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Outliers of Lower Cretaceous Chaswood Formation in northern Nova Scotia: results of scientific drilling and studies of sedimentology and sedimentary petrography

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Preface

This Open File Report presents data and a preliminary interpretation of the Lower Cretaceous Chaswood Formation in new boreholes drilled in 2002 in central Nova Scotia. The Chaswood Formation is a fluvial succession equivalent to the deltaic Missisauga and Logan Canyon formations of the Scotian basin, which are the principal reservoir rocks for the gas resources of the Sable sub-basin. The Chaswood Formation is an important source of industrial minerals: it is actively mined for silica sand and has been explored for kaolin. The entire Open File is available as a pdf file; tabular material is also presented as Excel files and graphical material as Coredraw v.9 files.

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Abstract

The majority of the known Lower Cretaceous Chaswood Formation sediments in Nova Scotia are located in the central part of the province. However there are three known outlier basins in the northern regions: Belmont in Colchester County, Brierly Brook in Antigonish County and Diogenes Brook in Inverness County on Cape Breton Island. New boreholes have been drilled in the former two locations, to improve the knowledge of Chaswood Formation in the basins including across and along-strike facies variations. Drilling in all three outliers has provided quality samples for petrographic analysis to better constrain the provenance, transport style, and diagenesis of these deposits. Results are compared with the better-known Chaswood Formation in the Elmsvale basin and at the Shubenacadie and West Indian Road outliers.

The northern outliers are preserved within small linear fault-bound basins. Lithofacies are similar to those in the better-known deposits of central Nova Scotia consisting of silica sand (stone) and mottled red and grey mudstone. At Brierly Brook, grey mudstones of debris-flow origin inter-finger with sands. The range of depositional and diagenetic environments is similar to that inferred for the Chaswood Formation of central Nova Scotia.

Thin section studies and X-ray diffraction show that the Belmont sandstones are typically finer grained, better sorted, more rounded and contain more quartz arenite and mudstone clasts, compared with Brierly Brook. Sandstones at both localities contain abundant kaolinite and some chlorite. Pseudorutile and rutile are present in stratigraphically lower sandstones at Brierly Brook. Pebbles within debris-flow deposits at Brierly Brook are of locally available lithologies. The stratigraphically youngest mudstones at Brierly Brook have high kaolinite, low illite, little or no vermiculite and chlorite, and generally abundant 21-25 Å mixed layered clays. Darker grey mudstone in the centre of the basin pass laterally into lighter grey mudstone with interbedded sand at the northern margin of the basin, where the mudstone contains much higher kaolinite and less pseudorutile. Such variations result from later clay mineral diagenesis aided by meteoric water flow through the permeable sands.

The sands at Belmont have a remarkably high proportion of ilmenite and its alteration products, suggesting that other sources are diluted by a local ilmenite-rich source in the central Cobequid Highlands. The abundance of detrital carbonate at Brierly Brook, together with thick debris-flow facies, provides evidence of important local sediment supply. A component of far-travelled sand is indicated by the abundance of detrital staurolite, which is also abundant at Diogenes Brook.

The permeable sand(stone)s at Belmont have undergone severe early diagenesis by meteoric water, with the development of oxisols, and the development of halloysite and kaolinite cements. Meteoric water has probably also altered any detrital feldspar and altered ilmenite to rutile. Lesser early diagenetic kaolinite is found at Brierly Brook, where it is most common in the permeable sands and interbedded mudstones on the northern margin of the basin. At both Brierly Brook and Belmont, diagenetic illite is a later cement and, as in the Elmsvale basin, may be related to basin fluids moving up-dip from the Scotian basin.

1. Introduction

1.1 Introduction and purpose

The Lower Cretaceous fluvial Chaswood Formation (Stea and Pullan 2001) is the proximal equivalent of thick deltaic units that are reservoir rocks for gas and oil in the offshore Scotian basin. The Chaswood Formation is best preserved in a series of fault-bound basins in central Nova Scotia, including the Elmsvale basin and the Shubenacadie, West Indian Road, and Upper Stewiacke outliers (Fig. 1.1). Small outliers are present at Belmont, Brierly Brook and Diogenes Brook in northern Nova Scotia (Dickie 1986; Stea et al. 1994) and at Vinegar Hill in southern New Brunswick (Falcon-Lang et al. 2003). The middle part of the Chaswood Formation has been generally assigned to the Aptian - Albian, whereas older Early Cretaceous biostratigraphic ages (Barremian and Valanginian) have been determined for some isolated deposits including the base of the Diogenes Brook section (Davies 1983).

The outliers of the Chaswood Formation in northern Nova Scotia are important for understanding the original extent, paleogeography and source of the Chaswood Formation. There are modern boreholes from Diogenes Brook, but at both Belmont and Brierly Brook there is an almost complete lack of outcrop and no useable previous borehole samples. As part of a study of the detrital petrology and diagenesis of the Chaswood Formation, we therefore drilled ten new boreholes from these two northern outliers. We have carried out laboratory analyses of samples from these boreholes, and also from boreholes at Diogenes Brook and a spoil heap at Upper Stewiacke (Stewiacke Cross Roads - Dickie 1986). The work reported in this Open File aims to describe the lithostratigraphy and geological setting of the Belmont and Brierly Brook outliers and to describe the sedimentary petrography of the principal facies, both coarse- and fine-grained, of the Chaswood Formation of northern Nova Scotia.

1.2 Lithofacies present in the Chaswood Formation

Studies of the Chaswood Formation in outcrop and boreholes suggest that six major facies associations can be distinguished. These are based principally on work on reference borehole RR-97-23 (Pe-Piper et al. 2004b) and outcrop studies at the West Indian Road pit (Gobeil 2002). These facies associations and their component facies (Table 1) are used in describing the boreholes in this study, although the poor recovery makes precise interpretation difficult in some cases.

The **sorted sandstone and conglomerate** facies association commonly occurs in graded beds with sharp bases. In the outcrops at the West Indian Road pit, Gobeil (2002) recognised six sandstone and four conglomerate facies, based on sedimentary structures, using the nomenclature of Miall (1978) and similar facies are recognisable in outcrop at Vinegar Hill. In boreholes, classification of the sorted sandstone and conglomerate is based on grain size, since structures are rarely preserved.

The **silty mudstone and muddy sandstone** facies association includes a range of poorly sorted lithologies. Silty mudstone is generally distinctly micaceous and commonly contains plant fragments. It generally gradationally overlies fine sandstone and passes upward into light gray mudstone. Poorly sorted, apparently structureless, muddy sandstone consists principally of mud and fine sand, but some beds include small amounts of medium or even coarse sand.

The **dark gray mudstone** facies association consists mainly of mudstone. Bed thicknesses range from a few centimetres to several metres and commonly shows alternation of lighter and darker gray colour. Rare beds show a distinct millimetre scale banding of dark gray and medium gray mudstone. Plant fragments are common and increase in abundance as in darker mudstone, as does the bulk organic carbon content. Mottling is rare. Lignitic mudstone, in beds < 0.5 m thick, resembles the dark gray mudstone but has more plant debris. Lignite, where present, is included in this facies association.

The **light gray mudstone** facies association consists predominantly of mudstone. Beds range in thickness from a few centimetres to several metres and thicker beds may show gradual changes in darkness. The light to medium gray mudstone locally contains organic detritus, but overall the bulk organic carbon content is low. The mudstones appear massive, except for a few cases of mm-scale lamination picked out by colour differences. Contacts are commonly gradational but, in some cases, are sharp. Some light gray mudstones have pinkish mottling. Where mottling is intense, the beds are included in the paleosol facies association (see below).

The **paleosol** facies association consists mostly of coloured mudstone, but also includes some stained fine sandstone beds. The mudstones are red, pink, yellow and purple, whereas the sandstones are mainly yellow or red. Paleosol features include sub-vertical tubular mottles that may be root traces and diagenetic nodules and mottles rich in hematite on a range of scales. Only a few well-organised paleosols are recognised, which are similar to oxisols and ultisols described by Retallack (1988).

The **debris-flow** facies association consists of contorted blocks of mudstone, in some cases with pebbles, with a mud or mud-sand matrix. It has been previously described from Clay Unit 1 at the West Indian Road pit by Gobeil (2002).

1.3 Methods

Drilling was carried out using a tracked drill-rig provided by Lantec Inc. Generally, overburden was augured and then the Chaswood Formation was drilled with HQ rods and cased. Sampling was generally by coring; in loose sands, a split spoon device was used on occasions. Samples from pumped water were taken in loose sands with poor recovery. Core samples were stored in standard core boxes which are archived at the Nova Scotia Department of Natural Resources Core Library in Stellarton.

Various laboratory procedures were used on selected samples. Poorly consolidated sands were

analysed by standard sieve analysis or by Coulter® laser analyser. Granules and gravel were separated from additional samples using a 2 mm sieve. Heavy minerals were separated using tetrabromoethane, using the 63 μm to 0.25 mm fraction, and were examined in polished thin sections of grain mounts.

Sandstone samples were made into thin sections and minerals were analyzed with a JEOL-733 electron microprobe equipped four wavelength spectrometers and a Tracor Northern 145 eV energy-dispersion detector. The beam was operated at 15 kV and 15 nA, with a beam diameter of 1-10 μm dependant on mineral and purpose of the analysis. Geological standards were used and were calibrated against reference kaolinite and other minerals. The data were reduced using a Tracor Northern ZAF matrix-correction program. Selected minerals were also examined in backscattered electron mode to characterise mineral morphology and interpret diagenetic relationships.

X-ray diffraction (XRD) analysis was on bulk sediment samples ground to a uniform powder. Bulk samples used a random mount made by lightly grinding the sample and stirring it onto a diffraction slide mount using methanol. X-ray diffraction was carried out on a Siemens Kristaloflex diffractometer using Co K$\propto$ radiation. Dry samples were scanned from 2°- 52° 2θ, with a slow scan from 28.5° - 30.5° 2θ to resolve any vermiculite or chlorite - kaolinite doublet, and glycolated samples were scanned from 2° - 17° 2θ to identify expandable clays. Mineral identification followed Moore and Reynolds (1997) and was based on previous analyses elsewhere in the Chaswood Formation (e.g. Pe-Piper et al. 2004b). Relative abundance of minerals was quantified using X-ray diffraction peak areas, but given variable crystallinity, no attempt was made to convert these values to weight percent.

The powdered bulk samples were also used for total carbon and organic carbon (after acid treatment) determination using a LECO carbon analyzer. Colour, measured as spectral reflectance, was determined from the powdered bulk samples using a Minolta hand-held spectrophotometer. In particular, we used the value of the a* (red-green) parameter as a proxy for hematite abundance (Balsam and Deaton, 1996).

2. Field observations and drilling program

2.1 Brierly Brook

2.1.1 Background and previous work

Stea et al.(1994) first discovered Chaswood Formation in the Brierly Brook area west of Antigonish. A narrow strip of Cretaceous rocks rests on the Windsor Group and is fault bound to the north by Horton Group sandstones that overlie Neoproterozoic basement of Browns Mountain Group (Fig. 2.1). Stea et al. (1994) described an apparent outcrop of silica sand on the Josef Andert property. Later drilling by Kaoclay Resources at the western end of the basin recovered 30 ft of dark grey clay at the northern edge of Kell's Enterprises Ltd. gravel pit (KH96-3, Gillis 1997), but thick Pleistocene elsewhere in the pit and elsewhere in the Brierly Brook lowlands (Fig. 2.1). Field investigations in 2002 (by D. Smeltzer) and 2003 (by R.R. Stea, see Stea et al. 2004) showed outcrops of silica sand, some with dark clay, in a zone WSW along strike between Kell's gravel pit and the outcrop discovered by Stea et al. (1994) and dark clays outcropped on the northeast side of a low ridge immediately north of the Kell's gravel pit, near Kaoclay borehole KH96-3. Northeast of the valley, on the flanks of Browns Mountain, are poorly sorted and moderately lithified polymictic coarse sandstone and conglomerate likely of the Horton Group (mapped as undivided Devonian-Carboniferous by Boehner and Giles (1993). Gypsum of the Bridgeville Formation (lower Windsor Group) is widespread on the southeast side of Brierly Brook.

2.1.2 Drilling strategy and summary of boreholes

The plan in the Brierly Brook area was to drill a series of holes to delineate across- and along-strike variation in Cretaceous strata. The Kell's Enterprises Ltd. lands (holes BB-02-1, 2 and 7) (Fig. 2.2) and the Hector MacIsaac property (holes BB-02-3, 4 and 5) were selected for the across-strike lines for logistical reasons, principally access to water. In addition, a hole (BB-02-6) was drilled at the most easterly known occurrence on the Josef Andert property.

Recovery was quite variable and poor in loose sands. Boreholes 1, 2 and 7 in the west of the area provided a stratigraphic cross-section across the entire narrow basin (Fig. 2.3). Boreholes 3, 4 and 5 formed a similar transect farther east: boreholes 3 and 4 encountered thick Pleistocene deposits, but Cretaceous sands were recovered on the northern edge of the basin at borehole 5. This borehole was adjacent to a large cut face in glacial till with thin Cretaceous rocks at the base. Borehole 6, at the eastern end of the basin was drilled beside a bank with spoil of silica sand, but encountered Windsor Group limestone bedrock beneath thin fill.

Borehole BB-02-1

5049936 N 20 571260 E

At base of slope north of Kell's Enterprises Ltd. gravel pit, adjacent to a small test pit in dark clays. The borehole went through thick dark grey clays with some sandy clays containing dispersed quartz granules, before reaching basement at 61'.

0-9'	red brown gravelly till
9-57'	dark grey clay, some silica sand, some clay and granules
57-62'	brown-grey clay
62'	brown weathered limestone over fresh well-bedded limestone

Borehole BB-02-2

5050060 N 20 571473E

On short skidder road 100 m up Browns Mountain road, on Kell's Enterprises Ltd. property.

0-7'	till
7-21'	sand and varicoloured clays
21-61'	dark grey clay and sandy clay with quartz granules
61'-82'	varicoloured clays, minor sands
82'-116'	principally sands (some granules), minor clay
116-131'	muddy sand and varicoloured clays, principally grey
131-136'	indurated polymictic pebbly sandstone
136-141'	rubble of limestone basement

Borehole BB-02-3

5050615N 20 572207E

On main valley floor at entrance to Hector MacIsaac property, near spring.

Carried out auger reconnaissance, which showed the presence of dark grey clay. Driling showed that the dark grey clay was glaciolacustrine sediment, overlying glacial till.

0-10':	Red till
10-18':	Gravel
18-32':	Dark sticky clay, some silt laminae, no quartz granules.
32-36':	Brown muddy till with green stones

Borehole BB-02-4

5050670N 20 572118E

Beside woodpile east of house, on Hector MacIsaac property

Attempted auger reconnaissance to 55'. Went into something soft at 52', interpreted as Cretaceous. Auger broke during recovery at 19': hole abandoned. Fishing for auger unsuccessful, so brought in excavator to recover. Discovered that there was a second break in the auger at about 35'. Drilled a second hole in the expectation that Cretaceous would be found at 52', but recovered stony till, with abundant drilled gabbro and Precambrian clasts, and a few sandy and muddy intervals.

Abandoned at 66' because no evidence of Cretaceous.

0-37: Gravelly red till

37-50': Grey till

Borehole BB-02-05

5050701N 20 571991E

Located adjacent to cut bank with Cretaceous outcrop beneath till, behind new barn on Hector MacIsaac property

In the adjacent bank, a 1 m high outcrop of massive dark grey clay, abundant wood, ?some bone. Also loose silica sand in bank.

0-15': Red sandy till

15-49': Poor recovery in sand, rare clay.

49-55' 25 cm dark grey limestone; grey returns, inferred limestone basement

55-60' tan returns and sand

60-66' grey returns, limestone basement again.

Borehole BB-02-6

5051314N 20 573079E

On Josef Andert's property, hard against bank with silica sand spoil reported by Stea et al. (1994).

0-25' Reddish till with green stones.

25.5-26' Dark limestone

Borehole BB-02-7

5050087N 20 571399E

near NE test pit on Kell's Enterprises Ltd property, to the north of holes BB-02-1 and BB-02-2

0-3' soil

3-31' varicoloured clays, some medium sand

31-51' mostly sand

51-76' dark sandy mud with granules, considerable medium sand
76-86' brown sand
86' basement limestone

2.1.3 Stratigraphic interpretation of new Brierly Brook boreholes

Thick Cretaceous deposits are found only in the western part of the area. Farther east, there are silica sand showings close to the northern contact with bedrock, but within the main valley Pleistocene erosion appears to have removed any Cretaceous deposits. (They might, of course, be present beneath a thick Pleistocene cover, but the results at BB-02-1 suggest that basement is not very deep).

The following stratigraphic section is recognised (Fig. 2.3):

Unit A varicoloured clays, some silica sand, particularly on the north side of the basin.

Unit B dark grey clay, some with quartz granules and clay clasts (debris-flow facies). In borehole 7, this unit has considerable interbedded sand. This facies resembles the Clay Unit 1 at the West Indian Road pit (Gobeil 2002).

Unit C varicoloured clays, some sands.

Unit D polymictic sandstone with common limestone detritus, resting unconformably on a weathered surface of Windsor Group limestone

Unit A is widespread. The clayey facies occurs in boreholes 1 and 2. The sandy facies occurs in boreholes 5 and 7 and also occurs in outcrop near boreholes 5 and 6. Unit B is found only in boreholes 1, 2 and 7. Units C and D are found only in borehole 2, with a probable thin development of D in borehole 7. This distribution could be interpreted as indicating tectonic movement following deposition of Unit C. This resulted in supply of muddy debris-flow deposits of Unit B and the onlap of Unit B onto Windsor limestone basement in boreholes 1 and 7 (Fig. 2.4). Original distribution of Units C and D is unknown - they likely were more extensive than their current preserved extent and were eroded prior to deposition of Unit B, in a manner analogous to that interpreted from seismic-reflection profiles in Elmsvale basin (Stea and Pullan 2001). An alternative interpretation is that units B and C are correlative, but represent rapid lateral facies changes, in which case the distribution of sediment types would provide no compelling evidence for syn-sedimentary tectonism.

The dip section of holes 1, 2 and 7 (Fig. 2.3) suggests that silica sand is most abundant near the northern faulted margin of the basin. This is consistent with the abundance of sand in hole 5 and the presence of sand near the site of hole 6. The possible duplication of basement Windsor Group limestone in borehole 5 (Fig. 2.2) is based on speed of drilling and colour of returns. It is interpreted to mean that there is some thrusting at this contact, analogous to that recognised by Stea and Pullan (2001) in the Branch Road section in the Elmsvale basin. This interpretation is consistent with the

faulting observed in the outcrops of Cretaceous strata in the cut bank behind the site of the borehole. Thus the Brierly Brook Cretaceous deposits are preserved in a very narrow basin. As argued by Stea et al. (2004), the deep but narrow fault-bound basin suggests an origin from strike-slip faulting.

2.2 Belmont

2.1.1 Background and previous work

The Belmont silica sand locality is located on the north side of the road that runs east from Belmont. A silica sand pit (Fig. 2.5) was operated by Shaw Resources some time in the late 1960's or early 1970's. There are no outcrops associated with this pit, but on the north side is large stock pile of silica sand and on the south side a stock pile in less pure sands. Previous boreholes reported by Cameron (1961) were poorly positioned because of snow!. Immediately to the southwest is a large sand pit in Pleistocene sediments extracted by Canada Cement. Older assessment reports also refer to silica sand on the south side of the road (Cole 1951), which may be of Pleistocene age (presumably reworked from the Cretaceous deposit). As a result, it is difficult to assess from reports of local residents where there is Cretaceous and where there is Pleistocene sand. Abundant white sand is reported from wells to the west and east of the silica sand pit.

2.5.2 Drilling strategy and summary of boreholes

Drilling in the Belmont area was limited by access to water and the residential nature of the area. Three boreholes were drilled, each 30 m apart (Fig. 2.2). Borehole 1, although on strike from the pit, went through 8 m of till overlying Triassic Wolfville Formation sandstone. Boreholes 2 and 3 both sampled Cretaceous deposits up to 20 m thick (Fig. 2.6), but there were hole control problems with the loose sands. Hole 3 is interpreted to have reached Triassic Blomidon Formation red mudstones at 20.5 m. Some of the Cretaceous sands were cemented, showing cross-bedding and heavy mineral concentrations. Mudstones are generally red in colour.

Borehole BM-02-1

5030672N 20 471978E

Located on SW side of pit on slight high

0-15': Red sandy till

15-20': Grey-green sandy till mixed with red

20-25': Slightly browner sandy till. End of auguring.

26-36': Drilled Triassic sandstone bedrock

Borehole BM-02-2

5030712N 20 471939E

0-26': Red sandy till as before

26-30': Disturbed silica sand with blebs of white and red clay

30-66': medium silica sand, poor recovery

Below 66' thick red mudstone, then more sand (poor recovery)

96' - 101', red mud again

Poor hole conditions, hole abandoned

Borehole BM-02-3

5030743N 20 471918E

0-5'	grey and tan silty clay
5-21'	red and pink clay, some other lithologies
21-31'	sand interbedded with red clay
31-51'	sand
51-61'	red clay, some sand
61'-81'	indurated red mottled brown and blue-grey shale, siltstone and sandstone, interpreted as upper Windsor Group while drilling, but now thought to be Blomidon Formation.

2.2.3 Stratigraphic interpretation of the new Belmont boreholes

Borehole 1, although on strike from the pit, sampled till overlying well-sorted and indurated sandstone similar to Wolfville Formation sandstone. Boreholes 2 and 3 both sampled Cretaceous deposits up to 20 m thick (Fig. 2.6), that interbed with principally red mudstones. Distribution of red mudstones is difficult to interpret because drilling in sands required high pump rates which in turn resulted in poor sample recovery. The more indurated red mudstones and interbedded sandstones in hole 3 are interpreted as pre-Cretaceous basement. The lithologies, including mudstones with fine sandstone intraclasts, resemble the Triassic Blomidon Formation, but could alternatively be of Carboniferous age. X-ray diffraction data presented below show the presence of smectites, known from the Triassic but not the Carboniferous of Nova Scotia (Brydon 1958). The pebbles recovered in BB-02-3 at 51' may represent a basal conglomerate to the Chaswood Formation.

Previous geological mapping and seismic-reflection profiles show that in the Belmont area, principal faults strike east-west (Fig. 2.5). The boreholes show that southwest of the pit, Wolfville Formation sandstone underlies < 9m of till, yet 40 m to the north there is > 20 m thickness of Cretaceous sediment (including thick silica sand) and a further 30 m to the north, Cretaceous sediment

is 20 m thick, but has much thinner sand. The identification of Cretaceous sands in the nearby domestic wells suggests that the Chaswood Formation forms a narrow E-W striking deposit. The rapid thickness variations suggest that an originally more extensive deposit is now bound by younger faults.

2.3 Diogenes Brook

Diogenes Brook (Glen Brook) runs down from the Creignish Hills and into the River Denys basin near Melford before reaching the Bras d'Or Lakes (Fig. 2.7). The western end of the brook flows in a narrow fault-bounded block of Windsor Group overlain by Cretaceous sands and clays. The Cretaceous rocks are exposed at the surface and sand was produced from 1923-1935 (Guernsey 1927; Kelly 1967). Three holes were drilled in 1982 by the Nova Scotia Department of Mines and Energy (Dickie 1986) and two holes in 1997 by Kaoclay Resources Inc (Feetham 1997). We have not carried out additional field investigations at Diogenes Brook.

One long borehole was drilled to 119 m by the Nova Scotia Department. of Mines and Energy, which was duplicated by Kaoclay to 116 m (Fig. 2.8). The original borehole penetrated principally sand, with limited recovery, to 92 m, overlying principally dark grey clay, with a 48 cm lignite bed at 115.4 m (Hacquebard 1984). Davies (in Dickie 1986) reported a late Aptian to early Albian palynomorph assemblage at 6-10 m, Barremian to early Aptian at 75-95 m and Valanginian at 97-119.5 m.

3. Relationship of bulk sediment properties to lithofacies

3.1. Grain size

Grain size has been measured by two main techniques. Larger samples were analysed by sieving, with the fine fraction (< 63μm) not subdivided. Smaller samples were analysed by Coulter® laser analyser after sieving off the >2 mm fraction. The laser analyser appears to slightly over-emphasise the fine fraction compared with the sieving technique. Comparison of apparently undisturbed sand samples from boreholes and samples taken from borehole washings show little difference in sand fraction distribution (compare washings sample at 64' in Fig. 3.1).

Three types of sand(stone) are distinguished on the basis of the abundance and type of fine fraction.

(1) Many sand(stone)s are well sorted, with < 1% silt and clay in sieved analyses and < 2% in analyses by Coulter laser. These include many sandstones from Belmont and unit B at Brierly Brook. Such

sand(stone)s are interpreted as the well-sorted deposits of normal river flow (either channelled or braided).

(2) Some sand(stone)s have a substantial clay matrix, but little silt, such as medium sand from Belmont (BM-02-2, 21'; Fig. 3.1) and poorly sorted sands from Brierly Brook (BB-02-2, 66', unit C; Fig. 3.2). The lack of silt-sized material indicates that the clay matrix is unlikely to be a primary depositional feature. This clay matrix is interpreted as a post-depositional effect due to downward leaching of clays in a soil zone, based on the development of pinkish clay and iron-oxide B zones in the conglomerates at the Vinegar Hill pit (Falcon-Lang et al. 2003).

(3) A few sand(stone)s are simply poorly sorted, with substantial coarse sand, fine sand, silt and clay fractions, such as the muddy sand(stone)s within a succession of muddy debris-flow deposits of unit B at Belmont (71', 74' in Fig. 3.2), which are interpreted as deposits of a sandy debris flow.

3.2. Reflectance spectroscopy

Reflectance spectrophotometry was measured using a Minolta C-2000 on the powder fraction of samples used for X-ray diffraction. The Minolta measures the reflected colour wavelengths every 10 μm from 400-700 μm as well as providing three-dimensional colour values of L (lightness: black – white), a* (hue: green – red), and b* (chroma: blue – yellow) (Table 3.4). Reflectance spectophotometry provides a rapid quantitative assessment of the sediment colour that has proved useful in the characterization and correlation of sediments (Balsam and Deaton 1996; Mix et al. 1995). The colour data from the northern outlier basins was plotted against lithological type (Fig. 3.4). The L, a* and b* values show that the grey mudstones have high L values and low a* and b* values. Correspondingly, although slightly more scattered, the red and mottled mudstones have similar L values but higher a*, and b* values due to their redder colour. The coarser sediment type show a much broader distribution in the L value range but when plotted against the a* value, two populations are visible: one with lower a* values (grey) and one with higher a* values (red), which likely reflects the grouping of the grey and red coloured silt- and sandstones. The distinction of these two populations is clearer in the siltstones and sandy mudstones than it is in the sandstones. This likely is a reflection of greater diversity between the grey and red sandstones or is an effect of grain size. However, on the triangular diagram of L, a* and b* (Fig. 3.4) both the sandstones and the mudstones plot in similar areas, suggesting that the grain size has little effect on the colour values.

3.3. Carbon content

Determinations of organic carbon and carbonate (expressed as $CaCO_3$) in selected samples is shown in Table 3.5. Samples from Belmont have <0.02% organic carbon (i.e. at the limits of analytical

detection) and virtually no carbonate. Dark grey clay at Brierly Brook typically contains 1-2% organic carbon, although in some samples it is as low as 0.2%. In contrast, light grey, red and mottled clays contain < 0.1% organic carbon. Several mudstone samples from Brierly Brook units B, C and D have high carbonate contents; most were identified as from debris-flow deposits or were sandy mudstone.

4. Sedimentary petrography

4.1 Pebble petrography

4.1.1. Bulk samples from stock piles

Bulk samples for determining pebble petrology were collected from old stock piles at Belmont, Upper Stewiacke and Brierly Brook. All these bulk samples appeared uncontaminated by glacial till and this was confirmed by subsequent petrographic analysis. At Belmont and Upper Stewiacke, a collection was made in addition of pebbles from the rain-washed surface of old stock piles. The presence of soft siltstone and mudstone pebbles of apparent Carboniferous provenance suggests that these surfaces could be slightly contaminated with pebbles from glacial till.

Pebbles from samples were counted and their lithologies catalogued (Table 4.1). Microphotographs of representative lithologies are shown in Appendix VIII. The most common type of pebble in all three localities was of vein quartz, which constituted over 50 percent of the pebbles (Figs. 4.1, 4.2), with yellow vein quartz particularly abundant at Belmont. Quartz arenite pebbles, likely of a Horton Group provenance (cf. Gobeil 2002), and quartz mylonites are also found at all localities, including from bulk samples that show no evidence for contamination by glacial till.

The interpretation of minor components found only in samples from washed surfaces of old stock piles is more difficult, because of the possibility of contamination by glacial till. At the West Indian Road pit, Stea and Fowler (1981) and Gobeil (2002) found minor quantities (<1% each) of mudstone, granite, rhyolite and gabbro as clasts from partly-lithified outcrops where there was no possibility of contamination by glacial till. Granite lithic clasts are found in sandstone from Belmont. Therefore, it is probable that the small amounts of spherulitic rhyolite and gabbro pebbles found at Belmont, and the pink granite and diabase pebbles at Upper Stewiacke were clasts in the Chaswood Formation. Gabbro would be sourced in the Wentworth pluton and minor gabbro stocks to the south; spherulitic rhyolite from the Fountain Lake Group to the north and west of the Wentworth pluton. Pink granite at Upper Stewiacke would be derived from the Wentworth or Gunshot Brook plutons. We considered whether rather soft mudstone "pebbles" might be an indicator of glacial transport. However, such

pebbles, which make up 2% of CS8 at Belmont and 3% of CS10 at Stewiacke, also make up <0.9% of samples at West Indian Road, where there is no contamination by glacial till: their significance at Belmont and Stewiacke is thus inconclusive.

4.1.2 Pebbles from boreholes

Pebbles from 15.5 m in BM-02-3 at Belmont are quartz-dominated and include polycrystalline quartz and quartz arenite (Table 4.2). In contrast, pebbles from pebbly sandstone in units C and D at Brierly Brook consist predominantly of limestone, similar to the underlying Windsor Group limestone, but also include coarse sandstone (Table 4.3). In unit B debris-flow deposits at Brierly Brook, pebbles include limestone, vein quartz and quartz mylonite.

4.2 Sandstone petrography

4.2.1 General petrography of sandstones

In general the sandstones observed in thin section from the Belmont boreholes are medium-grained, moderately sorted, with sub-angular to round quartz grains (Table 4.2). Mineralogically they are composed principally of monocrystalline quartz grains, with common grains of polycrystalline quartz resembling vein quartz. Muscovite and altered Fe-Ti oxides, many with trellis structures, are common. Quartz arenite lithic clasts are common. Lithoclasts of rhyolite, gabbro and granite were found at Belmont, but not at Brierly Brook. Matrix is generally dusty clay with silt size quartz grains. Cement is principally kaolinite, commonly as well-developed booklets, and illite, in less euhedral crystals.

At Brierly Brook (Table 4.3), the sand and silt grains are principally monocrystalline quartz, some with abundant fluid inclusions that in some grains form trails. Muscovite and tourmaline are also common inclusions, with zircon inclusions less common. Sand grains tend to be larger and more angular than at Belmont. Polycrystalline quartz grains, when compared to the monocrystalline quartz grains, are typically rounder, exhibit a greater range in grain size, and may be mylonitised. Altered Fe-Ti oxides, although present, was much less prolific than at Belmont. Hematite was difficult to identify due to red dye used to highlight porosity in the thin sections, however, X-ray diffraction indicated that it commonly occurred in small amounts (Table 4.4). The carbonate rich samples in the middle of boreholes BB-02 –1, 2 and 5 are consistent with LECO carbon analysis and X-ray diffraction (Tables 3.5 & 4.4). The matrix is composed of dark clay with silty quartz grains. The only significant cement was pyrite, which appeared to be more abundant in the shallower samples (Table 4.3).

Triangular plots of quartz, feldspar and lithic fragments (QFL) (Figs. 4.3a, 4.4a) indicate that much of the sediment is composed of quartz and is very comparable to the sedimentary rocks of central

Nova Scotia (Fig. 4.4a). The Brierly Brook sediments with higher lithic component have abundant detrital carbonate. If polycrystalline quartz is added to the lithic fraction (Figs. 4.3b, 4.4b), the distribution is similar to that seen in the central Nova Scotia (Fig. 4.5b).

4.2.2 SEM and microprobe studies of sandstone diagenesis

At Belmont, fine-grained fibrous halloysite fills some pore space (Appendix XII, fig. 2). Elsewhere, 10 μm-size booklets of kaolinite fill the pore space (Appendix XII, fig. 3) and in some samples, kaolinite and illite are intergrown (Appendix XII, fig. 4). Both kaolinite and illite appear to crystallise diagenetically from interstitial mud that also contains detrital quartz (Appendix XII, fig. 1, 5). In some cases where illite is intergrown with kaolinite, illite is clearly the younger phase (Appendix XII, fig. 6). Detrital muscovite is in places altered to illite (Appendix XII, fig. 7) and in places to kaolinite (Appendix XII, fig. 9). Euhedral to subhedral <10 μm quartz crystals (e.g. Appendix XII, fig. 9) in some muddy matrix appear detrital.

Sandstones from Brierly Brook contain corroded detrital limestone (Appendix XII, fig. 11). Some 10 μm quartz grains have a sharp crystal margin and hexagonal shape: it is unclear whether they are detrital (volcanic) or have silica overgrowths (Appendix XII, fig. 9). The character of the grain on the upper right of Fig. 13 of Appendix XII shows no disturbance of the matrix as a result of silica overgrowth and the embayed part of the crystal suggests that it is detrital (volcanic). Possible silica overgrowths have been identified on one quartz grain (Appendix XII, fig. 10), but this appears to be detrital. Overall, convincing evidence for diagenetic silica is lacking and the euhedral quartz grains of a range of sizes are likely of volcanic origin.

Halloysite, in fibrous crystals, is present as the sole diagenetic mineral in some pore space at Brierly Brook (Appendix XII, fig. 13). Booklets of diagenetic kaolinite are developed in some muddy matrix (Appendix XII, fig. 14); some illite might be diagenetic but this identification is not unequivocal (Appendix XII, fig. 15). Siderite cement appears to postdate kaolinite (Appendix XII, fig. 15). In some samples, diagenetic barite is present in pore space as large prismatic intergrown crystals (Appendix XII, figs. 21, 22, 27). Diagenetic illite fills pore space between barite crystals (Appendix XII, fig. 23) and some kaolinite may also post-date barite (Appendix XII, fig. 24). In the same sample, diagenetic siderite may predate barite (Appendix XII, figs. 25, 26), and is overgrown first by rhodochrosite and then clays (Appendix XII, figs. 24, 25).

4.2.3 Interpretation of XRD mineralogy of bulk sandstone samples

The mineralogy of bulk samples of both sandstones and mudstones was determined by X-ray diffraction (Table 4.4), with mineral distribution summarised in down-hole plots in Figures 4.6 - 4.13.

At Belmont, the rarity of muddy matrix in the sands results in overall low illite. Kaolinite is the most common clay mineral present, consistent with its abundance as a diagenetic mineral in pore space and matrix. Expandable mixed-layer clays are present in small amounts, with a kaolinite - expandable mixed layer clay giving a peak at 17-18Å and a trioctahedral mica - vermiculite mixed layer clay with a peak at ~24Å. The identification of rutile and pseudorutile is consistent with the abundance of detrital altered ilmenite in the heavy mineral fraction (see 4.2.4 below). The Belmont sandstones have higher kaolinite and expandables and lower illite than at Brierly Brook.

At Brierly Brook, sandstones from three of the four stratigraphic units have been studied by X-ray diffraction: units A, B and D (the last with only one sample). Unit A appears to have a higher amount of kaolinite than B. Chlorite is present in small amounts in many samples but does not appear to be controlled stratigraphically and is presumably detrital. Trace amounts of expandables and mixed-layer clays are present. Calcite and dolomite predominate in the one sample from unit D, and is likely detrital from the underlying Windsor Group limestone. Pseudo-rutile and rutile are found in units C (in sandy mudstones) and B, but in only one sand(stone) in unit A.

Only two sand(stone)s have been analysed from Diogenes Brook. Kaolinite is more abundant that at the other two localities, some illite is present, and expandable clays are very low.

4.2.4 Heavy minerals

Point counts of the heavy mineral separates were made from polished grain mounts and included counts of all mineral grains (Table 4.5) from which the non-detrital grains were subtracted (Table 4.6). Detrital heavy minerals are composed principally of ilmenite, and in lesser amounts staurolite and tourmaline, and varying amounts of zircon, monazite, and andalusite. Rarely found were grains of rutile, garnet, amphibole, and orthopyroxene. Also, in Brierly Brook some samples had a high percentage of calcite grains and clinopyroxene was present.

Table 4.7 summarises the principal regional differences in heavy mineral abundance. Samples from Elmsvale basin (borehole RR-97-23) and the West Indian Road pit have 85-90 % ilmenite and altered ilmenite, generally 2-3 % zircon + monazite and 3-7 % each of tourmaline and staurolite, with staurolite more abundant in Elmsvale basin and the two minerals of similar abundance at the West Indian Road pit. Staurolite and tourmaline are also of similar abundance in the upper member of the Chaswood Formation at Shubenacadie (although the size fraction counted ranged from 63μm to 0.5 mm). Sands from Belmont show similar heavy mineral abundance, except that at many levels the abundance of ilmenite reaches 95%, thus diluting the other components.

In contrast, heavy mineral assemblages at both Diogenes Brook and Brierly Brook are rather different. At Diogenes Brook, ilmenite makes up only 80% of the heavy mineral fraction, with

abundant staurolite (11-13%) and rather low tourmaline (3%) and zircon + monazite (1%). At Brierly Brook, calcite is a significant but variable component of the heavy mineral assemblage. Ilmenite is < 75% in all samples and staurolite is abundant (15-45 %). There is also a high component of dolomite

4.2.5 Chemical composition of heavy minerals

Detailed studies of the chemical composition of heavy minerals from Belmont (Table 4.8) and Brierly Brook (Table 4.9) can be compared with analyses from the Chaswood Formation in central Nova Scotia (Pe-Piper et al., 2004a, b). Garnets from unit A at Brierly Brook fall in the same two compositional clusters as do garnets from Shubenacadie (Fig. 4.14). Fe-rich garnet (four analyses) is similar to garnet in the South Mountain batholith, and may therefore be of second-cycle origin derived from Carboniferous rocks. Garnet with subequal Fe and Mn (one analysis) is similar to garnet from some Meguma Supergroup metasedimentary rocks.

Tourmaline compositions from Brierly Brook and Belmont are similar to those at Shubenacadie and the West Indian Road pit. They include common tourmaline of the type derived from Li-poor granite (field 2 in Fig. 4.15), which are probably second-cycle from Carboniferous rocks originally derived from the South Mountain batholith, together with compositions typical of clastic metasedimentary rocks.

Detrital ilmenite, generally in the form of its alteration products pseudorutile (a mineral with a well-defined structure), leucoxene (a mix of pseudorutile and rutile) and rutile, is similar to that elsewhere in the Chaswood Formation. The ratio of Ti/(Ti + Fe) is used to name the mineral species present, with ilmenite < 0.5; pseudorutile 0.5-0.7; leucoxene 0.7-0.9; and rutile >0.9 (Fig. 4.16). Based on few samples, ilmenite from deep in the Diogenes Brook borehole appears more altered than elsewhere (Fig. 4.17). At Brierly Brook, there is a higher proportion of leucoxene and rutile in unit B. Samples from Belmont have a lower range of abundance of both MnO and MgO than do samples from Brierly Brook and Diogenes Brook and in this regard resemble the stratigraphically highest samples from Shubenacadie (Pe-Piper et al. 2004a).

4.3 Mineralogy of bulk mudstone samples

At Belmont, only one certain Chaswood Formation mudstone has been analysed: a brick red mudstone from about 20 m depth in hole 2. It has high illite, moderate kaolinite and a trace of expandable clays, together with hematite and rutile.

In hole 3 at Belmont, the mudstones below the conglomerate at 15.5 m may be part of the Chaswood Formation or may be a paleosol developed in the underlying Blomidon Formation (see section 4.4 below). The down-hole change in abundance of minerals through the possible paleosol is

very similar to that identified in oxisols within the Chaswood Formation at borehole RR-97-23 in the Elmsvale basin (Pe-Piper et al. 2004b). Mottled and red mudstones of the AB horizon overlie a highly indurated hematite-cemented fine sandstone representing the Bt horizon. Kaolinite is most abundant in the middle of the AB horizon, decreasing in abundance both upwards and downwards, with illite showing the opposite behaviour. Goethite and hematite are abundant in the Bt horizon and vermiculite is present only below the Bt horizon.

At Brierly Brook, mudstones in Unit A have abundant kaolinite, low illite, little or no vermiculite, some 21-25 Å mixed layer clays, low expandables, and some contain minor chlorite. Unit B dark clays (some of which are mudflow deposits) are quite variable and include detrital calcite and dolomite. Other samples contain minor vermiculite. Mudstones in unit B of hole 7 have more abundant kaolinite than in holes 1 and 2 and light grey mudstones are developed in this hole. In unit C in hole 2, two sandy mudstones includes kaolinite, illite, minor expandable clays and vermiculite. In hole 1, a dark grey silty mudstone has halloysite and vermiculite. Small amounts of rutile and pseudorutile are present in many mudstone samples.

4.4 Stratigraphic interpretation of ?basement in BM-02-3

The interpretation of the rocks in the lower part of borehole BM-02-3 at Belmont is not self-evident. Down to 51', rocks are clearly Cretaceous silica sand. The presence of a few pebbles at 51' is interpreted as a basal conglomerate (cf. Vinegar Hill pit, where the coarsest pebbles are at the base of the sand and gravel succession and overlie about 10 m of alternating sandstone and mudstone of the lower Chaswood Formation). From 51'-61' the rocks comprise principally brick red clay with grey mottles. It is unclear whether these are Cretaceous, Triassic or Carboniferous. Arguments for a Cretaceous age are the presence of pyrite in a hematitic red clay at 56':80-85cm and the general similarity of the clay mineral assemblage to Cretaceous rocks. (Note that hematite plus pyrite occur in unit U1 at RR-97-23, inferred to be from the uplift and paleosol development of original dark grey claystone). The brick-red clay in the middle of BM-02-2, definitely of Cretaceous age, is also reported to contain pyrite and hematite. On the other hand, the lithologic description is not strongly different from 61'-76'. The quartz-goethite-hematite sandstone at 61':39-52cm is interpreted as a Bt soil-horizon at an unconformity, either an unconformity at 51'+ or near 61'. The overlying clay sample is also unusually rich in hematite. As noted above, the entire succession of mudstone from 51' resembles oxisol soil profiles elsewhere in the Chaswood Formation. Whether the protolith is Cretaceous mudstone (cf. Vinegar Hill) or older mudstones is uncertain. Samples below 61' have low kaolinite and a notable 2M-muscovite peak, similar to what is found in the Wolfville Formation sandstone in borehole BM-02-1 and in contrast to the Chaswood Formation silty mudstone at the bottom of BM-02-

2, which has high kaolinite and lacks a 2M-muscovite peak. The presence of smectite and mixed-layer clays below 61' in BM-02-3 suggests that these rocks are not of Carboniferous age (Brydon 1958) and lithologically they resemble the Triassic Blomidon Formation.

5. Discussion

5.1 Depositional and tectonic environment of the northern outliers

Depositional facies in the Chaswood Formation at Belmont consist principally of sorted sand(stone) and conglomerate, with minor paleosol mudstone, comparable with deposits at West Indian Road pit (Gobeil 2002) and Shubenacadie (Stea et al. 1996; Pe-Piper et al. 2004a). The rocks are preserved in a small fault-bound basin along an E-W fault, presumably predominantly strike-slip, that juxtaposes Wolfville Formation with Blomidon Formation. There is no structural nor sedimentological (e.g. basin-margin facies) evidence that the fault was active during deposition of the Chaswood Formation, although syn-sedimentary deformation is recognised elsewhere in the Chaswood Formation (West Indian Road pit, Elmsvale basin).

At Brierly Brook, sorted sand(stone) and conglomerate alternates with debris-flow facies association and a range of other mudstones. In general, light grey mudstone and paleosols are much less abundant than elsewhere in the Chaswood Formation and are concentrated near the northern margin of the basin, where sorted sand(stone)s are also most abundant. The lower units B to D resemble the Basal Clay unit at the West Indian Road pit, which Gobeil (2002) interpreted to have accumulated in a local fault-bound basin. The poorly sorted debris-flow facies in unit B, with clasts of local Windsor Group limestone, is evidence of a local source and steep relief at the basin margin. On the other hand, the sorted sand(stone)s contain heavy minerals (notably staurolite) that are common elsewhere in the Chaswood Formation and indicate more distant transport. This suggests that a trunk river was present, which probably flowed parallel to the NE-trending faults that now bound the basin. The restriction of stratigraphic units C and D to the central part of the basin and their absence in boreholes only 100 m distant (Fig. 2.4) suggests that there was syn-sedimentary faulting influencing the distribution of sedimentary units, although the variation could be interpreted solely as the result of lateral facies changes. On the other hand, the original depositional basin was probably wider than the now preserved Chaswood Formation at Brierly Brook.

At Diogenes Brook, sorted sand(stone) and conglomerate predominates, with interbedded grey mudstone and lignite, that can only be interpreted in the light of other developments of the Chaswood Formation. Its present distribution is clearly the result of younger faulting.

5.2 Detrital mineralogy and provenance of the northern outliers

Studies elsewhere in the Chaswood Formation suggest that there are two types of sediment source: distant and local. The distant source is most clearly identified from geochronology of detrital monazite, which shows that in the Elmsvale basin and at the Vinegar Hill pit, the monazite is derived from a Taconic metamorphic source (Pe-Piper and MacKay, unpublished data). At Vinegar Hill, where paleocurrents are to the southwest, staurolite is abundant, presumably derived from the Taconic metamorphic rocks of northern New Brunswick. Similar staurolite is characteristic of all known outcrops of the Chaswood Formation.

Pebbles at Vinegar Hill, the coarsest grained and most proximal occurrence of the Chaswood Formation, consist principally of vein quartz. Other lithologies include quartz arenite that resembles Ordovician rocks of the Miramichi terrane; staurolite-bearing metasedimentary rocks, perhaps from Mount Pleasant or the southern Miramichi terrane; purplish rhyolite; and dark hornfels similar to Silurian metasedimentary rocks intruded by Devonian granite in central New Brunswick, and grey rhyolite, similar to Precambrian rhyolites of the local Coldbrook Group.

The northern outliers of Nova Scotia, together with the West Indian Road pit, also have predominant vein quartz pebbles, together with quartz arenite. They also contain clasts with a local provenance: Horton Group arenites and Cobequid Highlands igneous rocks and quartz mylonite at the West Indian Road pit (Gobeil 2002) and Belmont (this study); possible Cobequid Highlands igneous rocks at Upper Stewiacke; and Windsor Group limestone at Brierly Brook. Local mineralised Carboniferous rocks are found as lithic clasts in coarse sandstones from Shubenacadie (Pe-Piper et al. 2004a).

The heavy mineral assemblages summarised in Table 4.7 suggest that the sands of the Chaswood Formation can also be interpreted in terms of distant travelled heavy minerals, with progressive loss of less stable minerals by weathering or abrasion and progressive dilution of the more stable minerals by minerals derived from more local sources, which in turn become diluted and abraded downstream. Based on the pebble petrology, sands at the Vinegar Hill pit include both northern Taconic sources and local Avalonian sources, with high zircon, monazite and staurolite. At Belmont, this assemblage is highly diluted by detrital ilmenite and its alteration products. The mafic rocks of the Wentworth pluton and alteration along the Cobequid fault zone are both rich in ilmenite. Ilmenite is a little less abundant in the Elmsvale basin, Shubenacadie and West Indian Road pit. At West Indian Road pit, dilution by local second cycle minerals from the Horton Group has been demonstrated by the dating of detrital muscovite by Gobeil (2002).

This detrital model for the Chaswood Formation, together with the evidence at Brierly Brook and the West Indian Road pit for basin-margin facies, indicates that depositional regions of Chaswood

Formation must have been separated by substantial upland areas that shed sediment. Given such a paleogeographic setting, it is likely that there were several separate southward draining braided river systems, with distribution controlled by the syn-sedimentary tectonism of the mid Cretaceous (Pe-Piper and Piper 2004). Geographic proximity and systematic changes in facies suggest that Belmont, the West Indian Road pit, Shubenacadie, and the western Elmsvale basin were all part of the same river system, but their relationship to Brierly Brook, Diogenes Brook and Vinegar Hill is unknown.

The high proportion of staurolite at Brierly Brook and at Diogenes Brook (where it is diluted by ilmenite), may indicate supply predominantly from a Miramichi Highland source, whereas at Vinegar Hill such a source is diluted by locally derived material from the Caledonia Highlands.

In general, the evidence of sediment derived from local sources becomes less abundant passing stratigraphically upward (e.g. carbonate lithic clasts at Brierly Brook and Shubenacadie). In the Elmsvale basin, at the West Indian Road pit, and at Brierly Brook, this corresponds to an upward decrease in the amount of syn-sedimentary faulting.

At Belmont, the presence of euhedral quartz crystals of both silt and sand size suggests a volcanic source. Although this might be in the late Devonian - early Carboniferous Fountain Lake Group, these generally appear too lithified and devitrified to yield such euhedral quartz. More likely, it is related to explosive pyroclastic volcanism of mid-Cretaceous age, known from the Missisauga Formation at the Brant and Mallard wells on the southwestern Grand Banks (Pe-Piper et al. 1994) and the lower Cree Member in the Orpheus graben (Weir-Murphy 2004).

5.3 Diagenesis of the northern outliers

The diagenetic processes at Belmont and Brierly Brook show many similarities to those inferred for the Elmsvale basin from a detailed study of borehole RR-97-23 (Pe-Piper et al. 2004b). As noted above, the well-developed oxisol at or near the basal unconformity at Belmont resembles in clay mineral distribution paleosols preserved in borehole RR-97-23. By analogy with the formation of kaolins in Georgia, USA (Hurst and Pickering 1997), the enrichment of the light grey mudstone facies association in kaolinite (as seen at the northern basin margin in hole 7 at Brierly Brook) took place below the water table as a result of the action of meteoric water. In Elmsvale basin, nconformities are marked by oxisols and the most intense kaolinitisation took place 5 - 25 m below the unconformities (Hundert et al. submitted). The ubiquitous development of halloysite and kaolinite cement in sandstones at Belmont is also interpreted to result from percolation of meteoric water. Similar diagenesis is noted at Brierly Brook, but is less widespread, probably because the abundance of mudstone and muddy debris-flow facies resulted in a much less permeable basin than that at Belmont. At both Belmont and Brierly Brook, illite diagenesis appears to be later than kaolinite. A similar

relationship in Elmsvale basin was interpreted by Pe-Piper et al. (2004b) as a consequence of expulsion of formation waters from the down-dip Scotian basin. At Brierly Brook, diagenetic barite predates illite and some kaolinite, in contrast to RR-97-23 where rare barite is a late pore-filling mineral. Whether the barite-rich fluid is derived from the underlying Carbonifeous rocks or the down-dip Scotian basin is unknown.

6. Conclusions

Scientific drilling at the Belmont and Brierly Brook outliers of the Chaswood Formation have greatly increased our understanding of lithologic, petrographic and tectonic variability in the Chaswood Formation.

The sands at Belmont have a remarkably high proportion of ilmenite and its alteration products, suggesting that other sources are diluted by a local ilmenite-rich source in the central Cobequid Highlands. The abundance of detrital carbonate at Brierly Brook, together with thick debris-flow facies, provides evidence of important local sediment supply. A component of far-travelled sand is indicated by the abundance of detrital staurolite, which is also abundant at Diogenes Brook.

The permeable sand(stone)s at Belmont have undergone severe early diagenesis by meteoric water, with the development of oxisols, and the development of halloysite and kaolinite cements. Meteoric water has probably also altered any detrital feldspar and altered ilmenite to rutile. Lesser early diagenetic kaolinite is found at Brierly Brook, where it is most common in the permeable sands and interbedded mudstones on the northern margin of the basin. At both Brierly Brook and Belmont, diagenetic illite is a later cement and, as in the Elmsvale basin, may be related to basin fluids moving up-dip from the Scotian basin.

The rapid changes in thickness and facies at Brierly Brook might be a result of syn-sedimentary faulting, but the evidence is equivocal. At both Belmont and Brierly Brook, the preservation of Chaswood Formation appears related to post-Chaswood faulting. This later faulting may also have separated the Chaswood Formation from the main Scotian basin.

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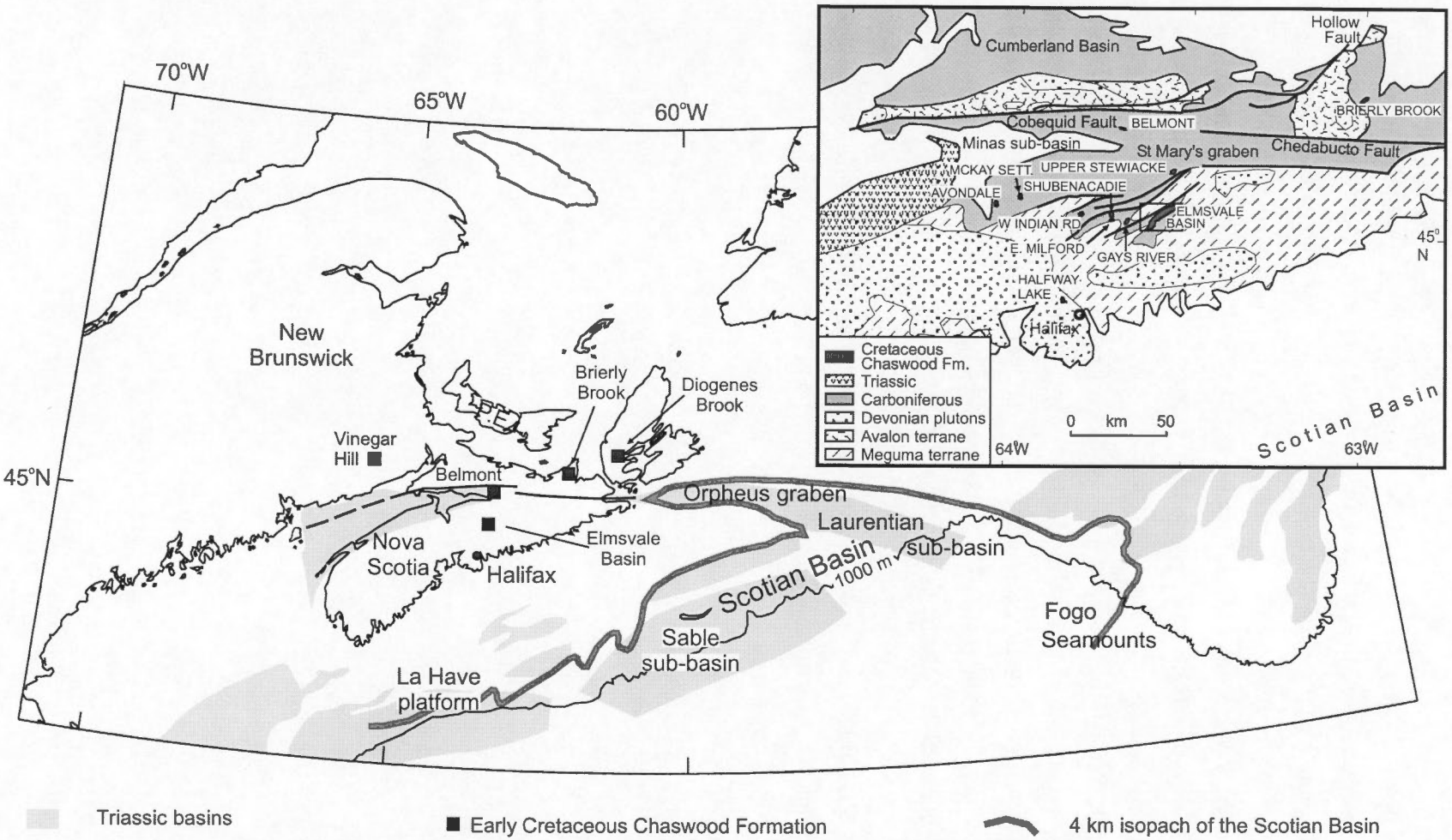


Fig. 1.1: Regional map showing the location of the Chaswood Formation outliers in Atlantic Canada.

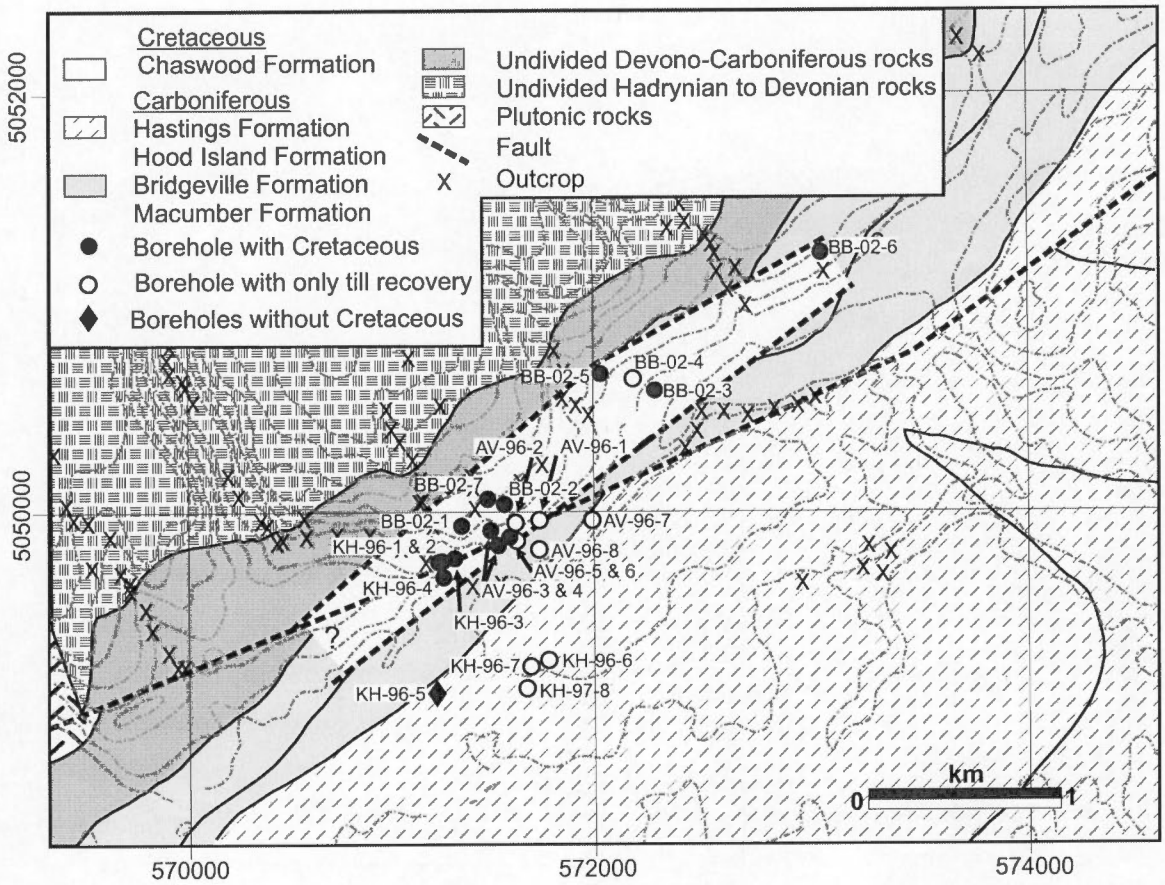


Fig. 2.1: Geological map of the Brierly Brook area.
Based on mapping by R.R. Stea (Stea et al. 2004).

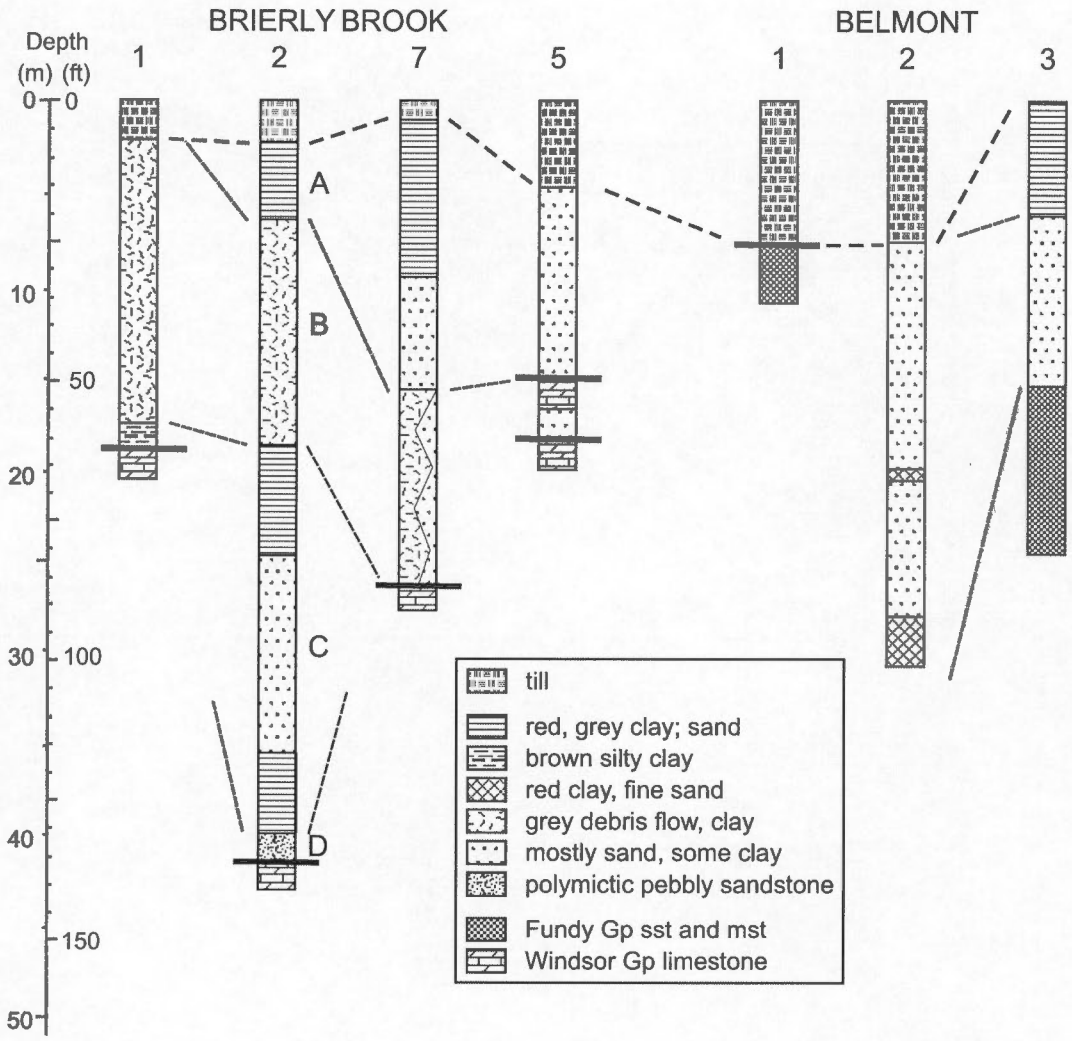


Fig. 2.2: Borehole stratigraphy of Brierly Brook and Belmont.

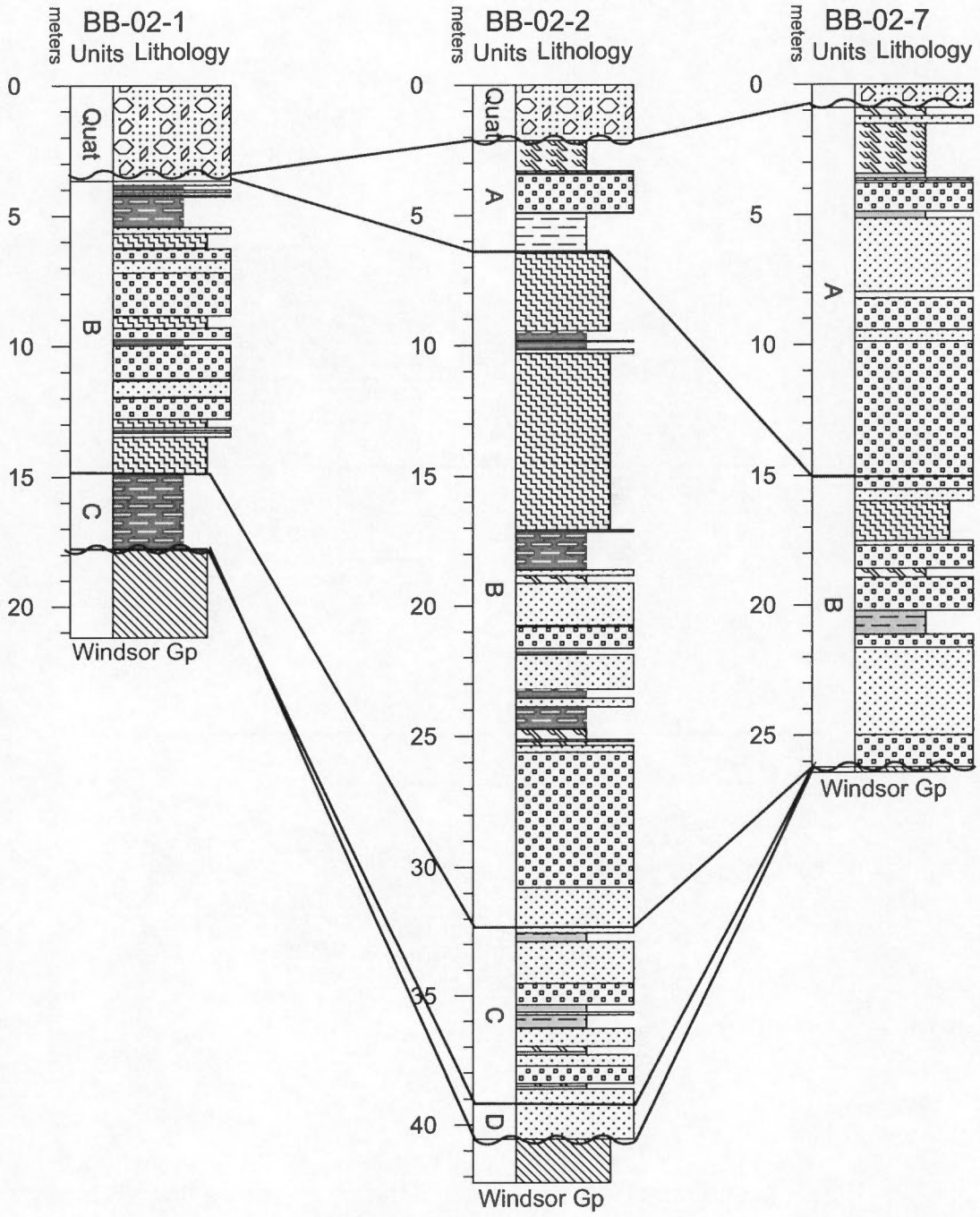


Fig. 2.3: Borehole summaries for Brierly Brook.

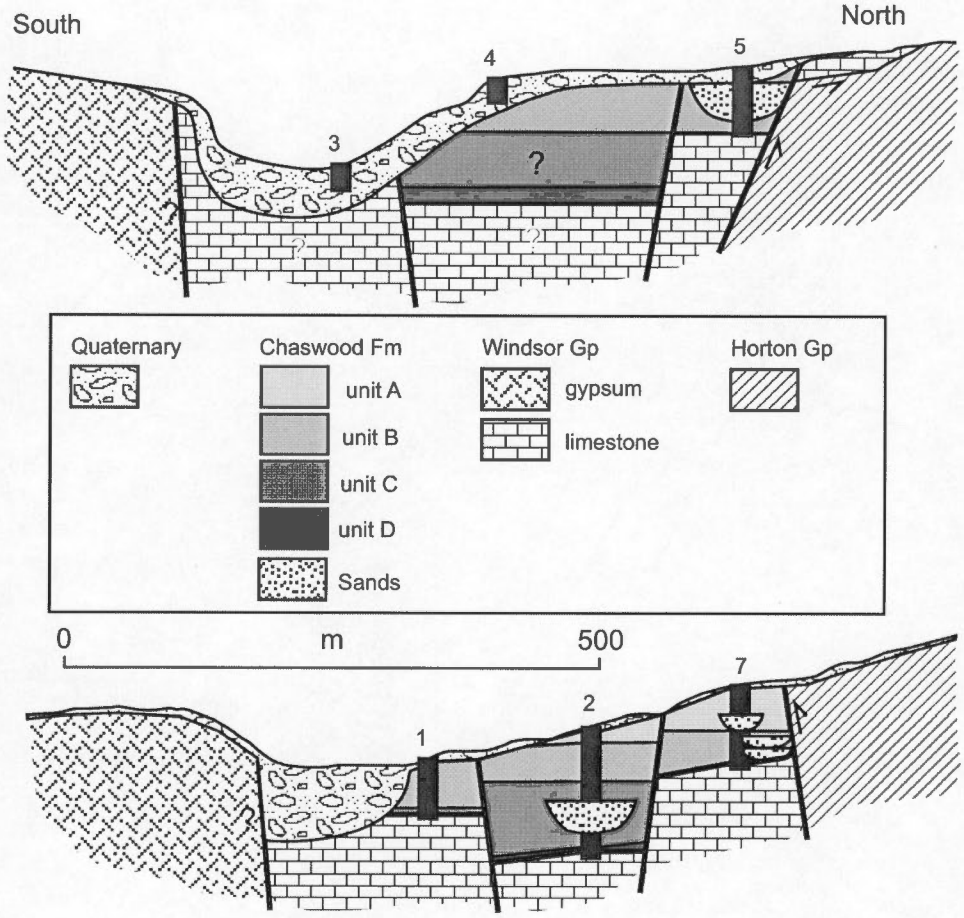


Fig. 2.4: Schematic cross section of the structural setting at Brierly Brook

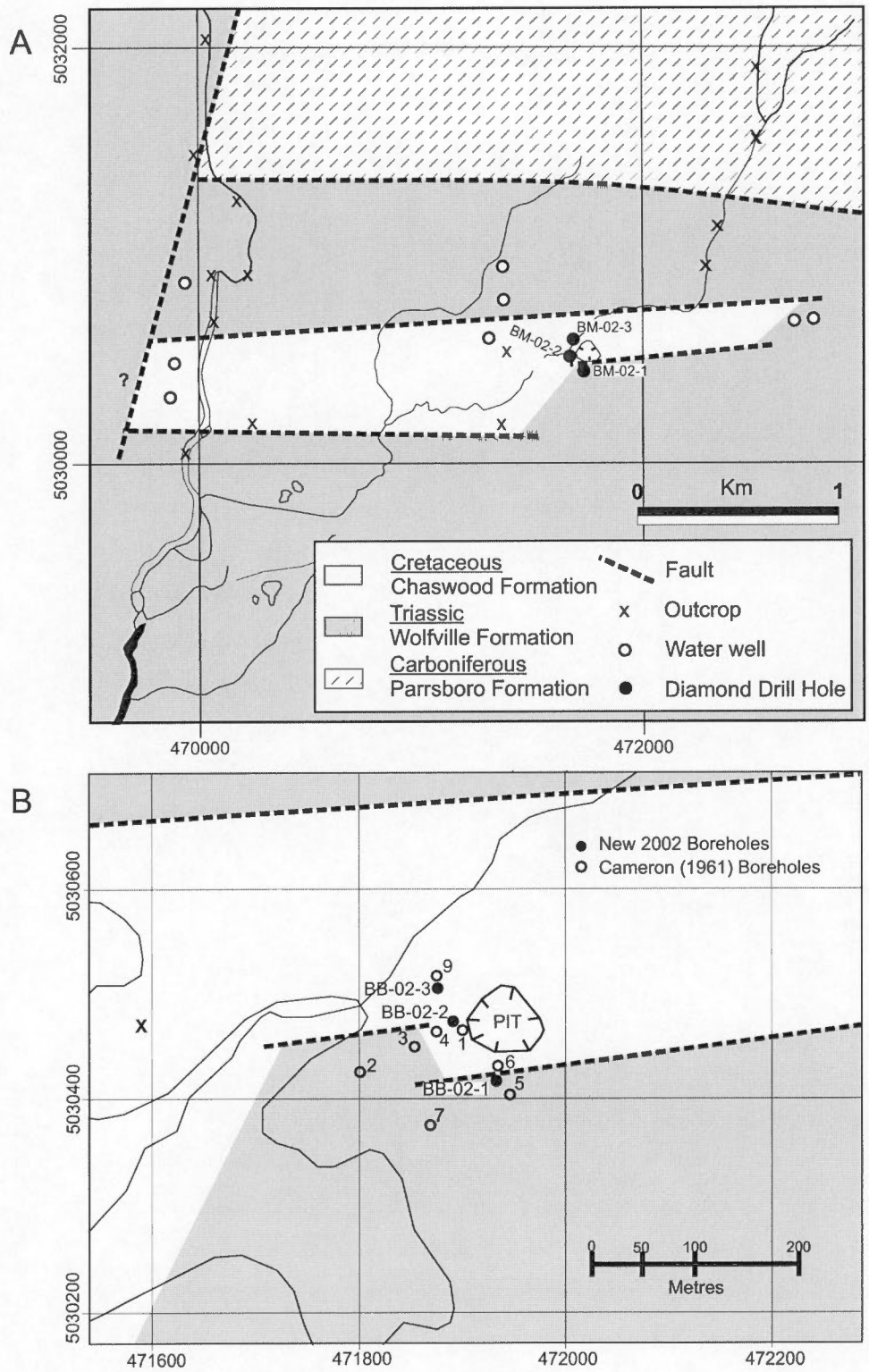


Fig. 2.5: (A) Geological map of the Belmont area, based on mapping by R.R. Stea (Stea et al. 2004).
(B) Detail of the abandoned Belmont silica sand pit with the locations of older boreholes from Cameron (1961) and the new 2002 boreholes.

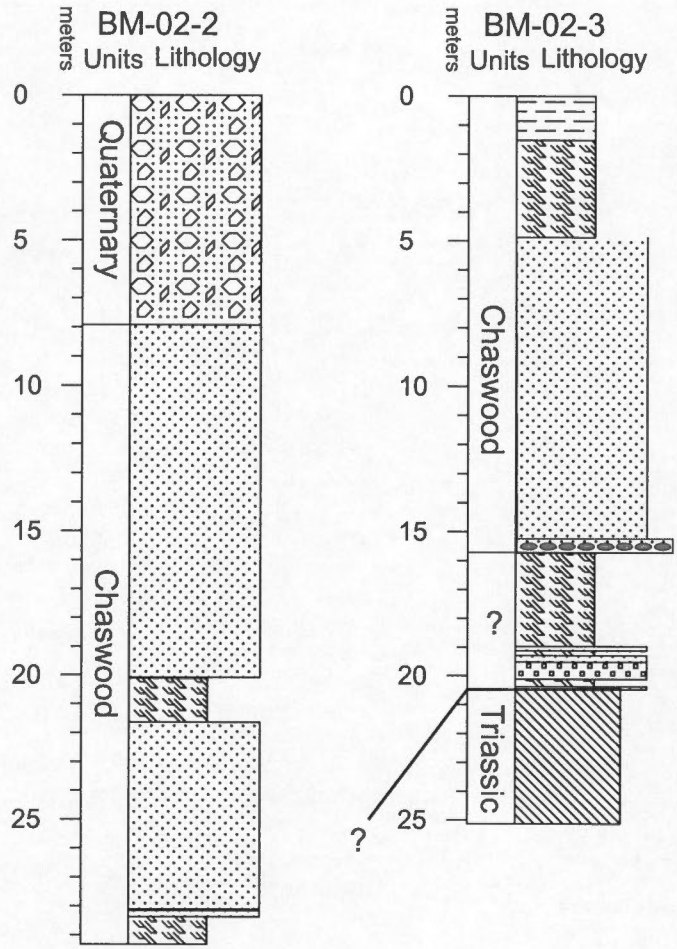


Fig. 2.6: Borehole summaries for Belmont.

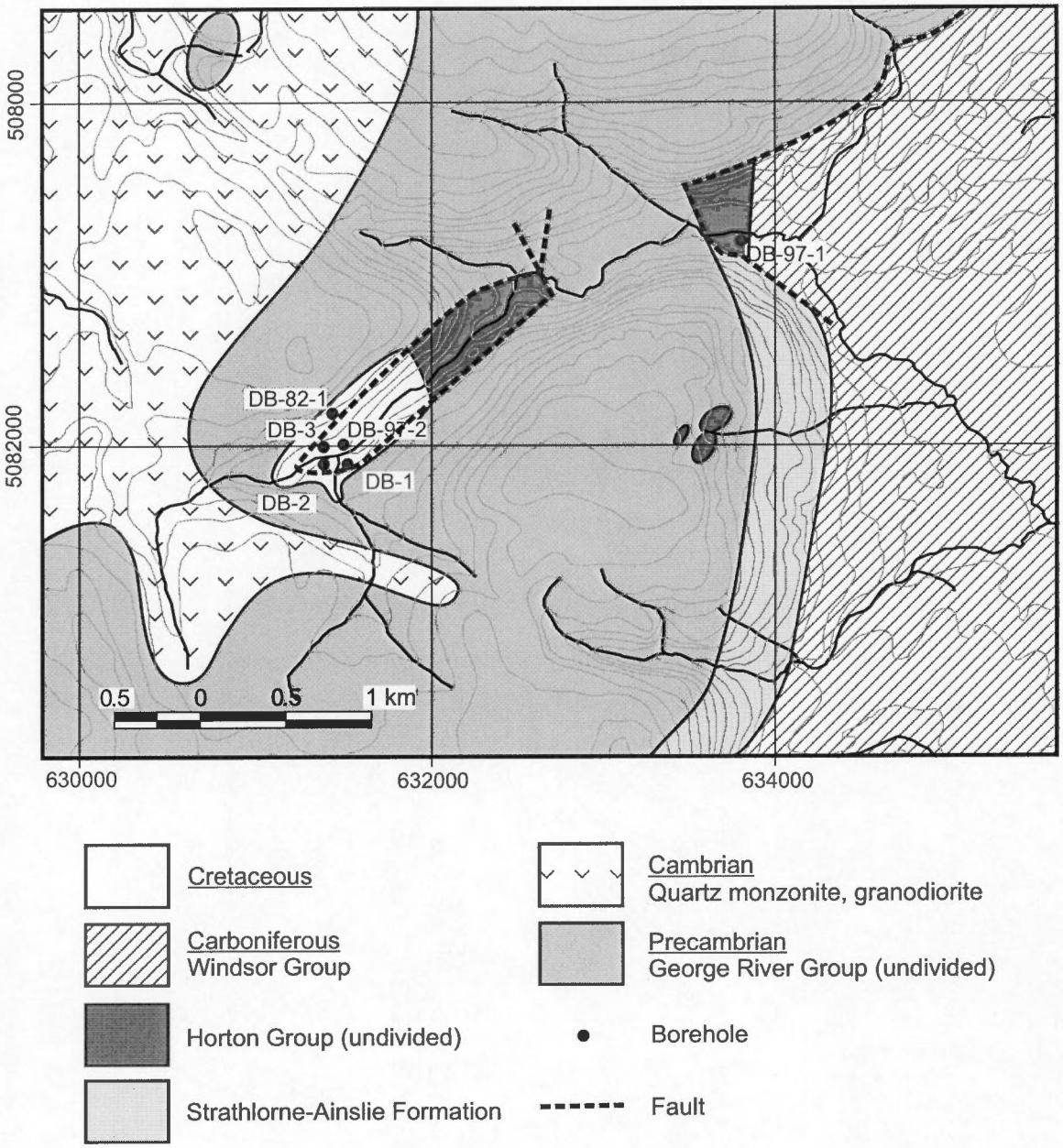


Fig. 2.7: Geological map of Diogenes Brook area. Geology after Dickie (map 2 1986) and references therein.

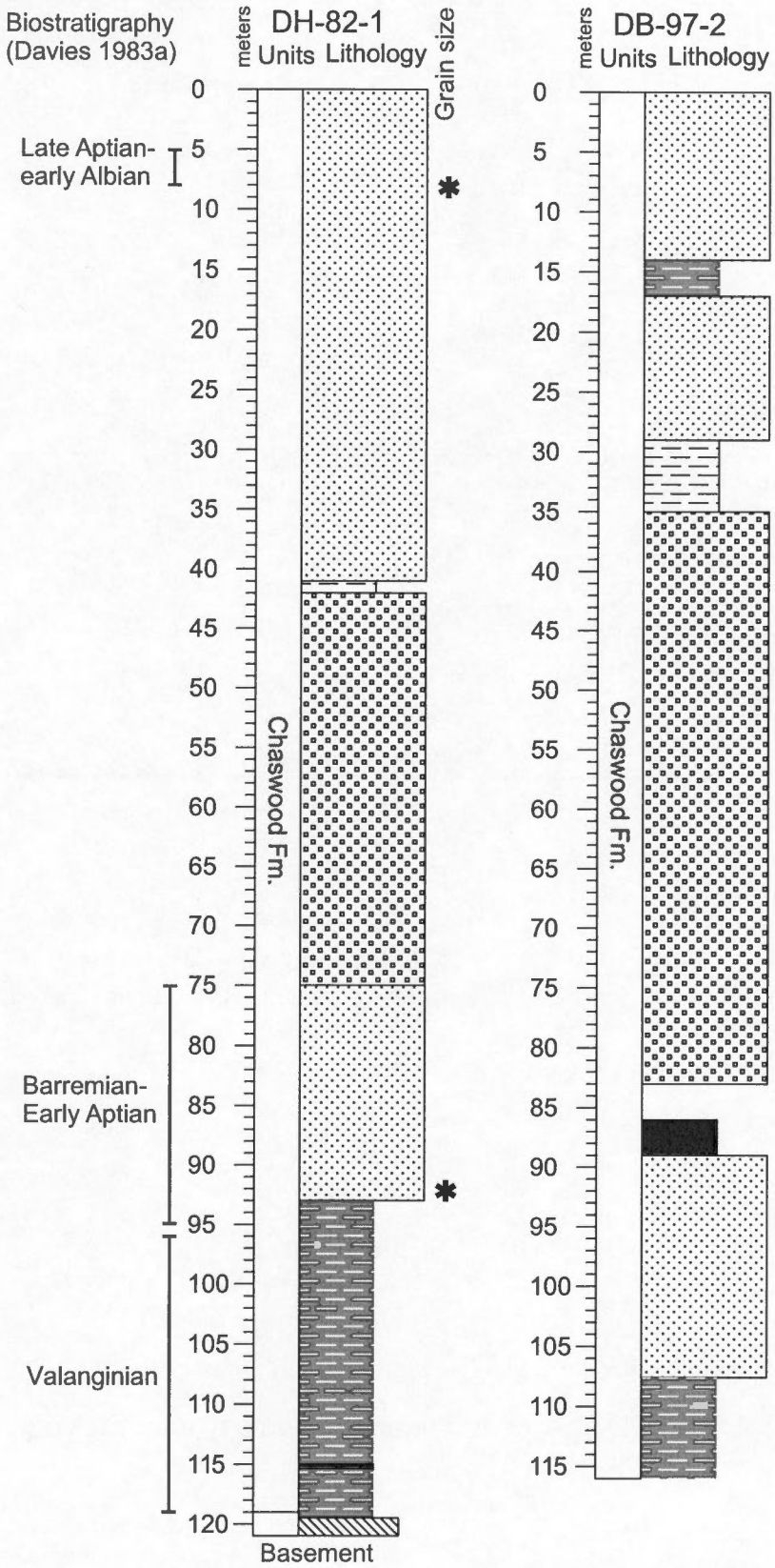


Fig. 2.8: Borehole summaries and biostratigraphy for Diogenes Brook

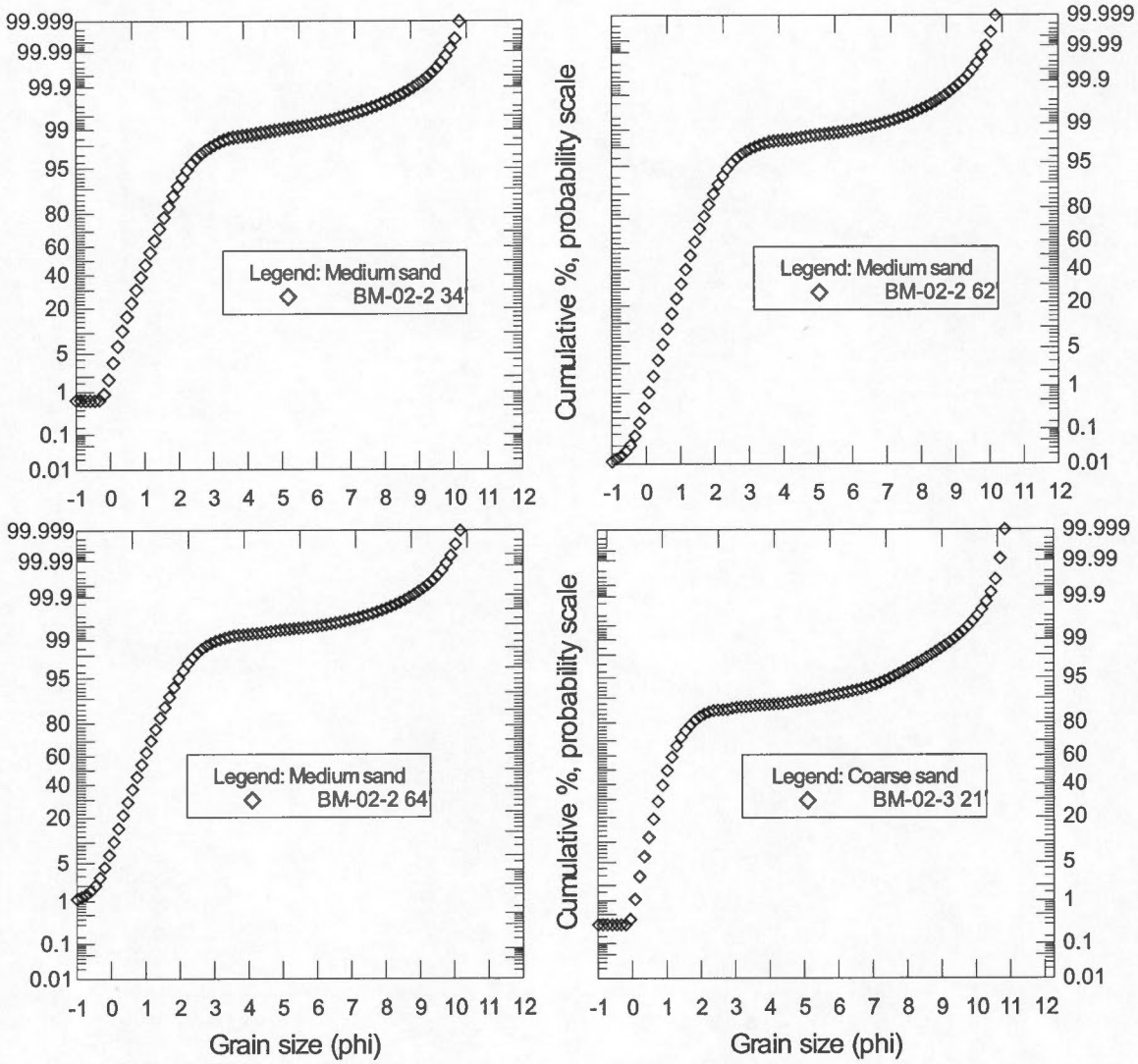


Fig. 3.1: Probability plots of laser Coulter grain size data for Belmont

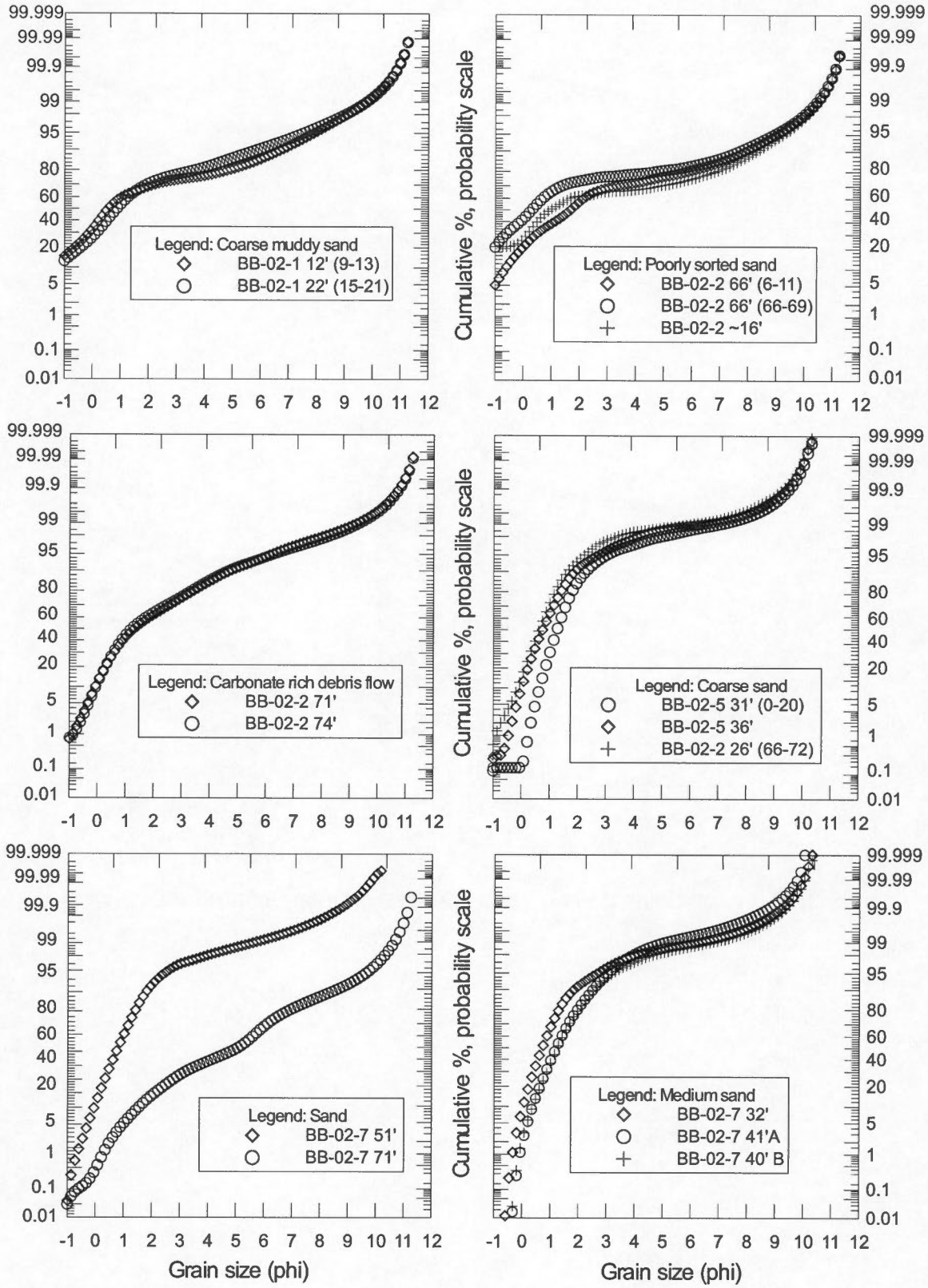


Fig. 3.2: Probability plots of laser Coulter grain size data for Brierly Brook

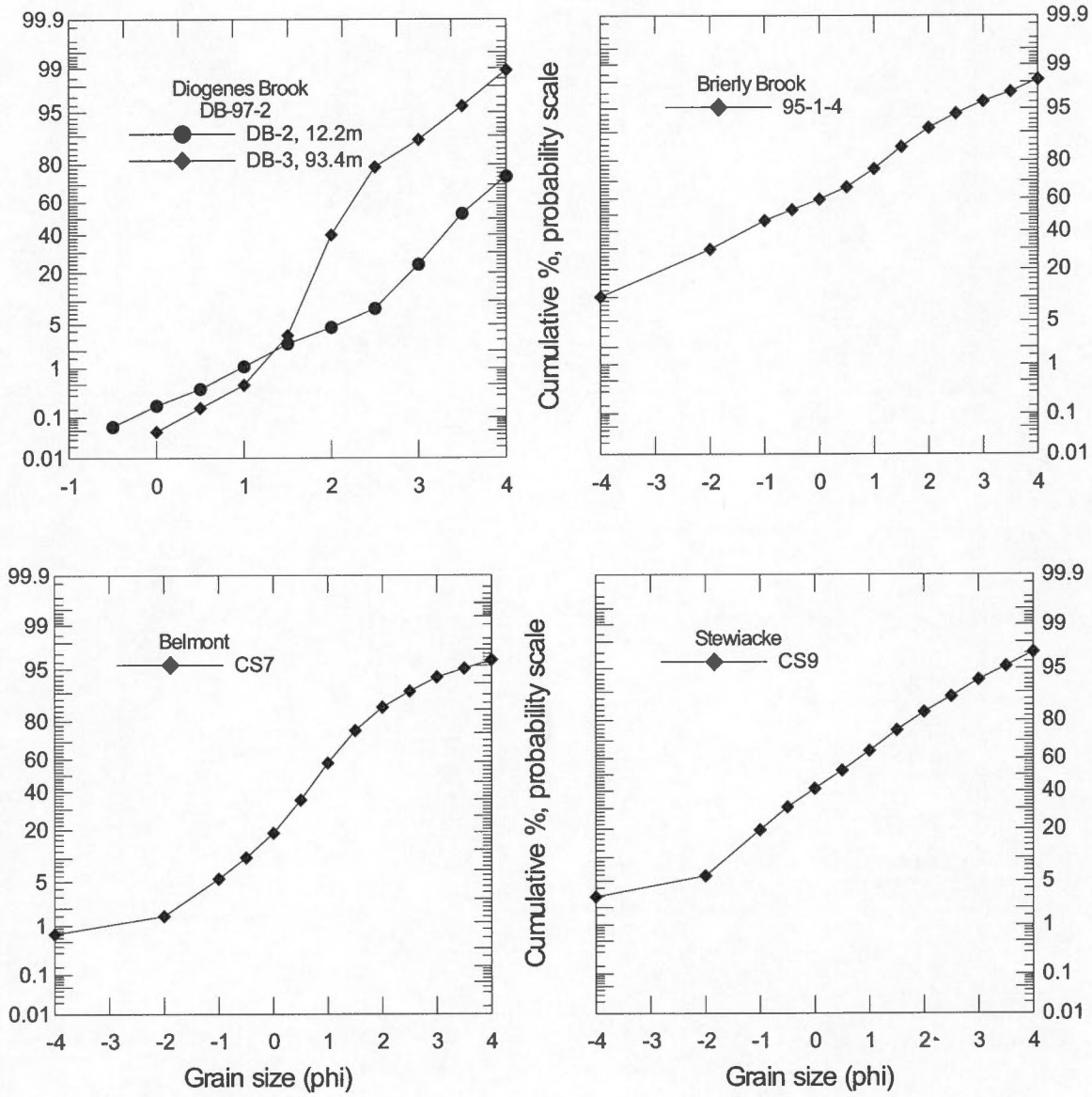


Fig. 3.3: Probability plots of sieve grain size data for Diogenes Brook, Brierly Brook, Belmont and Stewiacke.

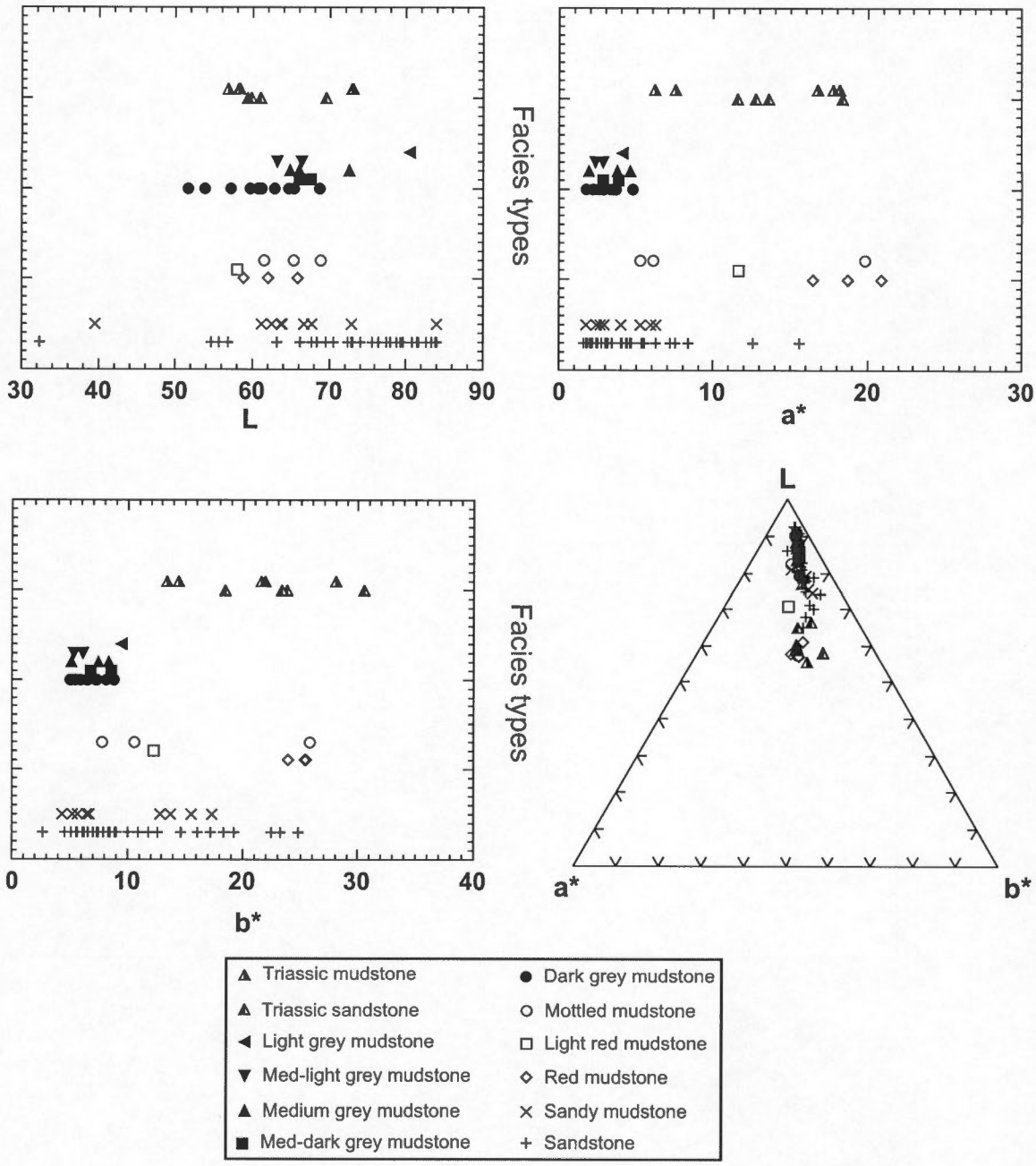
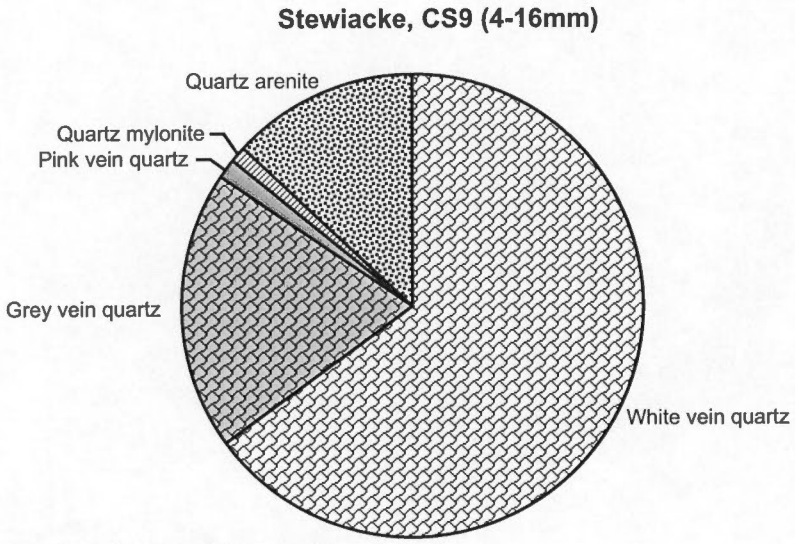


Fig. 3.4: Plots of L, a* and b* colour values for various lithofacies from Belmont and Brierly Brook.



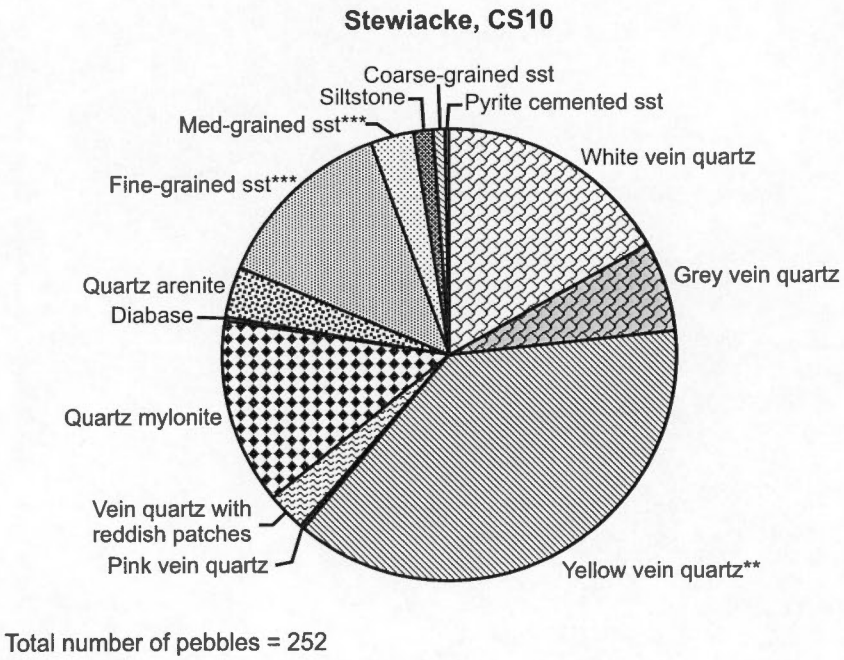


Fig. 4.1: Pie diagrams of representative pebble lithologies for Stewiacke

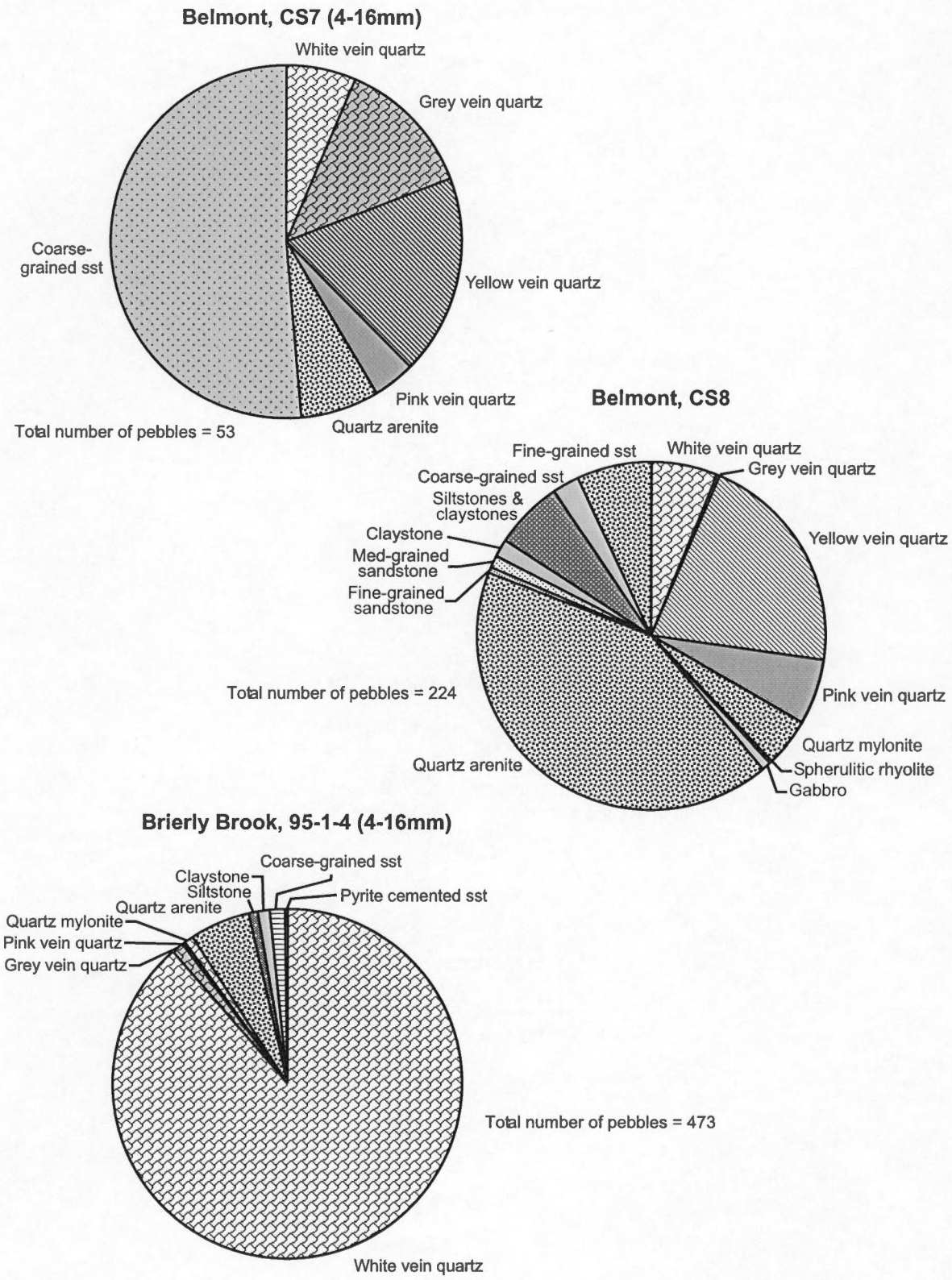


Fig. 4.2: Pie diagrams of representative pebble lithologies from Belmont and Brierly Brook.

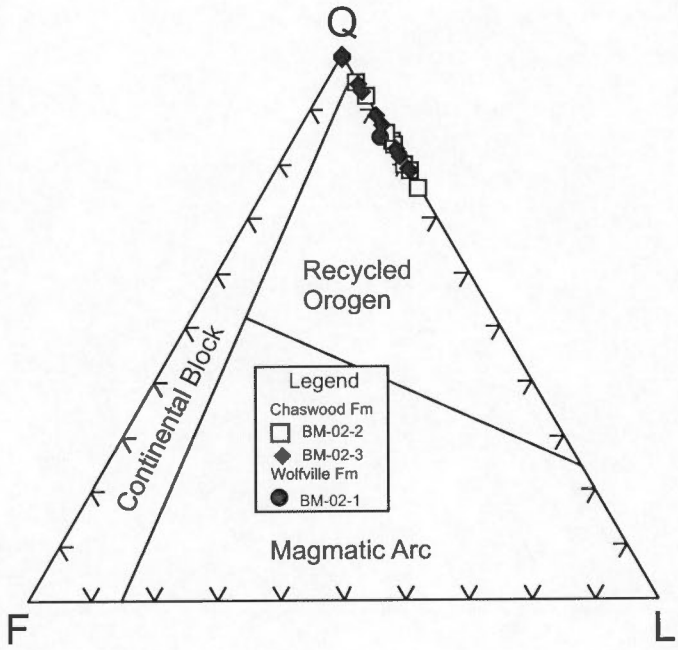


Fig. 4.3a: QFL plot for the framework modes for sand(stones) from Belmont. The paleotectonic fields are from Dickinson (1983). Q=quartz, F=Feldspar, L=lithics

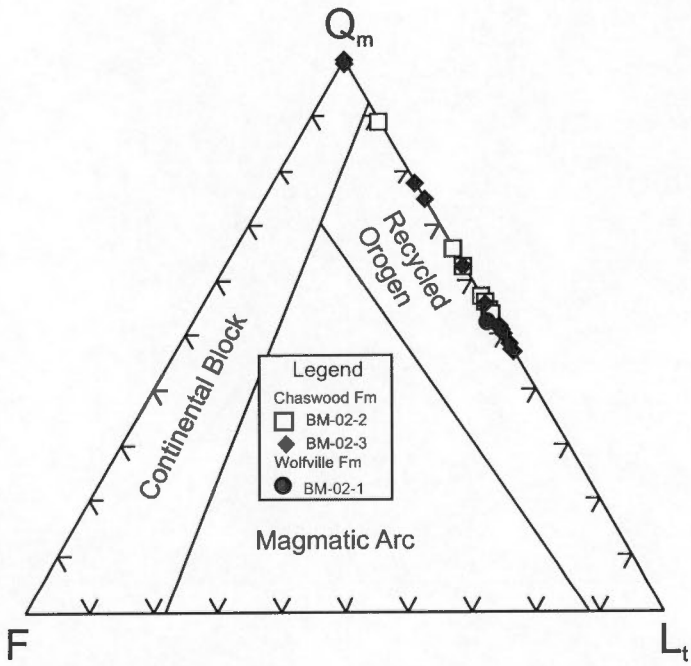


Fig. 4.3b: QmFLt plot (Qm = monocrystalline quartz; Lt includes polycrystalline quartz) for the framework modes for sand(stone) from Belmont. The paleotectonic fields are from Dickinson (1983).

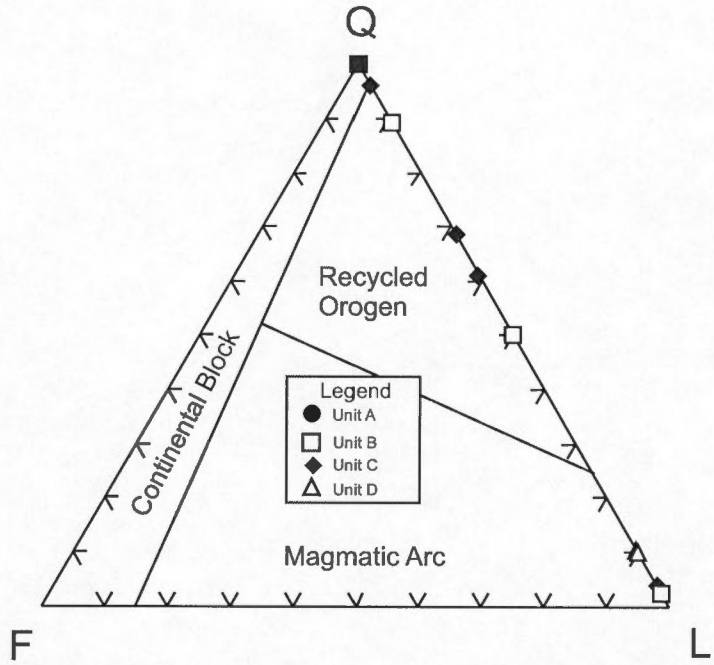


Fig. 4.4a: QFL plot for the framework modes for sand(stones) rocks rom Brierly Brook. The paleotectonic fields are from Dickinson (1983). Q=quartz, F=feldspar and L=lithics.

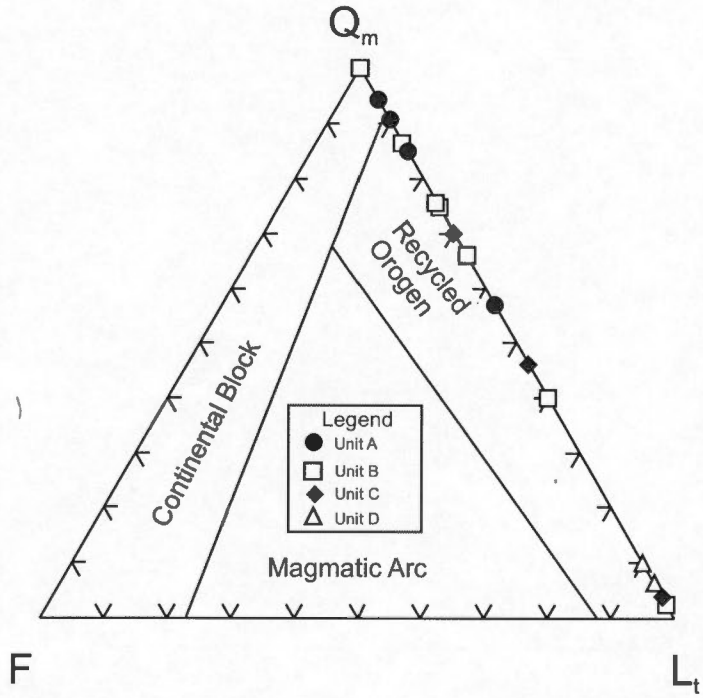


Fig. 4.4b: QmFLt plot (Qm = monocrystalline quartz; Lt includes polycrystalline quartz) for the framwork modes for sand(stones) rocks from Brierly Brook. The paleotectonic fields are from Dickinson (1983).

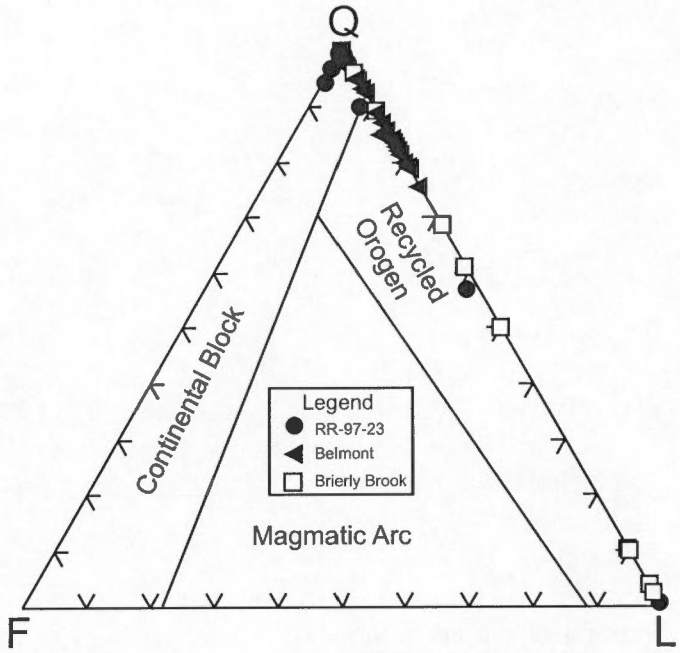


Fig. 4.5a: A comparative QFL plot for the framework modes of sand(stone)s from borehole RR-97-23, Belmont and Brierly Brook. The paleotectonic fields are from Dickinson (1983). Q=quartz, F=feldspar and L=lithics.

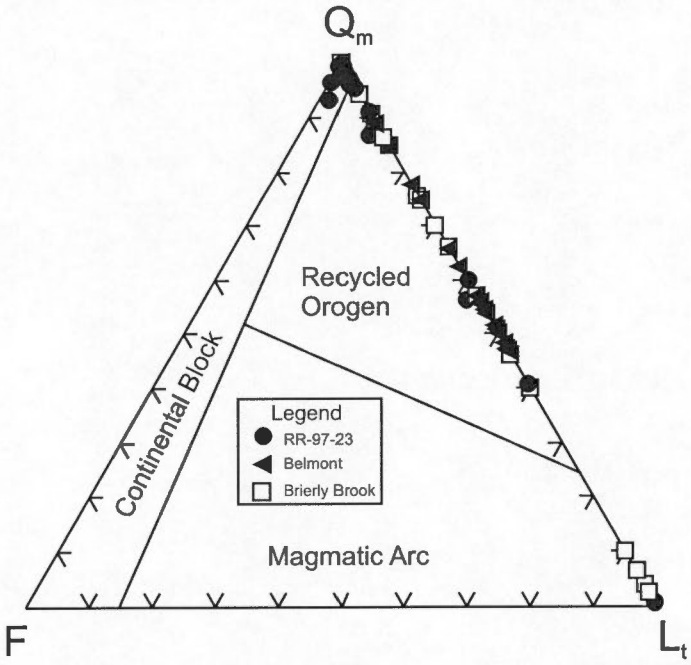


Fig. 4.5b: A comparative QmFLt plot (Qm = monocrystalline quartz; Lt includes polycrystalline quartz) for the framwork modes for sand(stone)s from borehole RR-97-23, Belmont and Brierly Brook. The paleotectonic fields are from Dickinson (1983).

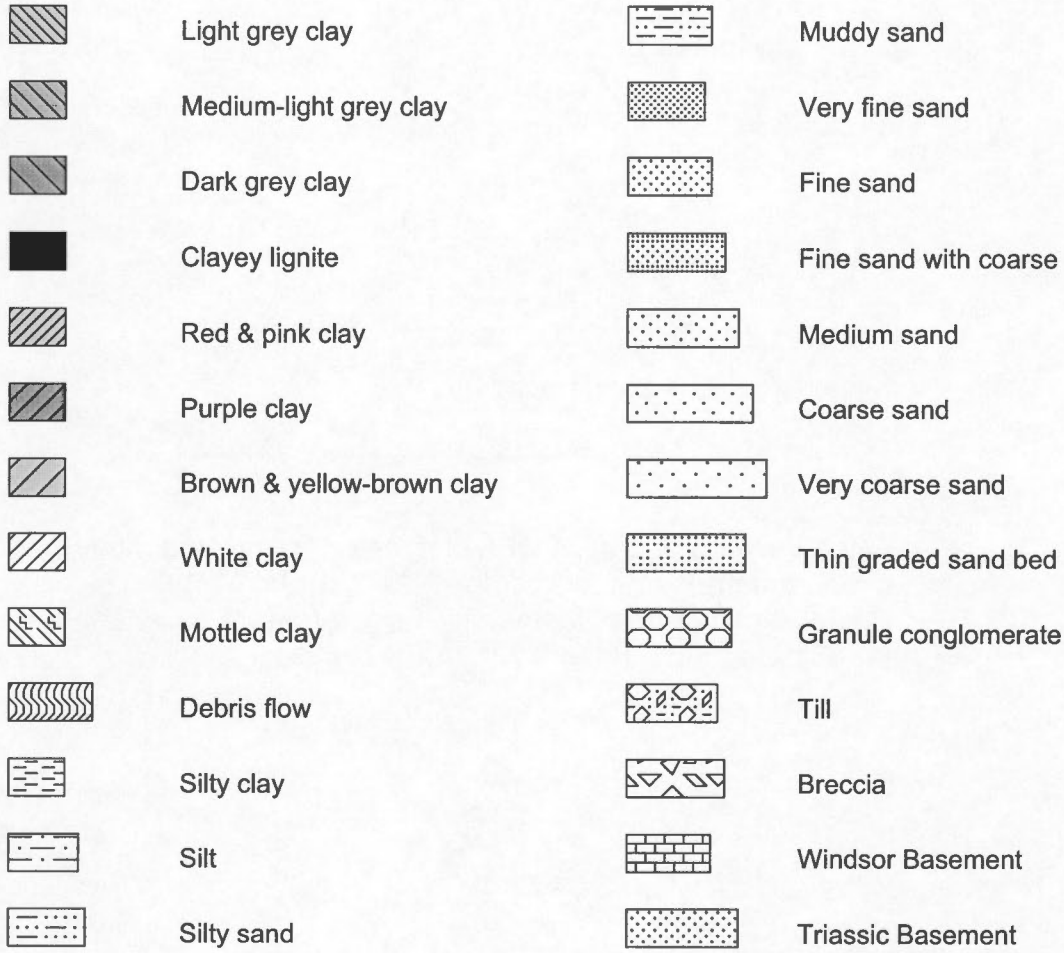


Figure 4.6: Lithofacies legend

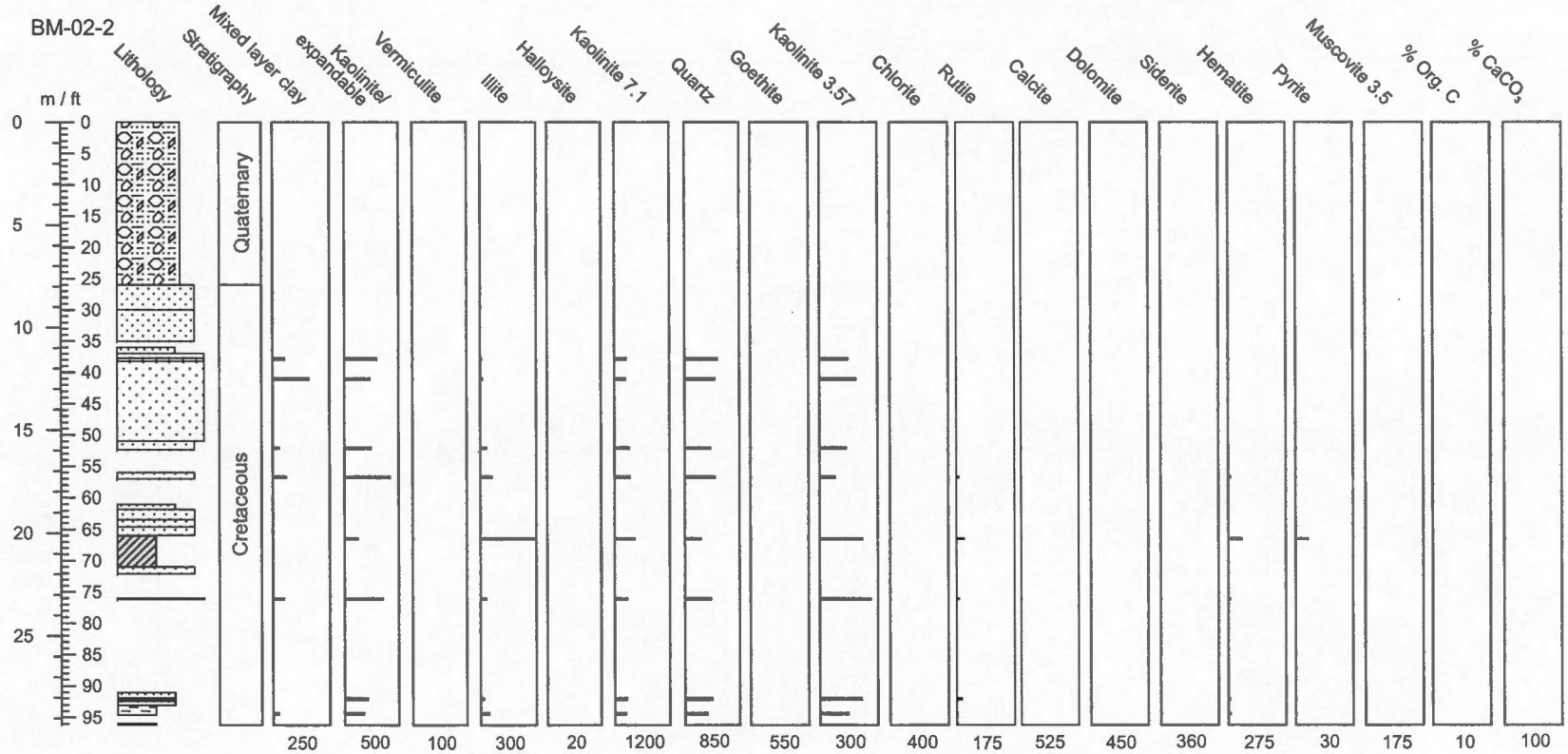


Fig. 4.7: Bulk mineral variation with depth for BM-02-2 from Belmont

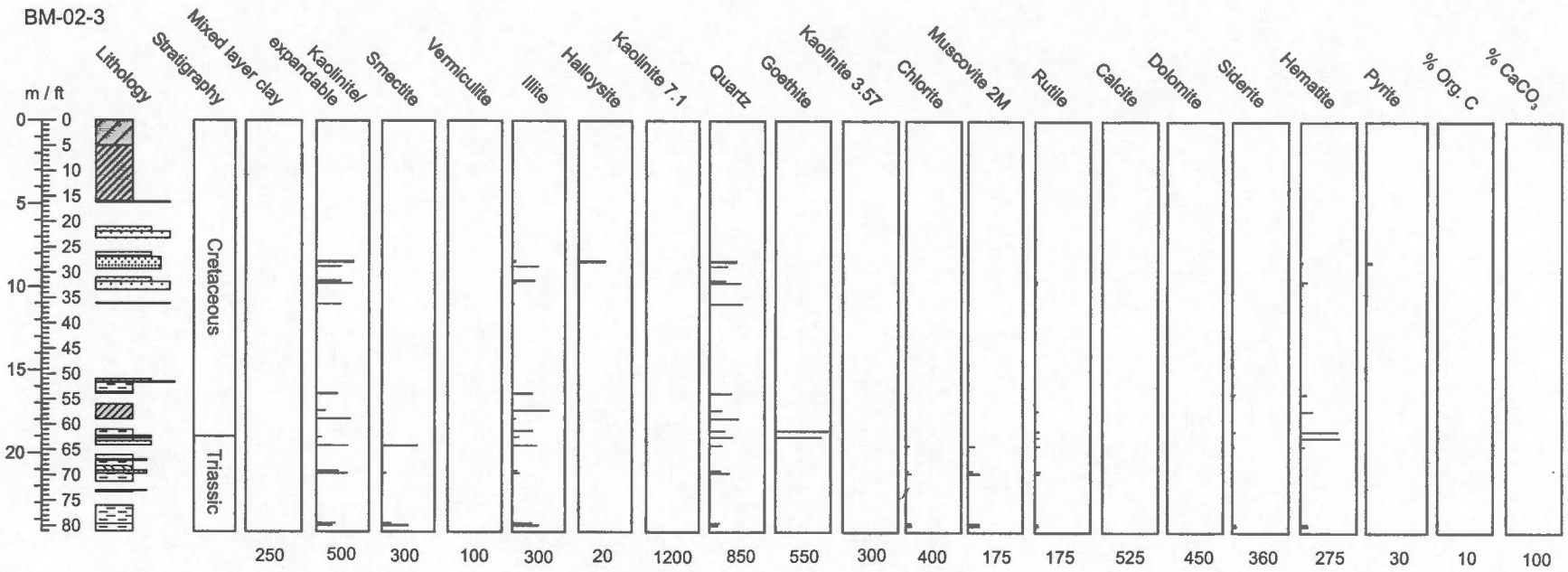


Fig. 4.8: Bulk mineral variation with depth for BM-02-3 from Belmont

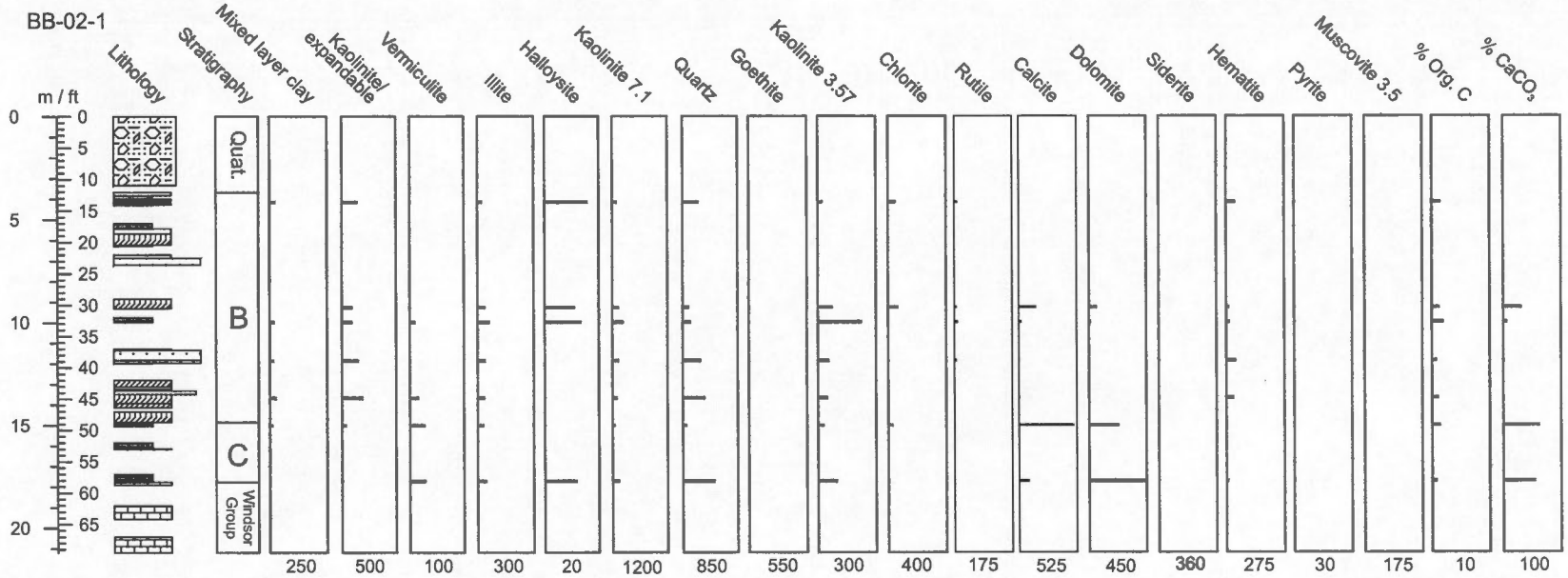


Fig. 4.9: Bulk mineral variation with depth for BB-02-1 from Brierly Brook

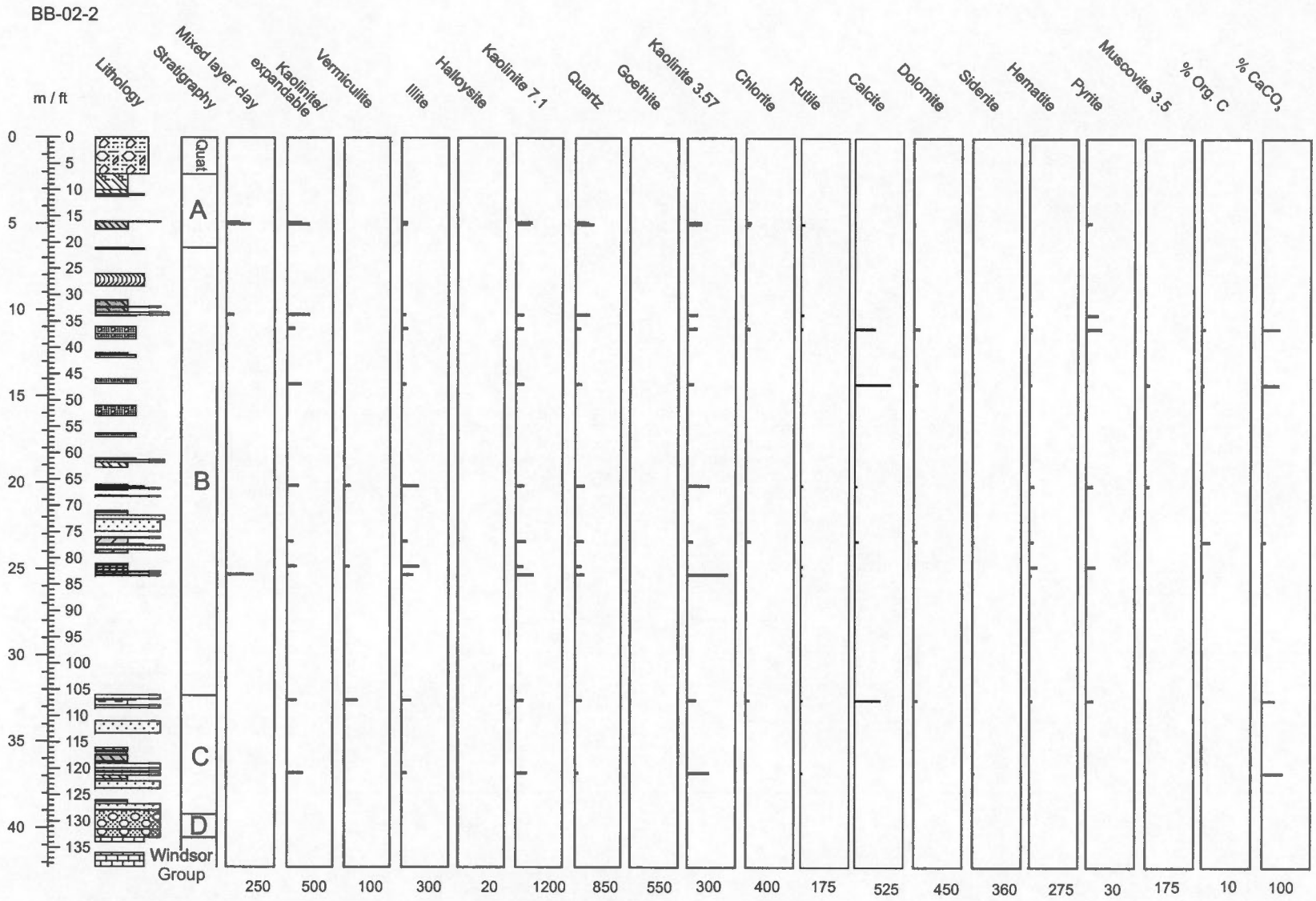


Fig. 4.10: Bulk mineral variation with depth for BB-02-2 from Brierly Brook

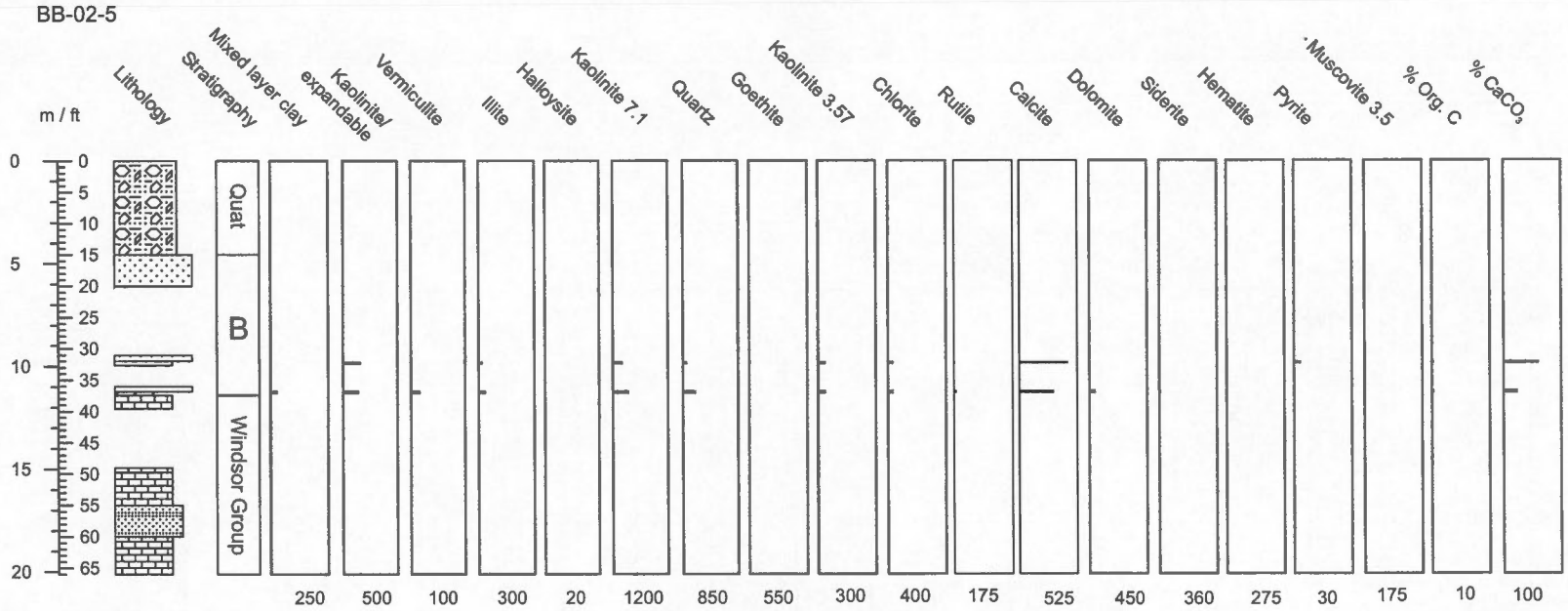


Fig. 4.11: Bulk mineral variation with depth for BB-02-5 from Brierly Brook

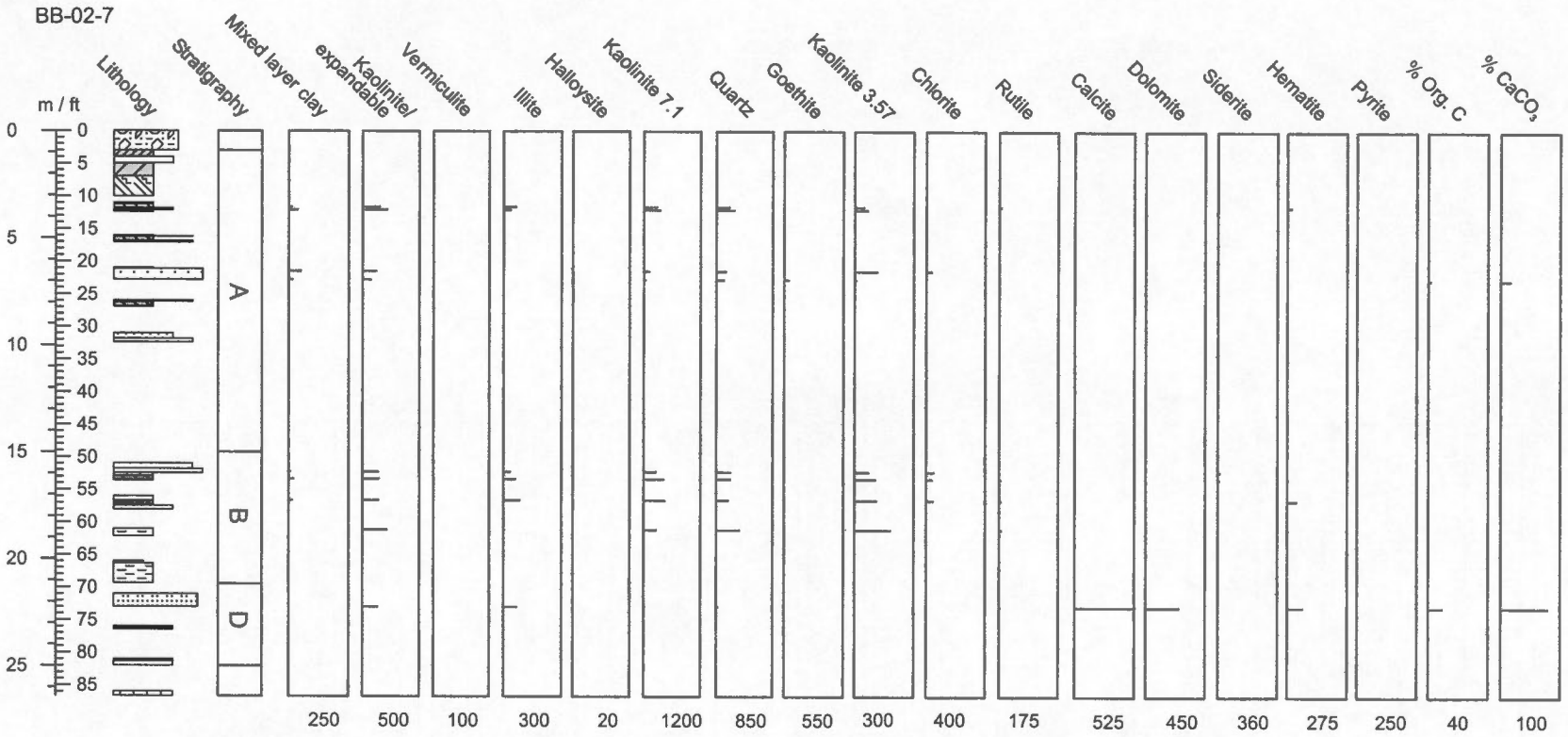


Fig. 12: Bulk mineral variation with depth for BB-02-7 from Brierly Brook

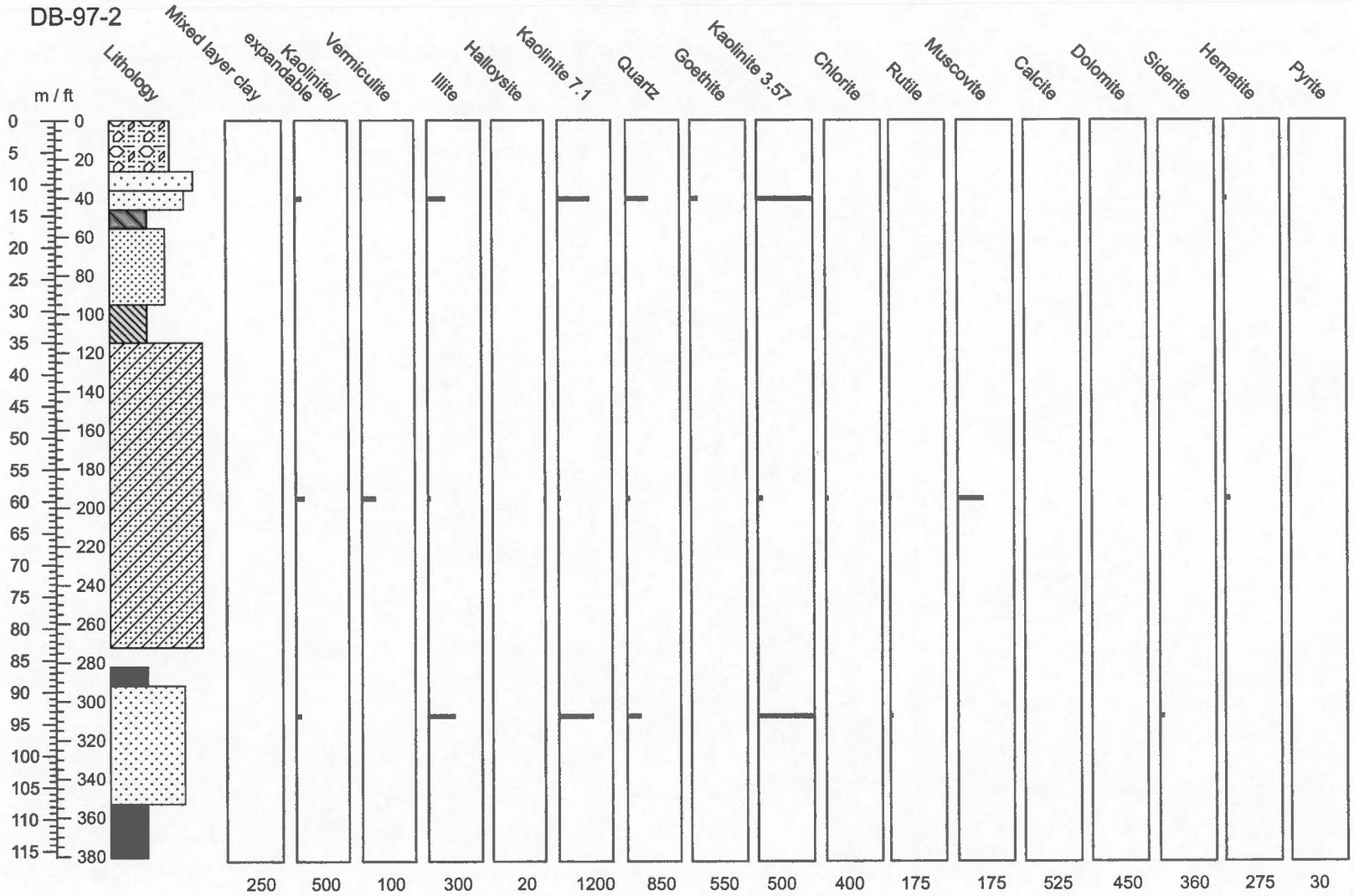


Fig. 4.13: Bulk mineral variation with depth for DB-97-2 from Diogenes Brook

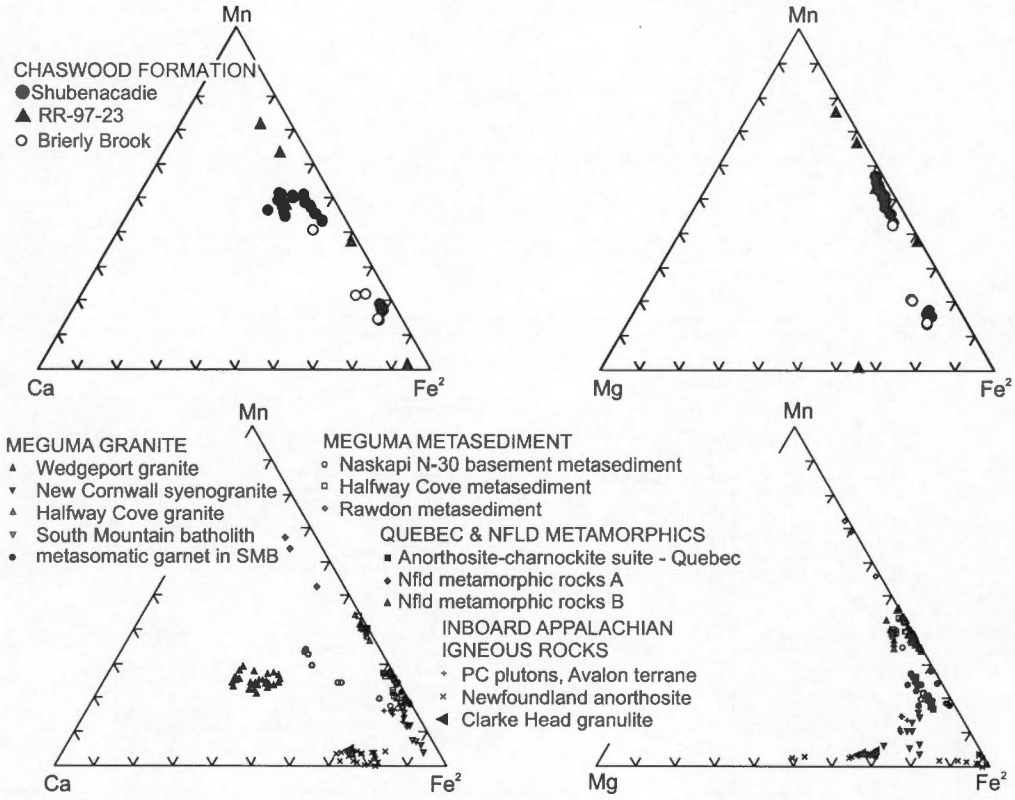


Fig. 4.14: Chemical variation in garnet from the Chaswood Formation and potential source areas. Source rock compositions from Pe-Piper and Ingram (2002); Ham (1988); Allan and Clarke (1981) and Feetham (1995).

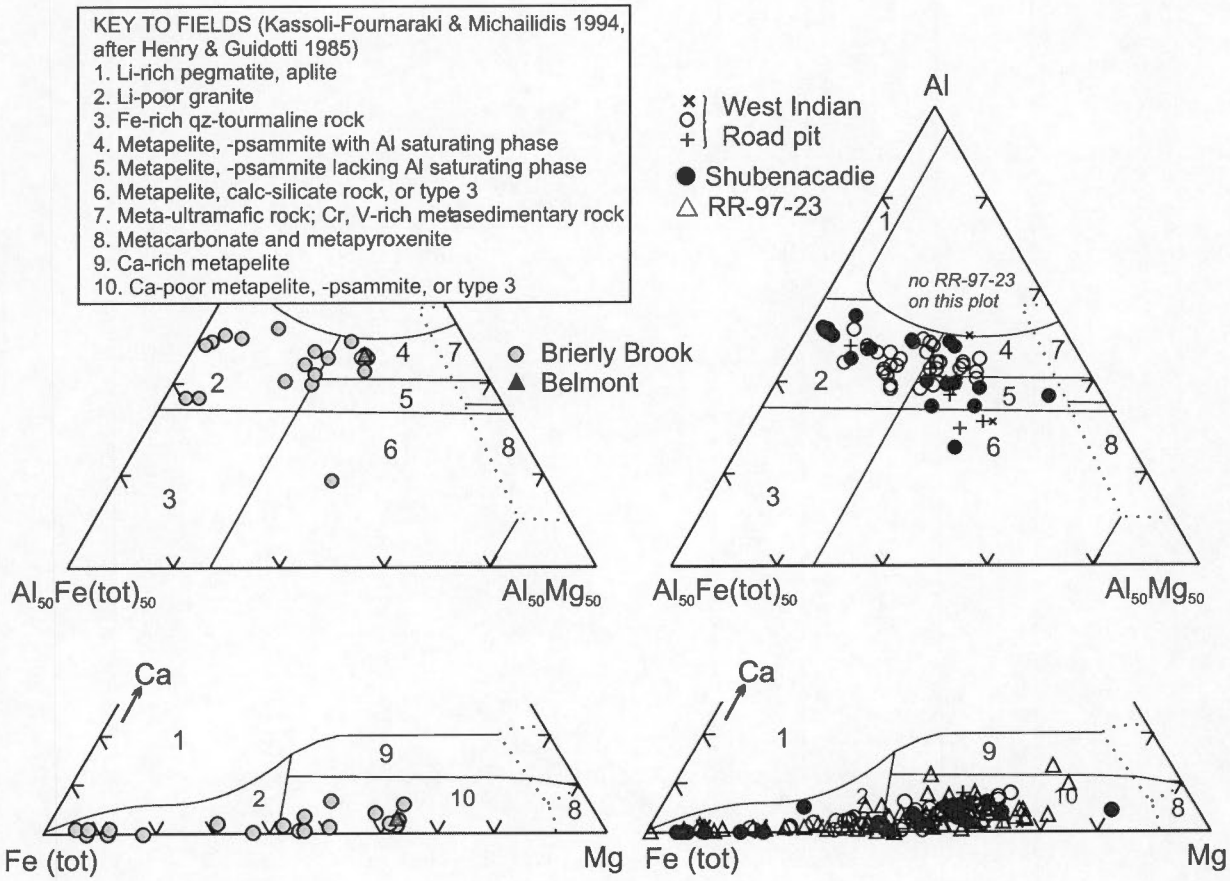


Fig. 4.15: Comparison of the chemical variation in tourmaline from Belmont and Brierly Brook to that of central Nova Scotia Chaswood Formation localities.

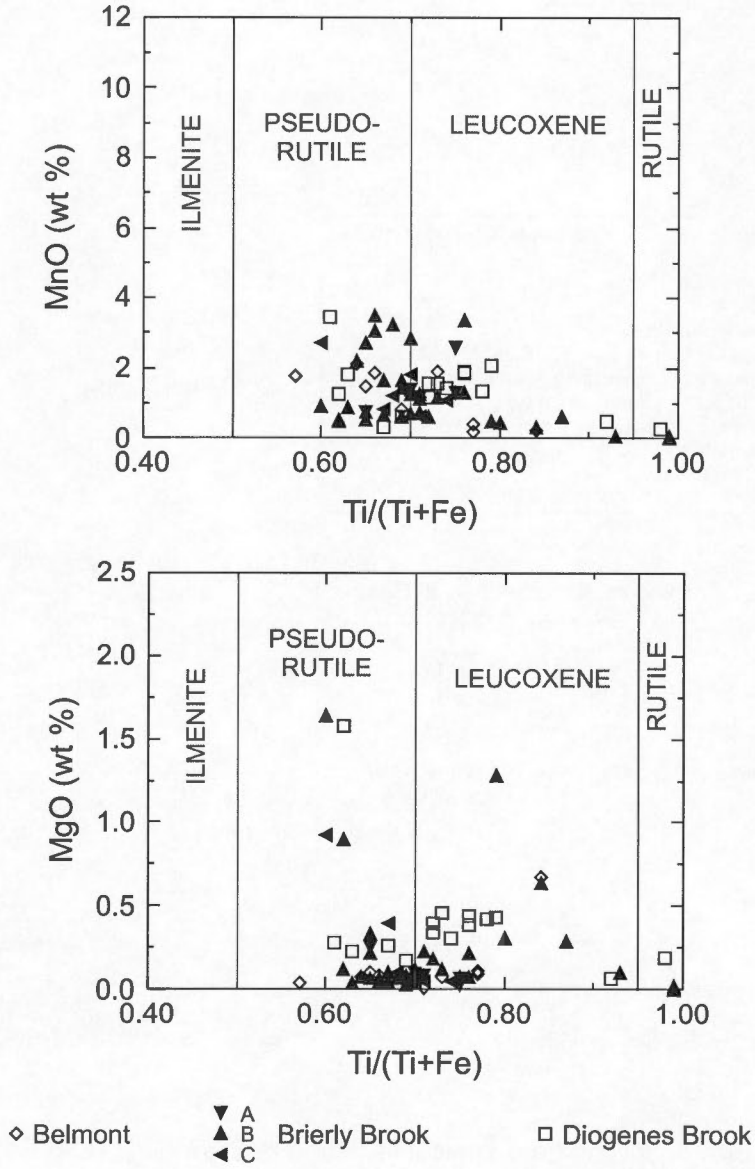


Fig. 4.16: Chemical variation in ilmenite and its alteration products from the northern outliers

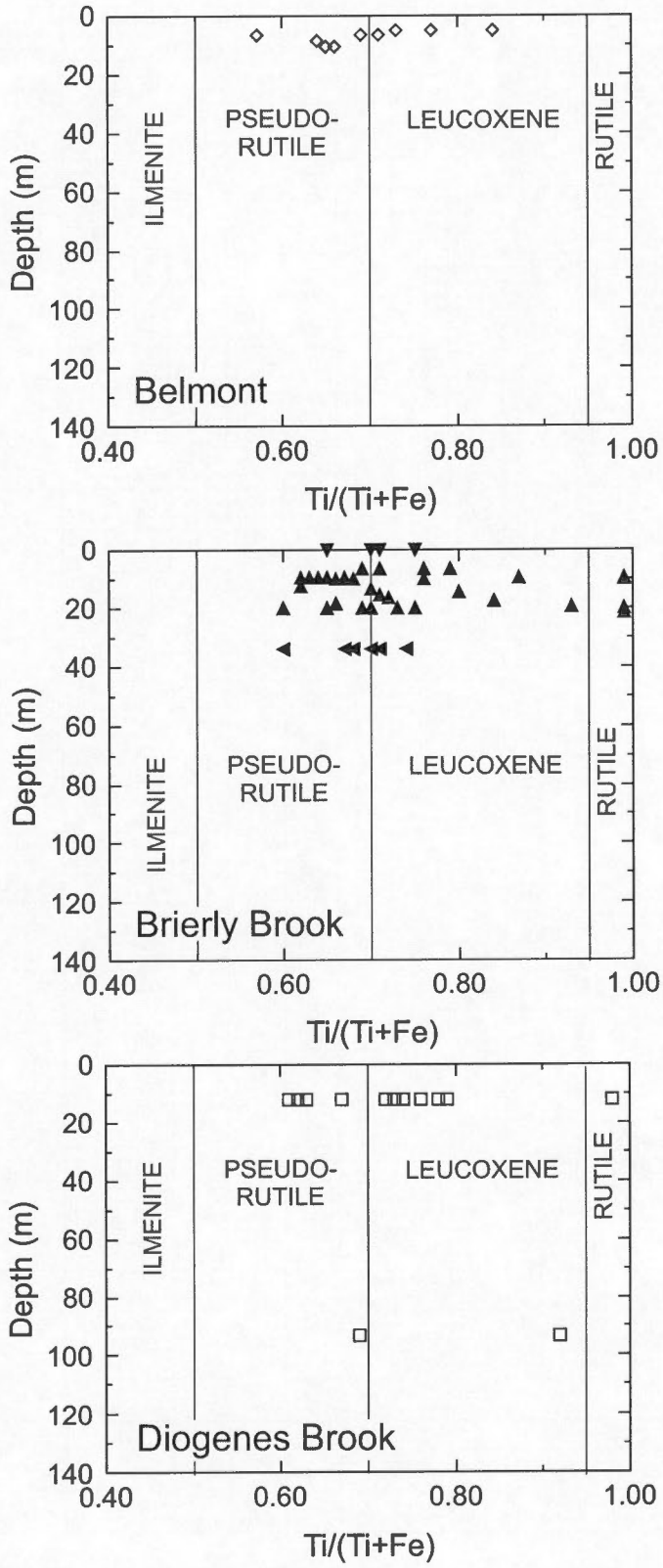


Fig. 4.17: Variation in ilmenite alteration products with depth at the northern outliers

Table 3.1: Laser Coulter grain size data for Belmont

Well		BM-02-2				BM-02-2				BM-02-2				BM-02-3			
Depth (ft/m)		34'				62'				64'				21'			
Sample		clean								washings				(60-64)			
(Φ)	µm	% vol	% wt	% norm	% cum.	% vol	% wt	% norm	% cum.	% vol	% wt	% norm	% cum.	% vol	% wt	% norm	% cum.
-1.00	2000		0.45	0.45	0.45		0.66	0.66	0.66		1.10	1.10	1.10		0.29	0.29	0.29
-0.87	1822	0	0.000	0.00	0.45	0.00	0.00	0.00	0.66	0.12	0.12	0.12	1.22	0.00	0.00	0.00	0.29
-0.73	1660	0	0.000	0.00	0.45	0.00	0.00	0.00	0.66	0.15	0.15	0.15	1.37	0.00	0.00	0.00	0.29
-0.60	1512	0	0.000	0.00	0.45	0.00	0.00	0.00	0.66	0.24	0.24	0.24	1.61	0.00	0.00	0.00	0.29
-0.46	1377	0	0.000	0.00	0.45	0.00	0.00	0.00	0.66	0.42	0.42	0.41	2.02	0.00	0.00	0.00	0.29
-0.33	1255	0.012	0.012	0.01	0.46	0.02	0.02	0.01	0.67	0.79	0.80	0.78	2.81	0.00	0.00	0.00	0.29
-0.19	1143	0.256	0.257	0.25	0.72	0.23	0.23	0.23	0.90	1.46	1.48	1.44	4.25	0.00	0.00	0.00	0.29
-0.06	1041	1.22	1.226	1.21	1.93	0.86	0.87	0.86	1.75	2.42	2.45	2.39	6.65	0.10	0.10	0.10	0.39
0.08	948.2	2.66	2.672	2.65	4.58	1.80	1.81	1.79	3.54	3.60	3.64	3.56	10.21	0.67	0.67	0.67	1.06
0.21	863.9	3.95	3.968	3.93	8.51	2.95	2.97	2.93	6.47	4.93	4.98	4.88	15.08	1.81	1.82	1.80	2.86
0.35	786.9	5.01	5.033	4.99	13.50	4.21	4.24	4.18	10.65	6.25	6.32	6.18	21.26	3.30	3.31	3.29	6.15
0.48	716.9	5.93	5.957	5.90	19.40	5.47	5.51	5.43	16.08	7.41	7.49	7.33	28.59	5.31	5.33	5.29	11.45
0.61	653	6.66	6.690	6.63	26.03	6.64	6.68	6.59	22.68	8.27	8.36	8.18	36.77	7.61	7.63	7.59	19.04
0.75	594.9	7.1	7.132	7.07	33.10	7.63	7.68	7.58	30.26	8.76	8.86	8.66	45.43	9.52	9.55	9.49	28.53
0.88	541.9	7.26	7.293	7.23	40.33	8.35	8.41	8.29	38.55	8.83	8.93	8.73	54.17	10.57	10.60	10.54	39.07
1.02	493.6	7.06	7.092	7.03	47.35	8.73	8.79	8.67	47.22	8.48	8.57	8.39	62.55	10.55	10.58	10.52	49.58
1.15	449.7	6.48	6.509	6.45	53.80	8.72	8.78	8.66	55.88	7.77	7.86	7.68	70.24	9.41	9.44	9.38	58.97
1.29	409.6	5.65	5.676	5.62	59.43	8.30	8.35	8.24	64.12	6.80	6.88	6.73	76.96	7.51	7.53	7.49	66.45
1.42	373.1	4.75	4.772	4.73	64.16	7.52	7.57	7.47	71.59	5.68	5.74	5.62	82.58	5.49	5.51	5.47	71.93
1.56	339.8	3.9	3.918	3.88	68.04	6.50	6.54	6.46	78.05	4.55	4.60	4.50	87.08	3.90	3.91	3.89	75.82
1.69	309.6	3.15	3.164	3.14	71.17	5.36	5.40	5.32	83.37	3.49	3.53	3.45	90.53	2.94	2.95	2.93	78.75
1.83	282.1	2.51	2.521	2.50	73.67	4.22	4.25	4.19	87.56	2.59	2.62	2.56	93.09	2.35	2.36	2.34	81.09
1.96	256.8	1.91	1.919	1.90	75.57	3.20	3.22	3.18	90.74	1.87	1.89	1.85	94.94	1.75	1.76	1.74	82.83
2.09	234.1	1.38	1.386	1.37	76.95	2.33	2.35	2.31	93.06	1.32	1.33	1.31	96.25	1.16	1.16	1.16	83.99
2.23	213.2	1.02	1.025	1.02	77.96	1.65	1.66	1.64	94.69	0.91	0.92	0.90	97.15	0.82	0.82	0.81	84.81
2.36	194.2	0.808	0.812	0.80	78.77	1.14	1.15	1.13	95.83	0.63	0.63	0.62	97.77	0.61	0.61	0.61	85.42
2.50	176.8	0.648	0.651	0.65	79.41	0.78	0.79	0.78	96.61	0.43	0.43	0.42	98.20	0.25	0.25	0.25	85.67
2.63	161.2	0.548	0.550	0.55	79.96	0.55	0.55	0.54	97.15	0.30	0.30	0.29	98.49	0.07	0.07	0.06	85.73
2.77	146.8	0.52	0.522	0.52	80.48	0.40	0.40	0.40	97.54	0.21	0.21	0.21	98.69	0.16	0.16	0.16	85.90
2.90	133.7	0.472	0.474	0.47	80.95	0.30	0.30	0.30	97.85	0.15	0.15	0.14	98.84	0.43	0.43	0.43	86.33
3.04	121.8	0.364	0.366	0.36	81.31	0.24	0.24	0.23	98.08	0.11	0.11	0.10	98.94	0.37	0.37	0.37	86.70
3.17	111	0.295	0.296	0.29	81.60	0.18	0.19	0.18	98.26	0.08	0.08	0.08	99.02	0.15	0.15	0.15	86.84
3.31	101.1	0.324	0.325	0.32	81.92	0.14	0.14	0.14	98.40	0.07	0.07	0.06	99.09	0.10	0.10	0.10	86.94
3.44	92.09	0.366	0.368	0.36	82.29	0.11	0.11	0.11	98.51	0.05	0.05	0.05	99.14	0.19	0.19	0.18	87.12
3.58	83.9	0.305	0.306	0.30	82.59	0.07	0.07	0.07	98.58	0.04	0.04	0.04	99.18	0.22	0.22	0.22	87.34
3.71	76.43	0.211	0.212	0.21	82.80	0.05	0.05	0.05	98.63	0.03	0.03	0.03	99.20	0.15	0.15	0.15	87.49
3.84	69.62	0.208	0.209	0.21	83.01	0.04	0.04	0.04	98.67	0.02	0.02	0.02	99.22	0.12	0.12	0.12	87.61
3.98	63.41	0.293	0.294	0.29	83.30	0.04	0.04	0.04	98.71	0.02	0.02	0.01	99.24	0.13	0.13	0.13	87.73
4.11	57.77	0.35	0.352	0.35	83.65	0.04	0.04	0.04	98.75	0.02	0.02	0.01	99.25	0.11	0.11	0.11	87.84
4.25	52.63	0.325	0.326	0.32	83.97	0.05	0.05	0.05	98.80	0.02	0.02	0.02	99.27	0.10	0.10	0.10	87.95
4.38	47.93	0.3	0.301	0.30	84.27	0.05	0.05	0.05	98.85	0.02	0.02	0.02	99.29	0.16	0.16	0.16	88.11
4.52	43.66	0.331	0.333	0.33	84.60	0.05	0.05	0.05	98.89	0.02	0.02	0.02	99.31	0.24	0.24	0.24	88.35
4.65	39.77	0.383	0.385	0.38	84.98	0.04	0.04	0.04	98.93	0.02	0.02	0.02	99.34	0.27	0.27	0.27	88.62
4.79	36.24	0.396	0.398	0.39	85.38	0.04	0.04	0.04	98.97	0.02	0.02	0.02	99.36	0.24	0.24	0.24	88.86
4.92	33	0.36	0.362	0.36	85.73	0.03	0.03	0.03	99.00	0.02	0.02	0.02	99.37	0.19	0.19	0.19	89.04
5.06	30.07	0.315	0.316	0.31	86.05	0.03	0.03	0.03	99.04	0.02	0.02	0.02	99.39	0.17	0.17	0.17	89.21
5.19	27.38	0.31	0.311	0.31	86.36	0.03	0.03	0.03	99.07	0.02	0.02	0.01	99.41	0.20	0.20	0.20	89.41
5.32	24.95	0.355	0.357	0.35	86.71	0.03	0.03	0.03	99.10	0.01	0.01	0.01	99.42	0.25	0.25	0.25	89.66
5.46	22.73	0.416	0.418	0.41	87.12	0.03	0.03	0.03	99.13	0.01	0.01	0.01	99.43	0.30	0.30	0.30	89.96
5.59	20.7	0.448	0.450	0.45	87.57	0.03	0.03	0.03	99.16	0.01	0.01	0.01	99.45	0.32	0.32	0.31	90.27
5.73	18.86	0.446	0.448	0.44	88.01	0.03	0.03	0.03	99.20	0.01	0.01	0.01	99.46	0.31	0.31	0.31	90.58
5.86	17.18	0.432	0.434	0.43	88.44	0.04	0.04	0.03	99.23	0.02	0.02	0.01	99.47	0.29	0.29	0.29	90.87
6.00	15.65	0.427	0.429	0.43	88.87	0.04	0.04	0.03	99.27	0.02	0.02	0.02	99.49	0.28	0.28	0.28	91.16
6.13	14.26	0.432	0.434	0.43	89.30	0.04	0.04	0.04	99.30	0.02	0.02	0.02	99.51	0.27	0.27	0.27	91.43
6.27	12.99	0.433	0.435	0.43	89.73	0.04	0.04	0.04	99.34	0.02	0.02	0.02	99.53	0.26	0.26	0.26	91.69
6.40	11.83	0.423	0.425	0.42	90.15	0.04	0.04	0.04	99.37	0.02	0.02	0.02	99.55	0.26	0.26	0.26	91.95
6.54	10.78	0.404	0.406	0.40	90.55	0.04	0.04	0.04	99.41	0.02	0.02	0.02	99.57	0.27	0.27	0.27	92.22
6.67	9.819	0.382	0.384	0.38	90.93	0.04	0.04	0.04	99.44	0.02	0.02	0.02	99.59	0.29	0.29	0.29	92.51
6.80	8.944	0.362	0.364	0.36	91.29	0.04	0.04	0.03	99.48	0.02	0.02	0.02	99.61	0.32	0.32	0.32	92.83
6.94	8.147	0.348	0.350	0.35	91.64	0.04	0.04	0.03	99.51	0.02	0.02	0.02	99.63	0.35	0.35	0.35	93.18
7.07	7.421	0.342	0.344	0.34	91.98	0.03	0.03	0.03	99.55	0.02	0.02	0.02	99.65	0.38	0.38	0.38	93.56
7.21	6.761	0.343	0.345	0.34	92.32	0.03	0.03	0.03	99.58	0.02	0.02	0.02	99.68	0.41	0.41	0.41	93.97
7.34	6.158	0.349	0.351	0.35	92.67	0.03	0.03	0.03	99.61	0.02	0.02	0.02	99.70	0.42	0.42	0.42	94.39
7.48	5.611	0.358	0.360	0.36	93.03	0.03	0.03	0.03	99.64	0.02	0.02	0.02	99.72	0.43	0.43	0.43	94.82
7.61	5.111	0.368	0.370	0.37	93.39	0.03	0.03	0.03	99.68	0.02	0.02	0.02	99.74	0.43	0.43	0.43	95.24
7.75	4.656	0.375	0.377	0.37	93.77	0.03	0.03	0.03	99.70	0.02	0.02	0.02	99.76	0.42	0.42	0.42	95.66
7.88	4.241	0.378	0.380	0.38	94.14	0.03	0.03	0.03	99.73	0.02	0.02	0.02	99.78	0.40	0.40	0.40	96.06
8.02	3.862	0.377	0.379	0.38	94.52	0.03	0.03	0.03	99.76	0.02	0.02	0.02	99.81	0.38	0.38	0.38	96.44
8.15	3.519	0.371	0.373	0.37	94.89	0.03	0.03	0.03	99.79	0.02	0.02	0.02	99.82	0.36	0.36	0.36	96.80
8.29	3.206	0.361	0.363	0.36	95.25	0.03	0.03	0.02	99.81	0.02	0.02	0.02	99.84	0.33	0.33	0.33	97.13
8.42	2.92	0.349	0.351	0.35	95.59	0.02	0.02	0.02	99.83	0.02	0.02	0.02	99.86	0.31	0.31	0.31	97.44
8.55	2.66	0.335	0.337	0.33	95.93	0.02	0.02	0.02	99.86	0.02	0.02	0.02	99.88	0.29	0.29	0.28	97.72
8.69	2.423	0.321	0.322	0.32	96.25	0.02	0.02	0.02	99.88	0.02	0.02	0.02	99.90	0.26	0.26	0.26	97.98
8.82	2.207	0.307	0.308	0.31	96.55	0.02	0.02	0.02	99.90	0.02	0.02	0.02	99.91	0.24	0.24	0.24	98.23
8.96	2.01	0.294	0.295	0.29	96.84	0.02	0.02	0.02	99.91	0.02	0.02	0.01	99.93	0.22	0.22	0.22	98.45
9.09	1.832	0.283	0.284	0.28	97.13	0.02	0.02	0.02	99.93	0.01	0.01	0.01	99.94	0.21	0.21	0.21	98.66
9.23	1.669	0.272	0.273	0.27	97.40	0.02	0.02	0.01	99.94	0.01	0.01	0.01	99.95	0.19	0.19	0.19	98.85
9.36	1.52	0.263	0.264	0.26	97.66	0.01	0.01	0.01	99.96	0.01	0.01	0.01	99.96	0.18	0.18	0.18	99.02
9.50	1.385	0.254	0.255	0.25	97.91	0.01	0.01	0.01	99.97	0.01	0.01	0.01	99.97	0.16	0.16	0.16	99.18
9.63	1.261	0.246	0.247	0.24	98.16	0.01	0.01	0.01	99.98	0.01	0.01	0.01	99.98	0.15	0.15	0.15	99.33
9.77	1.149	0.237	0.238	0.24	98.39	0.01	0.01	0.01	99.99	0.01	0.01	0.01	99.99	0.14	0.14	0.13	99.47
9.90	1.047	0.227	0.228	0.23	98.62	0.01	0.01	0.01	99.99	0.01	0.01	0.00	99.99	0.12	0.12	0.12	99.59
10.04	0.953	0.216	0.217	0.22	98.83	0.00	0.00	0.00	100.00	0.00	0.00	0.00	100.00	0.11	0.11	0.11	99.69
10.17	0.869	0.203	0.204	0.20	99.04	0.00	0.00	0.00	100.00	0.00	0.00	0.00	100.00	0.09	0.09	0.09	99.78
10.30	0.791	0.188	0.189	0.19	99.22	0.00	0.00	0.00	100.00	0.00	0.00	0.00	100.00	0.08	0.08	0.08	99.86
10.44	0.721	0.172	0.173	0.17	99.39	0.00	0.00	0.00	100.00	0.00	0.00	0.00	100.00	0.06	0.06	0.06	99.92
10.57	0.657	0.154	0.155	0.15	99.55	0.00	0.00	0.00	100.00	0.00	0.00	0.00	100.00	0.04	0.04	0.04	99.97
10.71	0.598	0.133	0.134	0.13	99.68	0.00	0.00	0.00	100.00	0.00	0.00	0.00	100.00	0.03	0.03	0.03	99.99
10.84	0.545	0.112	0.113	0.11	99.79	0.00	0.00	0.00	100.00	0.00	0.00	0.00	100.00	0.01	0.01	0.01	100.00
10.98	0.496	0.088	0.088	0.09	99.88	0.00	0.00	0.00	100.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	100.00
11.11	0.452	0.064	0.064	0.06	99.94	0.00	0.00	0.00	100.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	100.00
11.25	0.412	0.038	0.038	0.04	99.98	0.00	0.00	0.00	100.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	100.00
11.38	0.375	0.02	0.020	0.02	100.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	100.00
Sum			100.461	100.00			100.687	100.00			101.111	100.00			100.300	100.00	
Seive separation		wt (g)	wt%			wt (g)	wt%			wt (g)	wt%			wt (g)	wt%		
Total wt		8.619	100.000			11.287	100.000			17.201	100.000			10.338	100.000		
wt > 2000 um		0.039	0.452			0.074	0.656			0.189	1.099			0.030	0.290		
wt < 2000 um		8.580	99.548			11.213	99.344			17.012	98.901			10.308	99.710		
Statistical results		Arithmetic	Geometric			Arithmetic	Geometric			Arithmetic	Geometric			Arithmetic	Geometric		
Mean:		467.0	245.4			515.1	450.5			619.5	544.3			466.7	294.1		
Sorting:		315.1	5.589			258.1	1.859			317.1	1.797			254.7	4.390		
Skewness:		0.972	-1.867			2.705	-3.332			2.297	-3.125			0.878	-2.308		
Kurtosis:		7.972	5.510			19.95	25.62			12.83	27.84			11.59	7.333		
Gravel%		0.5%				0.7%				1.1%				0.3%			
Sand%		82.9%				98.1%				98.1%				87.5%			
Mud%		16.6%				1.3%				0.8%				12.2%			

Table 3.2: Laser Coulter grain size data for Brierly Brook.

Well		BB-02-1				BB-02-1				BB-02-1				BB-02-1			
Depth (ft/m)		12'				17'				22'				42'			
Size		(9-13)				(57-61)				(15-21)							
(Φ)	µm	% vol	% wt	% norm	% cum.	% vol	% wt	% norm	% cum.	% vol	% wt	% norm	% cum.	% vol	% wt	% norm	% cum.
-1.00	2000		14.93	14.93	14.93		7.84	7.84	7.84		12.70	12.70	12.70		14.34	14.34	14.34
-0.87	1822	2.07	2.43	1.76	16.69	0.08	0.08	0.07	7.91	1.72	1.97	1.50	14.20	2.33	2.72	2.00	16.33
-0.73	1660	2.17	2.55	1.85	18.54	0.26	0.28	0.24	8.15	1.79	2.05	1.56	15.77	2.46	2.87	2.11	18.44
-0.60	1512	2.34	2.75	1.99	20.53	0.55	0.60	0.51	8.65	1.89	2.16	1.65	17.42	2.69	3.14	2.30	20.75
-0.46	1377	2.60	3.06	2.21	22.74	1.09	1.18	1.00	9.66	2.04	2.34	1.78	19.20	2.97	3.47	2.54	23.29
-0.33	1255	2.91	3.42	2.48	25.22	1.76	1.91	1.62	11.28	2.21	2.53	1.93	21.13	3.22	3.76	2.76	26.05
-0.19	1143	3.34	3.93	2.84	28.06	2.52	2.73	2.32	13.61	2.45	2.81	2.14	23.27	3.41	3.98	2.92	28.97
-0.06	1041	3.87	4.55	3.29	31.35	3.26	3.54	3.01	16.61	2.78	3.18	2.43	25.69	3.52	4.11	3.01	31.98
0.08	948.2	4.42	5.20	3.76	35.11	3.89	4.22	3.59	20.20	3.17	3.63	2.77	28.46	3.56	4.16	3.05	35.03
0.21	863.9	4.86	5.71	4.13	39.25	4.34	4.71	4.00	24.20	3.59	4.11	3.13	31.60	3.54	4.13	3.03	38.06
0.35	786.9	5.06	5.95	4.30	43.55	4.57	4.96	4.21	28.41	3.97	4.55	3.47	35.06	3.51	4.10	3.01	41.07
0.48	716.9	4.95	5.82	4.21	47.76	4.61	5.00	4.25	32.66	4.28	4.90	3.74	38.80	3.48	4.06	2.98	44.05
0.61	653	4.52	5.31	3.85	51.61	4.51	4.89	4.16	36.82	4.46	5.11	3.89	42.69	3.43	4.00	2.94	46.99
0.75	594.9	3.87	4.55	3.29	54.90	4.31	4.68	3.97	40.79	4.49	5.14	3.92	46.61	3.31	3.86	2.83	49.82
0.88	541.9	3.15	3.70	2.68	57.58	4.07	4.42	3.75	44.55	4.38	5.02	3.82	50.44	3.10	3.62	2.65	52.48
1.02	493.6	2.49	2.93	2.12	59.70	3.79	4.11	3.49	48.04	4.15	4.75	3.62	54.06	2.80	3.27	2.40	54.87
1.15	449.7	1.97	2.32	1.68	61.38	3.47	3.77	3.20	51.24	3.82	4.38	3.34	57.40	2.43	2.84	2.08	56.96
1.29	409.6	1.62	1.90	1.38	62.76	3.09	3.35	2.85	54.09	3.43	3.93	2.99	60.39	2.05	2.39	1.76	58.71
1.42	373.1	1.42	1.67	1.21	63.96	2.67	2.90	2.46	56.55	3.02	3.46	2.64	63.03	1.73	2.02	1.48	60.19
1.56	339.8	1.33	1.56	1.13	65.09	2.23	2.42	2.06	58.61	2.61	2.99	2.28	65.31	1.49	1.74	1.28	61.47
1.69	309.6	1.29	1.52	1.10	66.19	1.81	1.96	1.67	60.28	2.24	2.57	1.96	67.26	1.33	1.55	1.14	62.61
1.83	282.1	1.26	1.48	1.07	67.26	1.45	1.57	1.34	61.61	1.91	2.19	1.67	68.93	1.23	1.44	1.05	63.66
1.96	256.8	1.22	1.43	1.04	68.30	1.17	1.27	1.08	62.69	1.64	1.88	1.43	70.36	1.14	1.33	0.98	64.64
2.09	234.1	1.15	1.35	0.98	69.28	0.97	1.06	0.90	63.59	1.43	1.64	1.25	71.61	1.04	1.21	0.89	65.53
2.23	213.2	1.04	1.22	0.88	70.17	0.85	0.92	0.79	64.37	1.26	1.44	1.10	72.71	0.93	1.09	0.80	66.33
2.36	194.2	0.91	1.07	0.78	70.94	0.79	0.86	0.73	65.10	1.13	1.29	0.99	73.70	0.82	0.96	0.70	67.03
2.50	176.8	0.78	0.92	0.67	71.61	0.76	0.82	0.70	65.80	1.02	1.17	0.89	74.59	0.73	0.85	0.63	67.66
2.63	161.2	0.68	0.79	0.57	72.18	0.74	0.81	0.68	66.49	0.92	1.05	0.80	75.39	0.66	0.77	0.57	68.22
2.77	146.8	0.60	0.71	0.51	72.69	0.71	0.77	0.65	67.14	0.83	0.96	0.73	76.12	0.61	0.71	0.52	68.74
2.90	133.7	0.56	0.65	0.47	73.17	0.64	0.69	0.59	67.73	0.76	0.87	0.66	76.78	0.57	0.67	0.49	69.23
3.04	121.8	0.53	0.62	0.45	73.61	0.54	0.59	0.50	68.23	0.71	0.81	0.62	77.40	0.54	0.63	0.46	69.70
3.17	111	0.50	0.59	0.42	74.04	0.44	0.48	0.41	68.64	0.67	0.77	0.58	77.98	0.52	0.61	0.45	70.14
3.31	101.1	0.46	0.55	0.39	74.43	0.36	0.39	0.33	68.97	0.65	0.74	0.57	78.55	0.51	0.60	0.44	70.58
3.44	92.09	0.43	0.51	0.37	74.80	0.33	0.35	0.30	69.27	0.65	0.74	0.56	79.11	0.51	0.60	0.44	71.02
3.58	83.9	0.41	0.49	0.35	75.15	0.34	0.37	0.31	69.58	0.65	0.75	0.57	79.68	0.51	0.60	0.44	71.45
3.71	76.43	0.42	0.49	0.36	75.51	0.39	0.42	0.36	69.94	0.67	0.76	0.58	80.26	0.52	0.60	0.44	71.90
3.84	69.62	0.46	0.54	0.39	75.90	0.46	0.50	0.43	70.36	0.69	0.79	0.60	80.86	0.52	0.61	0.45	72.34
3.98	63.41	0.51	0.60	0.44	76.33	0.53	0.58	0.49	70.85	0.71	0.81	0.62	81.48	0.54	0.64	0.47	72.81
4.11	57.77	0.58	0.68	0.49	76.82	0.58	0.63	0.54	71.39	0.74	0.85	0.65	82.13	0.59	0.68	0.50	73.31
4.25	52.63	0.64	0.75	0.54	77.36	0.61	0.67	0.57	71.96	0.77	0.88	0.67	82.80	0.64	0.75	0.55	73.86
4.38	47.93	0.68	0.80	0.58	77.95	0.63	0.69	0.58	72.54	0.80	0.91	0.70	83.50	0.71	0.82	0.60	74.46
4.52	43.66	0.72	0.85	0.61	78.56	0.66	0.72	0.61	73.15	0.81	0.93	0.71	84.21	0.75	0.88	0.64	75.11
4.65	39.77	0.74	0.87	0.63	79.19	0.71	0.77	0.65	73.81	0.80	0.92	0.70	84.91	0.77	0.90	0.66	75.77
4.79	36.24	0.75	0.88	0.64	79.83	0.77	0.84	0.71	74.52	0.78	0.89	0.68	85.58	0.75	0.88	0.64	76.41
4.92	33	0.76	0.89	0.64	80.47	0.84	0.91	0.77	75.29	0.74	0.84	0.64	86.22	0.71	0.83	0.61	77.02
5.06	30.07	0.76	0.89	0.65	81.12	0.90	0.97	0.83	76.12	0.69	0.79	0.60	86.83	0.67	0.78	0.57	77.59
5.19	27.38	0.77	0.90	0.65	81.77	0.93	1.01	0.86	76.98	0.66	0.75	0.57	87.40	0.65	0.76	0.56	78.15
5.32	24.95	0.79	0.92	0.67	82.44	0.94	1.02	0.87	77.85	0.63	0.72	0.55	87.95	0.66	0.77	0.56	78.71
5.46	22.73	0.81	0.95	0.69	83.13	0.94	1.02	0.87	78.72	0.61	0.70	0.53	88.48	0.69	0.81	0.59	79.31
5.59	20.7	0.84	0.99	0.72	83.85	0.93	1.01	0.86	79.57	0.60	0.69	0.52	89.01	0.73	0.85	0.63	79.93
5.73	18.86	0.87	1.02	0.74	84.59	0.93	1.00	0.85	80.43	0.59	0.67	0.51	89.52	0.76	0.89	0.65	80.58
5.86	17.18	0.89	1.05	0.76	85.35	0.93	1.00	0.85	81.28	0.57	0.65	0.50	90.01	0.77	0.90	0.66	81.25
6.00	15.65	0.89	1.05	0.76	86.11	0.93	1.01	0.85	82.14	0.55	0.62	0.48	90.49	0.76	0.89	0.65	81.90
6.13	14.26	0.89	1.04	0.75	86.86	0.92	1.00	0.85	82.99	0.52	0.60	0.45	90.94	0.74	0.86	0.63	82.53
6.27	12.99	0.87	1.02	0.74	87.60	0.92	0.99	0.84	83.83	0.50	0.57	0.44	91.38	0.72	0.84	0.62	83.15
6.40	11.83	0.85	1.00	0.72	88.32	0.90	0.98	0.83	84.66	0.48	0.55	0.42	91.80	0.72	0.84	0.61	83.76
6.54	10.78	0.83	0.98	0.71	89.03	0.89	0.97	0.82	85.49	0.47	0.54	0.41	92.21	0.72	0.84	0.62	84.38
6.67	9.819	0.82	0.96	0.69	89.73	0.88	0.95	0.81	86.29	0.46	0.53	0.40	92.61	0.74	0.86	0.63	85.01
6.80	8.944	0.80	0.93	0.68	90.40	0.87	0.94	0.80	87.09	0.45	0.52	0.40	93.01	0.75	0.88	0.64	85.65
6.94	8.147	0.77	0.91	0.66	91.06	0.85	0.92	0.78	87.88	0.45	0.51	0.39	93.40	0.77	0.90	0.66	86.31
7.07	7.421	0.75	0.88	0.64	91.70	0.84	0.91	0.77	88.65	0.44	0.50	0.38	93.78	0.79	0.92	0.67	86.99
7.21	6.761	0.72	0.85	0.61	92.31	0.82	0.89	0.75	89.40	0.43	0.49	0.37	94.16	0.80	0.94	0.69	87.67
7.34	6.158	0.69	0.81	0.59	92.90	0.79	0.86	0.73	90.13	0.42	0.48	0.36	94.52	0.81	0.95	0.69	88.37
7.48	5.611	0.66	0.78	0.56	93.46	0.77	0.84	0.71	90.84	0.41	0.46	0.35	94.87	0.81	0.95	0.70	89.06
7.61	5.111	0.63	0.74	0.53	93.99	0.74	0.81	0.68	91.53	0.39	0.45	0.34	95.22	0.81	0.95	0.69	89.76
7.75	4.656	0.59	0.70	0.51	94.50	0.71	0.77	0.66	92.18	0.38	0.43	0.33	95.54	0.80	0.93	0.69	90.44
7.88	4.241	0.56	0.66	0.47	94.97	0.68	0.74	0.63	92.81	0.36	0.41	0.32	95.86	0.78	0.91	0.67	91.11
8.02	3.862	0.52	0.61	0.44	95.42	0.65	0.70	0.59	93.40	0.34	0.39	0.30	96.16	0.76	0.89	0.65	91.77
8.15	3.519	0.49	0.57	0.41	95.83	0.61	0.66	0.56	93.96	0.33	0.38	0.29	96.45	0.73	0.86	0.63	92.39
8.29	3.206	0.45	0.53	0.39	96.22	0.58	0.62	0.53	94.49	0.31	0.36	0.27	96.72	0.71	0.82	0.60	93.00
8.42	2.92	0.42	0.49	0.36	96.58	0.54	0.59	0.50	94.99	0.30	0.34	0.26	96.98	0.67	0.79	0.58	93.58
8.55	2.66	0.39	0.46	0.33	96.91	0.51	0.55	0.47	95.46	0.28	0.32	0.25	97.23	0.64	0.75	0.55	94.12
8.69	2.423	0.36	0.42	0.31	97.22	0.47	0.51	0.44	95.90	0.27	0.31	0.24	97.46	0.61	0.71	0.52	94.65
8.82	2.207	0.33	0.39	0.28	97.50	0.44	0.48	0.41	96.31	0.26	0.29	0.22	97.69	0.58	0.67	0.49	95.14
8.96	2.01	0.31	0.36	0.26	97.76	0.42	0.45	0.38	96.69	0.25	0.28	0.21	97.90	0.55	0.64	0.47	95.61
9.09	1.832	0.29	0.34	0.25	98.01	0.39	0.42	0.36	97.05	0.24	0.27	0.21	98.11	0.52	0.60	0.44	96.05
9.23	1.669	0.27	0.31	0.23	98.24	0.36	0.39	0.33	97.38	0.22	0.26	0.20	98.30	0.49	0.57	0.42	96.47
9.36	1.52	0.25	0.29	0.21	98.45	0.34	0.37	0.31	97.69	0.21	0.24	0.19	98.49	0.46	0.54	0.40	96.87
9.50	1.385	0.23	0.27	0.20	98.64	0.32	0.34	0.29	97.98	0.20	0.23	0.18	98.67	0.44	0.51	0.38	97.24
9.63	1.261	0.21	0.25	0.18	98.83	0.29	0.32	0.27	98.25	0.19	0.22	0.17	98.83	0.41	0.48	0.35	97.60
9.77	1.149	0.20	0.23	0.17	98.99	0.27	0.30	0.25	98.50	0.18	0.21	0.16	98.99	0.39	0.45	0.33	97.93
9.90	1.047	0.18	0.21	0.15	99.15	0.25	0.27	0.23	98.74	0.17	0.20	0.15	99.14	0.36	0.42	0.31	98.24
10.04	0.953	0.17	0.20	0.14	99.29	0.23	0.25	0.21	98.95	0.16	0.18	0.14	99.28	0.34	0.39	0.29	98.53
10.17	0.869	0.15	0.18	0.13	99.42	0.21	0.23	0.19	99.14	0.15	0.17	0.13	99.41	0.31	0.36	0.26	98.79
10.30	0.791	0.14	0.16	0.12	99.54	0.19	0.21	0.17	99.31	0.14	0.15	0.12	99.53	0.28	0.33	0.24	99.03
10.44	0.721	0.12	0.14	0.10	99.64	0.17	0.18	0.15	99.47	0.12	0.14	0.11	99.63	0.25	0.29	0.22	99.25
10.57	0.657	0.11	0.13	0.09	99.73	0.15	0.16	0.13	99.60	0.11	0.12	0.09	99.73	0.22	0.26	0.19	99.44
10.71	0.598	0.09	0.11	0.08	99.81	0.13	0.14	0.12	99.72	0.09	0.10	0.08	99.81	0.19	0.22	0.16	99.60
10.84	0.545	0.08	0.09	0.06	99.88	0.11	0.11	0.10	99.82	0.08	0.09	0.07	99.87	0.16	0.19	0.14	99.74
10.98	0.496	0.06	0.07	0.05	99.93	0.08	0.09	0.08	99.89	0.06	0.07	0.05	99.92	0.13	0.15	0.11	99.85
11.11	0.452	0.04	0.05	0.04	99.96	0.06	0.06	0.05	99.94	0.04	0.05	0.04	99.96	0.09	0.10	0.08	99.92
11.25	0.412	0.03	0.03	0.02	99.99	0.04	0.04	0.04	99.98	0.03	0.03	0.02	99.99	0.06	0.07	0.05	99.97
11.38	0.375	0.02	0.02	0.01	100.00	0.02	0.02	0.02	100.00	0.02	0.02	0.01	100.00	0.03	0.04	0.03	100.00
Sum			117.54	100.00			108.46	100.00			114.53	100.00			116.76	100.00	
Seive separation		wt (g)	wt %			wt (g)	wt %			wt (g)	wt %			wt (g)	wt %		
Total wt		11.103	100.00			7.372	100.00			10.747	100.00			11.681	100.00		
wt > 2000 um		1.658	14.93			0.578	7.84			1.365	12.70			1.675	14.34		
wt < 2000 um		9.445	85.07			6.794	92.16			9.382	87.30			10.006	85.66		
Statistical results		Arithmetic	Geometric			Arithmetic	Geometric			Arithmetic	Geometric			Arithmetic	Geometric		
MEAN		854.3	295.0			603.6	187.6			777.4	317.0			820.4	230.7		
SORTING		808.7	7.931			656.1	8.290			763.0	6.331			821.9	9.933		
SKEWNESS		0.799	-1.097			1.486	-0.913			1.076	-1.299			0.815	-0.966		
KURTOSIS		2.426	3.076			4.756	2.643			2.996	4.108			2.382	2.669		
% GRAVEL:		14.9%				7.8%				12.7%				14.3%			
% SAND:		61.5%				63.1%				68.9%				58.5%			
% MUD:		23.6%				29.1%				18.4%				27.1%			

Table 3.2: Laser Coulter grain size data for Brierly Brook.

Well		BB-02-2				BB-02-2				BB-02-2				BB-02-2			
Depth (ft/m)		~16'				26'				66'				66'			
Size						(66-72)				(6-11)				(66-69)			
(Φ)	µm	% vol	% wt	% norm	% cum.	% vol	% wt	% norm	% cum.	% vol	% wt	% norm	% cum.	% vol	% wt	% norm	% cum.
-1.00	2000		0.57	0.57	0.57		21.24	21.24	21.24		5.04	5.04	5.04		20.91	20.91	20.91
-0.87	1822	0.73	0.73	0.72	1.29	0.00	0.00	0.00	21.24	1.91	2.01	1.63	6.67	4.04	5.11	3.43	24.34
-0.73	1660	0.76	0.76	0.75	2.04	0.00	0.00	0.00	21.24	2.07	2.43	1.97	8.64	3.97	4.67	3.13	27.47
-0.60	1512	0.88	0.89	0.88	2.92	0.01	0.01	0.01	21.25	2.20	2.59	2.09	10.73	3.78	4.44	2.98	30.45
-0.46	1377	1.16	1.17	1.15	4.07	0.13	0.16	0.10	21.36	2.32	2.73	2.21	12.94	3.51	4.13	2.77	33.22
-0.33	1255	1.74	1.75	1.73	5.80	0.66	0.77	0.52	21.87	2.36	2.77	2.25	15.18	3.27	3.84	2.58	35.80
-0.19	1143	2.69	2.71	2.67	8.48	1.61	1.89	1.27	23.14	2.43	2.86	2.31	17.49	3.26	3.83	2.57	38.37
-0.06	1041	3.93	3.95	3.91	12.38	2.77	3.26	2.18	25.32	2.54	2.99	2.42	19.91	3.53	4.15	2.78	41.15
0.08	948.2	5.31	5.34	5.28	17.66	3.76	4.42	2.96	28.29	2.68	3.15	2.55	22.46	4.00	4.70	3.15	44.30
0.21	863.9	6.63	6.67	6.59	24.26	4.53	5.33	3.57	31.85	2.76	3.24	2.63	25.08	4.44	5.22	3.50	47.80
0.35	786.9	7.72	7.76	7.68	31.93	4.97	5.84	3.91	35.77	2.75	3.23	2.62	27.70	4.68	5.50	3.69	51.49
0.48	716.9	8.47	8.52	8.42	40.35	4.98	5.85	3.92	39.69	2.63	3.09	2.50	30.20	4.61	5.42	3.63	55.13
0.61	653	8.79	8.84	8.74	49.10	4.59	5.40	3.62	43.31	2.44	2.87	2.32	32.52	4.26	5.01	3.36	58.49
0.75	594.9	8.63	8.68	8.58	57.68	3.94	4.63	3.10	46.41	2.25	2.64	2.14	34.66	3.73	4.38	2.94	61.43
0.88	541.9	8.02	8.07	7.97	65.65	3.26	3.83	2.57	48.98	2.12	2.49	2.02	36.68	3.18	3.74	2.51	63.93
1.02	493.6	7.04	7.08	7.00	72.65	2.74	3.22	2.16	51.14	2.07	2.43	1.97	38.65	2.69	3.16	2.12	66.05
1.15	449.7	5.83	5.86	5.80	78.45	2.47	2.90	1.95	53.08	2.11	2.48	2.01	40.66	2.28	2.68	1.80	67.85
1.29	409.6	4.57	4.60	4.54	82.99	2.41	2.83	1.90	54.98	2.24	2.63	2.13	42.79	1.93	2.27	1.52	69.37
1.42	373.1	3.43	3.45	3.41	86.40	2.42	2.84	1.91	56.89	2.45	2.88	2.33	45.12	1.61	1.89	1.27	70.64
1.56	339.8	2.51	2.52	2.50	88.90	2.34	2.75	1.84	58.73	2.71	3.19	2.58	47.70	1.31	1.54	1.03	71.68
1.69	309.6	1.86	1.87	1.85	90.75	2.01	2.36	1.58	60.31	2.96	3.48	2.82	50.51	1.05	1.23	0.83	72.50
1.83	282.1	1.42	1.43	1.41	92.16	1.43	1.68	1.13	61.44	3.13	3.68	2.98	53.49	0.83	0.98	0.66	73.16
1.96	256.8	1.15	1.16	1.14	93.30	0.79	0.93	0.62	62.06	3.12	3.67	2.97	56.46	0.69	0.82	0.55	73.71
2.09	234.1	0.95	0.96	0.95	94.25	0.36	0.43	0.29	62.35	2.91	3.42	2.77	59.23	0.64	0.75	0.50	74.21
2.23	213.2	0.81	0.81	0.80	95.05	0.22	0.26	0.18	62.52	2.52	2.96	2.40	61.62	0.64	0.75	0.51	74.71
2.36	194.2	0.68	0.68	0.67	95.73	0.32	0.38	0.25	62.78	2.05	2.41	1.95	63.57	0.66	0.78	0.52	75.24
2.50	176.8	0.56	0.56	0.56	96.28	0.61	0.72	0.48	63.26	1.59	1.87	1.51	65.09	0.65	0.76	0.51	75.75
2.63	161.2	0.45	0.46	0.45	96.74	0.94	1.11	0.74	64.00	1.24	1.46	1.18	66.27	0.56	0.66	0.44	76.19
2.77	146.8	0.36	0.36	0.36	97.09	1.04	1.22	0.82	64.82	1.00	1.18	0.95	67.22	0.42	0.50	0.33	76.53
2.90	133.7	0.27	0.27	0.27	97.36	0.83	0.98	0.66	65.47	0.86	1.01	0.81	68.03	0.29	0.34	0.23	76.76
3.04	121.8	0.21	0.21	0.20	97.56	0.46	0.54	0.36	65.83	0.76	0.90	0.72	68.76	0.22	0.25	0.17	76.93
3.17	111	0.18	0.18	0.17	97.74	0.18	0.21	0.14	65.98	0.69	0.81	0.65	69.41	0.21	0.25	0.17	77.09
3.31	101.1	0.17	0.17	0.17	97.90	0.08	0.09	0.06	66.04	0.61	0.71	0.58	69.98	0.27	0.31	0.21	77.30
3.44	92.09	0.16	0.16	0.16	98.06	0.10	0.12	0.08	66.12	0.53	0.62	0.50	70.49	0.34	0.40	0.27	77.57
3.58	83.9	0.13	0.13	0.13	98.19	0.21	0.25	0.17	66.29	0.47	0.56	0.45	70.94	0.38	0.44	0.30	77.87
3.71	76.43	0.11	0.11	0.10	98.30	0.36	0.43	0.29	66.57	0.45	0.52	0.42	71.36	0.35	0.41	0.28	78.15
3.84	69.62	0.08	0.08	0.08	98.38	0.44	0.52	0.35	66.92	0.45	0.53	0.43	71.79	0.29	0.34	0.23	78.37
3.98	63.41	0.07	0.07	0.07	98.44	0.45	0.52	0.35	67.27	0.49	0.58	0.47	72.26	0.23	0.27	0.18	78.56
4.11	57.77	0.06	0.06	0.06	98.50	0.43	0.51	0.34	67.61	0.56	0.65	0.53	72.79	0.21	0.25	0.17	78.72
4.25	52.63	0.06	0.06	0.06	98.56	0.45	0.53	0.35	67.97	0.62	0.73	0.59	73.38	0.25	0.29	0.19	78.91
4.38	47.93	0.05	0.05	0.05	98.61	0.51	0.60	0.40	68.37	0.67	0.78	0.63	74.02	0.32	0.38	0.25	79.17
4.52	43.66	0.04	0.04	0.04	98.65	0.61	0.72	0.48	68.85	0.68	0.80	0.65	74.66	0.41	0.48	0.32	79.49
4.65	39.77	0.04	0.04	0.04	98.69	0.70	0.82	0.55	69.40	0.66	0.78	0.63	75.29	0.47	0.55	0.37	79.86
4.79	36.24	0.04	0.04	0.04	98.72	0.73	0.86	0.58	69.97	0.61	0.72	0.58	75.87	0.47	0.55	0.37	80.23
4.92	33	0.04	0.04	0.03	98.76	0.71	0.83	0.56	70.53	0.56	0.65	0.53	76.40	0.43	0.50	0.34	80.57
5.06	30.07	0.04	0.04	0.03	98.79	0.66	0.77	0.52	71.05	0.51	0.60	0.48	76.89	0.36	0.43	0.29	80.85
5.19	27.38	0.03	0.03	0.03	98.83	0.62	0.73	0.49	71.53	0.49	0.57	0.46	77.35	0.32	0.37	0.25	81.10
5.32	24.95	0.03	0.03	0.03	98.86	0.63	0.74	0.49	72.03	0.50	0.58	0.47	77.82	0.32	0.37	0.25	81.36
5.46	22.73	0.03	0.03	0.03	98.89	0.69	0.81	0.54	72.57	0.53	0.62	0.50	78.33	0.36	0.43	0.29	81.64
5.59	20.7	0.03	0.03	0.03	98.92	0.79	0.92	0.62	73.19	0.57	0.67	0.55	78.87	0.44	0.52	0.35	81.99
5.73	18.86	0.03	0.03	0.03	98.95	0.88	1.03	0.69	73.88	0.61	0.72	0.58	79.45	0.52	0.61	0.41	82.40
5.86	17.18	0.03	0.03	0.03	98.98	0.93	1.09	0.73	74.61	0.63	0.74	0.60	80.05	0.57	0.67	0.45	82.85
6.00	15.65	0.03	0.03	0.03	99.01	0.94	1.10	0.74	75.35	0.63	0.74	0.60	80.66	0.59	0.69	0.47	83.32
6.13	14.26	0.03	0.03	0.03	99.04	0.92	1.08	0.72	76.07	0.63	0.73	0.59	81.25	0.59	0.69	0.46	83.78
6.27	12.99	0.03	0.03	0.03	99.07	0.90	1.06	0.71	76.78	0.62	0.73	0.59	81.84	0.58	0.68	0.45	84.23
6.40	11.83	0.03	0.03	0.03	99.10	0.90	1.06	0.71	77.49	0.62	0.73	0.59	82.43	0.58	0.68	0.46	84.69
6.54	10.78	0.04	0.04	0.03	99.14	0.92	1.09	0.73	78.22	0.63	0.74	0.60	83.03	0.59	0.70	0.47	85.16
6.67	9.819	0.04	0.04	0.04	99.17	0.96	1.13	0.76	78.98	0.65	0.76	0.62	83.65	0.62	0.73	0.49	85.65
6.80	8.944	0.04	0.04	0.04	99.21	1.01	1.19	0.80	79.77	0.67	0.79	0.64	84.29	0.65	0.76	0.51	86.16
6.94	8.147	0.04	0.04	0.04	99.25	1.05	1.23	0.83	80.60	0.70	0.82	0.66	84.95	0.68	0.80	0.54	86.70
7.07	7.421	0.04	0.04	0.04	99.29	1.10	1.29	0.87	81.47	0.72	0.85	0.69	85.64	0.71	0.83	0.56	87.26
7.21	6.761	0.04	0.04	0.04	99.33	1.14	1.34	0.90	82.36	0.74	0.87	0.71	86.35	0.74	0.87	0.58	87.84
7.34	6.158	0.04	0.04	0.04	99.37	1.18	1.39	0.93	83.29	0.76	0.89	0.72	87.07	0.76	0.90	0.60	88.44
7.48	5.611	0.04	0.04	0.04	99.41	1.20	1.41	0.95	84.24	0.77	0.90	0.73	87.80	0.78	0.92	0.61	89.05
7.61	5.111	0.04	0.04	0.04	99.46	1.21	1.42	0.95	85.19	0.77	0.90	0.73	88.53	0.79	0.93	0.62	89.68
7.75	4.656	0.04	0.04	0.04	99.50	1.21	1.42	0.95	86.14	0.76	0.89	0.72	89.25	0.79	0.93	0.62	90.30
7.88	4.241	0.04	0.04	0.04	99.54	1.20	1.41	0.95	87.09	0.75	0.88	0.71	89.96	0.78	0.92	0.61	90.91
8.02	3.862	0.04	0.04	0.04	99.58	1.18	1.39	0.93	88.02	0.73	0.85	0.69	90.65	0.76	0.90	0.60	91.52
8.15	3.519	0.04	0.04	0.04	99.62	1.15	1.35	0.91	88.92	0.70	0.83	0.67	91.32	0.74	0.87	0.59	92.10
8.29	3.206	0.04	0.04	0.04	99.66	1.11	1.30	0.87	89.80	0.68	0.79	0.64	91.96	0.72	0.84	0.56	92.66
8.42	2.92	0.04	0.04	0.04	99.70	1.07	1.26	0.84	90.64	0.65	0.76	0.61	92.58	0.69	0.81	0.54	93.20
8.55	2.66	0.04	0.04	0.04	99.74	1.02	1.20	0.80	91.45	0.62	0.72	0.59	93.16	0.66	0.77	0.52	93.72
8.69	2.423	0.04	0.04	0.04	99.77	0.97	1.14	0.76	92.21	0.59	0.69	0.56	93.72	0.63	0.74	0.50	94.22
8.82	2.207	0.03	0.03	0.03	99.81	0.91	1.07	0.72	92.93	0.56	0.66	0.53	94.25	0.60	0.71	0.47	94.69
8.96	2.01	0.03	0.03	0.03	99.84	0.86	1.01	0.68	93.61	0.53	0.63	0.51	94.76	0.58	0.68	0.45	95.15
9.09	1.832	0.03	0.03	0.03	99.87	0.81	0.96	0.64	94.25	0.51	0.60	0.49	95.24	0.55	0.65	0.44	95.58
9.23	1.669	0.03	0.03	0.03	99.89	0.77	0.90	0.60	94.85	0.49	0.57	0.46	95.71	0.53	0.63	0.42	96.00
9.36	1.52	0.02	0.02	0.02	99.92	0.72	0.85	0.57	95.42	0.47	0.55	0.45	96.15	0.51	0.60	0.41	96.41
9.50	1.385	0.02	0.02	0.02	99.94	0.68	0.80	0.54	95.96	0.45	0.53	0.43	96.58	0.50	0.58	0.39	96.80
9.63	1.261	0.02	0.02	0.02	99.96	0.65	0.76	0.51	96.47	0.43	0.51	0.41	96.99	0.48	0.56	0.38	97.18
9.77	1.149	0.02	0.02	0.01	99.97	0.61	0.71	0.48	96.95	0.41	0.48	0.39	97.38	0.46	0.54	0.36	97.54
9.90	1.047	0.01	0.01	0.01	99.98	0.57	0.67	0.45	97.39	0.39	0.46	0.37	97.75	0.44	0.51	0.35	97.89
10.04	0.953	0.01	0.01	0.01	99.99	0.53	0.62	0.42	97.81	0.37	0.43	0.35	98.10	0.42	0.49	0.33	98.21
10.17	0.869	0.01	0.01	0.00	100.00	0.49	0.58	0.39	98.20	0.35	0.41	0.33	98.43	0.39	0.46	0.31	98.52
10.30	0.791	0.00	0.00	0.00	100.00	0.45	0.53	0.35	98.55	0.32	0.38	0.30	98.74	0.36	0.43	0.29	98.81
10.44	0.721	0.00	0.00	0.00	100.00	0.41	0.48	0.32	98.87	0.29	0.34	0.28	99.01	0.33	0.39	0.26	99.07
10.57	0.657	0.00	0.00	0.00	100.00	0.36	0.42	0.28	99.15	0.26	0.30	0.24	99.26	0.29	0.34	0.23	99.30
10.71	0.598	0.00	0.00	0.00	100.00	0.31	0.37	0.24	99.40	0.22	0.26	0.21	99.47	0.26	0.30	0.20	99.50
10.84	0.545	0.00	0.00	0.00	100.00	0.26	0.31	0.21	99.60	0.19	0.22	0.18	99.65	0.22	0.25	0.17	99.67
10.98	0.496	0.00	0.00	0.00	100.00	0.21	0.24	0.16	99.77	0.15	0.18	0.14	99.79	0.17	0.20	0.14	99.81
11.11	0.452	0.00	0.00	0.00	100.00	0.15	0.17	0.11	99.88	0.11	0.12	0.10	99.89	0.12	0.14	0.09	99.90
11.25	0.412	0.00	0.00	0.00	100.00	0.10	0.12	0.08	99.96	0.07	0.08	0.07	99.96	0.08	0.10	0.06	99.96
11.38	0.375	0.00	0.00	0.00	100.00	0.06	0.06	0.04	100.00	0.04	0.05	0.04	100.00	0.05	0.05	0.04	100.00
Sum			100.57	100.00			117.53	100.00			117.34	100.00			117.92	100.00	
Seive separation		wt (g)	wt %			wt (g)	wt %			wt (g)	wt %			wt (g)	wt %		
Total wt		10.338	100.00			10.879	100.00			11.132	100.00			15.196	100.00		
wt > 2000 um		0.059	0.57			2.311	21.24			0.561	5.04			3.178	20.91		
wt < 2000 um		10.279	99.43			8.568	78.76			10.571	94.96			12.018	79.09		
Statistical results		Arithmetic	Geometric			Arithmetic	Geometric			Arithmetic	Geometric			Arithmetic	Geometric		
MEAN		694.5	587.4			803.7	170.2			570.0	163.0			1031.4	332.8		
SORTING		348.6	2.089			895.2	12.45			649.9	8.981			876.5	10.18		
SKEWNESS		1.288	-3.524			0.946	-0.728			1.378	-0.917			0.426	-1.300		
KURTOSIS		6.594	24.08			2.373	2.103			4.122	2.727			1.772	3.360		
% GRAVEL:		0.6%				21.2%				5.0%				20.9%			
% SAND:		97.9%				46.1%				67.3%				57.7%			
% MUD:		1.5%				32.7%				27.7%				21.4%			

Table 3.2: Laser Coulter grain size data for Brierly Brook.

Well		BB-02-2				BB-02-2				BB-02-2				BB-02-02			
Depth (ft/m)		71'				74'				82'				111'			
Size		(88-95)												(111-115)			
(Φ)	µm	% vol	% wt	% norm	% cum.	% vol	% wt	% norm	% cum.	% vol	% wt	% norm	% cum.	% vol	% wt	% norm	% cum.
-1.00	2000		0.76	0.76	0.76		0.81	0.81	0.81		20.54	20.54	20.54		16.06	16.06	16.06
-0.87	1822	0.35	0.35	0.30	1.05	0.15	0.15	0.15	0.96	0.11	0.14	0.09	20.63	2.59	3.09	2.17	18.23
-0.73	1660	0.55	0.65	0.55	1.60	0.37	0.37	0.37	1.33	0.11	0.14	0.09	20.71	2.99	3.56	2.51	20.74
-0.60	1512	0.79	0.93	0.78	2.39	0.62	0.63	0.62	1.95	0.20	0.25	0.16	20.88	3.33	3.97	2.80	23.54
-0.46	1377	1.18	1.39	1.17	3.56	1.06	1.07	1.05	3.00	0.47	0.59	0.37	21.25	3.74	4.46	3.14	26.68
-0.33	1255	1.67	1.96	1.66	5.21	1.58	1.59	1.57	4.57	1.00	1.26	0.79	22.04	4.04	4.81	3.39	30.07
-0.19	1143	2.26	2.66	2.24	7.46	2.22	2.24	2.20	6.77	1.78	2.24	1.41	23.45	4.25	5.06	3.57	33.64
-0.06	1041	2.88	3.39	2.86	10.32	2.93	2.95	2.91	9.68	2.64	3.32	2.10	25.55	4.33	5.16	3.64	37.27
0.08	948.2	3.45	4.06	3.43	13.74	3.63	3.66	3.60	13.28	3.40	4.28	2.70	28.25	4.27	5.09	3.58	40.86
0.21	863.9	3.91	4.60	3.88	17.62	4.24	4.27	4.21	17.48	3.95	4.97	3.14	31.39	4.07	4.85	3.42	44.28
0.35	786.9	4.21	4.95	4.18	21.80	4.68	4.72	4.64	22.13	4.24	5.34	3.37	34.76	3.81	4.54	3.20	47.47
0.48	716.9	4.37	5.14	4.34	26.14	4.91	4.95	4.87	27.00	4.28	5.39	3.40	38.16	3.55	4.23	2.98	50.45
0.61	653	4.39	5.16	4.36	30.50	4.93	4.97	4.89	31.89	4.12	5.18	3.27	41.43	3.35	3.99	2.81	53.27
0.75	594.9	4.29	5.04	4.26	34.76	4.77	4.81	4.73	36.62	3.81	4.79	3.03	44.46	3.18	3.79	2.67	55.94
0.88	541.9	4.10	4.82	4.07	38.83	4.46	4.50	4.42	41.05	3.41	4.29	2.71	47.17	3.02	3.60	2.54	58.47
1.02	493.6	3.83	4.50	3.80	42.63	4.06	4.09	4.03	45.08	2.97	3.74	2.36	49.53	2.81	3.35	2.36	60.83
1.15	449.7	3.51	4.13	3.48	46.12	3.63	3.66	3.60	48.68	2.53	3.18	2.01	51.54	2.54	3.03	2.13	62.96
1.29	409.6	3.17	3.73	3.15	49.26	3.21	3.24	3.18	51.86	2.12	2.67	1.68	53.22	2.23	2.66	1.87	64.84
1.42	373.1	2.86	3.36	2.84	52.10	2.85	2.87	2.83	54.69	1.76	2.21	1.40	54.62	1.93	2.30	1.62	66.46
1.56	339.8	2.59	3.04	2.57	54.67	2.55	2.57	2.53	57.22	1.47	1.85	1.17	55.79	1.69	2.01	1.42	67.87
1.69	309.6	2.37	2.79	2.35	57.03	2.32	2.34	2.30	59.52	1.23	1.55	0.98	56.77	1.50	1.79	1.26	69.13
1.83	282.1	2.20	2.59	2.18	59.21	2.14	2.16	2.12	61.64	1.02	1.28	0.81	57.58	1.35	1.61	1.13	70.27
1.96	256.8	2.08	2.45	2.06	61.28	2.00	2.02	1.98	63.63	0.84	1.06	0.67	58.25	1.22	1.45	1.02	71.29
2.09	234.1	1.99	2.34	1.98	63.25	1.89	1.91	1.88	65.50	0.69	0.87	0.55	58.79	1.08	1.29	0.91	72.20
2.23	213.2	1.92	2.26	1.91	65.16	1.78	1.79	1.77	67.27	0.56	0.70	0.44	59.24	0.93	1.11	0.78	72.98
2.36	194.2	1.88	2.21	1.87	67.02	1.69	1.70	1.68	68.95	0.46	0.58	0.37	59.61	0.81	0.96	0.68	73.66
2.50	176.8	1.85	2.17	1.84	68.86	1.62	1.63	1.61	70.55	0.41	0.51	0.32	59.93	0.72	0.86	0.61	74.26
2.63	161.2	1.81	2.13	1.80	70.66	1.58	1.59	1.57	72.12	0.39	0.49	0.31	60.24	0.69	0.82	0.58	74.84
2.77	146.8	1.75	2.06	1.74	72.40	1.55	1.56	1.54	73.66	0.39	0.49	0.31	60.55	0.70	0.83	0.58	75.42
2.90	133.7	1.68	1.97	1.67	74.06	1.54	1.55	1.53	75.19	0.41	0.52	0.33	60.88	0.72	0.85	0.60	76.02
3.04	121.8	1.61	1.89	1.60	75.66	1.54	1.55	1.53	76.72	0.44	0.55	0.35	61.22	0.73	0.86	0.61	76.63
3.17	111	1.54	1.81	1.53	77.19	1.52	1.53	1.51	78.22	0.45	0.56	0.35	61.58	0.71	0.85	0.60	77.23
3.31	101.1	1.48	1.74	1.47	78.66	1.47	1.48	1.46	79.68	0.43	0.55	0.34	61.92	0.68	0.81	0.57	77.81
3.44	92.09	1.42	1.67	1.41	80.07	1.41	1.42	1.40	81.08	0.40	0.51	0.32	62.24	0.65	0.78	0.55	78.35
3.58	83.9	1.35	1.59	1.34	81.41	1.33	1.34	1.32	82.40	0.36	0.46	0.29	62.53	0.63	0.75	0.53	78.89
3.71	76.43	1.28	1.50	1.27	82.68	1.24	1.25	1.23	83.63	0.34	0.42	0.27	62.80	0.63	0.75	0.53	79.42
3.84	69.62	1.21	1.42	1.20	83.88	1.15	1.16	1.14	84.77	0.34	0.43	0.27	63.07	0.65	0.77	0.55	79.96
3.98	63.41	1.13	1.33	1.12	85.00	1.06	1.07	1.05	85.82	0.39	0.49	0.31	63.38	0.68	0.81	0.57	80.54
4.11	57.77	1.07	1.26	1.06	86.07	0.98	0.99	0.97	86.80	0.48	0.60	0.38	63.76	0.73	0.87	0.61	81.15
4.25	52.63	1.01	1.19	1.00	87.07	0.91	0.91	0.90	87.70	0.58	0.73	0.46	64.22	0.77	0.91	0.64	81.79
4.38	47.93	0.94	1.10	0.93	88.00	0.83	0.84	0.83	88.52	0.68	0.85	0.54	64.76	0.80	0.95	0.67	82.46
4.52	43.66	0.85	1.00	0.85	88.85	0.77	0.77	0.76	89.28	0.74	0.92	0.58	65.34	0.80	0.95	0.67	83.13
4.65	39.77	0.76	0.89	0.75	89.60	0.70	0.70	0.69	89.97	0.75	0.94	0.59	65.94	0.77	0.92	0.65	83.77
4.79	36.24	0.66	0.77	0.65	90.25	0.63	0.63	0.62	90.60	0.72	0.91	0.57	66.51	0.72	0.86	0.60	84.38
4.92	33	0.57	0.67	0.56	90.81	0.56	0.56	0.55	91.15	0.69	0.87	0.55	67.06	0.66	0.79	0.55	84.93
5.06	30.07	0.50	0.59	0.50	91.32	0.50	0.50	0.49	91.64	0.67	0.85	0.53	67.59	0.61	0.72	0.51	85.44
5.19	27.38	0.47	0.55	0.46	91.78	0.45	0.45	0.44	92.09	0.69	0.87	0.55	68.14	0.57	0.68	0.48	85.92
5.32	24.95	0.45	0.53	0.45	92.23	0.41	0.41	0.41	92.50	0.74	0.93	0.59	68.73	0.57	0.68	0.48	86.40
5.46	22.73	0.46	0.53	0.45	92.68	0.39	0.39	0.39	92.88	0.82	1.03	0.65	69.37	0.58	0.69	0.49	86.89
5.59	20.7	0.46	0.54	0.45	93.13	0.38	0.38	0.37	93.26	0.89	1.12	0.71	70.08	0.60	0.71	0.50	87.39
5.73	18.86	0.45	0.53	0.45	93.58	0.37	0.37	0.37	93.62	0.95	1.19	0.75	70.84	0.60	0.72	0.51	87.89
5.86	17.18	0.44	0.51	0.43	94.02	0.36	0.36	0.36	93.98	0.98	1.23	0.77	71.61	0.59	0.70	0.49	88.39
6.00	15.65	0.41	0.49	0.41	94.43	0.35	0.35	0.35	94.33	0.98	1.24	0.78	72.39	0.56	0.67	0.47	88.86
6.13	14.26	0.39	0.45	0.38	94.81	0.33	0.33	0.33	94.65	0.99	1.24	0.78	73.17	0.52	0.62	0.44	89.29
6.27	12.99	0.36	0.42	0.35	95.16	0.31	0.31	0.31	94.96	1.00	1.25	0.79	73.96	0.49	0.58	0.41	89.70
6.40	11.83	0.33	0.38	0.32	95.49	0.29	0.29	0.29	95.25	1.02	1.28	0.81	74.77	0.46	0.55	0.39	90.09
6.54	10.78	0.30	0.35	0.30	95.78	0.27	0.28	0.27	95.52	1.05	1.32	0.83	75.61	0.45	0.54	0.38	90.47
6.67	9.819	0.27	0.32	0.27	96.05	0.25	0.26	0.25	95.78	1.10	1.38	0.87	76.48	0.44	0.53	0.37	90.84
6.80	8.944	0.25	0.29	0.25	96.30	0.24	0.24	0.24	96.01	1.14	1.43	0.91	77.39	0.44	0.53	0.37	91.22
6.94	8.147	0.23	0.27	0.23	96.53	0.22	0.22	0.22	96.23	1.19	1.50	0.95	78.33	0.44	0.53	0.37	91.59
7.07	7.421	0.21	0.25	0.21	96.74	0.21	0.21	0.21	96.44	1.24	1.56	0.99	79.32	0.44	0.53	0.37	91.96
7.21	6.761	0.20	0.23	0.20	96.94	0.20	0.20	0.20	96.64	1.28	1.61	1.02	80.33	0.45	0.53	0.38	92.33
7.34	6.158	0.19	0.22	0.18	97.12	0.19	0.19	0.19	96.83	1.32	1.66	1.05	81.38	0.45	0.53	0.38	92.71
7.48	5.611	0.17	0.20	0.17	97.29	0.18	0.18	0.18	97.01	1.34	1.69	1.06	82.45	0.45	0.53	0.38	93.09
7.61	5.111	0.17	0.19	0.16	97.46	0.17	0.17	0.17	97.18	1.35	1.70	1.07	83.52	0.44	0.53	0.37	93.46
7.75	4.656	0.16	0.18	0.15	97.61	0.17	0.17	0.17	97.35	1.35	1.70	1.07	84.59	0.44	0.52	0.37	93.83
7.88	4.241	0.15	0.18	0.15	97.76	0.16	0.16	0.16	97.50	1.33	1.67	1.06	85.65	0.43	0.51	0.36	94.19
8.02	3.862	0.14	0.17	0.14	97.90	0.16	0.16	0.15	97.66	1.30	1.64	1.03	86.68	0.42	0.50	0.35	94.54
8.15	3.519	0.14	0.16	0.14	98.04	0.15	0.15	0.15	97.81	1.26	1.59	1.00	87.68	0.41	0.49	0.34	94.88
8.29	3.206	0.13	0.16	0.13	98.17	0.15	0.15	0.15	97.96	1.21	1.52	0.96	88.64	0.40	0.47	0.33	95.22
8.42	2.92	0.13	0.15	0.13	98.30	0.15	0.15	0.14	98.10	1.16	1.46	0.92	89.57	0.39	0.46	0.32	95.54
8.55	2.66	0.13	0.15	0.13	98.43	0.14	0.14	0.14	98.24	1.10	1.38	0.87	90.44	0.38	0.45	0.32	95.86
8.69	2.423	0.12	0.14	0.12	98.55	0.14	0.14	0.14	98.38	1.04	1.31	0.83	91.27	0.37	0.44	0.31	96.17
8.82	2.207	0.12	0.14	0.12	98.67	0.14	0.14	0.13	98.51	0.98	1.23	0.78	92.04	0.36	0.42	0.30	96.46
8.96	2.01	0.12	0.14	0.12	98.79	0.13	0.13	0.13	98.64	0.92	1.16	0.73	92.77	0.35	0.41	0.29	96.76
9.09	1.832	0.11	0.13	0.11	98.90	0.13	0.13	0.13	98.77	0.87	1.09	0.69	93.46	0.34	0.41	0.29	97.04
9.23	1.669	0.11	0.13	0.11	99.01	0.12	0.13	0.12	98.89	0.82	1.03	0.65	94.11	0.33	0.39	0.28	97.32
9.36	1.52	0.11	0.13	0.11	99.12	0.12	0.12	0.12	99.01	0.78	0.98	0.62	94.73	0.32	0.38	0.27	97.59
9.50	1.385	0.10	0.12	0.10	99.22	0.12	0.12	0.11	99.13	0.74	0.93	0.59	95.31	0.31	0.37	0.26	97.85
9.63	1.261	0.10	0.12	0.10	99.31	0.11	0.11	0.11	99.24	0.70	0.88	0.56	95.87	0.30	0.36	0.26	98.11
9.77	1.149	0.09	0.11	0.09	99.41	0.11	0.11	0.10	99.34	0.67	0.84	0.53	96.40	0.29	0.35	0.25	98.35
9.90	1.047	0.09	0.10	0.09	99.50	0.10	0.10	0.10	99.44	0.63	0.80	0.50	96.90	0.28	0.33	0.23	98.59
10.04	0.953	0.08	0.10	0.08	99.58	0.09	0.09	0.09	99.53	0.60	0.76	0.48	97.38	0.26	0.31	0.22	98.81
10.17	0.869	0.08	0.09	0.08	99.65	0.09	0.09	0.08	99.62	0.56	0.71	0.45	97.83	0.25	0.29	0.21	99.02
10.30	0.791	0.07	0.08	0.07	99.72	0.08	0.08	0.08	99.69	0.52	0.66	0.42	98.25	0.23	0.27	0.19	99.21
10.44	0.721	0.06	0.07	0.06	99.78	0.07	0.07	0.07	99.76	0.48	0.60	0.38	98.62	0.21	0.25	0.17	99.38
10.57	0.657	0.06	0.06	0.05	99.84	0.06	0.06	0.06	99.82	0.43	0.53	0.34	98.96	0.18	0.22	0.15	99.54
10.71	0.598	0.05	0.06	0.05	99.89	0.05	0.05	0.05	99.87	0.37	0.47	0.30	99.26	0.16	0.19	0.13	99.67
10.84	0.545	0.04	0.05	0.04	99.92	0.04	0.04	0.04	99.92	0.32	0.40	0.25	99.51	0.13	0.16	0.11	99.78
10.98	0.496	0.03	0.04	0.03	99.96	0.04	0.04	0.03	99.95	0.25	0.32	0.20	99.71	0.11	0.13	0.09	99.87
11.11	0.452	0.02	0.03	0.02	99.98	0.02	0.02	0.02	99.98	0.18	0.22	0.14	99.85	0.07	0.09	0.06	99.93
11.25	0.412	0.02	0.02	0.01	99.99	0.02	0.02	0.02	99.99	0.12	0.15	0.10	99.95	0.05	0.06	0.04	99.98
11.38	0.375	0.01	0.01	0.01	100.00	0.01	0.01	0.01	100.00	0.07	0.09	0.05	100.00	0.03	0.03	0.02	100.00
	Sum		117.52	100.00			100.79	100.00			125.87	100.00			119.12	100.00	
Seive separation		wt (g)	wt %			wt (g)	wt %			wt (g)	wt %			wt (g)	wt %		
Total wt		10.859	100.00			10.698	100.00			8.199	100.00			13.039	100.00		
wt > 2000 um		0.082	0.76			0.087	0.81			1.684	20.54			2.094	16.06		
wt < 2000 um		10.777	99.24			10.611	99.19			6.515	79.46			10.945	83.94		
Statistical results		Arithmetic	Geometric			Arithmetic	Geometric			Arithmetic	Geometric			Arithmetic	Geometric		
MEAN		487.1	259.2			496.4	269.3			777.5	142.9			922.2	345.9		
SORTING		430.3	4.294			420.1	4.319			898.3	13.47			823.1	7.680		
SKEWNESS		1.277	-1.393			1.231	-1.522			0.966	-0.589			0.645	-1.345		
KURTOSIS		5.264	5.117			5.459	5.502			2.404	1.876			2.142	3.923		
% GRAVEL:		0.8%				0.8%				20.5%				16.1%			
% SAND:		84.4%				85.2%				42.9%				64.6%			
% MUD:		14.8%				14.0%				36.6%				19.4%			

Table 3.2: Laser Coulter grain size data for Brierly Brook.

Well		BB-02-5				BB-02-5				BB-02-5				BB-02-7		
Depth (ft/m)		31'				36'				36'-41'				32'		
Size																
(Φ)	µm	% vol	% wt	% norm	% cum.	% vol	% wt	% norm	% cum.	% vol	% wt	% norm	% cum.	% vol	% wt	% cum
-1.00	2000		0.12	0.12	0.12		0.27	0.27	0.27		1.04	1.04	1.04		0.00	0.00
-0.87	1822	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.27	2.01	2.03	1.99	3.03	0.00	0.00	0.00
-0.73	1660	0.00	0.00	0.00	0.12	0.01	0.01	0.01	0.29	2.04	2.06	2.02	5.05	0.00	0.00	0.00
-0.60	1512	0.00	0.00	0.00	0.12	0.16	0.16	0.16	0.45	2.18	2.20	2.16	7.21	0.01	0.01	0.01
-0.46	1377	0.00	0.00	0.00	0.12	0.54	0.54	0.53	0.98	2.50	2.53	2.47	9.68	0.21	0.21	0.22
-0.33	1255	0.00	0.00	0.00	0.12	1.19	1.19	1.19	2.17	3.07	3.10	3.04	12.72	0.89	0.89	1.11
-0.19	1143	0.00	0.00	0.00	0.12	2.25	2.26	2.24	4.42	3.94	3.98	3.90	16.62	2.03	2.03	3.14
-0.06	1041	0.00	0.00	0.00	0.12	3.54	3.55	3.53	7.95	5.00	5.05	4.95	21.57	3.49	3.49	6.63
0.08	948.2	0.07	0.07	0.07	0.19	4.89	4.90	4.88	12.82	6.09	6.15	6.03	27.60	5.06	5.06	11.69
0.21	863.9	0.49	0.49	0.49	0.68	6.16	6.18	6.14	18.97	7.04	7.11	6.97	34.56	6.54	6.54	18.23
0.35	786.9	1.36	1.36	1.36	2.04	7.18	7.20	7.16	26.13	7.69	7.77	7.61	42.18	7.73	7.73	25.96
0.48	716.9	2.51	2.51	2.51	4.55	7.84	7.86	7.82	33.95	7.97	8.05	7.89	50.06	8.52	8.52	34.48
0.61	653	4.02	4.02	4.01	8.56	8.09	8.11	8.07	42.02	7.87	7.95	7.79	57.85	8.88	8.88	43.36
0.75	594.9	5.79	5.80	5.78	14.34	7.99	8.01	7.97	49.99	7.44	7.52	7.36	65.22	8.80	8.80	52.16
0.88	541.9	7.62	7.63	7.61	21.95	7.60	7.62	7.58	57.57	6.75	6.82	6.68	71.90	8.30	8.30	60.46
1.02	493.6	9.19	9.20	9.18	31.13	7.03	7.05	7.01	64.58	5.91	5.97	5.85	77.75	7.45	7.45	67.91
1.15	449.7	10.12	10.13	10.11	41.24	6.30	6.32	6.28	70.87	4.99	5.04	4.94	82.69	6.34	6.34	74.25
1.29	409.6	10.22	10.23	10.21	51.44	5.44	5.45	5.43	76.29	4.07	4.11	4.03	86.72	5.11	5.11	79.36
1.42	373.1	9.52	9.53	9.51	60.95	4.52	4.53	4.51	80.80	3.20	3.23	3.17	89.88	3.92	3.92	83.28
1.56	339.8	8.23	8.24	8.22	69.17	3.60	3.61	3.59	84.39	2.44	2.47	2.42	92.30	2.90	2.90	86.18
1.69	309.6	6.68	6.69	6.67	75.84	2.77	2.78	2.76	87.15	1.82	1.84	1.80	94.10	2.12	2.12	88.30
1.83	282.1	5.14	5.15	5.13	80.98	2.08	2.09	2.07	89.23	1.32	1.33	1.31	95.41	1.58	1.58	89.88
1.96	256.8	3.79	3.79	3.78	84.76	1.56	1.56	1.56	90.78	0.95	0.96	0.94	96.35	1.22	1.22	91.10
2.09	234.1	2.73	2.73	2.73	87.49	1.17	1.17	1.17	91.95	0.69	0.69	0.68	97.03	0.99	0.99	92.09
2.23	213.2	1.98	1.98	1.98	89.46	0.89	0.90	0.89	92.84	0.49	0.50	0.49	97.52	0.84	0.84	92.92
2.36	194.2	1.50	1.50	1.50	90.96	0.72	0.72	0.71	93.55	0.35	0.35	0.34	97.86	0.73	0.73	93.65
2.50	176.8	1.19	1.19	1.19	92.15	0.62	0.62	0.62	94.17	0.25	0.25	0.24	98.10	0.64	0.64	94.29
2.63	161.2	0.97	0.97	0.97	93.12	0.56	0.56	0.56	94.73	0.19	0.19	0.18	98.28	0.57	0.57	94.86
2.77	146.8	0.79	0.79	0.79	93.91	0.50	0.50	0.50	95.23	0.15	0.16	0.15	98.44	0.52	0.52	95.38
2.90	133.7	0.64	0.64	0.64	94.55	0.44	0.45	0.44	95.67	0.13	0.13	0.13	98.56	0.47	0.47	95.86
3.04	121.8	0.53	0.53	0.53	95.08	0.40	0.40	0.39	96.07	0.10	0.10	0.10	98.66	0.41	0.41	96.26
3.17	111	0.44	0.44	0.44	95.51	0.35	0.35	0.35	96.42	0.08	0.08	0.08	98.74	0.35	0.35	96.62
3.31	101.1	0.36	0.36	0.36	95.88	0.31	0.31	0.31	96.73	0.07	0.07	0.07	98.82	0.30	0.30	96.92
3.44	92.09	0.29	0.29	0.29	96.17	0.27	0.27	0.27	97.00	0.07	0.07	0.07	98.89	0.26	0.26	97.18
3.58	83.9	0.24	0.24	0.24	96.41	0.23	0.23	0.23	97.23	0.06	0.06	0.06	98.95	0.23	0.23	97.41
3.71	76.43	0.20	0.20	0.20	96.61	0.20	0.20	0.20	97.43	0.05	0.05	0.05	99.00	0.19	0.19	97.60
3.84	69.62	0.19	0.19	0.19	96.80	0.19	0.19	0.19	97.62	0.04	0.04	0.04	99.04	0.17	0.17	97.77
3.98	63.41	0.19	0.19	0.19	96.98	0.18	0.18	0.18	97.81	0.04	0.04	0.04	99.08	0.15	0.15	97.91
4.11	57.77	0.19	0.19	0.19	97.17	0.17	0.17	0.17	97.98	0.04	0.04	0.04	99.12	0.13	0.13	98.04
4.25	52.63	0.18	0.18	0.18	97.35	0.15	0.15	0.15	98.13	0.04	0.04	0.04	99.16	0.12	0.12	98.16
4.38	47.93	0.17	0.17	0.17	97.52	0.13	0.13	0.13	98.26	0.04	0.04	0.04	99.20	0.10	0.10	98.26
4.52	43.66	0.15	0.15	0.15	97.66	0.11	0.11	0.11	98.37	0.04	0.04	0.04	99.24	0.09	0.09	98.34
4.65	39.77	0.13	0.13	0.13	97.79	0.09	0.09	0.09	98.46	0.03	0.03	0.03	99.27	0.08	0.08	98.42
4.79	36.24	0.11	0.11	0.11	97.90	0.07	0.07	0.07	98.53	0.03	0.03	0.03	99.30	0.07	0.07	98.49
4.92	33	0.09	0.09	0.09	97.99	0.07	0.07	0.07	98.60	0.02	0.02	0.02	99.32	0.06	0.06	98.55
5.06	30.07	0.08	0.08	0.08	98.07	0.06	0.06	0.06	98.66	0.02	0.02	0.02	99.34	0.06	0.06	98.60
5.19	27.38	0.08	0.08	0.08	98.14	0.06	0.06	0.06	98.71	0.02	0.02	0.02	99.36	0.05	0.05	98.65
5.32	24.95	0.08	0.08	0.08	98.22	0.05	0.05	0.05	98.76	0.02	0.02	0.02	99.38	0.05	0.05	98.70
5.46	22.73	0.08	0.08	0.08	98.31	0.05	0.05	0.04	98.81	0.02	0.02	0.02	99.40	0.05	0.05	98.74
5.59	20.7	0.08	0.08	0.08	98.39	0.04	0.04	0.04	98.85	0.03	0.03	0.02	99.43	0.04	0.04	98.79
5.73	18.86	0.08	0.08	0.08	98.47	0.03	0.03	0.03	98.88	0.03	0.03	0.03	99.45	0.04	0.04	98.83
5.86	17.18	0.08	0.08	0.07	98.55	0.03	0.03	0.03	98.91	0.03	0.03	0.03	99.48	0.04	0.04	98.87
6.00	15.65	0.07	0.07	0.07	98.61	0.03	0.03	0.03	98.93	0.03	0.03	0.03	99.51	0.04	0.04	98.91
6.13	14.26	0.06	0.06	0.06	98.67	0.02	0.02	0.02	98.96	0.03	0.03	0.03	99.54	0.04	0.04	98.95
6.27	12.99	0.06	0.06	0.05	98.73	0.03	0.03	0.02	98.98	0.03	0.03	0.03	99.57	0.04	0.04	98.99
6.40	11.83	0.05	0.05	0.05	98.78	0.03	0.03	0.03	99.01	0.03	0.03	0.03	99.60	0.04	0.04	99.04
6.54	10.78	0.05	0.05	0.05	98.83	0.03	0.03	0.03	99.04	0.03	0.03	0.03	99.63	0.04	0.04	99.08
6.67	9.819	0.05	0.05	0.04	98.87	0.03	0.03	0.03	99.07	0.03	0.03	0.03	99.66	0.05	0.05	99.13
6.80	8.944	0.05	0.05	0.04	98.92	0.03	0.03	0.03	99.10	0.03	0.03	0.03	99.68	0.05	0.05	99.17
6.94	8.147	0.05	0.05	0.04	98.96	0.04	0.04	0.03	99.13	0.03	0.03	0.03	99.71	0.05	0.05	99.22
7.07	7.421	0.05	0.05	0.05	99.01	0.04	0.04	0.04	99.17	0.03	0.03	0.02	99.73	0.05	0.05	99.26
7.21	6.761	0.05	0.05	0.05	99.05	0.04	0.04	0.04	99.21	0.02	0.02	0.02	99.76	0.05	0.05	99.31
7.34	6.158	0.05	0.05	0.05	99.10	0.04	0.04	0.04	99.25	0.02	0.02	0.02	99.78	0.05	0.05	99.35
7.48	5.611	0.05	0.05	0.05	99.15	0.04	0.04	0.04	99.29	0.02	0.02	0.02	99.80	0.05	0.05	99.40
7.61	5.111	0.05	0.05	0.05	99.20	0.04	0.04	0.04	99.34	0.02	0.02	0.02	99.82	0.05	0.05	99.45
7.75	4.656	0.05	0.05	0.05	99.25	0.05	0.05	0.05	99.38	0.02	0.02	0.02	99.84	0.05	0.05	99.49
7.88	4.241	0.05	0.05	0.05	99.31	0.05	0.05	0.05	99.43	0.02	0.02	0.02	99.85	0.04	0.04	99.54
8.02	3.862	0.05	0.05	0.05	99.36	0.05	0.05	0.05	99.48	0.02	0.02	0.02	99.87	0.04	0.04	99.58
8.15	3.519	0.06	0.06	0.05	99.42	0.05	0.05	0.05	99.52	0.02	0.02	0.01	99.89	0.04	0.04	99.62
8.29	3.206	0.06	0.06	0.05	99.47	0.05	0.05	0.05	99.57	0.01	0.01	0.01	99.90	0.04	0.04	99.66
8.42	2.92	0.06	0.06	0.05	99.53	0.05	0.05	0.05	99.62	0.01	0.01	0.01	99.91	0.04	0.04	99.70
8.55	2.66	0.05	0.05	0.05	99.58	0.05	0.05	0.04	99.66	0.01	0.01	0.01	99.92	0.04	0.04	99.74
8.69	2.423	0.05	0.05	0.05	99.63	0.04	0.04	0.04	99.71	0.01	0.01	0.01	99.94	0.04	0.04	99.77
8.82	2.207	0.05	0.05	0.05	99.69	0.04	0.04	0.04	99.75	0.01	0.01	0.01	99.95	0.03	0.03	99.81
8.96	2.01	0.05	0.05	0.05	99.73	0.04	0.04	0.04	99.79	0.01	0.01	0.01	99.95	0.03	0.03	99.84
9.09	1.832	0.05	0.05	0.05	99.78	0.04	0.04	0.04	99.82	0.01	0.01	0.01	99.96	0.03	0.03	99.87
9.23	1.669	0.04	0.04	0.04	99.82	0.04	0.04	0.03	99.86	0.01	0.01	0.01	99.97	0.03	0.03	99.89
9.36	1.52	0.04	0.04	0.04	99.86	0.03	0.03	0.03	99.89	0.01	0.01	0.01	99.98	0.02	0.02	99.92
9.50	1.385	0.04	0.04	0.03	99.90	0.03	0.03	0.03	99.92	0.01	0.01	0.01	99.98	0.02	0.02	99.94
9.63	1.261	0.03	0.03	0.03	99.93	0.02	0.02	0.02	99.94	0.01	0.01	0.00	99.99	0.02	0.02	99.96
9.77	1.149	0.03	0.03	0.02	99.95	0.02	0.02	0.02	99.96	0.00	0.00	0.00	99.99	0.02	0.02	99.97
9.90	1.047	0.02	0.02	0.02	99.97	0.02	0.02	0.02	99.98	0.00	0.00	0.00	99.99	0.01	0.01	99.98
10.04	0.953	0.01	0.01	0.01	99.99	0.01	0.01	0.01	99.99	0.00	0.00	0.00	100.00	0.01	0.01	99.99
10.17	0.869	0.01	0.01	0.01	99.99	0.01	0.01	0.01	100.00	0.00	0.00	0.00	100.00	0.01	0.01	100.00
10.30	0.791	0.00	0.00	0.00	100.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	100.00	0.00	0.00	100.00
10.44	0.721	0.00	0.00	0.00	100.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	100.00	0.00	0.00	100.00
10.57	0.657	0.00	0.00	0.00	100.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	100.00	0.00	0.00	100.00
10.71	0.598	0.00	0.00	0.00	100.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	100.00	0.00	0.00	100.00
10.84	0.545	0.00	0.00	0.00	100.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	100.00	0.00	0.00	100.00
10.98	0.496	0.00	0.00	0.00	100.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	100.00	0.00	0.00	100.00
11.11	0.452	0.00	0.00	0.00	100.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	100.00	0.00	0.00	100.00
11.25	0.412	0.00	0.00	0.00	100.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	100.00	0.00	0.00	100.00
11.38	0.375	0.00	0.00	0.00	100.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	100.00	0.00	0.00	100.00
Sum			100.13	100.00			100.26	100.00			101.03	100.00			100.00	100.00
Seive separation		wt (g)	wt %			wt (g)	wt %			wt (g)	wt %			wt (g)	wt %	
Total wt		4.166	100.00			14.665	100.00			6.631	100.00			8.899	100.00	
wt > 2000 um		0.005	0.12			0.040	0.27			0.069	1.04			0.000	0.00	
wt < 2000 um		4.161	99.88			14.625	99.73			6.562	98.96			8.899	100.00	
Statistical results		Arithmetic	Geometric			Arithmetic	Geometric			Arithmetic	Geometric			Arithmetic	Geometric	
MEAN		420.8	360.0			619.8	517.6			800.9	687.3			620.6	526.6	
SORTING		183.5	2.109			299.3	2.182			415.8	1.901			269.9	2.128	
SKEWNESS		1.507	-3.723			0.808	-3.352			1.187	-2.673			0.129	-3.520	
KURTOSIS		18.61	22.56			5.869	20.70			4.813	20.64			2.900	21.54	
% GRAVEL:		0.1%				0.3%				1.0%				0.0%		
% SAND:		96.9%				97.6%				98.0%				97.9%		
% MUD:		3.0%				2.2%				0.9%				2.1%		

Table 3.2: Laser Coulter grain size data for Brierly Brook.

Well		BB-02-7			BB-02-7				BB-02-7				BB-02-7			
Depth (ft/m)		40'A			40'B				50'				71'			
Size		washings														
(Φ)	µm	% vol	% wt	% cum	% vol	% wt	% norm	% cum.	% vol	% wt	% norm	% cum.	% vol	% wt	% norm	% cum.
-1.00	2000		0.00	0.00		0.00	0.00	0.00		1.18	1.18	1.18		0.99	0.99	0.99
-0.87	1822	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.54	2.57	2.51	3.69	0.46	0.47	0.46	1.45
-0.73	1660	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.84	2.87	2.81	6.50	0.36	0.36	0.35	1.80
-0.60	1512	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.24	3.28	3.20	9.70	0.28	0.28	0.27	2.08
-0.46	1377	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.82	3.87	3.78	13.48	0.25	0.25	0.25	2.32
-0.33	1255	0.02	0.02	0.02	0.03	0.03	0.03	0.03	4.59	4.65	4.54	18.02	0.34	0.34	0.33	2.66
-0.19	1143	0.24	0.24	0.26	0.34	0.34	0.34	0.37	5.45	5.52	5.39	23.40	0.57	0.57	0.56	3.22
-0.06	1041	0.85	0.85	1.11	1.03	1.03	1.03	1.40	6.26	6.34	6.19	29.59	0.94	0.95	0.93	4.15
0.08	948.2	1.66	1.66	2.77	1.78	1.78	1.78	3.18	6.89	6.97	6.81	36.40	1.38	1.39	1.37	5.52
0.21	863.9	2.59	2.59	5.36	2.55	2.55	2.55	5.73	7.24	7.33	7.16	43.55	1.80	1.82	1.78	7.30
0.35	786.9	3.56	3.56	8.92	3.29	3.29	3.29	9.02	7.30	7.39	7.21	50.77	2.11	2.13	2.09	9.39
0.48	716.9	4.50	4.50	13.42	4.00	4.00	4.00	13.02	7.08	7.16	7.00	57.77	2.29	2.31	2.27	11.65
0.61	653	5.38	5.38	18.80	4.76	4.76	4.76	17.78	6.64	6.72	6.56	64.33	2.35	2.37	2.33	13.98
0.75	594.9	6.18	6.18	24.98	5.56	5.56	5.56	23.34	6.07	6.14	6.00	70.33	2.35	2.37	2.33	16.31
0.88	541.9	6.85	6.85	31.83	6.38	6.38	6.38	29.72	5.43	5.50	5.37	75.69	2.32	2.34	2.30	18.61
1.02	493.6	7.31	7.31	39.14	7.07	7.07	7.07	36.79	4.76	4.82	4.70	80.40	2.31	2.33	2.29	20.89
1.15	449.7	7.48	7.48	46.62	7.47	7.47	7.47	44.26	4.07	4.12	4.02	84.42	2.33	2.35	2.31	23.20
1.29	409.6	7.29	7.29	53.91	7.48	7.48	7.48	51.75	3.37	3.41	3.33	87.75	2.38	2.40	2.36	25.56
1.42	373.1	6.77	6.77	60.68	7.07	7.07	7.07	58.82	2.71	2.74	2.68	90.43	2.44	2.46	2.42	27.97
1.56	339.8	6.03	6.03	66.71	6.37	6.37	6.37	65.19	2.10	2.13	2.08	92.50	2.47	2.49	2.45	30.42
1.69	309.6	5.19	5.19	71.90	5.52	5.52	5.52	70.71	1.58	1.60	1.56	94.07	2.47	2.49	2.45	32.86
1.83	282.1	4.37	4.37	76.27	4.66	4.66	4.66	75.37	1.16	1.17	1.15	95.21	2.41	2.43	2.39	35.25
1.96	256.8	3.66	3.66	79.93	3.87	3.87	3.87	79.24	0.86	0.87	0.85	96.06	2.33	2.35	2.31	37.56
2.09	234.1	3.08	3.08	83.01	3.20	3.20	3.20	82.44	0.64	0.65	0.63	96.69	2.24	2.26	2.22	39.77
2.23	213.2	2.62	2.62	85.63	2.66	2.66	2.66	85.10	0.49	0.49	0.48	97.17	2.17	2.19	2.15	41.92
2.36	194.2	2.24	2.24	87.87	2.23	2.23	2.23	87.33	0.38	0.38	0.37	97.55	2.14	2.16	2.12	44.04
2.50	176.8	1.92	1.92	89.79	1.88	1.88	1.88	89.21	0.30	0.30	0.30	97.85	2.12	2.14	2.10	46.14
2.63	161.2	1.63	1.63	91.42	1.58	1.58	1.58	90.79	0.24	0.25	0.24	98.09	2.09	2.11	2.07	48.21
2.77	146.8	1.37	1.37	92.79	1.31	1.31	1.31	92.10	0.20	0.20	0.19	98.28	2.04	2.06	2.02	50.23
2.90	133.7	1.14	1.14	93.93	1.07	1.07	1.07	93.17	0.15	0.15	0.15	98.43	1.94	1.96	1.92	52.15
3.04	121.8	0.94	0.94	94.87	0.86	0.86	0.86	94.03	0.11	0.12	0.11	98.54	1.81	1.83	1.79	53.94
3.17	111	0.78	0.78	95.65	0.69	0.69	0.69	94.72	0.09	0.09	0.08	98.63	1.66	1.68	1.64	55.59
3.31	101.1	0.64	0.64	96.29	0.57	0.57	0.57	95.29	0.07	0.07	0.07	98.70	1.52	1.54	1.51	57.09
3.44	92.09	0.52	0.52	96.81	0.47	0.47	0.47	95.76	0.07	0.07	0.07	98.77	1.39	1.40	1.38	58.47
3.58	83.9	0.42	0.42	97.23	0.39	0.39	0.39	96.15	0.07	0.07	0.07	98.84	1.29	1.30	1.28	59.75
3.71	76.43	0.34	0.34	97.57	0.33	0.33	0.33	96.48	0.07	0.07	0.07	98.91	1.22	1.23	1.21	60.95
3.84	69.62	0.28	0.28	97.84	0.29	0.29	0.29	96.77	0.07	0.07	0.07	98.98	1.18	1.19	1.17	62.12
3.98	63.41	0.23	0.23	98.07	0.26	0.26	0.26	97.03	0.06	0.06	0.06	99.04	1.16	1.17	1.15	63.27
4.11	57.77	0.19	0.19	98.26	0.23	0.23	0.23	97.26	0.05	0.05	0.05	99.09	1.15	1.16	1.14	64.41
4.25	52.63	0.16	0.16	98.42	0.20	0.20	0.20	97.47	0.05	0.05	0.05	99.14	1.14	1.15	1.13	65.54
4.38	47.93	0.14	0.14	98.56	0.18	0.18	0.18	97.64	0.05	0.05	0.05	99.19	1.13	1.14	1.12	66.66
4.52	43.66	0.12	0.12	98.68	0.16	0.16	0.16	97.80	0.04	0.04	0.04	99.23	1.10	1.11	1.09	67.75
4.65	39.77	0.10	0.10	98.78	0.14	0.14	0.14	97.94	0.04	0.04	0.04	99.27	1.09	1.10	1.08	68.83
4.79	36.24	0.09	0.09	98.87	0.12	0.12	0.12	98.05	0.04	0.04	0.04	99.31	1.12	1.13	1.11	69.93
4.92	33	0.08	0.08	98.94	0.10	0.10	0.10	98.16	0.04	0.04	0.04	99.35	1.19	1.20	1.18	71.11
5.06	30.07	0.07	0.07	99.01	0.09	0.09	0.09	98.25	0.04	0.04	0.03	99.38	1.32	1.33	1.31	72.42
5.19	27.38	0.06	0.06	99.06	0.08	0.08	0.08	98.33	0.03	0.03	0.03	99.41	1.49	1.50	1.48	73.89
5.32	24.95	0.05	0.05	99.11	0.08	0.08	0.08	98.41	0.03	0.03	0.03	99.45	1.66	1.68	1.64	75.54
5.46	22.73	0.05	0.05	99.16	0.07	0.07	0.07	98.48	0.03	0.03	0.03	99.48	1.79	1.81	1.77	77.31
5.59	20.7	0.04	0.04	99.20	0.07	0.07	0.07	98.54	0.03	0.03	0.03	99.50	1.84	1.86	1.82	79.13
5.73	18.86	0.04	0.04	99.24	0.06	0.06	0.06	98.61	0.03	0.03	0.03	99.53	1.81	1.83	1.79	80.92
5.86	17.18	0.04	0.04	99.28	0.06	0.06	0.06	98.67	0.03	0.03	0.03	99.56	1.70	1.72	1.68	82.61
6.00	15.65	0.04	0.04	99.32	0.06	0.06	0.06	98.72	0.03	0.03	0.03	99.58	1.53	1.55	1.51	84.12
6.13	14.26	0.04	0.04	99.35	0.05	0.05	0.05	98.77	0.03	0.03	0.02	99.61	1.36	1.37	1.35	85.47
6.27	12.99	0.04	0.04	99.39	0.05	0.05	0.05	98.82	0.02	0.02	0.02	99.63	1.18	1.19	1.17	86.64
6.40	11.83	0.04	0.04	99.42	0.05	0.05	0.05	98.87	0.02	0.02	0.02	99.65	1.03	1.04	1.02	87.66
6.54	10.78	0.03	0.03	99.46	0.05	0.05	0.05	98.92	0.02	0.02	0.02	99.68	0.90	0.90	0.89	88.55
6.67	9.819	0.03	0.03	99.49	0.05	0.05	0.05	98.97	0.02	0.02	0.02	99.70	0.79	0.79	0.78	89.32
6.80	8.944	0.03	0.03	99.52	0.05	0.05	0.05	99.01	0.02	0.02	0.02	99.72	0.70	0.70	0.69	90.01
6.94	8.147	0.03	0.03	99.56	0.05	0.05	0.05	99.06	0.02	0.02	0.02	99.74	0.62	0.63	0.62	90.63
7.07	7.421	0.03	0.03	99.59	0.05	0.05	0.05	99.11	0.02	0.02	0.02	99.76	0.57	0.57	0.56	91.19
7.21	6.761	0.03	0.03	99.62	0.05	0.05	0.05	99.16	0.02	0.02	0.02	99.78	0.52	0.53	0.51	91.70
7.34	6.158	0.03	0.03	99.65	0.05	0.05	0.05	99.21	0.02	0.02	0.02	99.80	0.48	0.49	0.48	92.18
7.48	5.611	0.03	0.03	99.68	0.05	0.05	0.05	99.26	0.02	0.02	0.02	99.82	0.45	0.45	0.44	92.62
7.61	5.111	0.03	0.03	99.70	0.05	0.05	0.05	99.31	0.02	0.02	0.02	99.83	0.42	0.42	0.41	93.04
7.75	4.656	0.03	0.03	99.73	0.05	0.05	0.05	99.36	0.02	0.02	0.02	99.85	0.40	0.40	0.39	93.43
7.88	4.241	0.03	0.03	99.76	0.05	0.05	0.05	99.41	0.02	0.02	0.01	99.86	0.37	0.38	0.37	93.80
8.02	3.862	0.03	0.03	99.78	0.05	0.05	0.05	99.46	0.01	0.01	0.01	99.88	0.36	0.36	0.35	94.15
8.15	3.519	0.02	0.02	99.81	0.05	0.05	0.05	99.51	0.01	0.01	0.01	99.89	0.34	0.34	0.34	94.49
8.29	3.206	0.02	0.02	99.83	0.05	0.05	0.05	99.56	0.01	0.01	0.01	99.90	0.33	0.33	0.32	94.81
8.42	2.92	0.02	0.02	99.85	0.05	0.05	0.05	99.61	0.01	0.01	0.01	99.91	0.32	0.32	0.31	95.13
8.55	2.66	0.02	0.02	99.87	0.05	0.05	0.05	99.66	0.01	0.01	0.01	99.93	0.31	0.31	0.31	95.43
8.69	2.423	0.02	0.02	99.89	0.05	0.05	0.05	99.70	0.01	0.01	0.01	99.94	0.30	0.31	0.30	95.73
8.82	2.207	0.02	0.02	99.91	0.04	0.04	0.04	99.74	0.01	0.01	0.01	99.95	0.30	0.30	0.30	96.03
8.96	2.01	0.02	0.02	99.92	0.04	0.04	0.04	99.79	0.01	0.01	0.01	99.95	0.30	0.30	0.29	96.32
9.09	1.832	0.02	0.02	99.94	0.04	0.04	0.04	99.82	0.01	0.01	0.01	99.96	0.30	0.30	0.29	96.62
9.23	1.669	0.01	0.01	99.95	0.04	0.04	0.04	99.86	0.01	0.01	0.01	99.97	0.29	0.30	0.29	96.91
9.36	1.52	0.01	0.01	99.96	0.03	0.03	0.03	99.89	0.01	0.01	0.01	99.98	0.29	0.29	0.29	97.20
9.50	1.385	0.01	0.01	99.97	0.03	0.03	0.03	99.92	0.01	0.01	0.01	99.98	0.29	0.29	0.29	97.48
9.63	1.261	0.01	0.01	99.98	0.02	0.02	0.02	99.94	0.01	0.01	0.00	99.99	0.29	0.29	0.28	97.77
9.77	1.149	0.01	0.01	99.99	0.02	0.02	0.02	99.96	0.00	0.00	0.00	99.99	0.28	0.28	0.28	98.04
9.90	1.047	0.01	0.01	100.00	0.02	0.02	0.02	99.98	0.00	0.00	0.00	99.99	0.27	0.27	0.27	98.31
10.04	0.953	0.00	0.00	100.00	0.01	0.01	0.01	99.99	0.00	0.00	0.00	99.99	0.26	0.26	0.26	98.57
10.17	0.869	0.00	0.00	100.00	0.01	0.01	0.01	100.00	0.00	0.00	0.00	100.00	0.25	0.25	0.24	98.81
10.30	0.791	0.00	0.00	100.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	100.00	0.23	0.23	0.23	99.04
10.44	0.721	0.00	0.00	100.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	100.00	0.21	0.21	0.21	99.25
10.57	0.657	0.00	0.00	100.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	100.00	0.19	0.19	0.19	99.43
10.71	0.598	0.00	0.00	100.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	100.00	0.16	0.17	0.16	99.60
10.84	0.545	0.00	0.00	100.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	100.00	0.14	0.14	0.14	99.73
10.98	0.496	0.00	0.00	100.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	100.00	0.11	0.11	0.11	99.84
11.11	0.452	0.00	0.00	100.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	100.00	0.08	0.08	0.08	99.92
11.25	0.412	0.00	0.00	100.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	100.00	0.05	0.05	0.05	99.97
11.38	0.375	0.00	0.00	100.00	0.00	0.00	0.00	100.00		0.00	0.00	100.00	0.03	0.03	0.03	100.00
Sum			100.00	100.00		99.98	100.00			101.18	100.00			101.00	100.00	
Seive separation		wt (g)	wt %		wt (g)	wt %			wt (g)	wt %			wt (g)	wt %		
Total wt		9.188	100.00		15.150	100.00			11.060	100.00			13.029	100.00		
wt > 2000 um		0.000	0.00		0.000	0.00			0.131	1.18			0.129	0.99		
wt < 2000 um		9.188	100.00		15.150	100.00			10.929	98.82			12.900	99.01		
Statistical results		Arithmetic	Geometric		Arithmetic	Geometric			Arithmetic	Geometric			Arithmetic	Geometric		
MEAN		454.9	382.9		446.6	365.6			872.0	742.3			294.0	99.69		
SORTING		227.5	2.011		231.7	2.218			445.9	1.944			391.5	6.105		
SKEWNESS		0.510	-2.338		0.586	-2.782			0.851	-2.541			2.556	-0.663		
KURTOSIS		2.986	14.02		3.183	15.87			3.724	18.22			11.78	2.823		
% GRAVEL:		0.0%			0.0%				1.2%				1.0%			
% SAND:		98.1%			97.1%				97.9%				62.5%			
% MUD:		1.9%			2.9%				1.0%				36.6%			

Table 3.3: Sieve grain size data for Diogenes Brook, Brierly Brook, Belmont and Stewiacke

Borehole or location		DB-97-2			DB-97-2			Brierly Brook			Belmont			Stewiacke		
Depth (m)		12.2			93.4			Surface			Surface			Surface		
Sample		DB-2			DB-2			95-1-4			CS7			CS9		
Weight (g)		43.88			51			61.14			72.71			67.34		
Sieve size																
(Φ)	(μm)	Weight	Weight %	Cum %	Weight	Weight %	Cum %	Weight	Weight %	Cum %	Weight	Weight %	Cum %	Weight	Weight %	Cum %
-4	16000	0	0	0	0	0	0	549.71	10.16	10.16	12.73	0.71	0.71	69.1	2.95	2.95
-2	4000	0	0	0	0	0	0	1052.38	19.46	29.62	13.87	0.77	1.47	68.36	2.92	5.87
-1	2000	0.00	0.00	0.00	0.00	0.00	0.00	902.81	16.69	46.31	72.52	4.02	5.49	318.68	13.60	19.47
-0.5	1410	0.00	0.00	0.00	0.03	0.06	0.06	7.46	6.65	52.96	3.54	4.68	10.17	9.21	11.18	30.64
0	1000	0.02	0.05	0.05	0.06	0.12	0.18	7.21	6.43	59.39	6.31	8.34	18.52	8.84	10.73	41.37
0.5	710	0.05	0.12	0.16	0.11	0.22	0.40	7.98	7.12	66.51	12.56	16.60	35.12	9.18	11.14	52.51
1	500	0.14	0.32	0.48	0.33	0.67	1.07	10.76	9.60	76.11	17.05	22.54	57.66	9.78	11.87	64.37
1.5	355	1.29	2.98	3.46	0.75	1.52	2.59	10.33	9.21	85.32	13.58	17.95	75.61	9.08	11.02	75.39
2	250	15.83	36.55	40.01	0.96	1.94	4.53	6.43	5.73	91.05	7.42	9.81	85.42	6.59	8.00	83.39
2.5	180	16.80	38.79	78.80	1.76	3.56	8.10	3.45	3.08	94.13	3.69	4.88	90.30	4.39	5.33	88.72
3	125	4.37	10.09	88.89	7.77	15.73	23.83	2.14	1.91	96.04	2.47	3.27	93.57	3.45	4.19	92.90
3.5	90	3.05	7.04	95.94	14.36	29.07	52.89	1.25	1.11	97.16	1.15	1.52	95.09	2.01	2.44	95.34
4	63	1.29	2.98	98.91	10.49	21.23	74.13	1.15	1.03	98.18	0.89	1.18	96.26	1.46	1.77	97.11
4.1	58	0.47	1.09	100.00	12.78	25.87	100.00	2.04	1.82	100.00	2.83	3.74	100.00	2.38	2.89	100.00
Weight after		43.31			49.4			Intial wt	5408.89		Intial wt	1803.83		Intial wt	2343.23	
Loss		0.57			1.6			> -1	2504.90	46.31	> -1	99.12	5.49	> -1	456.14	19.47
% Loss		1.30%			3.14%			<-1	2903.99	53.69	<-1	1704.71	94.51	<-1	1887.09	80.53
								weight used from <-1			weight used from <-1			weight used from <-1		
									60.2			71.49			66.37	
		Arithmetic	Geometric		Arithmetic	Geometric		Arithmetic	Geometric		Arithmetic	Geometric		Arithmetic	Geometric	
MEAN		236.1	216.9		115.6	98.18		2824.9	621.1		782.1	507.1		1280.3	581.4	
SORTING		84.56	1.488		98.09	1.611		3657.2	12.20		1011.6	2.711		1770.8	4.709	
SKEWNESS		1.279	-0.955		6.593	1.495		1.302	-1.511		6.220	-1.807		3.520	-1.924	
KURTOSIS		14.26	4.306		72.70	6.470		2.997	4.706		54.00	12.82		17.33	9.073	
% GRAVEL:		0.0%			0.0%			46.3%			5.5%			19.5%		
% SAND:		99.0%			76.6%			52.0%			91.1%			77.9%		
% MUD:		1.0%			23.4%			1.6%			3.4%			2.6%		

Table 3.4: Reflection spectrophotometry measurements of sandstones and mudstones from Belmont, Brierly Brook and Diogenes Brook.

Sample	Depth in feet	Depth in metres	Lithilogy	Stratigraphic unit	L	a	b
BM-02-1 31'(62-68)	33.03	10.07	Triassic sandstone	Tr	69.59	11.54	23.77
BM-02-2 34'	34.00	10.36	Clean		79.67	4.44	17.22
BM-02-2 36'(53-57)	37.74	11.50	Coarse sandstone		83.81	1.59	6.99
BM-02-2 40'	40.00	12.19	Coarse washed sand		82.63	1.84	6.6
BM-02-2 52'	52.00	15.85	Medium sandstone		77.97	1.76	4.52
BM-02-2 56'(20-25)	56.66	17.27	Med sandstone some red staining		83.91	3.18	8.48
BM-02-2 62'	62.00	18.90	Washed		72.87	6.3	14.68
BM-02-2 64'	64.00	19.51	Washed		70.58	7.54	16.12
BM-02-2 66'(10-20)	66.33	20.22	Red clay		61.99	21.3	23.86
BM-02-2 76'(0-5)	76.00	23.16	Sandstone		81.44	1.96	6.17
BM-02-2 91'(28-31)	91.92	28.02	Fine sandstone		78.7	2.54	7.89
BM-02-2 91'(100-105)	94.28	28.74	Red silty clay		65.89	16.82	25.46
BM-02-3 21'	21.00	6.40	Sand		81.49	5.36	11.84
BM-02-3 26'(46-58)	28.66	8.73	Medium sandstone with bedding		76.49	7.21	11.86
BM-02-3 26'(81-85)	31.39	9.57	Medium sandstone with bedding		74.03	12.55	22.51
BM-02-3 31'(12-19)	31.89	9.72	Pink fine sandstone		75.62	15.55	24.85
BM-02-3 31'(27-32)	36.00	10.97	Sandstone		80.83	2.39	6.26
BM-02-3 36'(0-4)	53.62	16.34	Medium white sandstone		83.25	3.03	7.42
BM-02-3 51'(80-88)	58.62	17.87	Mottled clay		61.54	19.9	25.76
BM-02-3 56'(80-85)	57.00	17.37	Red clay		58.76	19.12	25.36
BM-02-3 57'	61.00	18.59	Fine-grained sandstone		83.82	1.58	5.15
BM-02-3 61'(0-5)	62.28	18.98	Red silty clay	Tr	58.08	18.16	28.08
BM-02-3 61'(90-94)	63.95	19.49	Indurated laminated fine sst	Tr	59.9	12.76	30.47
BM-02-3 61'(39-43)	68.89	21.00	Red sandy/silty clay	Tr	60.93	18.38	23.38
BM-02-3 66'(88-93)	69.35	21.14	Light red clay	Tr	73.09	7.53	14.37
BM-02-3 66'(102-108)	79.25	24.15	Light red silty clay	Tr	72.88	6.23	13.41
BM-02-3 76'(99-103)	79.61	24.26	Red silty clay	Tr	58.35	16.77	21.51
BM-02-3 76'(110-120)	81.87	24.95	Red silty clay	Tr	56.78	17.77	21.86
BM-02-3 76'(179-186)	120.59	36.76	Micaceous sandstone	Tr	59.32	13.53	18.43
BB-02-1 12'(9-13)	12.30	3.75	Poorly sorted muddy granule sst	B	63.82	2.89	6.41
BB-02-1 12'(46-49)	13.51	4.12	Dark grey clay	B	53.8	2.59	5.43
BB-02-1 22'(15-21)	22.49	6.86	Coarse granule muddy sst	B	62.5	1.76	4.35
BB-02-1 29'(39-47)	30.28	9.23	Dark grey clay	B	57.19	3.51	7.34
BB-02-1 32'(20-23)	32.66	9.95	Dark grey clay (clean)	B	59.61	2.82	6.43
BB-02-1 37'(55-62)	38.80	11.83	Poorly sorted coarse sand	B	63.17	2.17	5.09
BB-02-1 42'(33-39)	43.08	13.13	Poorly sorted muddy coarse sst	B	61.16	2.66	5.66
BB-02-1 42'(84-92)	44.76	13.64	Dark grey silty clay	B	64.62	2.16	4.96
BB-02-1 47'(65-71)	49.13	14.98	Med. dark grey clay with silt	B	66.04	3.82	8.61
BB-02-1 57'(32-39)	58.05	17.69	Dark grey silty clay	B	62.87	3.3	7.28
BB-02-2 ~16	16.00	4.88	Considerable sand washout	A	66.27	8.36	18.3
BB-02-2 16'(0-4)	16.00	4.88	Muddy light grey med. sand	A	83.97	2.38	6.67
BB-02-2 16'(11-15)	16.36	4.99	Light grey clay	A	80.46	4.08	9.44
BB-02-2 26'(66-72)	28.17	8.58	Dark grey mudstone	B	60.63	2.21	5.87

Table 3.4: Reflection spectrophotometry measurements of sandstones and mudstones from Belmont, Brierly Brook and Diogenes Brook.

Sample	Depth in feet	Depth in metres	Lithilogy	Stratigraphic unit	L	a	b
BB-02-2 31'(78-84)	33.56	10.23	Dark grey mudstone	B	68.78	1.78	5.13
BB-02-2 41'(6-9)	41.20	12.56	Dark grey mudstone	B	61.1	2.95	6.55
BB-02-2 51'(22-30)	51.72	15.76	Dark grey mudstone	B	65.31	3.65	8.1
BB-02-2 61'(0-5)	66.00	20.12	Mottled red / grey clay	B	65.36	6.14	7.86
BB-02-2 66'(6-11)	66.20	20.18	Fine sandstone	B	79.21	2.08	5.66
BB-02-2 66'(66-69)	68.17	20.78	Poorly sorted sst	B	77.5	3.38	7.47
BB-02-2 71'(88-95)	73.89	22.52	well sorted sst	B	54.62	3.99	8.37
BB-02-2 74'	74.00	22.56	Sand	B	55.6	4.11	9.07
BB-02-2 76'(17-23)	76.56	23.33	Dark grey brown clay	B	51.68	4.8	8.8
BB-02-2 81'(9-14)	81.30	24.78	Red clay	C	57.95	11.64	12.33
BB-02-2 82'(28-36)	82.92	25.27	Meduim grey clay 5% red mottles	C	72.64	3.75	7.52
BB-02-2 106'(23-28)	106.75	32.54	Meduim grey clay with some granules	C	66.09	4.59	8.36
BB-02-2 111'(51-55)	112.67	34.34	Muddy medium-grained sst	C	63.73	6.26	12.89
BB-02-2 116'(140-145)	120.59	36.76	Mottled silty clay	C	68.91	5.28	10.59
BB-02-5 31'(0-20)	31.00	9.45	Semi-lithified sst	B	63.24	7.56	19.25
BB-02-5 31'(37-41)	32.21	9.82	Brown sandy clay	B	72.86	5.28	13.76
BB-02-5 31'(37-41)	32.21	9.82	Brown sandy clay	B	69.88	8.22	21.14
BB-02-5 31'-36'	33.50	10.21	Sandstone to mudstone	B	67.76	5.92	17.3
BB-02-5 36'(27-34)	36.89	11.24	Brown clay w/ interbedded vfs	B	66.63	6.26	15.54
BB-02-7 11'(17-21)	11.56	3.52	Med grey clay	A	64.8	1.93	5.12
BB-02-7 11'(29-34)	11.95	3.64	Yellow well sorted fine sst	A	81.57	5.4	23.23
BB-02-7 21'(10-15)	21.33	6.50	Coarse muddy black sst	A	39.61	4.02	5.22
BB-02-7 21'(52-54)	22.71	6.92	Sandstone	A	32.28	2.54	2.68
BB-02-7 32'	32.00	9.75		A	67.68	4.61	8.96
BB-02-7 40B	40.00	12.19		A	68.46	5.5	12.58
BB-02-7 40A	40.00	12.19	Washing	A	72.37	4.38	10.91
BB-02-7 50'	50.00	15.24		B	69.61	4.64	10.06
BB-02-7 51'(34-41)	52.12	15.88	Lithified sandstone	B	56.87	2.77	5.62
BB-02-7 51'(68-73)	53.23	16.22	Med-light grey stiff clay	B	66.32	2.81	6.09
BB-02-7 56'(15-20)	56.49	17.22	Med-light grey stiff clay	B	63.17	2.36	5.29
BB-02-7 61'(0-5)	61.00	18.59	Med-dark grey silty mud	B	67.57	2.86	6.77
BB-02-7 71'(55-60)	72.80	22.19	Well sorted sand	B	73	3.1	7.39

Tr = Triassic

Table 3.5: Carbon analyses of sandstones and claystones from Belmont and Brierly Brook.

Sample	Depth (m)	Strat. unit	Total C	Organic C	Inorganic C by diff.	% $CaCO_3$
BM-02-1 31'(62-68)	10.07	Tr	0.0151	0.0102	0.005	0.04
BM-02-2 36'(53-57)	11.50		0.0095	0.0067	0.003	0.02
BM-02-2 40'	12.19		0.0030	0.0179	-0.015	0.00
BM-02-2 52'	15.85		0.0088	0.0151	-0.006	0.00
BM-02-2 56'(20-25)	17.27		0.0833	0.0109	0.072	0.60
BM-02-2 66'(10-20)	20.22		0.0289	0.0190	0.010	0.08
BM-02-2 76'(0-5)	23.16		0.0075	0.0164	-0.009	0.00
BM-02-2 91'(28-31)	28.02		0.0074	0.0057	0.002	0.01
BM-02-2 91'(100-105)	28.74		0.0067	0.0127	-0.006	0.00
BM-02-3 26'(46-58)	8.38		0.0057	0.0167	0.000	0.00
BM-02-3 26'(81-85)	8.73		0.0091	0.0090	0.000	0.00
BM-02-3 31'(12-19)	9.57		0.0050	0.0164	0.000	0.00
BM-02-3 31'(27-32)	9.72		0.0073	0.0169	0.000	0.00
BM-02-3 36'(0-4)	10.97		0.0036	0.0144	0.000	0.00
BM-02-3 51'(80-88)	16.34		0.0103	0.0128	0.000	0.00
BM-02-3 56'(80-85)	17.87		0.0128	0.0144	0.000	0.00
BM-02-3 57'	17.37		0.0068	0.0202	0.000	0.00
BM-02-3 61'(0-5)	18.59	Tr	0.0268	0.0325	0.000	0.00
BM-02-3 61'(90-94)	18.98	Tr	0.0257	0.020	0.010	0.08
BM-02-3 61'(39-43)	19.49	Tr	0.0151	0.0659	0.000	0.00
BM-02-3 66'(88-93)	21.00	Tr	0.0055	0.0152	0.000	0.00
BM-02-3 66'(102-108)	21.14	Tr	0.0046	0.0138	0.000	0.00
BM-02-3 76'(99-103)	24.15	Tr	0.0066	0.0295	-0.023	0.00
BM-02-3 76'(110-120)	24.26	Tr	0.0300	0.030	0.000	0.00
BM-02-3 76'(179-186)	24.95	Tr	0.3560	0.0054	0.351	2.92
BB-02-1 12'(46-49)	4.12	B	1.37	1.37	0.000	0.00
BB-02-1 29'(39-47)	9.23	B	4.90	1.20	3.700	30.83
BB-02-1 32'(20-23)	9.95	B	2.57	1.87	0.700	5.83
BB-02-1 37'(55-62)	11.83	B	0.531	0.735	-0.204	0.00
BB-02-1 42'(84-92)	13.64	B	0.888	0.961	-0.073	0.00
BB-02-1 47'(65-71)	14.98	B	8.66	1.33	7.330	61.08
BB-02-1 57'(32-39)	17.69	B	7.18	0.72	6.460	53.83
BB-02-2 16'(0-4)	4.88	A	0.0394	0.0542	-0.015	0.00
BB-02-2 16'(11-15)	4.99	A	0.0637	0.0630	0.001	0.01
BB-02-2 31'(78-84)	10.23	B	0.143	0.179	-0.036	0.00
BB-02-2 41'(6-9)	12.56	B	4.71	0.536	4.174	34.78
BB-02-2 51'(22-30)	15.76	B	4.31	0.30	4.007	33.39
BB-02-2 61'(0-5)	20.12	B	0.110	0.110	0.000	0.00
BB-02-2 76'(17-23)	23.33	B	2.300	1.56	0.740	6.17
BB-02-2 81'(9-14)	24.78	C	0.0694	0.0365	0.033	0.27
BB-02-2 82'(28-36)	25.27	C	0.2630	0.238	0.025	0.21
BB-02-2 106'(23-28)	32.54	C	3.35	0.25	3.096	25.80

Table 3.5: Carbon analyses of sandstones and claystones from Belmont and Brierly Brook.

Sample	Depth (m)	Strat. unit	Total C	Organic C	Inorganic C by diff.	% $CaCO_3$
BB-02-2 116'(140-145)	36.76	C	5.20	0.17	5.026	41.88
BB-02-5 31'(37-41)	9.82	B	7.32	0.17	7.147	59.56
BB-02-5 36'(27-34)	11.24	B	3.01	0.24	2.766	23.05
BB-02-7 11'(17-21)	3.52	A	0.303	0.319	0.000	0.00
BB-02-7 11'(29-34)	3.64	A	0.065	0.0458	0.019	0.16
BB-02-7 21'(10-15)	6.50	A	6.26	6.26	0.000	0.00
BB-02-7 21'(52-54)	6.92	A	28.40	26.40	2.000	16.67
BB-02-7 51'(34-41)	15.88	B	1.94	2.03	0.000	0.00
BB-02-7 51'(68-73)	16.22	B	0.605	0.565	0.040	0.33
BB-02-7 56'(15-20)	17.22	B	0.714	0.682	0.032	0.27
BB-02-7 61'(0-7)	18.59	B	0.178	0.201	0.000	0.00
BB-02-7 71'(55-60)	22.19	B	9.67	0.144	9.526	79.38

Tr = Triassic sample

Table 4.1: Abundance of representative pebble lithologies from Stewiacke, Belmont and Brierly Brook

Sample	Photo	Belmont CS7		Belmont CS8*	Stewiacke CS9		Stewiacke CS10*	Stewiacke CS11*	BB 95-1-4	
		4-16mm	>16mm		4-16mm	>16mm			4-16mm	>16mm
White vein quartz	✓	7		15	281		43		426	23
Grey vein quartz		14		1	84		16		6	
Yellow vein quartz		20		51			95**			
Pink vein quartz		4		15	6		1		1	
Vein quartz with reddish patches							7			
Quartz mylonite	✓			11	4		33		4	1
Pink granite	✓							4		
Spherulitic rhyolite	✓			1						
Gabbro	✓			2						
Diabase	✓						1			
Quartz arenite	✓	8		104	57	2	9	1	26	4
Fine-grained sst***	✓			1			33	2		
Med-grained sst***	✓			3			8	1		
Siltstone	✓						3		4	
Mudstone				4			2	1	6	
Lithified Chaswood Formation rocks										
siltstones and mudstones				16						
coarse-grained sst		56		6					6	
Pyrite cemented sst									2	
fine-grained sst				17						
Iron oxide							1			
Total		109	0	247	432	2	157	9	481	28

* Samples CS7, CS9 and BB-95-1-4 are the pebble fraction of bulk samples of pebbly sand. Samples CS8 and CS10 are pebbles picked off of old stock piles. Sample CS11 is of apparent exotic clasts picked from an old stock pile, but may include till contamination.

** much of the "yellow" vein quartz is a surface stain

*** sandstones probably Carboniferous, except in CS8 where they resemble Triassic.

Table 4.2: Petrography of sedimentary rocks from Belmont

Sample No.	Rock Name	Grains				for each mineral or rock-type, number of grains as a percentage of total grains														
depth (m)		% of total rock	mean size (μm)	sorting (good,poor)	roundness of quartz grains	Monocrystalline quartz	Polycrystalline quartz	Foliated mono quartz crystals	Feldspar	Muscovite	Biotite	Other Fe-Mg minerals	Fe-Ti oxides	Light-coloured heavy minerals	Igneous rock fragments	Metamorphic rock fragments	Sedimentary rock fragments	Carbonate rock fragments	Intraformational clasts	Fossils
BM-02-1 31' (62-68)	Triassic Wolfville Formation sandstone	86	225	moderate	angular - round	47	30	2	1	3	tr	0	3	tr	0	0	10	0	2	0
BM-02-2 36' (53-57)	Coarse-grained sandstone	95	300	moderate	sub-angular - round	60	20	0	0	tr	0	0	4	0	0	0	11	0	5	0
BM-02-2 40'	Coarse-grained sandstone	85	200	moderate	sub-angular - round	52	21	0	0	tr	0	0	4	0	0	0	12	0	12	0
BM-02-2 52'	Limonite stained med. Sandstone	90	100	well	sub-angular - round	80	6	0	0	0	0	0	10	0	0	0	0	0	4	0
BM-02-2 55'	Fine-grained sandstone	85	150	well	sub ang- sub round	49	20	0	0	1	0	0	11	tr	0	0	11	0	8	0
BM-02-2 56' (20-25)	Med. sandstone with red staining.	90	400	moderate	angular - round	64	18	0	0	0	0	0	2	0	0	0	10	0	6	0
BM-02-2 61' (135-137)	Chunks of med. sandstone	80	300	well	sub-round - round	50	20	0	0	3	0	0	10	0	0	0	10	0	8	0
BM-02-2 76' (0-5)	Coarse-grained sandstone	80	200	moderate	sub-round - round	50	25	0	0	3	0	tr	10	0	0	0	10	0	3	0
BM-02-2 91' (28-31)	Fine-grained sandstone	90	100	well	sub-round - round	48	33	0	0	2	0	0	10	tr	0	0	4	0	2	0
BM-02-3 26' (46-58) A	Laminated sandstone	70	125	moderate	sub-round - round	40	26	tr	0	tr	0	tr	20	tr	0	0	10	0	4	0
BM-02-3 26' (46-58) B	Laminated sandstone	70	155	moderate	sub-round - round	40	30	0	0	tr	0	0	16	tr	tr	0	10	0	4	0
BM-02-3 26' (81-85)	Very fine-grained sandstone	70	50	well	sub-angular - round	50	30	0	0	0	0	0	10	tr	0	0	10	0	0	tr
BM-02-3 31' (12-19)	Pink fine-grained sandstone	50	75	well	angular - round	70	14	0	0	tr	0	0	10	0	0	0	6	0	0	0
BM-02-3 31' (27-32)	Coarse-grained sandstone	70	300	moderate	sub-round - round	47	30	0	0	tr	0	0	3	0	0	0	16	0	4	0
BM-02-3 36' (0-4)	Medium-grained white sandstone	70	250	moderate	sub-round - round	44	30	0	0	3	0	0	3	tr	0	0	16	0	4	0
BM-02-3 51' ((7-10)	Fine-grained white sandstone	70	125	moderate	sub-angular - round	50	26	0	0	16	0	0	4	0	0	0	4	0	0	0
BM-02-3 51' (15-16)A	Quartz arenite pebble from a conglm.	n/a																		
BM-02-3 51' (15-16)B	Poly. quartz pebble from conglm.	n/a																		
BM-02-3 57'	Fine-grained sandstone	60	125	moderate	sub-angular - round	50	30	0	0	0	0	0	2	0	tr	0	15	0	3	0
BM-02-3 61' (38-43)	Indurated fine-grained sandstone	40	50	well	angular	95	0	0	0	5	0	0	0	0	0	0	0	0	0	0
BM-02-3 61' (90-94)	Fine sst clasts within a silty mud matrix	80	100	well	angular - round	40	28	0	0	10	8	0	5	tr	0	0	10	0	0	0
BM-02-3 61' (90-94)	Silty mud matrix around the fine sst	30	20	well	silt is angular	87	0	0	0	10	0	0	3	tr	0	0	0	0	0	0
BM-02-3 76' (110-120)	Red silty mudstone	20	20	well	angular - round	85	0	0	0	10	0	0	5	tr	0	0	tr	0	0	0
BM-02-3 76' (179-186)	Very fine-grained red sandstone	50	50	well	angular - sub-round	60	20	0	0	16	0	0	4	0	0	0	tr	0	0	0

Table 4.2: Petrography of sedimentary rocks from Belmont

Sample No.	Matrix		Cement	*listed in chronological order where apparent and indicated by (#); otherwise order is unknown*				Porosity	
depth (m)	% of total rock	description of material	% of total rock	cement 1: mineral	cement 2: mineral	cement 3: mineral	other cements	remaining porosity as % of total rock	NOTES: List noteworthy minerals and rock fragments, note alteration of minerals
BM-02-1 31' (62-68)	10	Mud	1	silica				3	Dusty fine silty mud
BM-02-2 36' (53-57)	3	Dusty mud w/ kaolinite	2	kaolinite	illite	halloysite			Trace pyrite kaolinite detrital kaolinite.Intra clasts of mudstone and qz arenite clasts.
BM-02-2 40'	15	Dusty mud with near isotropic silt-size qz grains							Common round qz arenite clasts. Some altered Fe-Ti oxides and mylonized qz.
BM-02-2 52'	5	Dusty mud with near isotropic silt-size qz grains	5	Opaque, more around Fe-Ti O_2					Clean fine silica sand. Some dusty poly qz (qz arenite). Common altered Fe-Ti oxides
BM-02-2 55'	15	Dusty mud							Common qz arenite and intraclasts of mudstone. Detrital ms and tur.
BM-02-2 56' (20-25)	10	dusty silty mud							Round qz arenite and mylonized qz grains. Traces of Fe-Ti oxides in intraformational clasts
BM-02-2 61' (135-137)	15	Dusty mud	5	Silica					Mylonized qz. Qz inclusions with of ms. and fluid. Round mud intraclasts with Fe-Ti oxides.
BM-02-2 76' (0-5)	10	Dusty mud	10	Kaolinite (17/60)	illite				Trace staurolite clasts. Less mudstone intraclasts but still qz arenite clasts
BM-02-2 91' (28-31)	5	Dusty mud	5	Kaolinite (16/61)					Qz inclusions of ms and fluid. Some mylonitic qz. Qz arenite. Detrital tur and ms.
BM-02-3 26' (46-58) A	15	Dusty mud Kaolinite rich (30\60)	10	Kaolinite (29\62)				5	Lots of Fe-Ti oxides, also 1 staurolite crystal.
BM-02-3 26' (46-58) B	10	Dusty mud	10	Kaolinite (29\59)				10	Concentrations of Fe-Ti oxides forming. detrital tur. & staurolite, trace granite
BM-02-3 26' (81-85)	10	Dusty mud	10	Kaolinite				10	Finer and more angular then above but similar minerals. No ms. Rutile trellis structure.
BM-02-3 31' (12-19)	40	Dusty mud	10	Kaolinite					No intra clasts some qz arenite clasts. Common detrital ms.
BM-02-3 31' (27-32)	13	Dusty mud	2	Kaolinite				15	Common qz arenite clasts, Trace granite. Qz inclusions of fluid ms & tur.
BM-02-3 36' (0-4)	23	Dusty mud	5	Kaolinite				2	Some detrital ms.
BM-02-3 51' ((7-10)	15	Dusty mud	10	Kaolinite				5	Common large detrital ms.
BM-02-3 51' (15-16)A									
BM-02-3 51' (15-16)B									Mylonitized polycrystalline quartz pebble from conglomerate.
BM-02-3 57'	35	Dusty mud	5	Kaolinite					Altered Fe-Ti oxides some with trellis rutile. Trace granite clasts and common qz arenite.
BM-02-3 61' (38-43)			60	Opaque (limonite)	Trace kaolinite in a fracture				Fine angular qz and ms.
BM-02-3 61' (90-94)	18	Dusty mud w/ silty qz & mica	2	Kaolinite					Trace tur. Altered Fe-Ti oxides some w/ trellis. Qz arenite and dusty clay clasts.
BM-02-3 61' (90-94)	35	Dusty mud	35	Kaolinite					Oriented xtals particularly around sst clasts suggest flow. Reddish mottling
BM-02-3 76' (110-120)	80	Reddish mud							Clay with fine sand. Qz angular, Hematite (07/69) sm. clay clast (07/69)
BM-02-3 76' (179-186)	50	Reddish mud							Fine silt Fe-Ti oxides, Common detrital ms. Qz angular.

Abbreviations: ang = angular, lg = large, lst = limestone, qz = quartz, frag = fragment, tur = turmaline, ms = muscovite, xtals = crystals, cal = calcite, sst = sandstone, poly = polycrystalline, mono = monocrystalline, carb = carbonate

Table 4.3: Petrography of sedimentary rocks from Brierly Brook

Unit	Sample No.	Rock Name	Grains				for each mineral or rock-type, number of grains as a percentage of total grains														
	Borehole feet (cm)		% of total rock	mean size (µm)	sorting (good,poor)	roundness of quartz grains	Monocrystalline quartz	Polycrystalline quartz	Foliated mono quartz crystals	Feldspar	Muscovite	Biotite	Other Fe-Mg minerals	Fe-Ti oxides	Light-coloured heavy minerals	Igneous rock fragments	Metamorphic rock fragments	Sedimentary rock fragments	Carbonate rock fragments	Intraformational clasts	Fossils
B	BB-02-1 37' (55-62)	Poorly sorted coarse sandstone	75	1500	poor	angular to sub-angular	75	25	0	0	tr	0	0	tr	tr	0	0	tr	0	0	0
B	BB-02-1 42' (84-92)	Dark grey silty mudstone	75	1200	poor	angular to sub-angular	75	24	0	0	tr	0	0	1	tr	0	0	0	0	0	0
	BB-02-1 67' (42-48)	Basement Windsor limestone		n/a																	
B	BB-02-2 31' (78-84)	Dark grey mudstone	50	1000	poor	angular to sub-angular	40	10	0	0	0	0	0	tr	tr	0	0	0	0	50	0
B	BB-02-2 31' (78-84)	Mylonitic qz pebble in dark grey mudstone	n/a	n/a																	
B	BB-02-2 31' (78-84)	Vein qz pebble in dark grey mudstone	n/a	n/a																	
B	BB-02-2-40'	Lg limestone pebble in dark grey mudstone	n/a	n/a																	
B	BB-02-2 46'	Dark grey mudstone	75	700	poor	angular to sub-angular	85	3	0	0	0	0	0	1	0	0	0	0	11	0	0
C	BB-02-2 101' (5-6)	Loose lithified sst pebble	50	700	moderate	sub-angular to round	70	26	0	0	tr	0	0	0	0	4	0	0	0	0	0
C	BB-02-2 106'	Poorly sorted sandstone	70	1800	poor	angular to round	44	14	0	0	0	0	0	4	0	0	0	0	37	0	0
C	BB-02-2 106' (23-28)	Muddy sandstone Debris flow?	70	1800	poor	angular to round	44	21	0	0	tr	0	0	4	0	0	0	0	30	0	0
C	BB-02-2 109'	Lst pebble from frags of indurated sst	n/a	n/a																	
C	BB-02-2 124'	Limestone pebble in indurated sst	80	2000	poor	angular to round	4	0	0	0	0	0	0	3	0	0	0	0	94	0	0
D	BB-02-2 127'	Limestone pebble	n/a	n/a																	
D	BB-02-2 131' (12-15)	Limestone pebble in a rubble of indurated sst	50	1800	poor	angular to round	6	4	0	0	0	0	tr	4	0	0	0	0	86	0	0
	BB-02-2 134'	Basement Windsor limestone	70	1200	poor	angular to round	10	0	0	0	0	0	0	tr	0	0	0	0	90	0	0
	BB-02-5 36' (80-85)	Basement Windsor limestone	90	120	moderate	angular	2	0	0	0	0	0	0	3	0	0	0	0	94	0	0
A	BB-02-7 11' (29-33)	Yellowish muddy sandstone	60	200	well	angular to sub-angular	80	8	0	0	10	0	0	2	tr	0	0	0	0	0	0
A	BB-02-7 16' (4-6)	Limonite cemented sst	70	700	moderate	angular to sub-angular	93	6	0	0	0	0	0	1	0	0	0	0	0	0	0
A	BB-02-7 21' (10-15)	Sandstone	45	800	poor	angular to sub-angular	50	38	0	0	0	0	0	5	0	0	0	0	0	0	8
A	BB-02-7 27'	Medium sandstone	70	600	Moderate	angular to sub-angular	80	14	0	0	4	0	0	1	tr	0	0	0	0	0	0
B	BB-02-7 51' (68-73)	Med-light grey mudstone	20	60	well	angular	70	0	0	0	20	0	0	10	0	0	0	0	0	0	0
B	BB-02-7 61' (0-5)	Med-dark grey silty mudstone	50	800	poor	angular to sub-angular	66	34	0	0	tr	0	0	tr	tr	0	0	0	0	0	tr

Table 4.3: Petrography of sedimentary rocks from Brierly Brook

Unit	Sample No.	Matrix		Cement	*listed in chronological order where apparent and indicated by (#); otherwise order is unknown*				Porosity	
	Borehole feet (cm)	% of total rock	description of material	% of total rock	cement 1: mineral	cement 2: mineral	cement 3: mineral	other cements	remaining porosity as % of total rock	NOTES: List noteworthy minerals and rock fragments, note alteration of minerals
B	BB-02-1 37' (55-62)	15	Silty mud	10	Pyrite				0	Poly qz rounded. Mono qz angular. Ms inclusions in qz. Altered Fe-Ti oxides
B	BB-02-1 42' (84-92)	20	Dusty mud	5	Pyrite				0	Poly qz rounded. Mono qz angular. Trace detrital tur.
	BB-02-1 67' (42-48)									Limestone clast or basement
B	BB-02-2 31' (78-84)	45	silty/sandy often foliated mud	5	Pyrite				0	Large foliated intraclasts. Common pyrite and other Fe-Ti oxides, rare tur.
B	BB-02-2 31' (78-84)									Quartz pebble from debris flow
B	BB-02-2 31' (78-84)									Quartz pebble from debris flow
B	BB-02-2-40'									Mylonitic limestone from debris flow
B	BB-02-2 46'	10	Silty mud	tr	Pyrite				15	Poly qz larger and rounder than mono qz with inclusions of ms+ tur. Round carb clasts
C	BB-02-2 101' (5-6)			50	Opaque; limonite and siderite	Barite	Illite	Rhodochrosite		Unknown columnar like crystals between grains of quartz identified as barite from SEM and probe.
C	BB-02-2 106'	25	silty mud. Silt a 60/40 qz/cal combination	3	Silica within carb clasts	Silica overgowths on quartz	Pyrite		2	Ms inclusions in qz. Common dusty carbonate clasts and carbonate crystals.
C	BB-02-2 106' (23-28)	20	silty lime mud. Silt a 40\60 qz\cal combination.	8	Silica within carb clasts	Pyrite			2	Carbonate clast as above. Qz with ms + fluid inclusions.
C	BB-02-2 109'									Limestone pebble
C	BB-02-2 124'	10	vfs, silt, mud . Calcite composes most of the silt and sand fraction	10	Calcite in voids and fractures	Yellow around Fe-Ti oxides	Pyrite	Silica within carb clasts		Sandstone composed of carbonate clasts and some angular detrital qz.
D	BB-02-2 127'									Limestone pebble
D	BB-02-2 131' (12-15)	48	Silty lime mud, silt = calcite and Qz	0	silica and calcite within carb clasts				2	Carbonate rich sandstone, angular mono quartz grains common.
	BB-02-2 134'	30	silty calcite and quartz	0					0	Range of carbonate clasts within a silty carbonate matrix
	BB-02-5 36' (80-85)	4	red/yellow slightly opaque	4	Sparry calcite				2	Large limestone intraclasts in a well sorted very fine carbonated sand.
A	BB-02-7 11' (29-33)	30	Mud	10	Kaolinite	Illite	Hallyosite		0	Silica rich sandstone, with trace detrital tur and common ms.
A	BB-02-7 16' (4-6)	0		10	Siderite	Kaolinite	Illite		20	Silica rich sandstone. Qz contains fluid and musc. Inclusions. Rare Fe-Ti oxides
A	BB-02-7 21' (10-15)	50	Opaque mud with fragments of coaly plant matter						5	Inclusions of fluid and ms in qz. Coaly plant matter
A	BB-02-7 27'	29	Silty mud, silt is qz and ms.	1	pyrite					Common lg. detrital ms, rare detrital tur. These are also inclusions in quartz
B	BB-02-7 51' (68-73)	75	Silty mud with fine ms and qz silt.						5	Fine detrital ms.
B	BB-02-7 61' (0-5)	43	silty mud	5	reddish opaque around qz grains	pyrite			2	Inclusions of ms, tur, and zircon. Notable trace organic material

Abbreviations: ang = angular, lg = large, lst = limestone, qz = quartz, frag = fragment, tur = turmaline, ms = muscovite, xtals = crystals, cal = calcite, sst = sandstone, poly = polycrystalline, mono = monocrystalline, carb = carbonate

Table 4.4: X-ray diffraction analyses of sandstones and mudstones from Belmont, Brierly Brook and Diogenes Brook.

Sample ID	Core Depth (ft)	Interval (cm)	Depth in feet	Depth in metres	File name	Lithology	Stratigraphic unit	Mixed clay layer*	Kaolinite/expandable	Smectite	Vermiculite	Illite 1M	Halloysite-7A	Kaolinite	Quartz	Goethite	Pseudorutile/Muscovite	Muscovite	Kaolinite	Chlorite	muscovite 2M	Rutile	Muscovite	Calcite	Dolomite	Siderite	Hematite	Pyrite
						d-spacing		~24	16.9-17.4	~15	14.2	10.1	7.5	7.1	4.26	4.18	3.85	3.7	3.58	3.55	3.5	3.25	3.18	3.04	2.885	2.79	2.69	2.71
Belmont CS7	surface				B-16	Sand		0	109	0	0	140	68	1582	156.1	88.3	16.3	10.5	1164.2	0	0	tr	22.1	0	0	11.8	0	0
BM-02-1	31'	62-68	33.03	10.07	BM02131	Triassic sandstone	Tr	69	269	shoulder	0	14.12	0	14.12	221	0	16.8	63	38	0	32.12	90	0	0	15.7	0	16.8	0
BM-02-2	36'	53-57	37.74	11.50	BM02236	Coarse sandstone		52	295	0	0	5.8	0	249.9	506	0	0	162	194	0	0	0	0	0	0	0	0	0
BM-02-2	40'		40.00	12.19	BM02240	Coarse washed sand		159	233	0	0	10.9	0	238	470.7	0	0	176	250	0	0	0	0	0	0	0	0	0
BM-02-2	52'		52.00	15.85	BM02252	Medium sandstone		28.4	242	0	0	32.6	15.89	316.5	397	0	0	62	184	0	0	0	15.38	0	0	0	0	0
BM-02-2	56'	20-25	56.66	17.27	BB02256	Med sandstone some red staining		58	420	0	0	60.5	0	322.4	468	0	0	47.72	104.82	0	0	6.16	15.98	0	0	5.24	8.62	0
BM-02-2	66'	10--20	66.33	20.22	BM02266	Red clay		0	120	0	0	290.4	0	436.2	243.3	0	29	59	293	0	0	22	49.6	0	0	0	64	6.14
BM-02-2	76'	0-5	76.00	23.16	BM02276	Sandstone		48	350	0	0	28.9	0	263.9	401.5	0	0	215	353	0	0	5.86	0	0	0	0	5.95	0
BM-02-2	91'	28-31	91.92	28.02	BM02291	Fine sandstone		0	210	0	0	14.2	0	255.9	419.2	0	5.95	182	288	0	0	13.56	0	0	0	0	4.62	0
BM-02-2	91'	100-105	94.28	28.74	BM02291B	Red silty clay		24.1	173	0	0	42.4	10.9	230.25	341	0	8.45	44	193	0	0	0	14.79	0	0	0	8.19	0
BM-02-3	26'	46-58	27.51	8.38	BM02326A	Medium sandstone with bedding		48	351	0	0	17.3	9.96	273.6	414	0	6	133	205	0	0	0	13.81	0	0	0	9.3	0
BM-02-3	26'	81-83	28.66	8.73	BM02326B	Medium sandstone with bedding		19.1	237	0	0	148.7	0	644	284	0	0	87	493	0	0	0	35.39	0	0	0	0	0
BM-02-3	31'	(12-19)	31.39	9.57	BM02331C	Pink fine sandstone		27	235.1	0	0	126.4	0	428.7	243.8	0	0	100	282	0	0	7.735	0	0	0	0	31.2	0
BM-02-3	31'	27-32	31.89	9.72	BM02331B	Sandstone		54.7	335	0	0	18.6	0	230.8	477	0	5.89	195	241	0	0	6.34	11.72	0	0	0	11.9	0
BM-02-3	36'	0-4	36.00	10.97	BM02336	Medium white sandstone		48.37	235.1	0	0	11.2	0	217.5	506	0	4.07	169	217	0	0	0	6.26	0	0	0	6	0
BM-02-3	51'	80-88	53.62	16.34	BM02351	Light grey/red clay		24	203	0	0	113.2	0	450.1	338	0	19.24	62	309		0	0	0	0	0	15.2	30	0
BM-02-3	56'	80-85	58.62	17.87	BM02356	Red clay		0	88	0	0	209.3	0	505.6	195.4	0	16.61	58	361.5	0	0	10.12	41	0	0	0	58	23
BM-02-3	57'		57.00	17.37	BM02357	Fine-grained sandstone		50	323	0	0	18.4	0	280.4	444.7	0	6.973	167	231	0	0	0	12.071	0	0	0	0	0
BM-02-3	61'	0-5	61.00	18.59	BM02361A	Red silty clay	Tr	0		0	0	113.9	0	194	237.93	525.4	17.44	34	95	0	0	12.84	27.53	0	0	18.1	182	0
BM-02-3	61'	39-42	62.28	18.98	BM02361D	Indurated laminated fine sst	Tr	32	49	0	0	38.1	0	0	357.35	453.4	12.25	0	0	0	0	14.03	12.78	0	0	0	189.1	0
BM-02-3	61'	90-94	63.95	19.49	BM02361C	Red sandy/silty clay	Tr	0	300	200	0	140.9	0	61.1	195	0	20.68	66	86	0	22.72	14.61	27.11	0	0	11.12	18.65	5.08
BM-02-3	66'	88-93	68.89	21.00	Bm23a	Light red clay	Tr	30.9	209	shoulder	0	27.1	0	26.5	174	0	8.68	18.63	20.38	0	15.72	17.82	15.58	0	0	0	0	0
BM-02-3	66'	102-108	69.35	21.14	BM02366	Light red silty clay	Tr	25.86	292	20	0	40.3	0	39.84	302	0	8.46	134	24	0	37.59	14.1	25.4	0	0	0	6.62	0
BM-02-3	76'	99-103	79.25	24.15	BM02376	Red silty clay	Tr	0	178	50	0	111.5	0	54.4	152.7	0	31	111	44.5	0	36.59	9.62	33.77	0	0	23.01	32.77	0
BM-02-3	76'	110-120	79.61	24.26	BM02376A	Red silty clay	Tr	0	150	150	0	148.6	0	63.45	128.9	0	26.45	71	43.1	0	38.49	11.38	41.58	0	0	28.25	35.58	0
BM-02-3	76'	179-186	81.87	24.95	BM02376B	Micaceous sandstone	Tr	0	0	431	0	58.3	0	33.3	191	0	13.42	0	22.4	0	19.16	13.1	13.98	0	9.25	7.1	19.04	0
BB-95-1-4	surface				BB-17	Sand		0	103	0	0	56.4	0	139.6	466.2	0	0	37.8	57.9	4.3	0	0	0	0	0	0	0	0
BB-02-1	12'	46-49	13.51	4.12	BB02112	Dark grey clay	B	22.734	139	0	0	22.2	15.74	86.242	239.9	0	8.814	133	28	48	0	7.536	9.148	0	0	0	40	0
BB-02-1	29'	39-47	30.28	9.23	BB02129	Dark grey clay	B	0	90.65	0	0	35.2	10.96	122.07	93.5	0	13.7	13.1	93.2	62.3	0	5	9.88	151.8	56.7	0	9.2	0
BB-02-1	32'	20-23	32.66	9.95	BB02132	Dark grey clay (clean)	B	16.898	88	0	9.65	61.9	13.27	217.57	118.4	0	10.46	0	298	0	0	9.449	10.921	17.089	10.3	0	12.52	0
BB-02-1	37'	55-62	38.80	11.83	BB02137	Poorly sorted coarse sand	B	14.37	148	0	0	38.038	0	115.15	268.7	0	5.956	165	70.3	0	0	5.849	5.033	0	tr	0	42.15	0
BB-02-1	42'	84-92	44.76	13.64	BB02142	Dark grey silty clay	B	25.259	185	0	15.3	33.251	0	87.329	330.5	0	5.898	153	60	0	0	0	0	0	0	0	30.25	tr
BB-02-1	47'	65-71	49.13	14.98	BB02147	Med. dark grey clay with silt	B	11.115	32.58	0	26.3	27.365	0	36.824	55.5	0	42.45	21.9	35.58	26.1	0	0	8.454	495.8	226	0	0	0
BB-02-1	57'	32-39	58.05	17.69	BB02157	Dark grey silty clay	B	0	0	0	27.5	43.303	11.67	129.52	483	0	7.153	19.1	126.7	0	0	tr	17.866	83.7	442.04	0	7.48	0
BB-02-2	16'	(0-4)	16.00	4.88	BB02216	Muddy light grey med. sand	A	66	150	0	0	32	12.8	393	234.4	0	0	30	112.7	34.6	0	0	16.38	0	0	0	0	3.1
BB-02-2	16'	(11-15)	16.36	4.99	BB022	Light grey clay	A	120	235	0	0	30.1	9.42	335	328.5	0	0	121	109.4	28.7	0	11.04	15.52	0	0	0	0	0
BB-02-2	31'	78-84	33.56	10.23	BB02231	Dark grey mudstone	B	34.6	239.8	0	0	20	8.71	187.1	254.4	0	0	79	79.8	0	0	8.321	10.96	0	0	0	10	6.94

Table 4.4: X-ray diffraction analyses of sandstones and mudstones from Belmont, Brierly Brook and Diogenes Brook.

Sample ID	Core Depth (ft)	Interval (cm)	Depth in feet	Depth in metres	File name	Lithology	Stratigraphic unit	Mixed clay layer*	Kaolinite/expandable	Smectite	Vermiculite	Illite 1M	Halloysite-7A	Kaolinite	Quartz	Goethite	Pseudorutile/Muscovite	Muscovite	Kaolinite	Chlorite	muscovite 2M	Rutile	Muscovite	Calcite	Dolomite	Siderite	Hematite	Pyrite
						d-spacing		~24	16.9-17.4	~15	14.2	10.1	7.5	7.1	4.26	4.18	3.85	3.7	3.58	3.55	3.5	3.25	3.18	3.04	2.885	2.79	2.69	2.71
BB-02-2	41'	(6-9)	41.20	12.56	BB02241	Dark grey mudstone	B	6.1	76	0	0	33.6	0	176.3	84.6	6.15	26.6	8.3	74	25.2	0	5.26	0	218.4	48.8	0	11.8	9.053
BB-02-2	51'	22-30	51.72	15.76	BB02251	Dark grey mudstone	B	0	149	0	0	21.4	0	193	104.8	3.5	37.2	23.1	45	0	12.77	0	0	383.7	33	4.7	8.83	0
BB-02-2	66'	(0-6)	66.00	20.12	BB02266	Mottled red / grey clay	B	0	118	0	12.2	102.9	10.08	197.5	158.5	11.48	0	36.9	177	0	12.07	5.738	12.24	19	0	5.2	21.98	3.66
BB-02-2	76'	17-23	76.56	23.33	BB02276	Dark grey brown clay	B	0	66	0	0	32	11.9	243	147.4	0	89	18.2	42.4	32.3	0	5.22	15.27	37.1	27.74	8.59	20.63	0
BB-02-2	81'	(9-14)	81.30	24.78	BB02281	Red clay	C	0	97	0	10.3	107.8	10.3	168.5	103.7	0	46	63.5	0	0	0	6.57	26.62	0	0	0	41	5.35
BB-02-2	82'	28-68	82.92	25.27	BB02282	Clay	C	136	0	0	0	69.7	0	429.4	158.7	0	10.63	19.9	330.3	0	0	4.29	0	0	0	0	7.68	0
BB-02-2	106'	23-28	106.75	32.54	BB022106	Clay and sand	C	0	100.5	0	28.1	55.3	0	189.9	107.7	5.91	70.4	33.3	69	24	0	4.84	0	273.5	27.3	0	11.34	4.07
BB-02-2	116'	140-145	120.59	36.76	BB022116	Sandy clay	C	0	171.9	0	0	29	0	265.2	47.1	0	30.2	11.5	175.9	0	0	4.88	9.22	0	0	9	0	0
BB-02-5	31'	37-41	32.21	9.82	BB02531	Sandy clay	B	0	152.3	0	0	16.5	12.2	190.7	52.5	7	42.7	7	45	28.4	0	0	0	436.8	0	0	0	3.09
BB-02-5	36'	27-34	36.89	11.24	BB02536	Brown clay overlain by vfs	B	26.9	137.8	0	16.06	33	0	331.5	179	0	49	26	47.5	30.1	0	5.34	0	308	39.1	0	0	0
BB-02-7	11'	17-21	11.56	3.52	BB02711A	Clay and sand	A	16.4	153	0	0	66.5	0	282	204.7	0	0	140	65	0	0	5.57	17.31	0	0	0	20.6	4.18
BB-02-7	11'	29-34	11.95	3.64	BB02711	Yellow well sorted fine sst	A	40	219	0	0	37.4	0	356.3	278.1	0	0	29.9	92.1	0	0	0	0	0	0	0	0	0
BB-02-7	21'	(10-15)	21.33	6.50	BB02721A	Coarse muddy black sst	A	53	123.64	0	0	0	0	128	148.9	0	0	59.1	157	37.9	0	0	0	0	0	0	0	0
BB-02-7	21'	52-54	22.71	6.92	BB02721	Sandstone	A	16.9	74.77	0	0	0	0	41.2	121.18	44.31	0	32.66	15.37	0	0	0	0	0	0	0	0	0
BB-02-7	51'	34-41	52.12	15.88	BB02751	Lithified sandstone	B	10.3	139	0	0	37.3	16.79	258	226.4	0	20.8	33	98	54.5	0	0	18.08	0	0	12.73	0	0
BB-02-7	51'	68-73	53.23	16.22	BB02751A	Clay	B	22	144	0	0	63.1	0	433	221.6	0	7.2	33	143.3	43.3	0	5.19	16.73	0	0	10.22	5.29	0
BB-02-7	56'	15-20	56.49	17.22	BB02756	Silty clay	B	16.9	145	0	0	85.7	0	455	185.5	0	7.77	55	151	52	0	6.285	15.02	0	0	0	44	0
BB-02-7	61'	0-5	61.00	18.59	BB02761	Silty mud	B	0	217	0	0	6.2	0	269.3	357	0	0	150	246	0	0	6.51	0	0	0	0	4.53	0
BB-02-7	71'	55-60	72.80	22.19	BB02771	Well sorted sand	B	0	135.4	0	0	71.1	9.78	24.69	28.3	0	44	20.5	0	0	0	2.872	10.82	519.8	254.3	0	71	0
DB-97-2	DB-2		35.06	12.2	DB-14	Tan-yellow sandstone		0	55.6	0	0	98.9	0	706.2	343.9	70.3	34.2	16.1	488.5	0	0	tr	7.3	0	0	6.8	9.8	0
DB-97-2	DB-3		268.39	93.4	DB-13	Grey samdstone		0	37.5	0	0	143.5	0	765	211.1	0	22.7	0	493	0	0	5.3	11.7	0	0	21.2	0	0
DB-97-2	DB-4		193.58	59	Db459	Jarosite		0	75	0	24.3	9.88	0	29.9	37.5	0	17.3	28.6	35.3	14.2	77	0	0	0	0	0	21.5	0

tr = trace

Tr = Triassic

* Mixed clay layer whose composition is uncertain, possible mica/vermiculite (Moore and Reynolds, 1997)

Table 4.5: Summary of overall point counts of heavy mineral separates from Belmont, Brierly Brook, and Diogenes Brook

Borehole	Sanple	Depth (m)	Unit	Quartz, undivided	Plagioclase	Calcite\Dolomite	Sedimentary clast	Fossils (Siderite plant material)	Altered ilmenite	Rutile	Pyrite	Limonite	Orthopyroxene	Amphibole	Muscovite	Zircon/Monazite	Tourmaline	Staurolite	Andalusite	Garnet	Siderite	Unknowns	# of grains counted
BB-02-1	12'	3.7	B	13.62	0.00	0.00	0.00	0.00	4.33	0.00	79.88	0.00	0.00	0.00	0.00	0.31	0.62	1.24	0.00	0.00	0.00	0.00	323
	17'	5.2	B	18.39	0.00	0.00	0.00	0.00	5.07	0.00	72.80	0.94	0.00	0.00	0.00	0.38	1.13	1.13	0.00	0.00	0.00	0.19	533
	22'	6.7	B	19.42	0.00	0.00	0.00	0.00	5.11	0.00	70.70	2.90	0.00	0.00	0.00	0.34	0.34	1.19	0.00	0.00	0.00	0.00	587
	42'	12.8	B	10.14	0.00	0.00	0.00	0.00	3.21	0.00	80.24	3.55	0.00	0.00	0.00	0.68	1.18	0.84	0.00	0.00	0.00	0.17	592
BB-02-2	16'	4.9	A	4.59	0.00	0.00	0.00	0.00	26.30	0.00	8.87	0.61	0.00	0.00	0.00	0.61	3.36	26.30	0.00	0.00	28.75	0.61	327
	26'	7.9	B	13.71	0.00	0.00	0.00	0.16	10.81	0.00	70.16	0.16	0.00	0.00	0.00	0.48	1.29	3.23	0.00	0.00	0.00	0.00	620
	66' (6-11)	20.2	B	23.18	0.00	0.00	0.00	0.00	54.58	0.00	4.11	0.00	0.00	0.00	0.00	2.06	0.75	14.02	0.00	0.00	0.00	1.31	535
	66'(66-69)	20.8	B	33.17	0.00	0.00	0.00	0.00	23.74	0.00	26.83	0.00	0.00	0.00	0.00	1.46	0.49	11.71	0.65	0.00	1.46	0.49	615
	74'	22.6	B	0.76	0.00	63.36	0.00	0.00	0.92	0.00	34.35	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.31	0.00	0.00	0.15	655
	82'(25-41)	25.2	C	26.01	0.00	0.00	0.00	0.00	20.88	0.73	41.76	0.00	0.00	0.00	0.00	0.73	0.00	6.59	0.73	0.73	0.00	1.83	273
	111'(51-55)	34.3	C	8.16	0.00	40.39	0.00	1.17	11.84	0.00	4.47	0.00	0.00	0.00	0.00	0.39	0.19	3.30	0.58	0.00	27.96	1.55	515
BB-02-5	31'(0-20)	9.4	B	7.89	0.00	7.09	0.00	0.00	3.64	0.00	0.00	16.40	0.00	0.00	0.00	0.40	1.82	7.29	0.61	0.00	54.05	0.81	494
	31'(36-41)	9.8	B	22.35	0.00	17.38	1.35	0.00	15.58	0.45	1.13	1.58	0.00	0.00	0.00	0.68	3.84	28.44	1.13	0.00	4.06	2.03	443
	31'-36'	10.2	B	12.67	0.00	29.11	1.03	0.00	15.24	0.34	0.86	9.08	0.17	0.34	0.00	1.20	1.54	6.51	0.86	0.00	20.72	0.34	584
BB-02-7	32'	9.8	B	16.67	0.00	0.00	0.00	0.00	49.13	0.00	2.81	0.43	0.43	0.00	0.00	1.30	4.33	24.46	0.22	0.00	0.00	0.22	462
	40'	12.2	B	19.71	0.00	1.60	0.00	0.00	42.34	0.00	13.18	0.00	0.00	0.00	0.00	2.26	0.93	17.44	0.53	0.13	0.93	0.93	751
	40'A	12.2	B	21.51	0.00	1.16	0.00	0.00	34.11	0.00	16.28	0.39	0.00	0.00	0.00	0.39	4.26	18.22	1.36	0.78	0.78	0.78	516
	50'	15.2	B	43.45	0.00	0.00	0.00	0.00	26.40	0.00	8.52	2.29	0.00	0.00	0.00	1.04	4.78	12.89	0.21	0.00	0.00	0.42	481
	71'(55-60)	22.2	D	1.82	0.00	35.04	0.00	0.00	1.09	0.00	61.68	0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	274
BM-02-2	34'	10.4		73.55	0.19	0.00	0.00	0.00	22.70	0.00	0.00	0.00	0.00	0.00	0.19	0.38	0.94	2.06	0.00	0.00	0.00	0.00	533
	62'	19.0		4.14	0.00	0.00	0.00	0.00	90.02	0.00	0.00	0.00	0.00	0.00	0.00	1.69	0.94	1.88	0.38	0.00	0.94	0.00	531
	64'	19.5		7.68	0.00	0.00	0.00	0.00	86.33	0.19	0.00	0.00	0.00	0.00	0.00	0.94	1.69	3.18	0.00	0.00	0.00	0.00	534
BM-02-3	21'	6.4		33.33	0.00	0.00	1.75	0.00	61.56	0.00	0.00	0.00	0.00	0.00	0.64	0.32	0.48	1.28	0.16	0.00	0.00	0.48	627
DB-97-2	DB-2 12.2m	12.2		5.00	0.00	0.00	0.00	0.00	79.75	0.50	0.00	0.00	0.00	0.00	0.00	0.50	2.75	10.75	0.75	0.00	0.00	0.00	400
	DB-3 93.4m	93.2		12.77	0.00	0.00	0.00	0.00	66.75	0.24	2.89	0.00	0.00	0.24	0.48	1.45	2.89	11.57	0.72	0.00	0.00	0.00	415

Table 4.6: Summary of point counts of detrital minerals from the heavy mineral separates.

Borehole	Sample #	Depth (m)	Unit	Plagioclase	Calcite/ Dolomite	Ilmenite	Rutile	Orthopyroxene	Amphibole	Muscovite	Zircon/ Monazite	Tourmaline	Staurolite	Andalusite	Garnet	Unknowns	# of grains counted
BB-02-1	12'	3.7	B	0.00	0.00	66.67	0.00	0.00	0.00	0.00	4.76	9.52	19.05	0.00	0.00	0.00	21
	17'	5.2	B	0.00	0.00	64.29	0.00	0.00	0.00	0.00	4.76	14.29	14.29	0.00	0.00	2.38	42
	22'	6.7	B	0.00	0.00	73.17	0.00	0.00	0.00	0.00	4.88	4.88	17.07	0.00	0.00	0.00	41
	42'	12.8	B	0.00	0.00	52.78	0.00	0.00	0.00	0.00	11.11	19.44	13.89	0.00	0.00	2.78	36
BB-02-2	16'	4.9	A	0.00	0.00	45.99	0.00	0.00	0.00	0.00	1.07	5.88	45.99	0.00	0.00	1.07	187
	26'	7.9	B	0.00	0.00	68.37	0.00	0.00	0.00	0.00	3.06	8.16	20.41	0.00	0.00	0.00	98
	66' (6-11)	20.2	B	0.00	0.00	75.06	0.00	0.00	0.00	0.00	2.83	1.03	19.28	0.00	0.00	1.80	389
	66'(66-69)	20.8	B	0.00	0.00	61.60	0.00	0.00	0.00	0.00	3.80	1.27	30.38	1.69	0.00	1.27	237
	74'	22.6	B	0.00	97.65	1.41	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0.47	0.00	0.24	425
	82'(25-41)	25.2	C	0.00	0.00	64.77	2.27	0.00	0.00	0.00	2.27	0.00	20.45	2.27	2.27	5.68	88
	111'(51-55)	34.3	C	0.00	69.33	20.33	0.00	0.00	0.00	0.00	0.67	0.33	5.67	1.00	0.00	2.67	300
BB-02-5	31'(0-20)	9.4	B	0.00	32.71	16.82	0.00	0.00	0.00	0.00	1.87	8.41	33.64	2.80	0.00	3.74	107
	31'(36-41)	9.8	B	0.00	25.00	22.40	0.65	0.00	0.00	0.00	0.97	5.52	40.91	1.62	0.00	2.92	308
	31'-36'	10.2	B	0.00	52.31	27.38	0.62	0.31	0.62	0.00	2.15	2.77	11.69	1.54	0.00	0.62	325
BB-02-7	32'	9.8	B	0.00	0.00	61.35	0.00	0.54	0.00	0.00	1.62	5.41	30.54	0.27	0.00	0.27	370
	40'	12.2	B	0.00	2.41	63.98	0.00	0.00	0.00	0.00	3.42	1.41	26.36	0.80	0.20	1.41	497
	40'A	12.2	B	0.00	1.90	55.87	0.00	0.00	0.00	0.00	0.63	6.98	29.84	2.22	1.27	1.27	315
	50'	15.2	B	0.00	0.00	57.73	0.00	0.00	0.00	0.00	2.27	10.45	28.18	0.45	0.00	0.91	220
	71'(55-60)	22.2	D	0.00	96.97	3.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	99
BM-02-2	34'	10.4		0.71	0.00	85.82	0.00	0.00	0.00	0.71	1.42	3.55	7.80	0.00	0.00	0.00	141
	62'	19.0		0.00	0.00	94.84	0.00	0.00	0.00	0.00	1.79	0.99	1.98	0.40	0.00	0.00	504
	64'	19.5		0.00	0.00	93.51	0.20	0.00	0.00	0.00	1.01	1.83	3.45	0.00	0.00	0.00	493
BM-02-3	21'	6.4		0.00	0.00	94.84	0.00	0.00	0.00	0.98	0.49	0.74	1.97	0.25	0.00	0.74	407
DB-97-2	DB-2 12.2m	12.2		0.00	0.00	83.95	0.53	0.00	0.00	0.00	0.53	2.89	11.32	0.79	0.00	0.00	380
	DB-3 93.4m	93.2		0.00	0.00	79.14	0.29	0.00	0.29	0.57	1.71	3.43	13.71	0.86	0.00	0.00	350

Table 4.7
Gross regional variation in principal heavy minerals

Locality	Strat. level	Dominant heavy minerals (%) in 0.25 - 0.063 mm fraction					Notes
		Ilm. etc	Zrn+ Mon	Staur	Tourm	Cal + Dol	
Vinegar Hill		35	2.5	20	2		
Diogenes Bk	high	80	1	11	3		
	deep	80	1	13	3		
Belmont	mid	86	1	8	4		
	high, deep	95	2	2	1		
Brierly Brook	A	46	1	46	6		
	top B	55 to 75	4	15 to 30	5 to 8	low	
	deep B, C, D					25 to 95	just dilutes everything with carbonate, varying staur/ilm ratio
RR-97-23	U6	85	3	7	3		
	U2	84	3	6	4		
	L	86	1	7	3		
WIRP	2.5 to 3.0 ϕ	87	0	6	6		
	3.0 to 3.5 ϕ	87	2	3	6		
	3.5 to 4.0 ϕ	90	1	3	3		
Shubenacadie	U. Mbr	75	4	7	8		
Shubenacadie	L. Mbr	50	4	3	8	0 to 35	

Table 4.8: Electron microprobe chemical analyses of representative minerals from heavy mineral separates of sand(stone)s for Belmont.

Borehole	Sample	Depth (m)	Mineral	Analysis no.*	SiO_2	TiO_2	$Al2O_3$	Cr_2O_3	FeO_t	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	ZrO_2	BaO	Total
BM-02-2	~16'	~4.92	Goethite	526	3.24	0.22	0.38	0.06	81.54	0.32	0.14	0.29	0.03	0.00	0.02	0.00	0.04	86.31
BM-02-2	~16'	~4.88	Altered Ilm.	522	0.28	75.33	0.83	0.26	17.38	0.38	0.09	0.18	0.00	0.00	0.28	0.00	0.00	96.94
BM-02-2	~16'	~4.89	Altered Ilm.	524	0.23	70.27	0.64	0.15	20.25	1.88	0.07	0.14	0.00	0.00	0.27	0.00	0.00	95.85
BM-02-2	~16'	~4.90	Altered Ilm.	529	0.57	73.32	1.98	0.34	16.76	0.19	0.11	0.28	0.01	0.00	0.21	0.13	0.00	95.79
BM-02-2	~16'	~4.91	Altered Ilm.	530	0.21	82.74	0.20	0.06	12.58	0.21	0.65	0.06	0.01	0.00	0.06	0.17	0.00	99.00
BM-02-2	26'(66-72)	8.59	Altered Ilm.	518	0.06	64.88	0.29	0.09	27.54	2.10	0.07	0.03	0.00	0.00	0.06	0.00	0.00	96.98
BM-02-2	34'	10.36	Altered Ilm.	308	0.00	62.35	0.44	0.15	25.97	1.46	0.10	0.08	0.00	0.00	0.14	0.21	0.00	92.05
BM-02-2	34'	10.36	Altered Ilm.	310	0.00	62.98	0.44	0.16	24.87	1.84	0.08	0.08	0.01	0.00	0.13	0.17	0.00	91.92
BM-02-2	34'	10.36	Altered Ilm.	311	18.77	51.71	0.46	0.06	14.87	4.44	0.02	0.01	0.01	0.00	0.15	0.13	0.00	91.53
BM-02-2	~16'	~4.93	Magnetite	531	5.95	9.94	1.07	0.17	69.47	0.86	0.27	4.51	0.04	0.00	0.01	0.00	0.25	92.57
BM-02-2	64'	19.51	Staurolite	495	26.60	0.35	54.07	0.04	13.61	0.48	1.49	0.00	0.00	0.00	0.00	0.00	0.01	96.66
BM-02-2	~16'	~4.94	Tourmaline	528	34.27	0.55	27.76	0.00	15.73	0.08	1.15	0.00	2.53	0.00	0.00	0.00	0.00	82.07
BM-02-2	34'	10.36	Tourmaline	307	34.52	0.78	32.53	0.04	6.20	0.00	5.92	0.41	1.77	0.00	0.00	0.00	0.00	82.17
BM-02-2	~16'	~4.95	Zircon	527	33.77	0.06	0.09	0.08	0.19	0.10	0.07	0.02	0.09	0.00	0.20	64.06	0.11	98.90
BM-02-2	26'(66-72)	8.59	Zircon	521	33.54	0.10	0.07	0.13	0.28	0.11	0.07	0.04	0.09	0.01	0.14	64.02	0.14	98.71
BM-02-2	34'	10.36	Zircon	315	31.44	0.19	0.08	0.11	0.26	0.16	0.07	0.05	0.07	0.00	0.25	68.28	0.32	101.40
BM-02-2	62'	18.9	Zircon	500	32.27	0.22	0.07	0.11	0.20	0.16	0.07	0.07	0.08	0.00	0.17	67.61	0.40	101.54
BM-02-2	62'	18.9	Zircon	501	31.39	0.16	0.10	0.10	0.19	0.15	0.06	0.05	0.10	0.00	0.17	67.50	0.31	100.41
BM-02-2	62'	18.9	Zircon	506	30.16	0.23	0.08	0.11	0.22	0.16	0.08	0.05	0.08	0.00	0.29	67.27	0.39	99.21
BM-02-2	64'	19.51	Zircon	474	32.28	0.26	0.08	0.14	0.25	0.16	0.07	0.05	0.10	0.00	0.33	67.91	0.49	102.25
BM-02-2	64'	19.51	Zircon	479	31.67	0.26	0.07	0.14	0.20	0.16	0.07	0.04	0.10	0.00	0.15	67.65	0.45	101.08
BM-02-3	21'	6.4	Altered Ilm.	325	0.83	68.78	0.88	0.07	23.44	0.82	0.04	0.05	0.00	0.16	0.14	0.21	0.00	96.54
BM-02-3	21'	6.4	Altered Ilm.	326	0.04	71.12	0.18	0.05	22.11	1.16	0.01	0.03	0.00	0.00	0.20	0.21	0.00	96.33
BM-02-3	21'	6.4	Altered Ilm.	329	0.00	61.27	0.02	0.10	35.05	1.78	0.04	0.04	0.00	0.00	0.03	0.22	0.00	99.59
BM-02-3	21'	6.4	Staurolite	319	24.73	0.33	54.74	0.03	13.46	0.46	1.30	0.00	0.00	0.00	0.01	0.00	0.04	95.11

* = Microprobe laboratory identifier

Ilm = Ilmenite

Table 4.9: Electron microprobe chemical analysis of representative minerals from heavy mineral separates of sand(stone)s for Brierly Brook.

Borehole	Sample	Depth (m)	Unit	Mineral	Analysis no.*	SiO_2	TiO_2	$Al2O_3$	Cr_2O_3	FeO_t	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	ZrO_2	BaO	Total
N/A	95-1-4	Surface	A	Andalusite	187	36.32	0.00	63.23	0.00	0.19	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.04	99.81
N/A	95-1-4	Surface	A	Clinopyroxene	190	52.66	0.38	1.80	0.35	7.56	0.20	18.77	19.53	0.18	0.00	0.00	0.00	0.07	101.53
N/A	95-1-4	Surface	A	Altered Ilm.	169	0.17	72.35	0.69	0.20	18.67	1.28	0.06	0.30	0.01	0.00	0.17	0.22	0.00	96.69
N/A	95-1-4	Surface	A	Altered Ilm.	171	0.06	70.77	0.39	0.12	23.68	1.38	0.09	0.20	0.00	0.00	0.16	0.17	0.00	99.40
N/A	95-1-4	Surface	A	Altered Ilm.	172	0.12	72.40	0.59	0.07	18.74	2.58	0.03	0.29	0.00	0.00	0.21	0.21	0.00	97.70
N/A	95-1-4	Surface	A	Altered Ilm.	183	0.00	67.41	0.28	0.12	27.51	0.74	0.25	0.18	0.00	0.00	0.06	0.37	0.00	99.18
N/A	95-1-4	Surface	A	Altered Ilm.	191	0.09	70.78	0.48	0.15	21.94	1.19	0.08	0.23	0.00	0.00	0.14	0.24	0.00	97.63
N/A	95-1-4	Surface	A	Limonite	170	3.25	0.23	1.18	0.11	76.52	0.29	0.24	0.67	0.00	0.00	0.43	0.31	0.34	83.81
N/A	95-1-4	Surface	A	Limonite	179	2.30	0.13	0.41	0.06	71.03	0.19	0.16	0.45	0.00	0.00	0.29	0.23	0.31	75.83
N/A	95-1-4	Surface	A	Limonite	188	4.97	0.18	0.94	0.10	75.19	0.24	0.11	0.99	0.01	0.00	0.45	0.29	0.44	84.33
N/A	95-1-4	Surface	A	Rutile	184	2.02	90.43	1.35	0.49	1.13	0.05	0.11	0.13	0.00	0.27	0.05	0.14	0.00	98.84
N/A	95-1-4	Surface	A	Siderite	177	5.70	0.17	4.66	0.01	51.89	0.06	0.07	0.13	0.00	0.16	0.05	0.09	0.21	63.39
N/A	95-1-4	Surface	A	Staurolite	173	27.16	0.57	55.05	0.05	14.17	0.06	1.35	0.00	0.02	0.00	0.00	0.00	0.14	98.57
N/A	95-1-4	Surface	A	Staurolite	174	26.12	0.41	57.08	0.00	13.20	0.17	1.41	0.00	0.00	0.00	0.00	0.00	0.11	98.50
N/A	95-1-4	Surface	A	Staurolite	175	27.41	0.62	54.93	0.04	13.92	0.20	1.69	0.00	0.02	0.00	0.00	0.00	0.06	98.90
N/A	95-1-4	Surface	A	Staurolite	176	26.06	0.38	56.74	0.04	14.30	0.15	1.05	0.00	0.01	0.00	0.00	0.00	0.10	98.83
N/A	95-1-4	Surface	A	Staurolite	181	26.96	0.47	54.61	0.02	13.46	0.33	1.49	0.00	0.05	0.00	0.00	0.00	0.06	97.46
N/A	95-1-4	Surface	A	Staurolite	185	27.25	0.38	54.37	0.03	12.85	0.11	1.29	0.01	0.12	0.00	0.00	0.00	0.10	96.51
N/A	95-1-4	Surface	A	Tourmaline	168	35.37	0.89	34.48	0.02	6.27	0.02	6.48	0.90	1.67	0.00	0.00	0.00	0.09	86.18
N/A	95-1-4	Surface	A	Tourmaline	180	34.96	0.81	33.91	0.00	9.11	0.06	4.42	0.46	2.01	0.00	0.00	0.00	0.07	85.81
N/A	95-1-4	Surface	A	Zircon	182	33.79	0.22	0.07	0.12	0.24	0.15	0.06	0.08	0.06	0.00	0.12	65.94	0.51	101.47
N/A	95-1-4	Surface	A	Zircon	186	33.64	0.22	0.07	0.12	0.26	0.13	0.07	0.09	0.05	0.00	0.13	66.61	0.46	101.97
N/A	95-1-4	Surface	A	Zircon	189	33.83	0.23	0.08	0.13	0.23	0.16	0.08	0.07	0.05	0.00	0.13	66.45	0.45	101.97
BB-02-1	22'	6.71	B	Garnet (alm)	260	36.37	0.26	20.93	0.03	28.11	7.94	2.29	2.08	0.03	0.00	0.05	0.07	0.10	98.28
BB-02-1	22'	6.71	B	Garnet (alm)	261	36.12	0.09	20.85	0.04	29.03	8.13	2.35	1.23	0.02	0.00	0.03	0.06	0.18	98.14
BB-02-1	22'	6.71	B	Garnet (alm)	262	36.44	0.14	20.90	0.04	32.17	5.42	2.27	1.40	0.00	0.00	0.01	0.02	0.12	98.94
BB-02-1	22'	6.71	B	Garnet (alm)	263	36.53	0.09	21.05	0.05	32.13	5.55	2.23	1.43	0.01	0.00	0.01	0.05	0.14	99.31
BB-02-1	42'	20.8	B	Garnet (sps)	427	36.69	0.13	20.77	0.06	22.10	16.66	0.95	2.77	0.02	0.00	0.01	0.01	0.10	100.28
BB-02-1	22'	6.71	B	Altered Ilm.	257	2.61	88.23	1.37	0.19	2.47	0.06	0.00	0.29	0.02	0.00	0.44	0.37	0.00	98.20
BB-02-1	22'	6.71	B	Altered Ilm.	259	0.02	68.35	0.54	0.20	23.66	1.42	0.07	0.05	0.02	0.00	0.19	0.24	0.00	96.64
BB-02-1	22'	6.71	B	Altered Ilm.	264	0.06	72.71	0.54	0.17	17.92	3.34	0.22	0.07	0.00	0.00	0.18	0.25	0.00	97.33
BB-02-1	22'	6.71	B	Altered Ilm.	265	0.08	74.74	0.62	0.23	15.33	0.48	1.28	0.03	0.00	0.00	0.22	0.20	0.00	95.20
BB-02-1	22'	6.71	B	Altered Ilm.	268	0.03	68.55	0.55	0.19	21.88	1.26	0.08	0.05	0.02	0.00	0.19	0.29	0.00	95.15
BB-02-1	22'	6.71	B	Altered Ilm.	269	0.00	69.03	0.47	0.26	22.15	0.75	0.23	0.03	0.01	0.00	0.15	0.30	0.00	94.99
BB-02-1	42'	12.8	B	Altered Ilm.	428	0.00	63.35	0.35	0.12	29.51	0.48	0.12	0.05	0.00	0.00	0.14	0.14	0.00	95.98
BB-02-1	42'	13.8	B	Altered Ilm.	431	0.00	69.46	0.44	0.14	22.47	0.68	0.07	0.05	0.01	0.00	0.12	0.21	0.00	95.14
BB-02-1	42'	14.8	B	Altered Ilm.	433	0.21	75.98	0.86	0.37	14.77	0.42	0.31	0.07	0.00	0.00	0.36	0.26	0.00	96.48
BB-02-1	42'	15.8	B	Altered Ilm.	438	0.00	68.16	0.51	0.14	21.09	1.12	0.23	0.03	0.00	0.00	0.13	0.19	0.00	93.28
BB-02-1	42'	16.8	B	Altered Ilm.	442	0.09	69.72	1.04	0.12	20.55	0.61	0.18	0.04	0.01	0.00	0.18	0.26	0.00	95.54
BB-02-1	42'	17.8	B	Altered Ilm.	444	0.27	78.82	1.41	0.42	11.86	0.31	0.64	0.07	0.00	0.00	0.43	0.39	0.00	97.10
BB-02-1	42'	18.8	B	Altered Ilm.	445	0.00	64.63	0.35	0.16	25.47	3.05	0.06	0.05	0.00	0.00	0.14	0.25	0.00	95.74

Table 4.9: Electron microprobe chemical analysis of representative minerals from heavy mineral separates of sand(stone)s for Brierly Brook.

Borehole	Sample	Depth (m)	Unit	Mineral	Analysis no.*	SiO_2	TiO_2	$Al2O_3$	Cr_2O_3	FeO_t	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	ZrO_2	BaO	Total
BB-02-1	42'	19.8	B	Altered Ilm.	446	0.19	87.73	1.50	0.38	5.21	0.07	0.10	0.05	0.00	0.00	0.55	0.53	0.00	99.37
BB-02-1	42'	21.8	B	Rutile	432	0.62	95.98	0.44	0.09	1.04	0.04	0.02	0.07	0.02	0.06	0.06	0.15	0.00	100.00
BB-02-1	22'	6.71	B	Staurolite	253	26.04	0.39	53.63	0.00	14.34	0.08	1.24	0.00	0.01	0.00	0.00	0.00	0.07	95.80
BB-02-1	22'	6.71	B	Staurolite	258	25.56	0.33	54.58	0.05	13.54	0.21	1.04	0.00	0.03	0.00	0.00	0.00	0.08	95.41
BB-02-1	42'	22.8	B	Staurolite	435	26.53	0.40	52.47	0.02	14.26	0.20	1.43	0.00	0.00	0.00	0.02	0.00	0.00	95.33
BB-02-1	42'	23.8	B	Staurolite	440	27.08	0.56	53.18	0.02	12.35	0.28	1.58	0.00	0.02	0.00	0.00	0.00	0.01	95.09
BB-02-1	42'	24.8	B	Staurolite	443	26.60	0.44	52.62	0.03	14.24	0.11	1.31	0.00	0.01	0.00	0.00	0.00	0.07	95.42
BB-02-1	12'	3.66	B	Tourmaline	624	35.92	0.50	31.25	0.00	7.98	0.09	4.62	0.16	2.08	0.00	0.00	0.00	0.04	82.64
BB-02-1	22'	6.71	B	Tourmaline	252	35.04	0.78	33.06	0.01	6.22	0.00	6.04	0.37	1.91	0.00	0.00	0.00	0.00	83.44
BB-02-1	22'	6.71	B	Tourmaline	256	34.11	0.74	33.77	0.00	10.27	0.08	2.54	0.24	1.74	0.00	0.02	0.00	0.07	83.59
BB-02-2	66'(66-69)	20.78	B	Calcite	604	0.25	41.81	0.57	0.06	19.33	3.88	0.05	0.32	0.00	0.00	0.17	0.01	1.75	68.27
BB-02-2	71'(55-60)	22.19	B	Calcite	620	0.00	0.06	0.00	0.01	0.13	0.05	0.50	58.10	0.04	0.02	0.06	0.20	0.15	59.68
BB-02-2	71'(55-60)	22.19	B	Calcite	622	0.00	0.03	0.00	0.02	0.16	0.17	0.59	58.79	0.03	0.01	0.02	0.25	0.10	60.34
BB-02-2	71'(55-60)	22.19	B	Calcite	623	0.00	0.01	0.00	0.02	0.16	0.06	0.83	60.72	0.05	0.02	0.05	0.26	0.12	62.54
BB-02-2	71'(88-95)	22.52	B	Calcite	464	0.00	0.00	0.00	0.00	0.01	0.01	1.24	60.55	0.04	0.00	0.03	0.07	0.08	62.40
BB-02-2	71'(88-95)	22.52	B	Calcite	465	0.00	0.00	0.00	0.00	0.01	0.00	0.99	59.66	0.25	0.00	0.04	0.09	0.02	61.29
BB-02-2	71'(88-95)	22.52	B	Calcite	466	0.00	0.00	0.00	0.00	0.00	0.00	0.51	56.31	0.00	0.00	0.03	0.05	0.02	57.00
BB-02-2	71'(88-95)	22.52	B	Calcite	467	0.00	0.00	0.06	0.01	0.04	0.00	0.78	56.70	0.02	0.00	0.05	0.02	0.08	57.97
BB-02-2	74'	22.56	B	Calcite	391	0.00	0.00	0.00	0.01	0.01	0.03	0.34	59.79	0.00	0.00	0.01	0.12	0.00	60.34
BB-02-2	74'	22.56	B	Calcite	396	0.00	0.00	0.00	0.01	0.09	0.00	0.67	56.80	0.01	0.00	0.03	0.19	0.00	58.05
BB-02-2	74'	22.56	B	Calcite	397	0.00	0.00	0.02	0.00	0.07	0.01	0.45	55.24	0.00	0.00	0.05	0.10	0.00	56.23
BB-02-2	74'	22.56	B	Calcite	398	0.00	0.00	0.00	0.03	0.07	0.01	0.66	62.11	0.00	0.00	0.01	0.02	0.00	63.02
BB-02-2	66' (6-11)	20.18	B	Altered Ilm.	402	0.00	70.32	0.26	0.11	23.11	1.38	0.06	0.10	0.02	0.00	0.10	0.25	0.00	96.85
BB-02-2	66' (6-11)	20.18	B	Altered Ilm.	404	0.00	68.64	0.32	0.14	23.97	0.60	0.03	0.17	0.02	0.00	0.14	0.23	0.00	95.44
BB-02-2	66' (6-11)	20.18	B	Altered Ilm.	405	0.21	71.85	0.84	0.17	18.66	1.28	0.07	0.19	0.02	0.00	0.32	0.35	0.00	95.13
BB-02-2	66' (6-11)	20.18	B	Altered Ilm.	409	0.00	66.90	0.32	0.14	23.03	1.66	0.08	0.21	0.02	0.00	0.13	0.36	0.00	93.93
BB-02-2	66' (6-11)	20.18	B	Altered Ilm.	414	0.00	67.34	0.30	0.12	21.96	2.84	0.04	0.21	0.01	0.00	0.18	0.22	0.00	94.37
BB-02-2	66' (6-11)	20.18	B	Altered Ilm.	415	0.07	70.98	0.42	0.12	20.23	1.15	0.12	0.23	0.00	0.00	0.19	0.21	0.00	94.93
BB-02-2	66' (6-11)	20.18	B	Altered Ilm.	417	0.00	60.35	0.07	0.07	31.61	0.91	1.64	0.05	0.00	0.00	0.04	0.42	0.00	96.08
BB-02-2	66' (6-11)	20.18	B	Altered Ilm.	418	2.79	66.53	2.70	0.10	19.77	0.92	0.08	0.21	0.14	0.45	0.16	0.20	0.00	95.21
BB-02-2	66' (6-11)	20.18	B	Altered Ilm.	419	0.00	65.46	0.15	0.16	27.17	0.74	0.22	0.13	0.00	0.00	0.11	0.19	0.00	95.34
BB-02-2	66' (6-11)	20.18	B	Altered Ilm.	423	0.02	68.73	0.52	0.15	22.32	1.25	0.12	0.17	0.01	0.00	0.21	0.26	0.00	94.93
BB-02-2	111'(51-55)	34.34	C	Altered Ilm.	336	0.24	70.49	0.56	0.14	18.99	1.08	0.05	0.27	0.09	0.00	0.15	0.26	0.00	93.25
BB-02-2	111'(51-55)	34.34	C	Altered Ilm.	342	3.95	78.81	2.86	0.07	2.89	0.05	0.12	0.35	0.07	0.66	0.18	0.20	0.00	91.26
BB-02-2	111'(51-55)	34.34	C	Altered Ilm.	343	0.08	68.58	0.29	0.13	22.46	1.83	0.04	0.17	0.04	0.00	0.13	0.26	0.00	94.98
BB-02-2	111'(51-55)	34.34	C	Altered Ilm.	355	0.04	64.62	0.29	0.13	24.19	0.82	0.40	0.16	0.01	0.00	0.08	0.26	0.00	92.15
BB-02-2	111'(51-55)	34.34	C	Altered Ilm.	357	0.00	59.48	0.12	0.05	30.78	2.70	0.92	0.10	0.02	0.00	0.04	0.57	0.00	95.74
BB-02-2	111'(51-55)	34.34	C	Altered Ilm.	358	0.17	69.08	0.43	0.15	21.29	0.60	0.05	0.29	0.07	0.00	0.11	0.29	0.00	93.63
BB-02-2	111'(51-55)	34.34	C	Altered Ilm.	360	0.00	67.41	0.30	0.06	24.28	1.22	0.10	0.15	0.06	0.00	0.10	0.22	0.00	94.99
BB-02-2	111'(51-55)	34.34	C	Limonite	337	2.26	0.18	0.06	0.05	74.85	0.11	0.28	0.67	0.14	0.00	0.09	0.26	0.31	79.65
BB-02-2	111'(51-55)	34.34	C	Limonite	340	2.26	0.13	0.05	0.05	73.56	0.15	0.22	0.53	0.03	0.00	0.05	0.27	0.19	77.76

Table 4.9: Electron microprobe chemical analysis of representative minerals from heavy mineral separates of sand(stone)s for Brierly Brook.

Borehole	Sample	Depth (m)	Unit	Mineral	Analysis no.*	SiO_2	TiO_2	$Al2O_3$	Cr_2O_3	FeO_t	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	ZrO_2	BaO	Total
BB-02-2	111'(51-55)	34.34	C	Limonite	353	3.03	0.15	0.14	0.06	71.59	0.10	0.34	0.79	0.32	0.00	0.10	0.30	0.23	77.34
BB-02-2	111'(51-55)	34.34	C	Limonite	356	6.36	0.24	0.09	0.06	73.12	0.14	0.23	0.51	0.04	0.00	0.05	0.23	0.23	81.49
BB-02-2	111'(51-55)	34.34	C	Limonite	359	2.28	0.16	0.09	0.06	75.92	0.11	0.20	0.57	0.40	0.00	0.07	0.26	0.23	80.48
BB-02-2	66' (6-11)	20.18	B	Rutile	412	0.00	97.68	0.03	0.08	0.53	0.03	0.00	0.02	0.00	0.00	0.02	0.24	0.00	100.00
BB-02-2	74'	22.56	B	Siderite	395	0.00	0.04	0.90	9.87	44.99	0.71	0.18	0.35	0.11	0.00	0.06	0.02	0.04	57.55
BB-02-2	66' (6-11)	20.18	B	Staurolite	416	27.18	0.37	53.57	0.01	13.78	0.14	1.55	0.00	0.02	0.00	0.00	0.00	0.08	96.69
BB-02-2	66' (6-11)	20.18	B	Zircon	403	32.27	0.19	0.07	0.10	0.18	0.16	0.06	0.08	0.09	0.00	0.15	66.32	0.26	100.00
BB-02-2	66' (6-11)	20.18	B	Zircon	421	33.12	0.19	0.09	0.10	0.19	0.17	0.07	0.07	0.08	0.00	0.18	67.47	0.36	102.14
BB-02-2	66'(66-69)	20.78	B	Zircon	594	30.76	0.19	0.05	0.15	0.20	0.12	0.07	0.06	0.08	0.00	0.17	68.12	0.36	100.47
BB-02-2	82'(25-41)	25.24	B	Zircon	559	33.58	0.08	0.08	0.08	0.24	0.08	0.08	0.04	0.08	0.00	0.14	66.81	0.19	101.49
BB-02-2	111'(51-55)	34.34	C	Zircon	339	29.88	0.24	0.06	0.13	0.32	0.12	0.08	0.09	0.08	0.00	0.14	67.32	0.21	98.80
BB-02-2	111'(51-55)	34.34	C	Zircon	344	30.46	0.21	0.04	0.12	0.29	0.13	0.06	0.05	0.10	0.00	0.15	67.87	0.30	99.88
BB-02-2	111'(51-55)	34.34	C	Zircon	345	28.88	0.18	0.06	0.12	0.23	0.13	0.06	0.05	0.08	0.00	0.16	67.66	0.24	97.94
BB-02-5	31'(36-41)	9.81	B	Hematite	375	0.42	0.34	0.27	0.14	86.74	0.32	0.01	0.11	0.00	0.00	0.04	0.31	0.17	88.88
BB-02-5	31'(0-20)	9.45	B	Altered Ilm.	450	0.08	64.08	0.46	0.21	26.40	0.54	0.33	0.18	0.00	0.00	0.10	0.17	0.00	93.68
BB-02-5	31'(0-20)	9.45	B	Altered Ilm.	454	0.14	63.07	0.43	0.12	25.95	2.71	0.06	0.21	0.02	0.00	0.20	0.31	0.00	94.08
BB-02-5	31'(36-41)	9.81	B	Altered Ilm.	368	0.60	82.68	1.67	0.30	9.51	0.61	0.29	0.67	0.06	0.00	0.37	0.31	0.00	98.50
BB-02-5	31'(36-41)	9.81	B	Altered Ilm.	370	0.17	60.98	0.55	0.29	28.29	0.54	0.90	0.14	0.02	0.00	0.05	0.21	0.00	93.14
BB-02-5	31'(36-41)	9.81	B	Altered Ilm.	384	0.15	62.55	0.44	0.10	28.84	0.87	0.04	0.23	0.03	0.00	0.10	0.23	0.00	94.43
BB-02-5	31'(36-41)	9.81	B	Altered Ilm.	386	0.16	65.77	0.47	0.21	24.45	0.67	0.10	0.29	0.02	0.00	0.16	0.20	0.00	93.41
BB-02-5	31'(36-41)	9.81	B	Altered Ilm.	387	0.07	64.69	0.47	0.13	28.01	2.22	0.07	0.20	0.05	0.00	0.11	0.19	0.00	97.12
BB-02-5	31'-36'	10.21	B	Altered Ilm.	275	0.00	66.49	0.25	0.14	23.91	3.24	0.06	0.15	0.00	0.00	0.11	0.23	0.00	95.80
BB-02-5	31'-36'	10.21	B	Altered Ilm.	281	0.40	73.48	0.91	0.17	17.81	1.29	0.07	0.49	0.04	0.00	0.26	0.27	0.00	96.53
BB-02-5	31'-36'	10.21	B	Altered Ilm.	285	0.34	65.73	0.78	0.14	24.53	1.65	0.05	0.40	0.02	0.00	0.21	0.22	0.00	95.41
BB-02-5	31'-36'	10.21	B	Altered Ilm.	290	0.00	64.73	0.24	0.11	26.05	3.50	0.05	0.16	0.00	0.00	0.09	0.24	0.00	96.34
BB-02-5	31'(0-20)	9.45	B	Limonite	451	6.17	0.12	1.99	0.06	66.64	0.11	0.27	0.40	0.01	0.29	0.18	0.15	0.22	76.71
BB-02-5	31'(0-20)	9.45	B	Limonite	452	3.10	0.14	0.25	0.04	72.32	0.18	0.20	0.61	0.00	0.00	0.29	0.21	0.18	77.66
BB-02-5	31'(0-20)	9.45	B	Limonite	453	4.07	0.13	1.06	0.07	72.43	0.14	0.14	0.99	0.06	0.00	0.29	0.21	0.26	80.09
BB-02-5	31'(36-41)	9.81	B	Limonite	372	2.57	0.12	0.23	0.07	77.45	0.51	0.09	0.59	0.23	0.00	0.28	0.24	0.21	82.79
BB-02-5	31'(36-41)	9.81	B	Limonite	374	2.68	0.14	0.48	0.07	73.68	0.29	0.09	0.68	0.19	0.01	0.23	0.20	0.23	79.25
BB-02-5	31'(36-41)	9.81	B	Limonite	385	3.77	0.14	0.59	0.09	72.72	0.17	0.12	0.66	0.07	0.00	0.28	0.21	0.13	79.10
BB-02-5	31'-36'	10.21	B	Limonite	273	2.48	0.25	0.19	0.05	70.45	0.13	0.17	0.29	0.00	0.00	0.13	0.19	0.17	74.62
BB-02-5	31'-36'	10.21	B	Limonite	276	2.37	0.13	0.20	0.08	73.14	0.15	0.26	0.57	0.00	0.00	0.28	0.24	0.23	77.73
BB-02-5	31'-36'	10.21	B	Limonite	279	2.37	0.13	0.18	0.07	74.34	0.36	0.19	0.35	0.00	0.00	0.22	0.24	0.21	78.72
BB-02-5	31'-36'	10.21	B	Limonite	280	2.74	0.29	0.14	0.07	71.57	0.56	0.16	0.46	0.00	0.00	0.30	0.18	0.25	76.85
BB-02-5	31'-36'	10.21	B	Limonite	289	1.51	0.10	0.26	0.07	70.54	0.23	0.31	0.53	0.00	0.00	0.27	0.22	0.21	74.65
BB-02-5	31'-36'	10.21	B	Limonite	291	3.27	0.12	0.40	0.07	70.53	0.19	0.11	0.46	0.04	0.00	0.24	0.17	0.22	76.16
BB-02-5	31'-36'	10.21	B	Limonite	298	2.19	0.09	0.18	0.07	72.89	0.13	0.18	0.53	0.01	0.00	0.22	0.23	0.25	77.03
BB-02-5	31'(36-41)	9.81	B	Magnetite	366	0.71	13.44	1.26	0.11	73.53	3.78	0.09	1.05	0.03	0.00	0.05	0.28	0.37	94.73
BB-02-5	31'(36-41)	9.81	B	Magnetite	383	1.57	13.60	1.24	0.09	72.38	3.61	0.10	1.72	0.03	0.00	0.05	0.23	0.29	94.94
BB-02-5	31'(0-20)	9.45	B	Rutile	449	0.07	96.33	0.58	0.28	0.90	0.06	0.00	0.24	0.00	0.00	0.21	0.21	0.00	100.26

Table 4.9: Electron microprobe chemical analysis of representative minerals from heavy mineral separates of sand(stone)s for Brierly Brook.

Borehole	Sample	Depth (m)	Unit	Mineral	Analysis no.*	SiO_2	TiO_2	$Al2O_3$	Cr_2O_3	FeO_t	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	ZrO_2	BaO	Total
BB-02-5	31'(0-20)	9.45	B	Rutile	456	0.00	97.58	0.04	0.08	0.84	0.02	0.00	0.03	0.00	0.00	0.03	0.13	0.00	100.00
BB-02-5	31'-36'	10.21	B	Rutile	282	0.00	96.92	0.21	0.05	0.70	0.05	0.01	0.07	0.00	0.00	0.02	0.11	0.00	99.65
BB-02-5	31'(36-41)	9.81	B	Siderite	379	8.10	0.13	7.54	0.10	59.47	0.10	0.46	0.41	0.07	0.70	0.57	0.32	0.14	78.14
BB-02-5	31'(0-20)	9.45	B	Staurolite	455	26.28	0.41	52.75	0.01	13.84	0.18	1.50	0.00	0.01	0.00	0.00	0.00	0.03	95.02
BB-02-5	31'(36-41)	9.81	B	Staurolite	376	27.06	0.65	53.11	0.04	13.92	0.17	1.55	0.00	0.00	0.00	0.00	0.00	0.00	96.52
BB-02-5	31'(36-41)	9.81	B	Staurolite	377	27.15	0.65	52.97	0.04	13.99	0.15	1.54	0.00	0.00	0.00	0.00	0.00	0.00	96.49
BB-02-5	31'(36-41)	9.81	B	Staurolite	378	27.06	0.64	53.42	0.04	13.63	0.24	1.73	0.00	0.00	0.00	0.00	0.00	0.00	96.77
BB-02-5	31'-36'	10.21	B	Staurolite	284	26.83	0.44	52.63	0.02	13.70	0.16	1.48	0.00	0.01	0.00	0.01	0.00	0.04	95.32
BB-02-5	31'-36'	10.21	B	Staurolite	294	27.10	0.55	52.97	0.06	13.71	0.12	1.41	0.00	0.00	0.00	0.01	0.00	0.07	96.00
BB-02-5	31'-36'	10.21	B	Tourmaline	277	34.62	0.91	33.56	0.02	6.53	0.03	5.35	0.54	1.59	0.00	0.00	0.00	0.04	83.19
BB-02-5	31'-36'	10.21	B	Tourmaline	296	33.80	0.09	33.41	0.00	13.51	0.33	0.99	0.11	1.69	0.00	0.01	0.00	0.00	83.95
BB-02-5	31'-36'	10.21	B	Tourmaline	300	35.15	0.32	33.06	0.00	8.17	0.08	4.69	0.16	1.95	0.00	0.01	0.00	0.04	83.62
BB-02-5	31'-36'	10.21	B	Tourmaline	301	35.02	0.68	32.96	0.03	6.64	0.00	5.97	0.28	1.94	0.00	0.00	0.00	0.03	83.54
BB-02-7	40'A	12.19	A	Chlorite	545	20.89	0.00	17.15	0.00	37.70	0.46	5.40	0.00	0.09	0.00	1.22	0.00	0.00	83.31
BB-02-7	40'A	12.19	A	Tourmaline	547	33.70	0.38	27.96	0.00	16.73	0.22	0.78	0.15	2.34	0.00	0.00	0.00	0.00	82.27
BB-02-7	32'	9.75	A	Zircon	571	33.95	0.12	0.07	0.12	0.16	0.09	0.08	0.02	0.09	0.00	0.14	64.36	0.16	99.37
BB-02-7	40'A	12.19	A	Zircon	551	33.75	0.08	0.06	0.07	0.20	0.10	0.05	0.01	0.09	0.00	0.15	64.25	0.14	99.00
BB-02-7	40'A	12.19	A	Zircon	552	33.57	0.07	0.06	0.10	0.17	0.08	0.06	0.00	0.10	0.00	0.19	64.96	0.14	99.55
BB-02-7	40'A	12.19	A	Zircon	553	33.67	0.03	0.06	0.06	0.19	0.08	0.04	0.01	0.09	0.00	0.14	64.67	0.15	99.27
BB-02-7	40'B	12.19	A	Zircon	588	32.95	0.16	0.08	0.11	0.26	0.10	0.08	0.04	0.06	0.00	0.16	67.56	0.24	101.86

* = Microprobe laboratory identifier
alm = almandine
sps = spessartine
Ilm = Ilmenite

Table 4.10: Electron microprobe chemical analysis of representative minerals from heavy mineral separates of sand(stone)s for Diogenes Brook.

Borehole	Sample	Depth (m)	Mineral	Analysis no.*	SiO_2	TiO_2	$Al2O_3$	Cr_2O_3	FeO_t	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	ZrO_2	BaO	Total
DB-97-2	DB-2	12.2	Andalusite	111	36.38	0.00	63.47	0.00	0.17	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	100.05
DB-97-2	DB-2	12.2	Andalusite	117	36.99	0.00	63.36	0.01	0.24	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	100.61
DB-97-2	DB-2	12.2	Altered Ilm.	128	0.45	60.03	0.48	0.24	29.89	3.30	0.27	0.21	0.16	0.10	0.13	0.83	0.00	99.00
DB-97-2	DB-2	12.2	Altered Ilm.	105	0.44	62.85	0.40	0.23	28.97	1.77	0.22	0.22	0.16	0.13	0.11	0.62	0.00	99.00
DB-97-2	DB-2	12.2	Altered Ilm.	106	0.80	72.25	0.82	0.62	17.23	1.83	0.43	0.36	0.12	0.10	0.26	0.76	0.00	99.00
DB-97-2	DB-2	12.2	Altered Ilm.	107	0.46	61.82	0.46	0.21	28.94	1.22	1.53	0.21	0.15	0.11	0.10	0.94	0.00	99.00
DB-97-2	DB-2	12.2	Altered Ilm.	108	1.24	66.25	1.13	0.24	24.65	0.29	0.26	0.43	0.15	0.11	0.30	0.63	0.00	99.00
DB-97-2	DB-2	12.2	Altered Ilm.	109	0.70	69.85	0.66	0.31	21.08	1.17	0.34	0.28	0.13	0.12	0.25	0.75	0.00	98.81
DB-97-2	DB-2	12.2	Altered Ilm.	116	0.72	69.72	0.69	0.35	20.79	1.56	0.39	0.31	0.14	0.11	0.26	0.72	0.00	99.00
DB-97-2	DB-2	12.2	Altered Ilm.	120	0.82	74.10	0.80	0.23	15.57	2.01	0.41	0.30	0.16	0.10	0.32	0.71	0.00	99.00
DB-97-2	DB-2	12.2	Altered Ilm.	122	0.90	74.67	0.83	0.24	16.45	1.36	0.42	0.30	0.14	0.11	0.27	0.79	0.00	99.82
DB-97-2	DB-2	12.2	Altered Ilm.	124	0.84	72.77	0.85	0.29	17.71	1.85	0.39	0.33	0.13	0.12	0.26	0.78	0.00	99.83
DB-97-2	DB-2	12.2	Altered Ilm.	126	0.67	71.48	0.70	0.37	19.39	1.40	0.30	0.26	0.15	0.12	0.27	0.69	0.00	99.00
DB-97-2	DB-2	12.2	Altered Ilm.	138	0.92	70.19	0.92	0.35	19.87	1.53	0.46	0.33	0.14	0.11	0.26	0.80	0.00	99.00
DB-97-2	DB-3	93.2	Altered Ilm.	144	0.10	70.47	0.43	0.20	24.24	0.59	0.17	0.09	0.00	0.00	0.19	0.22	0.00	98.88
DB-97-2	DB-3	93.2	Altered Ilm.	149	0.13	87.24	0.99	0.12	6.12	0.47	0.06	0.22	0.02	0.00	0.59	0.28	0.00	99.00
DB-97-2	DB-2	12.2	Limonite	136	1.66	5.30	1.86	0.07	73.41	0.23	0.11	0.31	0.00	0.00	0.54	0.35	0.44	84.63
DB-97-2	DB-2	12.2	Rutile	123	0.42	92.00	0.27	0.19	1.57	0.26	0.19	0.17	0.25	0.18	0.08	0.58	0.00	100.00
DB-97-2	DB-2	12.2	Staurolite	112	27.01	0.49	55.37	0.00	13.80	0.23	1.82	0.00	0.00	0.00	0.01	0.00	0.00	98.74
DB-97-2	DB-2	12.2	Staurolite	113	27.14	0.45	55.57	0.01	13.46	0.28	1.15	0.00	0.02	0.00	0.02	0.00	0.06	98.17
DB-97-2	DB-2	12.2	Staurolite	114	26.56	0.50	55.45	0.00	14.08	0.14	1.44	0.01	0.01	0.00	0.00	0.00	0.00	98.19
DB-97-2	DB-2	12.2	Staurolite	115	27.23	0.51	54.70	0.01	14.22	0.15	1.48	0.00	0.02	0.00	0.00	0.00	0.01	98.34
DB-97-2	DB-2	12.2	Staurolite	116	0.71	69.01	0.68	0.35	20.58	1.54	0.39	0.31	0.14	0.11	0.26	0.71	3.08	98.00
DB-97-2	DB-2	12.2	Staurolite	121	27.46	0.52	54.69	0.02	13.76	0.08	1.15	0.00	0.04	0.00	0.01	0.00	0.00	97.74
DB-97-2	DB-2	12.2	Staurolite	132	27.39	0.51	55.13	0.00	13.72	0.24	0.94	0.00	0.00	0.00	0.01	0.00	0.01	97.96
DB-97-2	DB-2	12.2	Staurolite	133	26.84	0.61	55.29	0.01	14.62	0.10	1.23	0.00	0.00	0.00	0.03	0.00	0.00	98.73
DB-97-2	DB-2	12.2	Staurolite	135	27.40	0.45	55.10	0.00	12.94	0.33	1.77	0.00	0.04	0.00	0.00	0.00	0.00	98.03
DB-97-2	DB-3	93.2	Staurolite	158	26.97	0.52	56.79	0.00	12.58	0.24	1.19	0.00	0.00	0.00	0.03	0.00	0.03	98.35
DB-97-2	DB-3	93.2	Staurolite	164	26.31	0.36	56.04	0.00	14.35	0.12	1.38	0.00	0.01	0.00	0.04	0.00	0.05	98.65
DB-97-2	DB-3	93.2	Tourmaline	152	35.71	0.93	31.79	0.01	9.87	0.09	5.74	0.54	2.10	0.00	0.04	0.00	0.00	86.83
DB-97-2	DB-3	93.2	Tourmaline	161	35.65	0.57	35.43	0.00	6.44	0.05	5.52	0.19	2.06	0.00	0.01	0.00	0.00	85.92
DB-97-2	DB-2	12.2	Zircon	125	33.53	0.21	0.06	0.09	0.24	0.16	0.07	0.08	0.03	0.00	0.13	66.86	0.41	101.99
DB-97-2	DB-2	12.2	Zircon	127	33.52	0.21	0.07	0.09	0.25	0.15	0.07	0.08	0.05	0.00	0.17	66.35	0.40	101.49
DB-97-2	DB-2	12.2	Zircon	129	33.43	0.18	0.09	0.12	0.29	0.15	0.08	0.09	0.05	0.00	0.13	66.60	0.48	101.84
DB-97-2	DB-2	12.2	Zircon	131	32.76	0.25	0.07	0.08	0.26	0.13	0.06	0.07	0.07	0.00	0.19	65.53	0.45	100.00
DB-97-2	DB-3	93.2	Zircon	151	33.92	0.41	0.06	0.16	0.27	0.15	0.07	0.08	0.04	0.00	0.16	65.61	0.42	101.49
DB-97-2	DB-3	93.2	Zircon	153	32.96	0.37	0.08	0.13	0.25	0.19	0.09	0.07	0.06	0.00	0.15	65.12	0.40	100.00
DB-97-2	DB-3	93.2	Zircon	162	32.65	0.32	0.07	0.15	0.26	0.15	0.08	0.07	0.04	0.00	0.15	65.69	0.38	100.08

* = Microprobe laboratory identifier

Ilm = Ilmenite

Appendix I
Borehole descriptions

DETAILED DESCRIPTIONS OF BOREHOLES

Conventions in this report

- Boreholes are labelled BB-02 (Brierly Brook 2002) and then a sequential number. A duplicate borehole at essentially the same site is identified as A.
- UTM positions use WGS 84
- Boreholes are logged in feet, but recovered core is measured in centimetres. Reported depths in feet are to the base of a section of core/ top of next section.
- [3-33] indicates photograph: film 2002/3
- EOB indicates end of core box
- (VIAL) or (BAG) indicate samples taken during drilling
- ***88-95*** indicates sample taken when cores were logged in detail, coded by centimetre depth

BRIERLY BROOK

Borehole BB-02-1 **30.ix.02**

Summary

5049936 N 20 571260 E

At base of slope north of Kell's Enterprises gravel pit, adjacent to small test pit in dark clays.

Hole went through thick dark grey clays with some sandy clays with dispersed quartz granules, before reaching basement at 61'.

Hole went through:

0-9'	red brown gravelly till
9-57'	dark grey clay, some silica sand, some clay and granules
57-62'	brown-grey clay
62'	brown weathered limestone over fresh well-bedded limestone

Detailed log

10'

0-28 cm: Green mafic clasts (in till)

12'

0-16 cm: Poorly sorted muddy granule sand	***9-13***	[4-36]
16-34 cm: Dark grey clay		
34-44 cm: Dark grey muddy granule sand		
44-55 cm: dark grey clay	***46-49***	[4-35]
55-61 cm: Poorly sorted granule sand		
61-64 cm: Dark grey silty clay		

17'

0-25 cm: Medium-dark grey clay	
25-50 cm: Medium dark grey muddy granule sand	
50-104 cm: Medium-dark grey muddy granule sand	***57-61***

with light and medium grey clay clasts and lignite clasts [4-34]
104-109 cm: Dark grey clay with 2 mm lignite chips
22'
0-15 cm: Medium-dark grey muddy granule sand with clay clasts as before
15-48 cm: Granule coarse sand with muddy matrix ***15-21*** [4-33]
29'
0-47 cm: Dark grey clay with disturbed very fine grained sand beds at 6-7, 23-24, 27-28 cm [4-32] and silt laminae elsewhere ***39-47***
32'
0-23 cm: Dark grey clay ***20-23***
EOB 1
37'
0-3 cm: Granule coarse sand with muddy matrix
3-5 cm: Medium-dark grey clay with laminatiom
5-54 cm: Coarse sand with muddy matrix, probably a few 2 cm silty clay beds
54-67 cm: Poorly sorted coarse sands, includes lignite clasts
55-62 [4-31]
67-71 cm: Dark grey silty clay
42'
0-33 cm: Poorly sorted coarse sand with discrete 1-4 cm light, dark clay and silty clasts, apparently a debris flow deposit [4-30]
33-44 cm: Poorly sorted muddy coarse sand ***33-39***
44-52 cm: Dark grey silty clay
52-69 cm: Dark grey muddy coarse sand grading up to very fine sand
69-112 cm: Dark grey silty clay, some fine sand, appears contorted like a debris flow ***84-92***
112-134: Dark grey silty clay with disturbed 2-8 mm thick silt-very fine sand beds
47'
0-52 cm: Dark grey clay, distorted fine sand beds, rare granules. Debris flow
52-71: Medium-dark grey clay, slightly brownish, 5% silt blebs and laminae
65-71
52'
0-28 cm: Medium-dark grey clay, sparse granules, some very sandy patches
28-32 cm: two limestone pebbles
EOB2
57'
0-12 cm: Medium-dark grey clay [4-29]
12-26 cm: Medium-dark grey clay with 0.5-2 cm silt beds
26-39 cm: Dark grey clay, 5% silt blebs ***32-39***
39-54 cm: Pebbles/rubble of fresh limestone
62'
0-66: Tan-brown weathered limestone, laminated
67' [4-28] - Weathered lst (below), fresh lst (above)
0-77 cm: Fresh laminated grey limestone ***42-45***
70'
EOB

Borehole BB-02-2 **1.x.02**

Summary

5050060 N 20 571473E

On short skidder road 100 m up Browns Mountain road, on Kell's Enterprises property.

Hole went through:

0-7'	till
7-21'	sand and varicoloured clays
21-61'	dark grey clay and sandy clay with quartz granules
61'-82'	varicoloured clays, minor sands
82'-116'	principally sands (some granules), minor clay
116-131'	muddy sand and varicoloured clays, principally grey
131-136'	indurated polymictic pebbly sandstone
136-141'	rubble of limestone basement

Photos on film 2002-3 are listed in detailed log below, those on 2002-4 as follows:

[4-27]: 10'-16' and 26'-27'

[4-26]: limestone clast just above 41'

[4-25]: red clays and sands below 66'

[4-24]: basement rubbly limestone at 127-128'

Detailed log

Augered brownish till to 7'

Then mottled grey (med) clay and pink clay to 10'

10'

0-24 cm: Mottled pink minor tan clay. Some quartz granules, many <5mm lignite chips

24-32 cm: Muddy sand, rare granules

32-38: Disturbed red clay, ?pebbles from till

16'

Considerable sand section, washed out. VIAL sample of cuttings

0-4 cm: Muddy light grey medium sand, rare granules. ***0-4***

4-46 cm: Light grey clay. Basal 10 cm has some yellow and light purple mottling. Sand along outside. Could be several interbedded washed-out sands.

11-15

21'

0-4 cm: Yellowish clay

5-12: Dark grey mudstone with common quartz granules ?debris flow

26'

0-72: Dark grey pebbly mudstone as before ***66-72***

31'

0-37: Dark grey mudstone, sparse granules

37-42: Chips of medium grained sandstone. (BAG sample).

42-70: Dark grey mudstone

70-86: Coarse grey sand ***78-84***

86-93: Dark grey mudstone with quartz granules

36'
0-43 cm: Dark grey mudstone with quartz granules
EOB 1
43-73: Dark grey mudstone with quartz granules. One 5 cm clast of basement with quartz veins. One large ?feldspar crystal - (BAG sample)
41'
0-12: Dark grey mudstone ***6-9***
12-28: Dark grey mudstone with quartz granules
46'
0-26: Dark grey mudstone with quartz granules
51'
0-60 cm: Dark grey mudstone with quartz granules ***22-30***
56'
(change to 10' lengths, core caved a little)
0-8 cm: Washed clasts of siliceous basement
8-29 cm: Dark grey mudstone with quartz granules
61'
0-3 cm: Dark grey mudstone with quartz granules
3-10 cm: Mottled dark red and dark grey clay
10-25 cm: Graded bed coarse to fine grey muddy sandstone /subvertical faulted contact
25-54 cm: Mottled dark red clay, minor grey clay [3-36]
54-85 cm: Muddy medium - coarse sand, grey, some granules.
66'
0-9 cm: Mottled dark red and dark grey clay, 80% red ***0-6***
9-14 cm: Light grey fine sand, rare granules ***6-11***
14-21 cm: Mottled dark red clay as before [3-35]
21-25 cm: Light grey medium sand with granules ***21-33***
25-34 cm: Mottled 90% red, 5% light grey clay
34-45 cm: Muddy medium sand with granules
EOB 2
45-63 cm: Muddy medium sand with granules
63-66 cm: Mottled dark grey and red mud over 1 cm lignitic mud
66-69 cm: Poorly sorted light grey medium - coarse sand, two about 2 cm clay partings, some granules ***66-69*** [3-31]
71'
0-10 cm: Mottled dark red and 10% light grey
10-26 cm: Silty clay, medium-dark grey
26-50 cm: Graded medium to very fine sand
50-119 cm: Medium grey (slightly brownish) well sorted medium sand, muddy (VIAL) ***88-95***
76'
0-6 cm: Medium muddy sand as before
6-40 cm: Dark brown - grey clay, some silty patches ***17-23***
40-46 cm: Muddy fine sand
46-48 cm: Brown clay
48-73 cm: Graded medium - fine dark brown sand

73-94 cm: Dark brown clay, some fine sand patches
81'
0-5 cm: Dark brown clay, some granules ?fallen down hole
5-12 cm: Mottled light grey, medium grey and red clay
12-26 cm: Bright red clay, 2% light grey (?bluish) mottles
9-14
82' (sic)
0-14 cm: Bright red clay, 5% light grey mottles [3-32]
14-22 cm: Light grey medium sand with granules (VIAL 83': it has 10% mud contaminant)
EOB 3
22-37 cm: Medium grey mud, 5% red mottles ***28-36***
37-43 cm: Poorly sorted medium sand with granules ***36-41***
43-63 cm: Muddy medium sand with granules

Then no recovery to **101'**. Changed bit.
Pebbles of limestone, vein quartz and lithified sandstone (?Cretaceous)
5-6 (sst)
8 cm brown muddy medium sand with granules
106'
0-23 cm: Indurated poorly sorted medium sand(stone) with granules (VIAL)
23-31 cm: medium grey mud, some granules (?debris-flow deposit)
23-28
31-59 cm: Brown silty mud
59-76 cm: Fragments of indurated sandstone (VIAL)
111'
0-70 cm: Variably indurated muddy medium sand, brown, granules restricted to a few horizons ***51-55***
116'
0-17 cm: Medium grey mud, locally dark grey ***5-7***
17-28 cm: Medium grey - brown silty mud
28-39 cm: Poorly sorted medium sandstone with granules, indurated
39-45 cm: Brown silty mud
45-79 cm: Medium grey mud. One 1 cm wood fragment. Some dark grey mud, some brown mud, all locally silty.
EOB 4
79-90 cm: Brownish silty mud as before
90-136 cm: Muddy brownish medium sand, rare granules (107-108 cm - pink clay)
136-145 cm: Mottled light grey and reddish silty clay ***140-145***
121'
0-9 cm: Poorly sorted muddy medium sand
9-30 cm: Variably mottled red and light grey clay
30-43 cm: Brown silty clay
43-85 cm: Brown muddy medium sand, variably indurated (BAG 124' indurated)
126'
0-10 cm: Reddish silty mud
10-22 cm: Light brown silty mud

22-58 cm: Chips of indurated medium sandstone (BAG 127')
58-60 cm: Basement ?clast or in situ
131'
1-15 cm: Rubble of indurated sandstone ***12-15***
15-62 cm: Medium sandstone with <1 cm polymictic clasts, angular, mostly basement limestone, some vein quartz, rare red rhyolite
[3-30]
62-90 cm: Rubble of limestone, some looking like basement. [4-24]
EOB 5
136'
0-80 cm: Medium sandstone as before and rubble of limestone clasts
141' T.D.
EOB 6

Borehole BB-02-3 2.x.02
Summary
5050615N 20 572207E
On main valley floor at entrance to Hector MacIsaac property, near spring.
Carried out auger reconnaissance, which showed the presence of dark grey clay. Later drilled the same section and decided that the dark grey clay was glaciolacustrine sediment, overlying glacial till.
Auger reconnaissance
0-5': Red till
5-10': Red till
10-15': Gravel and deeper to ?30'
On recovery, top dark grey clay at 20-25', rotated back up auger. Samples.
35-55': all drilled same: dark sticky clay. Same dark grey clay preserved on bit. No sign of quartz granules.

Core hole BB-02-3A 5.x.02
5 m north of hole 3
Auger to 20'. Black clay starts at 18' from washings
Start drilling **18'**
0-7 cm: Brick red sandy till
7-56 cm: Dark brownish grey silty mud, some mud laminae
21'
0-155 cm: Brownish silty mud, bioturbated, some silt laminae
26'
0-104 cm: Laminated brown silty mud, some black beds and laminae, common silt laminae, some soft sediment deformation
EOB 1
31'
0-100 cm: Brown mud with silt - cross lamination
100-166 cm: Brown muddy till with green stones
36'
Abandon hole, presumed Quaternary

Borehole BB-02-4 **2.x.02**

Summary

5050670N 20 572118E beside woodpile east of house on Hector MacIsaac property
Attempted auger reconnaissance to 55'. Went into something soft at 52', interpreted as Cretaceous. Auger broke duing recovery at 19': hole abandoned. Fishing for auger unsuccessful, so brought in excavator to recover. Discovered that there was a second break in the auger at about 35'.
0-37: Gravelly red till
37-50': Grey till
Drilled a second hole in the expectation that Cretaceous would be found at 52'

Core hole BB-02-4A ***4.x.02***

Drilled from 26' to 66'
Stony till, abundant drilled gabbro and Precambrian clasts. A few sandy and muddy intervals
Abandoned at 66' because no evidence of Cretaceous. Very slow drilling through stony till.

Borehole BB-02-05 **2-3.x.02**

Summary

5050701N 20 571991E
Located adjacent to cut bank with Cretaceous outcrop beneath till, behind new barn on Hector MacIsaac property
In bank, outcrop of about 1 m massive dark grey clay, abundant wood, ?some bone. Also loose silica sand in bank.

Auger to 20'
0-15': Red sandy till
15-20': Yellowish muddy medium sand
set casing
31-36': Coarse sand caught in bucket from wash water. Small clay plug.
36-41': Coarse sand jammed corer. Set more casing
bedrock at about 49', then more sand. ?thrust or cavings
41-49': soft medium grey clayey sand
25 cm dark grey rock
49-55' grey returns, inferred basement
55-60' tan returns and sand
60-66' grey returns, basement again.

Detailed log

31'

0-30 cm: Medium sand, a few semi-lithified areas sampled
0-20
30-49 cm: Brown sandy mud ***37-41***
49-51 cm: Clasts of fresh limestone

36'

0-26 cm: Bag of sand washings

26-45 cm: Brown clay with interbedded 1-2 cm beds very fine sand

27-34

45-110 cm: Rubble and drilled core of Windsor limestone

80-85

Below this, all recovery is limestone

BB-02-5A

5' to E from previous hole

4 spoon samples to 37'

20-22'	medium-coarse silica sand, minor clay
25-27'	medium-coarse tan clayey sand
30-32'	tan-grey silty clay
35-37'	tan-grey sandy clay

Borehole BB-02-6 5.x.02

Summary

5051314N 20 573079E

On Josef Andert's property, hard against bank with silica sand spoil [3-24]

Hit something hard at 25.5' when augering

Split spoon recovered dark limestone at 26'

This is overlain by red-brown clay and brown till with greenish clasts

Some near-surface Cretaceous spoil

Borehole BB-02-7 5-6.x.02

Summary

5050087N 20 571399E

near NE test pit on Kell's Enterprises property, to the north of holes BB-02-1 and BB-02-2

Hole went through:

0-3'	soil
3-31'	varicoloured clays, some medium sand
31-51'	mostly sand
51-76'	dark sandy mud with granules, considerable medium sand
76-86'	?basement clasts and brown sand
86'	basement limestone

Detailed log

Augering

0-3': Soil

3-4': Red clay, some lignite, some quartz granules. Some grey clay

4-5': Yellow mudy sand

5-7': Grey and yellow clay

7-10': Mottled red clay

Then set casing and begin drilling

Severe wash problems with sand 36-51': set casing to 40'.

11'
0-7 cm: Pinkish clay
7-26 cm: Mostly medium grey clay, minor light grey and dark grey about 1 cm layers. Some 1 cm lignite chunks. Rare granules and sand at one level
17-21
26-35 cm: Yellow well sorted fine sand [4-23] from top to here, also 21', 4-54 interval
29-33
35-40 cm: light grey, slightly purplish grey, bedded clay
40-44 cm: Dark grey silty clay
16'
0-4 cm: Medium grey clay
4-6 cm: Limonite cemented medium sandstone ***4-6***
6-26 cm: Medium grey clay
26-33 cm: Gravelly medium sand, light coloured
21'
0-4 cm: Light grey mud
4-54 cm: Jet black coarse muddy sandstone, some granules
10-15, 52-54
26'
0-5 cm: Light grey gravelly medium sand
5-29 cm: Medium grey mud, some light grey mud, a little medium sand
31'
0-25 cm: Fine sand wash
25-42 cm: Light grey gravelly medium muddy sand
36'
washed to **51'** (Two BAG samples of washed sand)
0-25 cm: Fine-medium sand wash
25-45 cm: Lithified coarse sandstone-granule gravel, medium grey
34-41
45-57 cm: Dark grey silty clay
57-80 cm: Medium-light grey stiff clay ***68-73***
56'
0-20 cm: Medium-light stiff silty clay ***15-20***
EOB 1
20-45 cm: Medium-dark grey clay
45-63 cm: Poorly sorted fine-medium sand
61'
0-36 cm: Silty mud, red-dark grey, with scattered granules
0-5
66'
0-10 cm: 2 cm quartz pebbles (overnight hole casing)
10-102 cm: Medium grey silty mud with dispersed quartz granules
71'
0-60 cm: Medium grey well sorted fine to down to medium sand
55-60
76'
0-5 cm: Medium grey muddy fine sand

5-15 cm: Chunks of limestone, some quartz pebbles
81'
0-10 cm: Chunks of limestone
10-30 cm: Muddy brown - grey fine sand
86'
Drilling very slowly
0-20 chunks of limestone
EOB2
91' End of hole TD

BELMONT

Borehole BM-02-1 **6.x.02**
Summary
5030672N 20 471978E
Located on SW side of pit on slight high
Auger:
0-5': Red sandy till
5-10': Red sandy till [3-23]
10-15': Red sandy till
15-20': Grey-green sandy till mixed with red
20-25': Slightly browner sandy till
26-36': Drilled Triassic sandstone bedrock recovered 4'
31': 62-68
Thus, at this site, sandy till rests directly on Wolfville Formation bedrock.

Borehole BM-02-2 **7.x.02**
Summary
5030712N 20 471939E

Auger:
0-26': Red sandy till as before
26-30': Disturbed silica sand with blebs of white and red clay
30-35': medium silica sand
Some sample contamination from red mud in hole
Set casing
Attempted spoon - no penetration or recovery
36-41': Coarse sand, some sandstone
Then jammed core barrel
51-56'
about 50 cm x-bedded medium sandstone with heavy mineral concentrations
61-66': Sand
Below this, thick red mud [3-21]
Then more sand
at 96' - 101', red mud again

Poor hole conditions, hole abandoned

Detailed log
36'
0-30 cm: washed fine sand
30-53 cm: washed coarse sand (BAG)
53-68 cm: coarse sandstone, some reddish laminae ***53-57***
then washed to **51'**
0-42 cm: medium sandstone, some limonite stained, some cross-bedded with dark lamine (BAG) (3 cm quartz pebble at base) [3-22]
56'
0-31 cm: medium sandstone, some red stained ***20-25***
61'
0-25 cm: washed fine sand
25-75 cm: washed medium sand (BAG)
75 - ~110 cm: washed sand (one 4' tray, but much water) (BAG)
EOB1
110-150 cm: Chunks of medium sst ***135-137***
66'
0-31 cm: Brick red clay, rare silty patches ***10-20***
71'
0-33 cm: Medium sand, rare sst
76'
0-5 cm: Coarse sst ***0-5***
91'
0-28 cm: Washed fine sand
28-37 cm: Fine sst, pink-yellow ***28-31***
37-43 cm: Brick red clay
43-63 cm: Washed fine sand (?out of place)
63-110 cm: Brick red silty clay, rare light mottles ***100-105***
96'
0-7 cm: Brick red silty clay, rare light mottles
EOB

Borehole BM-02-3 8.x.02
Summary
5030743N 20 471918E
0-5' grey and tan silty clay
5-21' red and pink clay, some other lithologies
21-31' sand interbedded with red clay
31-51' sand
51-61' red clay, some sand
61'-81' indurated red mottled brown and blue-grey shale, siltstone and sandstone, interpreted as Windsor Group while drilling, but now thought to be Cretaceous

Detailed log

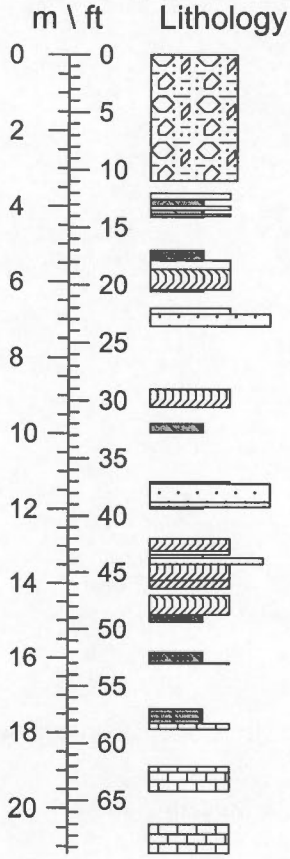
16'
0-5 cm: Lithified medium sst with woody fragments
5-6 cm: Pink clay
21'
0-27 cm: Washed fine sand
27-68 cm: Medium sand, ?partly washed ***60-64***
26'
0-23 cm: Washed pink fine sand
23-29 cm: Brick red clay with silt lamination [4-22]
29-101 cm: Red and white cross-bedded medium and fine sst, heavy mineral concentrations ***46-58 & 81-85***
31'
0-25 cm: Pink fine sst, low-angle cross-bedding ***12-19*** [4-21]
25-73 cm: Medium sst, locally coarse. Iron staining. Some dark laminae ***27-32***
36'
0-4 cm: Medium white sst ***0-4***
51' ***7-10***
0-20 cm: Fine sst chunks, plus a few granules and fine pebbles of quartz (<3 cm). Looks like basal conglomerate. **15-16** (2 pebbles)
20-80 cm: Brick red silty clay
gradual transtition to
80-88 cm: Mottled light grey and brick red clay ***80-88***
56'
0-90 cm: Brick red clay, local silty mottles (bioturbation), 2% light grey mottles ***80-85***
61'
0-37 cm: Brick red silty clay ***0-5***
37-38 cm: Yellowish fine sst
38-51 cm: Indurated laminated fine sst ***39-43*** [4-20]
51-53 cm: Yellowish fine sst
53-94 cm: Brick red sand with white mottles, passing up into brick red silty clay ***90-94***
66'
0-25 cm: Brick red silty clay
25-35 cm: Mottled red and light grey very fine sst
35-67 cm: Brick red silty clay
67-93 cm: Mottled 50% light grey 50% red clay ***88-93***
93-112 cm; Light grey very fine sst, 30% red mottles ***102-108*** [4-18]
112-161 cm: Brick red mottled silty clay -- all red, some lighter red
73'
0-1 cm: Light grey very fine sst
1-9 cm: Brick red silty clay
76'
0-110 cm: Brick red silty clay ***99-103*** [4-19]

EOB3

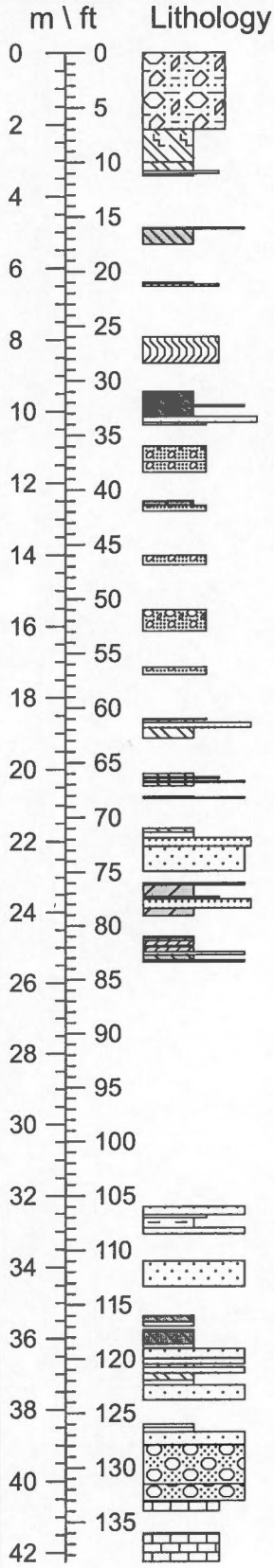
110-158 cm: Brick red silty claystone [4-19] ***110-120***
158-197 cm: Brick red muddy very fine sst ***179-186***
81'
EOH

Appendix II
Detailed logs of new boreholes

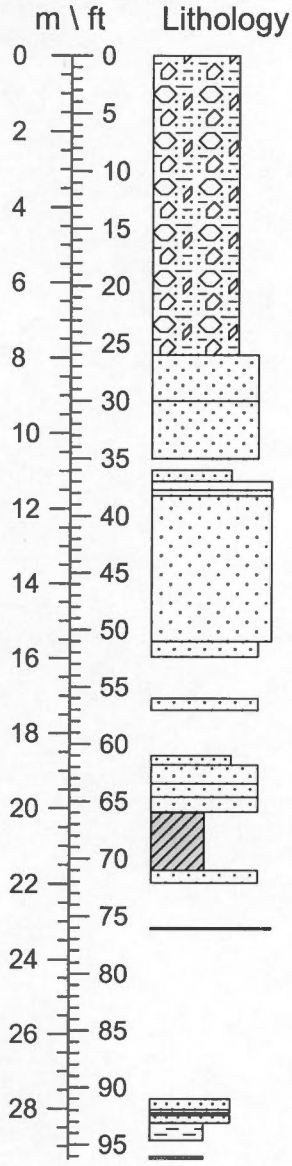
Borehole: BB-02-1	Northing:	Easting:
Depth:21.3m \ 70ft	5049936	571260



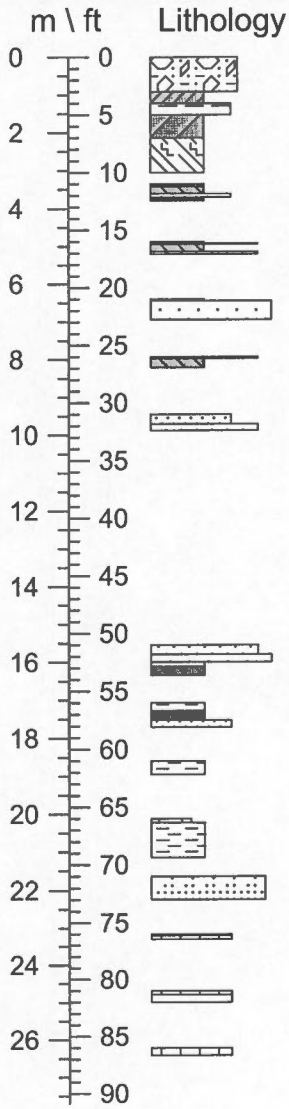
Borehole: BB-02-2	Northing:	Easting:
Depth:43m \ 141ft	5050060	571473



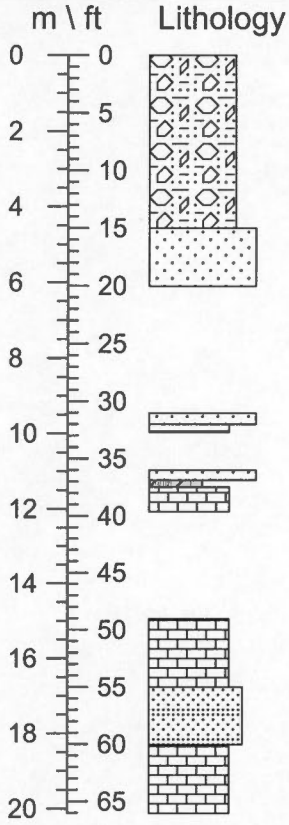
Borehole: BM-02-2	Northing:	Easting:
Depth:29.3m \ 96ft	5030712	471939



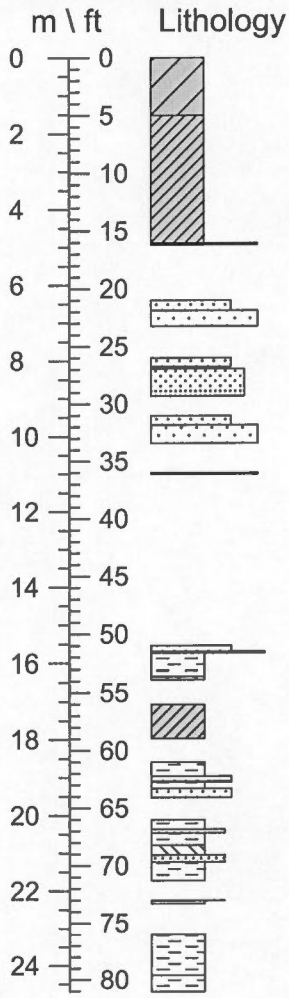
Borehole: BB-02-7	Northing:	Easting:
Depth:27.7m \ 91ft	5051314	573079



Borehole: BB-02-5	Northing:	Easting:
Depth:15m \ 65ft	505070	571991



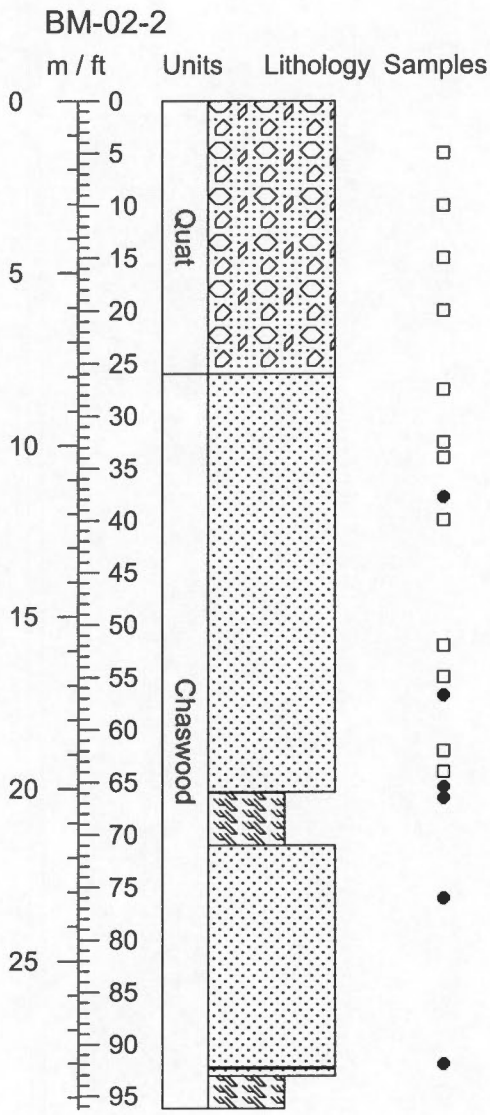
Borehole: BM-02-3	Northing:	Easting:
Depth:24.7m \ 81ft	5030743	471918

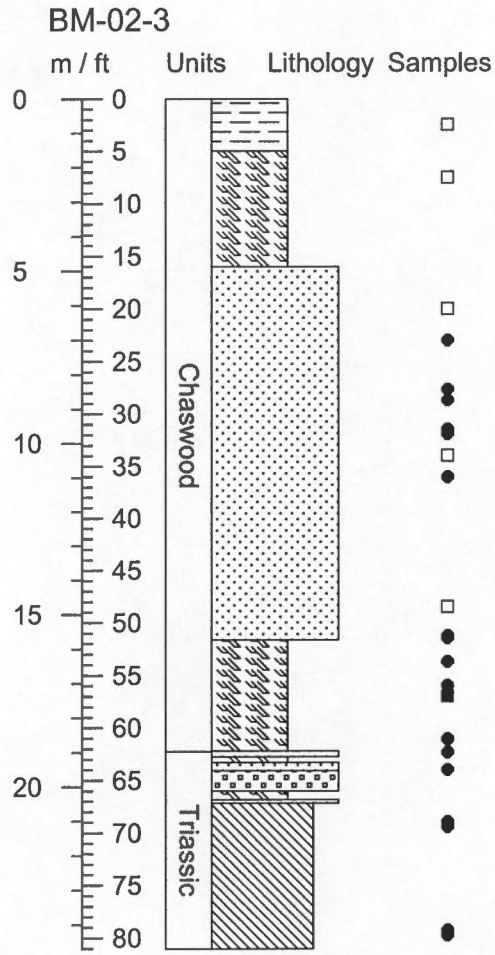


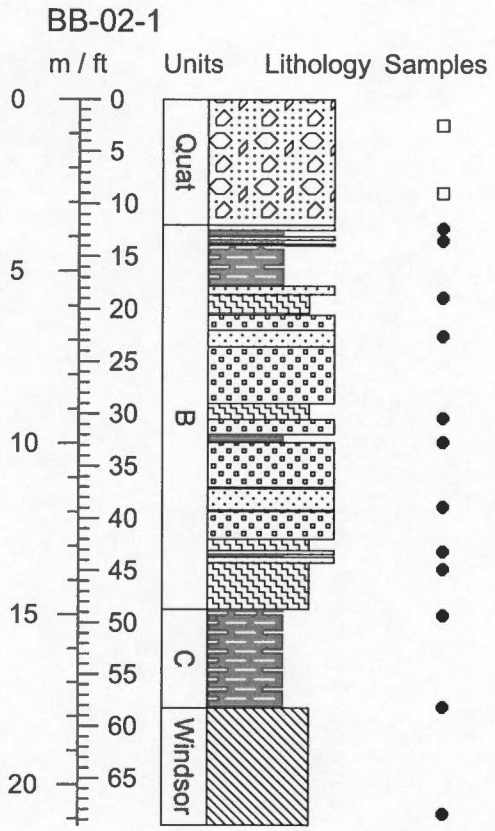
Appendix III
Borehole summaries and sample locations

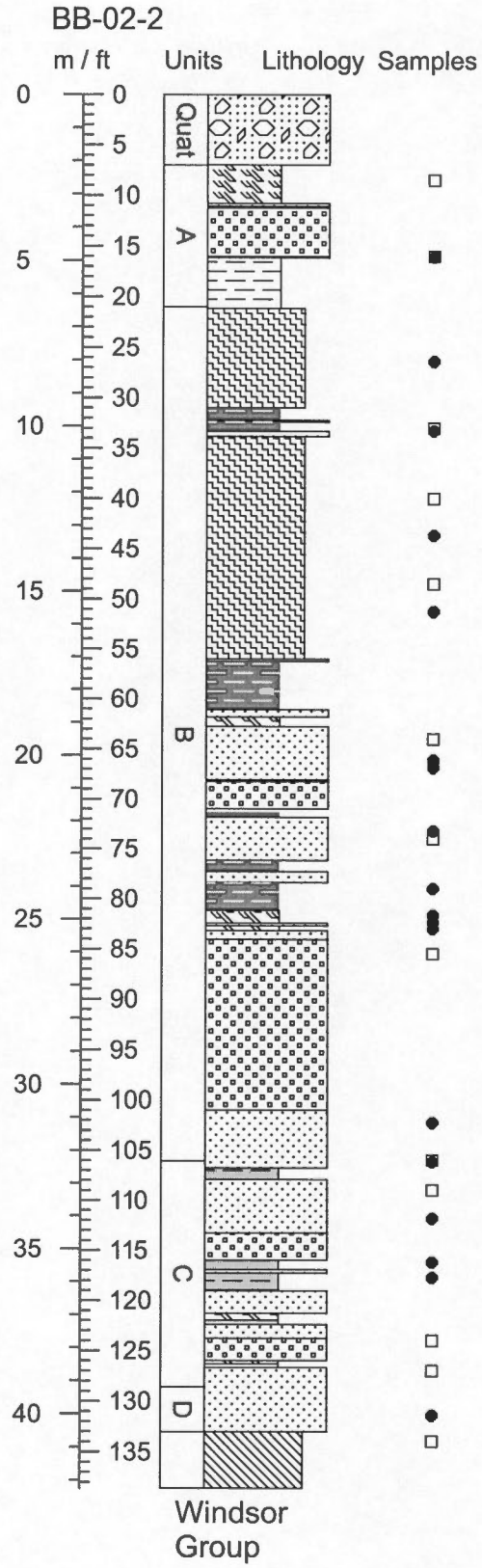
Legend

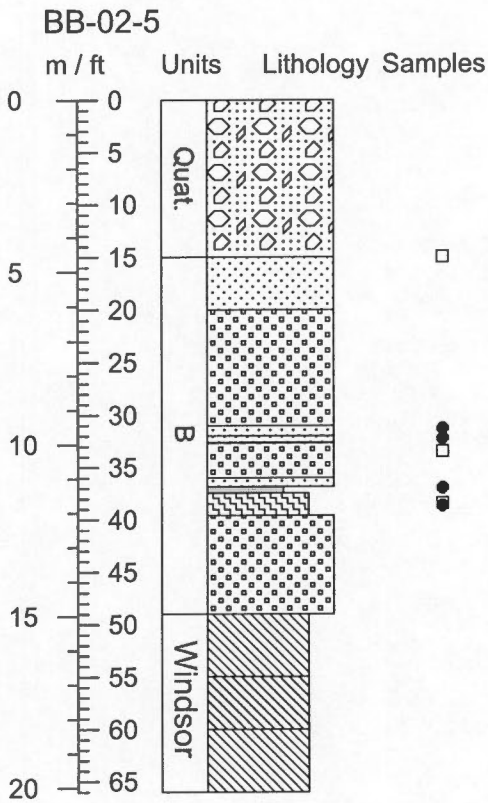
- Till
- Mottled mudstones
- Light coloured mudstones
- Medium grey mudstone
- Dark grey mudstone
- Lignitic mudstone and lignite
- Debris flow
- Sand(stone)s
- Sand wash out
- No core due to sampling
- Basement
- ● Discrete samples taken from boreholes
- □ Bulk samples taken during drilling

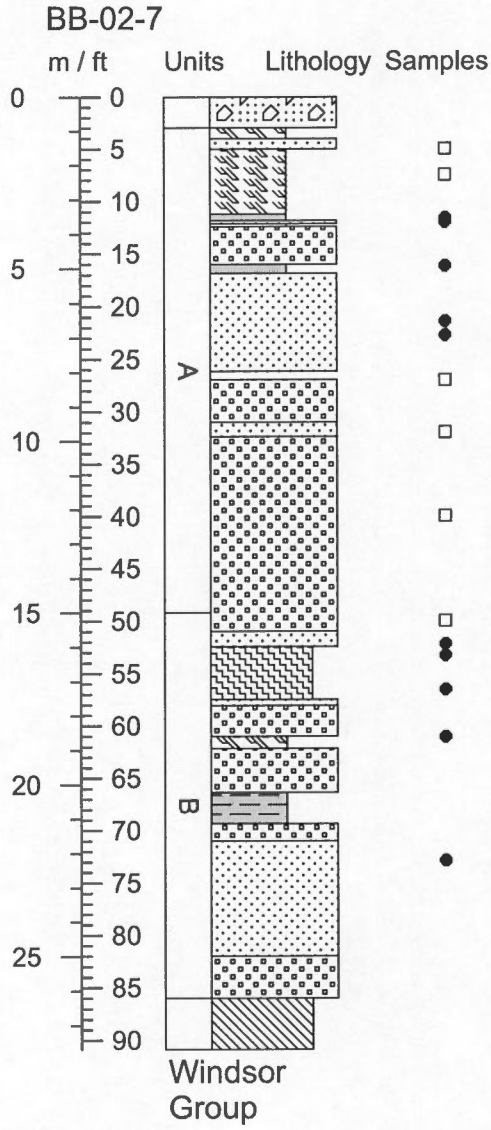

BM-02-2
m / ft
Units
Lithology
Samples
Quat
Chaswood
0
5
10
15
20
25
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95


BM-02-3
m / ft
Units
Lithology
Samples
Chaswood
Triassic
0
5
10
15
20
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80

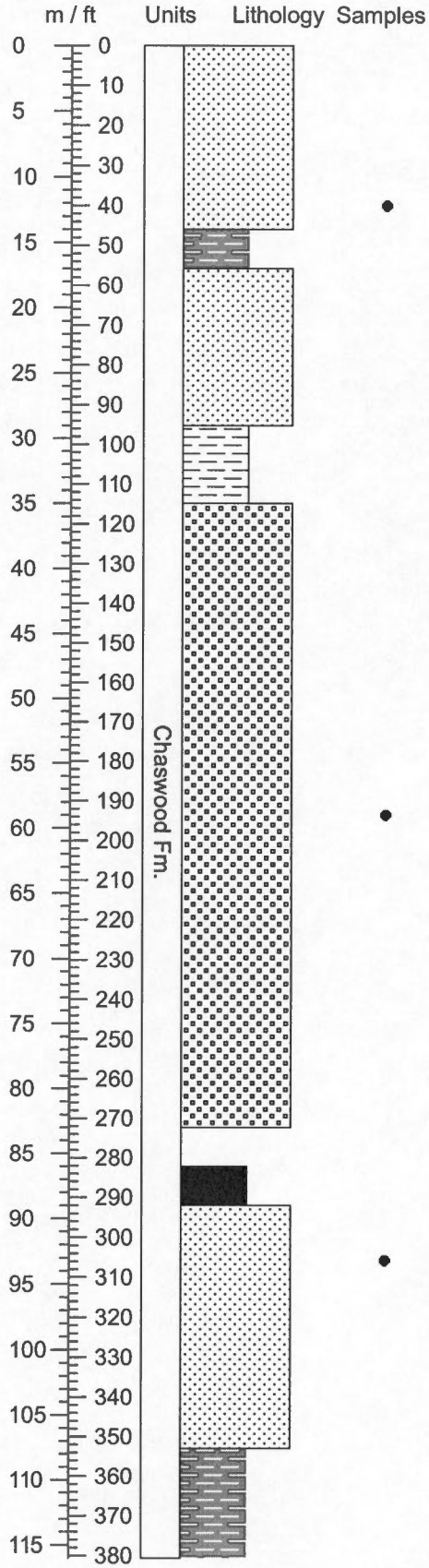

BB-02-1
m / ft
Units
Lithology
Samples
Quat
B
C
Windsor


BB-02-2
m / ft
Units
Lithology
Samples
Quat
A
B
C
D
Windsor Group


BB-02-5
m / ft
Units
Lithology
Samples
Quat.
B
Windsor


BB-02-7
m / ft
Units
Lithology
Samples
A
B
Windsor
Group

DB-97-2


m / ft
Units
Lithology
Samples
Chaswood Fm.
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
105
110
115
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
210
220
230
240
250
260
270
280
290
300
310
320
330
340
350
360
370
380

Appendix IV
Sample descriptions and actions taken

Appendix IV
SAMPLES FROM SAINT MARY'S 2002 DRILLING PROGRAM

1. Subsamples taken at Stellarton (25/10/02)

Sample No	Lithology	Activities
BB-02-1		
12′ (9-13)	poorly sorted muddy granule sand	gs, h, psh
12′ (46-49)	dark grey clay	ca, xrd, p
17′ (57-61)	debris flow	gs, h, psh
22′ (15-21)	coarse granule sand with muddy matrix	gs, h, psh
29′ (39-47)	dark grey clay	ca, xrd, p
32′ (20-23)	dark grey clay (clean)	ca, xrd, p
37′ (55-62)	poorly sorted coarse sand	ca, xrd, ps
42′ (33-39)	poorly sorted muddy coarse sand	gs, h, psh
42′ (84-92)	dark grey silty clay	ca, xrd, ps
47′ (65-71)	medium dark clay with silt	ca, xrd, p
57′ (32-39)	dark grey clay with silt	ca, xrd, p
67′ (42-45)	Windsor lst	ps
BB-02-2		
16′ (0-4)	muddy light grey sand	ca, xrd, gs, h, psh for the sand
16′ (11-15)	light grey clay	ca, xrd, p
26′ (66-72)	dark grey mudstone	gs, h, psh
31′ (78-84)	dark grey mudstone	ca, xrd,
41′ (6-9)	dark grey mudstone	ca, xrd, p
51′ (22-30)	dark grey mudstone	ca, xrd
66′ (0-6)	mottled red clay (80%)	ca, xrd, p
66′ (6-11)	fine sand	gs, p (clay sent) h, psh
66′ (21-33)	poorly sorted sand	abandoned
66′ (66-69)	poorly sorted sand	gs, h, psh
71′ (88-95)	well sorted sand	gs, h, psh
74′	grey coarse sand	gs, h, psh
76′ (17-23)	clay (dark brown grey)	ca, xrd, p
81′ (9-14)	red clay (remove grey)	ca, xrd, p
82′ (28-36)*	clay	ca, xrd, p
82′ (36-41)*	sand	gs, h, psh
101′(5-6)	pebble	ps
106′ (23-28)	clay + sand	ca, xrd, ps
111′ (51-55)	muddy sst	gs, h, psh
116′ (5-7)	clay	p
116′ (140-145)	sandy clay	ca, xrd, p
131′ (12-15)	Windsor lst	ps

Sample No	Lithology	Activities
BB-02-5		
31′ (0-20)	semi-lithified sst	gs, h, psh
31′ (37-41)	sandy clay	ca, xrd
31′ – 36′	coarse sand	gs, h, psh
36′ – 41′	coarse sand	gs, h, psh
36′ (27-34)	brown clay overlain by v.f.sand	ca, xrd, p
below 36′ (80-85)	drilled Windsor lst	ps
BB-02-7		
11′ (29-33)	well sorted yellow sand	ca, xrd, ps
16′ (4-6)	limonite cemented sst	ps
21′ (10-15)	coarse muddy black sst	ca, xrd, ps
21′ (52-54)	sst	?ca, xrd
32′	sand	gs, h, psh
40′	sand	gs, h, psh
40A′	sand	gs, h, psh
50′	sand	gs, h, psh
51′ (34-41)	lithified sst	ca, xrd, p
51′ (68-73)	clay	ca, xrd, ps,
11′ (17-21)	clay + sand	ca, xrd, p
56′ (15-20)	silty clay	ca, xrd
61′ (0-5)	silty mud	ca, xrd, ps
71′ (55-60)	well sorted sand	ca, xrd, gs, h, psh
BM-02-3		
21′ (60-64)	sand	gs, h, psh
26′ (46-58)	sst with bedding	ca, xrd, psA, psB, psh
26′ (81-85)	sst with bedding	ca, xrd, ps
31′ (12-19)	pink fine sst	ca, xrd, ps
31′ (27-32)	sst	ca, xrd, ps
36′ (0-4)	white sst	ca, xrd, ps
51′ (7-10)	white sst	ps
51′ (15-16)	a pink and a white pebble	psA, psB
51′ (80-88)	light grey+red clay	ca, xrd
56′ (80-85)	red clay	ca, xrd, p
57′	fine-grained sandstone	ca, xrd, ps
61′ (0-5)	red silty clay	ca, xrd
61′ (39-43)	indurated fine sst	ca, xrd, p
61′ (90-94)	red sand-silty clay	ca, xrd, ps
66′ (88-93)	red clay	ca, xrd
66′ (102-108)	red silty clay	ca, xrd
76′ (99-103)	red silty clay	ca, xrd
76′ (110-120)	red silty clay	ca, xrd, ps

76′ (179-186)	micaceous sst	ca, xrd, ps
Sample No	**Lithology**	**Activities**
BM-02-1		
31′ (62-68)	Triassic sst	ca, xrd, ps
BM-02-2		
34′	medium silica sand	gs, h, psh
36′ (53-57)	coarse sst, one reddish laminae	ca, xrd, ps
56′ (20-25)	medium sst, some red stained	ca, xrd, ps
61′ (135-137)	medium sst	ps
62′	sand	gs, h, psh
64′	sand	gs, h, psh
66′ (10-20)	red clay	ca, xrd
76′ (0-5)	sst	ca, xrd, ps
91′ (28-31)	fine sst	ca, xrd, ps
91′ (100-105)	red silty clay	ca, xrd
BM-02-3		
21′	sand	gs, h, psh

*: These two samples are in the same bag

Lithologies found:
Sands: grain size, heavy minerals, whole chemical analysis (sand fraction)
Sandstones: polished thin section (probe), whole rock chemical analysis
Clays: XRD, whole rock chemical analysis, palynology

Abreviations for the items under Activities:
ca = whole rock chemical analysis; xrd = XRD; p = palynology; ps = polished thin section; gs = grain size analysis; h = heavy mineral separation after partial grain size analysis; psh = polished thin section of heavy mineral separate.

2. Other samples collected during the drilling operations

Sample No.	Type	Collector	Activities
BB-02-1			
0-5′	grab	(M)	
9′	grab	(M)	
BB-02-2			
7-10′		(M)	
about 16		(D)	gs
33′		(D)	
46′		(D)	ps
about 40′		(D)	ps
74′		(D)	gs
83′		(D)	
106′		(D)	ps
109′		(D)	ps
124′		(D)	ps
127′		(D)	ps
134′		(D)	ps
BB-02-3			
0-5′		(M)	
5-10′		(M)	
15′		(M)	
20-25′		(M)	
20-25′		(M)	
25′		(M)	
37′		(M)	
BB-02-5			
15′		(M)	
31-36′		(D)	h
36-41′		(D)	h
BB-02-5A			
20-22′	spoon	(M)	
25-27′		(M)	
30-32′		(M)	
35-37′		(M)	
BB-02-6			
0-5′		(M)	
5-10′		(M)	
10-15′		(M)	
15-20′		(M)	

Appendix IV (continued)

3. Samples from borehole DB-97-2, Diogenes Brook

Sample No	Lithology	Activities
DB-97-2		
DB-1 (at about 12m)	concretion	ps
DB-2 (12.2m)	sst (loosely indurated)	gs, h, ca
DB-3 (93.4m)	sst (loosely indurated)	gs, h, ca
DB-4 (59.0m)	jarosite	ps

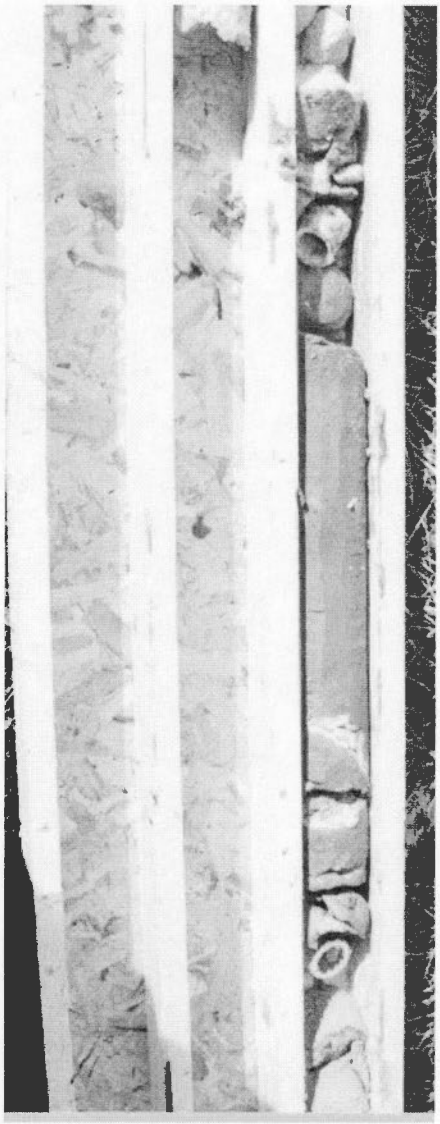
4. Surface samples from Brierly Brook, Belmont and Stewiacke deposits

Brierly Brook		
95-1-4	sand	gs, h, ca, pi, ps
Belmont		
CS07	sand	gs, h, ca, pi, ps
CS08	pebbles	pi
Stewiacke		
CS09	sand	gs, h, ca, pi, ps
CS10	pebbles	pi
CS11	pebbles	pi

Abbreviations under the activities

gs = grain size analysis; ca = whole rock chemical analysis; h = heavy mineral separation after partial grain size analysis; pi = pebble identification using handspecimen and in some cases probe thin section; ps = probe thin section description

Appendix V
Core photographs



2002_3_21

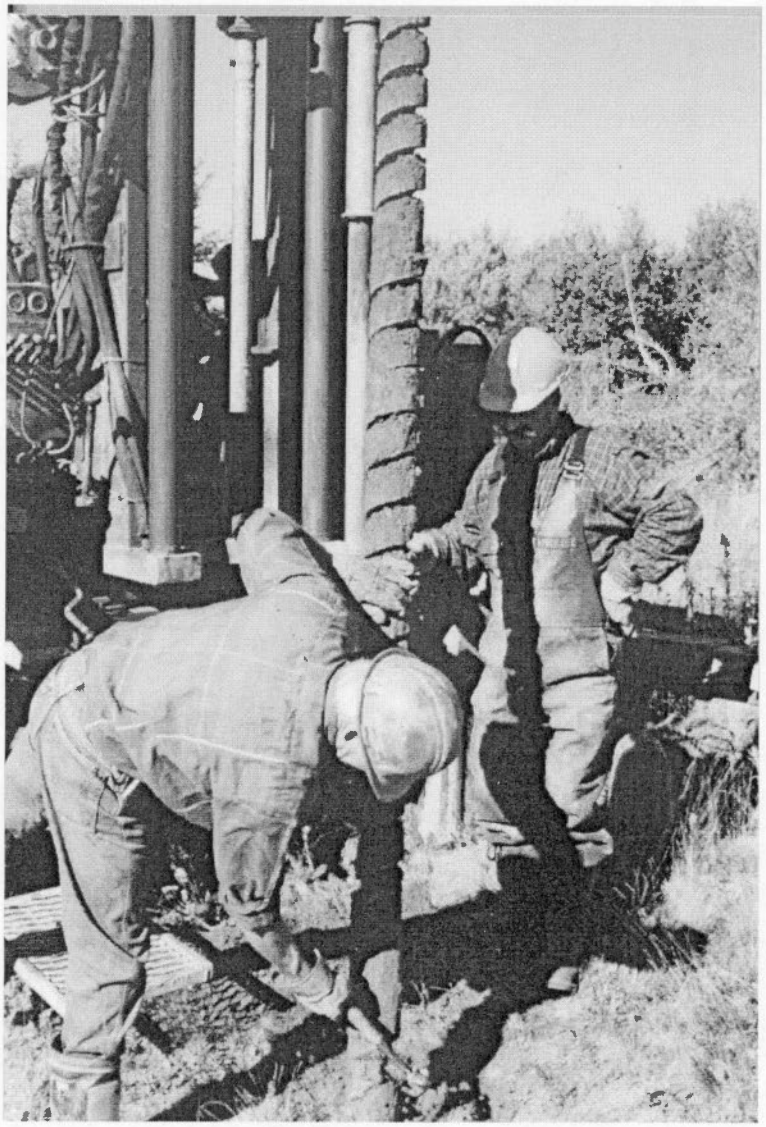
BM-02-2
67'

Red mudstone, Belmont

2002_3_22

BM-02-2
52'

Cross-bedded medium sandstone with heavy mineral concentrations, Belmont



BM-02-1

5-10 ft

2002__3_23

Auguring red sandy till, Belmont 5030672 471978

BB-02-6

Silica sand spoil at J. Andert's property, Brierly Brook

2002__3_24
5051314 573079

BB-02-4

Recovering stuck auger with backhoe, Brierly Brook

2002__3_26
5050670 572118

BB-02-3

Auguring red till, Brierly Brook

2002__3_29
5050615 572207

BB-02-3

Drilling Quaternary lacustrine sediment, Brierly Brook

2002__3_30A

BB-02-2
132'

Medium grained polymictic pebbly sandstone

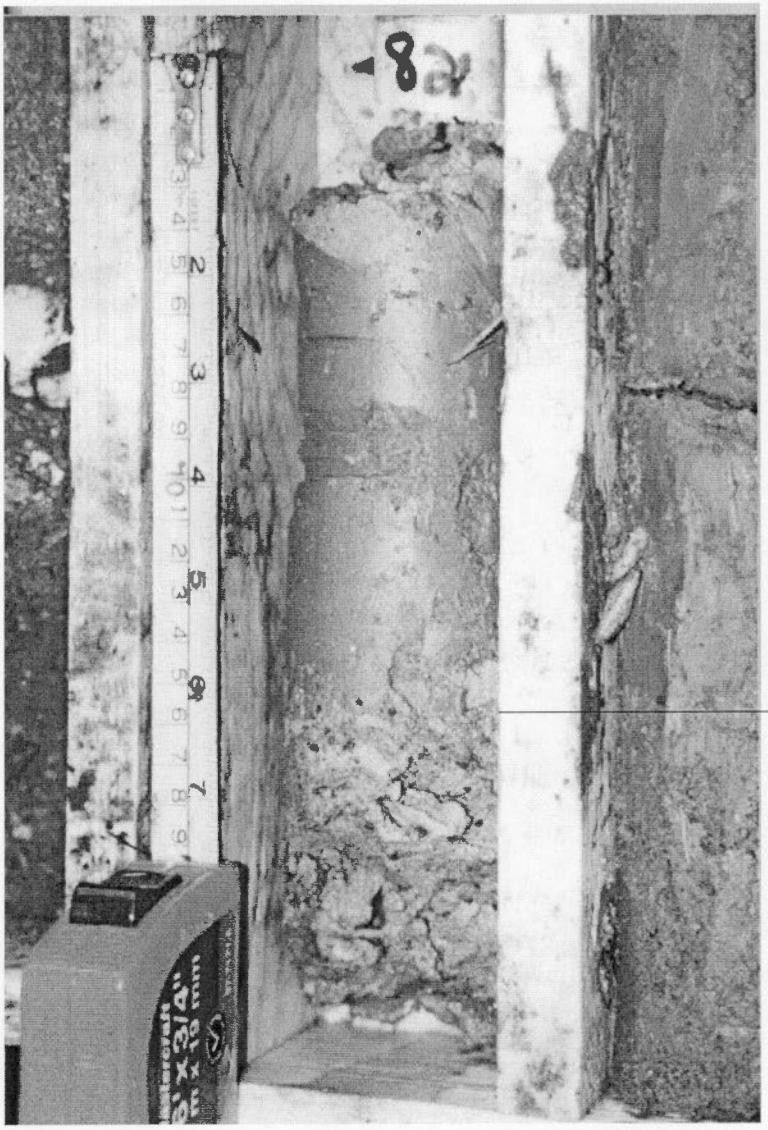
Rhyolite

2002_3_30

BB-02-2
69'

Poorly sorted light grey
medium-coarse
sand with clay partings

2002_3_31



BB-02-2
82'

Red clay with grey mottles overlying medium sand with granules

2002_3_32

BB-02-2
16'

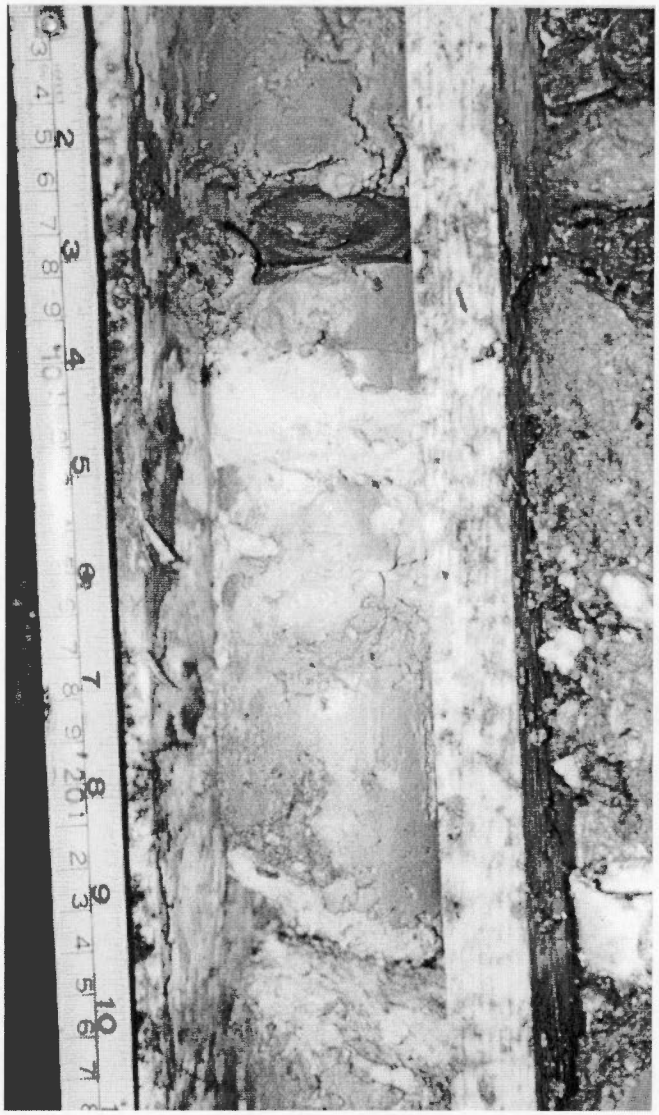
Light grey clay

2002_3_33
5050060 571473

BB-02-2
34'

Dark grey mudstone with quartz granules

2002_3_34
5050060 571473

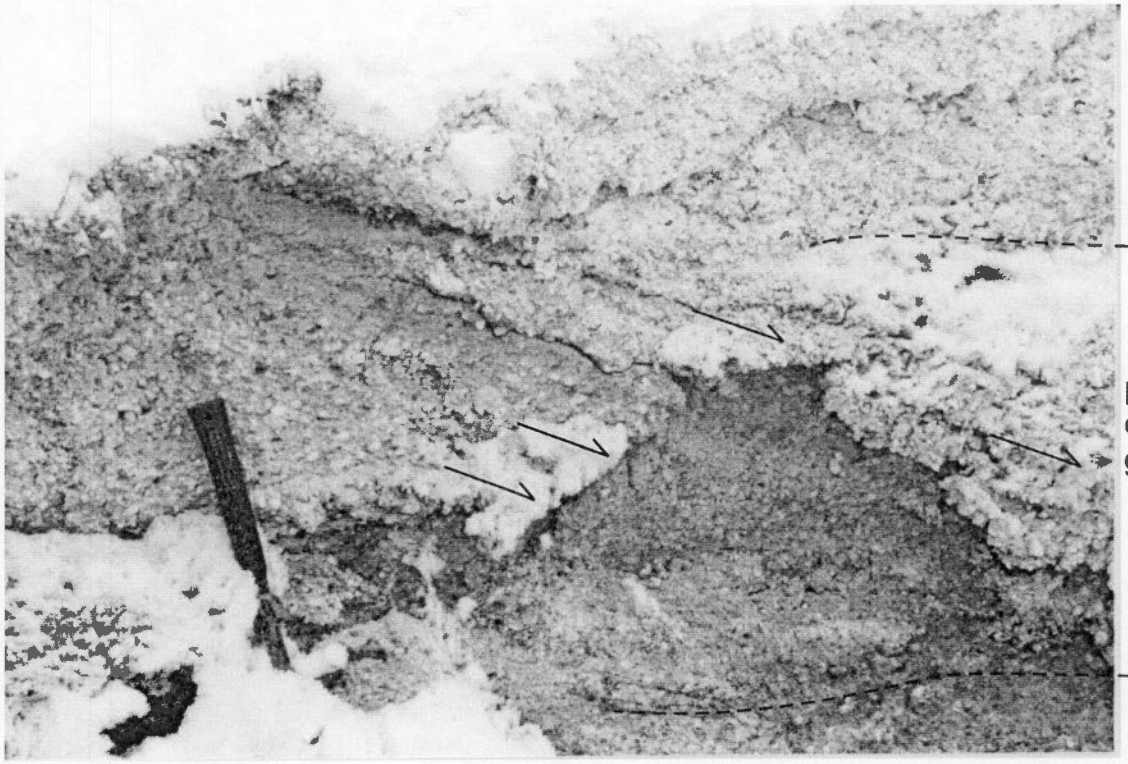


BB-02-2
62'

Mottled red and grey clay

2002_3_36
5050060 571473

General view southward from north end of Cassidy Lake pit 2002_4_9



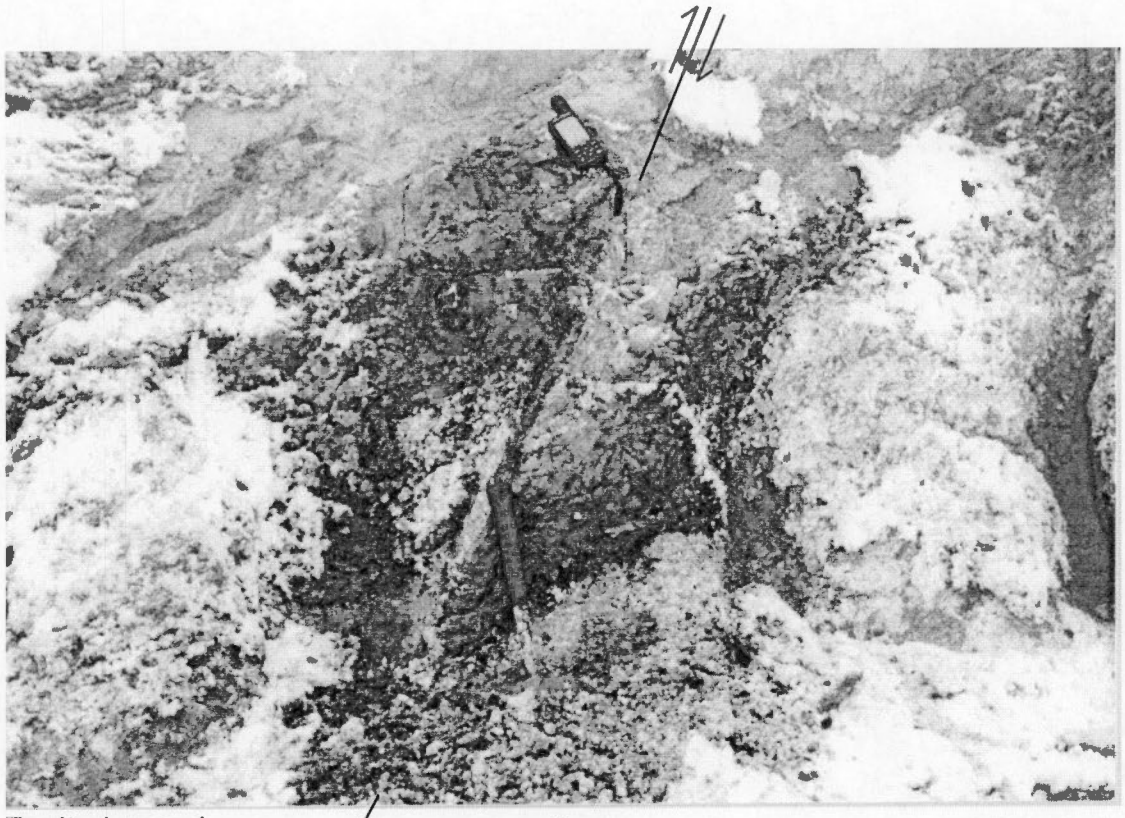
Planar cross-bedded gravel, dipping 230°, Cassidy Lake pit 2002_4_11
5053297 302342

General view of gravel with clay parting and development of a paleosol B-horizon. Cassidy Lake pit

2002_4_12
5053297 302342

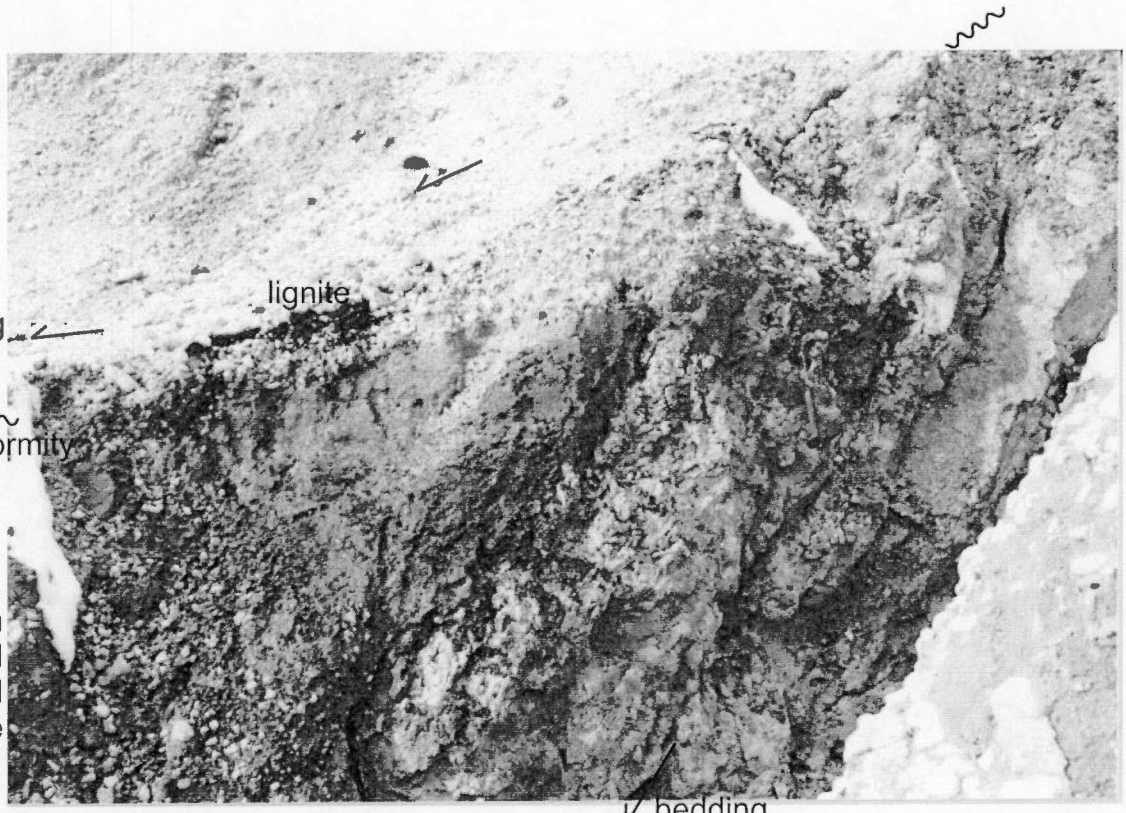
Detail of clay parting, see photo [12]
Cassidy Lake pit

2002_4_13
5053297 302342



Faulted gravel,
Cassidy Lake pit

2002_4_14
5053341 302145



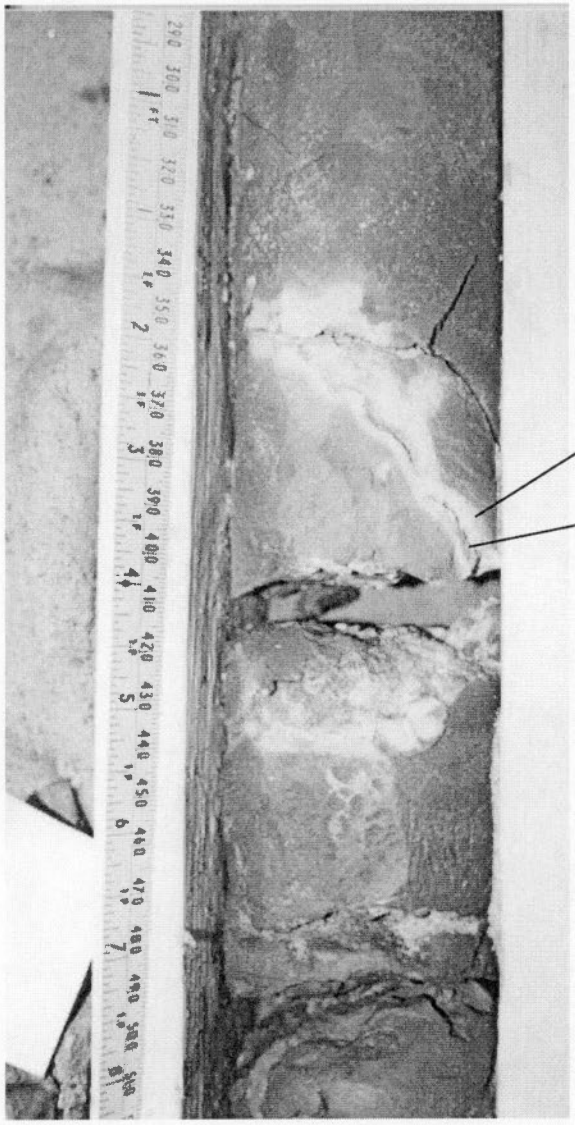
Steeply dipping clay overlain
unconformably by coarse sand with lignite, Cassidy Lake pit

2002_4_15
5053394 302268

Light grey massive clay, Cassidy Lake pit

2002_4_16
5053405 302261

BM-02-2
68'



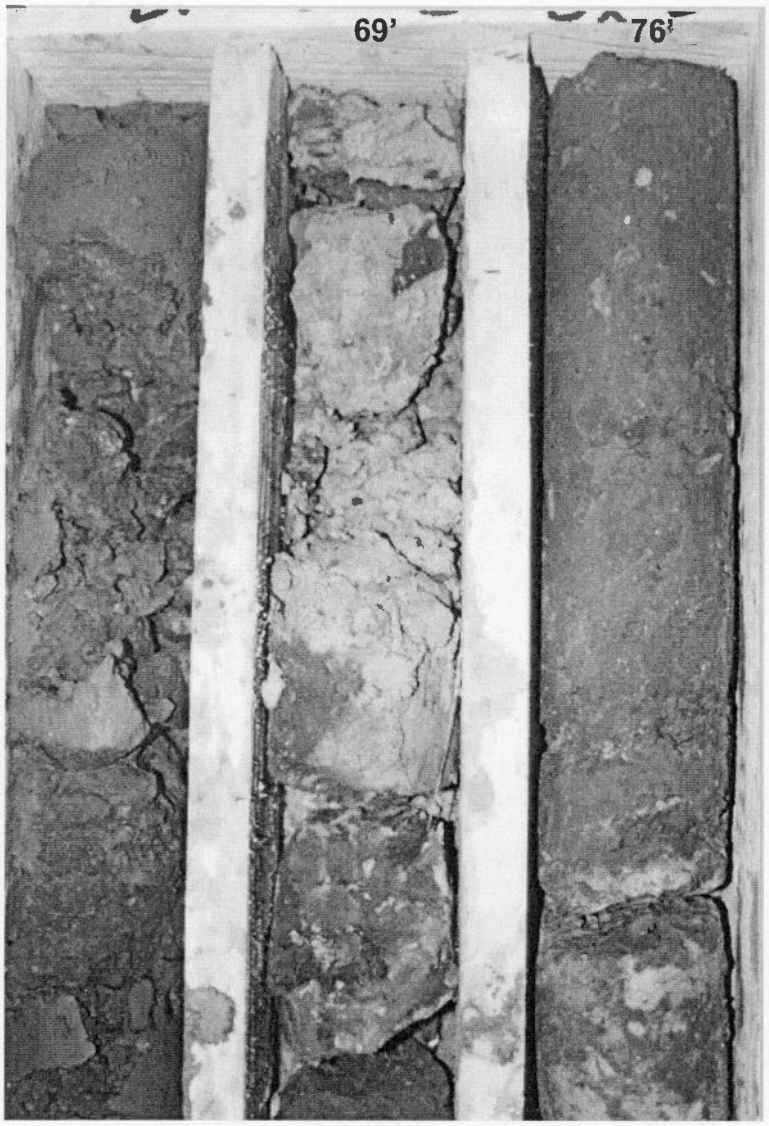
white halo

sandstone

2002_4_17

Red clay and silty clay
with irregular sheet of
medium sandstone

5030712 472939

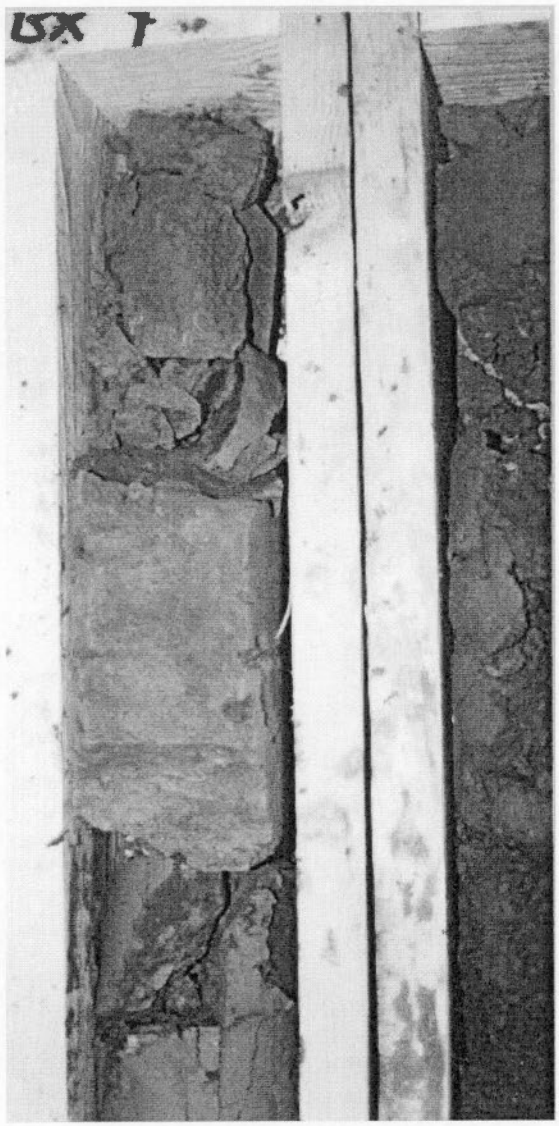


BM-02-3

(centre row) Light grey sandstone with red mottles
(right row) Red silty clay

2002_4_18
5030743 471918

BM-02-3



2002_4_19

Red silty clay

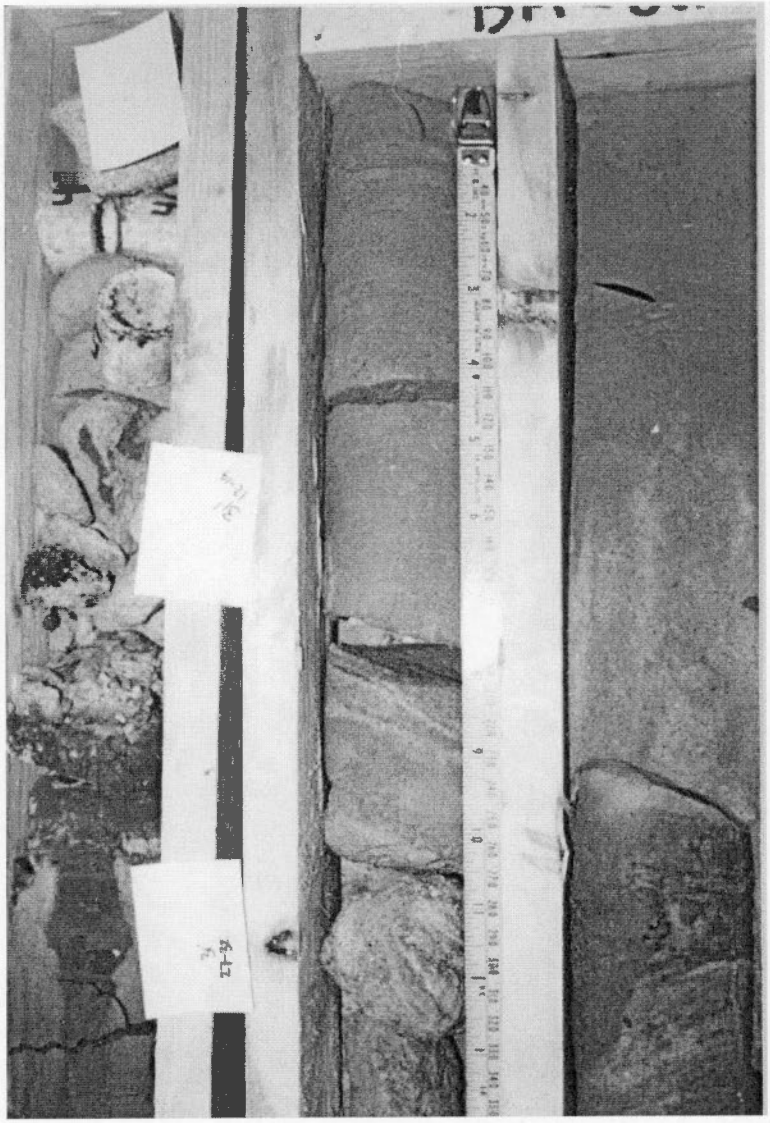
5030743 471918

BM-02-3
63'

2002_4_20

Indurated laminated
fine sandstone

5030743 471918

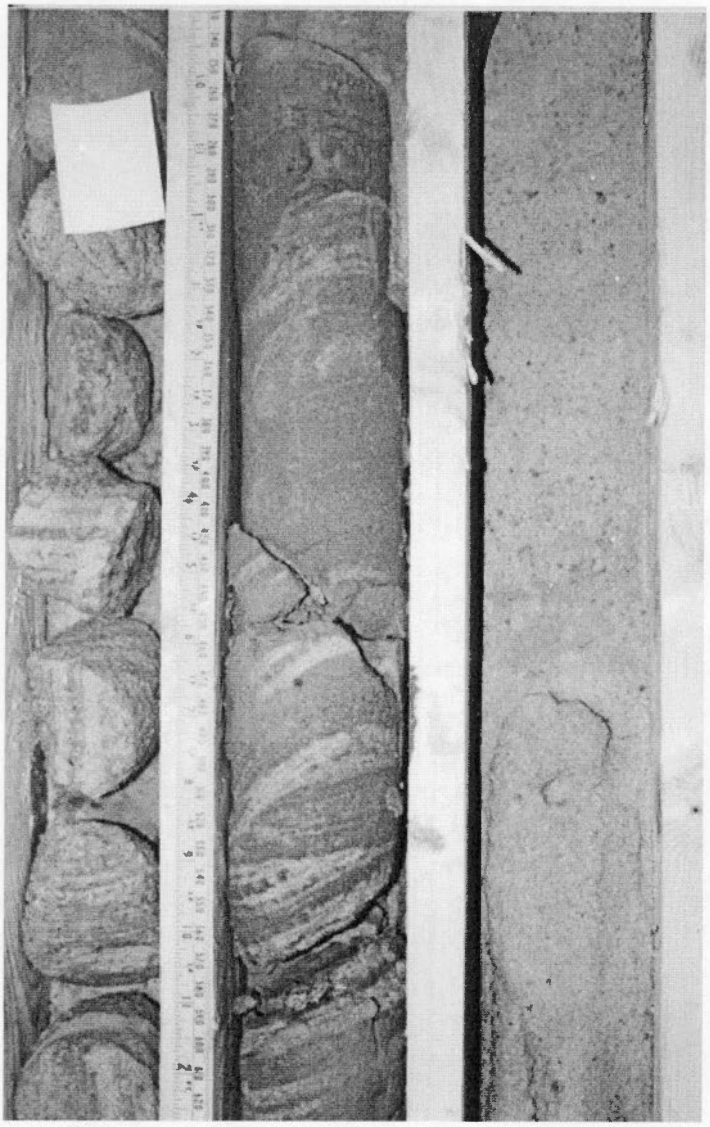


BM-02-3
32'

2002_4_21

Pink fine sandstone over medium sandstone, both cross bedded

5030743 471918

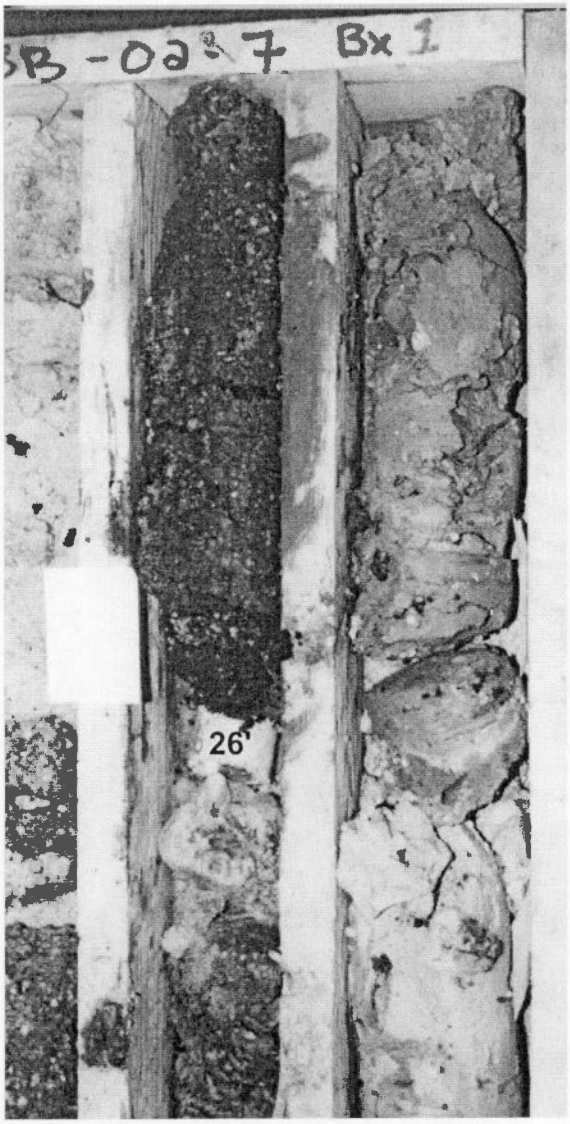


BM-02-3
27,29'

Cross-bedded medium and fine sandstone with heavy mineral concentrations

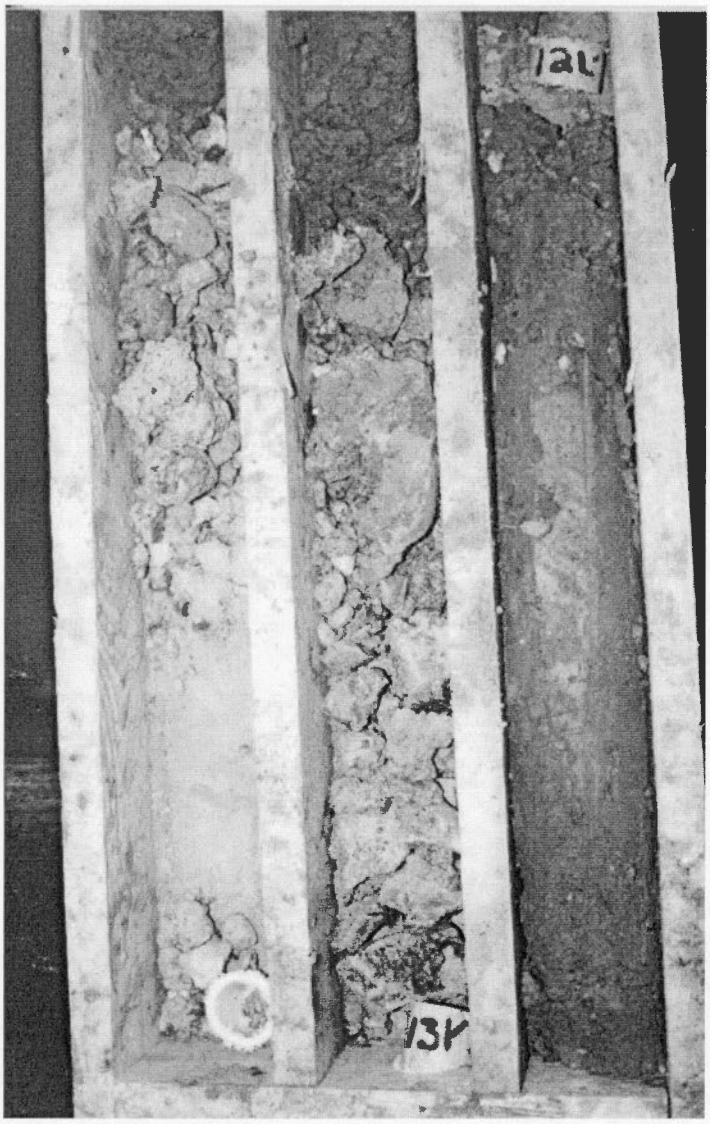
2002_4_22
5030743 471918

BB-02-7
21'



Black coarse muddy sandstone, some granules

2002_4_23
5050087 571399

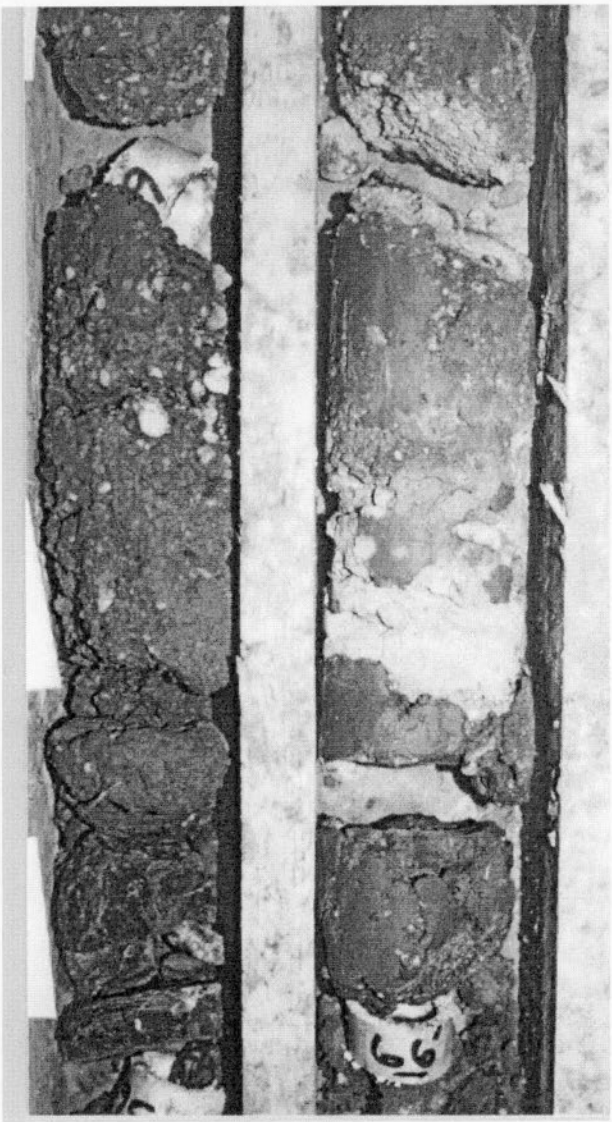


BB-02-2
128'

Rubbly Windsor limestone

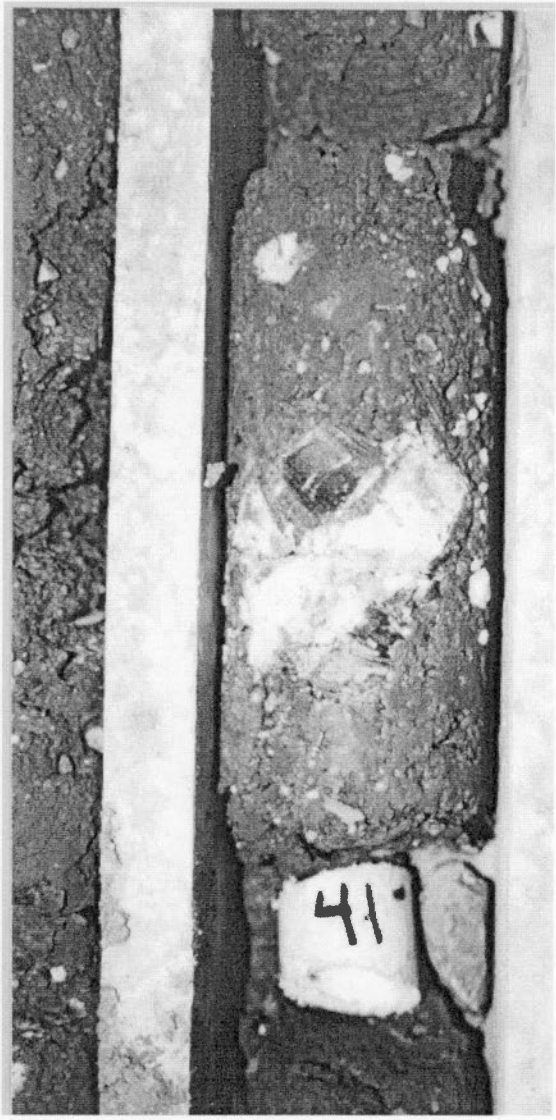
2002_4_24
5050060 571473

BB-02-2
67'



Mottled red clay and fine sand

2002_4_25
5050060 571473

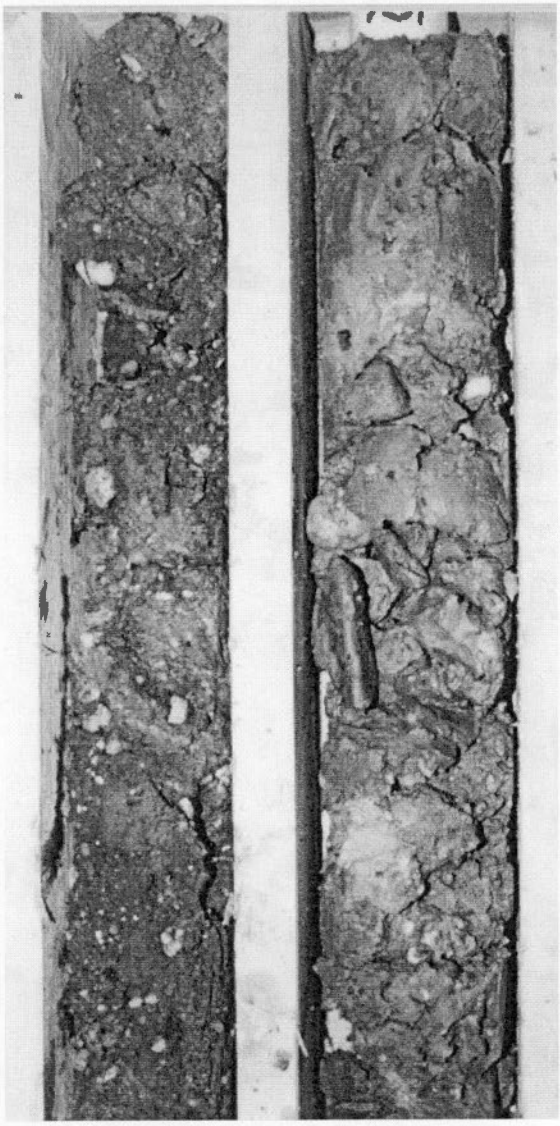


BB-02-2
38'

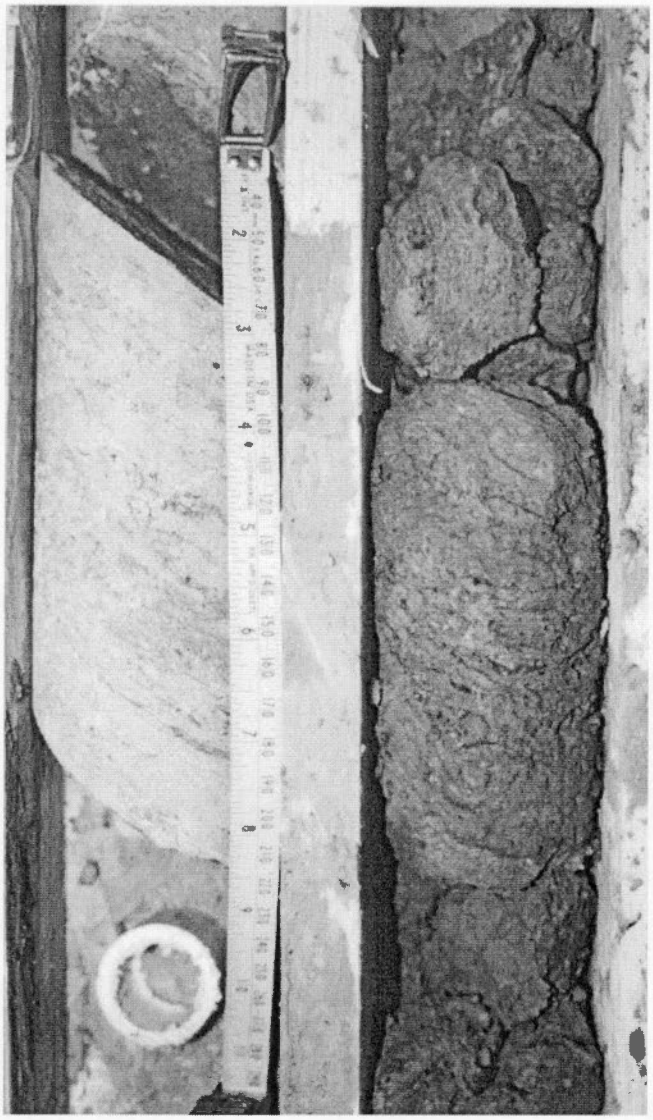
Limestone clast and quartz granules in dark grey mudstone

2002_4_26
5050060 571473

BB-02-2
11' and 27'



(right) Mottled pink clay 2002_4_27
(left) Dark grey pebbly mudstone 5050060 571473



BB-02-1
63' and 68'

(right) Weathered Windsor limestone
(left) Fresh Windsor limestone

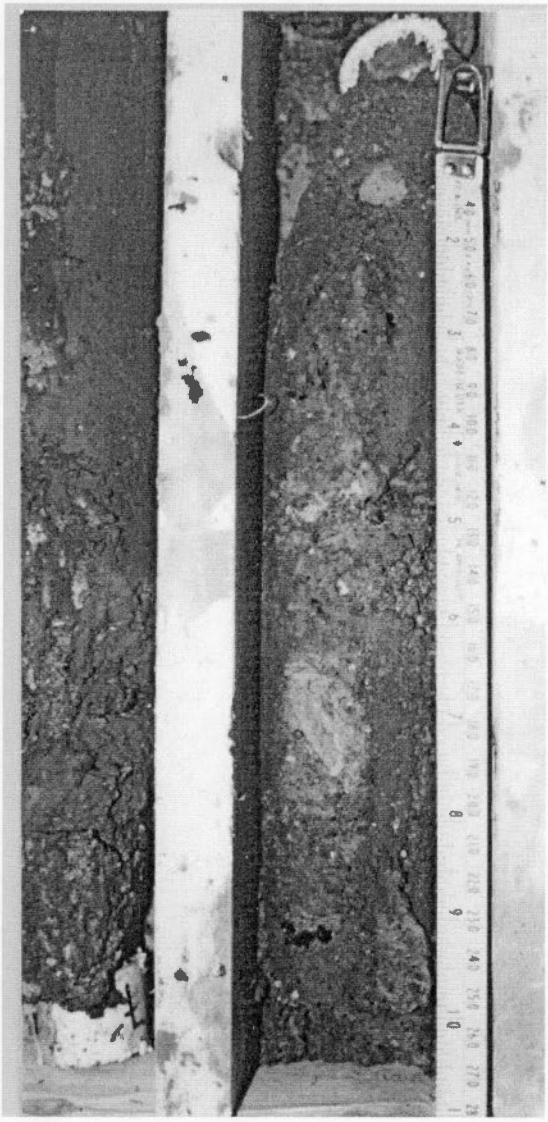
2002_4_28
5049936 571260

BB-02-1
58'

Dark grey clay with silt beds

2002_4_29
5049936 571260

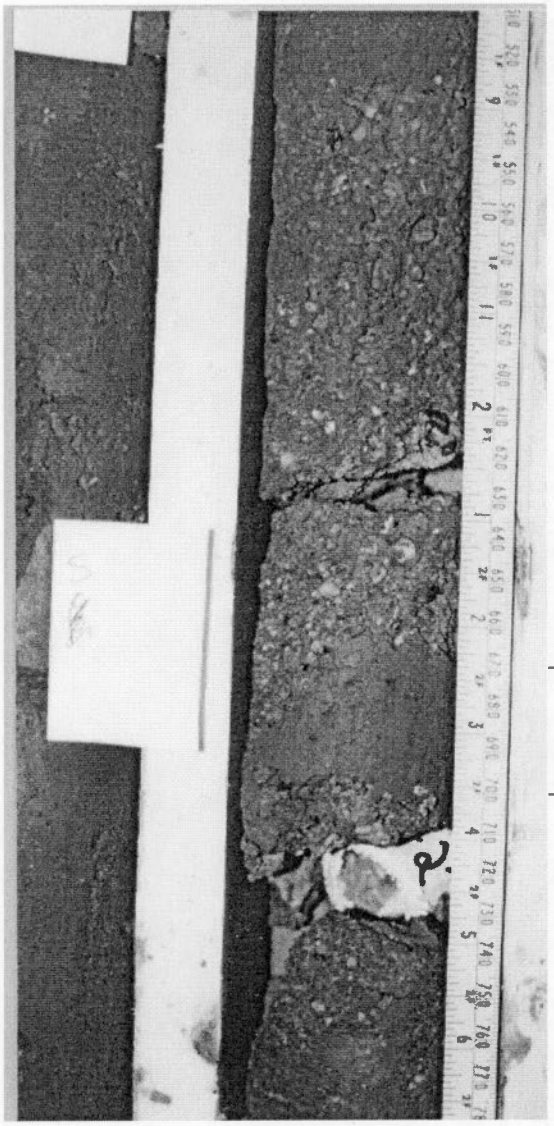
BB-02-1
43'



Debris-flow deposit
Poorly sorted coarse sand
with polymictic clay clasts

2002_4_30
5049936 571260

BB-02-1
39'

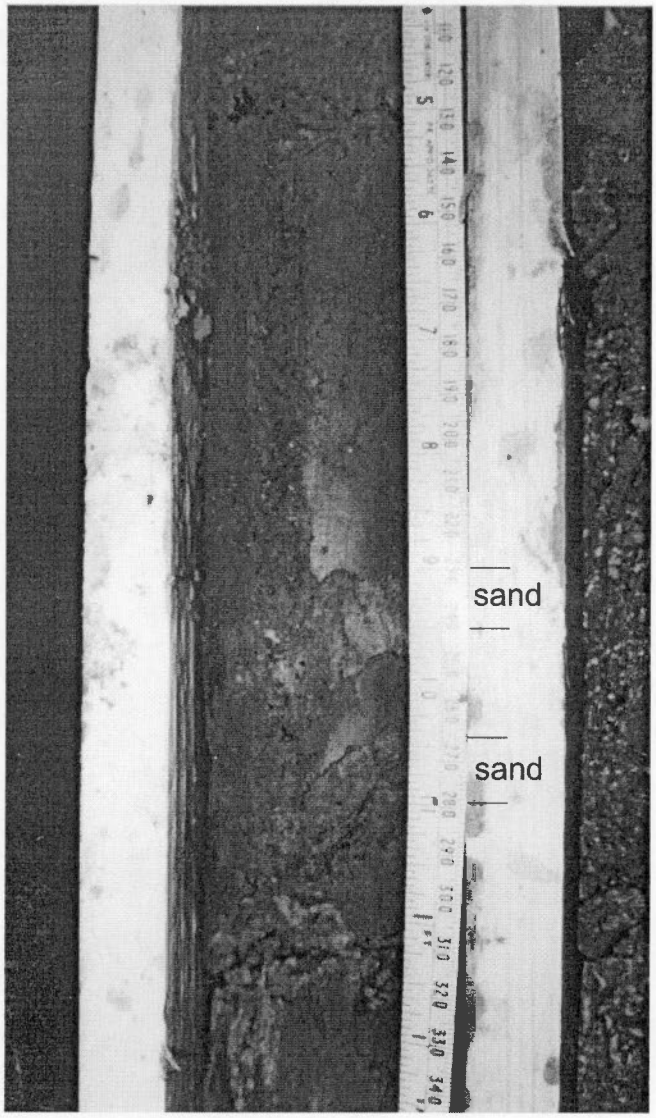


silty clay

Poorly sorted coarse sand with lignite clasts

2002_4_31
5049936 571260

BB-02-1
30'



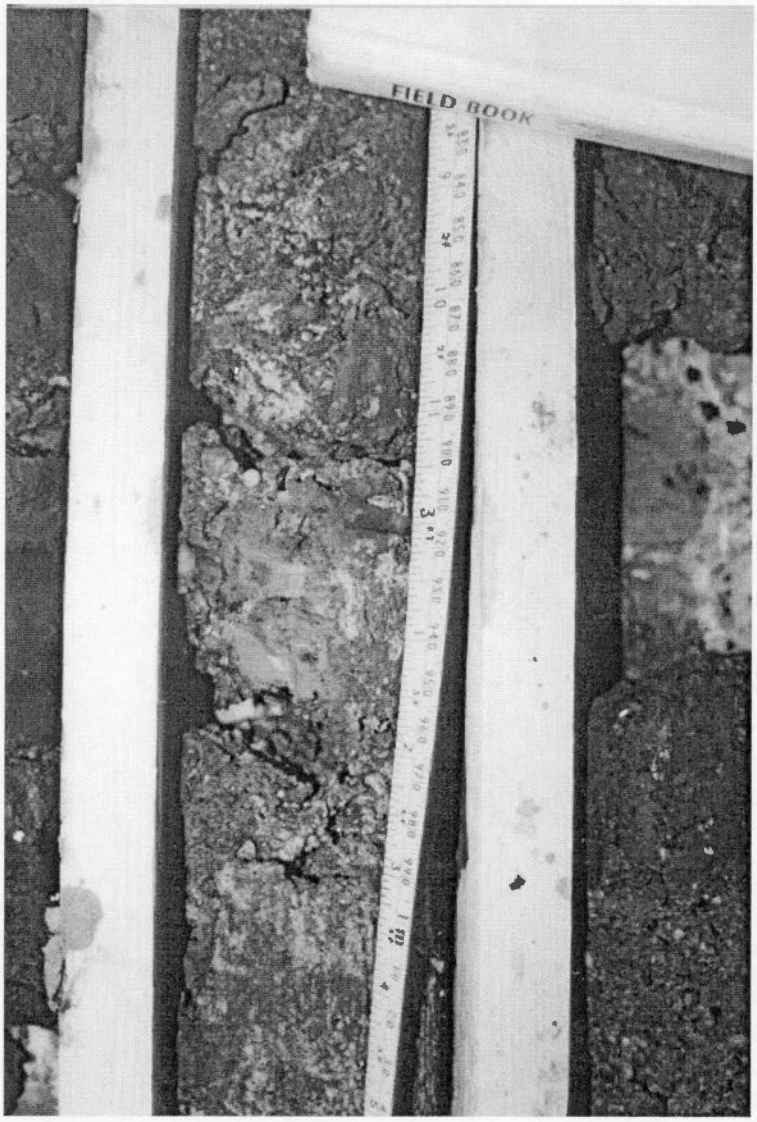
Dark grey clay with disturbed very fine sand beds

2002_4_32
5049936 571260

BB-02-1
23'

Granule coarse sand
with muddy matrix

2002_4_33
5049936 571260

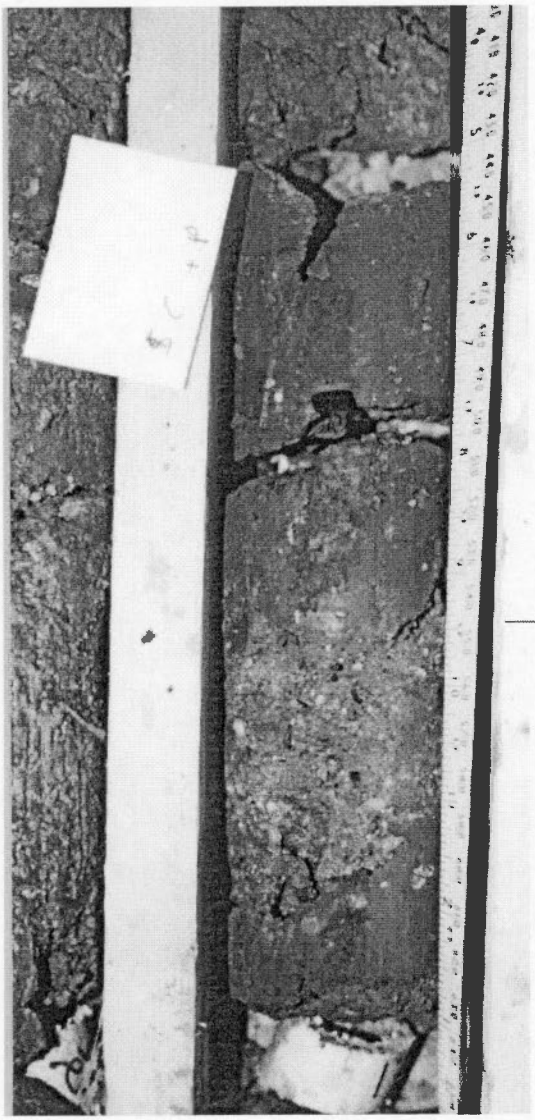


BB-02-1
19'

Muddy granule sand with clay and lignite clasts

2002_4_34
5049936 571260

BB-02-1
14'



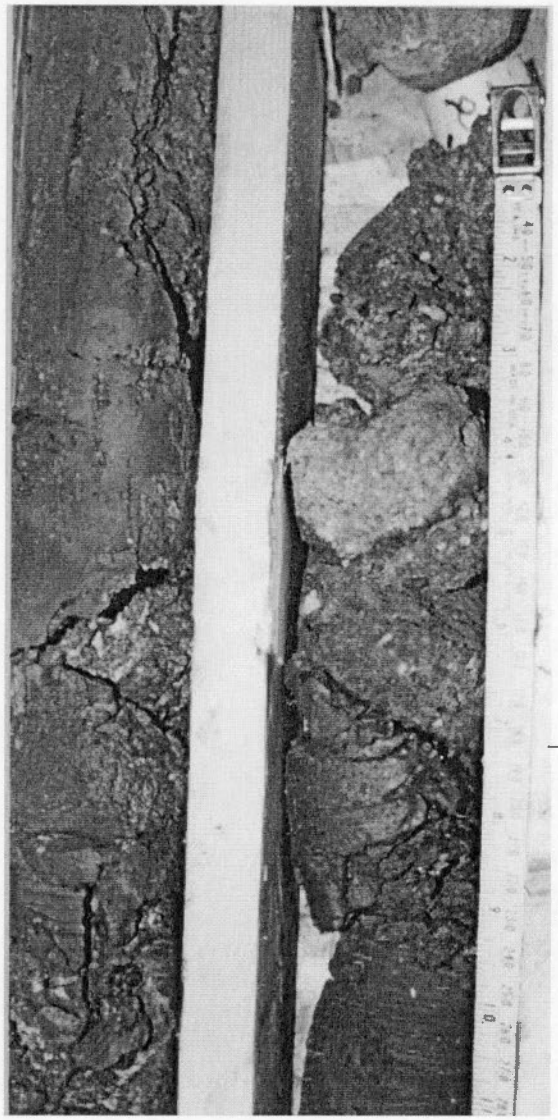
clay

granule sand

Poorly sorted granule sand overlain by grey clay

2002_4_35
5049936 571260

BB-02-1
12'

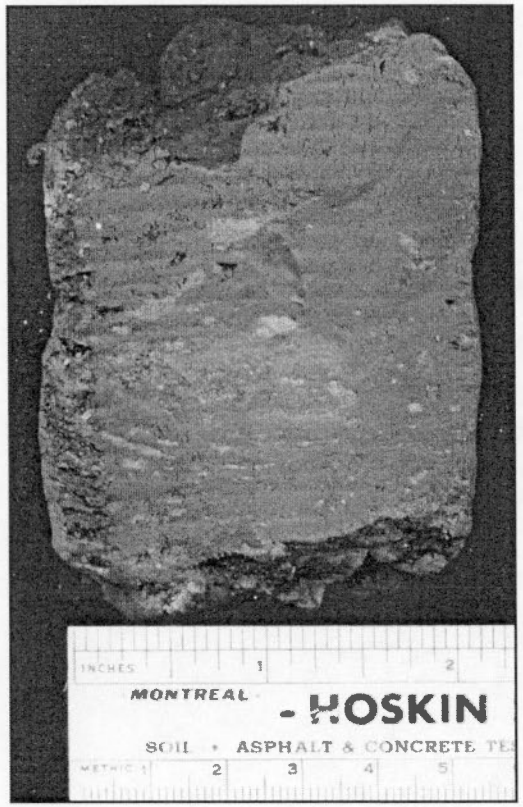


granule sand

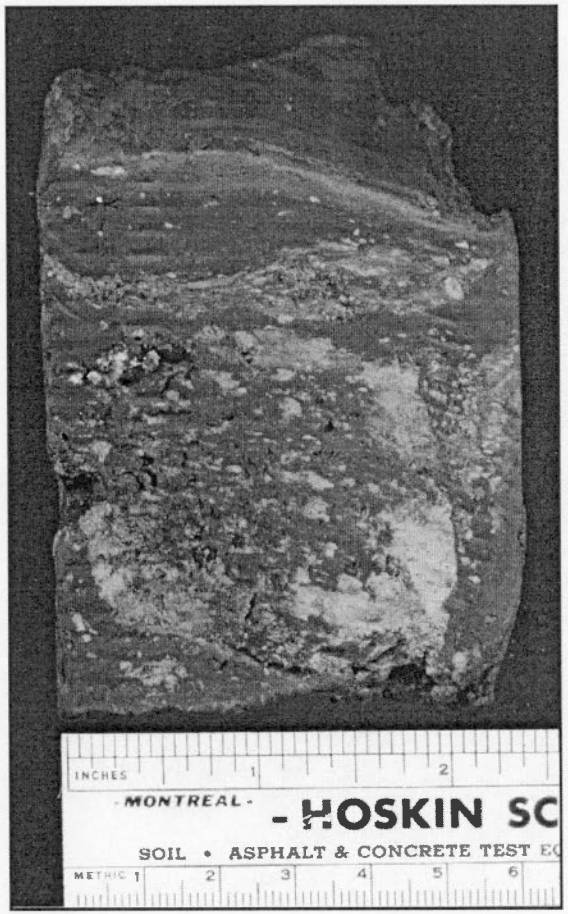
clay

Poorly sorted muddy
granule sand
overlying grey clay

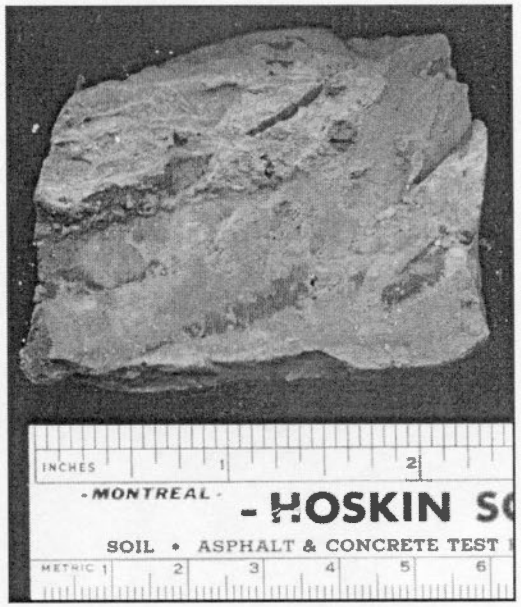
2002_4_36
5049936 571260



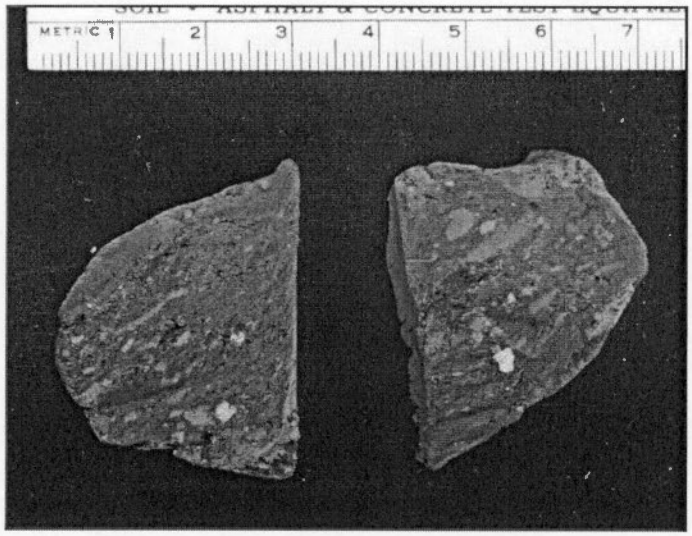
BB-02-1 29' (39-47): Dark grey claystone with disturbed beds of siltstone and poorly sorted sandstone.

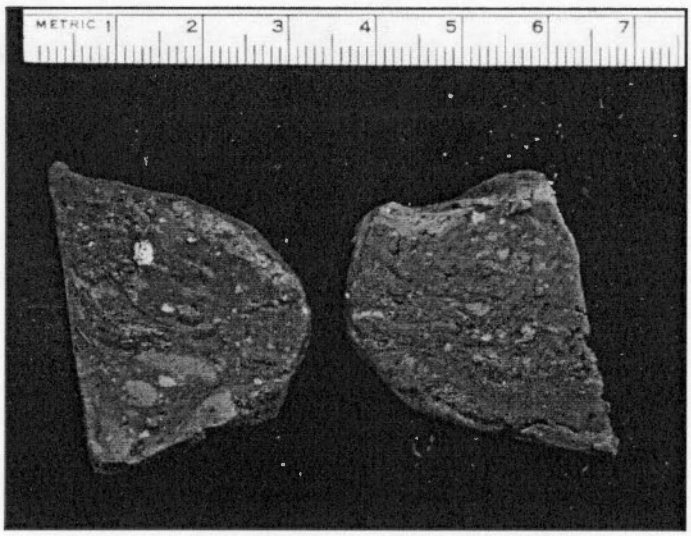


BB-02-1 57' (32-39): Dark grey claystone with disturbed beds of poorly sorted calcarenite, derived from immediately underlying Windsor Group.

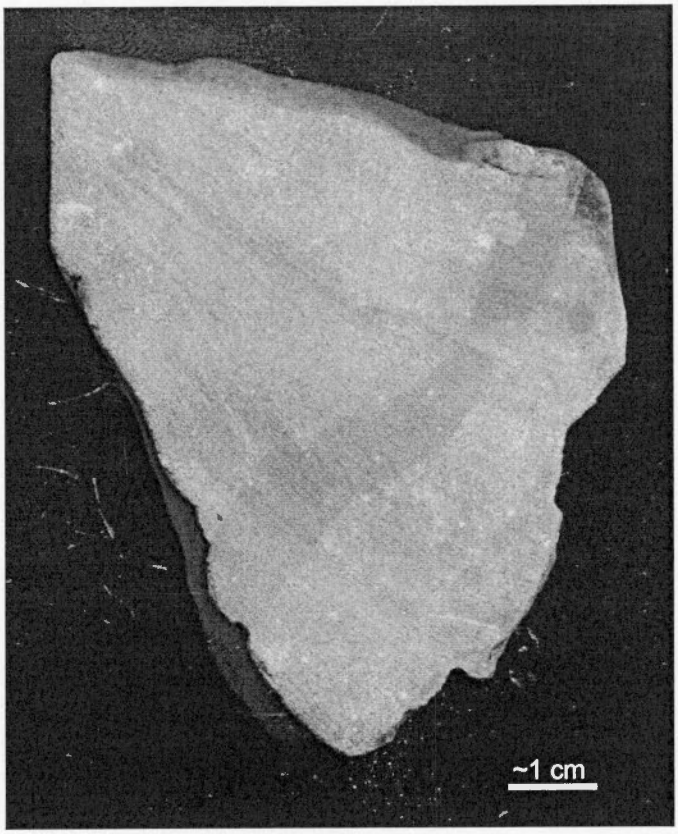


BB-02-2 82' (28-36): Medium grey claystone with bioturbational mottles including red claystone from the overlying bed.





BB-02-7 11' (17-21): Debris-flow facies association consisting of intraclasts of clay, lithic granules, sand, and pyrite, in a clayey matrix.

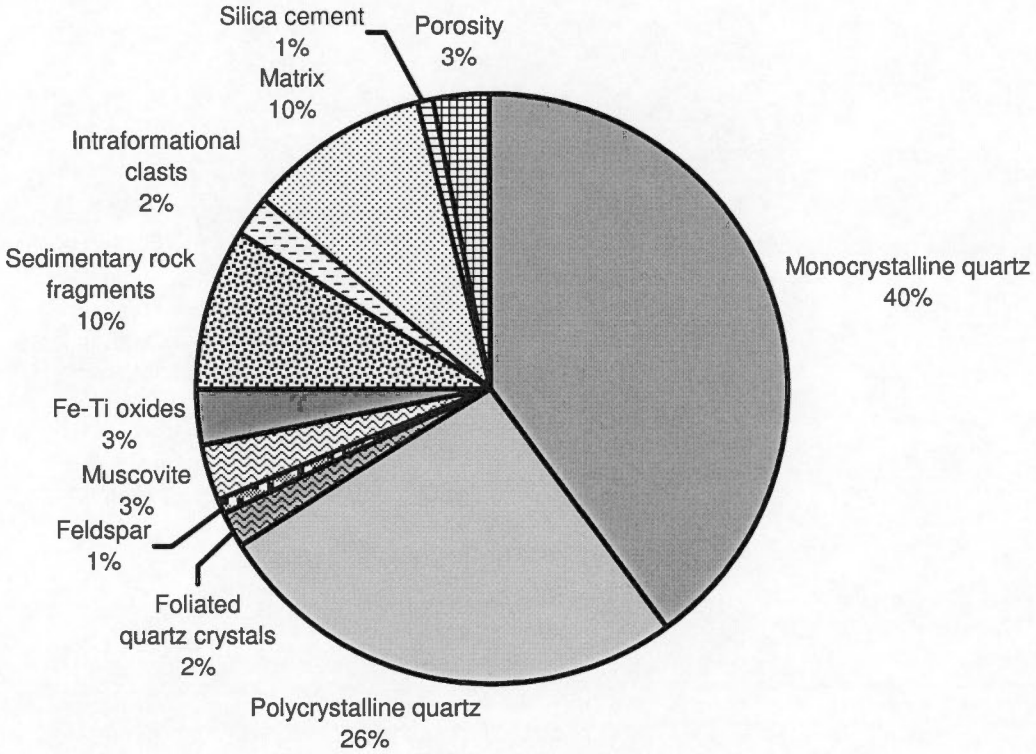


BM-02-3 76′ (179-186): Brick red Triassic silty claystone.

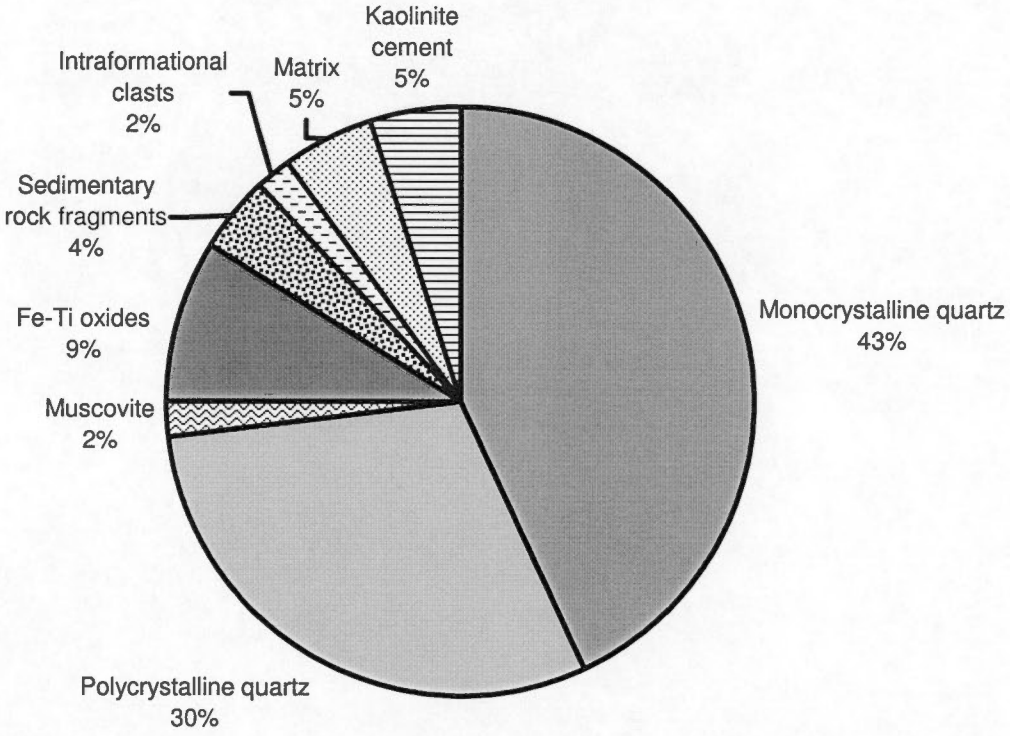
Appendix VI:

Pie diagrams of sedimentary petrography from Belmont

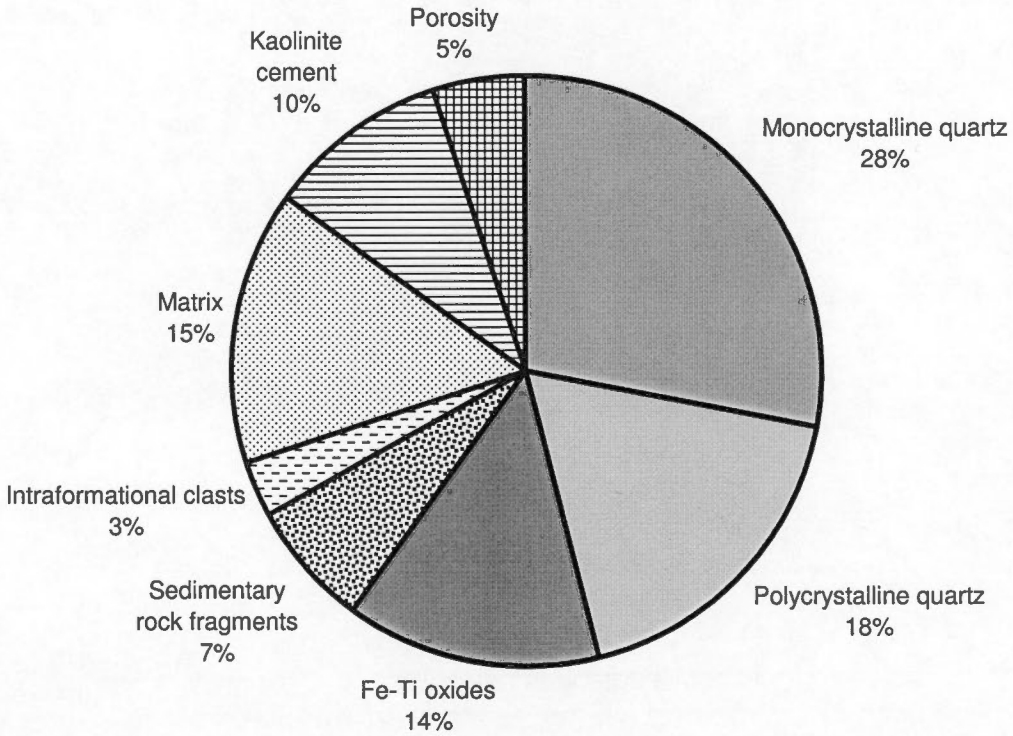
BM-02-1 31' (62-68)
Triassic Wolfville Formation sandstone



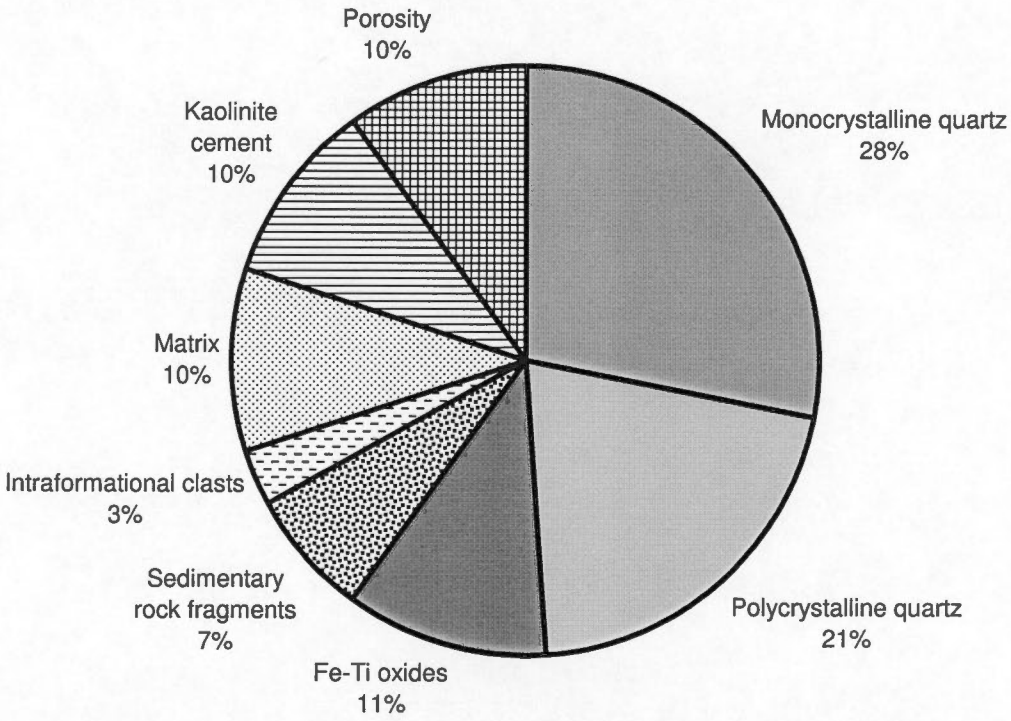
BM-02-2 91' (28-31)
Fine-grained sandstone



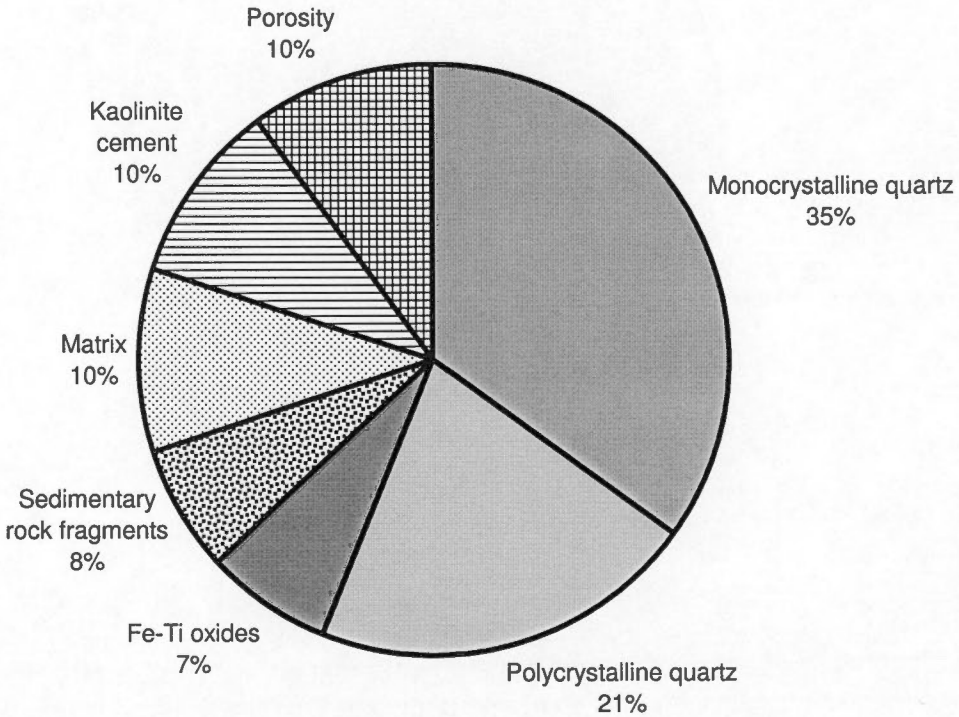
BM-02-3 26' (46-58) A
Laminated sandstone



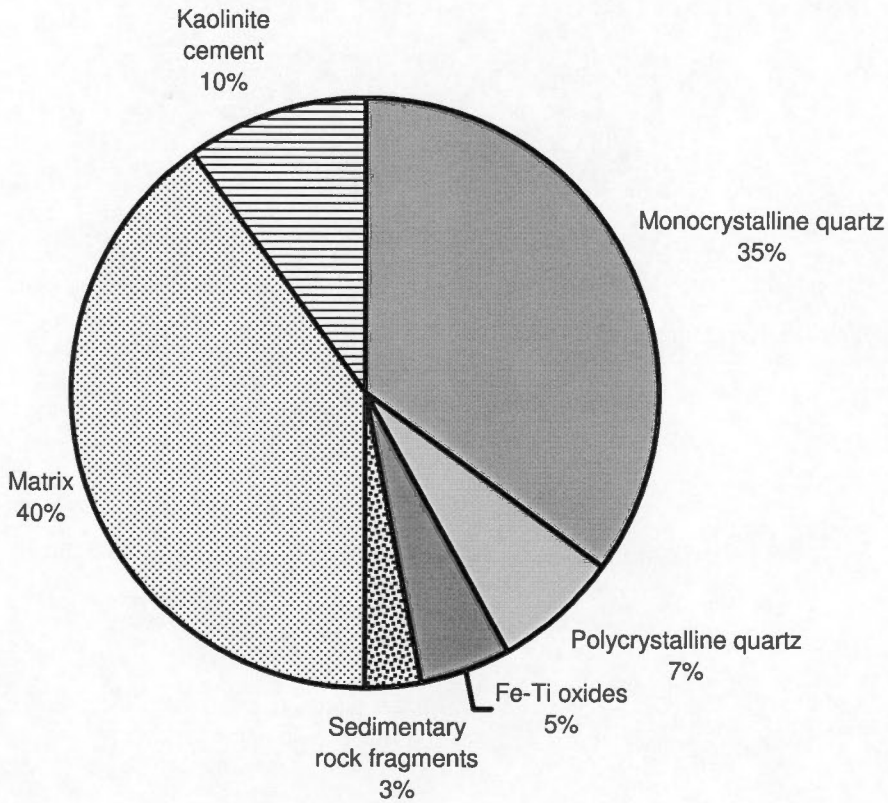
BM-02-3 26' (46-58) B
Laminated sandstone



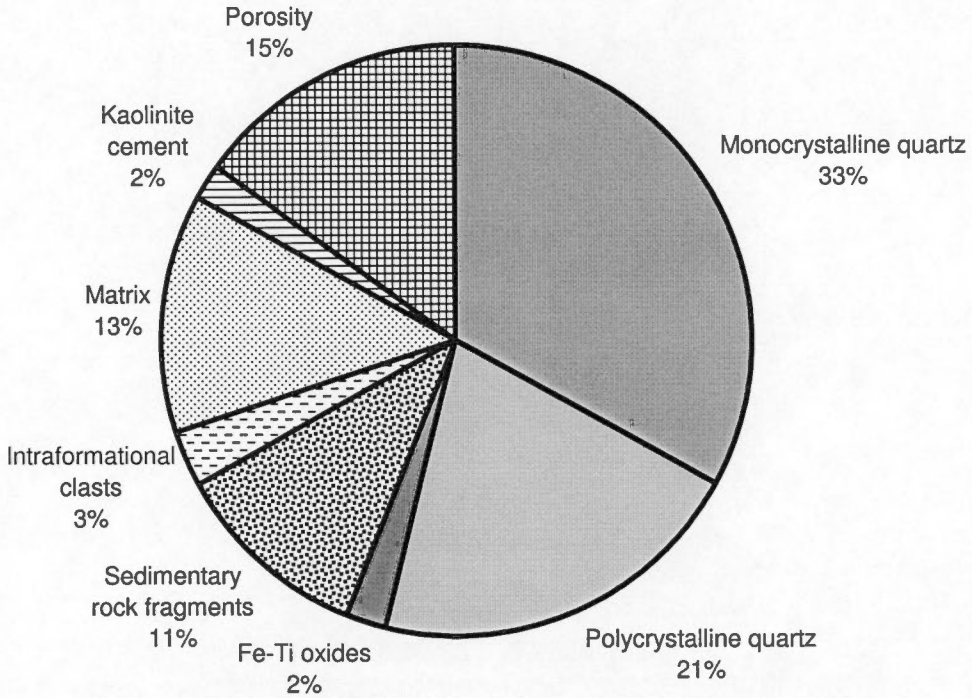
BM-02-3 26' (81-85)
Laminated sandstone



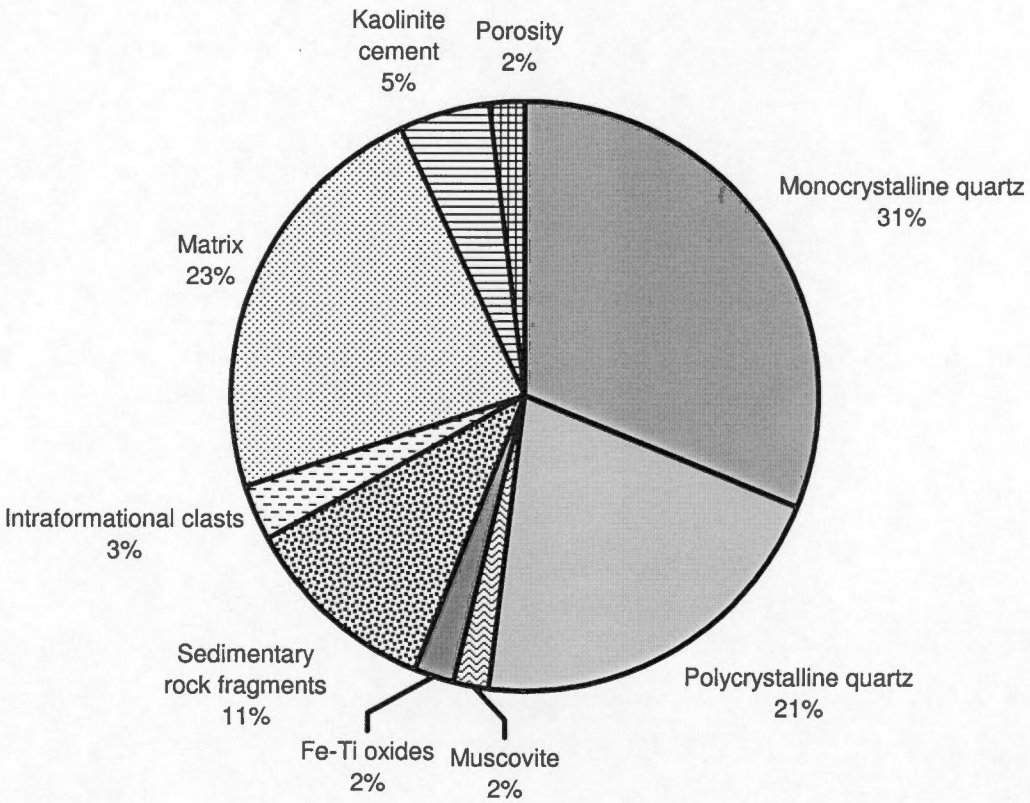
BM-02-3 31' (12-19)
Pink fine-grained sandstone



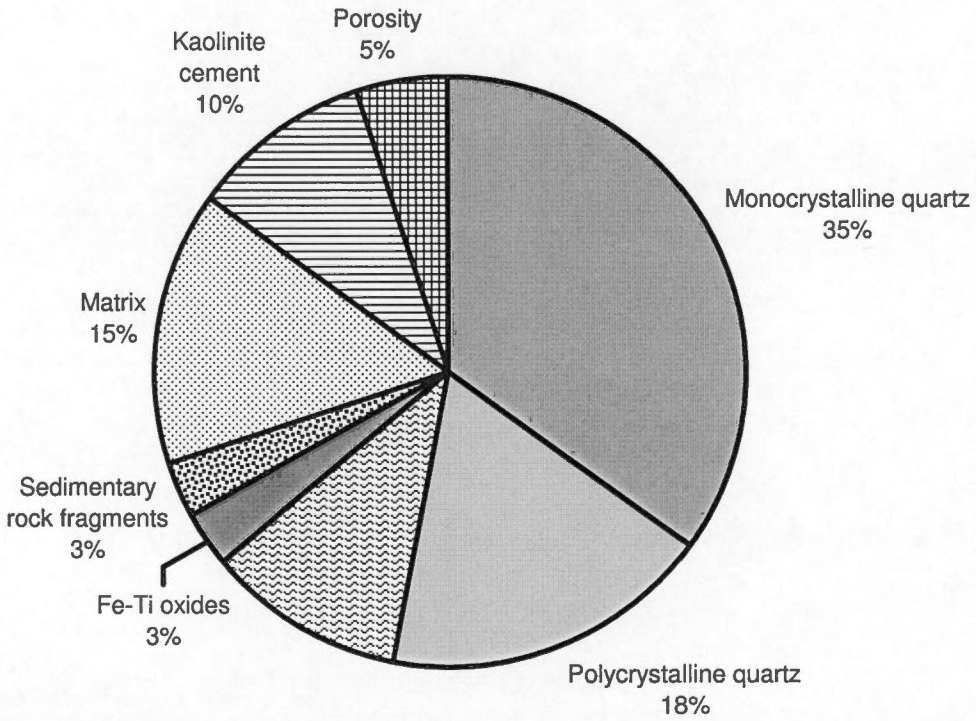
BM-02-3 31' (27-32)
Coarse sandstone



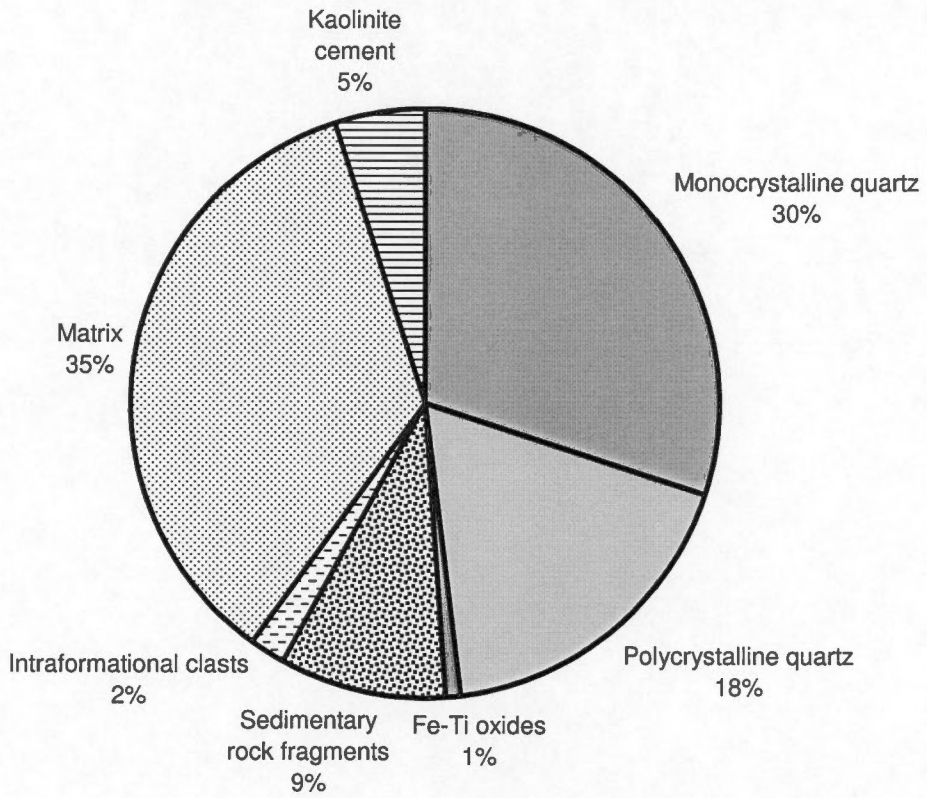
BM-02-3 36' (0-4)
Medium-grained white sandstone



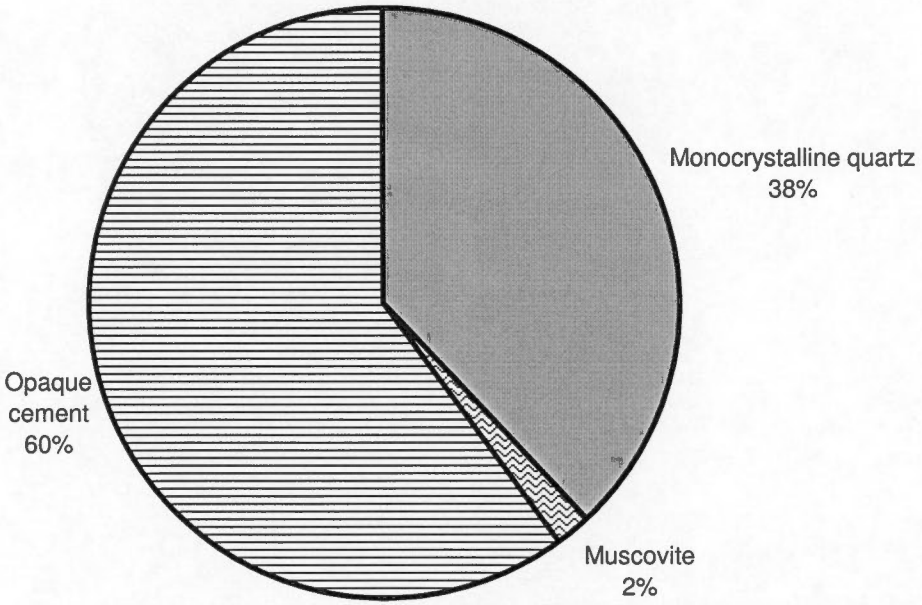
BM-02-3 51' ((7-10)
Fine-grained white sandstone



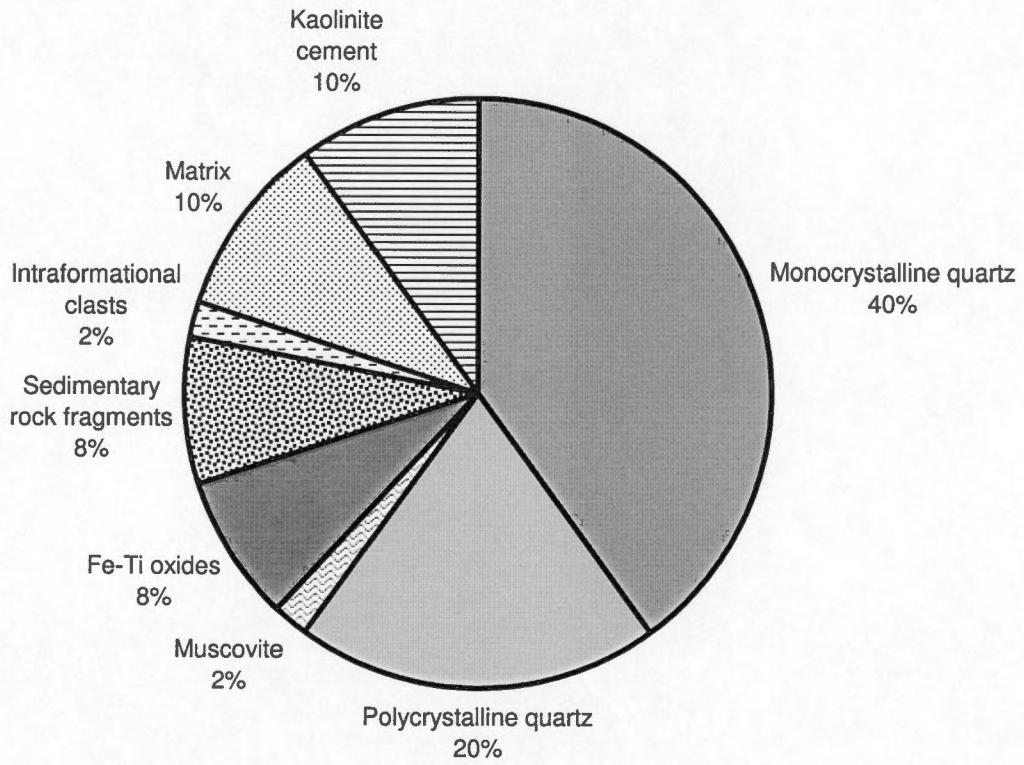
BM-02-3 57'
Fine-grained sandstone



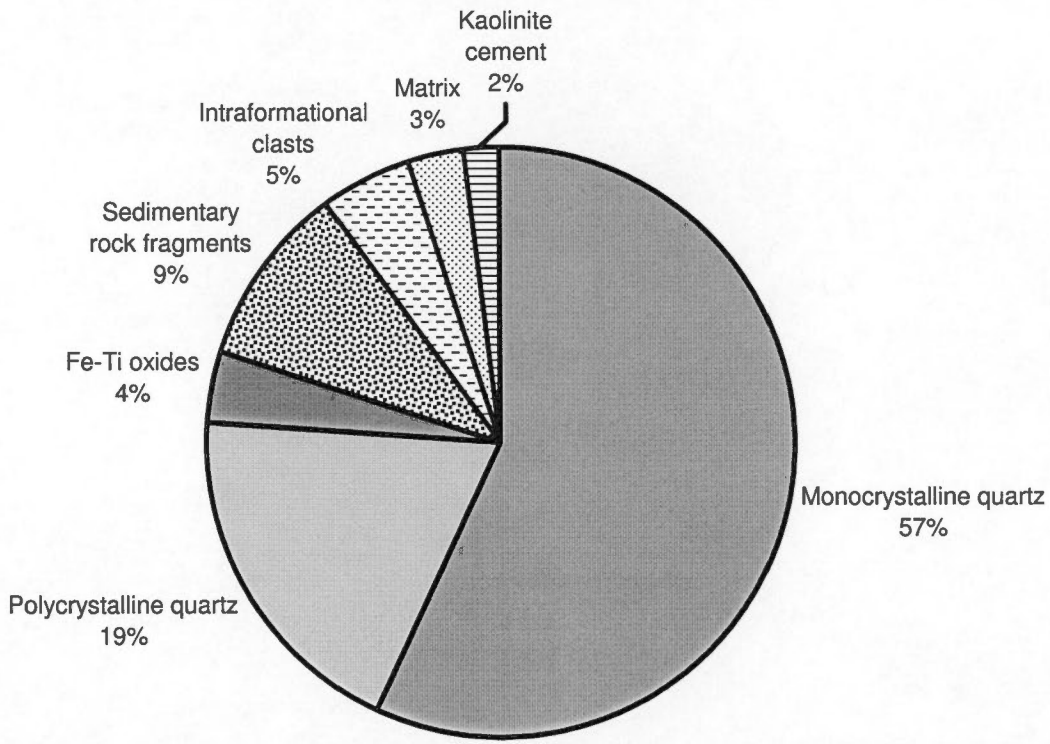
BM-02-3 61' (38-43)
Indurated fine-grained sandstone



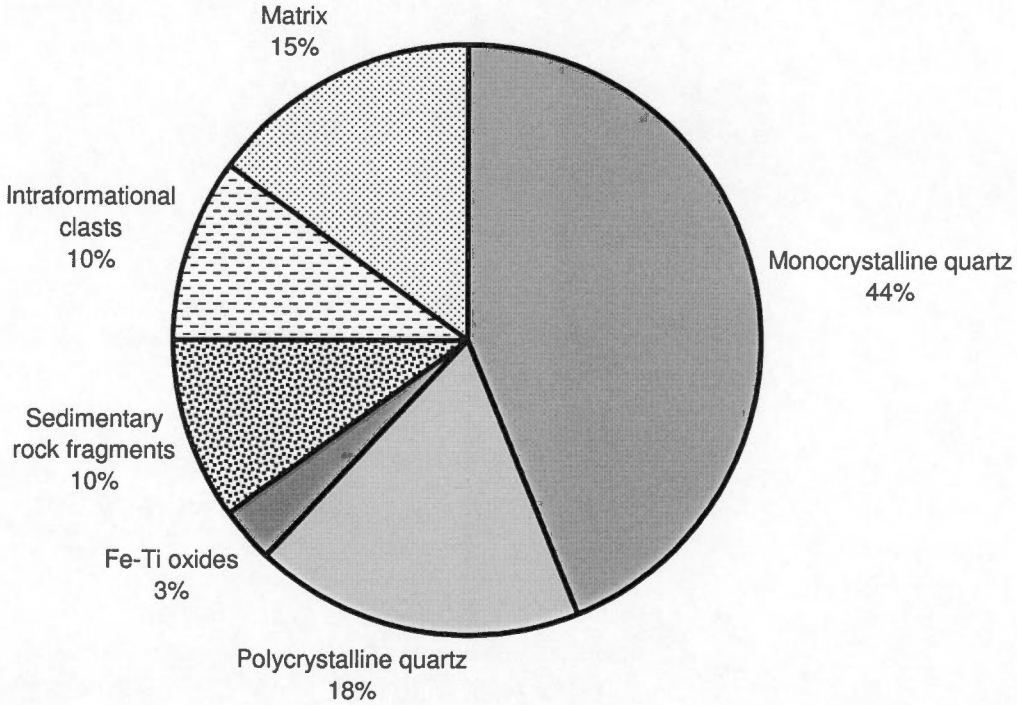
BM-02-2 76' (0-5)
Coarse-grained sandstone



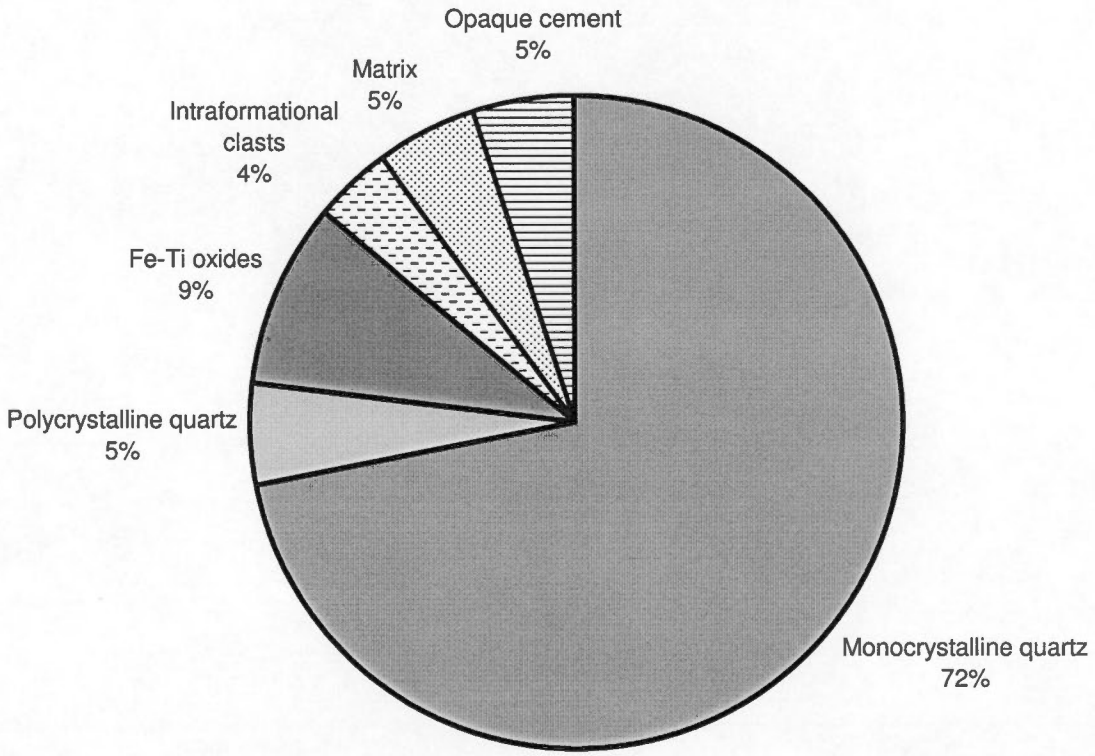
BM-02-2 36' (53-57)
Coarse-grained sandstone



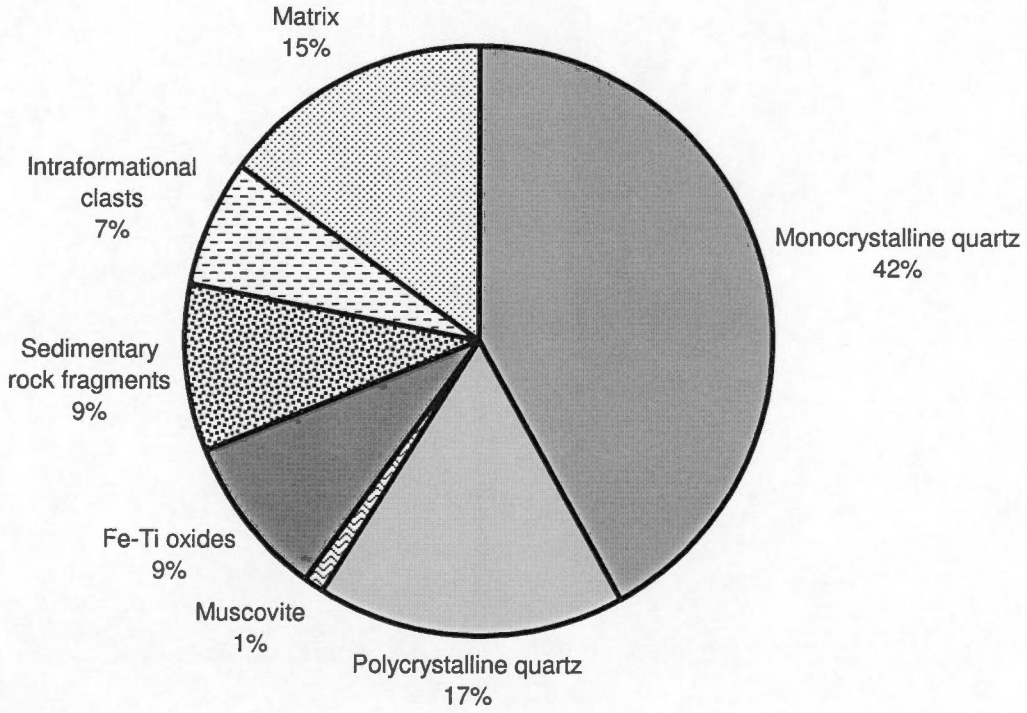
BM-02-2 40'
Coarse-grained sandstone



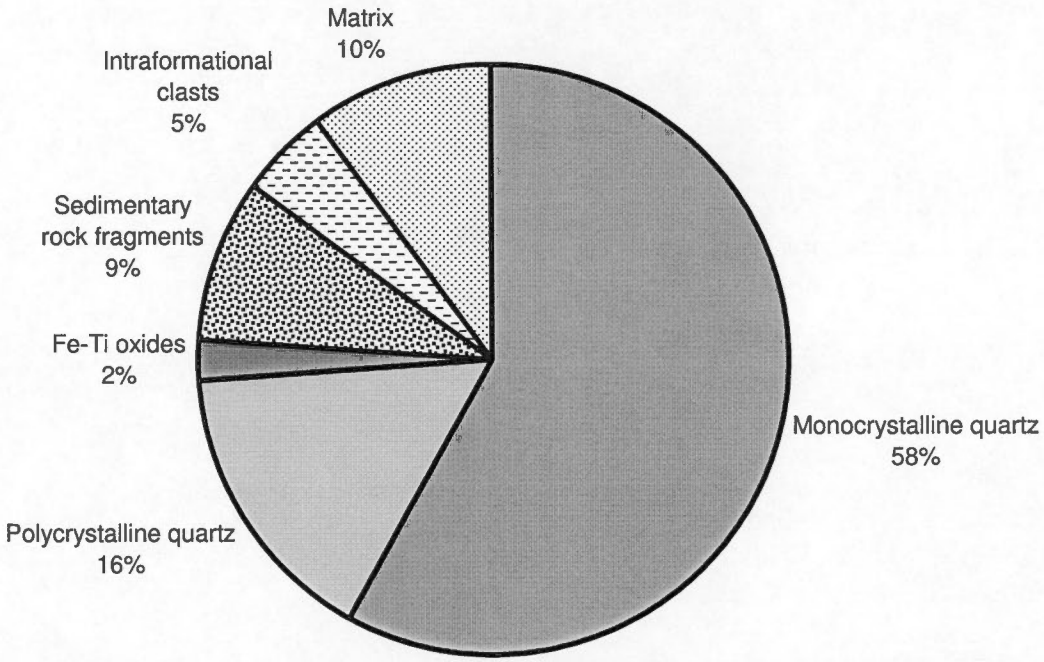
BM-02-2 52'
Limonite cemented medium-grained sandstone



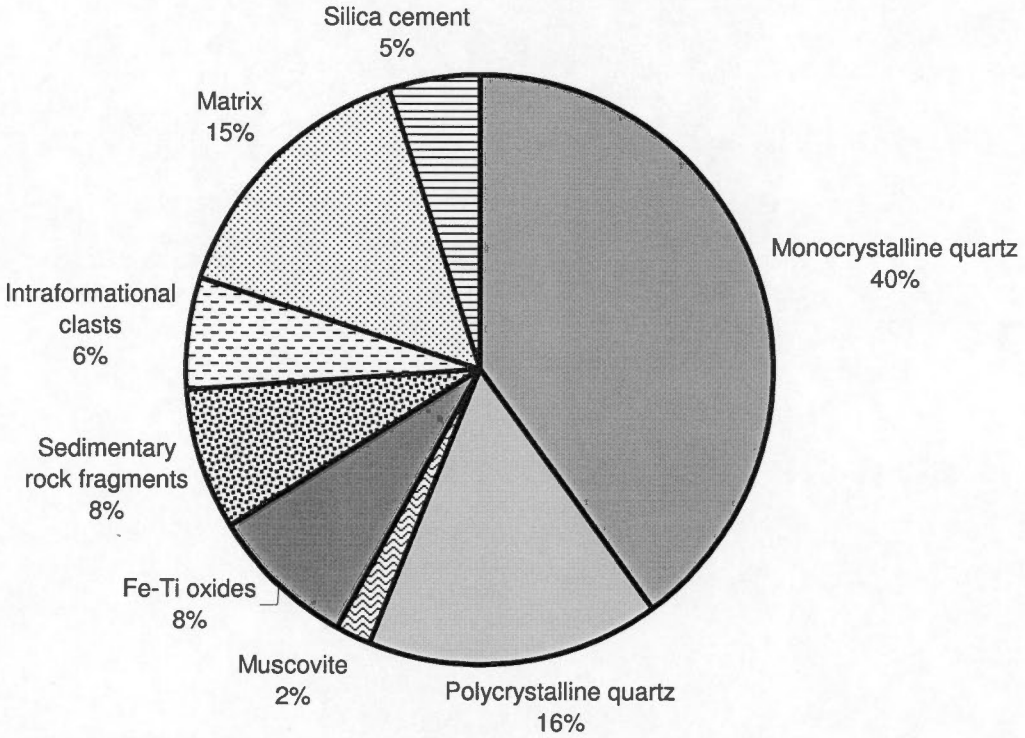
BM-02-2 55'
Fine-grained sandstone



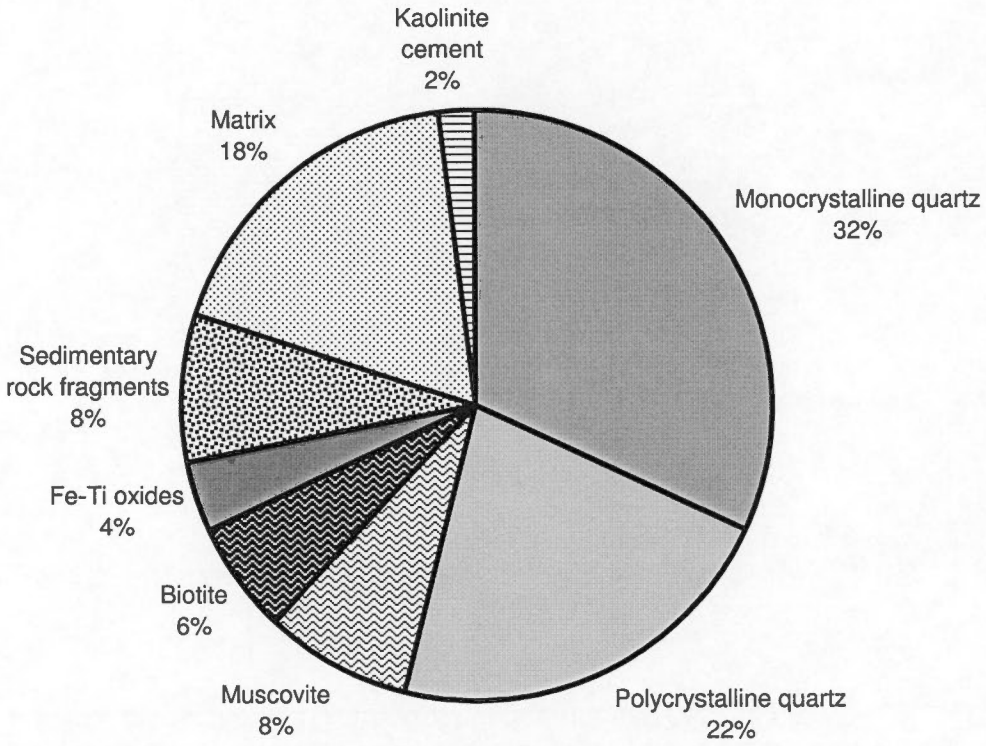
BM-02-2 56' (20-25)
Medium-grained sandstone with red staining



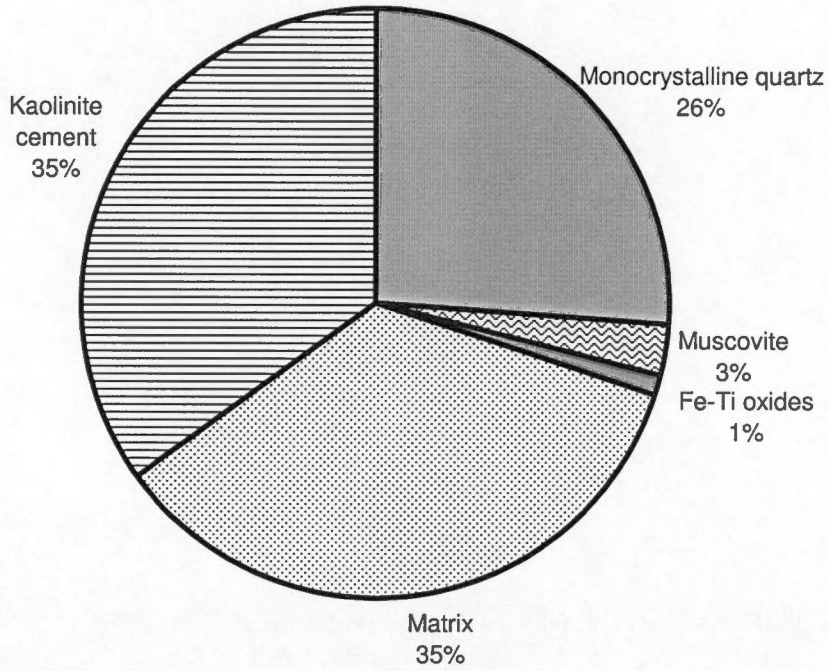
BM-02-2 61' (135-137)
Medium-grained sandstone



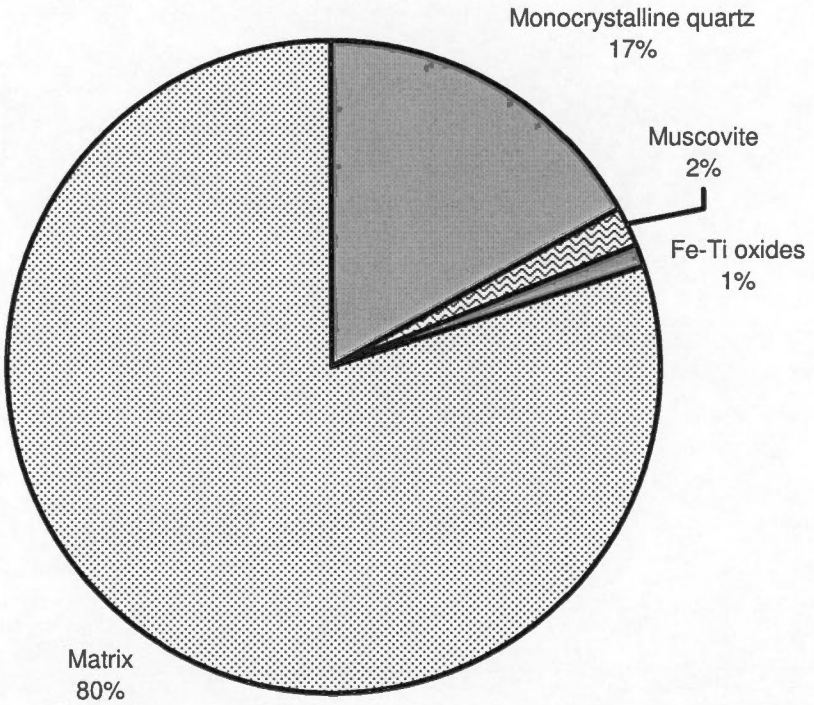
BM-02-3 61' (90-94)
The fine-grained sandstone clasts within a silty mudstone matrix



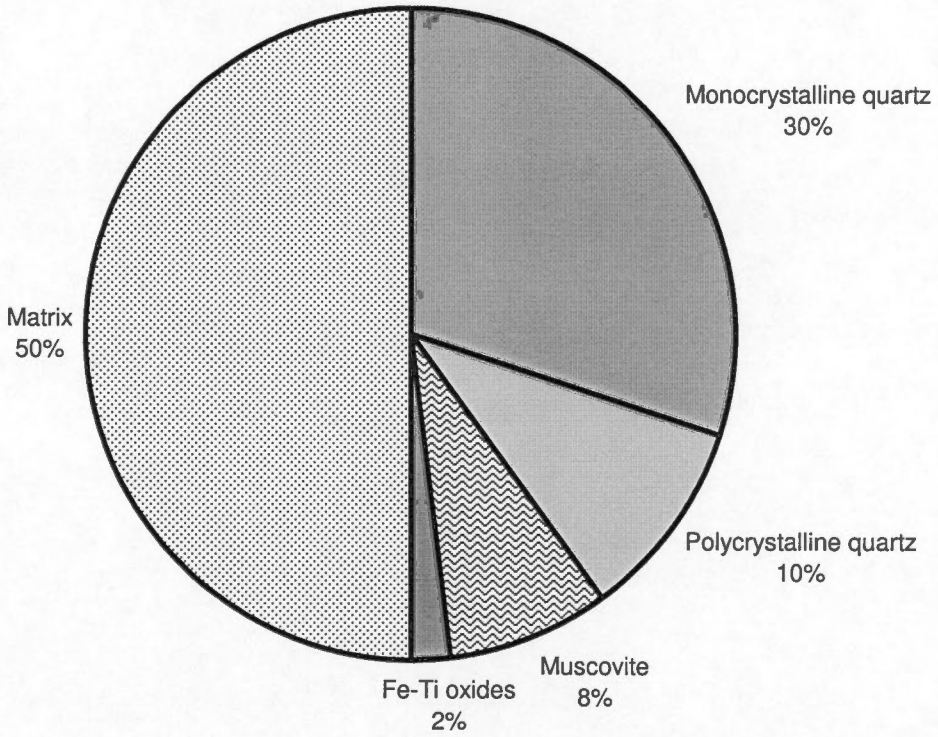
BM-02-3 61' (90-94)
Silty mudstone matrix areounf the fine-grained sandstone clasts



BM-02-3 76' (110-120)
Red silty mudstone



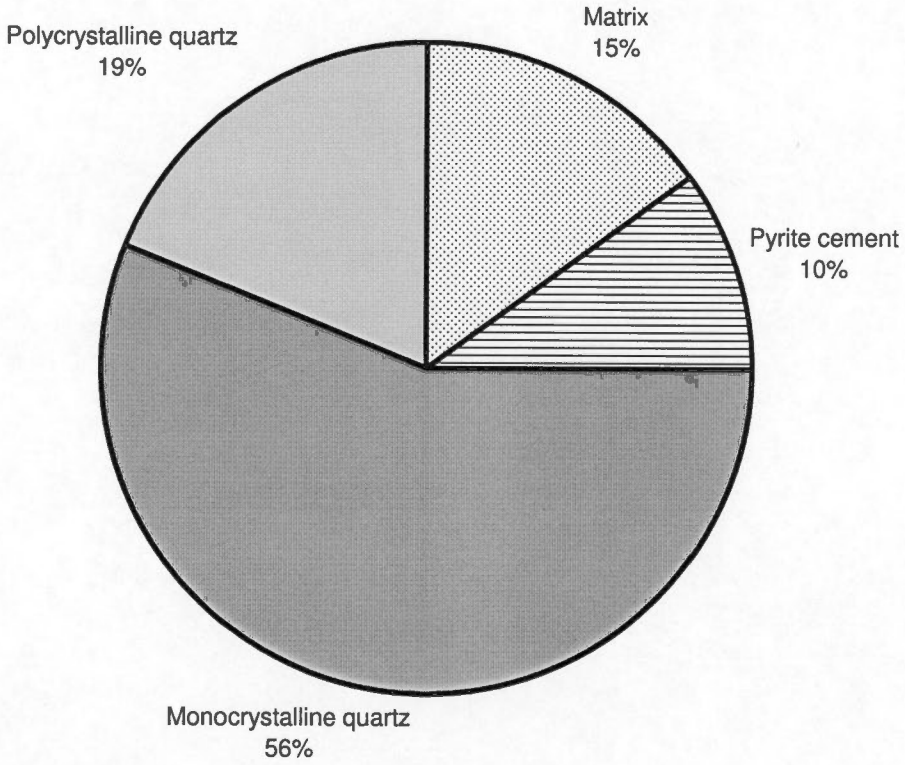
BM-02-3 76' (179-186)
Red silty mudstone



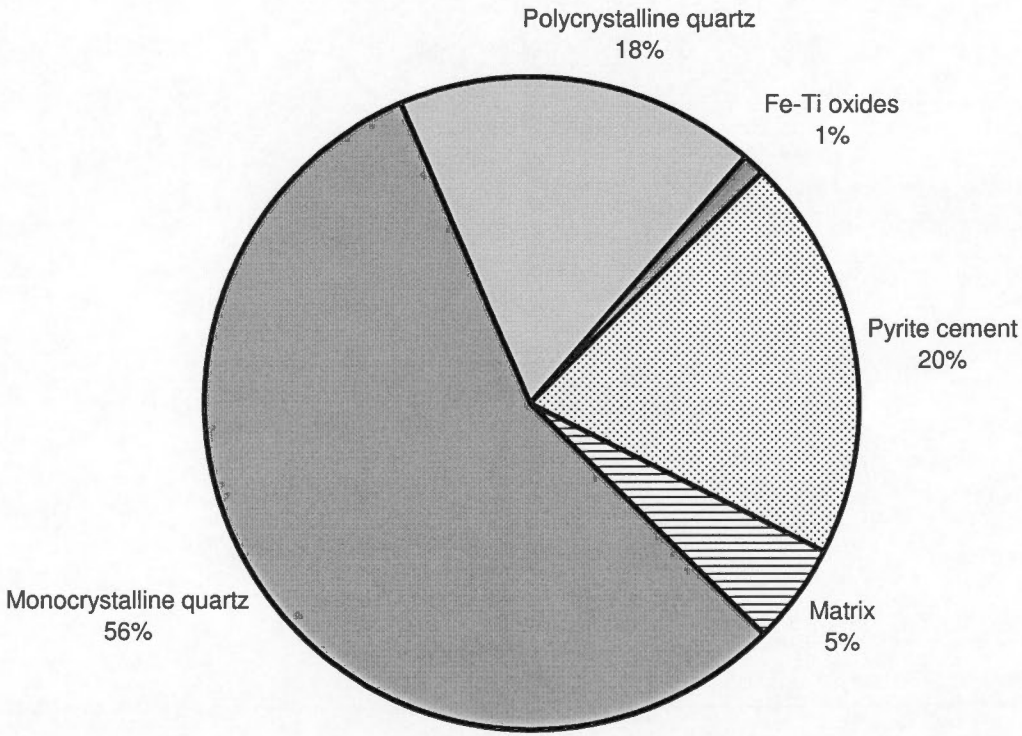
Appendix VII:

Pie Diagrams of sedimentary petrography from Brierly Brook

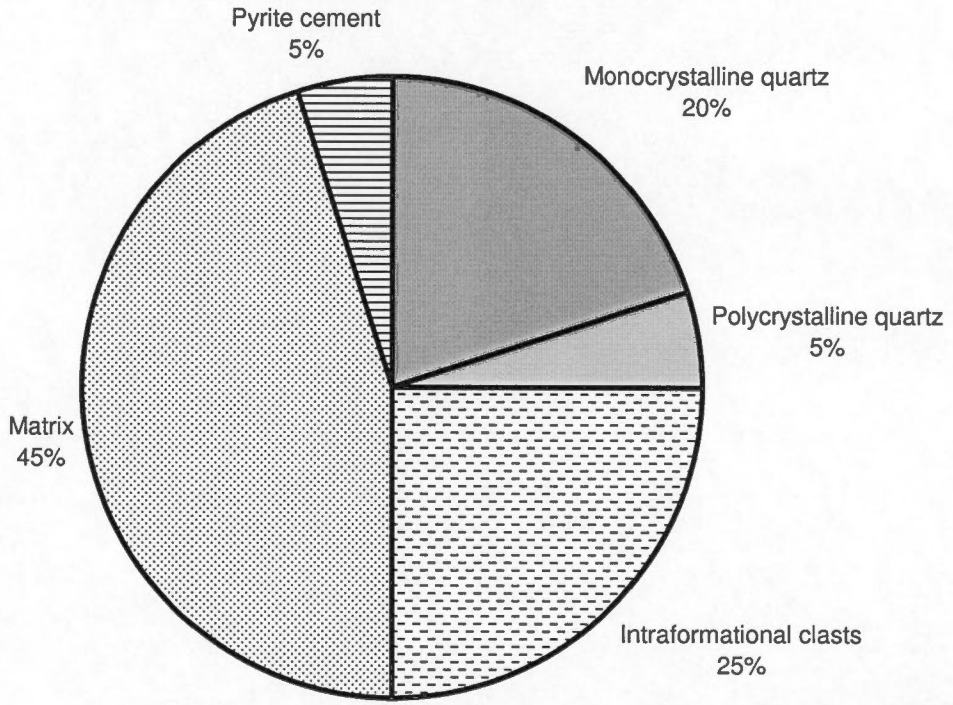
BB-02-1 37' (55-62)
Poorly sorted coarse sandstone



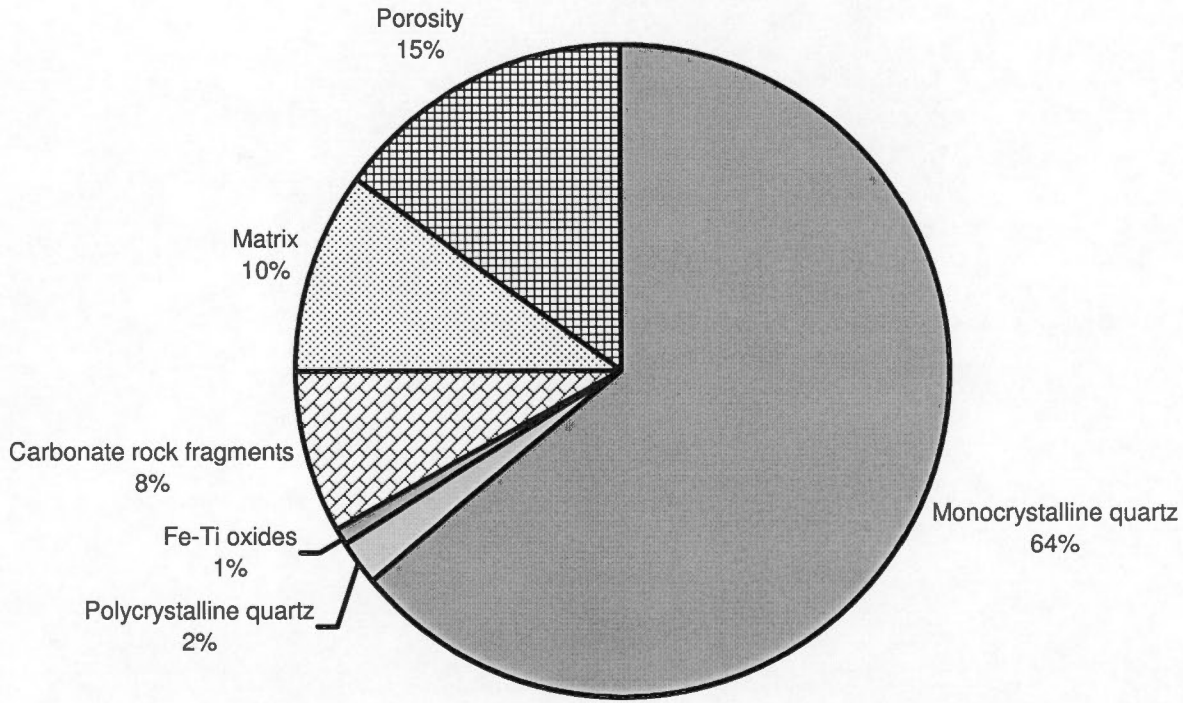
BB-02-1 42' (84-92)
Dark grey silty mudstone



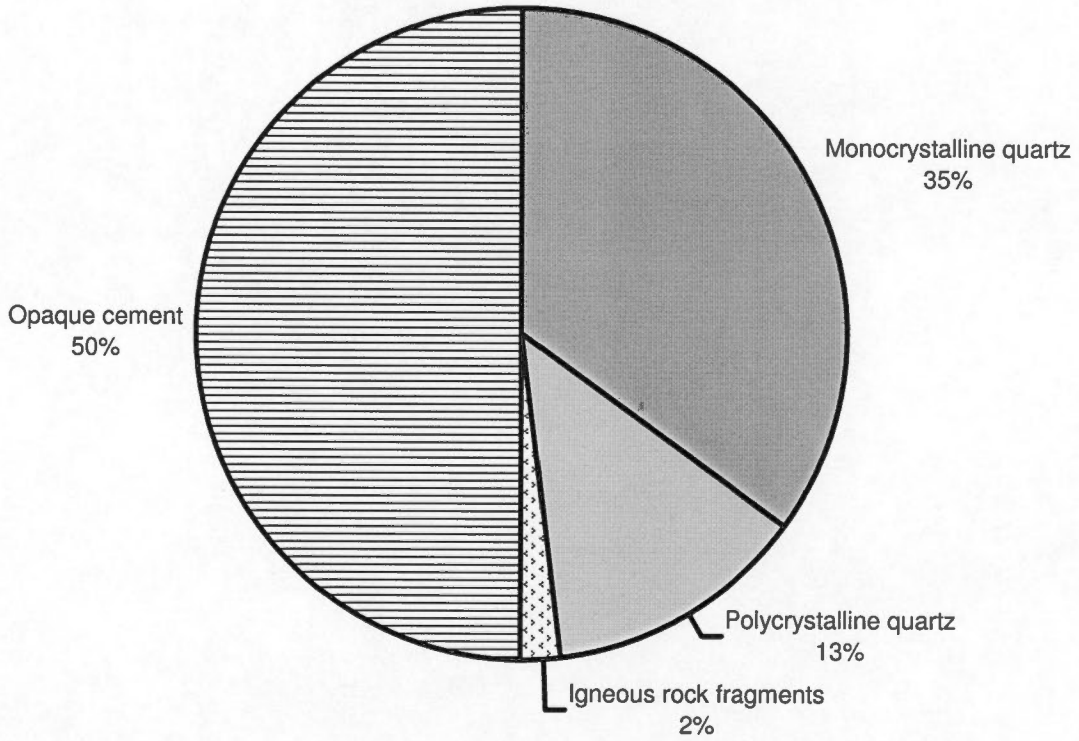
BB-02-2 31' (78-84)
Dark grey mudstone



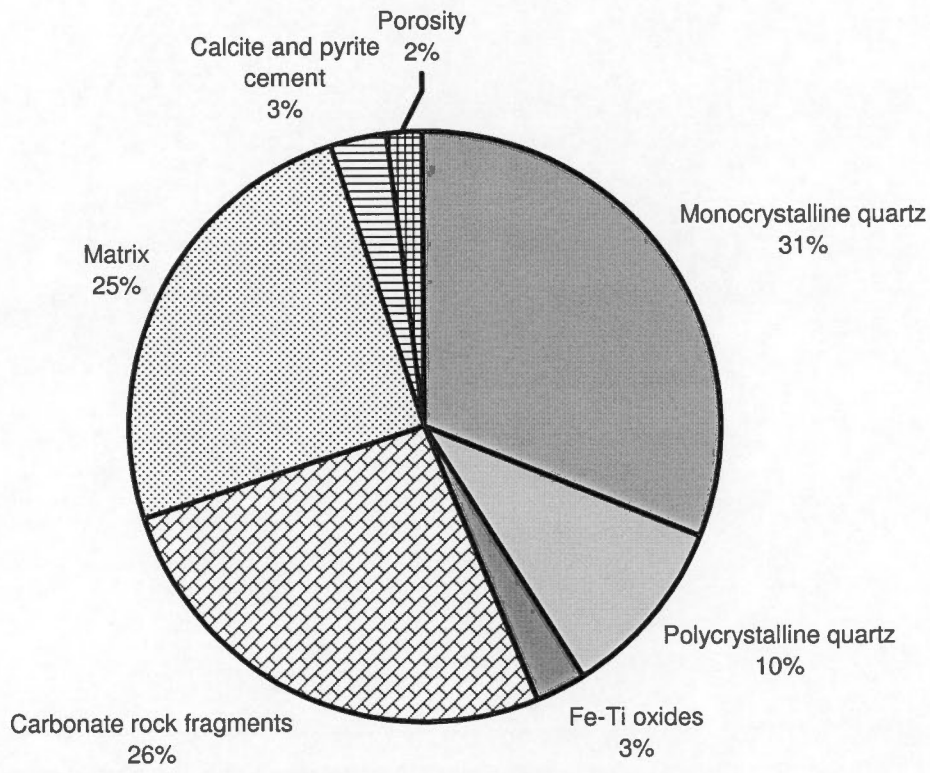
BB-02-2 46'
Dark grey mudstone



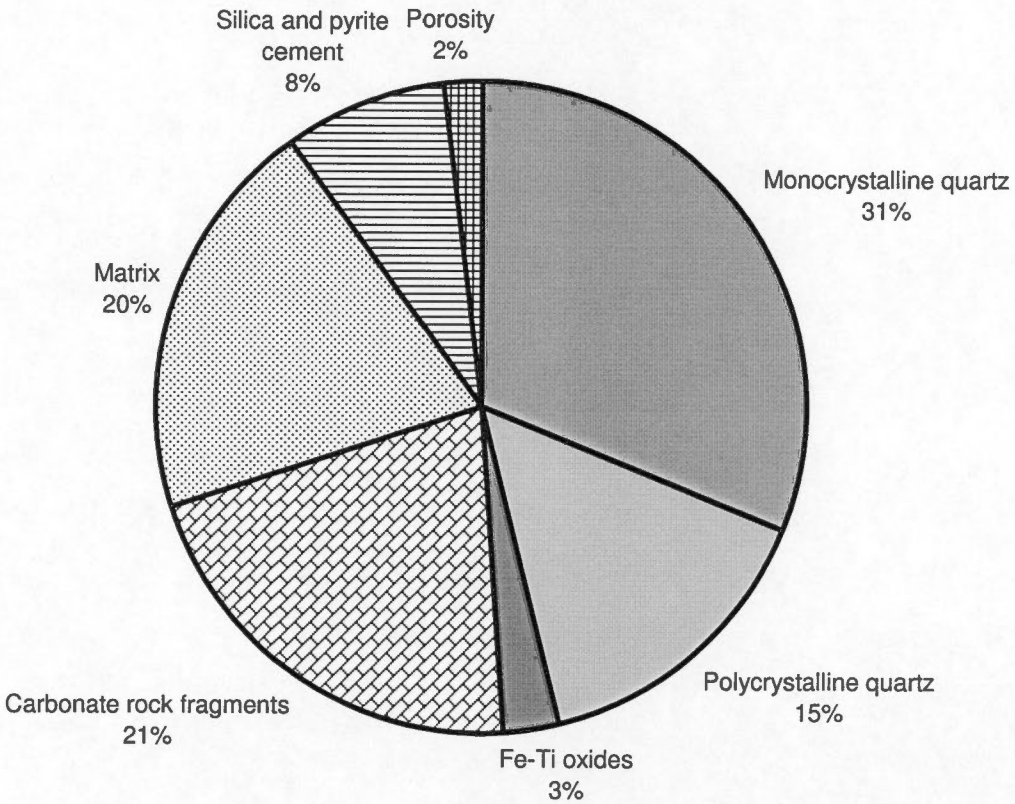
BB-02-2 101' (5-6)
Loose lithified sandstone pebble



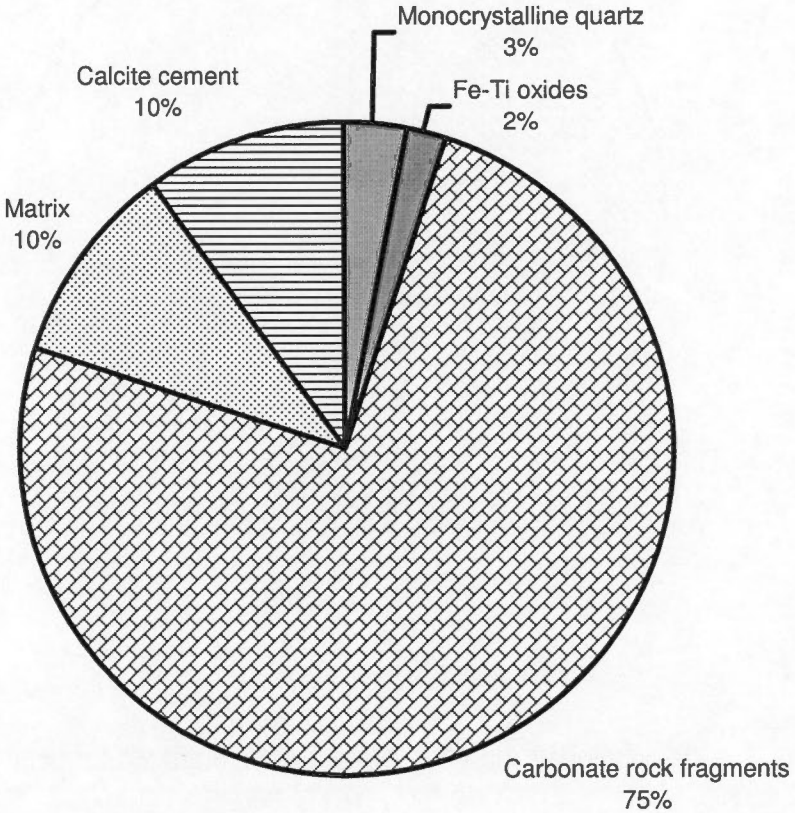
BB-02-2 106'
Poorly sorted sandstone



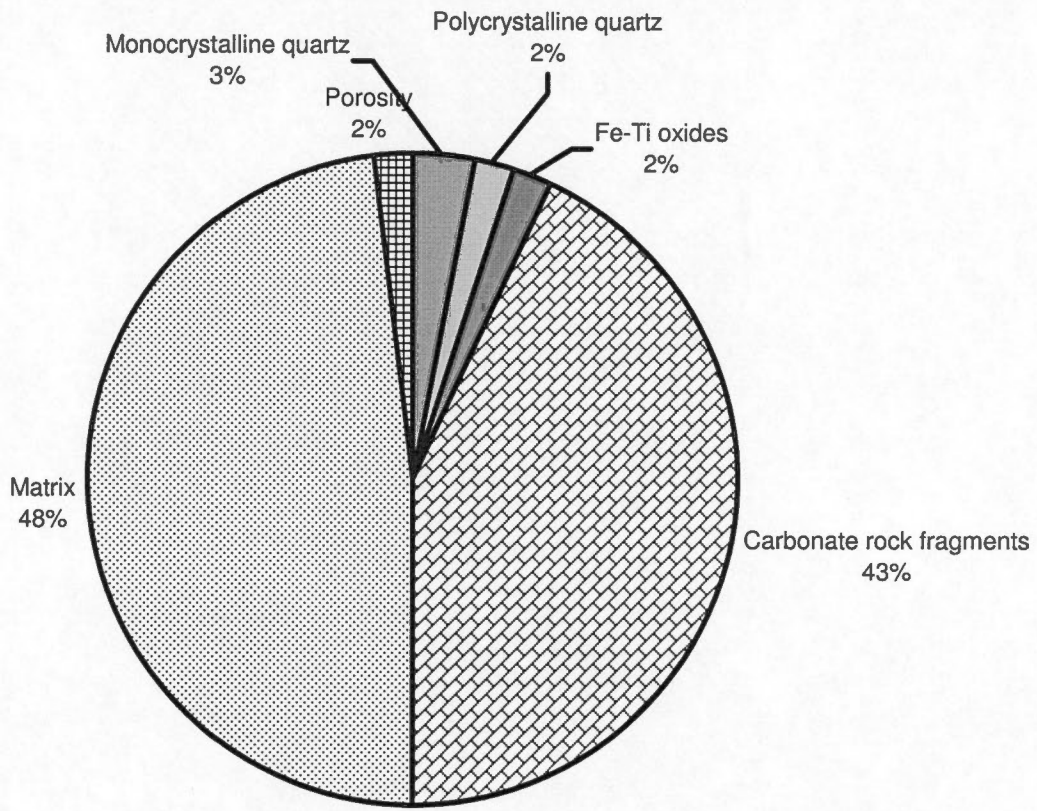
BB-02-2 106' (23-28)
Muddy sandstone from debris flow



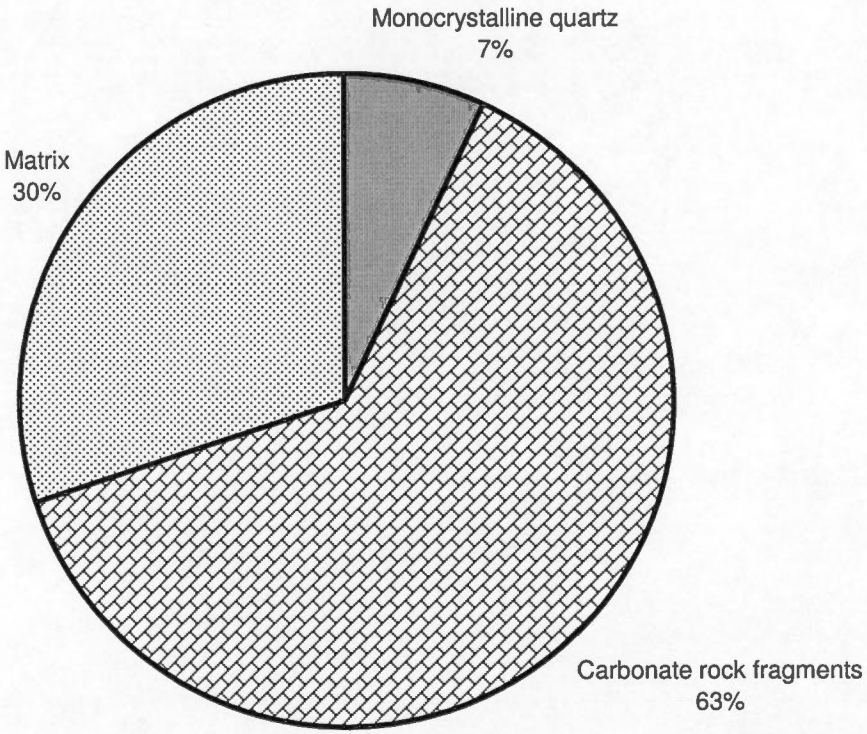
BB-02-2 124'
Limestone pebble in sandstone



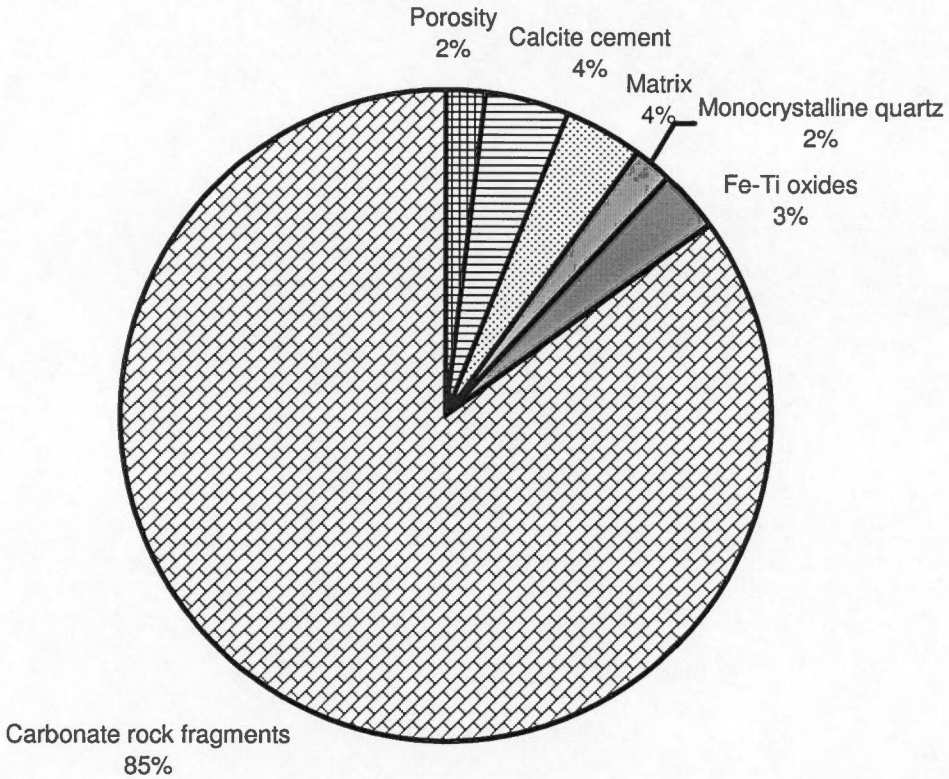
BB-02-2 131' (12-15)
Limestone pebble in a rubble of indurated sandstone



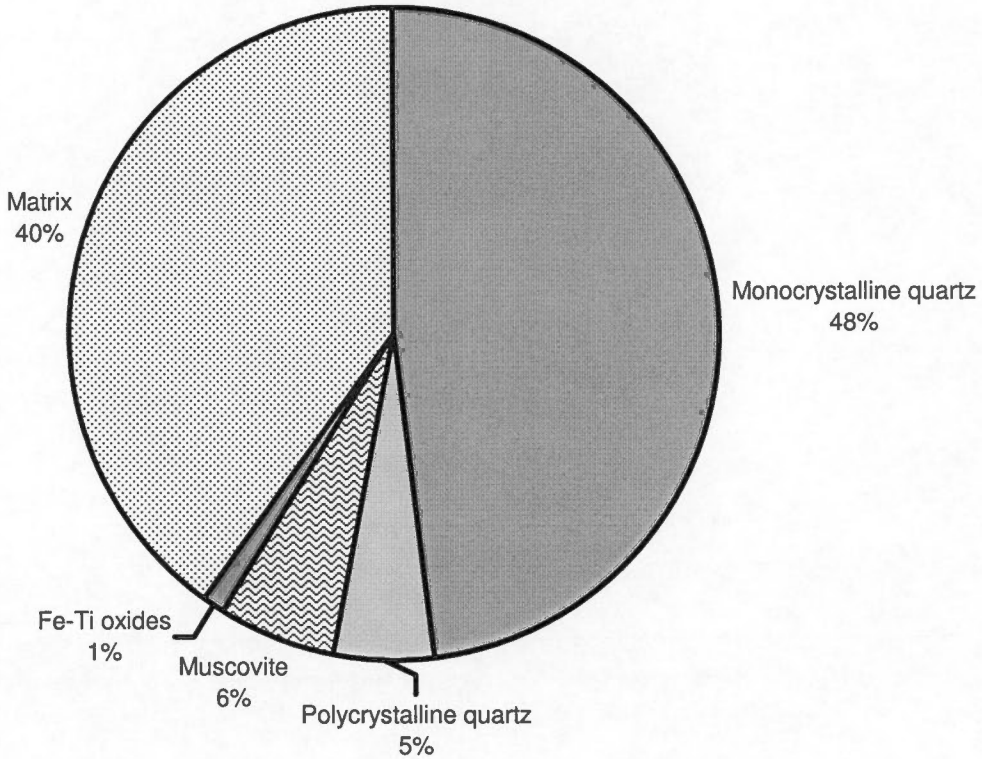
BB-02-2 134'
Basement Windsor limestone



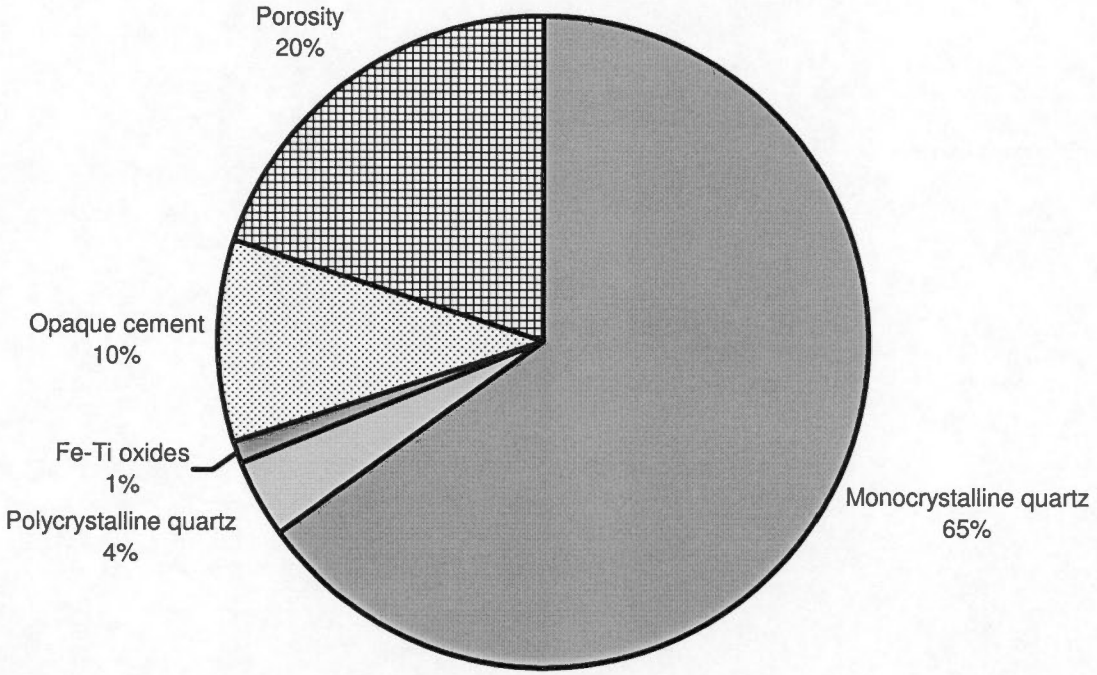
BB-02-5 36' (80-85)
Limestone



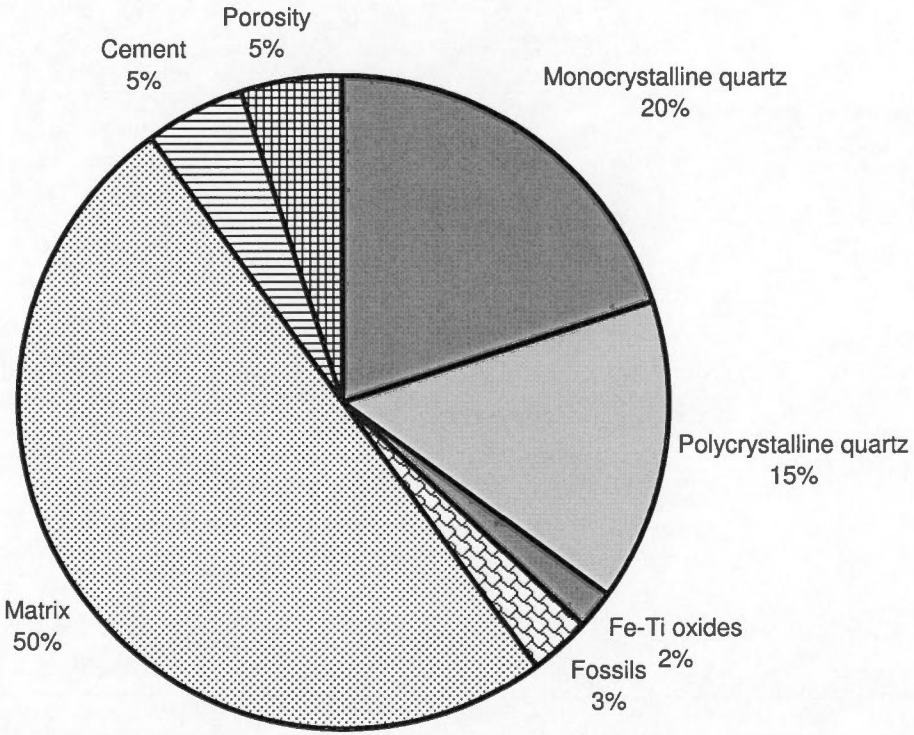
BB-02-7 11' (29-33)
Yellowish muddy sandstone



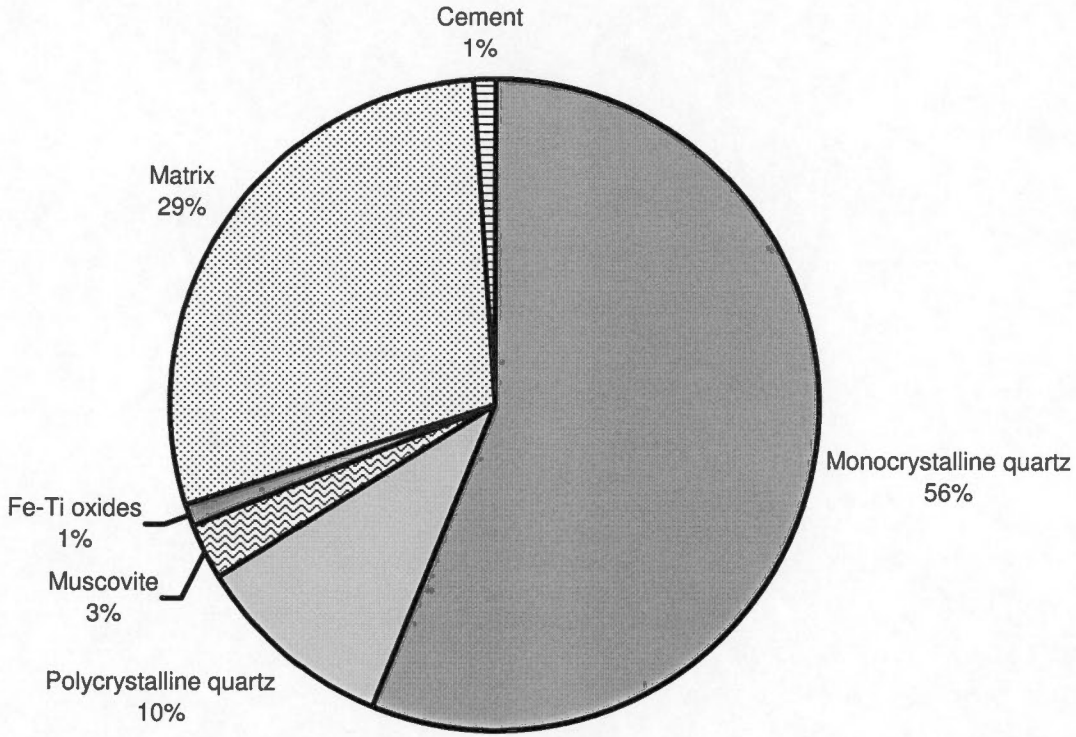
BB-02-7 16' (4-6)
Limonite cemented sandstone



BB-02-7 21' (10-15)
Sandstone

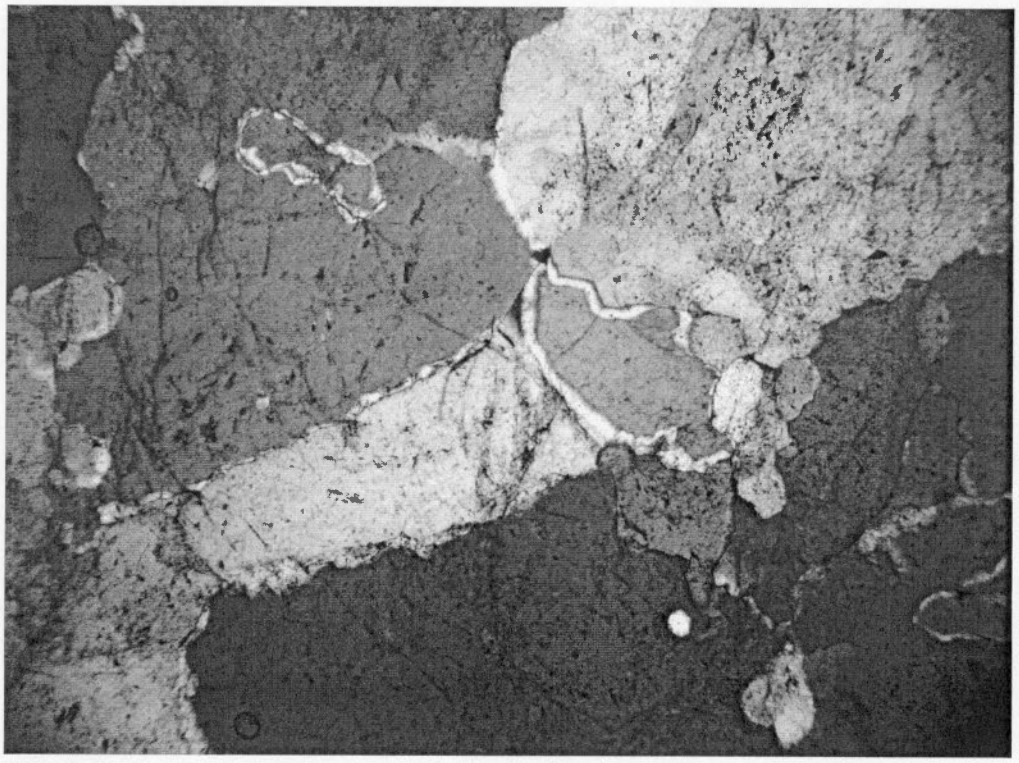


BB-02-7 27'
Medium-grained sandstone



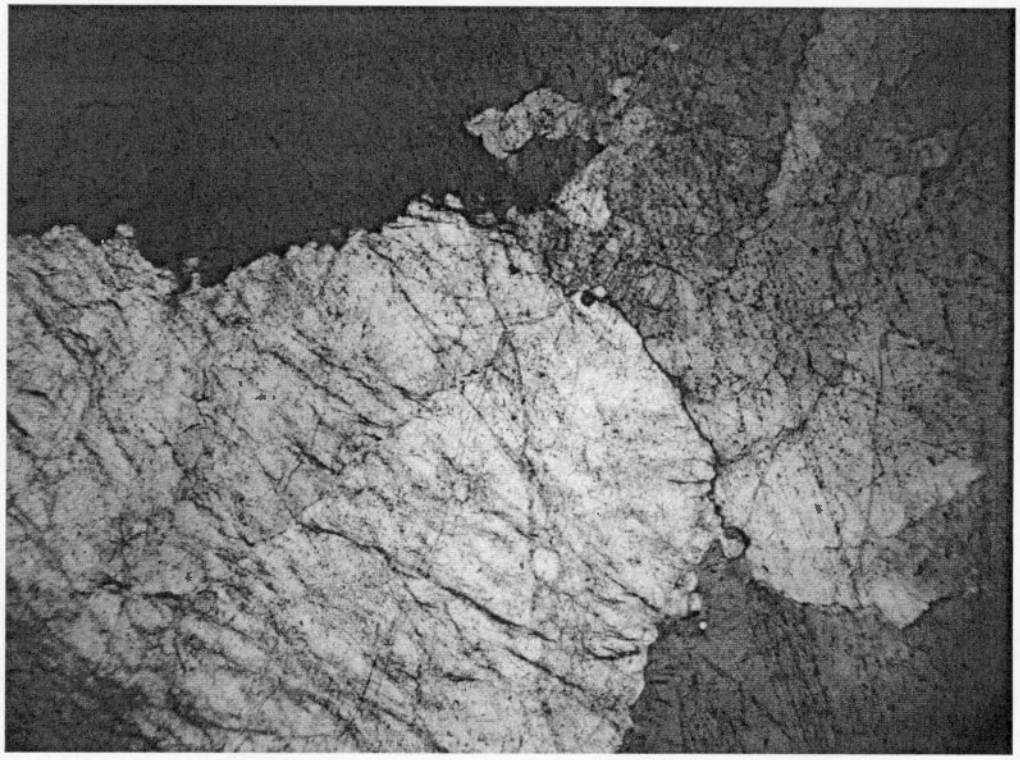
Appendix VIII:

Microphotographs of representative pebble types for Stewiacke (samples CS10 and CS11) and Belmont (samples CS8)



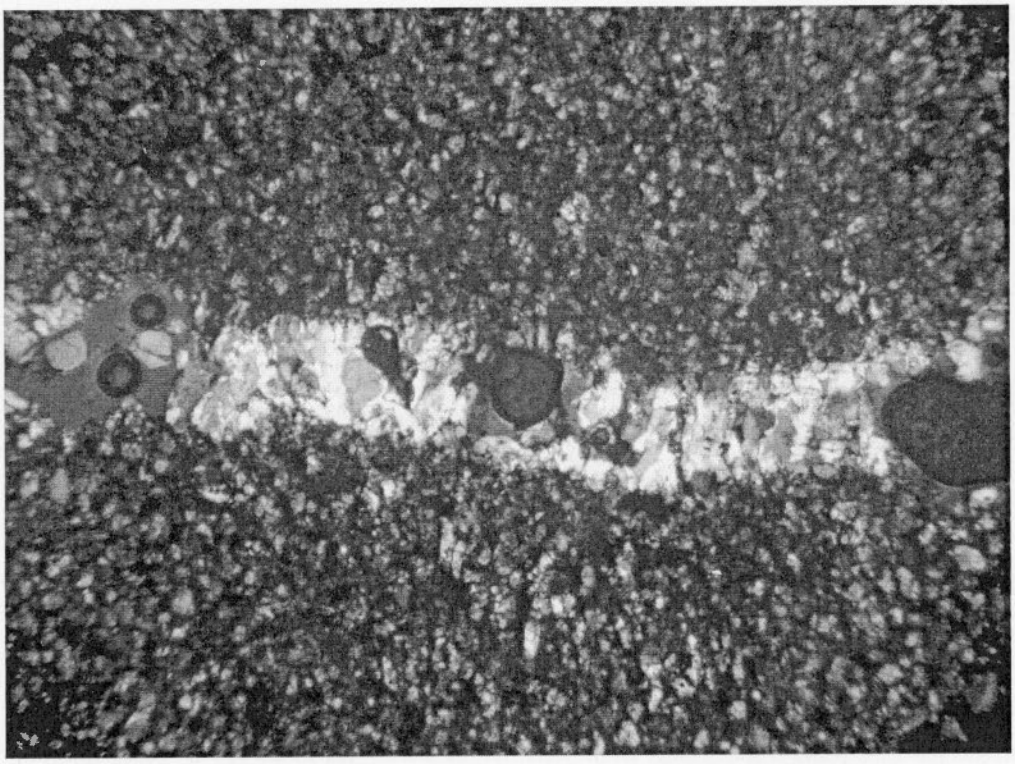
CS10-3

1mm



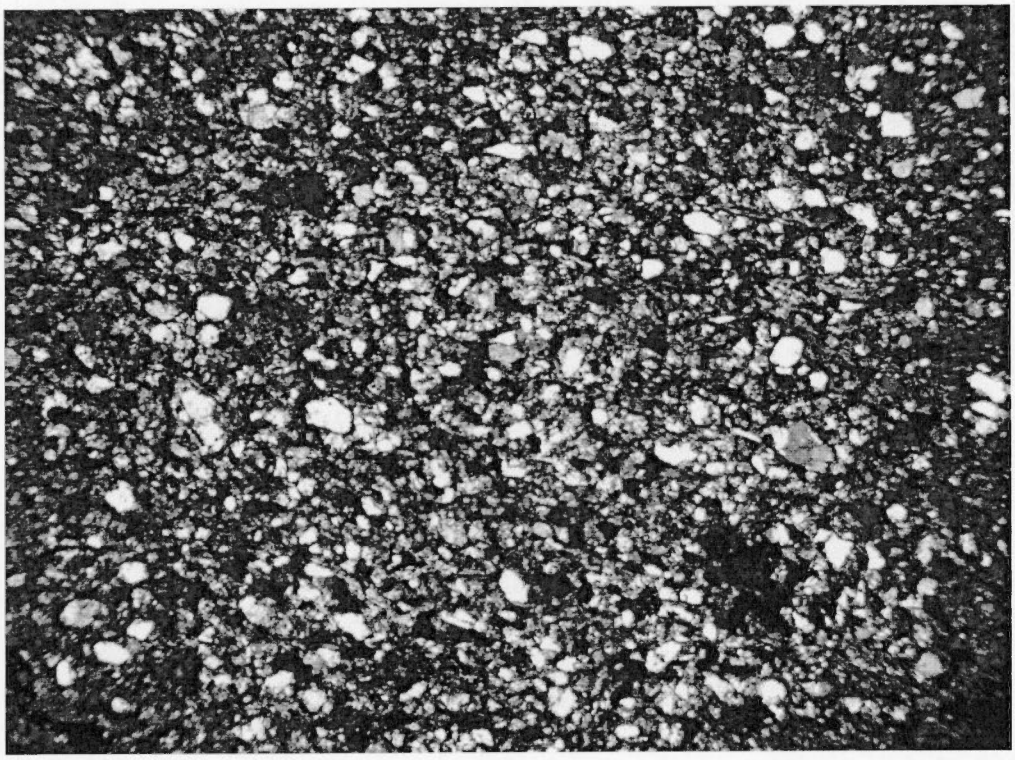
CS10-9

Fig. 1: Examples of vein quartz in thin section (cross polars) from Stewiacke.



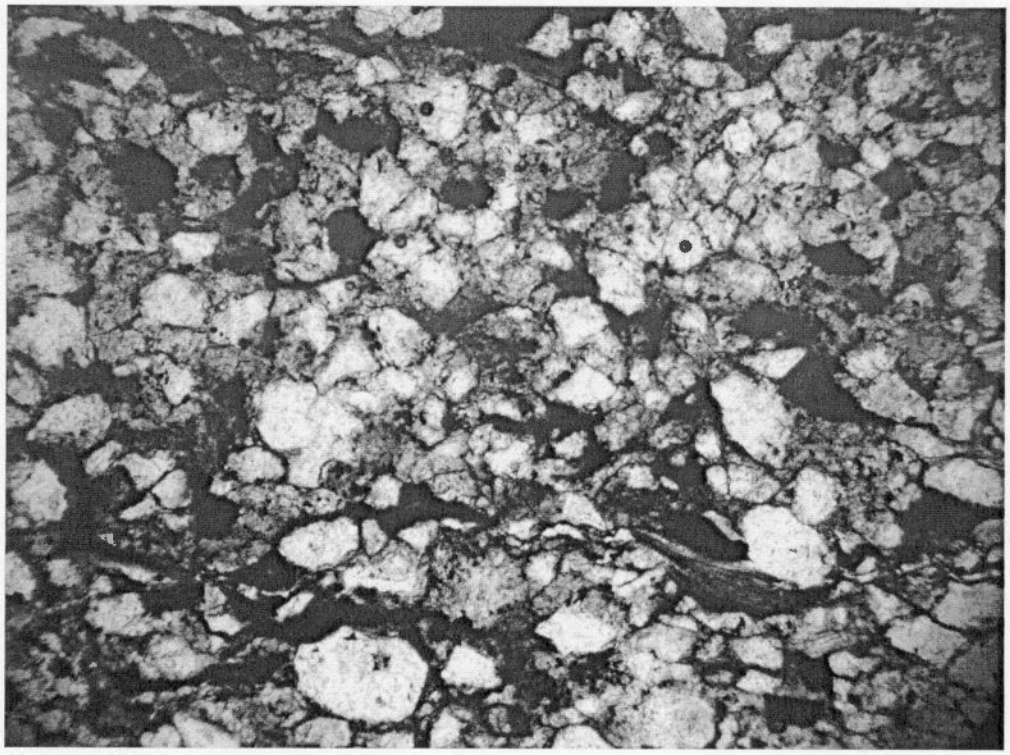
CS10-25

1mm



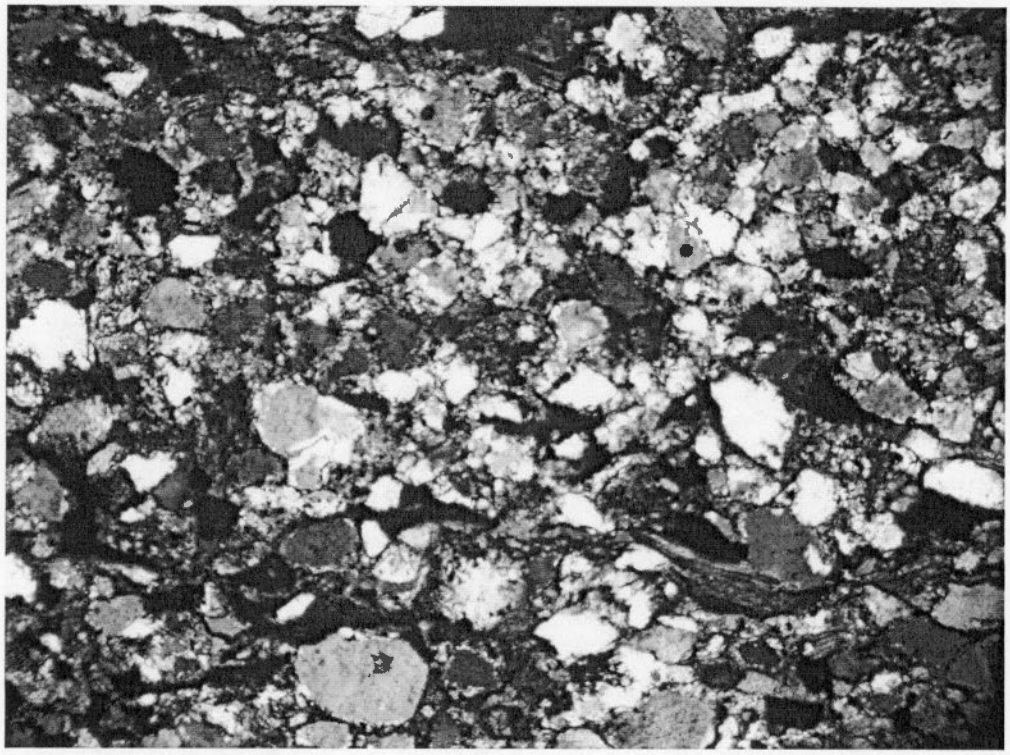
CS10-22

Fig. 2: Examples of siltstone (CS10-25)and fine-grained sandstone (CS10-22)in thin section (cross polars) from Stewiacke.



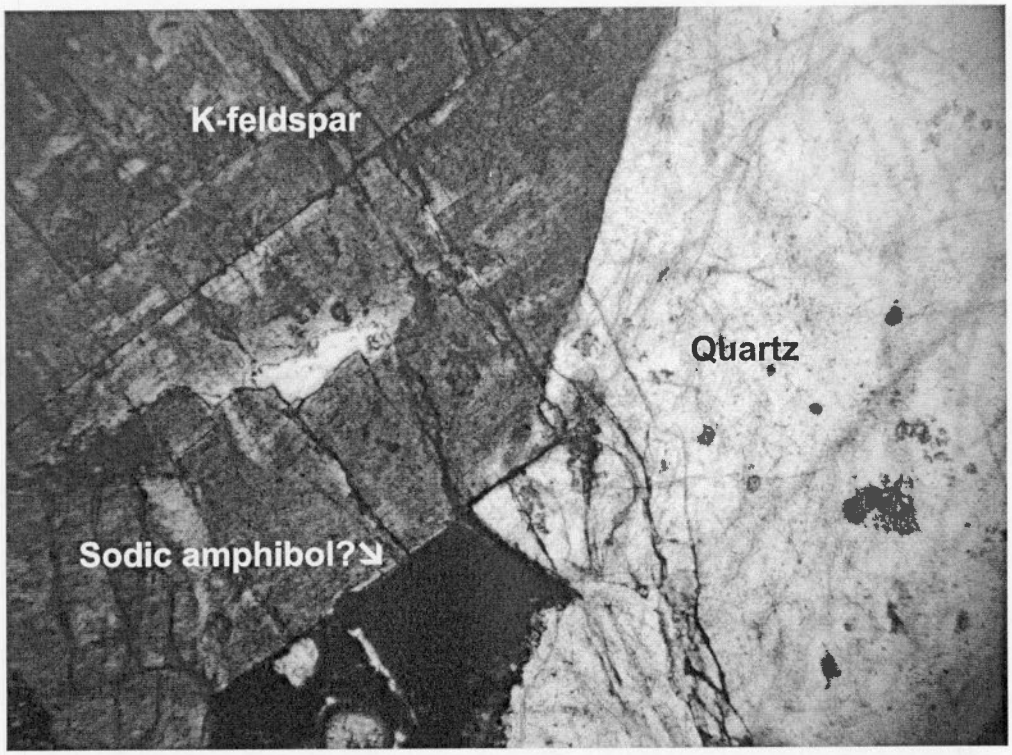
CS10-28 Plain pollarized light

1mm



CS10-28 Cross polars

Fig. 3: An Example of a medium-grained sandstone in thin section from Stewiacke.

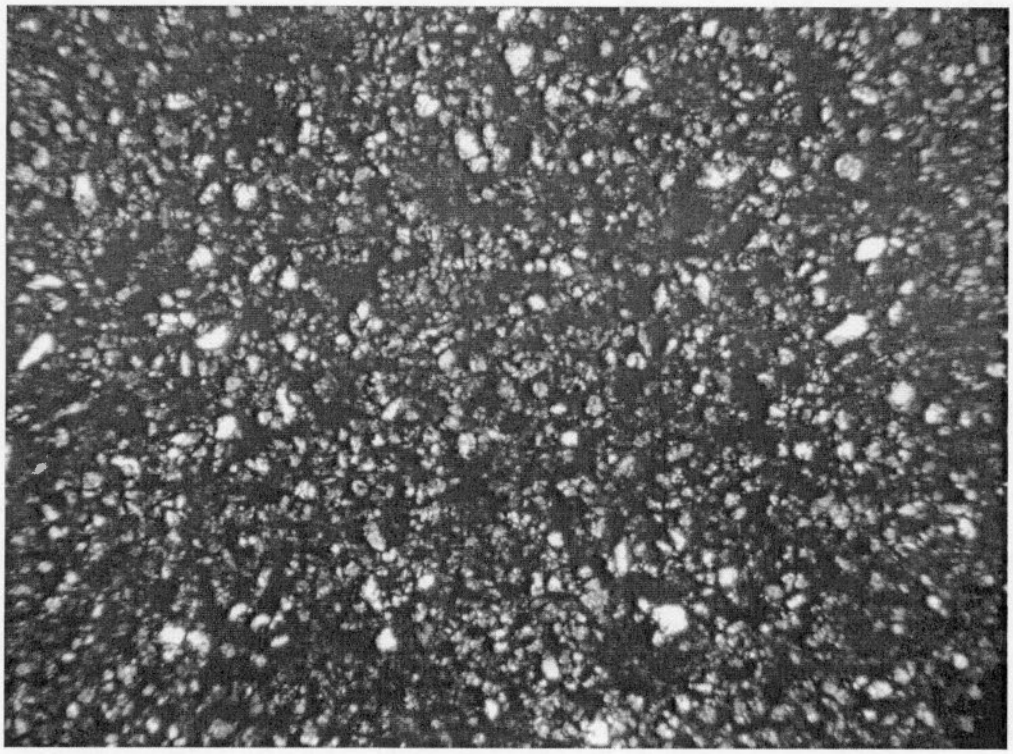


CS11-2P Plain polarized light

1mm

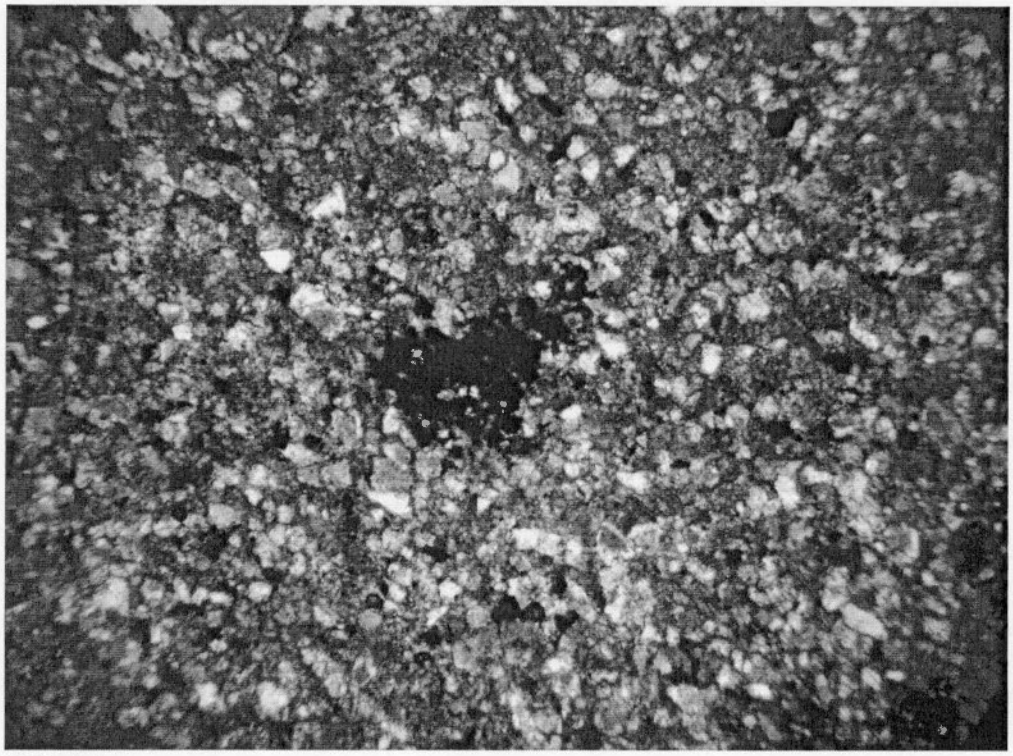
CS11-2P Cross polars

Fig. 4: Examples of A-type granite in thin section with possible sodic amphibole at the bottom of the images. Pebble is from Stewiacke.



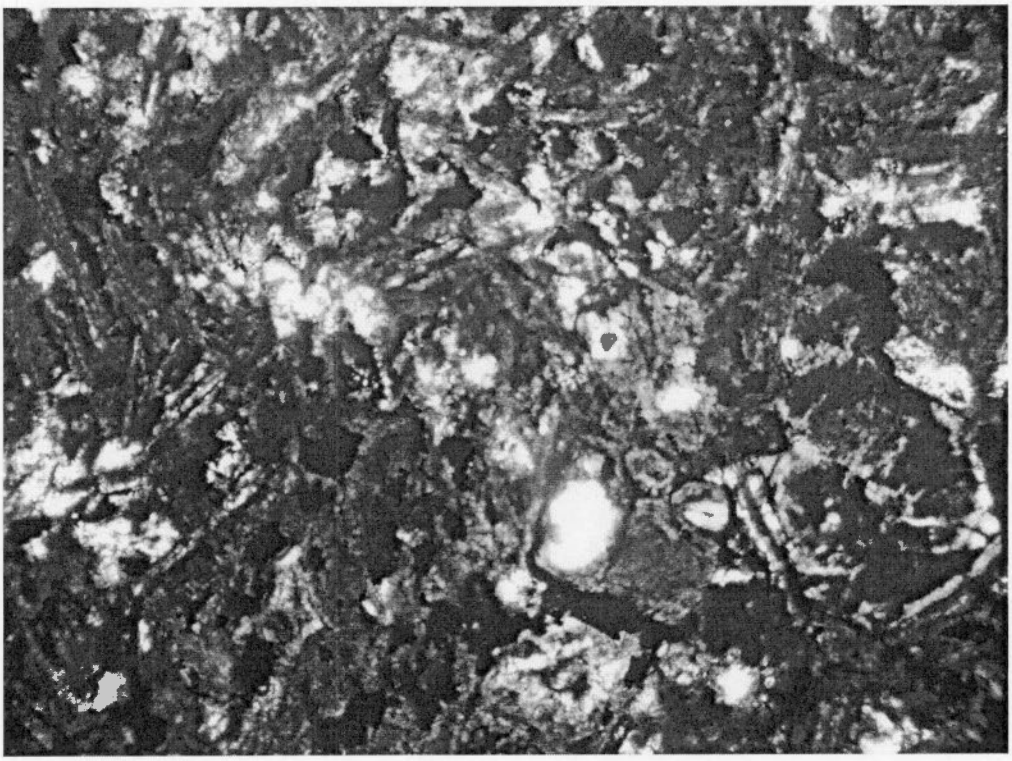
CS11-7

1mm



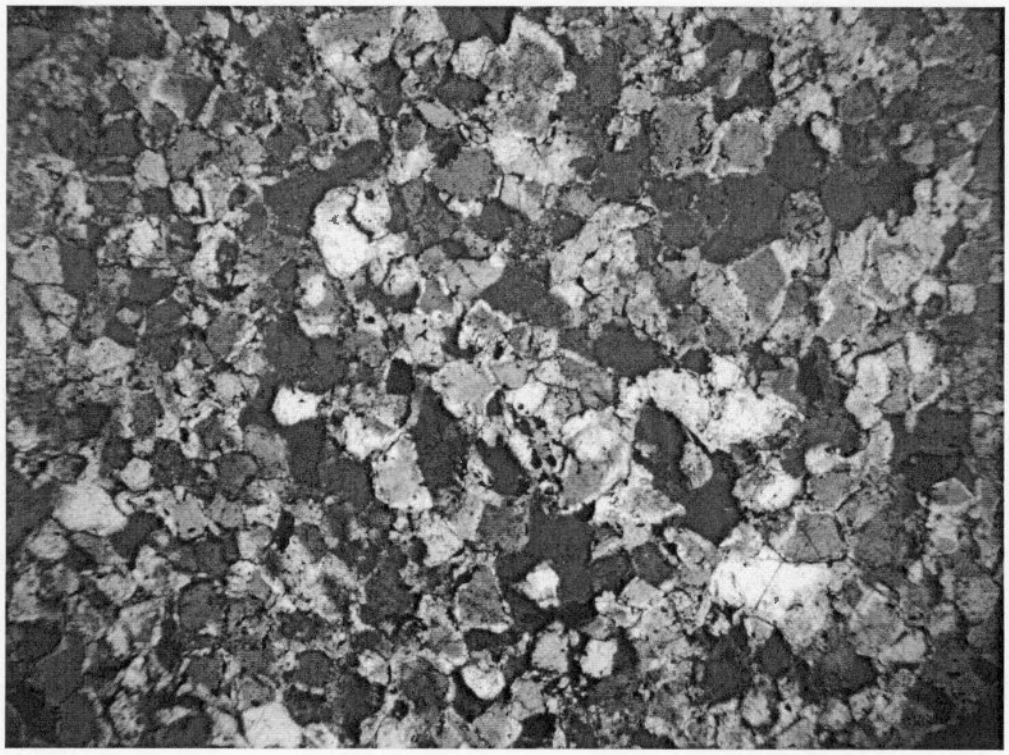
CS11-5

Fig. 5: Examples of siltstone (CS11-7) and fine-grained sandstone (CS11-5) in thin section (cross polars) from Stewiacke.



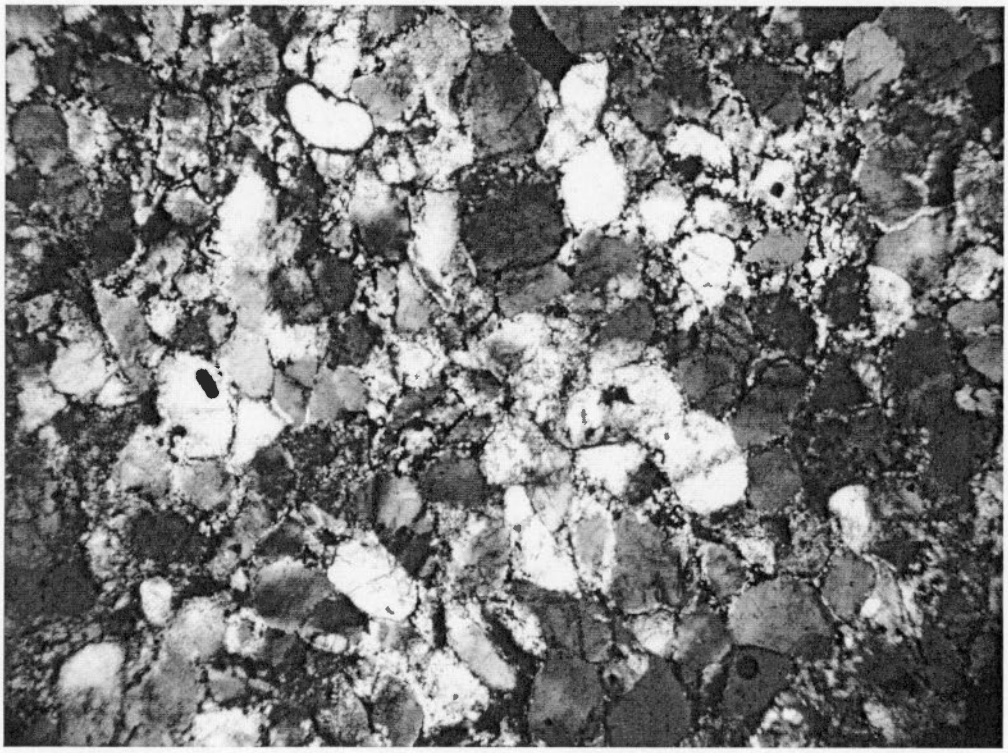
CS10-1P 1mm

Fig. 6: An example of a diabase pebbles in thin section (cross polars) from Stewiacke.



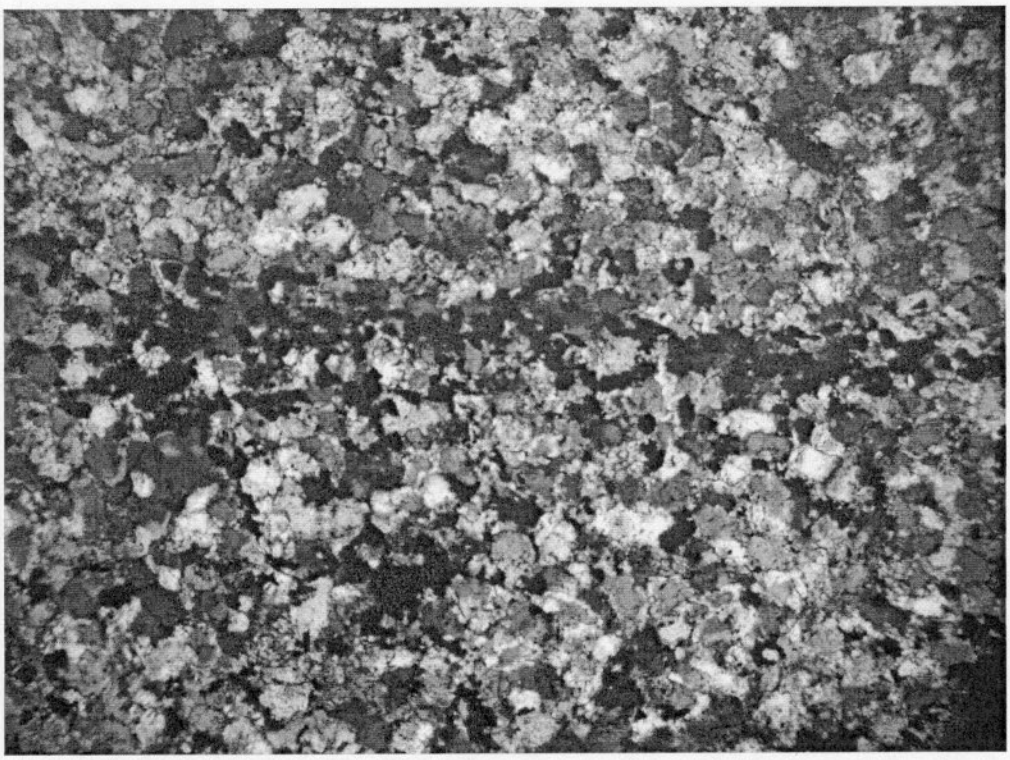
CS8-8A

1mm



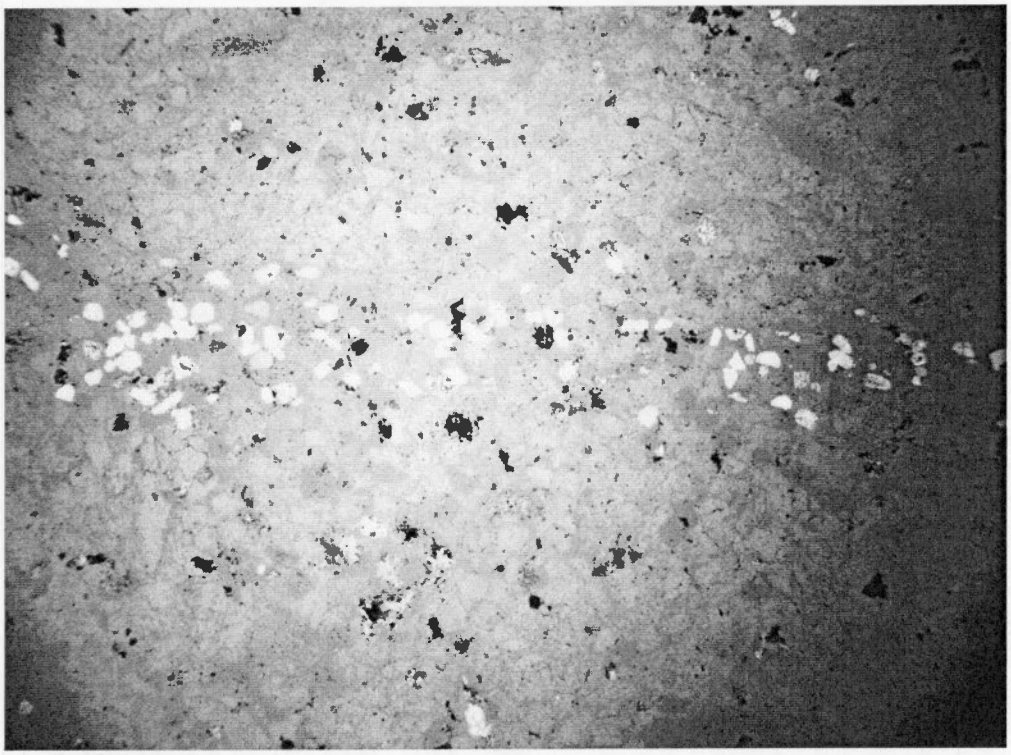
CS8-17B

Fig. 7: Examples of quart arenites in thin section (cross polars) from Belmont.



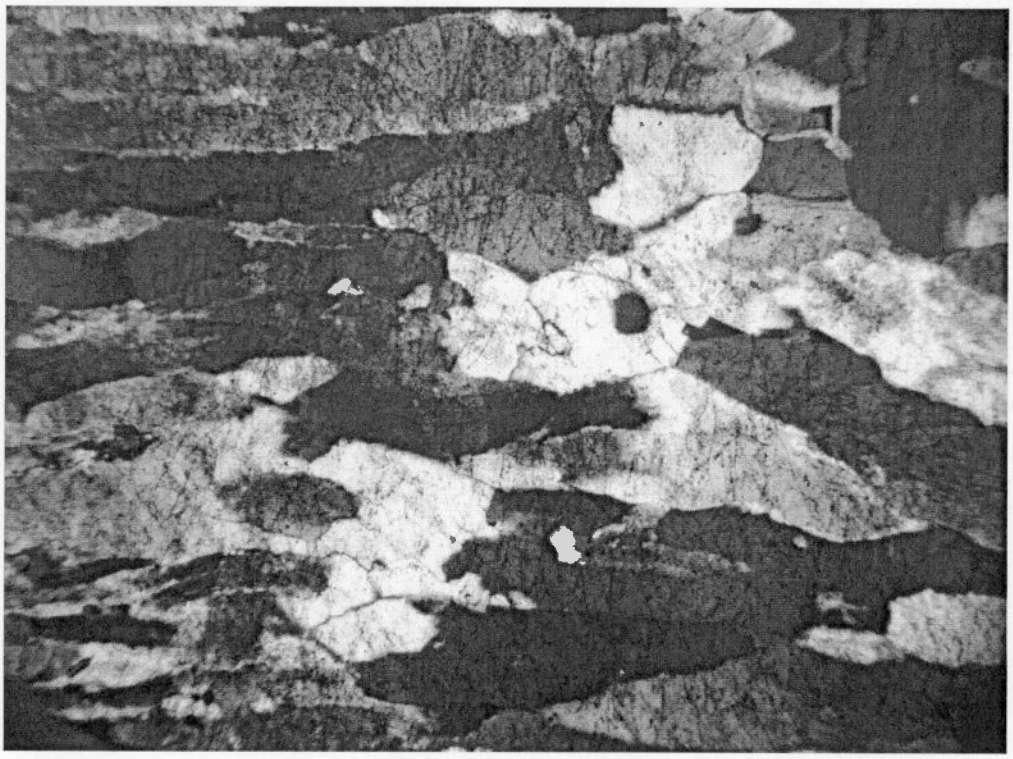
CS8-17A Cross polars

1mm



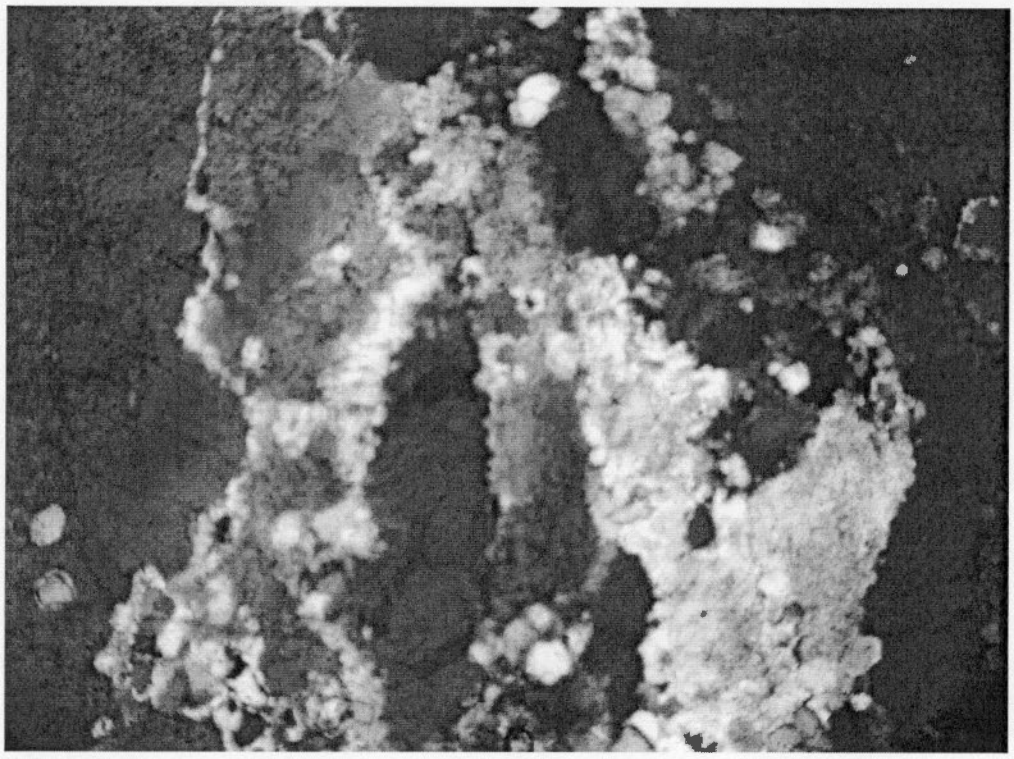
CS8-17A Reflected light

Fig 8: Example of a quartrz arenite with a band of opaque pyrite and Fe-Ti oxide minerals from Belmont.



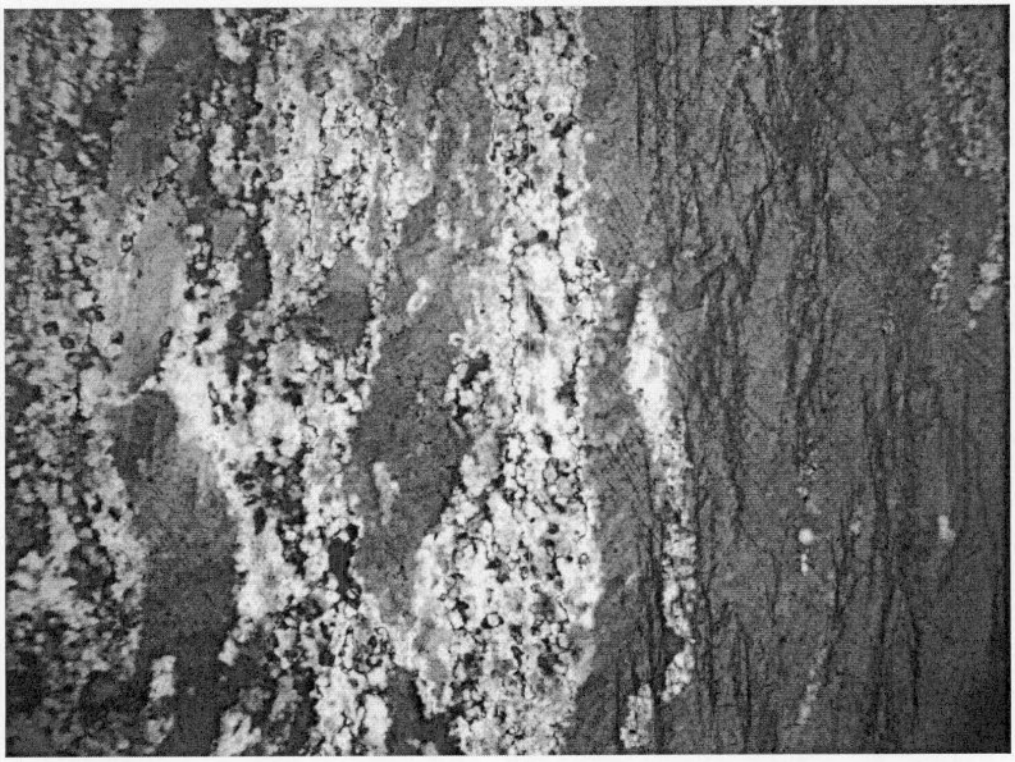
CS8-14B

1mm



CS8-13A

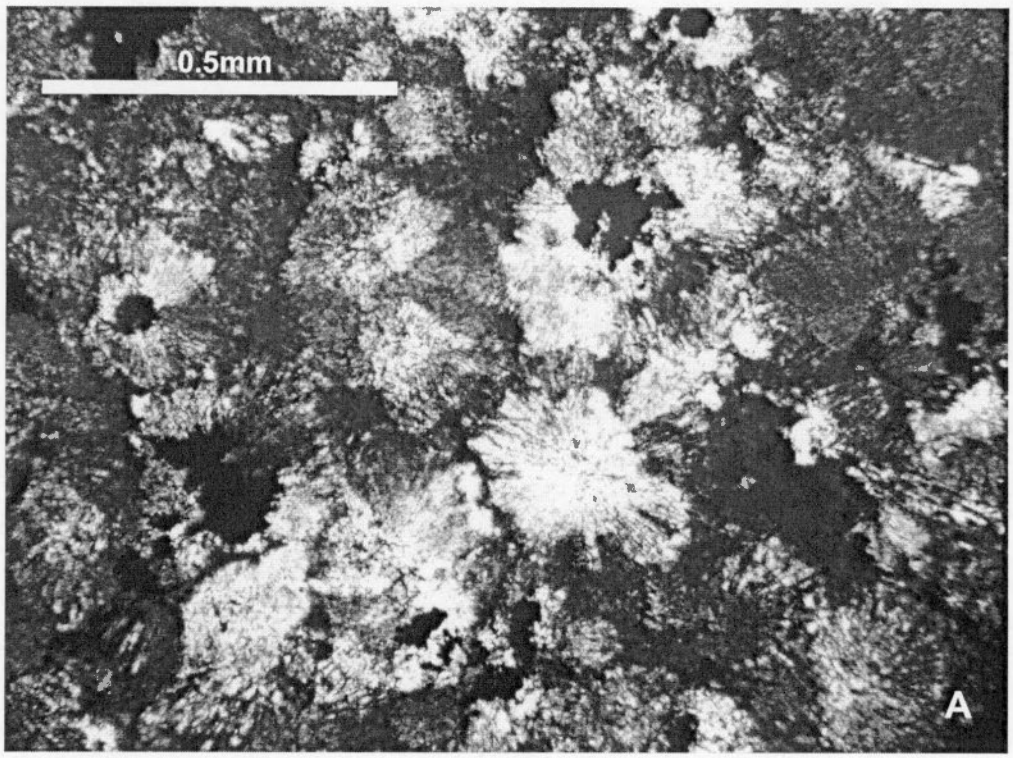
Fig. 9: Examples of mylonitized vein quartz in thin section (cross polars) from Belmont.



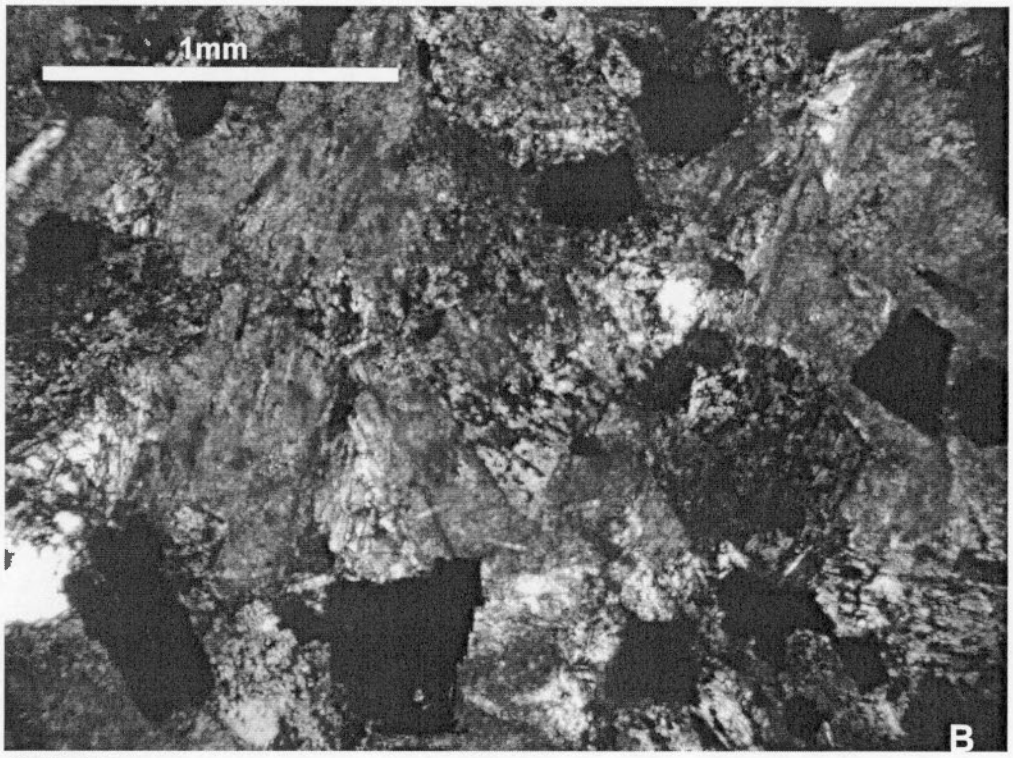
CS8-12A

1mm

Fig. 10: An other example of mylonitized vein quartz (cross polars) from Belmont.



CS8-17D



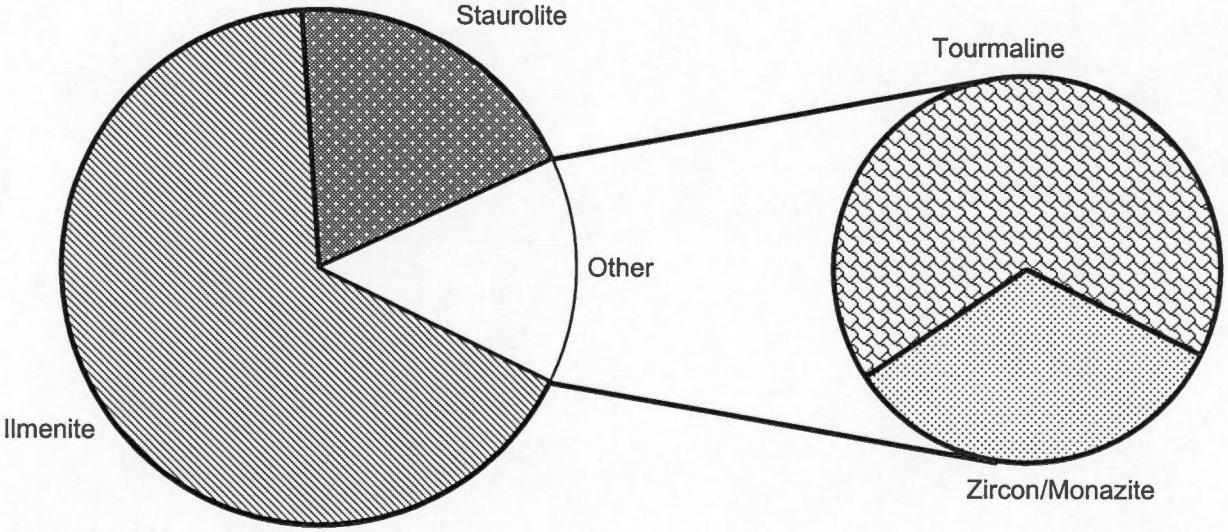
CS8-1P

Fig. 11: Examples of A) spherulitic rhyolite and B) gabbro pebbles in thin section (cross polars) from Belmont.

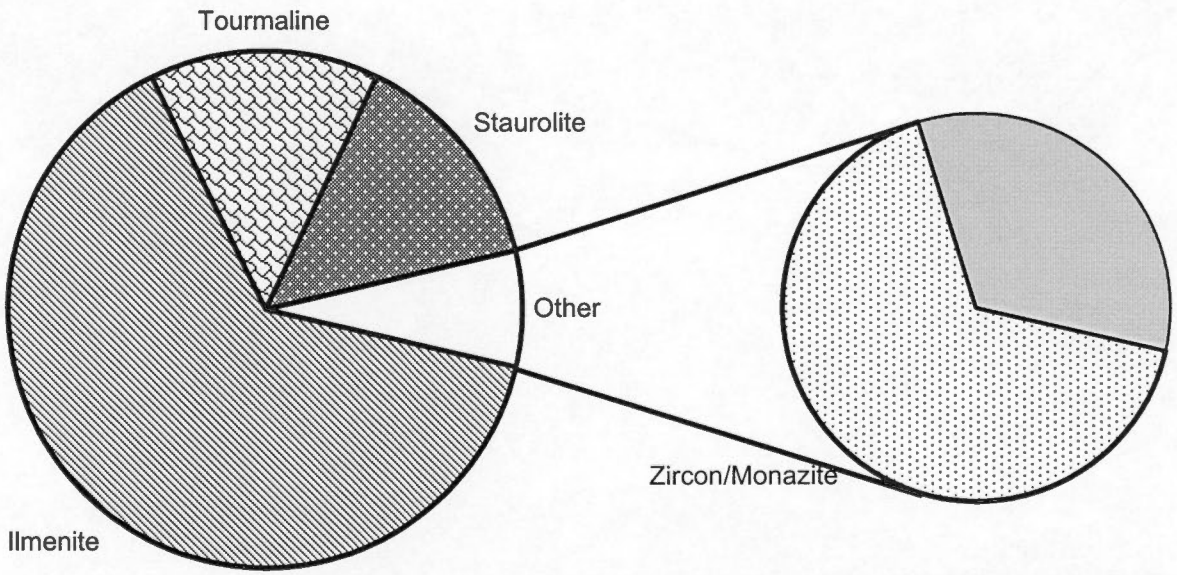
Appendix IX:

Pie diagrams of detrital minerals from heavy mineral separates for Belmont, Brierly Brook, and Diogenes Brook

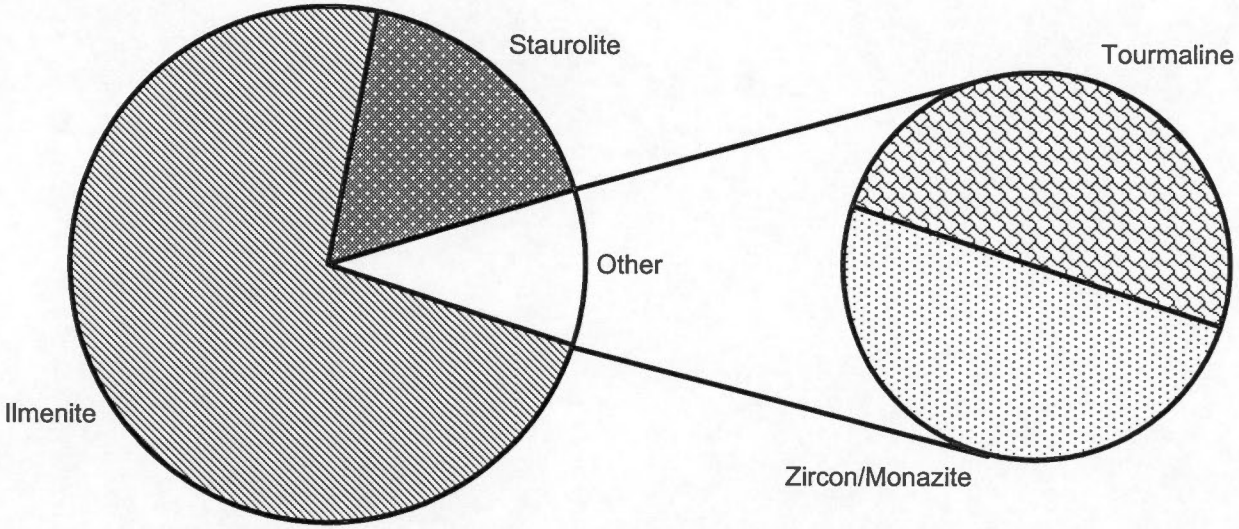
BB-02-1 12'



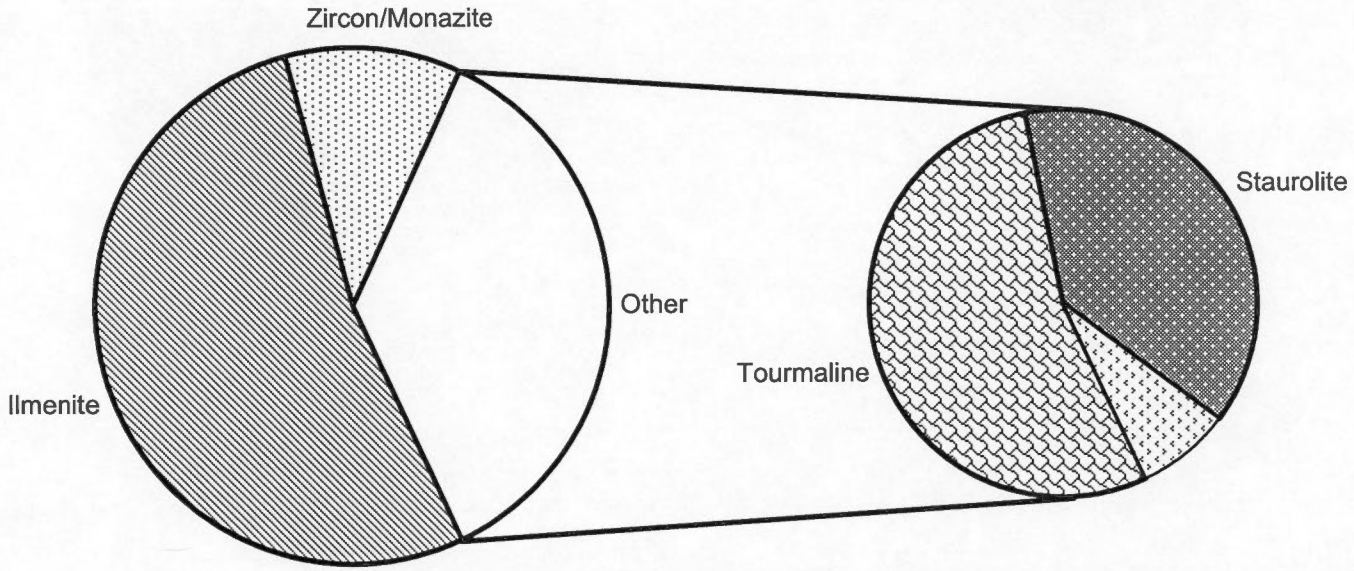
BB-02-1 17'



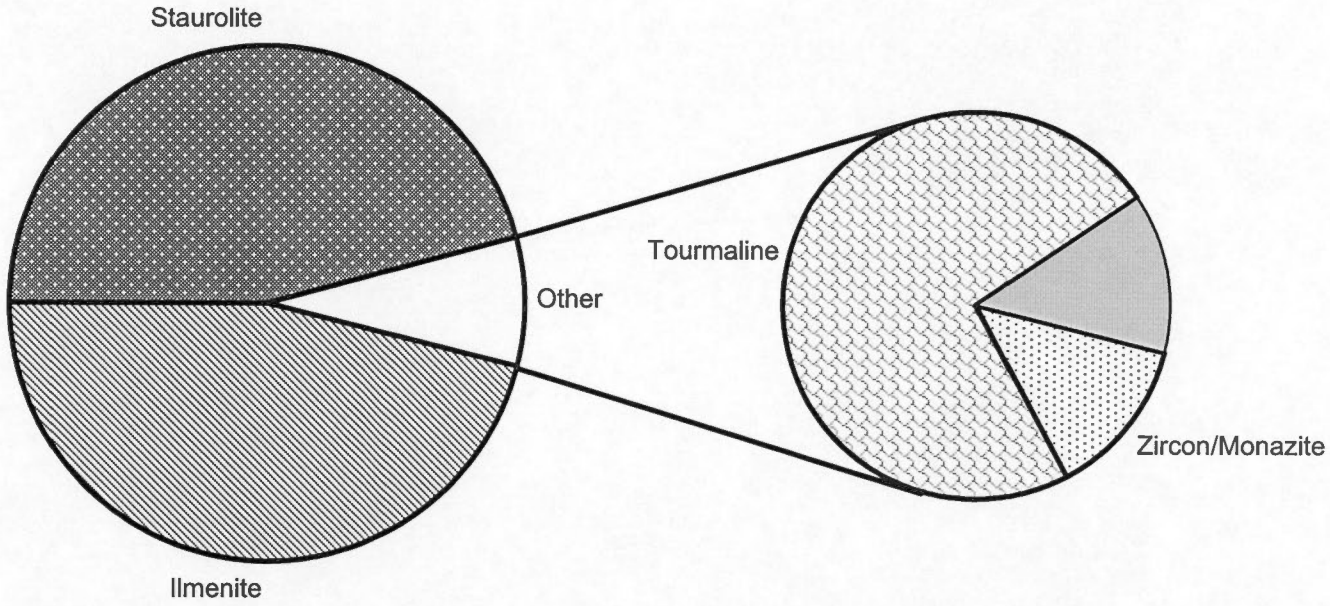
BB-02-1 22'



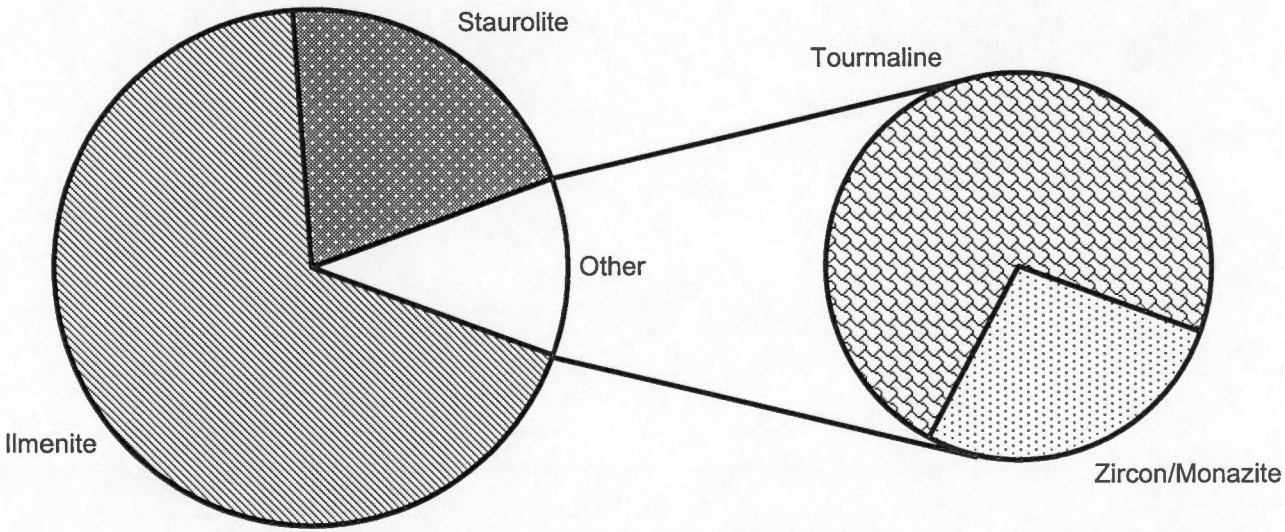
BB-02-1 42'



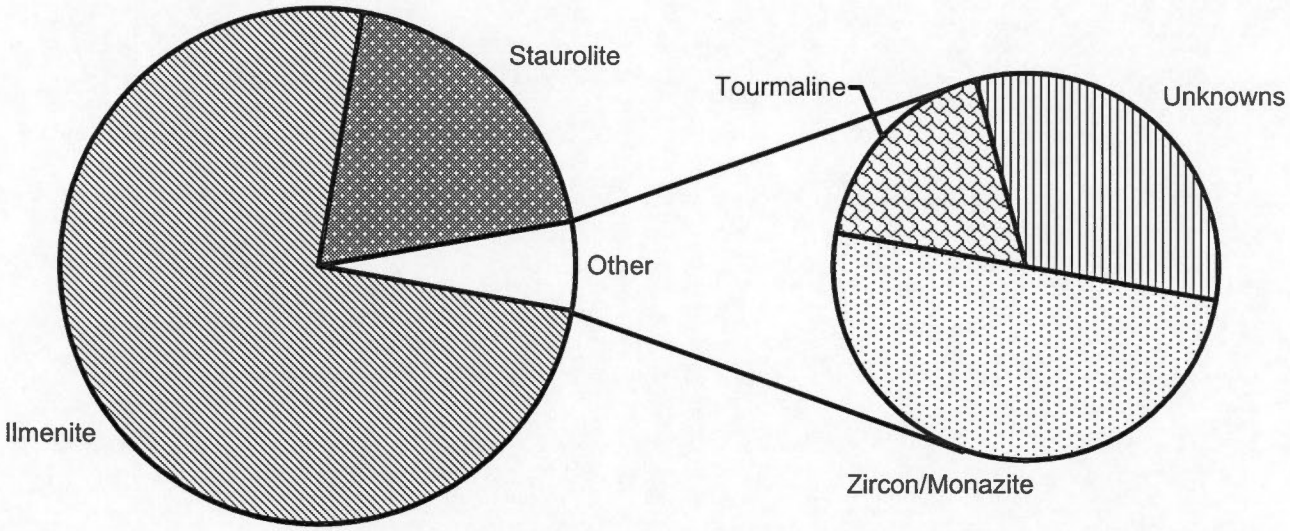
BB-02-2 16'



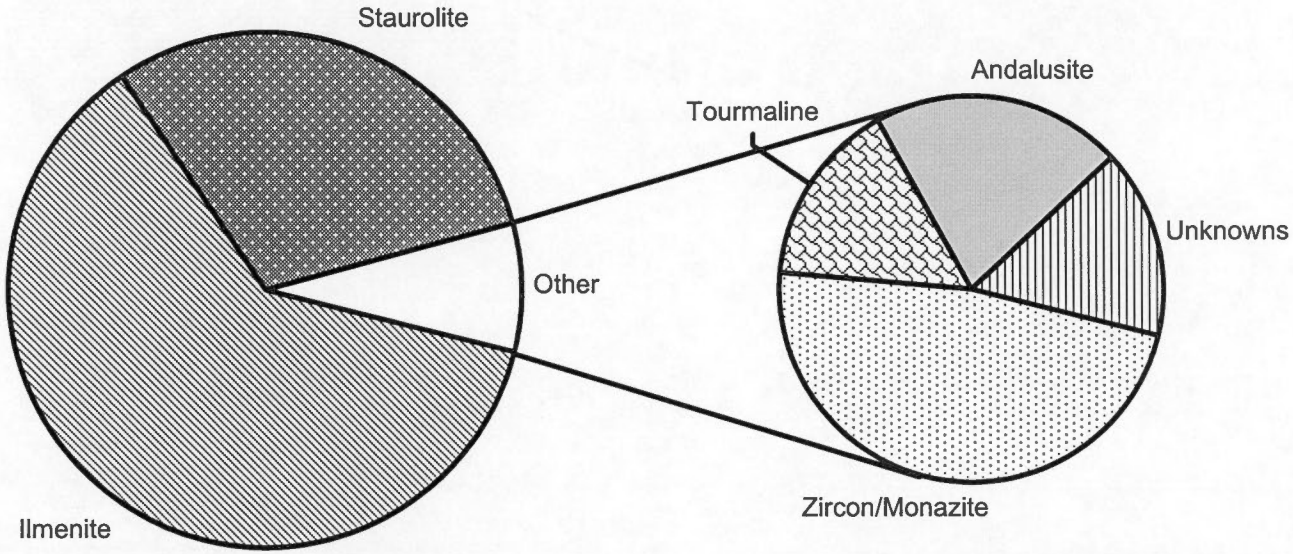
BB-02-2 26'



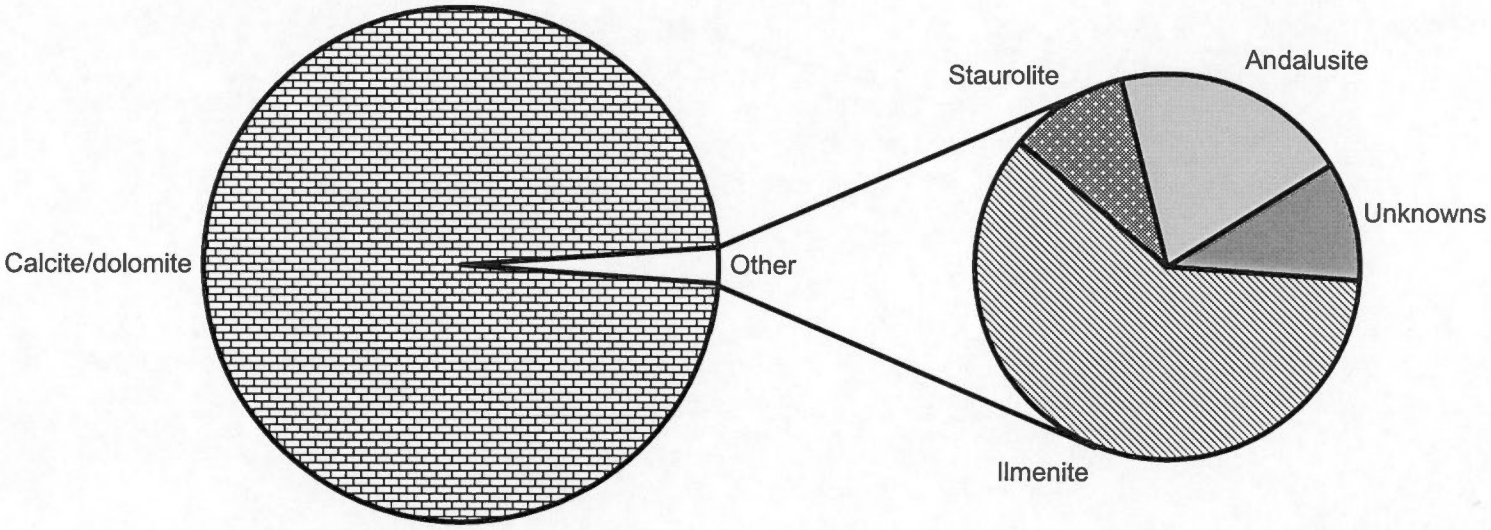
BB-02-2 66' (6-11)


Staurolite
Tourmaline
Unknowns
Other
Ilmenite
Zircon/Monazite

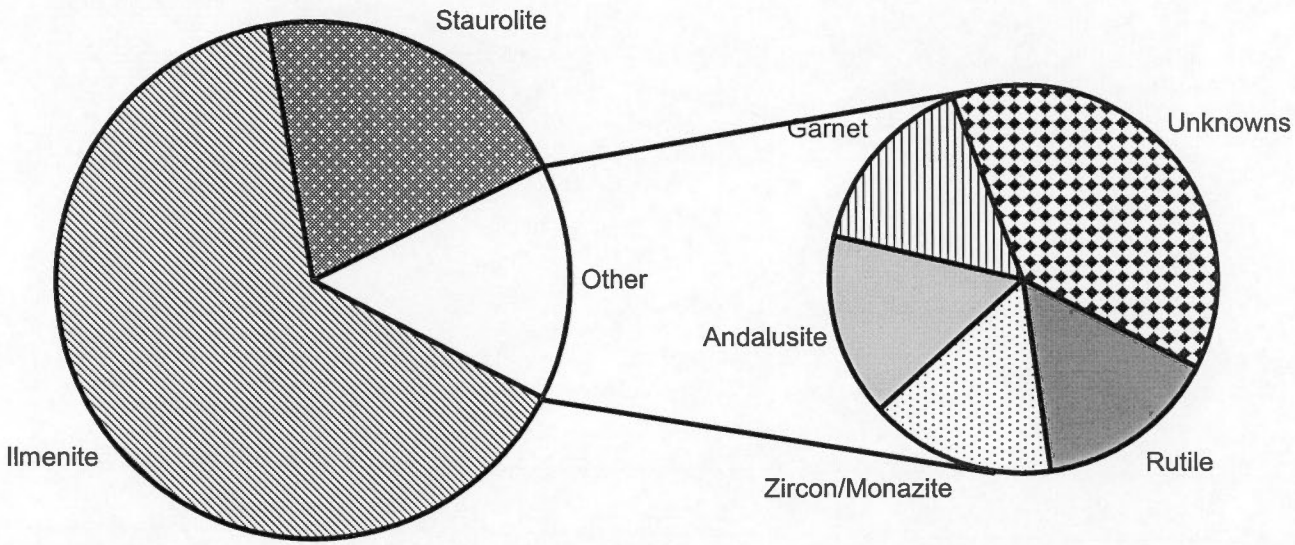
BB-02-2 66'(66-69)



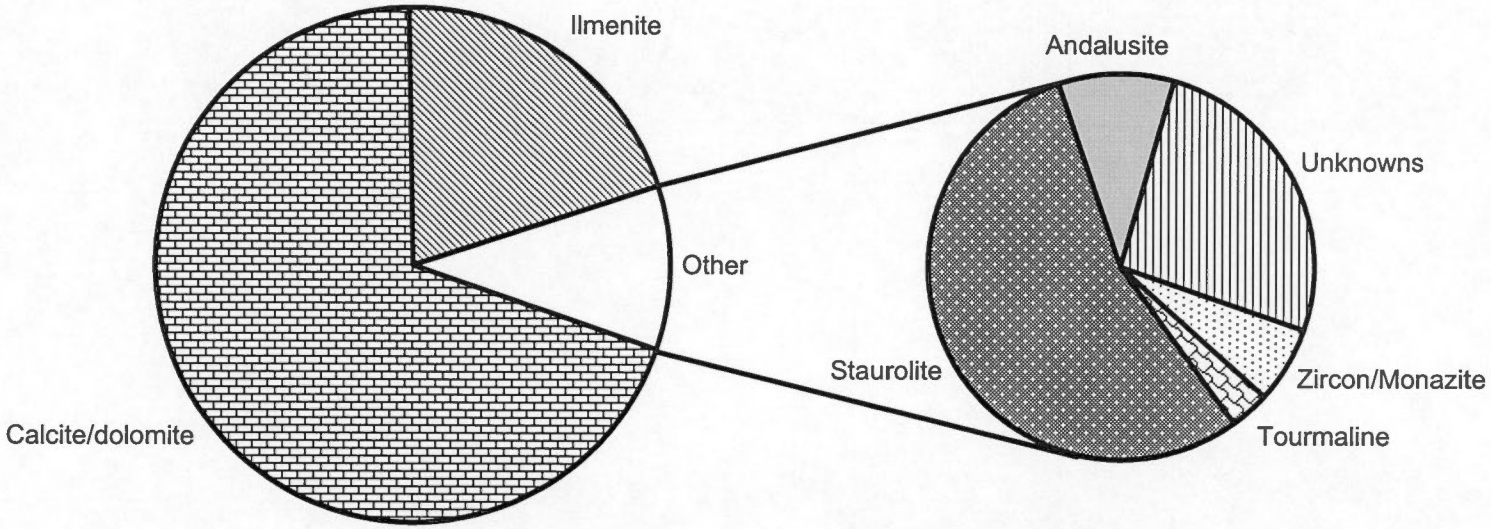
BB-02-2 74'


Calcite/dolomite
Other
Staurolite
Andalusite
Unknowns
Ilmenite

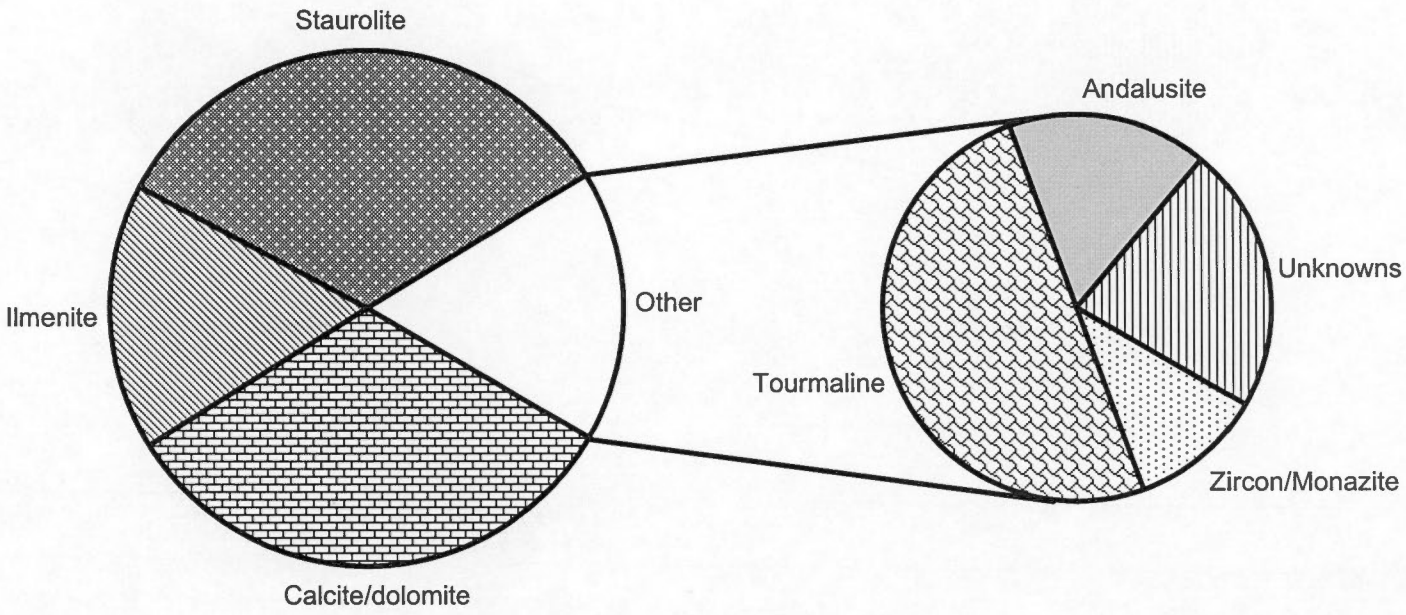
BB-02-2 82' (25-41)



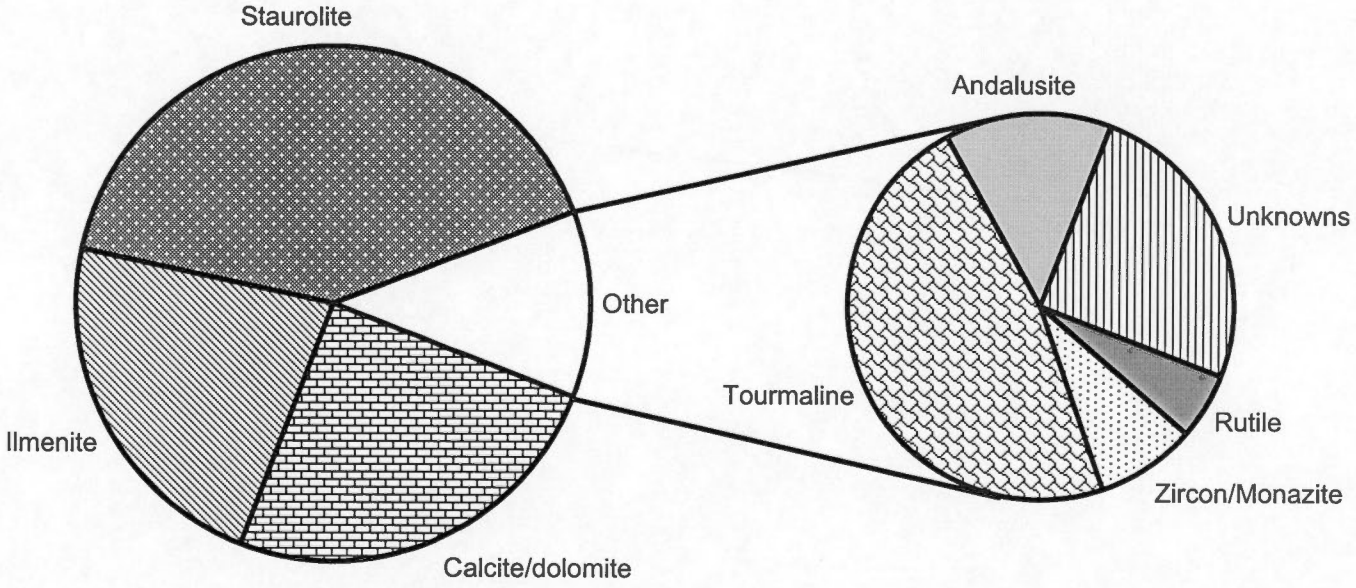
BB-02-2 111'(51-55)



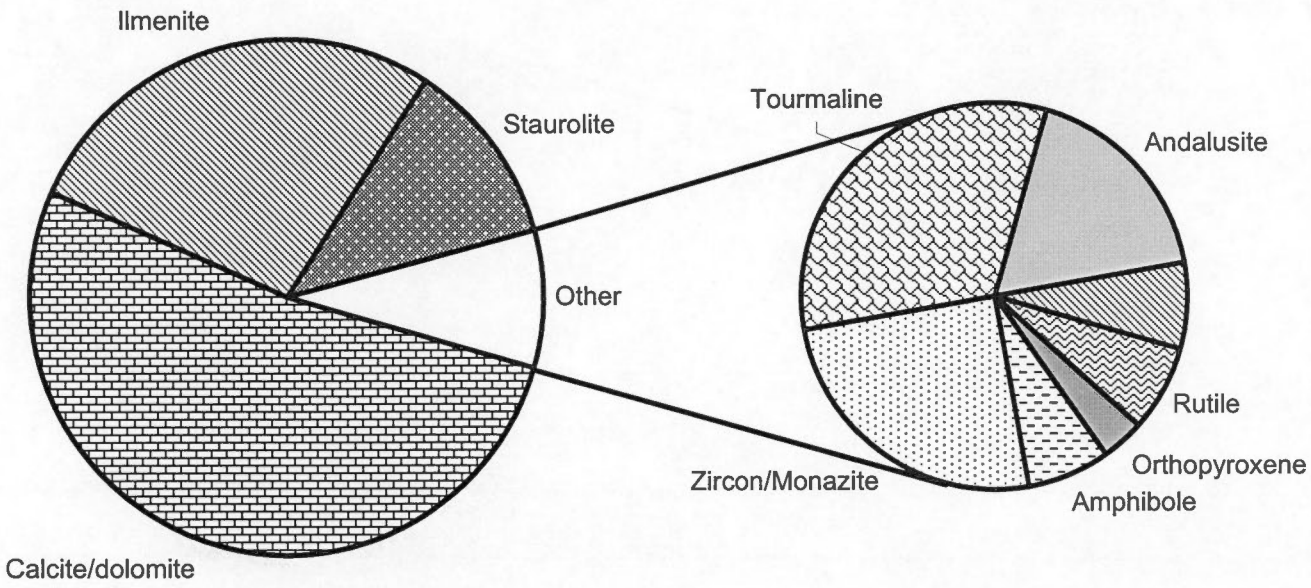
BB-02-5 31'(0-20)


Staurolite
Ilmenite
Other
Calcite/dolomite
Andalusite
Unknowns
Tourmaline
Zircon/Monazite

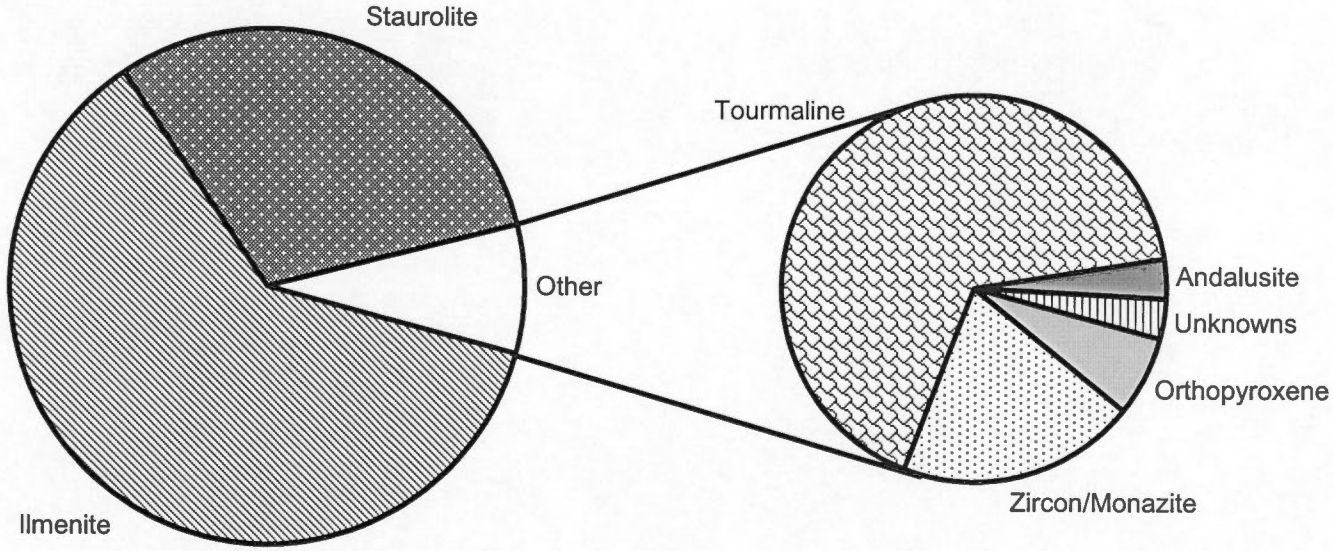
BB-02-5 31' (36-41)



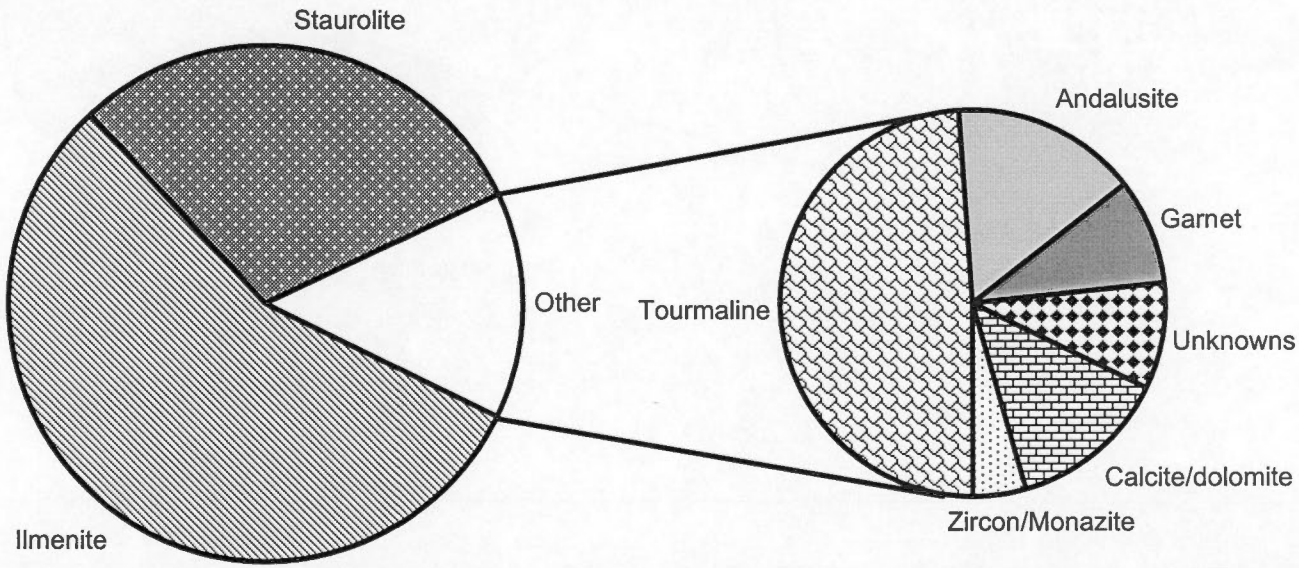
BB-02-5 31'-36'


Ilmenite
Staurolite
Other
Calcite/dolomite
Tourmaline
Andalusite
Rutile
Orthopyroxene
Amphibole
Zircon/Monazite

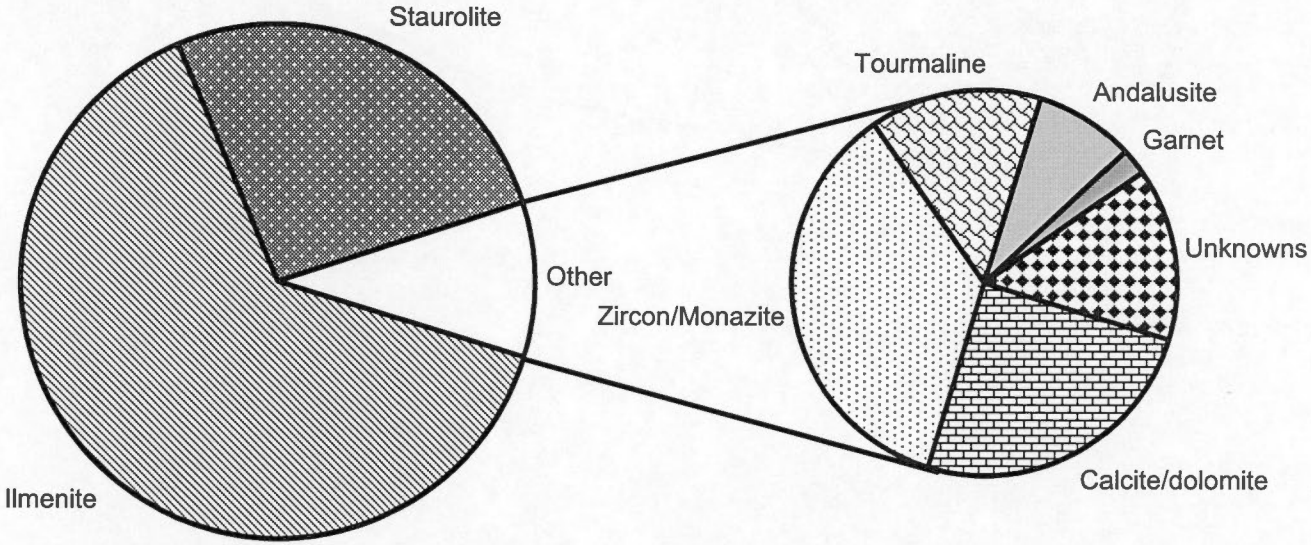
BB-02-7 32'


Staurolite
Tourmaline
Other
Andalusite
Unknowns
Orthopyroxene
Zircon/Monazite
Ilmenite

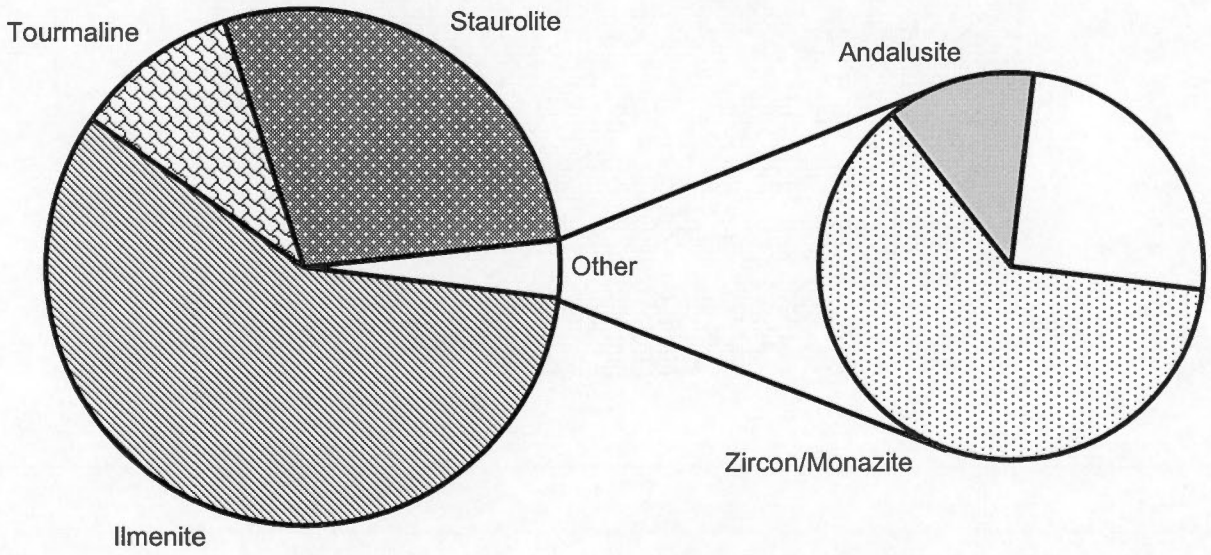
BB-02-7 40' A


Staurolite
Ilmenite
Other
Tourmaline
Andalusite
Garnet
Unknowns
Calcite/dolomite
Zircon/Monazite

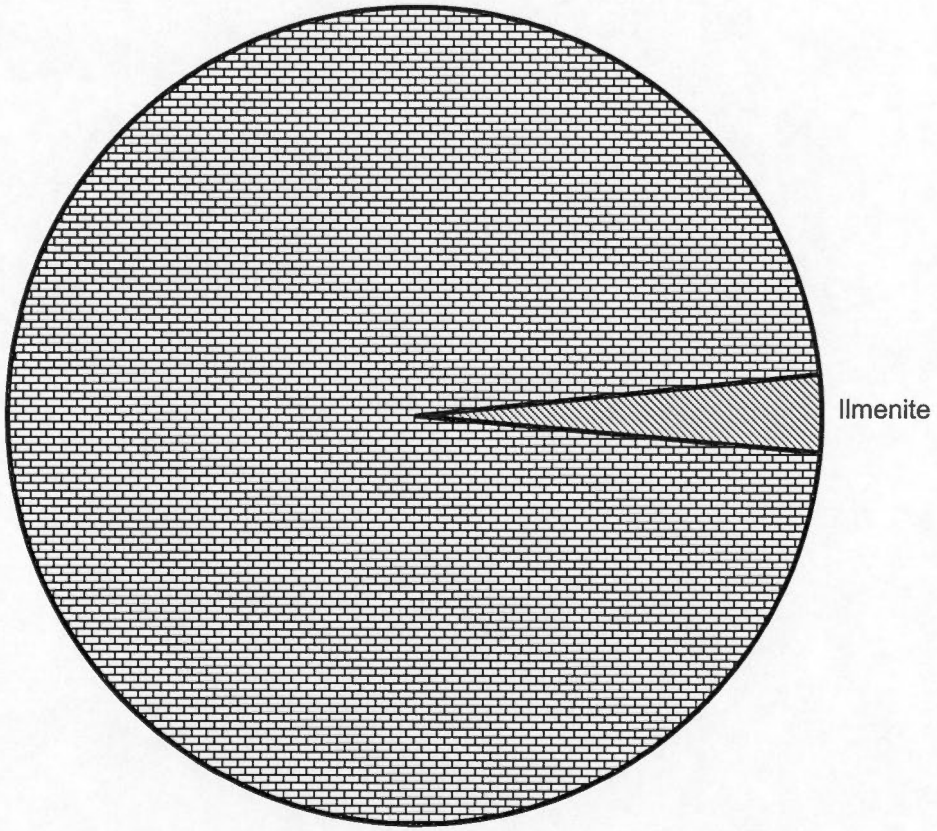
BB-02-7 40'B


Staurolite
Ilmenite
Other
Zircon/Monazite
Tourmaline
Andalusite
Garnet
Unknowns
Calcite/dolomite

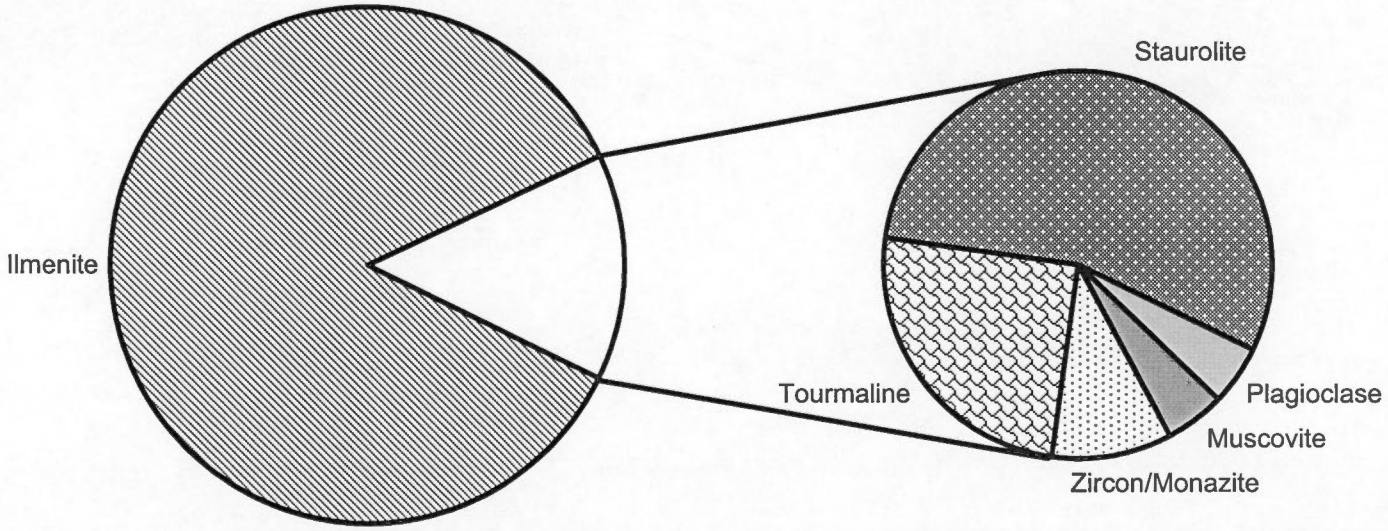
BB-02-7 50'


Tourmaline
Staurolite
Andalusite
Other
Zircon/Monazite
Ilmenite

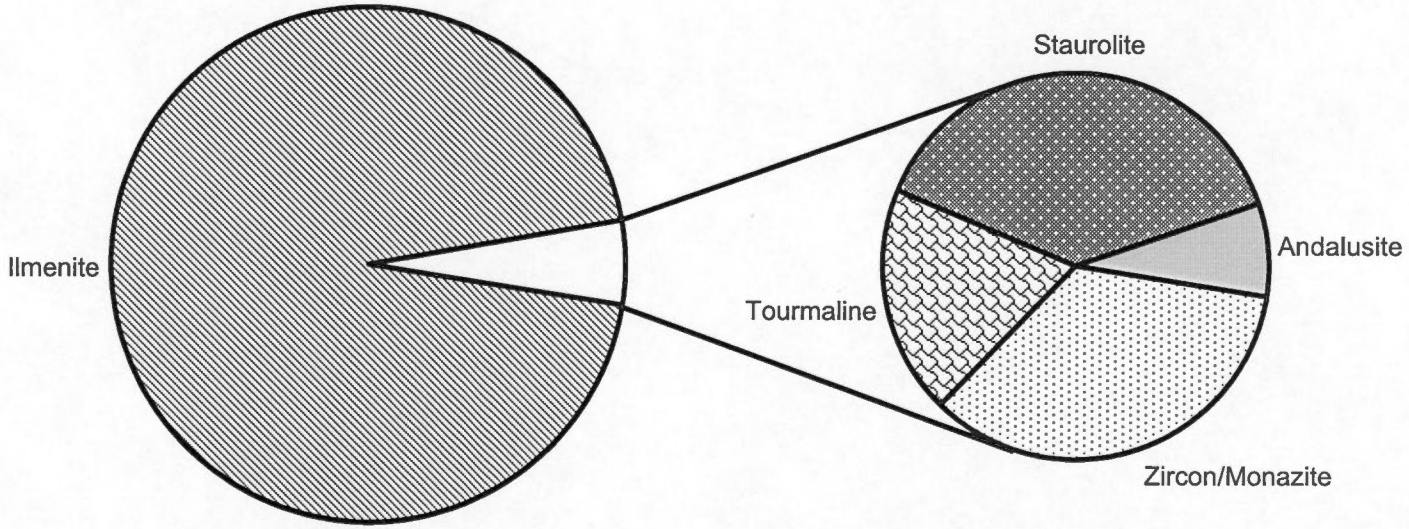
BB-02-7 71'(55-60)



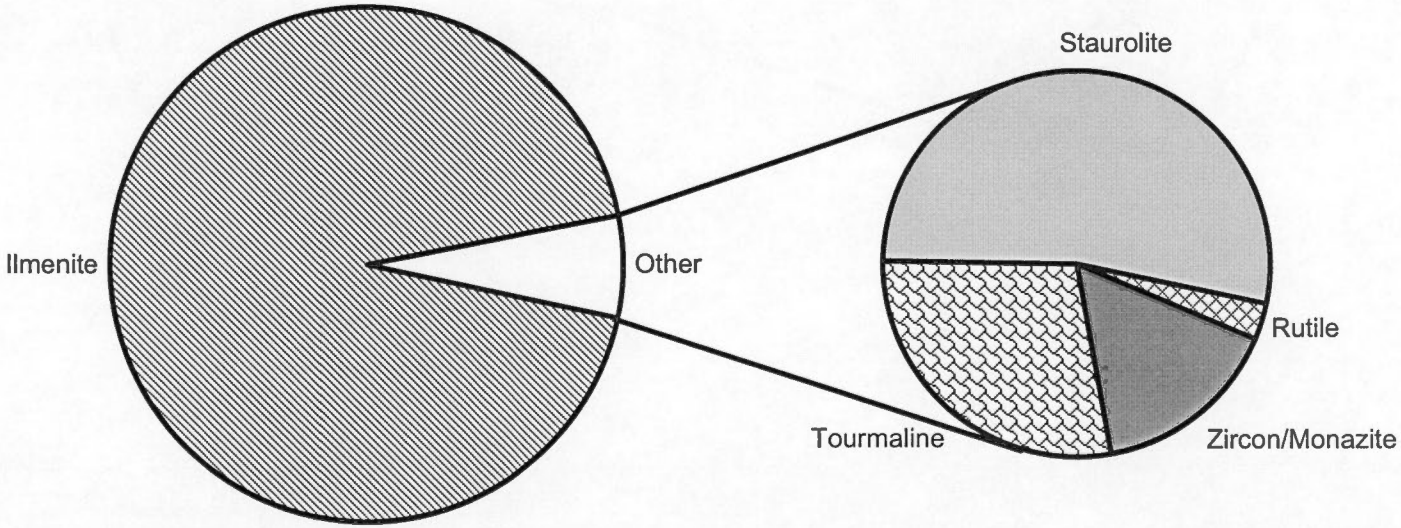
BM-02-2 34'


Ilmenite
Staurolite
Tourmaline
Plagioclase
Muscovite
Zircon/Monazite

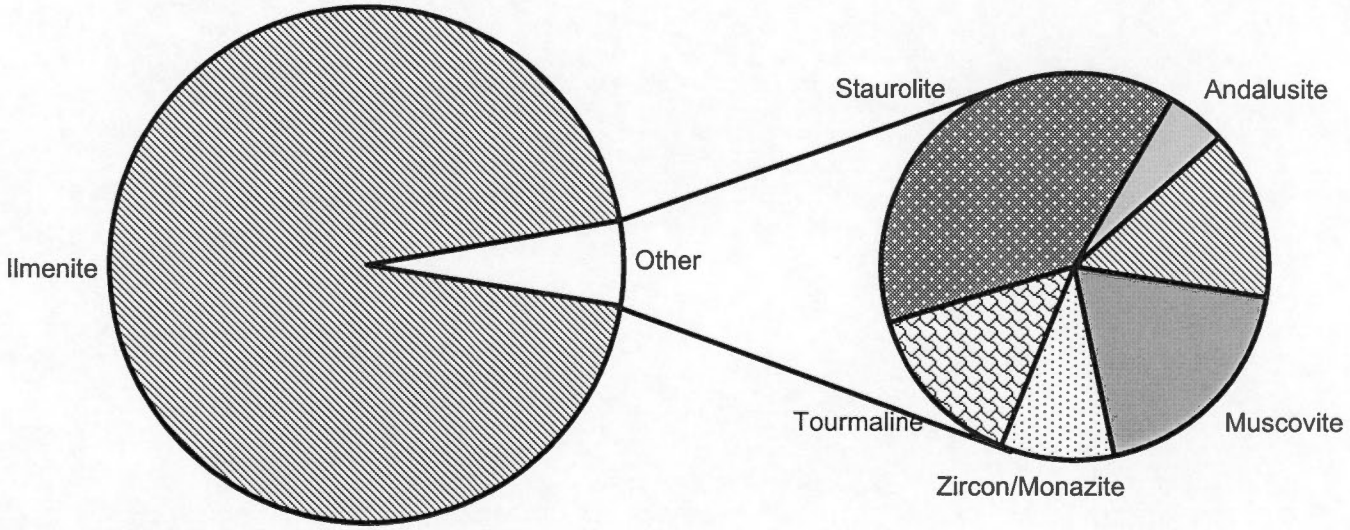
BM-02-2 62'


Ilmenite
Staurolite
Andalusite
Tourmaline
Zircon/Monazite

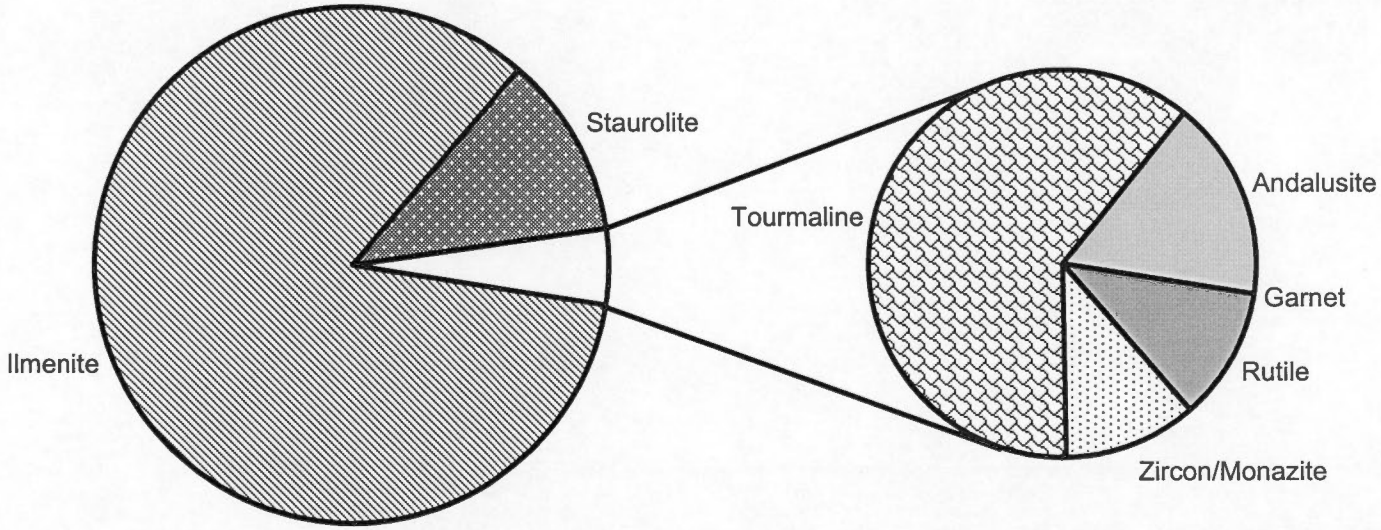
BM-02-2 64'


Ilmenite
Other
Staurolite
Rutile
Tourmaline
Zircon/Monazite

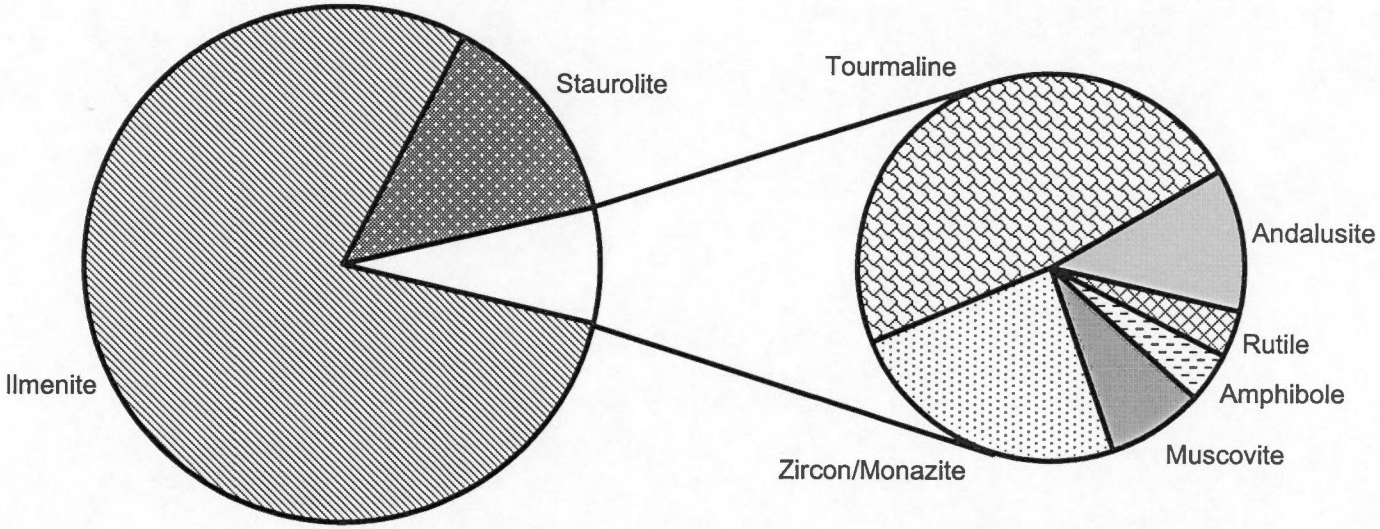
BM-02-3 21'


Ilmenite
Other
Staurolite
Andalusite
Tourmaline
Muscovite
Zircon/Monazite

DB-97-2 12.2m


Staurolite
Ilmenite
Tourmaline
Andalusite
Garnet
Rutile
Zircon/Monazite

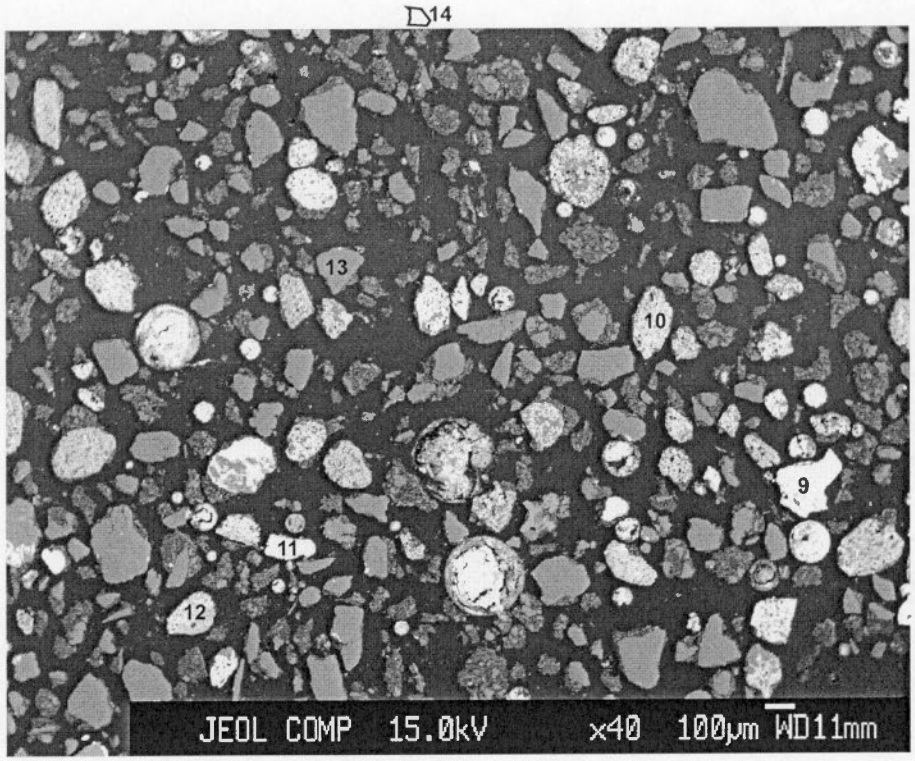
DB-97-2 93.4m


Staurolite
Ilmenite
Tourmaline
Andalusite
Rutile
Amphibole
Muscovite
Zircon/Monazite

Appendix X:

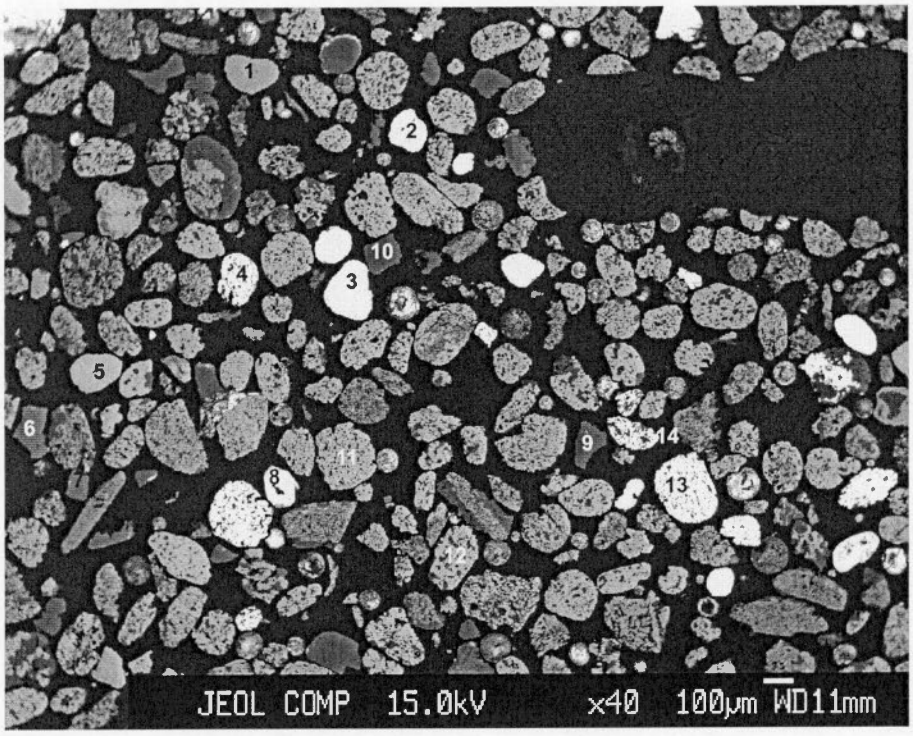
Back-scatter electron images and mineral identification of heavy mineral separates from representative sandstone samples from Belmont, Brierly Brook and Diogenes Brook

Appendix X
Part A: Belmont



9: ilmenite
10: ilmenite
11: ilmenite
12: ilmenite
13: quartz
14: zircon

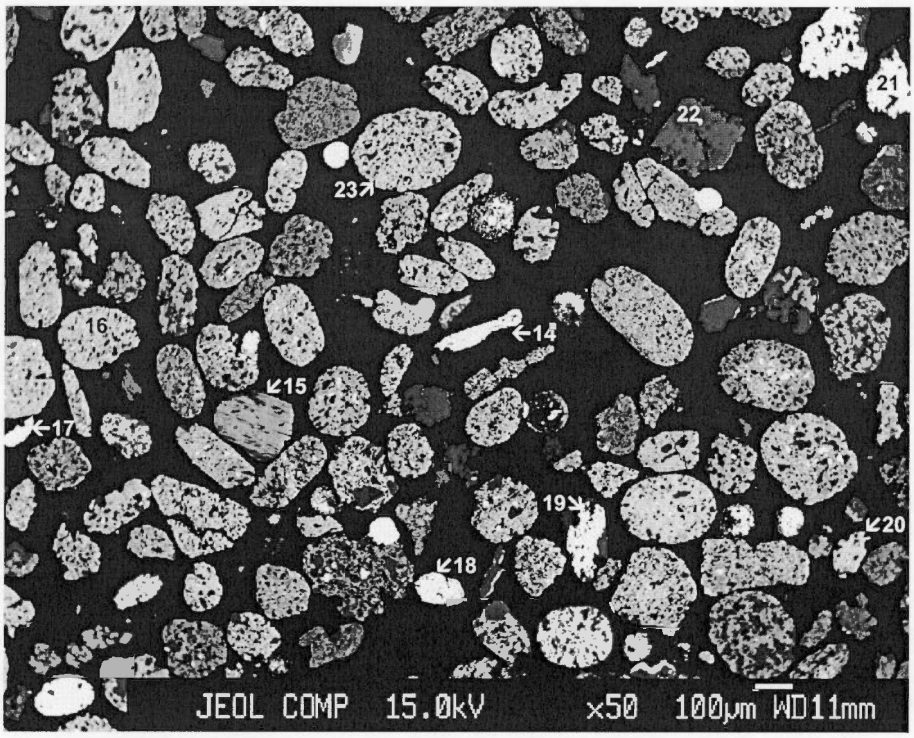
Figure 1 BM-02-2 34'



1: rutile
2: zircon
3: zircon
4: monazite
5: ilmenite
6: staurolite
7: tourmaline
8: zircon
9: quartz
10: quartz
11: ilmenite
12: ilmenite
13: monazite*
14: monazite*

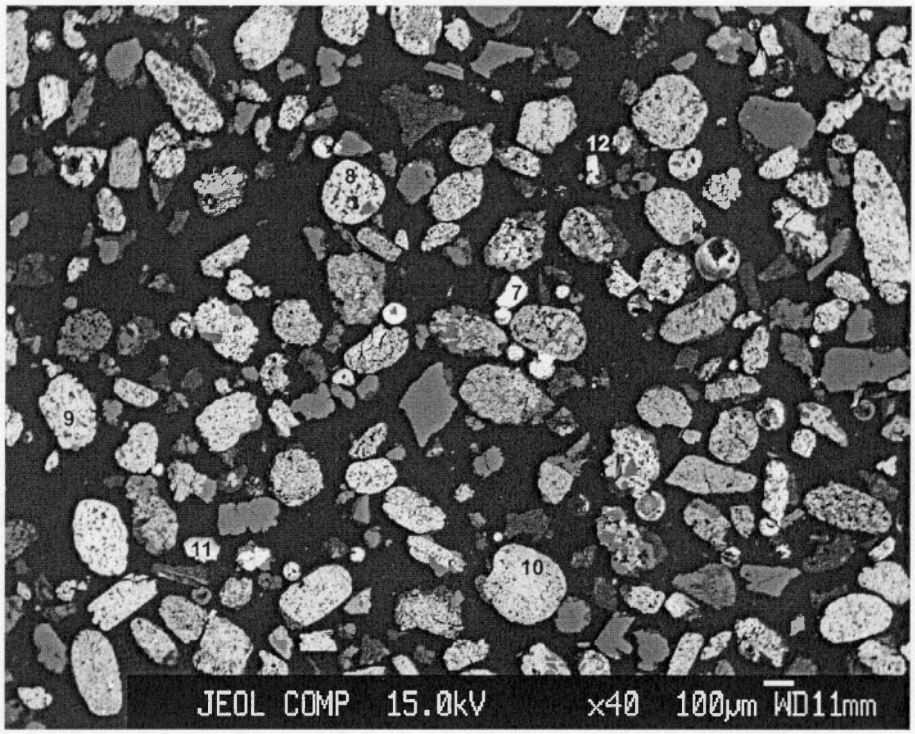
* not analysed but identified based on comparison to other analysed grains.

Figure 2 BM-02-2 62'



14: monazite
15: rutile
16: ilmenite
17: zircon
18: monazite
19: monazite
20: ilmenite
21:monazite
22: staurolite
23: ilmenite

Figure 3 BM-02-2 64'



7: zircon
8: ilmenite
9: ilmenite
10: ilmenite
11: garnet (spessertine)
12: ilmenite

Figure 4 BM-02-3 21'

Appendix X
Part B: Brierly Brook

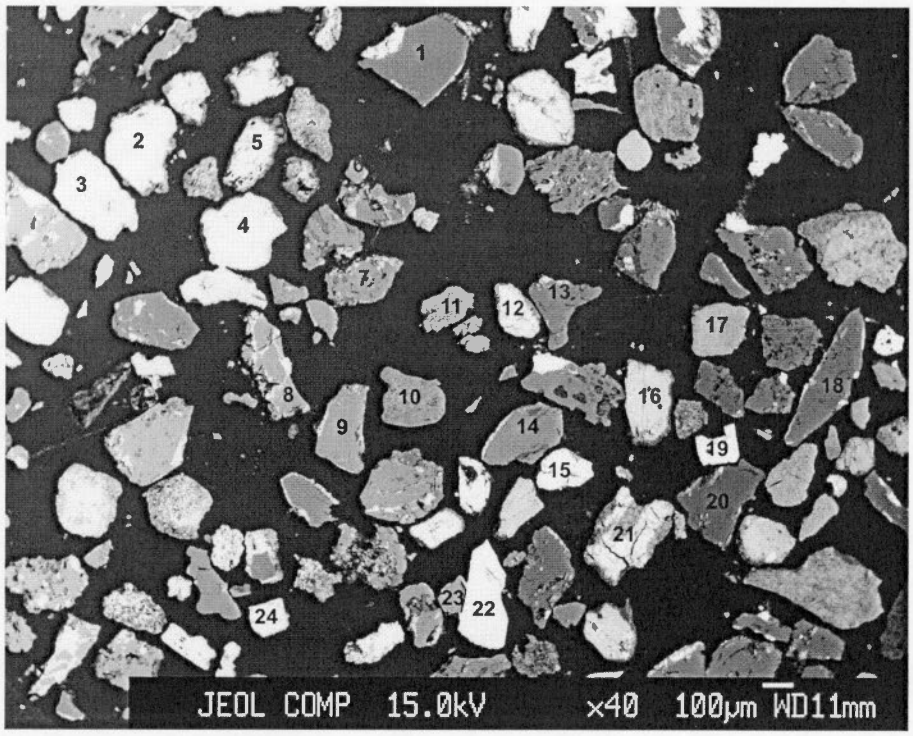


Figure 1 BB 95-1-4 surface sample

1: tourmaline
2: ilmenite
3: limonite
4: ilmenite
5: ilmenite
6: staurolite
7: staurolite
8: staurolite
9: staurolite
10: siderite
11: quartz
12: limonite
13: tourmaline
14: staurolite
15: zircon
16: ilmenite
17: rutile
18: staurolite
19: zircon
20: andalusite
21; limonite
22: zircon
23: clinopyroxene
24: ilmenite
25: ilmenite (grain not marked)

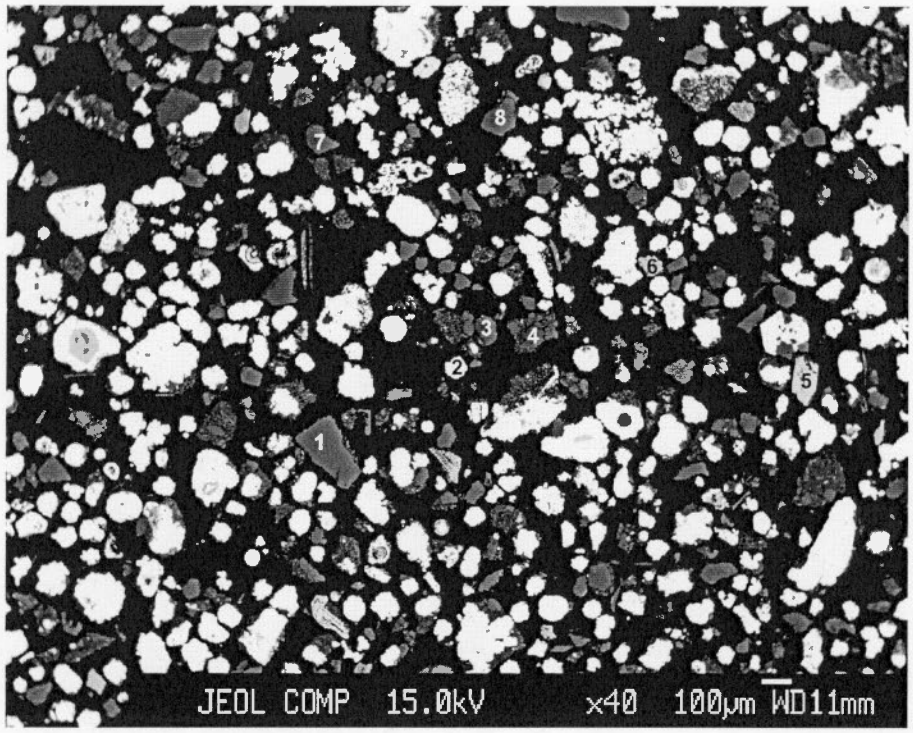
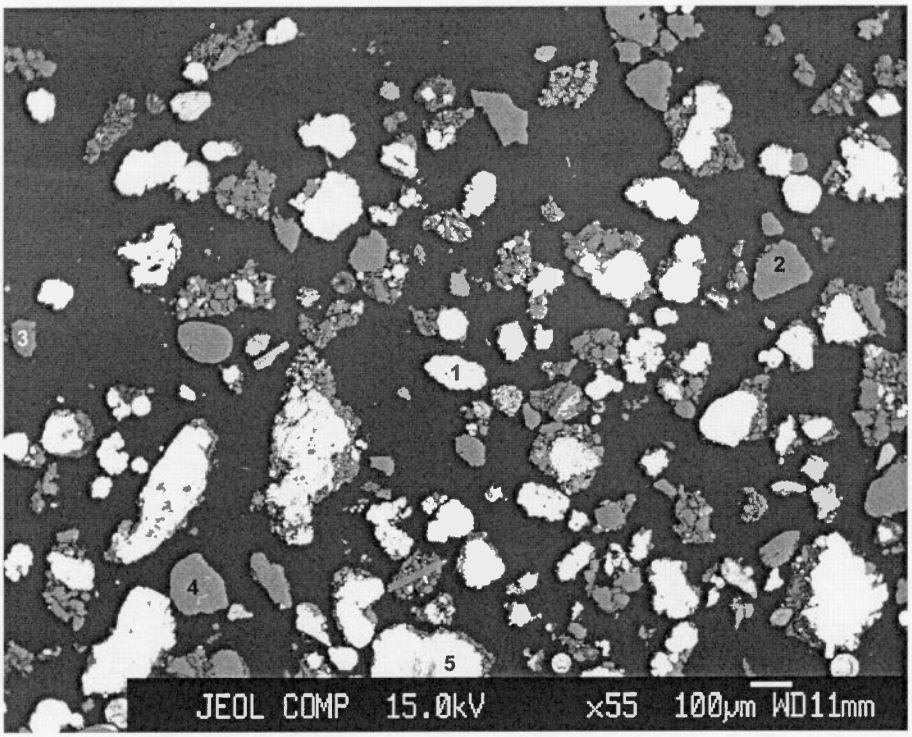


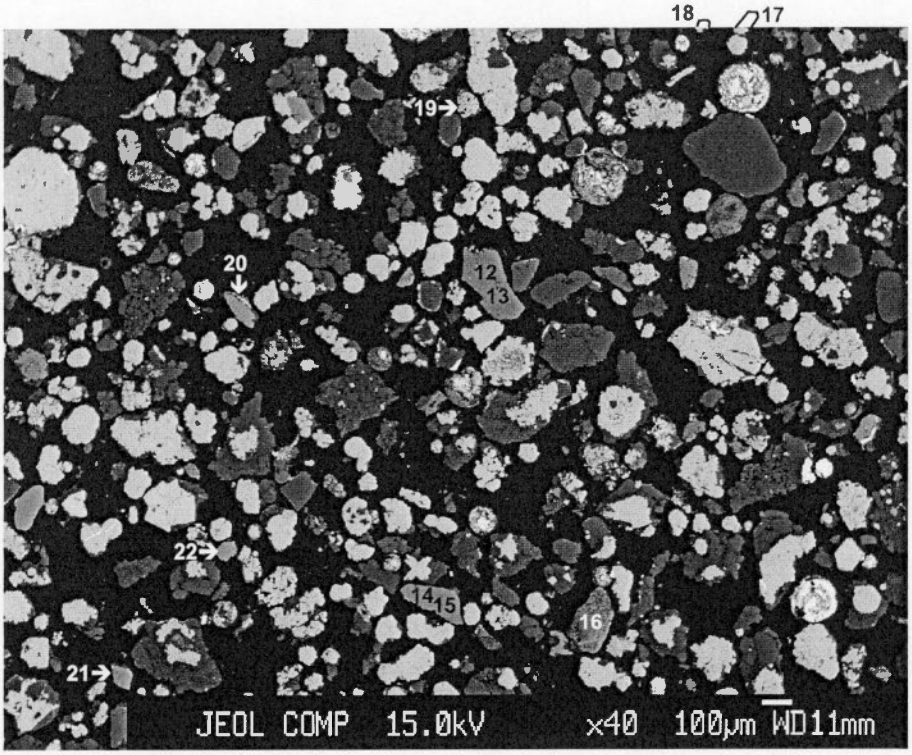
Figure 2 BB-02-1 12'

1: tourmaline
2: monazite
3: quartz
4: quartz
5: altered muscovite
6: bad analysis
7: quartz
8: tourmaline



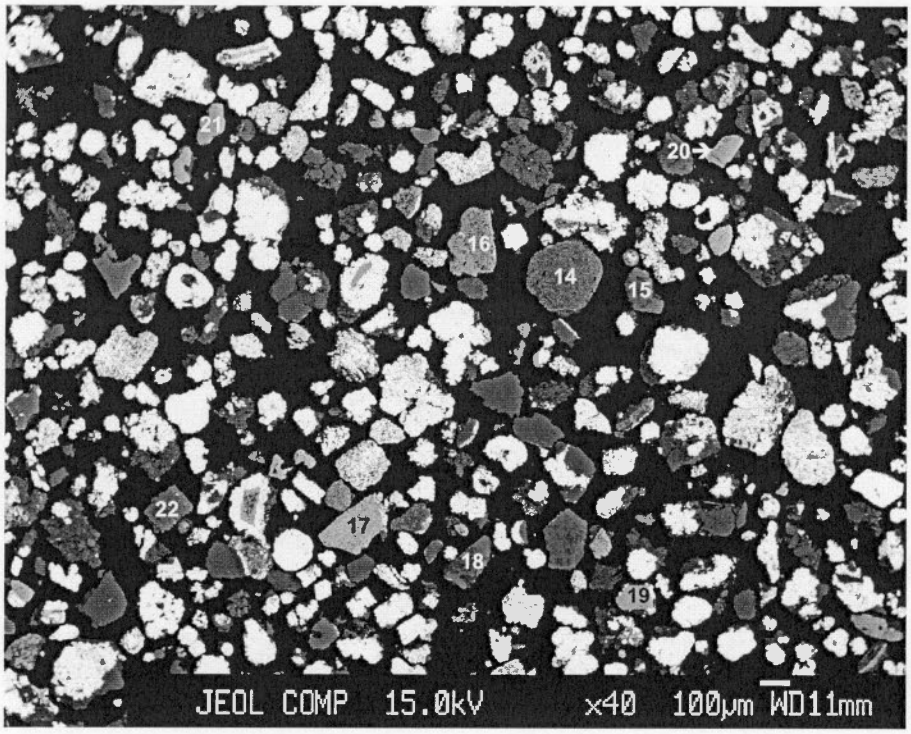
1: monazite
2: quartz
3: garnet (grossulour)
4: quartz
5: ilmenite

Figure 3 BB-02-1 17'



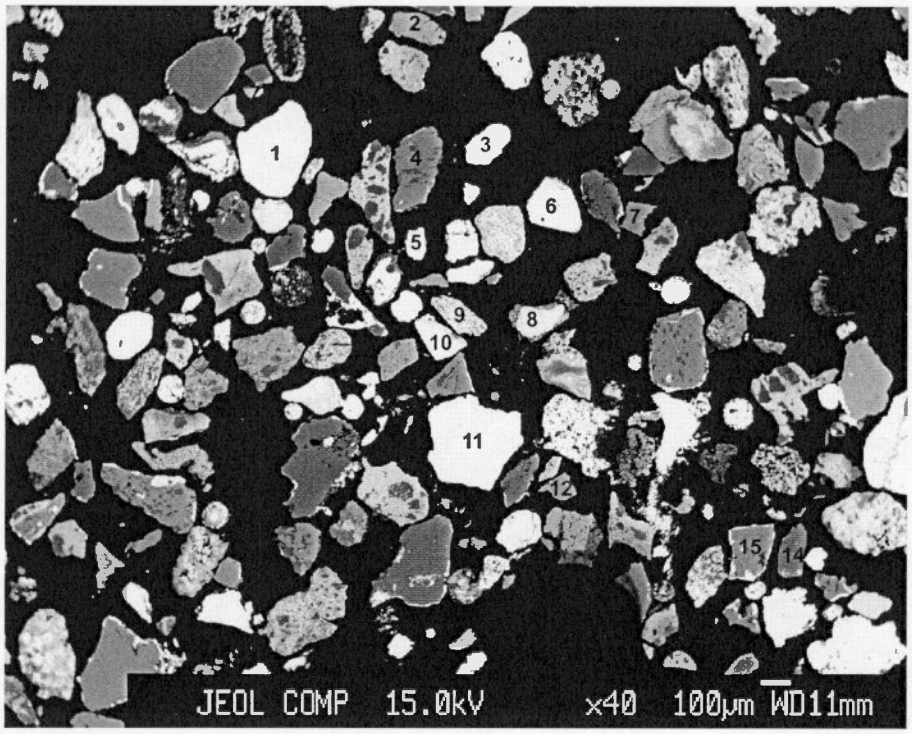
12: garnet (almandine)
13: garnet (almandine)
14: garnet (almandine)
15: garnet (almandine)
16: ilmenite
17: ilmenite
18: rutile
19: zircon
20: ilmenite
21: ilmenite
22: rutile

Figure 4 BB-02-1 22'



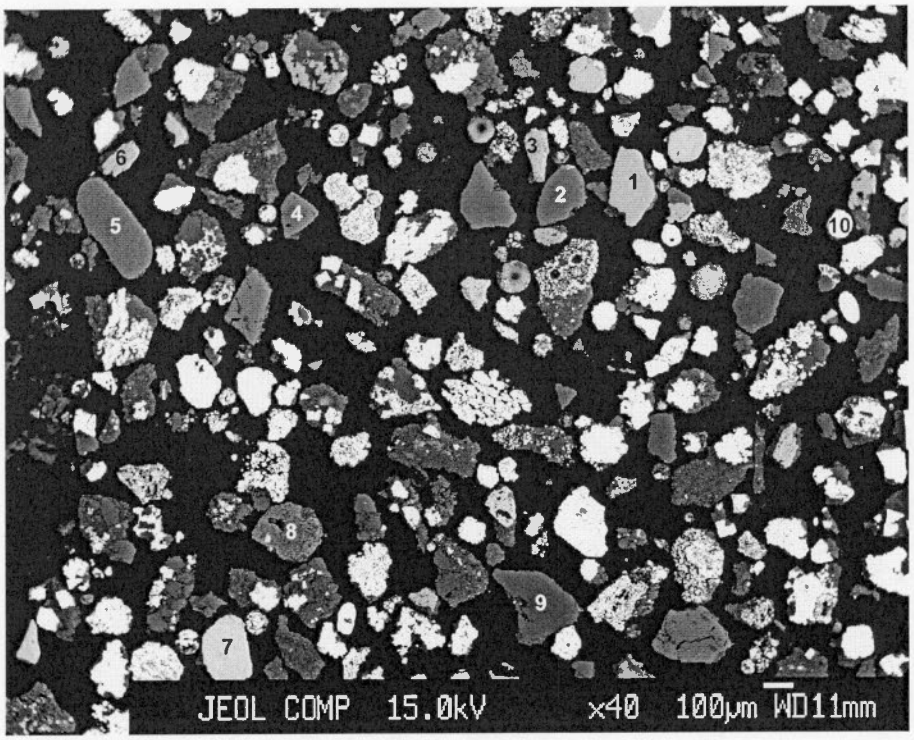
14: ilmenite in staurolite
15: ilmenite
16: staurolite
17: ilmenite
18: ilmenite in staurolite
19: staurolite
20:ilmenite
21: ilmenite
22: ilmenite in staurolite

Figure 5 BB-02-1 42'



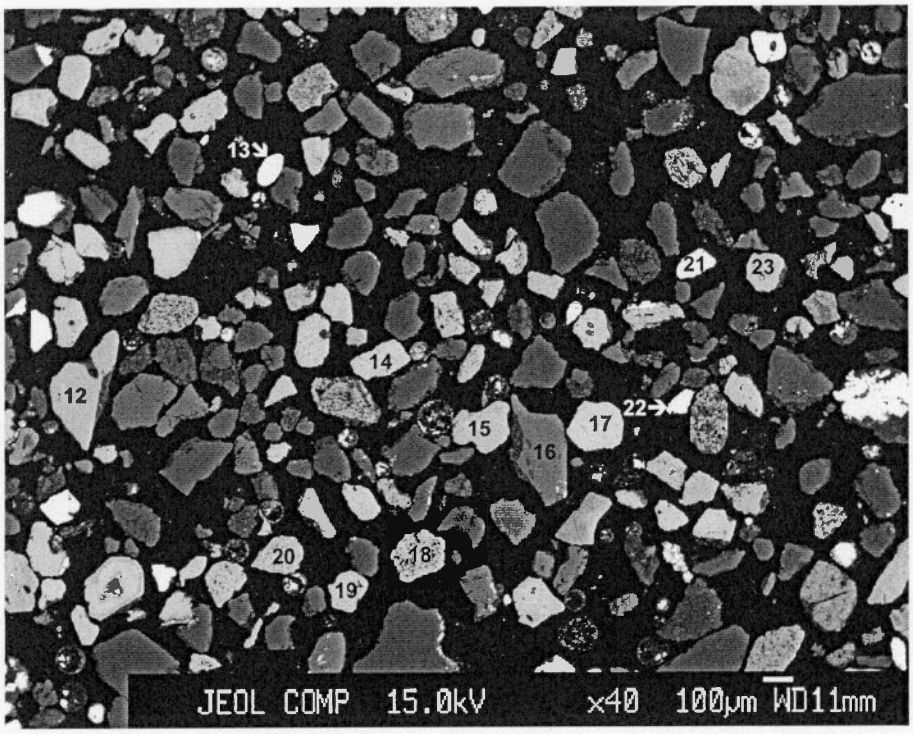
1: ilmenite
2: epidote
3: ilmenite
4: staurolite
5: geothite
6: zircon
7: Tourmaline
8: ilmenite
9: ilmenite
10: magnetite
11: magnetite
12: staurolite
13: epidote
14: tourmaline
15: staurolite

Figure 6 BB-02-1 ~16'



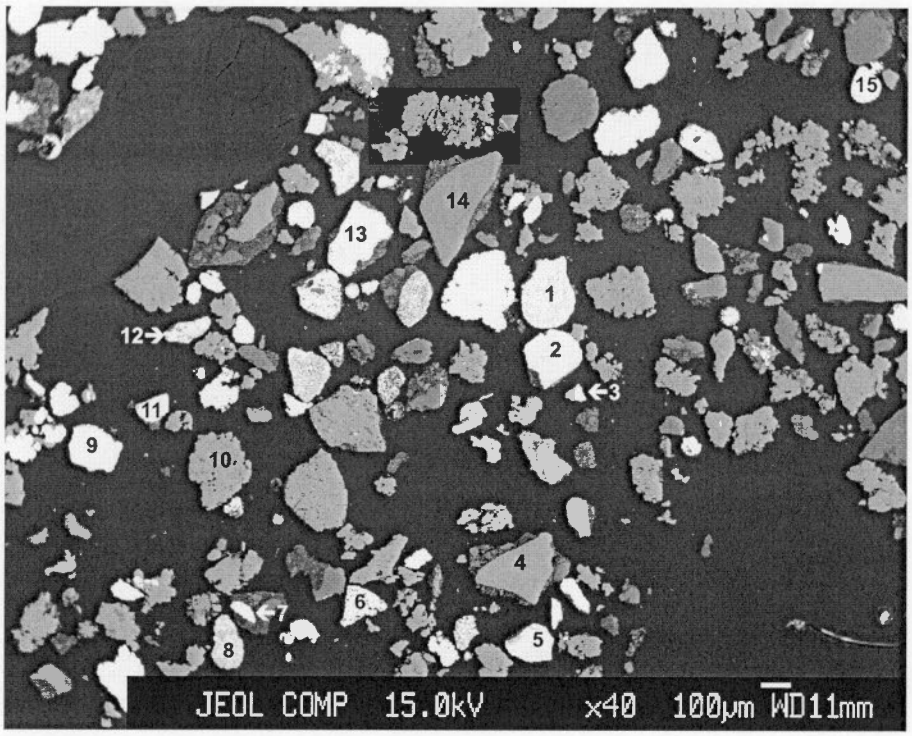
1: rutile
2: tourmaline
3: ilmenite
4: staurolite
5: tourmaline
6: rutile
7: ilmenite
8: rutile
9: quartz
10: zircon

Figure 7 BB-02-2 26' (66-72)



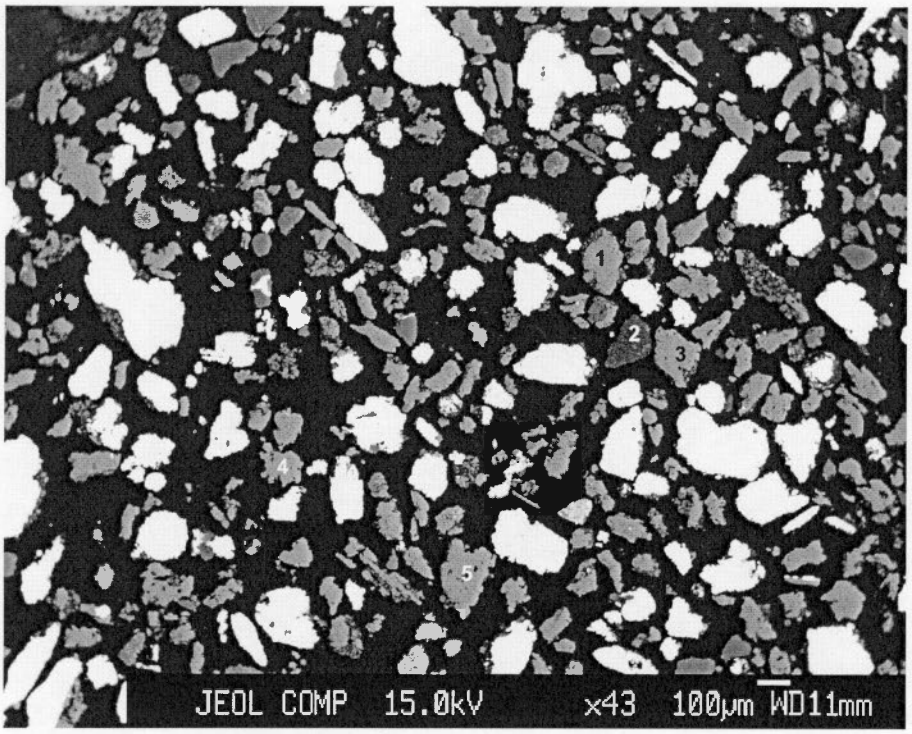
12: rutile
13: zircon
14: ilmenite
15: ilmenite
16: staurolite
17: ilmenite
18: ilmenite
19: ilmenite
20: ilmenite
21: zircon
22: monazite
22: ilmenite

Figure 8 BB-02-2 66' (6-11)



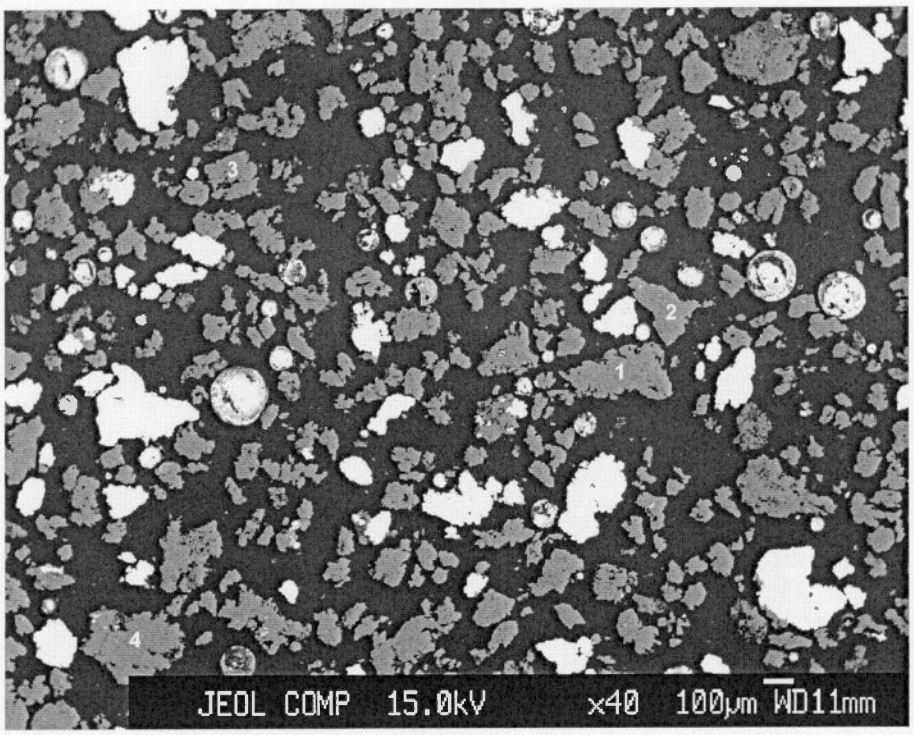
1: Rutile
2: zircon
3: monazite
4: staurolite
5: ilmenite
6: ilmenite
7: monazite
8: ilmenite
9: ilmenite
10: calcite
11: ilmenite
12: ilmenite
13: ilmenite
14: tourmaline
15: zircon

Figure 9 BB-02-2 66' (66-69)



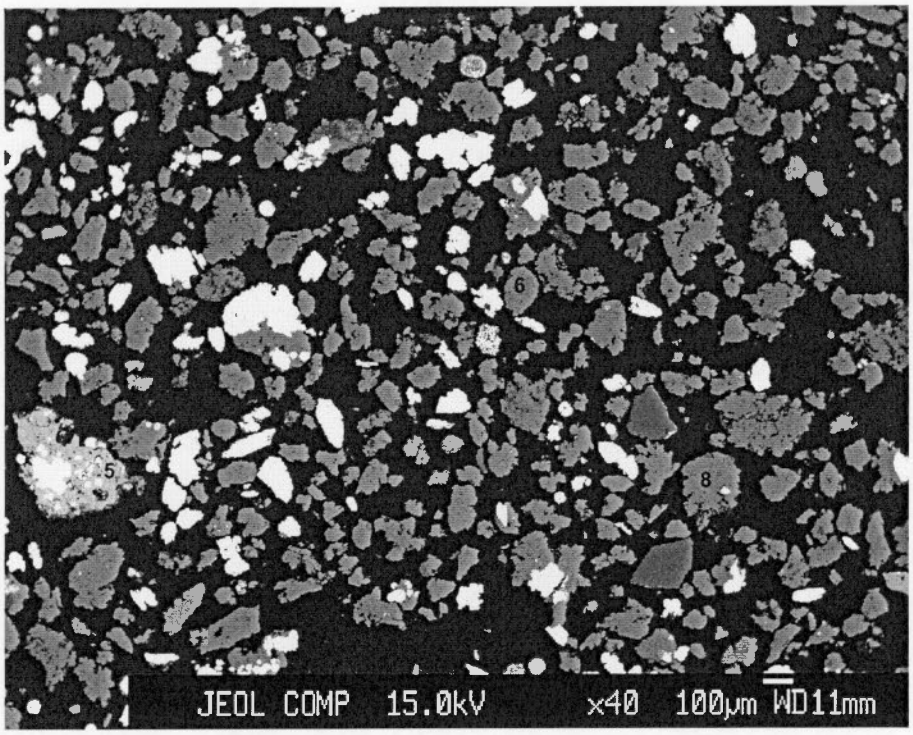
1: ??
2: calcite
3: quartz
4: calcite
5: calcite

Figure 10 BB-02-2 71' (55-60)



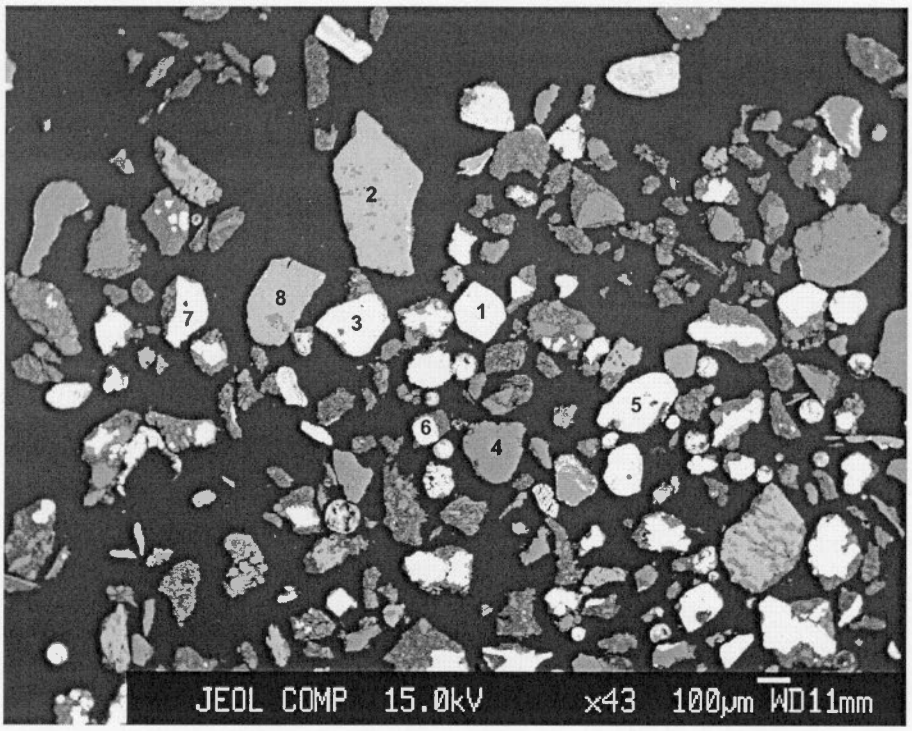
1: calcite
2: calcite
3: calcite
4: calcite

Figure 11 BB-02-2 71' (88-95)



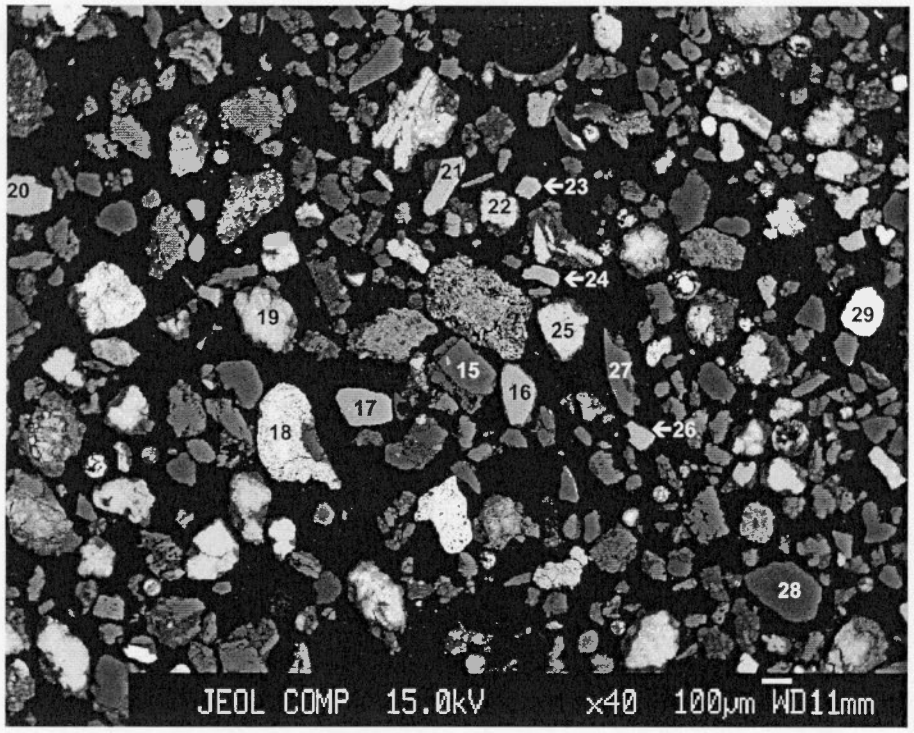
5: limonite
6: calcite
7: calcite
8: calcite

Figure 12 BB-02-2 74'



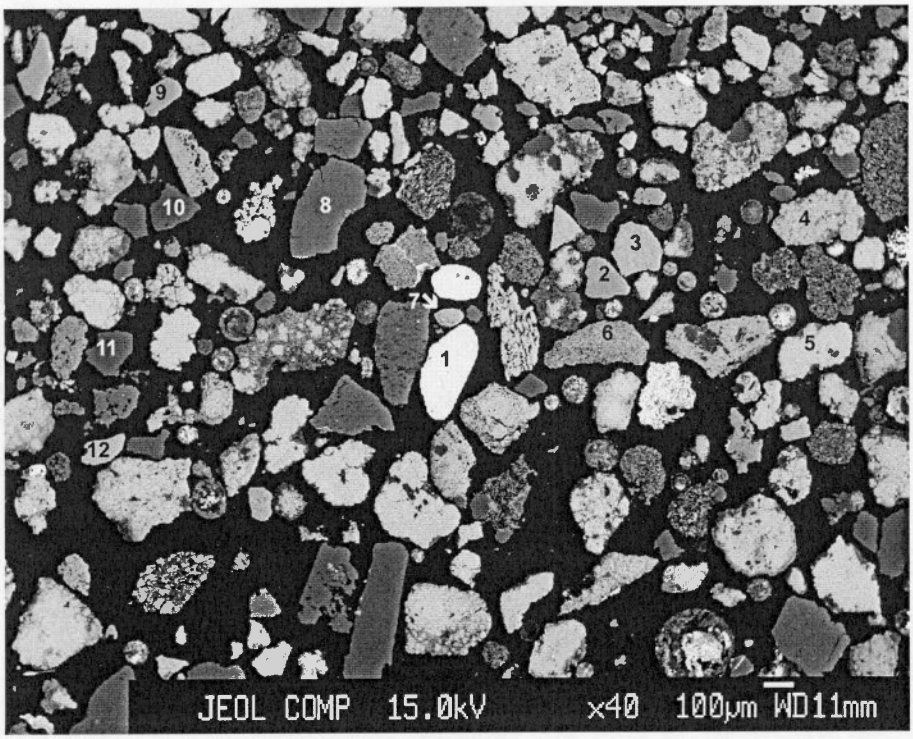
1: ilmenite
2: staurolite
3: ilmenite
4: - -
5: ilmenite
6: zircon
7: ilmenite

Figure 11 BB-02-2 82' (25-41)



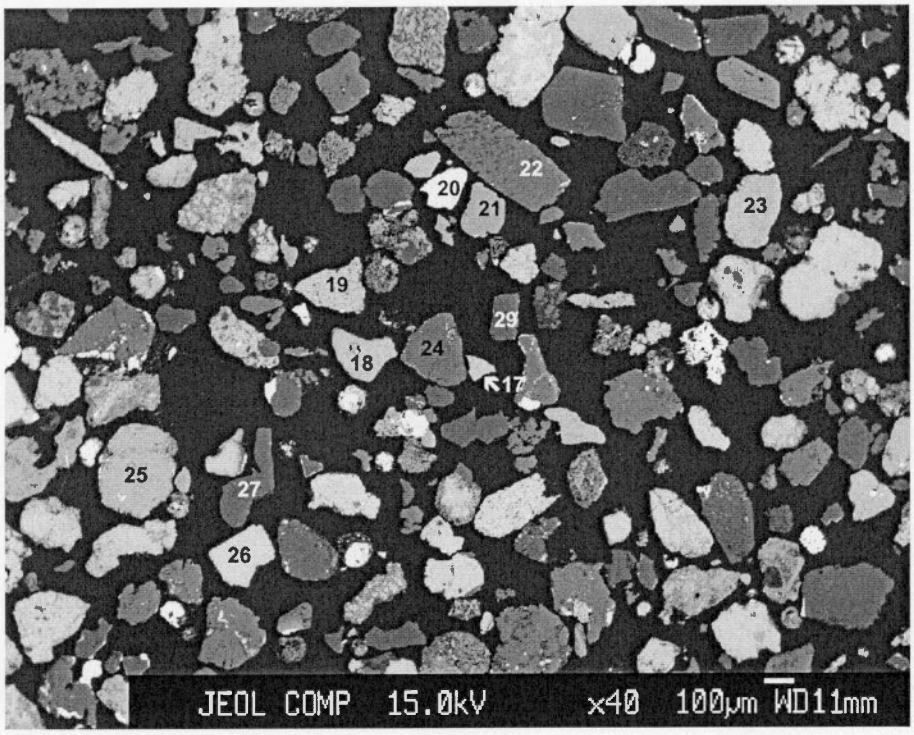
15: staurolite
16: ilmenite
17: rutile
18: barite
19: limonite
20: Al-phoshate
21: ilmenite
22: limonite
23: ilmenite
24: ilmenite
25: limonite
26: ilmenite
27: staurolite
28: quartz
29: barite

Figure 14 BB-02-1 111' (55-56)



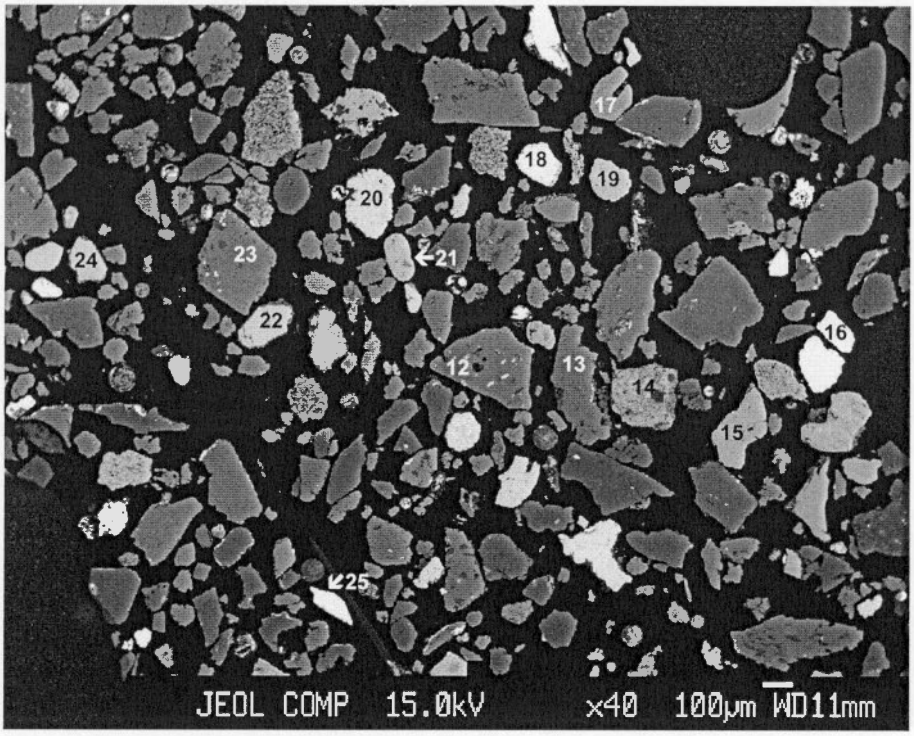
1: zircon
2: rutile
3: ilmenite
4: limonite
5: limonite
6: limonite
7: ilmenite
8: staurolite
9: rutile
10: quartz in staurolite
11: quartz
12: ilmenite
13: barite (not marked on image)

Figure 15 BB-02-5 31' (0-20)



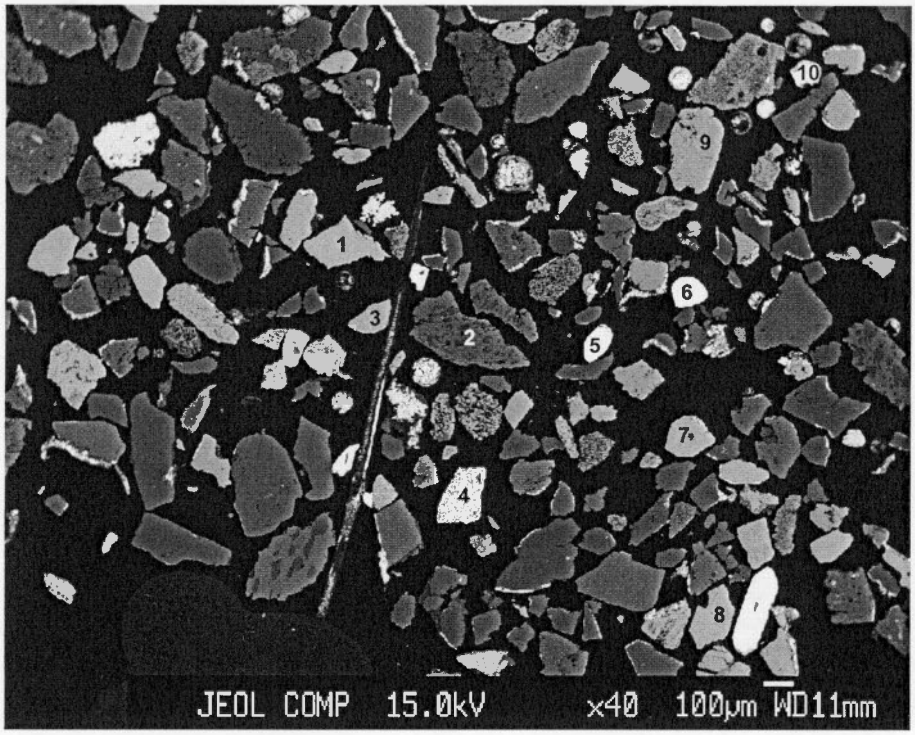
17: limonite
18: ilmenite
19: limonite
20: zircon
21: ilmenite
22: staurolite
23: ilmenite
24: tourmaline
25: ilmenite
26: limonite
27: quartz
28: tourmaline (not marked on image)
29: tourmaline

Figure 16 BB-02-5 31' - 36'



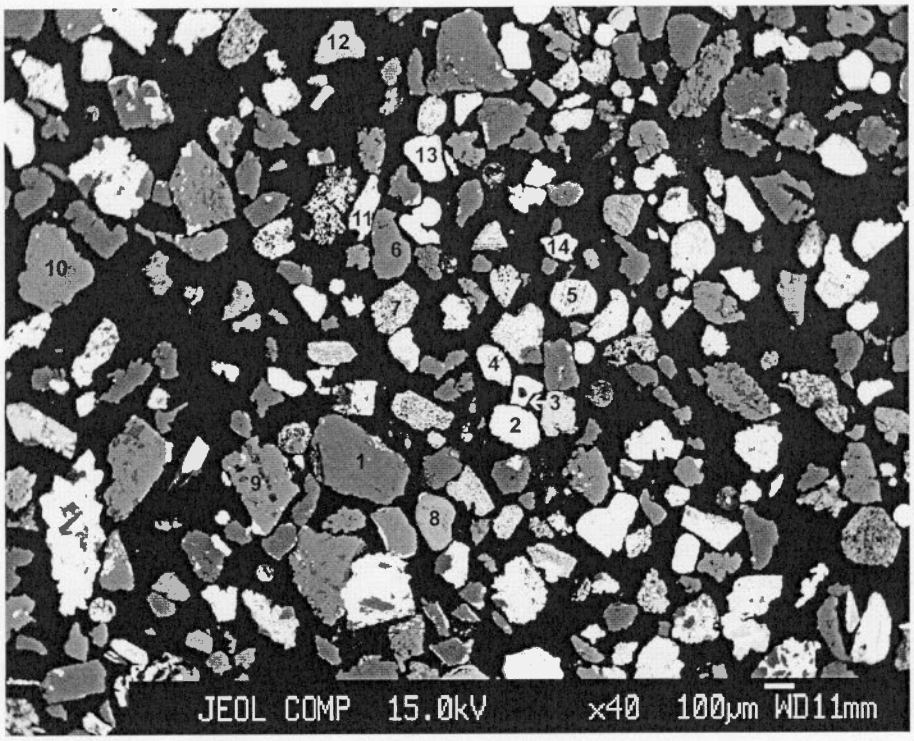
12: stauroloite
13: staurolite
14: magnetite
15: rutile
16: monazite
17: ilmenite
18: magnetite
19: ilmenite
20: limonite
21: ilmenite
22: ilmenite
23: staurolite
24: ilmenite
25: limonite

Figure 17 BB-02-5 31' (26-41)



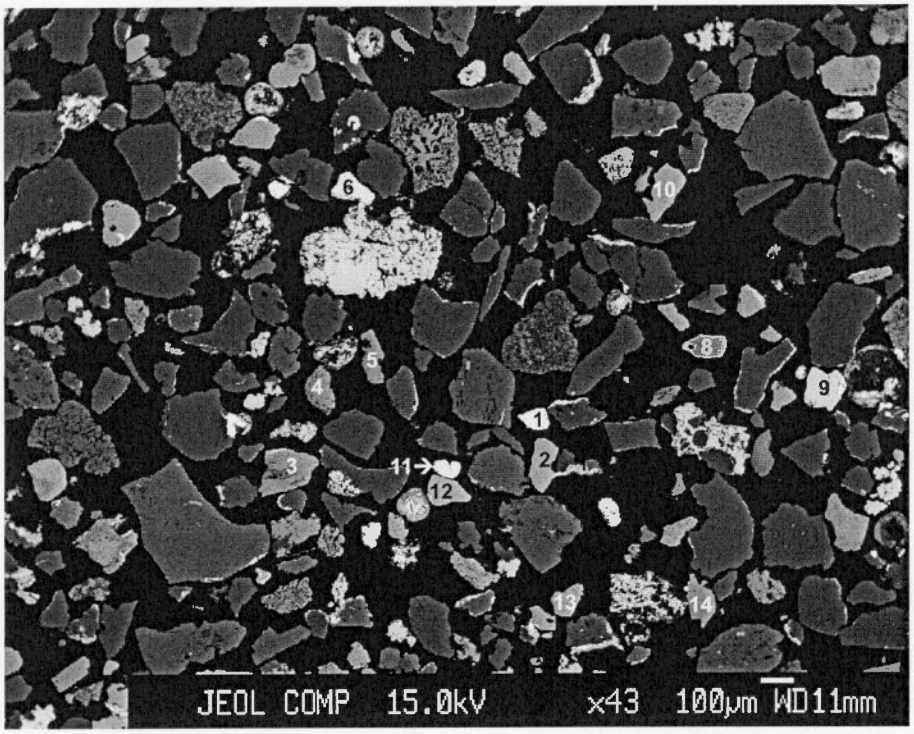
1: ilmenite
2: staurolite
3: ilmenite
4: zircon
5: zircon
6: zircon
7: ilmenite
8: ilmenite
9: rutile
10: zircon

Figure 18 BB-02-7 32'



1: tourmaline
2: ilmenite
3: ilmenite
4: ilmenite
5: ilmenite
6: tourmaline
7: ilmenite
8: chlorite
9: staurolite
10: tourmaline
11: ilmenite
12: ilmenite
13: ilmenite
14: zircon

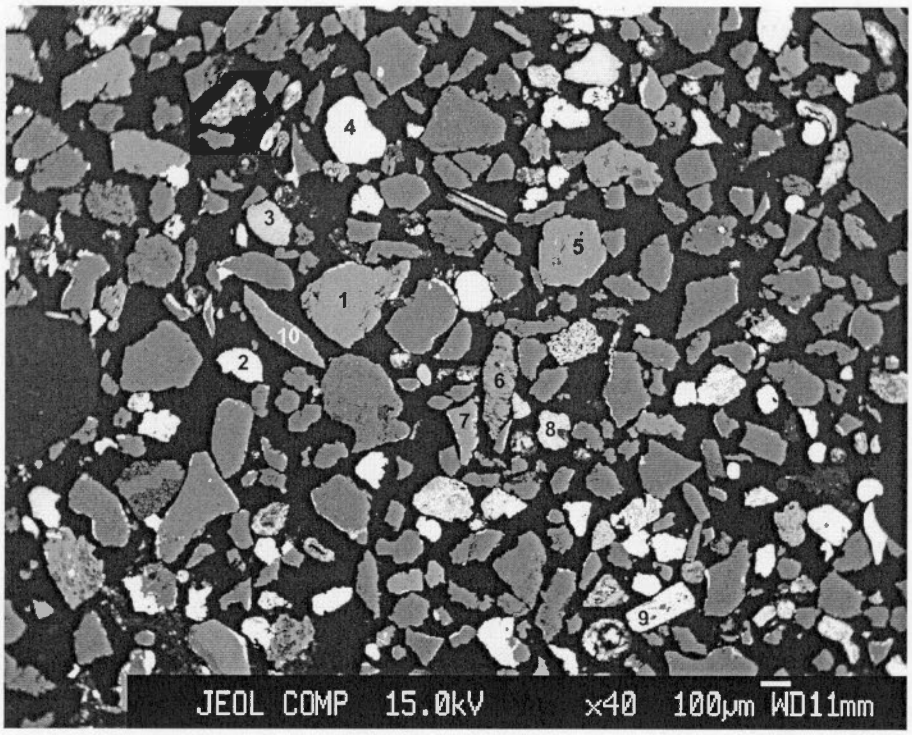
Figure 19 BB-02-7 40'A



1: monazite
2: ilmenite
3: ilmenite
4: ilmenite
5: rutile
6: rutile
7a: zircon*
7b: ilmenite*
8: rutile
9: sulphide
10: ilmenite
11: zircon
12: ilmenite
13: ilmenite
14: rutile

* not marked on the image.

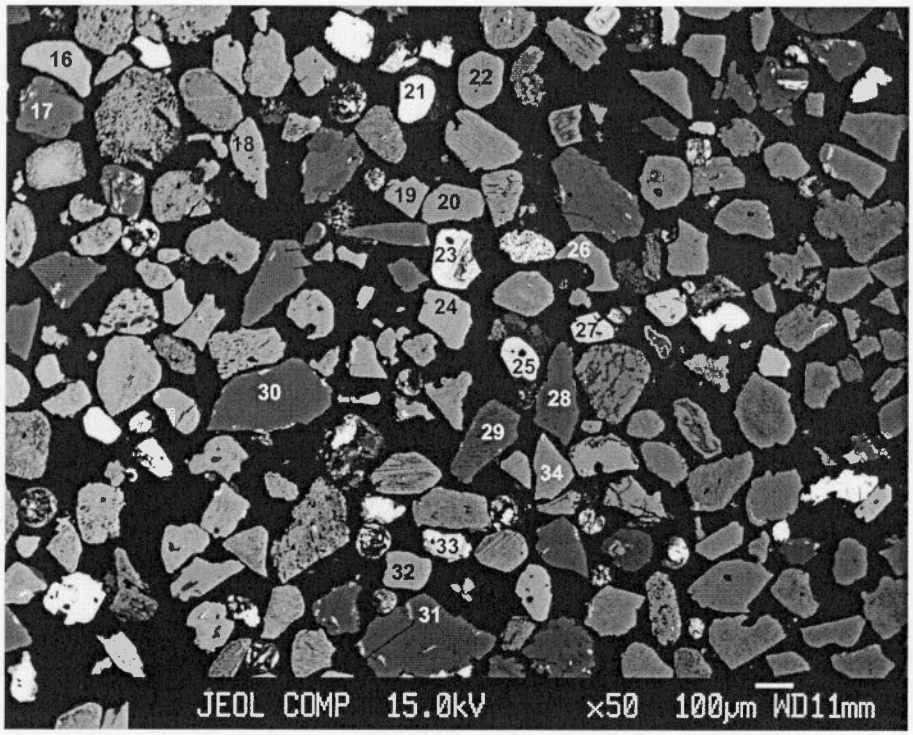
Figure 19 BB-02-7 40'B



1: staurolite
2: ilmenite
3: ilmenite
4: ilmenite
5: staurolite
6: quartz
7: staurolite
8: ilmenite
9: ilmenite
10: staurolite

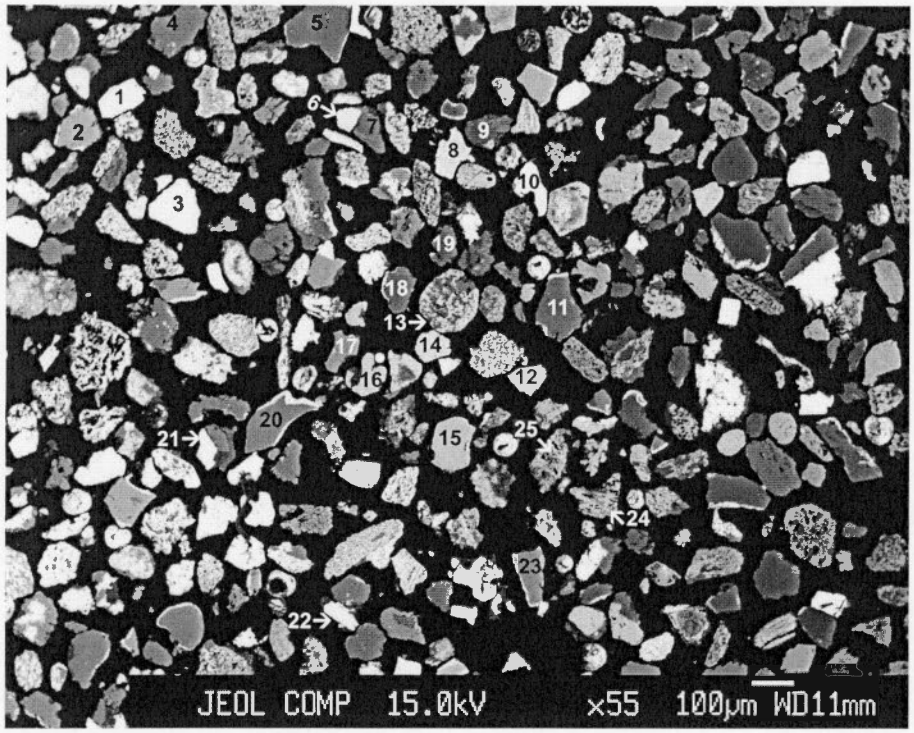
Figure 21 BB-02-7 50'

Appendix X
Part C: Diogenes Brook



16: ilmenite
17: staurolite
18: ilmenite
19: rutile
20: ilmenite
21:zircon
22: ilmenite
23: zircon
24: ilmenite
25: zircon
26: ilmenite
27: zircon
28: staurolite
29: staurolite
30: staurolite
31: staurolite
32: limonite
33: zircon

Figure 1 DB-97-2 12.2m sample DB-2



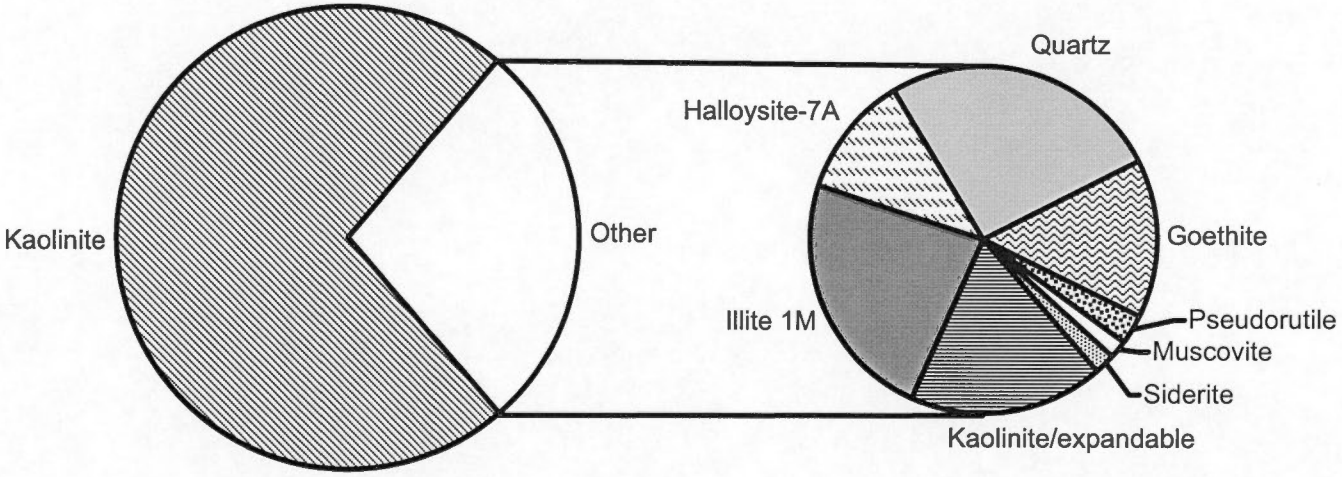
1: ?phosohate (monazite)
2: staurolite
3: ilmenite
4: quartz
5: ilmenite
6: rutile
7: quartz
8: rutile
9: quartz
10: zircon
11: tourmaline
12: zircon
13: ilmenite
14: rutile
15: garnet (alm/sp)
16: garnet
17: staurolite
18: quartz
19: quartz
20: tourmaline
21: zircon
22: monazite
23: staurolite
24: ilmenite
25: quartz in above ilmenite

Figure 2 DB-97-2 93.2 m sample DB-3

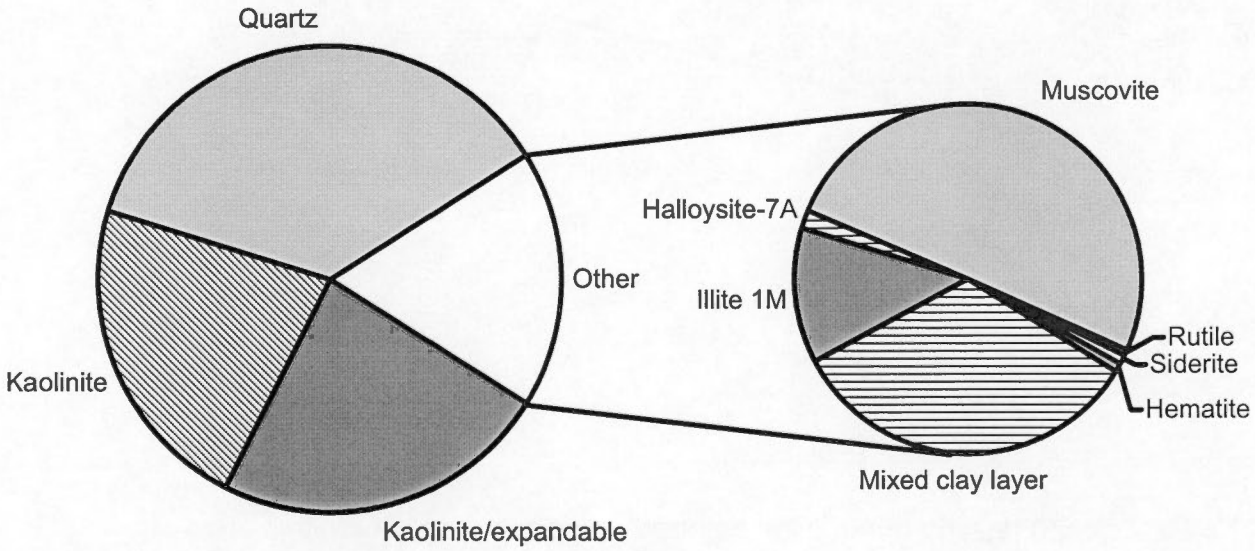
Appendix XI:

Pie diagrams of clay variation for Belmont, Brierly Brook, and Diogenes Brook

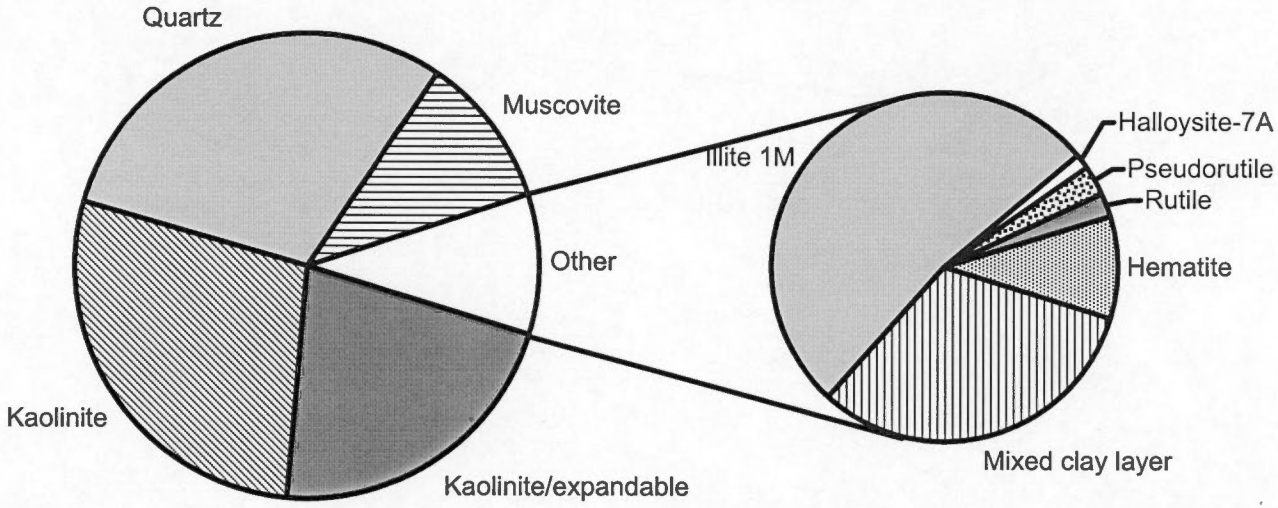
Belmont
Clay minerals from the surface sand sample, CS-7



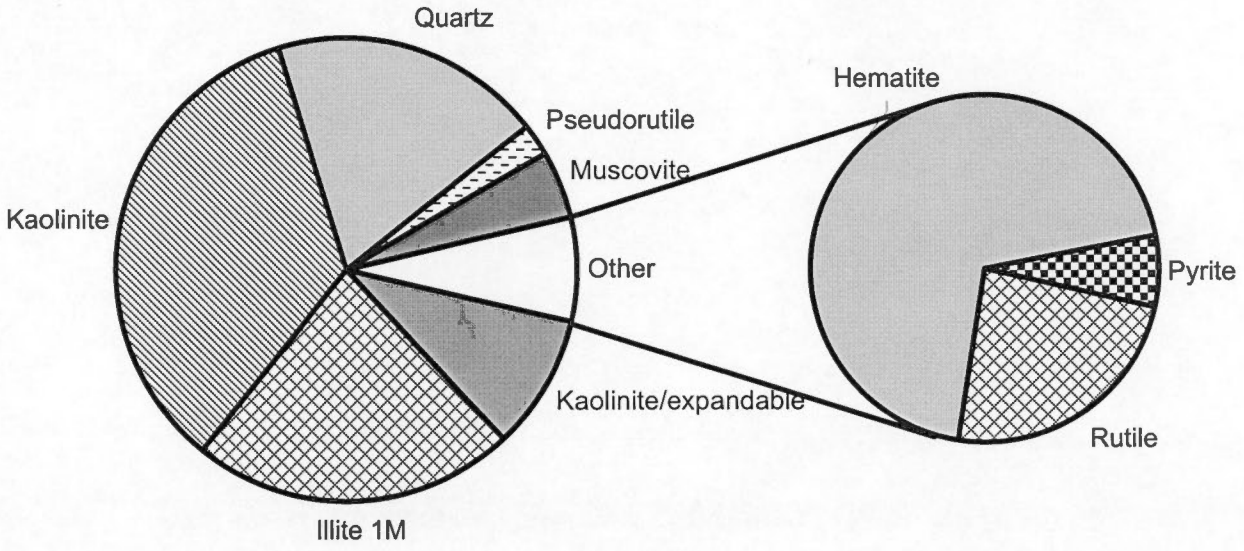
Belmont
Average clay minerals of the upper sanstones in borehole BM-02-2



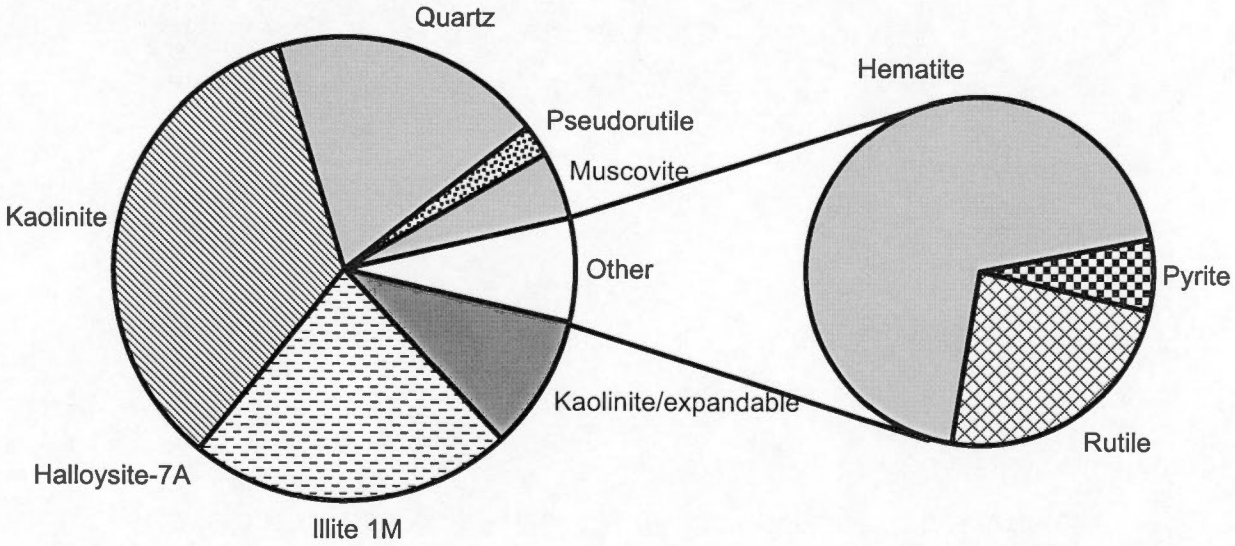
Belmont
Average clay minerals of the upper sandstones in borehole BM-02-3



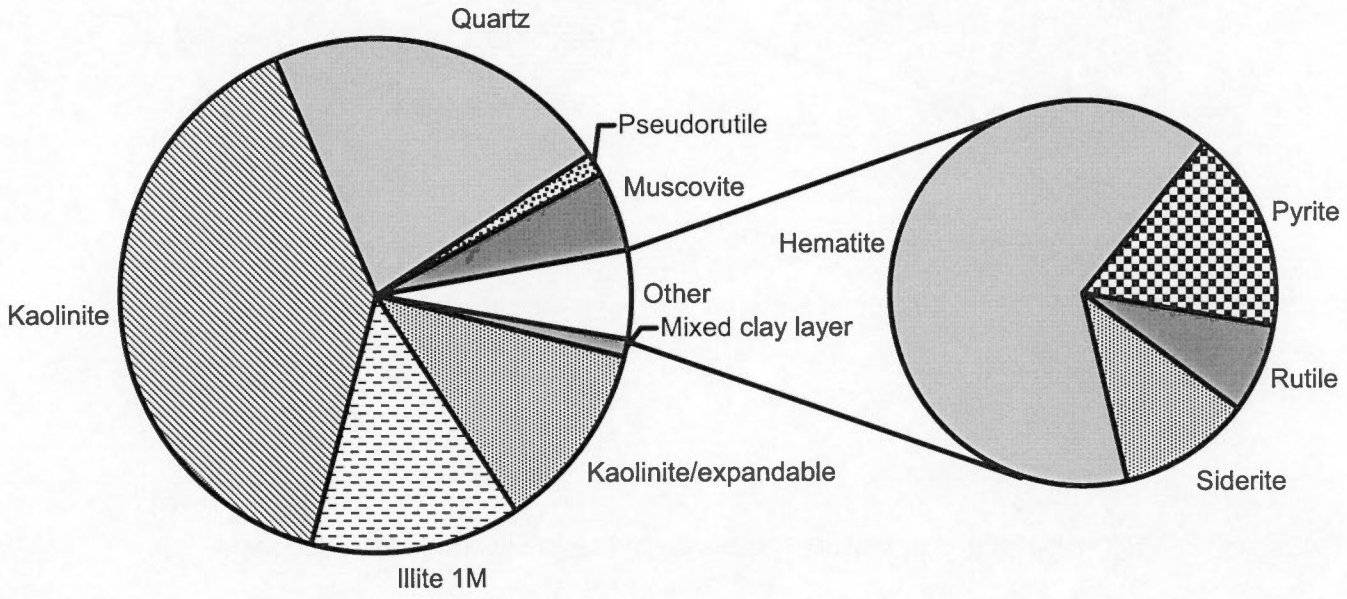
Belmont
Average clay minerals within the middle claystone unit of BM-02-2



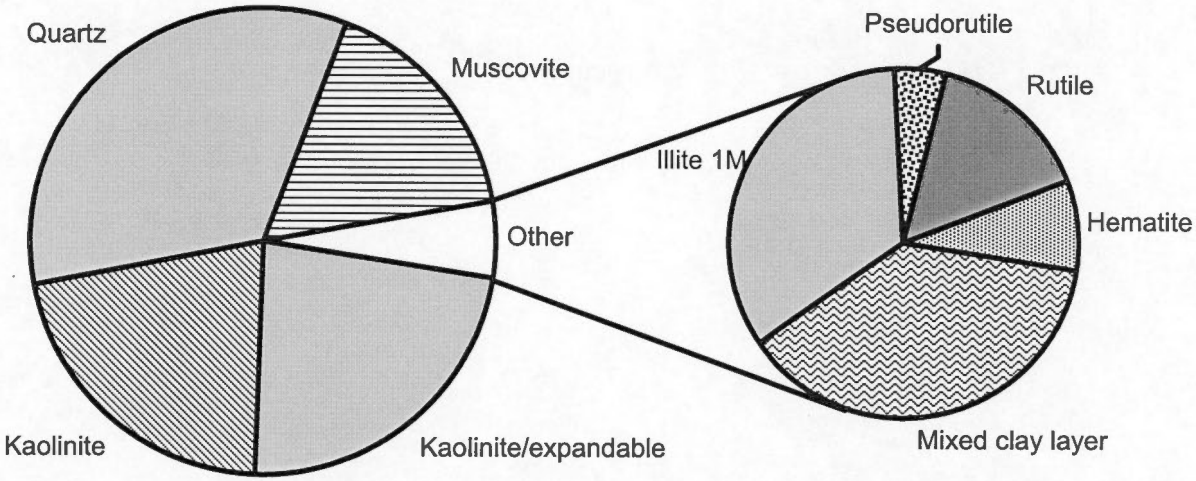
Belmont
Average clay minerals of the lower claystones of borehole BM-02-2



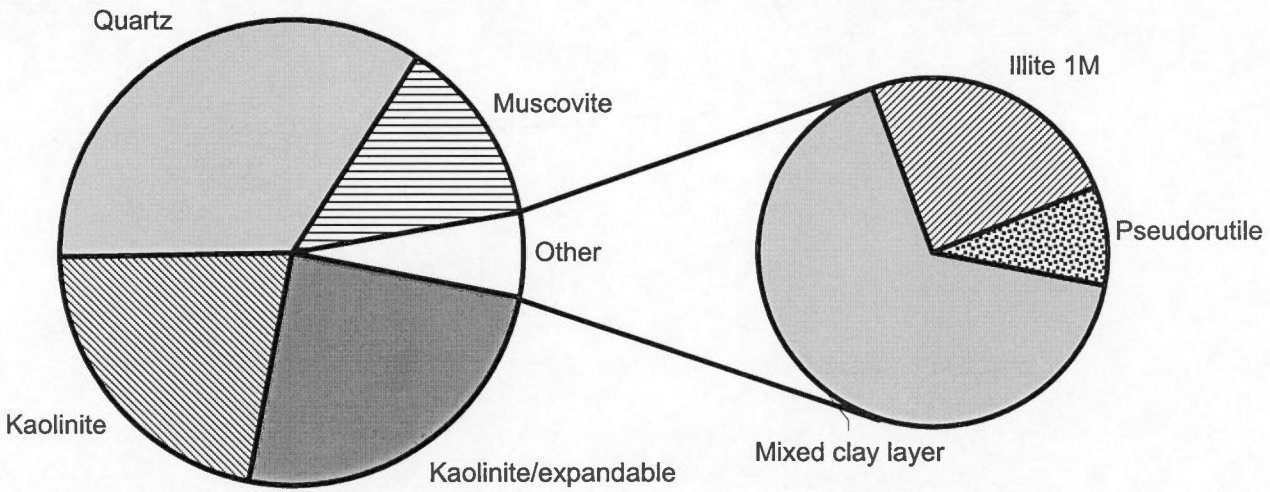
Belmont
Average clay minerals of the lower claystones of borehole BM-02-3



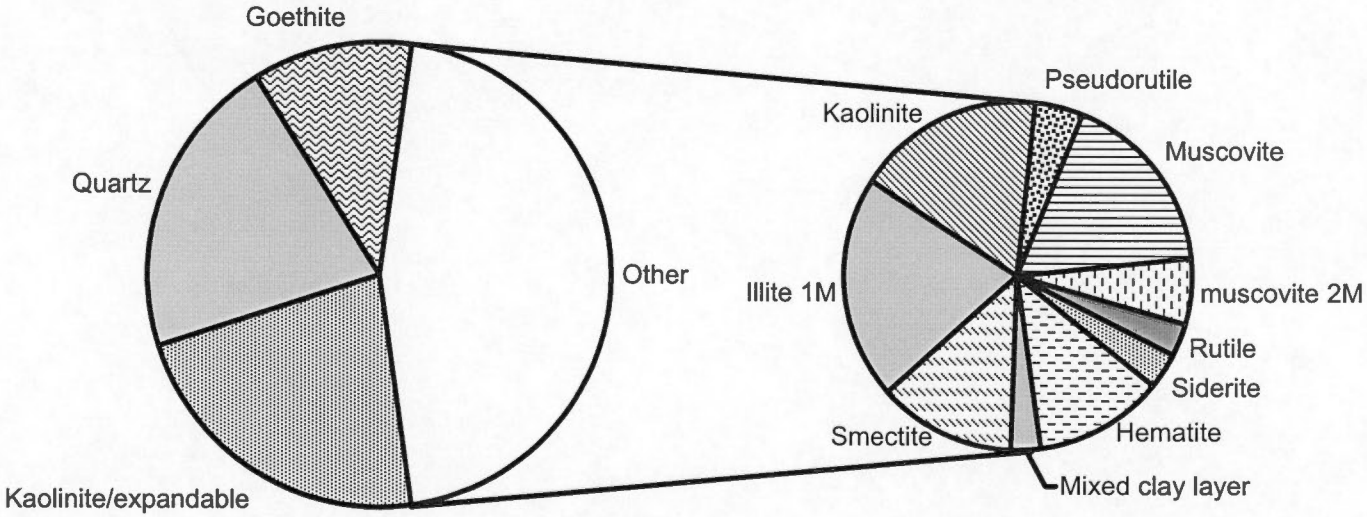
Belmont
Average clay minerals of the lower sandstone in borehole BM-02-2



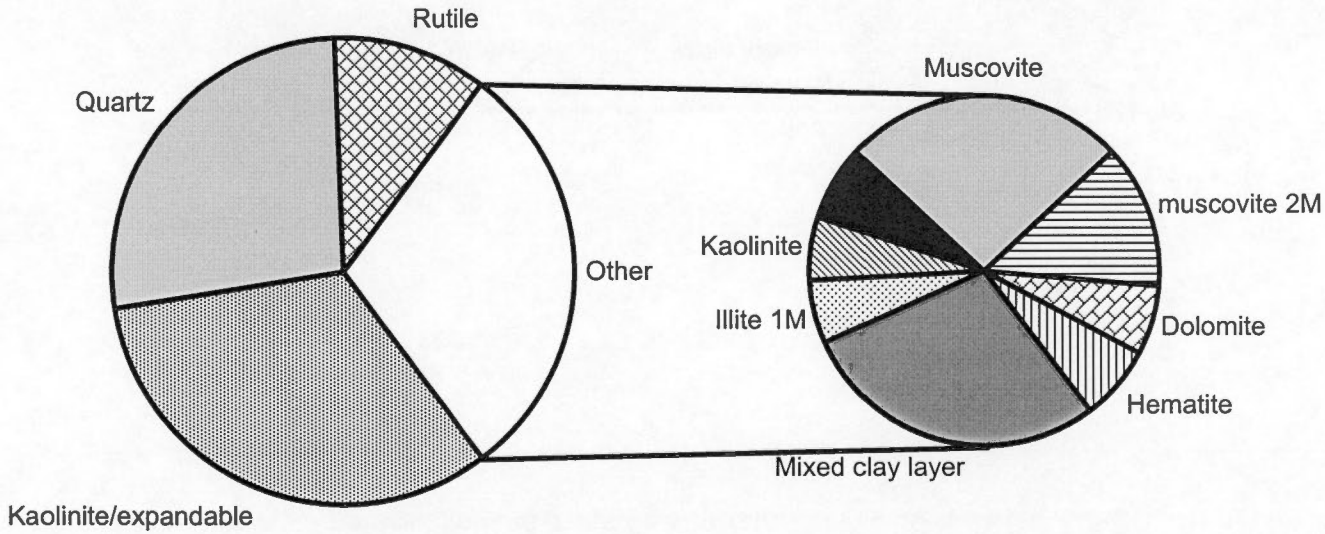
Belmont
Average clay minerals of the lower sandstones in borehole BM-02-3



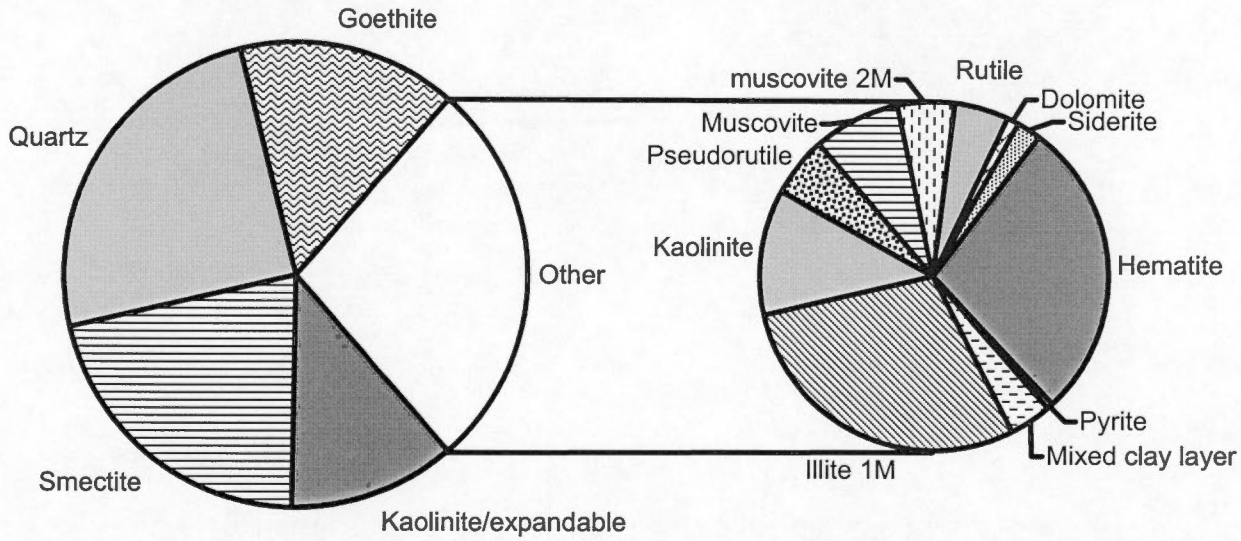
Belmont
Average clay minerals of Triassic mudstone in borehole BM-02-3



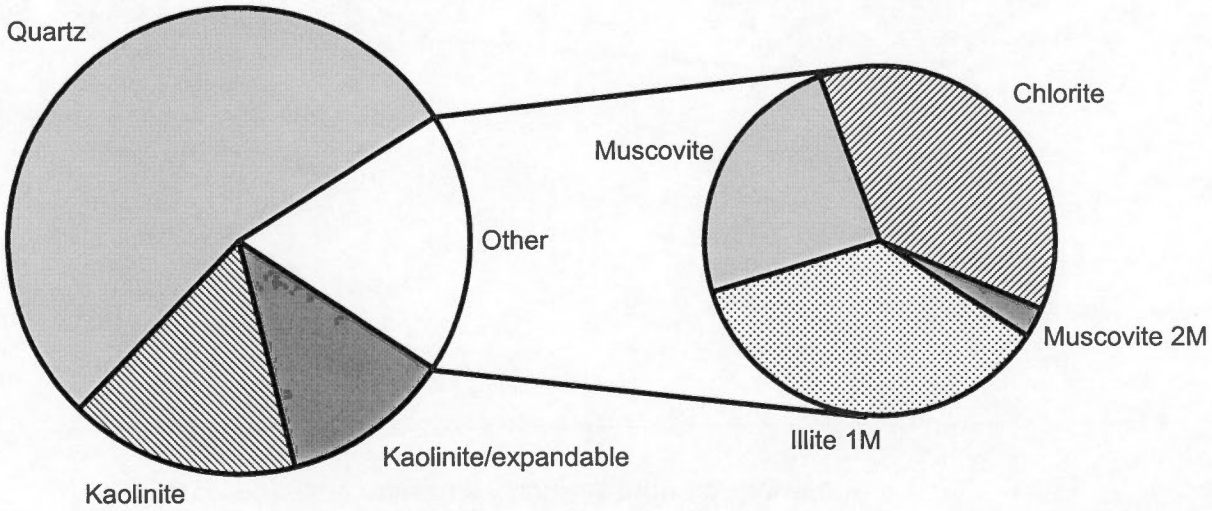
Belmont
Clay minerals for the Triassic sandstones in borehole BM-02-1



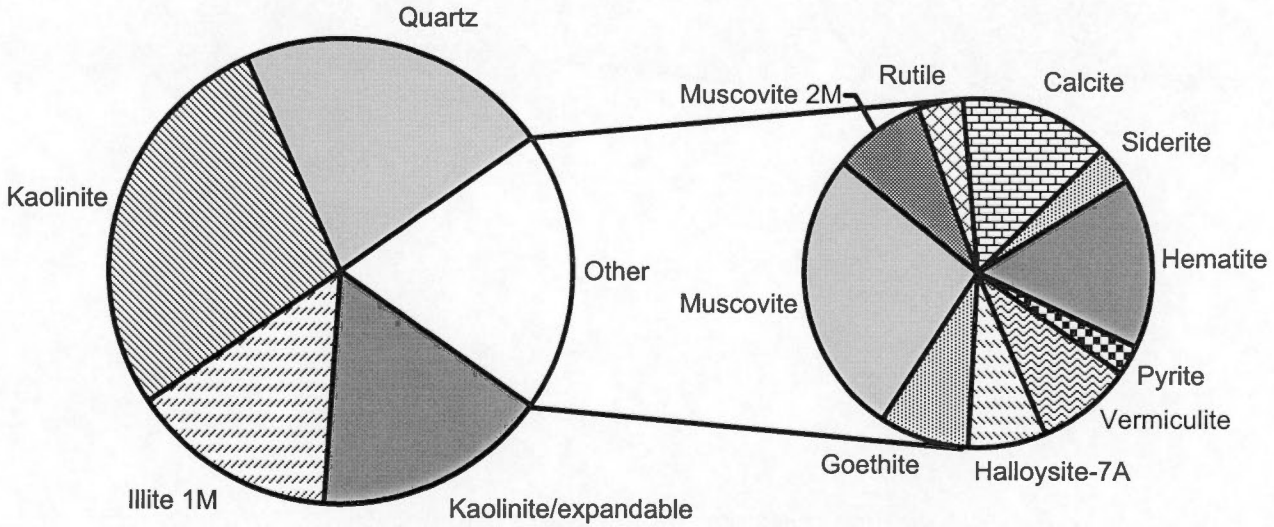
Belmont
Average clay minerals for the Triassic sandstones in borehole BM-02-3



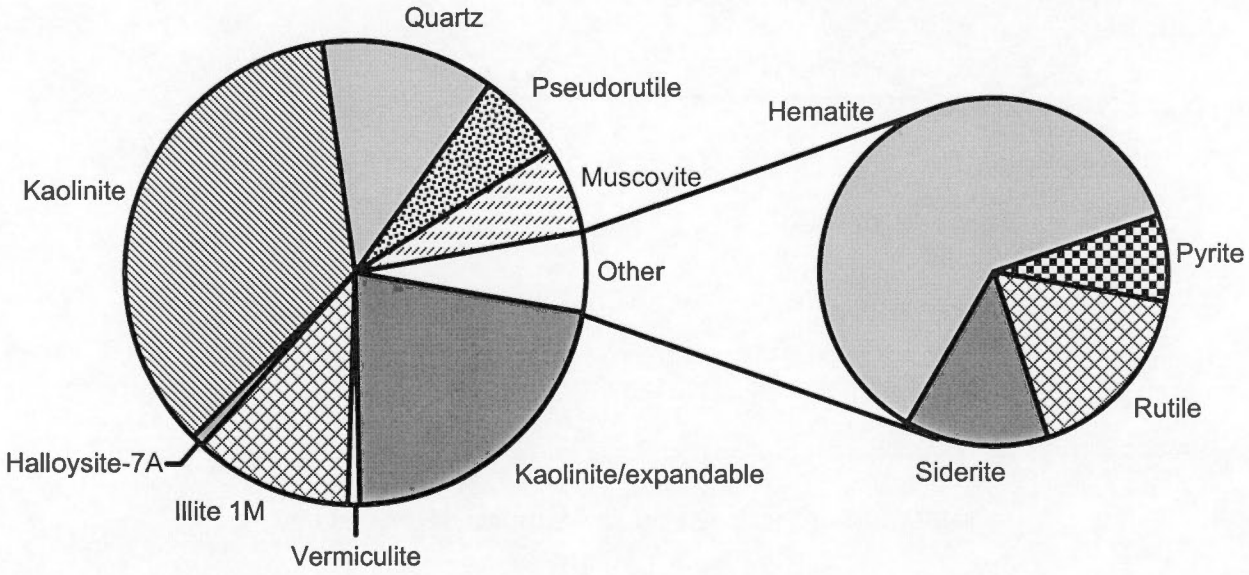
Brierly Brook 95-1-4
Clay minerals within a surface sand sample



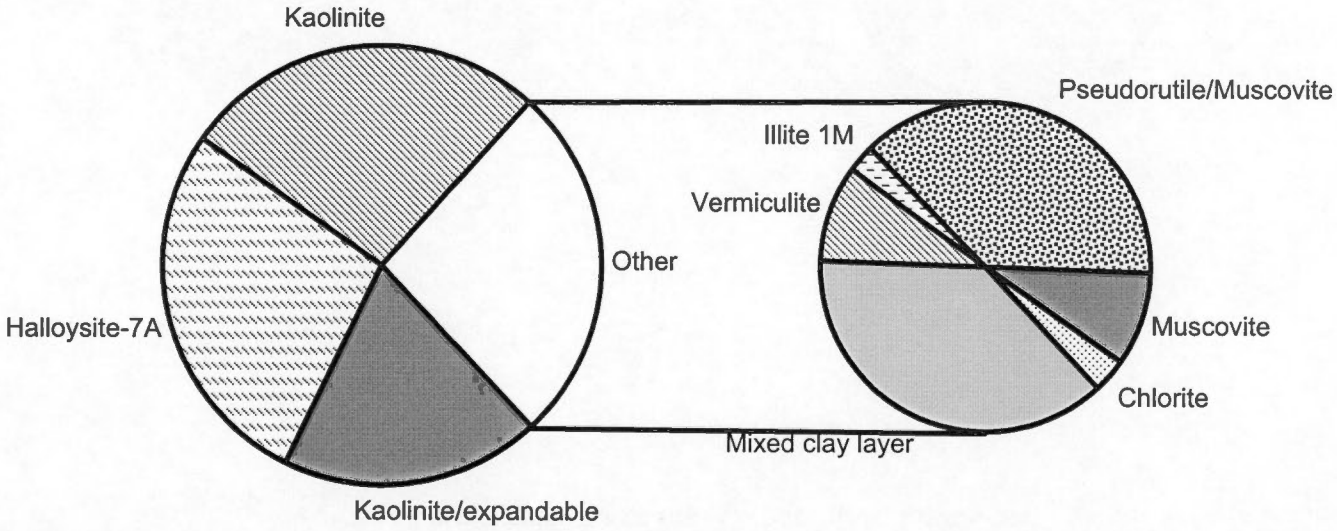
Brierly Brook
Average clay minerals of unit B mottled mudstones



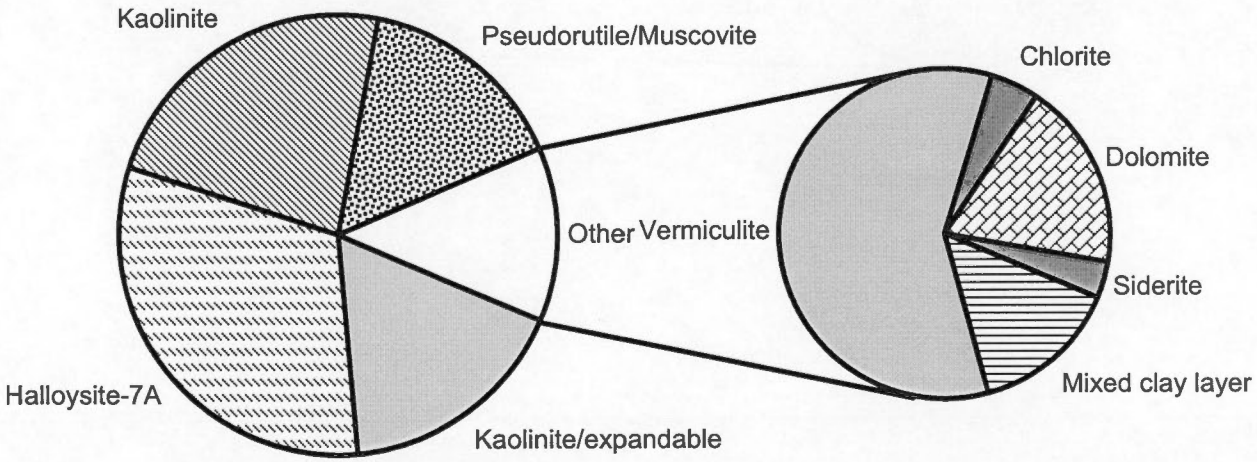
Brierly Brook
Average clay minerals of unit C mottled mudstones



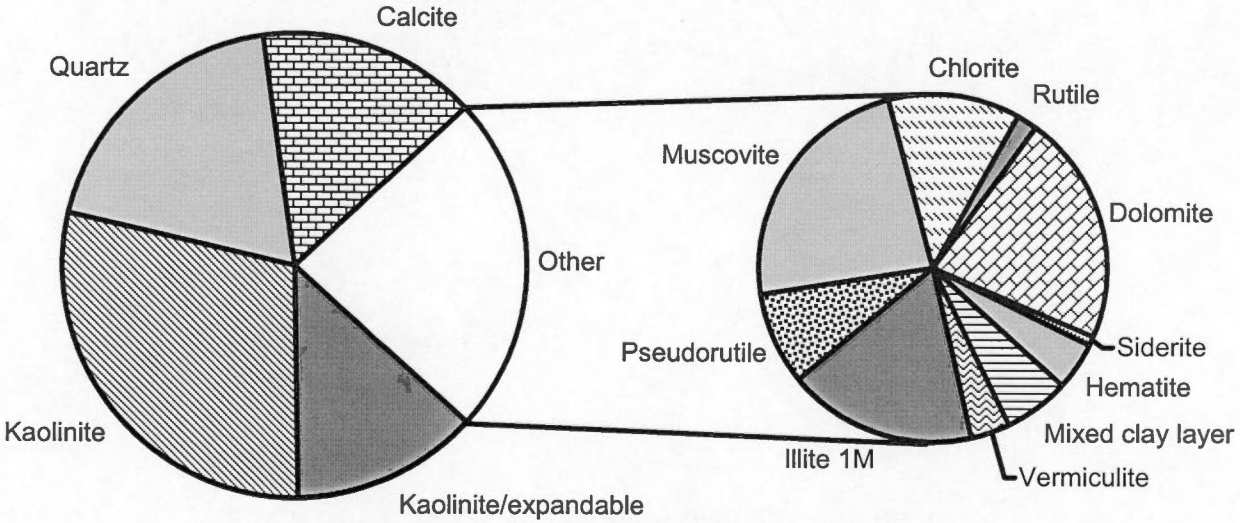
Brierly Brook
Average clay minerals of unit A light grey mudstone



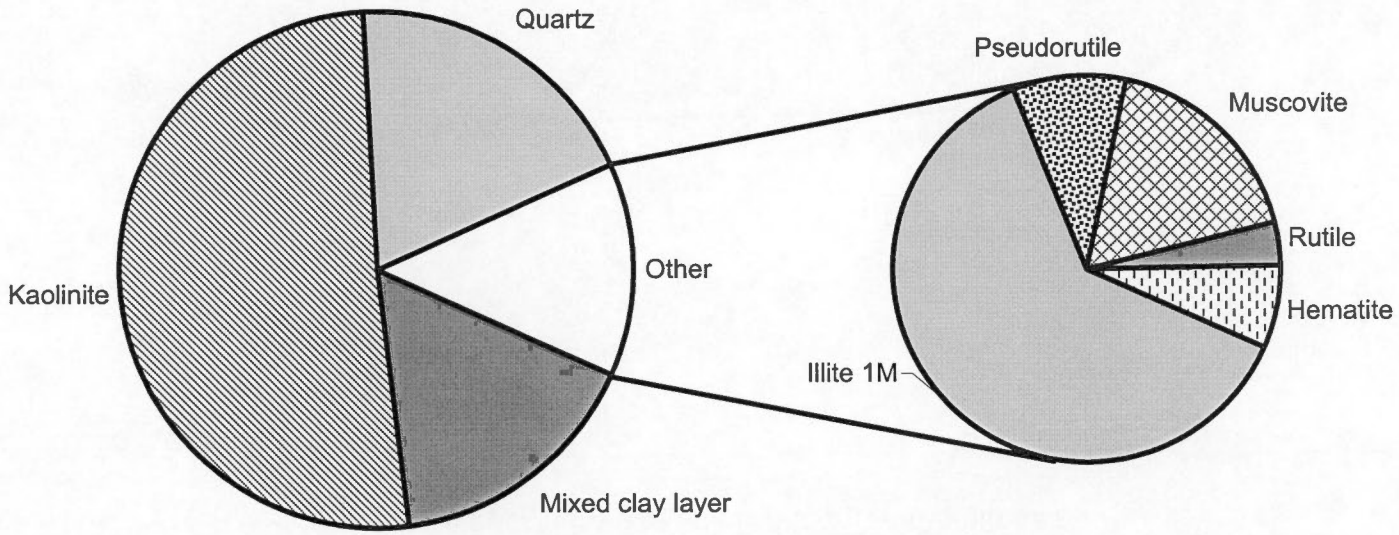
Brierly Brook
Average clay minerals of unit A medium grey mudstones



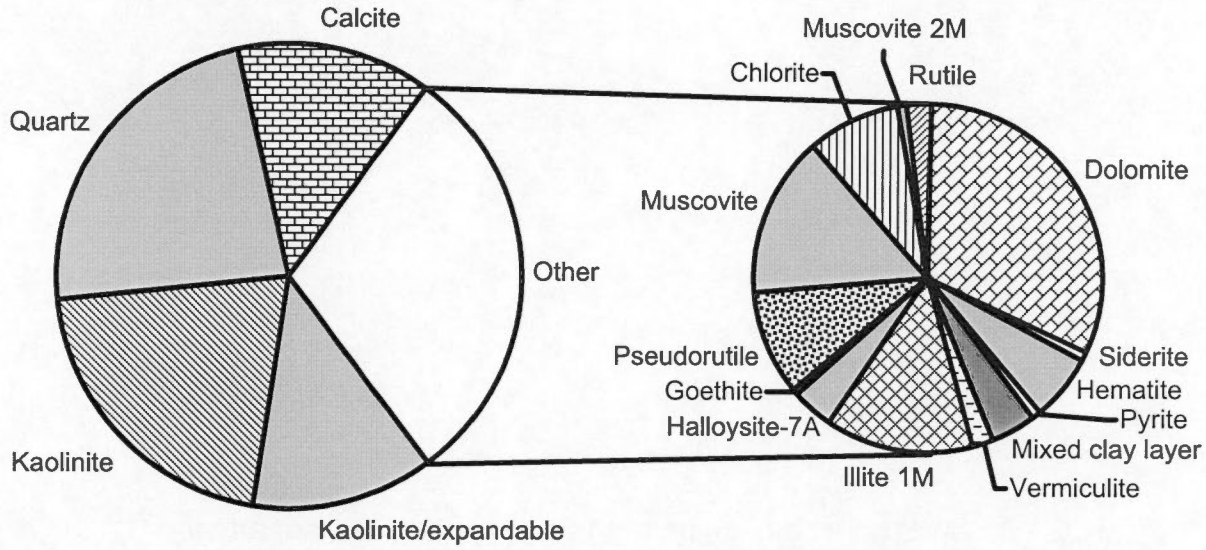
Brierly Brook
Average clay minerals of unit B medium grey claystones



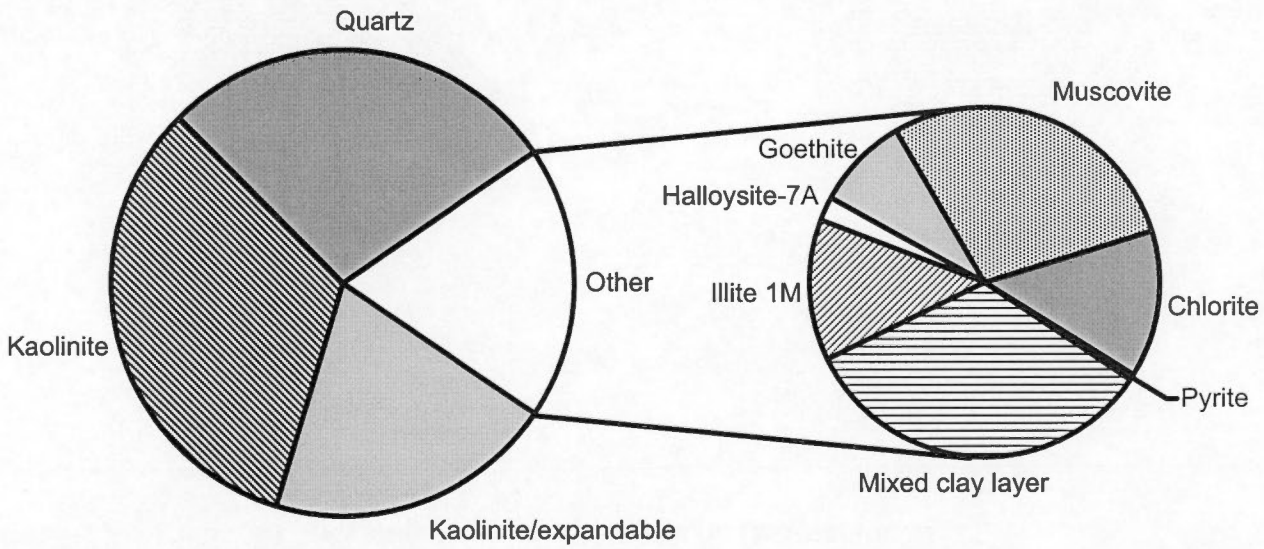
Brierly Brook
Average clay minerals of unit C medium grey mudstones



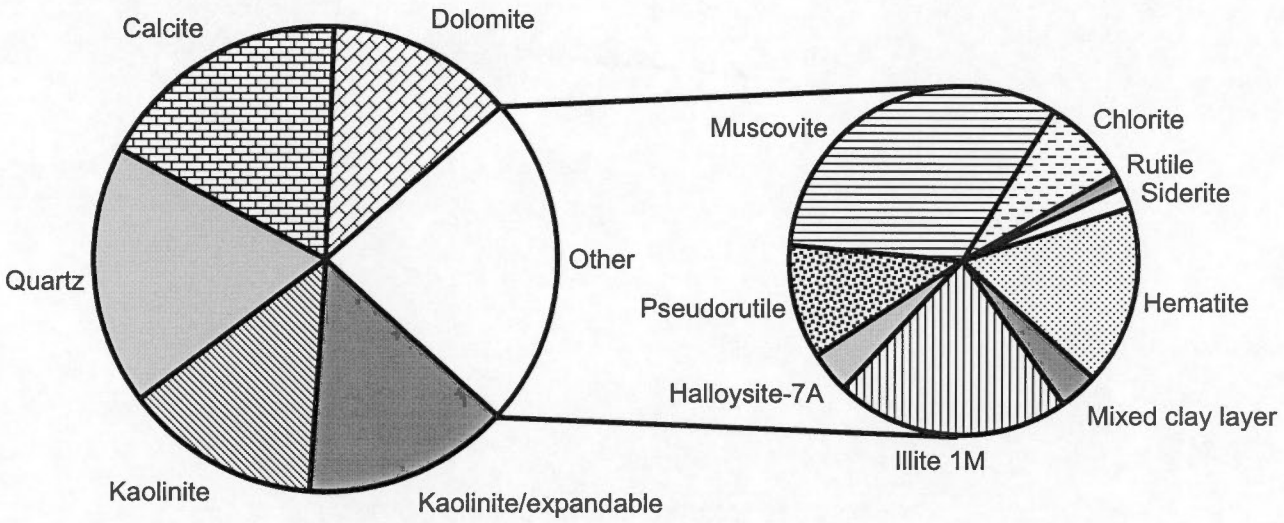
Brierly Brook
Average clay minerals of unit B dark grey mudstones



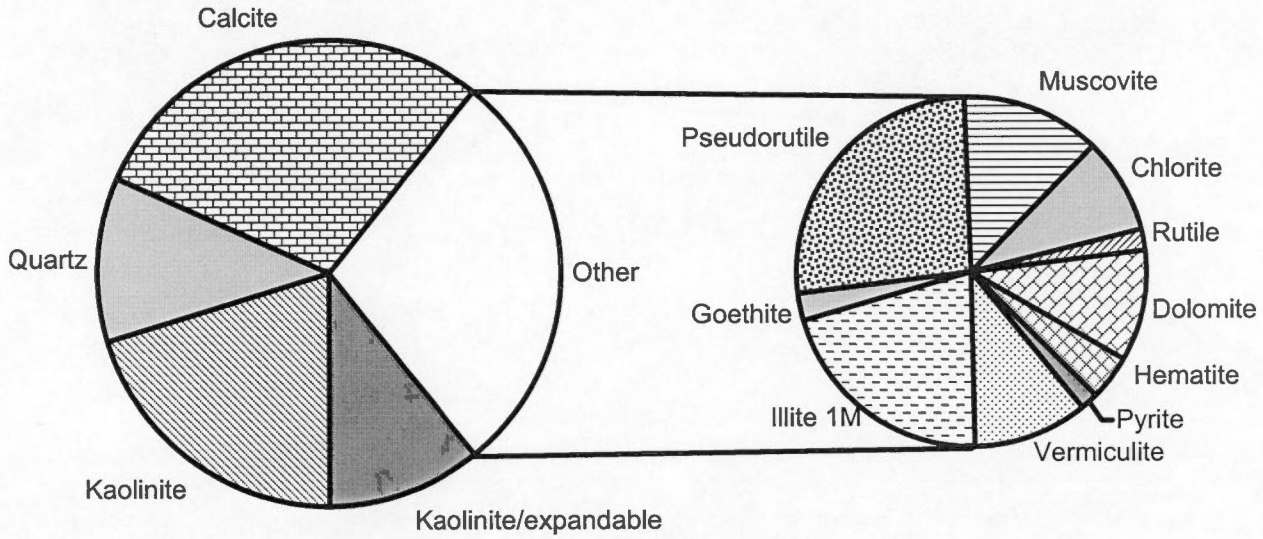
Brierly Brook
Average clay minerals in unit A sandstones



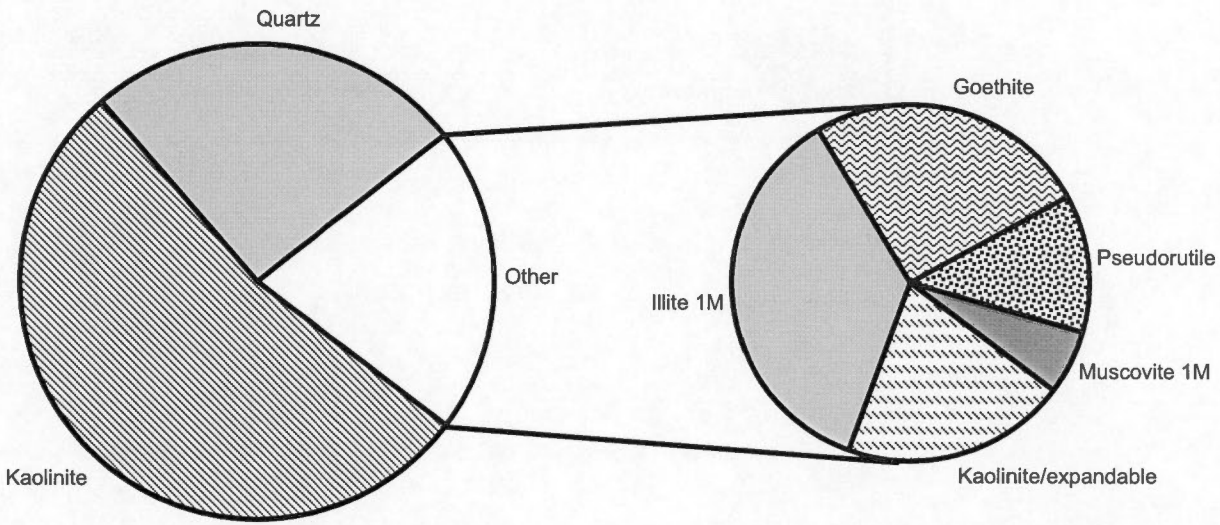
Brierly Brook
Average clay minerals of unit B sandstones



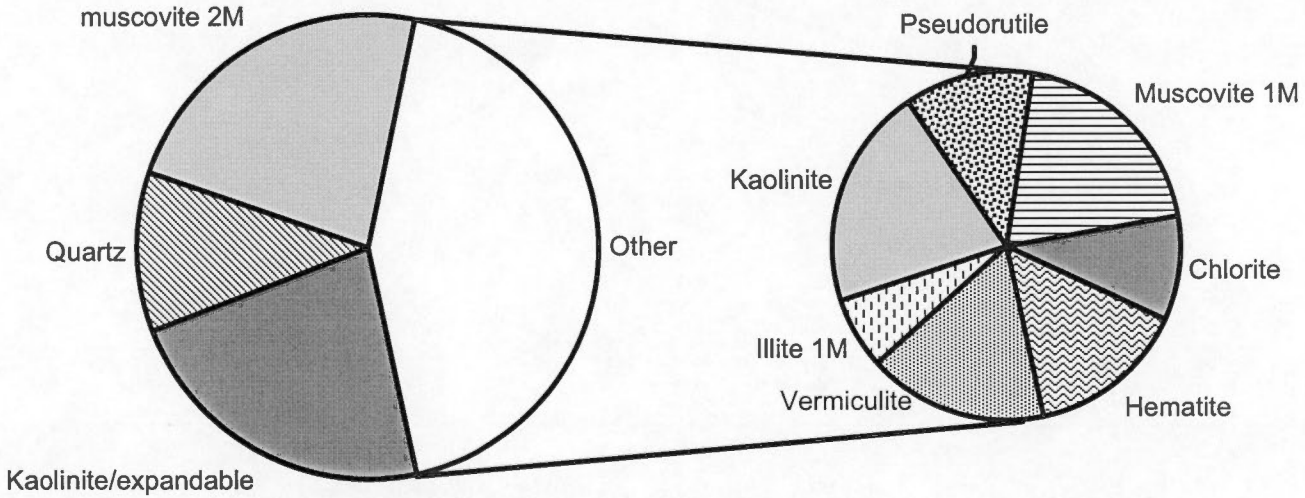
Brierly Brook
Average clay minerals of Unit C sandstone



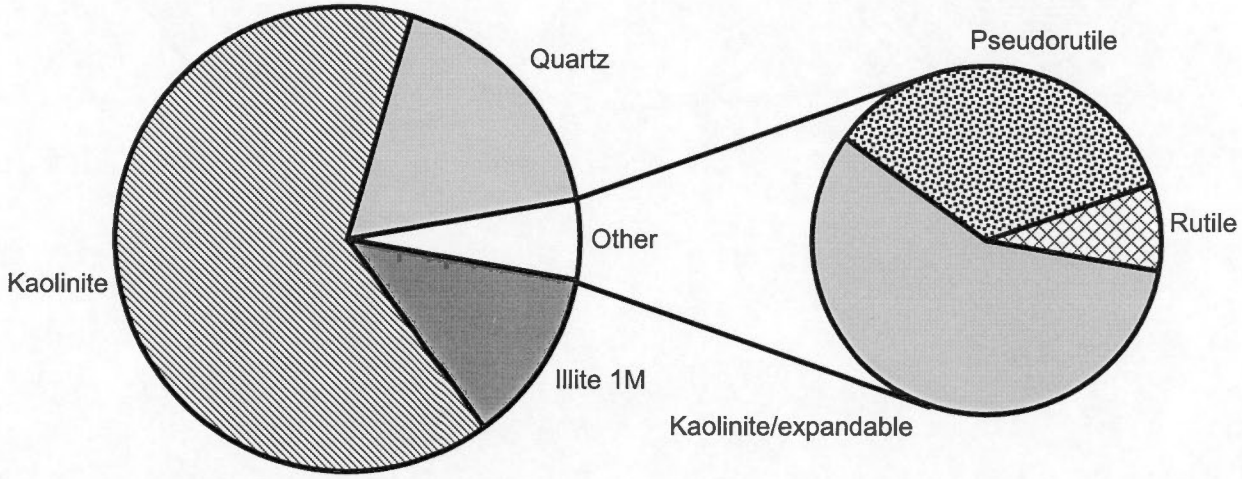
Diogenes Brook
Clay minerals within sandstone in borehole DB-97-2, 12.2 m



Diogenes Brook
Clay minerals in a Jarosite unit in borehole DB-97-2, 59m



Diogenes Brook
Clay minerals within sandstone in borehole DB-97-2, 93.2 m

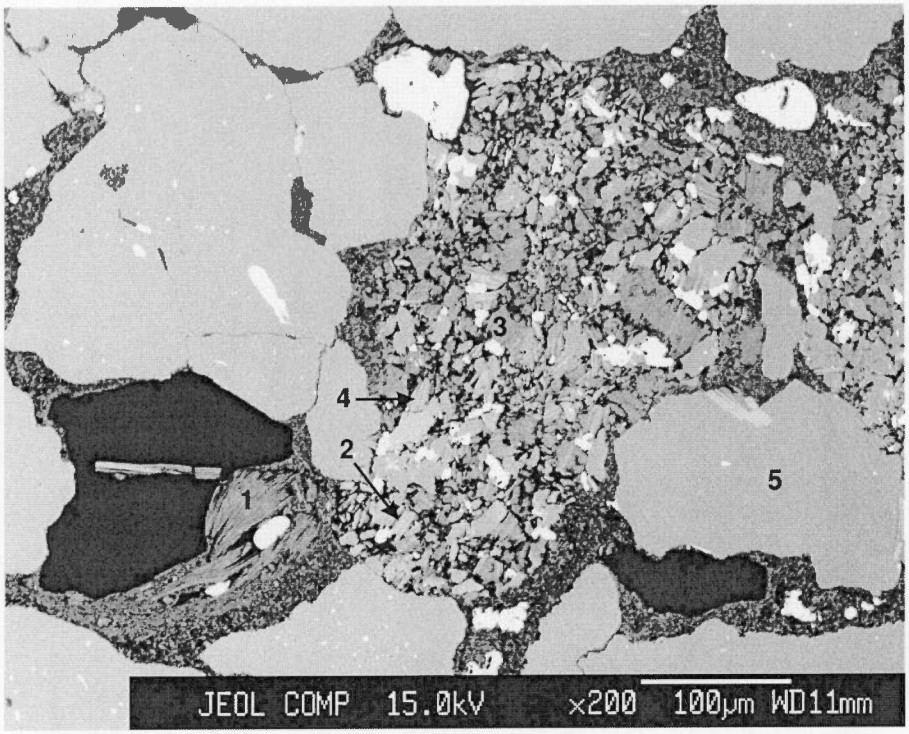


Appendix XII
Observational data on diagenesis of selected samples From Belmont and Brierly Brook

Part A:
Backscatter images and electron microprobe analyses of diagenetic minerals of Belmont and Brierly Brook basins.

BM 02-2 36' (53-57)

(LDBM001.bmp)



1: halloysite
2: illite
3: kaolinite
4: illite
5: quartz

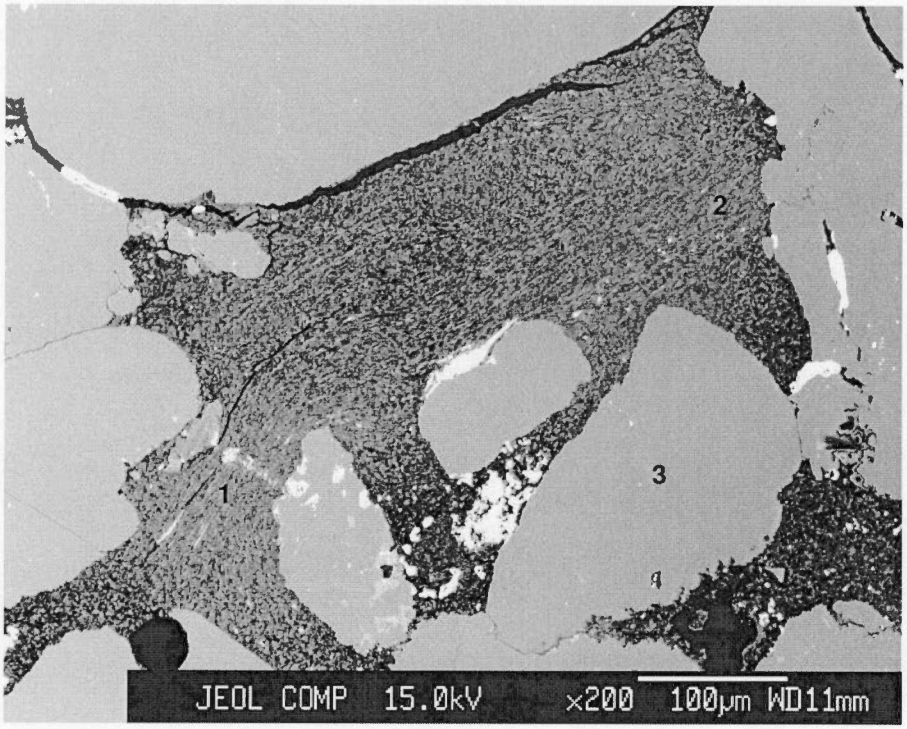
Fig. 1

Notes:

- Booklets of inter-grown kaolinite and illite are common; typically the booklet is mostly kaolinite with few illite layers (illite is brighter in compo. images).
- Illite booklets (spots 2 & 4) have darker grey between layers, which may be kaolinite.
- Detrital silt-sized quartz is interspersed with diagenetic clays (illite & kaolinite) – some quartz grains appear to have sharp crystal margins and may actually be small diagenetic crystals (only about 10μm diameter).
- Halloysite (spot 1) has a fibrous habit and is growing in isolation (not mixed in with illite, kaolinite or quartz).

BM 02-2 36' (53-57)

(LDBM003.bmp)



1: halloysite
2: halloysite
3: quartz

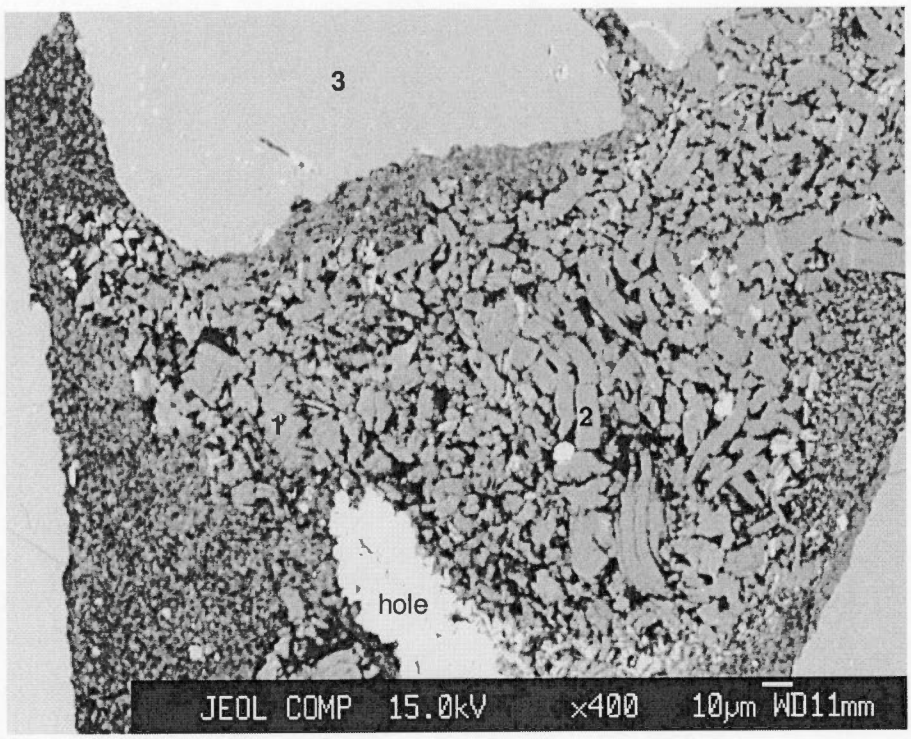
Fig. 2

Notes:

- Halloysite (spots 1 & 2) occurs as a fibrous mat almost completely filling in pore space between medium to coarse sand-sized quartz grains.
- Halloysite is the only cement in this pore space –it is not found in association with other cements or with silt-sized quartz (as illite often is).
- The halloysite does not appear to have developed as a replacement of feldspar grains (as in some cases in RR-97-23 where the halloysite had a rectangular outline and hollow core).

BM 02-2 36' (53-57)

(LDBM002.bmp)



1: kaolinite
2: kaolinite
3: quartz

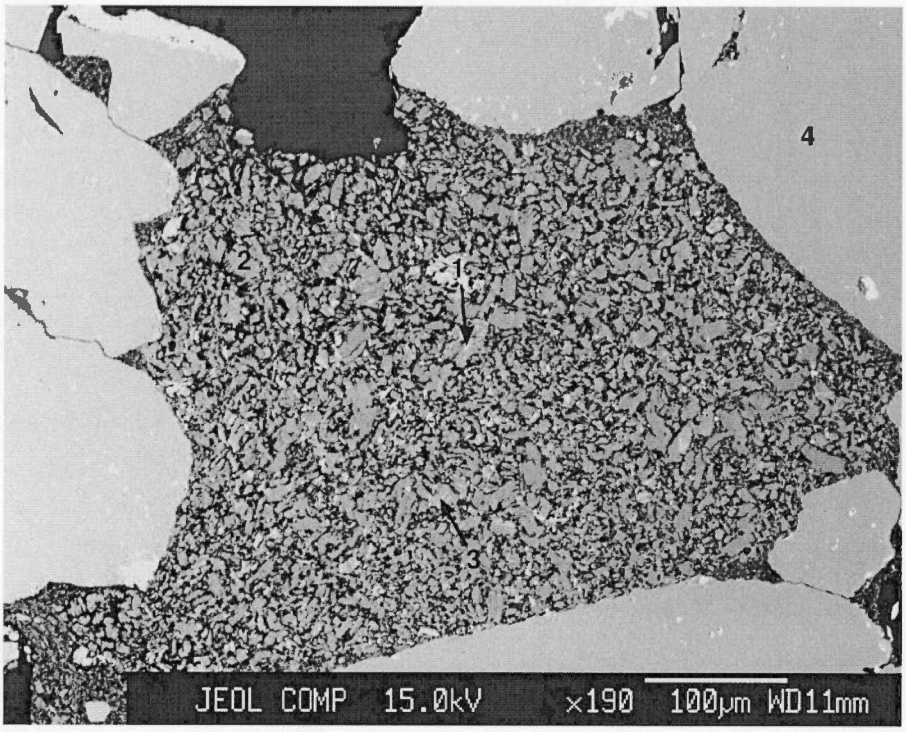
Fig. 3

Notes:

- Kaolinite occurs as well developed booklets and 'thin' vermicular stacks (up to ~50μm long, commonly less than 10μm diameter).
- There may be some illite intergrown with the kaolinite but there is not much, if any.
- There does not appear to be any quartz amidst the kaolinite filling in the pore space but is hard to tell for sure; while on the probe, the impression was that there were only diagenetic clays and no quartz, but due to the similar colour of quartz and kaolinite in reflected light it is not readily apparent if there are very small quartz grains mixed in.

BM 02-2 36' (53-57)

(LDBM009.bmp)



1: illite
2: kaolinite
3: illite
4: quartz

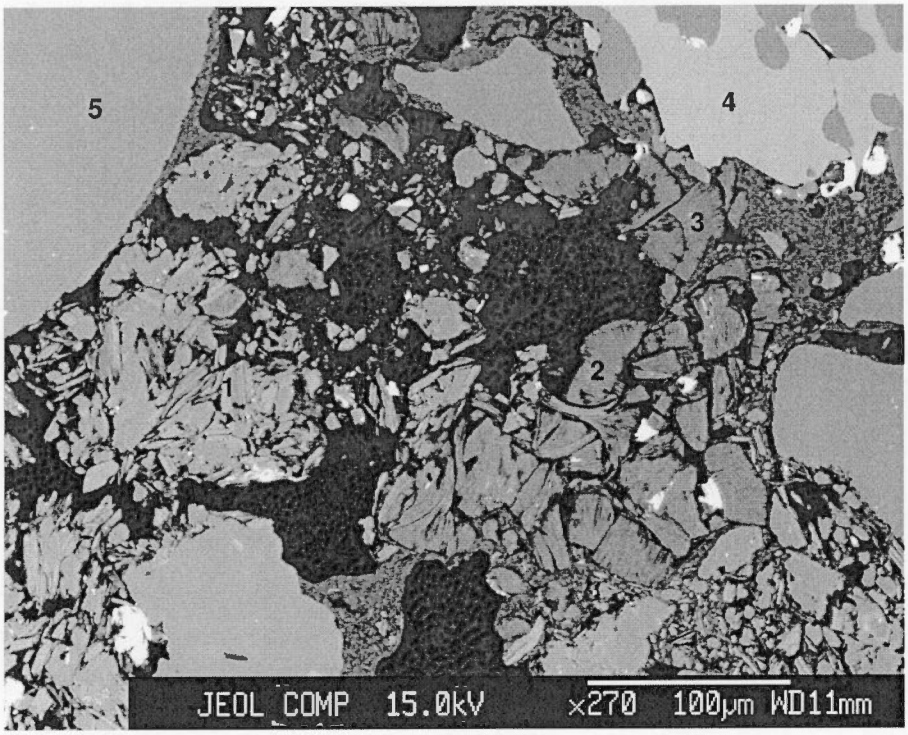
Fig. 4

Notes:

- Kaolinite and illite occur together (inter-grown) as booklets and short stacks (up to ~30μm long, not more than ~20μm diameter and commonly closer to 10μm) -the illite layers are brighter (whitish/lighter grey) than the kaolinite (medium grey coloured).
- Kaolinite is much more abundant than illite; some kaolinite booklets do not appear to contain any illite in their structure.
- Possibly some silt-sized quartz amongst the diagenetic clays but is difficult to tell in the image; same comment as in LDBM002.bmp.

BM 02-2 76' (0-5)

(LDBM004.bmp)



1: illite
2: kaolinite
3: kaolinite
4: staurolite
5: quartz

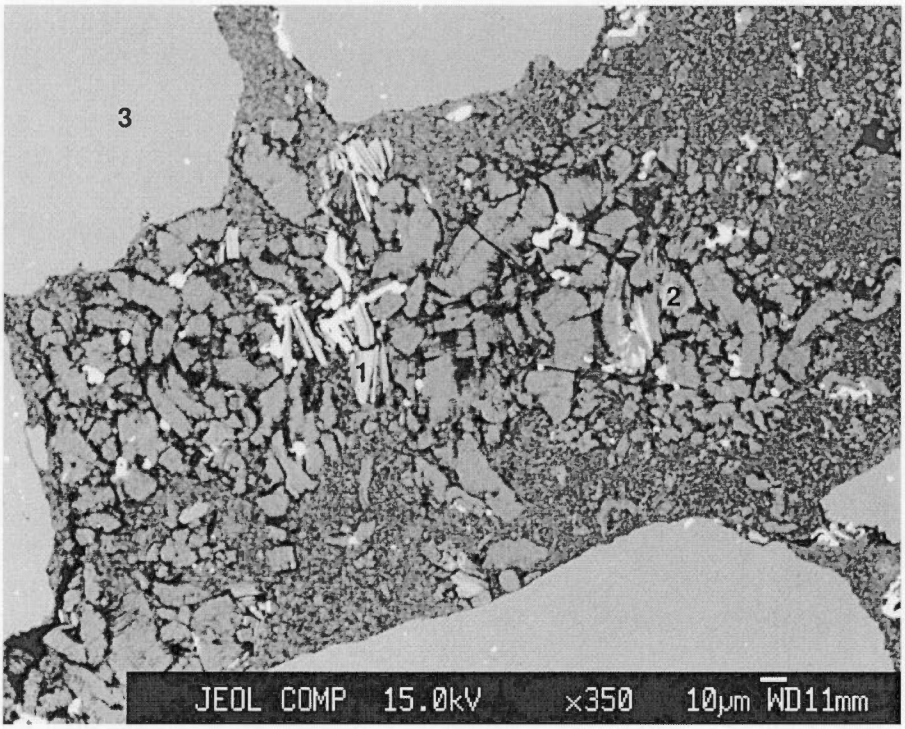
Fig. 5

Notes:

- Illite (spot 1) is found amongst detrital silt-sized quartz grains whereas the kaolinite is not (spots 2 & 3). Some of the quartz grains appear to have straight crystal margins and a hexagonal outline and thus may be diagenetic (these crystals are not more than about 10μm in diameter)
- Kaolinite is found in vermicular stacks (up to ~40μm long) and in some parts, appears more fibrous and has possibly developed from muscovite (see, for example, directly below the stack analyzed as spot 3 where the kaolinite fans out towards the right)

BM 02-2 76' (0-5)

(LDBM005.bmp)



1: illite
2: kaolinite
3: quartz

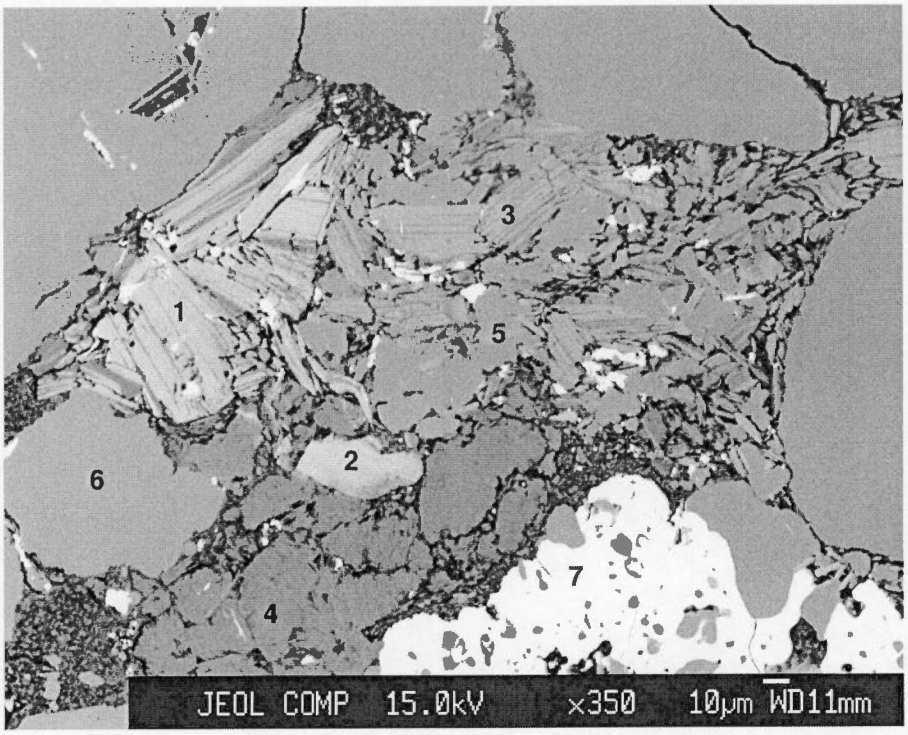
Fig. 6

Notes:

- Kaolinite occurs as well-developed booklets (spot 2) and vermicular stacks (up to ~30μm long, not more than ~15μm in diameter and commonly ≤10μm).
- There are only a few booklets of illite (spot 1) found amongst the kaolinite and the kaolinite booklets/stacks do not seem to have illite inter-grown between the layers in most cases.
- Appears to be no quartz amongst the diagenetic clays (if there is any, it is minimal).

BM 02-2 76' (0-5)

(LDBM006.bmp)



1: muscovite
2: muscovite
3: illite
4: kaolinite
5: quartz
6: quartz
7: ilmenite

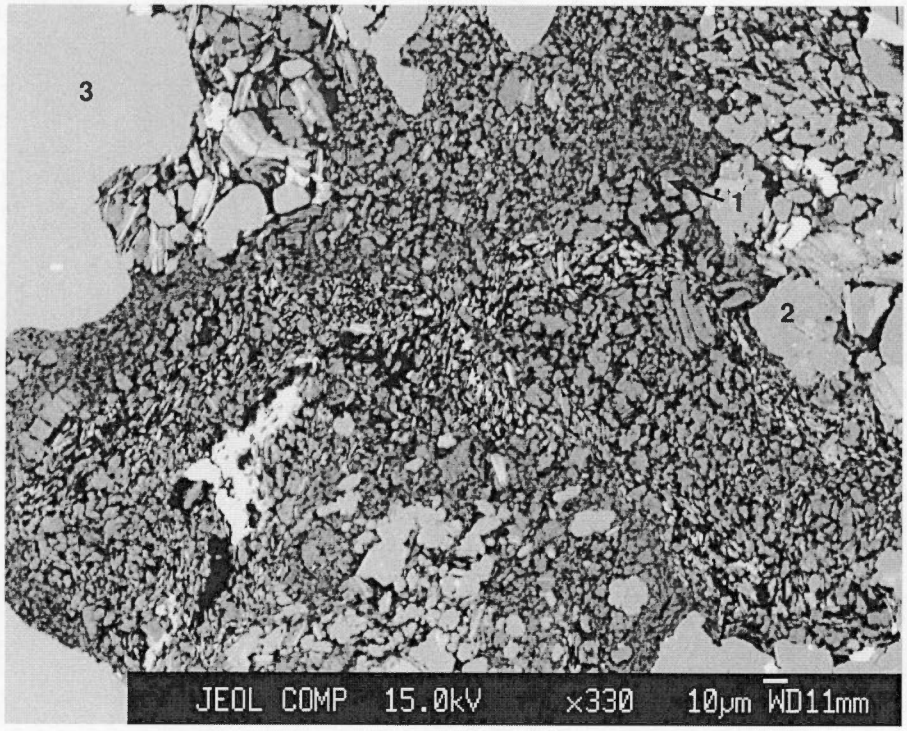
Fig. 7

Notes:

- Detrital quartz and muscovite grains are found along with diagenetic illite and kaolinite; however the kaolinite grows in isolation (in an area within the pore space where there are no other detrital and diagenetic minerals).
- Detrital muscovite (spots 1 & 2; identified as muscovite based on grain size and abraded appearance) appears to be breaking down to form illite (spot 3) (+ kaolinite?); possible kaolinite between muscovite layers (darker grey areas between lighter muscovite sheets) unfortunately was not analyzed.
- Kaolinite occurs as well-formed booklets (spot 4) and 'wide' vermicular stacks (up to ~40μm long, up to ~20μm wide); minimal, if any, illite inter-grown with the kaolinite
- Detrital ilmenite (EDS identification; grain may be altered to pseudorutile) at lower right of image has numerous quartz inclusions with "necks" (i.e. felsic igneous rock source)

BM 02-2 76' (0-5)

(LDBM007.bmp)



1: kaolinite
2: quartz
3: quartz

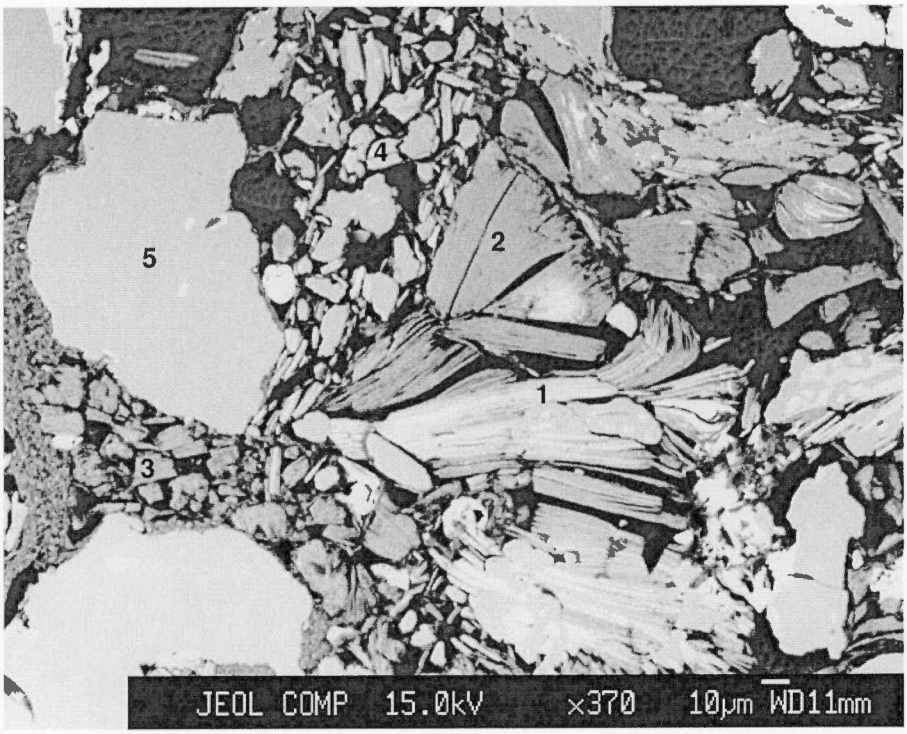
Fig. 8

Notes:

- Pore space is largely filled in with kaolinite, occurring mostly as small booklets (spot 1) with some short vermicular stacks (up to ~25μm long, all <10μm diameter).
- Quartz crystallites look diagenetic based on hexagonal outline, sharp crystal margins and small grain size (<10μm) –at upper right corner of image and bottom in the centre
- Some detrital quartz is also found within the pore space.
- Illite (not analyzed), likely derived from muscovite, is found near a large detrital quartz grain at upper left of image and at the right in the centre; some kaolinite may have illite intergrown between layers but is minimal overall (if present).

BM 02-2 76' (0-5)

(LDBM008.bmp)



1: muscovite
2: kaolinite
3: kaolinite
4: illite
5: quartz

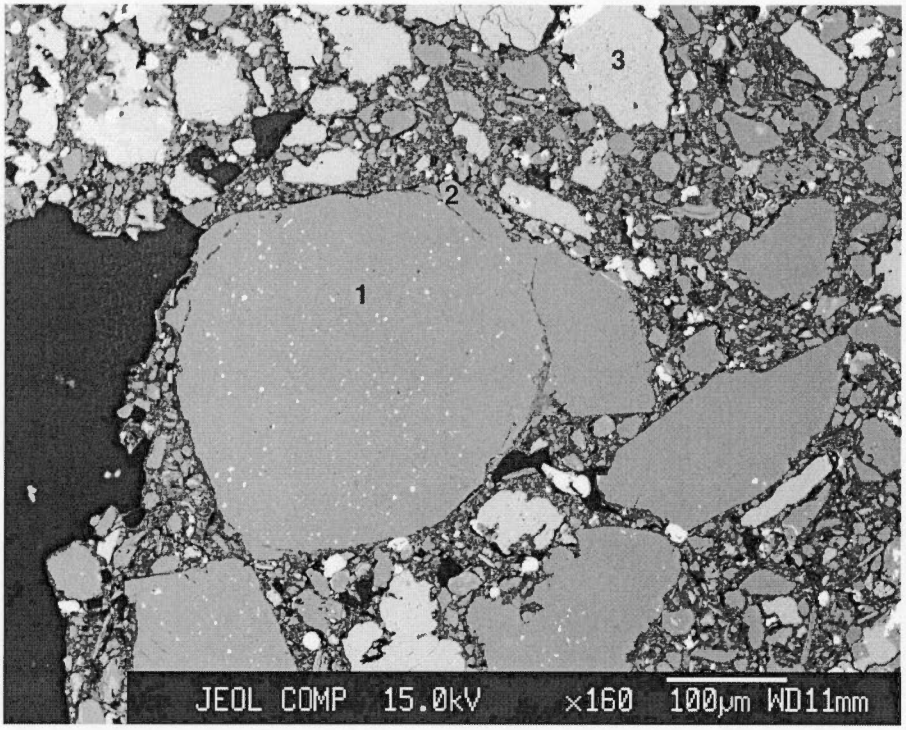
Fig. 9

Notes:

- Kaolinite (spot 2) appears to have developed from detrital muscovite (spot 1).
- Kaolinite also occurs as small (~10μm), well-formed booklets (spot 3).
- Illite (spot 4) is found with quartz grains.
- Some quartz crystals may be diagenetic –see, for example, muscovite grain altering to kaolinite near the bottom of the image with associated quartz crystals <10μm in size.

BB 02-2 106'

(LDBB004.bmp)



1: quartz
2: quartz
3: calcite

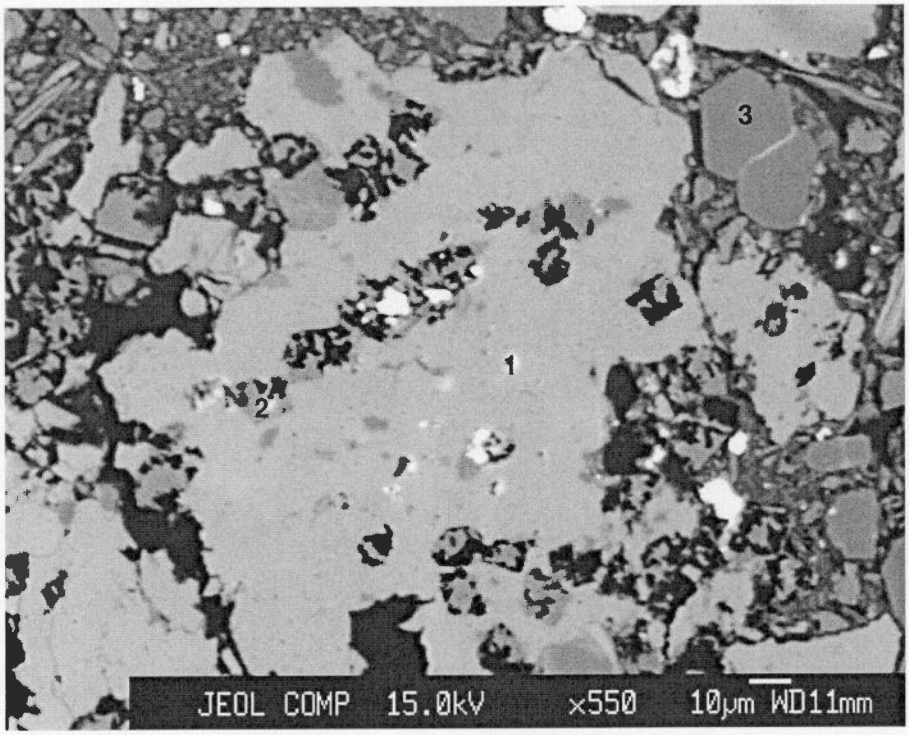
Fig. 10

Notes:

- Silica overgrowths on a detrital quartz grain –verified by EDS analysis only.

BB 02-2 106'

(LDBB006.bmp)



1: calcite
2: dolomite
3: quartz

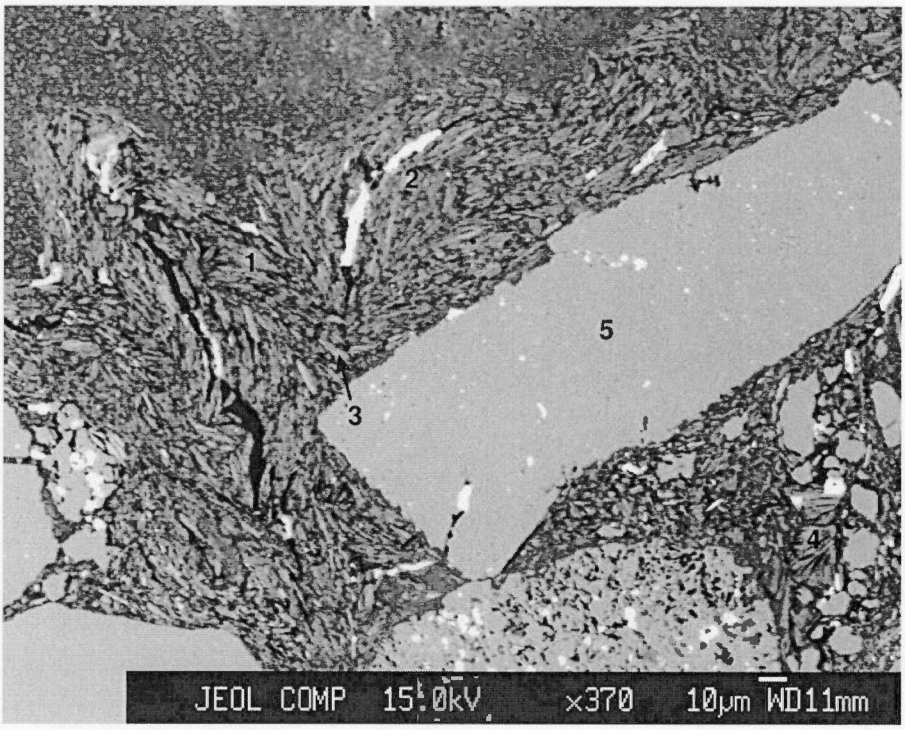
Fig. 11

Notes:

- Detrital calcite (spot 1) with diagenetic dolomite, seen as darker grey patches and crystallites that appear to be growing in holes within the calcite crystal (spot 2).
- Small diagenetic quartz grains in upper right of image (spot 3) identified as cement based on sharp crystal margins and hexagonal crystal shape (or shape is a result of silica overgrowths over quartz grains).

BB 02-7 11' (29-33)

(LDBB001.bmp)



1: ?illite
2: kaolinite
3: ?illite
4: kaolinite + ?illite
5: quartz

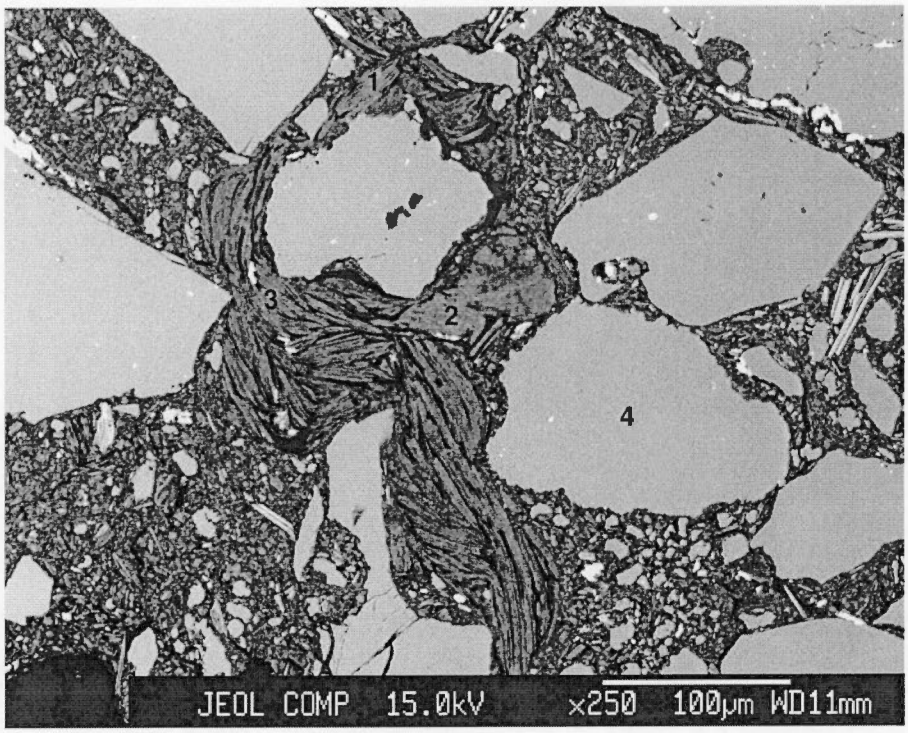
Fig. 12

Notes:

- Illite occurs as small platelets (spots 1 & 3) in an overall changing (but not random) orientation/growth pattern.
- Some kaolinite is found as very small booklets (spot 2) amidst the mass of illite; relative abundances of the two minerals is unclear but while on the probe, it seemed that illite was much more abundant in this (central) area of the image.
- The uppermost portion of the image is very fine-grained kaolinite (low total but no K).
- Kaolinite is also found in somewhat larger booklets (spot 4) (~10μm diameter).
- No evidence of diagenetic Silica.

BB 02-7 11' (29-33)

(LDBB002.bmp)



1: halloysite
2: halloysite
3: halloysite
4: quartz

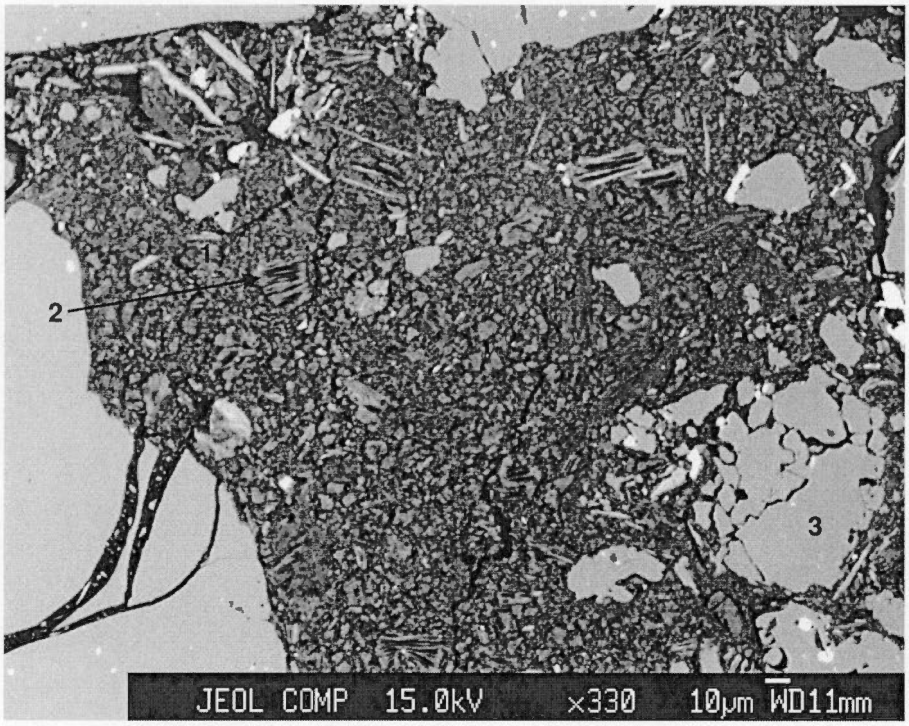
Fig. 13

Notes:

- Halloysite (spots 1,2 and 3) is found as fibrous crystals growing in and around detrital quartz grains; it is not found in association with any other cements.

BB 02-7 11' (29-33)

(LDBB003.bmp)



1: kaolinite
2: kaolinite
3: quartz

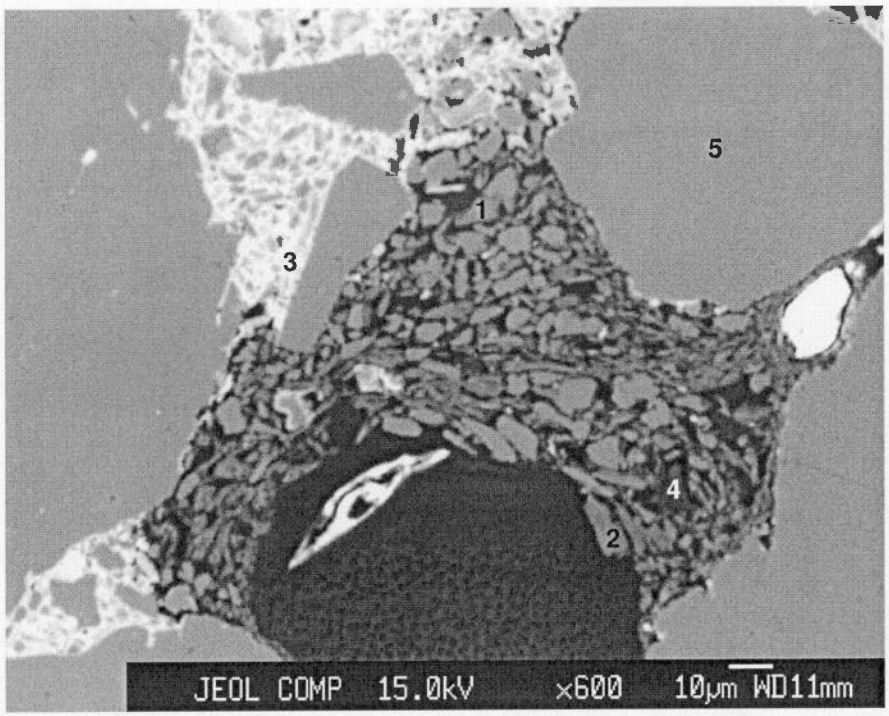
Fig. 14

Notes:

- Some diagenetic kaolinite is found within a matrix comprised largely of detrital clays with some detrital silt-sized quartz.
- Kaolinite booklets (spots 1 and 2) range in size from <10μm wide and <10μm long to ~20μm wide and ~15μm long.
- No evidence of diagenetic silica or illite in this area.

BB 02-7 16' (4-6)

(LDBB008.bmp)



1: kaolinite
2: illite
3: siderite + clays
4: coal
5: quartz

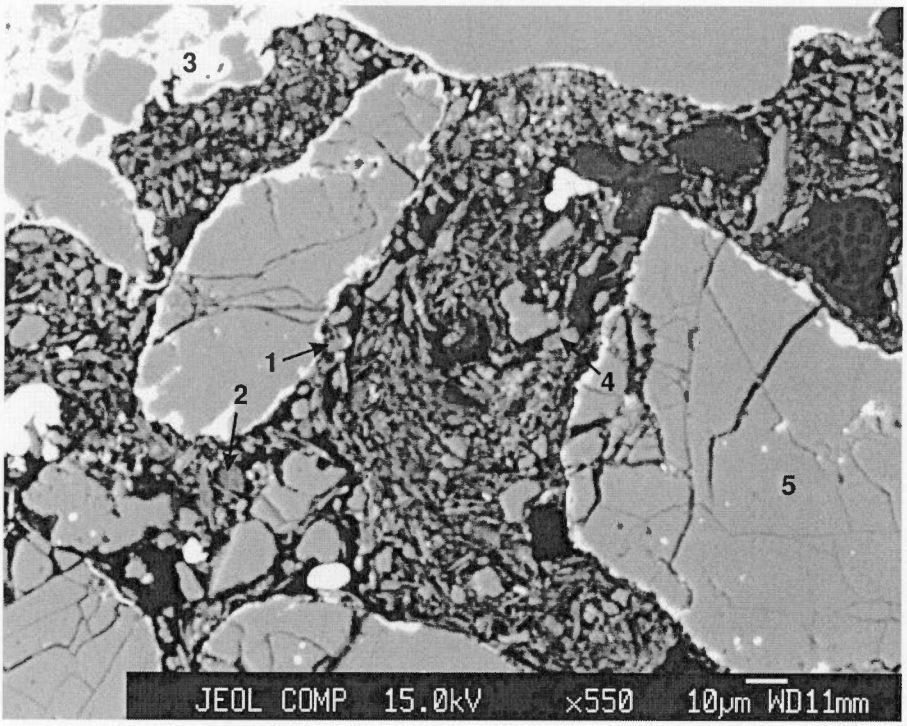
Fig. 15

Notes:

- A small 'pocket' of matrix between detrital quartz grains contains a few kaolinite (spot 1) and a few illite (spot 2) booklets that appear to be diagenetic.
- All quartz grains appear to be detrital; there is no evidence of diagenetic silica.
- Two small crystals (e.g. spot 4) are coal.
- Siderite (spot 3) is found as cement surrounding detrital quartz and clay as well as a minor amount of diagenetic clays (some well-formed booklets have been seen – e.g. near top and centre of image).

BB 02-7 16' (4-6)

(LDBB009.bmp)



1: kaolinite
2: kaolinite
3: siderite + clays
4: kaolinite
5: quartz

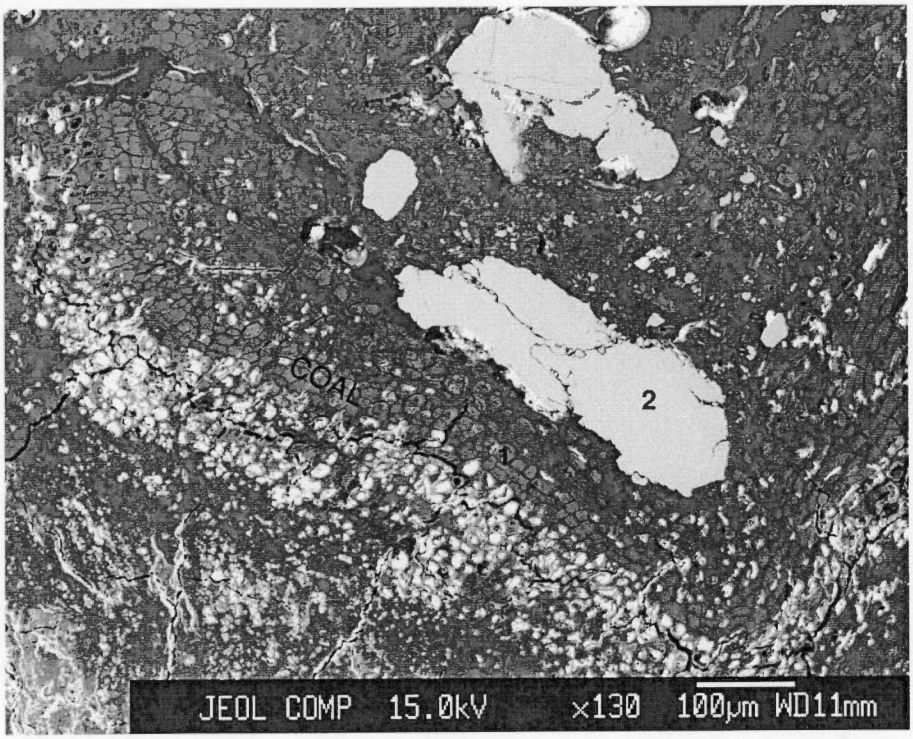
Fig. 16

Notes:

- A few booklets of diagenetic kaolinite (spots 1,2 & 4) are found within a clay and silt size quartz matrix. However, much of the diagenetic kaolinite dose not form booklets, but are considered to be diagenetic based on size (only about 5μm in length & diameter, definitely <10μm) and more importantly, form (sharp crystal margins, distinct platelets spaced evenly apart –spot 4 is the best example visible in this image).
- Most of the matrix in this slide is cemented by siderite, as seen at upper left of the image (analysis suggests a mix of siderite + clays).
- There are some detrital coal grains, that based on EDS contain minor amounts of Ti and Fe.
- There is no evidence of diagenetic silica.

BB 02-7 21' (10-15)

(LDBB007.bmp)



1: coal
2: quartz

Fig. 17

Notes:

- Verified by EDS (Figs. 18 and 19) the small spherules (spot 1) are coal.
- Detrital quartz grains are also found

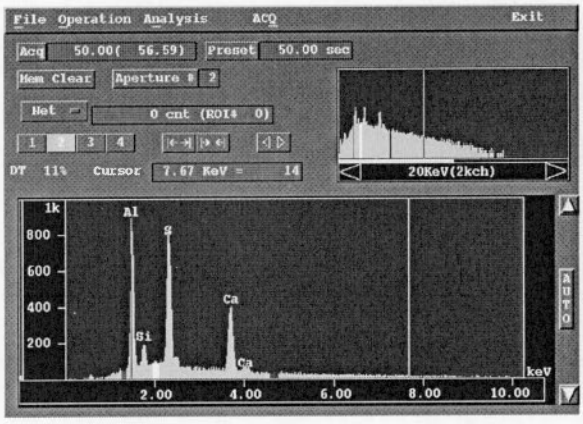


Fig. 18

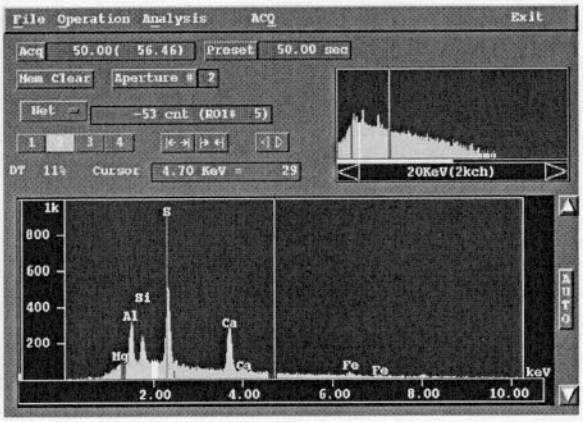
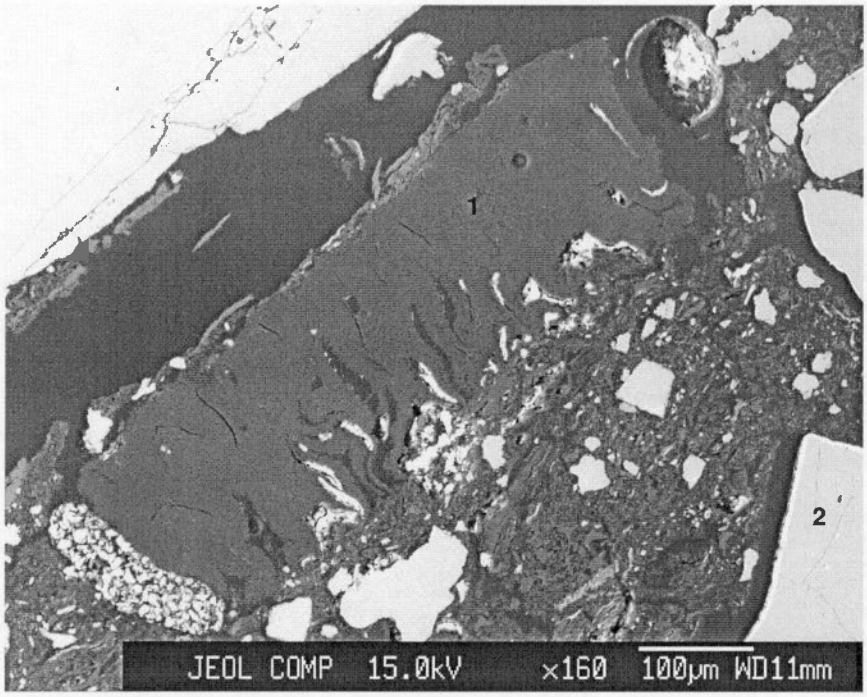


Fig. 19

BB 02-7 21' (10-15)

(LDBB005.bmp)



1: coal
2: quartz

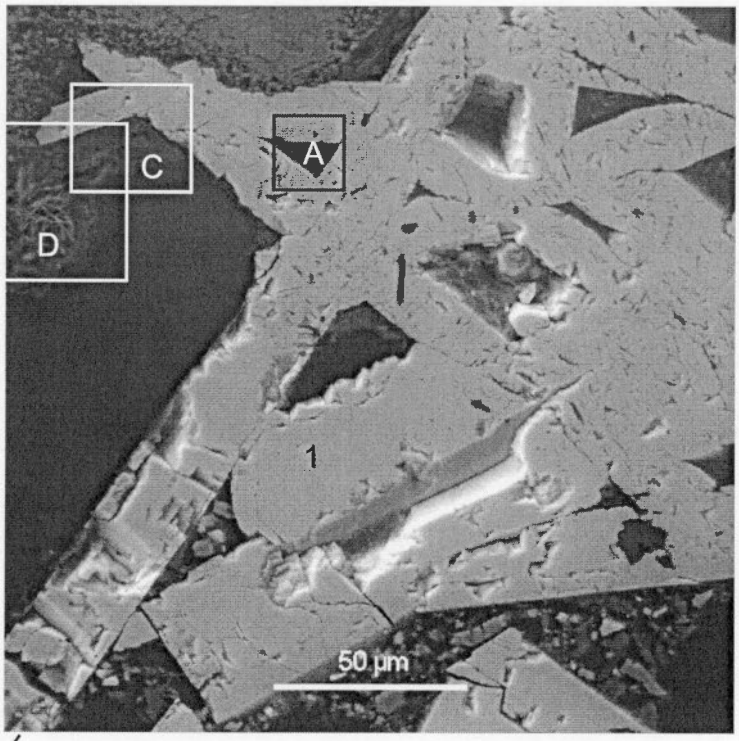
Fig. 20

Notes:

- Fibrous-looking mat has very similar composition based on EDS analyses to that of the spherules in LDBB007.bmp is coal.
- Under a polarizing microscope, the coal appeares deep red and translucent, similar to hematite.

Part B:
Scanning electron microscope analyses of columnar diagenetic mineral with further study by electron microprobe of associated diagenetic minerals.

BB-02-2 101' (5-6)



1: Barite (analysis from SEM)

Fig. 21

B

BB-02-2 101' (5-6)

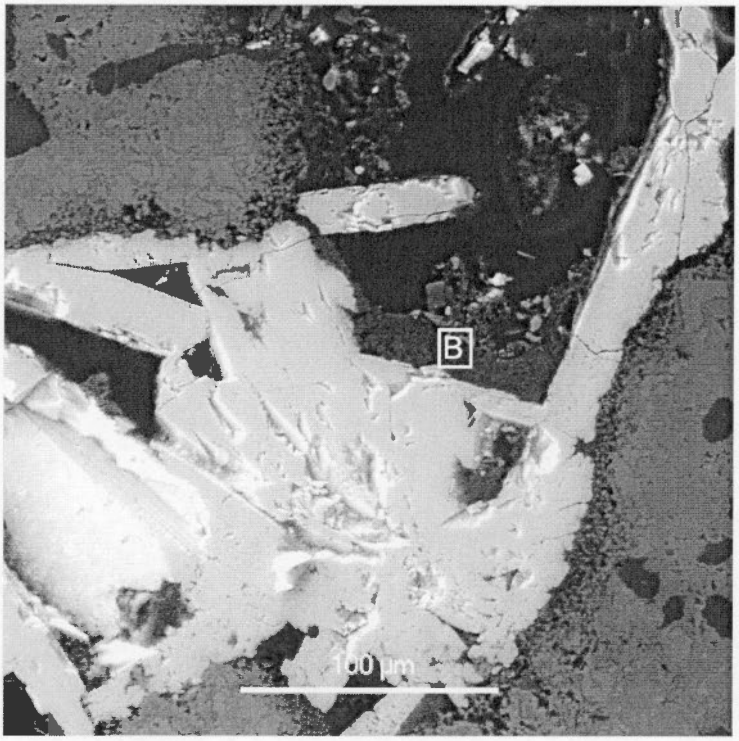
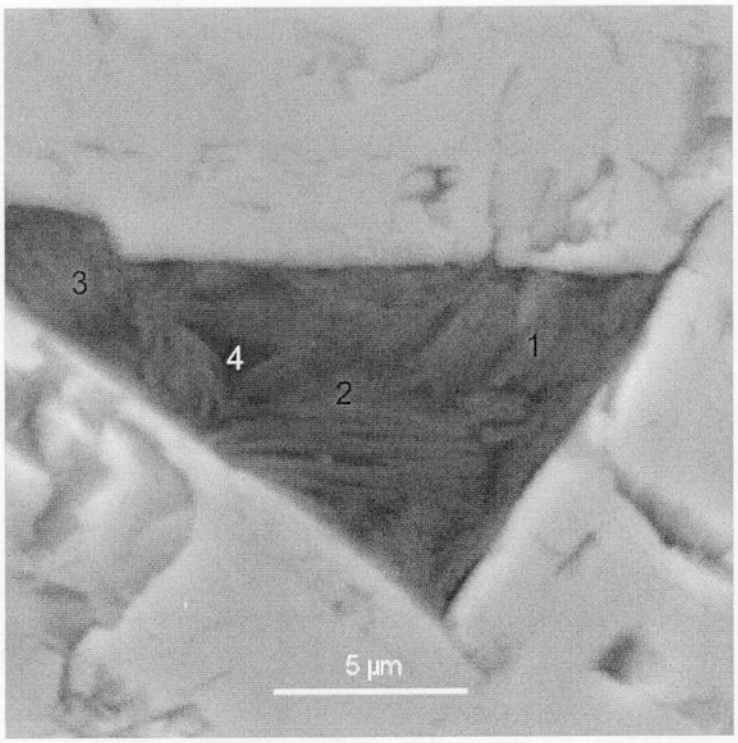


Fig. 22

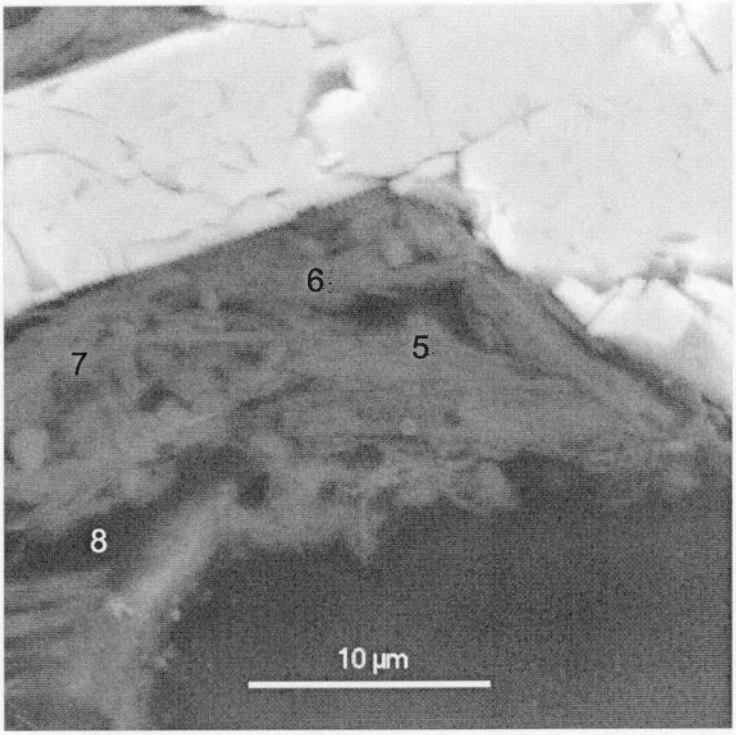
BB-02-2 101' (5-6)



1: Illite
2: Illite
3: Illite
4: Empty space

Fig. 23: Area A of Fig. 21, numbers represent locations of microprobe analyses.

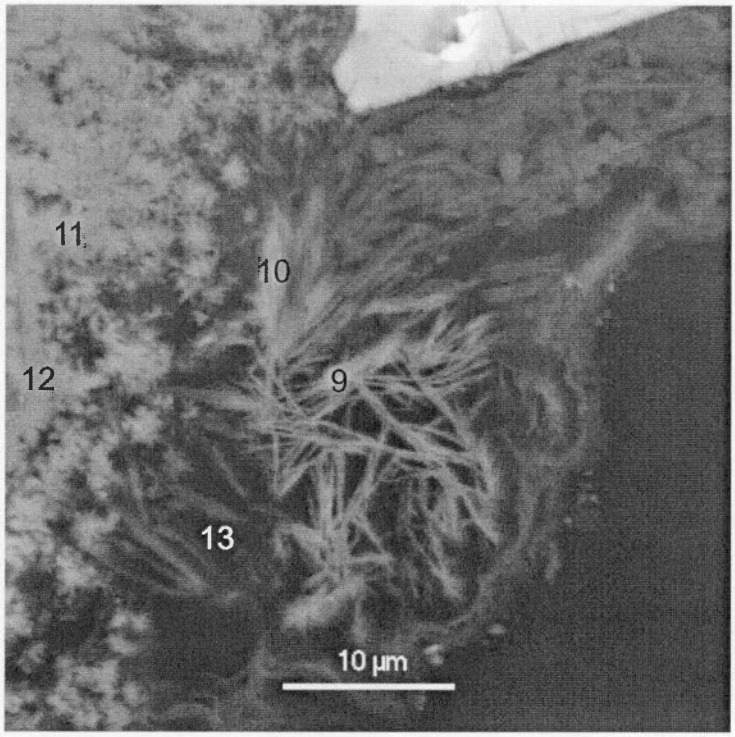
BB-02-2 101' (5-6)



5: Illite + rhodo-chrosite
6: Illite
7: Kaolinite
8: Empty space

Fig. 24: Area Cof Fig. 21.

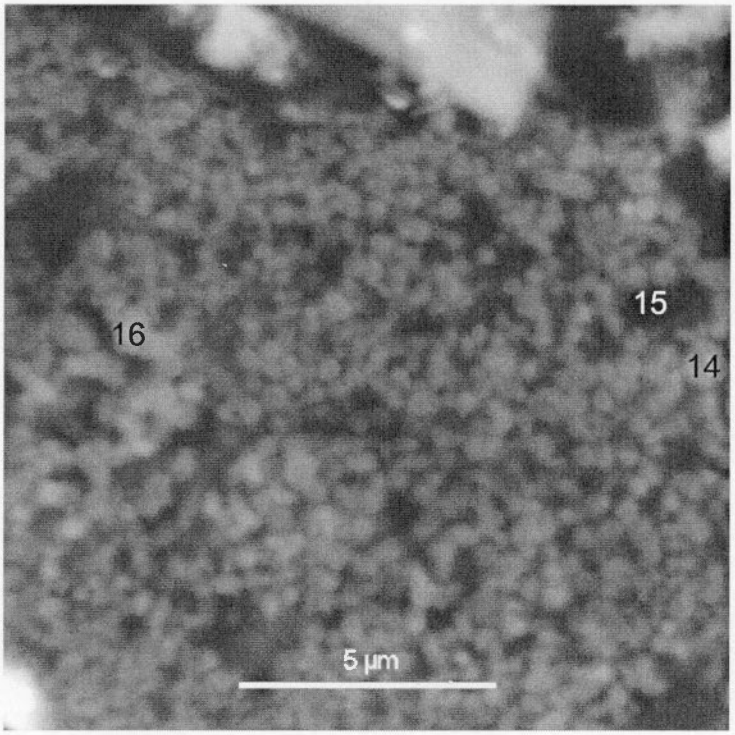
BB-02-2 101' (5-6)



9: Rhodochrosite
10: Rhodochrosite
11: Limonite
12: Limonite
13: Empty space

Fig. 25: Area D of Fig. 21.

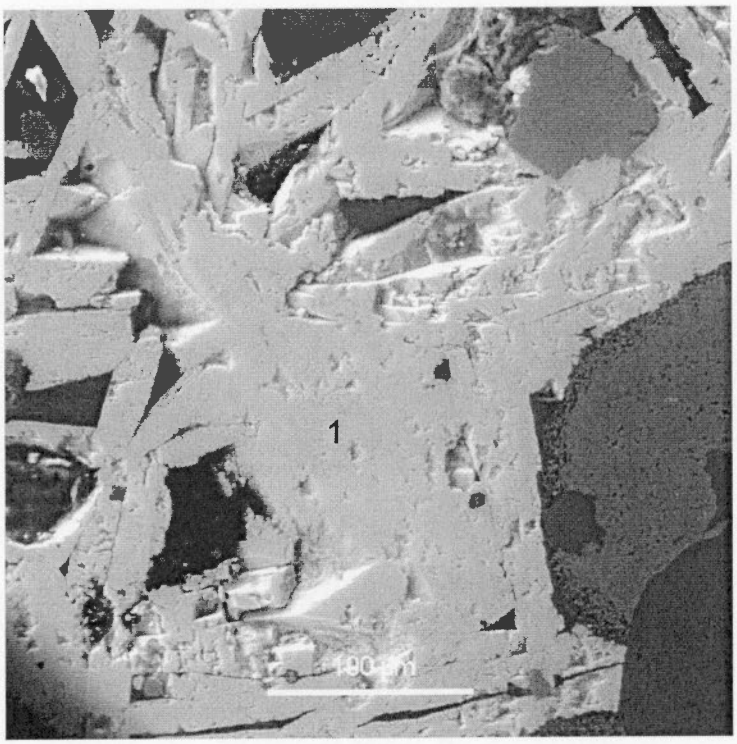
BB-02-2 101' (5-6)



14: Siderite
15: Siderite
16: Siderite

Fig. 26: Area Bof Fig. 22.

BB-02-2 101' (5-6)



1: Barite (analysis from SEM)

Fig. 27