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

SAMPLE IDENTIFICATION: KigA43-N1
WELL NAME/DEPTH: Gulf et al. Kiggavik
A-43-70-00-135-45/2113.85 m

INDURATION: moderate either dry or immersed in water.
COLOUR: light brown with dark grey grains.
SEDIMENTARY STRUCTURES: vague planar laminae are defined by concentrations of coal grains and carbonaceous films, a 1 cm sized mudstone intraclast is present in the sample.

GRAIN SIZE/COMPOSITION (VOLUMETRIC ESTIMATES):
Terrigenous Constituent %: 71

%gravel size: 1

%sand size: 53

%silt size: 15

%clay size: 2?

Cement %: 3% pore-lining kaolinite, 1% quartz overgrowths, trace sparry calcite cement, trace framboidal pyrite.

Porosity %: 25

Modal Size: 0.12 mm.

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

Verbal Sorting Scale: moderately sorted.

GRAIN SIZE NAME: silty very fine sandstone.

COMPOSITION: 15% monocrystalline qauartz grains, 3% polycrystalline quartz grains, 15% chert clasts, 30% phylloid and siltstone clasts, 2% alkali feldspar grains, 2% carbonaceous films and coal grains, 1% muscovite flakes, trace plagioclase grains, trace high birefringent high relief minerals.

ROCK NAME (cements, miscellaneous transported constituents, clan designation): kaolinite and quartz cemented silty coal-bearing very fine grained litharenite.

PETROGENESIS/ADDITIONAL INFORMATION: The porosity distribution is approximately as follows; at least 3% is moldic, 17% is intergranular and 5% is intragranular. About half of the intergranular porosity comprises elongate and oversized pores of secondary origin. Intragranular porosity is best developed in phylloid and chert grains. Relict sparry calcite cement replacing grain boundaries as well as rhomb-shaped molds both within grains

(especially the chert and phylloid clasts) suggests that decementation of carbonate (which had both cemented and in part replaced framework grains and matrix) was responsible for the high porosity. Honeycombed alkali feldspar grains are also present. Other diagenetic events include the alteration of muscovite (as flakes and in phylloid clasts) to chlorite, clays and carbonate. The kaolinite and quartz line secondary pores which suggests their formation relatively late in the diagenetic sequence. Compaction after decementation was negligible because the elongate and oversized pores are well preserved. Only a few ductile grains have been compactionally forced into the rhomb-shaped corrosion molds of adjacent competent grains.

THIN SECTION MODAL AND GRAIN SIZE ANALYSIS

Sample I.D.: KigA43-N1

	No of Points	Percentage of Components	Percentages of Detrital Components
Detrital Components			
Monocrystalline Quartz	90	30.00	37.82
Polycrystalline Quartz	20	6.67	8.40
Clear Chert	46	15.33	19.33
Black Chert	9	3.00	3.78
Alkali Feldspar	20	6.67	8.40
Plagioclase	0	0.00	0.00
Phylloid Clasts	37	12.33	15.55
Volcanic Clasts	2	0.67	0.84
Chlorite	1	0.33	0.42
Mica	7	2.33	2.94
Siltstone Clasts	1	0.33	0.42
Coal	1	0.33	0.42
Unidentified (too small)	0	0.00	0.00
Other Clasts	4	1.33	1.68
Cements			
Kaolinite	0	0.00	
Carbonate	4	1.33	
Other	4	1.33	
Porosity			
Intergranular/ Moldic	54	18.00	

Intragranular	0	0.00

Plucked Grains=2

Total number of points counted minus plucked grains= 300

GRAIN SIZE ANALYSIS

Sample I.D.: KigA43-N1

Class Interval (phi)	No. Freq of Max Apparent Grain Dimen-sion	Percentage Frequency	Cumulative Percentage Frequency
2.0 to 1.5	4	2.0	2.0
2.5 to 2.0	25	12.5	14.5
3.0 to 2.5	57	28.5	43.0
3.5 to 3.0	49	24.5	67.5
4.0 to 3.5	29	14.5	82.0
4.5 to 4.0	22	11.0	93.0
5.0 to 4.5	8	4.0	97.0
5.5 to 5.0	4	2.0	99.0
6.0 to 5.5	1	0.5	99.5
6.5 to 6.0	0	0.0	99.5
7.0 to 6.5	0	0.0	99.5
7.5 to 7.0	0	0.0	99.5
8.0 to 7.5	0	0.0	99.5
8.5 to 8.0	1	0.5	100.0

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

Sample I.D.: KigA43-N1

Percentiles	Phi Values	Micrometres
1	-	-

5	2.21	216
16	2.54	172
25	2.73	151
50	3.13	114 (very fine sand size)
75	3.73	75
84	4.08	59
95	4.72	38

$$\text{Graphic Sorting (Inman)} = \frac{\text{Phi(84)} - \text{Phi(16)}}{2} = 0.77$$

Verbal Sorting Scale= moderately sorted

Total Number of Grains Measured=200

Note: Kaolinite cement was not detected by thin section modal analysis, though it is visible in a sample fracture surface. In addition, a lower proportion of phylloid/siltstone and alkali feldspar clasts was determined by modal analysis than was estimated qualitatively.

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

SAMPLE IDENTIFICATION: KigA43-N2
WELL NAME/DEPTH: Gulf et al. Kiggavik
A-43-70-00-135-45/2113.96 m.

INDURATION: poor when dry, disaggregates by itself a few minutes after immersion in water.
COLOUR: light brown with dark grey grains.
SEDIMENTARY STRUCTURES: low-angle cross-laminae (the thin sections contain a cross-laminated unit (a set) about 1 cm thick).

GRAIN SIZE/COMPOSITION (VOLUMETRIC ESTIMATES):
Terrigenous Constituent %: 65

%gravel size: 0

%sand size: 47

%silt size: 15

%clay size: 3?

Cement %: 2% pore-lining kaolinite, 1% quartz overgrowths, 2% sparry carbonate, tr pyrite framboids.

Porosity %: 30

Modal Size: 0.13 mm.

Sorting: 16%/84% diameter ratio=
250 micrometres/ 70 micrometres = 3.6

Verbal Sorting Scale: moderately sorted.

GRAIN SIZE NAME: silty fine sandstone.

COMPOSITION: 20% monocrystalline quartz, 3% polycrystalline quartz, 15% chert, 15% phylloid and siltstone clasts, 1% alkali feldspar, 2% muscovite flakes (partly altered to chlorite or clays), 1% chlorite flakes (altered muscovite?), 2% clasts of brown microspar-sized carbonate (probably siderite), 3% coal clasts and carbonaceous films, trace plagioclase, trace volcanic rock fragments, trace microcline, trace glauconite pellets, trace high birefringence/high relief minerals.

ROCK NAME (cements, miscellaneous transported constituents, clan designation): kaolinite/quartz/carbonate-cemented coal-bearing silty fine grained litharenite.

PETROGENESIS/ADDITIONAL INFORMATION: The distribution of porosity is approximately as follows; 3% is moldic, 3% is within grains and 24% is between grains. Intragranular porosity occurs mainly

in the clay-rich phylloid clasts and is difficult to estimate because of the minute pore size. The estimate is therefore a minimum. The porosity between grains (about half of which is secondary in origin) occurs mainly as oversized and elongate pores. The rhomb-shaped dissolution molds within grains and at grain margins as well as the relict sparry carbonate cement provide overwhelming evidence that the secondary porosity was formed by decementation of carbonate occuring as cement and as grain or partial grain replacements. Other petrographic criteria for secondary porosity development such as floating and corroded grains and inhomogeneity of packing are also present. Compaction after the development of secondary porosity was minor because the elongate pores are preserved and very few ductile grains have been compactionally forced to fill the rhomb-shaped corrosion molds along the grain margins of adjacent competent grains. The kaolinite and quartz cements line secondary pores and therefore postdate the decementation event. The alteration of muscovite (as flakes and in phylloid clasts such as quartz-muscovite schist) to chlorite, carbonate or clays was another important diagenetic process but one that is difficult to fit into the sequence.

The quality of the polished thin sections is good except that in places the blue dye has discoloured to pink.

THIN SECTION MODAL AND GRAIN SIZE ANALYSIS

Sample I.D.: KigA43-N2

	No of Points	Percentage of Components	Percentages of Detrital Components
Detrital Components			
Monocrystalline Quartz	76	25.33	29.80
Polycrystalline Quartz	30	10.00	11.76
Clear Chert	47	15.67	18.43
Black Chert	8	2.67	3.14
Alkali Feldspar	11	3.67	4.31
Plagioclase	1	0.33	0.39
Phylloid Clasts	56	18.67	21.96
Volcanic Clasts	1	0.33	0.39
Chlorite	7	2.33	2.75
Mica	7	2.33	2.75
Siltstone Clasts	2	0.67	0.78
Coal	2	0.67	0.78
Unidentified (too small)	0	0.00	0.00
Other Clasts	7	2.33	2.75
Cements			
Kaolinite	0	0.00	
Carbonate	3	1.00	
Other	2	0.67	
Porosity			
Intergranular/ Moldic	39	13.00	

Intragranular	1	0.33

Plucked Grains=0

Total number of points counted minus plucked grains= 300

GRAIN SIZE ANALYSIS

Sample I.D.: KigA43-N2

Class Interval (phi)	No. Freq of Max Apparent Grain Dimension	Percentage Frequency	Cumulative Percentage Frequency
1.5 to 1.0	2	1.0	1.0
2.0 to 1.5	4	2.0	3.0
2.5 to 2.0	34	17.0	20.0
3.0 to 2.5	62	31.0	51.0
3.5 to 3.0	35	17.5	68.5
4.0 to 3.5	38	19.0	87.5
4.5 to 4.0	10	5.0	92.5
5.0 to 4.5	7	3.5	96.0
5.5 to 5.0	5	2.5	98.5
6.0 to 5.5	3	1.5	100.0

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

Sample I.D.: KigA43-N2

Percentiles	Phi Values	Micrometres
1	1.50	354
5	2.11	232
16	2.43	186
25	2.60	165
50	2.98	127 (fine sand size)

75	3.64	80
84	3.89	67
95	4.84	14

$$\text{Graphic Sorting (Inman)} = \frac{\text{Phi}(84) - \text{Phi}(16)}{2} = 0.73$$

Verbal Sorting Scale= moderately sorted

Total Number of Grains Measured=200

Note: Kaolinite cement was not detected in thin section but was observed from a sample fracture surface. Comparison with the qualitative description shows only relatively minor differences.

ELECTRON MICROPROBE CARBONATE ANALYSES

SAMPLE I.D.: KigA43-N2.
WELL NAME/DEPTH (M): Kiggavik A43/2113.96.
LEGEND FOR ANALYZED MATERIAL (COLUMN HEADINGS): C1a.1 and C3b.1 are analyses in different areas of carbonate cement midway between framework grains. C1b.1 and C3a.1 are analyses in different areas of carbonate cement near the boundaries of framework grains.

	C1A.1	C1B.1	C3A.1	C3B.1
OXIDE WEIGHT PERCENT				
MGO	1.67	1.13	.96	.79
FEO	2.22	2.14	2.01	2.07
MNO	.49	.43	.41	.32
CAO	49.21	48.65	51.30	49.26
TOTAL	53.59	52.35	54.68	52.44
ATOMIC PROPORTIONS (FORMULA ON THE BASIS 2 OXYGENS)				
MG	.086	.060	.049	.042
FE	.065	.064	.058	.062
MN	.014	.013	.012	.010
CA	1.835	1.863	1.882	1.886
TOTAL	2.000	2.000	2.001	2.000

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

SAMPLE IDENTIFICATION: KigA43-N3
WELL NAME/DEPTH: Gulfet al. Kiggavik
A-43-70-00-135-45/2114.90 m

INDURATION: moderate when dry, disaggregates by itself one hour after immersion in water.
COLOUR: light brown.
SEDIMENTARY STRUCTURES: planar laminae are defined by carbonaceous films.

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

%gravel size: 0

%sand size: 56

%silt size: 10

%clay size: 4?

Cement %: 3% pore-lining kaolinite, 1% quartz overgrowths, 1% calcite, tr pore-lining pyrite framboids.

Porosity %: 25

Modal Size: 0.15 mm.

Sorting: 16%/84% diameter ratio=
250 micrometres/ 70 micrometres = 3.6

Verbal Sorting Scale: moderately sorted.

GRAIN SIZE NAME: silty fine sandstone.

COMPOSITION: 20% monocrystalline quartz grains, 5% polycrystalline quartz grains, 15% chert, 18% phylloid and siltstone clasts, 2% clasts of brown microcrystalline carbonate (probably siderite), 2% carbonate (mainly as grain replacement), 2% alkali feldspar, 2% muscovite flakes (partly altered to chlorite, carbonate and clays), 2% carbonaceous films, trace volcanic rock fragments, trace unaltered glauconite pellets, trace microcline. Unidentified silt and clay-sized material comprises the remainder.

ROCK NAME (cements, miscellaneous transported constituents, clan designation): Kaolinite/quartz/carbonate-cemented glauconite- and carbonaceous silty fine grained litharenite.

PETROGENESIS/ADDITIONAL INFORMATION: The porosity distribution is approximately as follows; 5% is moldic, 5% (at least) is within grains and 15% is between grains. Secondary porosity accounts for

at least half of the total rock porosity. The intragranular porosity occurs mainly in the phylloid, chert and polycrystalline quartz clasts where rhomb-shaped carbonate dissolution molds provide clear evidence for previous replacement by carbonate. Trace quantities of honeycombed alkali feldspar are also present. Most of the secondary porosity, however occurs between grains as elongate and oversized pores. Rhomb-shaped partial molds at grain margins as well as relict calcite suggest that carbonate was much more common previously. The margins of competent grains are not corroded along the contacts with squeezed ductile grains in about two thirds of the cases. This suggests that most of the mechanical compaction occurred before carbonate cementation. Pore throats, enlarged during decementation ensure a high permeability. The kaolinite and pyrite framboids and probably the the quartz overgrowths as well line secondary pores and therefore postdate the carbonate decementation.

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

SAMPLE IDENTIFICATION: KoaO22-N2
WELL NAME/DEPTH: Dome Hunt Gulf Koakoak
O-22-70-30-134-00/3491.75 m

INDURATION: very poor either dry or immersed in water.
COLOUR: medium brown with scattered dark grey grains.
SEDIMENTARY STRUCTURES: vague planar lamination is defined by grain size variation (there is a 5 mm thick muddy unit).

GRAIN SIZE/COMPOSITION (VOLUMETRIC ESTIMATES):
Terrigenous Constituent %: 64 (excludes the mud-rich lamina).

%gravel size: 0

%sand size: 52

%silt size: 10

%clay size: 2?

Cement %: 1% pore-lining kaolinite, tr quartz overgrowths, trace pyrite framboids, trace carbonate cement.

Porosity %: 35 (a porosity of 29.2% and a permeability of 611 millidarcies was measured for core plug 3 taken near the sample).

Modal Size: 0.15 mm.

Sorting: 16%/84% diameter ratio=
250 micrometres/ 100 micrometres = 2.5

Verbal Sorting Scale: moderately sorted.

GRAIN SIZE NAME: silty fine sandstone.

COMPOSITION: (excluding the muddy lamina): 15% monocrystalline quartz grains, 5% polycrystalline quartz grains, 20% chert grains, 10% phylloid and siltstone clasts, 5% alkali feldspar grains, 2% muscovite flakes (in part altered to chlorite or clays), 3% coal grains and carbonaceous films, trace plagioclase (partly altered to clays), trace volcanic rock fragments, trace microcline, trace high-relief/high birefringence heavy minerals, trace unaltered glauconite pellets, 1% clasts composed of brown microspar-sized carbonate (siderite?).

ROCK NAME (cements, miscellaneous transported constituents, clan designation): kaolinite/quartz/carbonate cemented carbonaceous and glauconitic silty fine grained litharenite.

PETROGENESIS/ADDITIONAL INFORMATION: The distribution of porosity is approximately as follows; 5% is moldic, 5% (at least) is within grains, and 20% is between grains. At least half of this

porosity is of secondary origin, mostly as oversized and elongate intergranular pores. Other petrographic criteria for secondary porosity, such as floating grains, corroded grain margins, and honeycombed grains are also present. The rhomb-shaped molds in chert and phylloid clasts, the relict sparry carbonate cement between grains and rhomb-shaped molds at grain boundaries provide ample evidence for the former presence of carbonate cement. Decementation of this carbonate is undoubtedly the cause for the high porosity. Rhomb-shaped molds at grain boundaries of competent grains in the mud-rich lamina, but which are surrounded by mud-sized particles rather than porosity suggest that the secondary porosity formed at relatively shallow depths. Inhomogeneity of packing is especially evident in the vicinity of and within the mud-rich lamina. Another diagenetic event of importance was the alteration of muscovite (as flakes and in phylloid clasts) to chlorite and/or clays. The kaolinite, quartz and pyrite cements line secondary pores, suggesting that they formed relatively late in the diagenetic sequence.

Excessive grain plucking occurred in the mud-rich lamina and in addition, surface relief is excessive. Surface impregnation of the thin section with clear cyanoacrylate prior to final lapping minimized subsequent grain plucking. Some of the fluorescent lime green concentrate was added to the epoxy impregnating medium which probably lowered the strength of the grain to epoxy bond and contributed to these problems.

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

SAMPLE IDENTIFICATION: Koa022-N3
WELL NAME/DEPTH: Dome Hunt Gulf Koakoak
O-22-70-30-134-00/3492.67 m
INDURATION: poor either wet or immersed in water.
COLOUR: light brown with dark grey grains.
SEDIMENTARY STRUCTURES: vague planar lamination defined by carbonaceous films.

GRAIN SIZE/COMPOSITION (VOLUMETRIC ESTIMATES):
Terrigenous Constituent %: 67

%gravel size: 0

%sand size: 54

%silt size: 10

%clay size: 3?

Cement %: 1% pore-lining kaolinite, 1% quartz overgrowths, 1% sparry carbonate cement, trace pyrite framboids.

Porosity %: 30 (a porosity of 30.1% and a permeability of 956 millidarcies was obtained for core plug 6, taken near the sample).

Modal Size: 0.15 mm.

Sorting: 16%/84% diameter ratio=
200 micrometres/ 70 micrometres = 2.9

Verbal Sorting Scale: moderately sorted

GRAIN SIZE NAME: silty fine sandstone.

COMPOSITION: 15% monocrystalline quartz grains, 5% polycrystalline quartz grains, 15% chert grains, 1% alkali feldspar, 2% muscovite flakes (in part altered to chlorite and clays), 20% phylloid and siltstone clasts, 3% coal clasts and carbonaceous films, trace microcline, trace plagioclase. The remainder is unidentified silt and clay-sized material.

ROCK NAME (cements, miscellaneous transported constituents, clan designation): Kaolinite/quartz/carbonate-cemented carbonaceous silty fine-grained litharenite.

PETROGENESIS/ADDITIONAL INFORMATION: The porosity distribution is approximately as follows; 5% is moldic, 5% is within grains, and 20% is between grains. The intragranular microporosity occurs mainly in phylloid and chert clasts and is partly secondary in origin, as revealed by rhomb-shaped carbonate dissolution molds. Honeycombed alkali feldspar grains are also present but their

contribution to porosity is negligible. At least half of the intergranular porosity is of secondary origin, and occurs mainly as elongate and oversized pores. Inhomogeneity of packing is especially apparent in this section. Relict carbonate cement and rhomb-shaped molds at grain margins suggest that carbonate cement was at one time much more abundant. The removal of this carbonate (including partially replaced grains and matrix) was undoubtedly responsible for the high secondary porosity. Judging by the nature of the grain contacts between competent and ductile grains, a moderate depth of burial was reached prior to carbonate cementation. Compaction after decementation was moderate, because the elongate and oversized pores are preserved and few ductile grains have been compactionally forced against the corroded margins of adjacent competent grains. The kaolinite, quartz and pyrite framboids line secondary pores and were therefore precipitated after decementation.

The quality of the thin sections is poor, probably because some of the fluorescent lime green concentrate (which contains toluene) was added to the epoxy impregnating medium. Although the solubility of the dyes was enhanced, grain fracturing during preparation and grain plucking is also higher. Prior to final thinning, the thin sections were surface impregnated with clear cyanoacrylate, which helped to prevent grain plucking. Further, too much of the epoxy was dissolved in the section stained with the lime green concentrate.

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

SAMPLE IDENTIFICATION: KoaO22-N4
WELL NAME/DEPTH: Dome Hunt Gulf KoaKoak
O-22-70-30-134-00/3493.30 m

INDURATION: poor either when dry or immersed in water.
COLOUR: medium brown with dark grey grains.
SEDIMENTARY STRUCTURES: soft sediment deformation and bioturbation.

GRAIN SIZE/COMPOSITION (VOLUMETRIC ESTIMATES):
Terrigenous Constituent %: 71

%gravel size: 0

%sand size: 52

%silt size: 15

%clay size: 4?

Cement %: 2% pore-lining kaolinite, 1% quartz overgrowths, 1% sparry carbonate cement.

Porosity %: 25 (the sample is part of core plug #9, fow which a porosity of 28.8% and a permeability of 162 millidarcies was measured). The porosity is much higher in the sandy parts of the sample.

Modal Size: 0.15 mm.

Sorting: 16%/84% diameter ratio=
250 micrometres/ 50 micrometres = 5

Verbal Sorting Scale: poorly sorted.

GRAIN SIZE NAME: silty fine sandstone.

COMPOSITION: (excluding the mud-rich lamina); 15% monocrystalline quartz grains, 3% polycrystalline quartz grains, 15% chert, 2% muscovite flakes (in part altered to chlorite and clays), 2% alkali feldspar, 20% phylloid and siltstone clasts, 3% chlorite, 5% coal grains and carbonaceous films, trace plagioclase clasts, trace unaltered glauconite pellets (also occur in the mudstone lamina). Unidentified silt and clay-sized material comprises the remainder.

ROCK NAME (cements, miscellaneous transported constituents, clan designation): kaolinite/quartz/carbonate-cemented carbonaceous and glauconitic silty fine-grained litharenite.

PETROGENESIS/ADDITIONAL INFORMATION: The porosity distribution is approximately as follows; 5% is moldic, 3% (at least) is

intragranular, and 17% is intergranular. The intragranular microporosity occurs mainly in the phylloid and chert clasts but rhomb-shaped molds are absent. Elongate and oversized pores of secondary origin account for about half of the intergranular porosity. Secondary porosity is much less common in the mudstone lamina. Relict carbonate occurs as cement and replaces some grain margins. These relationships, together with the oversized and elongate pores provide evidence for secondary porosity development by the dissolution of carbonate and carbonate-replaced grains. Subsequent compaction is apparent from ductile grains that have been squeezed into the corroded margins of adjacent competent grains. A reduction of about 3% in porosity is estimated to have occurred after decementation but this could be grossly in error.

The blue dye in the epoxy is partly discoloured to pink in part of the thin sections, perhaps because of overheating during curing. Otherwise, the sections are of reasonable quality.

ELECTRON MICROPROBE CARBONATE ANALYSES

SAMPLE I.D.: KoaO22-N4.
WELL NAME/DEPTH (M): KoakoaK O-22/3493.30 m.
LEGEND FOR ANALYZED MATERIAL (COLUMN HEADINGS): C1a.1 and C2a.1 are analyses in different areas of carbonate cement midway between framework grains. C1b.1 is an analysis of carbonate cement near the edge of a framework grain.

	C1A.1	C1B.1	C2A.1
OXIDE WEIGHT PERCENT			
MGO	19.99	20.12	21.21
FEO	1.40	1.80	.20
MNO	.06	.19	.14
CAO	32.37	30.25	31.16
TOTAL	53.82	52.36	52.71

ATOMIC PROPORTIONS (FORMULA ON THE BASIS 2 OXYGENS)

MG	.907	.936	.968
FE	.036	.047	.005
MN	.002	.005	.004
CA	1.056	1.012	1.023
TOTAL	2.001	2.000	2.000

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

SAMPLE IDENTIFICATION: KoaO22-N5
WELL NAME/DEPTH: Dome Hunt Gulf KoaKoak
O-22-70-30-134-00/3493.65 m

INDURATION: poor, either when dry or immersed in water.
COLOUR: medium brown with dark grey grains.
SEDIMENTARY STRUCTURES: massive.

GRAIN SIZE/COMPOSITION (VOLUMETRIC ESTIMATES):
Terrigenous Constituent %: 77

%gravel size: 0

%sand size: 63

%silt size: 10

%clay size: 4?

Cement %: 2% pore-lining kaolinite, 1% quartz overgrowths, trace pyrite framboids.

Porosity %: 30 (a porosity of 29.8% and a permeability of 1080 millidarcies was measured for core plug 12, taken near the sample).

Modal Size: 0.20 mm.

Sorting: 16%/84% diameter ratio=
250 micrometres/ 70 micrometres = 3.1

Verbal Sorting Scale: moderately sorted.

GRAIN SIZE NAME: silty fine sandstone.

COMPOSITION: 25% monocrystalline quartz, 5% polycrystalline quartz, 15% chert, 15% phylloid and siltstone clasts, 1% microcline, 1% plagiocalse (in part altered to clays), 1% alkali feldspar, trace clasts of microcrystalline siderite, trace clasts of sparry carbonate, trace unaltered glauconite pellets, trace muscovite flakes, trace coal clasts, trace high-birefringent/high relief heavy minerals. The remainder is unidentified silt and clay-sized material.

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

PETROGENESIS/ADDITIONAL INFORMATION: The porosity distribution is approximately as follows; 5% is moldic, 5% is within grains and 20% is between grains. The intragranular porosity occurs mainly in the phylloid and chert grains although honeycombed alkali

feldspar is also present in trace amounts. About two-thirds of the intergranular porosity is secondary in origin, mainly occurring as elongate and oversized pores. Though carbonate cement is absent from the sample, rhomb-shaped molds both within grains and at grain margins provide evidence of its former presence. Compaction after carbonate dissolution was minimal because only a few ductile grains were compactionally squeezed into the rhomb-shaped molds and corroded grain boundaries of adjacent competent grains. The kaolinite and quartz cements line the enlarged pores, a relation which without doubt requires that they formed after carbonate dissolution. The high permeability of the sample is related in part to the enlarged pore throats of the oversized and elongate pores.

The polished thin sections are of good quality except that the fluorescent lime green concentrate did not stain the epoxy, probably due to overheating during curing.

THIN SECTION MODAL AND GRAIN SIZE ANALYSIS

Sample I.D.: Koa022-N5

	No of Points	Percentage of Components	Percentages of Detrital Components
Detrital Components			
Monocrystalline Quartz	98	32.67	43.56
Polycrystalline Quartz	19	6.33	8.44
Clear Chert	43	14.33	19.11
Black Chert	5	1.67	2.22
Alkali Feldspar	16	5.33	7.11
Plagioclase	2	0.67	0.89
Phylloid Clasts	32	10.67	14.22
Volcanic Clasts	1	0.33	0.44
Chlorite	2	0.67	0.89
Mica	4	1.33	1.78
Siltstone Clasts	2	0.67	0.89
Coal	0	0.00	0.00
Unidentified (too small)	0	0.00	0.00
Other Clasts	1	0.33	0.44
Cements			
Kaolinite	0	0.00	
Carbonate	0	0.00	
Other	0	0.00	
Porosity			
Intergranular/ Moldic	71	23.67	

Intragranular	4	1.33

Plucked Grains=2

Total number of points counted minus plucked grains= 300

GRAIN SIZE ANALYSIS

Sample I.D.: KoaO22-N5

Class Interval (phi)	No. Freq of Max Apparent Grain Dimen-sion	Percentage Frequency	Cumulative Percentage Frequency
1.0 to 0.5	2	1.0	1.0
1.5 to 1.0	3	1.5	2.5
2.0 to 1.5	43	21.5	24.0
2.5 to 2.0	72	36.0	60.0
3.0 to 2.5	41	20.5	80.5
3.5 to 3.0	14	7.0	87.5
4.0 to 3.5	13	6.5	94.0
4.5 to 4.0	4	2.0	96.0
5.0 to 4.5	3	1.5	97.5
5.5 to 5.0	1	0.5	98.0
6.0 to 5.5	2	1.0	99.0
6.5 to 6.0	0	0.0	99.0
7.0 to 6.5	2	1.0	100.0

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

Sample I.D.: KoaO22-N5

Percentiles	Phi Values	Micrometres
1	1.00	500
5	1.62	325

16	1.88	272
25	2.03	245
50	2.38	192 (fine sand size)
75	2.85	139
84	3.19	110
95	4.23	53

$$\text{Graphic Sorting (Inman)} = \frac{\text{Phi(84)} - \text{Phi(16)}}{2} = 0.66$$

Verbal Sorting Scale= moderately sorted.

Total Number of Grains Measured=200

Note: The thin section grain size analysis agrees well with qualitative estmates. A higher alkali feldspar proportion was determined by modal analysis, however than was estimated qualitatively. On the other and, kaolinite and quartz cements, seen in a fracture surface of the sample, were not determined by thin section modal analysis.

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

SAMPLE IDENTIFICATION: KoaO22-N6
WELL NAME/DEPTH: Dome Hunt Gulf Koakoak
O-22-70-30-134-00/3496.75 m

INDURATION: poor either when dry or wet.
COLOUR: medium brown with dark grey grains.
SEDIMENTARY STRUCTURES: planar lamination is defined by concentrations of mud-sized material together with carbonaceous films. The laminae are about 0.5 mm thick.

GRAIN SIZE/COMPOSITION (VOLUMETRIC ESTIMATES):
Terrigenous Constituent %: 73

%gravel size: 0

%sand size: 53

%silt size: 15

%clay size: 5?

Cement %: 2% kaolinite, trace quartz overgrowths, trace framboidal pyrite, trace sparry carbonate cement.

Porosity %: 25 (a porosity of 29.7% was obtained for core plug 18, taken near the sample. Permeability was not measured).

Modal Size: 0.15 mm.

Sorting: 16%/84% diameter ratio=
250 micrometres/ 40 micrometres = 6.2

Verbal Sorting Scale: poorly sorted.

GRAIN SIZE NAME: silty fine sandstone.

COMPOSITION: 20% monocrystalline quartz grains, 3% polycrystalline quartz grains, 15% chert, 15% phylloid clasts, 1% muscovite flakes (partly altered to chlorite and clays), 3% alkali feldspar, 10% carbonaceous films, trace plagioclase (partly altered to clays). The remainder is unidentified silt/clay-sized material.

ROCK NAME (cements, miscellaneous transported constituents, clan designation): Kaolinite/quartz-cemented interlaminated silty fine grained litharenite and carbonaceous mudstone.

PETROGENESIS/ADDITIONAL INFORMATION: The porosity is distributed approximately as follows; 3% is moldic, 3% is within grains and 19% is intergranular. The intragranular porosity occurs mainly as leached phylloid and chert clasts, a few of which contain rhomb-shaped dissoluion molds. The estimate is a minimum because the

invisible microporosity in phylloid clasts is not included. The approximately 5% higher measured porosity may include some of this microporosity. In the sandy laminae, oversized and elongate pores of secondary origin comprise most of the intergranular porosity and rhomb-shape corrosion molds are common at grain margins. This is also the case in the muddy/carbonaceous laminae but ductile grains and matrix have been forced into these molds which suggests that compaction after formation of secondary porosity was much more severe in the muddy/carbonaceous laminae than in the sandy laminae. The kaolinite, quartz and pyrite cements line pores of secondary origin and therefore formed after carbonate decementation.

Grain plucking and fracturing was a problem, probably because fluorescent lime green concentrate was added to the epoxy impregnating medium. The grain plucking was minimized prior to final lapping by impregnating the surface with clear cyanoacrylate.

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

SAMPLE IDENTIFICATION: MalL38-N1
WELL NAME/DEPTH: IOE Mallik L-38-69-30-134-30/920.80 m.

INDURATION: excellent.
COLOUR: mainly dark grey pebbles in a light buff cement, trace of green pebbles.

SEDIMENTARY STRUCTURES: massive.

GRAIN SIZE/COMPOSITION (VOLUMETRIC ESTIMATES):
Terrigenous Constituent %: 65

%gravel size: 50

%sand size: 15

%silt size: 0

%clay size: 0

Cement %: 30% carbonate cement of botryoidal habit, concentrically banded and internally radiating.

Porosity %: 5%

Modal Size: 6.0 mm.

Sorting: 16%/84% diameter ratio=
10,000 micrometres/ 2000 micrometres = 5

Verbal Sorting Scale: moderately sorted.

GRAIN SIZE NAME: sandy pebbly conglomerate.

COMPOSITION: 37% well rounded chert and polycrystalline quartz pebbles, 3% monocrystalline quartz, coal (cellular structure is common).

ROCK NAME (cements, miscellaneous transported constituents, clan designation): carbonate-cemented sandy chert pebble conglomerate.

PETROGENESIS/ADDITIONAL INFORMATION: The coal pebbles must have been derived from a nearby source in order to have survived transport. Some of the chert clasts contain carbonate as spar-sized rhombs as well as rhomb-shaped molds. In some of these molds concentrically banded, internally radiating carbonate has been precipitated. The concentrically banded internally radiating carbonate also fills the fractures of compactionally fractured pebbles, suggesting that moderate depths of burial were reached prior to carbonate cementation. Many of the pebble margins and in some cases the interior of pebbles as well have been replaced by carbonate.

In the stained thin section, one of the pebbles fell out of the sample before mounting on the slide, resulting in what appears to be secondary porosity.

ELECTRON MICROPROBE CARBONATE ANALYSES

SAMPLE I.D.: MalL38-N1
WELL NAME/DEPTH (M): Mallik L-38/920.80 m.
LEGEND FOR ANALYZED MATERIAL (COLUMN HEADINGS): Analyses were carried out for many of the concentric laminae of the carbonate pore-lining cement from the central cavity between grains (a) to the brown lamina adjacent to the grains (d). Lamina C is clear.

	1B.1	1B.2	1C.1	1C.2	1D.1
OXIDE WEIGHT PERCENT					
MGO	21.94	18.61	18.14	18.77	16.52
FEO	.11	.15	.10	.17	.12
MNO	.17	.75	1.03	1.42	.74
CAO	30.19	32.79	32.89	32.09	34.58
TOTAL	52.41	52.30	52.16	52.45	51.96
ATOMIC PROPORTIONS (FORMULA ON THE BASIS 2 OXYGENS)					
MG	1.002	.872	.855	.878	.789
FE	.003	.004	.003	.005	.003
MN	.004	.020	.028	.038	.020
CA	.991	1.104	1.115	1.080	1.187
TOTAL	2.000	2.000	2.001	2.001	1.999

	1D.2
OXIDE WEIGHT PERCENT	
MGO	16.39
FEO	.20
MNO	.77
CAO	34.71
TOTAL	52.07
ATOMIC PROPORTIONS (FORMULA ON THE BASIS OF 2 OXYGENS)	
MG	.782
FE	.005
MN	.021
CA	1.191
TOTAL	1.999

ELECTRON MICROPROBE CARBONATE ANALYSES

SAMPLE I.D.: MalL38-N1
WELL NAME/DEPTH (M): Mallik L-38/920.80 m.
LEGEND FOR ANALYZED MATERIAL (COLUMN HEADINGS): Analyses were carried out for many of the concentric laminae of the carbonate pore-lining cement from the grain margin (lamina a) to midway between the grains (lamina e).

	2A.1	2A.2	2B.1	2B.2	2C.1
OXIDE WEIGHT PERCENT					
MGO	17.18	17.25	15.85	16.51	16.99
FEO	.04	.07	.11	.13	.13
MNO	.86	.63	.71	.73	.86
CAO	34.36	34.50	35.08	35.12	34.24
TOTAL	52.44	52.45	51.75	52.49	52.22
ATOMIC PROPORTIONS (FORMULA ON THE BASIS OF 2 OXYGENS)					
MG	.811	.813	.763	.782	.806
FE	.001	.002	.003	.003	.004
MN	.023	.017	.020	.020	.023
CA	1.165	1.168	1.214	1.195	1.167
TOTAL	2.000	2.000	2.000	2.000	2.000

	2C.2	2D.1	2E.1	2E.2
OXIDE WEIGHT PERTCENT				
MGO	16.50	21.33	22.52	22.33
FEO	.13	.10	.06	.02
MNO	.89	.30	.19	.03
CAO	34.36	31.36	30.14	29.85
TOTAL	51.88	53.09	52.91	52.23
ATOMIC PROPORTIONS (FORMULA ON THE BASIS OF 2 OXYGENS)				
MG	.790	.967	1.016	1.019
FE	.003	.003	.002	.000
MN	.024	.008	.005	.001
CA	1.182	1.022	.978	.979
TOTAL	1.999	2.000	2.001	1.999