HAND SPECIMEN/THIN SECTION MICROSCOPE DESCRIPTION: MACKENZIE DELTA-BEAUFORT SEA SUBSURFACE CONVENTIONAL DRILL CORE SAMPLES.

SAMPLE IDENTIFICATION: AIV2I45-N1
WELL NAME/DEPTH: Dome Aiverk 2-I-45-70-30-133-30/3942.0 m

INDURATION: good when dry, disaggregates in water.
COLOUR: medium grey
SEDIMENTARY STRUCTURES: vague planar lamination, disrupted.

GRAIN SIZE/COMPOSITION (VOLUMETRIC ESTIMATES):
Terrigenous Constituent %: 90

%gravel size: 0

%sand size: 45

%silt size: 20

%clay size: 25

Cement %: 0

Porosity %: 10

Modal Size: 0.125 mm.

Sorting: 16%/84% diameter ratio=
200 micrometres/ 3 micrometres = 66

Verbal Sorting Scale: very poorly sorted

GRAIN SIZE NAME: interlaminated very fine to fine sandy mudstone and mudstone.

COMPOSITION: 10% silt and sand-sized mica, 10 % carbonaceous flakes and grains, sand-sized grains are mainly monocrystalline quartz, with lesser amounts of polycrystalline quartz, chert and phylloid clasts, traces of pyrite, glauconite, carbonate, plagioclase, alkali feldspar and translucent brown resinous grains.

ROCK NAME (cements, miscellaneous transported constituents, clan designation): interlaminated sandy (carbonaceous/micaceous/litharenitic) mudstone and carbonaceous/micaceous mudstone.

PETROGENESIS/ADDITIONAL INFORMATION: Except for intergranular and moldic porosity amounting to about 1% by volume and minor quartz overgrowths, extreme mechanical compaction is the only significant diagenetic process observed in this sample.

THIN SECTION MODAL AND GRAIN SIZE ANALYSIS

Sample I.D.: Aiv2I45-N1

	No of Points	Percentage of Components	Percentages of Detrital Components
Detrital Components			
Monocrystalline Quartz	93	31	31
Polycrystalline Quartz	13	4.33	4.33
Clear Chert	28	9.33	9.33
Black Chert	1	0.33	0.33
Alkali Feldspar	6	2.00	2.00
Plagioclase	1	0.33	0.33
Phylloid Clasts	26	8.67	8.67
Volcanic Clasts	0	0.00	0.00
Chlorite	0	0.00	0.00
Mica	53	17.67	17.67
Siltstone Clasts	2	0.67	0.67
Coal	10	3.33	3.33
Unidentified (too small)	66	22.00	22.00
Other Clasts	1	0.33	0.33
Cements			
Kaolinite	0.0	0.0	0.0
Carbonate	0.0	0.0	0.0
Other	0.0	0.0	0.0
Porosity			
Intergranular/ Moldic	0.0	0.0	0.0

Intragranular	0.0	0.0	0.0

Plucked Grains 3

Total number of points counted minus plucked grains=303-3=300

GRAIN SIZE ANALYSIS

Sample I.D. AIV2I45-N1

Class Interval (phi)	No. Freq of Max Apparent Grain Dimension	Percentage Frequency	Cumulative Percentage Frequency
-1.5 to -2.0			
-1.0 to -1.5			
-0.5 to -1.0			
0.0 to -0.5			
0.5 to 0.0			
1.0 to 0.5			
1.5 to 1.0	1	0.5	0.5
2.0 to 1.5	2	1	1.5
2.5 to 2.0	7	3.5	5.0
3.0 to 2.5	14	7.0	12.0
3.5 to 3.0	18	9.0	21.0
4.0 to 3.5	7	3.5	24.5
4.5 to 4.0	13	6.5	31.0
5.0 to 4.5	9	4.5	35.5
5.5 to 5.0	14	7	42.5
6.0 to 5.5	19	9.5	52.0
6.5 to 6.0	19	9.5	61.5
7.0 to 6.5	27	13.5	75.0
7.5 to 7.0	19	9.5	84.5

8.0 to 7.5	18	9	93.5
8.5 to 8.0	3	1.5	95.0
9.0 to 8.5	8	4	99.0
9.5 to 9.0	2	1	100.0
10.0 to 9.5	0	0	100.0
>10.0	0	0	100.0

GRAPHIC GRAIN SIZE CUMULATIVE PERCENTILES IN PHI (MICROMETRE) UNITS OF SELECTED DETRITAL COMPONENTS

Sample I.D.: Aiv2I45-N1

Percentiles	Phi Values	Micrometres
1	1.8	287
5	2.5	177
16	3.25	105
25	4.03	61
50	5.90	17
75	7.02	8
84	7.48	6
95	8.5	3

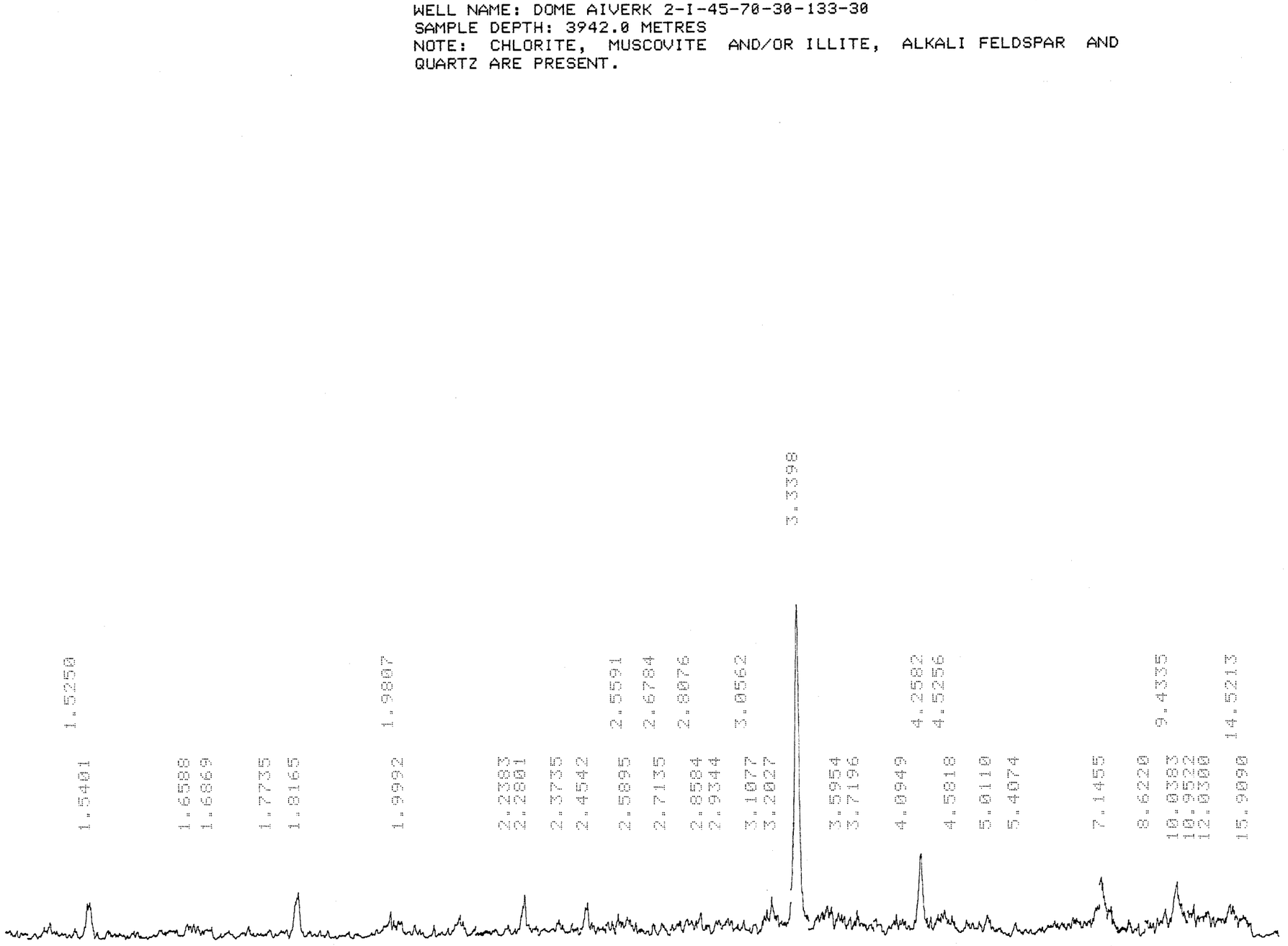
$$\text{Graphic Sorting (Inman)} = \frac{\text{Phi(84)} - \text{Phi(16)}}{2} = 2.1$$

Verbal Sorting Scale= very poorly sorted.

Total Number of Grains Measured=200

Note: Comparison of the qualitative and quantitative analyses show significant differences between modal size, and porosity, largely owing to the fine particle size and the difficulty of distinguishing squeezed phylloid clasts from mud-sized matrix. The 10% porosity estimate, using a medium power objective with incident light on a sample fracture surface is, however more reliable than the 0% porosity value obtained from the modal analysis.

X-RAY DIFFRACTION ANALYSIS
SAMPLE IDENTIFICATION: AIV2I45-N1
WELL NAME: DOME AIVERK 2-I-45-70-30-133-30
SAMPLE DEPTH: 3942.0 METRES
NOTE: CHLORITE, MUSCOVITE AND/OR ILLITE, ALKALI FELDSPAR AND QUARTZ ARE PRESENT.



HAND SPECIMEN/THIN SECTION MICROSCOPE DESCRIPTION: MACKENZIE DELTA-BEAUFORT SEA SUBSURFACE CONVENTIONAL DRILL CORE SAMPLES.

SAMPLE IDENTIFICATION: AlePZ3-1
WELL NAME/DEPTH: Esso Pex Alerk P-23-70-00-132-45/2017.15 m

INDURATION: very poor when dry, disaggregates by itself moments after immersion in water.
COLOUR: light brown.
SEDIMENTARY STRUCTURES: very vague planar lamination. The section contains 5 worm(?) tubes 0.5 mm in diameter.

GRAIN SIZE/COMPOSITION (VOLUMETRIC ESTIMATES):
Terrigenous Constituent %: 63

%gravel size: 0

%sand size: 53

%silt size: 5

%clay size: 5

Cement %: 2% kaolinite.

Porosity %: 35% (a porosity of 35.8% and a permeability of 987 millidarcies was measured for core plug 1, taken near the sample).

Modal Size: 0.12 mm.

Sorting: 16%/84% diameter ratio=
200 micrometres/ 80 micrometres = 2.5

Verbal Sorting Scale: moderately sorted.

GRAIN SIZE NAME: muddy very fine sandstone.

COMPOSITION: 20% monocrystalline quartz grains, 3% polycrystalline quartz grains, 15% chert clasts, 15% phylloid clasts, 1% coal grains, 1% alkali feldspar grains, trace plagioclase grains, trace unaltered glauconite pellets (2 in the unstained thin section), trace sparry carbonate clasts, trace muscovite and chlorite flakes, trace clasts of microcrystalline carbonate, trace volcanic rock fragments (with feldspar laths). Unidentified silt and clay-sized material comprises the remainder.

ROCK NAME (cements, miscellaneous transported constituents, clan designation): Kaolinite-cemented coal/glauconite-bearing muddy very fine grained litharenite.

PETROGENESIS/ADDITIONAL INFORMATION: The porosity distribution is approximately as follows; 3% is moldic, 3% is intragranular and 29% is intergranular. Secondary porosity development was an extremely important process, accounting for at least half of the

present porosity, mainly as elongate and oversized pores. Other evidence for secondary porosity includes honeycombed alkali feldspar and enhanced intragranular porosity in phylloid and chert clasts. Although carbonate cement is absent, there is overwhelming evidence for its former presence as partial rhomb-shaped molds at grain margins and to a lesser extent, complete molds within grains. The elongate and oversized pores of secondary origin with large pore throat size explains the high measured permeability. The time of formation and depth of burial at which carbonate cementation occurred is difficult to determine. In one case, however, the opposite sides of a grain fracture of a compactionaly fractured quartz grain were observed to be etched such that opposite sides of the fracture no longer matched. The etching was undoubtedly by carbonate replacement/dissolution which, if true, would suggest that carbonate cementation (including grain replacement) occurred after burial that was sufficiently deep to fracture quartz grains. Evidence for compaction after secondary porosity development is rare, comprising only a few ductile grains that have been squeezed into the rhomb-shaped molds of adjacent competent grains. Kaolinite lines pores of secondary origin and is therefore a relatively late diagenetic mineral.

The polished thin sections are of good quality, probably because of the low clay content, the high permeability, and the use of an epoxy impregnant undiluted with solvent.

THIN SECTION MODAL AND GRAIN SIZE ANALYSIS

Sample I.D.: AlePZ3-1

	No of Points	Percentage of Components	Percentages of Detrital Components
Detrital Components			
Monocrystalline Quartz	98	32.67	49.25
Polycrystalline Quartz	17	5.67	8.54
Clear Chert	32	10.67	16.08
Black Chert	5	1.67	2.51
Alkali Feldspar	11	3.67	5.53
Plagioclase	0	0.00	0.00
Phylloid Clasts	19	6.33	9.55
Volcanic Clasts	0	0.00	0.00
Chlorite	3	1.00	1.51
Mica	2	0.67	1.01
Siltstone Clasts	1	0.33	0.50
Coal	2	0.67	1.01
Unidentified (too small)	7	2.33	3.52
Other Clasts	2	0.67	1.01
Cements			
Kaolinite	0	0.00	
Carbonate	0	0.00	
Other	3	1.00	
Porosity			
Intergranular/ Moldic	93	31.00	

Intragranular	5	1.67

Plucked Grains= 3

Total number of points counted minus plucked grains= 300

GRAIN SIZE ANALYSIS

Sample I.D.: AlePZ3-1

Class Interval (phi)	No. Freq of Max Apparent Grain Dimen-sion	Percentage Frequency	Cumulative Percentage Frequency
2.0 to 1.5	3	1.5	1.5
2.5 to 2.0	21	10.5	12.0
3.0 to 2.5	70	35.0	47.0
3.5 to 3.0	56	28.0	75.0
4.0 to 3.5	14	7.0	82.0
4.5 to 4.0	11	5.5	87.5
5.0 to 4.5	3	1.5	89.0
5.5 to 5.0	5	2.5	91.5
6.0 to 5.5	1	0.5	92.0
6.5 to 6.0	1	0.5	92.5
7.0 to 6.5	3	1.5	94.0
1.5 to 7.0	1	0.5	94.5
8.0 to 7.5	1	0.5	95.0
8.5 to 8.0	3	1.5	96.5
9.0 to 8.5	5	2.5	99.0
9.5 to 9.0	2	1.0	100.0

GRAPHIC GRAIN SIZE CUMULATIVE PERCENTILES IN PHI (MICROMETRE) UNITS OF SELECTED DETRITAL COMPONENTS

Sample I.D.: AlePZ3-1

Percentiles	Phi Values	Micrometres	
1	-	-	
5	2.26	209	
16	2.58	167	
25	2.72	152	
50	3.05	121	(very fine sand size)
75	3.50	88	
84	4.18	55	
95	8.00	4	

$$\text{Graphic Sorting (Inman)} = \frac{\text{Phi(84)} - \text{Phi(16)}}{2} = 0.80$$

Verbal Sorting Scale= moderately sorted

Total Number of Grains Measured= 200

Note: More silt was determined by thin section grain size analysis than was qualitatively estimated. Modal analysis suggests a higher proportion of monocrystalline quartz grains (33 rather than 20%), polycrystalline quartz grains (6 instead of 3%), and alkali feldspar grains (4 compared with 1%) than was estimated qualitatively. The point count porosity estimate (32.7%) is close to the qualitative estimate (35%) and the porosimeter value (35.8%) of a nearby sample.

HAND SPECIMEN/THIN SECTION MICROSCOPE DESCRIPTION: MACKENZIE DELTA-BEAUFORT SEA SUBSURFACE CONVENTIONAL DRILL CORE SAMPLES.

SAMPLE IDENTIFICATION: AlePZ3-3
WELL NAME/DEPTH: Esso Pex Alerk P-23-70-00-132-45/2017.90 m.

INDURATION: poor
COLOUR: light brown
SEDIMENTARY STRUCTURES: planar bedding is defined by coaly films and minor mudstone laminae in the sandstone. Minor bioturbation is present as subvertical tubes of sandstone in the sandy mudstone lamina.

GRAIN SIZE/COMPOSITION (VOLUMETRIC ESTIMATES):
Terrigenous Constituent %: 75

%gravel size: 0

%sand size: 62

%silt size: 8

%clay size: 5?

Cement %: trace pyrite framboids.

Porosity %: 25 (a porosity of 31.5% and a permeability of 101 millidarcies was measured for core plug 4, taken near the sample).

Modal Size: 0.09 mm.

Sorting (of the sandstone lithology: 16%/84% diameter ratio= 150 micrometres/ 70 micrometres = 2.1

Verbal Sorting Scale: moderately sorted.

GRAIN SIZE NAME (of the sandstone lithology): muddy very fine grained sanstone.

COMPOSITION (of the sandstone lithology): 20% monocrystalline quartz grains, 1% polycrystalline quartz grains, 15% chert clasts, 20% phylloid and siltstone grains, 1% muscovite flakes (in part altered to chlorite and clays), 1% alkali feldspar, 2% coal grains and minor films, trace unaltered glauconite pellets, trace plagioclase grains (partly altered to clays), trace microcline grains, trace chlorite flakes. Unidentified clay and silt-sized material comprises the remainder.

ROCK NAME (cements, miscellaneous transported constituents, clan designation): coal/glauconite-bearing muddy very fine-grained litharenite.

PETROGENESIS/ADDITIONAL INFORMATION: The porosity distribution is approximately as follows; 3% is moldic, at least 3% is

intragranular and 19% is intergranular. About one-third to one-half of the porosity is of secondary origin, mainly as elongate and oversized intergranular pores. Partial rhomb-shaped molds at grain margins point to dissolution of grain-replaced carbonate as the mechanism of porosity enhancement. Floating grains, inhomogeneity of packing ad leached grains provide further evidence for the development of secondary porosity. Compaction after secondary porosity development was minmal, judging by the nature of grain contacts and the high proportion of preserved porosity. Secondary porosity is much more common in the sandstone than in the sandy mudstone, which suggests a permeability control on its development. Other diagenetic processes included the alteration of muscovite (in flakes and in phylloid clasts) to chlorite or clays. In addition, pyrite framboids line pores of secondary origin, indicating a relatively late origin. One observation of general interest was made in this slide. Some competent grains with rhomb-shaped molds but which are completely enclosed in mud-sized material suggest that some of the molds may be inherited by reworking of an older sequence, as opposed to always being diagenetic. It is clear that carbonate could not possibly have formed these molds in place which suggests that such molds should be used with caution, together with other criteria, such as associated elongate and oversized pores.

HAND SPECIMEN/THIN SECTION MICROSCOPE DESCRIPTION: MACKENZIE DELTA-BEAUFORT SEA SUBSURFACE CONVENTIONAL DRILL CORE SAMPLES.

SAMPLE IDENTIFICATION: AlePZ3-4
WELL NAME/DEPTH: Esso Pex Alerk P-23-70-00-132-45/2018.1 m.

INDURATION: poor when dry, disaggregates by itself a few minutes after immersion in water.
COLOUR: medium brown.
SEDIMENTARY STRUCTURES: vague planar lamination defined by subhorizontal coaly films, moderate bioturbation (possible worm tubes 1 mm in diameter).

GRAIN SIZE/COMPOSITION (VOLUMETRIC ESTIMATES):
Terrigenous Constituent %: 80

%gravel size: 0

%sand size: 30

%silt size: 30

%clay size: 20

Cement %: trace pyrite framboids, kaolinite(?).

Porosity %: 20

Modal Size: 0.04 mm.

Sorting: 16%/84% diameter ratio=
125 micrometres/ 3? micrometres = 42

Verbal Sorting Scale: very poorly sorted.

GRAIN SIZE NAME: sandy mudstone.

COMPOSITION: 15% monocrystalline quartz grains, 3% polycrystalline quartz grains, 5% chert clasts, 20% phylloid clasts, 3% muscovite flakes, trace alkali feldspar, trace plagioclase grains (partly altered to clays), 5% films and grains of coal, trace unaltered glauconite pellets. Unidentified clay- and silt-sized material comprises the remainder.

ROCK NAME (cements, miscellaneous transported constituents, clan designation): glauconite- and coal-bearing sandy (litharenitic) mudstone.

PETROGENESIS/ADDITIONAL INFORMATION: The porosity distribution is approximately as follows; 1% is moldic, at least 1% is intragranular, and 18% is intergranular. Secondary intergranular porosity as elongate and oversized pores is well-developed in the mud-poor bioturbated parts of the sample. Secondary porosity is, however poorly developed in the mudstone. Rhomb-shaped molds at grain margins leave no doubt that the secondary porosity was

formed by the dissolution of carbonate. Pyrite framboids occur in secondary pores and are therefore relatively late diagenetic.

HAND SPECIMEN/THIN SECTION MICROSCOPE DESCRIPTION: MACKENZIE DELTA-BEAUFORT SEA SUBSURFACE CONVENTIONAL DRILL CORE SAMPLES.

SAMPLE IDENTIFICATION: AlePZ3-N1
WELL NAME/DEPTH: Esso Pex Alerk P-23-70-00-132-45/2018.75 m

INDURATION: poor
COLOUR: light grey
SEDIMENTARY STRUCTURES: vague planar lamination

GRAIN SIZE/COMPOSITION (VOLUMETRIC ESTIMATES):
Terrigenous Constituent %: 80

%gravel size: 0

%sand size: 45

%silt size: 25

%clay size: 10

Cement %: at least 2% kaolinite booklets in secondary porosity.

Porosity %: 18%

Modal Size: 0.150 mm.

Sorting: 16%/84% diameter ratio=
200 micrometres/ 20 micrometres = 10

Verbal Sorting Scale: poorly sorted

GRAIN SIZE NAME: muddy fine sandstone

COMPOSITION: 20% carbonaceous flakes and coaly grains, one of which is 0.6 mm in size. At least 10% muscovite in the sand and silt size range. The most common sand-sized grains are monocrystalline quartz with lesser polycrystalline quartz, chert and phylloid clasts. Also present is about 2% chlorite (stained pink by the dye mixed with the epoxy). 2% brown translucent resinous material, 1% alkali feldspar, tr pyrite framboids.

ROCK NAME (cements, miscellaneous transported constituents, clan designation): carbonaceous and micaceous muddy fine grained litharenite.

PETROGENESIS/ADDITIONAL INFORMATION: Mechanical compaction, combined with the large volume of silt and clay has resulted in low porosity and perrmeability. This has been offset in the more sandy perhaps more permeable parts of the sample by the extensive development of secondary porosity (10% at least) between and to a lesser extent within grains. Dissolution of detrital clay between grains and corrosion of many of the grains (muscovite, phylloid and others) has resulted in a considerble amount of porosity, in

which kaolinite booklets have precipitated.

The sample is extensively fractured, perhaps because of its poor induration, as a result of the coring process or during sample preparation. A poor polish was obtained because of grain plucking/scratching. The lime green stain for epoxy may have absorbed onto clays or stained the epoxy surrounding now plucked grains. Porosity is therefore overestimated.

HAND SPECIMEN/THIN SECTION MICROSCOPE DESCRIPTION: MACKENZIE DELTA-BEAUFORT SEA SUBSURFACE CONVENTIONAL DRILL CORE SAMPLES.

SAMPLE IDENTIFICATION: AlePZ3-N2
WELL NAME/DEPTH: Esso Pex Alerk P-23-70-00-132-45/2019.10 m

INDURATION: moderate, disaggregates easily in water
COLOUR: light brown
SEDIMENTARY STRUCTURES: vague planar lamination, worm? tubes 3 mm in diameter common, vertical fractures formed during sample preparation.

GRAIN SIZE/COMPOSITION (VOLUMETRIC ESTIMATES):
Terrigenous Constituent %: 85

%gravel size: 0

%sand size: 15

%silt size: 50

%clay size: 20

Cement %: 0?

Porosity %: 15

Modal Size: 0.030 mm.

Sorting: 16%/84% diameter ratio=
62 micrometres/ 3 micrometres = 20

Verbal Sorting Scale: very poorly sorted

GRAIN SIZE NAME: sandy (very fine grained) siltstone

COMPOSITION: 5% muscovite flakes, minor carbonaceous laminae, 20% carbonaceous flakes/coal grains, 15% phylloid clasts form pseudomatrix, 5% translucent brownish-red resinous material. The sand-sized grains are mainly monocrystalline quartz, with lesser amounts of polycrystalline quartz and chert. 5% grains of clay-sized siderite? Minor grains of chlorite (stained pink by oil blue dye added to the epoxy) and kaolinite booklets. Trace euhedral sphene, carbonate grains and carbonate cement.

ROCK NAME (cements, miscellaneous transported constituents, clan designation): carbonaceous litharenitic sandy siltstone.

PETROGENESIS/ADDITIONAL INFORMATION:
Secondary porosity is present in laminae with slightly coarser sand-sized grains. Evidence of grain moulds (tr), elongate pores, corroded and partially leached grains is present. The finer grained laminae undoubtedly were of insufficient permeability to allow the development of secondary porosity.

Trace amounts of muscovite have altered to chlorite. Kaolinite booklets are more common lining secondary rather than primary pores.

Due to excessive grain plucking observed when the section was about 0.1 mm thick, the thin section was surface impregnated with clear cyanoacrylate in a sealed plastic bag.

THIN SECTION MODAL AND GRAIN SIZE ANALYSIS

Sample I.D.: AleP23-N2

	No of Points	Percentage of Components	Percentages of Detrital Components
Detrital Components			
Monocrystalline Quartz	90	30.00	30.00
Polycrystalline Quartz	7	2.33	2.33
Clear Chert	30	10.00	10.00
Black Chert	1	0.33	0.33
Alkali Feldspar	2	0.67	0.67
Plagioclase	0	0.00	0.00
Phylloid Clasts	63	21.00	21.00
Volcanic Clasts	0	0.00	0.00
Chlorite	4	1.33	1.33
Mica	36	12.00	12.00
Siltstone Clasts	4	1.33	1.33
Coal	24	8.00	8.00
Unidentified (too small)	36	12.00	12.00
Other Clasts	2	0.67	0.67
Cements			
Kaolinite	0	0.00	0.00
Carbonate	0	0.00	0.00
Other	1	0.33	0.33
Porosity			
Intergranular/ Moldic	0	0.00	0.00

Intragranular	0	0.00	0.00

Plucked Grains: 15

Total number of points counted minus plucked grains= 300

GRAIN SIZE ANALYSIS

Sample I.D. AlePZ3-N2

Class Interval (phi)	No. Freq of Max Apparent Grain Dimen-sion	Percentage Frequency	Cumulative Percentage Frequency
-1.5 to -2.0			
-1.0 to -1.5			
-0.5 to -1.0			
0.0 to -0.5			
0.5 to 0.0			
1.0 to 0.5			
1.5 to 1.0	1	0.5	0.5
2.0 to 1.5	1	0.5	1.0
2.5 to 2.0	1	0.5	1.5
3.0 to 2.5	4	2.0	3.5
3.5 to 3.0	14	7.0	10.5
4.0 to 3.5	18	9.0	19.5
4.5 to 4.0	29	14.5	34.0
5.0 to 4.5	28	14.0	48.0
5.5 to 5.0	18	9.0	57.0
6.0 to 5.5	27	13.5	70.5
6.5 to 6.0	30	15.0	85.5
7.0 to 6.5	13	6.5	92.0
7.5 to 7.0	7	3.5	95.5

8.0 to 7.5	4	2.0	97.5
8.5 to 8.0	2	1.0	98.5
9.0 to 8.5			
9.5 to 9.0			
10.0 to 9.5			
>10.0			

GRAPHIC GRAIN SIZE CUMULATIVE PERCENTILES IN PHI (MICROMETRE) UNITS OF SELECTED DETRITAL COMPONENTS

Sample I.D.: AleP23-N2

Percentiles	Phi Values	Micrometres
1	2.00	250
5	3.16	112
16	3.83	70
25	4.22	54
50	5.22	27
75	6.14	14
84	6.43	12
95	7.42	6

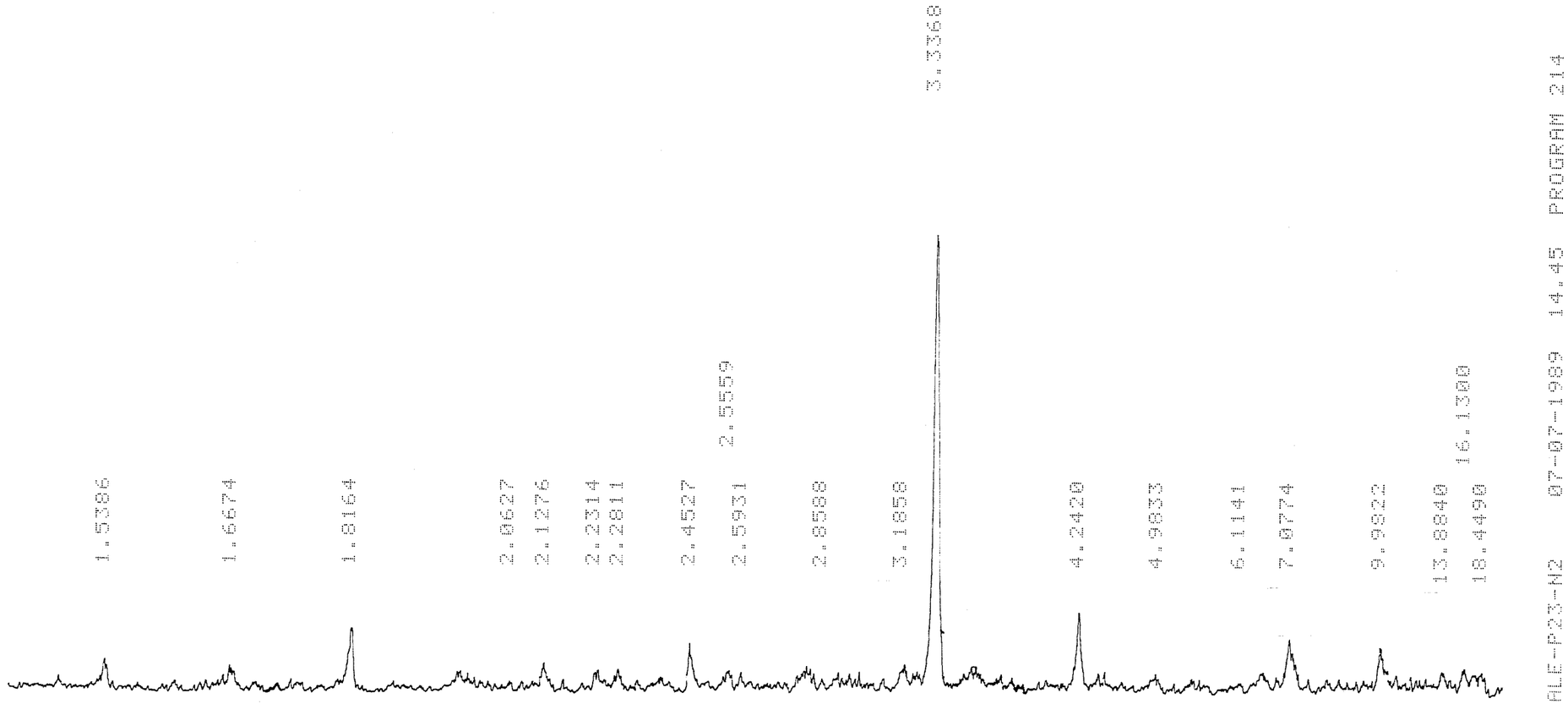
$$\text{Graphic Sorting (Inman)} = \frac{\text{Phi(84)} - \text{Phi(16)}}{2} = 1.30$$

Verbal Sorting Scale= poorly sorted.

Total Number of Grains Measured=200

Note: No porosity was observed in thin section because of the very small particle size. A 15% porosity value that was estimated from a sample fracture surface qualitatively is a more reasonable value. In addition, less clay-sized material was observed in thin section than was estimated from a sample fracture surface (compare the qualitative and quantitative descriptions).

X-RAY DIFFRACTION ANALYSIS
SAMPLE IDENTIFICATION: ALEP23-N2
WELL NAME: ESSO PEX ALERK P-23-70-00-132-45
SAMPLE DEPTH: 2019.10 METRES
NOTE: MUSCOVITE AND/OR ILLITE, CHLORITE(?), ALKALI FELDSPAR AND QUARTZ ARE INDICATED.



HAND SPECIMEN/THIN SECTION MICROSCOPE DESCRIPTION: MACKENZIE DELTA-BEAUFORT SEA SUBSURFACE CONVENTIONAL DRILL CORE SAMPLES.

SAMPLE IDENTIFICATION: AlePZ3-N3
WELL NAME/DEPTH: Esso Pex Alerk P-23-70-00-132-45/2019.87 m

INDURATION: moderate when dry, disaggregates easily in water.
COLOUR: light brown
SEDIMENTARY STRUCTURES: planar lamination and parting marked by dark grey carbonaceous films which vary from 5 to 40% by volume.

GRAIN SIZE/COMPOSITION (VOLUMETRIC ESTIMATES):
Terrigenous Constituent %: 85

%gravel size: 0

%sand size: 40

%silt size: 25

%clay size: 20

Cement %: 0

Porosity %: 15

Modal Size: 0.050 mm.

Sorting: 16%/84% diameter ratio=
80 micrometres/ 5 micrometres = 16

Verbal Sorting Scale: very poor to poorly sorted.

GRAIN SIZE NAME: sandy mudstone.

COMPOSITION: 20% subhorizontal carbonaceous flakes (concentration varies vertically), 15% monocrystalline quartz, 4% polycrystalline quartz and chert, 3% phylloid clasts, 1% chlorite grains, 1% muscovite grains, 1% composite siderite grains, tr pyrite grains, and the remainder is too small for identification.

ROCK NAME (cements, miscellaneous transported constituents, clan designation): carbonaceous sandy (litharenitic) mudstone.

PETROGENESIS/ADDITIONAL INFORMATION: The fine-grained nature of the sample precludes detailed analysis in thin section. Mechanical compaction is, however, evidenced by crushed carbonaceous and micaceous flakes.

In addition to pressure and vapour exchange methods of impregnation, the section was surface impregnated with clear cyanoacrylate at a thickness of 0.1 mm because of excessive grain plucking. The lime green epoxy stain overestimates porosity because it has stained the epoxy surrounding plucked grains.

HAND SPECIMEN/THIN SECTION MICROSCOPE DESCRIPTION: MACKENZIE DELTA-BEAUFORT SEA SUBSURFACE CONVENTIONAL DRILL CORE SAMPLES.

SAMPLE IDENTIFICATION: AlePZ3-N4
WELL NAME/DEPTH: Esso Pex Alerk P-23-70-00-132-45/2020.51 m

INDURATION: poor when dry
COLOUR: light brown
SEDIMENTARY STRUCTURES: vague planar lamination defined by varying concentrations of carbonaceous flakes.

GRAIN SIZE/COMPOSITION (VOLUMETRIC ESTIMATES):
Terrigenous Constituent %: 70 or 90 (see below).

%gravel size: 0

%sand size: 50

%silt size: 20

%clay size: 20 (possibly most is kaolinite cement).

Cement %: 20% authigenic or detrital clay?, 1% spar.

Porosity %: 9

Modal Size: 0.10 mm.

Sorting: 16%/84% diameter ratio=
160 micrometres/ 4 micrometres = 40

Verbal Sorting Scale: very poorly sorted

GRAIN SIZE NAME: muddy sandstone.

COMPOSITION: 20% monocrystalline quartz, 15% clear chert, 10% polycrystalline quartz, ?% phylloid clasts as pseudomatrix, 10% scattered carbonaceous flakes and grains, 10% muscovite flakes, 1% siderite clasts, tr chlorite, spar, pyrite, glauconite and brown resinous grains.

ROCK NAME (cements, miscellaneous transported constituents, clan designation): carbonaceous/micaceous muddy litharenite.

PETROGENESIS/ADDITIONAL INFORMATION: Some of the muscovite flakes have been replaced by carbonate or chlorite. Otherwise, mechanical compaction is the most important diagenetic process. However, much of the clay may be authigenic kaolinite. The sample was taken close to core plug 6, for which a porosity of 20.7% and a permeability of 413 millidarcies was obtained.

Fractures in the sample were undoubtedly formed by drying of the core, given the clay content and poor induration.

HAND SPECIMEN/THIN SECTION MICROSCOPE DESCRIPTION: MACKENZIE DELTA-BEAUFORT SEA SUBSURFACE CONVENTIONAL DRILL CORE SAMPLES.

SAMPLE IDENTIFICATION: AleP23-7
WELL NAME/DEPTH: Esso Pex Alerk P-23-70-00-132-45/2026.2 m.

INDURATION: poor when dry, disaggregates a few minutes after immersion in water.
COLOUR: light brown.
SEDIMENTARY STRUCTURES: vague planar lamination, minor bioturbation (tubes 0.3 mm in diameter).

GRAIN SIZE/COMPOSITION (VOLUMETRIC ESTIMATES):
Terrigenous Constituent %: 85

%gravel size: 0

%sand size: 10

%silt size: 45

%clay size: 30

Cement %: trace sparry carbonate, kaolinite(?), trace pyrite framboids.

Porosity %: 15?

Modal Size: 0.03 mm.

Sorting: 16%/84% diameter ratio=
60 micrometres/ 3? micrometres = 20

Verbal Sorting Scale: very poorly sorted.

GRAIN SIZE NAME: sandy mudstone.

COMPOSITION: 20% monocrystalline quartz, 10% muscovite flakes (in part replaced by carbonate and clays), 10% phylloid clasts, 5% grains and flakes of coal, 3% clasts of brown microcrystalline carbonate, 2% alkali feldspar, trace chlorite flakes, trace polycrystalline quartz and chert grains, trace volcanic rock fragments (feldspar laths preserved), trace unaltered glauconite pellets. Unidentified silt- and clay-sized material comprises the remainder.

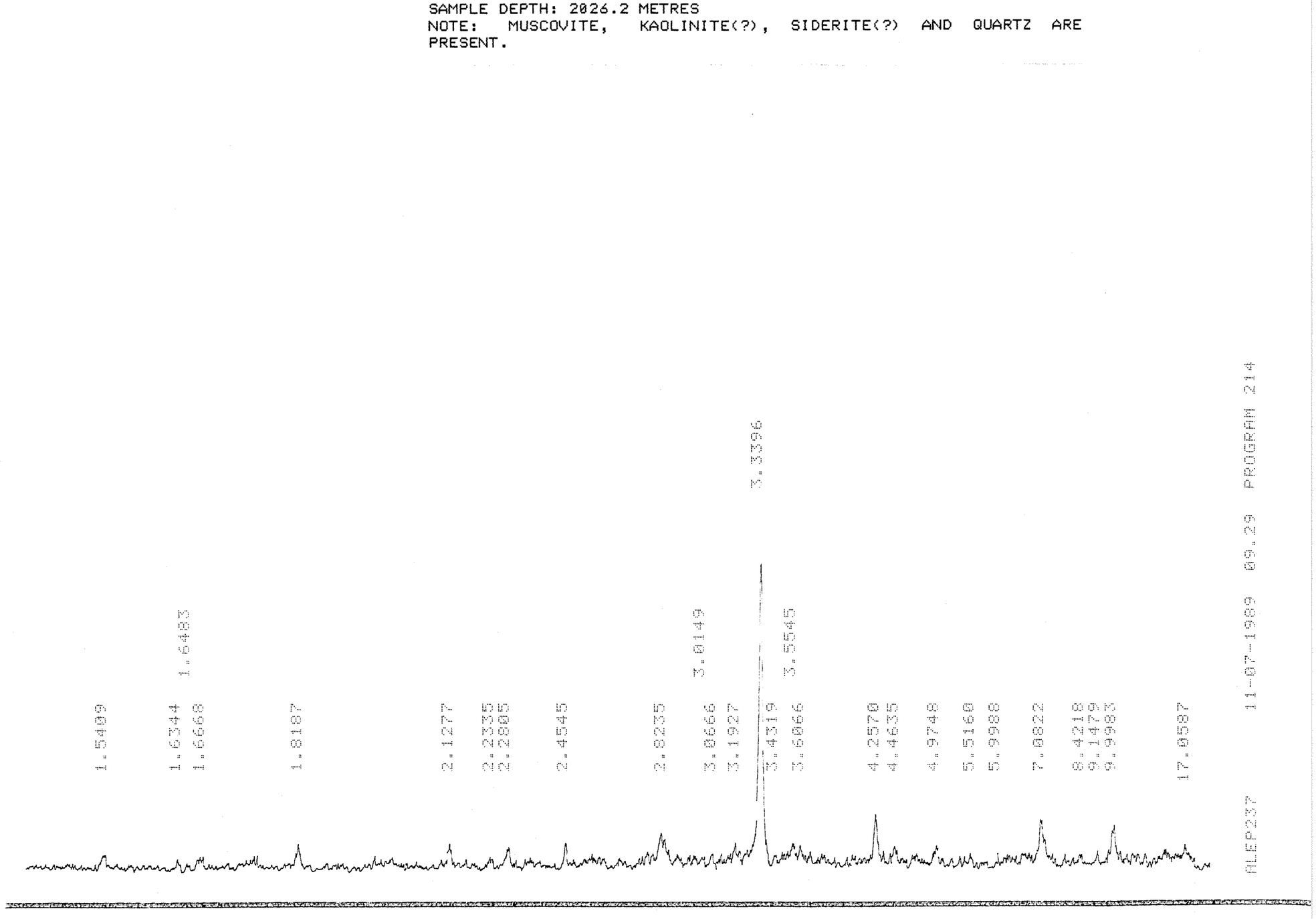
ROCK NAME (cements, miscellaneous transported constituents, clan designation): carbonate-cemented micaceous coal- and glauconite-bearing sandy (litharenitic) mudstone.

PETROGENESIS/ADDITIONAL INFORMATION: The occurrence of unaltered glauconite pellets suggests a marine origin, even though coal is present. Mechanical compaction was the major diagenetic event as evidenced by the high pseudomatrix content. The small particle size makes it difficult to assess the importance of secondary

porosity, but it appears to have been relatively insignificant.

The fractures in the thin section were undoubtedly formed during drying of the core.

X-RAY DIFFRACTION ANALYSIS
SAMPLE IDENTIFICATION: ALEP23-7
WELL NAME: ESSO PEX ALERK P-23-70-00-132-45
SAMPLE DEPTH: 2026.2 METRES
NOTE: MUSCOVITE, KAOLINITE(?), SIDERITE(?) AND QUARTZ ARE PRESENT.



HAND SPECIMEN/THIN SECTION MICROSCOPE DESCRIPTION: MACKENZIE DELTA-BEAUFORT SEA SUBSURFACE CONVENTIONAL DRILL CORE SAMPLES.

SAMPLE IDENTIFICATION: AlePZ3-N6
WELL NAME/DEPTH: Esso Pex Alerk P23-70-00-132-45/2027.20 m

INDURATION: poor, disaggregates spontaneously when placed in water.
COLOUR: light brown
SEDIMENTARY STRUCTURES: massive

GRAIN SIZE/COMPOSITION (VOLUMETRIC ESTIMATES):
Terrigenous Constituent %: 70

%gravel size: 0

%sand size: 40

%silt size: 22

%clay size: 8

Cement %: 5% microspar and spar.

Porosity %: 30

Modal Size: 0.10 mm.

Sorting: 16%/84% diameter ratio=
200 micrometres/ 80 micrometres = 2.5

Verbal Sorting Scale: moderately sorted

GRAIN SIZE NAME: silty sandstone

COMPOSITION: 5% siderite grains, 10% chlorite (grains and replacement), 20% monocrystalline quartz, 10% chert, 5% polycrystalline quartz, 15% phylloid clasts, 5% coaly grains, tr glauconite ? grains, and material too small to identify.

ROCK NAME (cements, miscellaneous transported constituents, clan designation): coaly, silty very fine grained litharenite

PETROGENESIS/ADDITIONAL INFORMATION: A textbook case of secondary porosity, showing evidence of partial dissolution, elongate pores, molds, inhomogeneity of packing, oversized pores and floating grains, elongate pores, corroded and honeycombed grains. Grains with intracrystalline porosity include phylloid clasts (especially chlorite-rich ones) and rare alkali feldspar. In addition, some of the lamellae of muscovite flakes have been dissolved. Carbonate (5%) is mainly replacing muscovite flakes. Chlorite (5%) is present in phylloid clasts and as a replacement of muscovite flakes and as discrete grains of unknown origin. Mechanical compaction subsequent to secondary porosity

development is minimal. The evidence suggests that dissolution of a former carbonate cement was responsible for the high degree of secondary porosity. The anomalously small amount of clay may also be a result of removal during the de-cementation event.

The subvertical fractures probably formed, given the poor induration, to drying of the core. The lime green concentrate was not properly removed, resulting in a few small patches. Toluene was added to the impregnating epoxy in an attempt to lower the viscosity of the epoxy and to increase the solubility of dye. However, this resulted in a cured epoxy which was very soluble in the lime green concentrate (which is also mainly toluene). This has resulted in excessive removal of epoxy between the grains. The unstained polished thin section is therefore of superior quality.

THIN SECTION MODAL AND GRAIN SIZE ANALYSIS

Sample I.D.: AlePZ3-N6

	No of Points	Percentage of Components	Percentages of Detrital Components
Detrital Components			
Monocrystalline Quartz	72	23.67	31.30
Polycrystalline Quartz	17	5.67	7.39
Clear Chert	20	6.67	8.70
Black Chert	4	1.33	1.74
Alkali Feldspar	21	7.00	9.13
Plagioclase	1	0.33	0.43
Phylloid Clasts	54	18.00	23.48
Volcanic Clasts	0	0.00	0.00
Chlorite	7	2.33	3.04
Mica	13	4.33	5.65
Siltstone Clasts	0	0.00	0.00
Coal	9	3.00	3.91
Unidentified (too small)	0	0.00	0.00
Other Clasts	12	4.00	5.22
Cements			
Kaolinite	1	0.33	
Carbonate	2	0.67	
Other	0	0.00	
Porosity			
Intergranular/ Moldic	63	21.00	

Intragranular	4	1.33

Plucked Grains = 11

Total number of points counted minus plucked grains= 311-11=300

GRAIN SIZE ANALYSIS

Sample I.D.: AlePZ3-N6

Class Interval (phi)	No. Freq of Max Apparent Grain Dimen-sion	Percentage Frequency	Cumulative Percentage Frequency
-1.5 to -2.0			
-1.0 to -1.5			
-0.5 to -1.0			
0.0 to -0.5			
0.5 to 0.0			
1.0 to 0.5			
1.5 to 1.0			
2.0 to 1.5	2	1.0	1.0
2.5 to 2.0	5	2.5	3.5
3.0 to 2.5	28	14.0	17.5
3.5 to 3.0	59	29.5	47.0
4.0 to 3.5	53	26.5	73.5
4.5 to 4.0	19	9.5	83.0
5.0 to 4.5	12	6.0	89.0
5.5 to 5.0	10	5.0	94.0
6.0 to 5.5	6	3.0	97.0
6.5 to 6.0	1	0.5	97.5
7.0 to 6.5	2	1.0	98.5
7.5 to 7.0	2	1.0	99.5

8.0 to 7.5	1	0.5	100.0
8.5 to 8.0	0	0.0	100.0

GRAPHIC GRAIN SIZE CUMULATIVE PERCENTILES IN PHI (MICROMETRE) UNITS OF SELECTED DETRITAL COMPONENTS

Sample I.D.: AlePZ3-N6

Percentiles	Phi Values	Micrometres
1	2.00	250
5	2.59	166
16	2.97	128
25	3.14	113
50	3.54	86
75	4.05	60
84	4.58	42
95	5.63	20

$$\text{Graphic Sorting (Inman)} = \frac{\text{Phi(84)} - \text{Phi(16)}}{2} = 0.805$$

Verbal Sorting Scale= moderately sorted

Total Number of Grains Measured=200

HAND SPECIMEN/THIN SECTION MICROSCOPE DESCRIPTION: MACKENZIE DELTA-BEAUFORT SEA SUBSURFACE CONVENTIONAL DRILL CORE SAMPLES.

SAMPLE IDENTIFICATION: AlePZ3-8
WELL NAME/DEPTH: Esso Pex Alerk P-23-70-00-132-45/2027.55 m.

INDURATION: very poor when dry, disaggregates by itself in about a minute after immersion in water.
COLOUR: medium brown.
SEDIMENTARY STRUCTURES: planar lamination/parting defined by thin laterally discontinuous carbonaceous films. Bioturbation is common as 0.5 mm diameter tubes filled mainly with finer grained mudstone, or rarely sandstone.

GRAIN SIZE/COMPOSITION (VOLUMETRIC ESTIMATES):
Terrigenous Constituent % (of the siltstone): 72

%gravel size: 0

%sand size: 5

%silt size: 57

%clay size: 10?

Cement %: 3% kaolinite(?), trace pyrite framboids (especially concentrated near and in carbonaceous films).

Porosity %: 25 (a porosity of 31.8% and a permeability of 306 millidarcies was measured for core plug 9, taken near the sample).

Modal Size: 0.04 mm.

Sorting: 16%/84% diameter ratio=
60 micrometres/ 2? micrometres = 30

Verbal Sorting Scale: very poorly sorted.

GRAIN SIZE NAME: siltstone, interlaminated with minor very fine to fine sandstone.

COMPOSITION (of the siltstone): 30% monocrystalline quartz grains, 1% polycrystalline quartz grains, 1% chert clasts, 1% alkali feldspar, 5% muscovite flakes (in part altered to chlorite, clays, or carbonate), at least 5% phylloid and siltstone clasts, 5% coaly grains and films, 3% clasts of brown microcrystalline carbonate, trace plagioclase (partly altered to clays). In addition, the sample is organic-rich, judging by the brown colour. Unidentified silt- and clay-sized material comprises the remainder.

ROCK NAME (cements, miscellaneous transported constituents, clan designation): micaceous/coaly litharenitic siltstone interlaminated with minor very fine- to fine-grained litharenite.

PETROGENESIS/ADDITIONAL INFORMATION: Mechanical compaction is the main diagenetic feature evident in the siltstone, owing to the small particle size. Secondary porosity is common, however in the sandy laminae, including sandstone-filled worm(?) tubes in the siltstone. Secondary porosity is present mainly as oversized and elongate pores though a few grain molds were also observed. It is of considerable interest that some of the bedding plane partings as well as subvertical fractures are lined with framboidal pyrite. It was earlier assumed that the subvertical fractures were formed during drying of the core during storage. The formation of subvertical fractures may be a very important diagenetic process. At least for this sample, the presence of subvertical fractures of probable late diagenetic origin is confirmed. The high subvertical fracture density may also exlain the relatively high measured permeability, assuming the lithologies of the core plug and the sample are similar.

HAND SPECIMEN/THIN SECTION MICROSCOPE DESCRIPTION: MACKENZIE DELTA-BEAUFORT SEA SUBSURFACE CONVENTIONAL DRILL CORE SAMPLES.

SAMPLE IDENTIFICATION: AleP23-11
WELL NAME/DEPTH: Esso Pex Alerk P-23-70-00-132-45/2028.4 m

INDURATION: poor when dry, disaggregates by itself a few minutes after immersion in water.
COLOUR: medium brown.
SEDIMENTARY STRUCTURES: planar laminae are defined by coal films and slight vertical grain size variations, minor bioturbation occurs as tubes 1 mm in diameter filled with sand-sized grains.

GRAIN SIZE/COMPOSITION (VOLUMETRIC ESTIMATES):
Terrigenous Constituent %: 80

%gravel size: 0

%sand size: 5% (but not uniformly distributed)

%silt size: 60

%clay size: 15

Cement %: trace pyrite framboids, trace carbonate?

Porosity %: 20 (a porosity of 29.5% and a permeability of 66 millidarcies was measured for core plug 13, taken near the sample). The permeability appears to be too high, suggesting that the lithology of the core plug was different from that of the sample taken.

Modal Size: 0.02 mm.

Sorting: 16%/84% diameter ratio=
60 micrometres/ 3? micrometres = 20

Verbal Sorting Scale: very poorly sorted.

GRAIN SIZE NAME: siltstone.

COMPOSITION: 25% monocrystalline quartz grains, trace polycrystalline quartz and chert grains, 5% muscovite flakes (in part replaced by carbonate and altered to chlorite and clays), at least 10% phylloid and siltstone clasts (in part compactionally deformed to pseudomatrix), 10% coal clasts (subequally divided as films and grains), 5% clasts of translucent brown microcrystalline carbonate (siderite?). Unidentified silt- and clay-sized material comprises the remainder.

ROCK NAME (cements, miscellaneous transported constituents, clan designation): coaly/micaceous glauconite-bearing litharenitic siltstone.

PETROGENESIS/ADDITIONAL INFORMATION: The main diagenetic event

was mechanical compaction. Secondary porosity, however, is well developed in the sandier parts, mainly as oversized and elongate pores but also as rare grain molds and leached phylloid clasts.

The thin section is of mediocre quality because of the high clay content. The surface was impregnated with clear cyanoacrylate prior to final lapping and polishing and the epoxy stain was not used.

HAND SPECIMEN/THIN SECTION MICROSCOPE DESCRIPTION: MACKENZIE DELTA-BEAUFORT SEA SUBSURFACE CONVENTIONAL DRILL CORE SAMPLES.

SAMPLE IDENTIFICATION: AleP23-N7
WELL NAME/DEPTH: Esso Pex Alerk P-23-70-00-132-45/2029.80 m

INDURATION: excellent
COLOUR: grey with yellowish-brown pyrite cement
SEDIMENTARY STRUCTURES: massive

GRAIN SIZE/COMPOSITION (VOLUMETRIC ESTIMATES):
Terrigenous Constituent %: 70

%gravel size: 25 (pebbles to 12 mm in size)

%sand size: 30

%silt size: 10

%clay size: 5

Cement %: 20 total: 15% pyrite as silt-sized crystals and 5% goethite?

Porosity %: 10

Modal Size: 0.5 mm.

Sorting: 16%/84% diameter ratio=
5000 micrometres/ 50 micrometres = 100

Verbal Sorting Scale: very poorly sorted

GRAIN SIZE NAME: conglomeratic muddy sandstone

COMPOSITION: 30% chert (some radiolarian) especially as pebbles, 10% polycrystalline quartz, 20% monocrystalline quartz, 5% phylloid and siltstone clasts, tr forams and calcareous algae, carbonaceous flakes and coal grains, chlorite, plagioclase, alkali feldspar and ?glauconite, 2% muscovite flakes, 5% detrital clays.

ROCK NAME (cements, miscellaneous transported constituents, clan designation): pyritic conglomeratic (cherty) and muddy litharenite.

PETROGENESIS/ADDITIONAL INFORMATION: The pebbles are well-rounded chert, suggesting that only the most resistant materials have remained. Pyrite cement as pore-lining, and to a lesser extent pore-filling is the most significant and unusual diagenetic feature. It is also present to a lesser extent filling the intragranular pores of phylloid and chert grains/pebbles. Some of the pyrite has altered to spherulitic microfibrous masses of goethite (5%) or a related mineral. There are excellent

examples of secondary porosity where the margins of grains under the pore-lining pyrite have dissolved. Also present are good examples of leached intragranular porosity (especially in phylloid clasts) and moldic porosity (defined by rims of fine-grained clays).

HAND SPECIMEN/THIN SECTION MICROSCOPE DESCRIPTION: MACKENZIE DELTA-BEAUFORT SEA SUBSURFACE CONVENTIONAL DRILL CORE SAMPLES.

SAMPLE IDENTIFICATION: AleP23-N8
WELL NAME/DEPTH: Esso Pex Alerk P-23-70-00-132-45/2031.48 m.

INDURATION: poor, disaggregates spontaneously in water
COLOUR: light brown
SEDIMENTARY STRUCTURES: vague planar lamination defined by laminae of higher clay content (a consequence of diagenesis).

GRAIN SIZE/COMPOSITION (VOLUMETRIC ESTIMATES):
Terrigenous Constituent %: 80

%gravel size: 0

%sand size: 35

%silt size: 25

%clay size: 20 (concentrated in laminae up to 3 mm thick)

Cement %: 5% chlorite

Porosity %: 20

Modal Size: 0.2 mm.

Sorting: 16%/84% diameter ratio=
300 micrometres/ 3 micrometres = 100

Verbal Sorting Scale: very poorly sorted

GRAIN SIZE NAME: sandy mudstone

COMPOSITION: 3% carbonaceous films, 2% coal grains, 15% mica (mainly muscovite), 20% monocrystalline quartz, 10% chert, 14% phylloid clasts, 1% glauconite pellets (now chlorite?), tr plagioclase. The remainder is unidentified silt and clay-sized material.

ROCK NAME (cements, miscellaneous transported constituents, clan designation): carbonaceous litharenitic mudstone.

PETROGENESIS/ADDITIONAL INFORMATION: The most significant diagenetic event was the development of considerable secondary porosity, especially by the removal of silt and clay matrix in some of the laminae. Most of the criteria of secondary porosity are clearly present in this thin section.

Toluene was added to the epoxy used to impregnate this sample. This made it very soluble in the fluorescent lime green concentrate used to stain the epoxy. In some areas the impregnating epoxy has been completely removed along with contained matrix. The unstained thin section was therefore used.

HAND SPECIMEN/THIN SECTION MICROSCOPE DESCRIPTION: MACKENZIE DELTA-BEAUFORT SEA SUBSURFACE CONVENTIONAL DRILL CORE SAMPLES.

SAMPLE IDENTIFICATION: AlePZ3-14
WELL NAME/DEPTH: Esso Pex Alerk P-23-70-00-132-45/2606.95 m.

INDURATION: poor when dry, a small chip disaggregates by itself in about 10 minutes after immersion in water.
COLOUR: light brown.
SEDIMENTARY STRUCTURES: vague planar lamination defined by coaly films and minor bioturbation. In addition, a small fault transects the sample.

GRAIN SIZE/COMPOSITION (VOLUMETRIC ESTIMATES):
Terrigenous Constituent %: 79

%gravel size: 0

%sand size: 44

%silt size: 20

%clay size: 15

Cement %: 1% sparry carbonate, trace pyrite framboids.

Porosity %: 20 (a porosit of 16.3% and a permeability of 5.6 millidarcies was measured for core plug 21, taken near the sample).

Modal Size: 0.08 mm.

Sorting: 16%/84% diameter ratio=
180 micrometres/ 5 micrometres = 36

Verbal Sorting Scale: very poorly sorted.

GRAIN SIZE NAME: muddy very fine sandstone.

COMPOSITION: 25% monocrystalline quartz grains, 1% polycrystalline quartz grains, 5% chert clasts, 3% alkali feldspar grains, 15% muscovite flakes (partly altered to chlorite and clays), at least 10% phylloid and siltstone clasts (largely as pseudomatrix), 1% chlorite flakes, 3% flakes and grains of coal, 3% clasts of translucent brown microcrystalline carbonate (siderite?), trace unaltered glauconite pellets, trace plagioclase and microcline grains. Unidentified clay- and silt-sized material comprises the remainder.

ROCK NAME (cements, miscellaneous transported constituents, clan designation): carbonate-cemented glauconite- and coal-bearing muddy very fine grained litharenite.

PETROGENESIS/ADDITIONAL INFORMATION: A marine origin is suggested by rare unaltered glauconite pellets, in spite of the presence of

coal. Mechanical compaction was the most important diagenetic event, as shown by mica, phylloid and other ductile grains, squeezed between the more competent quartzose grains. Secondary porosity is not important except in minor areas characterized by larger sand-sized grains. It accounts for about 3% porosity, mainly as oversized and elongate pores but also including rare intragranular porosity formed by leaching of chert grains. Relict rhomb-shaped molds at grain margins as well as relict sparry carbonate suggests that dissolution of carbonate-replaced material was the process of secondary porosity formation. A few pyrite framboids were observed in pores of secondary origin, suggesting a relatively late diagenetic time of formation.

The thin sections are of good quality but the epoxy stain was not used because of the potential problem of staining clay minerals.

HAND SPECIMEN/THIN SECTION MICROSCOPE DESCRIPTION: MACKENZIE DELTA-BEAUFORT SEA SUBSURFACE CONVENTIONAL DRILL CORE SAMPLES.

SAMPLE IDENTIFICATION: AleP23-15
WELL NAME/DEPTH: Esso Pex Alerk P-23-70-00-132-45/2607.45 m

INDURATION: moderate when dry, a small chip disaggregates by itself in about 5 minutes after immersion in water.
COLOUR: medium grey.
SEDIMENTARY STRUCTURES: planar laminated with excellent parting. The laminae are defined by carbonaceous films, flat-lying muscovite flakes and slight grain size differences.

GRAIN SIZE/COMPOSITION (VOLUMETRIC ESTIMATES):
Terrigenous Constituent %: 84

%gravel size: 0

%sand size: 1

%silt size: 52

%clay size: 30

Cement %: 2% sparry carbonate, trace pyrite framboids.

Porosity %: 15?

Modal Size: 0.015 mm.

Sorting: 16%/84% diameter ratio=
30 micrometres/ 3? micrometres = 10

Verbal Sorting Scale: poorly sorted.

GRAIN SIZE NAME: mudstone.

COMPOSITION: 15% monocrystalline quartz grains, trace chert and polycrystalline quartz grains, 20% muscovite flakes (in part replaced by carbonate), 1% clasts of brown translucent microcrystalline carbonate, at least 10% phylloid clasts (now largely pseudomatrix), 5% coal grains, trace unaltered glauconite pellets. Unidentified clay- and silt-sized material comprises the remainder.

ROCK NAME (cements, miscellaneous transported constituents, clan designation): carbonate-cemented coaly glauconite-bearing mudstone.

PETROGENESIS/ADDITIONAL INFORMATION: Unaltered glauconite pellets suggest a marine origin, in spite of the coal content. Mechanical compaction was the most obvious diagenetic process, as indicated by mica flakes and ductile phylloid clasts crushed and squeezed by adjacent competent grains. The small particle size makes the recognition of other diagenetic events, such as secondary

porosity formation difficult. A few subvertical fractures terminate at bedding plane partings but the time/depth of their formation is not apparent.

The surface of the thin section was impregnated with clear cyanoacrylate prior to final lapping and polishing because of excessive grain plucking.

HAND SPECIMEN/THIN SECTION MICROSCOPE DESCRIPTION: MACKENZIE DELTA-BEAUFORT SEA SUBSURFACE CONVENTIONAL DRILL CORE SAMPLES.

SAMPLE IDENTIFICATION: AlePZ3-N9
WELL NAME/DEPTH: Esso Pex Alerk P-23-70-00-132-45/2799.70 m

INDURATION: poor when dry, disaggregates immediately in water
COLOUR: light brown
SEDIMENTARY STRUCTURES: planar laminated

GRAIN SIZE/COMPOSITION (VOLUMETRIC ESTIMATES):
Siltstone is interlaminated with conglomerate. The 5 mm thick conglomerate laminae are composed almost entirely of chert (in part radiolarian) pebbles, with only minor polycrystalline quartz pebbles. The pebbles, which are up to 10 mm in size, are rounded to subrounded.

Terrigenous Constituent % of the mudstone lithology: 80

%gravel size: 0

%sand size: 0

%silt size: 60

%clay size: 20

Cement %: tr carbonate

Porosity %: 20

Modal Size: 0.10 mm.

Sorting (of siltstone laminae): 16%/84% diameter ratio=
15 micrometres/ 3 micrometres = 5

Verbal Sorting Scale (of predominant mudstone laminae): poorly sorted

GRAIN SIZE NAME: interlaminated muddy conglomerate and siltstone.

COMPOSITION (of siltstone laminae): at least 10% monocrystalline silt-sized quartz, 5% carbonaceous film and grains, 20% muscovite flakes, 15% phylloid clasts, 2% translucent brownish-red ?resinous material, tr ?glauconite pellets, zircon, spar-sized carbonate grains, 28% unidentifiable phylloid clasts, silt and clay-sized material.

ROCK NAME (cements, miscellaneous transported constituents, clan designation): interlaminated chert pebble conglomerate and carbonaceous/micaceous litharenitic siltstone.

PETROGENESIS/ADDITIONAL INFORMATION: In addition to mechanical compaction, the replacement of 10% of the muscovite flakes by microspar-sized carbonate (calcite?) was the most important

diagenetic process. Rhombic crystal molds of sparry carbonate in chert pebbles attests to carbonate decementation but it is not clear if this occurred after deposition because only a few of the chert pebbles are affected in this manner.

Most of the fracture porosity was probably produced by drying of the core. The 20% porosity estimate made from a fracture surface is similar to that obtained from the thin section stained with the lime green concentrate. An excessive amount of the epoxy impregnant was removed, however, because toluene was added to the epoxy in this sample, which made it more soluble to the lime green concentrate (which also contains toluene). The unstained thin section, however, shows very little porosity, owing to the fine grain size and the low concentration of blue dye in the epoxy.

HAND SPECIMEN/THIN SECTION MICROSCOPE DESCRIPTION: MACKENZIE DELTA-BEAUFORT SEA SUBSURFACE CONVENTIONAL DRILL CORE SAMPLES.

SAMPLE IDENTIFICATION: AleP23-N10
WELL NAME/DEPTH: Esso Pex Alerk P-23-70-00-132-45/2810.00 m

INDURATION: ? sample already impregnated
COLOUR: -
SEDIMENTARY STRUCTURES: massive

GRAIN SIZE/COMPOSITION (VOLUMETRIC ESTIMATES):
Terrigenous Constituent %: 75

%gravel size: 20

%sand size: 45

%silt size: 5

%clay size: 5

Cement %: tr carbonate

Porosity %: 25

Modal Size: 0.40 mm.

Sorting: 16%/84% diameter ratio=
1500 micrometres/ 150 micrometres = 10

Verbal Sorting Scale: poorly sorted

GRAIN SIZE NAME: conglomeratic muddy sandstone

COMPOSITION: 15% monocrystalline quartz, 10% polycrystalline quartz (in part replaced by carbonate), 35% chert (especially sand and pebble-sized), 10% phylloid clasts, 5% muscovite flakes (most of which have been replaced by carbonate), tr glauconite pellets, plagioclase, alkali feldspar and sphene grains.

ROCK NAME (cements, miscellaneous transported constituents, clan designation): muddy conglomeratic (chert pebble) chert litharenite.

PETROGENESIS/ADDITIONAL INFORMATION: Mechanical compaction has resulted in considerable deformation of soft phylloid grains. This reduction in porosity has, however been more than compensated for by the later development of secondary porosity. In addition to mechanical compaction, pressure solution is common between chert and quartz grains. The extensively developed secondary porosity (about 15%) is evidenced by oversized pores, elongate pores (about 10%), corroded grains (some with carbonate rhomb molds), honeycombed grains of alkali and plagioclase feldspar (minor) and molds (also of minor importance).

Intragranular porosity (5%) is common in chert and phylloid clasts. Quartz overgrowths are poorly to well developed on monocrystalline quartz grains. Elongate pores around squeezed phylloid clasts suggest that most of the secondary porosity post-dates mechanical compaction.

The stained thin section appears to have a high proportion of plucked grains but this is a consequence of dissolution of the epoxy by the fluorescent lime green concentrate. Addition of toluene to the epoxy in this sample made it extremely soluble in the staining solution. In the unstained thin section grain plucking was reduced by surface impregnating with clear cyanoacrylate when the section was 0.1 mm thick.