	Kfs	63.59	0.04	18.17	0.02	0.32	0.02	0.00	0.04	0.91	14.57	0.00	0.04	0.00	0.48	0.00	0.00	0.00	98.20	
Esperanto K78	2968.46	84	K-feldspar (LT)	Kfs	64.20	0.01	17.94	0.00	0.12	0.01	0.00	0.04	0.77	14.77	0.01	0.00	0.00	0.03	0.00	0.00	0.00	97.92	14
Esperanto K78	2968.46	85	K-Feldspar	Kfs	64.37	0.00	17.94	0.00	0.13	0.01	0.00	0.05	0.75	15.07	0.01	0.00	0.00	0.00	0.00	0.00	0.00	98.33	14
Esperanto K78	2968.46	88	K-feldspar (LT)	Kfs	63.27	0.03	18.53	0.01	0.07	0.01	0.00	0.11	0.91	14.19	0.42	0.01	0.00	0.01	0.00	0.00	0.00	97.56	
Esperanto K78	2968.46	89	K-feldspar	Kfs	64.09	0.03	18.51	0.01	0.07	0.03	0.00	0.04	0.87	14.59	0.19	0.02	0.00	0.07	0.00	0.00	0.00	98.52	

Table B3b: Electron Microprobe chemical analyses of representative detrital minerals from the Esperanto K-78 well, sorted by mineral.

Well-Esperanto	Depth	File #	Mineral	Symbol[3]	SiO_2	TiO_2	Al_2O_3	Cr_2O_3	FeO_t	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	NiO	SrO	BaO	V_2O_3	NiO	ZnO	Total	BSE[1] Image
Esperanto K78	2968.46	92	K-feldspar	Kfs	63.76	0.11	18.42	0.00	0.08	0.03	0.00	0.02	0.63	14.74	0.01	0.05	0.00	1.10	0.00	0.00	0.00	98.94	
Esperanto K78	2968.46	93	K-feldspar	Kfs	63.73	0.12	18.51	0.01	0.08	0.04	0.00	0.01	0.48	14.67	0.00	0.01	0.00	1.26	0.00	0.00	0.00	98.92	
Esperanto K78	2968.46	113	K-feldspar (LT)	Kfs	64.07	0.00	18.12	0.00	0.02	0.00	0.00	0.02	1.05	13.84	0.00	0.00	0.00	0.07	0.00	0.00	0.00	97.19	
Esperanto K78	2968.46	114	K-feldspar (LT)	Kfs	63.83	0.00	17.99	0.00	0.03	0.00	0.00	0.03	0.70	14.36	0.01	0.00	0.00	0.22	0.00	0.00	0.00	97.16	
Esperanto K78	2968.46	115	K-feldspar (LT)	Kfs	62.68	0.00	17.98	0.00	0.03	0.00	0.00	0.04	0.61	15.05	0.00	0.00	0.00	0.40	0.00	0.00	0.00	96.79	
Esperanto K78	2968.46	116	K-feldspar (LT)	Kfs	62.14	0.00	17.91	0.00	1.41	0.00	0.00	0.05	0.35	14.06	0.02	0.00	0.00	0.51	0.00	0.00	0.00	96.45	
Esperanto K78	2968.46	117	K-feldspar (LT)	Kfs	63.36	0.00	18.05	0.00	0.00	0.00	0.00	0.02	0.63	15.04	0.00	0.00	0.00	0.26	0.00	0.00	0.00	97.37	
Esperanto K78	2968.46	118	K-feldspar (LT)	Kfs	63.22	0.00	18.07	0.00	0.00	0.00	0.00	0.01	0.61	14.53	0.00	0.00	0.00	0.24	0.00	0.00	0.00	96.67	
Esperanto K78	2968.46	81	Quartz	Qtz	92.27	0.02	2.16	0.00	2.20	0.03	0.89	0.07	0.00	0.19	0.03	0.01	0.52	0.04	0.00	0.00	0.00	98.43	4
Esperanto K78	2968.46	82	Quartz	Qtz	95.87	0.00	0.50	0.00	0.21	0.00	0.00	0.04	0.01	0.04	0.01	0.00	0.57	0.00	0.00	0.00	0.00	97.25	5
Esperanto K78	2961.78	130	Tourmaline	Tur	34.51	0.50	34.44	0.00	10.63	0.13	2.26	0.20	1.85	0.05	0.08	0.01	0.10	0.00	0.00	0.00	0.00	84.78	1
Esperanto K78	2961.78	131	Tourmaline	Tur	34.42	0.57	34.27	0.00	10.57	0.13	2.26	0.19	1.86	0.05	0.06	0.00	0.13	0.00	0.00	0.00	0.00	84.52	1

Notes: 1= The numbers in this column refer to appendix 1; LT[2] =low total; 3= Mineral symbols after Kretz 1983.

Table B4. Summary of electron microprobe analyses, Esperanto K-78

Petrographic notes on the samples with electron microprobe mineral analyses (Table 2a, 2b) from Esperanto K-78. All percentages are as percent of total sample unless stated otherwise.

2961.78
The sample contains 3% K-feldspar, 2% of the sample is microcline and perthite. One grain each of muscovite and tourmaline (analyses 130-131) and two zircon grains were located. No other heavy minerals were found.

2968.46
The sample contains 2% feldspar. Two rare apatite (analyses 94-97), and 0.1% muscovite was found. No other heavy minerals were located.

2968.46A
The sample contains 1% feldspar. One grain each of apatite (analyses 121, 122), tourmaline (analyses 112), chromite (analyses 138, 139), muscovite and biotite were located in the sample. No other heavy minerals were located.

Table B5: Detrital and Neomorphic Mineral Assemblages with depth in the Esperanto K-78 well.

Depth (m)	Formation	Mean size (μm)	Sorting (poor, fair, good)	Detrital Minerals	Neomorphic Minerals	Lithic clasts
2961.78	Missisauga	400	P	Mylonitized quartz, K-feldspar, Tourmaline, Muscovite, Plagioclase	Quartz overgrowths, Siderite, Kaolinite, Pyrite, Coated grains	Chert, Polycrystalline quartz, Microgranite, Mudstone, Rhyolite*
2968.46	Missisauga	500	P	Mylonitized quartz, Apatite, Tourmaline, Biotite, Bornite?, Chromite, K-feldspar, Amphibole, Muscovite, Plagioclase, Rutile	Quartz Overgrowths, Calcite, Rutile, Pyrite, Siderite, Fe-Oxides, Kaolinite, Chlorite, Hydromuscovite	Chert, Mudstone, Microgranite*, Polycrystalline quartz
2968.88	Missisauga	600	P	Mylonitized quartz, Rutile, Zircon, Tourmaline	Quartz Overgrowths, Calcite, Rutile, Silica, Siderite	Mudstone, Rhyolite*, Microgranite, Polycrystalline quartz, Intrusive Rhyolite (Porphyry), Chert

Note: * indicates Lithic clast that is most abundant in thin section.

Table C1: Lithofacies interpretation for the Hesper I-52 well.

Well	Core #	Depth (m)	Facies	Condensed notes from logger:
Hesper I-52	1	2750.82-2751.89	0m	Mega unit of rubbly mst or sh. Sparse graded slt to mud layers. Not preserved enough to get a lot of info. Occasional slt lenses.
Hesper I-52	1	2751.32-2751.35	0m	Erosive contact of shale over wave rippled fg sst and slt laminations. Also some mud laminations present. Cross-lamination.
Hesper I-52	1	2751.89-2753.02	0m	Mega unit of slt, mg sst to fg sst, interbedded w/sh. Moderate biot in some areas. Some laminations still preserved. Some sharp based mud to slt beds. Erosional contacts in some places.
Hesper I-52	1	2751.89-2151.96	0m/0b	Short interval of mg sst and slt with a few mud layers.
Hesper I-52	1	2751.96-2152.14	0b	Fg sst to slt interbedded with muds. Some moderate biot. Noticeable burrows in laminae.
Hesper I-52	1	2752.14-2753.02	0b	Mostly mud with less fg sst. Sparse biot.
Hesper I-52	1	2752.30-2752.46	0b/0m	Moderate biot.
Hesper I-52	1	2752.70	0m	Erosional contact, slty mud over mud with slt laminations. Sparsely biot near the top of the slty mud
Hesper I-52	1	2052.79	0m	Horizontal slt laminations overlying slightly dipping slt lense.
Hesper I-52	1	2753.02-2753.52	0m/3x	Mega unit of highly (intense) biot fg sst and mud. Abundant bioclasts. Shell fragments are large (cm), possibly oysters. Some siderite concretions and cementation. Sst and mst is not cemented by carbonate.
Hesper I-52	1	2753.09	3x	First large shell fragment. Gradually becoming more sideritic.
Hesper I-52	1	2753.14	3x	Abundant large shells.
Hesper I-52	1	2753.40	3x	Starts becoming less sideritic, less abundant shells.
Hesper I-52	1	2753.52-2753.93	2b	Mega unit of sparse to intensely biot fg to mg sst interbedded with mud and slts. More sst than mst (due to biot?). Some red to purple (sideritic?) intervals.
Hesper I-52	1	2753.52	2b	Mostly mud, sparse biot.
Hesper I-52	1	2753.56-2753.93	2b	Becomes increasingly biot leaving mostly disturbed fg sst with mud mixed in. Becomes sideritic at the bottom. Same siderite concretions or possible intraclasts.
Hesper I-52	1	2753.93-2754.04	2b	Mega unit of predominantly mud (sh) with horizontal slt lenses and laminations. Sparse biot.
Hesper I-52	1	2754.04	2b	Intensely biot. Mostly fg sst.
Hesper I-52	1	2754.04-2754.31	2b	Mega unit of highly biot fg sst and muds with abundant coaly wood fragments at the base. Sparse bioclasts.
Hesper I-52	1	2754.15	2b	Begin to see wood clasts. Moderate biot. Sparse bioclasts.
Hesper I-52	1	2754.31-2754.98	2b/2o	Mega unit of fg-mg sst. Sparse biot. Sparse mud. Bioclasts in some intervals. Bedding is horizontal- slightly dipping. One interval has cross bedding and erosional contacts. Occasional siderite clasts or concretions. Mud lined burrows.
Hesper I-52	1	2754.31	2o	Contact between these lamination units is irregular and not sharp.
Hesper I-52	1	2754.30- 2754.76	2o	Massive mg sst w/ occasional large mud-lined burrows.
Hesper I-52	1	2754.76-2757.00	2o	Sub-horizontal (low-angle) mg sst with occasional mud lined burrow and sparse mud intraclasts. Occasional sparse bioclast intervals.
Hesper I-52	1	2756.28-2756.32	2o	Sparse bioclast interval.
Hesper I-52	1	2756.48-2756.81	2o	Sparse bioclast interval.
Hesper I-52	1	2756.81- 2757.00	2o	Mg-cg sst, sub-horizontal bedding. Layers of concentrated bioclasts. Sparse siderite intraclasts. Some cg lithic granules.
Hesper I-52	1	2757.00-2757.05	2o/9g	Fg sst w/ cross-laminated sets. Each having erosional base.

Table C1: Lithofacies interpretation for the Hesper I-52 well.

Hesper I-52	1	2757.05- 2757.19	9g	Horizontal fg sst and mud laminations. Sparse biot. Sparse bioclast near base.
Hesper I-52	1	2757.19-2757.30	9g	Massive mg sst.
Hesper I-52	1	2757.25-2757.26	9g	1 cm fg sst and slty mud laminations.
Hesper I-52	1	2757.28-2757.29	9g	1 cm fg sst and slty mud laminations.
Hesper I-52	1	2757.30-2757.70	9g	Fg sst w/ a carbonate cement. Massive sparse biot.
Hesper I-52	1	2757.37	9g	Sub-horizontal calcareous fg sst. Sparse mud laminations, siderite.
Hesper I-52	1	2757.67-2757.68	9g	1 cm fg sst and slt laminations. Not calcareous shell fragments overlying this.
Hesper I-52	1	2757.70	9g	Siderite clast at very bottom.
Note: Fg= fine grained; Mg= medium grained; ; Cg= coarse grained; Sst= sandstone; Sh=shale; Mst=mudstone; Biot=bioturbated; Lst= limestone; Slt= silt; w/=with.				

Table C2: Petrography of representative samples from the Hester I-52 well.

	(Fields marked with asterisk* add up to 100)																												
Well	**Depth (m)**	**Rock name**	**Grains***				*for each mineral or rock type, number of grains as a percentage of total grains*													**Matrix***		**Cement***	*list in chronological order where apparent*				**Porosity***	**NOTES**
			% of total rock	mean size μm	sorting (poor, fair, good)	roundness of quartz	mono quartz	poly quartz	feldspar	muscovite	biotite	igneous rock fragments	siliceous rock fragments	foliated rock fragments	carbonate rock fragments	fossils	other ferro-mag minerals	opaque minerals	light-coloured heavy minerals	NOTES: List noteworthy minerals and rock fragments, alteration of minerals.	% of total rock	description of material	% of total rock	cement 1: mineral, % (of total cement), form and any alteration	cement 2: mineral, % (of total cement), form and any alteration	cement 3: mineral, % (of total cement), form and any alteration	other cements	remaining porosity, % of total rock	include information on deformation and veins; cross reference to photomicrographs, BSEI, etc.
Hesper I-52	2754.93	med. sst	83	300	P	SA	98		2.3											Glt,my-Qtz,chert	3	mud/clay	4	Kln (1)	Qtz.over (3)			10	
Hesper I-52	2756.63	med. sst	85	200	P	SR	99		1							<1				Zrn, Glt, Chr(?)	2	silt/clay	3	Kln (<1)	Qtz.over (2)			10	fossils or wood fragments
Hesper I-52	2757.19	fine sst	88	100	F	SR	93		1.1	5.5	<1	<1	<1							Ksp, Pl, Zrn, Rt, Chr, chert	4	silt/mud	5	Kln (1)	Qtz.over (4)			3	
Hesper I-52	2757.58	med. sst	70	260	F-G	SA	90	3.6	6	<1										Ksp, Pl, my-Qtz	1	silt	20	Cal (15)	silica (5)			9	zone of higher porosity on one side - 15 - 20% vs 5 - 9%

Notes: med= medium; crs= coarse; my-qtz= mylonitic quartz; sst= sandstone; P= poor; F= fair, G=good; SA= sub-angular; SR= sub-rounded; over= overgrowth; all mineral abbreviations after Kretz 1983.

Table C3: Detrital and Neomorphic minerals in samples from the Hesper I-52 well.

Depth (m)	Formation	Mean size (µm)	Sorting (poor, fair, good)	Detrital Minerals	Neomorphic Minerals	Lithic clasts
2754.93	Missisauga	300	P	Mylonitized Quartz, Biotite, Microcline, Albite, Zircon, Apatite, Muscovite, K-feldspar, Plagioclase	Quartz overgrowths, Kaolinite, Siderite, Rutile, Barite (or contaminant), Glauconite, Pyrite, Hematite, Chlorite	Chert, Microgranite, Rhyolite*, Mudstone
2756.63	Missisauga	200	P	Zircon, Chromite?, Plagioclase, Titanite, Muscovite, Albite, Apatite, K-feldspar, Biotite, Xenotime, Monazite	Quartz overgrowths, Kaolinite, Siderite, Albite, Barite (or contaminant), Glauconite, Chert, Pyrite, Chlorite, Rutile	Intrusive Rhyolite, Carbonate bioclast?, Rhyolite, Microgranite, Polycrystalline quartz*
2757.19	Missisauga	100	F	K-Feldspar, Plagioclase, Zircon, Tourmaline, Mica, Albite, Monazite, Spinel, Chromite, Muscovite	Quartz overgrowths, Kaolinite, Rutile, Albite, Chlorite, Pyrite	Microgranite*, Intrusive rhyolite, Schist, Chert
2757.58	Missisauga	260	F-G	K-Feldspar, Plagioclase, Mylonitized quartz, Zircon, Albite, Spinel, Muscovite, Biotite, Apatite	Calcite, Chlorite, Rutile, Kaolinite, Silica, Siderite	Rhyolite*, Microgranite, Schist

Note: * indicates lithic clast that is most abundant in thin section.

Table D1: Lithofacies interpretation from the South Griffin J-13 well.

Well	Core #	Depth (m)	Facies	Condensed notes from logger:
South Griffin J-13	1	4138.25-4141.25		Strong silica cemented fg-cg sst. Mostly fg but some cg deposits. Almost looks like lst. Irregular mud layers which have a vein-like structure. Occasional biot in places. Some vertical infilled cracks (possibly calcite). The cg sst laminae are horizontal. Occasional mud partings. Some occasional mud clasts.
South Griffin J-13	1	4138.25	4o	Same thin <1 mm mud partings (vein- like) at the top.
South Griffin J-13	1	4138.36	4o	2 mm thick mud parting although discontinuous through burrow on bottom of broken core
South Griffin J-13	1	4138.40	4o	6 cm vertical crack. Not infilled.
South Griffin J-13	1	4138.47	4o	Vertical burrow (2 cm).
South Griffin J-13	1	4138.58	4o	4-5 mm mud parting with vein structures, or bird's foot structures.
South Griffin J-13	1	4138.58-4138.71	4o	Moderately biot.
South Griffin J-13	1	4138.71	4o	Mud clast.
South Griffin J-13	1	4138.77	4o	5-6 mm thick mud parting. Same vein structure.
South Griffin J-13	1	4138.86	4o	2 cm wide burrow on horizontal plane.
South Griffin J-13	1	4138.90	4o	Diagonal burrow.
South Griffin J-13	1	4139.05	4o	5 cm vertical crack.
South Griffin J-13	1	4139.27-4139.48	4o	3 cracks (maybe 2 if they connect). Each are 6-8 cm long and infilled with a yellow/white substance. Calcite?
South Griffin J-13	1	4139.48	4o	Irregular mud parting at top. 1-2 mm thick.
South Griffin J-13	1	4139.63-4139.67	4o	4 cm thick horizontal deposit of cg sst (qtz). Possible lithic fragments. Some visible pore space.
South Griffin J-13	1	4139.89	4o	Thin (1 mm) mud partings. Minor biot.
South Griffin J-13	1	4139.99	4o	Good 1-2 cm burrow.
South Griffin J-13	1	4140.09	4o	A few good burrows.
South Griffin J-13	1	4140.31	4o	0.75 cm mud parting (thick). W/ thinner mud laminations surrounding it. Minor burrows through muds
South Griffin J-13	1	4140.37	4o	Large 2 cm wide burrow track.
South Griffin J-13	1	4140.43-4140.56	4o	Moderate biot.
South Griffin J-13	1	4140.56	4o	1-2 mm mud parting.
South Griffin J-13	1	4140.61	4o	Some mg sst deposits (horizontal).
South Griffin J-13	1	4140.64	4o	Mud and biot at top.
South Griffin J-13	1	4140.67	4o	4 cm long lense which has been cemented differently or not.
South Griffin J-13	1	4140.70-4140.72	4o	2 cm of cg sst (qtz grains).
South Griffin J-13	1	4140.73	4o	Thin (<1 mm) mud parting. Minor biot.
South Griffin J-13	1	4140.91	4o	0.5 mm horizontal cg sst deposit (laminations).
South Griffin J-13	1	4141.05	4o	Some siderite.
South Griffin J-13	1	4141.13-4141.20	4o	Some scattered mg-cg fragments.
South Griffin J-13	1	4141.19	4o	Thin (<1 mm) mud parting. Minor biot.
South Griffin J-13	1	4141.21	4o	Burrow.
South Griffin J-13	1	4141.24	4o	Thin (<1 mm) mud parting.
Note: Fg= fine grained; Mg= medium grained; ; Cg= coarse grained; Sst= sandstone; Sh=shale; Mst=mudstone; Biot=bioturbated; Lst= limestone; Slt= silt; w/=with.				

Table D2: Petrography of representative samples from the South Griffin J-13 well.

	(Fields marked with asterisk* add up to 100)																												
Well	**Depth (m)**	**Rock name**	**Grains***				*for each mineral or rock type, number of grains as a percentage of total grains*														**Matrix***		**Cement***	*list in chronological order where apparent*				**Porosity***	**NOTES**
			% of total rock	mean size µm	sorting (poor, fair, good)	roundness of quartz	mono quartz	poly quartz	feldspar	muscovite	biotite	igneous rock fragments	siliceous rock fragments	foliated rock fragments	carbonate rock fragments	fossils	other ferro-mag minerals	opaque minerals	light-coloured heavy minerals	NOTES: List noteworthy minerals and rock fragments, alteration of minerals.	% of total rock	description of material	% of total rock	cement 1: mineral, % (of total cement), form and any alteration	cement 2: mineral, % (of total cement), form and any alteration	cement 3: mineral, % (of total cement), form and any alteration	other cements	remaining porosity, % of total rock	include information on deformation and veins; cross reference to photomicrographs, BSEI, etc.
South Griffin J-13	4139.40	fine sst	75	200	P	SR	94	<1	2.5	3.5										Zrn, Chr, Tur, Rt, And, my-Qtz, Mnz	10	clay/mud	12	Py (1)	Ilt+ chl (3)	Qtz over. (5)	Silica (3)	5	range of Qtz grain size: ~100 - 1200 µm; and larger ones are grouped linearly
South Griffin J-13	4139.65	crs sst (?)	85	1000	P	SA	98	<1	1	1										Zrn, Aln, Tur, my-Qtz	3	clay/mud	16.1	Kln (0.1), Py (1)	Qtz over (10)	Silica (5)	Cal (1)	1	secondary porosity (?)
South Griffin J-13	4140.57	med sst	80	300	P	SA	94	1	4	1										Zrn, Rt, Chr, Aln, Tur?, my-Qtz	3	clay/mud	15.1	Kln (0.1), Py (0.1)	Ilt+ chl (3)	Qtz over (7)	Silica	5	
South Griffin J-13	4140.70A	med sst	80	500	P	SR	95	<1	4	1										Zrn, Glt, Tur, Ttn, my-Qtz	1	clay/mud	18	Py (3)	Kln (3)	Qtz over (7)	Silica (5)	4	check all slides from this well to see if main constituent is perthitic Ksp or a type of fractured Qtz
South Griffin J-13	4140.70B	med sst	80	600	P	SA	95	<1	4	1										Rt, Zrn, Ap, Tur, Ttn, chert, my-Qtz	2	clay/mud	16	Kln (3), Py (3)	Ilt+ chl (1)	Qtz over (7)	Silica (5)	5	

Notes: med= medium; crs= coarse; my-qtz= mylonitic quartz; sst= sandstone; P= poor; over= overgrowth; SA= sub-angular; SR= sub-rounded; all mineral abbreviations after Kretz 1983.

Table D3: Detrital and Neomorphic minerals in samples from the South Griffin J-13 well.

Depth (m)	Formation	Mean size µm	Sorting (poor, fair, good)	Detrital Minerals	Neomorphic Minerals	Lithic Clasts
4139.40	Missisauga	200	P	Mylonitized quartz, Zircon, Monazite, Chromite, K-feldspar, Tourmaline, Muscovite, Andalucite?, Rutile	Quartz overgrowths, Rutile, Pyrite	Intrusive Rhyolite, Chert, Polycrystalline quartz, Siltstone, Rhyolite*, Microgranite
4139.65	Missisauga	1000	P	Mylonitized quartz, Zircon, Tourmaline, Allanite, K-feldspar, Muscovite, Plagioclase	Quartz overgrowths, Chlorite, Pyrite, Calcite, Kaolinite	Chert*, Mudstone, Polycrystalline quartz, Rhyolite, Microgranite
4140.57	Missisauga	300	P	Mylonitized quartz, Zircon, Tourmaline?, Allanite, K-feldspar, Chromite, Muscovite	Quartz overgrowths, Rutile, Pyrite, Kaolinite	Polycrystalline quartz, Rhyolite, Microgranite, Chert*
4140.70A	Missisauga	500	P	Mylonitized quartz, Titanite, Zircon, Tourmaline, K-feldspar, Glauconite, Albite	Quartz overgrowths, Kaolinite, Pyrite, Rutile, Albite, Glauconite	Rhyolite*, Intrusive Rhyolite, Microgranite, Chert
4140.70B	Missisauga	600	P	Mylonitized quartz, Titanite, Zircon, Tourmaline, Apatite, Biotite, K-feldspar	Rutile, Chlorite, Pyrite, Sphalerite	Intrusive Rhyolite, Chert, Microgranite, Rhyolite*

Note: * indicates lithic clast that is most abundant in thin section.

Appendix B1: Backscattered Electron Images of detrital and diagenetic minerals and lithic clasts by Scanning Electron Microscope for Esperanto K-78

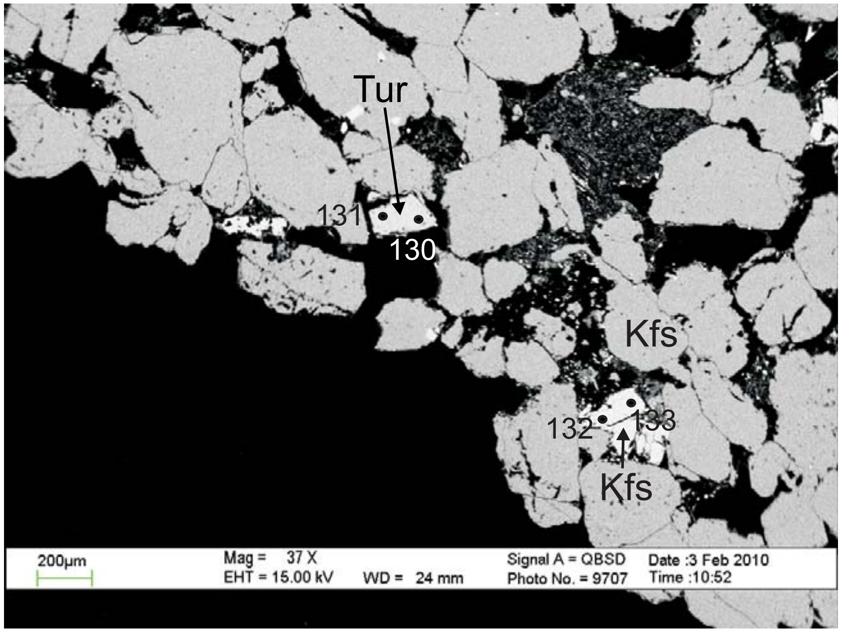


Figure 1: 2961.78 m., Tourmaline (pos. 130, 131); K-feldspar (pos. 132,133)

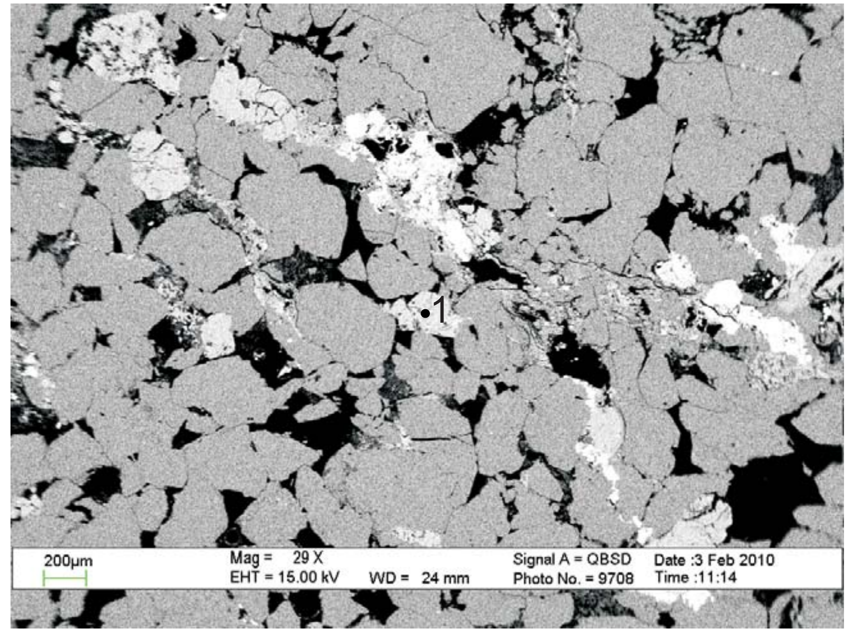


Figure 2: 2961.78m., Mixture of K-feldspar and albite (pos. 1)

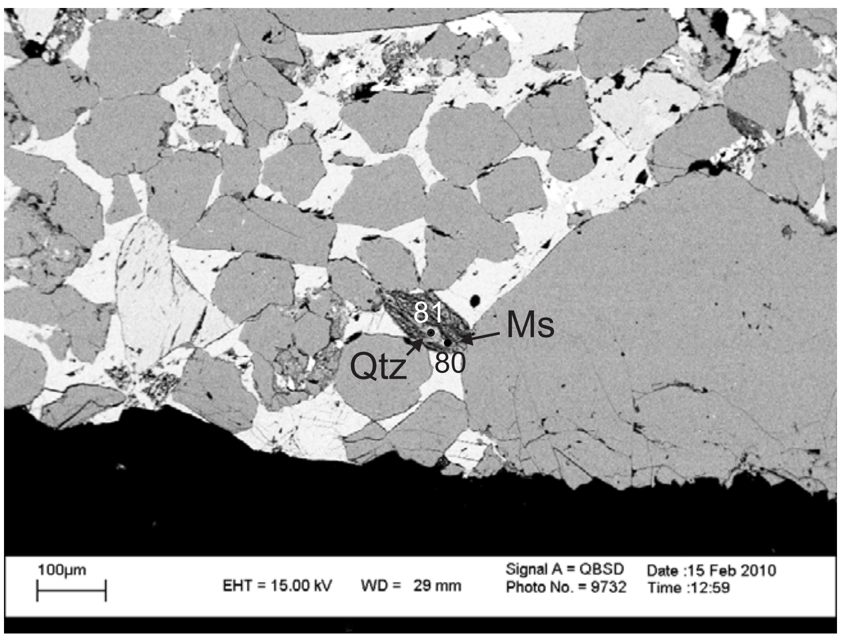


Figure 3: 2968.46 m., Hydromuscovite (pos. 80); Quartz (pos. 81)

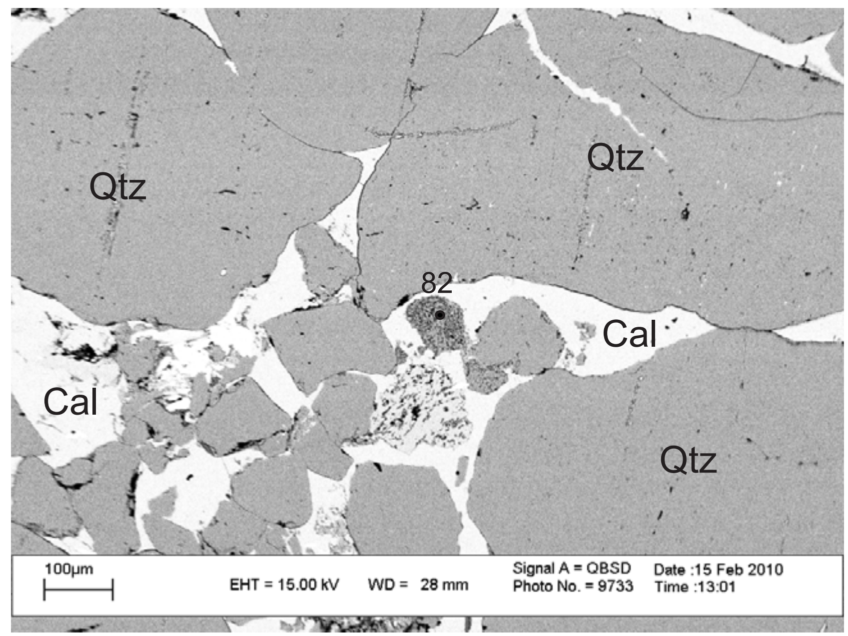


Figure 4: 2968.46 m., Altered K-feldspar (pos. 82)

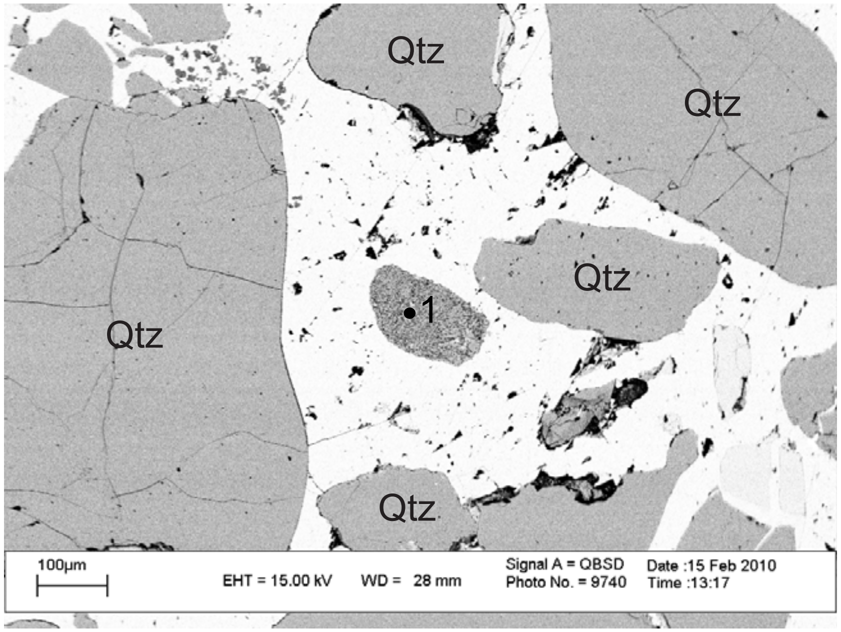


Figure 5: 2968.46 m., Altered Feldspar (pos. 1)

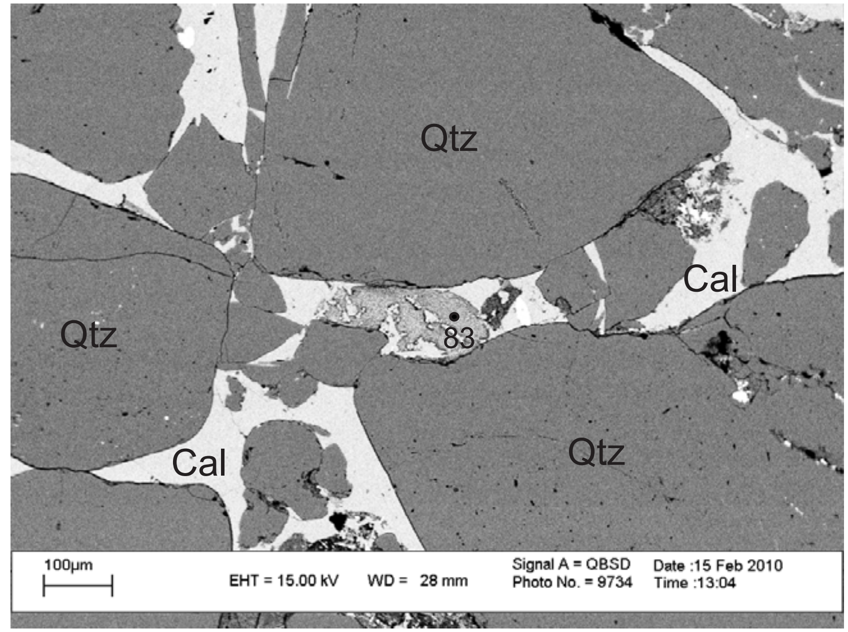


Figure 6: 2968.46 m., Chlorite (pos. 83)

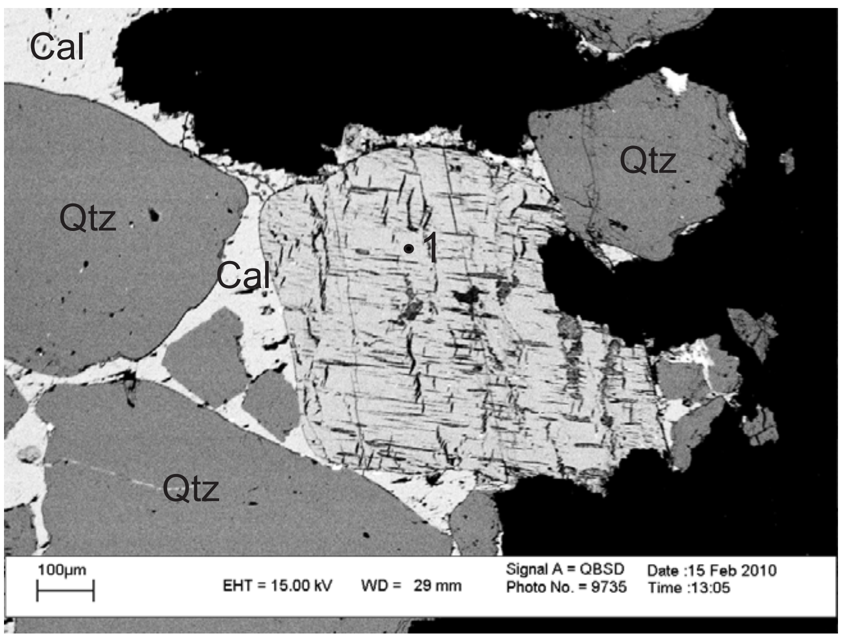


Figure 7: 2968.46 m., K-feldspar (pos. 1)

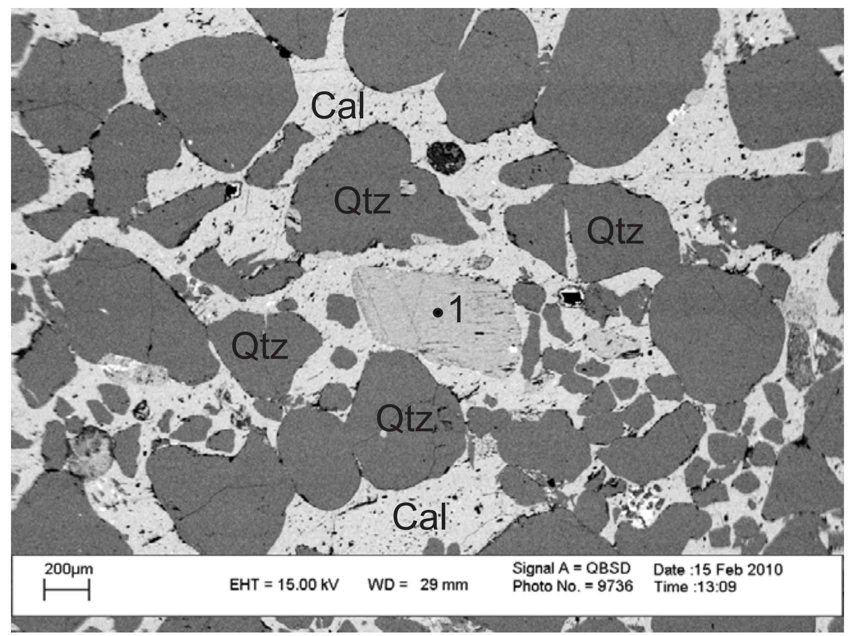


Figure 8: 2968.46 m., K-feldspar (pos. 1)

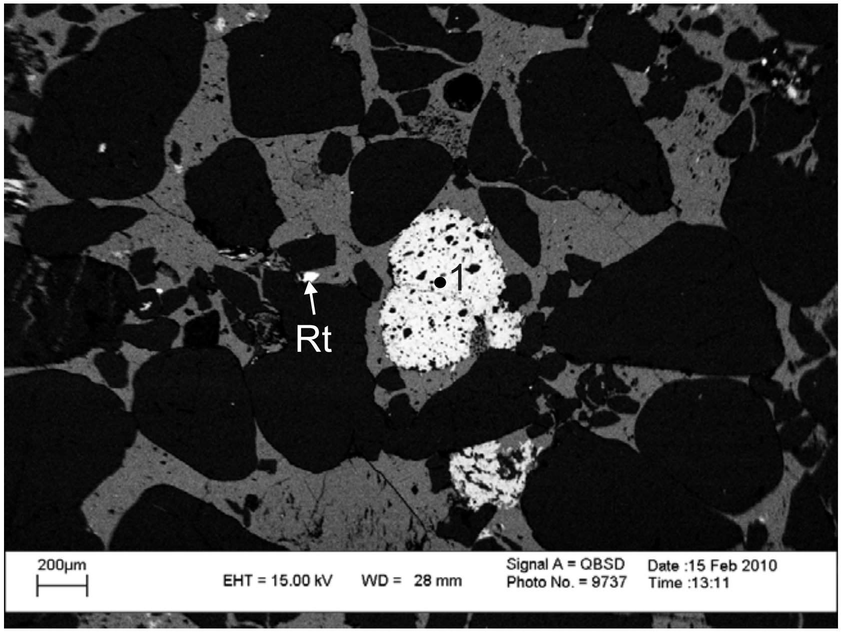


Figure 9: 2968.46 m., Chromite (pos. 1)

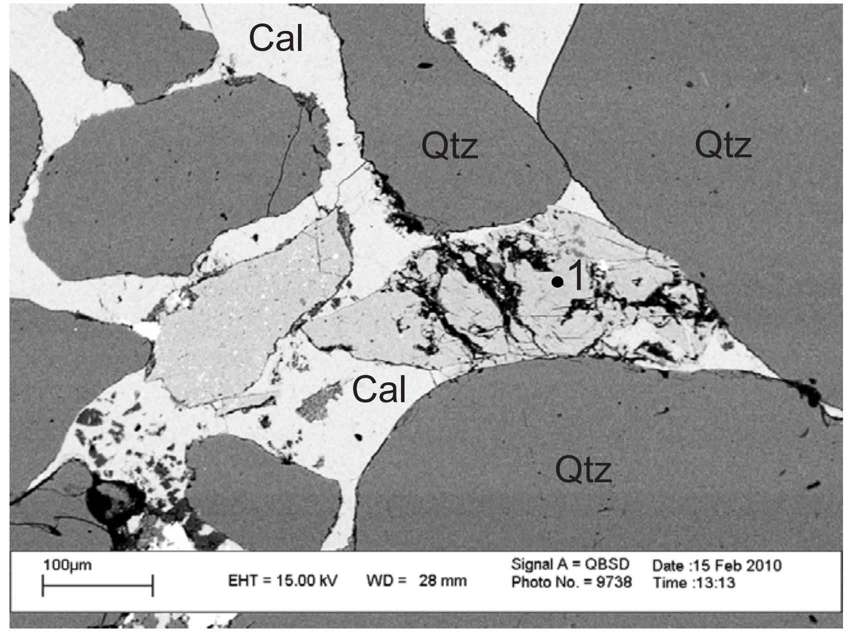


Figure 10: 2968.46 m., Altered Feldspar (pos. 1)

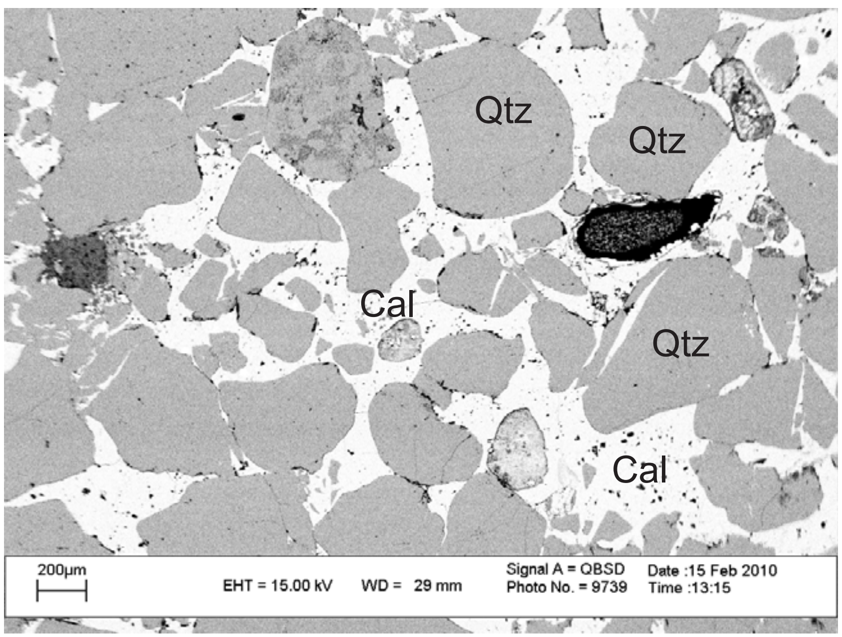


Figure 11: 2968.46 m., Quartz, Calcite cement

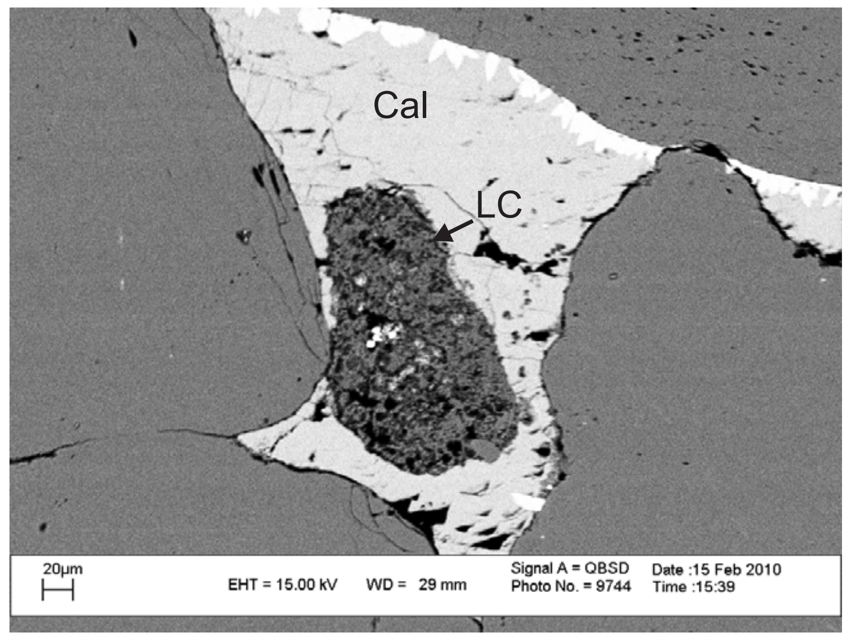


Figure 12: 2968.46 m., Lithic Clast (LC)

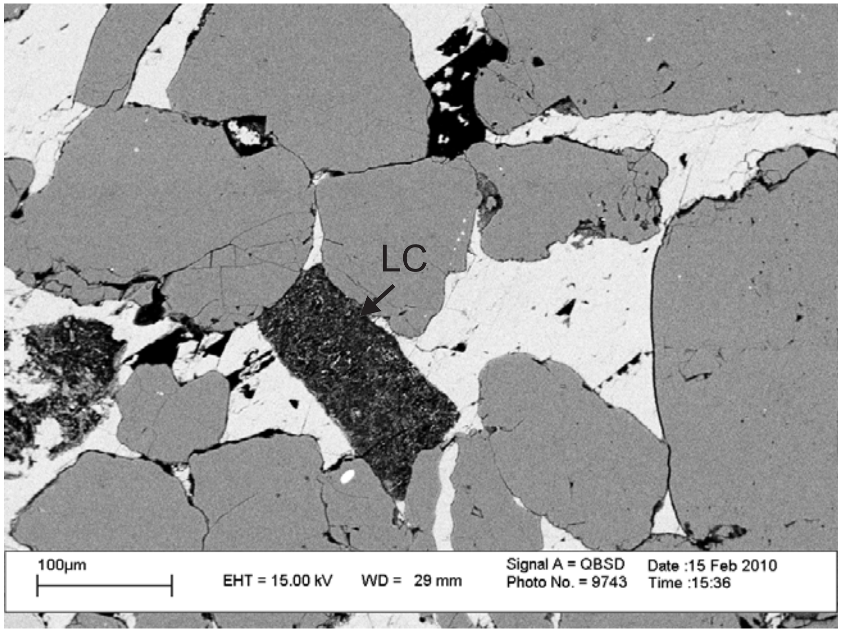


Figure 13: 2968.46 m., Lithic Clast (LC)

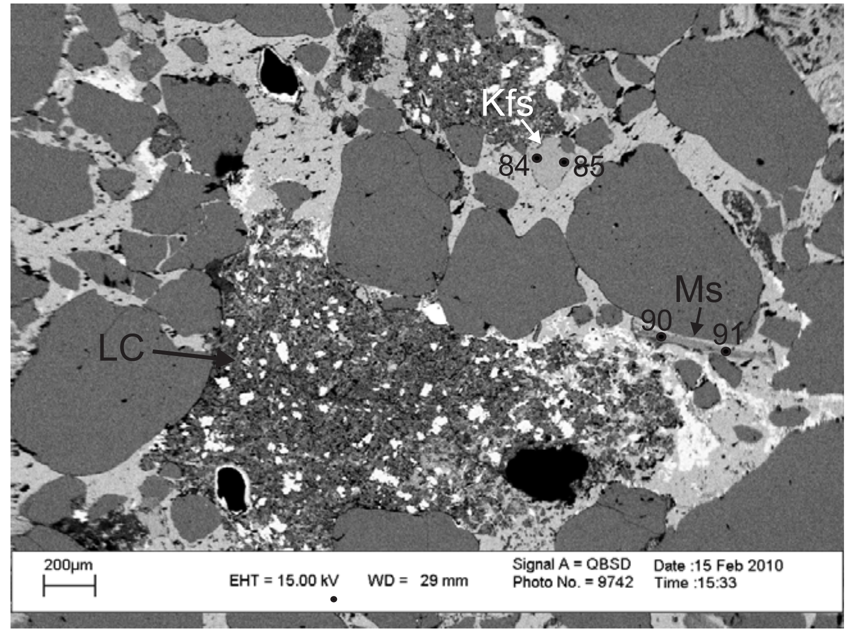
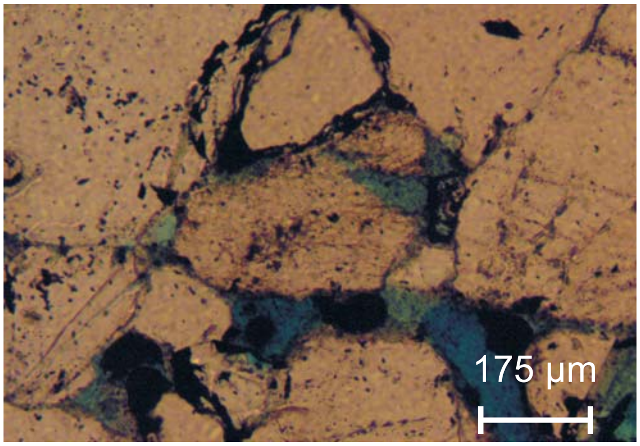


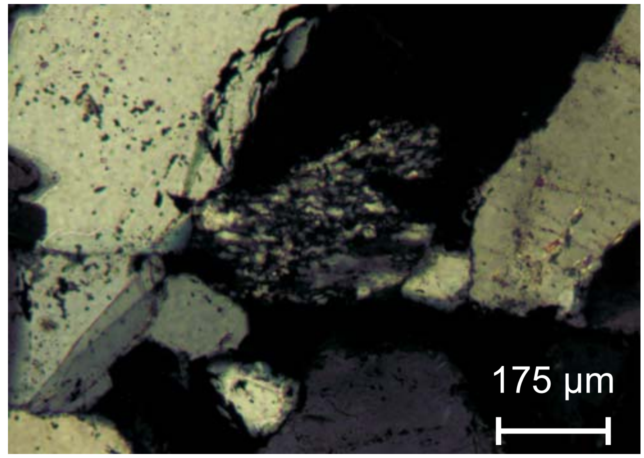
Figure 14: 2968.46 m., K-feldspar (pos. 84, 85); Hydromuscovite (pos. 90, 91) and Lithic Clast (LC)

Appendix B2: Microphotographs of representative Lithic Clasts from the Esperanto K-78 well.

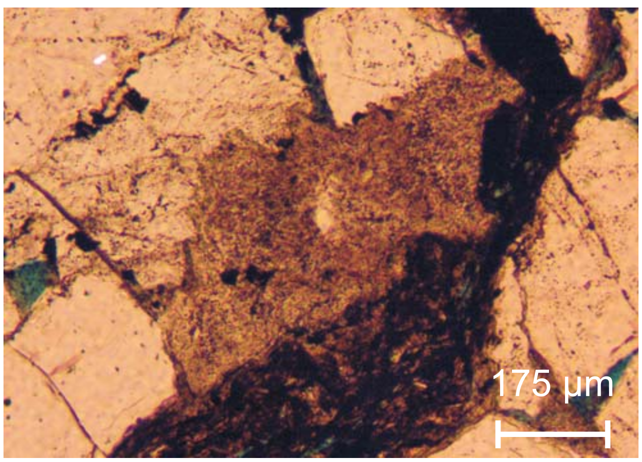
Appendix 2: Representative Lithic Clasts from the Esperanto K-78 well.



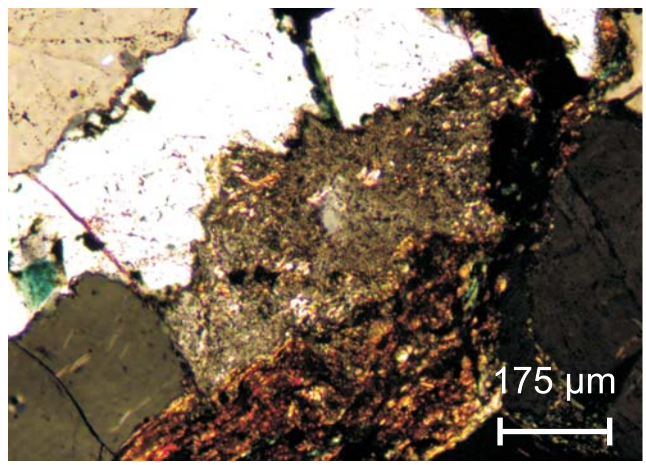
2961.78: Chert 100X ppl



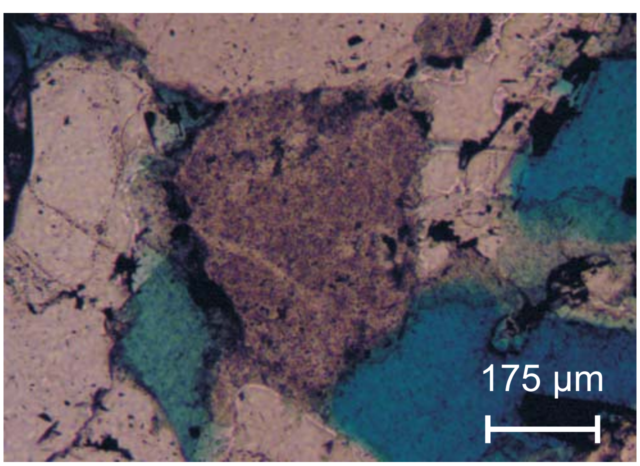
2961.78: Chert 100X xpl



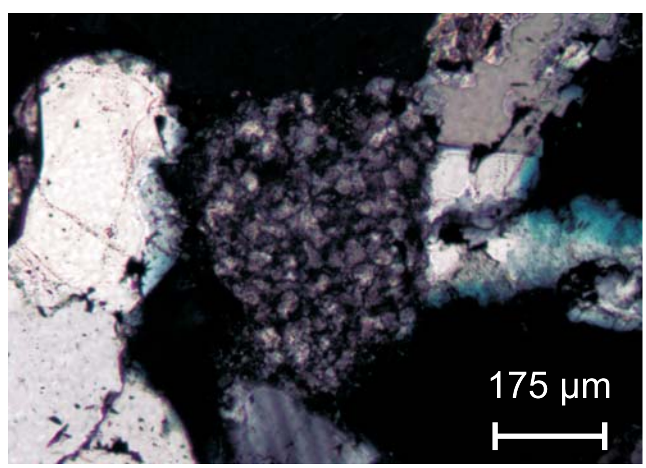
2961.78: Mudstone 100X ppl



2961.78: Mudstone 100X xpl

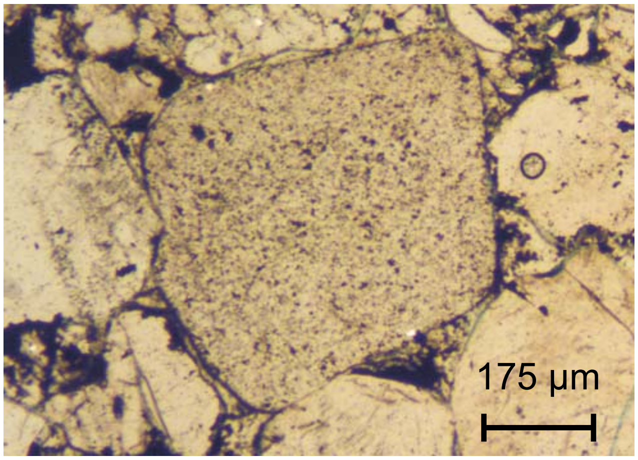


2961.78: Rhyolite 100X ppl

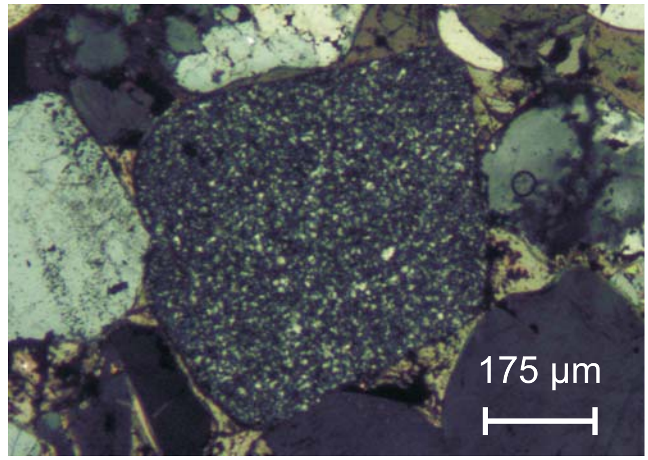


2961.78: Rhyolite 100X xpl

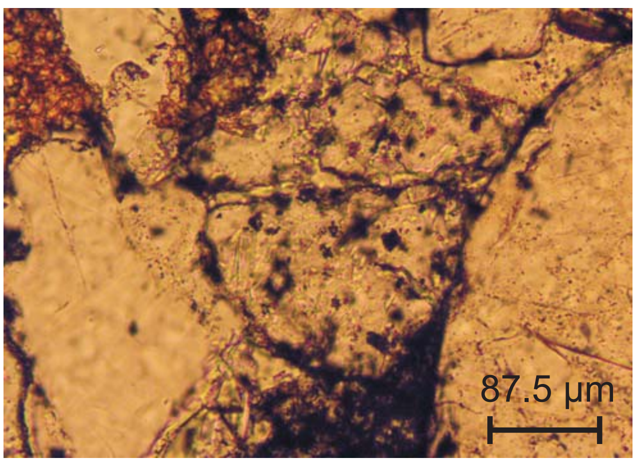
Appendix 2: Representative Lithic Clasts from the Esperanto K-78 well.



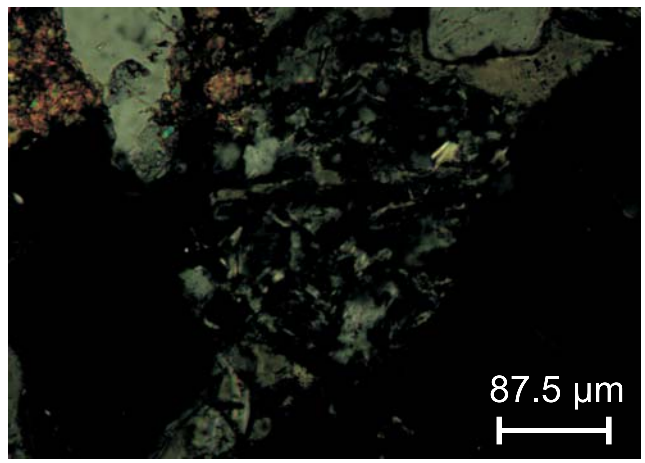
2968.46: Microgranite 100X ppl



2968.46: Microgranite 100X xpl



2968.88: Intrusive Rhyolite (porphyry) 200X ppl



2968.88: Intrusive Rhyolite (porphyry) 200X xpl

Appendix C1: Back Scattered Electron (BSE) images and semi-quantitative SEM chemical analyses of minerals from the Hesper I-52 well

Appendix 1a: BSE images of sample 2754.93 m

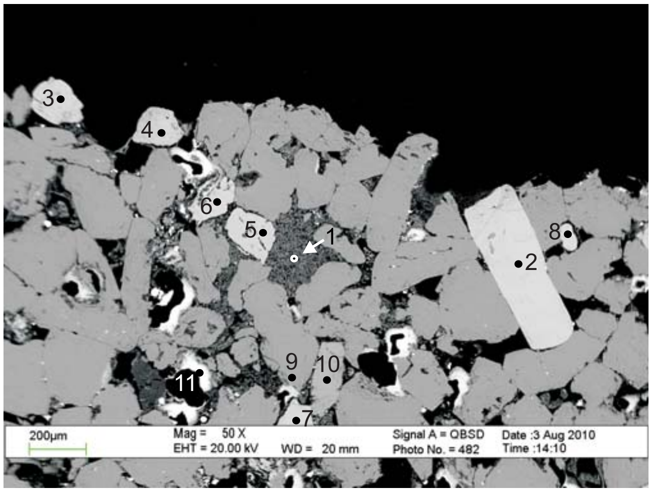


Figure 1: 2754.93 m., Kaolinite (pos.1); K-feldspar (pos. 2-8); Siderite (pos. 9, 11); Oligoclase (pos. 10)

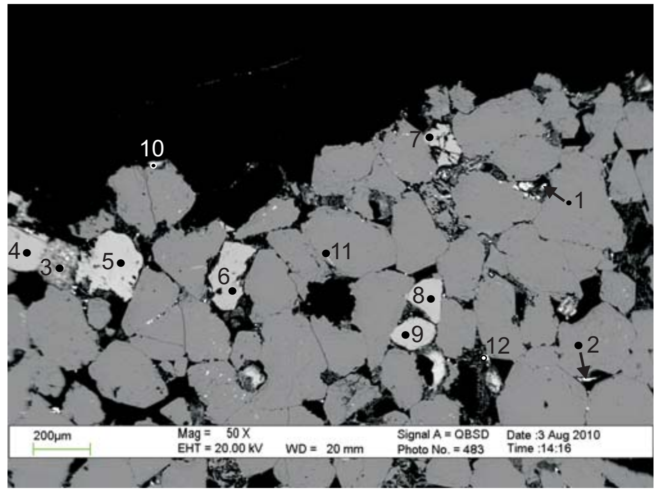


Figure 2: 2754.93 m., Barite (pos. 1); Siderite (pos. 2); K-feldspar (pos. 3-9), Siderite+ coal (pos. 10);Quartz+ Kaolinite (pos. 11); Unknown (pos. 12)

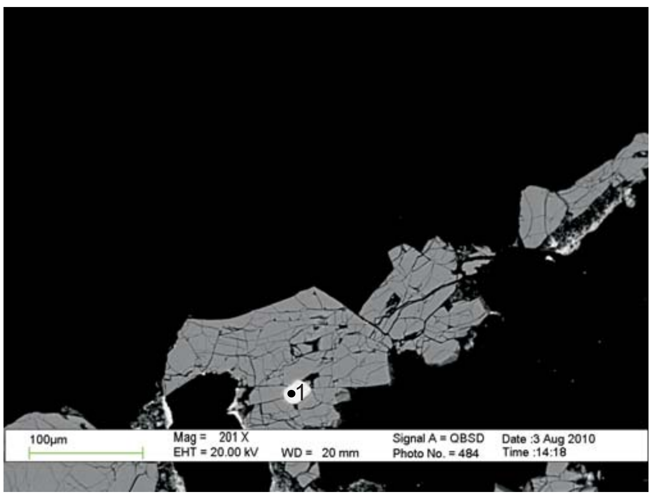


Figure 3: 2754.93 m., Biotite (pos. 1)

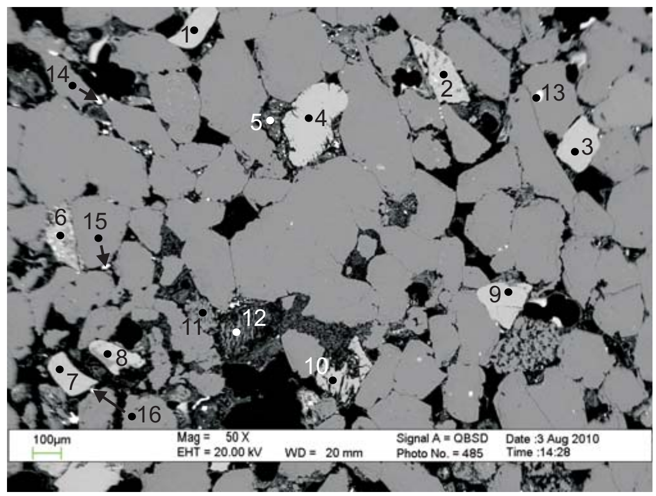


Figure 4: 2754.93 m., K-feldspar (pos. 1-4, 6-10, 12); Kaolinite (pos. 5); Kaolinite+ Quartz (pos. 11); Zircon (pos. 13); Barite (pos. 14); Pyrite (pos. 15); Pyrite+ Barite (pos. 16)

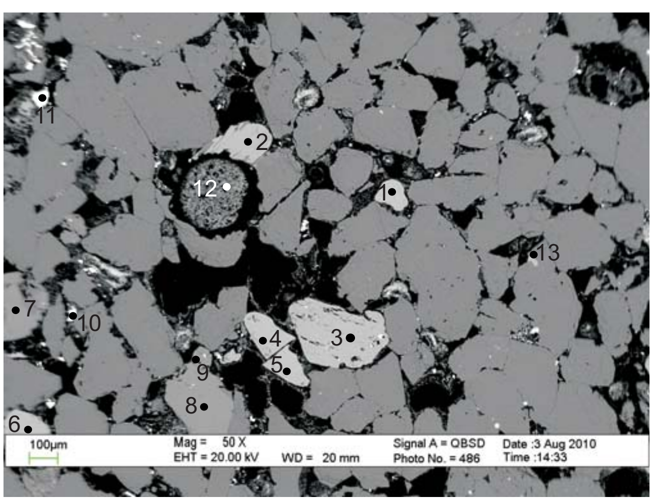


Figure 5: 2754.93 m., K-feldspar (pos 1-6, 13); Oligoclase (pos. 7,9);K-feldspar (pos. 8); Pyrite (pos. 10, 11); Mixture (pos. 12)

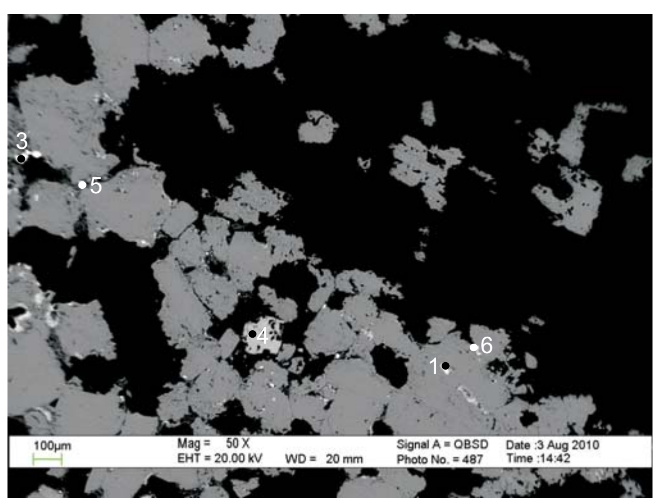


Figure 6: 2754.93 m.,Biotite (pos. 1); Pyrite (Pos. 3); K-feldspar (pos. 4); Pyrite+ Barite (pos. 5); Quartz (pos. 6)

Appendix 1a: BSE images of sample 2754.93 m

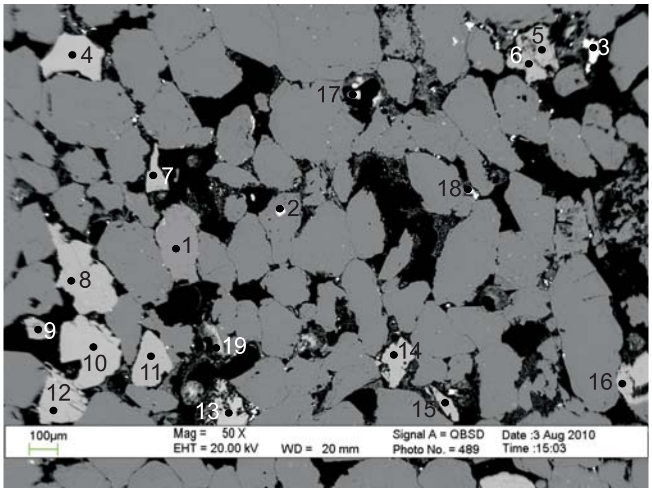


Figure 7: 2754.93 m., Oligoclase (pos. 1); Apatite (pos. 2); Pyrite (pos 3, 18); K-feldspar (4-16); Siderite (pos. 17, 19)

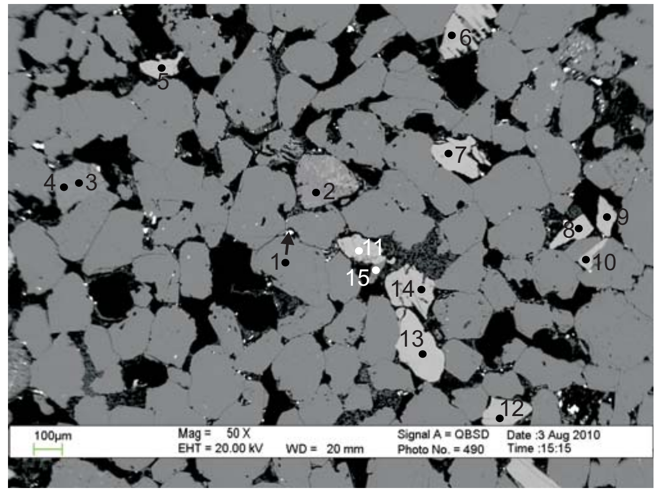


Figure 8: 2754.93 m., Barite (pos 1); Albite (pos. 2); Quartz+ K-feldspar (pos 3,4); K-feldspar (pos. 5-14); Quartz (pos. 15)

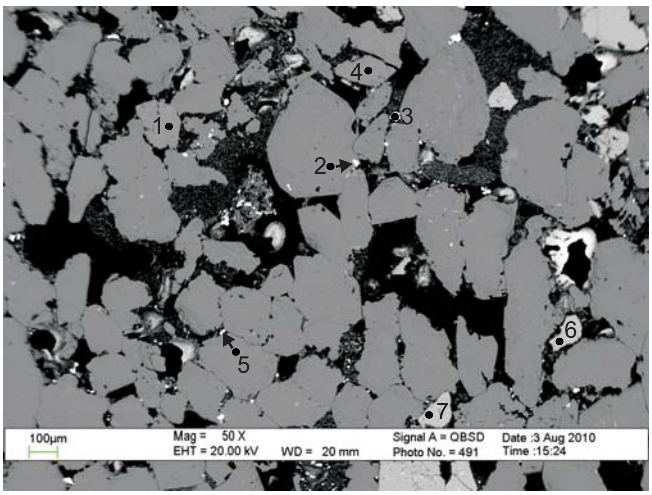


Figure 9: 2754.93 m., Albite (pos. 1,4); Pyrite (pos. 2,3); Pyrite +Barite (pos. 5); K-feldspar (pos. 6,7)

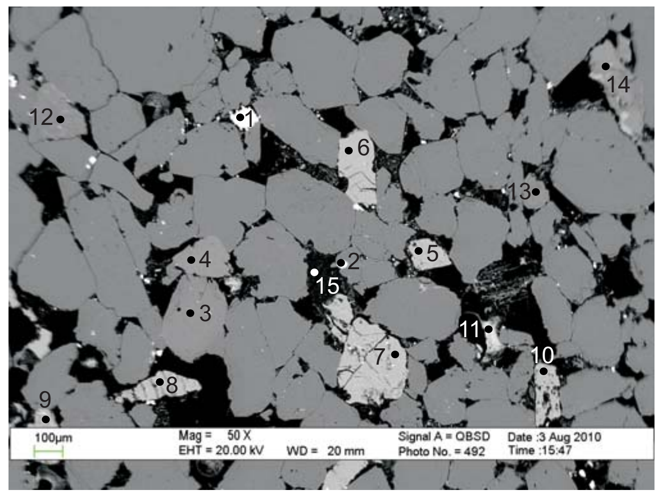


Figure 10: 2754.93 m., Pyrite (pos. 1); Zircon (pos.2); Albite (pos 3); Oligoclase (pos. 4, 13,14); K-feldspar (pos. 5-10, 15); Siderite (pos. 11); Quartz+ Kaolinite (pos. 12)

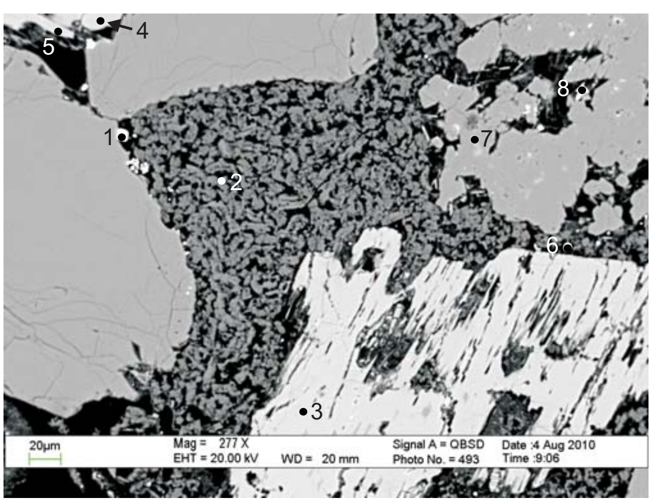


Figure 11: 2754.93 m., Pyrite (pos. 1); Kaolinite (pos. 2); K-feldspar (pos. 3-5, 7); Hematite (pos. 6,8)

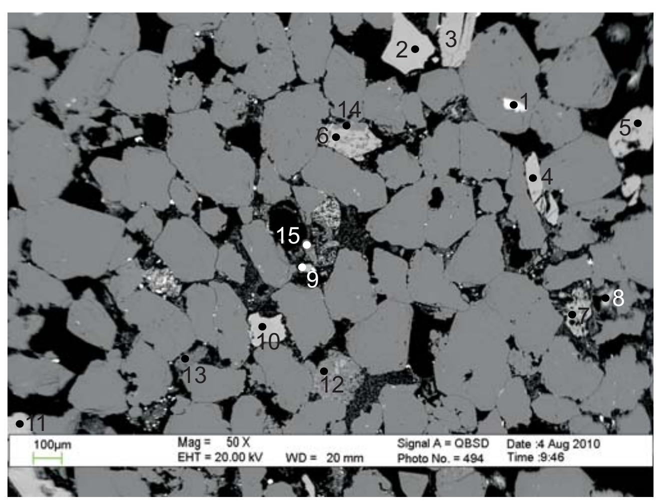


Figure 12: 2754.93 m., Apatite (pos. 1); K-feldspar (pos. 2-7, 9-11); Siderite+ coal (pos. 8); K-feldspar+ Albite (pos. 12); Quartz (pos. 13, 15); Albite (pos. 14)

Appendix 1a: BSE images of sample 2754.93 m

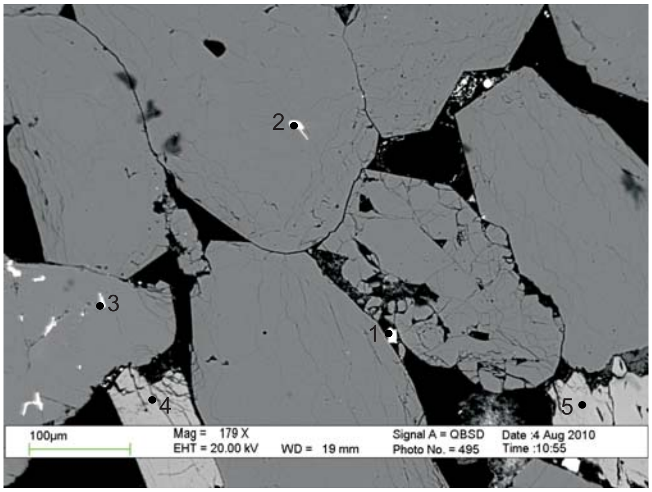


Figure 13: 2754.93 m., Barite (pos. 1); Zircon (pos. 2); Pyrite (pos. 3); K-feldspar (pos. 4,5)

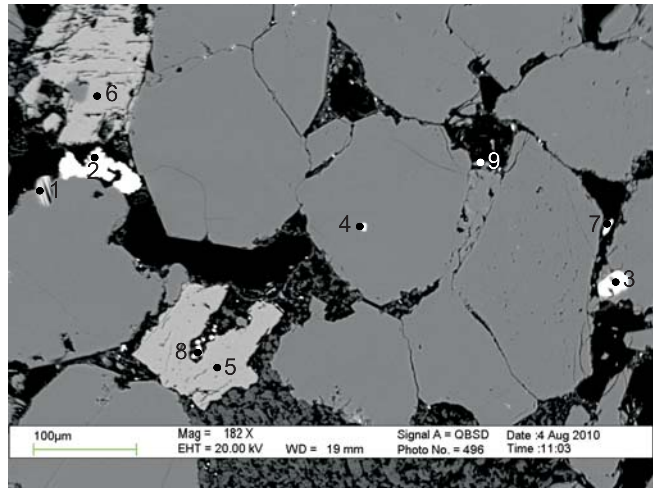


Figure 14: 2754.93 m., Biotite (altered) (pos. 1); Pyrite (pos 2, 8); Rutile (pos. 3); Apatite (pos. 4); K-feldspar (pos. 5,6); Barite (pos. 7); Albite (pos. 9)

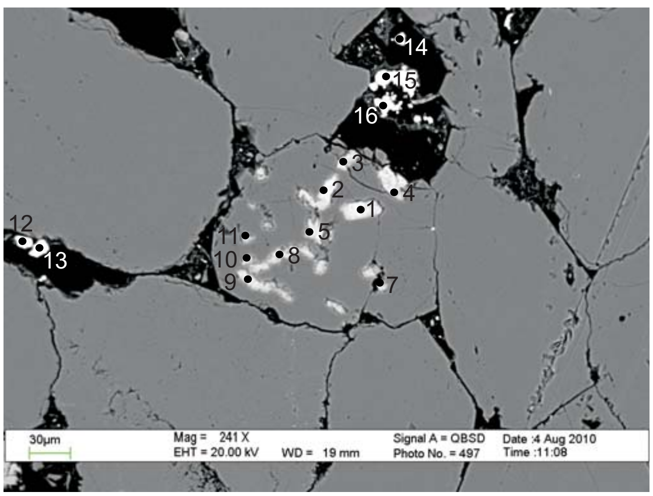


Figure 15: 2754.93 m., Clast of mafic rock (schist): Chlorite (pos 1-11); Barite (pos. 12-13); Pyrite (pos 14-16)

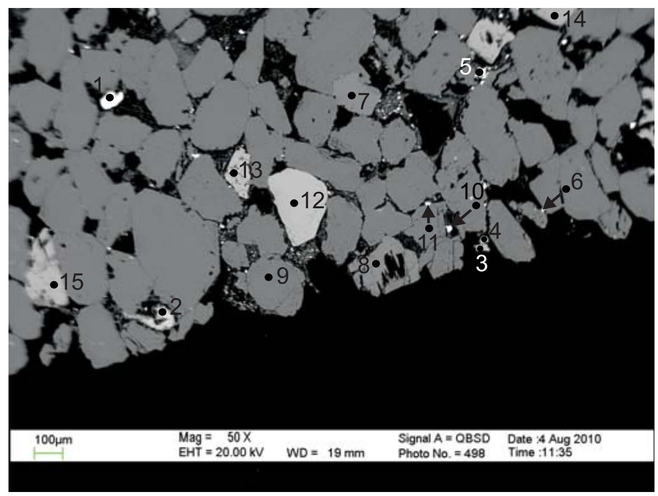


Figure 16: 2754.93 m., Pyrite (pos. 1,5,6,10); Siderite+ coal (pos. 2, 11); K-feldspar (pos. 3,4,12-15); Oligoclase (pos. 7,8); Quartz (pos. 9)

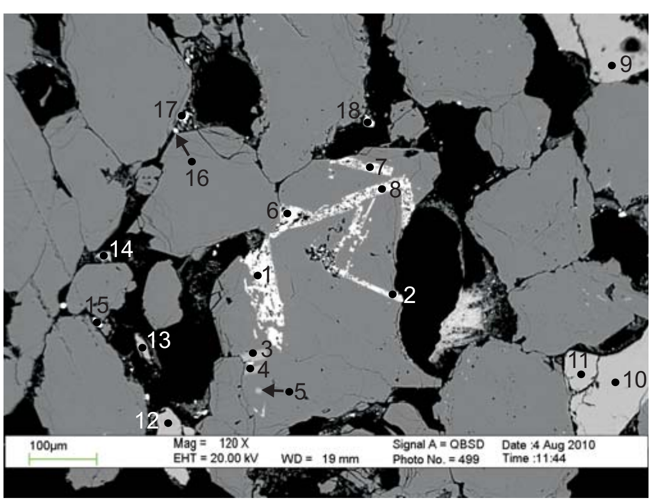


Figure 17: 2754.93 m., Rutile (pos. 1,2,6-8); Muscovite (pos. 3,4); K-feldspar (pos. 5, 9-14); Pyrite +Barite (pos. 15); Barite (pos 16, 17); Siderite+ Barite (pos. 18)

Appendix C1, Table 1a: Semi- quantatitive Scanning Electron Microscope chemical analyses of sample 2754.93 from Hesper I-52 well.

Sample	Site	Figure$^+$	Position$^+$	SiO_2	TiO_2	Al_2O_3	FeO_t	Cr_2O_3	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	BaO	Ce_2O_3	CO_2	SO_3	ZrO_2	Total	Mineral Name
2754.93	2	1	1	49.99	0	35.01	0	0	0	0	0	0	0	0	0	0	0	0	0	85	Kaolinite
2754.93	2	1	2	68.90	0	17.08	0	0	0	0	0	0	14.02	0	0	0	0	0	0	100	K-feldspar
2754.93	2	1	3	68.72	0	17.40	0	0	0	0	0	0	13.88	0	0	0	0	0	0	100	K-feldspar
2754.93	2	1	4	69.69	0	16.59	0	0	0	0	0	0	13.73	0	0	0	0	0	0	100	K-feldspar
2754.93	2	1	5	66.93	0	18.42	0	0	0	0	0	0	14.65	0	0	0	0	0	0	100	K-feldspar
2754.93	2	1	6	68.75	0	17.36	0	0	0	0	0	0	13.88	0	0	0	0	0	0	100	K-feldspar
2754.93	2	1	7	68.62	0	16.02	0	0	0	0	0	0	15.36	0	0	0	0	0	0	100	K-feldspar
2754.93	2	1	8	68.14	0	17.08	0	0	0	0	0	0	14.78	0	0	0	0	0	0	100	K-feldspar
2754.93	2	1	9	0	0	0	36.71	0	0	0	1.73	0	0	0	0	0	61.56	0	0	100	Siderite
2754.93	2	1	10	68.51	0	20.56	0	0	0	0	3.43	7.50	0	0	0	0	0	0	0	100	Oligoclase
2754.93	2	1	11	0	0	0	50.37	0	0	0	1.23	0	0	0	0	0	48.39	0	0	100	Siderite
2754.93	3	2	1	0	0	0	0	0	0	0	0	0	0	0	73.71	0	0	26.29	0	100	Barite
2754.93	3	2	2	0	0	0	64.29	0	0	0	0	0	0	0	0	0	35.71	0	0	100	Siderite
2754.93	3	2	3	67.38	0	17.30	1.55	0	0	0	0	1.49	12.28	0	0	0	0	0	0	100	K-feldspar
2754.93	3	2	4	70.08	0	15.21	0	0	0	0	0	0	14.71	0	0	0	0	0	0	100	K-feldspar
2754.93	3	2	5	67.99	0	17.95	0	0	0	0	0	0	14.05	0	0	0	0	0	0	100	K-feldspar
2754.93	3	2	6	68.78	0	17.10	0	0	0	0	0	0	14.12	0	0	0	0	0	0	100	K-feldspar
2754.93	3	2	7	68.90	0	17.42	0	0	0	0	0	0	13.69	0	0	0	0	0	0	100	K-feldspar
2754.93	3	2	8	68.32	0	16.70	0	0	0	0	0	0	14.97	0	0	0	0	0	0	100	K-feldspar
2754.93	3	2	9	70.04	0	16.64	0	0	0	0	0	0	13.32	0	0	0	0	0	0	100	K-feldspar
2754.93	3	2	10	0	0	0	16.53	0	0	0	0	0	0.00	0	0	0	83.47	0	0	100	Siderite+ coal
2754.93	3	2	11	95.12	0	4.88	0	0	0	0	0	0	0.00	0	0	0	0	0	0	100	Quartz+ Kaolinite
2754.93	3	2	12	65.49	0	6.01	12.79	0	0	0	0	0	0.00	0	0	0	0	15.71	0	100	?
2754.93	4	3	1	39.70	3.13	15.18	20.51	0	0	8.79	0	0	8.68	0	0	0	0	0	0	96	Biotite
2754.93	5	4	1	69.42	0	15.08	0	0	0	0	0	0	15.50	0	0	0	0	0	0	100	K-feldspar
2754.93	5	4	2	69.67	0	15.88	0	0	0	0	0	0	14.45	0	0	0	0	0	0	100	K-feldspar
2754.93	5	4	3	68.85	0	16.40	0	0	0	0	0	0	14.75	0	0	0	0	0	0	100	K-feldspar
2754.93	5	4	4	69.71	0	16.65	0	0	0	0	0	0	13.64	0	0	0	0	0	0	100	K-feldspar
2754.93	5	4	5	54.52	0	30.48	0	0	0	0	0	0	0	0	0	0	0	0	0	85	Kaolinite
2754.93	5	4	6	69.14	0	15.80	0	0	0	0	0	0	15.07	0	0	0	0	0	0	100	K-feldspar
2754.93	5	4	7	68.18	0	18.56	0	0	0	0	0	0	13.26	0	0	0	0	0	0	100	K-feldspar
2754.93	5	4	8	70.03	0	16.62	0	0	0	0	0	0	13.35	0	0	0	0	0	0	100	K-feldspar
2754.93	5	4	9	68.14	0	17.24	0	0	0	0	0	0	14.62	0	0	0	0	0	0	100	K-feldspar
2754.93	5	4	10	69.45	0	16.58	0	0	0	0	0	0	13.97	0	0	0	0	0	0	100	K-feldspar
2754.93	5	4	11	95.14	0	4.86	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz + Kaolinite
2754.93	5	4	12	72.77	0	17.36	0	0	0	0	0	4.35	5.51	0	0	0	0	0	0	100	K-feldspar
2754.93	5	4	13	44.09	0	0	0	0	0	0	0	0	0	0	0	0	0	0	55.91	100	Zircon
2754.93	5	4	14	0	0	0	0	0	0	0	0	0	0	0	74.02	0	0	25.98	0	100	Barite
2754.93	5	4	15	0	0	0	42.70	0	0	0	0	0	0	0	0	0	0	57.30	0	100	Pyrite
2754.93	5	4	16	0	0	0	29.73	0	0	0	0	0	0	0	25.50	0	0	44.78	0	100	Pyrite+ Barite
2754.93	6	5	1	68.53	0	17.73	0	0	0	0	0	0	13.73	0	0	0	0	0	0	100	K-feldspar
2754.93	6	5	2	69.49	0	17.15	0	0	0	0	0	2.25	11.11	0	0	0	0	0	0	100	K-feldspar
2754.93	6	5	3	68.43	0	16.33	0	0	0	0	0	0	15.24	0	0	0	0	0	0	100	K-feldspar
2754.93	6	5	4	67.37	0	17.44	0	0	0	0	0	0	15.19	0	0	0	0	0	0	100	K-feldspar
2754.93	6	5	5	68.49	0	17.50	0	0	0	0	0	0	14.00	0	0	0	0	0	0	100	K-feldspar
2754.93	6	5	6	68.47	0	17.11	0	0	0	0	0	0	14.41	0	0	0	0	0	0	100	K-feldspar

Notes: 1) Total iron is expressed as FeO; 2) += These figures and positions are shown in Appendix C1; 3) Original analyses of minerals have been recalculated appropriately.

Appendix C1, Table 1a: Semi- quantatitive Scanning Electron Microscope chemical analyses of sample 2754.93 from Hesper I-52 well.

Sample	Site	Figure$^+$	Position$^+$	SiO_2	TiO_2	Al_2O_3	FeO_t	Cr_2O_3	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	BaO	Ce_2O_3	CO_2	SO_3	ZrO_2	Total	Mineral Name
2754.93	6	5	7	66.57	0	22.28	0	0	0	0	4.60	6.24	0.30	0	0	0	0	0	0	100	Oligoclase
2754.93	6	5	8	69.03	0	21.50	0	0	0	0	0	5.95	3.51	0	0	0	0	0	0	100	K-feldspar
2754.93	6	5	9	66.03	0	22.51	0	0	0	0	4.25	7.21	0	0	0	0	0	0	0	100	Plagioclase
2754.93	6	5	10	0	0	0	40.42	0	0	0	0	0	0	0	0	0	0	59.58	0	100	Pyrite
2754.93	6	5	11	0	0	0	42.00	0	0	0	0	0	0	0	0	0	0	58.00	0	100	Pyrite
2754.93	6	5	12	79.11	0	0	0	0	0	4.14	8.07	8.02	0.67	0	0	0	0	0	0	100	Mixture
2754.93	6	5	13	73.85	0	13.93	0	0	0	0	0	0	12.22	0	0	0	0	0	0	100	K-feldspar
2754.93	8	6	1	37.96	2.59	18.48	22.61	0	0	6.86	0	0	7.49	0	0	0	0	0	0	96	Biotite
2754.93	8	6	2	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
2754.93	8	6	3	0	0	0	42.29	0	0	0	0	0	0	0	0	0	0	57.71	0	100	Pyrite
2754.93	8	6	4	69.40	0	17.60	0	0	0	0	0	0	13.00	0	0	0	0	0	0	100	K-feldspar
2754.93	8	6	5	0	0	0	4.81	0	0	0	0	0	0	0	67.44	0	0	27.76	0	100	Pyrite+ Barite
2754.93	8	6	6	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
2754.93	11	7	1	69.10	0	19.84	0	0	0	0	4.06	7.00	0	0	0	0	0	0	0	100	Oligoclase
2754.93	11	7	2	0	0	0	0	0	0	0	69.17	0	0	30.83	0	0	0	0	0	100	Apatite
2754.93	11	7	3	0	0	0	41.37	0	0	0	0	0	0	0	0	0	0	58.63	0	100	Pyrite
2754.93	11	7	4	69.61	0	17.11	0	0	0	0	0	0	13.28	0	0	0	0	0	0	100	K-feldspar
2754.93	11	7	5	68.32	0	17.87	0	0	0	0	0	0	13.81	0	0	0	0	0	0	100	K-feldspar
2754.93	11	7	6	68.50	0	18.10	0	0	0	0	0	0	13.41	0	0	0	0	0	0	100	K-feldspar
2754.93	11	7	7	69.02	0	18.40	0	0	0	0	0	0	12.58	0	0	0	0	0	0	100	K-feldspar
2754.93	11	7	8	67.76	0	18.01	0	0	0	0	0	0	14.22	0	0	0	0	0	0	100	K-feldspar
2754.93	11	7	9	68.56	0	17.15	0	0	0	0	0	0	14.29	0	0	0	0	0	0	100	K-feldspar
2754.93	11	7	10	66.94	0	18.16	0	0	0	0	0	0	14.90	0	0	0	0	0	0	100	K-feldspar
2754.93	11	7	11	68.21	0	17.71	0	0	0	0	0	0	14.08	0	0	0	0	0	0	100	K-feldspar
2754.93	11	7	12	68.34	0	18.16	0	0	0	0	0	0	13.50	0	0	0	0	0	0	100	K-feldspar
2754.93	11	7	13	69.77	0	17.95	0	0	0	0	0	0	12.28	0	0	0	0	0	0	100	K-feldspar
2754.93	11	7	14	68.71	0	17.23	0	0	0	0	0	0	14.06	0	0	0	0	0	0	100	K-feldspar
2754.93	11	7	15	70.75	0	14.93	0	0	0	0	0	0	14.31	0	0	0	0	0	0	100	K-feldspar
2754.93	11	7	16	70.61	0	15.72	0	0	0	0	0	0	13.67	0	0	0	0	0	0	100	K-feldspar
2754.93	11	7	17	0	0	0	44.70	0	0	0	2.09	0	0	0	0	0	53.21	0	0	100	Siderite
2754.93	11	7	18	0	0	0	39.48	0	0	0	0	0	0	0	0	0	0	60.52	0	100	Pyrite
2754.93	11	7	19	0	0	0	36.44	0	0	0	1.73	0	0	0	0	0	61.83	0	0	100	Siderite
2754.93	14	8	1	0	0	0	0	0	0	0	0	0	0	0	72.32	0	0	27.68	0	100	Barite
2754.93	14	8	2	71.72	0	19.02	0	0	0	0	1.95	7.32	0	0	0	0	0	0	0	100	Albite
2754.93	14	8	3	96.13	0	2.64	0	0	0	0	0	0	1.23	0	0	0	0	0	0	100	Quartz+ K-feldspar
2754.93	14	8	4	90.73	0	5.11	2.58	0	0	0	0	0	1.58	0	0	0	0	0	0	100	Quartz+ K-feldspar
2754.93	14	8	5	68.84	0	16.65	0	0	0	0	0	0	14.51	0	0	0	0	0	0	100	K-feldspar
2754.93	14	8	6	68.38	0	16.97	0	0	0	0	0	0	14.65	0	0	0	0	0	0	100	K-feldspar
2754.93	14	8	7	67.99	0	18.09	0	0	0	0	0	0	13.92	0	0	0	0	0	0	100	K-feldspar
2754.93	14	8	8	69.06	0	17.74	0	0	0	0	0	0	13.20	0	0	0	0	0	0	100	K-feldspar
2754.93	14	8	9	68.90	0	17.18	0	0	0	0	0	0	13.93	0	0	0	0	0	0	100	K-feldspar
2754.93	14	8	10	70.77	0	15.59	0	0	0	0	0	0	13.64	0	0	0	0	0	0	100	K-feldspar
2754.93	14	8	11	65.94	0	18.69	0	0	0	0	0	0	15.37	0	0	0	0	0	0	100	K-feldspar
2754.93	14	8	12	71.18	0	15.21	0	0	0	0	0	0	13.62	0	0	0	0	0	0	100	K-feldspar
2754.93	14	8	13	71.33	0	15.28	0	0	0	0	0	0	13.39	0	0	0	0	0	0	100	K-feldspar
2754.93	14	8	14	69.01	0	16.95	0	0	0	0	0	0	14.04	0	0	0	0	0	0	100	K-feldspar

Notes: 1) Total iron is expressed as FeO; 2) += These figures and positions are shown in Appendix C1; 3) Original analyses of minerals have been recalculated appropriately.

Appendix C1, Table 1a: Semi- quantatitive Scanning Electron Microscope chemical analyses of sample 2754.93 from Hesper I-52 well.

Sample	Site	Figure[+]	Position[+]	SiO_2	TiO_2	Al_2O_3	FeO_t	Cr_2O_3	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	BaO	Ce_2O_3	CO_2	SO_3	ZrO_2	Total	Mineral Name
2754.93	14	8	15	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
2754.93	17	9	1	71.06	0	19.87	0	0	0	0	1	8.07	0	0	0	0	0	0	0	100	Albite
2754.93	17	9	2	0	0	0	42.34	0	0	0	0	0	0	0	0	0	0	57.66	0	100	Pyrite
2754.93	17	9	3	0	0	0	39.01	0	0	0	0	0	0	0	0	0	0	60.99	0	100	Pyrite
2754.93	17	9	4	69.92	0	20.66	0	0	0	0	0.89	7.57	0.97	0	0	0	0	0	0	100	Albite
2754.93	17	9	5	0	0	0	7.24	0	0	0	0	0	0	0	68.15	0	0	24.61	0	100	Pyrite+ Barite
2754.93	17	9	6	66.95	0	18.27	0	0	0	0	0	0	14.78	0	0	0	0	0	0	100	K-feldspar
2754.93	17	9	7	68.98	0	17.59	0	0	0	0	0	0	13.43	0	0	0	0	0	0	100	K-feldspar
2754.93	22	10	1	0	0	0	41.34	0	0	0	0	0	0	0	0	0	0	58.66	0	100	Pyrite
2754.93	22	10	2	52.43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	47.57	100	Zircon
2754.93	22	10	3	71.18	0	19.53	0	0	0	0	1.87	7.41	0	0	0	0	0	0	0	100	Albite
2754.93	22	10	4	70.16	0	19.88	0	0	0	0	3.33	6.63	0	0	0	0	0	0	0	100	Oligoclase
2754.93	22	10	5	68.32	0	18.17	0	0	0	0	0	0	13.51	0	0	0	0	0	0	100	K-feldspar
2754.93	22	10	6	68.81	0	18.17	0	0	0	0	0	0	13.01	0	0	0	0	0	0	100	K-feldspar
2754.93	22	10	7	69.43	0	16.20	0	0	0	0	0	0	14.37	0	0	0	0	0	0	100	K-feldspar
2754.93	22	10	8	68.79	0	17.04	0	0	0	0	0	0	14.17	0	0	0	0	0	0	100	K-feldspar
2754.93	22	10	9	68.55	0	17.41	0	0	0	0	0	0	14.04	0	0	0	0	0	0	100	K-feldspar
2754.93	22	10	10	68.34	0	17.58	0	0	0	0	0	0	14.07	0	0	0	0	0	0	100	K-feldspar
2754.93	22	10	11	0	0	0	39.49	0	0	0	2.00	0	0	0	0	0	58.50	0	0	100	Siderite
2754.93	22	10	12	96.75	0	3.25	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz+ Kaolinite
2754.93	22	10	13	70.92	0	19.20	0	0	0	0	2.58	7.30	0	0	0	0	0	0	0	100	Oligoclase
2754.93	22	10	14	66.74	0	21.99	0	0	0	0	4.67	6.60	0	0	0	0	0	0	0	100	Oligoclase
2754.93	22	10	15	69.33	0	17.35	0	0	0	0	0	0	13.32	0	0	0	0	0	0	100	K-feldspar
2754.93	24	11	1	0	0	0	41.03	0	0	0	0	0	0	0	0	0	0	58.97	0	100	Pyrite
2754.93	24	11	2	49.79	0	35.21	0	0	0	0	0	0	0	0	0	0	0	0	0	85	Kaolinite
2754.93	24	11	3	68.39	0	17.66	0	0	0	0	0	0.78	13.17	0	0	0	0	0	0	100	K-feldspar
2754.93	24	11	4	69.60	0	17.05	0	0	0	0	0	0	13.35	0	0	0	0	0	0	100	K-feldspar
2754.93	24	11	5	69.10	0	16.69	0	0	0	0	0	0	14.21	0	0	0	0	0	0	100	K-feldspar
2754.93	24	11	6	0	0	0	36.41	0	0	0	0	0	0	0	0	0	0	53.59	0	90	Hematite
2754.93	24	11	7	76.66	0	12.34	1.87	0	0	0	0	2.55	6.58	0	0	0	0	0	0	100	K-feldspar
2754.93	24	11	8	0	0	0	39.40	0	0	0	0	0	0	0	0	0	0	50.60	0	90	Hematite
2754.93	27	12	1	0	0	0	0	0	0	0	21.68	0	0	58.20	0	20.12	0	0	0	100	Apatite
2754.93	27	12	2	68.58	0	17.08	0	0	0	0	0	0	14.34	0	0	0	0	0	0	100	K-feldspar
2754.93	27	12	3	66.80	0	17.83	0	0	0	0	0	0	15.37	0	0	0	0	0	0	100	K-feldspar
2754.93	27	12	4	70.03	0	16.00	0	0	0	0	0	0	13.98	0	0	0	0	0	0	100	K-feldspar
2754.93	27	12	5	68.33	0	17.17	0	0	0	0	0	0	14.50	0	0	0	0	0	0	100	K-feldspar
2754.93	27	12	6	67.21	0	17.89	0	0	0	0	0	0	14.90	0	0	0	0	0	0	100	K-feldspar
2754.93	27	12	7	68.82	0	16.15	0	0	0	0	0	0	15.02	0	0	0	0	0	0	100	K-feldspar
2754.93	27	12	8	0	0	0	34.72	0	0	0	1.99	0	0	0	0	0	63.28	0	0	100	Siderite+ coal
2754.93	27	12	9	69.57	0	15.47	0	0	0	0	0	0	14.96	0	0	0	0	0	0	100	K-feldspar
2754.93	27	12	10	67.56	0	17.44	0	0	0	0	0	0	15.01	0	0	0	0	0	0	100	K-feldspar
2754.93	27	12	11	68.09	0	17.08	0	0	0	0	0	0	14.83	0	0	0	0	0	0	100	K-feldspar
2754.93	27	12	12	70.91	0	18.44	0	0	0	0	0	6.24	4.42	0	0	0	0	0	0	100	K-feldspar+ Albite
2754.93	27	12	13	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
2754.93	27	12	14	72.47	0	18.82	0	0	0	0	0	8.71	0	0	0	0	0	0	0	100	Albite
2754.93	27	12	15	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz

Notes: 1) Total iron is expressed as FeO; 2) += These figures and positions are shown in Appendix C1; 3) Original analyses of minerals have been recalculated appropriately.

Appendix C1, Table 1a: Semi- quantatitive Scanning Electron Microscope chemical analyses of sample 2754.93 from Hesper I-52 well.

Sample	Site	Figure[+]	Position[+]	SiO_2	TiO_2	Al_2O_3	FeO_t	Cr_2O_3	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	BaO	Ce_2O_3	CO_2	SO_3	ZrO_2	Total	Mineral Name
2754.93	28	13	1	0	0	0	0	0	0	0	0	0	0	0	75.30	0	0	24.70	0	100	Barite
2754.93	28	13	2	49.37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	50.63	100	Zircon
2754.93	28	13	3	0	0	0	42.47	0	0	0	0	0	0	0	0	0	0	57.53	0	100	Pyrite
2754.93	28	13	4	70.07	0	16.20	0	0	0	0	0	0	13.73	0	0	0	0	0	0	100	K-feldspar
2754.93	28	13	5	68.46	0	17.92	0	0	0	0	0	0	13.62	0	0	0	0	0	0	100	K-feldspar
2754.93	29	14	1	34.29	3.19	17.13	31.91	0	0	7.55	0	0	1.94	0	0	0	0	0	0	96	Biotite (altered)
2754.93	29	14	2	0	0	0	40.93	0	0	0	0	0	0	0	0	0	0	59.07	0	100	Pyrite
2754.93	29	14	3	0	97.11	0	2.89	0	0	0	0	0	0	0	0	0	0	0	0	100	Rutile
2754.93	29	14	4	0	0	0	0	0	0	0	66.59	0	0	33.41	0	0	0	0	0	100	Apatite
2754.93	29	14	5	68.24	0	16.48	0	0	0	0	0	0	15.28	0	0	0	0	0	0	100	K-feldspar
2754.93	29	14	6	68.28	0	17.05	0	0	0	0	0	0	14.67	0	0	0	0	0	0	100	K-feldspar
2754.93	29	14	7	0	0	0	0	0	0	0	0	0	0	0	72.24	0	0	27.76	0	100	Barite
2754.93	29	14	8	0	0	0	39.77	0	0	0	0	0	0	0	0	0	0	60.23	0	100	Pyrite
2754.93	29	14	9	72.67	0	18.60	2.60	0	0	0	0	6.13	0	0	0	0	0	0	0	100	Albite
2754.93	30	15	1	27.42	0	19.74	35.17	0	0	5.67	0	0	0	0	0	0	0	0	0	88	Chlorite
2754.93	30	15	2	27.20	0	19.58	35.43	0	0	5.79	0	0	0	0	0	0	0	0	0	88	Chlorite
2754.93	30	15	3	29.01	0	18.01	36.15	0	0	4.83	0	0	0	0	0	0	0	0	0	88	Chlorite
2754.93	30	15	4	28.94	0	19.07	33.40	0	0	6.59	0	0	0	0	0	0	0	0	0	88	Chlorite
2754.93	30	15	5	26.83	0	19.99	36.43	0	0	4.75	0	0	0	0	0	0	0	0	0	88	Chlorite
2754.93	30	15	6	49.69	0	12.35	20.78	0	0	5.19	0	0	0	0	0	0	0	0	0	88	Chlorite
2754.93	30	15	7	56.14	0	9.19	20.58	0	0	2.09	0	0	0	0	0	0	0	0	0	88	Chlorite
2754.93	30	15	8	51.37	0	11.62	21.17	0	0	3.84	0	0	0	0	0	0	0	0	0	88	Chlorite
2754.93	30	15	9	32.30	0	18.05	32.11	0	0	5.55	0	0	0	0	0	0	0	0	0	88	Chlorite
2754.93	30	15	10	30.39	0	19.74	33.36	0	0	4.51	0	0	0	0	0	0	0	0	0	88	Chlorite
2754.93	30	15	11	34.94	0	17.79	30.54	0	0	4.74	0	0	0	0	0	0	0	0	0	88	Chlorite
2754.93	30	15	12	0	0	0	0	0	0	0	0	0	0	0	73.21	0	0	26.79	0	100	Barite
2754.93	30	15	13	0	0	0	0	0	0	0	0	0	0	0	73.18	0	0	26.82	0	100	Barite
2754.93	30	15	14	0	0	0	37.40	0	0	0	0	0	0	0	0	0	0	62.60	0	100	Pyrite
2754.93	30	15	15	0	0	0	40.13	0	0	0	0	0	0	0	0	0	0	59.87	0	100	Pyrite
2754.93	30	15	16	0	0	0	40.72	0	0	0	0	0	0	0	0	0	0	59.28	0	100	Pyrite
2754.93	31	16	1	0	0	0	44.46	0	0	0	0	0	0	0	0	0	0	55.54	0	100	Pyrite
2754.93	31	16	2	0	0	0	29.60	0	0	0	1.49	0	0	0	0	0	67.78	1.13	0	100	Siderite+ coal
2754.93	31	16	3	67.28	0	16.51	0	0	0	0	0	0	16.22	0	0	0	0	0	0	100	K-feldspar
2754.93	31	16	4	68.24	0	16.69	0	0	0	0	0	0	15.07	0	0	0	0	0	0	100	K-feldspar
2754.93	31	16	5	0	0	0	41.54	0	0	0	0	0	0	0	0	0	0	58.46	0	100	Pyrite
2754.93	31	16	6	0	0	0	43.20	0	0	0	0	0	0	0	0	0	0	56.80	0	100	Pyrite
2754.93	31	16	7	69.81	0	20.13	0	0	0	0	2.54	7.52	0	0	0	0	0	0	0	100	Oligoclase
2754.93	31	16	8	67.45	0	21.55	0	0	0	0	3.81	7.20	0	0	0	0	0	0	0	100	Oligoclase
2754.93	31	16	9	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
2754.93	31	16	10	0	0	0	41.97	0	0	0	0	0	0	0	0	0	0	58.03	0	100	Pyrite
2754.93	31	16	11	0	0	0	11.16	0	0	0	0.36	0	0	0	0	0	88.48	0	0	100	Coal+ siderite
2754.93	31	16	12	67.34	0	18.58	0	0	0	0	0	0	14.08	0	0	0	0	0	0	100	K-feldspar
2754.93	31	16	13	69.55	0	16.06	0	0	0	0	0	0	14.39	0	0	0	0	0	0	100	K-feldspar
2754.93	31	16	14	70.39	0	16.38	0	0	0	0	0	0	13.23	0	0	0	0	0	0	100	K-feldspar
2754.93	31	16	15	69.19	0	16.84	0	0	0	0	0	0	13.96	0	0	0	0	0	0	100	K-feldspar
2754.93	32	17	1	0	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Rutile

Notes: 1) Total iron is expressed as FeO; 2) += These figures and positions are shown in Appendix C1; 3) Original analyses of minerals have been recalculated appropriately.

Appendix C1, Table 1a: Semi- quantatitive Scanning Electron Microscope chemical analyses of sample 2754.93 from Hesper I-52 well.

Sample	Site	Figure+	Position+	SiO_2	TiO_2	Al_2O_3	FeO_t	Cr_2O_3	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	BaO	Ce_2O_3	CO_2	SO_3	ZrO_2	Total	Mineral Name
2754.93	32	17	2	0	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Rutile
2754.93	32	17	3	51.83	0	26.67	4.86	0	0	1.50	0	0	10.15	0	0	0	0	0	0	95	Muscovite
2754.93	32	17	4	48.34	0	28.21	5.87	0	0	1.86	0	0	10.72	0	0	0	0	0	0	95	Muscovite
2754.93	32	17	5	76.98	0	12.47	0	0	0	0	0	0	10.54	0	0	0	0	0	0	100	K-feldspar
2754.93	32	17	6	0	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Rutile
2754.93	32	17	7	0	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Rutile
2754.93	32	17	8	0	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Rutile
2754.93	32	17	9	68.12	0	17.36	0	0	0	0	0	0	14.51	0	0	0	0	0	0	100	K-feldspar
2754.93	32	17	10	68.81	0	16.44	0	0	0	0	0	0	14.75	0	0	0	0	0	0	100	K-feldspar
2754.93	32	17	11	68.11	0	18.07	0	0	0	0	0	0	13.81	0	0	0	0	0	0	100	K-feldspar
2754.93	32	17	12	70.71	0	16.38	0	0	0	0	0	0	12.91	0	0	0	0	0	0	100	K-feldspar
2754.93	32	17	13	70.45	0	15.75	0	0	0	0	0	0	13.79	0	0	0	0	0	0	100	K-feldspar
2754.93	32	17	14	69.35	0	16.74	0	0	0	0	0	0	13.92	0	0	0	0	0	0	100	K-feldspar
2754.93	32	17	15	0	0	0	5.04	0	0	0	0	0	0	0	71.56	0	0	23.40	0	100	Pyrite+ Barite
2754.93	32	17	16	0	0	0	0	0	0	0	0	0	0	0	74.12	0	0	25.88	0	100	Barite
2754.93	32	17	17	0	0	0	0	0	0	0	0	0	0	0	73.78	0	0	26.22	0	100	Barite
2754.93	32	17	18	0	0	0	26.38	0	5.25	0	0	0	0	0	25.86	0	33.53	8.98	0	100	Siderite+ Barite

Notes: 1) Total iron is expressed as FeO; 2) += These figures and positions are shown in Appendix C1; 3) Original analyses of minerals have been recalculated appropriately.

Appendix 1b: BSE images of sample 2756.63 m

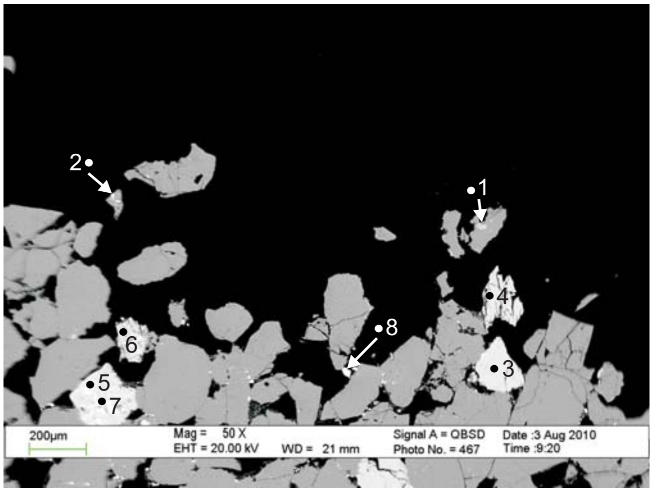


Figure 1: 2756.63 m., Muscovite (pos. 1); Pyrite (pos. 2); K-feldspar (3-7); Barite (pos. 8)

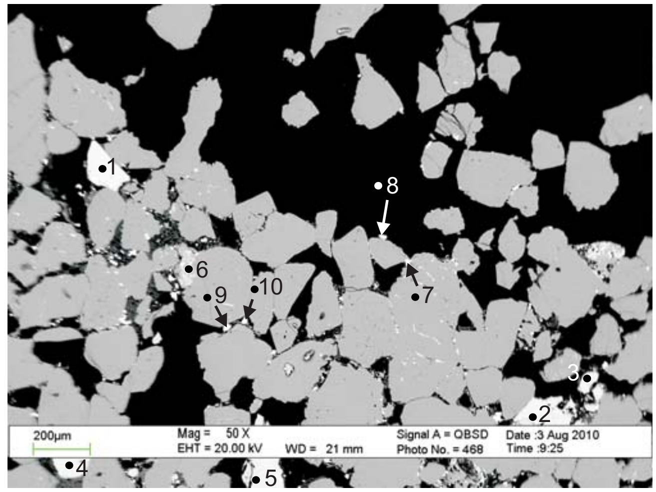


Figure 2: 2756.63 m., K-feldspar (pos.1- 5); Quartz (pos. 6); Pyrite (pos. 7,8); Barite (pos. 9,10)

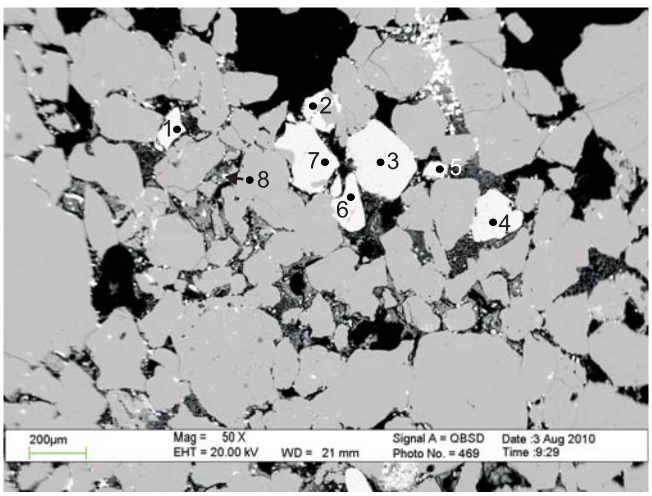


Figure 3: 2756.63 m., K-feldspar (pos. 1-7); Barite (pos. 8)

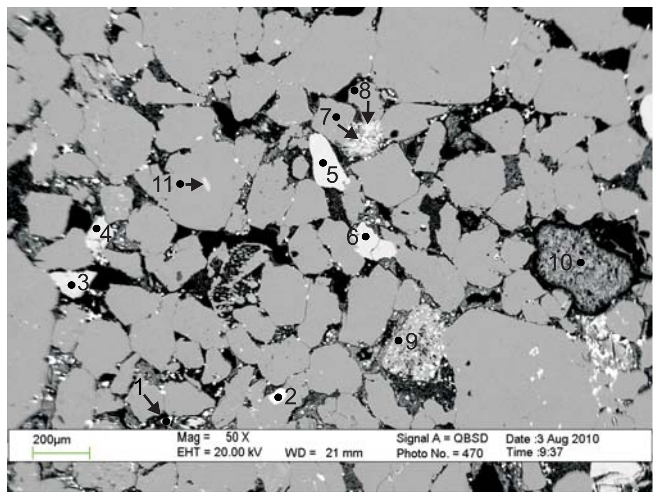


Figure 4: 2756.63 m., Barite (pos. 1); Zircon (pos. 2); K-feldspar (pos. 3-8); Albite+ K-feldspar (pos. 9); Altered feldspar (pos. 10); Muscovite (pos. 11)

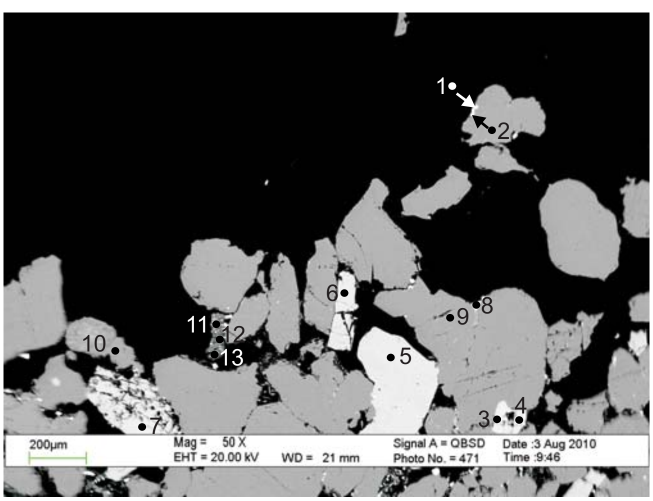


Figure 5: 2756.63 m., Quartz (pos. 1,9,10); Pyrite (pos. 2); K-feldspar+ Apatite (pos. 3); K-feldspar (pos. 4-7); Mixture (pos. 8,11,12); Chlorite+ Muscovite (pos. 13)

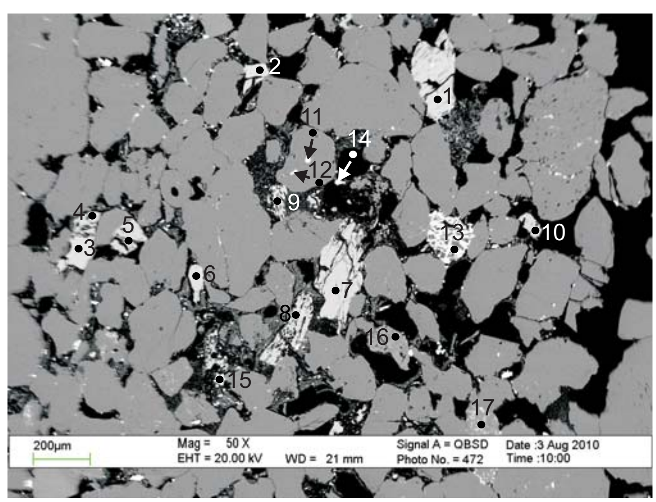


Figure 6: 2756.63 m., K-feldspar (pos. 1-9); Titanite (pos. 11,12); Rutile (pos. 13); Barite (pos. 14); Pyrite (pos 15); Albite (pos. 16); Quartz (pos. 17)

Appendix 1b: BSE images of sample 2756.63 m

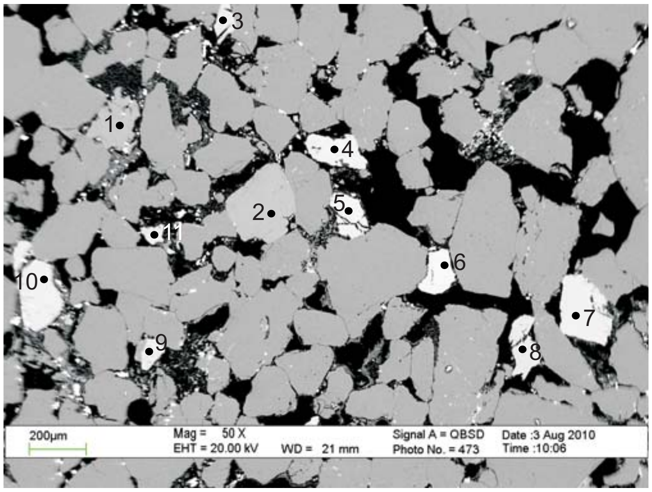


Figure 7: 2756.63 m.,Oligoclase (pos. 1,2); K-feldspar (pos. 3-11)

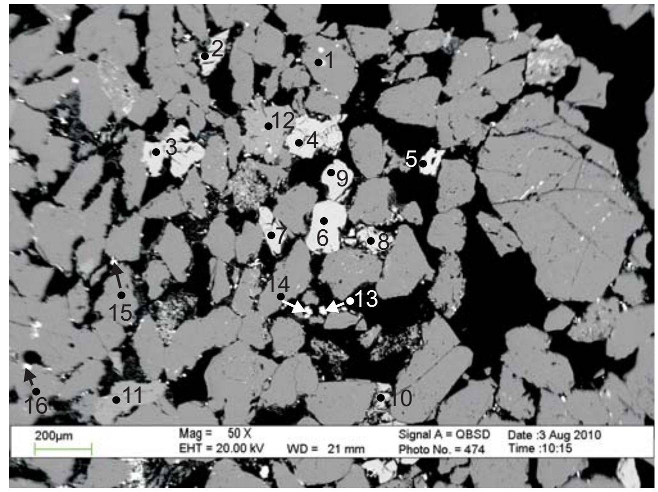


Figure 8: 2756.63 m., K-feldspar (pos. 1-10); Oligoclase (pos. 11,12); Barite (contaminant) (pos. 13-15); Pyrite+ Quartz (pos. 16)

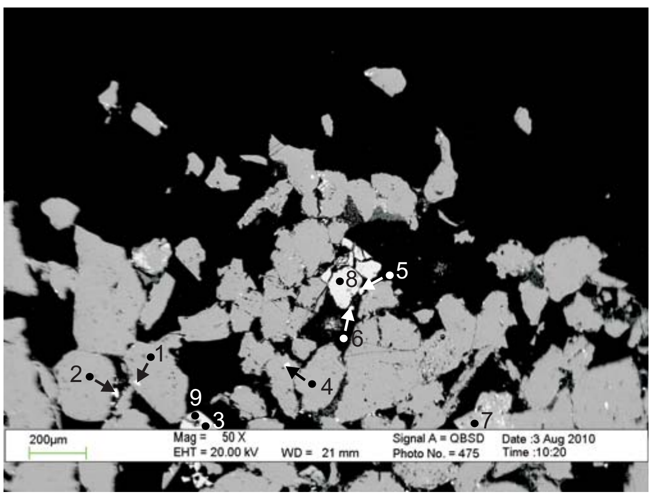


Figure 9: 2756.63 m., Pyrite (pos. 1, 4); Barite (pos. 2,5,6); K-feldspar (pos. 3,8,9); Albite (pos. 7)

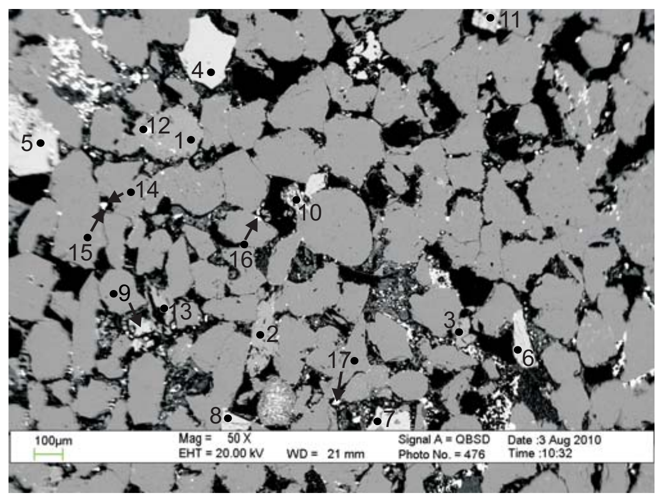


Figure 10: 2756.63 m., Albite (pos. 1); Oligoclase (pos. 2-3); K-feldspar (pos. 4-11); Rutile (pos. 12); Unknown (pos. 13); Barite (pos. 14,15); Zircon (pos. 16)

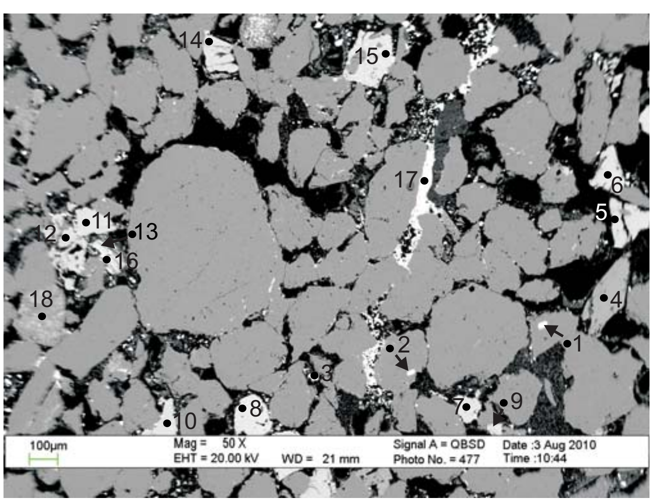


Figure 11: 2756.63 m., Apatite (pos. 1); Zircon (pos. 2); Barite (pos. 3); Oligoclase (pos. 4); K-feldspar (pos. 5-12,14,15); Chlorite+ pyrite (pos. 13); Chlorite (pos. 16); Siderite (pos. 17); Quartz+ K-feldspar (pos. 18)

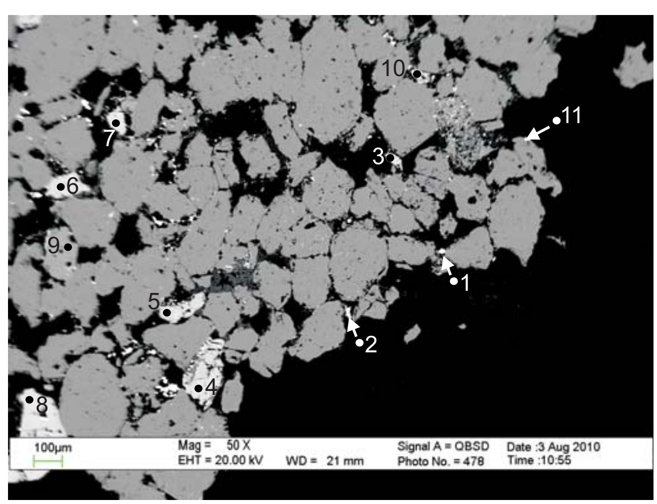


Figure 12: 2756.63 m., Barite (pos. 1,2); K-feldspar (pos. 3-8,10); Albite (pos. 9); Pyrite (pos. 11)

Appendix 1b: BSE images of sample 2756.63 m

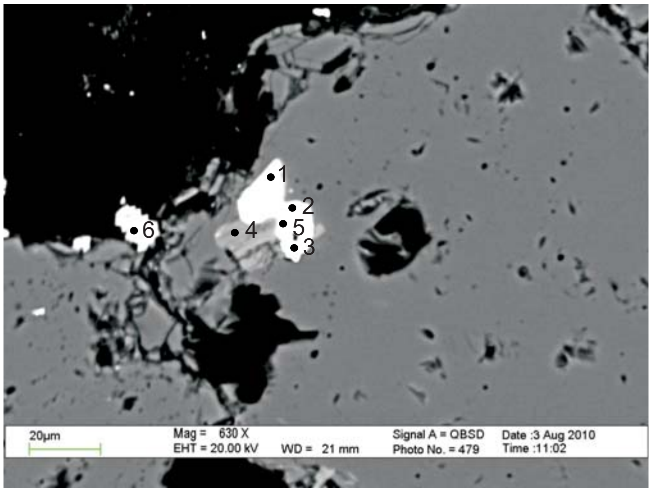


Figure 13: 2756.63 m., Xenotime (pos. 1); Zircon (pos. 2); Monazite (pos. 3,5); K-feldspar (pos. 4); Siderite (pos. 6)

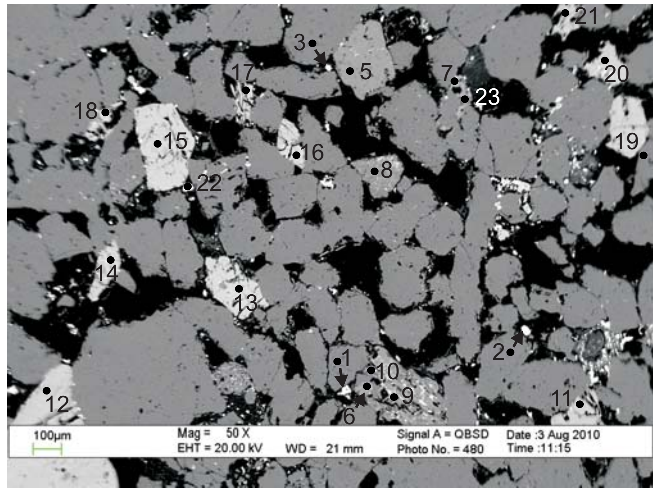


Figure 14: 2756.63 m., Barite (pos. 1-3,22); Pyrite (pos. 4); Albite (pos. 5,9); Oligoclase (pos. 6); Muscovite (pos. 7, 23); K-feldspar+ Quartz (pos. 8); K-feldspar (pos. 11-21); Quartz (pos. 10)

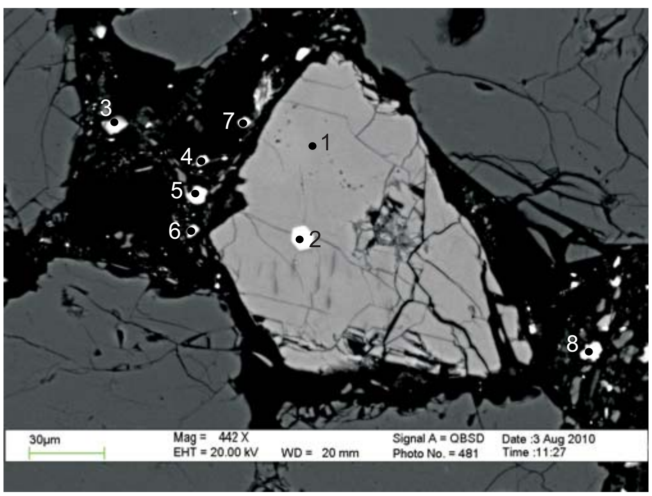


Figure 15: 2756.63 m., K-feldspar (pos. 1); Apatite (pos. 2); Siderite (pos. 3); Barite (pos. 4-7); Pyrite (pos. 8)

Appendix C1, Table 1b: Semi- quantitative Scanning Electron Microscope chemical analyses of sample 2756.63 from Hesper I-52 well.

Sample	Site	Figure+	Position+	SiO_2	TiO_2	Al_2O_3	FeO_t	Cr_2O_3	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	SO_3	BaO	Ce_2O_3	CO_2	ZrO_2	Y_2O_3	Gd_2O_3	Dy_2O_3	Yb_2O_3	Nd_2O_3	La_2O_3	ThO_2	Total	Mineral Name
2756.63	2	1	1	49.63	0	31.99	2.36	0	0	0.67	0	0.78	9.57	0	0	0	0	0	0	0	0	0	0	0	0	0	95	Muscovite
2756.63	2	1	2	0	0	0	41.21	0	0	0	0	0	0	0	58.79	0	0	0	0	0	0	0	0	0	0	0	100	Pyrite
2756.63	2	1	3	69.37	0	16.24	0	0	0	0	0	0	14.39	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	2	1	4	68.92	0	17.22	0	0	0	0	0	0	13.86	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	2	1	5	68.71	0	17.79	0	0	0	0	0	0	13.50	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	2	1	6	69.15	0	17.38	0	0	0	0	0	0	13.48	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	2	1	7	68.50	0	16.42	0	0	0	0	0	0	15.08	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	2	1	8	0	0	0	0	0	0	0	0	0	0	0	26.30	73.70	0	0	0	0	0	0	0	0	0	0	100	Barite
2756.63	3	2	1	68.66	0	17.80	0	0	0	0	0	0	13.54	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	3	2	2	69.43	0	16.51	0	0	0	0	0	0	14.06	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	3	2	3	68.86	0	16.44	0	0	0	0	0	0	14.70	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	3	2	4	70.06	0	16.64	0	0	0	0	0	0	13.30	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	3	2	5	70.67	0	16.44	0	0	0	0	0	0	12.89	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	3	2	6	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
2756.63	3	2	7	0	0	0	39.85	0	0	0	0	0	0	0	60.15	0	0	0	0	0	0	0	0	0	0	0	100	Pyrite
2756.63	3	2	8	0	0	0	44.50	0	0	0	0	0	0	0	55.50	0	0	0	0	0	0	0	0	0	0	0	100	Pyrite
2756.63	3	2	9	0	0	0	0	0	0	0	0	0	0	0	26.02	73.98	0	0	0	0	0	0	0	0	0	0	100	Barite
2756.63	3	2	10	0	0	0	0	0	0	0	0	0	0	0	26.61	73.39	0	0	0	0	0	0	0	0	0	0	100	Barite
2756.63	4	3	1	69.26	0	16.48	0	0	0	0	0	0	14.26	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	4	3	2	67.17	0	17.70	0	0	0	0	0	0	15.13	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	4	3	3	69.53	0	16.55	0	0	0	0	0	0	13.92	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	4	3	4	68.56	0	18.16	0	0	0	0	0	0	13.28	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	4	3	5	68.06	0	18.43	0	0	0	0	0	0	13.51	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	4	3	6	72.09	0	14.91	0	0	0	0	0	0	13.00	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	4	3	7	68.30	0	16.86	0	0	0	0	0	0	14.84	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	4	3	8	0	0	0	0	0	0	0	0	0	0	0	25.58	74.42	0	0	0	0	0	0	0	0	0	0	100	Barite
2756.63	5	4	1	0	0	0	2.70	0	0	0	0	0	0	0	26.09	71.21	0	0	0	0	0	0	0	0	0	0	100	Barite
2756.63	5	4	2	46.90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	53.10	0	0	0	0	0	0	0	100	Zircon
2756.63	5	4	3	68.52	0	16.98	0	0	0	0	0	0	14.50	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	5	4	4	68.18	0	17.94	0	0	0	0	0	0	13.89	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	5	4	5	68.03	0	16.87	0	0	0	0	0	0	15.09	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	5	4	6	68.38	0	16.73	0	0	0	0	0	0	14.89	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	5	4	7	69.37	0	19.68	0	0	0	0	0	0	10.95	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	5	4	8	67.92	0	17.21	0	0	0	0	0	0	14.88	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	5	4	9	69.82	0	18.81	1.99	0	0	0	0	7.28	2.10	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Albite+ K-feldspar
2756.63	5	4	10	77.32	0	0	0	0	0	4.70	8.69	9.29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Altered feldspar
2756.63	5	4	11	50.20	0.66	30.83	2.42	0	0	0.91	0	0	9.99	0	0	0	0	0	0	0	0	0	0	0	0	0	95	Muscovite
2756.63	6	5	1	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
2756.63	6	5	2	0	0	0	45.16	0	0	0	0	0	0	0	54.84	0	0	0	0	0	0	0	0	0	0	0	100	Pyrite
2756.63	6	5	3	55.13	0	13.76	1.77	0	0	0	12.16	0	10.45	6.74	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar + Apatite
2756.63	6	5	4	68.82	0	17.39	0	0	0	0	0	0	13.79	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	6	5	5	69.01	0	16.22	0	0	0	0	0	0	14.77	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	6	5	6	67.57	0	16.78	0	0	0	0	0	0	15.65	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	6	5	7	68.91	0	16.85	0	0	0	0	0	0	14.24	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	6	5	8	18.22	0.52	13.15	39.42	0	0	3.27	0	1.25	0	0	24.17	0	0	0	0	0	0	0	0	0	0	0	100	Mixture
2756.63	6	5	9	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
2756.63	6	5	10	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
2756.63	6	5	11	39.62	0	17.59	24.18	0	0	2.95	0.70	0	3.45	0	11.52	0	0	0	0	0	0	0	0	0	0	0	100	Mixture
2756.63	6	5	12	36.49	0	18.94	25.30	0	0	4.55	0	0	1.83	0	12.88	0	0	0	0	0	0	0	0	0	0	0	100	Mixture
2756.63	6	5	13	46.52	0	20.78	22.91	0	1	3.96	1.05	0	3.95	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Chlorite+ Muscovite
2756.63	7	6	1	69.96	0	16.26	0	0	0	0	0	0	13.78	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	7	6	2	68.66	0	16.25	0	0	0	0	0	0	15.09	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	7	6	3	69.44	0	15.24	0	0	0	0	0	0	15.31	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	7	6	4	70.02	0	18.04	0	0	0	0	0	0	11.94	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar

Notes: 1) Total iron is expressed as FeO; 2) += These figures and positions are shown in Appendix 1; 3) Original analyses of minerals have been recalculated appropriately.

Appendix C1, Table 1b: Semi- quantitative Scanning Electron Microscope chemical analyses of sample 2756.63 from Hesper I-52 well.

Sample	Site	Figure+	Position+	SiO_2	TiO_2	Al_2O_3	FeO_t	Cr_2O_3	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	SO_3	BaO	Ce_2O_3	CO_2	ZrO_2	Y_2O_3	Gd_2O_3	Dy_2O_3	Yb_2O_3	Nd_2O_3	La_2O_3	ThO_2	Total	Mineral Name
2756.63	7	6	5	70.68	0	15.41	0	0	0	0	0	0	13.91	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	7	6	6	68.84	0	16.32	0	0	0	0	0	0	14.84	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	7	6	7	68.06	0	17.33	0	0	0	0	0	0	14.61	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	7	6	8	67.68	0	17.26	0	0	0	0	0	0	15.06	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	7	6	9	68.23	0	18.26	0	0	0	0	0	0	13.51	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	7	6	10	68.06	0	17.06	0	0	0	0	0	0.59	14.29	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	7	6	11	34.50	34.82	2.88	1.38	0	0	0	26.41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Titanite
2756.63	7	6	12	59.92	21.77	1.33	0	0	0	0	16.97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Titanite
2756.63	7	6	13	0	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Rutile
2756.63	7	6	14	0	0	0	0	0	0	0	0	0	0	0	26.34	73.66	0	0	0	0	0	0	0	0	0	0	100	Barite
2756.63	7	6	15	0	0	0	39.55	0	0	0	0	0	0	0	60.45	0	0	0	0	0	0	0	0	0	0	0	100	Pyrite
2756.63	7	6	16	70.19	0	20.76	0	0	0	0	1.46	7.59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Albite
2756.63	7	6	17	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
2756.63	8	7	1	68.53	0	20.47	0	0	0	0	2.85	8.15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Oligoclase
2756.63	8	7	2	67.82	0	21.50	0	0	0	0	3.32	7.36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Oligoclase
2756.63	8	7	3	69.57	0	17.07	0	0	0	0	0	0	13.36	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	8	7	4	68.79	0	16.37	0	0	0	0	0	0	14.84	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	8	7	5	68.59	0	17.88	0	0	0	0	0	0	13.53	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	8	7	6	70.56	0	16.87	0	0	0	0	0	0	12.57	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	8	7	7	69.07	0	17.30	0	0	0	0	0	0	13.64	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	8	7	8	69.22	0	16.29	0	0	0	0	0	0	14.49	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	8	7	9	67.82	0	17.67	0	0	0	0	0	0	14.52	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	8	7	10	69.27	0	16.78	0	0	0	0	0	0	13.96	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	8	7	11	69.56	0	16.50	0	0	0	0	0	0	13.94	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	9	8	1	69.30	0	17.16	0	0	0	0	0	0	13.54	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	9	8	2	68.36	0	16.57	0	0	0	0	0	0	15.07	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	9	8	3	68.88	0	17.24	0	0	0	0	0	0	13.87	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	9	8	4	69.60	0	16.67	0	0	0	0	0	0	13.73	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	9	8	5	69.31	0	17.90	0	0	0	0	0	0	12.79	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	9	8	6	69.46	0	16.85	0	0	0	0	0	0	13.69	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	9	8	7	69.46	0	16.48	0	0	0	0	0	0	14.06	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	9	8	8	67.00	0	18.44	0	0	0	0	0	0	14.56	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	9	8	9	69.24	0	16.55	0	0	0	0	0	0	14.21	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	9	8	10	69.62	0	16.90	0	0	0	0	0	0	13.48	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	9	8	11	68.78	0	20.21	0	0	0	0	3.40	7.61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Oligoclase
2756.63	9	8	12	68.95	0	20.26	0	0	0	0	3.53	7.26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Oligoclase
2756.63	9	8	13	0	0	0	0	0	0	0	0	0	0	0	26.52	73.48	0	0	0	0	0	0	0	0	0	0	100	Barite
2756.63	9	8	14	0	0	0	0	0	0	0	0	0	0	0	26.25	73.75	0	0	0	0	0	0	0	0	0	0	100	Barite
2756.63	9	8	15	0	0	0	0	0	0	0	0	0	0	0	27.72	72.28	0	0	0	0	0	0	0	0	0	0	100	Barite
2756.63	9	8	16	52.78	0	0	18.10	0	0	0	0	0	0	0	29.12	0	0	0	0	0	0	0	0	0	0	0	100	Pyrite+ Quartz
2756.63	10	9	1	0	0	0	40.57	0	0	0	0	0	0	0	59.43	0	0	0	0	0	0	0	0	0	0	0	100	Pyrite
2756.63	10	9	2	0	0	0	0	0	0	0	0	0	0	0	30.30	69.70	0	0	0	0	0	0	0	0	0	0	100	Barite
2756.63	10	9	3	68.70	0	17.12	0	0	0	0	0	0	14.18	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	10	9	4	0	0	0	56.44	0	0	0	0	0	0	0	43.56	0.00	0	0	0	0	0	0	0	0	0	0	100	Pyrite
2756.63	10	9	5	0	0	0	0	0	0	0	0	0	0	0	26.30	73.70	0	0	0	0	0	0	0	0	0	0	100	Barite
2756.63	10	9	6	0	0	0	0	0	0	0	0	0	0	0	22.11	77.89	0	0	0	0	0	0	0	0	0	0	100	Barite
2756.63	10	9	7	74.80	0	16.94	0	0	0	0	0	8.26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Albite
2756.63	10	9	8	69.66	0	16.92	0	0	0	0	0	0	13.43	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	10	9	9	68.57	0	17.70	0	0	0	0	0	0	13.73	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	11	10	1	70.29	0	19.39	0	0	0	0	1.92	8.40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Albite
2756.63	11	10	2	68.86	0	20.94	0	0	0	0	2.83	7.37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Oligoclase
2756.63	11	10	3	67.59	0	22.38	0	0	0	0	4.25	5.78	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Oligoclase
2756.63	11	10	4	68.58	0	16.89	0	0	0	0	0	0	14.52	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	11	10	5	68.93	0	16.73	0	0	0	0	0	0	14.34	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	11	10	6	68.94	0	17.03	0	0	0	0	0	0	14.03	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	11	10	7	67.66	0	17.71	0	0	0	0	0	0	14.62	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	11	10	8	67.28	0	17.61	0	0	0	0	0	0	15.11	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar

Notes: 1) Total iron is expressed as FeO; 2) += These figures and positions are shown in Appendix 1; 3) Original analyses of minerals have been recalculated appropriately.

Appendix C1, Table 1b: Semi- quantitative Scanning Electron Microscope chemical analyses of sample 2756.63 from Hesper I-52 well.

Sample	Site	Figure[+]	Position[+]	SiO_2	TiO_2	Al_2O_3	FeO_t	Cr_2O_3	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	SO_3	BaO	Ce_2O_3	CO_2	ZrO_2	Y_2O_3	Gd_2O_3	Dy_2O_3	Yb_2O_3	Nd_2O_3	La_2O_3	ThO_2	Total	Mineral Name
2756.63	11	10	9	67.93	0	17.80	0	0	0	0	0	0	14.27	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	11	10	10	67.87	0	16.81	0	0	0	0	0	0	15.32	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	11	10	11	67.00	0	19.41	0	0	0	0	0	0	13.58	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	11	10	12	0	91.92	0	0.60	0	0	0	0	0	0	0	0	0	0	7.48	0	0	0	0	0	0	0	0	100	Rutile
2756.63	11	10	13	21.30	0	0	0	0	0	0	3.98	6.50	68.22	0	0	0	0	0	0	0	0	0	0	0	0	0	100	?
2756.63	11	10	14	0	0	0	0	0	0	0	0	0	0	0	29.70	70.30	0	0	0	0	0	0	0	0	0	0	100	Barite
2756.63	11	10	15	0	0	0	0	0	0	0	0	0	0	0	26.39	73.61	0	0	0	0	0	0	0	0	0	0	100	Barite
2756.63	11	10	16	44.76	0	0	0	0	0	0	0	0	0	0	0	0	0	0	55.24	0	0	0	0	0	0	0	100	Zircon
2756.63	13	11	1	0	0	0	0	0	0	0	66.97	0	0	33.03	0	0	0	0	0	0	0	0	0	0	0	0	100	Apatite
2756.63	13	11	2	47.67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	52.33	0	0	0	0	0	0	0	100	Zircon
2756.63	13	11	3	0	0	0	0	0	0	0	0	0	0	0	28.20	71.80	0	0	0	0	0	0	0	0	0	0	100	Barite
2756.63	13	11	4	67.63	0	21.39	0	0	0	0	3.86	7.13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Oligoclase
2756.63	13	11	5	69.30	0	16.85	0	0	0	0	0	0	13.85	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	13	11	6	68.60	0	17.70	0	0	0	0	0	0	13.70	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	13	11	7	69.54	0	17.05	0	0	0	0	0	0	13.41	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	13	11	8	67.51	0	19.18	0	0	0	0	0	0	13.32	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	13	11	9	67.59	0	18.27	0	0	0	0	0	0	14.14	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	13	11	10	68.22	0	17.64	0	0	0	0	0	0	14.15	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	13	11	11	69.53	0	15.88	0	0	0	0	0	0	14.59	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	13	11	12	69.27	0	16.66	0	0	0	0	0	0	14.07	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	13	11	13	26.10	0	15.33	39.40	0	0	4.49	2.07	0	0	0	12.60	0	0	0	0	0	0	0	0	0	0	0	100	Chlorite+ Pyrite
2756.63	13	11	14	69.58	0	17.04	0	0	0	0	0	0	13.38	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	13	11	15	66.70	0	18.34	0	0	0	0	0	0	14.96	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	13	11	16	28.88	0	20.34	32.22	0	0	5.47	1.09	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	88	Chlorite
2756.63	13	11	17	0.00	0	0	48.88	0	1.14	0	4.29	0	0	0	0	0	0	45.70	0	0	0	0	0	0	0	0	100	Siderite
2756.63	13	11	18	94.67	0	3.30	0	0	0	0	0	0	2.03	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz+ K-feldspar
2756.63	15	12	1	0	0	0	0	0	0	0	0	0	0	0	23.93	76.07	0	0	0	0	0	0	0	0	0	0	100	Barite
2756.63	15	12	2	0	0	0	0	0	0	0	0	0	0	0	28.83	71.17	0	0	0	0	0	0	0	0	0	0	100	Barite
2756.63	15	12	3	69.18	0	17.64	0	0	0	0	0	0	13.18	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	15	12	4	68.86	0	16.28	0	0	0	0	0	0	14.86	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	15	12	5	68.12	0	17.99	0	0	0	0	0	0	13.88	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	15	12	6	68.69	0	16.66	0	0	0	0	0	0	14.65	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	15	12	7	69.31	0	17.37	0	0	0	0	0	0	13.32	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	15	12	8	68.49	0	17.15	0	0	0	0	0	0	14.36	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	15	12	9	70.51	0	19.96	0	0	0	0	1.63	7.90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Albite
2756.63	15	12	10	69.68	0	16.64	0	0	0	0	0	0	13.68	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	15	12	11	0	0	0	44.61	0	0	0	0	0	0	0	55.39	0	0	0	0	0	0	0	0	0	0	0	100	Pyrite
2756.63	17	13	1	0	0	0	0	0	0	0	0	0	0	35.35	0	0	0	0	0	40.69	4.54	9.97	9.45	0	0	0	100	Xenotime
2756.63	17	13	2	65.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	34.99	0	0	0	0	0	0	0	100	Zircon
2756.63	17	13	3	12.04	0	0	0	0	0	0	1.19	0	0	31.10	0	0	14.81	0	0	26.06	0	5.99	0	8.82	0	0	100	Monazite
2756.63	17	13	4	52.72	0	35.02	2.04	0	0	0	0	0	10.22	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	17	13	5	0	0	0	0.00	0	0	0	1.91	0	0	23.60	0	0	34.85	0	0	0	0	0	0	15	13.58	11.17	100	Monazite
2756.63	17	13	6	0	0	0	48.33	0	1.73	0	4.61	0	0	0	0	0	0	45.33	0	0	0	0	0	0	0	0	100	Siderite
2756.63	18	14	1	0	0	0	0	0	0	0	0	0	0	0	28.00	72.00	0	0	0	0	0	0	0	0	0	0	100	Barite
2756.63	18	14	2	0	0	0	0	0	0	0	0	0	0	0	26.18	73.82	0	0	0	0	0	0	0	0	0	0	100	Barite
2756.63	18	14	3	0	0	0	0	0	0	0	0	0	0	0	27.37	72.63	0	0	0	0	0	0	0	0	0	0	100	Barite
2756.63	18	14	4	0	0	0	43.08	0	0	0	0	0	0	0	56.92	0	0	0	0	0	0	0	0	0	0	0	100	Pyrite
2756.63	18	14	5	70.70	0	21.00	0	0	0	0	0.82	7.48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Albite
2756.63	18	14	6	67.66	0	20.87	0	0	0	0	4.37	7.10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Oligoclase
2756.63	18	14	7	49.49	0	31.84	2.12	0	0	1.40	1.15	0	9.00	0	0	0	0	0	0	0	0	0	0	0	0	0	95	Muscovite
2756.63	18	14	8	85.90	0	8.37	1.42	0	0	0	0	0	4.30	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar + Quartz
2756.63	18	14	9	78.18	0	12.88	2.99	0	0	0	0	5.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Albite
2756.63	18	14	10	100	0	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
2756.63	18	14	11	67.69	0	16.82	0	0	0	0	0	0	15.49	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	18	14	12	66.60	0	18.96	0	0	0	0	0	0	14.43	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar

Notes: 1) Total iron is expressed as FeO; 2) += These figures and positions are shown in Appendix 1; 3) Original analyses of minerals have been recalculated appropriately.

Appendix C1, Table 1b: Semi- quantitative Scanning Electron Microscope chemical analyses of sample 2756.63 from Hesper I-52 well.

Sample	Site	Figure+	Position+	SiO_2	TiO_2	Al_2O_3	FeO_t	Cr_2O_3	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	SO_3	BaO	Ce_2O_3	CO_2	ZrO_2	Y_2O_3	Gd_2O_3	Dy_2O_3	Yb_2O_3	Nd_2O_3	La_2O_3	ThO_2	Total	Mineral Name
2756.63	18	14	13	68.00	0	16.81	0	0	0	0	0	0	15.20	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	18	14	14	67.86	0	18.24	0	0	0	0	0	0	13.90	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	18	14	15	69.42	0	16.51	0	0	0	0	0	0	14.07	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	18	14	16	67.26	0	17.71	0	0	0	0	0	0	15.03	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	18	14	17	69.47	0	16.86	0	0	0	0	0	0	13.67	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	18	14	18	68.59	0	18.00	0	0	0	0	0	0	13.41	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	18	14	19	68.33	0	17.91	0	0	0	0	0	0	13.76	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	18	14	20	68.84	0	16.89	0	0	0	0	0	0	14.27	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	18	14	21	67.94	0	18.16	0	0	0	0	0	0	13.90	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	18	14	22	0	0	0	0	0	0	0	0	0	0	0	30.88	69.12	0	0	0	0	0	0	0	0	0	0	100	Barite
2756.63	18	14	23	49.44	0	31.24	4.63	0	0	1.38	0	0	8.31	0	0	0	0	0	0	0	0	0	0	0	0	0	95	Muscovite
2756.63	22	15	1	68.67	0	16.36	0	0	0	0	0	0	14.97	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2756.63	22	15	2	0	0	0	0	0	0	0	69.53	0	0	30.47	0	0	0	0	0	0	0	0	0	0	0	0	100	Apatite
2756.63	22	15	3	0	0	0	45.74	0	0	4.90	1.98	0	0	0	0	0	0	47.37	0	0	0	0	0	0	0	0	100	Siderite
2756.63	22	15	4	0	0	0	0	0	0	0	0	0	0	0	27.89	72.11	0	0	0	0	0	0	0	0	0	0	100	Barite
2756.63	22	15	5	0	0	0	0	0	0	0	0	0	0	0	26.35	73.65	0	0	0	0	0	0	0	0	0	0	100	Barite
2756.63	22	15	6	0	0	0	0	0	0	0	0	0	0	0	29.05	70.95	0	0	0	0	0	0	0	0	0	0	100	Barite
2756.63	22	15	7	0	0	0	0	0	0	0	0	0	0	0	27.60	72.40	0	0	0	0	0	0	0	0	0	0	100	Barite
2756.63	22	15	8	0	0	0	40.75	0	0	0	0	0	0	0	59.25	0	0	0	0	0	0	0	0	0	0	0	100	Pyrite

Notes: 1) Total iron is expressed as FeO; 2) += These figures and positions are shown in Appendix 1; 3) Original analyses of minerals have been recalculated appropriately.

Appendix 1c: BSE images of sample 2757.19 m

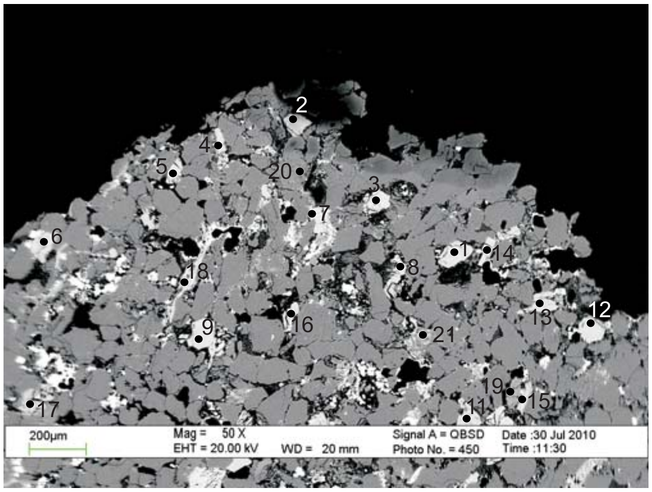


Figure 1: 2757.19 m., K-feldspar (pos. 1-14, 16, 17, 21); Chlorite +Muscovite (pos. 15); Muscovite+ chlorite (pos. 18); Tourmaline (pos. 19); Quartz (pos. 20)

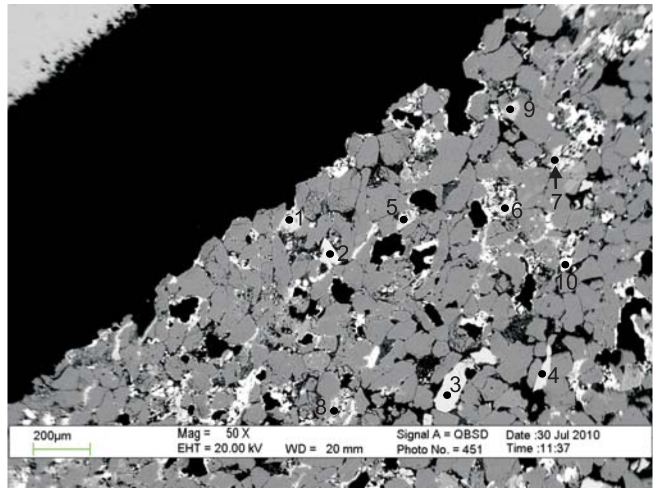


Figure 2: 2757.19 m., K-feldspar (pos. 1-8); Muscovite+ Chlorite (pos. 9); Unknown (pos. 10)

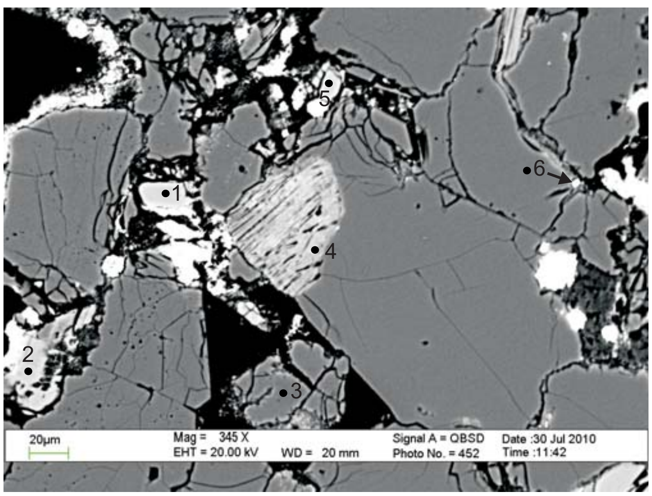


Figure 3: 2757.19 m., K-feldspar (pos. 1,2,5); Quartz (pos. 3); Muscovite (pos. 4); Pyrite+ K-feldspar+ TiO_2 (pos. 6)

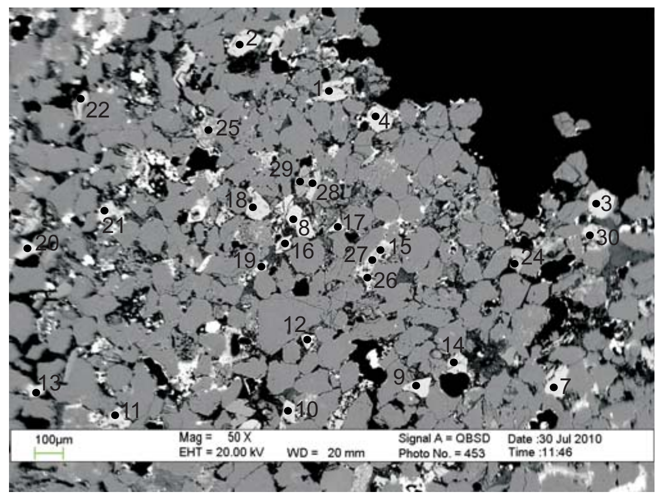


Figure 4: 2757.19 m., K-feldspar (pos. 1-22 ,26, 27,30); Tourmaline (pos. 23,24); Albite (pos. 25); Muscovite (pos. 28); Tourmaline+ TiO_2 (pos. 29)

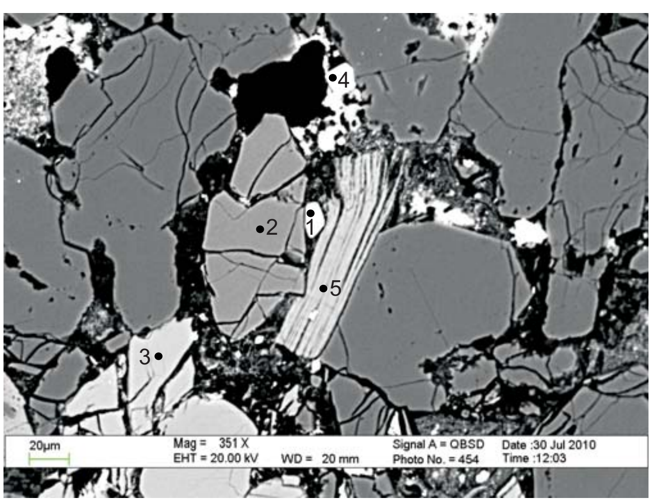


Figure 5: 2757.19 m., Rutile (pos. 1,4); Tourmaline (pos. 2); K-feldspar (pos. 3); Muscovite+ TiO_2 (pos. 5)

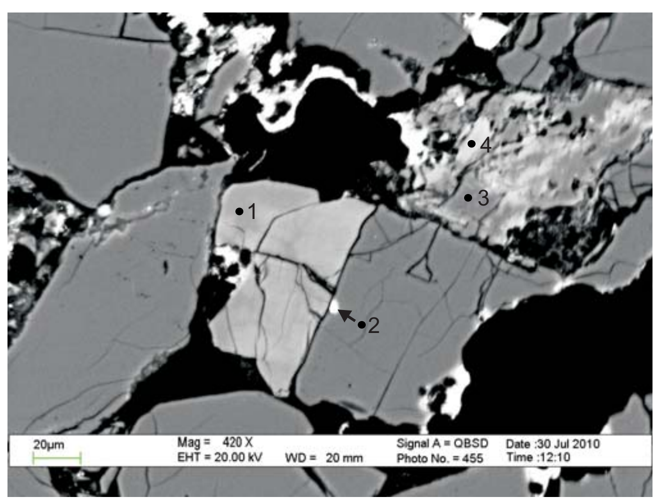


Figure 6: 2757.19 m., Tourmaline (pos. 1); Pyrite (pos. 2); Quartz (pos. 3); K-feldspar (pos. 4)

Appendix 1c: BSE images of sample 2757.19 m

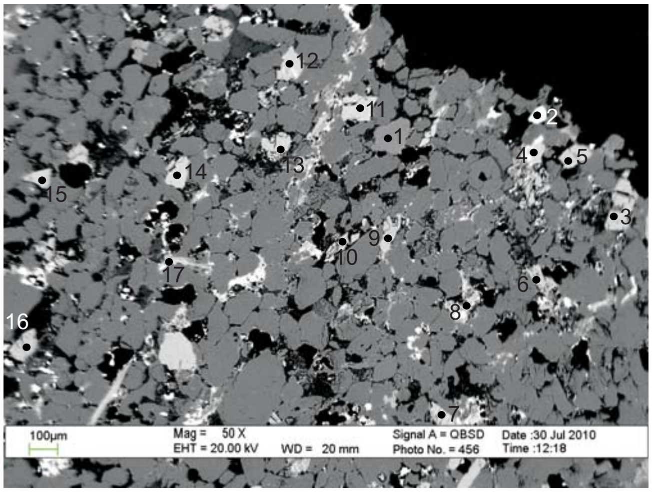


Figure 7: 2757.19 m., Albite (pos. 1); Rutile (pos. 2); K-feldspar (pos. 3-7; 9-16); Chlorite (pos. 8,17)

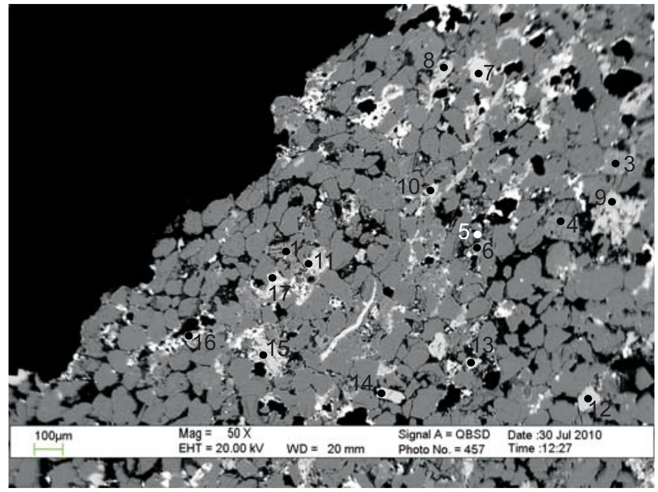


Figure 8: 2757.19 m., Oligoclase (pos. 1,18); Quartz (pos. 2,4,5); Albite+ K-feldspar (pos. 3); K-feldspar (pos. 6-16); Pyrite (pos. 17)

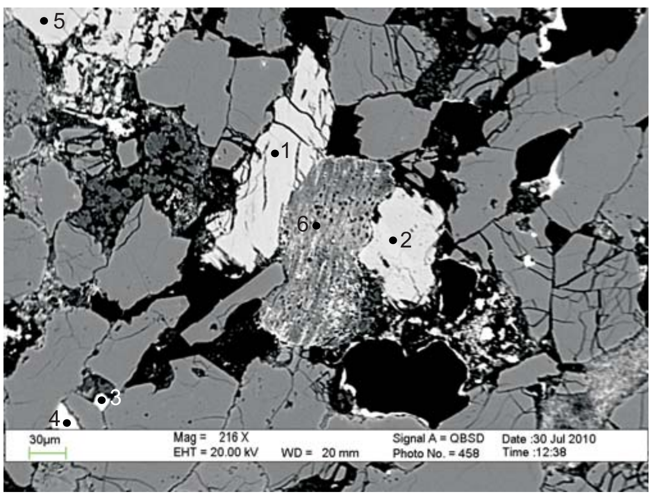


Figure 9: 2757.19 m., K-feldspar (pos. 1-3 ,5); Rutile (pos. 4); Chlorite (pos. 6)

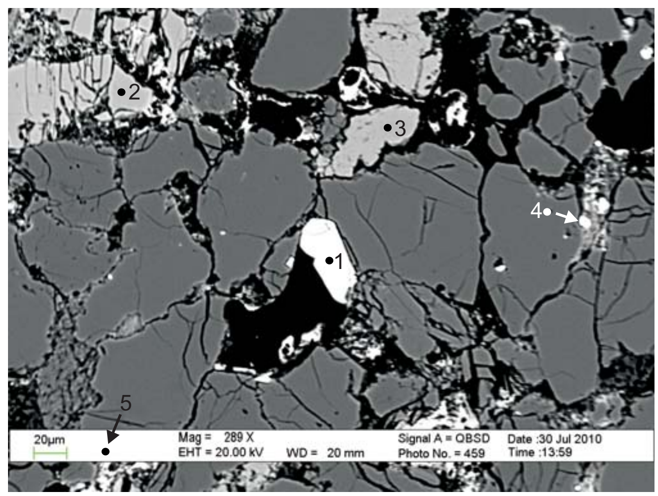


Figure 10: 2757.19 m., Apatite (pos. 1); K-feldspar (pos. 2,3); Pyrite (pos. 4,5)

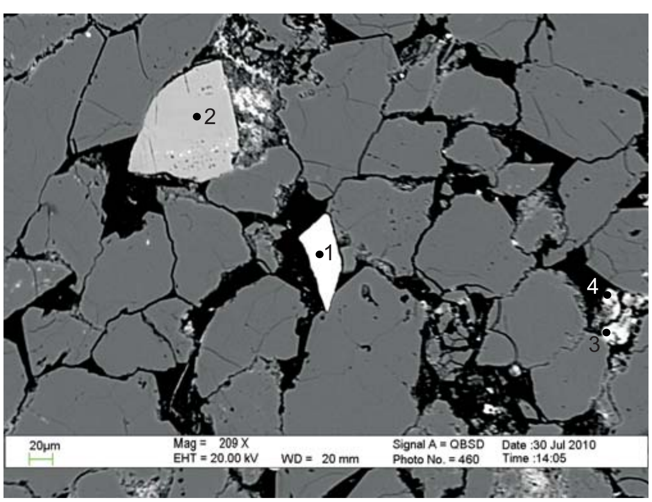


Figure 11: 2757.19 m., Chromite (pos. 1); K-feldspar (pos. 2); Rutile (pos. 3,4)

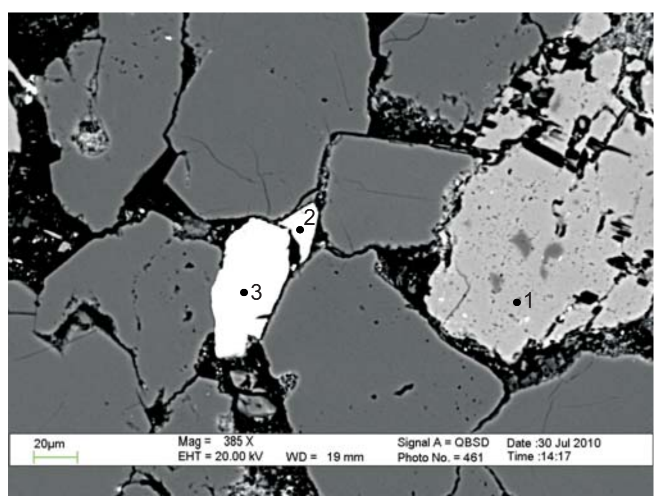


Figure 12: 2757.19 m., K-feldspar (pos. 1); Chromite (pos. 2,3)

Appendix 1c: BSE images of sample 2757.19 m

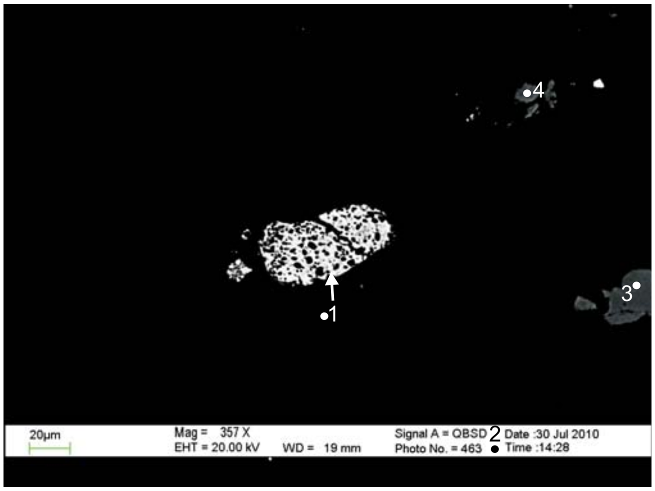


Figure 13: 2757.19 m., Chromite (pos. 1); Pyrite (pos. 2); Rutile (pos. 3,4)

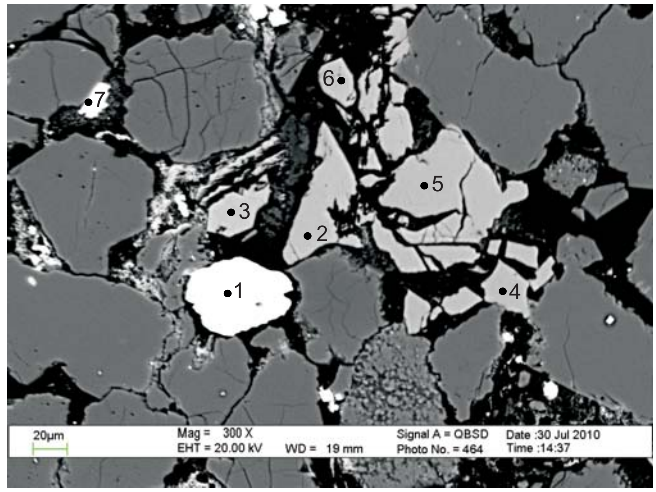


Figure 14: 2757.19 m., Monazite (pos. 1); K-feldspar (pos. 2-6); Rutile (pos. 7)

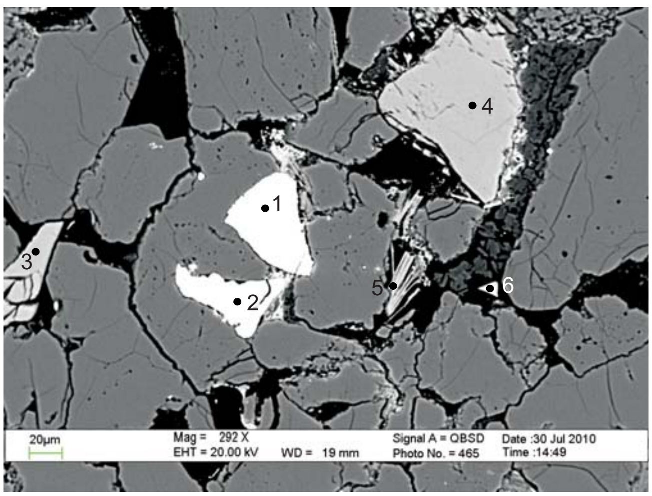


Figure 15: 2757.19 m., Chromite (pos. 1,2); K-feldspar (pos. 3,4); Muscovite (pos. 5); Rutile (pos. 6)

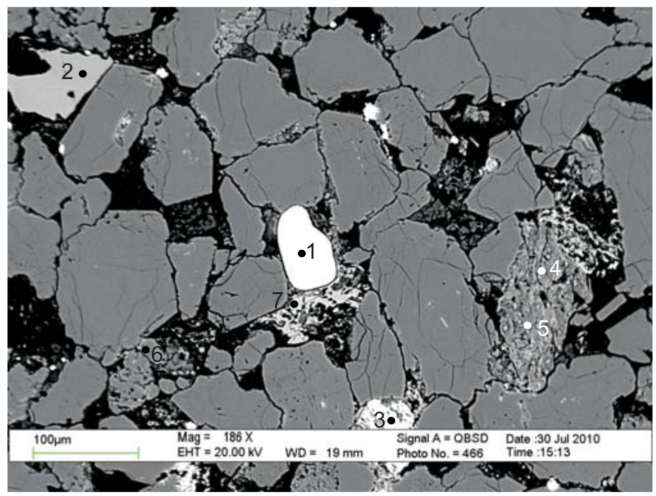


Figure 16: 2757.19 m., Spinel (pos. 1); K-feldspar (pos. 2,4,5 7); Rutile (pos. 3); Quartz (pos. 6)

Appendix C1, Table 1c: Semi- quantitative Scanning Electron Microscope chemical analyses of sample 2757.19 from Hesper I-52 well.

Sample	Site	Figure[+]	Position[+]	SiO_2	TiO_2	Al_2O_3	FeO_t	Cr_2O_3	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	Ce_2O_3	La_2O_3	SO_3	ZrO_2	Nd_2O_3	ThO_2	Total	Mineral Name
2757.19	1	1	1	69.44	0	17.27	0	0	0	0	0	0	13.28	0	0	0	0	0	0	0	100	K-feldspar
2757.19	1	1	2	69.87	0	15.26	0	0	0	0	0	0	14.86	0	0	0	0	0	0	0	100	K-feldspar
2757.19	1	1	3	69.17	0	16.90	0	0	0	0	0	0	13.93	0	0	0	0	0	0	0	100	K-feldspar
2757.19	1	1	4	68.20	0	17.44	0	0	0	0	0	1.36	13.00	0	0	0	0	0	0	0	100	K-feldspar
2757.19	1	1	5	68.00	0	18.38	0	0	0	0	0	0	13.63	0	0	0	0	0	0	0	100	K-feldspar
2757.19	1	1	6	67.28	0	19.39	0	0	0	0	0	1.86	11.47	0	0	0	0	0	0	0	100	K-feldspar
2757.19	1	1	7	69.51	0	17.22	0	0	0	0	0	0	13.27	0	0	0	0	0	0	0	100	K-feldspar
2757.19	1	1	8	69.11	0	17.11	0	0	0	0	0	0	13.78	0	0	0	0	0	0	0	100	K-feldspar
2757.19	1	1	9	67.95	0	18.28	0	0	0	0	0	0	13.77	0	0	0	0	0	0	0	100	K-feldspar
2757.19	1	1	10	69.46	0	17.56	0	0	0	0	0	0	12.98	0	0	0	0	0	0	0	100	K-feldspar
2757.19	1	1	11	68.92	0	17.21	0	0	0	0	0	0	13.87	0	0	0	0	0	0	0	100	K-feldspar
2757.19	1	1	12	69.59	0	16.58	0	0	0	0	0	0	13.83	0	0	0	0	0	0	0	100	K-feldspar
2757.19	1	1	13	69.30	0	17.30	0	0	0	0	0	0	13.40	0	0	0	0	0	0	0	100	K-feldspar
2757.19	1	1	14	68.99	0	16.33	0	0	0	0	0	0	14.68	0	0	0	0	0	0	0	100	K-feldspar
2757.19	1	1	15	51.35	1.38	29.32	6.53	0	0	1.41	0	0	10.01	0	0	0	0	0	0	0	100	Chlorite+ muscovite
2757.19	1	1	16	70.10	0	16.00	0	0	0	0	0	0	13.89	0	0	0	0	0	0	0	100	K-feldspar
2757.19	1	1	17	68.10	0	17.88	0	0	0	0	0	0	14.02	0	0	0	0	0	0	0	100	K-feldspar
2757.19	1	1	18	45.23	0	24.38	18.25	0	0	7.80	0	0	4.33	0	0	0	0	0	0	0	100	Muscovite+ Chlorite
2757.19	1	1	19	38.85	0.89	27.47	6.95	0	0	7.49	2.18	1.18	0	0	0	0	0	0	0	0	85	Tourmaline
2757.19	1	1	20	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
2757.19	1	1	21	85.56	0	7.81	0	0	0	0	0	0	6.63	0	0	0	0	0	0	0	100	K-feldspar
2757.19	2	2	1	68.87	0	16.45	0	0	0	0	0	0	14.68	0	0	0	0	0	0	0	100	K-feldspar
2757.19	2	2	2	70.62	0	16.11	0	0	0	0	0	0	13.28	0	0	0	0	0	0	0	100	K-feldspar
2757.19	2	2	3	68.82	0	17.19	0	0	0	0	0	0	13.98	0	0	0	0	0	0	0	100	K-feldspar
2757.19	2	2	4	69.19	0	16.63	0	0	0	0	0	0	14.18	0	0	0	0	0	0	0	100	K-feldspar
2757.19	2	2	5	68.61	0	17.20	0	0	0	0	0	0	14.19	0	0	0	0	0	0	0	100	K-feldspar
2757.19	2	2	6	69.14	0	15.95	0	0	0	0	0	0	14.91	0	0	0	0	0	0	0	100	K-feldspar
2757.19	2	2	7	67.32	0	17.82	0	0	0	0	0	0	14.86	0	0	0	0	0	0	0	100	K-feldspar
2757.19	2	2	8	69.57	0	16.42	0	0	0	0	0	0	14.01	0	0	0	0	0	0	0	100	K-feldspar
2757.19	2	2	9	47.87	0	27.96	7.64	0	0	5.97	1.14	0	9.43	0	0	0	0	0	0	0	100	Muscovite+ chlorite
2757.19	2	2	10	0	0	0	0	0	0	0	0	0	0	0	0	0	70.71	29.29	0	0	100	?
2757.19	3	3	1	69.39	0	16.78	0	0	0	0	0	0	13.84	0	0	0	0	0	0	0	100	K-feldspar
2757.19	3	3	2	68.78	0	16.74	0	0	0	0	0	0	14.48	0	0	0	0	0	0	0	100	K-feldspar
2757.19	3	3	3	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
2757.19	3	3	4	47.93	0	28.78	4.38	0	0	4.22	0	0	9.70	0	0	0	0	0	0	0	95	Muscovite
2757.19	3	3	5	67.61	0	18.18	0	0	0	0	0	0	14.21	0	0	0	0	0	0	0	100	K-feldspar
2757.19	3	3	6	16.67	0.83	5.17	33.50	0	0	0	0	0	1.59	0	0	0	42.25	0	0	0	100	Pyrite+ K-feldspar+ TiO_2
2757.19	4	4	1	69.00	0	16.86	0	0	0	0	0	0	14.14	0	0	0	0	0	0	0	100	K-feldspar
2757.19	4	4	2	69.59	0	16.25	0	0	0	0	0	0	14.16	0	0	0	0	0	0	0	100	K-feldspar
2757.19	4	4	3	68.84	0	16.89	0	0	0	0	0	0	14.27	0	0	0	0	0	0	0	100	K-feldspar
2757.19	4	4	4	69.55	0	17.28	0	0	0	0	0	0	13.17	0	0	0	0	0	0	0	100	K-feldspar
2757.19	4	4	5	69.88	0	16.74	0	0	0	0	0	0	13.37	0	0	0	0	0	0	0	100	K-feldspar
2757.19	4	4	6	69.85	0	16.21	0	0	0	0	0	0	13.94	0	0	0	0	0	0	0	100	K-feldspar
2757.19	4	4	7	67.96	0	16.53	0	0	0	0	0	0	15.51	0	0	0	0	0	0	0	100	K-feldspar
2757.19	4	4	8	68.98	0	17.24	0	0	0	0	0	0	13.78	0	0	0	0	0	0	0	100	K-feldspar
2757.19	4	4	9	69.81	0	16.45	0	0	0	0	0	0	13.73	0	0	0	0	0	0	0	100	K-feldspar

Notes: 1) Total iron is expressed as FeO; 2) += These figures and positions are shown in Appendix 1; 3) Original analyses of minerals have been recalculated appropriately.

Appendix C1, Table 1c: Semi- quantitative Scanning Electron Microscope chemical analyses of sample 2757.19 from Hesper I-52 well.

Sample	Site	Figure+	Position+	SiO_2	TiO_2	Al_2O_3	FeO_t	Cr_2O_3	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	Ce_2O_3	La_2O_3	SO_3	ZrO_2	Nd_2O_3	ThO_2	Total	Mineral Name
2757.19	4	4	10	66.85	0	18.57	0	0	0	0	0	0	14.57	0	0	0	0	0	0	0	100	K-feldspar
2757.19	4	4	11	71.23	0	15.72	0	0	0	0	0	0	13.04	0	0	0	0	0	0	0	100	K-feldspar
2757.19	4	4	12	66.89	0	18.24	0	0	0	0	0	0	14.87	0	0	0	0	0	0	0	100	K-feldspar
2757.19	4	4	13	67.89	0	17.36	0	0	0	0	0	0	14.75	0	0	0	0	0	0	0	100	K-feldspar
2757.19	4	4	14	68.19	0	17.38	0	0	0	0	0	0	14.43	0	0	0	0	0	0	0	100	K-feldspar
2757.19	4	4	15	69.63	0	17.52	0	0	0	0	0	0	12.85	0	0	0	0	0	0	0	100	K-feldspar
2757.19	4	4	16	69.71	0	17.14	0	0	0	0	0	0	13.15	0	0	0	0	0	0	0	100	K-feldspar
2757.19	4	4	17	69.52	0	18.71	0	0	0	0	0	0	11.77	0	0	0	0	0	0	0	100	K-feldspar
2757.19	4	4	18	71.13	0	15.44	0	0	0	0	0	0	13.43	0	0	0	0	0	0	0	100	K-feldspar
2757.19	4	4	19	70.15	0	15.67	0	0	0	0	0	0	14.18	0	0	0	0	0	0	0	100	K-feldspar
2757.19	4	4	20	67.36	0	17.88	0	0	0	0	0	0	14.76	0	0	0	0	0	0	0	100	K-feldspar
2757.19	4	4	21	69.61	0	17.60	0	0	0	0	0	0	12.79	0	0	0	0	0	0	0	100	K-feldspar
2757.19	4	4	22	70.01	0	16.72	0	0	0	0	0	0	13.28	0	0	0	0	0	0	0	100	K-feldspar
2757.19	4	4	23	38.55	0.73	27.96	6.82	0	0	7.47	2.26	1.21	0	0	0	0	0	0	0	0	85	Tourmaline
2757.19	4	4	24	38.82	0	26.29	10.89	0	0	6.54	0.73	1.73	0	0	0	0	0	0	0	0	85	Tourmaline
2757.19	4	4	25	68.39	0	18.72	4.95	0	0	0	0	7.94	0	0	0	0	0	0	0	0	100	Albite
2757.19	4	4	26	66.43	0	17.21	2.97	0	0	0	0	0	13.39	0	0	0	0	0	0	0	100	K-feldspar
2757.19	4	4	27	68.37	0	17.63	0	0	0	0	0	0.97	13.02	0	0	0	0	0	0	0	100	K-feldspar
2757.19	4	4	28	50.32	1.15	27.77	5.47	0	0	0	0	0	10.28	0	0	0	0	0	0	0	95	Muscovite
2757.19	4	4	29	46.16	1.14	31.79	8.56	0	0	8.18	3.05	1.12	0	0	0	0	0	0	0	0	100	Tourmaline+ TiO_2
2757.19	4	4	30	69.55	0	15.25	0	0	0	0	0	0	15.20	0	0	0	0	0	0	0	100	K-feldspar
2757.19	5	5	1	0	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Rutile
2757.19	5	5	2	38.47	0.83	28.19	6.85	0	0	7.40	2.29	0.98	0	0	0	0	0	0	0	0	85	Tourmaline
2757.19	5	5	3	68.76	0	17.29	0	0	0	0	0	0	13.95	0	0	0	0	0	0	0	100	K-feldspar
2757.19	5	5	4	0.00	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Rutile
2757.19	5	5	5	51.93	1.37	28.99	7.71	0	0	0	0	0	10.00	0	0	0	0	0	0	0	100	Muscovite+ TiO_2
2757.19	6	6	1	39.10	0.67	27.66	8.07	0	0	6.90	0.95	1.65	0	0	0	0	0	0	0	0	85	Tourmaline
2757.19	6	6	2	0	0	0	39.46	0	0	0	0	0	0	0	0	0	60.54	0	0	0	100	Pyrite
2757.19	6	6	3	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
2757.19	6	6	4	70.04	0	17.03	0	0	0	0	0	2.16	10.77	0	0	0	0	0	0	0	100	K-feldspar
2757.19	7	7	1	78.69	0	12.51	2.80	0	0	0	1.34	4.01	0.64	0	0	0	0	0	0	0	100	Albite
2757.19	7	7	2	0	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Rutile
2757.19	7	7	3	67.95	0	18.33	0	0	0	0	0	0	13.72	0	0	0	0	0	0	0	100	K-feldspar
2757.19	7	7	4	68.55	0	17.50	0	0	0	0	0	0	13.95	0	0	0	0	0	0	0	100	K-feldspar
2757.19	7	7	5	69.55	0	16.84	0	0	0	0	0	0	13.60	0	0	0	0	0	0	0	100	K-feldspar
2757.19	7	7	6	68.82	0	16.40	0	0	0	0	0	0	14.77	0	0	0	0	0	0	0	100	K-feldspar
2757.19	7	7	7	69.55	0	16.73	0	0	0	0	0	2.37	11.36	0	0	0	0	0	0	0	100	K-feldspar
2757.19	7	7	8	32.87	0	24.77	26.25	0	0	4.11	0	0	0	0	0	0	0	0	0	0	88	Chlorite
2757.19	7	7	9	67.52	0	17.36	0	0	0	0	0	0	15.12	0	0	0	0	0	0	0	100	K-feldspar
2757.19	7	7	10	67.98	0	17.66	0	0	0	0	0	0	14.37	0	0	0	0	0	0	0	100	K-feldspar
2757.19	7	7	11	68.66	0	17.54	0	0	0	0	0	0	13.80	0	0	0	0	0	0	0	100	K-feldspar
2757.19	7	7	12	69.29	0	16.17	0	0	0	0	0	0	14.55	0	0	0	0	0	0	0	100	K-feldspar
2757.19	7	7	13	68.50	0	17.02	0	0	0	0	0	0	14.48	0	0	0	0	0	0	0	100	K-feldspar
2757.19	7	7	14	67.63	0	18.33	0	0	0	0	0	0	14.04	0	0	0	0	0	0	0	100	K-feldspar
2757.19	7	7	15	69.04	0	18.21	0	0	0	0	0	0	12.75	0	0	0	0	0	0	0	100	K-feldspar
2757.19	7	7	16	67.88	0	18.07	0	0	0	0	0	0	14.05	0	0	0	0	0	0	0	100	K-feldspar
2757.19	7	7	17	32.25	7.64	20.64	23.03	0	0	3.88	0	0	0.56	0	0	0	0	0	0	0	88	Chlorite
2757.19	9	8	1	69.47	0	20.40	0	0	0	0	2.81	7.32	0	0	0	0	0	0	0	0	100	Oligoclase

Notes: 1) Total iron is expressed as FeO; 2) += These figures and positions are shown in Appendix 1; 3) Original analyses of minerals have been recalculated appropriately.

Appendix C1, Table 1c: Semi- quantitative Scanning Electron Microscope chemical analyses of sample 2757.19 from Hesper I-52 well.

Sample	Site	Figure[+]	Position[+]	SiO_2	TiO_2	Al_2O_3	FeO_t	Cr_2O_3	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	Ce_2O_3	La_2O_3	SO_3	ZrO_2	Nd_2O_3	ThO_2	Total	Mineral Name
2757.19	9	8	2	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
2757.19	9	8	3	68.50	0	22.13	0	0	0	0	0.86	6.62	1.88	0	0	0	0	0	0	0	100	Albite+ K-feldspar
2757.19	9	8	4	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
2757.19	9	8	5	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
2757.19	9	8	6	82.66	0	8.70	0	0	0	0	0	0	8.64	0	0	0	0	0	0	0	100	K-feldspar
2757.19	9	8	7	69.56	0	16.00	0	0	0	0	0	0	14.44	0	0	0	0	0	0	0	100	K-feldspar
2757.19	9	8	8	68.53	0	17.33	0	0	0	0	0	0	14.13	0	0	0	0	0	0	0	100	K-feldspar
2757.19	9	8	9	67.95	0	16.92	1.15	0	0	0	0	0	13.98	0	0	0	0	0	0	0	100	K-feldspar
2757.19	9	8	10	67.60	0	18.72	0	0	0	0	0	0	13.68	0	0	0	0	0	0	0	100	K-feldspar
2757.19	9	8	11	69.83	0	16.08	0	0	0	0	0	0	14.09	0	0	0	0	0	0	0	100	K-feldspar
2757.19	9	8	12	68.11	0	17.97	0	0	0	0	0	0	13.92	0	0	0	0	0	0	0	100	K-feldspar
2757.19	9	8	13	69.04	0	17.24	0	0	0	0	0	0	13.72	0	0	0	0	0	0	0	100	K-feldspar
2757.19	9	8	14	67.96	0	17.06	0	0	0	0	0	0	14.99	0	0	0	0	0	0	0	100	K-feldspar
2757.19	9	8	15	69.38	0	14.82	0	0	0	0	0	0	15.81	0	0	0	0	0	0	0	100	K-feldspar
2757.19	9	8	16	69.41	0	16.77	0	0	0	0	0	0	13.81	0	0	0	0	0	0	0	100	K-feldspar
2757.19	9	8	17	0	0	0	72.94	0	0	0	0	0	0	0	0	0	27.06	0	0	0	100	Pyrite
2757.19	9	8	18	72.30	0	17.99	0	0	0	0	0	5.67	4.03	0	0	0	0	0	0	0	100	K-feldspar
2757.19	13	9	1	68.00	0	17.52	0	0	0	0	0	1.96	12.52	0	0	0	0	0	0	0	100	K-feldspar
2757.19	13	9	2	70.02	0	15.80	0	0	0	0	0	0	14.18	0	0	0	0	0	0	0	100	K-feldspar
2757.19	13	9	5	0	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	K-feldspar
2757.19	13	9	4	0	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Rutile
2757.19	13	9	5	68.38	0	17.76	0	0	0	0	0	0	13.86	0	0	0	0	0	0	0	100	K-feldspar
2757.19	13	9	6	43.41	0	30.23	12.73	0	0	1.63	0	0	0	0	0	0	0	0	0	0	88	Chlorite
2757.19	23	10	1	0	0	0.00	0	0	0	0	68.08	0	0	31.92	0	0	0	0	0	0	100	Apatite
2757.19	23	10	2	69.64	0	16.77	0	0	0	0	0	0	13.59	0	0	0	0	0	0	0	100	K-feldspar
2757.19	23	10	3	69.32	0	17.03	0	0	0	0	0	0	13.65	0	0	0	0	0	0	0	100	K-feldspar
2757.19	23	10	4	0	0	0	40.78	0	0	0	0	0	0	0	0	0	59.22	0	0	0	100	Pyrite
2757.19	23	10	5	0	0	0	43.29	0	0	0	0	0	0	0	0	0	56.71	0	0	0	100	Pyrite
2757.19	25	11	1	0	0	10.04	25.14	57.74	0	7.08	0	0	0	0	0	0	0	0	0	0	100	Chromite
2757.19	25	11	2	68.72	0	16.95	0	0	0	0	0	0	14.33	0	0	0	0	0	0	0	100	K-feldspar
2757.19	25	11	3	0	93.10	0	6.90	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Rutile
2757.19	25	11	4	0	91.70	0	8.30	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Rutile
2757.19	29	12	1	67.68	0	17.01	0	0	0	0	0	0	15.31	0	0	0	0	0	0	0	100	K-feldspar
2757.19	29	12	2	0	0	14.88	25.43	51.00	0	8.69	0	0	0	0	0	0	0	0	0	0	100	Chromite
2757.19	29	12	3	0	0	15.25	23.33	52.07	0	9.34	0	0	0	0	0	0	0	0	0	0	100	Chromite
2757.19	32	13	1	0	0	3.37	36.21	55.73	4.69	0	0	0	0	0	0	0	0	0	0	0	100	Chromite
2757.19	32	13	2	0	0	0	43.67	0	0	0	0	0	0	0	0	0	56.33	0	0	0	100	Pyrite
2757.19	32	13	3	0	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Rutile
2757.19	32	13	4	0	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Rutile
2757.19	35	14	1	0	0	0	0	0	0	0	1.42	0	0	22.23	38.31	21.58	0	0	11.14	5.32	100	Monazite
2757.19	35	14	2	70.36	0	15.17	0	0	0	0	0	0	14.47	0	0	0	0	0	0	0	100	K-feldspar
2757.19	35	14	3	68.11	0	18.03	0	0	0	0	0	0	13.87	0	0	0	0	0	0	0	100	K-feldspar
2757.19	35	14	4	69.46	0	16.19	0	0	0	0	0	0	14.35	0	0	0	0	0	0	0	100	K-feldspar
2757.19	35	14	5	70.64	0	15.95	0	0	0	0	0	0	13.41	0	0	0	0	0	0	0	100	K-feldspar
2757.19	35	14	6	69.48	0	18.10	0	0	0	0	0	0	12.43	0	0	0	0	0	0	0	100	K-feldspar
2757.19	35	14	7	0	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Rutile
2757.19	38	15	1	0	0	17.57	20.08	54.64	0	7.71	0	0	0	0	0	0	0	0	0	0	100	Chromite
2757.19	38	15	2	0	0	17.36	18.22	58.05	0	6.37	0	0	0	0	0	0	0	0	0	0	100	Chromite
2757.19	38	15	3	69.44	0	16.91	0	0	0	0	0	0	13.64	0	0	0	0	0	0	0	100	K-feldspar

Notes: 1) Total iron is expressed as FeO; 2) += These figures and positions are shown in Appendix 1; 3) Original analyses of minerals have been recalculated appropriately.

Appendix C1, Table 1c: Semi- quantitative Scanning Electron Microscope chemical analyses of sample 2757.19 from Hesper I-52 well.

Sample	Site	Figure[+]	Position[+]	SiO_2	TiO_2	Al_2O_3	FeO_t	Cr_2O_3	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	Ce_2O_3	La_2O_3	SO_3	ZrO_2	Nd_2O_3	ThO_2	Total	Mineral Name
2757.19	38	15	4	69.52	0	15.79	0	0	0	0	0	0	14.69	0	0	0	0	0	0	0	100	K-feldspar
2757.19	38	15	5	52.74	0	23.74	6.78	0	0	2.43	0	0	9.31	0	0	0	0	0	0	0	95	Muscovite
2757.19	38	15	6	0	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Rutile
2757.19	42	16	1	0	0	21.85	20.74	48.82	0	8.59	0	0	0	0	0	0	0	0	0	0	100	Spinel
2757.19	42	16	2	70.42	0	16.98	0	0	0	0	0	3.51	9.08	0	0	0	0	0	0	0	100	K-feldspar
2757.19	42	16	3	0	99.39	0	0.61	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Rutile
2757.19	42	16	4	56.54	0	35.78	0	0	0	0	0	2.01	5.68	0	0	0	0	0	0	0	100	K-feldspar
2757.19	42	16	5	53.04	0	34.85	5.97	0	0	0	0	2.31	3.83	0	0	0	0	0	0	0	100	K-feldspar
2757.19	42	16	6	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
2757.19	42	16	7	67.85	0	17.06	0	0	0	0	0	0	15.08	0	0	0	0	0	0	0	100	K-feldspar

Notes: 1) Total iron is expressed as FeO; 2) += These figures and positions are shown in Appendix 1; 3) Original analyses of minerals have been recalculated appropriately.

Appendix 1d: BSE images of sample 2757.58 m

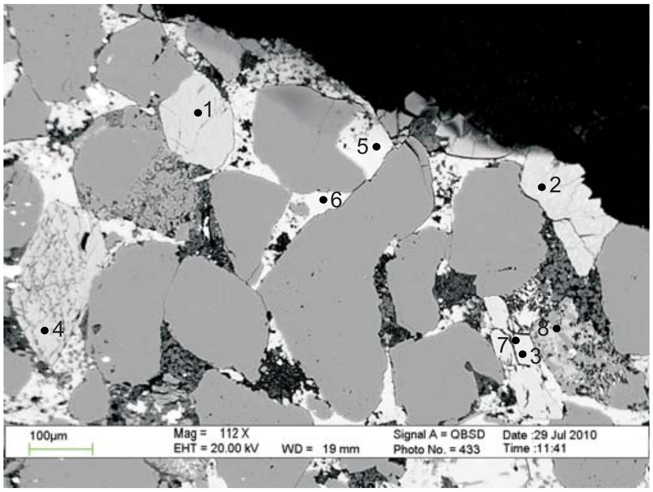


Figure 1: 2757.58 m., K-feldspar (pos. 1-4, 7,8); Calcite (pos. 5,6)

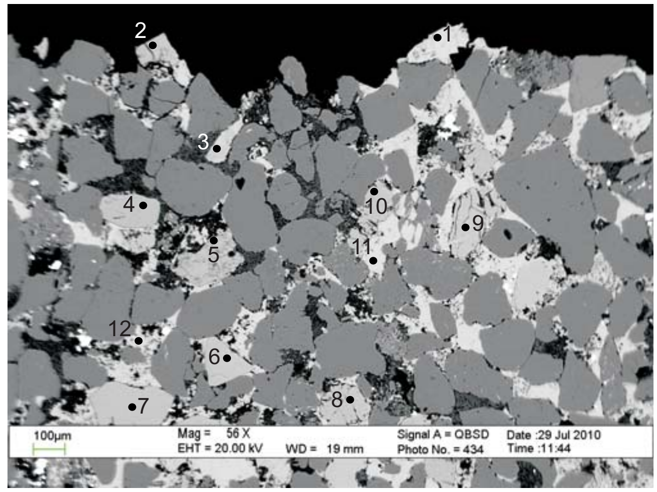


Figure 2: 2757.58 m., Calcite (pos. 1,12); K-feldspar (pos. 2, 4-10); K-feldspar+ calcite (pos. 3); Unknown (pos. 11)

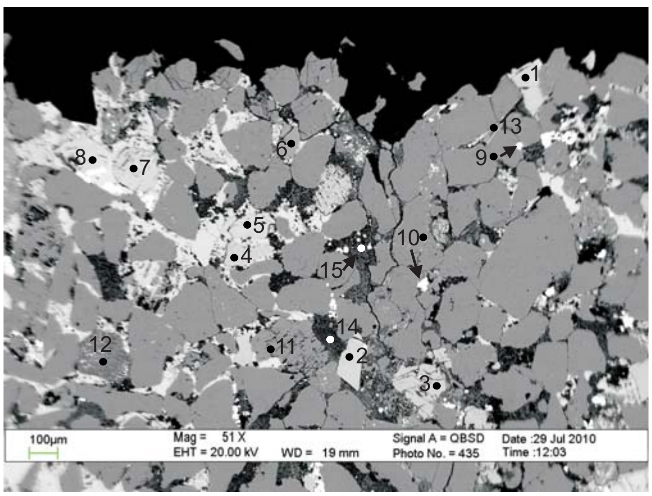


Figure 3: 2757.58 m., K-feldspar (pos. 1-5, 7,8,13); Oligoclase (pos. 6); Zircon (pos. 10); Albite (pos. 11); Chlorite+ quartz (pos. 12); Chlorite (pos. 14); Kaolinite (pos. 15)

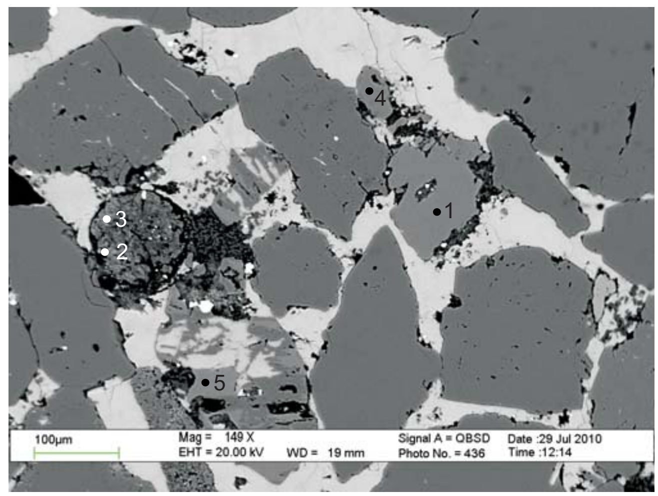


Figure 4: 2757.58 m., Plagioclase+ Calcite (pos. 1); Chlorite+ Muscovite (pos. 2,3); Oligoclase (pos. 4,5)

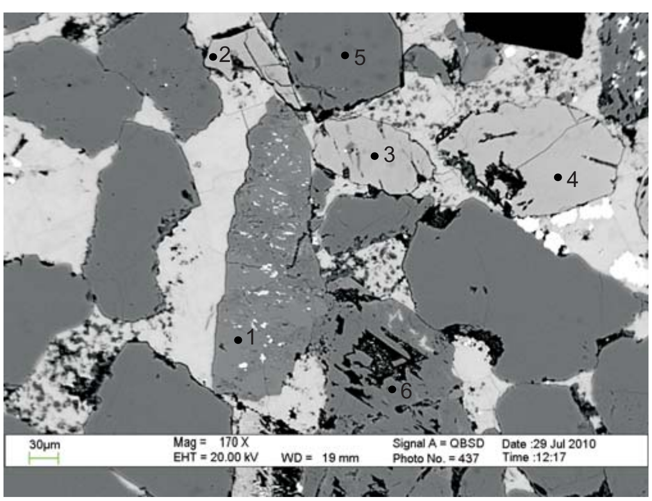


Figure 5: 2757.58 m., Oligoclase (pos. 1); K-feldspar (pos. 2-4); Quartz (pos. 5), Albite (pos. 6)

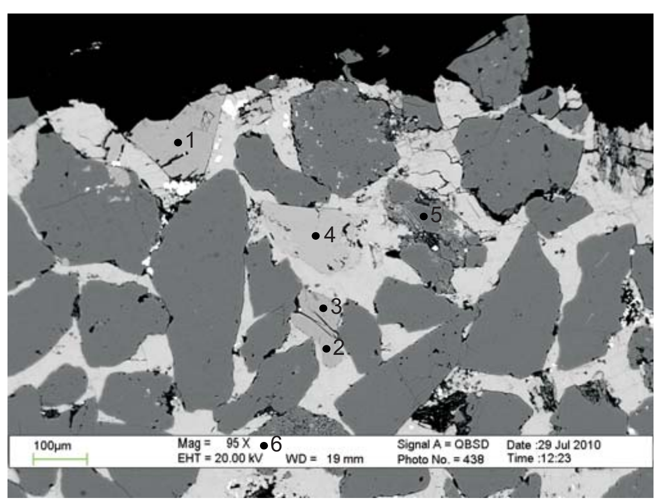


Figure 6: 2757.58 m., K-feldspar (pos. 1-4); Mixture (pos. 5)

Appendix 1d: BSE images of sample 2757.58 m

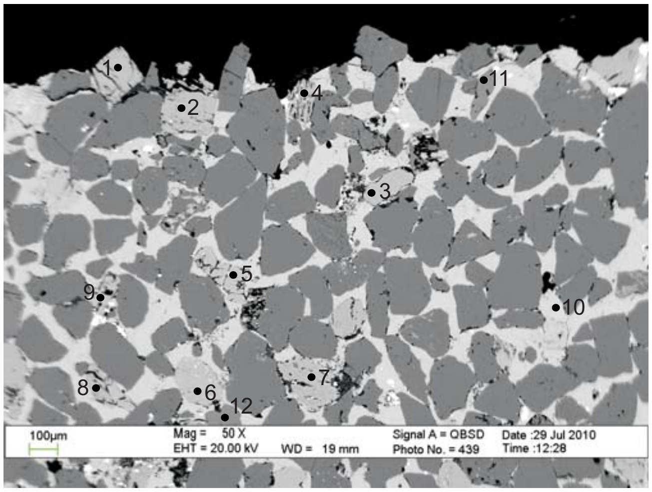


Figure 7: 2757.58 m., K-feldspar (pos. 1-9); K-feldspar+ calcite (pos. 10); Oligoclase (pos. 11,12)

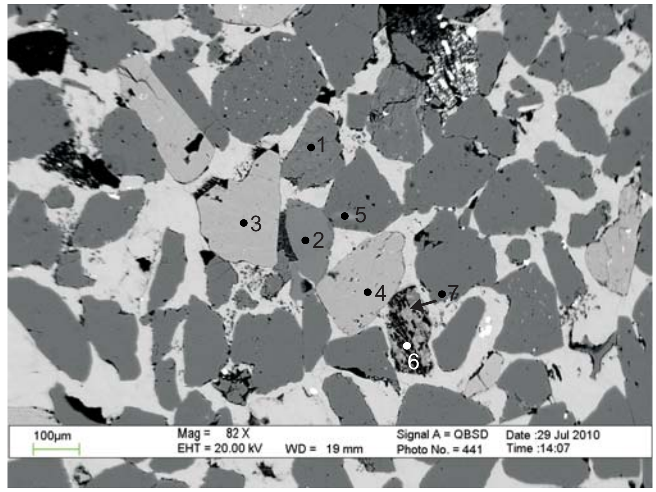


Figure 8: 2757.58 m., K-feldspar (pos. 1,3-7); Unknown (pos. 2)

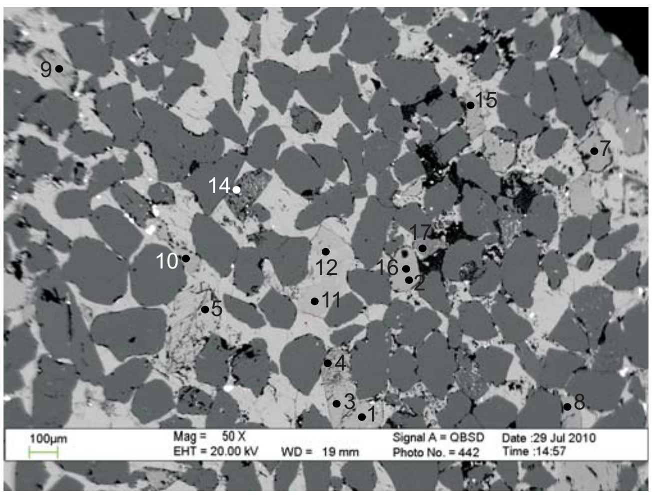


Figure 9: 2757.58 m., Siderite (pos.1)

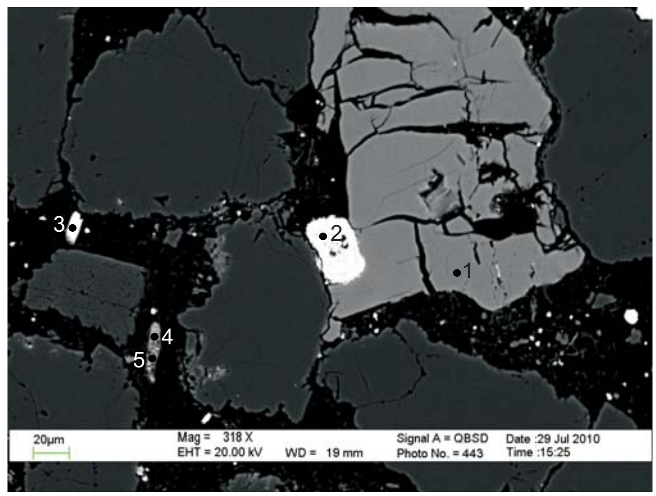


Figure 10: 2757.58 m., K-feldspar (pos. 1); Siderite (pos 2); Rutile (pos. 3); Unknown (pos. 4); Chlorite+ CaO (pos. 5)

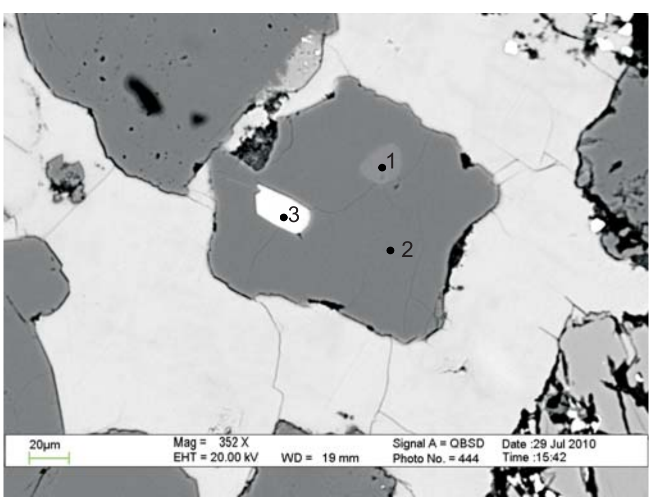


Figure 11: 2757.58 m., Oligoclase (pos. 1); Quartz (pos. 2); Biotite (pos. 3)

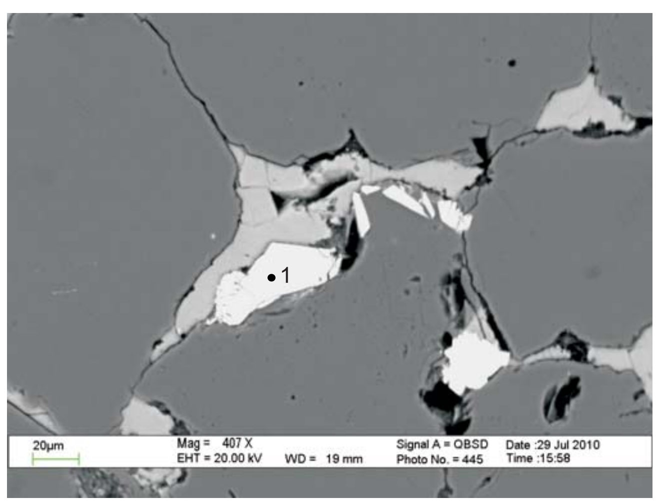


Figure 12: 2757.58 m., Spinel (pos. 1)

Appendix 1d: BSE images of sample 2757.58 m

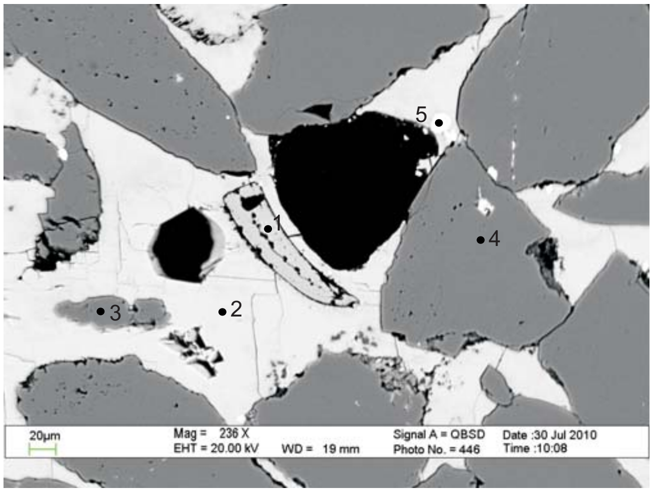


Figure 13: 2757.58 m., Calcite (pos. 1,2,5); Quartz (pos. 3,4)

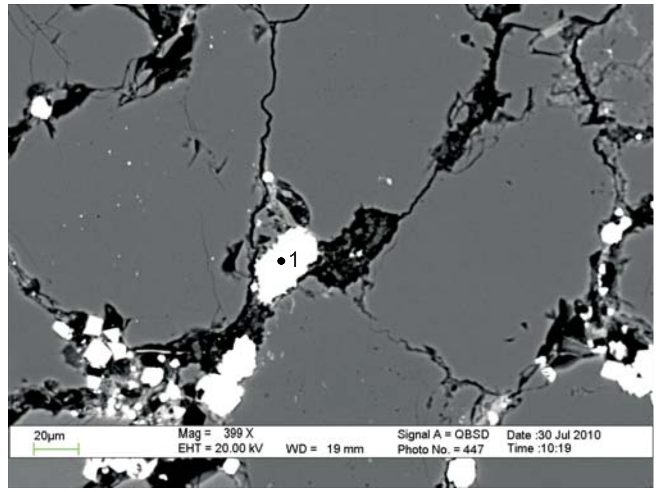


Figure 14: 2757.58 m., Siderite (pos. 1)

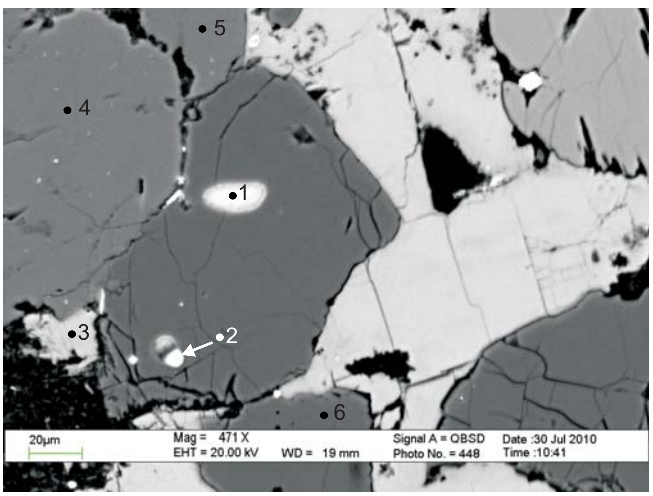


Figure 15: 2757.58 m., Biotite (pos. 1); Calcite (pos. 2); Plagioclase (pos. 3,4); Quartz (pos. 5)

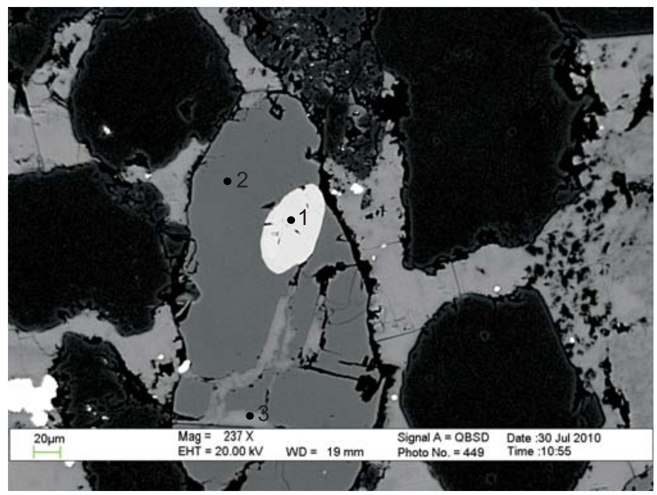


Figure 16: 2757.58 m., Apatite (pos. 1); K-feldspar (pos. 2); Calcite (pos. 3)

Appendix C1, Table 1d: Semi- quantative Scanning Electron Microscope chemical analyses of sample 2757.58 from Hesper I-52 well.

Sample	Site	Figure+	Position+	SiO_2	TiO_2	Al_2O_3	FeO_t	Cr_2O_3	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	BaO	Ce_2O_3	CO_2	SO_3	ZrO_2	Total	Mineral Name
2757.58	1	1	1	68.34	0	16.61	0	0	0	0	0	0	15.05	0	0	0	0	0	0	100	K-feldspar
2757.58	1	1	2	70.16	0	15.68	0	0	0	0	0	0	14.16	0	0	0	0	0	0	100	K-feldspar
2757.58	1	1	3	69.27	0	17.34	0	0	0	0	0	0	13.39	0	0	0	0	0	0	100	K-feldspar
2757.58	1	1	4	68.24	0	15.69	0	0	0	0	0	0	16.06	0	0	0	0	0	0	100	K-feldspar
2757.58	1	1	5	0	0	0	1.41	0	1	0	62.15	0	0	0	0	0	35.22	0	0	100	Calcite
2757.58	1	1	6	0	0	0	0	0	0	0	63.19	0	0	0	0	0	36.81	0	0	100	Calcite
2757.58	1	1	7	68.37	0	16.90	0	0	0	0	0	0	14.72	0	0	0	0	0	0	100	K-feldspar
2757.58	1	1	8	71.59	0	16.47	0	0	0	0	0	0	11.93	0	0	0	0	0	0	100	K-feldspar
2757.58	2	2	1	0	0	0	0	0	0	0	60.62	0	0	0	0	0	39.38	0	0	100	Calcite
2757.58	2	2	2	69.37	0	16.59	0	0	0	0	0	0	14.04	0	0	0	0	0	0	100	K-feldspar
2757.58	2	2	3	61.05	0	15.26	0	0	0	0	11.58	0	12.12	0	0	0	0	0	0	100	K-feldspar+ calcite
2757.58	2	2	4	69.05	0	16.80	0	0	0	0	0	0	14.16	0	0	0	0	0	0	100	K-feldspar
2757.58	2	2	5	68.66	0	17.61	0	0	0	0	0	2.51	11.22	0	0	0	0	0	0	100	K-feldspar
2757.58	2	2	6	68.27	0	17.71	0	0	0	0	0	0	14.02	0	0	0	0	0	0	100	K-feldspar
2757.58	2	2	7	68.03	0	17.22	0	0	0	0	0	0	14.74	0	0	0	0	0	0	100	K-feldspar
2757.58	2	2	8	68.36	0	18.16	0	0	0	0	0	0	13.49	0	0	0	0	0	0	100	K-feldspar
2757.58	2	2	9	68.79	0	17.01	0	0	0	0	0	0	14.21	0	0	0	0	0	0	100	K-feldspar
2757.58	2	2	10	68.28	0	17.40	0	0	0	0	0	0	14.33	0	0	0	0	0	0	100	K-feldspar
2757.58	2	2	11	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0	0	100	?
2757.58	2	2	12	0	0	0	0	0	0	0	60.72	0	0	0	0	0	39.28	0	0	100	Calcite
2757.58	3	3	1	69.28	0	17.17	0	0	0	0	0	0	13.55	0	0	0	0	0	0	100	K-feldspar
2757.58	3	3	2	68.26	0	17.54	0	0	0	0	0	0	14.20	0	0	0	0	0	0	100	K-feldspar
2757.58	3	3	3	69.55	0	16.67	0	0	0	0	0	0	13.78	0	0	0	0	0	0	100	K-feldspar
2757.58	3	3	4	67.51	0	17.23	0	0	0	0	0	0	15.26	0	0	0	0	0	0	100	K-feldspar
2757.58	3	3	5	68.39	0	17.22	0	0	0	0	0	0	14.39	0	0	0	0	0	0	100	K-feldspar
2757.58	3	3	6	69.35	0	20.42	0	0	0	0	2.97	7.25	0	0	0	0	0	0	0	100	Oligoclase
2757.58	3	3	7	68.59	0	17.17	0	0	0	0	0	0	14.24	0	0	0	0	0	0	100	K-feldspar
2757.58	3	3	8	68.24	0	18.56	0	0	0	0	0	0	13.20	0	0	0	0	0	0	100	K-feldspar
2757.58	3	3	10	45.25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	54.75	100	Zircon
2757.58	3	3	11	73.13	0	18.61	0	0	0	0	0	8.26	0	0	0	0	0	0	0	100	Albite
2757.58	3	3	12	65.70	0	15.43	16.82	0	0	2.06	0	0	0	0	0	0	0	0	0	100	Chlorite+ quartz
2757.58	3	3	13	54.94	0	35.94	0	0	0	0	0	0	9.12	0	0	0	0	0	0	100	K-feldspar
2757.58	3	3	14	45.19	0	30.78	10.91	0	0	1.12	0	0	0	0	0	0	0	0	0	88	Chlorite
2757.58	3	3	15	50.42	0	34.58	0	0	0	0	0	0	0	0	0	0	0	0	0	85	Kaolinite
2757.58	4	4	1	75.10	0	9.00	1.31	0	0	0	11.71	2.88	0	0	0	0	0	0	0	100	Plagioclase+ Calcite
2757.58	4	4	2	55.19	0	19.03	16.70	0	0	2.53	0	0	6.54	0	0	0	0	0	0	100	Chlorite+ Muscovite
2757.58	4	4	3	55.18	0	17.46	16.38	0	0	3.17	1.24	0	6.57	0	0	0	0	0	0	100	Chlorite+ Muscovite
2757.58	4	4	4	68.73	0	20.51	0	0	0	0	3.21	7.55	0	0	0	0	0	0	0	100	Oligoclase
2757.58	4	4	5	66.43	0	23.12	0	0	0	0	5.40	5.04	0	0	0	0	0	0	0	100	Oligoclase
2757.58	5	5	1	68.34	0	21.16	0	0	0	0	4	6.24	0	0	0	0	0	0	0	100	Oligoclase
2757.58	5	5	2	68.38	0	16.75	0	0	0	0	0	0	14.87	0	0	0	0	0	0	100	K-feldspar

Notes: 1) Total iron is expressed as FeO; 2) += These figures and positions are shown in Appendix 1; 3) Original analyses of minerals have been recalculated appropriately.

Appendix C1, Table 1d: Semi- quantative Scanning Electron Microscope chemical analyses of sample 2757.58 from Hesper I-52 well.

Sample	Site	Figure+	Position+	SiO_2	TiO_2	Al_2O_3	FeO_t	Cr_2O_3	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	BaO	Ce_2O_3	CO_2	SO_3	ZrO_2	Total	Mineral Name
2757.58	5	5	3	68.77	0	16.76	0	0	0	0	0	0	14.47	0	0	0	0	0	0	100	K-feldspar
2757.58	5	5	4	68.44	0	17.12	0	0	0	0	0	0.70	13.74	0	0	0	0	0	0	100	K-feldspar
2757.58	5	5	6	73.97	0	17.71	0	0	0	0	0	8.32	0	0	0	0	0	0	0	100	Albite
2757.58	6	6	1	69.74	0	16.15	0	0	0	0	0	0	14.11	0	0	0	0	0	0	100	K-feldspar
2757.58	6	6	2	68.77	0	16.98	0	0	0	0	0	0	14.25	0	0	0	0	0	0	100	K-feldspar
2757.58	6	6	3	69.25	0	16.88	0	0	0	0	0	0	13.87	0	0	0	0	0	0	100	K-feldspar
2757.58	6	6	4	69.38	0	16.97	0	0	0	0	0	0	13.65	0	0	0	0	0	0	100	K-feldspar
2757.58	6	6	5	84.29	0	10.00	1.87	0	0	0	0	1.28	2.57	0	0	0	0	0	0	100	Mixture
2757.58	7	7	1	68.27	0	17.12	0	0	0	0	0	0	14.61	0	0	0	0	0	0	100	K-feldspar
2757.58	7	7	2	68.05	0	17.39	0	0	0	0	0	0	14.56	0	0	0	0	0	0	100	K-feldspar
2757.58	7	7	3	68.05	0	16.71	0	0	0	0	0	0	15.24	0	0	0	0	0	0	100	K-feldspar
2757.58	7	7	4	70.41	0	14.35	0	0	0	0	0	0	15.23	0	0	0	0	0	0	100	K-feldspar
2757.58	7	7	5	68.53	0	17.19	0	0	0	0	0	0	14.28	0	0	0	0	0	0	100	K-feldspar
2757.58	7	7	6	70.08	0	17.17	0	0	0	0	0	0	12.74	0	0	0	0	0	0	100	K-feldspar
2757.58	7	7	7	68.34	0	16.35	0	0	0	0	0	0	15.31	0	0	0	0	0	0	100	K-feldspar
2757.58	7	7	8	68.12	0	17.58	0	0	0	0	0	0	14.30	0	0	0	0	0	0	100	K-feldspar
2757.58	7	7	9	68.81	0	16.97	0	0	0	0	0	0	14.23	0	0	0	0	0	0	100	K-feldspar
2757.58	7	7	10	74.32	0	2.70	0	0	0	0	21.58	0	1.40	0	0	0	0	0	0	100	K-feldspar+ calcite
2757.58	7	7	11	67.83	0	21.51	0	0	0	0	3.93	6.73	0	0	0	0	0	0	0	100	Oligoclase
2757.58	7	7	12	69.43	0	20.18	0	0	0	0	2.39	8.01	0	0	0	0	0	0	0	100	Oligoclase
2757.58	16	8	1	67.95	0	18.33	0	0	0	0	0	0	13.72	0	0	0	0	0	0	100	K-feldspar
2757.58	16	8	2	77.75	0	3.15	1	0	0	0	17	0	1.40	0	0	0	0	0	0	100	?
2757.58	16	8	3	68.91	0	17.38	0	0	0	0	0	0	13.71	0	0	0	0	0	0	100	K-feldspar
2757.58	16	8	4	69.10	0	16.81	0	0	0	0	0	0	14.09	0	0	0	0	0	0	100	K-feldspar
2757.58	16	8	5	68.08	0	16.93	0	0	0	0	0	0	14.99	0	0	0	0	0	0	100	K-feldspar
2757.58	16	8	6	68.44	0	17.09	0	0	0	0	0	0	14.47	0	0	0	0	0	0	100	K-feldspar
2757.58	16	8	7	67.26	0	17.82	0	0	0	0	0	0	14.92	0	0	0	0	0	0	100	K-feldspar
2757.58	16	8	8	69.09	0	16.37	0	0	0	0	0	0	14.55	0	0	0	0	0	0	100	K-feldspar
2757.58	16	8	9	68.43	0	16.75	0	0	0	0	0	2.33	12.49	0	0	0	0	0	0	100	K-feldspar
2757.58	16	8	10	68.79	0	16.57	0	0	0	0	0	0	14.64	0	0	0	0	0	0	100	K-feldspar
2757.58	16	8	11	69.68	0	16.97	0	0	0	0	0	0	13.35	0	0	0	0	0	0	100	K-feldspar
2757.58	16	8	12	62.37	0	16.02	0	0	0	0	9.26	0	12.35	0	0	0	0	0	0	100	K-feldspar
2757.58	16	8	13	71.08	0	17.46	0	0	0	0	0	5.29	6.16	0	0	0	0	0	0	100	K-feldspar
2757.58	16	8	14	72.87	0	18.35	0	0	0	0	0	4.45	4.33	0	0	0	0	0	0	100	K-feldspar
2757.58	16	8	15	70.10	0	15.53	0	0	0	0	0	0	14.37	0	0	0	0	0	0	100	K-feldspar
2757.58	16	8	16	68.40	0	18.08	0	0	0	0	0	0	13.52	0	0	0	0	0	0	100	K-feldspar
2757.58	16	8	17	70.44	0	17.11	0	0	0	0	0	4.09	8.37	0	0	0	0	0	0	100	K-feldspar
2757.58	23	9	1	0	0	0	54.01	0	3.00	0	3.66	0	0	0	0	0	39.33	0	0	100	Siderite
2757.58	24	10	1	67.37	0	17.42	0	0	0	0	0	0	15.22	0	0	0	0	0	0	100	K-feldspar
2757.58	24	10	2	0	0	0	49.77	0	2.68	0	3.66	0	0	0	0	0	43.90	0	0	100	Siderite
2757.58	24	10	3	0	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Rutile
2757.58	24	10	4	54.07	0	30.62	0	0	0	6.84	8.47	0	0	0	0	0	0	0	0	100	?
2757.58	24	10	5	32.41	0	20.77	37.47	0	0	6.11	3.24	0	0	0	0	0	0	0	0	100	Chlorite+ CaO
2757.58	28	11	1	67.88	0	21.03	0	0	0	0	3.58	7.51	0	0	0	0	0	0	0	100	Oligoclase

Notes: 1) Total iron is expressed as FeO; 2) += These figures and positions are shown in Appendix 1; 3) Original analyses of minerals have been recalculated appropriately.

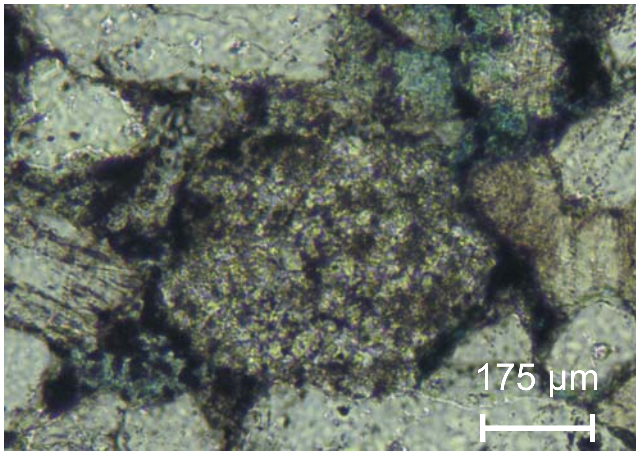
Appendix C1, Table 1d: Semi- quantative Scanning Electron Microscope chemical analyses of sample 2757.58 from Hesper I-52 well.

Sample	Site	Figure+	Position+	SiO_2	TiO_2	Al_2O_3	FeO_t	Cr_2O_3	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	BaO	Ce_2O_3	CO_2	SO_3	ZrO_2	Total	Mineral Name
2757.58	28	11	2	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
2757.58	28	11	3	36.53	3.52	16.81	24.10	0	0.59	5.70	0	0	8.75	0	0	0	0	0	0	96	Biotite
2757.58	32	12	1	0	0	29.63	20.13	40.45	0.47	9.33	0	0	0	0	0	0	0	0	0	100	Spinel
2757.58	36	13	1	0	0	0	0	0	0	0	59.28	0	0	0	0	0	40.72	0	0	100	Calcite
2757.58	36	13	2	0	0	0	0	0	0	0	56.21	0	0	0	0	0	43.79	0	0	100	Calcite
2757.58	36	13	3	100	0	0	0	0	0	0	0.00	0	0	0	0	0	0	0	0	100	Quartz
2757.58	39	14	1	0	0	0	53.73	0	0	0	1.83	0	0	0	0	0	44.45	0	0	100	Siderite
2757.58	43	15	1	38.20	3.65	15.34	22.76	0	0	8.44	0	0.00	7.61	0	0	0	0	0	0	96	Biotite
2757.58	43	15	2	0	0	0	0	0	0	0	53.92	0	0	0	0	0	46.08	0	0	100	Calcite
2757.58	43	15	3	67.79	0	21.14	0	0	0	0	4.24	6.83	0	0	0	0	0	0	0	100	Plagioclase
2757.58	43	15	4	66.82	0	22.39	0	0	0	0	4.84	5.95	0	0	0	0	0	0	0	100	Plagioclase
2757.58	43	15	5	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
2757.58	45	16	1	0	0	0	0	0	0	0	67.83	0	0	32.17	0	0	0	0	0	100	Apatite
2757.58	45	16	2	68.99	0	17.29	0	0	0	0	0	0	13.72	0	0	0	0	0	0	100	K-feldspar
2757.58	45	16	3	0	0	0	0	0	0	0	51.22	0	0	0	0	0	48.78	0	0	100	Calcite

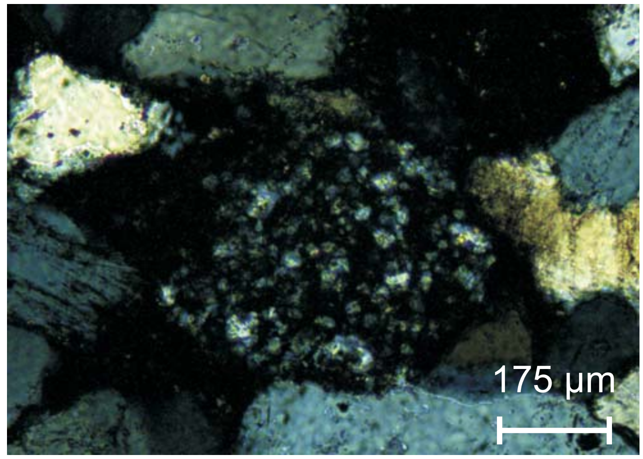
Notes: 1) Total iron is expressed as FeO; 2) += These figures and positions are shown in Appendix 1; 3) Original analyses of minerals have been recalculated appropriately.

Appendix C2: Microphotographs of representative Lithic Clasts from the Hesper I-52 well.

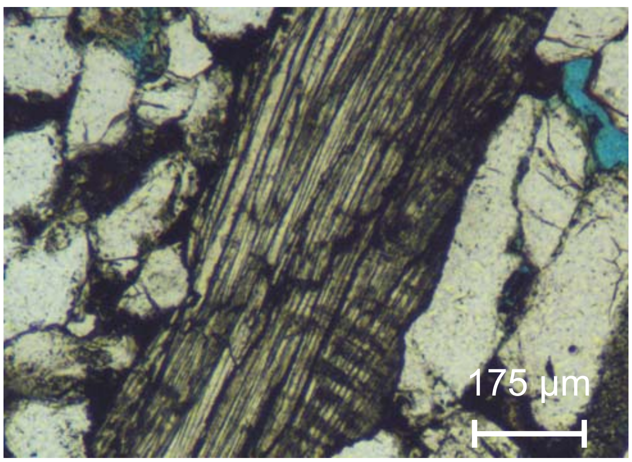
Appendix 2: Representative Lithic Clasts from the Hesper I-52 well.



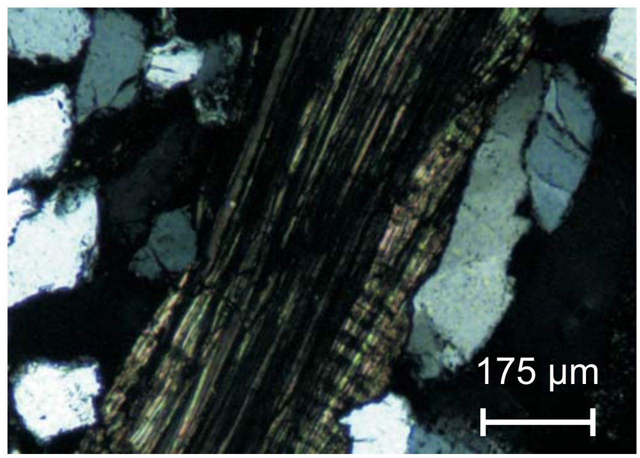
2756.63 m: Intrusive Rhyolite 100X ppl



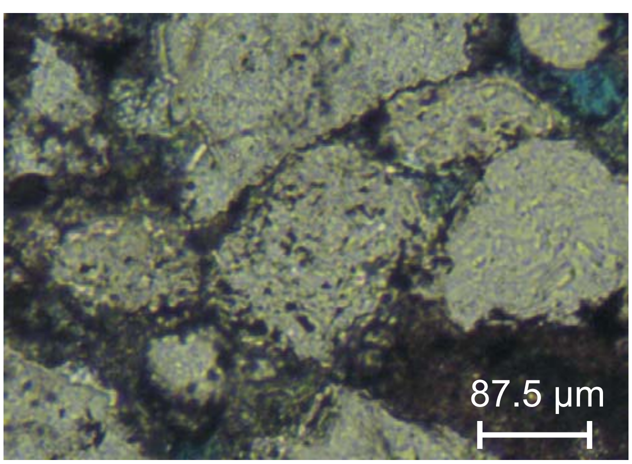
2756.63 m: Intrusive Rhyolite 100X xpl



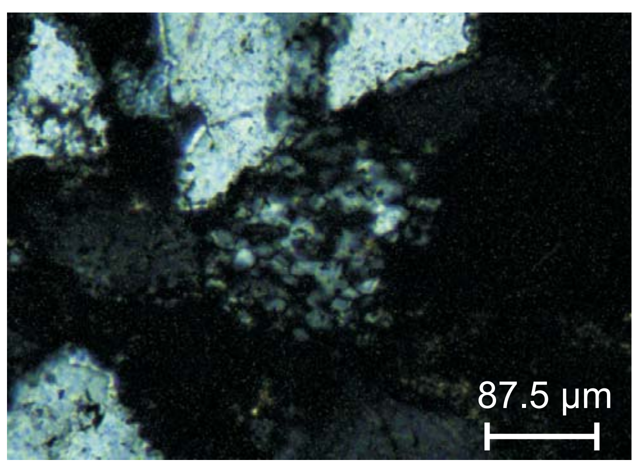
2756.63 m: Carbonate bioclast? 100X ppl



2756.63 m: Carbonate bioclast? 100X xpl

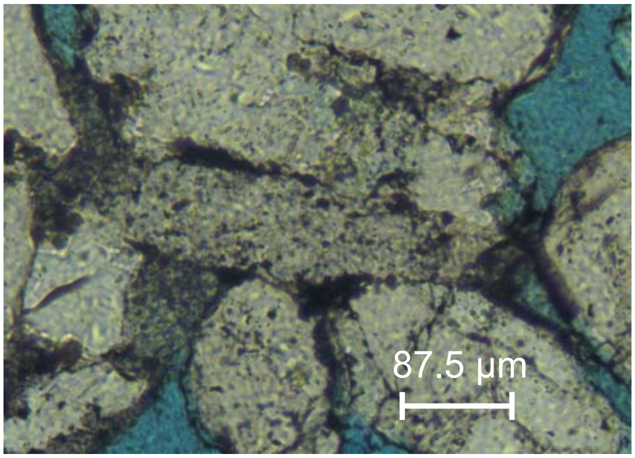


2756.63 m: Chert 200X ppl

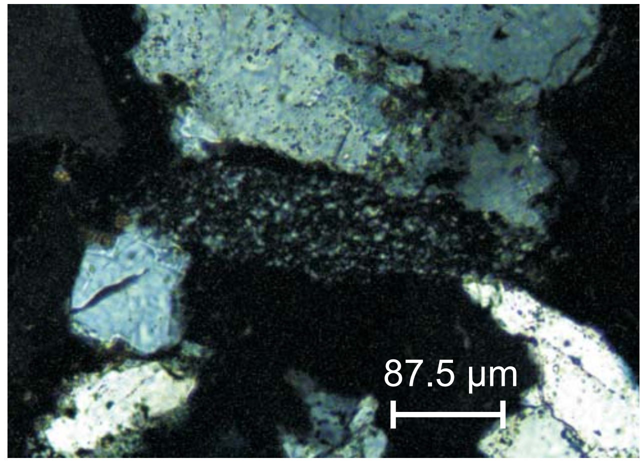


2756.63 m: Chert 200X xpl

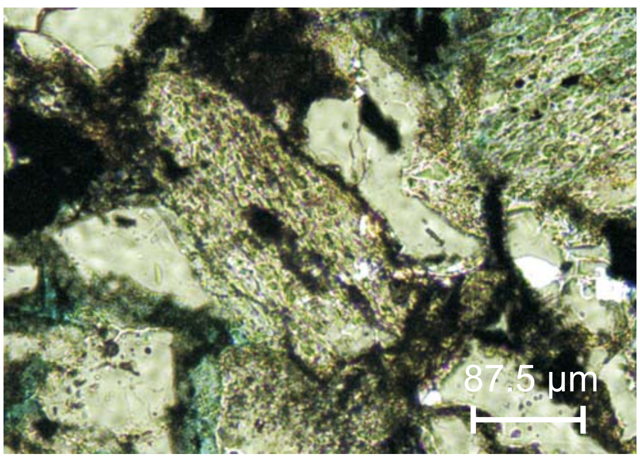
Appendix 2: Representative Lithic Clasts from the Hesper I-52 well.



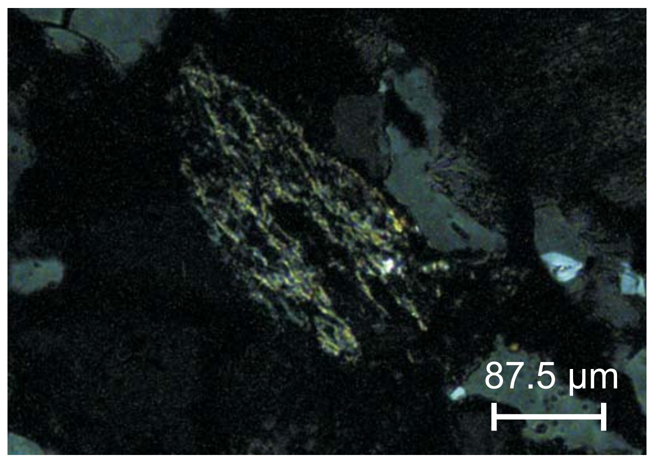
2756.63 m: Microgranite 200X ppl



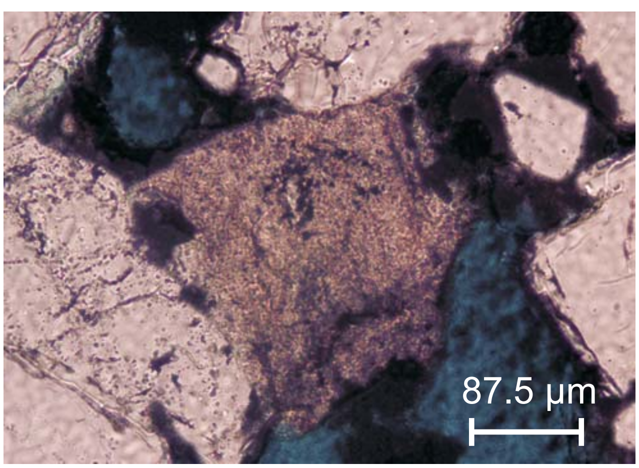
2756.63 m: Microgranite 200X xpl



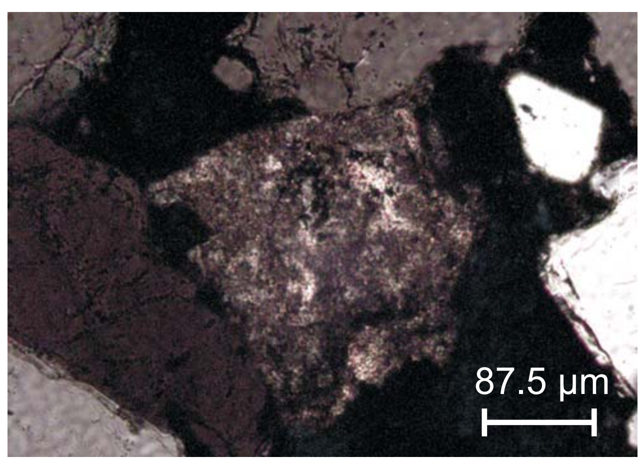
2757.19 m: Schist 200X ppl



2757.19 m: Schist 200X xpl

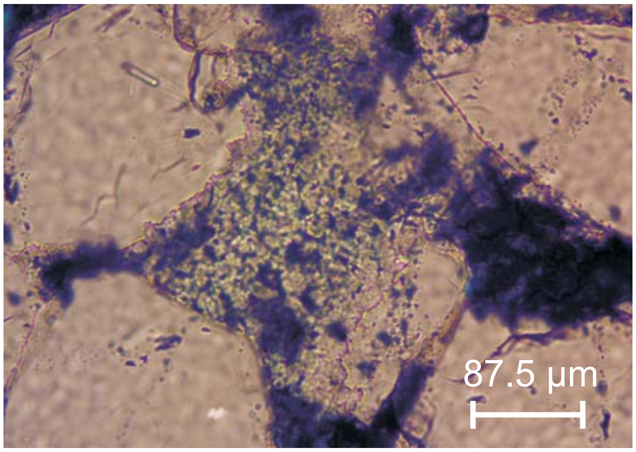


2754.93 m: Mudstone 200X ppl

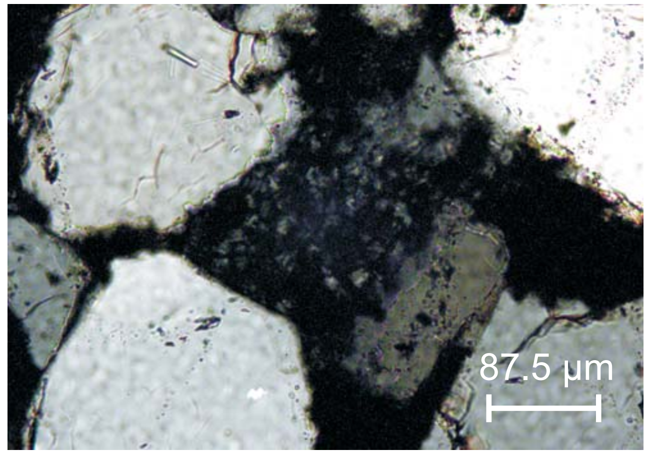


2754.93 m: Mudstone 200X xpl

Appendix 2: Representative Lithic Clasts from the Hesper I-52 well.



2754.93 m: Rhyolite 200X ppl



2754.93 m: Rhyolite 200X xpl

Appendix D1: Back Scattered Electron (BSE) Images by SEM and semi-quantitative SEM chemical analyses of minerals from the South Griffin J-13 well

Note: Focused study to discern whether main mineral constituent was a perthitic K-feldspar or a highly- fractured quartz; we concluded it was the latter, although K-feldspar is also a common detrital mineral.

Appendix 1a: BSE images of sample 4139.40 m

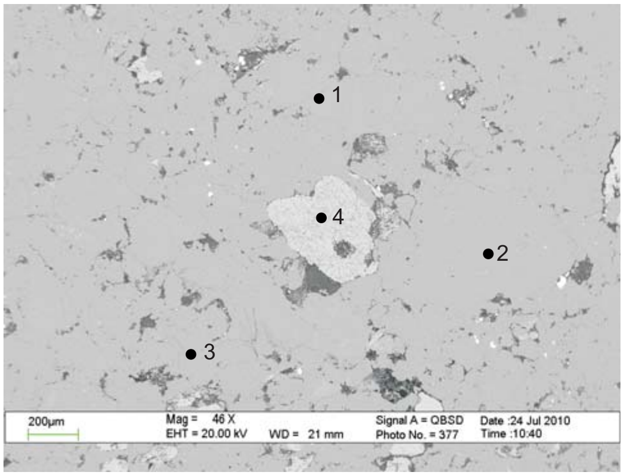


Figure 1: 4139.40 m., Quartz (pos. 1-3); K-feldspar (pos. 4)

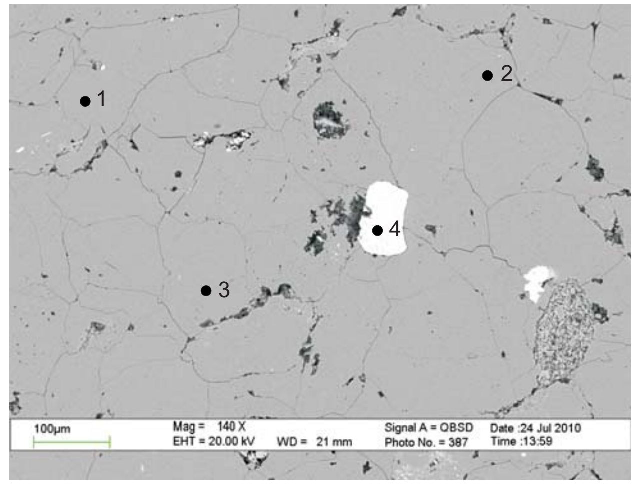


Figure 2: 4139.40 m.,Quartz (pos. 1-3); Chromite (pos. 4)

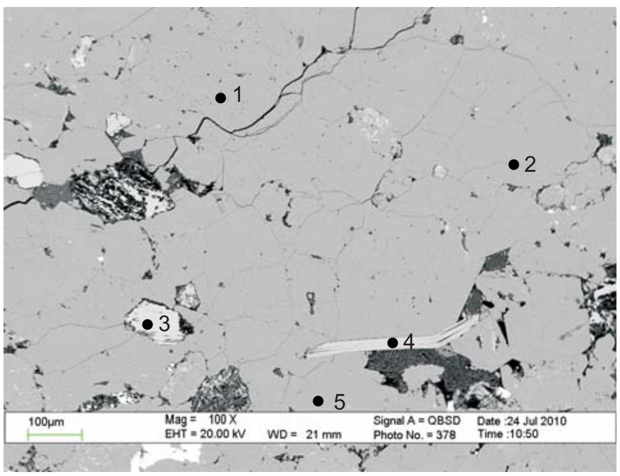


Figure 3: 4139.40 m., Quartz (pos. 1,2,5); K-feldspar (pos. 3); Muscovite (pos. 4)

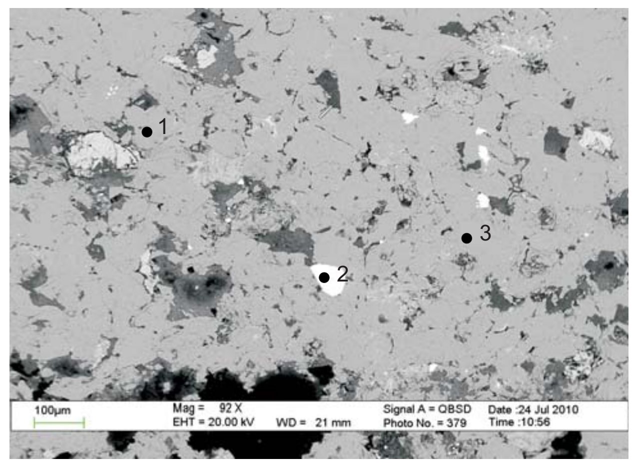


Figure 4: 4139.40 m., Quartz (pos. 1,3); Zircon (pos. 2)

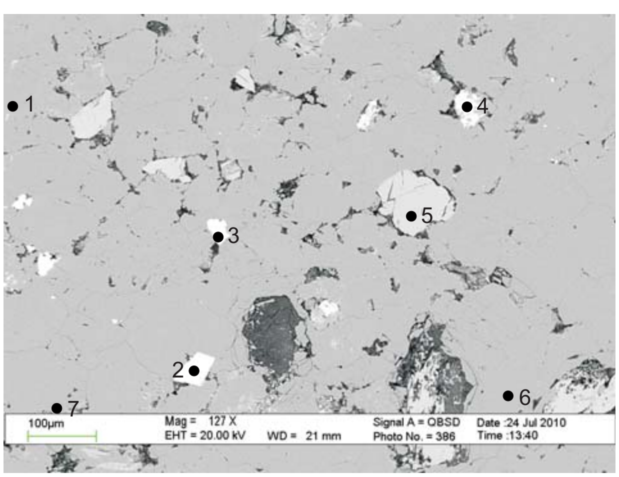


Figure 5: 4139.40 m., Quartz (pos. 1,6,7); Chromite (pos. 2); Titanium Oxide (pos. 3,4); K-feldspar (pos. 5)

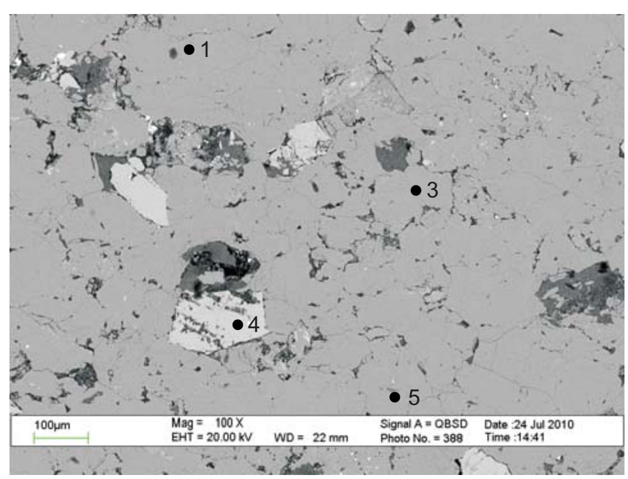


Figure 6: 4139.40 m.,Quartz (pos. 1,3,5); K-feldspar (pos. 4)

Appendix D1, Table 1a: Semi- quantitative Scanning Electron Microscope chemical analyses of sample 4139.40 from South Griffin J-47 well.

Sample	Figure[+]	Position[+]	SiO_2	TiO_2	Al_2O_3	FeO_t	Cr_2O_3	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	ZrO_2	Total	Mineral Name
4139.40-1	1	1	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4139.40-1	1	2	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4139.40-1	1	3	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4139.40-1	1	4	69.03	0	16.49	0	0	0	0	0	0	14.48	0	0	100	K-feldspar
4139.40-2	2	1	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4139.40-2	2	2	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4139.40-2	2	3	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4139.40-2	2	4	0	0	31.33	20.52	39.70	0	8.44	0	0	0	0	0	100	Chromite
4139.40-3	3	1	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4139.40-3	3	2	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4139.40-3	3	3	69.10	0	17.71	0	0	0	0	0	0	13.19	0	0	100	K-feldspar
4139.40-3	3	4	49.97	0	32.26	3.40	0	0	0	0	0	9.36	0	0	95	Muscovite
4139.40-3	3	5	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4139.40-4	4	1	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4139.40-4	4	2	58.45	0	2.53	3.85	0	0	7.18	3.28	0	0	0.00	24.71	100	Zircon
4139.40-4	4	3	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4139.40-5	5	1	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4139.40-5	5	2	0	0	12.69	27.01	54.65	0	5.65	0	0	0	0	0	100	Chromite
4139.40-5	5	3	0	100	0	0	0	0	0	0	0	0	0	0	100	TiO_2
4139.40-5	5	4	0	100	0	0	0	0	0	0	0	0	0	0	100	TiO_2
4139.40-5	5	5	69.69	0	16.22	0	0	0	0	0	0	14.09	0	0	100	K-feldspar
4139.40-5	5	6	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4139.40-5	5	7	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4139.40-6	6	1	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4139.40-6	6	2	68.20	0	17.09	0	0	0	0	0	0	14.71	0	0	100	K-feldspar
4139.40-6	6	3	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4139.40-6	6	4	70.73	0	16.54	0	0	0	0	0	0	12.73	0	0	100	K-feldspar
4139.40-6	6	5	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz

Notes: 1) Total iron is expressed as FeO; 2) += These figures and positions are shown in Appendix D1; 3) Original analyses of minerals have been recalculated appropriately.

Appendix 1b: BSE images of sample 4139.65 m

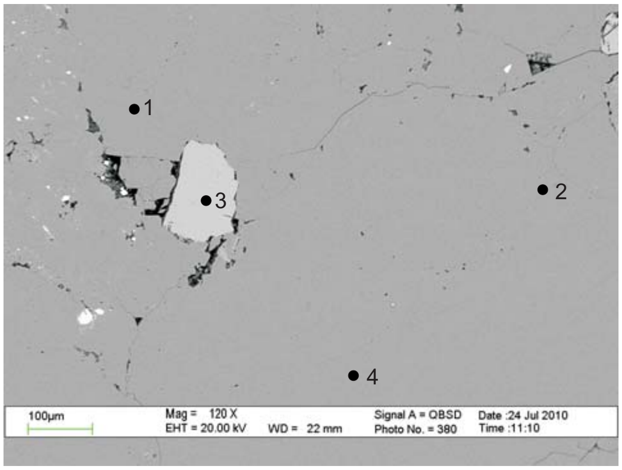


Figure 1: 4139.65 m., Quartz (pos. 1,2,4); K-feldspar (pos. 3)

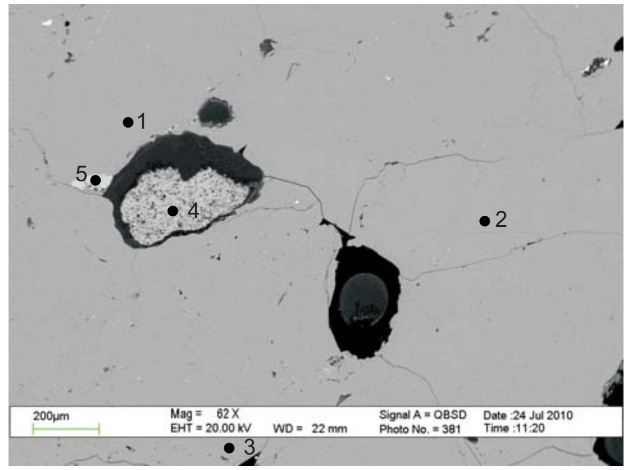


Figure 2: 4139.65., Quartz (pos. 1-3); Altered Feldspar (pos. 4); K-feldspar (pos. 5)

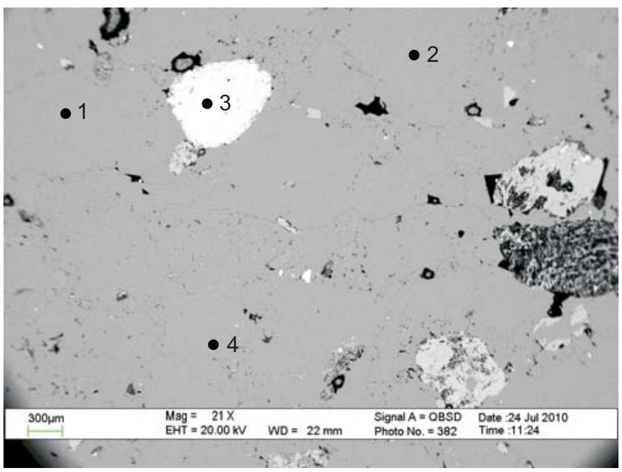


Figure 3: 4139.65 m., Quartz (pos. 1,2,4); Pyrite (pos. 3)

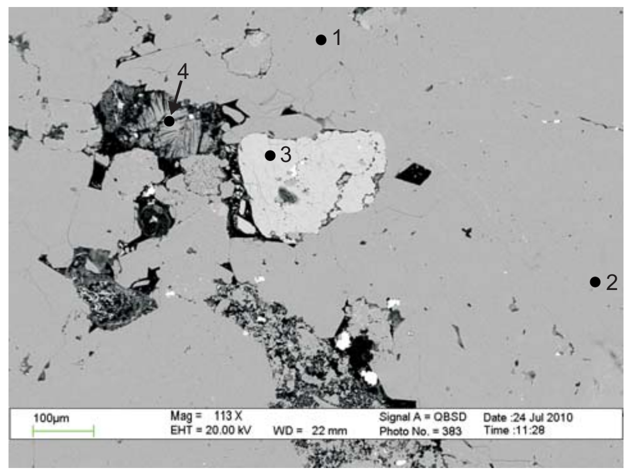


Figure 4: 4139.65 m., Quartz (pos. 1,3); K-feldspar (pos 2); Muscovite (pos. 4)

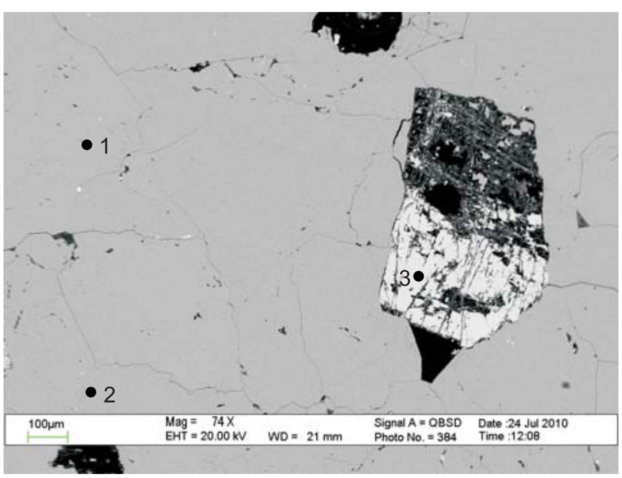


Figure 5: 4139.65 m., Quartz (pos. 1,2); K-feldspar (pos. 3)

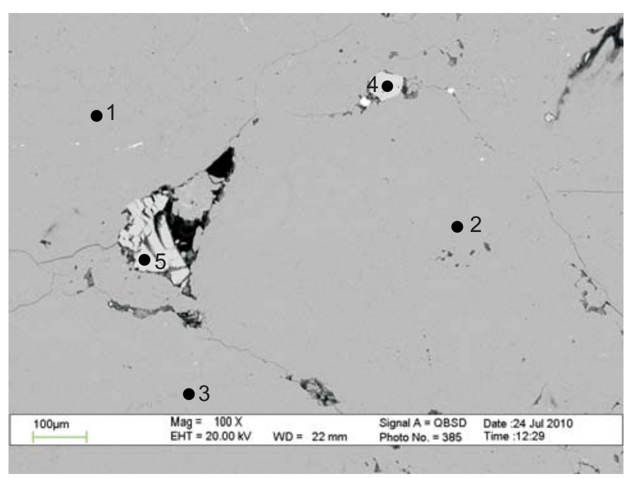


Figure 6: 4139.65 m., Quartz (pos. 1-3); Chlorite+Calcite (pos. 4); K-feldspar (pos. 5)

Appendix D1, Table 1b: Semi- quantitative Scanning Electron Microscope chemical analyses of sample 4139.65 from South Griffin J-47 well.

Sample	Figure[+]	Position[+]	SiO_2	TiO_2	Al_2O_3	FeO_t	Cr_2O_3	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	S	Total	Mineral Name	
4139.65-1	1	1	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz	
4139.65-1	1	2	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz	
4139.65-1	1	3	68.98	0	16.18	0	0	0	0	0	0	14.84	0	0	100	K-feldspar	
4139.65-1	1	4	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz	
4139.65-2	2	1	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz	
4139.65-2	2	2	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz	
4139.65-2	2	3	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz	
4139.65-2	2	4	78.94	0	0	0	0	0	4.75	7.04	9.27	0	0	0	100	Altered Feldspar	
4139.65-2	2	5	68.32	0	16.59	0	0	0	0	0	0	15.08	0	0	100	K-feldspar	
4139.65-3	3	1	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz	
4139.65-3	3	2	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz	
4139.65-3	3	3	0	0	0	46.81	0	0	0	0	0	0	0	53.19	100	Pyrite*	*
4139.65-3	3	4	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz	
4139.65-4	4	1	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz	
4139.65-4	4	2	70.73	0	14.83	0	0	0	0	0	0	14.44	0	0	100	K-feldspar	
4139.65-4	4	3	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz	
4139.65-4	4	4	56.56	0	28.03	2.53	0	0	0	0	0	7.89	0	0	95	Muscovite	
4139.65-5	5	1	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz	
4139.65-5	5	2	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz	
4139.65-5	5	3	87.31	0	6.19	0	0	0	0	0	0	6.50	0	0	100	K-feldspar+Quartz	
4139.65-6	6	1	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz	
4139.65-6	6	2	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz	
4139.65-6	6	3	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz	
4139.65-6	6	4	45.31	0	28.80	17.36	0	0	5.75	2.78	0	0	0	0	100	Chl (+Cal)	
4139.65-6	6	5	70.60	0	14.75	0	0	0	0	0	0	14.65	0	0	100	K-feldspar	

Notes: 1) Total iron is expressed as FeO; 2) += These figures and positions are shown in Appendix D1; 3) Original analyses of minerals have been recalculated appropriately.

Appendix 1c: BSE images of sample 4140.57 m

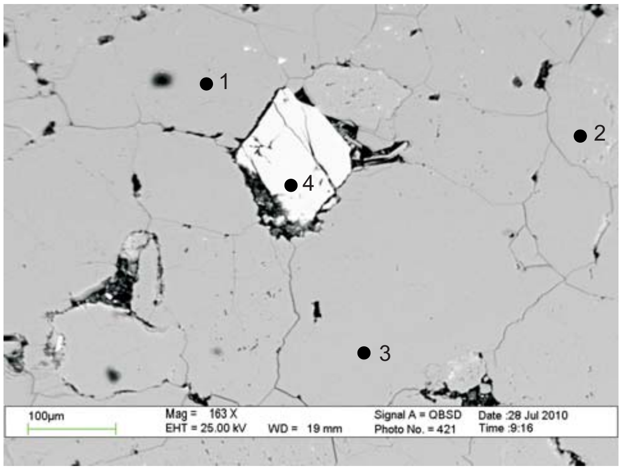


Figure 1: 4140.57 m., Quartz (pos. 1-3); K-feldspar (pos. 4)

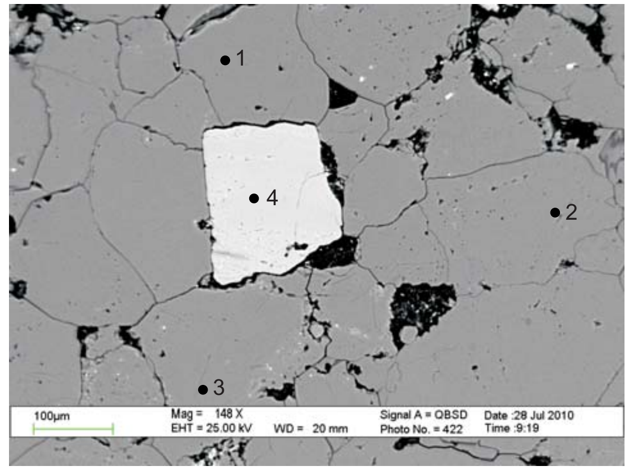


Figure 2: 4140.57 m., Quartz (pos. 1-3); K-feldspar (pos. 4)

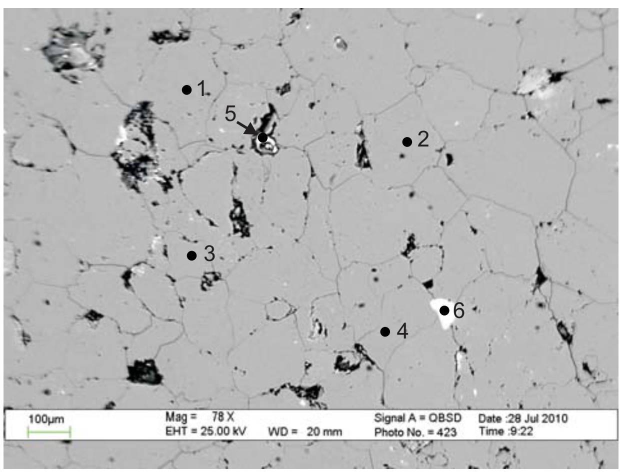


Figure 3: 4140.57 m., Quartz (pos. 1-4); K-feldspar (pos 5); Zircon (pos 6)

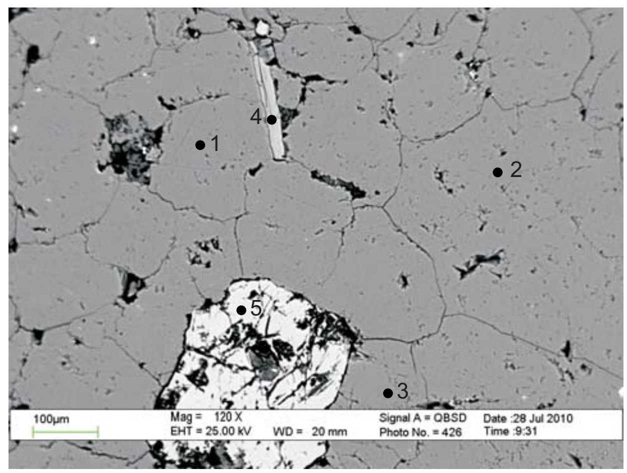


Figure 4: 4140.57 m., Quartz (1-3); Muscovite (pos. 4); K-feldspar (pos. 5)

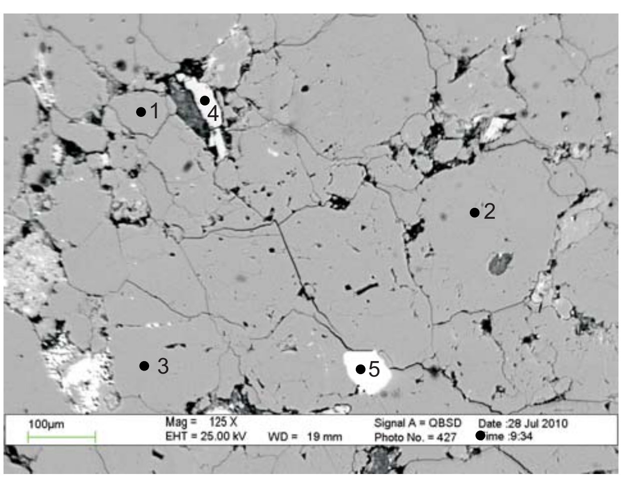


Figure 5: 4140.57 m., Quartz (pos.1-3); K-feldspar (pos. 4); Zircon (pos. 5)

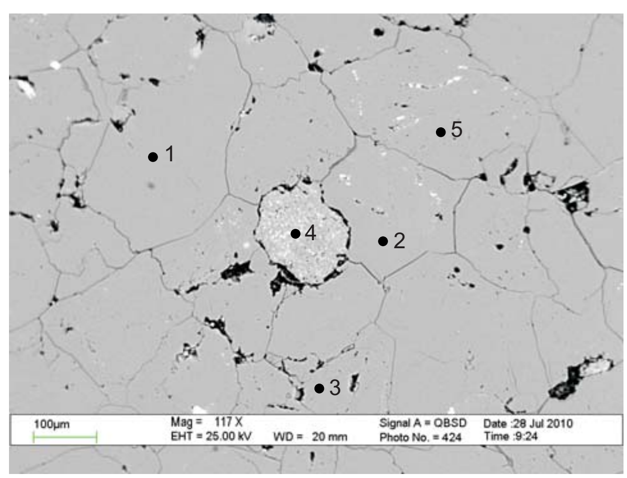


Figure 6: 4140.57 m., Quartz (pos. 1-5)

Appendix D1, Table 1c: Semi- quantitative Scanning Electron Microscope chemical analyses of sample 4140.57 from South Griffin J-47 well.

Sample	Figure[+]	Position[+]	SiO_2	TiO_2	Al_2O_3	FeO_t	Cr_2O_3	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	ZrO_2	Total	Mineral Name
4140.57-1	1	1	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.57-1	1	2	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.57-1	1	3	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.57-1	1	4	69.38	0	17.58	0	0	0	0	0	0	13.04	0	0	100	K-feldspar
4140.57-2	2	1	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.57-2	2	2	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.57-2	2	3	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.57-2	2	4	69.07	0	17.48	0	0	0	0	0	0	13.45	0	0	100	K-feldspar
4140.57-3	3	1	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.57-3	3	2	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.57-3	3	3	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.57-3	3	4	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.57-3	3	5	72.12	0	15.01	0	0	0	0	0	0	12.87	0	0	100	K-feldspar
4140.57-3	3	6	45.48	0	0	0	0	0	0	0	0	0	0	54.52	100	Zircon
4140.57-4	4	1	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.57-4	4	2	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.57-4	4	3	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.57-4	4	4	49.86	0	35.28	0	0	0	0	0	0	9.87	0	0	95	Muscovite
4140.57-4	4	5	70.53	0	16.04	0	0	0	0	0	0	13.43	0	0	100	K-feldspar
4140.57-5	5	1	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.57-5	5	2	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.57-5	5	3	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.57-5	5	4	71.77	0	12.39	0	0	0	0	0	0	15.83	0	0	100	K-feldspar
4140.57-5	5	5	47.09	0	0	0	0	0	0	0	0	0	0	52.91	100	Zircon
4140.57-6	6	1	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.57-6	6	2	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.57-6	6	3	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.57-6	6	4	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.57-6	6	5	100	0	0	0	0	0	0	0	0	0	0	0	100	Quartz

Notes: 1) Total iron is expressed as FeO; 2) += These figures and positions are shown in Appendix D1; 3) Original analyses of minerals have been recalculated appropriately.

Appendix 1d: BSE images of sample 4140.70A m

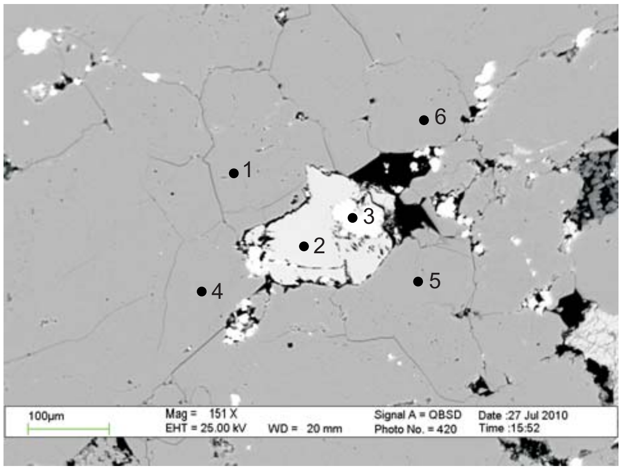


Figure 1: 4140.70A m., Quartz (pos. 1, 4-6); K-feldspar (pos. 2); Pyrite (pos. 3)

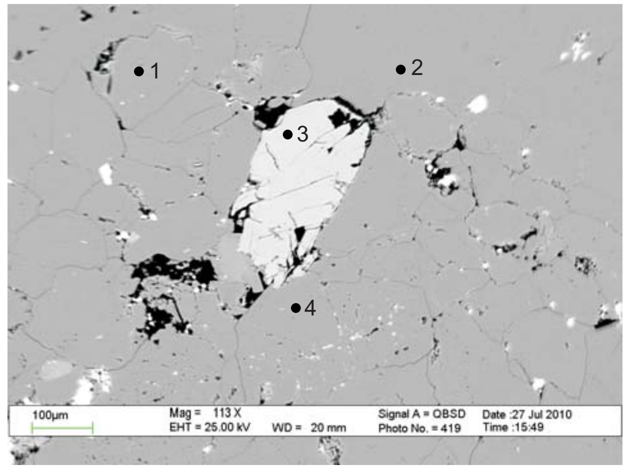


Figure 2: 4140.70A m., Quartz (pos. 1,2,4); K-feldspar (pos. 3)

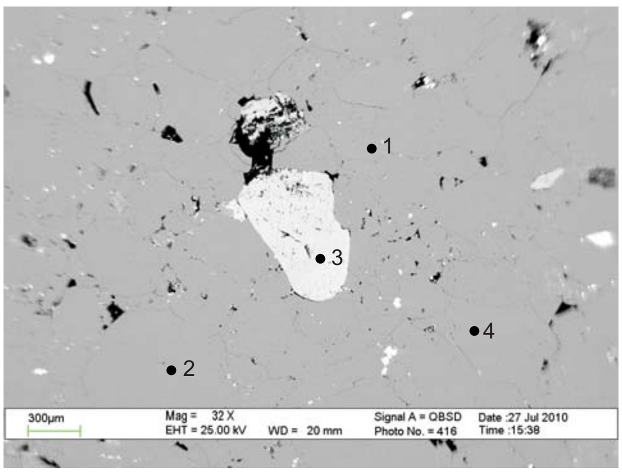


Figure 3: 4140.70A m., Quartz (1,2,4); K-feldspar (pos. 3)

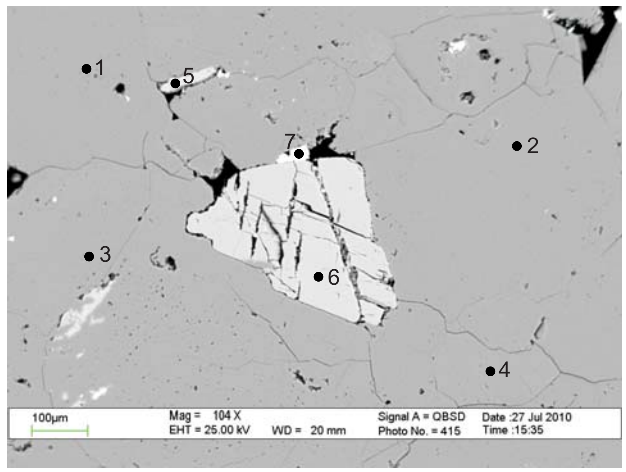


Figure 4: 4140.70A m., Quartz (pos. 1-4); K-feldspar (pos. 5,6); Pyrite (pos. 7)

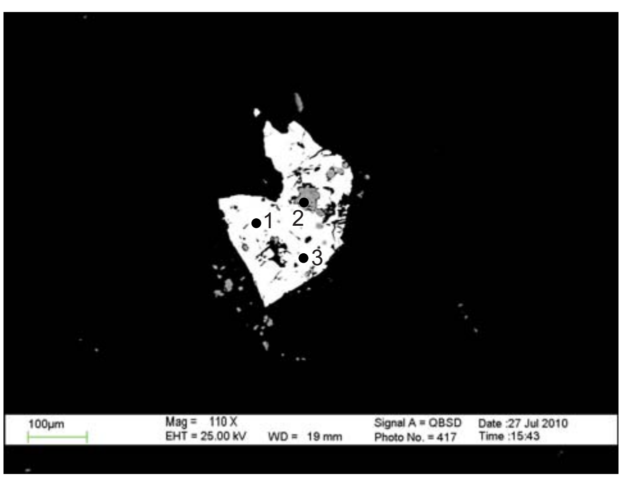


Figure 5: 4140.70A m., Sphalerite (pos. 1,3); Pyrite (pos. 2)

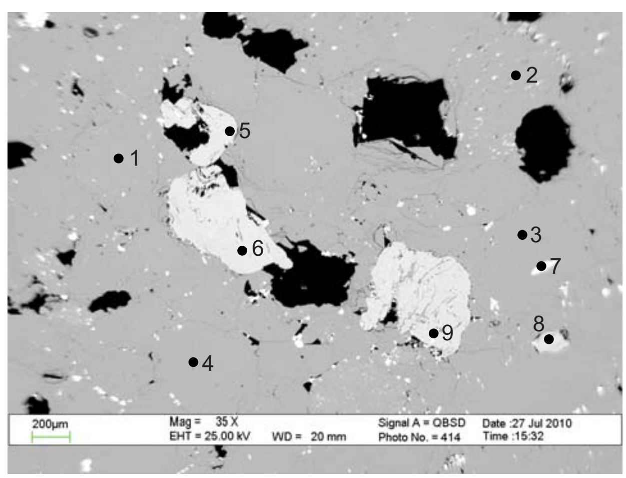


Figure 6: 4140.70A m., Quartz (1-4); K-feldspar (pos. 5,6,8,9); Biotite(pos. 7)

Appendix D1, Table 1d: Semi- quantitative Scanning Electron Microscope chemical analyses of sample 4140.70A from South Griffin J-47 well.

Sample	Figure[+]	Position[+]	SiO_2	TiO_2	Al_2O_3	FeO_t	Cr_2O_3	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	S	Hg	Zn	Pb	Cu	Total	Mineral Name
4140.70B-1	1	1	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.70A-1	1	2	69.97	0	16.58	0	0	0	0	0	0	13.45	0	0	0	0	0	0	100	K-feldspar
4140.70A-1	1	3	0	0	0	43.09	0	0	0	0	0	0	0	56.91	0	0	0	0	100	Pyrite*
4140.70A-1	1	4	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.70A-1	1	5	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.70A-1	1	6	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.70A-1	2	1	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.70A-1	2	2	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.70A-1	2	3	71.35	0	14.85	0	0	0	0	0	0	13.80	0	0	0	0	0	0	100	K-feldspar
4140.70A-1	2	4	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.70A-1	3	1	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.70A-1	3	2	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.70A-1	3	3	69.07	0	17.07	0	0	0	0	0	0	13.86	0	0	0	0	0	0	100	K-feldspar
4140.70A-1	3	4	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.70A-1	4	1	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.70A-1	4	2	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.70A-1	4	3	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.70A-1	4	4	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.70A-1	4	5	69.26	0	16.50	0	0	0	0	0	0	14.24	0	0	0	0	0	0	100	K-feldspar
4140.70A-1	4	6	71.07	0	15.18	0	0	0	0	0	0	13.75	0	0	0	0	0	0	100	K-feldspar
4140.70A-1	4	7	0	0	0	45.07	0	0	0	0	0	0	0	51.80	0	0	3.12	0	99.99	Pyrite
4140.70A-1	5	1	0	0	0	0	0	0	0	0	0	0	0	37.04	1.27	61.69	0	0	100	Sphalerite
4140.70A-1	5	2	0	0	0	44.35	0	0	0	0	0	0	0	55.65	0	0	0	0	100	Pyrite
4140.70A-1	5	3	0	0	0	0	0	0	0	0	0	0	0	38.48	0	60.54	0	0.97	99.99	Sphalerite
4140.70A-1	6	1	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.70A-1	6	2	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.70A-1	6	3	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.70A-1	6	4	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.70A-1	6	5	69.60	0	17.57	0	0	0	0	0	0	12.83	0	0	0	0	0	0	100	K-feldspar
4140.70A-1	6	6	69.05	0	16.22	0	0	0	0	0	0	14.73	0	0	0	0	0	0	100	K-feldspar
4140.70A-1	6	7	40.95	3.25	15.31	21.24	0	0	6.36	0	0	8.89	0	0	0	0	0	0	96	Biotite
4140.70A-1	6	8	69.55	0	16.66	0	0	0	0	0	0	13.79	0	0	0	0	0	0	100	K-feldspar
4140.70A-1	6	9	69.15	0	16.81	0	0	0	0	0	0	14.04	0	0	0	0	0	0	100	K-feldspar

Notes: 1) Total iron is expressed as FeO; 2) += These figures and positions are shown in Appendix D1; 3) Original analyses of minerals have been recalculated appropriately.

Appendix 1e: BSE images of sample 4140.70B m

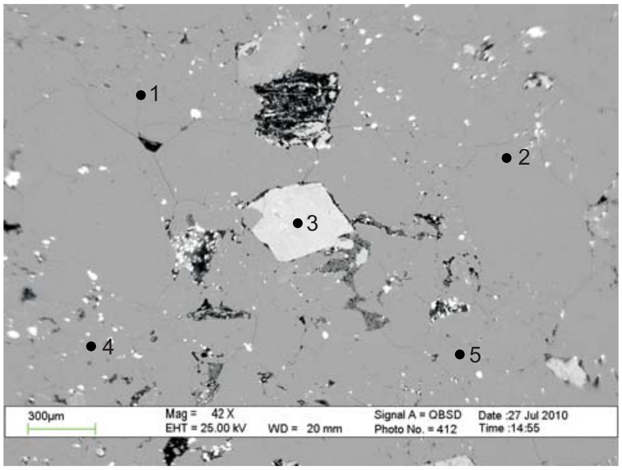


Figure 1: 4140.70B m., Quartz (pos. 1,2,4,5); K-feldspar (pos. 3)

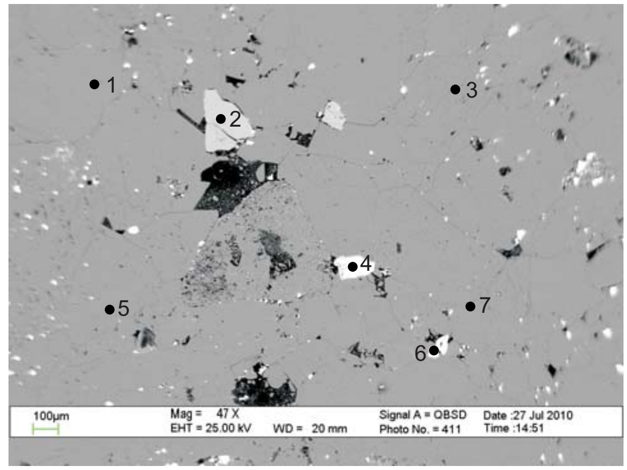


Figure 2: 4140.70B m. Quartz (pos. 1,3,5,7); K-feldspar (pos. 2); TiO_2+ Pyrite (pos. 4); Pyrite (pos. 6)

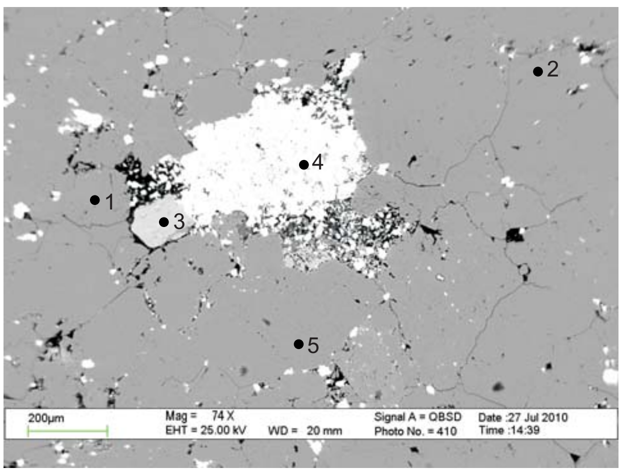


Figure 3: 4140.70B m., Quartz (pos. 1,2,5); ??K-feldspar (pos. 3); Pyrite + Quartz (pos. 4)

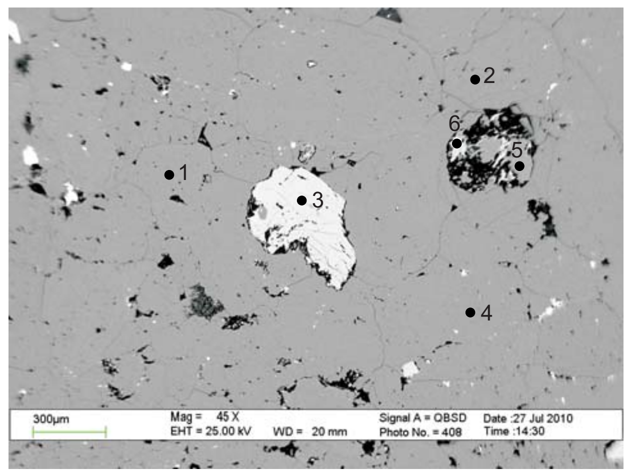


Figure 4: 4140.70B m., Quartz (pos. 1,2,4); K-feldspar (pos. 3, 6); Albite (pos. 5)

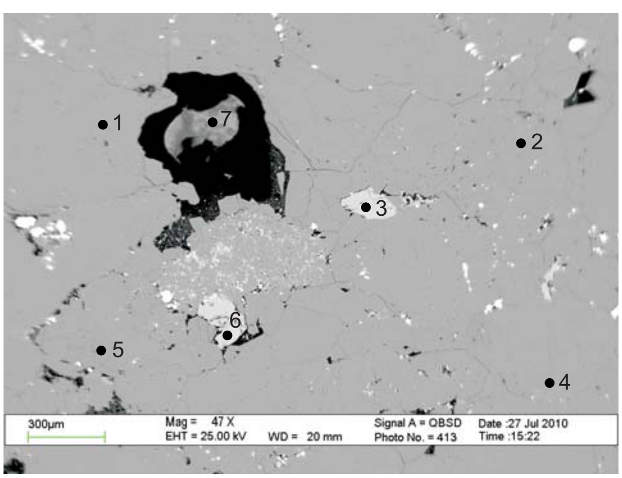


Figure 5: 4140.70B m., Quartz (1,2,4,5); K-feldspar (pos. 3,6); Mixture (pos. 7)

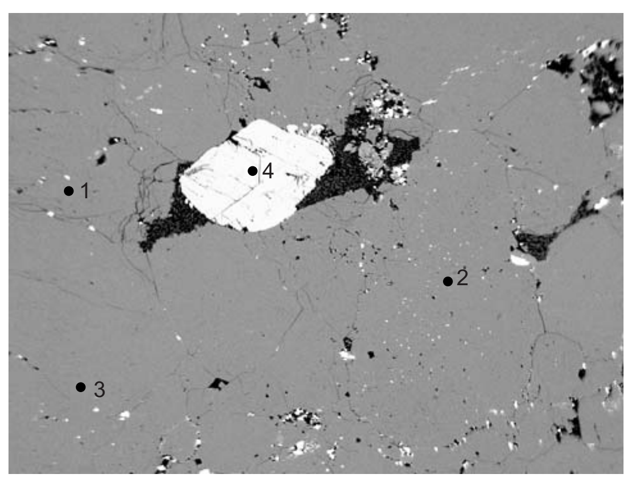


Figure 6: 4140.70B m., Quartz (pos. 1-3); K-feldspar (pos. 4)

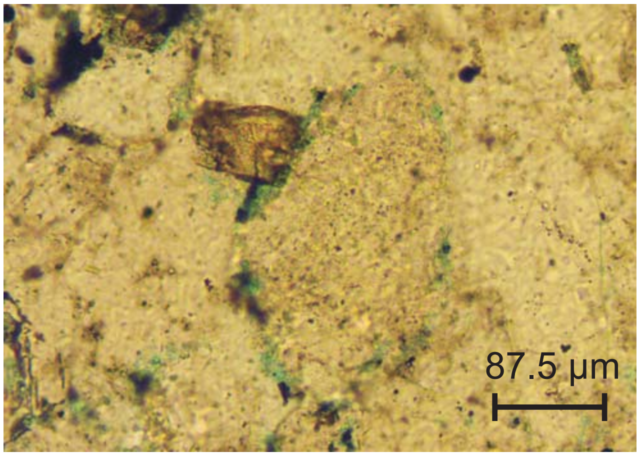
Appendix D1, Table 1e: Semi- quantitative Electron Microscope chemical analyses of sample 4140.70B from South Griffin J-47 well.

Sample	Figure+	Position+	SiO_2	TiO_2	Al_2O_3	FeO_t	Cr_2O_3	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	S	Pb	Total	Mineral Name
4140.70B-1	1	1	100	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.70B-1	1	2	100	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.70B-1	1	3	70.51	0	14.60	0	0	0	0	0	0	14.89	0	0	0	100	K-feldspar
4140.70B-1	1	4	100	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.70B-1	1	5	100	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.70B-1	2	1	100	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.70B-1	2	2	69.83	0	16.53	0	0	0	0	0	0	13.64	0	0	0	100	K-feldspar
4140.70B-1	2	3	100	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.70B-1	2	4	0	84.98	0	10.61	0	0	0	0	0	0	0	4.41	0	100	TiO_2+ Pyrite
4140.70B-1	2	5	100	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.70B-1	2	6	0	0	0	53.14	0	0	0	0	0	0	0	46.86	0	100	Pyrite*
4140.70B-1	2	7	100	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.70B-1	3	1	100	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.70B-1	3	2	100	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.70B-1	3	3	81.34	0	0	0	0	0	0	0	0	18.66	0	0	0	100	??K-feldspar
4140.70B-1	3	4	14.39	0	0	37.14	0	0	0	0	0	0	0	43.09	5.38	100	Pyrite+ Quartz
4140.70B-1	3	5	100	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.70B-1	4	1	100	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.70B-1	4	2	100	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.70B-1	4	3	70.14	0	15.55	0	0	0	0	0	0	14.31	0	0	0	100	K-feldspar
4140.70B-1	4	4	100	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.70B-1	4	5	74.38	0	16.02	0	0	0	0	0	9.60	0	0	0	0	100	Albite
4140.70B-1	4	6	69.55	0	14.35	0	0	0	0	0	0	16.11	0	0	0	100	K-feldspar
4140.70B-1	5	1	100	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.70B-1	5	2	100	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.70B-1	5	3	69.89	0	16.68	0	0	0	0	0	0	13.42	0	0	0	100	K-feldspar
4140.70B-1	5	4	100	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.70B-1	5	5	100	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.70B-1	5	6	70.03	0	16.46	0	0	0	0	0	0	13.50	0	0	0	100	K-feldspar
4140.70B-1	5	7	68.74	0	8.84	11.07	0	0	5.71	5.64	0	0	0	0	0	100	Mixture
4140.70B-1	6	1	100	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.70B-1	6	2	100	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.70B-1	6	3	100	0	0	0	0	0	0	0	0	0	0	0	0	100	Quartz
4140.70B-1	6	4	69.05	0	17.03	0	0	0	0	0	0	13.93	0	0	0	100	K-feldspar

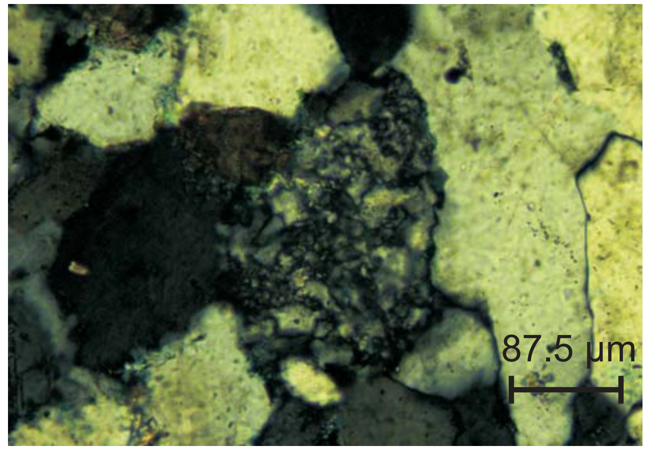
Notes: 1) Total iron is expressed as FeO; 2) += These figures and positions are shown in Appendix D1; 3) Original analyses of minerals have been recalculated appropriately.

Appendix D2: Microphotographs of representative Lithic Clasts from the South Griffin J-13 well.

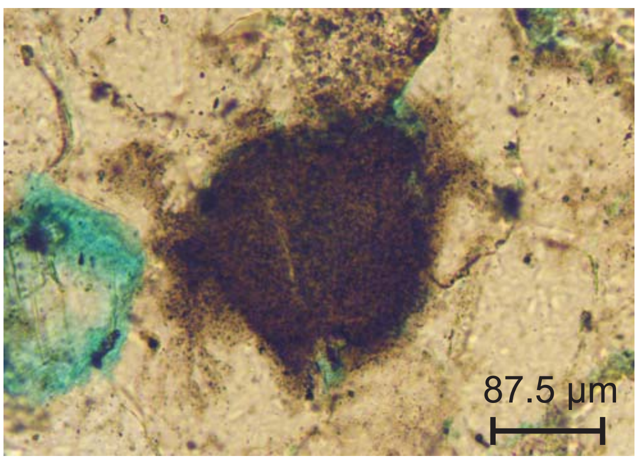
Appendix 2: Representative Lithic Clasts from the South Griffin J-13 well.



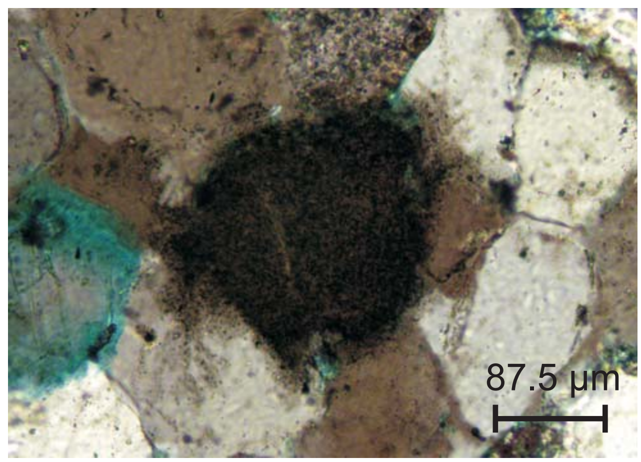
4139.40: Chert 200X ppl



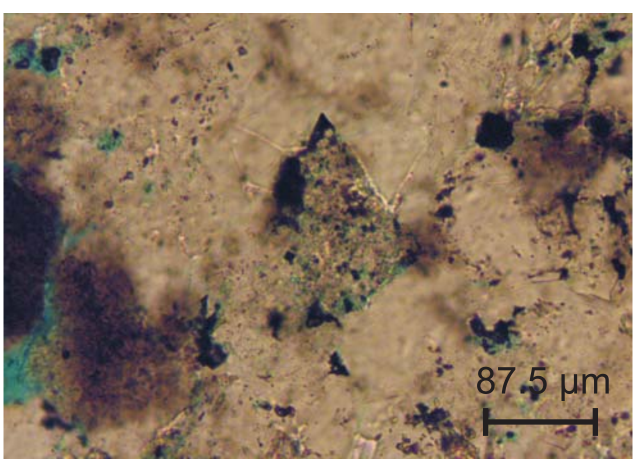
4139.40: Chert 200X xpl



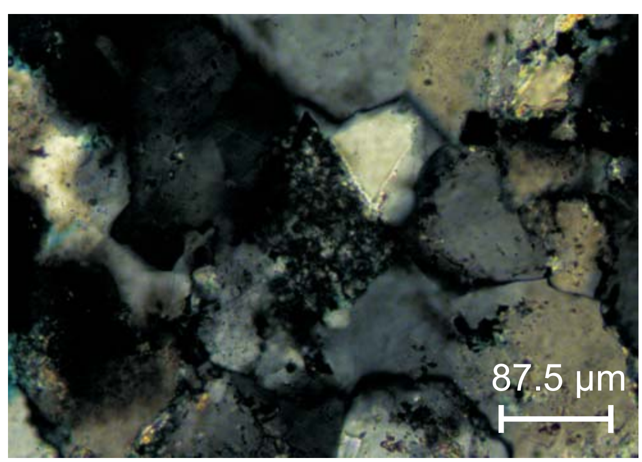
4139.40: Mudstone 200X ppl



4139.40: Mudstone 200X xpl

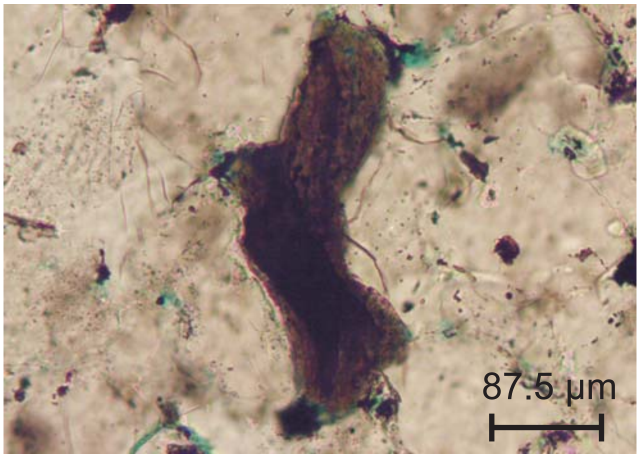


4139.40: Rhyolite 200X ppl

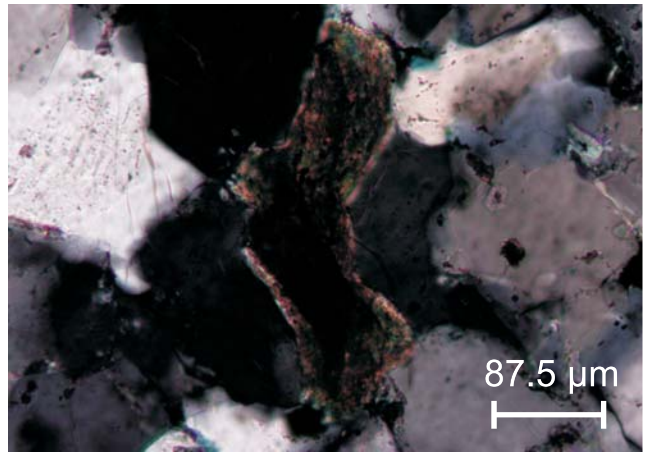


4139.40: Rhyolite 200X xpl

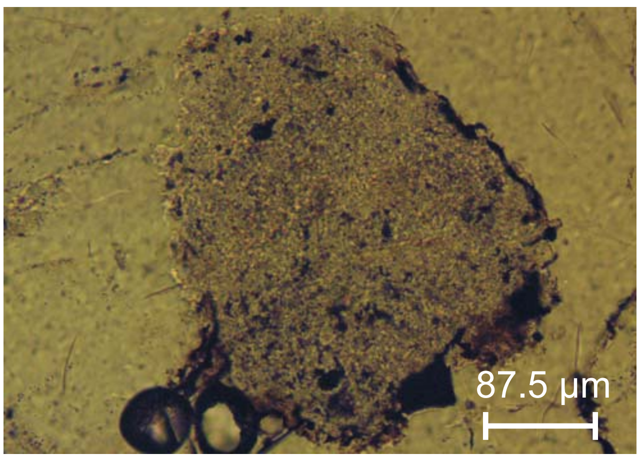
Appendix 2: Representative Lithic Clasts from the South Griffin J-13 well.



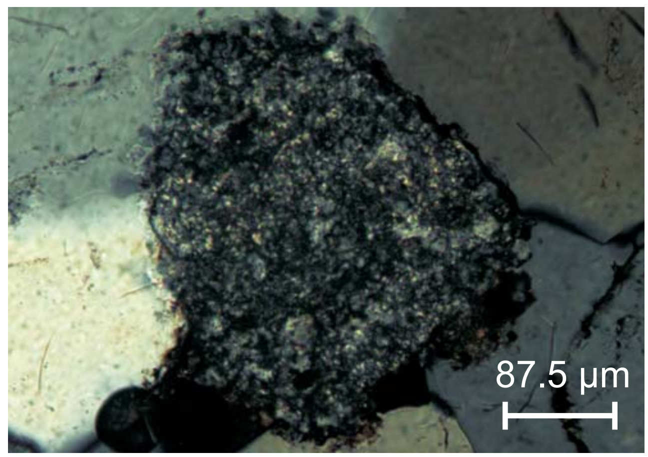
4139.40: Siltstone 200X ppl



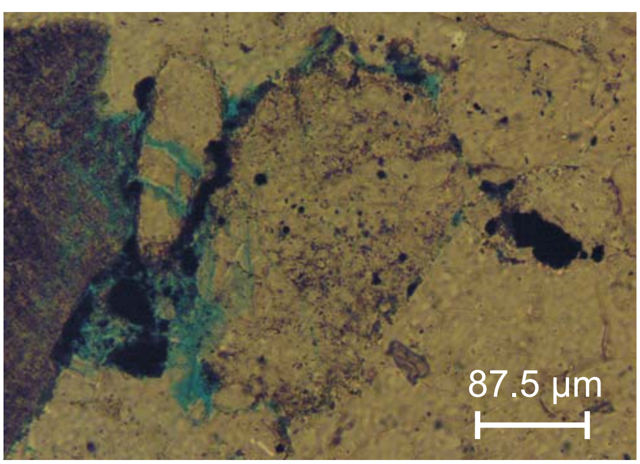
4139.40: Siltstone 200X xpl



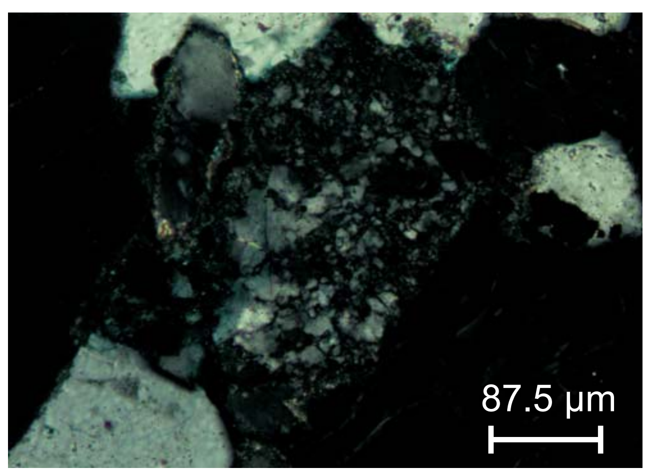
4139.65: Microgranite 200X ppl



4139.65: Microgranite 200X xpl



4140.70A: Intrusive Rhyolite 200X ppl



4140.70A: Intrusive Rhyolite 200X xpl