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G. Pe-Piper and D. J.W. Piper

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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. This report provides the results of a study of detrital mineralogy and geochemistry from Lower Cretaceous rocks of the Dauntless D-35 well at the southeastern end of the Scotian Shelf. It contributes to a growing database on the provenance of different parts of the Scotian basin. An understanding of provenance is an exploration tool for major sandstone distribution. Detrital minerals play an important role in influencing diagenesis and hence reservoir quality.

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ABSTRACT

The sedimentary petrography of the Lower Cretaceous (2160–3600 m) in the Dauntless D-35 well has been studied from cuttings samples and one short conventional core. The 3.5 m long conventional core was logged sedimentologically and sampled for petrographic thin sections. 37 cuttings samples were studied in detail and a "heavy mineral" fraction was separated. Detrital minerals diagnostic of provenance were analysed by electron microprobe and their chemical composition compared with elsewhere in the Scotian basin and with bedrock in the hinterland. Diagenetic minerals were characterized by scanning electron microscopy of rock chips, backscattered electron images of thin sections, and electron microprobe analysis.

The conventional core from the upper Missisauga Formation consists of medium-coarse grained sandstone beds deposited as river-mouth turbidites. These beds are cut by liquefied sandstone sills. Sandstones in the conventional core are largely silica cemented, but in places silica overgrowths were inhibited by the presence of chlorite rims. Kaolinite was an earlier pore-filling cement. Halite is interpreted as a later diagenetic cement.

Lithological characterization of the cuttings samples shows substantial down-hole contamination. The "heavy mineral" fraction is dominated by carbonate cemented chips and few diagnostic detrital minerals or lithic clasts were found. The cuttings samples contain siderite-cemented mudstone and siderite or calcite–Fe-calcite cemented muddy sandstone, both probably formed during sea-floor diagenesis. As in the Sable sub-basin, siderite with high Ca and Mg is most abundant in the Logan Canyon Formation. Late carbonate cements are rare.

In both cuttings and conventional core, K-feldspar makes up 3–5 % of the framework grains. Almandine garnet is sourced principally from (meta)mafic igneous rocks. All analysed tourmaline and most analysed biotite is of metasedimentary provenance. Chromite and chrome spinel indicates an ophiolitic source and is distinctive in the presence of ferrian chromite and the absence of boninitic chromite. Identifiable lithic clasts are principally of granite and volcanic rocks, the latter perhaps from Cretaceous volcanic rocks in Orpheus graben. The detrital assemblage is similar to that in the Peskowesk A-99 well, but differs in important respects from wells in the Sable sub-basin, notably the abundance of K-feldspar and different assemblages of garnet and chromite.

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1. Introduction

Many of the important petroleum gas discoveries in the Scotian basin are in Lower Cretaceous deltaic sandstone reservoirs (Wade and MacLean, 1990). Detrital petrology is an important guide to the dispersal patterns of these deltaic sands and detrital petrography also influences reservoir quality. This Open File report documents studies of the petrology and chemical mineralogy of both detrital and authigenic minerals in sandstone samples from the Dauntless D-35 well. The Dauntless D-35 well is the most easterly well on the Scotian Shelf and lies in the eastern part of the Abenaki sub-basin (Fig. 1). This report complements previous studies of Naskapi N-30 and Sambro I-29 on the La Have Platform (Pe-Piper and Piper, 2007), various wells in the Sable sub-basin (Pe-Piper et al., 2004a, 2009; Karim et al., 2008) and the Peskowesk A-99 well in the western Abenaki sub-basin (Pe-Piper et al., 2005). When all these studies are integrated, we hope to obtain further insight and understanding of both the provenance and the diagenetic history of the Lower Cretaceous sedimentary rocks of the Scotian basin.

The Dauntless D-35 well is located approximately 200 km ENE of Sable Island (Figure 1) at 44°44'08.03" N latitude and 57°20'46.6" W longitude (MacLean & Wade, 1993). It was drilled by Mobil-TETCO on April 26, 1971 and was subsequently plugged and abandoned after drilling to a depth of 4741 m (MacLean & Wade, 1993). Two intervals of conventional core were taken, one sampling the Missisauga Formation and the other sampling the Mic Mac Formation. 5 m in total were recovered as well as cuttings samples from 313.9 m to 4742.7 m.

2. Methods

Cuttings from the entire Lower Cretaceous interval of Dauntless D-35 were examined at the Canada-Nova Scotia Offshore Petroleum Board Geoscience Research Centre and the proportions of major components were estimated and logged (Appendix 6). The two conventional cores were described and photographed.

Selected cutting samples and core 1 were sub-sampled (Table 1). The core samples were carefully brushed and washed to remove any remnant drilling mud and other contaminants such as minerals evaporated from residual seawater. The cutting samples, in total 37 (Table 1), were washed through a 63 μm sieve. The coarse fraction was separated using a 2 mm sieve. The grains greater than 2 mm were divided on the basis of grain size and lithology and then further subdivided on the basis of color or apparent cement using a binocular microscope (Appendix 1). The grains < 2 mm were separated through the use of the heavy liquid tetrabromoethane (specific gravity 2.97) into a "heavy mineral" and a "light mineral" fraction (Table 2). Polished thin sections of 28 such "heavy mineral" fractions were made. These polished thin sections were used to identify both detrital and diagenetic minerals and lithic clasts (Appendices 2-4) using optical microscopy and electron microprobe. A summary of the petrology of sandstone cutting samples is also given in Table 3. Small fractions of samples from the studied conventional core intervals were broken off to be used for scanning electron microscopy. Scanning electron microscopy was carried out at the Geological Survey of Canada (Atlantic) (GSCA). The GSCA's environmental scanning electron microscope is an ElectronScan E3, which is equipped with a Noran Voyager X-ray energy dispersive spectrometer (EDS). EDS analysis was carried out on diagenetic phases in order to aid in identification (Appendix 5)

The chemical compositions of detrital and authigenic minerals were analysed using the JEOL-8200 electron microprobe at the Dalhousie Regional Electron Microprobe Centre, having five wavelength spectrometers and a Noran 133 eV energy dispersion detector. The beam was operated at 15 kV and 20 nA, with a beam diameter of 1-10 μm.

3. Stratigraphy of the Dauntless D-35 well

General stratigraphy of the Lower Cretaceous

The Lower Cretaceous rocks in the Dauntless D-35 well (Fig. 2) comprise the Logan Canyon and Missisauga formations. MacLean and Wade (1993) picked the boundaries of members based on wireline log interpretation and regional seismic correlation. The Marmora Member is a thin (41 m) sandstone unit at the top of the Logan Canyon Formation. The underlying Sable Member (107 m) is predominantly shale. The Cree Member is 438 m thick and predominantly sandstone, but with more shale in the upper part of the member. The Naskapi Member (188 m) is predominantly shale, with lesser sandstone in the lower part of the member.

Inboard from Dauntless D-35, in the Orpheus graben, both the top and base of the Missisauga Formation are marked by unconformities (Weir-Murphy, 2004). The Upper Member of the

Missisauga Formation extends from the top-Missisauga unconformity to the base of the O-marker, a regional limestone unit. The upper part of the Upper Member is predominantly sandstone, with conventional core 1 near the base. The O-marker unit consists of limestone, with lesser shale and sandstone. The top of the Middle Member is marked by return to dominant sandstone. The basal 90 m above the base-Cretaceous unconformity are particularly sandy.

MacLean and Wade (1993) include 86 m of sandstones below the base-Cretaceous unconformity in the Middle Member of the Missisauga Formation. We regard these strata as correlative with the Lower Member in the Thebaud and Venture fields and they were not studied further in this report.

Lithological summary of cuttings samples

Cuttings samples were logged throughout the Lower Cretaceous section (Appendix 6 and Fig. 3). This work was carried out in part to evaluate the extent of down-hole contamination by cuttings if detrital minerals from cuttings samples were to be used for provenance analysis.

Wireline logs show that the predominantly sandy Marmora Member of the Logan Canyon Formation extends from 2162.0 m to 2200.0 m. The primary lithology in cuttings from 2158.0 m to 2231.0 m is very fine sandstone except for the top 5 m, which consists of shale of the Dawson Canyon Formation. At 2225.0 m to 2231.0 m the dominant cuttings lithology was very fine to fine grained red sandstone, presumably siderite cemented. Wireline logs show a sandstone interval from 2241.0 m to 2250.0 m, and cuttings samples from 2238.0 m to 2250.0 m show a change in grain size to fine grained sandstone with calcareous cement and some limestone cuttings. This interval has a few cuttings of quartz granules, which may indicate coarse granule sandstone at one or more horizons. As none of these lithologies are found in higher cuttings samples, they are interpreted as representative of the rocks in this interval.

The wireline logs show that the interval from 2250.0 m to 2284.0 m consists primarily of shale. At 2250.0 m the cuttings lithology is primarily sandy siltstone. This lithology is present to a depth of 2277.0 m, but the cuttings from 2268.0 m to 2274.0 m consist principally of dark mudstone and silty mudstone, with lesser siderite-cemented mudstone and sandy limestone (probably a down-hole contaminant). From 2277.0 m to 2285.0 m the dominant cuttings lithology is mudstone with siltstone laminae.

Sandstone content of cuttings increases in the interval between 2285.0 m to 2293.0 m. This corresponds to the lower part of the Sable member from 2284.0 m to 2310.0 m, which wireline logs show consists of shale with two to four metre thick sandier intervals. A 5 m interval of cuttings of mudstone and sandstone, neither dominant, continues to a depth of 2298.0 m. The following succession, from 2298.0 m to 2310.0 m, is predominantly siltstone.

Cuttings from 2310.0 m to 2323.0 m are dominated by limestone. Wireline logs indicate a limestone interval at this depth. The wireline logs show a shale interval from 2323.0 m to 2333.0 m and mudstone dominates cuttings in the interval between 2323.0 m to 2377.5 m, though cuttings consist principally of shale from 2328.5 m to 2335.0 m and contain greater amounts of fine sandstone from 2335.0 m to 2342.0 m (Table 3). Wireline logs show a coarsening-up sandstone unit from 2333.0 m to 2350.0 m.

Wireline logs show that from 2350.0 m to 2475.0 m there is an interval of shale with minor sandstone beds. From 2377.5 m to 2390.0 m, cuttings consist principally of silty sandstones that are calcareous and sideritic. Cuttings in the interval between 2390.0 m to 2475.5 m are comprised primarily of siltstone with some cuttings of silty sandstone that show traces of glauconite. From 2395.5 m to 2402.0 m cuttings consist almost entirely of dark shale.

Silty sandstone with abundant glauconite is the predominant lithology in cuttings from 2475.5 m to a depth of 2487.0 m. From 2487.0 m to 2505.5 m the dominant cuttings lithology is limestone. Wireline logs confirm the analysis of limestone. At 2505.5 m to 2548.0 m cuttings consist of sandstone and mudstone with abundant siltstone at one interval and abundant sandy siltstone in another interval. Then from 2548.0 m to 2566.0 m the dominant cuttings lithology consists of dark shale with some cuttings of very fine-grained red sandstone. Wireline logs show that from 2505.0 m to 2573.0 m there is a series of shale beds with interbedded sandstones.

From 2566.0 m to 2572.5 m cuttings consist of silty sandstone and below this shale predominates with minor amounts of silty sandstone spanning 17.5 m, from 2572.5 m to 2594.0 m. This is followed by a 21 m interval in which silty sandstone cuttings predominate. Then at 2615.0 m to 2633.0 m medium sandstones occur in the cuttings, together with variable amounts of mudstone and sandstone. The sandstone within this interval is fine grained with patchy amounts of carbonate cement. Siltstones contain moderate amounts of glauconite and are laminated with mudstone. This series, as show on wireline logs from 2573.0 m to 2664.0 m, is predominantly shale with rare beds of sandstone.

Generally, the interval between 2633.0 m to 2716.0 m passes from mostly dark shale cuttings to an interval with common coarse sandstone and then back to a predominance of shale. Within the interval with abundant sandstone, there are mudstone laminations as well as quartz granules. In the shaly interval there are a few cuttings of red mudstone and of medium grained sandstone.

The following succession extends from 2716.0 m to 2804.0 m, although there are a few intervals for which no cuttings samples are available. Wireline logs show, for the interval in which no cutting samples are available, that sandstone dominates. The lithology of the sequence has neither a dominant amount of sandstone or mudstone. Additionally, within some cuttings there were shell fragments, very finely laminated siltstone and traces of glauconite. The interval between 2707.0 m to 2752.0 m shows on wireline logs that the dominant lithology is shale with minor sandstone intervals. This is consistent in wireline log patterns as the bottom of the Cree member overlies the Naskapi shale.

The next interval with rather uniform cuttings samples spans a large 128 m interval within the Naskapi Member. Cuttings in this interval consist of shale with lesser fine-grained red and grey sandstone (Table 3). Some of the sandstones have calcareous cement and traces of glauconite. Siderite cement is common in both sandstone and shale in the depth ranges from 2804.0 m to 2932.0 m. Wireline analysis of this interval confirms that the dominant lithology is shale.

From 2932.0 m to 2948.0 m the dominant cuttings lithology is coarse sandstone. At 2948.0 m there is a change in lithology where neither mudstone nor sandstone is dominant. There is also an abundance of fossil fragments in cuttings at this level. Wireline logs show that at this depth there are a series of alternating shale and sandstone beds at the top of the Missisauga Formation.

Limestone is the main cuttings lithology from 2965.5 m to 2987.0 m. From 2987.0 m to 2999.0 m there is a significant occurrence of coarse sandstone cuttings with a few granules visible. Then, there is a sharp decrease in grain size as the next 10.5 m are primarily shale. This interval directly overlies another interval with common limestone cuttings, which except for approximately the first 8 m have a moderate mudstone and siltstone content. Wireline logs for this interval show that limestone predominates, however, there are minor beds of shale.

Directly underlying the interval with mudstone and limestone cuttings is an interval with mostly shale cuttings spanning the depths of 3048.0 m to 3157.5 m. Within this interval are a few quartz granules and small amounts of fine-grained grey sandstone (Table 3). Wireline analysis shows that between the depths of 3048.0 m to 3148.0 m there is primarily shale with some small intervals of silty sandstone.

Core 1 extends from 3157.5 m to 3170.0 m, and is principally composed of medium and coarse grained sandstone. The cuttings from 3158.0 m to 3164.0 m consist principally of silty mudstone, interpreted as down-hole contaminant. This conclusion is also derived from wireline logs, which show that the interval is predominantly sandstone. Directly beneath the cored interval for 12 m, cuttings consist mostly of shale. There are traces of glauconite and quartz granules.

The next main lithologic unit consists of 24 m in which the dominant cuttings are muddy limestone, 3183.0 m to 3207.0 m, and 30 m, 3207.0 m to 3237.0 m, in which the dominant cuttings type is limestone. From 3237.0 m to 3453.5 m the principal lithology is dark mudstone with lesser amounts of limestone, muddy limestone and sideritic shale (Table 3). This entire interval corresponds to the O-marker unit. A few cuttings of coal fragments, minor glauconite, quartz granules and laminated mudstone were recovered.

The remainder of the logged cuttings interval tends to alternate between mixtures of mudstone and sandstone with intervals in which shale predominates. Wireline logs show that from 3267.0 m to 3323.0 m neither shale nor sandstone dominates. From 3323.0 m to 3365.0 m there is a predominant shale sequence. The mix of mudstone and sandstone occurs in two intervals, one at 3453.5 m and another at 3496.5 m. These intervals are approximately 21 m and 25 m thick, respectively, and contain traces of coal, glauconite, and quartz granules with neither the sandstone or mudstone content dominant. Wireline logs show that from 3365.0 m to 3390.0 m there are silty sandstone beds that overlie shale, which extend to 3464.0 m. The alternating sequences include shale and siltstone cuttings, which terminate at a depth of 3596.0 m. There tends to be a moderate amount of coal fragments in the lower sections and some fine white laminations in the mudstone cuttings. Wireline analysis from 3464.0 m to 3560.0 m show alternating sandstone and shale, though sandstone appears to dominate. At 3560.0 m the wireline log shows a silty sandstone rather than mudstone in the interval to 3596.0 m, and therefore these final cutting samples may be down-hole contaminants.

Sedimentological observations in conventional core 1

Core 1 consists principally of medium and coarse grained sandstones (Figs. 4, 5). Core recovery was < 40 %, so that the continuity of the recovered core is uncertain. The dominant facies is massive or graded very coarse to medium grained sandstone beds decimetres thick, locally with parallel lamination. Generally these sandstone beds are unbioturbated, but one has *Ophiomorpha* burrows at the top. Interbedded with these coarser beds are highly bioturbated units of very fine sandstone and lesser mudstone, in which original sedimentary structures are unclear. Also interbedded are three 10–25 cm thick beds of medium–coarse-grained sandstone with dispersed cm-size mudstone clasts and an apparent homogeneity of the sandstone of the type ascribed to liquefaction where seen in the Alma and Glenelg fields (Piper et al., 2004).

The graded sandstone beds with minor interbedded fine-grained sandstones and mudstones closely resemble facies Sm1 from the Venture field, interpreted by Gould et al. (2009) as river-mouth turbidites. The homogeneous sandstones with dispersed mudstone clasts resemble intrusive sandstone dykes and sills recognised in prodeltaic facies in the Alma K-85 well (Piper et al., 2004).

4. Petrology

Thin sections from conventional core

Detailed petrographic analysis from thin sections is possible only from the samples from conventional core. Four representative thin sections from conventional core 1, from the upper member of the Missisauga Formation, are medium grained sandstone. Petrological observations are summarised in Table 4. These sandstones classify as subarkose in the nomenclature of Pettijohn et al. (1987), with feldspars making up 3–5% of the total framework grains. The dominant feldspar is K-feldspar, which commonly shows perthitic texture (Appendix 4, Figure 12). Quartz makes up 88–94% of the framework grains. Typically polycrystalline quartz is found in small amounts while monocrystalline quartz dominates. Commonly the monocrystalline quartz crystals contain inclusions of biotite (Appendix 4, Figures 13 and 14) and occasionally tourmaline. A variety of lithic clasts is present, including granite (Appendix 4, Figure 18 and 19) and partly altered volcanic rocks (Appendix 4, Figure 16). Other detrital minerals include 1–2% muscovite and about 1% biotite in three of the four thin sections studied. In sample 3162.76 m there is approximately 3% wood fragments. Resistant detrital heavy minerals include tourmaline, zircon, garnet, and rutile. Opaque oxides and hydroxides are common, including detrital iron-titanium oxides. Fe-rich clay coatings are present on mudstone intraclasts (Appendix 3, Fig. 1) as well as on some quartz grains (Appendix 4, Figure 14).

The dominant cement in all four samples is silica, with common quartz overgrowths (Appendix 4, Figure 19). Other cements include chlorite (Appendix 5, Figures 10-12) and kaolinite (Appendix 5, Figures 5-7), which are found in acicular and booklet form, respectively. Halite is commonly found with these two minerals: texturally it appears to engulf kaolinite and probably also the chlorite (Appendix 5, Figures 8-10) and might either be a diagenetic mineral or formed from evaporation of seawater after the core was cut. The lack of precipitated gypsum suggests that a diagenetic origin is more likely. Barite has also been identified in pore space in one sample, 3162.76 m (Appendix 4, Figure 15), but lacks euhedral form and could be a drilling mud contaminant. Pyrite is the dominant opaque cement, found in several habits such as rosettes and framboids (Appendix 5, Figures 1–4). The limonite present is probably altered from pyrite cement (File numbers 93 and 184, Table 5, Depth 3165.65-3493.01).

Petrography of cuttings

Petrographic observations of the washed cutting samples were made on the >2 mm fraction with the help of a binocular stereoscope. A summary of these petrographic observations is given in Appendix 1.

Petrographic observations have been made from thin sections of the “heavy mineral” fraction using a petrographic microscope (Appendix 2) and some backscattered electron images are available (Appendix 4). The stratigraphic distribution of the heavy minerals tourmaline, garnet and biotite and of lithic clasts of volcanic and granitic origin are shown in Figure 2. No clear stratigraphic trends are apparent in the distribution of either minerals or lithic clasts.

Common sand-sized chips of carbonate-cemented sediment are found in the “heavy mineral” fraction. In many cases, either siderite or calcite–Fe-calcite has cemented poorly sorted sandy mud prior to significant compaction (Appendix 4, Figures 2, 3, 7, 20, 21). In places, this sediment includes what appear to be coated grains of the type described by Pe-Piper and Weir-Murphy (2008).Coated grains of chlorite composition were presumably originally Fe-rich clay and are associated with some phosphate cement (Appendix 4, Figures 25, 26). Siderite-cemented mudstone is also found (Appendix 4, Figure 24). The “intraclast” described in Appendix 3 may also be a coated grain.

Chemical mineralogy of detrital minerals

Chemical composition of detrital minerals and selected authigenic minerals was determined by electron microprobe analysis. These results are listed in Tables 5a and b. Backscattered electron (BSE) images are also included and are presented in Appendices 3 and 4.

Analyzed detrital minerals include feldspar, biotite, muscovite, garnet, chromite and chrome spinel, tourmaline, zircon, and spodumene. Limonite and goethite, considered as alteration products of iron bearing minerals, were also analyzed, as were apatite and rutile, although for all four minerals it is difficult to determine if they are detrital or diagenetic.

Biotite

Biotite is abundant in many metamorphic rocks and in some granitoid rocks. Almost all of the biotite analyses have relatively high Al_2O_3 content (Fig. 6a) that suggests a metamorphic source (based on analyses reported by Fleet, 1997). One analysis with low Al_2O_3 and high TiO_2 content is clearly of igneous origin (Fig. 6a). This biotite grain plots in the calc-alkaline igneous field of Abdel-Rahmen (1994) (Fig. 6b). This diagram also shows that if the Al-rich biotite grains were derived from igneous rock, then those igneous rocks would have been of peraluminous composition. On the other hand, none of the biotite analyses plots in the field defined by peraluminous granite in the data of Fleet (1997). A metamorphic source for most of the biotite appears most likely.

Muscovite

There is only limited number of muscovite analyses in this report and it is not clear whether the muscovite is of igneous or metamorphic origin. Reynolds et al. (2009) argued on the basis of geochronology that most of the muscovite in the Scotian basin is of metamorphic origin. If the muscovites are igneous, then they plot in the compositional field of primary igneous muscovite (after Miller et al., 1981) (not shown here).

Tourmaline

Tourmaline compositions (Fig. 7) are compared with source rock fields identified by Henry and Guidotti (1985) and Kassoli-Fournaraki and Michailidis (1994). The four analyses all fall in the metapelite-psammite field. However, tourmaline has also been found as inclusions in detrital quartz and feldspars. These observations suggest that igneous rocks were also sources for some of the detrital tourmaline.

Chromian spinel and Chromite

The total range of chemical composition of chromite and chromian spinel (Fig. 8) falls in two of the three compositional fields distinguished by Pearce et al. (2000): Mid Ocean Ridge Basalt (MORB) and island-arc thoeliite. The Dauntless D-35 well is also the only well in which ferrian chromites have been identified in the "heavy mineral" separates (Appendix 4, Fig. 17). The textures seen in these chromite grains are very similar to chromite grains from contact metamorphosed ultramafic rocks in the western Sierra Nevada Foothills, California (Springer 1974, Plates 1E and F). In the Atlantic Canada, there are strongly (amphibolite-granulite facies) metamorphosed ultramafic rocks (ophiolites) in the Dashwoods subzone of western Newfoundland: they are the pre-490 Ma Long Range mafic-ultramafic complex and correlatives and parts of the 480-477 Ma Annieopsquotch belt. They both contain chromite-bearing metaharzburgite, lherzolite (rare) and dunite. The high-grade metamorphism is regional, but the accompanying penetrative deformation is highly heterogeneous such that it is weak to absent in several places and hence had the same imprint on the rock textures as thermal metamorphism would (personal communication, C. Van Staal and V. Owen, 2009).

Garnet

The analysed garnets are mostly almandine and Mn-rich almandine (Tables 5a and b, Fig. 9). All analysed garnets are from the Logan Canyon Formation (Fig. 10): garnet appears to be less abundant in the Missisauga Formation (Fig. 2). On the Almandine–Grossular–Pyrope and Almandine–Grossular–Spessartine ternary diagram (Fig. 9), most garnets plot as types 1 and 3. Garnet type 3 is almandine with prominent grossular substitutions and garnet type 1 is almandine with prominent pyrope ± grossular substitutions. We have a substantial number of comparison analyses from potential igneous and metamorphic sources. In the potential rock sources, garnet types 1 and 3 are common in (meta)mafic igneous rocks from the Grenville Province and the Clark Head orthogneiss (Cobequid Highlands, Nova Scotia). Garnet from the Peskowesk A-99 well, in the western Abenaki sub-basin (Fig. 1), is of similar compositional range to that from Dauntless D-35 (Fig. 10). It is also more abundant in the Logan Canyon Formation than in the Missisauga Formation, where its abundance is paralleled by much more abundant metamorphic lithic clasts (Pe-Piper et al., 2006).

Spodumene

Rare grains of spodumene have been analysed from the Missisauga Formation sedimentary rocks of this well (Appendix 4, Fig. 22). Spodumene suggests an origin from a Li-rich granite or pegmatite.

Feldspars

The majority of the analyzed feldspars is K-feldspar, although minor amounts of plagioclase, albite and oligoclase, are also present (Fig. 11). Some of the analyzed feldspars show signs of alteration. The K-feldspar is likely derived from granitoid rocks. The plagioclase compositions suggest origin of the grains from felsic igneous and low grade metamorphic rocks.

Chemical mineralogy of diagenetic minerals

Chemical analyses of diagenetic minerals (Tables 5a and b) include silica and quartz overgrowths, chlorite, glauconite, kaolinite, barite (?), siderite, calcite and ferroan calcite (Table 2). In addition pyrite and halite have also been identified using optical microscopy and scanning electron microscope with EDS analysis.

Chemical variation in carbonates (Fig. 12) is generally similar to that in the western Sable sub-basin described by Karim et al.(2008). Most of the siderite and calcite–Fe-calcite appears to be of early diagenetic origin. Unlike in the western Sable sub-basin, siderite with < 3% calcite and magnesite component occurs in the Missisauga Formation at Dauntless. Siderite with high Ca and Mg is most abundant in the Logan Canyon Formation. Ankerite and Mg-calcite are less common in the Dauntless well than in the western Sable sub-basin. Some of these differences may result from mudstones predominating in the cuttings samples at Dauntless, whereas the work in the western Sable sub-basin was done on sandstone samples from conventional core. No carbonate cements were seen in core 1 from Dauntless.

5. Discussion

Reliability of cuttings samples for provenance work

One of the concerns early on in this study was whether, in the absence of conventional core, cuttings samples were acceptable for provenance analysis using mineral chemistry. The detailed logging of cuttings shows that distinctive lithologies, such as limestones, may predominate in cuttings up to 20 m below the occurrence of the bed (e.g. the limestone at 2480 m in Fig. 3a) and that trace amounts may occur much deeper (e.g. single limestone chips in cuttings samples at 3145 and 3176 m; Appendix 1).

"Heavy minerals" separates usually contain a majority of carbonate- or pyrite-cemented chips which together with lithic clasts may dilute the true heavy minerals. Where only a few heavy minerals have been found, as is the case for tourmaline, the question remains as to whether the mineral might be a contaminant from a higher stratigraphic level. In other cases, such as garnet, there is more confidence that most grains are approximately in place: the abundance of garnet varies stratigraphically in a systematic manner and a similar stratigraphic pattern involving garnets of similar composition is seen in the Peskowesk A-99 well.

We conclude that cuttings samples can be used for provenance work, but that care must be taken in interpreting small amounts of data.

Stratigraphic variation in detrital minerals and comparison with Peskowesk A-99

Little stratigraphic variation in detrital minerals can be inferred from the limited available data. Garnet in both Dauntless D-35 and Peskowesk A-99 appears more abundant in the Logan Canyon Formation than in the Missisauga Formation, but that might be the result of diagenetic loss of garnet with deeper burial (Morton and Holdsworth, 1999, 2007). In general, the detrital minerals found in Dauntless D-35 are more similar to those at Peskowesk A-99 than to those in wells from the Sable sub-basin.

Nature of the source area

The source area for Dauntless D-35 is likely similar to that for Peskowesk A-99. In the latter well, the availability of conventional core has allowed the recognition of many types of lithic clast (Pe-Piper et al., 2006). Because of the limited availability of conventional core, very few lithic clasts have been identified at Dauntless.

At Dauntless, there is clear evidence for a granitic source. K-feldspar (including perthite) makes up 3–5% of the framework grains. Lithic clasts of quartz plus K-feldspar appear to be of granite origin. Monocrystalline quartz with biotite or tourmaline inclusions is likely of granite origin, as is the mineral spodumene. Nevetheless, there is no evidence for sand-sized tourmaline grains of granitic origin, of the type that are found in the Chaswood Formation (Pe-Piper et al., 2004b). Type 4 garnets are sourced either from peraluminous granites or Al-rich metasedimentary rocks, such as occur in the Gander terrane of southwest Newfoundland and Cape Breton Island.

An important metasedimentary source area is indicated by the chemical composition of both biotite and tourmaline, which are predominantly of metamorphic, not igneous origin. The occurrence of chromite and chromian spinel indicates an ophiolite source area, likely first cycle based on the morphology of the chromite. The presence of ferrian chromite and the absence of boninitic chromite makes the chromite assemblage quite different from that in the southwestern Sable sub-basin, where bonitic chromite predominates (Pe-Piper et al. 2004a). Garnet types 1 and 3 may also be derived from ophiolites or from metamafic igneous rocks.

A volcanic source area is indicated by the presence of lithic clasts of volcanic rocks. At Peskowesk A-99, apparently similar volcanic clasts were abundant and investigated in more detail: many were of alkaline intermediate to felsic composition. In both the Logan Canyon Formation at Peskowesk and the upper Missisauga Formation at Dauntless, detrital zircon of Cretaceous age makes up 5–12 % of the total detrital zircon population (G. Pe-Piper, unpublished data). These Cretaceous detrital zircons may be related to erosion of Lower Cretaceous volcanic rocks along the Cobequid-Chedabucto fault zone (Pe-Piper and Jansa, 1987).

The significance of the diagenetic minerals

Remnants of diagenetic minerals in cuttings samples and in the conventional core show diagenetic features similar to those seen elsewhere in the Scotian basin. Seafloor diagenesis is represented by coated grains, now of chlorite and phosphate but presumably originally of Fe-rich clay and francolite. Siderite-cemented mudstone and siderite or calcite–Fe-calcite cemented muddy sandstone probably represents sea-floor diagenesis, based on observations of similar cementation from conventional core in the southwest Sable sub-basin (Karim et al. 2008). Siderite with high Ca and Mg is most abundant in the Logan Canyon Formation and a similar pattern has been noted in the Glenelg field (Karim et al., 2008).

Kaolinite is a significant diagenetic mineral in the conventional core samples. As in Venture (Gould et al. 2009) and the southwest Sable sub-basin (Karim et al. 2008), it appears to have formed during eodiagenesis, probably as a result of meteoric water at sea-level lowstands. It predates widespread silica cementation, which was locally inhibited by the presence of chlorite rims, in a manner similar to that in the Venture field (Gould et al., 2009). The role of late carbonate cements is uncertain; they are not found in the conventional core samples and appear rare in cuttings samples. Halite may be a significant later diagenetic mineral: it appears to posdate kaolinite and chlorite. Given the absence of gypsum/anhydrite, the halite is more likely related to flux of saline formation water (with NaCl derived from the Argo salt) than a modern artefact of the evaporation of sea water.

6. Conclusions

1. Cuttings samples are difficult to use for provenance studies. There is a substial risk of down-hole contamination. The “heavy mineral” fraction is dominated by carbonate cemented chips and few diagnostic detrital minerals or lithic clasts were found.
2. Conventional core 1 from the upper Missisauga Formation consists of medium-coarse grained sandstone beds deposited as river-mouth turbidites. These beds are cut by liquefied sandstone sills.
3. Sandstones in the conventional core are largely silica cemented, but in places silica overgrowths were inhibited by the presence of chlorite rims. Kaolinite was an earlier pore-filling cement. Halite is interpreted as a later diagenetic cement.
4. The detrital minerals and lithic clasts indicate that the hinterland supplied detritus from granitoid plutons, metasedimentary rocks, ophiolites, and probably from Cretaceous volcanic rocks. Detrital biotite and tourmaline are predominantly of metasedimentary origin.
5. The detrital assemblage is similar to that in the Peskowesk A-99 well, but differs in important

respects from wells in the Sable sub-basin, notably the abundance of K-feldspar, the lack of boninitic chromite and granitoid tourmaline, and different assemblages of garnet.

6. The cuttings samples provide some information on diagenetic carbonates. Siderite-cemented mudstone and siderite or calcite–Fe-calcite cemented muddy sandstone probably represents sea-floor diagenesis. As in the Sable sub-basin, siderite with high Ca and Mg is most abundant in the Logan Canyon Formation.

References

Abdel-Rahmen, A., 1994, Nature of biotites from alkaline, calc-alkaline and peraluminous magmas. Journal of Petrology, Vol. 35, 525-541.

Chang, L.L.Y., Howie, R.A. and Zussman, J., 1996. Non-silicates: Sulphates, Carbonates, Phosphates, Halides. Rock-Forming minerals, v.5B, 2nd edition

Deer, W.A., Howie, R.A. and Zussman, J., 1967. Rock-Forming minerals, vol. 4 (Framework Silicates) 135pp, Longmans, Green and Co Ltd.

Gould, K., Pe-Piper, G. and Piper, D.J.W., 2009. Relationship of diagenetic chlorite rims to depositional facies in Lower Cretaceous reservoir sandstones of the Scotian Basin. Sedimentology, in press.

Henry, D. J., and Guidotti, C. V. 1985. Tourmaline as a petrogenetic indicator mineral: an example from the staurolite-grade metapelites of NW Maine. American Mineralogist, v. 70, p. 1–15.

Karim, A., Pe-Piper, G., and Piper, D J W, 2008. Distribution of diagenetic minerals in Lower Cretaceous sandstones and their relationship to stratigraphy and lithofacies: Glenelg, Thebaud and Chebucto fields, offshore Scotian Basin. Geological Survey of Canada, Open File 5880, 423 p. Available on line at:
http://geopub.nrcan.gc.ca/register_e.php?id=225621&dnld=ESSPublications

Kassoli-Fournaraki, A. and Michailidis, K., 1994: Chemical composition of tourmaline in quartz veins from Nea Roda and Thasos areas in Macedonia, Northern Greece. Canadian Mineralogist, v. 32, p. 607–615.

MacLean, B.C. and Wade, J.A., 1993. Seismic markers and stratigraphic picks in the Scotian Basin wells, East Coast Basin Atlas Series.

Miller, C.F., Stoddard, E.F., Bradfish, L.J., and Dollasse, W.A., 1981, Composition of plutonic muscovite: genetic implications. Canadian Mineralogist, Vol. 19, 25-34.

Morton, A., and Hallsworth C.R., 1999. Processes controlling the composition of heavy mineral assemblages in sandstones. Sedimentary Geology, 124, 3-29.

Pearce, J.A., Barker, P.F., Edwards, S.J., Parkinson, I.J., and Leat, P.T., 2000. Geochemistry and tectonic significance of peridotites from the South Sandwich arc-basin system. Contributions to Mineralogy and Petrology, v. 139, p. 36–53.

Pe-Piper, G. and Jansa, L.F., 1987. Geochemistry of the late Middle Jurassic-Early Cretaceous igneous rocks on the eastern North American margin. Bulletin of the Geological Society of America, v. 99, p. 803–813.

Pe-Piper, G. and Piper, D.J.W., 2007. Sedimentary petrology of the Lower Cretaceous in the Naskapi N-30 and Sambro I-29 wells, LaHave Platform, Scotian basin, offshore eastern Canada. Geological Survey of Canada Open File 5594, 98 p.

Pe-Piper, G., MacKie, H., and Piper, D.J.W., 2009. Petrology, mineralogy and geochemistry of the Musquodoboit E-23 well, Scotian Shelf. Geological Survey of Canada Open File

Pe-Piper, G., Piper, D.J.W., Vaughan, A.D., Shannon, J. and Ingram S., 2004a. Sedimentary petrology of Lower Cretaceous rocks of the southwestern Sable sub-basin (North Triumph B-52, Alma K-85 and Glenelg N-49 wells), Scotian Basin. Geological Survey of Canada, Open File 4836, 92 p.

Pe-Piper, G., Piper, D.J.W., Gould, K.M. and Shannon, J. 2006. Depositional environment and provenance analysis of the Lower Cretaceous sedimentary rocks at the Peskowesk A-99 well, Scotian Basin. Geological Survey of Canada, Open File 5383, 171 p.

Pe-Piper, G., Stea, R.R., Ingram, S., and Piper, D.J.W. 2004b. Heavy minerals and sedimentary petrology of the Cretaceous sands from the Shubenacadie outlier, Nova Scotia. Nova Scotia Department of Natural Resources, Open File Report ME 2004-5, 78 p.

Pe-Piper, G., Tsikouras, V., Piper, D.J.W., and Triantafyllidis, S., 2009. Chemical fingerprinting of detrital minerals of the Lower Cretaceous sandstones, Scotian Basin. Geological Survey of Canada, Open File (in review).

Pettijohn, F. J, Potter, P. E. and Siever, R., 1987. Detrital Minerals. In Sand and Sandstone (2nd ed.), 29-32. New York: Springer-Verlag.

Piper, D.J.W., Pe-Piper, G. and Ingram, S.I., 2004. Early Cretaceous sediment failure in the southwestern Sable sub-basin, offshore Nova Scotia. American Association of Petroleum Geologists Bulletin, v. 88, p. 991–1006.

Reynolds, P.H., Pe-Piper, G., Piper, D.J.W. and Grist, A.M., 2009. Single-grain detrital muscovite ages from Lower Cretaceous sandstones, Scotian basin, and their implications for provenance: Bulletin of Canadian Petroleum Geology, v. 57, p. 25–42.

Shannon, J., 2003. Lower Cretaceous lithofacies and petrology of Peskowesk A-99 and Dauntless D-35 wells, Scotian Basin. Unpublished B.Sc. (honours) thesis, Saint Mary's University, Halifax, N.S., 121 p

Springer, R.K., 1974. Contact metamorphosed ultramafic rocks in the western Sierra Nevada Foothills, California. Journal of Petrology, v. 15, p.160–195.

Williams, H. and Grant, A.C., 1998. Tectonic assemblages, Atlantic region, Canada. [1:3m map]. Geological Survey of Canada Open File 3657, 1 sheet.

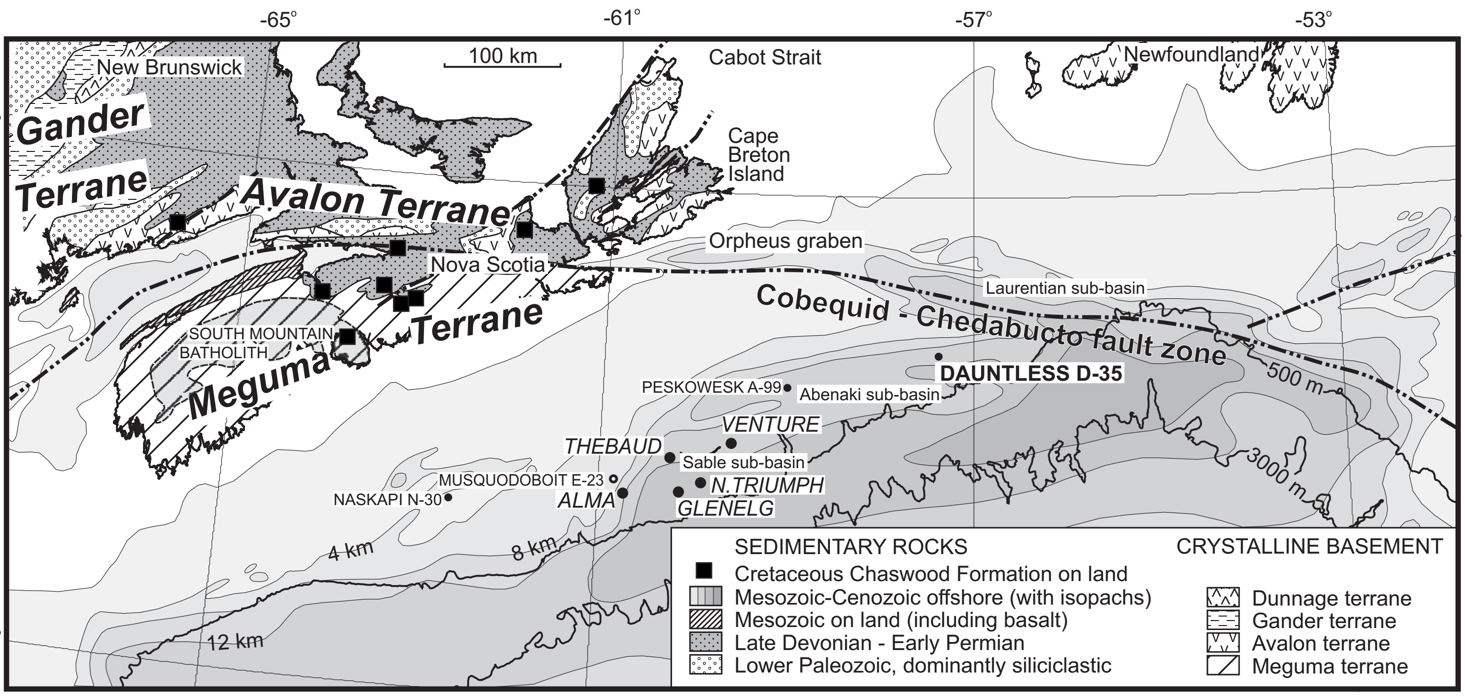


Figure 1: Location of Dauntless D-35, other wells and fields on the Scotian Shelf with detailed petrographic studies, and Chaswood Formation localities on land. Also shows isopachs of Scotian basin and generalized geology on land (modified from Williams and Grant, 1998).

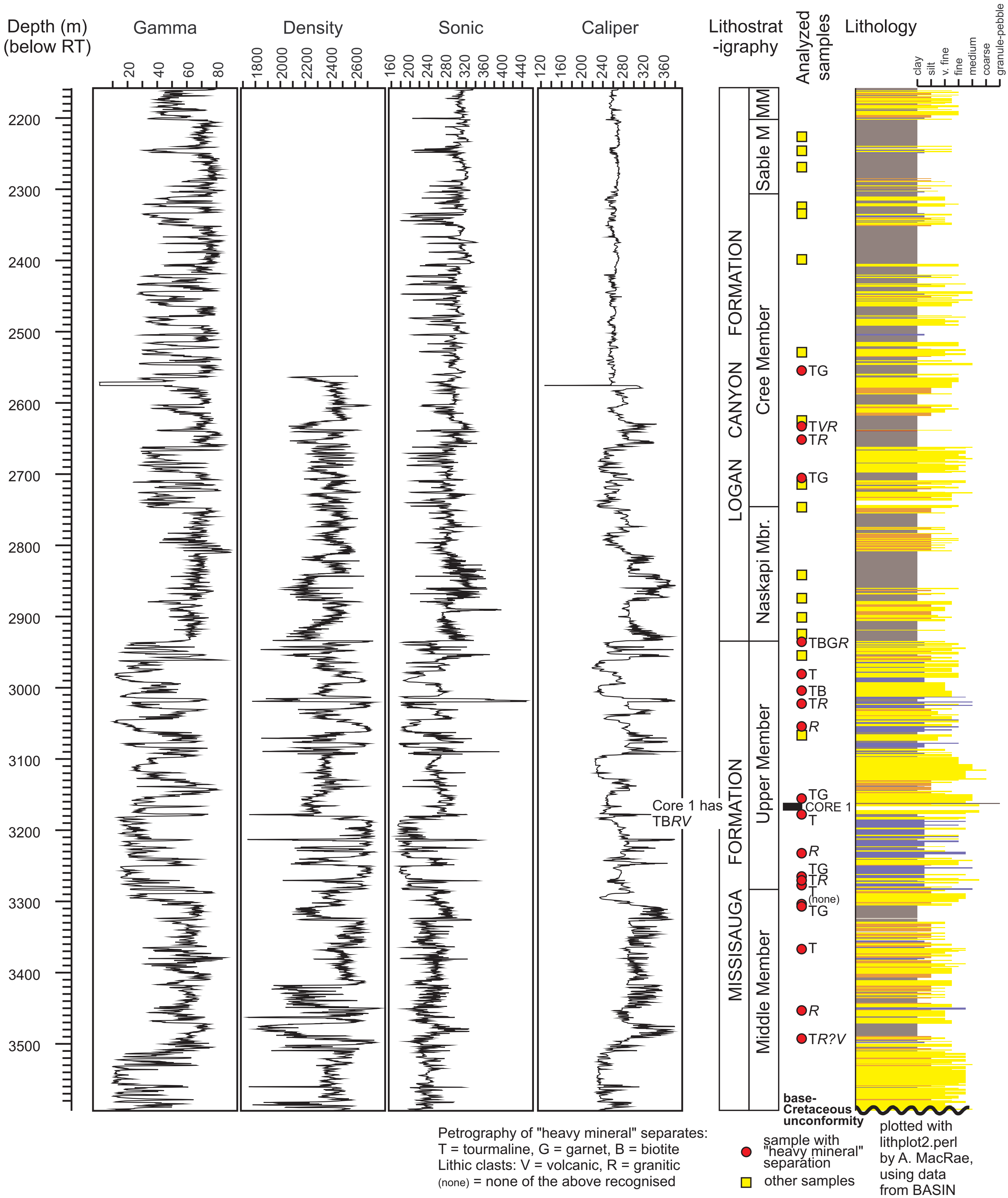


Figure 2: Stratigraphic section through the Lower Cretaceous of the Dauntless D-35 well. Shows location of analyzed core and cuttings and selected minerals and lithic clasts identified from "heavy mineral" separates. Stratigraphic picks from MacLean and Wade (1993); MM = Marmora Mbr.

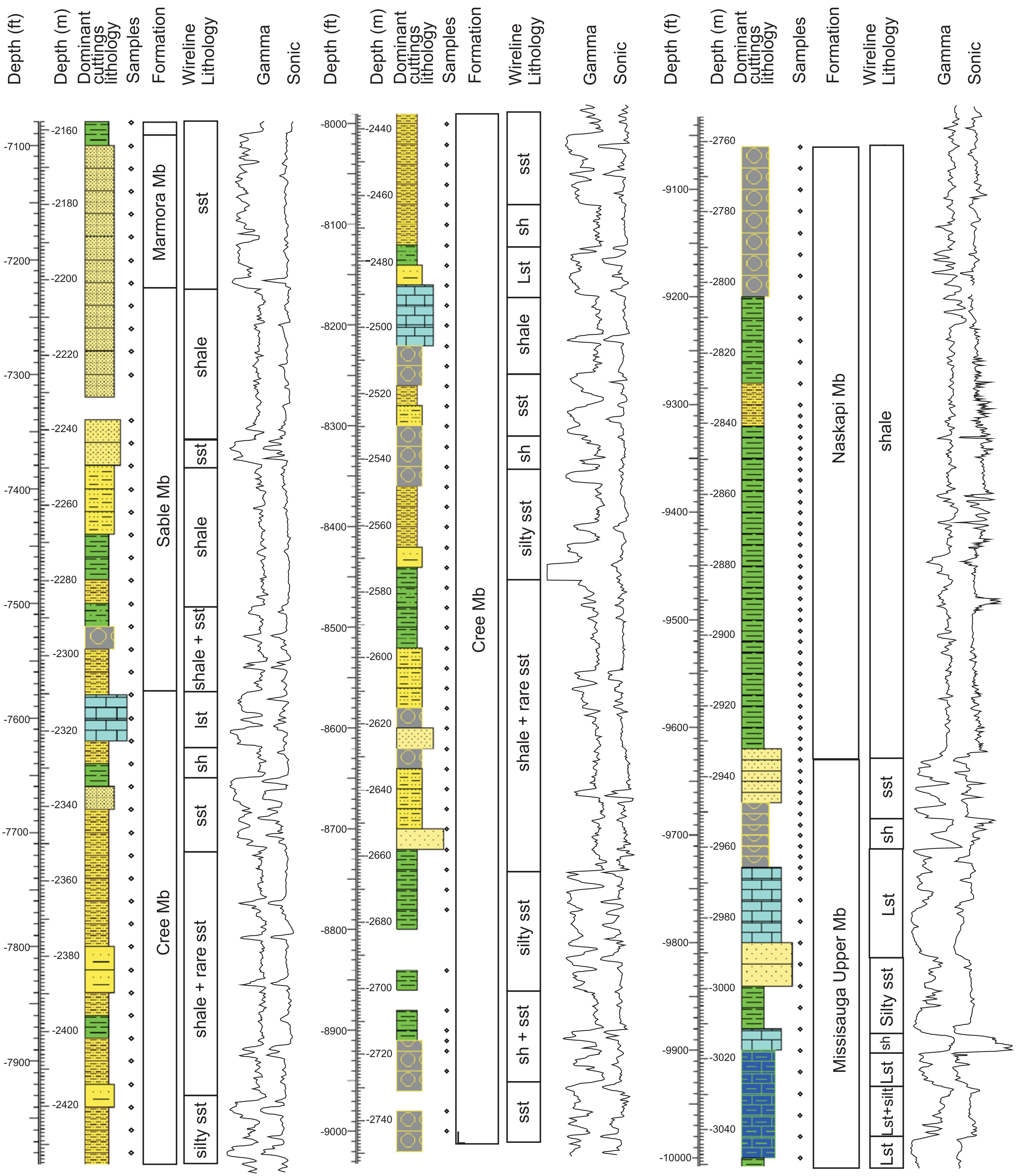


Figure 3a. Dominant lithologies in cuttings from Logan Canyon Formation in Dauntless D-35 compared with wireline logs. Legend on next page. Scale for logs in Fig. 2. Modified from Shannon (2003).

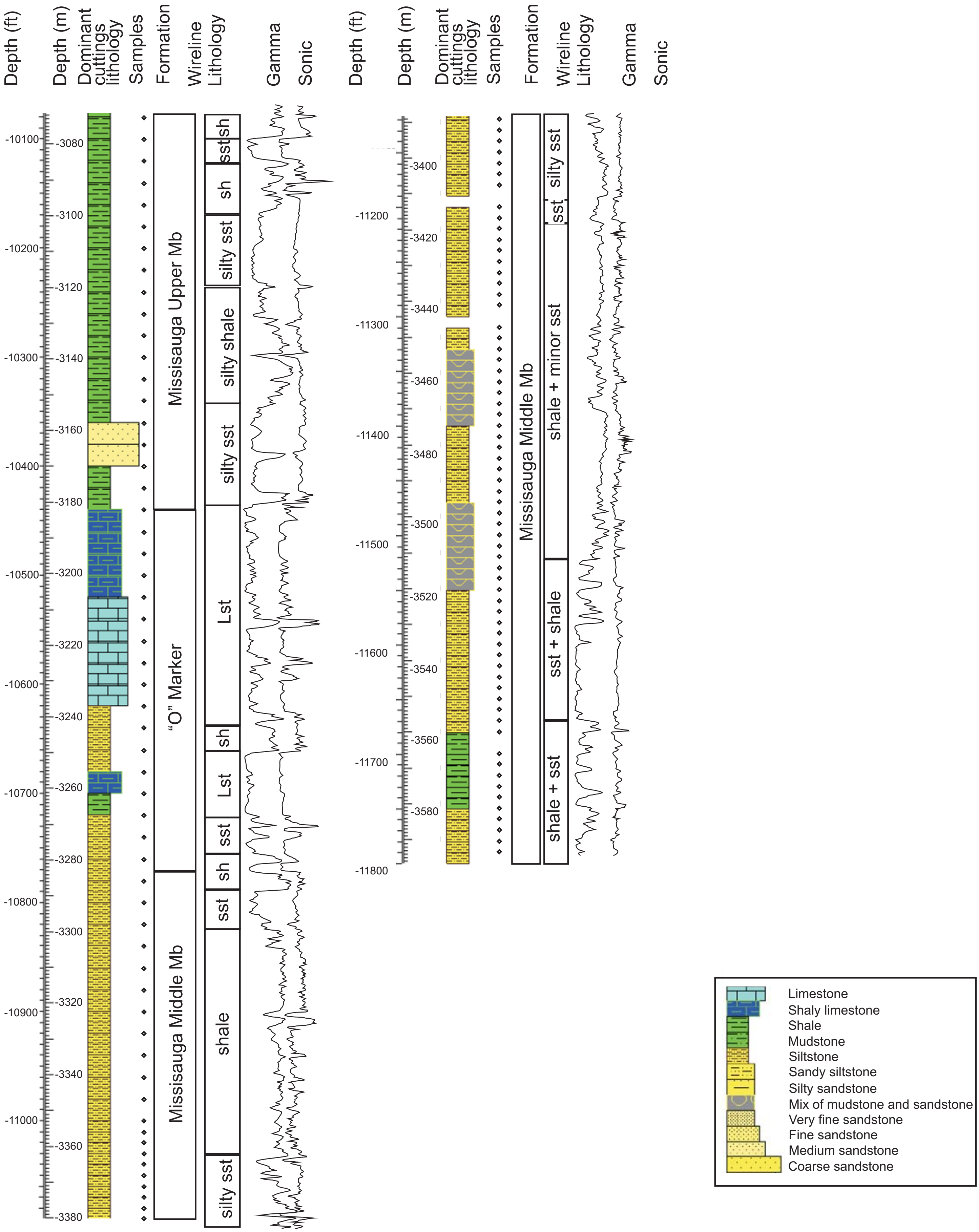


Figure 3b. Dominant lithologies in cuttings from Missisauga Formation in Dauntless D-35 compared with wireline logs. Modified from Shannon (2003).

Figure 4: (a) Photographs of core 1, sandstone and minor shale, Missisauga Formation, Dauntless D-35, 3162.6-3172.1 m.

Figure 4: (b) Photographs of core 2, limestone and minor shale, Mic Mac Formation, Dauntless D-35, 4719.3-4728.4 m.

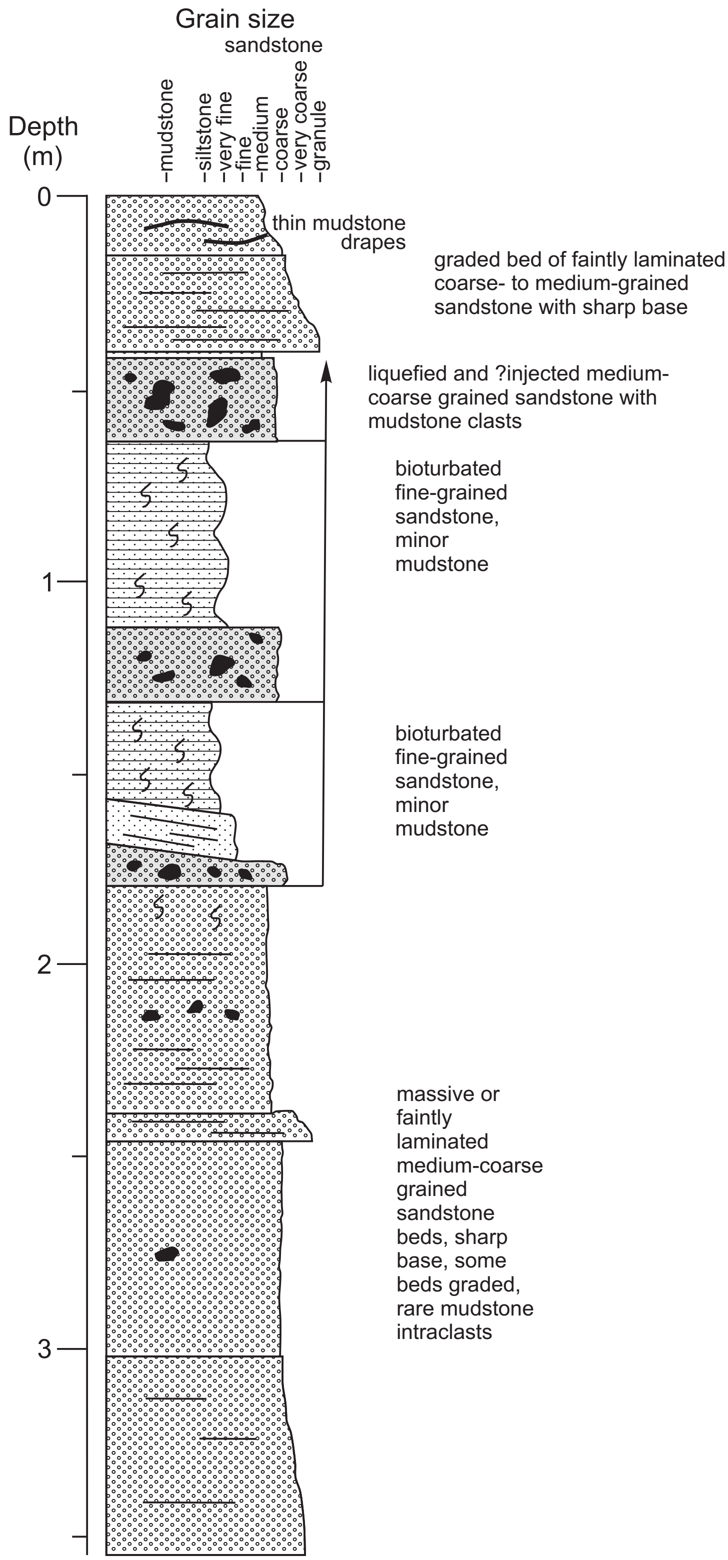


Figure 5: Interpreted sedimentological log of conventional core 1 in Dauntless D-35

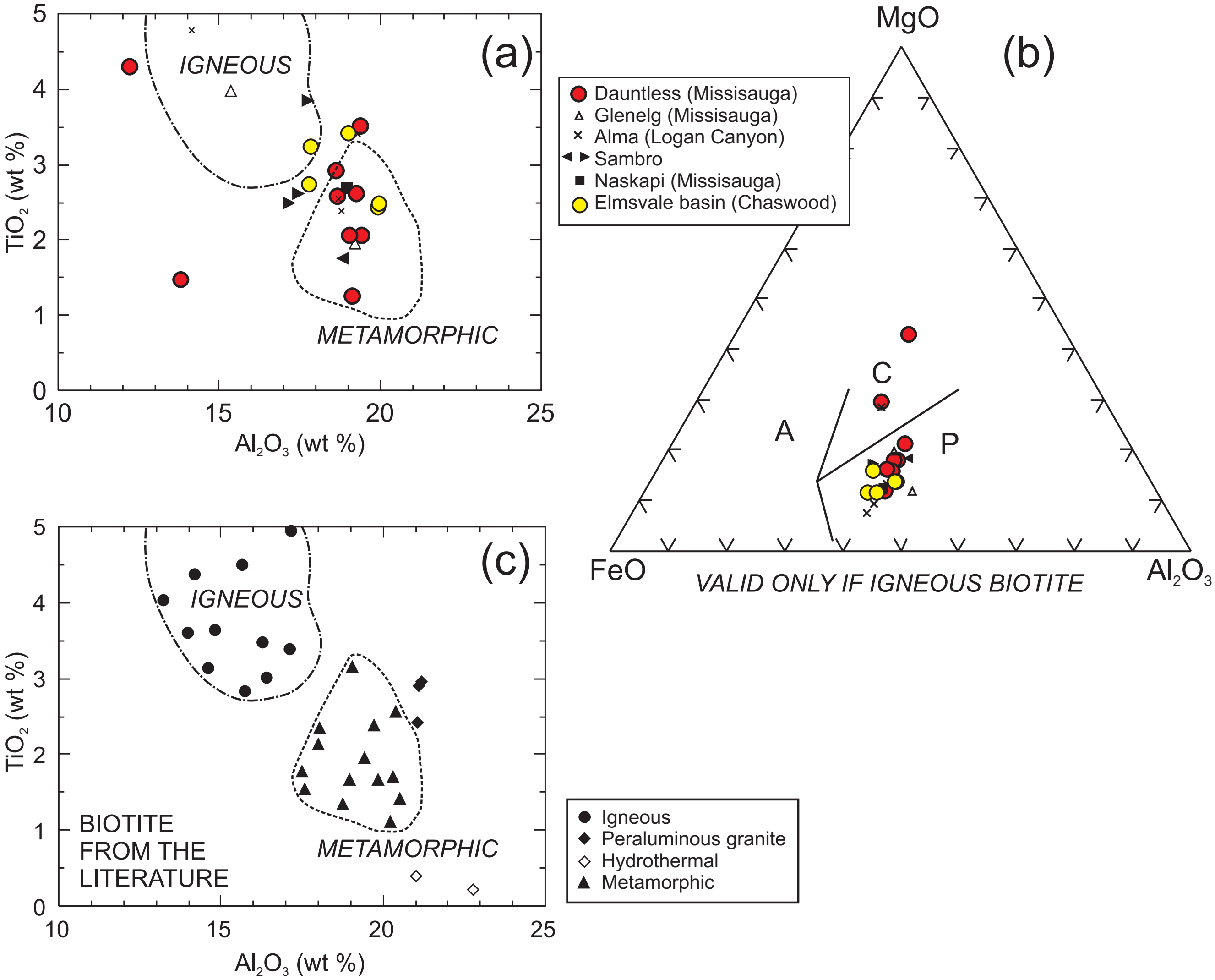


Figure 6: Chemical variation in biotite from core 1, upper Missisauga Formation, Dauntless D-35, compared with analyses from elsewhere in the Scotian Basin and the Chaswood Formation. (a) Discrimination of igneous and metamorphic biotites, based on data in (c) below. (b) Discrimination of different types of igneous rocks, if the biotites are of igneous origin. Fields are from Abdel-Rahmen (2004): P = peraluminous granite; A = alkali granite; C = calc-alkali granite. (c) Plot of TiO_2 vs. Al_2O_3 for analyses reported by Fleet (1997) showing possible discrimination of igneous and metamorphic biotites.

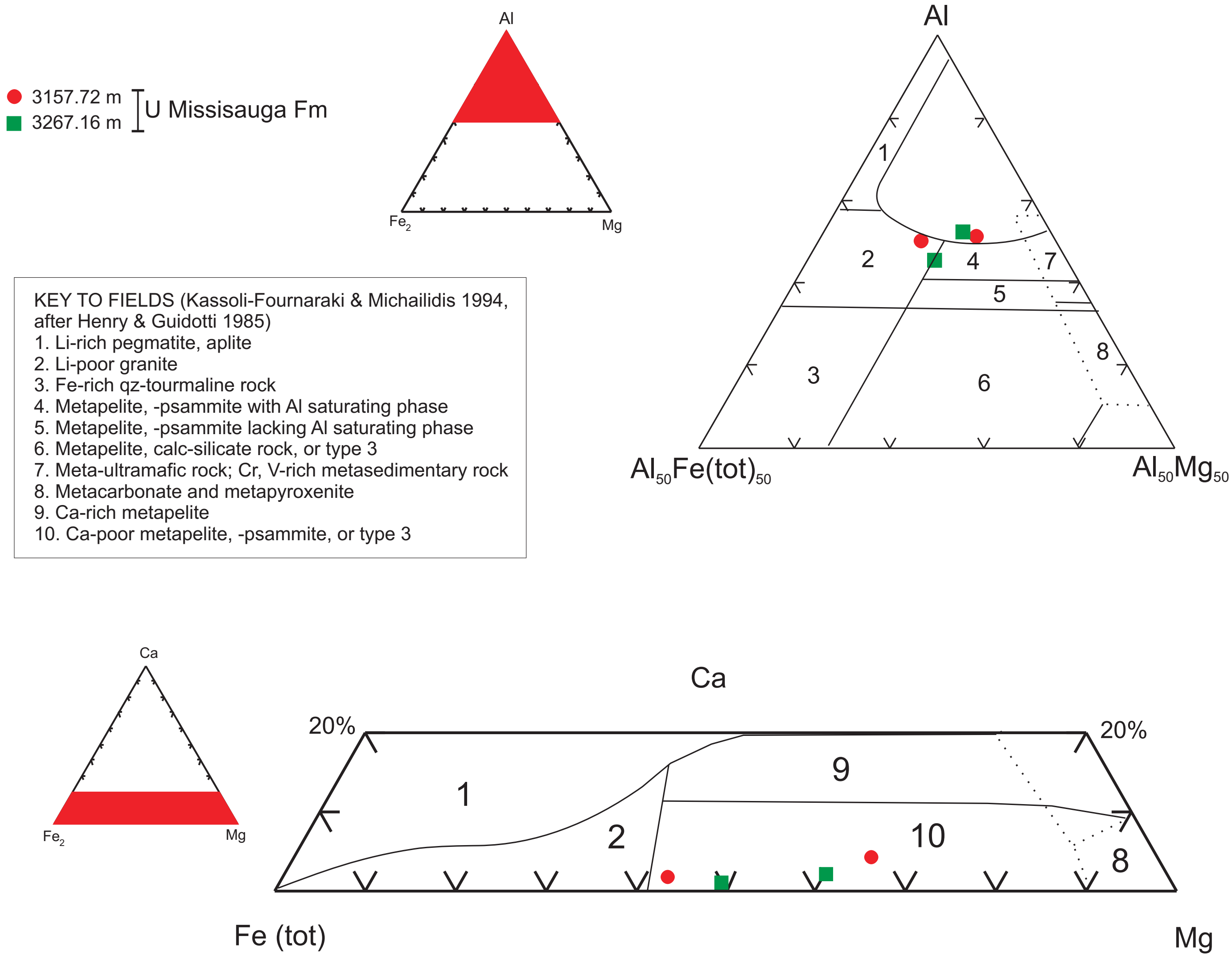


Figure 7: Chemical variations in tourmaline from Dauntless D-35

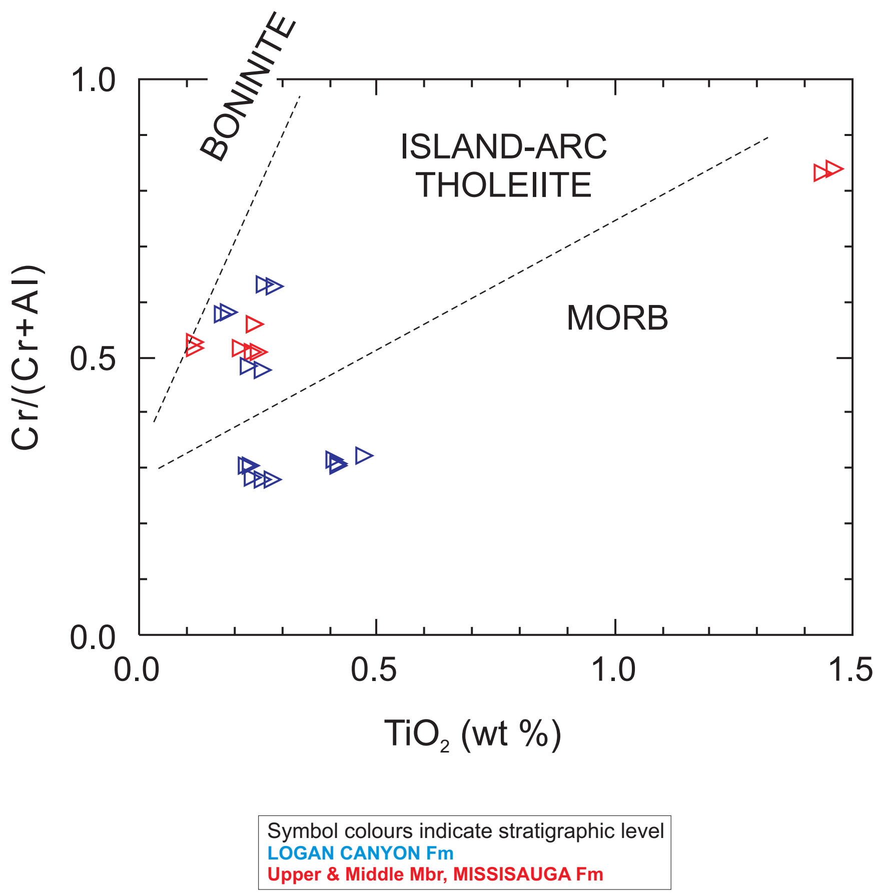


Figure 8: Chemical variation in chromites with stratigraphic level. Fields from Pearce et al. (2000).

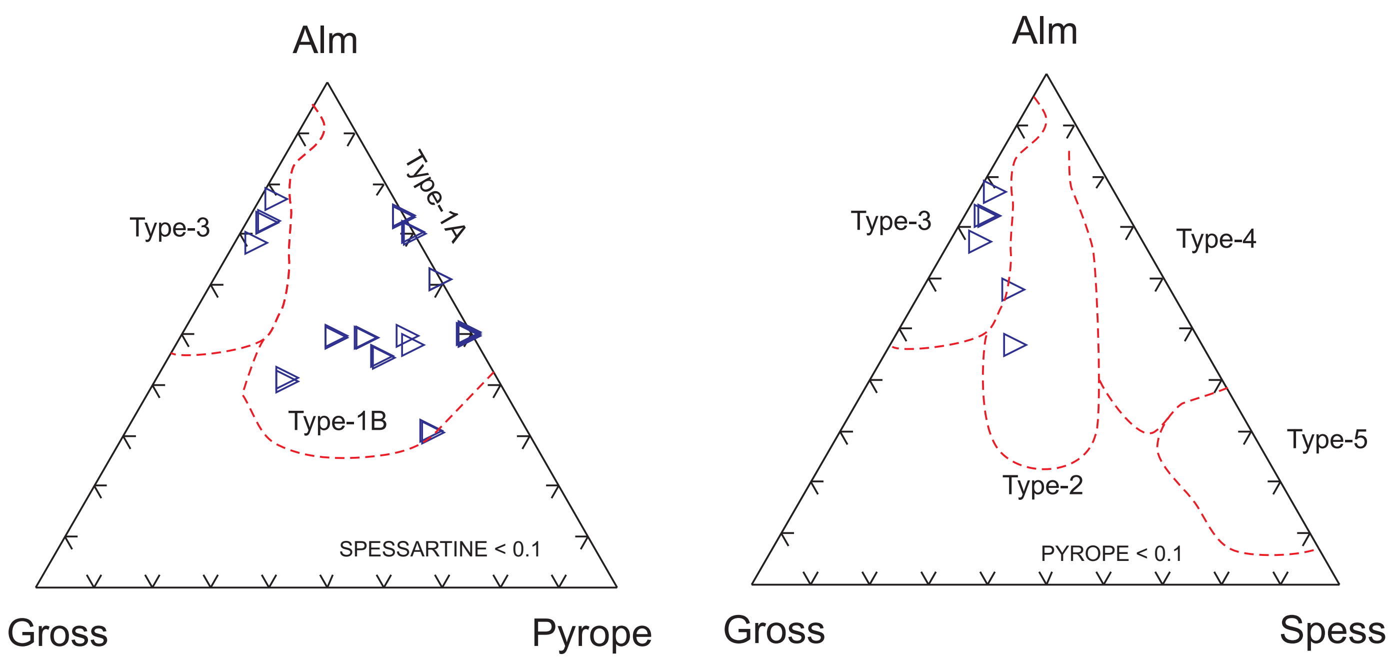


Figure 9: Identification of garnet types from Dauntless D-35. Types 1-5 are defined by Pe-Piper et al. (2009). Alm = almandine; Gross = grossular; Spess = spessartine.

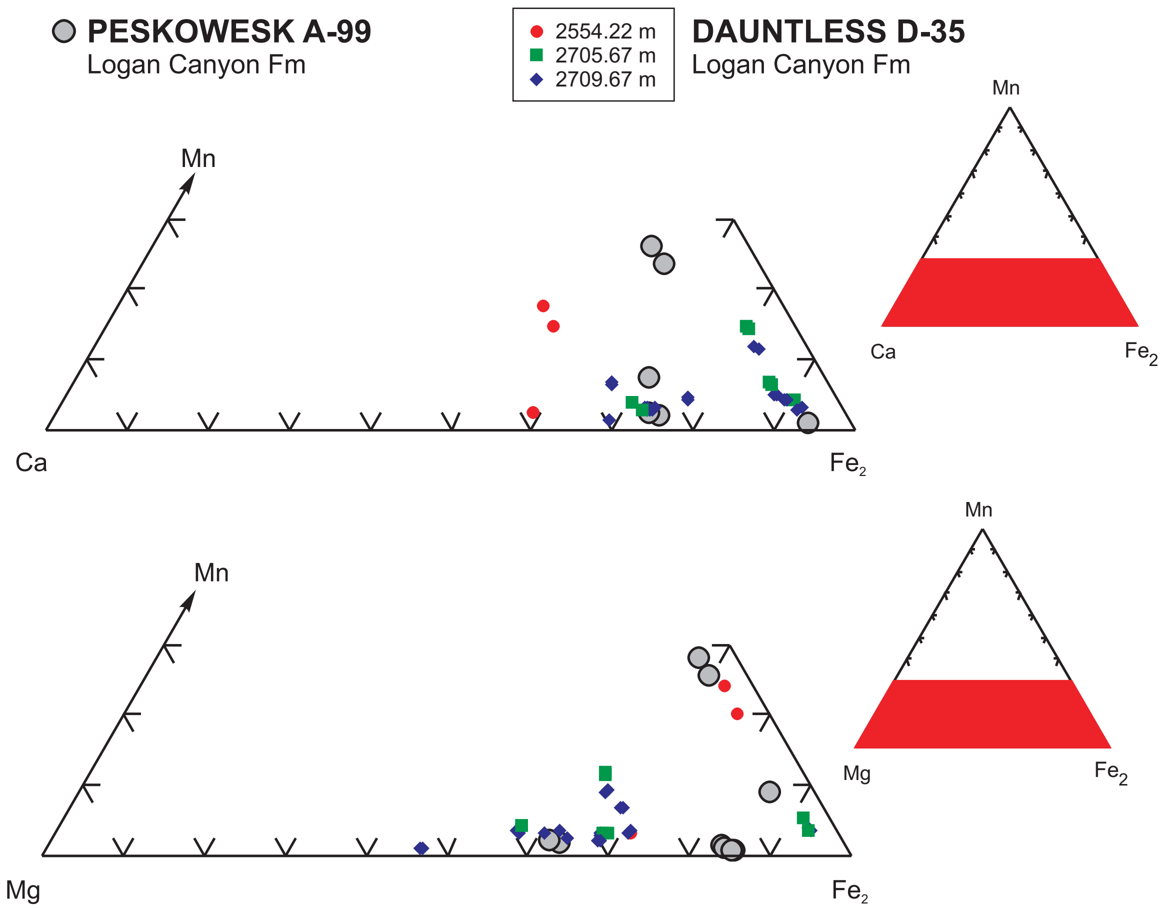


Figure 10: Stratigraphic variation in garnet chemistry from Dauntless D-35 and comparison with Peskowesk A-99.

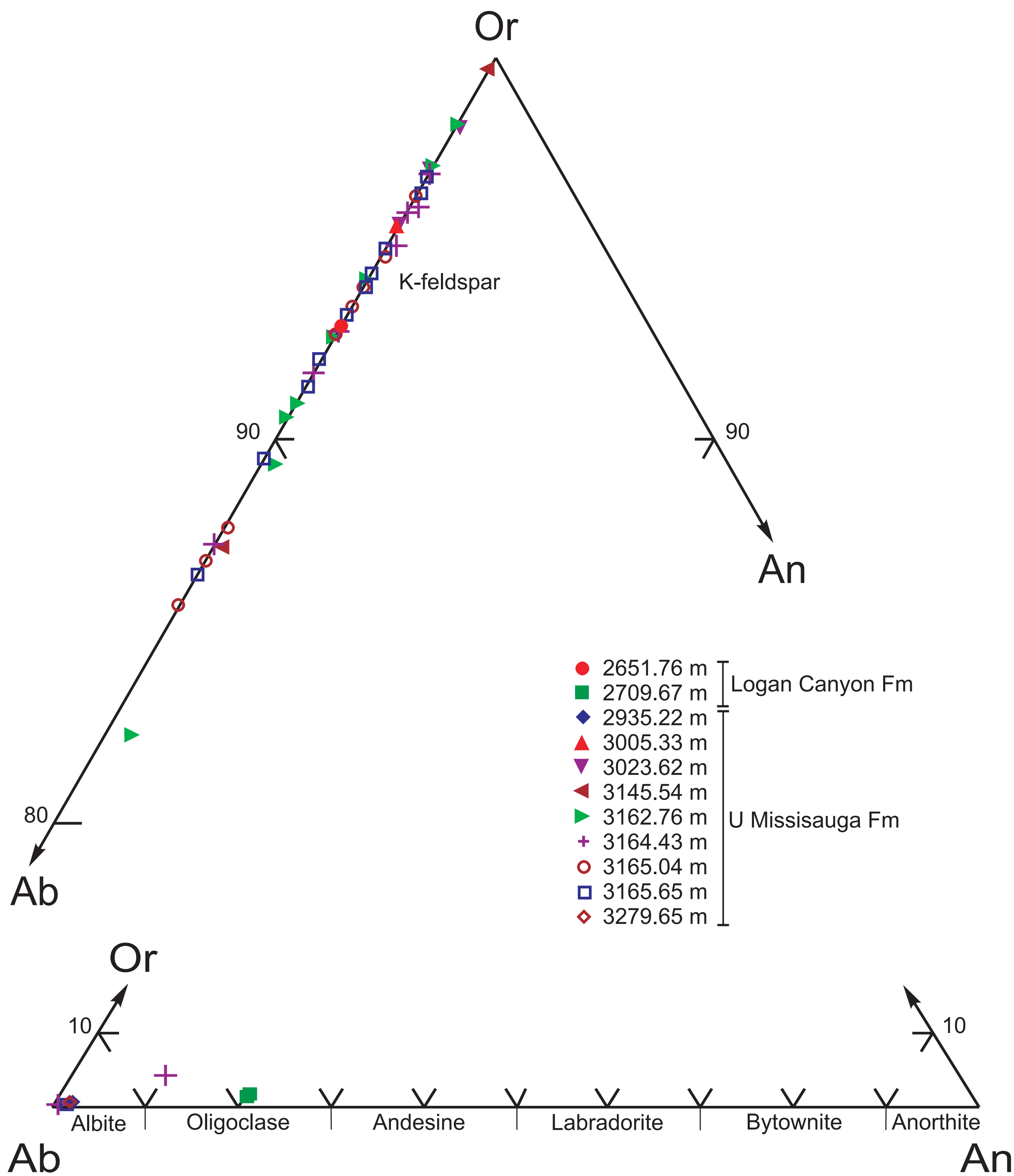


Figure 11: Chemical variation in feldspars. Compositional fields from Deer et al. (1967).

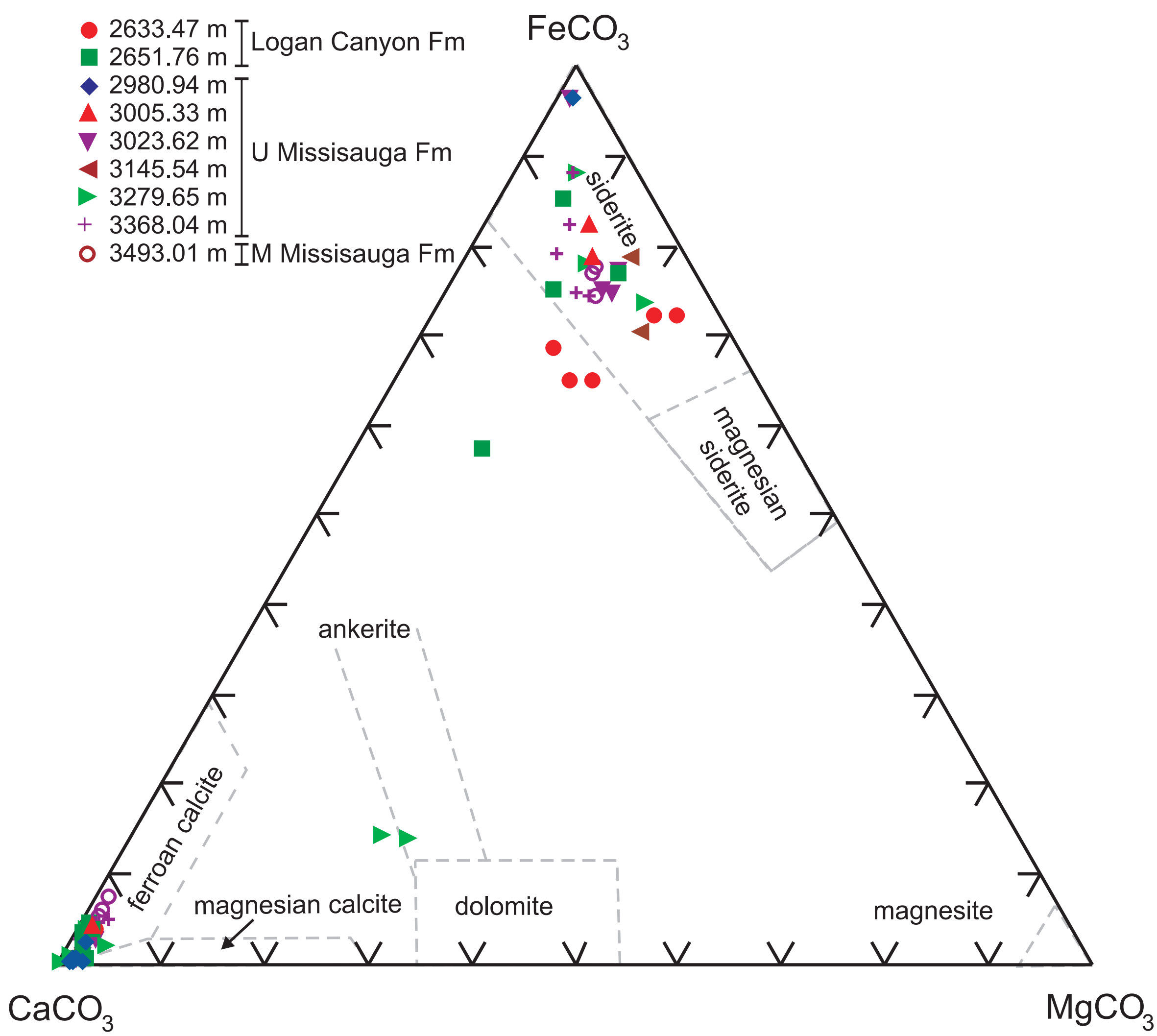


Figure 12: Chemical variation of diagenetic carbonate minerals. Nomenclature from Chang et al. (1996).

Table 1: Studied core and cutting samples for Dauntless D-35 well.

DEPTH (m)	DEPTH (ft)	REMARKS	TOTAL(g)	>2MM(g)	<2MM(g)	%>2mm	%<2mm
2225.04-2231.14	7300-7320	unwashed cuttings	8.52	0.79	7.75	9.27	90.96
2243.33-2249.42	7360-7380	unwashed cuttings	15.37	2.16	13.2	14.05	85.88
2267.71-2273.81	7440-7460	unwashed cuttings	10.54	1.99	8.56	18.88	81.21
2322.58-2328.67	7620-7640	unwashed cuttings	8.56	2.51	6.05	29.32	70.68
2334.77-2340.86	7660-7680	unwashed cuttings	16.37	4.13	12.24	25.23	74.77
2395.73-2401.82	7860-7880	unwashed cuttings	6.05	1.94	4.12	32.07	68.10
2529.84-2535.94	8300-8320	unwashed cuttings	24.6	7.39	17.2	30.04	69.92
2554.22-2560.32	8380-8400	unwashed cuttings	12.81	1.45	11.37	11.32	88.76
2621.28-2627.38	8600-8620	unwashed cuttings	20.76	2.92	17.87	14.07	86.08
2633.47-2639.57	8640-8660	unwashed cuttings	6.09	0.62	5.41	10.18	88.83
2651.76-2657.86	8700-8720	unwashed cuttings	28.14	1.89	26.25	6.72	93.28
2709.62-2712.72	8880-8900	unwashed cuttings	16.03	4	12.04	24.95	75.11
2715.77-2718.82	8910-8920	unwashed cuttings	33.53	12.18	21.21	36.33	63.26
2743.20-2749.30	9000-9020	unwashed cuttings	20.96	7.08	13.87	33.78	66.17
2840.74-2843.78	9320-9330	unwashed cuttings	21.5	8.08	13.44	37.58	62.51
2871.22-2874.26	9420-9430	unwashed cuttings	40.94	12.7	28.05	31.02	68.51
2898.65-2901.70	9510-9520	unwashed cuttings	28.88	6.62	22.26	22.92	77.08
2926.08-2929.13	9600-9610	unwashed cuttings	29.04	10.98	18.06	37.81	62.19
2935.22-2938.27	9630-9640	unwashed cuttings	29.41	10.96	18.43	37.27	62.67
2956.56-2959.61	9700-9710	unwashed cuttings	45.67	10.61	34.84	23.23	76.29
2980.94-2987.04	9780-9800	unwashed cuttings	71.31	24.34	47.01	34.13	65.92
2999.23-3005.33	9840-9860	unwashed cuttings	62.48	8.58	53.87	13.73	86.22
3017.52-3023.62	9900-9920	unwashed cuttings	54.13	10.4	43.6	19.21	80.55
3048-3054.10	10000-10020	unwashed cuttings	46.93	14.78	32.12	31.49	68.44
3066.29-3072.38	10060-10080	unwashed cuttings	48.65	19.38	29.22	39.84	60.06
3145.54-3151.63	10320-10340	unwashed cuttings	47.03	14.51	32.49	30.85	69.08
3157.73-3163.82	10360-10380	unwashed cuttings	58.8	0.68	58.13	1.16	98.86
3162.76	10376.50	loose piece of sandstone					
3163.21	10378.00	some grains form bag of rubble (?silt)	11.81	9.16	2.64	77.56	22.35
3164.43	10382.00	loose piece of sandstone					
3165.04	10384.00	loose piece of sandstone					
3165.65	10386.00	piece from bag of broken sandstone					
3176.02-3182.11	10420-10440	unwashed cuttings	41.03	6.98	33.99	17.01	82.84
3236.98-3243.07	10620-10640	unwashed cuttings	53	19.03	39.51	35.91	74.55
3261.36-3267.46	10700-10720	unwashed cuttings	54.8	21.61	33.11	39.43	60.42
3267.46-3273.55	10720-10740	unwashed cuttings	42.1	13.36	28.73	31.73	68.24
3273.55-3279.65	10740-10760	unwashed cuttings	56.19	19.45	36.69	34.61	65.30
3297.94-3304.03	10820-10840	unwashed cuttings	41.26	15.1	26.09	36.60	63.23
3304.03-3310.13	10840-10860	unwashed cuttings	43	22.99	19.95	53.47	46.40
3368.04	11050.00	unwashed cuttings	50.08	13.63	36.39	27.22	72.66
3453.38-3456.43	11330-11340	unwashed cuttings	58.75	18.26	39.51	31.08	67.25
3493.01-3496.06	11460-11470	unwashed cuttings	44.44	9.44	34.85	21.24	78.42

Table 2: Heavy "mineral" separation from the studied cutting samples

SAMPLE	Formation	Bulk Sample	>2mm	<2mm	>2mm	<2mm	<2mm Fraction In Ttbn* Sink (heavies)	Float (lights)	% Sink (heavies)	% Float (lights)
Depth (m)		Wt (g)	Wt (g)	Wt (g)	Wt%	Wt%	Wt (g)	Wt (g)	Wt%	Wt%
2225.04 - 2231.14	Logan Canyon	8.52	0.79	7.75	9.27	90.96	2.044	7.981	20.39	79.61
2243.33 - 2249.42	Logan Canyon	15.37	2.16	13.20	14.05	85.88	1.335	10.989	10.83	89.17
2267.71 - 2273.81	Logan Canyon	10.54	1.99	8.56	18.88	81.21	1.298	6.709	16.21	83.79
2322.58 - 2328.67	Logan Canyon	8.56	2.51	6.05	29.32	70.68	1.301	4.401	22.82	77.18
2334.77 - 2340.86	Logan Canyon	16.37	4.13	12.24	25.23	74.77	1.562	9.455	14.19	85.81
2395.73 - 2401.82	Logan Canyon	6.05	1.94	4.12	32.07	68.10	0.640	2.187	22.64	77.36
2529.84 - 2535.94	Logan Canyon	24.60	7.39	17.20	30.04	69.92	1.173	15.555	7.01	92.99
2554.22 - 2560.32	Logan Canyon	12.81	1.45	11.37	11.32	88.76	0.500	10.396	4.59	95.41
2621.28 - 2627.38	Logan Canyon	20.76	2.92	17.87	14.07	86.08	1.083	16.147	6.29	93.71
2633.47 - 2639.57	Logan Canyon	6.09	0.62	5.41	10.18	88.83	0.138	4.828	2.78	97.22
2651.76 - 2657.86	Logan Canyon	28.14	1.89	26.25	6.72	93.28	0.553	25.025	2.16	97.84
2709.62 - 2712.72	Logan Canyon	16.03	4.00	12.04	24.95	75.11	0.217	11.453	1.86	98.14
2715.77 - 2718.82	Logan Canyon	33.53	12.18	21.21	36.33	63.26	1.004	19.633	4.87	95.13
2743.20 - 2749.30	Logan Canyon	20.96	7.08	13.87	33.78	66.17	0.734	12.690	5.47	94.53
2840.74 - 2843.78	Logan Canyon	21.50	8.08	13.44	37.58	62.51	3.054	9.984	23.42	76.58
2871.22 - 2874.26	Logan Canyon	40.94	12.70	28.05	31.02	68.51	5.216	21.406	19.59	80.41
2898.65 - 2901.70	Logan Canyon	28.88	6.62	22.26	22.92	77.08	1.952	19.580	9.07	90.93
2926.08 - 2929.13	Logan Canyon	29.04	10.98	18.06	37.81	62.19	1.427	16.158	8.11	91.89
2935.22 - 2938.27	Upper Missisauga	29.41	10.96	18.43	37.27	62.67	0.842	14.551	5.47	94.53
2956.56 - 2959.61	Upper Missisauga	45.67	10.61	34.84	23.23	76.29	0.850	32.462	2.55	97.45
2980.94 - 2987.04	Upper Missisauga	71.31	24.34	47.01	34.13	65.92	0.679	42.270	1.58	98.42
2999.23 - 3005.33	Upper Missisauga	62.48	8.58	53.87	13.73	86.22	0.799	51.660	1.52	98.48
3017.52 - 3023.62	Upper Missisauga	54.13	10.40	43.60	19.21	80.55	0.379	41.920	0.90	99.10
3048.00 - 3054.10	Upper Missisauga	46.93	14.78	32.12	31.49	68.44	0.350	30.953	1.12	98.88
3066.29 - 3072.38	Upper Missisauga	48.65	19.38	29.22	39.84	60.06	0.992	26.826	3.57	96.43
3145.54 - 3151.63	Upper Missisauga	47.03	14.51	32.49	30.85	69.08	0.599	30.575	1.92	98.08
3157.73 - 3163.82	Upper Missisauga	58.80	0.68	58.13	1.16	98.86	0.359	55.240	0.65	99.35
3176.02 - 3182.11	Upper Missisauga	41.03	6.98	33.99	17.01	82.84	0.419	32.555	1.27	98.73
3236.98 - 3243.07	Upper Missisauga	53.00	19.03	39.51	35.91	74.55	0.200	32.739	0.61	99.39
3261.36 - 3267.46	Upper Missisauga	54.80	21.61	33.11	39.43	60.42	0.133	31.611	0.42	99.58
3267.46 - 3273.55	Upper Missisauga	42.10	13.36	28.73	31.73	68.24	0.263	27.501	0.95	99.05
3273.55 - 3279.65	Upper Missisauga	56.19	19.45	36.69	34.61	65.30	0.352	35.678	0.98	99.02
3297.94 - 3304.03	Upper Missisauga	41.26	15.10	26.09	36.60	63.23	0.637	24.968	2.49	97.51
3304.03 - 3310.13	Upper Missisauga	43.00	22.99	19.95	53.47	46.40	0.496	17.792	2.71	97.29
3368.04	Upper Missisauga	50.08	13.63	36.39	27.22	72.66	0.408	34.522	1.17	98.83
3453.38 - 3456.43	Upper Missisauga	58.75	18.26	39.51	31.08	67.25	0.613	37.750	1.60	98.40
3493.01 - 3496.06	Upper Missisauga	44.44	9.44	34.85	21.24	78.42	0.443	33.422	1.31	98.69

* Ttbn = tetrabromoethane

Table 3: Petrology of representative sandstone cutting samples from Dauntless D-35 well

top	base	predominant (in order if >1) or other interpreted in place	interpretation	significant interpreted as contamination
			top of Sable Mbr at 2202 m (LC)	
2225	2231	fine red sandstone		
2243	2249	calcareous sandstone		
		limestone		
		quartz granules	imply a coarse granule sand	
2268	2274	dark mudstone and silty mudstone		
		sandy limestone		
		sideritic mudstone		
			top of Cree Mbr at 2309 (LC)	
2323	2329	grey silty mudstone		
		fine red sandstone		
		fine grey sandstone		
2335	2347	dark mudstone and silty mudstone		minor chalk
		fine grey sandstone		
		medium siderite cemented sst		
		fine red sandstone		
		calcareous sandstone		
2396	2402	dark mudstone		minor sandstone
2530	2536	dark mudstone and silty mudstone		
		calcareous sandstone		
		sideritic mudstone		
2554	2560	dark mudstone		
		very fine red sandstone		
2621	2627	dark mudstone and silty mudstone		
		medium and fine white sandstone		
		sideritic mudstone		
		coal		
2633	2640	dark mudstone		
2652	2658	dark mudstone		
		calcareous sandstone		
		quartz granules	imply a coarse granule sand	
2710	2713	dark mudstone and silty mudstone		
		fine grey sandstone		
2716	2719	dark mudstone and silty mudstone		quartz granules
		medium red sandstone		
		fine grey sandstone		
2743	2749	dark mudstone and silty mudstone	*top of Naskapi Mbr at 2747 m (LC)*	
		fine grey sandstone		
		fine red sandstone		
2841	2844	dark mudstone and silty mudstone		
		sideritic mudstone		
		fine red sandstone		
		fine grey sandstone		
2871	2874	fine red sandstone		
		fine grey sandstone		
		dark mudstone and silty mudstone		
		calcareous sandstone		
2899	2902	dark mudstone and silty mudstone		
		fine grey sandstone		
		sideritic mudstone and sandstone		
2926	2929	dark mudstone and silty mudstone		
		fine grey sandstone		
		fine red sandstone		
		sideritic mudstone		

Table 3: Petrology of representative sandstone cutting samples from Dauntless D-35 well

2935	2938	fine grey sandstone	*top of Missisauga Fm at 2935 m (MS)*	
		dark mudstone		
2957	2960	dark mudstone		
		fine grey sandstone		
		calcareous mudstone		
2981	2987	limestone		
		dark mudstone		
2999	3005	dark mudstone		
		sandy limestone		?limestone is contaminant
3018	3024	dark mudstone		
		limestone		
		sideritic mudstone		
3048	3054	dark mudstone and silty mudstone		limestone
		sideritic mudstone		
3066	3072	dark mudstone and silty mudstone		
		fine grey sandstone		
		sideritic mudstone		
3146	3152	dark mudstone and silty mudstone		
		quartz granules	imply a coarse granule sand	
		fine grey sandstone		
		sideritic mudstone		
3158	3164	silty mudstone		chalk/shell
3176	3182	dark mudstone	just above O marker (top is 3182 m)	fine grey sandstone
		sideritic mudstone		quartz granules
3237	3243	dark mudstone	within O marker	quartz granules
		limestone		
		sandy limestone		
		sideritic mudstone		
3261	3267	limestone		
		dark mudstone		
		sideritic mudstone		
3267	3274	dark mudstone and silty mudstone		
		sandy limestone		
		micritic limestone		
		sideritic mudstone		
3274	3280	dark mudstone and silty mudstone		
		calcareous sandstone		
		calcareous mudstone	*base of O marker at 3282 m*	?limestone
3298	3304	dark mudstone		
		calcareous sandstone		
		sideritic mudstone		
		silty mudstone		
3304	3310	dark mudstone and silty mudstone		
		sideritic mudstone		
		calcareous sandstone		limestone
3368		dark mudstone		
		sideritic mudstone		
		fine grey sandstone		limestone
3453	3456	dark mudstone and silty mudstone		
		limestone		
		sandy limestone		
		sideritic mudstone		
3493	3496	dark mudstone and silty mudstone		limestone
*LC= Logan Canyon Formation, MS= Upper Missisauga Formation				

Table 4: Petrology of representative sandstone core samples from Dauntless D-35 well

Sample no	**Formation**	**Rock name**	**Grains**				*for each mineral or rock-type, number of grains as a percentage of total grains*													
			% of total rock	mean size μm	sorting (good, poor)	roundness of quartz	moncrystalline quartz	polycrystalline quartz	feldspar	muscovite	biotite	igneous rock fragments	siliceous rock fragments	foliated rock fragments	carbonate rock fragments	fossils	glauconite	other ferro-mag minerals	opaque minerals	resistant heavy minerals
3162.76	Upper Missisauga	MED SST	80%	300	MOD	SUB-R to R	83%	5%	3%	1%	1%		1%			3%			2%	1%
3164.43	Upper Missisauga	MED SST	80%	300	GOOD	SUB-R to R	90%	3%	3%	1%	1%		1%							1%
3165.04	Upper Missisauga	MED SST	75%	300	GOOD	SUB-A to SUB-R	90%	4%	3%				1%						1%	1%
3165.65	Upper Missisauga	MED SST	85%	400	GOOD	SUB-R to R	85%	5%	5%	2%	1%		1%						1%	

Notes: VF= Very fine

FN= Fine

MED= Medium

CRS= Coarse

GRAN= Granule

SST= Sandstone

MOD= Moderate

SUB-A= Subangular

SUB-R= Subrounded

R= Rounded

Table 4: Petrology of representative sandstone core samples from Dauntless D-35 well

	Matrix		**Cement**	*list in chronological order, where apparent*					**NOTES**
NOTES: List noteworthy minerals and rock fragments, note 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 photomicographs, BSEI etc.
Wood/Coal, Tourmaline, Zircon, Fe-Ti Oxides	5%	Brown mud	5%	Pyrite - 5%	Chlorite - 15%	Silica - 60%	Kaolinite - 20%	10%	Large pyrite framboids, chlorite rims and perthite grains.
Rutile, Zircon, Tourmaline, Opx?	10%	Brown mud	5%	Pyrite - 2%	Chlorite - 23%	Silica - 50%	Kaolinite - 25%	5%	Quartz veins, chlorite rims and perthite grains.
Rutile, Tourmaline, Zircon, Fe-Ti Oxides	5%	Brown mud	10%	Pyrite - 2%	Chlorite - 20%	Silica - 63%	Kaolinite - 15%	10%	Chlorite rims
Zircon, Fe-Ti Oxides, Tourmaline, Limonite	3%	Brown mud	7%	Pyrite - 8%	Chlorite - 45%	Silica - 35%	Kaolinite - 12%	5%	Chlorite rims, granite clasts(BEI)

Table 5a: Electron microprobe chemical analyses of minerals in representative samples by depth

Well	Formation	Depth (m)	File [#]	Mineral	Symbol	SiO_2	TiO_2	Al_2O_3	Cr_2O_3	FeO_t	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	ZrO_2	BaO	Total
Dauntless D-35	MS	2554.22	11 [3]	Chromian-spinel	Chsp	b.d.	0.41	35.51	24.52	21.78	0.89	15.49	0.01	0.03	0.02	n.d.	n.d.	n.d.	98.65
Dauntless D-35	MS	2554.22	12 [3]	Chromian-spinel	Chsp	b.d.	0.47	35.24	25.07	21.59	0.80	15.57	0.02	b.d.	0.02	n.d.	n.d.	n.d.	98.79
Dauntless D-35	LC(c)	2554.22		Chromian-spinel	Chsp	b.d.	0.42	38.00	25.16	22.56	0.17	14.92	0.02	b.d.	0.02	n.d.	n.d.	n.d.	101.27
Dauntless D-35	LC(c)	2554.22		Chromian-spinel	Chsp	b.d.	0.42	38.12	25.11	22.40	0.22	15.14	0.02	b.d.	0.02	n.d.	n.d.	n.d.	101.45
Dauntless D-35	LC(c)	2554.22		Almandine	Grt	37.89	0.03	20.92	0.01	23.84	0.95	4.59	11.60	b.d.	0.03	n.d.	n.d.	n.d.	99.86
Dauntless D-35	LC(c)	2554.22		Almandine	Grt	37.74	0.03	21.06	b.d.	23.91	0.93	4.58	11.54	0.01	0.04	n.d.	n.d.	n.d.	99.82
Dauntless D-35	LC(c)	2554.22		Mn-almandine	Grt	36.49	0.17	20.73	b.d.	23.58	7.36	0.64	9.92	b.d.	0.03	n.d.	n.d.	n.d.	98.91
Dauntless D-35	LC(c)	2554.22		Mn-almandine	Grt	36.68	0.13	20.61	0.01	24.78	6.22	0.71	9.89	0.02	0.03	n.d.	n.d.	n.d.	99.08
Dauntless D-35	LC(c)	(f) 2633.47	254 [3]	Quartz	Qtz	99.92	b.d.	0.01	b.d.	0.39	b.d.	b.d.	b.d.	b.d.	b.d.	b.d.	b.d.	b.d.	100.32
Dauntless D-35	LC(c)	2633.47	255 [3]	Siderite	Sd	2.82	0.09	1.78	0.04	40.70	0.38	6.15	9.52	0.08	0.27	3.46	0.95	0.12	66.34
Dauntless D-35	LC(c)	2633.47	256 [3]	Siderite	Sd	0.43	0.03	0.32	0.02	38.40	0.51	8.65	8.39	0.02	b.d.	0.11	0.07	0.07	57.01
Dauntless D-35	LC(c)	2633.47	257 [3]	Siderite	Sd	7.91	0.64	4.79	0.02	39.53	0.55	9.04	3.15	0.06	0.14	0.05	0.07	0.08	66.02
Dauntless D-35	LC(c)	2633.47	258 [3]	Siderite	Sd	2.13	0.20	1.08	0.03	41.70	0.44	10.69	2.07	b.d.	0.18	0.02	0.02	0.04	58.61
Dauntless D-35	LC(c)	2633.47	259 [3]	Barite	Brt	0.01	4.42	0.63	0.16	0.40	0.22	0.05	0.12	0.24	b.d.	0.10	0.56	56.45	63.37
Dauntless D-35	LC(c)	2633.47	260 [3]	Barite	Brt	0.01	4.22	0.65	0.16	0.33	0.22	0.05	0.11	0.24	b.d.	0.09	0.58	56.76	63.42
Dauntless D-35	LC(c)	2633.47	261 [3]	Siderite	Sd	1.00	0.40	0.59	0.02	37.14	0.16	7.48	9.26	0.05	0.01	0.24	0.13	0.06	56.54
Dauntless D-35	LC(c)	2633.47	262 [3]	Calcite	Cal	1.83	b.d.	1.31	b.d.	2.57	0.06	0.84	54.92	b.d.	0.08	0.04	0.01	b.d.	61.67
Dauntless D-35	LC(c)	2633.47	263 [3]	Quartz	Qtz	100.28	b.d.	0.01	b.d.	0.22	b.d.	b.d.	0.01	b.d.	b.d.	0.01	b.d.	b.d.	100.52
Dauntless D-35	LC(c)	2633.47	264 [3]	Quartz	Qtz	99.50	b.d.	0.02	b.d.	0.19	b.d.	0.01	b.d.	b.d.	b.d.	b.d.	b.d.	b.d.	99.72
Dauntless D-35	LC(c)	(f) 2651.76	228 [2]	K-feldspar	Kfs	63.27	b.d.	17.82	b.d.	0.44	0.01	b.d.	b.d.	0.89	17.89	b.d.	b.d.	0.64	100.95
Dauntless D-35	LC(c)	2651.76	229 [2]	Fe-Calcite	Cal	b.d.	b.d.	b.d.	b.d.	2.96	0.38	0.38	56.42	b.d.	b.d.	0.72	0.14	b.d.	61.01
Dauntless D-35	LC(c)	2651.76	230 [2]	Fe-Calcite	Cal	b.d.	b.d.	b.d.	0.02	2.53	0.58	0.42	59.36	b.d.	b.d.	0.02	0.03	0.04	63.00
Dauntless D-35	LC(c)	2651.76	231 [2]	Siderite	Sd	0.96	0.06	0.33	0.04	43.89	0.63	4.66	7.66	0.05	b.d.	0.48	0.20	0.11	59.06
Dauntless D-35	LC(c)	2651.76	232 [2]	Fe-Calcite	Cal	b.d.	b.d.	0.00	b.d.	2.57	0.15	0.81	55.75	0.00	b.d.	0.07	0.07	0.00	59.42
Dauntless D-35	LC(c)	2651.76	233 [2]	Ankerite	Ank	0.42	0.01	0.24	0.04	33.71	0.58	5.60	15.98	0.04	b.d.	0.06	0.02	0.04	56.75
Dauntless D-35	LC(c)	2651.76	234 [2]	Siderite	Sd	0.45	0.03	0.40	0.05	44.08	1.61	6.99	3.69	b.d.	b.d.	0.01	0.07	0.10	57.48
Dauntless D-35	LC(c)	2651.76	235 [2]	Calcite	Cal	b.d.	b.d.	b.d.	b.d.	0.33	0.67	0.86	53.17	0.02	b.d.	0.06	0.08	b.d.	55.18
Dauntless D-35	LC(c)	2651.76	237 [2]	Barite	Brt	b.d.	4.50	0.61	0.20	0.26	0.24	0.07	0.13	0.26	b.d.	0.07	0.63	60.21	67.19
Dauntless D-35	LC(c)	2651.76	238 [2]	Siderite	Sd	4.40	0.10	2.18	0.20	55.26	1.09	3.19	4.92	0.07	0.20	1.27	0.44	0.15	73.47
Dauntless D-35	LC(c)	2651.76	239 [2]	Calcite	Cal	b.d.	b.d.	0.01	0.03	1.28	0.12	0.77	58.24	0.01	b.d.	0.08	0.05	0.06	60.65
Dauntless D-35	LC(c)	2651.76	240 [2]	Siderite+Quartz(?)		14.24	0.03	1.32	0.05	40.13	1.07	3.46	10.61	0.10	0.26	1.50	0.38	0.16	73.32
Dauntless D-35	LC(c)	2651.76	241 [2]	Quartz	Qtz	96.48	b.d.	0.41	b.d.	1.15	b.d.	0.08	b.d.	0.01	b.d.	0.01	b.d.	b.d.	98.14
Dauntless D-35	LC(c)	2651.76	242 [2]	Calcite	Cal	b.d.	b.d.	b.d.	b.d.	0.28	b.d.	1.16	52.54	0.27	b.d.	0.03	0.09	0.01	54.38
Dauntless D-35	LC(c)	2705.67	1 [3]	Almandine	Grt	36.97	0.12	20.48	0.02	31.92	1.70	0.63	8.66	0.03	0.01	n.d.	n.d.	n.d.	100.51
Dauntless D-35	LC(c)	2705.67	2 [3]	Almandine	Grt	36.95	0.10	20.50	0.05	32.64	1.20	0.65	8.32	0.03	0.02	n.d.	n.d.	n.d.	100.47
Dauntless D-35	LC(c)	2705.67	3 [3]	Almandine	Grt	38.13	b.d.	21.21	b.d.	30.98	1.36	6.94	1.36	0.00	0.02	n.d.	n.d.	n.d.	100.00
Dauntless D-35	LC(c)	2705.67	4 [3]	Almandine	Grt	38.10	b.d.	21.16	b.d.	30.80	1.37	7.07	1.47	0.01	0.01	n.d.	n.d.	n.d.	99.99
Dauntless D-35	LC(c)	2705.67	5 [3]	Chromian-spinel	Chsp	b.d.	0.22	38.94	25.38	18.30	0.66	14.58	b.d.	0.03	0.01	n.d.	n.d.	n.d.	98.13
Dauntless D-35	LC(c)	2705.67	6 [3]	Chromian-spinel	Chsp	b.d.	0.23	38.64	25.44	18.16	0.57	14.39	b.d.	0.02	0.02	n.d.	n.d.	n.d.	97.47
Dauntless D-35	LC(c)	2705.67	7 [3]	Almandine	Grt	38.61	b.d.	21.72	0.04	27.08	1.87	9.78	1.67	0.00	0.01	n.d.	n.d.	n.d.	100.78
Dauntless D-35	LC(c)	2705.67	8 [3]	Almandine	Grt	38.46	b.d.	21.64	0.02	27.04	1.95	9.77	1.72	b.d.	0.02	n.d.	n.d.	n.d.	100.61
Dauntless D-35	LC(c)	2705.67	9 [3]	Almandine	Grt	37.83	b.d.	21.11	0.03	29.61	4.96	6.11	1.70	b.d.	0.01	n.d.	n.d.	n.d.	101.37
Dauntless D-35	LC(c)	2705.67	10 [3]	Almandine	Grt	37.56	b.d.	21.27	0.06	29.38	5.15	6.07	1.64	0.01	0.03	n.d.	n.d.	n.d.	101.16
Dauntless D-35	LC©	2709.67		Oligoclase	Pl	63.61	b.d.	23.80	b.d.	0.18	b.d.	b.d.	4.29	9.19	0.27	n.d.	n.d.	n.d.	101.36
Dauntless D-35	LC(c)	2709.67		Oligoclase	Pl	63.61	b.d.	23.87	b.d.	0.23	b.d.	b.d.	4.43	9.30	0.29	n.d.	n.d.	n.d.	101.74
Dauntless D-35	LC(c)	2709.67		Chromian-spinel	Chsp	0.02	0.26	41.41	24.19	21.21	0.23	12.35	0.03	0.01	0.02	n.d.	n.d.	n.d.	99.74
Dauntless D-35	LC(c)	2709.67		Chromian-spinel	Chsp	0.01	0.28	41.57	24.24	21.37	0.20	12.23	0.03	0.01	0.02	n.d.	n.d.	n.d.	99.95
Dauntless D-35	LC(c)	2709.67		Chromian-spinel	Chsp	b.d.	0.24	41.26	24.52	21.42	0.20	12.26	0.03	0.02	0.02	n.d.	n.d.	n.d.	99.96
Dauntless D-35	LC(c)	2709.67		Almandine	Grt	37.64	0.04	20.99	0.06	25.71	2.43	5.05	7.64	0.04	0.04	n.d.	n.d.	n.d.	99.62
Dauntless D-35	LC(c)	2709.67		Almandine	Grt	37.63	0.03	20.78	0.05	26.01	2.37	5.02	7.71	0.01	0.03	n.d.	n.d.	n.d.	99.64
Dauntless D-35	LC(c)	2709.67		Almandine	Grt	37.75	0.02	21.54	0.04	31.15	0.93	7.45	1.43	0.01	0.03	n.d.	n.d.	n.d.	100.33
Dauntless D-35	LC(c)	2709.67		Almandine	Grt	37.76	b.d.	21.39	0.05	31.35	0.97	7.42	1.30	0.01	0.03	n.d.	n.d.	n.d.	100.29
Dauntless D-35	LC(c)	2709.67		Chromite	Chr	0.06	0.28	17.65	44.48	29.50	0.42	6.81	0.07	0.02	0.03	n.d.	n.d.	n.d.	99.32
Dauntless D-35	LC(c)	2709.67		Chromite	Chr	0.06	0.26	17.78	45.20	28.16	0.40	6.08	0.05	0.03	0.04	n.d.	n.d.	n.d.	98.07
Dauntless D-35	LC(c)	2709.67		Chromian-spinel	Chr	0.04	0.18	21.92	44.95	21.96	0.33	10.52	0.05	0.03	0.04	n.d.	n.d.	n.d.	100.02
Dauntless D-35	LC(c)	2709.67		Chromian-spinel	Chr	0.06	0.19	21.91	45.31	21.74	0.37	10.64	0.05	0.02	0.03	n.d.	n.d.	n.d.	100.33
Dauntless D-35	LC(c)	2709.67		Almandine	Grt	37.71	0.04	21.33	0.06	31.94	1.41	6.11	1.75	b.d.	0.03	n.d.	n.d.	n.d.	100.37
Dauntless D-35	LC(c)	2709.67		Almandine	Grt	37.84	0.03	21.63	0.04	31.95	1.38	6.22	1.74	0.03	0.03	n.d.	n.d.	n.d.	100.89
Dauntless D-35	LC(c)	2709.67		Almandine	Grt	39.41	0.05	22.23	b.d.	19.92	0.33	11.95	6.33	0.01	0.02	n.d.	n.d.	n.d.	100.26
Dauntless D-35	LC(c)	2709.67		Almandine	Grt	39.39	0.04	22.18	b.d.	19.77	0.34	11.98	6.31	0.01	0.02	n.d.	n.d.	n.d.	100.03
Dauntless D-35	LC(c)	2709.67		Almandine	Grt	38.29	0.01	21.69	0.03	26.26	1.46	7.76	4.65	b.d.	0.02	n.d.	n.d.	n.d.	100.16
Dauntless D-35	LC(c)	2709.67		Almandine	Grt	38.36	0.03	21.67	0.03	25.72	1.28	8.24	4.62	b.d.	0.03	n.d.	n.d.	n.d.	99.96
Dauntless D-35	LC(c)	2709.67		Almandine	Grt	37.62	0.04	21.35	0.05	29.37	3.96	6.12	1.74	b.d.	0.04	n.d.	n.d.	n.d.	100.29
Dauntless D-35	LC(c)	2709.67		Almandine	Grt	37.53	0.01	21.02	0.06	29.38	3.86	6.19	1.65	0.02	0.03	n.d.	n.d.	n.d.	99.75
Dauntless D-35	LC(c)	2709.67		Almandine	Grt	38.49	b.d.	21.80	0.01	26.75	1.42	9.86	1.64	b.d.	0.02	n.d.	n.d.	n.d.	100.01
Dauntless D-35	LC(c)	2709.67		Almandine	Grt	38.54	b.d.	21.98	0.01	26.71	1.46	9.93	1.71	0.02	0.02	n.d.	n.d.	n.d.	100.38
Dauntless D-35	LC(c)	2709.67		Almandine	Grt	37.74	0.06	20.81	0.03	25.88	0.92	7.29	6.33	b.d.	0.03	n.d.	n.d.	n.d.	99.09
Dauntless D-35	LC(c)	2709.67		Almandine	Grt	37.80	0.02	21.14	b.d.	25.88	0.92	7.32	6.36	0.02	0.02	n.d.	n.d.	n.d.	99.49
Dauntless D-35	LC(c)	2709.67		Almandine	Grt	36.42	0.10	20.60	0.07	32.99	1.33	0.67	7.66	0.03	0.03	n.d.	n.d.	n.d.	99.90
Dauntless D-35	LC(c)	2709.67		Almandine	Grt	36.29	0.13	20.39	0.09	32.85	1.17	0.64	7.78	0.03	0.03	n.d.	n.d.	n.d.	99.41
Dauntless D-35	LC(c)	2709.67		Chromian-spinel	Chsp	0.03	0.23	27.47	38.19	23.33	0.34	9.24	0.05	0.02	0.02	n.d.	n.d.	n.d.	98.92
Dauntless D-35	LC(c)	2709.67		Chromian-spinel	Chsp	0.04	0.26	27.84	37.59	23.64	0.33	9.05	0.06	0.02	0.04	n.d.	n.d.	n.d.	98.86
Dauntless D-35	LC(c)	2709.67		Almandine	Grt	37.81	0.06	20.94	0.02	26.63	1.10	6.23	6.63	0.01	0.02	n.d.	n.d.	n.d.	99.42
Dauntless D-35	LC(c)	2709.67		Almandine	Grt	37.19	0.06	20.81	0.03	26.65	1.11	6.26	6.50	0.01	0.04	n.d.	n.d.	n.d.	98.67
Dauntless D-35	MS	2935.22	180	Albite	Pl	68.13	b.d.	20.58	b.d.	0.16	b.d.	b.d.	0.39	11.60	0.12	0.01	n.d.	n.d.	100.97
Dauntless D-35	MS	(f) 2980.94	279 [3]	Calcite	Cal	b.d.	b.d.	b.d.	0.03	0.32	0.04	0.75	50.84	0.02	b.d.	0.03	b.d.	b.d.	52.03
Dauntless D-35	MS	2980.94	280 [3]	Fe-Calcite	Cal	3.35	0.10	1.73	0.09	1.51	0.10	0.78	51.67	0.08	0.18	0.08	b.d.	b.d.	59.66
Dauntless D-35	MS	2980.94	281 [3]	Calcite	Cal	b.d.	b.d.	b.d.	0.02	0.25	0.04	0.56	57.18	0.07	b.d.	0.03	b.d.	b.d.	58.15
Dauntless D-35	MS	2980.94	282 [3]	Rutile	Rt	1.03	92.05	1.18	0.11	1.39	0.06	0.02	0.75	0.06	b.d.	0.07	0.56	1.75	99.02

Table 5a: Electron microprobe chemical analyses of minerals in representative samples by depth

Well	Formation	Depth (m)	File [#]	Mineral	Symbol	SiO_2	TiO_2	Al_2O_3	Cr_2O_3	FeO_t	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	ZrO_2	BaO	Total
Dauntless D-35	MS	2980.94	283 [3]	Calcite	Cal	b.d.	b.d.	0.04	0.06	0.45	0.08	0.57	54.41	0.03	b.d.	0.09	0.02	b.d.	55.77
Dauntless D-35	MS	2980.94	284 [3]	Calcite	Cal	b.d.	b.d.	b.d.	b..d	0.29	0.10	0.74	58.92	0.02	b.d.	0.04	b.d.	b.d.	60.11
Dauntless D-35	MS	2980.94	285 [3]	Siderite	Sd	3.34	0.09	1.85	0.40	58.58	1.34	0.73	1.05	0.08	0.02	0.05	0.13	0.15	67.79
Dauntless D-35	MS	2980.94	286 [3]	Calcite	Cal	b.d.	b.d.	b.d.	0.01	0.20	0.02	1.21	57.62	0.02	b.d.	0.07	b.d.	b.d.	59.15
Dauntless D-35	MS	2980.94	287 [3]	Zircon	Zrn	33.97	0.18	0.08	0.13	0.20	0.13	0.06	0.25	0.08	b.d.	0.12	66.21	0.27	101.69
Dauntless D-35	MS	2980.94	1cr [3]	Chromian-spinel	Chr	b.d.	0.24	22.88	43.26	19.66	0.31	12.54	0.10	0.04	b.d.	b.d.	b.d.	b.d.	99.03
Dauntless D-35	MS	2980.94	1rm [3]	Chromian-spinel	Chr	b.d.	0.24	23.50	44.50	17.07	0.28	9.95	0.19	0.03	b.d.	b.d.	b.d.	b.d.	95.76
Dauntless D-35	MS	2980.94	2cr [3]	Chromian-spinel	Chr	b.d.	0.12	24.45	40.66	20.11	0.29	10.82	0.09	0.05	b.d.	b.d.	b.d.	b.d.	96.58
Dauntless D-35	MS	2980.94	2rm [3]	Chromian-spinel	Chr	b.d.	0.11	25.34	40.28	20.04	0.28	11.01	0.12	0.04	b.d.	b.d.	b.d.	b.d.	97.24
Dauntless D-35	MS	(f) 3005.33	176 [2]	Siderite	Sd	0.46	0.06	0.04	0.03	51.08	0.52	4.88	4.21	0.15	b.d.	0.43	0.16	0.12	62.13
Dauntless D-35	MS	3005.33	177 [2]	Siderite	Sd	0.05	0.05	0.00	0.04	49.41	1.22	6.06	5.07	0.02	b.d.	0.06	0.02	0.08	62.08
Dauntless D-35	MS	3005.33	178 [2]	?Fe-Calcite	Cal	9.88	b.d.	9.15	b.d.	2.13	0.20	0.46	41.46	0.01	b.d.	0.04	b.d.	b.d.	63.32
Dauntless D-35	MS	3005.33	179 [2]	Calcite	Cal	0.56	b.d.	0.45	b.d.	0.62	0.07	0.96	53.71	0.01	b.d.	0.17	0.04	b.d.	56.58
Dauntless D-35	MS	3005.33	180 [2]	Fe-Calcite	Cal	0.00	b.d.	0.00	b.d.	1.10	0.19	0.61	54.10	0.02	b.d.	0.12	0.03	0.01	56.18
Dauntless D-35	MS	3005.33	181 [2]	K-feldspar	Kfs	64.09	b.d.	17.60	b.d.	0.01	b.d.	b.d.	0.01	0.56	18.54	0.02	b.d.	0.09	100.91
Dauntless D-35	MS	3005.33	182 [2]	Goethite	Gt	1.53	0.14	0.12	0.14	79.52	0.52	0.09	0.27	0.16	b.d.	0.06	0.24	0.26	83.05
Dauntless D-35	MS	3005.33	183 [2]	Barite	Brt	0.00	4.39	0.63	0.19	0.29	0.24	0.04	0.18	0.29	b.d.	0.08	0.57	58.06	64.96
Dauntless D-35	MS	(f) 3023.62	216 [2]	Siderite	Sd	0.08	0.06	0.05	0.04	45.68	0.51	7.66	4.99	0.07	b.d.	0.27	0.16	0.13	59.68
Dauntless D-35	MS	3023.62	217 [2]	K-feldspar	Kfs	61.67	b.d.	17.51	0.02	0.76	0.01	b.d.	0.03	0.20	17.68	b.d.	b.d.	0.20	98.08
Dauntless D-35	MS	3023.62	218 [2]	Siderite	Sd	0.23	0.10	0.30	0.04	44.82	0.46	6.91	5.26	0.09	b.d.	0.34	0.16	0.12	58.82
Dauntless D-35	MS	3023.62	219 [2]	Calcite	Cal	b.d.	b.d.	b.d.	0.02	0.49	0.00	0.81	55.60	0.13	b.d.	0.01	0.03	b.d.	57.09
Dauntless D-35	MS	3023.62	220 [2]	Fe-Calcite	Cal	b.d.	b.d.	b.d.	0.02	1.87	0.39	1.22	54.93	0.05	b.d.	0.13	0.04	b.d.	58.65
Dauntless D-35	MS	3023.62	221 [2]	Siderite	Sd	0.66	0.11	0.34	0.02	45.89	0.32	7.12	3.87	0.04	b.d.	0.23	0.13	0.12	58.87
Dauntless D-35	MS	3023.62	222 [2]	?Siderite	Sd	6.24	0.12	2.86	0.08	64.84	0.22	0.72	1.29	0.02	0.41	0.03	0.19	0.20	77.21
Dauntless D-35	MS	3023.62	223 [2]	Calcite	Cal	b.d.	b.d.	b.d.	b.d.	0.70	0.12	0.95	57.90	0.03	b.d.	0.06	0.03	b.d.	59.80
Dauntless D-35	MS	3023.62	224 [2]	K-feldspar	Kfs	61.77	b.d.	17.83	0.01	0.38	b.d.	b.d.	b.d.	0.54	18.30	b.d.	b.d.	0.58	99.41
Dauntless D-35	MS	3023.62	225 [2]	Zircon	Zrn	31.01	0.18	0.09	0.14	0.80	0.15	0.06	0.10	0.05	b.d.	0.30	66.79	0.34	100.00
Dauntless D-35	MS	3023.62	226 [2]	K-feldspar	Kfs	63.08	b.d.	17.96	0.01	0.31	b.d.	b.d.	b.d.	0.37	18.90	b.d.	b.d.	0.46	101.10
Dauntless D-35	MS	(c) 3145.54	193 [2]	Siderite	Sd	1.69	0.12	0.93	0.03	46.49	0.42	7.40	2.73	0.03	0.13	0.16	0.12	0.02	60.25
Dauntless D-35	MS	3145.54	194 [2]	K-feldspar	Kfs	63.37	0.03	18.14	b.d.	0.32	0.01	0.01	0.05	1.53	16.15	b.d.	b.d.	0.42	100.01
Dauntless D-35	MS	3145.54	195 [2]	K-feldspar	Kfs	64.05	b.d.	17.78	b.d.	0.62	0.01	b.d.	b.d.	0.03	16.58	0.04	b.d.	b.d.	99.11
Dauntless D-35	MS	3145.54	196 [2]	Rutile	Rt	b.d.	96.44	0.09	0.03	1.29	0.05	b.d.	0.18	b.d.	b.d.	0.04	0.24	1.63	100.00
Dauntless D-35	MS	3145.54	196	Rutile	Rt	b.d.	93.90	0.09	0.03	1.26	0.05	b.d.	0.18	b.d.	b.d.	0.04	0.23	1.59	97.36
Dauntless D-35	MS	3145.54	197 [2]	Siderite	Sd	b.d.	0.09	b.d	0.03	41.53	0.27	9.65	4.41	0.01	b.d.	0.07	0.08	0.03	56.17
Dauntless D-35	MS	3145.54	199 [2]	Zircon	Zrn	28.66	0.36	1.29	0.13	2.53	0.20	0.27	1.07	0.09	0.00	1.68	63.51	0.34	100.14
Dauntless D-35	MS	3157.72	178	Tourmaline	Tur	35.78	0.60	35.37	b.d.	9.38	0.08	4.02	0.24	1.99	0.04	0.02	n.d.	n.d.	87.51
Dauntless D-35	MS	3157.72	179	Tourmaline	Tur	35.64	0.85	35.84	b.d.	5.39	0.02	6.12	0.54	1.92	0.04	b.d.	n.d.	n.d.	86.36
Dauntless D-35	MS	(cr) 3162.76	65 [1]	Biotite	Bt	33.58	3.51	19.37	b.d.	21.73	0.40	5.45	0.01	0.26	10.21	b.d.	b.d.	b.d.	94.52
Dauntless D-35	MS	3162.76	66 [1]	Biotite	Bt	35.21	2.61	19.27	b.d.	20.61	0.20	7.43	b.d.	0.19	9.91	b.d.	b.d.	b.d.	95.43
Dauntless D-35	MS	3162.76	67 [1]	Biotite	Bt	35.18	2.59	18.66	b.d.	20.90	0.22	7.57	b.d.	0.24	9.74	b.d.	b.d.	b.d.	95.10
Dauntless D-35	MS	3162.76	68 [1]	Biotite	Bt	35.48	2.06	19.44	b.d.	20.66	0.15	8.86	b.d.	0.36	9.18	b.d.	b.d.	b.d.	96.19
Dauntless D-35	MS	3162.76	69 [1]	Biotite	Bt	34.13	2.07	19.07	b.d.	19.55	0.14	8.51	b.d.	0.42	8.74	b.d.	b.d.	b.d.	92.64
Dauntless D-35	MS	3162.76	1 [1]	K-Feldspar	Kfs	62.76	b.d.	17.57	b.d.	0.18	b.d.	b.d.	b.d.	0.33	17.64	b.d.	b.d.	b.d.	98.48
Dauntless D-35	MS	3162.76	2 [1]	K-Feldspar	Kfs	64.03	b.d.	18.17	b.d.	b.d.	b.d.	b.d.	0.01	1.11	16.94	b.d.	b.d.	b.d.	100.26
Dauntless D-35	MS	3162.76	3 [1]	K-Feldspar	Kfs	61.35	b.d.	17.44	b.d.	b.d.	b.d.	b.d.	0.01	0.85	16.50	b.d.	b.d.	b.d.	96.15
Dauntless D-35	MS	3162.76	4 [1]	K-Feldspar	Kfs	61.98	0.21	19.01	b.d.	0.12	b.d.	b.d.	b.d.	1.06	15.58	b.d.	b.d.	b.d.	97.96
Dauntless D-35	MS	3162.76	5 [1]	K-Feldspar	Kfs	62.38	b.d.	17.90	b.d.	0.05	b.d.	0.01	0.06	1.32	17.35	b.d.	b.d.	b.d.	99.07
Dauntless D-35	MS	3162.76	6 [1]	K-Feldspar	Kfs	63.73	b.d.	18.02	b.d.	0.06	b.d.	0.01	b.d.	0.70	17.43	b.d.	b.d.	b.d.	99.95
Dauntless D-35	MS	3162.76	7 [1]	K-Feldspar	Kfs	64.57	b.d.	18.12	b.d.	0.03	b.d.	b.d.	0.13	2.09	15.24	b.d.	b.d.	b.d.	100.18
Dauntless D-35	MS	3162.76	8 [1]	K-Feldspar	Kfs	62.19	b.d.	17.73	b.d.	0.08	b.d.	0.01	b.d.	0.20	18.02	b.d.	b.d.	b.d.	98.23
Dauntless D-35	MS	3162.76	75 [1]	Muscovite	Ms	45.40	0.50	35.29	b.d.	0.90	b.d.	0.51	b.d.	1.21	8.53	b.d.	b.d.	b.d.	92.34
Dauntless D-35	MS	(cr) 3164.43	9 [1]	K-Feldspar	Kfs	65.18	b.d.	18.12	b.d.	0.11	b.d.	b.d.	0.01	1.50	15.63	b.d.	b.d.	b.d.	100.55
Dauntless D-35	MS	3164.43	10 [1]	K-Feldspar	Kfs	64.16	b.d.	17.64	b.d.	0.07	b.d.	b.d.	0.04	0.41	16.15	b.d.	b.d.	b.d.	98.47
Dauntless D-35	MS	3164.43	11 [1]	K-Feldspar	Kfs	63.85	0.03	17.78	b.d.	0.19	b.d.	b.d.	b.d.	0.45	16.60	b.d.	b.d.	b.d.	98.90
Dauntless D-35	MS	3164.43	12 [1]	K-Feldspar	Kfs	64.23	0.03	18.23	b.d.	b.d.	b.d.	b.d.	0.01	0.81	16.12	b.d.	b.d.	b.d.	99.43
Dauntless D-35	MS	3164.43	13 [1]	K-Feldspar	Kfs	62.84	0.02	17.96	b.d.	b.d.	b.d.	b.d.	0.05	0.52	15.94	b.d.	b.d.	b.d.	97.33
Dauntless D-35	MS	3164.43	14 [1]	K-Feldspar	Kfs	64.36	0.05	18.06	b.d.	0.15	b.d.	b.d.	b.d.	0.34	16.75	b.d.	b.d.	b.d.	99.71
Dauntless D-35	MS	3164.43	15 [1]	K-Feldspar	Kfs	64.01	0.04	18.17	b.d.	0.13	b.d.	b.d.	0.01	0.94	15.90	b.d.	b.d.	b.d.	99.20
Dauntless D-35	MS	3164.43	60 [1]	Albite	Pl	68.65	b.d.	19.22	b.d.	0.04	b.d.	b.d.	0.12	11.94	0.04	b.d.	b.d.	b.d.	100.01
Dauntless D-35	MS	3164.43	61 [1]	Albite	Pl	64.23	b.d.	21.57	b.d.	0.50	b.d.	0.19	2.05	9.43	0.69	b.d.	b.d.	b.d.	98.66
Dauntless D-35	MS	3164.43	70 [1]	Biotite	Bt	38.47	1.48	13.79	b.d.	16.75	1.08	12.74	0.02	0.09	9.41	b.d.	b.d.	b.d.	93.83
Dauntless D-35	MS	3164.43	71 [1]	Biotite	Bt	37.81	4.30	12.22	b.d.	11.06	0.39	17.41	0.02	0.79	8.59	b.d.	b.d.	b.d.	92.59
Dauntless D-35	MS	3164.43	81 [1]	Chlorite	Chl	27.73	0.07	19.07	b.d.	22.80	0.23	12.85	0.27	0.18	b.d.	b.d.	b.d.	b.d.	83.20
Dauntless D-35	MS	3164.43	82 [1]	Chlorite	Chl	26.86	0.77	17.58	b.d.	27.83	0.16	11.42	0.16	0.19	b.d.	b.d.	b.d.	b.d.	84.97
Dauntless D-35	MS	3164.43	83 [1]	Chlorite	Chl	28.33	0.49	20.20	b.d.	25.22	0.05	9.98	0.12	0.08	0.84	b.d.	b.d.	b.d.	85.31
Dauntless D-35	MS	3164.43	94 [1]	Glauconite?	Glt	45.67	b.d.	15.29	b.d.	5.47	b.d.	2.28	0.03	0.40	9.65	b.d.	b.d.	b.d.	78.79
Dauntless D-35	MS	3164.43	76 [1]	Muscovite	Ms	45.42	0.70	35.00	b.d.	1.05	b.d.	0.52	b.d.	0.80	7.63	b.d.	b.d.	b.d.	91.12
Dauntless D-35	MS	(cr) 3165.04	1cr [3]	Chromian-spinel	Chr	0.04	0.21	23.95	37.99	23.97	0.37	10.45	0.02	0.08	b.d.	b.d.	b.d.	b.d.	97.07
Dauntless D-35	MS	3165.04	1rm [3]	Chromite	Chr	3.67	1.46	4.52	35.41	35.37	0.31	1.00	0.23	1.38	0.06	b.d.	b.d.	b.d.	83.42
Dauntless D-35	MS	3165.04	2cr [3]	Chromian-spinel	Chr	0.02	0.25	24.46	37.75	23.42	0.34	10.77	b.d.	0.08	b.d.	b.d.	b.d.	b.d.	97.08
Dauntless D-35	MS	3165.04	2rm [3]	Chromite	Chr	4.35	1.59	4.27	35.10	34.12	0.33	0.53	0.20	1.78	0.12	b.d.	b.d.	b.d.	82.37
Dauntless D-35	MS	3165.04	3cr [3]	Chromian-spinel	Chr	0.03	0.24	24.18	37.66	23.91	0.37	10.25	0.01	0.04	b.d.	b.d.	b.d.	b.d.	96.70
Dauntless D-35	MS	3165.04	3rm [3]	Chromite	Chr	4.28	1.44	4.77	35.29	34.36	0.29	0.59	0.16	1.72	0.10	b.d.	b.d.	b.d.	83.00
Dauntless D-35	MS	3165.04	84 [1]	Chlorite	Chl	26.53	0.17	20.29	b.d.	24.65	0.02	10.77	0.30	0.17	b.d.	b.d.	b.d.	b.d.	82.90
Dauntless D-35	MS	3165.04	85 [1]	Chlorite	Chl	26.37	b.d.	19.37	b.d.	26.95	0.54	13.24	0.01	0.02	b.d.	b.d.	b.d.	b.d.	86.50

Table 5a: Electron microprobe chemical analyses of minerals in representative samples by depth

Well	Formation	Depth (m)	File #	Mineral	Symbol	SiO_2	TiO_2	Al_2O_3	Cr_2O_3	FeO_t	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	ZrO_2	BaO	Total
Dauntless D-35	MS	3165.04	16 [1]	K-Feldspar	Kfs	62.30	0.03	17.84	b.d.	1.20	b.d.	0.10	b.d.	1.66	15.17	b.d.	b.d.	b.d.	98.30
Dauntless D-35	MS	3165.04	17 [1]	K-Feldspar	Kfs	63.36	b.d.	18.10	b.d.	0.11	b.d.	b.d.	b.d.	0.88	17.27	b.d.	b.d.	b.d.	99.72
Dauntless D-35	MS	3165.04	18 [1]	K-Feldspar	Kfs	61.61	b.d.	17.82	b.d.	0.78	b.d.	0.05	0.03	0.61	17.12	b.d.	b.d.	b.d.	98.02
Dauntless D-35	MS	3165.04	19 [1]	K-Feldspar	Kfs	63.12	0.05	18.10	b.d.	0.11	b.d.	b.d.	0.01	0.85	16.70	b.d.	b.d.	b.d.	98.94
Dauntless D-35	MS	3165.04	20 [1]	K-Feldspar	Kfs	63.18	b.d.	18.03	b.d.	0.01	b.d.	b.d.	b.d.	0.74	17.66	b.d.	b.d.	b.d.	99.62
Dauntless D-35	MS	3165.04	21 [1]	K-Feldspar	Kfs	63.78	b.d.	17.88	b.d.	0.02	b.d.	b.d.	b.d.	0.80	17.42	b.d.	b.d.	b.d.	99.90
Dauntless D-35	MS	3165.04	22 [1]	K-Feldspar	Kfs	64.19	b.d.	18.10	b.d.	0.04	b.d.	0.01	b.d.	0.39	15.98	b.d.	b.d.	b.d.	98.71
Dauntless D-35	MS	3165.04	23 [1]	K-Feldspar	Kfs	63.40	b.d.	18.34	b.d.	0.01	b.d.	b.d.	0.01	1.57	15.77	b.d.	b.d.	b.d.	99.10
Dauntless D-35	MS	3165.04	24 [1]	K-Feldspar	Kfs	64.57	b.d.	18.60	b.d.	b.d	b.d.	b.d.	0.02	1.20	13.06	b.d.	b.d.	b.d.	97.45
Dauntless D-35	MS	3165.65	62 [1]	Albite	Pl	66.17	b.d.	20.09	b.d.	0.02	b.d.	b.d.	0.30	11.93	0.02	b.d.	b.d.	b.d.	98.53
Dauntless D-35	MS	3165.65	73 [1]	Biotite	Bt	33.73	1.26	19.13	b.d.	18.31	0.15	10.04	0.01	0.10	8.76	b.d.	b.d.	b.d.	91.49
Dauntless D-35	MS	3165.65	86 [1]	Chlorite	Chl	23.99	0.05	22.39	b.d.	26.99	0.44	12.07	0.02	0.04	b.d.	b.d.	b.d.	b.d.	85.99
Dauntless D-35	MS	3165.65	87 [1]	Chlorite	Chl	25.87	0.03	22.66	b.d.	26.70	0.40	11.57	0.06	0.11	0.06	b.d.	b.d.	b.d.	87.46
Dauntless D-35	MS	3165.65	25 [1]	K-Feldspar	Kfs	62.10	b.d.	18.75	b.d.	b.d	b.d.	b.d.	b.d.	0.61	17.76	b.d.	b.d.	b.d.	99.22
Dauntless D-35	MS	3165.65	26 [1]	K-Feldspar	Kfs	62.87	b.d.	18.83	b.d.	0.02	b.d.	0.01	b.d.	0.83	17.60	b.d.	b.d.	b.d.	100.16
Dauntless D-35	MS	3165.65	27 [1]	K-Feldspar	Kfs	62.02	b.d.	18.76	b.d.	0.04	0.01	0.01	b.d.	0.38	17.91	b.d.	b.d.	b.d.	99.13
Dauntless D-35	MS	3165.65	28 [1]	K-Feldspar	Kfs	62.61	b.d.	18.62	b.d.	0.06	b.d.	0.01	0.03	0.42	18.02	b.d.	b.d.	b.d.	99.77
Dauntless D-35	MS	3165.65	29 [1]	K-Feldspar	Kfs	63.17	b.d.	18.77	b.d.	0.30	b.d.	b.d.	0.01	1.50	14.62	b.d.	b.d.	b.d.	98.37
Dauntless D-35	MS	3165.65	30 [1]	K-Feldspar	Kfs	61.11	0.01	18.81	b.d.	0.13	b.d.	0.01	b.d.	0.94	16.58	b.d.	b.d.	b.d.	97.59
Dauntless D-35	MS	3165.65	31 [1]	K-Feldspar	Kfs	60.47	0.05	18.91	b.d.	0.50	b.d.	0.05	0.02	0.99	16.15	b.d.	b.d.	b.d.	97.14
Dauntless D-35	MS	3165.65	32 [1]	K-Feldspar	Kfs	62.67	b.d.	18.57	b.d.	0.07	b.d.	b.d.	b.d.	0.70	17.76	b.d.	b.d.	b.d.	99.77
Dauntless D-35	MS	3165.65	33 [1]	K-Feldspar	Kfs	62.21	b.d.	18.93	b.d.	b.d	b.d.	b.d.	b.d.	1.25	16.24	b.d.	b.d.	b.d.	98.63
Dauntless D-35	MS	3165.65	34 [1]	K-Feldspar	Kfs	61.96	b.d.	18.73	b.d.	0.03	b.d.	b.d.	0.02	0.73	17.66	b.d.	b.d.	b.d.	99.13
Dauntless D-35	MS	3165.65	93 [1]	Limonite	Lm	b.d.	0.09	b.d.	b.d.	72.18	0.18	0.06	0.05	b.d.	b.d.	b.d.	b.d.	b.d.	72.56
Dauntless D-35	MS	3267.16	176	Tourmaline	Tur	35.66	0.69	33.92	0.02	9.04	0.06	4.96	0.15	2.35	0.05	n.d.	n.d.	n.d.	86.88
Dauntless D-35	MS	3267.16	177	Tourmaline	Tur	36.11	0.08	36.36	n.d.	6.15	0.02	5.51	0.27	1.98	0.03	n.d.	n.d.	n.d.	86.50
Dauntless D-35	MS	(f) 3279.65	202 [2]	Albite	Pl	68.82	b.d.	19.92	b.d.	0.11	b.d.	0.02	0.31	10.71	0.09	0.01	b.d.	b.d.	99.99
Dauntless D-35	MS	3279.65	203 [2]	Calcite	Cal	b.d.	b.d.	0.05	b.d.	2.80	0.45	0.39	60.22	b.d.	b.d.	0.03	b.d.	b.d.	63.94
Dauntless D-35	MS	3279.65	204 [2]	Siderite	Sd	0.16	0.06	0.21	0.03	45.53	0.30	5.38	5.32	0.04	b.d.	0.31	0.11	0.10	57.56
Dauntless D-35	MS	3279.65	205 [2]	Fe-Calcite	Cal	b.d.	b.d.	b.d.	0.01	1.23	0.20	1.70	52.62	0.02	b.d.	0.05	b.d.	b.d.	55.83
Dauntless D-35	MS	3279.65	206 [2]	Rutile	Rt	b.d.	98.15	0.02	0.03	1.11	0.07	0.02	0.44	b.d.	b.d.	0.05	0.10	b.d.	99.98
Dauntless D-35	MS	3279.65	207 [2]	Zircon	Zrn	31.10	0.19	0.08	0.12	1.32	0.15	0.07	0.09	0.06	b.d.	0.28	66.14	0.39	99.99
Dauntless D-35	MS	3279.65	208 [2]	Ankerite	Ank	0.39	b.d.	0.28	0.02	9.15	0.31	13.37	34.85	b.d.	b.d.	0.02	b.d.	b.d.	58.39
Dauntless D-35	MS	3279.65	209 [2]	Ankerite	Ank	b.d.	b.d.	b.d.	b.d.	9.60	0.36	12.40	36.77	b.d.	b.d.	0.02	b.d.	0.01	59.16
Dauntless D-35	MS	3279.65	210 [2]	Calcite	Cal	b.d.	b.d.	b.d.	0.02	0.73	0.13	0.34	62.57	b.d.	b.d.	0.03	b.d.	0.01	63.84
Dauntless D-35	MS	3279.65	211 [2]	Siderite	Sd	2.51	0.17	1.14	0.04	57.36	0.68	3.07	3.27	0.15	0.20	0.76	0.24	0.17	69.76
Dauntless D-35	MS	3279.65	212 [2]	Quartz	Qtz	97.58	b.d.	b.d.	b.d.	0.55	b.d.	b.d.	b.d.	b.d.	b.d.	b.d.	b.d.	b.d.	98.13
Dauntless D-35	MS	3279.65	213 [2]	Calcite	Cal	b.d.	b.d.	b.d.	b.d.	0.19	0.02	0.13	58.83	0.07	b.d.	0.04	0.02	b.d.	59.30
Dauntless D-35	MS	3279.65	214 [2]	Siderite	Sd	b.d.	0.01	b.d.	0.03	44.53	0.41	9.17	3.49	b.d.	b.d.	0.13	0.03	0.10	57.90
Dauntless D-35	MS	3304.03		Spodumene	Spd	64.66	b.d.	28.00	b.d.	0.29	0.02	b.d.	b.d.	0.11	b.d.	n.d.	n.d.	n.d.	93.08
Dauntless D-35	MS	3304.03		Spodumene	Spd	65.06	b.d.	28.14	b.d.	0.32	0.01	b.d.	b.d.	0.12	b.d.	n.d.	n.d.	n.d.	93.66
Dauntless D-35	MS	3304.03		Spodumene	Spd	64.24	b.d.	27.95	b.d.	0.32	b.d.	b.d.	b.d.	0.13	b.d.	n.d.	n.d.	n.d.	92.64
Dauntless D-35	MS	(f) 3368.04	266 [3]	Fe-Calcite	Cal	b.d.	b.d.	b.d.	b.d.	3.03	0.38	0.88	55.99	b.d.	b.d.	0.04	0.01	0.02	60.35
Dauntless D-35	MS	3368.04	267 [3]	Siderite	Sd	2.72	0.04	0.89	0.03	49.94	0.54	4.17	6.90	0.13	0.15	0.25	0.15	0.15	66.05
Dauntless D-35	MS	3368.04	268 [3]	Barite	Brt	0.04	4.20	0.60	0.16	0.30	0.23	0.05	0.13	0.30	b.d.	0.09	0.53	55.28	61.92
Dauntless D-35	MS	3368.04	269 [3]	Siderite	Sd	2.19	0.15	1.08	0.04	42.91	0.46	5.66	6.52	0.14	0.07	1.78	0.58	0.11	61.69
Dauntless D-35	MS	3368.04	270 [3]	Fe-Calcite	Cal	b.d.	b.d.	b.d.	b.d.	1.89	1.00	0.53	61.72	b.d.	b.d.	0.04	0.06	0.02	65.25
Dauntless D-35	MS	3368.04	271 [3]	Siderite	Sd	10.13	0.20	8.13	0.02	34.67	0.28	5.13	4.86	0.05	b.d.	0.24	0.10	0.08	63.90
Dauntless D-35	MS	3368.04	272 [3]	Chlorite	Chl	26.08	0.17	20.83	0.02	29.54	0.06	7.04	0.55	0.06	b.d.	0.37	0.10	0.10	84.92
Dauntless D-35	MS	3368.04	274 [3]	Siderite	Sd	3.42	0.15	1.27	0.03	54.42	0.75	2.71	3.40	0.17	0.07	0.95	0.36	0.16	67.87
Dauntless D-35	MS	3368.04	275 [3]	Fe-Calcite	Cal	0.45	b.d.	0.15	b.d.	2.87	0.28	1.02	47.07	0.10	b.d.	0.09	0.09	b.d.	52.12
Dauntless D-35	MS	3368.04	276 [3]	Siderite	Sd	8.33	0.14	4.11	b.d.	48.95	0.96	3.89	4.90	0.11	0.60	0.90	0.37	0.16	73.42
Dauntless D-35	MS	3368.04	277 [3]	Fe-Calcite	Cal	b.d.	b.d.	b.d.	b.d.	3.37	0.42	0.82	60.32	b.d.	b.d.	0.08	b.d.	0.01	65.02
Dauntless D-35	MS	(c) 3493.01	244 [3]	Chlorite	Chl	25.31	0.06	20.33	0.05	33.59	0.03	6.65	0.13	0.02	b.d.	0.03	0.04	0.02	86.26
Dauntless D-35	MS	3493.01	245 [3]	Apatite	Ap	b.d.	b.d.	0.01	0.02	0.19	0.02	b.d	59.23	0.08	b.d.	38.06	b.d.	0.00	97.60
Dauntless D-35	MS	3493.01	246 [3]	Fe-Calcite	Cal	b.d.	0.19	0.10	b.d.	4.80	0.12	0.64	51.52	0.01	b.d.	0.11	0.05	b.d.	57.54
Dauntless D-35	MS	3493.01	247 [3]	Fe-Calcite	Cal	b.d.	b.d.	b.d.	0.01	3.90	0.04	0.69	60.59	b.d.	b.d.	0.07	b.d.	b.d.	65.30
Dauntless D-35	MS	3493.01	248 [3]	Chlorite	Chl	26.73	0.13	20.67	0.08	32.35	0.01	6.40	0.13	0.59	0.31	b.d.	b.d.	0.05	87.43
Dauntless D-35	MS	3493.01	249 [3]	Apatite	Ap	0.81	0.02	0.61	0.03	0.27	b.d.	0.04	57.96	0.10	0.04	36.82	b.d.	0.01	96.71
Dauntless D-35	MS	3493.01	250 [3]	Chlorite	Chl	25.59	0.06	19.95	0.08	33.39	0.03	6.43	0.21	0.03	0.15	0.03	b.d.	b.d.	85.97
Dauntless D-35	MS	3493.01	251 [3]	Apatite	Ap	2.05	b.d.	1.40	0.03	0.82	b.d.	0.29	55.32	0.11	0.12	35.79	b.d.	0.03	95.95
Dauntless D-35	MS	3493.01	252 [3]	Siderite	Sd	0.51	0.04	0.50	0.02	43.60	0.62	5.68	4.65	0.12	b.d.	0.34	0.13	0.06	56.26
Dauntless D-35	MS	3493.01	184 [2]	Limonite	Lm	1.75	0.11	1.13	0.06	69.34	1.09	2.38	1.15	0.17	0.07	0.65	0.36	0.19	78.44
Dauntless D-35	MS	3493.01	185 [2]	Apatite	Ap	3.17	0.05	2.23	0.03	0.37	0.03	0.20	52.62	0.21	0.38	35.11	b.d.	0.03	94.41
Dauntless D-35	MS	3493.01	186 [2]	Chlorite	Chl	24.46	0.84	19.86	0.06	35.45	0.06	6.62	0.14	0.20	b.d.	0.03	0.02	0.08	87.81
Dauntless D-35	MS	3493.01	187 [2]	Calcite	Cal	b.d.	b.d.	b.d.	b.d.	4.07	0.07	0.69	57.71	b.d.	b.d.	0.09	0.01	0.03	62.68
Dauntless D-35	MS	3493.01	188 [2]	Apatite	Ap	0.51	0.02	0.34	0.02	0.15	0.04	0.03	57.35	0.13	b.d.	37.80	b.d.	0.03	96.57
Dauntless D-35	MS	3493.01	189 [2]	Chlorite	Chl	24.81	0.06	20.06	0.04	34.40	0.04	6.51	0.12	0.02	b.d.	0.03	b.d.	0.03	86.13
Dauntless D-35	MS	3493.01	190 [2]	Siderite	Sd	0.99	0.03	0.81	0.03	43.55	0.27	6.70	5.64	0.10	b.d.	0.23	0.09	0.10	58.56
Dauntless D-35	MS	3493.01	191 [2]	Siderite	Sd	1.44	0.06	0.74	0.03	46.48	0.39	6.11	5.41	0.13	0.01	0.29	0.14	0.09	61.32

MS = Missisauga
LC(c) = Logan Canyon (Cree Member)

b.d.= below detection limits
n.d. = no data

(f) = fine fraction (<2mm)
(c) = coarse fraction (>2mm)
(cr) = core

[1] = Min 24
[2] = Binder 16 A
[3] = Binder 16 B

Table 5b: Electron microprobe chemical analyses of minerals in representative samples

Well	FM	Depth (m)	File [#]	Mineral	Symbol	SiO_2	TiO_2	Al_2O_3	Cr_2O_3	FeO_t	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	ZrO_2	BaO	Total
Dauntless D-35	LC(c)	2554.22		Almandine	Grt	37.89	0.03	20.92	0.01	23.84	0.95	4.59	11.60	b.d.	0.03	n.d.	n.d.	n.d.	99.86
Dauntless D-35	LC(c)	2554.22		Almandine	Grt	37.74	0.03	21.06	b.d.	23.91	0.93	4.58	11.54	0.01	0.04	n.d.	n.d.	n.d.	99.82
Dauntless D-35	LC(c)	2709.67		Almandine	Grt	37.64	0.04	20.99	0.06	25.71	2.43	5.05	7.64	0.04	0.04	n.d.	n.d.	n.d.	99.62
Dauntless D-35	LC(c)	2709.67		Almandine	Grt	37.63	0.03	20.78	0.05	26.01	2.37	5.02	7.71	0.01	0.03	n.d.	n.d.	n.d.	99.64
Dauntless D-35	LC(c)	2709.67		Almandine	Grt	37.75	0.02	21.54	0.04	31.15	0.93	7.45	1.43	0.01	0.03	n.d.	n.d.	n.d.	100.33
Dauntless D-35	LC(c)	2709.67		Almandine	Grt	37.76	b.d.	21.39	0.05	31.35	0.97	7.42	1.30	0.01	0.03	n.d.	n.d.	n.d.	100.29
Dauntless D-35	LC(c)	2709.67		Almandine	Grt	37.71	0.04	21.33	0.06	31.94	1.41	6.11	1.75	b.d.	0.03	n.d.	n.d.	n.d.	100.37
Dauntless D-35	LC(c)	2709.67		Almandine	Grt	37.84	0.03	21.63	0.04	31.95	1.38	6.22	1.74	0.03	0.03	n.d.	n.d.	n.d.	100.89
Dauntless D-35	LC(c)	2709.67		Almandine	Grt	39.41	0.05	22.23	b.d.	19.92	0.33	11.95	6.33	0.01	0.02	n.d.	n.d.	n.d.	100.26
Dauntless D-35	LC(c)	2709.67		Almandine	Grt	39.39	0.04	22.18	b.d.	19.77	0.34	11.98	6.31	0.01	0.02	n.d.	n.d.	n.d.	100.03
Dauntless D-35	LC(c)	2709.67		Almandine	Grt	38.29	0.01	21.69	0.03	26.26	1.46	7.76	4.65	b.d.	0.02	n.d.	n.d.	n.d.	100.16
Dauntless D-35	LC(c)	2709.67		Almandine	Grt	38.36	0.03	21.67	0.03	25.72	1.28	8.24	4.62	b.d.	0.03	n.d.	n.d.	n.d.	99.96
Dauntless D-35	LC(c)	2709.67		Almandine	Grt	37.62	0.04	21.35	0.05	29.37	3.96	6.12	1.74	b.d.	0.04	n.d.	n.d.	n.d.	100.29
Dauntless D-35	LC(c)	2709.67		Almandine	Grt	37.53	0.01	21.02	0.06	29.38	3.86	6.19	1.65	0.02	0.03	n.d.	n.d.	n.d.	99.75
Dauntless D-35	LC(c)	2709.67		Almandine	Grt	38.49	b.d.	21.80	0.01	26.75	1.42	9.86	1.64	b.d.	0.02	n.d.	n.d.	n.d.	100.01
Dauntless D-35	LC(c)	2709.67		Almandine	Grt	38.54	b.d.	21.98	0.01	26.71	1.46	9.93	1.71	0.02	0.02	n.d.	n.d.	n.d.	100.38
Dauntless D-35	LC(c)	2709.67		Almandine	Grt	37.74	0.06	20.81	0.03	25.88	0.92	7.29	6.33	b.d.	0.03	n.d.	n.d.	n.d.	99.09
Dauntless D-35	LC(c)	2709.67		Almandine	Grt	37.80	0.02	21.14	b.d.	25.88	0.92	7.32	6.36	0.02	0.02	n.d.	n.d.	n.d.	99.49
Dauntless D-35	LC(c)	2709.67		Almandine	Grt	36.42	0.10	20.60	0.07	32.99	1.33	0.67	7.66	0.03	0.03	n.d.	n.d.	n.d.	99.90
Dauntless D-35	LC(c)	2709.67		Almandine	Grt	36.29	0.13	20.39	0.09	32.85	1.17	0.64	7.78	0.03	0.03	n.d.	n.d.	n.d.	99.41
Dauntless D-35	LC(c)	2709.67		Almandine	Grt	37.81	0.06	20.94	0.02	26.63	1.10	6.23	6.63	0.01	0.02	n.d.	n.d.	n.d.	99.42
Dauntless D-35	LC(c)	2709.67		Almandine	Grt	37.19	0.06	20.81	0.03	26.65	1.11	6.26	6.50	0.01	0.04	n.d.	n.d.	n.d.	98.67
Dauntless D-35	LC(c)	2554.22		Mn-almandine	Grt	36.49	0.17	20.73	b.d.	23.58	7.36	0.64	9.92	b.d.	0.03	n.d.	n.d.	n.d.	98.91
Dauntless D-35	LC(c)	2554.22		Mn-almandine	Grt	36.68	0.13	20.61	0.01	24.78	6.22	0.71	9.89	0.02	0.03	n.d.	n.d.	n.d.	99.08
Dauntless D-35	LC(c)	2705.67	1 [3]	Almandine	Grt	36.97	0.12	20.48	0.02	31.92	1.70	0.63	8.66	0.03	0.01	n.d.	n.d.	n.d.	100.51
Dauntless D-35	LC(c)	2705.67	2 [3]	Almandine	Grt	36.95	0.10	20.50	0.05	32.64	1.20	0.65	8.32	0.03	0.02	n.d.	n.d.	n.d.	100.47
Dauntless D-35	LC(c)	2705.67	3 [3]	Almandine	Grt	38.13	b.d.	21.21	b.d.	30.98	1.36	6.94	1.36	0.00	0.02	n.d.	n.d.	n.d.	100.00
Dauntless D-35	LC(c)	2705.67	4 [3]	Almandine	Grt	38.10	b.d.	21.16	b.d.	30.80	1.37	7.07	1.47	0.01	0.01	n.d.	n.d.	n.d.	99.99
Dauntless D-35	LC(c)	2705.67	7 [3]	Almandine	Grt	38.61	b.d.	21.72	0.04	27.08	1.87	9.78	1.67	0.00	0.01	n.d.	n.d.	n.d.	100.78
Dauntless D-35	LC(c)	2705.67	8 [3]	Almandine	Grt	38.46	b.d.	21.64	0.02	27.04	1.95	9.77	1.72	b.d.	0.02	n.d.	n.d.	n.d.	100.61
Dauntless D-35	LC(c)	2705.67	9 [3]	Almandine	Grt	37.83	b.d.	21.11	0.03	29.61	4.96	6.11	1.70	b.d.	0.01	n.d.	n.d.	n.d.	101.37
Dauntless D-35	LC(c)	2705.67	10 [3]	Almandine	Grt	37.56	b.d.	21.27	0.06	29.38	5.15	6.07	1.64	0.01	0.03	n.d.	n.d.	n.d.	101.16
Dauntless D-35	MS	2935.22	180	Albite	Pl	68.13	b.d.	20.58	b.d.	0.16	b.d.	b.d.	0.39	11.60	0.12	0.01	n.d.	n.d.	100.97
Dauntless D-35	MS	3164.43	60 [1]	Albite	Pl	68.65	b.d.	19.22	b.d.	0.04	b.d.	b.d.	0.12	11.94	0.04	b.d.	b.d.	b.d.	100.01
Dauntless D-35	MS	3164.43	61 [1]	Albite	Pl	64.23	b.d.	21.57	b.d.	0.50	b.d.	0.19	2.05	9.43	0.69	b.d.	b.d.	b.d.	98.66
Dauntless D-35	MS	3165.65	62 [1]	Albite	Pl	66.17	b.d.	20.09	b.d.	0.02	b.d.	b.d.	0.30	11.93	0.02	b.d.	b.d.	b.d.	98.53
Dauntless D-35	MS	(f) 3279.65	202 [2]	Albite	Pl	68.82	b.d.	19.92	b.d.	0.11	b.d.	0.02	0.31	10.71	0.09	0.01	b.d.	b.d.	99.99
Dauntless D-35	LC(c)	2709.67		Oligoclase	Pl	63.61	b.d.	23.80	b.d.	0.18	b.d.	b.d.	4.29	9.19	0.27	n.d.	n.d.	n.d.	101.36
Dauntless D-35	LC(c)	2709.67		Oligoclase	Pl	63.61	b.d.	23.87	b.d.	0.23	b.d.	b.d.	4.43	9.30	0.29	n.d.	n.d.	n.d.	101.74
Dauntless D-35	MS	(f) 2651.76	228 [2]	K-feldspar	Kfs	63.27	b.d.	17.82	b.d.	0.44	0.01	b.d.	b.d.	0.89	17.89	b.d.	b.d.	0.64	100.95
Dauntless D-35	MS	3005.33	181 [2]	K-feldspar	Kfs	64.09	b.d.	17.60	b.d.	0.01	b.d.	b.d.	0.01	0.56	18.54	0.02	b.d.	0.09	100.91
Dauntless D-35	MS	3023.62	217 [2]	K-feldspar	Kfs	61.67	b.d.	17.51	0.02	0.76	0.01	b.d.	0.03	0.20	17.68	b.d.	b.d.	0.20	98.08
Dauntless D-35	MS	3023.62	224 [2]	K-feldspar	Kfs	61.77	b.d.	17.83	0.01	0.38	b.d.	b.d.	b.d.	0.54	18.30	b.d.	b.d.	0.58	99.41
Dauntless D-35	MS	3023.62	226 [2]	K-feldspar	Kfs	63.08	b.d.	17.96	0.01	0.31	b.d.	b.d.	b.d.	0.37	18.90	b.d.	b.d.	0.46	101.10
Dauntless D-35	MS	3145.54	194 [2]	K-feldspar	Kfs	63.37	0.03	18.14	b.d.	0.32	0.01	0.01	0.05	1.53	16.15	b.d.	b.d.	0.42	100.01
Dauntless D-35	MS	3145.54	195 [2]	K-feldspar	Kfs	64.05	b.d.	17.78	b.d.	0.62	0.01	b.d.	b.d.	0.03	16.58	0.04	b.d.	b.d.	99.11
Dauntless D-35	MS	3162.76	1 [1]	K-feldspar	Kfs	62.76	b.d.	17.57	b.d.	0.18	b.d.	b.d.	b.d.	0.33	17.64	b.d.	b.d.	b.d.	98.48
Dauntless D-35	MS	3162.76	2 [1]	K-feldspar	Kfs	64.03	b.d.	18.17	b.d.	b.d.	b.d.	b.d.	0.01	1.11	16.94	b.d.	b.d.	b.d.	100.26
Dauntless D-35	MS	3162.76	3 [1]	K-feldspar	Kfs	61.35	b.d.	17.44	b.d.	b.d.	b.d.	b.d.	0.01	0.85	16.50	b.d.	b.d.	b.d.	96.15
Dauntless D-35	MS	3162.76	4 [1]	K-feldspar	Kfs	61.98	0.21	19.01	b.d.	0.12	b.d.	b.d.	b.d.	1.06	15.58	b.d.	b.d.	b.d.	97.96
Dauntless D-35	MS	3162.76	5 [1]	K-feldspar	Kfs	62.38	b.d.	17.90	b.d.	0.05	b.d.	0.01	0.06	1.32	17.35	b.d.	b.d.	b.d.	99.07
Dauntless D-35	MS	3162.76	6 [1]	K-feldspar	Kfs	63.73	b.d.	18.02	b.d.	0.06	b.d.	0.01	b.d.	0.70	17.43	b.d.	b.d.	b.d.	99.95
Dauntless D-35	MS	3162.76	7 [1]	K-feldspar	Kfs	64.57	b.d.	18.12	b.d.	0.03	b.d.	b.d.	0.13	2.09	15.24	b.d.	b.d.	b.d.	100.18
Dauntless D-35	MS	3162.76	8 [1]	K-feldspar	Kfs	62.19	b.d.	17.73	b.d.	0.08	b.d.	0.01	b.d.	0.20	18.02	b.d.	b.d.	b.d.	98.23
Dauntless D-35	MS	(cr) 3164.43	9 [1]	K-feldspar	Kfs	65.18	b.d.	18.12	b.d.	0.11	b.d.	b.d.	0.01	1.50	15.63	b.d.	b.d.	b.d.	100.55
Dauntless D-35	MS	3164.43	10 [1]	K-feldspar	Kfs	64.16	b.d.	17.64	b.d.	0.07	b.d.	b.d.	0.04	0.41	16.15	b.d.	b.d.	b.d.	98.47
Dauntless D-35	MS	3164.43	11 [1]	K-feldspar	Kfs	63.85	0.03	17.78	b.d.	0.19	b.d.	b.d.	b.d.	0.45	16.60	b.d.	b.d.	b.d.	98.90
Dauntless D-35	MS	3164.43	12 [1]	K-feldspar	Kfs	64.23	0.03	18.23	b.d.	b.d.	b.d.	b.d.	0.01	0.81	16.12	b.d.	b.d.	b.d.	99.43
Dauntless D-35	MS	3164.43	13 [1]	K-feldspar	Kfs	62.84	0.02	17.96	b.d.	b.d.	b.d.	b.d.	0.05	0.52	15.94	b.d.	b.d.	b.d.	97.33
Dauntless D-35	MS	3164.43	14 [1]	K-feldspar	Kfs	64.36	0.05	18.06	b.d.	0.15	b.d.	b.d.	b.d.	0.34	16.75	b.d.	b.d.	b.d.	99.71
Dauntless D-35	MS	3164.43	15 [1]	K-feldspar	Kfs	64.01	0.04	18.17	b.d.	0.13	b.d.	b.d.	0.01	0.94	15.90	b.d.	b.d.	b.d.	99.20
Dauntless D-35	MS	3165.04	16 [1]	K-feldspar	Kfs	62.30	0.03	17.84	b.d.	1.20	b.d.	0.10	b.d.	1.66	15.17	b.d.	b.d.	b.d.	98.30
Dauntless D-35	MS	3165.04	17 [1]	K-feldspar	Kfs	63.36	b.d.	18.10	b.d.	0.11	b.d.	b.d.	b.d.	0.88	17.27	b.d.	b.d.	b.d.	99.72
Dauntless D-35	MS	3165.04	18 [1]	K-feldspar	Kfs	61.61	b.d.	17.82	b.d.	0.78	b.d.	0.05	0.03	0.61	17.12	b.d.	b.d.	b.d.	98.02
Dauntless D-35	MS	3165.04	19 [1]	K-feldspar	Kfs	63.12	0.05	18.10	b.d.	0.11	b.d.	b.d.	0.01	0.85	16.70	b.d.	b.d.	b.d.	98.94
Dauntless D-35	MS	3165.04	20 [1]	K-feldspar	Kfs	63.18	b.d.	18.03	b.d.	0.01	b.d.	b.d.	b.d.	0.74	17.66	b.d.	b.d.	b.d.	99.62
Dauntless D-35	MS	3165.04	21 [1]	K-feldspar	Kfs	63.78	b.d.	17.88	b.d.	0.02	b.d.	b.d.	b.d.	0.80	17.42	b.d.	b.d.	b.d.	99.90
Dauntless D-35	MS	3165.04	22 [1]	K-feldspar	Kfs	64.19	b.d.	18.10	b.d.	0.04	b.d.	0.01	b.d.	0.39	15.98	b.d.	b.d.	b.d.	98.71
Dauntless D-35	MS	3165.04	23 [1]	K-feldspar	Kfs	63.40	b.d.	18.34	b.d.	0.01	b.d.	b.d.	0.01	1.57	15.77	b.d.	b.d.	b.d.	99.10
Dauntless D-35	MS	3165.04	24 [1]	K-feldspar	Kfs	64.57	b.d.	18.60	b.d.	b.d	b.d.	b.d.	0.02	1.20	13.06	b.d.	b.d.	b.d.	97.45
Dauntless D-35	MS	3165.65	25 [1]	K-feldspar	Kfs	62.10	b.d.	18.75	b.d.	b.d	b.d.	b.d.	b.d.	0.61	17.76	b.d.	b.d.	b.d.	99.22
Dauntless D-35	MS	3165.65	26 [1]	K-feldspar	Kfs	62.87	b.d.	18.83	b.d.	0.02	b.d.	0.01	b.d.	0.83	17.60	b.d.	b.d.	b.d.	100.16
Dauntless D-35	MS	3165.65	27 [1]	K-feldspar	Kfs	62.02	b.d.	18.76	b.d.	0.04	0.01	0.01	b.d.	0.38	17.91	b.d.	b.d.	b.d.	99.13
Dauntless D-35	MS	3165.65	28 [1]	K-feldspar	Kfs	62.61	b.d.	18.62	b.d.	0.06	b.d.	0.01	0.03	0.42	18.02	b.d.	b.d.	b.d.	99.77
Dauntless D-35	MS	3165.65	29 [1]	K-feldspar	Kfs	63.17	b.d.	18.77	b.d.	0.30	b.d.	b.d.	0.01	1.50	14.62	b.d.	b.d.	b.d.	98.37
Dauntless D-35	MS	3165.65	30 [1]	K-feldspar	Kfs	61.11	0.01	18.81	b.d.	0.13	b.d.	0.01	b.d.	0.94	16.58	b.d.	b.d.	b.d.	97.59
Dauntless D-35	MS	3165.65	31 [1]	K-feldspar	Kfs	60.47	0.05	18.91	b.d.	0.50	b.d.	0.05	0.02	0.99	16.15	b.d.	b.d.	b.d.	97.14
Dauntless D-35	MS	3165.65	32 [1]	K-feldspar	Kfs	62.67	b.d.	18.57	b.d.	0.07	b.d.	b.d.	b.d.	0.70	17.76	b.d.	b.d.	b.d.	99.77
Dauntless D-35	MS	3165.65	33 [1]	K-feldspar	Kfs	62.21	b.d.	18.93	b.d.	b.d	b.d.	b.d.	b.d.	1.25	16.24	b.d.	b.d.	b.d.	98.63
Dauntless D-35	MS	3165.65	34 [1]	K-feldspar	Kfs	61.96	b.d.	18.73	b.d.	0.03	b.d.	b.d.	0.02	0.73	17.66	b.d.	b.d.	b.d.	99.13
Dauntless D-35	MS	(cr) 3162.76	65 [1]	Biotite	Bt	33.58	3.51	19.37	b.d.	21.73	0.40	5.45	0.01	0.26	10.21	b.d.	b.d.	b.d.	94.52
Dauntless D-35	MS	3162.76	66 [1]	Biotite	Bt	35.21	2.61	19.27	b.d.	20.61	0.20	7.43	b.d.	0.19	9.91	b.d.	b.d.	b.d.	95.43
Dauntless D-35	MS	3162.76	67 [1]	Biotite	Bt	35.18	2.59	18.66	b.d.	20.90	0.22	7.57	b.d.	0.24	9.74	b.d.	b.d.	b.d.	95.10
Dauntless D-35	MS	3162.76	68 [1]	Biotite	Bt	35.48	2.06	19.44	b.d.	20.66	0.15	8.86	b.d.	0.36	9.18	b.d.	b.d.	b.d.	96.19
Dauntless D-35	MS	3162.76	69 [1]	Biotite	Bt	34.13	2.07	19.07	b.d.	19.55	0.14	8.51	b.d.	0.42	8.74	b.d.	b.d.	b.d.	92.64
Dauntless D-35	MS	3164.43	70 [1]	Biotite	Bt	38.47	1.48	13.79	b.d.	16.75	1.08	12.74	0.02	0.09	9.41	b.d.	b.d.	b.d.	93.83
Dauntless D-35	MS	3164.43	71 [1]	Biotite	Bt	37.81	4.30	12.22	b.d.	11.06	0.39	17.41	0.02	0.79	8.59	b.d.	b.d.	b.d.	92.59
Dauntless D-35	MS	3165.65	73 [1]	Biotite	Bt	33.73	1.26	19.13	b.d.	18.31	0.15	10.04	0.01	0.10	8.76	b.d.	b.d.	b.d.	91.49
Dauntless D-35	MS	3162.76	75 [1]	Muscovite	Ms	45.40	0.50	35.29	b.d.	0.90	b.d.	0.51	b.d.	1.21	8.53	b.d.	b.d.	b.d.	92.34
Dauntless D-35	MS	3164.43	76 [1]	Muscovite	Ms	45.42	0.70	35.00	b.d.	1.05	b.d.	0.52	b.d.	0.80	7.63	b.d.	b.d.	b.d.	91.12
Dauntless D-35	MS	3164.43	94 [1]	Glauconite?	Glt	45.67	b.d.	15.29	b.d.	5.47	b.d.	2.28	0.03	0.40	9.65	b.d.	b.d.	b.d.	78.79
Dauntless D-35	MS	3157.72	178	Tourmaline	Tur	35.78	0.60	35.37	b.d.	9.38	0.08	4.02	0.24	1.99	0.04	0.02	n.d.	n.d.	87.51
Dauntless D-35	MS	3157.72	179	Tourmaline	Tur	35.64	0.85	35.84	b.d.	5.39	0.02	6.12	0.54	1.92	0.04	b.d.	n.d.	n.d.	86.36
Dauntless D-35	MS	3267.16	176	Tourmaline	Tur	35.66	0.69	33.92	0.02	9.04	0.06	4.96	0.15	2.35	0.05	n.d.	n.d.	n.d.	86.88
Dauntless D-35	MS	3267.16	177	Tourmaline	Tur	36.11	0.08	36.36	n.d.	6.15	0.02	5.51	0.27	1.98	0.03	n.d.	n.d.	n.d.	86.50

Table 5b: Electron microprobe chemical analyses of minerals in representative samples

Well	FM	Depth (m)	File #	Mineral	Symbol	SiO_2	TiO_2	Al_2O_3	Cr_2O_3	FeO_t	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	ZrO_2	BaO	Total
Dauntless D-35	LC(c)	(f) 2633.47	254 [3]	Quartz	Qtz	99.92	b.d.	0.01	b.d.	0.39	b.d.	b.d.	b.d.	b.d.	b.d.	b.d.	b.d.	b.d.	100.32
Dauntless D-35	LC(c)	2633.47	263 [3]	Quartz	Qtz	100.28	b.d.	0.01	b.d.	0.22	b.d.	b.d.	0.01	b.d.	b.d.	0.01	b.d.	b.d.	100.52
Dauntless D-35	LC(c)	2633.47	264 [3]	Quartz	Qtz	99.50	b.d.	0.02	b.d.	0.19	b.d.	0.01	b.d.	b.d.	b.d.	b.d.	b.d.	b.d.	99.72
Dauntless D-35	MS	2651.76	241 [2]	Quartz	Qtz	96.48	b.d.	0.41	b.d.	1.15	b.d.	0.08	b.d.	0.01	b.d.	0.01	b.d.	b.d.	98.14
Dauntless D-35	MS	3279.65	212 [2]	Quartz	Qtz	97.58	b.d.	b.d.	b.d.	0.55	b.d.	b.d.	b.d.	b.d.	b.d.	b.d.	b.d.	b.d.	98.13
Dauntless D-35	MS	2980.94	287 [3]	Zircon	Zrn	33.97	0.18	0.08	0.13	0.20	0.13	0.06	0.25	0.08	b.d.	0.12	66.21	0.27	101.69
Dauntless D-35	MS	3023.62	225 [2]	Zircon	Zrn	31.01	0.18	0.09	0.14	0.80	0.15	0.06	0.10	0.05	b.d.	0.30	66.79	0.34	100.00
Dauntless D-35	MS	3145.54	199 [2]	Zircon	Zrn	28.66	0.36	1.29	0.13	2.53	0.20	0.27	1.07	0.09	0.00	1.68	63.51	0.34	100.14
Dauntless D-35	MS	3279.65	207 [2]	Zircon	Zrn	31.10	0.19	0.08	0.12	1.32	0.15	0.07	0.09	0.06	b.d.	0.28	66.14	0.39	99.99
Dauntless D-35	MS	3304.03		Spodumene	Spd	64.66	b.d.	28.00	b.d.	0.29	0.02	b.d.	b.d.	0.11	b.d.	n.d.	n.d.	n.d.	93.08
Dauntless D-35	MS	3304.03		Spodumene	Spd	65.06	b.d.	28.14	b.d.	0.32	0.01	b.d.	b.d.	0.12	b.d.	n.d.	n.d.	n.d.	93.66
Dauntless D-35	MS	3304.03		Spodumene	Spd	64.24	b.d.	27.95	b.d.	0.32	b.d.	b.d.	b.d.	0.13	b.d.	n.d.	n.d.	n.d.	92.64
Dauntless D-35	MS	3164.43	81 [1]	Chlorite	Chl	27.73	0.07	19.07	b.d.	22.80	0.23	12.85	0.27	0.18	b.d.	b.d.	b.d.	b.d.	83.20
Dauntless D-35	MS	3164.43	82 [1]	Chlorite	Chl	26.86	0.77	17.58	b.d.	27.83	0.16	11.42	0.16	0.19	b.d.	b.d.	b.d.	b.d.	84.97
Dauntless D-35	MS	3164.43	83 [1]	Chlorite	Chl	28.33	0.49	20.20	b.d.	25.22	0.05	9.98	0.12	0.08	0.84	b.d.	b.d.	b.d.	85.31
Dauntless D-35	MS	3165.04	84 [1]	Chlorite	Chl	26.53	0.17	20.29	b.d.	24.65	0.02	10.77	0.30	0.17	b.d.	b.d.	b.d.	b.d.	82.90
Dauntless D-35	MS	3165.04	85 [1]	Chlorite	Chl	26.37	b.d.	19.37	b.d.	26.95	0.54	13.24	0.01	0.02	b.d.	b.d.	b.d.	b.d.	86.50
Dauntless D-35	MS	3165.65	86 [1]	Chlorite	Chl	23.99	0.05	22.39	b.d.	26.99	0.44	12.07	0.02	0.04	b.d.	b.d.	b.d.	b.d.	85.99
Dauntless D-35	MS	3165.65	87 [1]	Chlorite	Chl	25.87	0.03	22.66	b.d.	26.70	0.40	11.57	0.06	0.11	0.06	b.d.	b.d.	b.d.	87.46
Dauntless D-35	MS	3368.04	272 [3]	Chlorite	Chl	26.08	0.17	20.83	0.02	29.54	0.06	7.04	0.55	0.06	b.d.	0.37	0.10	0.10	84.92
Dauntless D-35	MS	(c) 3493.01	244 [3]	Chlorite	Chl	25.31	0.06	20.33	0.05	33.59	0.03	6.65	0.13	0.02	b.d.	0.03	0.04	0.02	86.26
Dauntless D-35	MS	3493.01	248 [3]	Chlorite	Chl	26.73	0.13	20.67	0.08	32.35	0.01	6.40	0.13	0.59	0.31	b.d.	b.d.	0.05	87.43
Dauntless D-35	MS	3493.01	250 [3]	Chlorite	Chl	25.59	0.06	19.95	0.08	33.39	0.03	6.43	0.21	0.03	0.15	0.03	b.d.	b.d.	85.97
Dauntless D-35	MS	3493.01	186 [2]	Chlorite	Chl	24.46	0.84	19.86	0.06	35.45	0.06	6.62	0.14	0.20	b.d.	0.03	0.02	0.08	87.81
Dauntless D-35	MS	3493.01	189 [2]	Chlorite	Chl	24.81	0.06	20.06	0.04	34.40	0.04	6.51	0.12	0.02	b.d.	0.03	b.d.	0.03	86.13
Dauntless D-35	LC(c)	2709.67		Chromite	Chr	0.06	0.28	17.65	44.48	29.50	0.42	6.81	0.07	0.02	0.03	n.d.	n.d.	n.d.	99.32
Dauntless D-35	LC(c)	2709.67		Chromite	Chr	0.06	0.26	17.78	45.20	28.16	0.40	6.08	0.05	0.03	0.04	n.d.	n.d.	n.d.	98.07
Dauntless D-35	LC(c)	2709.67		Chromian-spinel	Chr	0.04	0.18	21.92	44.95	21.96	0.33	10.52	0.05	0.03	0.04	n.d.	n.d.	n.d.	100.02
Dauntless D-35	LC(c)	2709.67		Chromian-spinel	Chr	0.06	0.19	21.91	45.31	21.74	0.37	10.64	0.05	0.02	0.03	n.d.	n.d.	n.d.	100.33
Dauntless D-35	MS	2980.94	1cr [3]	Chromian-spinel	Chr	b.d.	0.24	22.88	43.26	19.66	0.31	12.54	0.10	0.04	b.d.	b.d.	b.d.	b.d.	99.03
Dauntless D-35	MS	2980.94	1rm [3]	Chromian-spinel	Chr	b.d.	0.24	23.50	44.50	17.07	0.28	9.95	0.19	0.03	b.d.	b.d.	b.d.	b.d.	95.76
Dauntless D-35	MS	2980.94	2cr [3]	Chromian-spinel	Chr	b.d.	0.12	24.45	40.66	20.11	0.29	10.82	0.09	0.05	b.d.	b.d.	b.d.	b.d.	96.58
Dauntless D-35	MS	2980.94	2rm [3]	Chromian-spinel	Chr	b.d.	0.11	25.34	40.28	20.04	0.28	11.01	0.12	0.04	b.d.	b.d.	b.d.	b.d.	97.24
Dauntless D-35	MS	(cr) 3165.04	1cr [3]	Chromian-spinel	Chr	0.04	0.21	23.95	37.99	23.97	0.37	10.45	0.02	0.08	b.d.	b.d.	b.d.	b.d.	97.07
Dauntless D-35	MS	3165.04	1rm [3]	Chromite	Chr	3.67	1.46	4.52	35.41	35.37	0.31	1.00	0.23	1.38	0.06	b.d.	b.d.	b.d.	83.42
Dauntless D-35	MS	3165.04	2cr [3]	Chromian-spinel	Chr	0.02	0.25	24.46	37.75	23.42	0.34	10.77	b.d.	0.08	b.d.	b.d.	b.d.	b.d.	97.08
Dauntless D-35	MS	3165.04	2rm [3]	Chromite	Chr	4.35	1.59	4.27	35.10	34.12	0.33	0.53	0.20	1.78	0.12	b.d.	b.d.	b.d.	82.37
Dauntless D-35	MS	3165.04	3cr [3]	Chromian-spinel	Chr	0.03	0.24	24.18	37.66	23.91	0.37	10.25	0.01	0.04	b.d.	b.d.	b.d.	b.d.	96.70
Dauntless D-35	MS	3165.04	3rm [3]	Chromite	Chr	4.28	1.44	4.77	35.29	34.36	0.29	0.59	0.16	1.72	0.10	b.d.	b.d.	b.d.	83.00
Dauntless D-35	MS	2554.22	11 [3]	Chromian-spinel	Chsp	b.d.	0.41	35.51	24.52	21.78	0.89	15.49	0.01	0.03	0.02	n.d.	n.d.	n.d.	98.65
Dauntless D-35	MS	2554.22	12 [3]	Chromian-spinel	Chsp	b.d.	0.47	35.24	25.07	21.59	0.80	15.57	0.02	b.d.	0.02	n.d.	n.d.	n.d.	98.79
Dauntless D-35	LC(c)	2554.22		Chromian-spinel	Chsp	b.d.	0.42	38.00	25.16	22.56	0.17	14.92	0.02	b.d.	0.02	n.d.	n.d.	n.d.	101.27
Dauntless D-35	LC(c)	2554.22		Chromian-spinel	Chsp	b.d.	0.42	38.12	25.11	22.40	0.22	15.14	0.02	b.d.	0.02	n.d.	n.d.	n.d.	101.45
Dauntless D-35	LC(c)	2705.67	5 [3]	Chromian-spinel	Chsp	b.d.	0.22	38.94	25.38	18.30	0.66	14.58	b.d.	0.03	0.01	n.d.	n.d.	n.d.	98.13
Dauntless D-35	LC(c)	2705.67	6 [3]	Chromian-spinel	Chsp	b.d.	0.23	38.64	25.44	18.16	0.57	14.39	b.d.	0.02	0.02	n.d.	n.d.	n.d.	97.47
Dauntless D-35	LC(c)	2709.67		Chromian-spinel	Chsp	0.02	0.26	41.41	24.19	21.21	0.23	12.35	0.03	0.01	0.02	n.d.	n.d.	n.d.	99.74
Dauntless D-35	LC(c)	2709.67		Chromian-spinel	Chsp	0.01	0.28	41.57	24.24	21.37	0.20	12.23	0.03	0.01	0.02	n.d.	n.d.	n.d.	99.95
Dauntless D-35	LC(c)	2709.67		Chromian-spinel	Chsp	b.d.	0.24	41.26	24.52	21.42	0.20	12.26	0.03	0.02	0.02	n.d.	n.d.	n.d.	99.96
Dauntless D-35	LC(c)	2709.67		Chromian-spinel	Chsp	0.03	0.23	27.47	38.19	23.33	0.34	9.24	0.05	0.02	0.02	n.d.	n.d.	n.d.	98.92
Dauntless D-35	LC(c)	2709.67		Chromian-spine	Chsp	0.04	0.26	27.84	37.59	23.64	0.33	9.05	0.06	0.02	0.04	n.d.	n.d.	n.d.	98.86
Dauntless D-35	MS	2980.94	282 [3]	Rutile	Rt	1.03	92.05	1.18	0.11	1.39	0.06	0.02	0.75	0.06	b.d.	0.07	0.56	1.75	99.02
Dauntless D-35	MS	3145.54	196 [2]	Rutile	Rt	b.d.	96.44	0.09	0.03	1.29	0.05	b.d.	0.18	b.d.	b.d.	0.04	0.24	1.63	100.00
Dauntless D-35	MS	3145.54	196	Rutile	Rt	b.d.	93.90	0.09	0.03	1.26	0.05	b.d.	0.18	b.d.	b.d.	0.04	0.23	1.59	97.36
Dauntless D-35	MS	3279.65	206 [2]	Rutile	Rt	b.d.	98.15	0.02	0.03	1.11	0.07	0.02	0.44	b.d.	b.d.	0.05	0.10	b.d.	99.98
Dauntless D-35	MS	3493.01	245 [3]	Apatite	Ap	b.d.	b.d.	0.01	0.02	0.19	0.02	b.d	59.23	0.08	b.d.	38.06	b.d.	0.00	97.60
Dauntless D-35	MS	3493.01	249 [3]	Apatite	Ap	0.81	0.02	0.61	0.03	0.27	b.d.	0.04	57.96	0.10	0.04	36.82	b.d.	0.01	96.71
Dauntless D-35	MS	3493.01	251 [3]	Apatite	Ap	2.05	b.d.	1.40	0.03	0.82	b.d.	0.29	55.32	0.11	0.12	35.79	b.d.	0.03	95.95
Dauntless D-35	MS	3493.01	185 [2]	Apatite	Ap	3.17	0.05	2.23	0.03	0.37	0.03	0.20	52.62	0.21	0.38	35.11	b.d.	0.03	94.41
Dauntless D-35	MS	3493.01	188 [2]	Apatite	Ap	0.51	0.02	0.34	0.02	0.15	0.04	0.03	57.35	0.13	b.d.	37.80	b.d.	0.03	96.57
Dauntless D-35	LC(c)	2633.47	259 [3]	Barite	Brt	0.01	4.42	0.63	0.16	0.40	0.22	0.05	0.12	0.24	b.d.	0.10	0.56	56.45	63.37
Dauntless D-35	LC(c)	2633.47	260 [3]	Barite	Brt	0.01	4.22	0.65	0.16	0.33	0.22	0.05	0.11	0.24	b.d.	0.09	0.58	56.76	63.42
Dauntless D-35	MS	2651.76	237 [2]	Barite	Brt	b.d.	4.50	0.61	0.20	0.26	0.24	0.07	0.13	0.26	b.d.	0.07	0.63	60.21	67.19
Dauntless D-35	MS	3005.33	183 [2]	Barite	Brt	0.00	4.39	0.63	0.19	0.29	0.24	0.04	0.18	0.29	b.d.	0.08	0.57	58.06	64.96
Dauntless D-35	MS	3368.04	268 [3]	Barite	Brt	0.04	4.20	0.60	0.16	0.30	0.23	0.05	0.13	0.30	b.d.	0.09	0.53	55.28	61.92
Dauntless D-35	MS	3005.33	182 [2]	Goethite	Gt	1.53	0.14	0.12	0.14	79.52	0.52	0.09	0.27	0.16	b.d.	0.06	0.24	0.26	83.05
Dauntless D-35	MS	3165.65	93 [1]	Limonite	Lm	b.d.	0.09	b.d.	b.d.	72.18	0.18	0.06	0.05	b.d.	b.d.	b.d.	b.d.	b.d.	72.56
Dauntless D-35	MS	3493.01	184 [2]	Limonite	Lm	1.75	0.11	1.13	0.06	69.34	1.09	2.38	1.15	0.17	0.07	0.65	0.36	0.19	78.44
Dauntless D-35	MS	2651.76	233 [2]	Ankerite	Ank	0.42	0.01	0.24	0.04	33.71	0.58	5.60	15.98	0.04	b.d.	0.06	0.02	0.04	56.75
Dauntless D-35	MS	3279.65	208 [2]	Ankerite	Ank	0.39	b.d.	0.28	0.02	9.15	0.31	13.37	34.85	b.d.	b.d.	0.02	b.d.	b.d.	58.39
Dauntless D-35	MS	3279.65	209 [2]	Ankerite	Ank	b.d.	b.d.	b.d.	b.d.	9.60	0.36	12.40	36.77	b.d.	b.d.	0.02	b.d.	0.01	59.16
Dauntless D-35	MS	3023.62	222 [2]	?Siderite	Sd	6.24	0.12	2.86	0.08	64.84	0.22	0.72	1.29	0.02	0.41	0.03	0.19	0.20	77.21
Dauntless D-35	LC(c)	2633.47	255 [3]	Siderite	Sd	2.82	0.09	1.78	0.04	40.70	0.38	6.15	9.52	0.08	0.27	3.46	0.95	0.12	66.34
Dauntless D-35	LC(c)	2633.47	256 [3]	Siderite	Sd	0.43	0.03	0.32	0.02	38.40	0.51	8.65	8.39	0.02	b.d.	0.11	0.07	0.07	57.01
Dauntless D-35	LC(c)	2633.47	257 [3]	Siderite	Sd	7.91	0.64	4.79	0.02	39.53	0.55	9.04	3.15	0.06	0.14	0.05	0.07	0.08	66.02
Dauntless D-35	LC(c)	2633.47	258 [3]	Siderite	Sd	2.13	0.20	1.08	0.03	41.70	0.44	10.69	2.07	b.d.	0.18	0.02	0.02	0.04	58.61
Dauntless D-35	LC(c)	2633.47	261 [3]	Siderite	Sd	1.00	0.40	0.59	0.02	37.14	0.16	7.48	9.26	0.05	0.01	0.24	0.13	0.06	56.54
Dauntless D-35	LC(c)	2651.76	231 [2]	Siderite	Sd	0.96	0.06	0.33	0.04	43.89	0.63	4.66	7.66	0.05	b.d.	0.48	0.20	0.11	59.06
Dauntless D-35	LC(c)	2651.76	234 [2]	Siderite	Sd	0.45	0.03	0.40	0.05	44.08	1.61	6.99	3.69	b.d.	b.d.	0.01	0.07	0.10	57.48
Dauntless D-35	LC(c)	2651.76	238 [2]	Siderite	Sd	4.40	0.10	2.18	0.20	55.26	1.09	3.19	4.92	0.07	0.20	1.27	0.44	0.15	73.47
Dauntless D-35	MS	2980.94	285 [3]	Siderite	Sd	3.34	0.09	1.85	0.40	58.58	1.34	0.73	1.05	0.08	0.02	0.05	0.13	0.15	67.79
Dauntless D-35	MS	(f) 3005.33	176 [2]	Siderite	Sd	0.46	0.06	0.04	0.03	51.08	0.52	4.88	4.21	0.15	b.d.	0.43	0.16	0.12	62.13
Dauntless D-35	MS	3005.33	177 [2]	Siderite	Sd	0.05	0.05	0.00	0.04	49.41	1.22	6.06	5.07	0.02	b.d.	0.06	0.02	0.08	62.08
Dauntless D-35	MS	(f) 3023.62	216 [2]	Siderite	Sd	0.08	0.06	0.05	0.04	45.68	0.51	7.66	4.99	0.07	b.d.	0.27	0.16	0.13	59.68
Dauntless D-35	MS	3023.62	218 [2]	Siderite	Sd	0.23	0.10	0.30	0.04	44.82	0.46	6.91	5.26	0.09	b.d.	0.34	0.16	0.12	58.82
Dauntless D-35	MS	3023.62	221 [2]	Siderite	Sd	0.66	0.11	0.34	0.02	45.89	0.32	7.12	3.87	0.04	b.d.	0.23	0.13	0.12	58.87
Dauntless D-35	MS	(c) 3145.54	193 [2]	Siderite	Sd	1.69	0.12	0.93	0.03	46.49	0.42	7.40	2.73	0.03	0.13	0.16	0.12	0.02	60.25
Dauntless D-35	MS	3145.54	197 [2]	Siderite	Sd	b.d.	0.09	b.d	0.03	41.53	0.27	9.65	4.41	0.01	b.d.	0.07	0.08	0.03	56.17
Dauntless D-35	MS	3279.65	204 [2]	Siderite	Sd	0.16	0.06	0.21	0.03	45.53	0.30	5.38	5.32	0.04	b.d.	0.31	0.11	0.10	57.56
Dauntless D-35	MS	3279.65	211 [2]	Siderite	Sd	2.51	0.17	1.14	0.04	57.36	0.68	3.07	3.27	0.15	0.20	0.76	0.24	0.17	69.76
Dauntless D-35	MS	3279.65	214 [2]	Siderite	Sd	b.d.	0.01	b.d.	0.03	44.53	0.41	9.17	3.49	b.d.	b.d.	0.13	0.03	0.10	57.90
Dauntless D-35	MS	3368.04	267 [3]	Siderite	Sd	2.72	0.04	0.89	0.03	49.94	0.54	4.17	6.90	0.13	0.15	0.25	0.15	0.15	66.05
Dauntless D-35	MS	3368.04	269 [3]	Siderite	Sd	2.19	0.15	1.08	0.04	42.91	0.46	5.66	6.52	0.14	0.07	1.78	0.58	0.11	61.69
Dauntless D-35	MS	3368.04	271 [3]	Siderite	Sd	10.13	0.20	8.13	0.02	34.67	0.28	5.13	4.86	0.05	b.d.	0.24	0.10	0.08	63.90
Dauntless D-35	MS	3368.04	274 [3]	Siderite	Sd	3.42	0.15	1.27	0.03	54.42	0.75	2.71	3.40	0.17	0.07	0.95	0.36	0.16	67.87
Dauntless D-35	MS	3368.04	276 [3]	Siderite	Sd	8.33	0.14	4.11	b.d.	48.95	0.96	3.89	4.90	0.11	0.60	0.90	0.37	0.16	73.42

Table 5b: Electron microprobe chemical analyses of minerals in representative samples

Well	FM	Depth (m)	File #	Mineral	Symbol	SiO_2	TiO_2	Al_2O_3	Cr_2O_3	FeO_t	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	ZrO_2	BaO	Total
Dauntless D-35	MS	3493.01	252 [3]	Siderite	Sd	0.51	0.04	0.50	0.02	43.60	0.62	5.68	4.65	0.12	b.d.	0.34	0.13	0.06	56.26
Dauntless D-35	MS	3493.01	190 [2]	Siderite	Sd	0.99	0.03	0.81	0.03	43.55	0.27	6.70	5.64	0.10	b.d.	0.23	0.09	0.10	58.56
Dauntless D-35	MS	3493.01	191 [2]	Siderite	Sd	1.44	0.06	0.74	0.03	46.48	0.39	6.11	5.41	0.13	0.01	0.29	0.14	0.09	61.32
Dauntless D-35	LC(c)	2651.76	240 [2]	Siderite+Quartz(?)		14.24	0.03	1.32	0.05	40.13	1.07	3.46	10.61	0.10	0.26	1.50	0.38	0.16	73.32
Dauntless D-35	LC(c)	3005.33	178 [2]	?Fe-Calcite	Cal	9.88	b.d.	9.15	b.d.	2.13	0.20	0.46	41.46	0.01	b.d.	0.04	b.d.	b.d.	63.32
Dauntless D-35	LC(c)	2633.47	262 [3]	Fe-Calcite	Cal	1.83	b.d.	1.31	b.d.	2.57	0.06	0.84	54.92	b.d.	0.08	0.04	0.01	b.d.	61.67
Dauntless D-35	LC(c)	2651.76	229 [2]	Fe-Calcite	Cal	b.d.	b.d.	b.d.	b.d.	2.96	0.38	0.38	56.42	b.d.	b.d.	0.72	0.14	b.d.	61.01
Dauntless D-35	LC(c)	2651.76	230 [2]	Fe-Calcite	Cal	b.d.	b.d.	b.d.	0.02	2.53	0.58	0.42	59.36	b.d.	b.d.	0.02	0.03	0.04	63.00
Dauntless D-35	LC(c)	2651.76	232 [2]	Fe-Calcite	Cal	b.d.	b.d.	0.00	b.d.	2.57	0.15	0.81	55.75	0.00	b.d.	0.07	0.07	0.00	59.42
Dauntless D-35	LC(c)	2651.76	235 [2]	Calcite	Cal	b.d.	b.d.	b.d.	b.d.	0.33	0.67	0.86	53.17	0.02	b.d.	0.06	0.08	b.d.	55.18
Dauntless D-35	LC(c)	2651.76	239 [2]	Fe-Calcite	Cal	b.d.	b.d.	0.01	0.03	1.28	0.12	0.77	58.24	0.01	b.d.	0.08	0.05	0.06	60.65
Dauntless D-35	LC(c)	2651.76	242 [2]	Calcite	Cal	b.d.	b.d.	b.d.	b.d.	0.28	b.d.	1.16	52.54	0.27	b.d.	0.03	0.09	0.01	54.38
Dauntless D-35	MS	(f) 2980.94	279 [3]	Calcite	Cal	b.d.	b.d.	b.d.	0.03	0.32	0.04	0.75	50.84	0.02	b.d.	0.03	b.d.	b.d.	52.03
Dauntless D-35	MS	2980.94	280 [3]	Fe-Calcite	Cal	3.35	0.10	1.73	0.09	1.51	0.10	0.78	51.67	0.08	0.18	0.08	b.d.	b.d.	59.66
Dauntless D-35	MS	2980.94	281 [3]	Calcite	Cal	b.d.	b.d.	b.d.	0.02	0.25	0.04	0.56	57.18	0.07	b.d.	0.03	b.d.	b.d.	58.15
Dauntless D-35	MS	2980.94	283 [3]	Calcite	Cal	b.d.	b.d.	0.04	0.06	0.45	0.08	0.57	54.41	0.03	b.d.	0.09	0.02	b.d.	55.77
Dauntless D-35	MS	2980.94	284 [3]	Calcite	Cal	b.d.	b.d.	b.d.	b..d	0.29	0.10	0.74	58.92	0.02	b.d.	0.04	b.d.	b.d.	60.11
Dauntless D-35	MS	2980.94	286 [3]	Calcite	Cal	b.d.	b.d.	b.d.	0.01	0.20	0.02	1.21	57.62	0.02	b.d.	0.07	b.d.	b.d.	59.15
Dauntless D-35	MS	3005.33	179 [2]	Calcite	Cal	0.56	b.d.	0.45	b.d.	0.62	0.07	0.96	53.71	0.01	b.d.	0.17	0.04	b.d.	56.58
Dauntless D-35	MS	3005.33	180 [2]	Calcite	Cal	0.00	b.d.	0.00	b.d.	1.10	0.19	0.61	54.10	0.02	b.d.	0.12	0.03	0.01	56.18
Dauntless D-35	MS	3023.62	219 [2]	Calcite	Cal	b.d.	b.d.	b.d.	0.02	0.49	0.00	0.81	55.60	0.13	b.d.	0.01	0.03	b.d.	57.09
Dauntless D-35	MS	3023.62	220 [2]	Fe-Calcite	Cal	b.d.	b.d.	b.d.	0.02	1.87	0.39	1.22	54.93	0.05	b.d.	0.13	0.04	b.d.	58.65
Dauntless D-35	MS	3023.62	223 [2]	Calcite	Cal	b.d.	b.d.	b.d.	b.d.	0.70	0.12	0.95	57.90	0.03	b.d.	0.06	0.03	b.d.	59.80
Dauntless D-35	MS	3279.65	203 [2]	Fe-Calcite	Cal	b.d.	b.d.	0.05	b.d.	2.80	0.45	0.39	60.22	b.d.	b.d.	0.03	b.d.	b.d.	63.94
Dauntless D-35	MS	3279.65	205 [2]	Fe-Calcite	Cal	b.d.	b.d.	b.d.	0.01	1.23	0.20	1.70	52.62	0.02	b.d.	0.05	b.d.	b.d.	55.83
Dauntless D-35	MS	3279.65	210 [2]	Calcite	Cal	b.d.	b.d.	b.d.	0.02	0.73	0.13	0.34	62.57	b.d.	b.d.	0.03	b.d.	0.01	63.84
Dauntless D-35	MS	3279.65	213 [2]	Calcite	Cal	b.d.	b.d.	b.d.	b.d.	0.19	0.02	0.13	58.83	0.07	b.d.	0.04	0.02	b.d.	59.30
Dauntless D-35	MS	(f) 3368.04	266 [3]	Fe-Calcite	Cal	b.d.	b.d.	b.d.	b.d.	3.03	0.38	0.88	55.99	b.d.	b.d.	0.04	0.01	0.02	60.35
Dauntless D-35	MS	3368.04	270 [3]	Fe-Calcite	Cal	b.d.	b.d.	b.d.	b.d.	1.89	1.00	0.53	61.72	b.d.	b.d.	0.04	0.06	0.02	65.25
Dauntless D-35	MS	3368.04	275 [3]	Fe-Calcite	Cal	0.45	b.d.	0.15	b.d.	2.87	0.28	1.02	47.07	0.10	b.d.	0.09	0.09	b.d.	52.12
Dauntless D-35	MS	3368.04	277 [3]	Fe-Calcite	Cal	b.d.	b.d.	b.d.	b.d.	3.37	0.42	0.82	60.32	b.d.	b.d.	0.08	b.d.	0.01	65.02
Dauntless D-35	MS	3493.01	246 [3]	Fe-Calcite	Cal	b.d.	0.19	0.10	b.d.	4.80	0.12	0.64	51.52	0.01	b.d.	0.11	0.05	b.d.	57.54
Dauntless D-35	MS	3493.01	247 [3]	Fe-Calcite	Cal	b.d.	b.d.	b.d.	0.01	3.90	0.04	0.69	60.59	b.d.	b.d.	0.07	b.d.	b.d.	65.30
Dauntless D-35	MS	3493.01	187 [2]	Fe-Calcite	Cal	b.d.	b.d.	b.d.	b.d.	4.07	0.07	0.69	57.71	b.d.	b.d.	0.09	0.01	0.03	62.68

MS = Missisauga
LC(c) = Logan Canyon (Cree Member)

b.d.= below detection limits
n.d. = no data

(f) = fine fraction (<2mm)
(c) = coarse fraction (>2mm)
(cr) = core; (rm) = rim

[1] = Min 24
[2] = Binder 16 A
[3] = Binder 16 B

Appendix 1: Petrographic summaries of the > 2mm fraction* of cutting samples.

WELL DAUNTLESS D-35

top depth (m)		2225.04	2243.33	2267.71	2322.58	2334.77	2395.73	2529.84
bottom depth (m)		2231.14	2249.42	2273.81	2328.67	2346.86	2401.82	2535.94
total number of grains		29	68	68	65	131	53	176
LITHOLOGY								
Sandstone: very fine	white/grey		5				1	
	red						4	
Sandstone: fine	white/grey	1			9	32	1	
	red	15			21	18		
Sandstone: medium	includes fn-med	2	2		2	22		4
Sandstone: coarse		3	1					
Calcareous Sandstone			24			9		34
Shell Fragments						2		
Coal						1		
Silty Mudstone		5		12	32	11		24
Mudstone				30		25	46	99
Calcareous Mudstone/Chalk		1	3			3	1	2
Sideritic Mudstone				9		7		10
Limestone			19					
Silty Limestone								
Sandy Limestone				16				
Micritic Limestone								
Granules - white quartz			5					2
Granules - pink quartz			4					
Granules - yellow quartz			2					
Granules - lithic clasts								
Pyrite Nodules			2		1			
Limonite Grains						1		
Rhyolite?		2	1					
Contact								

top depth (m)		2554.22	2621.28	2633.47	2651.76	2709.62	2715.77	2743.20
bottom depth (m)		2560.32	2627.38	2639.57	2657.86	2712.72	2718.82	2749.30
total number of grains		52	114	24	99	112	357	225
LITHOLOGY								
Sandstone: very fine	white/grey						1	
	red	8		2	3			
Sandstone: fine	white/grey		24		3	11	27	45
	red		2			3		15
Sandstone: medium	includes fn-med		36				31	
Sandstone: coarse					1			
Calcareous Sandstone		3		4	19			
Shell Fragments								
Coal			2		1			
Silty Mudstone		1	10		3	18	159	40
Mudstone		40	23	14	46	80	132	116
Calcareous Mudstone/Chalk								4
Sideritic Mudstone			17	4	4			3
Limestone								
Silty Limestone								
Sandy Limestone								
Micritic Limestone								
Granules - white quartz					17		6	
Granules - pink quartz							1	
Granules - yellow quartz					2			
Granules - lithic clasts								
Pyrite Nodules								2
Limonite Grains								
Rhyolite?								
Contact								

Appendix 1: Petrographic summaries of the > 2mm fraction* of cutting samples.

top depth (m)		2840.74	2871.22	2898.65	2926.08	2935.22	2956.56	2980.94
bottom depth (m)		2843.78	2874.26	2901.70	2929.13	2938.27	2959.61	2987.04
total number of grains		248	612	268	363	403	433	937
LITHOLOGY								
Sandstone: very fine	white/grey	19			26			
	red			6				
Sandstone: fine	white/grey		174	84		216	160	
	red	42	221		10	3		10
Sandstone: medium	includes fn-med							
Sandstone: coarse								
Calcareous Sandstone			20					
Shell Fragments								
Coal								
Silty Mudstone		19	32	18	46			
Mudstone		128	164	149	254	177	248	140
Calcareous Mudstone/Chalk							3	
Sideritic Mudstone		39		11	27	7	20	
Limestone								787
Silty Limestone								
Sandy Limestone								
Micritic Limestone								
Granules - white quartz								
Granules - pink quartz								
Granules - yellow quartz								
Granules - lithic clasts							1	
Pyrite Nodules								
Limonite Grains								
Rhyolite?								
Contact							1	

top depth (m)		2999.23	3017.52	3048.00	3066.29	3145.54	3157.73	3176.02
bottom depth (m)		3005.33	3023.62	3054.10	3072.38	3151.63	3163.82	3182.11
total number of grains		421	411	401	559	535	32	335
LITHOLOGY								
Sandstone: very fine	white/grey		4		6	11		
	red							
Sandstone: fine	white/grey				45	11	2	4
	red							
Sandstone: medium	includes fn-med				10			
Sandstone: coarse								
Calcareous Sandstone								
Shell Fragments								
Coal						1		
Silty Mudstone			5	36	23	24	24	5
Mudstone		336	220	321	444	419		309
Calcareous Mudstone/Chalk							2	
Sideritic Mudstone		9	22	33	25	15		13
Limestone			160	11	6	1		1
Silty Limestone		5						
Sandy Limestone		71						
Micritic Limestone								
Granules - white quartz						43		2
Granules - pink quartz						1		
Granules - yellow quartz						8		1
Granules - lithic clasts						1		
Pyrite Nodules								
Limonite Grains								
Rhyolite?								
Contact								
Artefact							4	

Appendix 1: Petrographic summaries of the > 2mm fraction* of cutting samples.

top depth (m)		3236.98	3261.36	3267.46	3273.55	3297.94	3304.03	3368.04
bottom depth (m)		3243.07	3267.46	3273.55	3279.65	3304.03	3310.13	
total number of grains		596	629	343	532	481	556	477
LITHOLOGY								
Sandstone: very fine	white/grey							12
	red							
Sandstone: fine	white/grey							
	red							
Sandstone: medium	includes fn-med							
Sandstone: coarse								
Calcareous Sandstone					181	74	25	
Shell Fragments			3					
Coal								
Silty Mudstone		3		23	64	8	26	9
Mudstone		339	291	204	254	382	488	422
Calcareous Mudstone/Chalk			1		14			
Sideritic Mudstone		10	13	10	6	17	13	20
Limestone		151	293		13		4	14
Silty Limestone		12	27					
Sandy Limestone		79		89				
Micritic Limestone				14				
Granules - white quartz		1						
Granules - pink quartz								
Granules - yellow quartz		1	1	3				
Granules - lithic clasts								
Pyrite Nodules								
Limonite Grains								
Rhyolite?								
Contact								

top depth (m)		3453.38	3493.01
bottom depth (m)		3456.43	3496.06
total number of grains		593	384
LITHOLOGY			
Sandstone: very fine	white/grey		
	red		
Sandstone: fine	white/grey		
	red		
Sandstone: medium	includes fn-med		
Sandstone: coarse			
Calcareous Sandstone			
Shell Fragments			
Coal			
Silty Mudstone		24	73
Mudstone		456	290
Calcareous Mudstone/Chalk			
Sideritic Mudstone		17	5
Limestone		76	15
Silty Limestone			
Sandy Limestone		19	
Micritic Limestone			
Granules - white quartz			
Granules - pink quartz			
Granules - yellow quartz			1
Granules - lithic clasts			
Pyrite Nodules			
Limonite Grains			
Rhyolite?			
Contact		1	

* Analytical work done by Chris Albert.

Appendix 2: Identified minerals and descriptions of clasts in "heavy mineral" samples.

Depth	Identified Minerals	Clast descriptions/cuttings	Notes/Comments
		Core	
3164.43 F	Pl, Kfs, Mc, Glt, Chl, Bt, Tur	**1**-Clt- Meta-Qtz, Brm, Alt-Qtz or Fds **4**-Clt- Meta-Glt, Meta-Fds **6**-Clt- Mds **8**-Clt- Alt-Fds **9**-Clt- Chl with unknown Ct **10**-Clt- Volc-Kfs, Qtz-Inc, spherulitic glass/chert **12**-Clt- Volc-Fds **14**-Clt- Glt	Core. No Grt found
3162.76 F	Pl, Kfs, Mc, Glt, Chl, Bt-alt, Ms, Ilm, Cg/Od	**3**-Clt- Pl, Qtz. **4**-Clt- Mc. **5**-Clt- Slst/Brm with Fds. **9**-Pl, Brm. **14**-Kfs, Qtz, Glt. **17**-Clt-Volc. Clt-Fds, Brm. **20**-Clt- Bt-Alt.	Core. No Grt, Tur found
3165.65 F	Pl, Mc, Kfs, Chl, Bt, Cg/Od	**5**-Clt- Fds, Chl, Alt-Fds. **9**-Clt- Chl, Feld. **16**-Clt- Chl, Brm, Ilm. **17**-Clt-Meta-Pl, Chl	Core. No Grt, Tur, Glt found

Abbreviations	Clasts	Minerals	Minerals	Others
	Clast---Clt	Feldspar/Feldspathic--Fds	Sericite---Ser	Cement---Ct
	Volcanic---Volc	K-Feldspar--Kfs	Glauconite--Glt	Inclustion---Inc
	Siltstone---Slst	Plagioclase--Pl	Chlorite--Chl	Coated Grain---Cg
	Mudstone---Mds	Microcline--Mc	Tourmaline--Tur	Ooid---Od
	Polycrystalline-Quartz ---PcQtz	Mica---Mica	Zircon--Zrn	Altered---Alt
		Biotite--Bt	Ilmanite--Ilm	Composite---Comp
	Metamorphic---Meta	Muscovite--Ms	Pyrite--Py	Brown mass---Brm
		Calcite--Cal	Garnet--Grt	Opaques---Opq
		Staurolite--St	Monazite--Mnz	
		Quartz--Qtz		

Appendix 2: Identified minerals and descriptions of clasts in "heavy mineral" samples.

Depth	Identified	Clast descriptions/cuttings	Notes/Comments
3165.04 F	Pl, Kfs, Chl, Glt, Bt, Tur, Cg/Od	**1**-Clt-Mds. **3**-Clt-Qtz, Chl, Brm. **4**-Clt-Glt. **6**-Clt-Slst, Qtz, Fds. **7**-Clt-Slst. **10**-Clt-Kfs, Brm. **12**-Clt-Alt-Kfs, Glt. **14**-Clt-Mds, Glt. **15**-Clt-Chl, Fds. **17**-Clt-Chl, Qtz, Brm.	Core. Could not determine where #4 was pointing. Grains on lines 8 and 10 were thick. No Grt found
Heavy Mineral Mounts			
2554.22 F	Tur, Grt, Alt Mica, Glt	**2**-Clt-Qtz, Brm, Opq **4**-Clt-Mds	Heavy Mineral Mount No Fds, or Chl found.
2633.49- 2639.57 F	Kfs, Tur, Glt	**2**-Clt-Volc-Qtz, Cal, Brm. **3**-Clt-Volc. **4**-Clt-x3--(1)Qtz. (2)Qtz, Fds. (3)Zrn, Cal, Brm. **6**-Clt-Slst. **9**-Clt x4-(1-4)Slst, Qtz, Cal.	Heavy Mineral Mount No Chl, Grt, or Mica found.
2651.76- 2659.86 F	Tur, Zrn, St or Cal, Kfs	**2**-Clt-Qtz, Brm. **3**-Clt-x2-(1)Qtz, Kfs. (2)Cal, Qtz, Brm. **7**-Clt-Qtz, Cal, Brm. **8**-Clt-x2-(1-2)Qtz, Cal, Brm.	Heavy Mineral Mount No Grt, Glt, Chl, or Mica found.
2705.67- 2712.72 F	Tur, Grt, Kfs, Pl, Mc	**11**-Clt-x3-(1-3)Slst. **13**-Clt-x3-(1-3)Qtz, Slst.	Heavy Mineral Mount No Mica, Chl, Glt found.

Abbreviations	Clasts	Minerals	Minerals	Others
	Clast---Clt	Feldspar/Feldspathic--Fds	Sericite---Ser	Cement---Ct
	Volcanic---Volc	K-Feldspar--Kfs	Glauconite--Glt	Inclustion---Inc
	Siltstone---Slst	Plagioclase--Pl	Chlorite--Chl	Coated Grain---Cg
	Mudstone---Mds	Microcline--Mc	Tourmaline--Tur	Ooid---Od
	Polycrystalline-Quartz ---PcQtz	Mica---Mica	Zircon--Zrn	Altered---Alt
		Biotite--Bt	Ilmanite--Ilm	Composite---Comp
	Metamorphic---Meta	Muscovite--Ms	Pyrite--Py	Brown mass---Brm
		Calcite--Cal	Garnet--Grt	Opaques---Opq
		Staurolite--St	Monazite--Mnz	
		Quartz--Qtz	Rutile--RT	

Appendix 2: Identified minerals and descriptions of clasts in "heavy mineral" samples.

Depth	Identified Minerals	Clast descriptions/cuttings	Notes/Comments
2935.22- 2938.27 F	Tur, Bt, Comp-Zrn, Grt, Ilm, Kfs	**2**-Clt-Slst. **3**-Clt-Qtz, Opq. **7**-Clt-x5-(1)Qtz, Fds, Opq. (2)Qtz, Fds, Opq (3)Qtz, Fds, Opq (4)Qtz, Fds, Opq (5)Qtz, Fds, Opq **8**-Clt-x3-(1)Qtz, Fds, Opq. (2)Mds (3)Qtz, Fds, Opq **10**-Clt-x4-(1)Fds, Brm (2)Cal, Brm (3)Qtz, Brm, Opq (4)Qtz, Fds, Opq **12**-Clt-x3-(1)Qtz, Fds, Brm, Opq (2)Qtz, Fds, Brm, Opq (3)Fds, Opq **13**-Clt-x3-(1)Qtz, Fds, Opq. (2)Cal, Brm (3)Cal, Brm **14**-Clt-x5-(1)Qtz, Fds. (2)Qtz, Fds, Opq (3)Qtz, Fds, Opq (4)Brm (5)Qtz, Fds, Opq	Heavy Mineral Mount No Chl, Glt found.
2980.94- 2987.04 F	Py, Bt, Tur		Heavy Mineral Mount The grains are too think to identify. No Clt, Chl, Fds, Grt found.
2999.23- 3005.33 F	Cg/Od, Tur, Fds, Cal, Alt-Bt	**1**-Clt-Qtz, Brm, Opq. **2**-Clt-x2-(1-2)Qtz, Brm, Alt-Bt. **3**-Clt-Cal, Brm. **5**-Clt-x2-(1)Qtz, Brm. (2)Cal, Brm. **7**-Clt-Cal, Qtz, Brm. **9**-Clt-Qtz, Brm. **10**-Clt-x2-(1)Fds. (2)PcQtz **11**-Clt-x2-(1-2)Qtz, Brm.	Heavy Mineral Mount The grains are too think to identify. No Clt, Chl, Grt found.
3017.52- 3023.62 F	Fds, Qtz, Zrn, Ca	**1**-Clt-Qtz, Cal **2**-Clt-Qtz, Fds. **4**-Clt, PcQtz.	Heavy Mineral Mount Sulphides and Oxides are abundant. Grains are too thick to identify. No Tur, Grt, Mica, Chl, Glt found.
3054.10 F	Fds, Qtz, Zrn, Cal	**1**-Clt-Qtz, Brm. **2**-Clt-Kfs, Brm. **3**-Clt-x3-(1-3)Qtz, Brm. **4**-Clt-x4-(1-4)Qtz, Brm. **5**-Clt-x2-(1-2)Qtz, Fds, Brm.	Heavy Mineral Mount Grains are too thick to identify. Blue Pb pollish contamination in the grains. No Tur, Grt, Mica Chl, Glt found.
3164.54 F	Py, Qtz, Zrn, Fds,	**1**-Clt-Qtz, Zrn, Fds, Opq. **2**-Clt-Qtz, Brm. **3**-Clt-x2-(1)Qtz, Brm. (2)Zrn, Fds, Brm. **4**-Clt-x3-(1)Qtz, Fds, Brm. (2)Qtz,Brm. (3)Qtz, Brm **5**-Clt-x2-(1)Zrn, Fds, Brm, (2)Zrn, Qtz, Opq **6**-Clt-x2-(1)Qtz, Py, Brm. (2)Zrn, Fds, Opq.	Heavy Mineral Mount Grains are too thick to identify. Blue Pb pollish contamination in the grains. Rusty orange alteration-probably pyrite being altered. No Tur, Mica, Chl, Glt, Grt found.

Abbreviations	Clasts	Minerals	Minerals	Others
	Clast---Clt	Feldspar/Feldspathic--Fds	Sericite---Ser	Cement---Ct
	Volcanic---Volc	K-Feldspar--Kfs	Glauconite--Glt	Inclusion---Inc
	Siltstone---Slst	Plagioclase--Pl	Chlorite--Chl	Coated Grain---Cg
	Mudstone---Mds	Microcline--Mc	Tourmaline--Tur	Ooid---Od
	Polycrystalline-Quartz ---PcQtz	Mica---Mica	Zircon--Zrn	Altered---Alt
		Biotite--Bt	Ilmanite--Ilm	Composite---Comp
	Metamorphic---Meta	Muscovite--Ms	Pyrite--Py	Brown mass---Brm
		Calcite--Cal	Garnet--Grt	Opaques---Opq
		Staurolite--St	Monazite--Mnz	
		Quartz--Qtz	Rutile--RT	

Appendix 2: Identified minerals and descriptions of clasts in "heavy mineral" samples.

Depth	Identified Minerals	Clast descriptions/cuttings	Notes/Comments
3157.72- 3163.82 F	Py, Tur, Kfs, Grt, Cal, Zrn	**1**-Clt-Qtz, Py, Opq. **2**-Clt-Qtz, Py, Opq. **3**-Clt-x3-(1)Qtz, Brm. (2)Qtz, Py, Opq. (3)Qtz, Py. **4**-Clt-x3-(1-3)Qtz, Opq. **5**-Clt-Py, Qtz, Brm. **6**-Clt-Qtz, Brm, Fds. **7**-Clt-x2-(1-2)Qtz, Opq. **8**-Clt-x3-(1)Qtz, Py, Brm, Opq. (2)Qtz, Opq, Brm. (3)Qtz, Opq **9**-Clt-x2-(1-2)Qtz, Brm. **11**-Clt-x3-(1)Qtz, Brm. (2)Qtz, Opq, Py. (3)Qtz, Brm. **12**-Clt-x2-(1)Cal, Py, Qtz, (2)Qtz, Brm, Possibly Grt **13**-Clt-Qtz, Brm, Zrn. **14**-Clt-x3-(1)Qtz, Brm, Py, Opq (2)Qtz, Brm, Py, Opq (3)Qtz, Brm, Zrn, Opq **15**-Clt-x2(1)Qtz, Zrn, Brm, Opq. (2)Qtz, Kfs, Brm, Zrn, Opq	Heavy Mineral Mount Grains are too thick to identify. Blue Pb pollish contamination in the grains. No Chl, Glt, Mica found.
3176.02- 3187.11 F	Tur, Qtz, Zrn, Py Cal, Chl	**1**-Clt-Zrn, Qtz, Opq. **2**-Clt-x3-(1)Cal, Zrn, Qtz, Opq. (2)Cal, Qtz, Brm, Opq (3)Cal, Qtz, Opq **3**-Clt-x2-(1)Cal, Brm, Opq (2)Cal, Qtz, Opq **4**-Clt-x3-(1)Qtz, Zrn, Opq (2)Zrn, Opq (3)Cal, Qtz, Zrn, Py, Opq **5**-Clt-x2-(1)Zrn, Qtz, Opq (2)Qtz, Opq, Brm **6**-Clt-x3-(1)Qtz, Cal, Brm, Opq (2)Cal, Opq (3)Cal, Qtz, Zrn, Opq	Heavy Mineral Mount Grains are too thick to identify. Blue Pb pollish contamination in the grains. No Glt, Grt, Mica, Fds found.
3236.98 F	Zrn, Qtz, Mnz	**1**-Clt-Zrn, Brm **2**-Clt-Zrn, Qtz, Brm, Opq **3**-Clt-Zrn, Qtz, Opq **4**-Clt-Zrn, Mnz	Heavy Mineral Mount Grains are too thick to identify. Blue Pb pollish contamination in the grains. No Tur, Grt, Mica, Chl, Glt, Fds found.

Abbreviations	Clasts	Minerals	Others
	Clast---Clt Volcanic---Volc Siltstone---Slst Mudstone---Mds Polycrystalline-Quartz ---PcQtz Metamorphic---Meta	Sericite---Ser Glauconite--Glt Chlorite--Chl Tourmaline--Tur Zircon--Zrn Ilmanite--Ilm Pyrite--Py Garnet--Grt Monazite--Mnz Rutile--RT	Cement---Ct Inclustion---Inc Coated Grain---Cg Ooid---Od Altered---Alt Composite---Comp Brown mass---Brm Opaques---Opq

Appendix 2: Identified minerals and descriptions of clasts in "heavy mineral" samples.

Depth	Identified Minerals	Clast descriptions/cuttings	Notes/Comments
3261.36- 3267.46 F	Tur, Glt, Grt, Qtz, Cal, Zrn, Fds, Py	**2**-Clt-x2-(1)Glt. (2)Qtz, Brm, Opq **3**-Clt-Qtz, Brm, Opq **4**-Clt-x4-(1)Qtz, Cal, Zrn, Opq (2)Fds, Zrn, Qtz, Opq (3)Zrn, Brm (4)Qtz, Zrn, Grt, Py, Fds, Opq **5**-Clt-Zrn, Qtz, Opq	Heavy Mineral Mount Grains are too thick to identify. Blue Pb pollish contamination in the grains. No Mica, Chl found.
3267.16- 3273.55 F	Qtz, Fds, Zrn, Py Cal, Tur, Ilm	**1**-Clt-Qtz, Fds, Zrn, Brm, Opq **2**-Clt-Cal, Qtz, Zrn, Brm, Ilm, Opq **3**-Clt-x2-(1)Qtz, Opq (2)Qtz, Fds, Brm, Opq **4**-Clt-x2-(1)Zrn, Opq (2)Zrn, Qtz, Opq **5**-Clt-x3-(1)Cal, Qtz, Ilm, Opq (2)Cal, Qtz, Brm, Opq (3)Cal, Brm, Opq **6**-Clt-x3-(1)Zrn, Qtz, Cal, Py , Brm, Opq (2)Zrn, Qtz, Opq (3)Cal, Py, Opq **7**-Clt-x4-(1)Qtz, Cal, Opq (2)Qtz, Brm (3)Zrn, Cal, Opq (4)Cal, Opq	Heavy Mineral Mount Grains are too thick to identify. Blue Pb pollish contamination in the grains. No Mica, Chl, Grt, Glt found.
3273.55- 3279.65 F	Py, Tur, Zrn, Cal, Kfs, Qtz	**2**-Clt-Mds **3**-Clt-Tur, Zrn, Cal, Kfs, Py, Brm **4**-Clt-x3-(1)Py, Qtz, Zrn, Opq (2)Cal, Py, Opq (3)Qtz, Py **5**-Clt-x3-(1)Mds, Qtz (2)Py, Qtz, Cal, Zrn (3)Cal **6**-Clt-x3-(1)Py, Qtz, Zrn (2)Py, Cal, Zrn (3)Py, Mds **7**-Clt-x3-(1)Py, Qtz, Zrn, Kfs (2)Py, Qtz, Zrn, Kfs (3)Py, Cal, Zrn.	Heavy Mineral Mount Grains are too thick to identify. No Mica, Chl, Grt, Glt found.
3297.94- 3304.03 F	Too Thick to identify anything.	Too Thick to identify anything.	Heavy Mineral Mount Grains are too thick to identify. Blue Pb pollish contamination in the grains. No Mica, Chl, Grt, Glt, Tur, Kfs found.

Abbreviations	Clasts	Minerals	Minerals	Others
	Clast---Clt	Feldspar/Feldspathic--Fds	Sericite---Ser	Cement---Ct
	Volcanic---Volc	K-Feldspar--Kfs	Glauconite--Glt	Inclusion---Inc
	Siltstone---Slst	Plagioclase--Pl	Chlorite--Chl	Coated Grain---Cg
	Mudstone---Mds	Microcline--Mc	Tourmaline--Tur	Ooid---Od
	Polycrystalline-Quartz ---PcQtz	Mica---Mica	Zircon--Zrn	Altered---Alt
		Biotite--Bt	Ilmanite--Ilm	Composite---Comp
	Metamorphic---Meta	Muscovite--Ms	Pyrite--Py	Brown mass---Brm
		Calcite--Cal	Garnet--Grt	Opaques---Opq
		Staurolite--St	Monazite--Mnz	
		Quartz--Qtz	Rutile--RT	

Appendix 2: Identified minerals and descriptions of clasts in "heavy mineral" samples.

Depth	Identified Minerals	Clast descriptions/cuttings	Notes/Comments
3304.03- 3310.03 F	Tur, Grt, Fds, Zrn Qtz	**1**-Clt-Qtz, Pl, Zrn, Brm **2**-Clt-Qtz, Pl, Brm, Opq **3**-Ctl-Tur, Opq **4**-Clt-x2-(1)Qtz, Opq (2)Qtz, Opq **5**-Clt-x3-(1)Qtz, Brm, Opq (2)Qtz, Fds, Brm, Opq (3)Qtz, Opq **7**-Clt-x2-(1)Qtz, Opq (2)Qtz, Opq.	Heavy Mineral Mount Grains are too thick to identify. Blue Pb pollish contamination in the grains. No Mica, Chl, Glt found.
3368.04 F	Py, Tur, Cal, Qtz Fds, (Zrn, Mnz, or And)	**2**-Clt-x2-(1)Qtz, Py, Opq (2)Cal, Qtz, Opq **3**-Clt-Cal, Opq **4**-Clt-Py, (Zrn, Mnz or And) **5**-Clt-Qtz, Fds, Brm, Py, Opq **7**-Clt-x2-(1)Qtz, Py, Opq (2)Qtz, Py, Opq. **8**-Clt-Slst with Cal **9**-Clt-Cal, Opq **10**-Clt-Cal, Opq	Heavy Mineral Mount Grains are too thick to identify. Blue Pb pollish contamination in the grains. No Mica, Chl, Glt Grt found.
3453.38 F	Qtz, Cal	**1**-Clt-Qtz, Opq **2**-Clt- Qtz, Cal, Brm **3**-Clt-Qtz, Cal, Brm	Heavy Mineral Mount Grains are too thick to identify. Blue Pb pollish contamination in the grains. No Mica, Chl, Glt Grt, Tur, Fds found.
3403.01- 3496.06 F	Glt, Qtz, Py, Fds Zrn/Mnz, Tur	**1**-Clt-Glt **2**-Clt-Pcr Qtz **3**-Clt-x2-(1)Qtz, Brm (2)Mds **5**-Clt-Possibly Volc with Tur, too thick to tell **6**-Clt-x2-Qtz, Brm,Opq **7**-Clt-x4(1)Mds,Qtz, Cal, Mnz/Zrn (2)Py, Qtz, Mnz/Zrn (3)Mds (4)Py, Qtz, Opq **8**-Clt-Qtz, Opq **9**-Clt-Possibly Volc with Qtz **10**-Clt-Cal, Qtz, Brm, Opq	Heavy Mineral Mount Grains are too thick to identify. No Mica, Chl, Grt found.
2554.22 C	Zrn, Qtz, Fds, Pl Cal,	**1**-Clt-Zrn, Qtz, Fds, Opq **2**-Clt-x2-(1)Mds, Qtz, Opq (2)Mds, Qtz, Zrn, Opq **3**-Clt-x2-(1)Mds, Qtz, Zrn, Opq (2)Mds, Qtz, Opq **4**-Clt-x2-(1)Mds, Qtz, Pl, Cal,Opq (2)Mds, Qtz, Zrn, Opq **5**-Clt-Qtz, Mds, Opq **6**-Clt-Mds, Qtz, Cal, Opq **7**-Clt-Qtz, Zrn, Mds	Not Coated Heavy Mineral Mount Grains are too thick to identify. No Mica, Chl, Grt, Tur, Glt found.

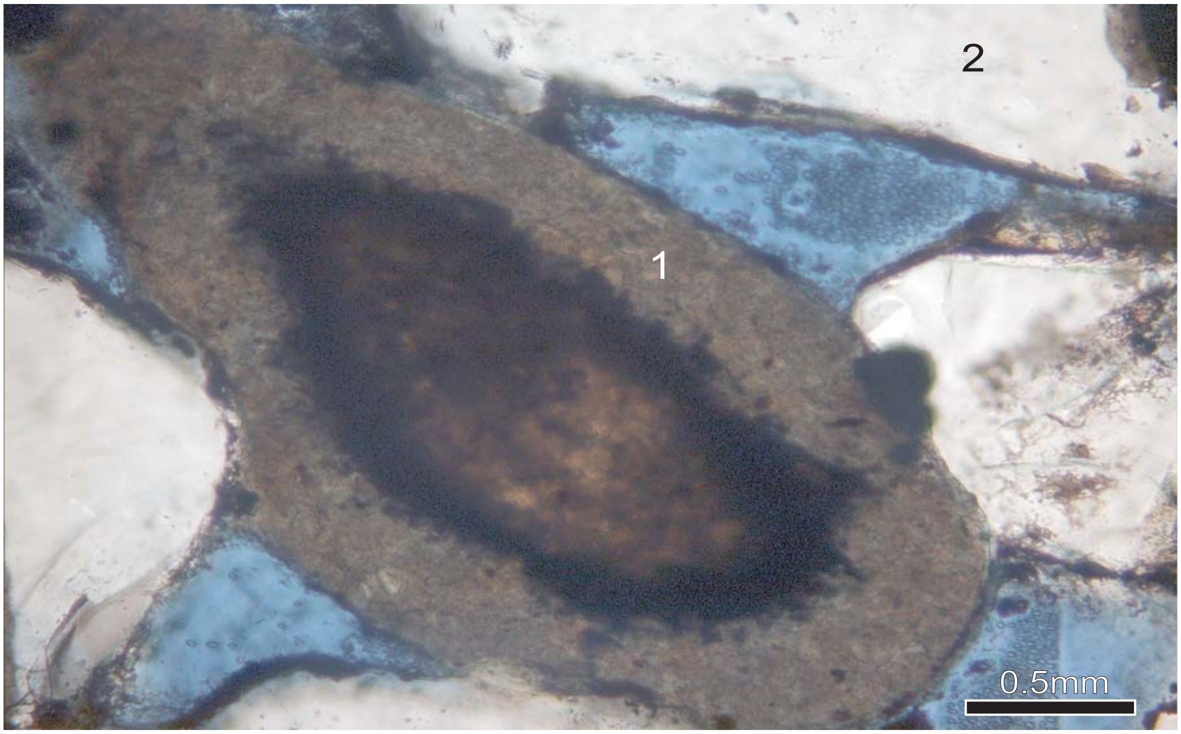
Abbreviations	Clasts	Minerals	Minerals	Others
	Clast---Clt Volcanic---Volc Siltstone---Slst Mudstone---Mds Polycrystalline-Quartz ---PcQtz Metamorphic---Meta	Feldspar/Feldspathic--Fds K-Feldspar--Kfs Plagioclase--Pl Microcline--Mc Mica---Mica Biotite--Bt Muscovite--Ms Calcite--Cal Staurolite--St Quartz--Qtz	Sericite---Ser Glauconite--Glt Chlorite--Chl Tourmaline--Tur Zircon--Zrn Ilmanite--Ilm Pyrite--Py Garnet--Grt Monazite--Mnz Rutile--RT	Cement---Ct Inclustion---Inc Coated Grain---Cg Ooid---Od Altered---Alt Composite---Comp Brown mass---Brm Opaques---Opq

Appendix 2: Identified minerals and descriptions of clasts in "heavy mineral" samples.

Depth	Identified Minerals	Clast descriptions/cuttings	Notes/Comments
2651.76 C	Fds, Tur, Qtz, Cal Zrn/Mnz,	**1**-Clt-Alt Fds, Qtz, Opq **2**-Clt-Tur, Qtz, Opq **3**-Clt-Qtz, Tur, Zrn/Mnz, Opq **4**-Clt Cal, Tur, Opq **5**-Clt-Tur, Qtz, Opq	Heavy Mineral Mount Grains are too thick to identify. No Mica, Chl, Grt, Glt found.
3017.52 C	Cal, Tur, Qtz, Zrn	**1**-Clt-Cal, Tur, Qtz, Opq **2**-Clt-Qtz, Tur, Opq **3**-Clt-Qtz, Zrn, Opq **4**-Clt-Qtz, Tur, Opq	Heavy Mineral Mount Grains are too thick to identify. No Mica, Chl, Grt, Glt, Fds found.
3145.54 C	Qtz, Zrn, Tur, Fds	**1**-Clt-Qtz, Zrn, Tur, Opq **2**-Clt-Qtz, Zrn, Tur, Opq **3**-Clt-Qtz, Zrn, Opq **4**-Clt-Mds **5**-Clt-Qtz, Zrn, Fds, Opq **6**-Clt-Qtz, Zrn, Opq.	Heavy Mineral Mount Grains are too thick to identify. No Mica, Chl, Grt, Glt, found.
3236.98 C	Cal, Qtz, Zrn, Fds Pl,	**1**-Clt-Cal, Qtz, Zrn, Opq **2**-Clt-Qtz, Fds, Opq **3**-Clt-Qtz, Fds, Opq **4**-Clt-Pl, Qtz, Opq **5**-Clt-Cal, Qtz, Zrn, Opq **6**-Clt-Fds, Qtz, Opq **7**-Clt-Fds, Qtz, Opq	Heavy Mineral Mount Grains are too thick to identify. No Mica, Chl, Grt, Glt, Tur found.
3453.38 C	Qtz, Fds, Zrn, Pl Cal	**1**-Clt-PcQtz, Opq **2**-Clt-Qtz, Fds, Opq **3**-Clt-Qtz, Fds, Opq **4**-Clt-Qtz, Zrn, Opq **5**-Clt-Fds, Qtz, Cal, Opq **6**-Clt-Pl, Qtz, Opq	Heavy Mineral Mount Grains are too thick to identify. No Mica, Chl, Grt, Glt, Tur found.
3403.01 C	Zrn, Py, Fds,Qtz Cal, possibly Alt Mica	**1**-Clt-Zrn, Py, Opq **2**-Clt-Fds **3**-Clt-x2-(1)Qtz, Fds, Py, Opq (2)Qtz, Fds, Py, Opq **4**-Clt-Qtz, Cal, Opq, Possibly Alt Mica **5**-Clt-Qtz, Cal, Alt--Unknown	Heavy Mineral Mount Grains are too thick to identify. No, Chl, Grt, Glt, Tur found.

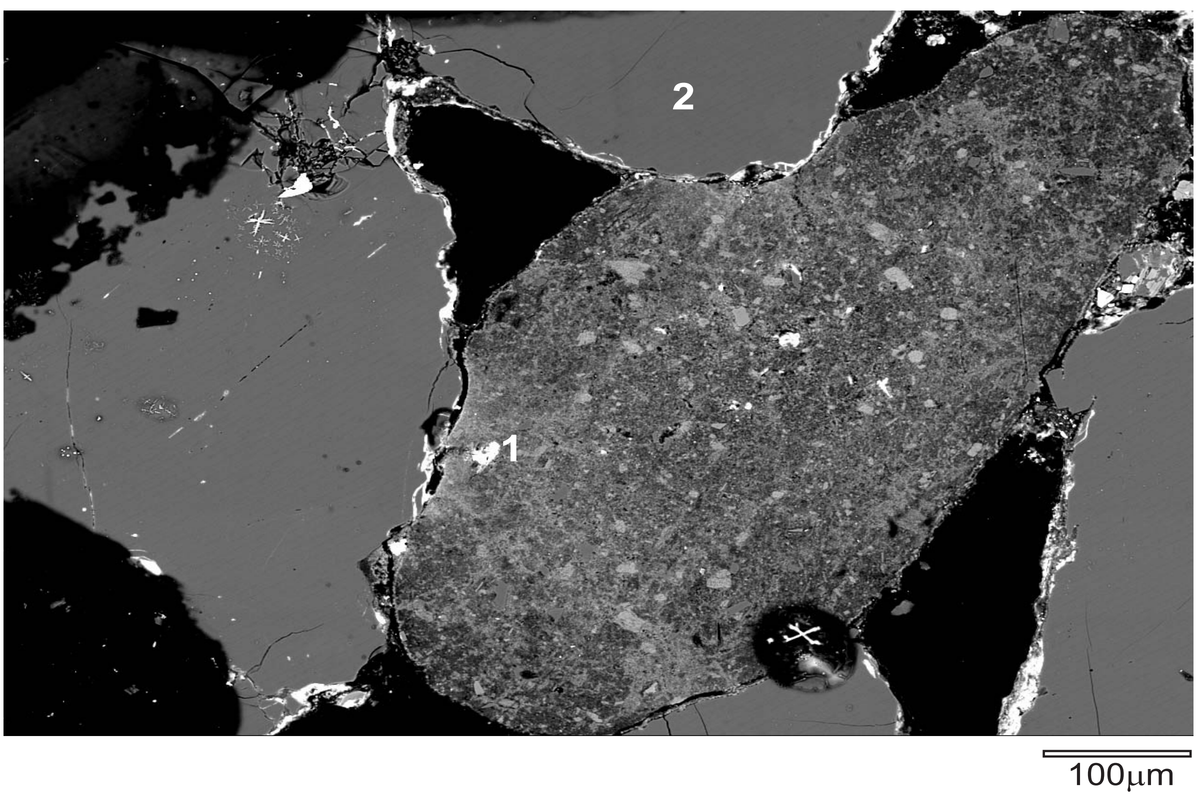
Abbreviations	Clasts	Minerals	Minerals	Others
	Clast---Clt	Feldspar/Feldspathic--Fds	Sericite---Ser	Cement---Ct
	Volcanic---Volc	K-Feldspar--Kfs	Glauconite--Glt	Inclustion---Inc
	Siltstone---Slst	Plagioclase--Pl	Chlorite--Chl	Coated Grain---Cg
	Mudstone---Mds	Microcline--Mc	Tourmaline--Tur	Ooid---Od
	Polycrystalline-Quartz ---PcQtz	Mica---Mica	Zircon--Zrn	Altered---Alt
		Biotite--Bt	Ilmanite--Ilm	Composite---Comp
	Metamorphic---Meta	Muscovite--Ms	Pyrite--Py	Brown mass---Brm
		Calcite--Cal	Garnet--Grt	Opaques---Opq
		Staurolite--St	Monazite--Mnz	
		Quartz--Qtz	Rutile--RT	

Appendix 3: Detailed Analysis of an Intraclast.



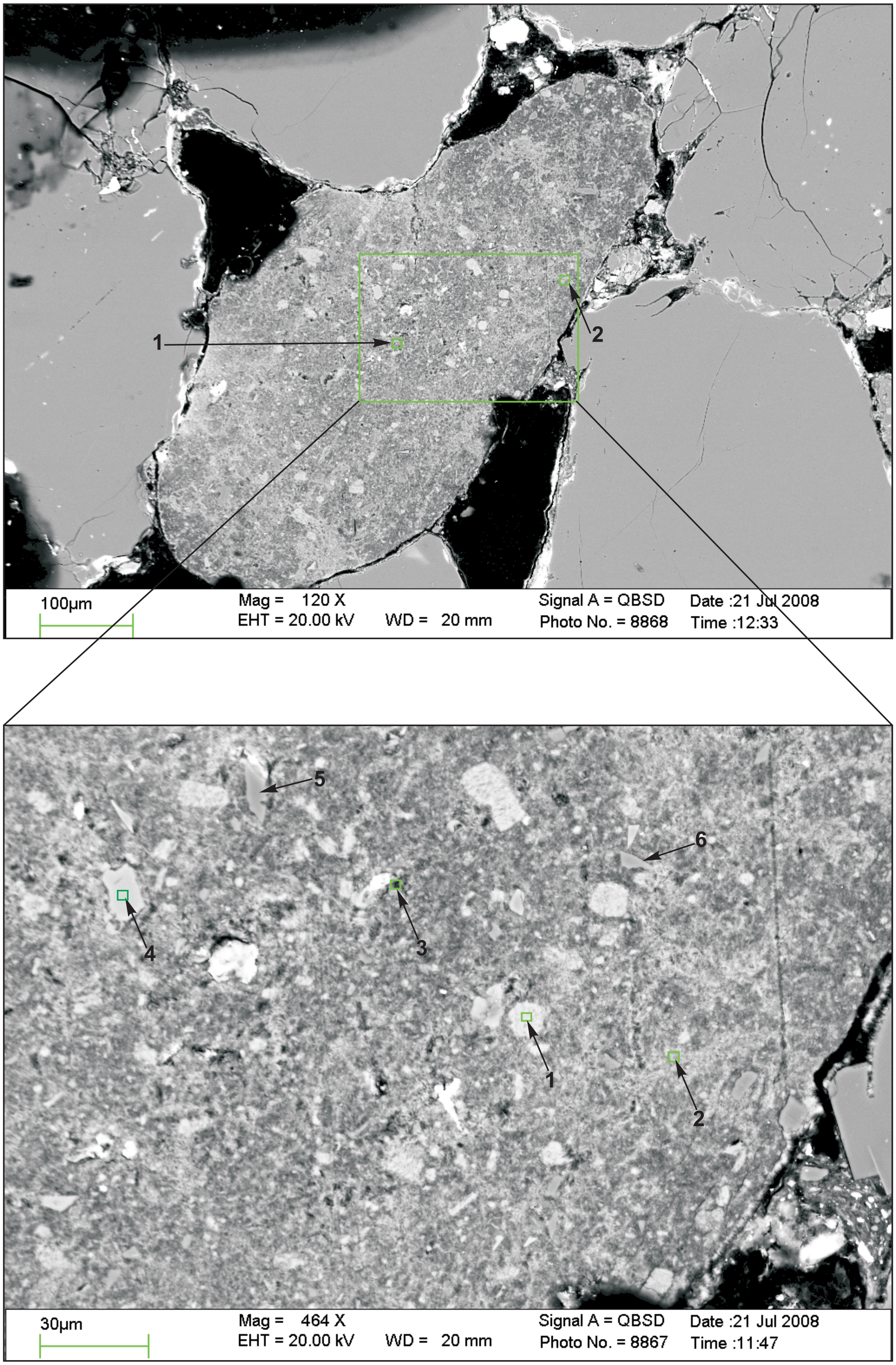
1. Chlorite
2. Quartz

Figure 1: 3162.76 m; Intraclast originally cemented by siderite, and with a rim that has been chloritized. Microphoto (PPL).



1. Chlorite
2. Quartz

Figure 2: 3162.76 m; Back-scattered electron image of the intraclast in Figure 1.



1. Chlorite + Feldspar + "Rutile".
2. Chlorite + Feldspar + "Rutile".

1: Chlorite + K-feldspar
2: Chlorite
3: Chlorite + Feldspar + Pyrite
4: K-feldspar
5, 6: Quartz

Figure 3: Detailed analysis of the intraclast in Figure 1.

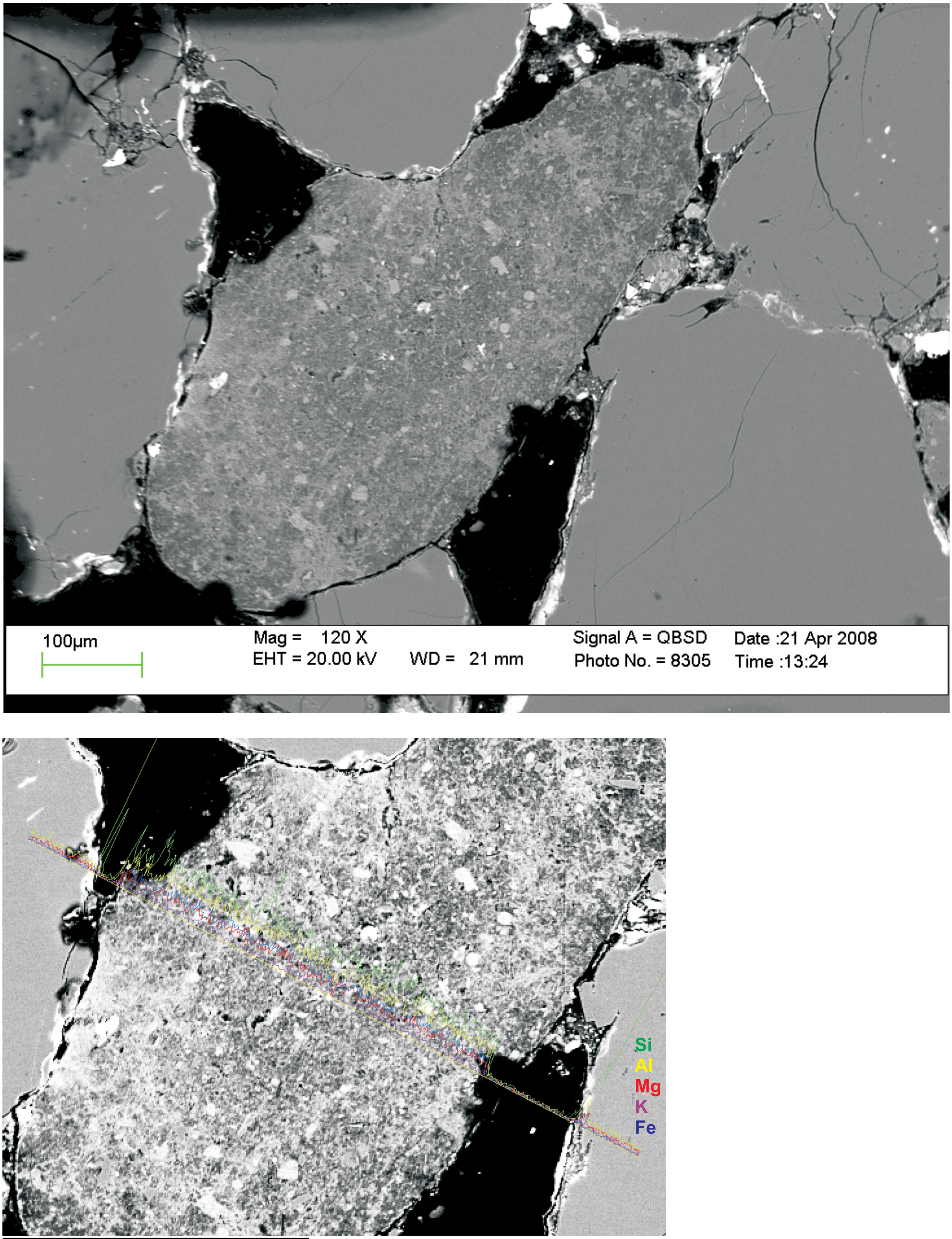
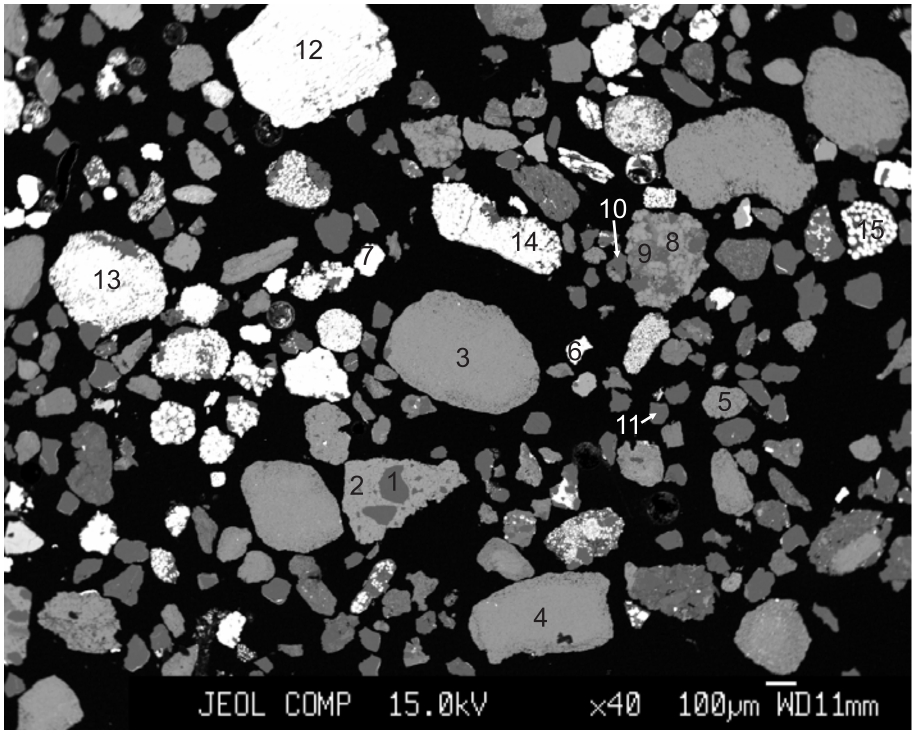


Figure 4: Backscatted electron image from SEM and EDS transect for various elements.

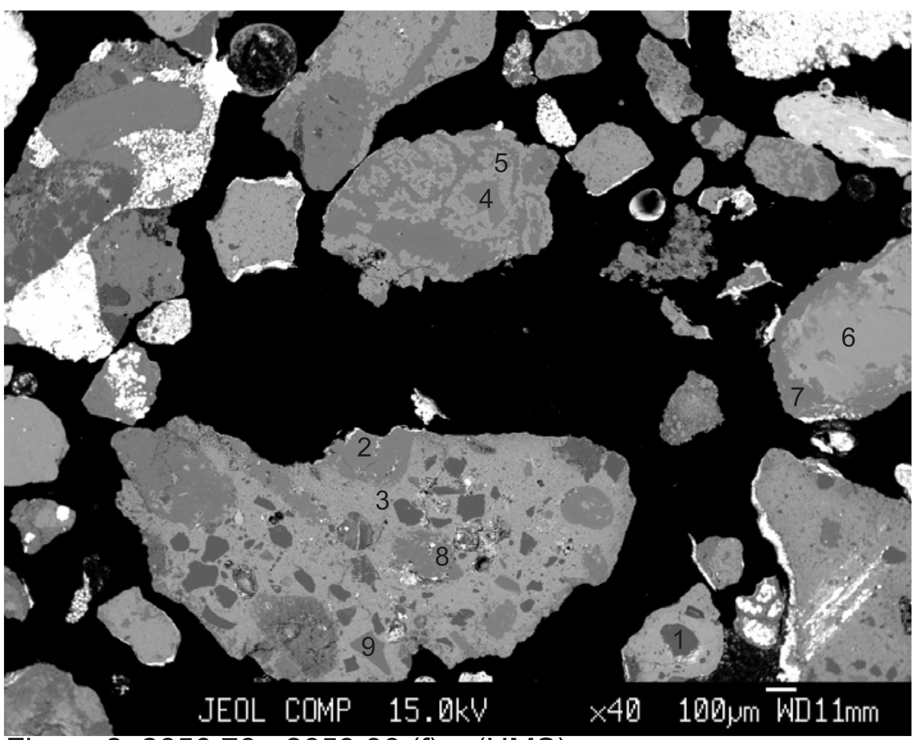
Appendix 4: Backscattered Electron (BSE) Images.



1. Quartz] Clast
2. Siderite
3. Siderite
4. Siderite
5. Siderite
6. Barite
7. Barite
8. Siderite
9. Fe-Calcite
10. Quartz
11. Quartz
12. Pyrite
13. Pyrite
14. Pyrite
15. Pyrite

Figure 1: 2633.47 (f)m (HMS)

Siderite ⟶ Calcite

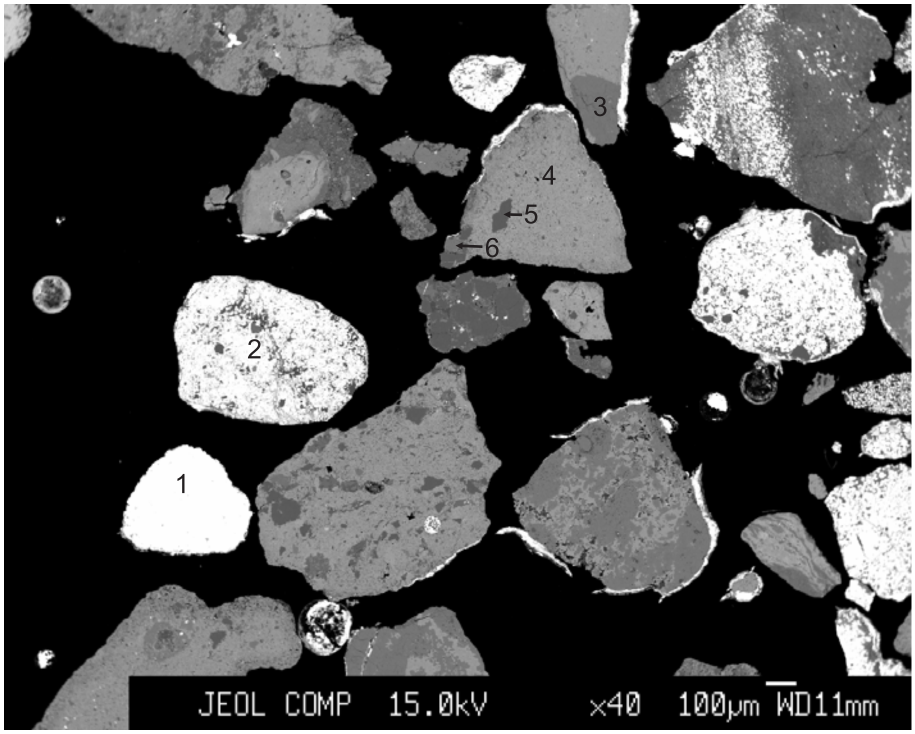


1. Fe-Calcite
2. Fe-Calcite
3. Siderite
4. Fe-Calcite
5. Ankerite
6. Siderite
7. Calcite
8. Hole
9. K-feldspar

Figure 2: 2656.76 - 2659.86 (f)m (HMS)

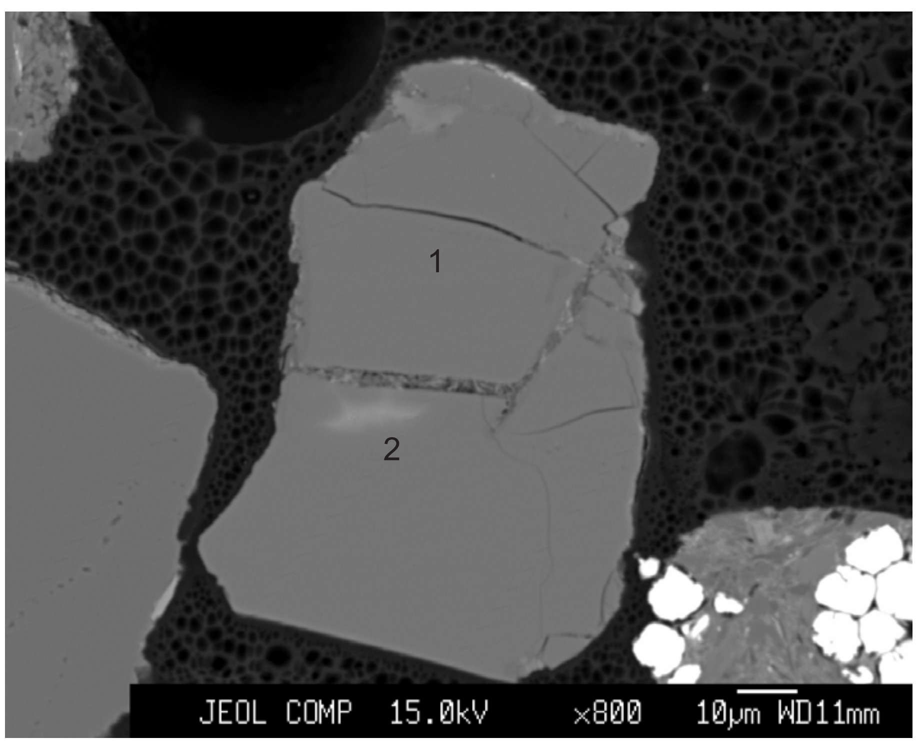
Siderite ⟶ Calcite ⟶ Ankerite

Note: f = fine fraction; c = coarse fraction; HMS = heavy mineral separate



1. Barite
2. Siderite
3. Fe-Calcite
4. Siderite + Quartz
5. Quartz
6. Calcite

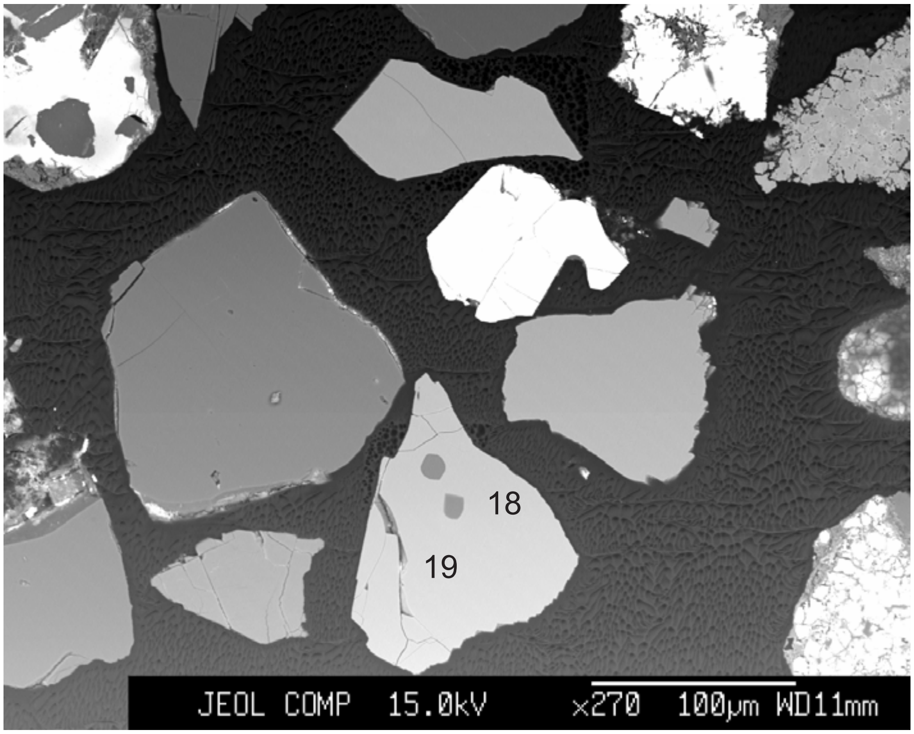
Figure 3: 2656.76 - 2659.86 (f)m (HMS)



1. Oligoclase
2. Oligoclase

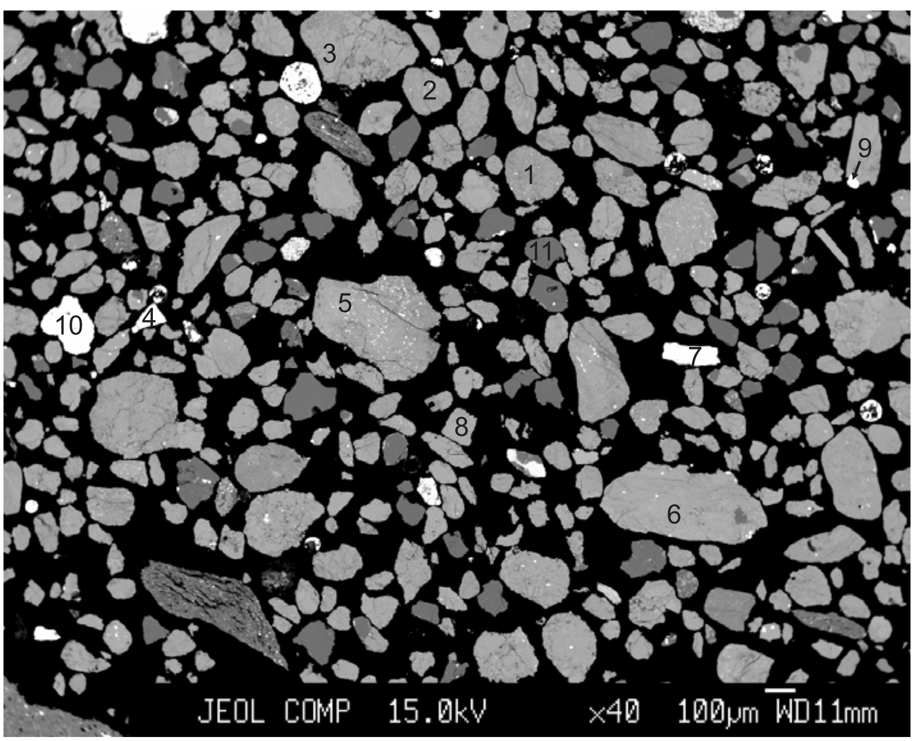
Figure 4: 2709.67 - 2712.72 m (HMS)

Note: f = fine fraction; c = coarse fraction; HMS = heavy mineral separate



18. Almandine
19. Almandine

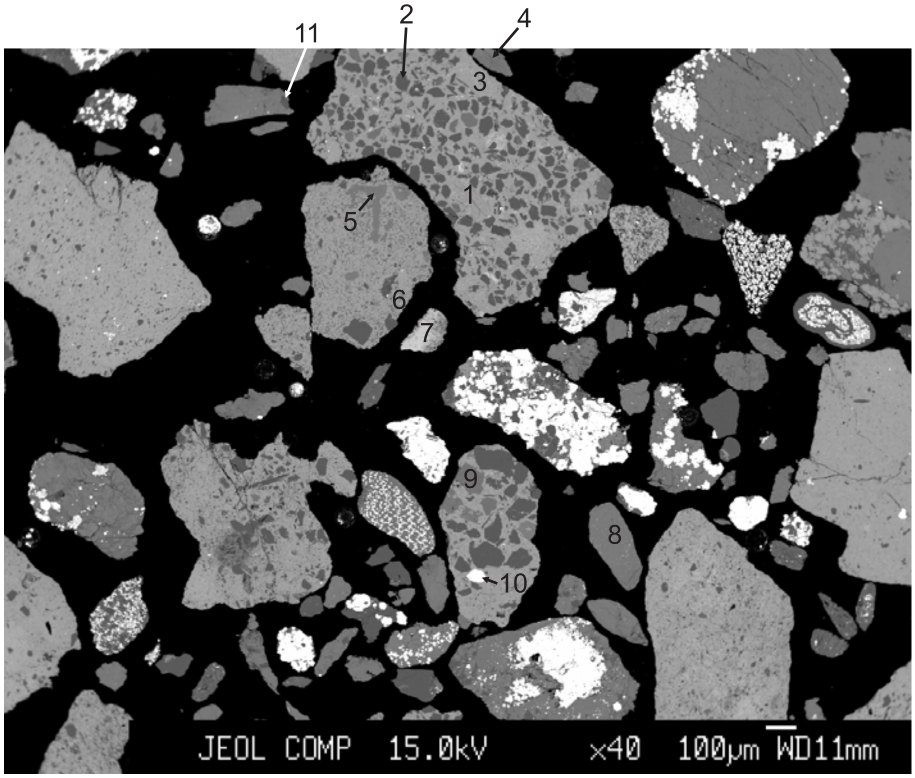
Figure 5: 2709.67 - 2712.72 m (HMS)



1. Calcite
2. Fe-Calcite
3. Calcite
4. Rutile
5. Calcite
6. Calcite
7. Siderite
8. Calcite
9. Zircon
10. Pyrite
11. Quartz

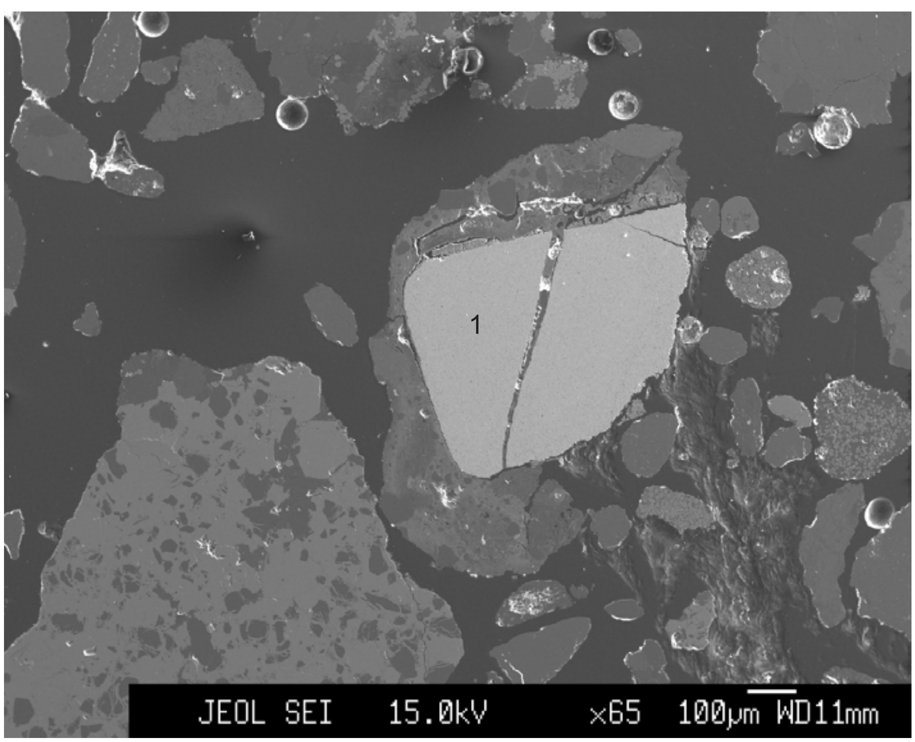
Figure 6: 2980.94 (f)m (HMS)

Note: f = fine fraction; c = coarse fraction; HMS = heavy mineral separate



1. Siderite
2. K-feldspar
3. Siderite
4. Calcite
5.Fe-Calcite
6. Siderite
7. Siderite
8. Calcite
9. K-feldspar
10. Zircon
11. K-feldspar

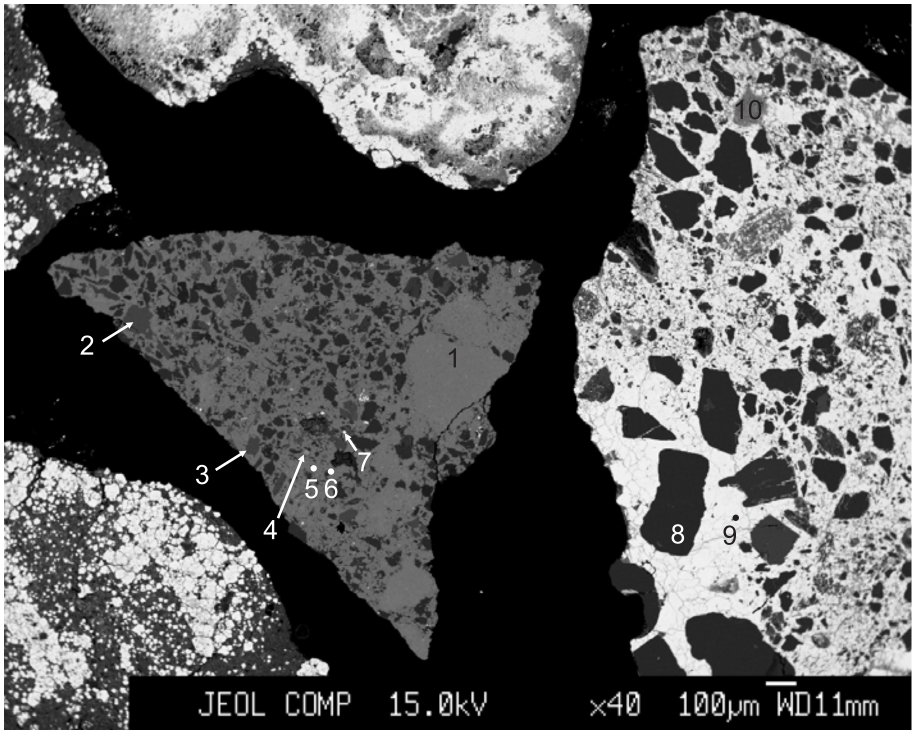
Figure 7: 3023.62 (f)m (HMS)



1. Tungstate ($-WO_3$)

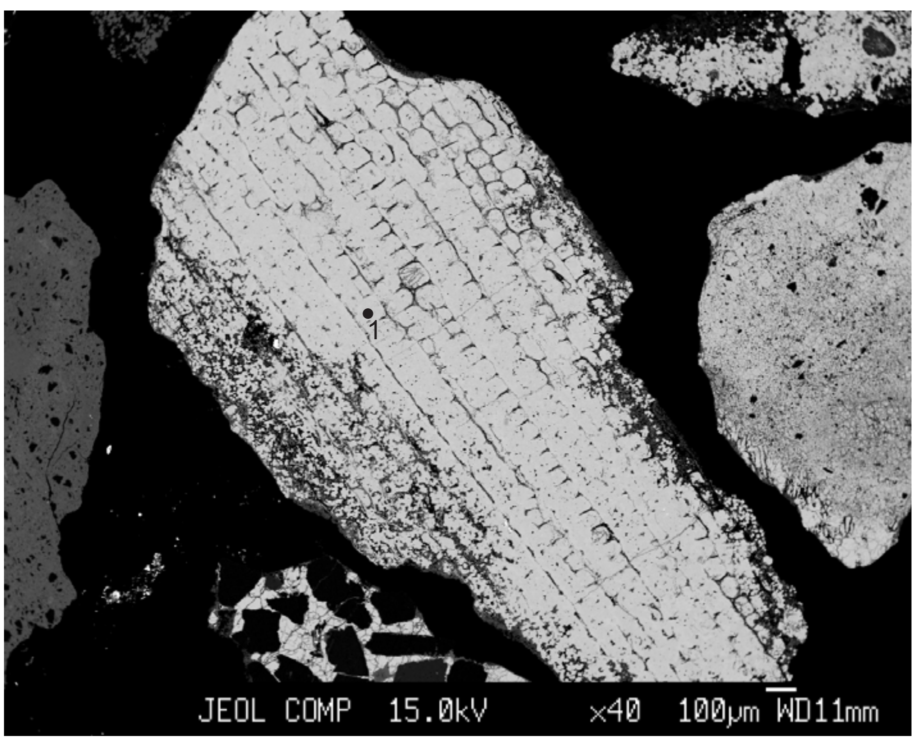
Figure 8: 3023.62 (f)m (HMS)

Note: f = fine fraction; c = coarse fraction; HMS = heavy mineral separate



1. Siderite
2. K-feldspar
3. K-feldspar
4. Rutile
5. Siderite
6. Chlorite
7. Zircon
8. Quartz
9. Pyrite
10. Siderite (?after K-feldspar)

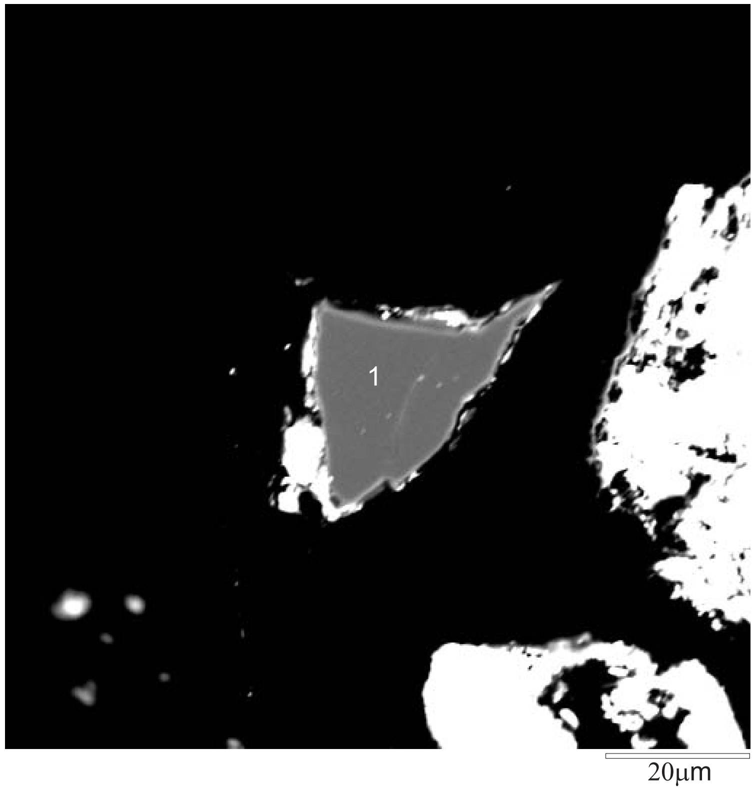
Figure 9: 3145.54 (c)m (HMS)



1. Pyrite

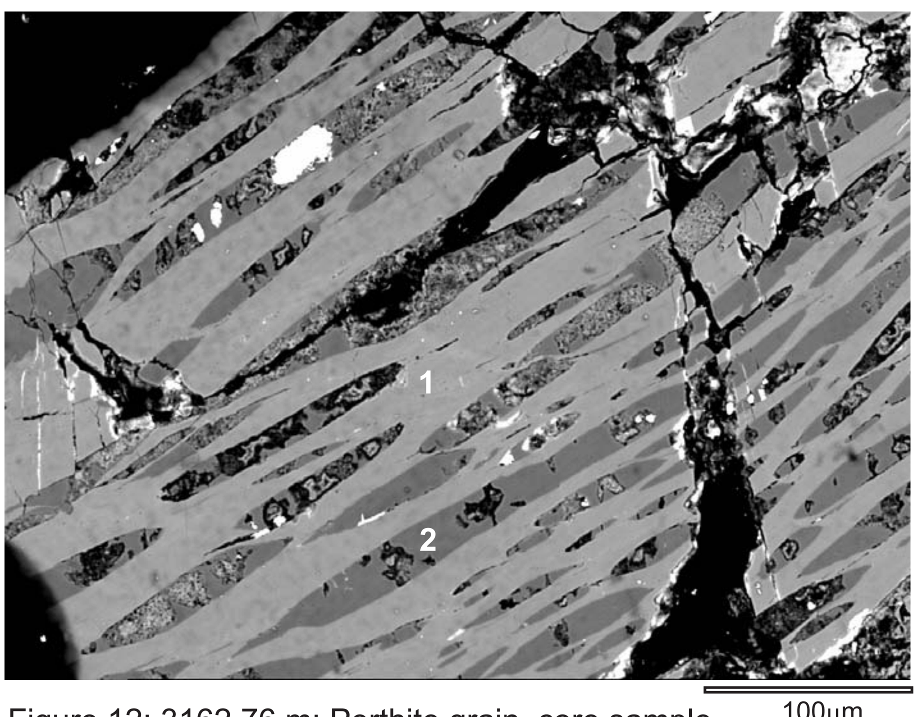
Figure 10: 3145.54 (c)m (HMS)

Note: f = fine fraction; c = coarse fraction; HMS = heavy mineral separate



1. Tourmaline

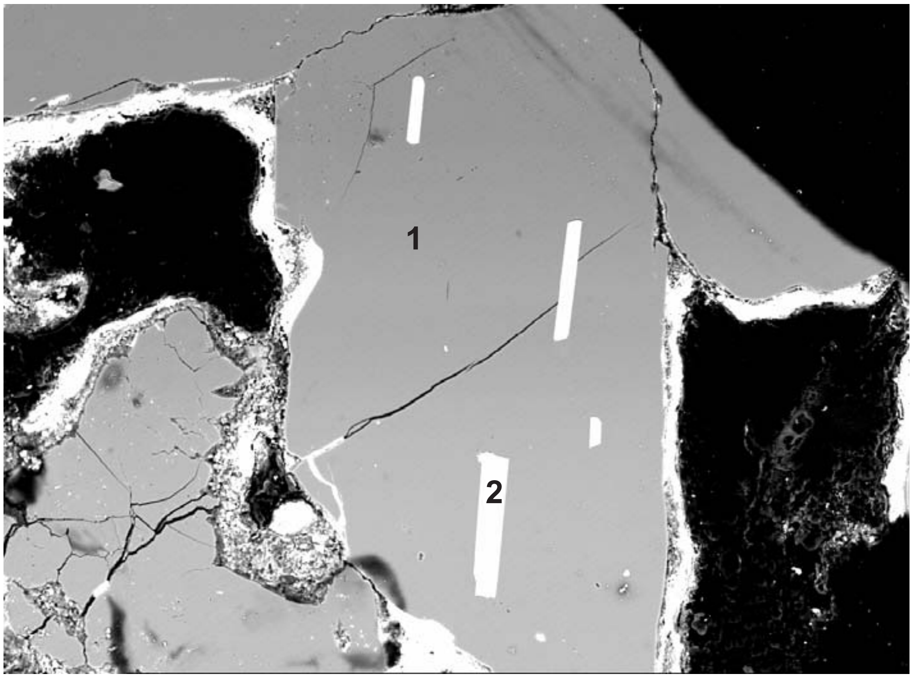
Figure 11: 3157.72 m; Tourmaline grain.



1. K-Feldspar
2. Albite

Figure 12: 3162.76 m; Perthite grain, core sample.

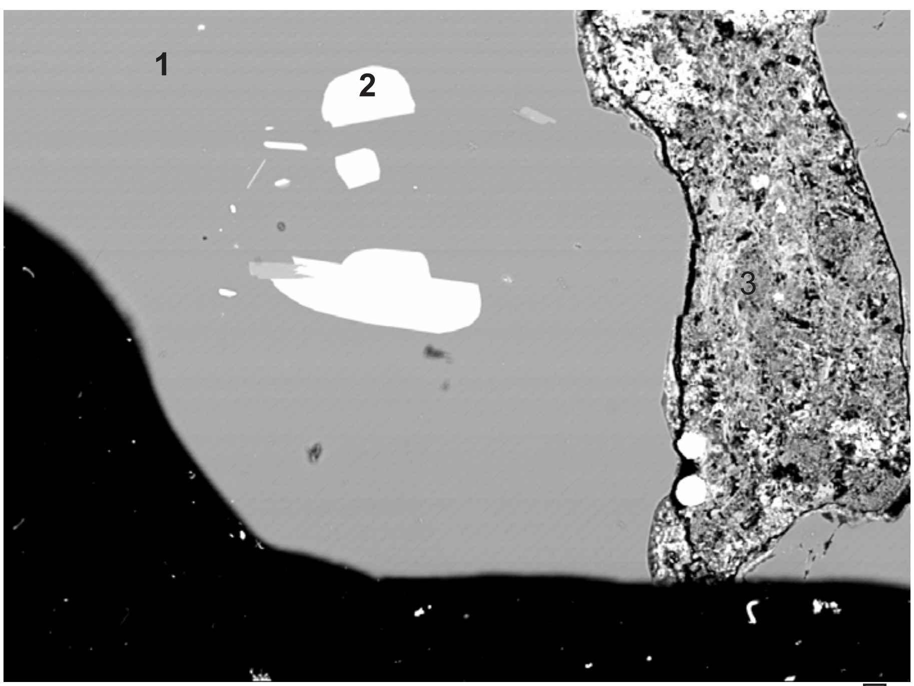
Note: f = fine fraction; c = coarse fraction; HMS = heavy mineral separate



1. Quartz
2. Biotite

Figure 13: 3162.76 m
Biotite inclusions within quartz grain, core sample.

100μm

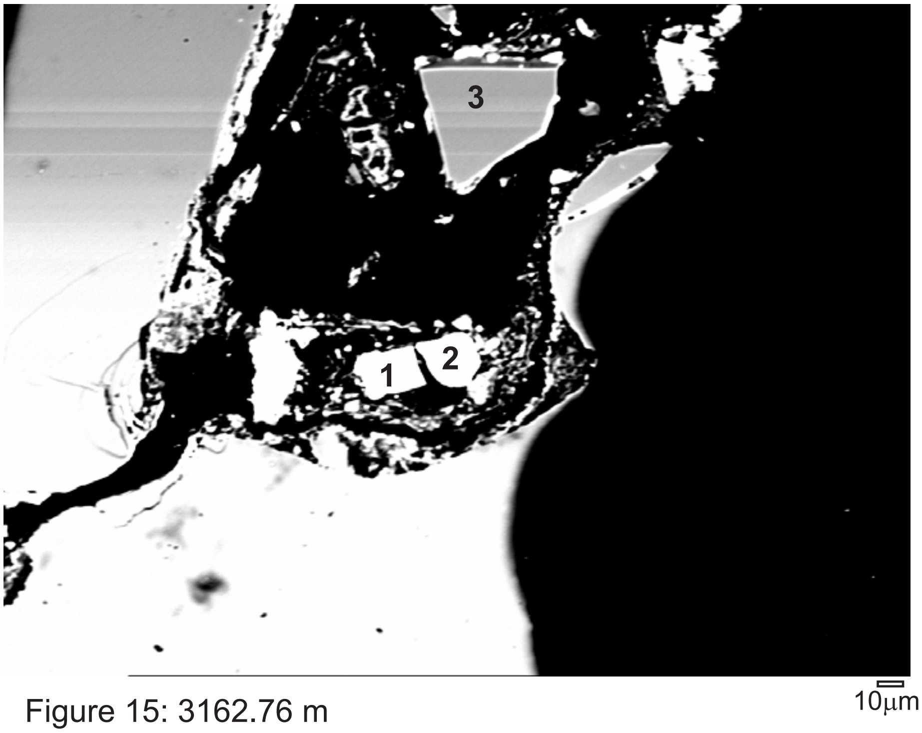


1. Quartz
2. Biotite
3. Fe-rich cement

Figure 14: 3162.76 m
Biotite inclusions within quartz grain, surrounded by Fe-rich cement.

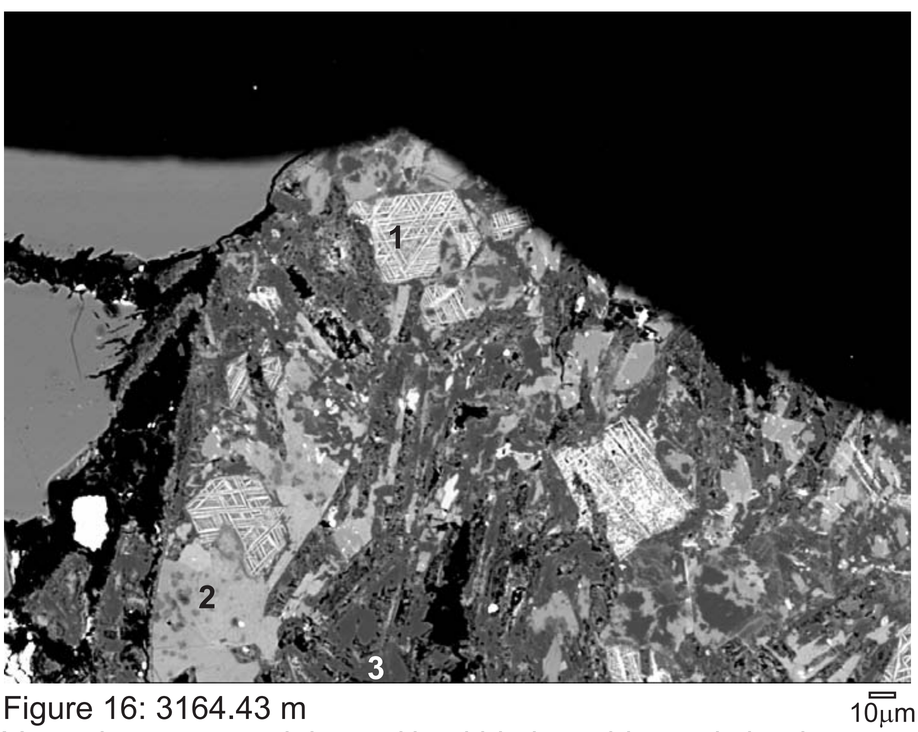
10μm

Note: f = fine fraction; c = coarse fraction; HMS = heavy mineral separate



1. Diagenetic Barite
2. Diagenetic Barite
3. Quartz

Figure 15: 3162.76 m
Diagenetic barite cement, core sample.



1. Rutilized Biotite
2. Albite
3. Chlorite

Figure 16: 3164.43 m
Volcanic clast containing rutilized biotite, albite and chlorite, core sample.

Note: f = fine fraction; c = coarse fraction; HMS = heavy mineral separate

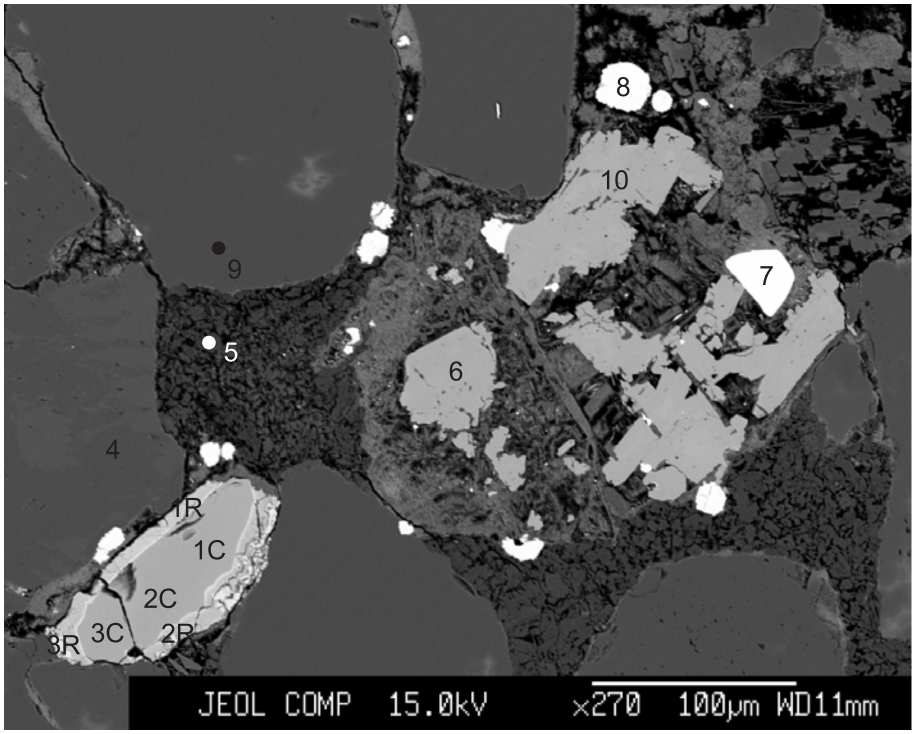


Figure 17: 3165.04 (f)m (HMS)

1,2,3 :Chromite
(R=rim; C=core)
4. Albite
5. Kaolinite
6. Rutile
7. Zircon
8. Pyrite
9. Quartz
10. Rutile

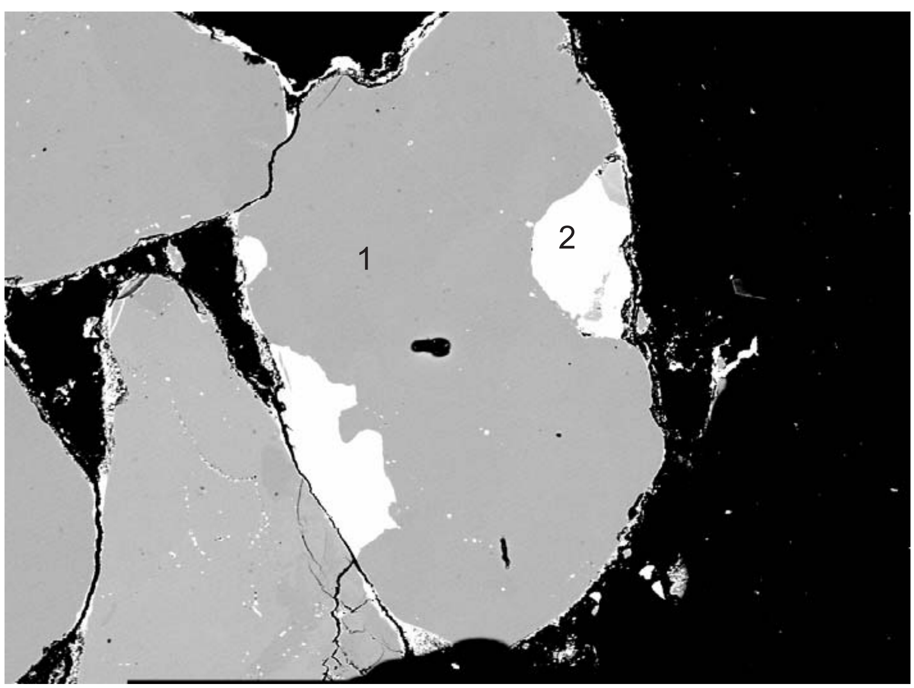
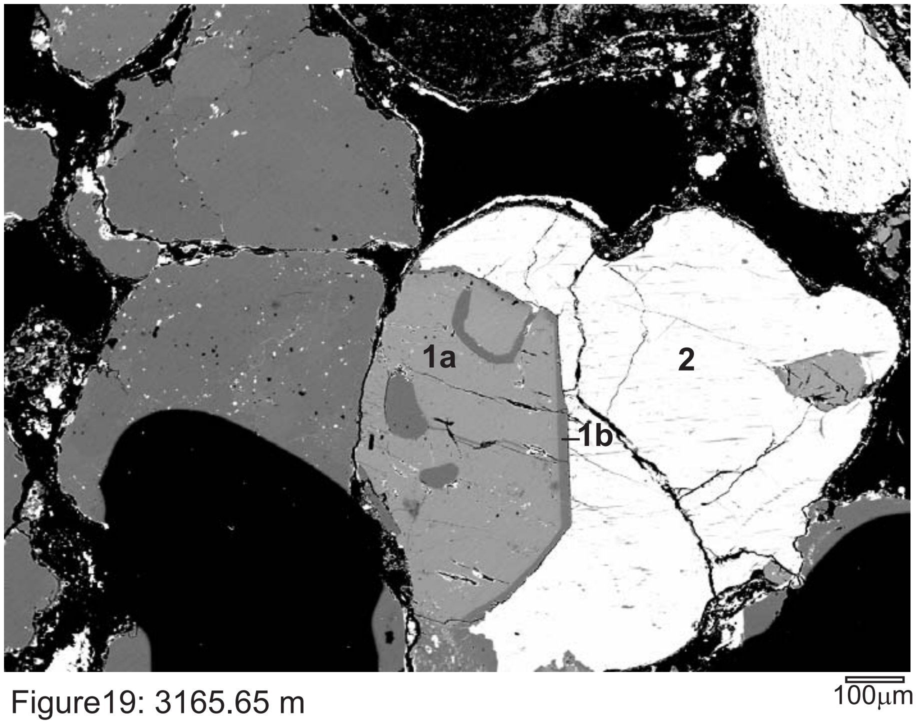


Figure 18: 3165.65 m
Granite clast.

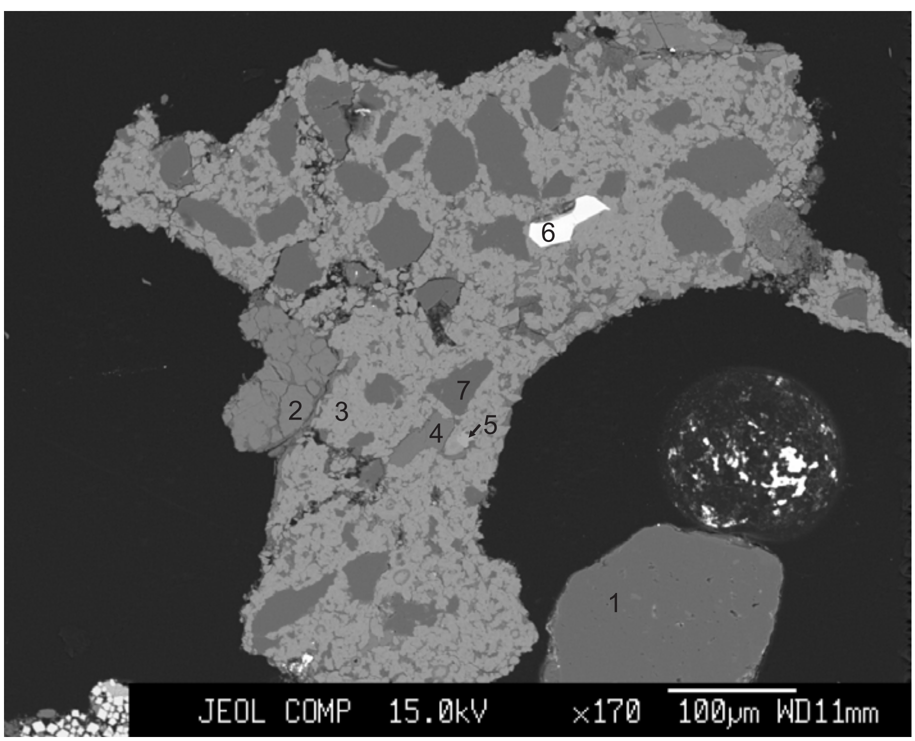
1. Quartz
2. K-feldspar

Note: f = fine fraction; c = coarse fraction; HMS = heavy mineral separate



1a. Quartz
1b. Quartz overgrowth
2. K-feldspar

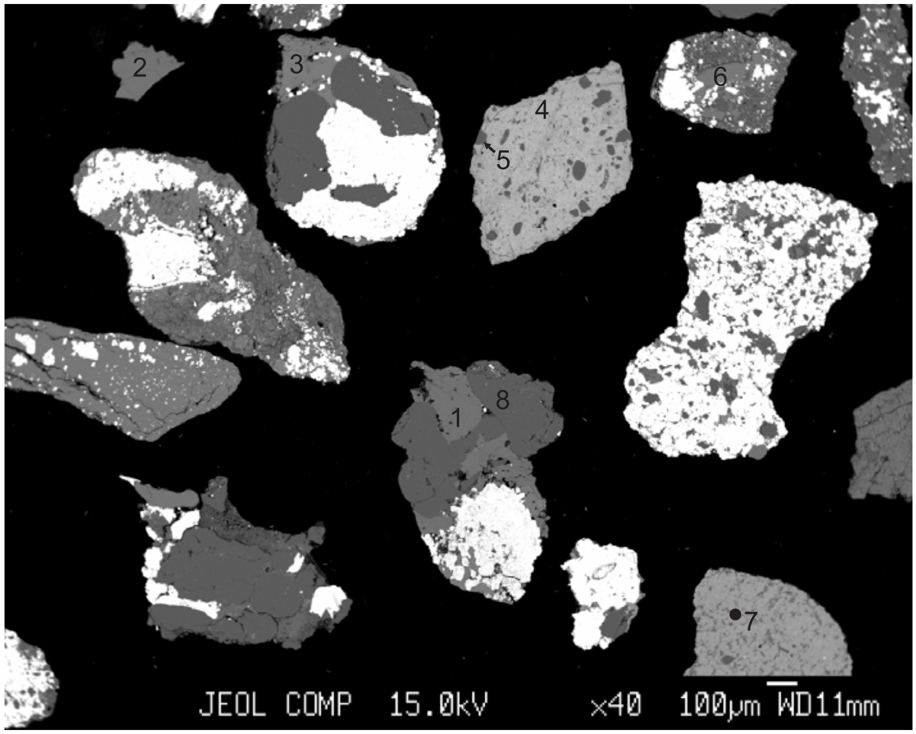
Figure19: 3165.65 m
Granite clast, quartz overgrowth, core sample.



1. Albite
2. Fe-Calcite
3. Siderite
4. Fe-Calcite
5. Rutile
6. Zircon
7. Quartz

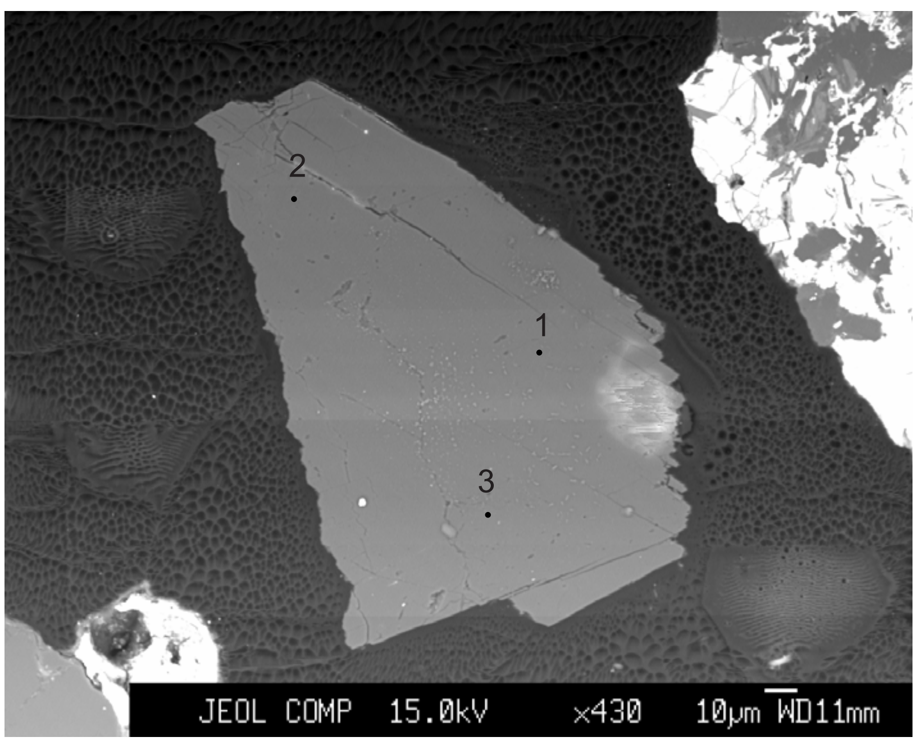
Figure 20: 3273.55 - 3279.65 (f)m (HMS)

Note: f = fine fraction; c = coarse fraction; HMS = heavy mineral separate



1. Ankerite
2. Ankerite
3. Calcite
4. Siderite
5. Quartz
6. Calcite
7. Siderite
8. Quartz

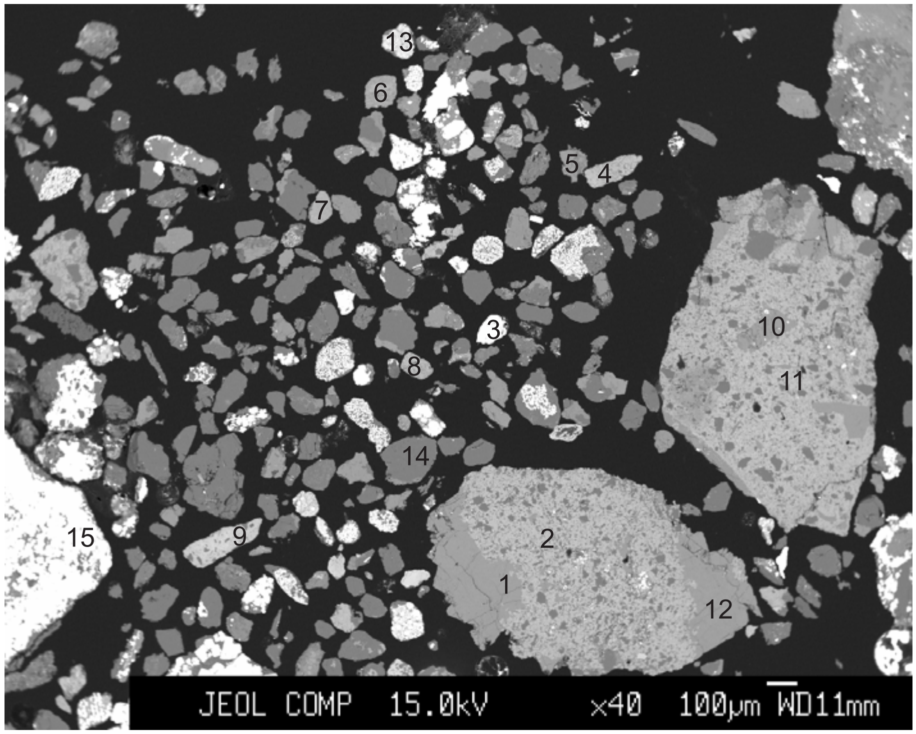
Figure 21: 3273.55 - 3279.65 (f)m (HMS)



1. Spodumene
2. Spodumene
3. Spodumene

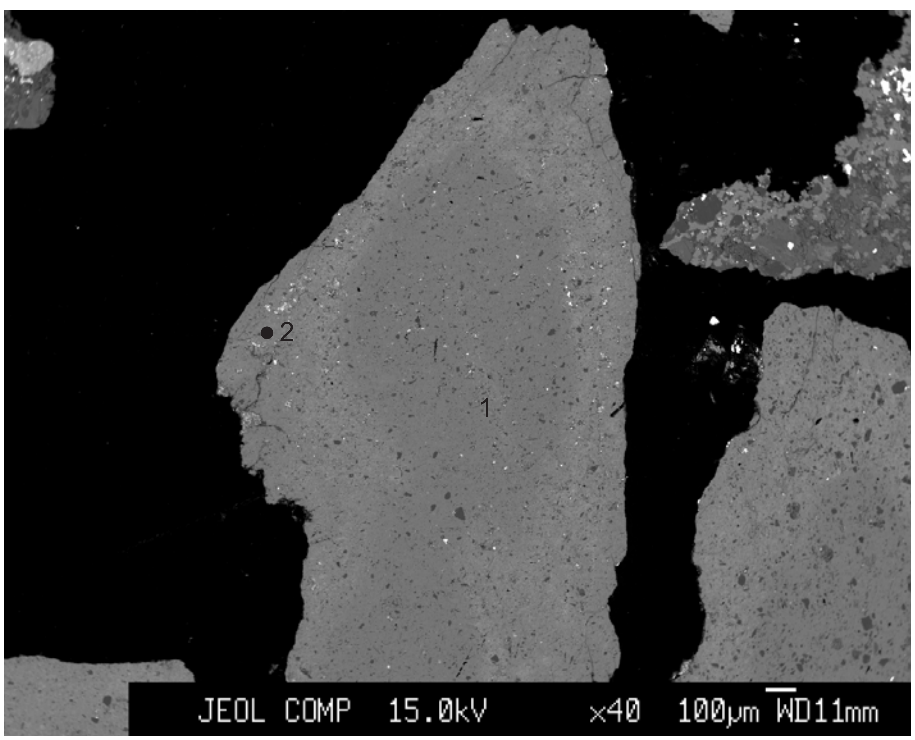
Figure 22: 3304.03 - 3310.03 (HMS)

Note: f = fine fraction; c = coarse fraction; HMS = heavy mineral separate



1. Fe-Calcite] clast
2. Siderite
3. Barite
4. Siderite
5. Fe-Calcite
6. Siderite
7. Chlorite
8. Rutile + Quartz
9. Siderite
10. Fe-Calcite] clast
11. Siderite
12. Fe-Calcite
13. Pyrite
14. Quartz
15. Pyrite

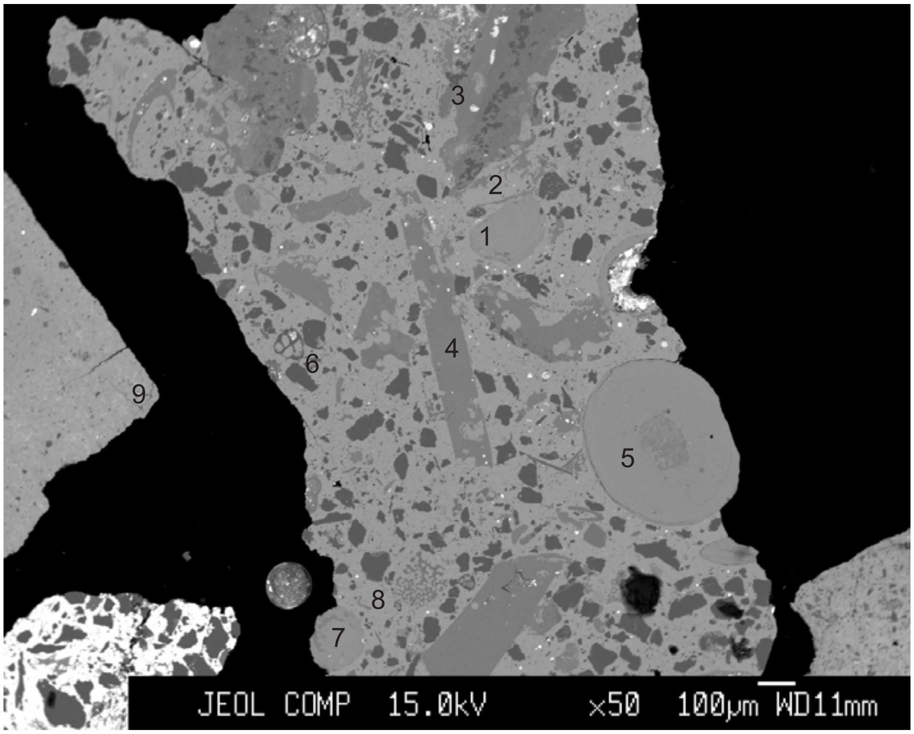
Figure 23: 3368.04 (f)m (HMS)



1. Siderite
2. Siderite

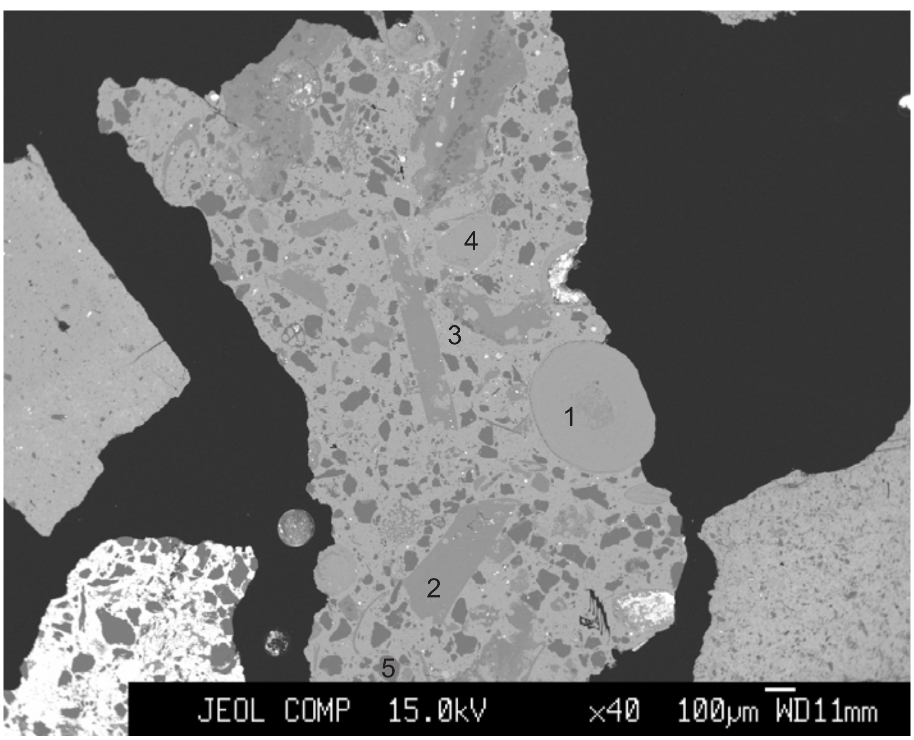
Figure 24: 3403.01 (c)m (HMS)

Note: f = fine fraction; c = coarse fraction; HMS = heavy mineral separate



1. Chlorite
2. Phosphate
3. Fe-Calcite
4. Fe-Calcite
5. Chlorite
6. Phosphate
7. Chlorite
8. Phosphate
9. Siderite

Figure 25: 3403.01 (c)m (HMS)



1. Chlorite
2. Fe-Calcite
3. Phosphate
4. Chlorite
5. Quartz

Figure 26: 3403.01 (c)m (HMS)

Note: f = fine fraction; c = coarse fraction; HMS = heavy mineral separate

Appendix 5: Environmental Scanning Electron Microprobe Images.
(From Shannon, 2003)

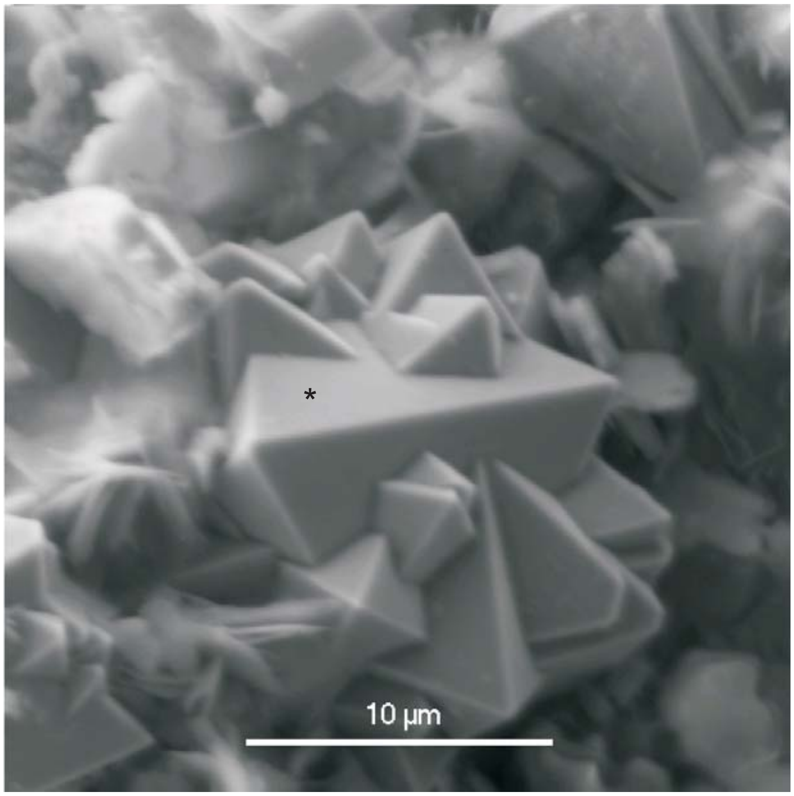


Figure 1: 3164.43 m, core sample.

Pyrite Rosette

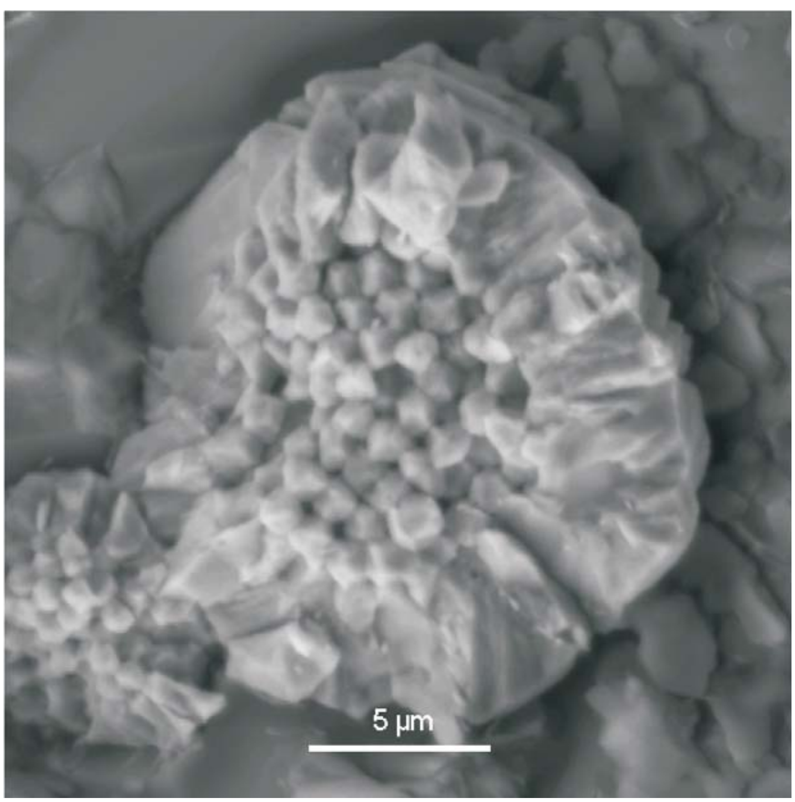
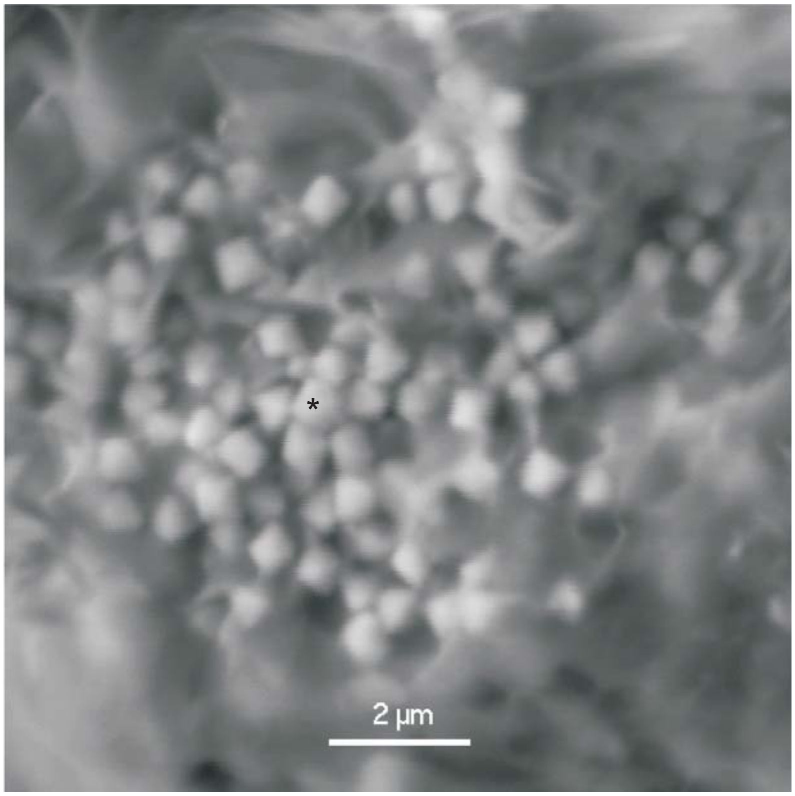


Figure 2: 3164.43 m, core sample.

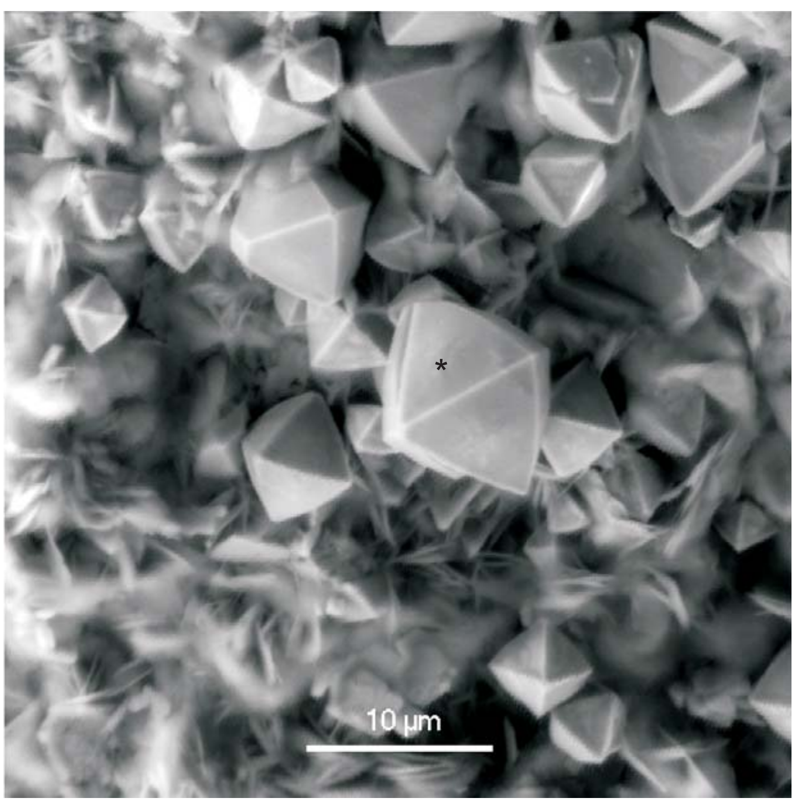
Framboidal Pyrite

Note: (*) indicates position of EDS analysis



Framboidal Pyrite

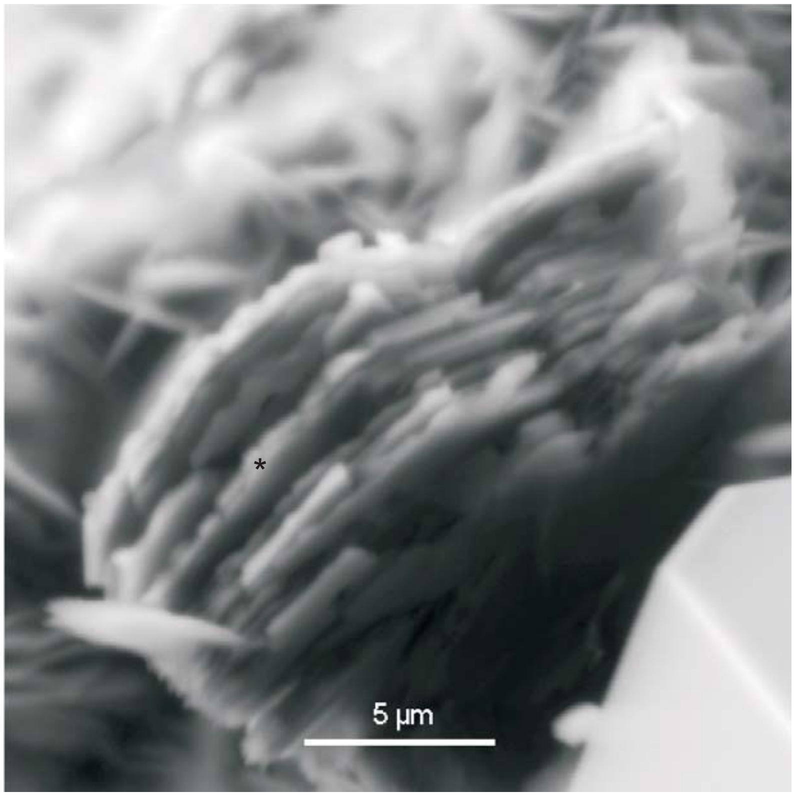
Figure 3: 3165.04 m



Pyrite

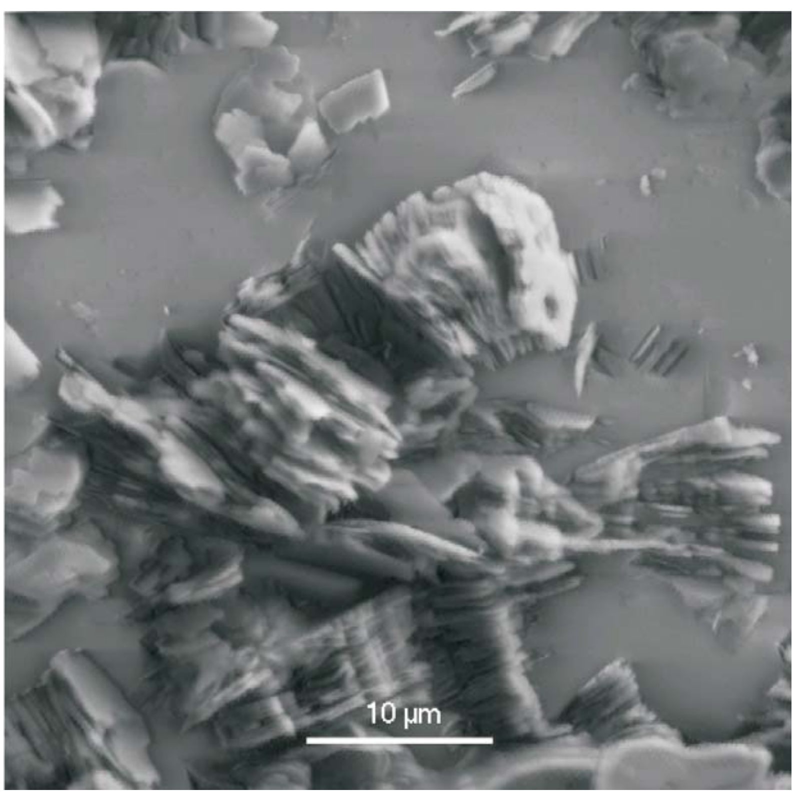
Figure 4: 3165.04 m

Note: (*) indicates position of EDS analysis



Kaolinite Booklets

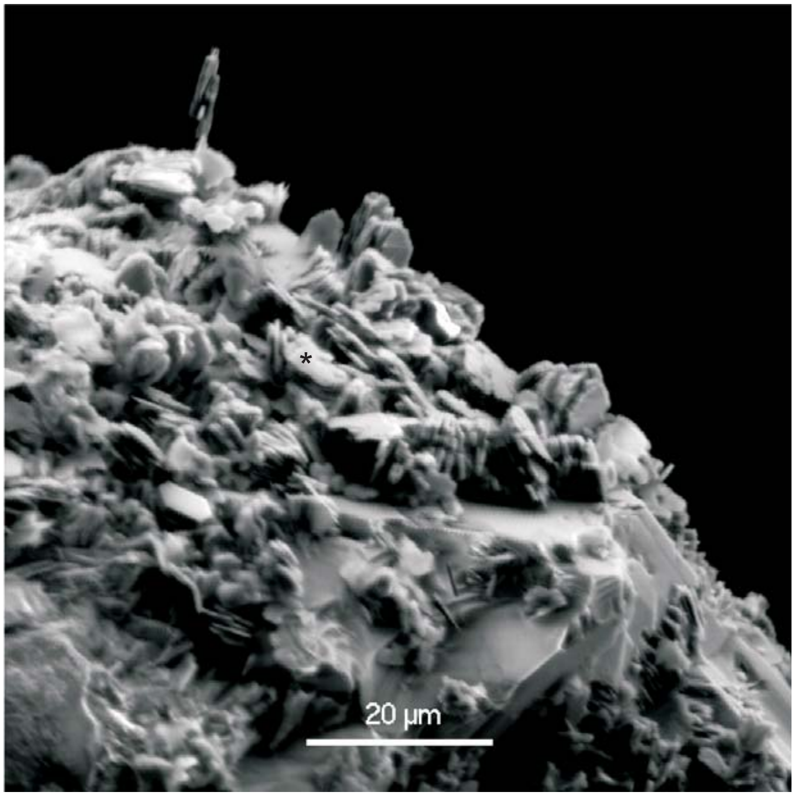
Figure 5: 3164.43 m



Kaolinite Booklets

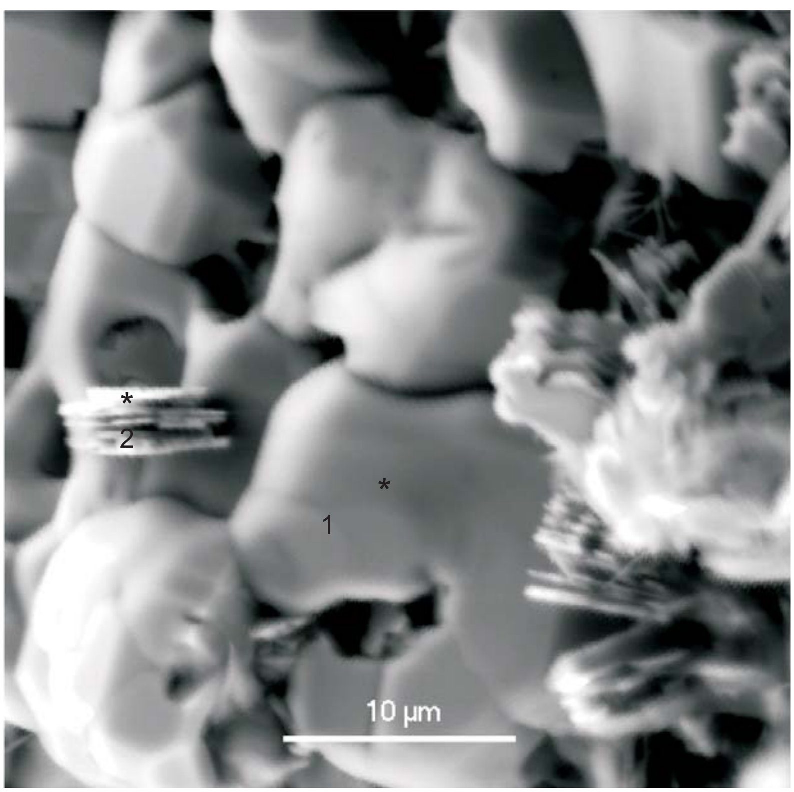
Figure 6: 3164.43 m

Note: (*) indicates position of EDS analysis



Kaolinite

Figure 7: 3165.04 m, core sample.



1. Blocky Halite
2. Kaolinite booklets

Figure 8: 3165.04 m, core sample.

Note: (*) indicates position of EDS analysis

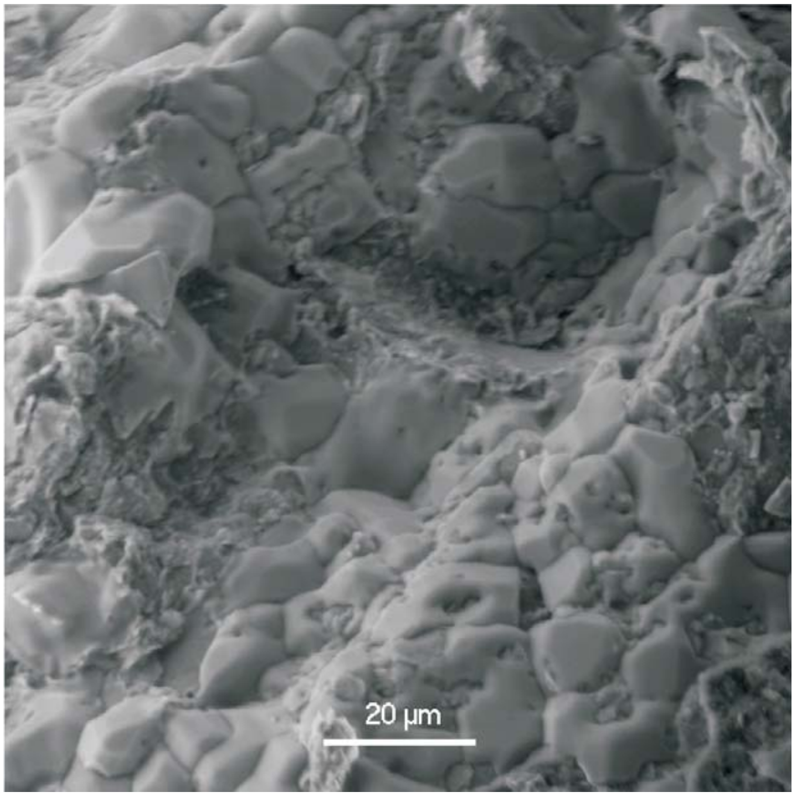


Figure 9: 3164.43 m, core sample.

Halite precipitated from formation fluid?

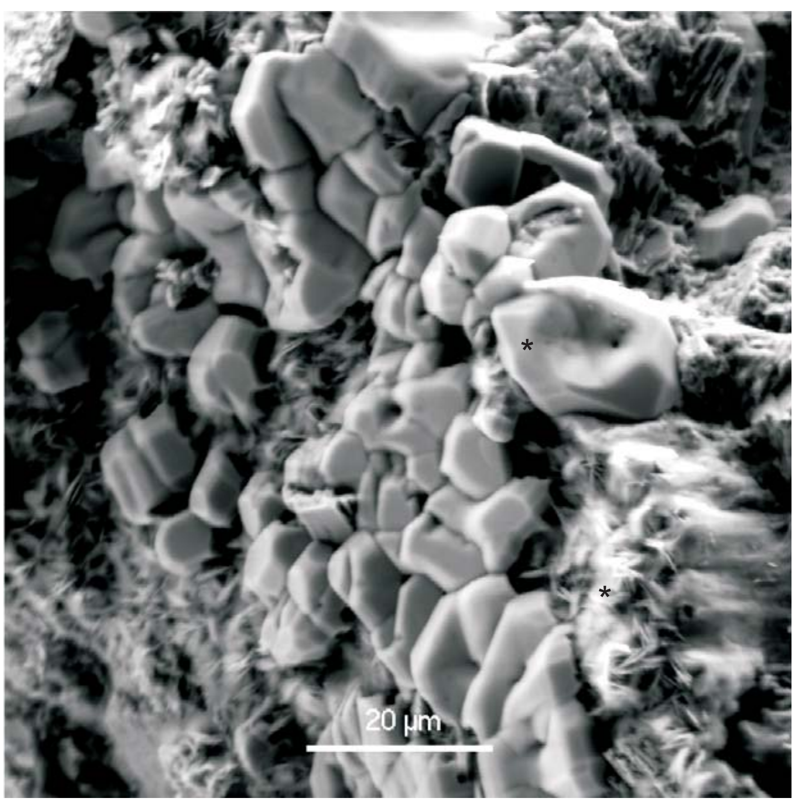
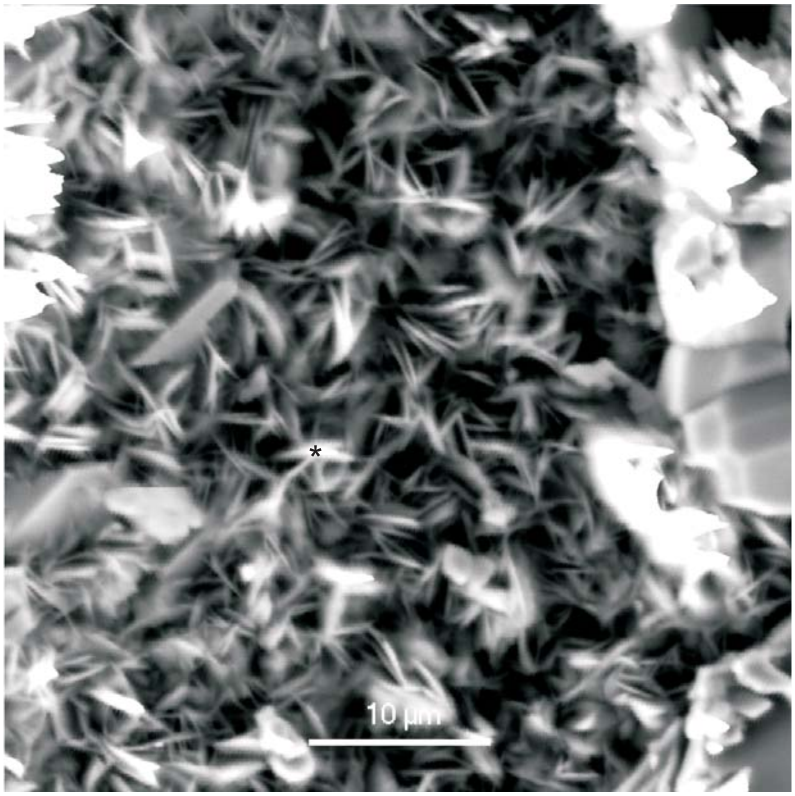


Figure 10: 3165.04 m, core sample.

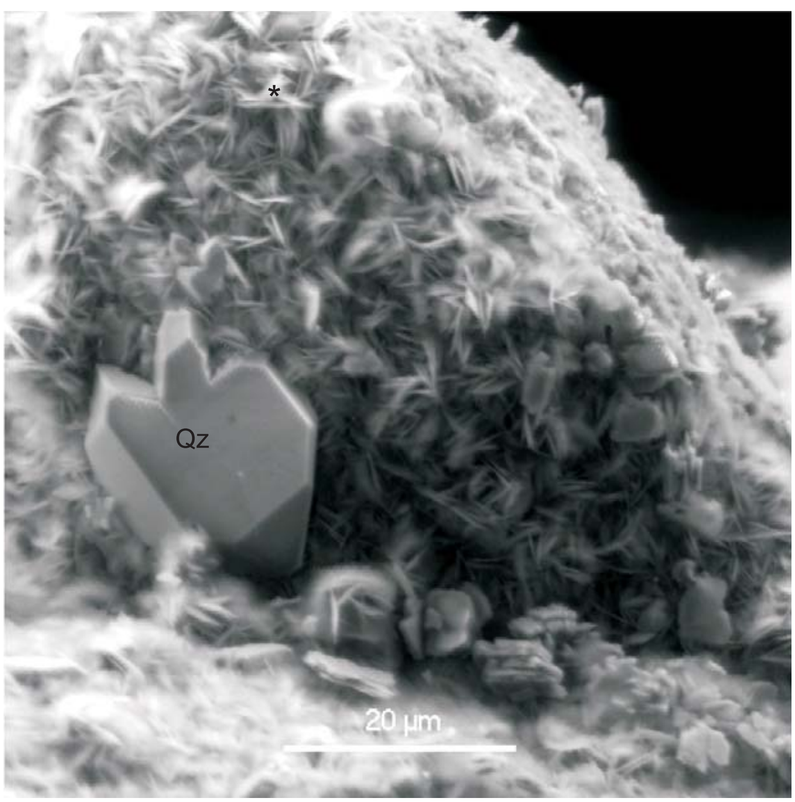
Note: (*) indicates position of EDS analysis

Halite with intergranular chlorite



Acicular Chlorite

Figure 11: 3165.04 m



Quartz rimmed by chlorite

Figure 12: 3165.04

Note: (*) indicates position of EDS analysis

cutting depth											% li
(ft)	formation	coal%	mudstone %	mud color	sandy silt %	sandy silt color	silty sand %	silty sand color	clay %	clay color	limestone %
11790		0	0	-	0	-	0	-	5	white	0
11780		0	0	-	0	-	0	-	5	white	0
11770		0	0	-	0	-	0	-	5	white	0
11760		0	0	-	0	-	0	-	2	white	0
11750		0	0	-	0	-	0	-	2	white	0
11740		0	0	-	0	-	0	-	0	-	0
11730		0	0	-	0	-	0	-	0	-	0
11720		0	0	-	0	-	0	-	0	-	0
11710		0	0	-	0	-	0	-	0	-	0
11700		0	0	-	0	-	0	-	0	-	0
11680		0	0	-	0	-	0	-	0	-	0
11670		0	0	-	0	-	0	-	0	-	0
11660		0	0	-	0	-	10	grey	0	-	0
11650		0	0	-	0	-	15	grey	0	-	0
11640		0	0	-	0	-	0	-	0	-	0
11630		0	0	-	0	-	0	-	0	-	0
11620		0	0	-	0	-	0	-	0	-	0
11610		0	0	-	0	-	0	-	0	-	0
11600		0	0	-	0	-	0	-	0	-	0
11590		0	0	-	0	-	0	-	0	-	0
11580		0	0	-	0	-	0	-	0	-	0
11570		0	0	-	0	-	0	-	0	-	0
11560		0	0	-	0	-	0	-	0	-	0
11550		0	0	-	0	-	0	-	0	-	0
11540		0	0	-	0	-	0	-	0	-	0
11530		0	0	-	0	-	0	-	0	-	0
11520		0	0	-	0	-	0	-	0	-	0
11510		0	0	-	0	-	0	-	0	-	0
11500		0	0	-	0	-	0	-	0	-	0
11490		0	0	-	0	-	0	-	0	-	0
11480		0	0	-	0	-	0	-	0	-	0
11470		0	0	-	0	-	0	-	0	-	0
11460		0	0	-	0	-	0	-	0	-	0
11450		0	0	-	0	-	0	-	0	-	0
11440		0	0	-	0	-	0	-	0	-	0
11430		0	0	-	0	-	0	-	0	-	0
11420		0	0	-	0	-	0	-	0	-	0
11410		0	0	-	0	-	0	-	0	-	0
11400		0	0	-	0	-	0	-	0	-	0
11390		0	0	-	0	-	0	-	0	-	0
11380		0	0	-	0	-	0	-	0	-	0
11370		0	0	-	0	-	0	-	0	-	0

cutting depth (ft)	ithology limestone color
11790	-
11780	-
11770	-
11760	-
11750	-
11740	-
11730	-
11720	-
11710	-
11700	-
11680	-
11670	-
11660	-
11650	-
11640	-
11630	-
11620	-
11610	-
11600	-
11590	-
11580	-
11570	-
11560	-
11550	-
11540	-
11530	-
11520	-
11510	-
11500	-
11490	-
11480	-
11470	-
11460	-
11450	-
11440	-
11430	-
11420	-
11410	-
11400	-
11390	-
11380	-
11370	-

cutting depth (ft)	siltstone %	siltst color	shale %	shale color	sandstone %	sand size	sand color	sorting (sand)	roundness (sand)
11790	80	5 red, 75 dk grey	0	-	15	mL-fU	white (qz)	mod	a-sa
11780	80	5 red, 75 dk grey	0	-	15	mL-fU	white (qz)	mod	a-sa
11770	80	5 red, 75 dk grey	0	-	15	mL-fU	white (qz)	mod	a-sa
11760	93	5 red, 88 dk grey	0	-	5	mL-fU	white (qz)	mod	a-sa
11750	93	5 red, 88 dk grey	0	-	5	mL-fU	white (qz)	mod	a-sa
11740	35	20 red, 15 greenish grey	60	dark grey	5	fL-fU	white	mod	sr
11730	35	20 red, 15 greenish grey	60	dark grey	5	fL-fU	white	mod	sr
11720	35	20 red, 15 greenish grey	60	dark grey	5	fL-fU	white	mod	sr
11710	35	20 red, 15 greenish grey	60	dark grey	5	fL-fU	white	mod	sr
11700	35	20 red, 15 greenish grey	60	dark grey	5	fL-fU	white	mod	sr
11680	35	20 red, 15 greenish grey	60	dark grey	5	fL-fU	white	mod	sr
11670	50	greenish grey	45	dark grey	5	fU	white	mod	sa
11660	75	greenish grey	10	dark grey	5	mU	white	well	sa
11650	65	greenish grey	10	dark grey	10	mU	white	well	sa
11640	65	5 red, 60 greenish grey	5	dark grey	30	vfU	buff	mod	sr
11630	65	5 red, 60 greenish grey	5	dark grey	30	vfU	buff	mod	sr
11620	65	5 red, 60 greenish grey	5	dark grey	30	vfU	buff	mod	sr
11610	50	5 red, 45 greenish grey	10	dark grey	40	30 mU, 10 vfL	vfL buff, mU white	mod	sa
11600	50	5 red, 45 greenish grey	10	dark grey	40	30 mU, 10 vfL	vfL buff, mU white	mod	sa
11590	50	5 red, 45 greenish grey	10	dark grey	40	30 mU, 10 vfL	vfL buff, mU white	mod	sa
11580	50	5 red, 45 greenish grey	10	dark grey	40	30 mU, 10 vfL	vfL buff, mU white	mod	sa
11570	50	5 red, 45 greenish grey	10	dark grey	40	30 mU, 10 vfL	vfL buff, mU white	mod	sa
11560	50	greenish grey	10	dark grey	40	10 mU, 30 vfL	vfL buff, mU white	mod	sr (vfL), sa (mU)
11550	50	greenish grey	10	dark grey	40	10 mU, 30 vfL	vfL buff, mU white	mod	sr (vfL), sa (mU)
11540	40	greenish grey	10	dark grey	50	10 mU, 40 fU	fU buff, mU white	mod - poor	sr
11530	40	greenish grey	10	dark grey	50	10 mU, 40 fU	fU buff, mU white	mod - poor	sr
11520	40	greenish grey	10	dark grey	50	10 mU, 40 fU	fU buff, mU white	mod - poor	sr
11510	40	greenish grey	10	dark grey	50	10 mU, 40 fU	fU buff, mU white	mod - poor	sr
11500	40	greenish grey	10	dark grey	50	10 mU, 40 fU	fU buff, mU white	mod - poor	sr
11490	45	greenish grey	20	dark grey	35	5 mU, 30 fU	fU buff, mU white	mod	sr-sa
11480	45	greenish grey	20	dark grey	35	5 mU, 30 fU	fU buff, mU white	mod	sr-sa
11470	45	greenish grey	20	dark grey	35	5 mU, 30 fU	fU buff, mU white	mod	sr-sa
11460	75	5 red, 70 greenish grey	20	dark grey	5	vfL	orangy	mod	sr-sa
11450	75	5 red, 70 greenish grey	20	dark grey	5	vfL	orangy	mod	sr-sa
11440	75	5 red, 70 greenish grey	20	dark grey	5	vfL	orangy	mod	sr-sa
11430	75	5 red, 70 greenish grey	20	dark grey	5	vfL	orangy	mod	sr-sa
11420	75	5 red, 70 greenish grey	20	dark grey	5	vfL	orangy	mod	sr-sa
11410	75	5 red, 70 greenish grey	20	dark grey	5	vfL	orangy	mod	sr-sa
11400	75	5 red, 70 greenish grey	20	dark grey	5	vfL	orangy	mod	sr-sa
11390	20	grey	40	dark grey	40	fL	white	mod	sr
11380	20	grey	40	dark grey	40	fL	white	mod	sr
11370	20	grey	40	dark grey	40	fL	white	mod	sr

cutting depth (ft)	muscovite	carbonaceous material	comments
11790	tr	tr	trace pyrite
11780	tr	tr	some pieces of dark grey siltstone have vfL white laminations
11770	tr	tr	
11760	tr	tr	trace pyrite
11750	tr	tr	
11740	mod	tr	
11730	mod	tr	
11720	mod	tr	trace pyrite, trace coal fragments
11710	mod	tr	
11700	mod	tr	
11680	mod	tr	
11670	mod	mod	trace coal fragments, trace ?glauconite, few loose quartz granuled
11660	tr	tr	trace pyrite, trace coal fragments
11650	tr	tr	moderate amount of coal (~3%), few loose quartz granules (subrounded)
11640	mod	tr	few loose quartz granules (subrounded)
11630	mod	tr	few loose quartz granules (subrounded)
11620	mod	tr	few loose quartz granules (subrounded), trace pyrite
11610	ab - mod	tr	moderate amount of quartz granules, trace pyrite, few rose quartz granules, trace glauconite, some siltstones have small vfL laminations
11600	ab - mod	tr	mod amount loose quartz granules (subrounded), trace ?glauconite
11590	ab - mod	tr	few loose quartz granules (subrounded)
11580	ab - mod	tr	
11570	ab - mod	tr	
11560	tr	tr	mod amount of pyrite, trace coal, trace rose quartz, trace ?glauconite, few subangular quartz granules
11550	tr	tr	
11540	tr	tr	
11530	tr	tr	
11520	tr	tr	trace ?glauconite, trace coal
11510	tr	tr	
11500	tr	tr	
11490	tr	tr	
11480	tr	tr	few rose quartz grains
11470	tr	tr	
11460	tr	tr	
11450	tr	tr	
11440	tr	tr	
11430	tr	tr	few loose subrounded quartz granules
11420	tr	tr	
11410	tr	tr	
11400	tr	tr	
11390	tr	mod	
11380	tr	mod	
11370	tr	mod	

Dauntless D-35

cutting depth (ft)	formation	coal%	mudstone %	mud color	sandy silt %	sandy silt color	silty sand %	silty sand color	clay %	clay color	limestone %
											% li
11360		0	0	-	0	-	0	-	0	-	0
11350		0	0	-	0	-	0	-	0	-	0
11340		0	0	-	0	-	0	-	0	-	0
11330		0	0	-	0	-	0	-	0	-	0
11320		0	0	-	0	-	0	-	0	-	0
11310		0	0	-	0	-	0	-	0	-	0
11290 - 11300		0	0	-	0	-	0	-	0	-	0
11280 - 11290		0	0	-	0	-	0	-	0	-	0
11270 - 11280	missisauga middle member	0	0	-	0	-	0	-	0	-	0
11260 - 11270		0	0	-	0	-	0	-	0	-	0
11250 - 11260		0	0	-	0	-	0	-	0	-	0
11240 - 11250		0	0	-	0	-	0	-	0	-	0
11230 - 11240		0	0	-	0	-	0	-	0	-	0
11220 - 11230		0	0	-	0	-	0	-	0	-	0
11210 - 11220		0	0	-	0	-	0	-	0	-	0
11200 - 11210		0	0	-	0	-	0	-	0	-	0
11180 - 11190		0	0	-	0	-	0	-	0	-	0
11170 - 11180		0	0	-	0	-	0	-	0	-	0
11160 - 11170		0	0	-	0	-	0	-	0	-	0
11150 - 11160		0	0	-	0	-	0	-	0	-	0
11140 - 11150		0	0	-	0	-	0	-	0	-	0
11130 - 11140		0	0	-	0	-	0	-	0	-	0
11120 - 11130		0	0	-	0	-	0	-	0	-	0
11110 - 11120		0	0	-	0	-	0	-	0	-	0
11090 - 11100		0	0	-	0	-	0	-	0	-	0
11080 - 11090		0	0	-	0	-	0	-	0	-	0
11070 - 11080		0	0	-	0	-	0	-	0	-	0
11060 - 11070		0	0	-	0	-	0	-	0	-	0
11050 - 11060		0	0	-	0	-	0	-	0	-	0
11040 - 11050		0	0	-	0	-	0	-	0	-	0
11030 - 11040		0	0	-	0	-	0	-	0	-	0
11020 - 11030		0	0	-	0	-	0	-	0	-	0
11010 - 11020		0	0	-	0	-	0	-	0	-	0
11000 - 11010		0	0	-	0	-	0	-	0	-	0
10980 - 11000		0	0	-	0	-	0	-	0	-	0
10960 - 10980		0	0	-	0	-	0	-	0	-	0
10940 - 10960		0	0	-	0	-	0	-	0	-	0
10920 - 10940		0	0	-	0	-	0	-	0	-	0
10900 - 10920		0	0	-	0	-	0	-	0	-	0
10880 - 10900		0	0	-	0	-	0	-	0	-	0
10860 - 10880		0	0	-	0	-	0	-	0	-	0
10840 - 10860		0	0	-	0	-	0	-	0	-	0

cutting depth (ft)		lithology limestone color
11360		-
11350		-
11340		-
11330		-
11320		-
11310		-
11290	- 11300	-
11280	- 11290	-
11270	- 11280	-
11260	- 11270	-
11250	- 11260	-
11240	- 11250	-
11230	- 11240	-
11220	- 11230	-
11210	- 11220	-
11200	- 11210	-
11180	- 11190	-
11170	- 11180	-
11160	- 11170	-
11150	- 11160	-
11140	- 11150	-
11130	- 11140	-
11120	- 11130	-
11110	- 11120	-
11090	- 11100	-
11080	- 11090	-
11070	- 11080	-
11060	- 11070	-
11050	- 11060	-
11040	- 11050	-
11030	- 11040	-
11020	- 11030	-
11010	- 11020	-
11000	- 11010	-
10980	- 11000	-
10960	- 10980	-
10940	- 10960	-
10920	- 10940	-
10900	- 10920	-
10880	- 10900	-
10860	- 10880	-
10840	- 10860	-

cutting depth (ft)		siltstone %	siltst color	shale %	shale color	sandstone %	sand size	sand color	sorting (sand)	roundness (sand)
11360		20	grey	40	dark grey	40	fL	white	mod	sr
11350		20	grey	40	dark grey	40	fL	white	mod	sr
11340		20	grey	40	dark grey	40	fL	white	mod	sr
11330		20	grey	40	dark grey	40	fL	white	mod	sr
11320		60	greenish grey	30	dark grey	10	vfL	buff	mod	sr
11310		60	greenish grey	30	dark grey	10	vfL	buff	mod	sr
11290	- 11300	60	greenish grey	30	dark grey	10	vfL	buff	mod	sr
11280	- 11290	60	greenish grey	30	dark grey	10	vfL	buff	mod	sr
11270	- 11280	60	greenish grey	30	dark grey	10	vfL	buff	mod	sr
11260	- 11270	60	greenish grey	30	dark grey	10	vfL	buff	mod	sr
11250	- 11260	60	greenish grey	30	dark grey	10	vfL	buff	mod	sr
11240	- 11250	60	greenish grey	30	dark grey	10	vfL	buff	mod	sr
11230	- 11240	60	greenish grey	30	dark grey	10	vfL	buff	mod	sr
11220	- 11230	60	greenish grey	30	dark grey	10	vfL	buff	mod	sr
11210	- 11220	60	greenish grey	30	dark grey	10	vfL	buff	mod	sr
11200	- 11210	60	greenish grey	30	dark grey	10	vfL	buff	mod	sr
11180	- 11190	60	greenish grey	30	dark grey	10	vfL	buff	mod	sr
11170	- 11180	60	greenish grey	30	dark grey	10	vfL	buff	mod	sr
11160	- 11170	60	greenish grey	30	dark grey	10	vfL	buff	mod	sr
11150	- 11160	70	dark grey	5	dark grey	25	vfU	white	mod	sr
11140	- 11150	70	dark grey	5	dark grey	25	vfU	white	mod	sr
11130	- 11140	70	dark grey	5	dark grey	25	vfU	white	mod	sr
11120	- 11130	70	dark grey	5	dark grey	25	vfU	white	mod	sr
11110	- 11120	70	dark grey	5	dark grey	25	vfU	white	mod	sr
11090	- 11100	70	dark grey	5	dark grey	25	vfU	white	mod	sr
11080	- 11090	70	dark grey	5	dark grey	25	vfU	white	mod	sr
11070	- 11080	70	dark grey	5	dark grey	25	vfU	white	mod	sr
11060	- 11070	70	dark grey	5	dark grey	25	vfU	white	mod	sr
11050	- 11060	70	dark grey	5	dark grey	25	vfU	white	mod	sr
11040	- 11050	50	5 red, 45 grey	45	dark grey	5	vfL	white	mod	sr
11030	- 11040	50	5 red, 45 grey	45	dark grey	5	vfL	white	mod	sr
11020	- 11030	50	5 red, 45 grey	45	dark grey	5	vfL	white	mod	sr
11010	- 11020	50	5 red, 45 grey	45	dark grey	5	vfL	white	mod	sr
11000	- 11010	50	5 red, 45 grey	45	dark grey	5	vfL	white	mod	sr
10980	- 11000	50	5 red, 45 grey	45	dark grey	5	vfL	white	mod	sr
10960	- 10980	50	5 red, 45 grey	45	dark grey	5	vfL	white	mod	sr
10940	- 10960	50	5 red, 45 grey	45	dark grey	5	vfL	white	mod	sr
10920	- 10940	50	5 red, 45 grey	45	dark grey	5	vfL	white	mod	sr
10900	- 10920	50	5 red, 45 grey	45	dark grey	5	vfL	white	mod	sr
10880	- 10900	50	5 red, 45 grey	45	dark grey	5	vfL	white	mod	sr
10860	- 10880	50	5 red, 45 grey	45	dark grey	5	vfL	white	mod	sr
10840	- 10860	50	5 red, 45 grey	45	dark grey	5	vfL	white	mod	sr

cutting depth (ft)		muscovite	carbonaceous material	comments
11360		tr	mod	few rounded quartz granules
11350		tr	mod	
11340		tr	mod	
11330		tr	mod	
11320		tr	tr	
11310		tr	tr	
11290	- 11300	tr	tr	
11280	- 11290	tr	tr	
11270	- 11280	tr	tr	
11260	- 11270	tr	tr	
11250	- 11260	tr	tr	
11240	- 11250	tr	tr	few rounded quartz granules, trace rose quartz
11230	- 11240	tr	tr	
11220	- 11230	tr	tr	
11210	- 11220	tr	tr	
11200	- 11210	tr	tr	
11180	- 11190	tr	tr	
11170	- 11180	tr	tr	
11160	- 11170	tr	tr	
11150	- 11160	tr	tr	
11140	- 11150	tr	tr	
11130	- 11140	tr	tr	
11120	- 11130	tr	tr	
11110	- 11120	tr	tr	
11090	- 11100	tr	tr	
11080	- 11090	tr	tr	
11070	- 11080	tr	tr	
11060	- 11070	tr	tr	
11050	- 11060	tr	tr	
11040	- 11050	tr	tr	
11030	- 11040	tr	tr	few angular to subangular quartz granules
11020	- 11030	tr	tr	
11010	- 11020	tr	tr	
11000	- 11010	tr	tr	
10980	- 11000	tr	tr	
10960	- 10980	tr	tr	
10940	- 10960	tr	tr	
10920	- 10940	tr	tr	
10900	- 10920	tr	tr	
10880	- 10900	tr	tr	
10860	- 10880	tr	tr	
10840	- 10860	tr	tr	

Dauntless D-35

cutting depth (ft)	formation	coal%	mudstone %	mud color	sandy silt %	sandy silt color	silty sand %	silty sand color	clay %	clay color	% li limestone %
10820 - 10840		0	0	-	0	-	0	-	0	-	0
10800 - 10820		0	0	-	0	-	0	-	0	-	0
10780 - 10800		0	0	-	0	-	0	-	0	-	0
10760 - 10780		0	0	-	0	-	0	-	0	-	0
10740 - 10760		0	0	-	0	-	0	-	0	-	0
10720 - 10740		0	0	-	0	-	0	-	0	-	0
10700 - 10720		0	0	-	0	-	0	-	0	-	20
10680 - 10700		0	0	-	0	-	0	-	0	-	40
10660 - 10680		0	0	-	0	-	0	-	0	-	5
10640 - 10660		0	0	-	0	-	0	-	0	-	5
10620 - 10640		0	0	-	0	-	0	-	0	-	5
10600 - 10620		0	0	-	0	-	0	-	0	-	50
10580 - 10600		0	0	-	0	-	0	-	0	-	50
10560 - 10580		0	0	-	0	-	0	-	0	-	50
10540 - 10560		0	0	-	0	-	0	-	0	-	50
10520 - 10540		0	0	-	0	-	0	-	0	-	50
10500 - 10520		0	0	-	0	-	0	-	0	-	30
10480 - 10500		0	0	-	0	-	0	-	0	-	30
10460 - 10480	"o" marker	0	0	-	0	-	0	-	0	-	30
10440 - 10460		0	0	-	0	-	0	-	0	-	30
10420 - 10440		0	0	-	0	-	0	-	0	-	5
10400 - 10420		0	0	-	0	-	0	-	0	-	0
10380 - 10400		0	0	-	0	-	0	-	0	-	0
10360 - 10380		0	0	-	0	-	0	-	0	-	0
10340 - 10360		0	0	-	0	-	0	-	0	-	0
10320 - 10340		0	0	-	0	-	0	-	0	-	0
10300 - 10320		0	0	-	0	-	0	-	0	-	0
10280 - 10300		0	0	-	0	-	0	-	0	-	0
10260 - 10280		0	0	-	0	-	0	-	0	-	0
10240 - 10260		0	0	-	0	-	0	-	0	-	0
10220 - 10240		0	0	-	0	-	0	-	0	-	0
10200 - 10220		0	0	-	0	-	0	-	0	-	0
10180 - 10200		0	0	-	0	-	0	-	0	-	0
10160 - 10180		0	0	-	0	-	0	-	0	-	0
10140 - 10160		0	0	-	0	-	0	-	0	-	0
10120 - 10140		0	0	-	0	-	0	-	0	-	0
10100 - 10120		0	0	-	0	-	0	-	0	-	0
10080 - 10100		0	0	-	0	-	0	-	0	-	0
10060 - 10080	er member	0	0	-	0	-	0	-	0	-	0
10040 - 10060		0	0	-	0	-	0	-	0	-	2
10020 - 10040		0	0	-	0	-	0	-	0	-	2
10000 - 10020		0	0	-	0	-	0	-	0	-	2

cutting depth (ft)		ithology limestone color
10820	- 10840	-
10800	- 10820	-
10780	- 10800	-
10760	- 10780	-
10740	- 10760	-
10720	- 10740	-
10700	- 10720	buff (slightly silty)
10680	- 10700	buff (slightly silty)
10660	- 10680	buff
10640	- 10660	buff
10620	- 10640	buff
10600	- 10620	buff
10580	- 10600	buff
10560	- 10580	buff
10540	- 10560	buff
10520	- 10540	buff
10500	- 10520	buff
10480	- 10500	buff
10460	- 10480	buff
10440	- 10460	buff
10420	- 10440	buff
10400	- 10420	-
10380	- 10400	-
10360	- 10380	-
10340	- 10360	-
10320	- 10340	-
10300	- 10320	-
10280	- 10300	-
10260	- 10280	-
10240	- 10260	-
10220	- 10240	-
10200	- 10220	-
10180	- 10200	-
10160	- 10180	-
10140	- 10160	-
10120	- 10140	-
10100	- 10120	-
10080	- 10100	-
10060	- 10080	-
10040	- 10060	buff
10020	- 10040	buff
10000	- 10020	buff

cutting depth (ft)	siltstone %	siltst color	shale %	shale color	sandstone %	sand size	sand color	sorting (sand)	roundness (sand)
10820 - 10840	60	dark grey	10	dark grey	30	fU-mU	white	mod-poor	sr
10800 - 10820	60	dark grey	30	dark grey	10	fU-mU	white	mod-poor	sr
10780 - 10800	60	dark grey	30	dark grey	10	fU-mU	white	mod-poor	sr
10760 - 10780	65	5 red, 60 dark grey	10	black	25	mL	white	mod	sr
10740 - 10760	65	5 red, 60 dark grey	10	black	25	mL	white	mod	sr
10720 - 10740	65	5 red, 60 dark grey	10	black	25	mL	white	mod	sr
10700 - 10720	20	5 red, 15 dark grey	60	black	0	-	-	-	-
10680 - 10700	15	dark grey	45	black	0	-	-	-	-
10660 - 10680	75	5 red, 70 dark grey	10	black	10	mU	white	mod	sr
10640 - 10660	75	5 red, 70 dark grey	10	black	10	mU	white	mod	sr
10620 - 10640	75	5 red, 70 dark grey	10	black	10	mU	white	mod	sr
10600 - 10620	15	5 red, 10 dark grey	30	black	5	mU	white	mod	sr
10580 - 10600	15	5 red, 10 dark grey	30	black	5	mU	white	mod	sr
10560 - 10580	15	5 red, 10 dark grey	30	black	5	mU	white	mod	sr
10540 - 10560	15	5 red, 10 dark grey	30	black	5	mU	white	mod	sr
10520 - 10540	15	5 red, 10 dark grey	30	black	5	mU	white	mod	sr
10500 - 10520	25	5 red, 20 dark grey	40	black	5	mU	white	mod	sr
10480 - 10500	25	5 red, 20 dark grey	40	black	5	mU	white	mod	sr
10460 - 10480	25	5 red, 20 dark grey	40	black	5	mU	white	mod	sr
10440 - 10460	25	5 red, 20 dark grey	40	black	5	mU	white	mod	sr
10420 - 10440	5	brick red	88	black	2	cL	white	-	-
10400 - 10420	10	medium grey	65	dark grey	25	cL-vcU (mainly loose)	white	poor	a-sr
10380 - 10400	10	medium grey	40	dark grey	50	cL-vcU (mainly loose)	white	poor	a-sr
10360 - 10380	10	medium grey	40	dark grey	50	cL-vcU (mainly loose)	white	poor	a-sr
10340 - 10360	25	5 red, 20 light grey	70	dark grey	5	vfL-vfU	white	well	sr
10320 - 10340	10	medium grey	65	dark grey	25	cL-vcU (mainly loose)	white	poor	a-sr
10300 - 10320	45	5 red, 40 light grey	50	dark grey	5	vfL-vfU	white	well	sr
10280 - 10300	45	5 red, 40 light grey	50	dark grey	5	vfL-vfU	white	well	sr
10260 - 10280	45	5 red, 40 light grey	50	dark grey	5	vfL-vfU	white	well	sr
10240 - 10260	45	5 red, 40 light grey	50	dark grey	5	vfL-vfU	white	well	sr
10220 - 10240	45	5 red, 40 light grey	50	dark grey	5	vfL-vfU	white	well	sr
10200 - 10220	45	5 red, 40 light grey	50	dark grey	5	vfL-vfU	white	well	sr
10180 - 10200	45	5 red, 40 light grey	50	dark grey	5	vfL-vfU	white	well	sr
10160 - 10180	45	5 red, 40 light grey	50	dark grey	5	vfL-vfU	white	well	sr
10140 - 10160	45	5 red, 40 light grey	50	dark grey	5	vfL-vfU	white	well	sr
10120 - 10140	40	15 red, 25 grey	50	dark grey	10	vfL-vfU	white	well	sr
10100 - 10120	40	15 red, 25 grey	50	dark grey	10	vfL-vfU	white	well	sr
10080 - 10100	40	15 red, 25 grey	50	dark grey	10	vfL-vfU	white	well	sr
10060 - 10080	40	15 red, 25 grey	50	dark grey	10	vfL-vfU	white	well	sr
10040 - 10060	15	5 red, 10 light grey	83	dark grey	0	-	-	-	-
10020 - 10040	15	5 red, 10 light grey	83	dark grey	0	-	-	-	-
10000 - 10020	15	5 red, 10 light grey	83	dark grey	0	-	-	-	-

cutting depth (ft)	muscovite	carbonaceous material	comments
10820 - 10840	tr	tr	
10800 - 10820	tr	tr	trace coal fragments
10780 - 10800	tr	tr	
10760 - 10780	tr	tr	
10740 - 10760	tr	tr	few coal fragments, couple of light green grains (unknown)
10720 - 10740	tr	tr	few coal fragments
10700 - 10720	tr	tr	
10680 - 10700	tr	tr	
10660 - 10680	tr	tr	
10640 - 10660	tr	tr	few subrounded quartz granules
10620 - 10640	tr	tr	
10600 - 10620	tr	tr	
10580 - 10600	tr	tr	
10560 - 10580	tr	tr	
10540 - 10560	tr	tr	
10520 - 10540	tr	tr	limestone is slightly silty and very fine grained, trace pyrite
10500 - 10520	tr	tr	
10480 - 10500	tr	tr	
10460 - 10480	tr	tr	
10440 - 10460	tr	tr	
10420 - 10440	tr	tr	trace pyrite, trace glauconite, few subrounded quartz granules
10400 - 10420	tr	tr	few very coarse orange grains (look like ?rhyolite), trace coal, some rose quartz
10380 - 10400	tr	tr	few very coarse orange grains (look like ?rhyolite), trace coal, some rose quartz
10360 - 10380	tr	tr	
10340 - 10360	tr	tr	few subrounded quartz granules
10320 - 10340	tr	tr	
10300 - 10320	tr	tr	
10280 - 10300	tr	tr	
10260 - 10280	tr	tr	
10240 - 10260	tr	tr	
10220 - 10240	tr	tr	
10200 - 10220	tr	tr	
10180 - 10200	tr	tr	few subrounded quartz granules
10160 - 10180	tr	tr	
10140 - 10160	tr	tr	
10120 - 10140	tr	tr	
10100 - 10120	tr	tr	
10080 - 10100	tr	tr	
10060 - 10080	tr	tr	
10040 - 10060	tr	mod	
10020 - 10040	tr	mod	
10000 - 10020	tr	mod	

cutting depth (ft)	formation	coal%	mudstone %	mud color	sandy silt %	sandy silt color	silty sand %	silty sand color	clay %	clay color	% li limestone %
9980 - 10000	missisauga upp	0	0	-	0	-	0	-	0	-	28
9960 - 9980		0	0	-	0	-	0	-	0	-	28
9940 - 9960		0	0	-	0	-	0	-	0	-	28
9920 - 9940		0	0	-	0	-	0	-	0	-	28
9900 - 9920		0	0	-	0	-	0	-	0	-	28
9880 - 9900		0	0	-	0	-	0	-	0	-	73
9860 - 9880		0	0	-	0	-	0	-	0	-	45
9840 - 9860		0	0	-	0	-	0	-	0	-	45
9820 - 9840		0	0	-	0	-	0	-	0	-	5
9800 - 9820		0	0	-	0	-	0	-	0	-	5
9780 - 9800		0	0	-	0	-	0	-	0	-	78
9760 - 9780		0	0	-	0	-	0	-	0	-	78
9740 - 9760		0	0	-	0	-	0	-	0	-	78
9730 - 9740		0	0	-	0	-	0	-	0	-	78
9720 - 9730		0	0	-	0	-	0	-	0	-	0
9710 - 9720		0	0	-	0	-	0	-	0	-	0
9700 - 9710		0	0	-	0	-	0	-	0	-	0
9690 - 9700		0	0	-	0	-	0	-	0	-	0
9680 - 9690		0	0	-	0	-	0	-	0	-	0
9670 - 9680		0	0	-	0	-	0	-	0	-	0
9660 - 9670		0	0	-	0	-	0	-	0	-	0
9650 - 9660		0	0	-	0	-	0	-	0	-	0
9640 - 9650		0	0	-	0	-	0	-	0	-	0
9630 - 9640		0	0	-	0	-	0	-	0	-	0
9620 - 9630		0	0	-	0	-	0	-	0	-	0
9610 - 9620		0	0	-	0	-	0	-	0	-	10
9600 - 9610		0	0	-	0	-	0	-	0	-	0
9590 - 9600		0	0	-	0	-	0	-	0	-	0
9580 - 9590		0	0	-	0	-	0	-	0	-	0
9570 - 9580		0	0	-	0	-	0	-	0	-	0
9560 - 9570		0	0	-	0	-	0	-	0	-	5
9550 - 9560		0	0	-	0	-	0	-	0	-	5
9540 - 9550		0	0	-	0	-	0	-	0	-	5
9530 - 9540		0	0	-	0	-	0	-	0	-	5
9520 - 9530		0	0	-	0	-	0	-	0	-	5
9510 - 9520		0	0	-	0	-	0	-	0	-	0
9500 - 9510		0	0	-	0	-	0	-	0	-	0
9490 - 9500		0	0	-	0	-	0	-	0	-	0
9480 - 9490		0	0	-	0	-	0	-	0	-	0
9470 - 9480		0	0	-	0	-	0	-	0	-	0
9460 - 9470		0	0	-	0	-	0	-	0	-	0
9450 - 9460		0	0	-	0	-	0	-	0	-	0

cutting depth (ft)		lithology limestone color
9980	- 10000	white/buff
9960	- 9980	white/buff
9940	- 9960	white/buff
9920	- 9940	white/buff
9900	- 9920	white/buff
9880	- 9900	buff
9860	- 9880	buff (sandy)
9840	- 9860	buff (sandy)
9820	- 9840	buff (sandy)
9800	- 9820	buff (sandy)
9780	- 9800	buff
9760	- 9780	buff
9740	- 9760	buff
9730	- 9740	buff
9720	- 9730	-
9710	- 9720	-
9700	- 9710	-
9690	- 9700	-
9680	- 9690	-
9670	- 9680	-
9660	- 9670	-
9650	- 9660	-
9640	- 9650	-
9630	- 9640	-
9620	- 9630	-
9610	- 9620	buff (sandy)
9600	- 9610	-
9590	- 9600	-
9580	- 9590	-
9570	- 9580	-
9560	- 9570	buff (very sandy)
9550	- 9560	buff (very sandy)
9540	- 9550	buff (very sandy)
9530	- 9540	buff (very sandy)
9520	- 9530	buff (very sandy)
9510	- 9520	-
9500	- 9510	-
9490	- 9500	-
9480	- 9490	-
9470	- 9480	-
9460	- 9470	-
9450	- 9460	-

cutting depth (ft)		siltstone %	siltst color	shale %	shale color	sandstone %	sand size	sand color	sorting (sand)	roundness (sand)
9980	- 10000	45	30 red, 15 light grey	25	dark grey	2	vf	white (calcite cement)	-	-
9960	- 9980	45	30 red, 15 light grey	25	dark grey	2	vf	white (calcite cement)	-	-
9940	- 9960	45	30 red, 15 light grey	25	dark grey	2	vf	white (calcite cement)	-	-
9920	- 9940	45	30 red, 15 light grey	25	dark grey	2	vf	white (calcite cement)	-	-
9900	- 9920	45	30 red, 15 light grey	25	dark grey	2	vf	white (calcite cement)	-	-
9880	- 9900	15	red	10	black	2	vfU	white (calcite cement)	-	-
9860	- 9880	5	red	50	black	0	-	-	-	-
9840	- 9860	5	red	50	black	0	-	-	-	-
9820	- 9840	35	medium grey	10	dark grey	50	cL-vcU (mainly loose)	white	mod-poor	sa
9800	- 9820	35	medium grey	10	dark grey	50	cL-vcU (mainly loose)	white	mod-poor	sa
9780	- 9800	20	medium grey	0	-	2	vcl	white (calcite cement)	-	-
9760	- 9780	20	medium grey	0	-	2	vcl	white (calcite cement)	-	-
9740	- 9760	20	medium grey	0	-	2	vcl	white (calcite cement)	-	-
9730	- 9740	20	medium grey	0	-	2	vcl	white (calcite cement)	-	-
9720	- 9730	35	5 red, 30 light greenish grey	30	dark grey	35	mL	white (calcite cement)	well	sr
9710	- 9720	35	5 red, 30 light greenish grey	30	dark grey	35	mL	white (calcite cement)	well	sr
9700	- 9710	35	5 red, 30 light greenish grey	30	dark grey	35	mL	white (calcite cement)	well	sr
9690	- 9700	45	5 red, 40 light greenish grey	40	dark grey	15	mL	white (calcite cement)	well	sr
9680	- 9690	45	5 red, 40 light greenish grey	40	dark grey	15	mL	white (calcite cement)	well	sr
9670	- 9680	45	5 red, 40 light greenish grey	40	dark grey	15	mL	white (calcite cement)	well	sr
9660	- 9670	15	5 red, 10 light greenish grey	25	dark grey	60	mL	white (calcite cement)	well	sr
9650	- 9660	15	5 red, 10 light greenish grey	25	dark grey	60	mL	white (calcite cement)	well	sr
9640	- 9650	15	5 red, 10 light greenish grey	25	dark grey	60	mL	white (calcite cement)	well	sr
9630	- 9640	15	5 red, 10 light greenish grey	25	dark grey	60	mL	white (calcite cement)	well	sr
9620	- 9630	15	5 red, 10 light greenish grey	25	dark grey	60	mL	white (calcite cement)	well	sr
9610	- 9620	15	5 red, 10 light grey	75	black	0	-	-	-	-
9600	- 9610	20	10 red, 10 light grey	80	dark grey	0	-	-	-	-
9590	- 9600	20	10 red, 10 light grey	80	dark grey	0	-	-	-	-
9580	- 9590	20	10 red, 10 light grey	80	dark grey	0	-	-	-	-
9570	- 9580	20	10 red, 10 light grey	80	dark grey	0	-	-	-	-
9560	- 9570	20	10 red, 10 light grey	75	black	0	-	-	-	-
9550	- 9560	20	10 red, 10 light grey	75	black	0	-	-	-	-
9540	- 9550	20	10 red, 10 light grey	75	black	0	-	-	-	-
9530	- 9540	20	10 red, 10 light grey	75	black	0	-	-	-	-
9520	- 9530	20	10 red, 10 light grey	75	black	0	-	-	-	-
9510	- 9520	15	10 red, 5 greenish grey	50	dark grey	35	fL	white (calcite cement)	mod	sr
9500	- 9510	15	10 red, 5 greenish grey	50	dark grey	35	fL	white (calcite cement)	mod	sr
9490	- 9500	15	10 red, 5 greenish grey	50	dark grey	35	fL	white (calcite cement)	mod	sr
9480	- 9490	15	10 red, 5 greenish grey	50	dark grey	35	fL	white (calcite cement)	mod	sr
9470	- 9480	15	10 red, 5 greenish grey	50	dark grey	35	fL	white (calcite cement)	mod	sr
9460	- 9470	15	10 red, 5 greenish grey	50	dark grey	35	fL	white (calcite cement)	mod	sr
9450	- 9460	15	10 red, 5 greenish grey	50	dark grey	35	fL	white (calcite cement)	mod	sr

cutting depth (ft)	muscovite	carbonaceous material	comments
9980 - 10000	tr	tr	
9960 - 9980	tr	tr	
9940 - 9960	tr	tr	
9920 - 9940	tr	tr	
9900 - 9920	tr	tr	
9880 - 9900	tr	tr	
9860 - 9880	tr	tr	
9840 - 9860	tr	tr	
9820 - 9840	tr	tr	few rose quartz grains, few quartz grains up to granules
9800 - 9820	tr	tr	
9780 - 9800	tr	tr	
9760 - 9780	tr	tr	abundant unknown fossil fragments (not shells) in limestone, trace pyrite, few loose vcL rounded quartz grains
9740 - 9760	tr	tr	
9730 - 9740	tr	tr	
9720 - 9730	tr	tr	
9710 - 9720	tr	tr	
9700 - 9710	tr	tr	
9690 - 9700	tr	tr	
9680 - 9690	tr	tr	
9670 - 9680	tr	tr	few reddish ?sandstone fragments, trace coal fragments, few loose cU rounded quartz grains, trace pyrite
9660 - 9670	tr	tr	
9650 - 9660	tr	tr	
9640 - 9650	tr	tr	
9630 - 9640	tr	tr	
9620 - 9630	tr	tr	
9610 - 9620	mod	mod	trace pyrite, trace coal, few loose vC subrounded quartz grains
9600 - 9610	mod	tr	
9590 - 9600	mod	tr	few loose vC subrounded quartz grains, moderate amount of pyrite
9580 - 9590	mod	tr	
9570 - 9580	mod	tr	
9560 - 9570	mod	tr	
9550 - 9560	mod	tr	
9540 - 9550	mod	tr	
9530 - 9540	mod	tr	
9520 - 9530	mod	tr	
9510 - 9520	tr	tr	
9500 - 9510	tr	tr	
9490 - 9500	tr	tr	
9480 - 9490	tr	tr	
9470 - 9480	tr	tr	some of the sand has more calcite cement than other pieces and some have traces of glauconite
9460 - 9470	tr	tr	
9450 - 9460	tr	tr	

cutting depth (ft)	formation	coal%	mudstone %	mud color	sandy silt %	sandy silt color	silty sand %	silty sand color	clay %	clay color	limestone %
											% li
9440 - 9450	Naskapi member	0	0	-	0	-	0	-	0	-	0
9430 - 9440		0	0	-	0	-	0	-	0	-	0
9420 - 9430		0	0	-	0	-	0	-	0	-	0
9410 - 9420		0	0	-	0	-	0	-	0	-	0
9400 - 9410		0	0	-	0	-	0	-	0	-	0
9390 - 9400		0	0	-	0	-	0	-	0	-	0
9380 - 9390		0	0	-	0	-	0	-	0	-	0
9370 - 9380		0	0	-	0	-	0	-	0	-	0
9360 - 9370		0	0	-	0	-	0	-	0	-	0
9350 - 9360		0	0	-	0	-	0	-	0	-	0
9340 - 9350		0	0	-	0	-	0	-	0	-	0
9330 - 9340		0	0	-	0	-	0	-	0	-	0
9320 - 9330		0	0	-	0	-	0	-	0	-	0
9310 - 9320		0	0	-	0	-	0	-	0	-	0
9300 - 9310		0	0	-	0	-	0	-	0	-	0
9280 - 9300		0	0	-	0	-	0	-	0	-	0
9240 - 9260		0	0	-	0	-	0	-	0	-	0
9260 - 9280		0	0	-	0	-	0	-	0	-	0
9220 - 9240		0	0	-	0	-	0	-	0	-	0
9200 - 9220		0	0	-	0	-	15	white to light grey	0	-	0
9180 - 9200		0	0	-	0	-	25	white to light grey	0	-	0
9160 - 9180		0	0	-	0	-	35	white to light grey	0	-	0
9140 - 9160		0	0	-	0	-	35	white to light grey	0	-	0
9120 - 9140		0	0	-	0	-	35	white to light grey	0	-	0
9100 - 9120		0	0	-	0	-	0	-	0	-	2
9080 - 9100		0	0	-	0	-	0	-	0	-	2
9060 - 9080		0	0	-	0	-	0	-	0	-	2
9000 - 9020		0	0	-	0	-	0	-	0	-	2
8980 - 9000		0	0	-	40	lt grey (some laminated)	5	red/brown (glauconitic)	0	-	5
8940 - 8960		0	0	-	40	lt grey (some laminated)	5	red/brown (glauconitic)	0	-	5
8920 - 8940		0	0	-	40	lt grey (some laminated)	30	red/brown (glauconitic)	0	-	5
8910 - 8920		0	0	-	40	lt grey (some laminated)	30	red/brown (glauconitic)	0	-	5
8900 - 8910		0	0	-	20	light grey	0	-	0	-	0
8880 - 8900		0	10	laminated (lt grey silt, dark grey clay)	0	-	0	-	0	-	0
8840 - 8860		0	0	-	0	-	0	-	0	-	0
8780 - 8800		0	0	-	0	-	5	light brownish red	0	-	0
8760 - 8780		0	0	-	0	-	5	light brownish red	0	-	0
8740 - 8760		0	0	-	0	-	5	light brownish red	0	-	0
8720 - 8740		0	0	-	0	-	5	light brownish red	0	-	0
8700 - 8720		0	0	-	5	light grey	0	-	0	-	0
8680 - 8700		0	0	-	90	medium grey	0	-	0	-	0
8660 - 8680		0	0	-	90	medium grey	0	-	0	-	0

cutting depth (ft)		lithology limestone color
9440	- 9450	-
9430	- 9440	-
9420	- 9430	-
9410	- 9420	-
9400	- 9410	-
9390	- 9400	-
9380	- 9390	-
9370	- 9380	-
9360	- 9370	-
9350	- 9360	-
9340	- 9350	-
9330	- 9340	-
9320	- 9330	-
9310	- 9320	-
9300	- 9310	-
9280	- 9300	-
9240	- 9260	-
9260	- 9280	-
9220	- 9240	-
9200	- 9220	-
9180	- 9200	-
9160	- 9180	-
9140	- 9160	-
9120	- 9140	-
9100	- 9120	buff
9080	- 9100	buff
9060	- 9080	buff
9000	- 9020	buff
8980	- 9000	buff
8940	- 8960	buff
8920	- 8940	buff
8910	- 8920	buff
8900	- 8910	-
8880	- 8900	-
8840	- 8860	-
8780	- 8800	-
8760	- 8780	-
8740	- 8760	-
8720	- 8740	-
8700	- 8720	-
8680	- 8700	-
8660	- 8680	-

cutting depth (ft)		siltstone %	siltst color	shale %	shale color	sandstone %	sand size	sand color	sorting (sand)	roundness (sand)
9440	- 9450	15	10 red, 5 greenish grey	50	dark grey	35	fL	white (calcite cement)	mod	sr
9430	- 9440	15	10 red, 5 greenish grey	50	dark grey	35	fL	white (calcite cement)	mod	sr
9420	- 9430	15	10 red, 5 greenish grey	50	dark grey	35	fL	white (calcite cement)	mod	sr
9410	- 9420	10	5 red, 5 light grey	85	dark grey - black	5	vfL	white	-	-
9400	- 9410	10	5 red, 5 light grey	85	dark grey - black	5	vfL	white	-	-
9390	- 9400	10	5 red, 5 light grey	85	dark grey - black	5	vfL	white	-	-
9380	- 9390	10	5 red, 5 light grey	85	dark grey - black	5	vfL	white	-	-
9370	- 9380	10	5 red, 5 light grey	85	dark grey - black	5	vfL	white	-	-
9360	- 9370	10	5 red, 5 light grey	85	dark grey - black	5	vfL	white	-	-
9350	- 9360	0		100	dark grey - black	0	-	-	-	-
9340	- 9350	0		100	dark grey - black	0	-	-	-	-
9330	- 9340	0		100	dark grey - black	0	-	-	-	-
9320	- 9330	0		100	dark grey - black	0	-	-	-	-
9310	- 9320	60	light grey	40	dark grey	0	-	-	-	-
9300	- 9310	60	light grey	40	dark grey	0	-	-	-	-
9280	- 9300	60	light grey	40	dark grey	0	-	-	-	-
9240	- 9260	30	light grey	65	dark grey	5	vfL	white (calcite cement)	-	-
9260	- 9280	30	light grey	65	dark grey	5	vfL	white (calcite cement)	-	-
9220	- 9240	30	light grey	65	dark grey	5	vfL	white (calcite cement)	-	-
9200	- 9220	20	5 red, 15 light grey	65	dark grey	0	-	-	well	sa
9180	- 9200	30	5 red, 25 light grey	45	dark grey	0	-	-	well	sa
9160	- 9180	30	5 red, 25 light grey	35	dark grey	0	-	-	well	sa
9140	- 9160	30	5 red, 25 light grey	35	dark grey	0	-	-	well	sa
9120	- 9140	30	5 red, 25 light grey	35	dark grey	0	-	-	well	sa
9100	- 9120	20	10 red, 10 grey	48	dark grey	30	vfL-fU	white (varying amt cement)	mod	sr
9080	- 9100	20	10 red, 10 grey	48	dark grey	30	vfL-fU	white (varying amt cement)	mod	sr
9060	- 9080	20	10 red, 10 grey	48	dark grey	30	vfL-fU	white (varying amt cement)	mod	sr
9000	- 9020	20	10 red, 10 grey	48	dark grey	30	vfL-fU	white (varying amt cement)	mod	sr
8980	- 9000	0		40	dark grey	10	fL	white	mod	sr
8940	- 8960	0		40	dark grey	10	fL	white	mod	sr
8920	- 8940	0		20	dark grey	5	fL	white	mod	sr
8910	- 8920	0		20	dark grey	5	fL	white	mod	sr
8900	- 8910	0		70	dark grey	10	fL	white (calcite cement)	mod	sa
8880	- 8900	0		90	dark grey - black	0	-	-	-	-
8840	- 8860	0		80	dk gy - bl (minor silt lam)	20	vfL	white (varying amt cement)	mod	sr
8780	- 8800	10	light grey	70	dark grey	15	fL-mU	white (varying amt cement)	mod	sa
8760	- 8780	10	light grey	70	dark grey	15	fL-mU	white (varying amt cement)	mod	sa
8740	- 8760	10	light grey	70	dark grey	15	fL-mU	white (varying amt cement)	mod	sa
8720	- 8740	10	light grey	70	dark grey	15	fL-mU	white (varying amt cement)	mod	sa
8700	- 8720	0		15	dark grey	80	cU-granules (loose)	white (qz)	mod-poor	a-sr
8680	- 8700	0		10	dark grey	0	-	-	-	-
8660	- 8680	0		10	dark grey	0	-	-	-	-

cutting depth (ft)		muscovite	carbonaceous material	comments
9440	- 9450	tr	tr	
9430	- 9440	tr	tr	
9420	- 9430	tr	tr	
9410	- 9420	tr	tr	
9400	- 9410	tr	tr	
9390	- 9400	tr	tr	trace pyrite, few orange sandstone grains
9380	- 9390	tr	tr	
9370	- 9380	tr	tr	
9360	- 9370	tr	tr	
9350	- 9360	tr	tr	
9340	- 9350	tr	tr	trace pyrite
9330	- 9340	tr	tr	
9320	- 9330	tr	tr	
9310	- 9320	tr	tr	
9300	- 9310	tr	tr	probably the mix of shale and silt was laminations although none are visible within a single cutting
9280	- 9300	tr	tr	
9240	- 9260	tr	tr-mod	few unidentifiable shells, some sand has very fine silt laminations, some siltstones have small bits of copper throughout, trace pyrite
9260	- 9280	tr	tr-mod	few unidentifiable shells, some sand has very fine silt laminations, trace pyrite
9220	- 9240	tr	tr-mod	
9200	- 9220	tr	tr	
9180	- 9200	tr	tr	
9160	- 9180	tr	tr	few shale fragments have <mm vfL-silt laminations, trace pyrite, trace coal
9140	- 9160	tr	tr	
9120	- 9140	tr	tr	
9100	- 9120	tr	tr	
9080	- 9100	tr	tr	trace ?glauconite
9060	- 9080	tr	tr	
9000	- 9020	tr	tr	
8980	- 9000	tr	tr	
8940	- 8960	tr	tr	few loose subrounded to rounded quartz granules, trace pyrite
8920	- 8940	tr	tr	few loose subrounded to rounded quartz granules, trace pyrite, moderate amount of ?glauconite
8910	- 8920	tr	tr	few red mud clasts with mm vfL sand clasts, few iron shavings
8900	- 8910	tr	tr	
8880	- 8900	tr	tr	
8840	- 8860	tr	tr	moderate pyrite
8780	- 8800	tr	tr	
8760	- 8780	tr	tr	some glauconite in sands, few subrounded quartz granules, some muds have minor laminations
8740	- 8760	tr	tr	
8720	- 8740	tr	tr	
8700	- 8720	tr	tr	
8680	- 8700	tr	tr	
8660	- 8680	tr	tr	

Dauntless D-35

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cutting depth (ft)	formation	coal%	mudstone %	mud color	sandy silt %	sandy silt color	silty sand %	silty sand color	clay %	clay color	limestone %
8640 - 8660		0	0	-	90	medium grey	0	-	0	-	0
8620 - 8640		0	0	-	0	-	30	light grey	0	-	0
8600 - 8620		0	0	-	40	lt grey (some laminated)	0	-	0	-	0
8580 - 8600		0	0	-	40	light brown	25	reddish brown	0	-	5
8560 - 8580		0	0	-	70	brown (some laminated)	0	-	0	-	0
8540 - 8560		0	0	-	70	brown (some laminated)	0	-	0	-	0
8520 - 8540		0	0	-	55	brown (some laminated)	0	-	0	-	0
8500 - 8520		0	20	medium to dark grey	0	-	0	-	0	-	0
8480 - 8500		0	20	medium to dark grey	0	-	0	-	0	-	0
8460 - 8480		0	40	medium to dark grey	0	-	0	-	0	-	0
8440 - 8460		0	20	medium to dark grey	0	-	0	-	0	-	0
8420 - 8440		0	0	-	0	-	80	light grey	0	-	0
8400 - 8420		0	0	-	0	-	0	-	0	-	0
8380 - 8400		0	0	-	0	-	0	-	0	-	0
8360 - 8380		0	0	-	0	-	0	-	0	-	0
8340 - 8360		0	0	-	0	-	0	-	0	-	0
8320 - 8340		0	0	-	0	-	0	-	0	-	0
8300 - 8320		0	0	-	0	-	0	-	0	-	0
8280 - 8300		0	25	dark grey	60	lt grey (some glauconite)	0	-	0	-	5
8260 - 8280	Cree member	0	0	-	0	-	0	-	0	-	0
8240 - 8260		0	0	-	0	-	30	medium grey	0	-	0
8220 - 8240		0	0	-	0	-	30	medium grey	0	-	0
8200 - 8220		0	0	-	0	-	0	-	0	-	60
8180 - 8200		0	0	-	0	-	0	-	0	-	60
8160 - 8180		0	0	-	0	-	0	-	0	-	60
8140 - 8160		0	0	-	0	-	80	light grey	0	-	0
8120 - 8140		0	50	dark grey	0	-	0	-	0	-	5
8100 - 8120		0	0	-	0	-	0	-	0	-	0
8080 - 8100		0	0	-	0	-	0	-	0	-	0
8060 - 8080		0	0	-	0	-	0	-	0	-	0
8040 - 8060		0	30	dark grey (some laminated)	0	-	20	white	0	-	0
8020 - 8040		0	40	dark grey (some laminated)	0	-	0	-	0	-	0
8000 - 8020		0	40	dark grey (some laminated)	0	-	0	-	0	-	0
7980 - 8000		0	40	dark grey (some laminated)	0	-	0	-	0	-	0
7960 - 7980		0	40	dark grey (some laminated)	0	-	0	-	0	-	0
7940 - 7960		0	40	dark grey (some laminated)	0	-	0	-	0	-	0
7920 - 7940		0	0	-	0	-	60	light grey	0	-	0
7900 - 7920		0	0	-	0	-	0	-	0	-	0
7880 - 7900		0	40	dark grey (some laminated)	0	-	0	-	0	-	0
7860 - 7880		0	0	-	0	-	0	-	0	-	0
7840 - 7860		0	0	-	0	-	0	-	0	-	0
7820 - 7840		0	0	-	0	-	60	light grey	0	-	0

cutting depth (ft)		ithology limestone color
8640	- 8660	-
8620	- 8640	-
8600	- 8620	-
8580	- 8600	buff
8560	- 8580	-
8540	- 8560	-
8520	- 8540	-
8500	- 8520	-
8480	- 8500	-
8460	- 8480	-
8440	- 8460	-
8420	- 8440	-
8400	- 8420	-
8380	- 8400	-
8360	- 8380	-
8340	- 8360	-
8320	- 8340	-
8300	- 8320	-
8280	- 8300	dark grey (some sand, shells, glauc)
8260	- 8280	-
8240	- 8260	-
8220	- 8240	-
8200	- 8220	pinkish
8180	- 8200	pinkish
8160	- 8180	pinkish
8140	- 8160	-
8120	- 8140	pinkish
8100	- 8120	-
8080	- 8100	-
8060	- 8080	-
8040	- 8060	-
8020	- 8040	-
8000	- 8020	-
7980	- 8000	-
7960	- 7980	-
7940	- 7960	-
7920	- 7940	-
7900	- 7920	-
7880	- 7900	-
7860	- 7880	-
7840	- 7860	-
7820	- 7840	-

cutting depth (ft)		siltstone %	siltst color	shale %	shale color	sandstone %	sand size	sand color	sorting (sand)	roundness (sand)
8640	- 8660	0		10	dark grey	0	-	-	-	-
8620	- 8640	40	light grey	30	dark grey	0	-	-	poor	sa
8600	- 8620	0		0	-	60	vfU-mU	white (varying amt cement)	poor	sr-a
8580	- 8600	0		0	-	30	25 fL-fU, 5 granules	white	mod	granules sr, fine sa-a
8560	- 8580	0		10	dark grey	20	vfL	white (varying amt cement)	mod	sa-sr
8540	- 8560	0		10	dark grey	20	vfL	white (varying amt cement)	mod	sa-sr
8520	- 8540	5	red	0	-	40	35 vfL-vfU, 5 fU	white	well	sr
8500	- 8520	0		75	dark grey	5	fL	white (glauconitic)	-	-
8480	- 8500	0		75	dark grey	5	fL	white (glauconitic)	-	-
8460	- 8480	0		45	dark grey	15	fL	white	-	-
8440	- 8460	0		75	dark grey	5	fL	white (glauconitic)	-	-
8420	- 8440	20	light grey	0	-	0	-	-	mod	sr
8400	- 8420	100	med grey (trace qz grains)	0	-	0	-	-	-	-
8380	- 8400	100	med grey (trace qz grains)	0	-	0	-	-	-	-
8360	- 8380	100	medium grey	0	-	0	-	-	-	-
8340	- 8360	40	medium grey	20	dark grey	40	cU-vcL (loose)	white	mod	well r-a
8320	- 8340	40	medium grey	20	dark grey	40	cU-vcL (loose)	white	mod	well r-a
8300	- 8320	40	medium grey	20	dark grey	40	cU-vcL (loose)	white	mod	well r-a
8280	- 8300	0		0	-	10	fU-mL	light grey (carbonate cement)	-	-
8260	- 8280	100	med grey (trace qz grains)	0	-	0	-	-	-	-
8240	- 8260	35	5 red, 30 med grey	35	dark grey	0	-	-	mod	sa
8220	- 8240	35	5 red, 30 med grey	35	dark grey	0	-	-	mod	sa
8200	- 8220	30	medium grey	0	-	10	fine	pinkish carbonate cement	-	-
8180	- 8200	30	medium grey	0	-	10	fine	pinkish carbonate cement	-	-
8160	- 8180	30	medium grey	0	-	10	fine	pinkish carbonate cement	-	-
8140	- 8160	20	light grey	0	-	0	-	-	mod	sr
8120	- 8140	5	light grey	0	-	40	fine	white, glauconitic, carb cement	mod	sa
8100	- 8120	100	med grey (trace qz grains)	0	-	0	-	-	-	-
8080	- 8100	100	med grey (trace qz grains)	0	-	0	-	-	-	-
8060	- 8080	100	med grey (trace qz, calcareous)	0	-	0	-	-	-	-
8040	- 8060	50	light grey (trace qz grains)	0	-	0	-	-	mod	sa
8020	- 8040	60	med grey (trace qz grains)	0	-	0	-	-	-	-
8000	- 8020	60	med grey (trace qz grains)	0	-	0	-	-	-	-
7980	- 8000	60	med grey (trace qz grains)	0	-	0	-	-	-	-
7960	- 7980	60	med grey (trace qz grains)	0	-	0	-	-	-	-
7940	- 7960	60	med grey (trace qz grains)	0	-	0	-	-	-	-
7920	- 7940	0		20	dark grey	20	fine	white (abund carbonate cement)	-	-
7900	- 7920	100	med grey (trace qz grains)	0	-	0	-	-	-	-
7880	- 7900	60	med grey (trace qz grains)	0	-	0	-	-	-	-
7860	- 7880	20	medium grey	80	dark grey	0	-	-	-	-
7840	- 7860	100	med grey (trace qz grains)	0	-	0	-	-	-	-
7820	- 7840	0		20	dark grey	20	fine	white (abund carbonate cement)	-	-

cutting depth (ft)		muscovite	carbonaceous material	comments
8640	- 8660	tr	tr	
8620	- 8640	tr	tr	sand contains moderate pyrite and traces of glauconite, some silts contain shale laminations
8600	- 8620	tr	tr	moderate to abundant glauconite in sand, trace pyrite, few loose coarse rose quartz grains
8580	- 8600	tr	tr	fine sand (variable amount of carbonate cement) contains mod amount of rose quartz, very fine silty sand contains mod amount of glauconite
8560	- 8580	tr	tr	
8540	- 8560	tr	tr	
8520	- 8540	tr	tr	trace pyrite
8500	- 8520	tr	tr	
8480	- 8500	tr	tr	
8460	- 8480	tr	tr	
8440	- 8460	tr	tr	
8420	- 8440	tr	tr	
8400	- 8420	none	tr	few loose subrounded quartz granules
8380	- 8400	none	tr	
8360	- 8380	none	tr	note on cuttings vial says "source rock"
8340	- 8360	tr	tr	
8320	- 8340	tr	tr	
8300	- 8320	tr	tr	
8280	- 8300	tr	tr	trace pyrite, abundant glauconite, few rounded quartz granules
8260	- 8280	none	tr	
8240	- 8260	tr	tr	
8220	- 8240	tr	tr	
8200	- 8220	none	tr	trace pyrite, trace glauconite, few rounded quartz granules
8180	- 8200	none	tr	
8160	- 8180	none	tr	
8140	- 8160	tr	tr	
8120	- 8140	tr	mod	trace coal, trace pyrite, abundant glauconite
8100	- 8120	none	tr	
8080	- 8100	none	tr	
8060	- 8080	none	tr	
8040	- 8060	tr	tr	few subrounded loose quartz granules, trace glauconite
8020	- 8040	tr	tr	
8000	- 8020	tr	tr	
7980	- 8000	tr	tr	
7960	- 7980	tr	tr	
7940	- 7960	tr	tr	
7920	- 7940	tr	tr	moderate amount of pyrite, trace glauconite
7900	- 7920	none	tr	
7880	- 7900	tr	tr	
7860	- 7880	tr	tr	some pieces of shale or siltstone have laminations of the other in them
7840	- 7860	none	tr	
7820	- 7840	tr	tr	

% li

cutting depth (ft)		formation	coal%	mudstone %	mud color	sandy silt %	sandy silt color	silty sand %	silty sand color	clay %	clay color	limestone %
7800	- 7820		0	0	-	0	-	60	light grey	0	-	0
7780	- 7800		0	0	-	0	-	0	-	0	-	0
7760	- 7780		0	40	dark grey (some laminated)	0	-	0	-	0	-	0
7740	- 7760		0	40	dark grey (some laminated)	0	-	0	-	0	-	0
7720	- 7740		0	40	dark grey (some laminated)	0	-	0	-	0	-	0
7700	- 7720		0	0	-	0	-	0	-	0	-	0
7680	- 7700		0	0	-	0	-	0	-	0	-	0
7660	- 7680		0	0	-	0	-	0	-	0	-	0
7640	- 7660		0	0	-	0	-	0	-	0	-	20
7620	- 7640		0	30	dark grey (some laminated)	0	-	20	white	0	-	0
7600	- 7620		0	0	-	0	-	0	-	0	-	60
7580	- 7600		0	0	-	0	-	0	-	0	-	60
7560	- 7580		0	0	-	0	-	0	-	0	-	25
7540	- 7560		0	0	-	0	-	0	-	0	-	25
7520	- 7540		0	0	-	0	-	0	-	0	-	5
7500	- 7520		0	0	-	0	-	0	-	0	-	5
7480	- 7500		0	0	-	0	-	0	-	0	-	0
7460	- 7480		0	0	-	0	-	0	-	0	-	0
7440	- 7460		0	35	lt grey (mainly silt with shale lams)	0	-	0	-	0	-	0
7420	- 7440		0	0	-	100	light to medium grey	0	-	0	-	0
7400	- 7420	sable member	0	0	-	100	light to medium grey	0	-	0	-	0
7380	- 7400		0	0	-	100	light to medium grey	0	-	0	-	0
7360	- 7380		0	0	-	0	-	0	-	0	-	5
7340	- 7360		0	0	-	0	-	0	-	0	-	5
7300	- 7320		0	0	-	0	-	0	-	0	-	0
7280	- 7300		0	0	-	0	-	0	-	0	-	0
7260	- 7280		0	0	-	0	-	0	-	0	-	0
7240	- 7260		0	0	-	0	-	0	-	0	-	0
7220	- 7240		0	0	-	0	-	0	-	0	-	0
7200	- 7220		0	0	-	0	-	0	-	0	-	0
7180	- 7200		0	0	-	0	-	0	-	0	-	0
7160	- 7180		0	0	-	0	-	0	-	0	-	0
7140	- 7160	marmora mbr	0	0	-	0	-	0	-	0	-	0
7120	- 7140		0	0	-	0	-	0	-	0	-	0
7100	- 7120		0	0	-	0	-	0	-	0	-	0
7080	- 7100		0	0	-	0	-	0	-	0	-	0

KB: 98' @ 75' draft (MLLW) water depth: 227' Lat: 44°44'08.26"N Long: 57°20'46.62"W

cutting depth (ft)		ithology
		limestone color
7800	- 7820	-
7780	- 7800	-
7760	- 7780	-
7740	- 7760	-
7720	- 7740	-
7700	- 7720	-
7680	- 7700	-
7660	- 7680	-
7640	- 7660	buff
7620	- 7640	-
7600	- 7620	buff (extensive sand and mud)
7580	- 7600	buff (extensive sand and mud)
7560	- 7580	buff (extensive sand and mud)
7540	- 7560	buff (extensive sand and mud)
7520	- 7540	buff
7500	- 7520	buff
7480	- 7500	-
7460	- 7480	-
7440	- 7460	-
7420	- 7440	-
7400	- 7420	-
7380	- 7400	-
7360	- 7380	buff
7340	- 7360	buff
7300	- 7320	-
7280	- 7300	-
7260	- 7280	-
7240	- 7260	-
7220	- 7240	-
7200	- 7220	-
7180	- 7200	-
7160	- 7180	-
7140	- 7160	-
7120	- 7140	-
7100	- 7120	-
7080	- 7100	-

Dauntless D-35

cutting depth (ft)		siltstone %	siltst color	shale %	shale color	sandstone %	sand size	sand color	sorting (sand)	roundness (sand)
7800	- 7820	0		20	dark grey	20	fine	white (abund carbonate cement)	-	-
7780	- 7800	100	med grey (trace qz grains)	0	-	0	-	-	-	-
7760	- 7780	60	med grey (trace qz grains)	0	-	0	-	-	-	-
7740	- 7760	60	med grey (trace qz grains)	0	-	0	-	-	-	-
7720	- 7740	60	med grey (trace qz grains)	0	-	0	-	-	-	-
7700	- 7720	100	med grey (trace qz grains)	0	-	0	-	-	-	-
7680	- 7700	80	light grey (trace qz grains)	20	dark grey	0	-	-	-	-
7660	- 7680	40	light grey	10	dark grey	50	vf	white (carb cement, tr glauc)	mod	sr
7640	- 7660	20	light grey	50	dark grey	10	vfL-vfU	white (abundant carb cement)	-	-
7620	- 7640	50	light grey (trace qz grains)	0	-	0	-	-	mod	sa
7600	- 7620	10	light grey	30	dark grey	0	-	-	-	-
7580	- 7600	10	light grey	30	dark grey	0	-	-	-	-
7560	- 7580	50	light grey	25	dark grey	0	-	-	-	-
7540	- 7560	50	light grey	25	dark grey	0	-	-	-	-
7520	- 7540	45	light grey	30	dark grey	20	vfL	white (well cemented)	mod	sr
7500	- 7520	45	light grey	45	dark grey	5	vfL	white (well cemented)	mod	sr
7480	- 7500	70	light grey	30	dark grey	0	-	-	-	-
7460	- 7480	40	light grey	50	dark grey	10	vfL	white (well cemented)	mod	sr
7440	- 7460	0		50	dark grey	15	vfL	white (well cemented)	mod	sr
7420	- 7440	0		0	-	0	-	-	-	-
7400	- 7420	0		0	-	0	-	-	-	-
7380	- 7400	0		0	-	0	-	-	-	-
7360	- 7380	25	medium grey	10	dark grey	60	fL-mL	white (well cemented)	mod	sa
7340	- 7360	25	medium grey	10	dark grey	60	fL-mL	white (well cemented)	mod	sa
7300	- 7320	40	light grey	10	dark grey	50	vf	white (carb cement, tr glauc)	mod	sr
7280	- 7300	40	light grey	10	dark grey	50	vf	white (carb cement, tr glauc)	mod	sr
7260	- 7280	40	light grey	10	dark grey	50	vf	white (carb cement, tr glauc)	mod	sr
7240	- 7260	40	light grey	10	dark grey	50	vf	white (carb cement, tr glauc)	mod	sr
7220	- 7240	40	light grey	10	dark grey	50	vf	white (carb cement, tr glauc)	mod	sr
7200	- 7220	40	light grey	10	dark grey	50	vf	white (carb cement, tr glauc)	mod	sr
7180	- 7200	40	light grey	10	dark grey	50	vf	white (carb cement, tr glauc)	mod	sr
7160	- 7180	40	light grey	10	dark grey	50	vf	white (carb cement, tr glauc)	mod	sr
7140	- 7160	40	light grey	10	dark grey	50	vf	white (carb cement, tr glauc)	mod	sr
7120	- 7140	40	light grey	10	dark grey	50	vf	white (carb cement, tr glauc)	mod	sr
7100	- 7120	40	light grey	10	dark grey	50	vf	white (carb cement, tr glauc)	mod	sr
7080	- 7100	25	5 red, 20 medium grey	75	dk gy (some minor silt)	0	-	-	-	-

mod = moderate, ab = abundant, tr = trac
sr = subrounded, sa = subangular

cutting depth (ft)		muscovite	carbonaceous material	comments
7800	- 7820	tr	tr	
7780	- 7800	none	tr	
7760	- 7780	tr	tr	
7740	- 7760	tr	tr	
7720	- 7740	tr	tr	
7700	- 7720	none	tr	
7680	- 7700	tr	tr	
7660	- 7680	tr	tr	trace pyrite
7640	- 7660	tr	tr	few subrounded quartz granules, trace glauconite
7620	- 7640	tr	tr	
7600	- 7620	tr	tr	trace pyrite, trace glauconite
7580	- 7600	tr	tr	
7560	- 7580	tr	tr	
7540	- 7560	tr	tr	
7520	- 7540	tr	tr	
7500	- 7520	tr	tr	trace pyrite
7480	- 7500	tr	tr	
7460	- 7480	tr	tr	
7440	- 7460	tr	tr	
7420	- 7440	tr	tr	
7400	- 7420	tr	tr	
7380	- 7400	tr	tr	
7360	- 7380	tr	tr	
7340	- 7360	tr	tr	poor sample
7300	- 7320	tr	tr	few subrounded quartz granlues
7280	- 7300	tr	tr	
7260	- 7280	tr	tr	
7240	- 7260	tr	tr	
7220	- 7240	tr	tr	
7200	- 7220	tr	tr	
7180	- 7200	tr	tr	
7160	- 7180	tr	tr	
7140	- 7160	tr	tr	
7120	- 7140	tr	tr	
7100	- 7120	tr	tr	
7080	- 7100	none	tr	trace pyrite

ce, a = angular, r = roundec