

PR - SUKUNKA 78 (3) A

SUKUNKA 1978 EXPLORATION

PROGRAM

BP - 53

(DDH).

665

Contractor: CMS
 Commenced: July 14, 1978
 Completed: August 3, 1978

Co-ordinates: 61 20860.636 N
 5 88169.653 E
 Surface Elevation: 1231.45m

Core Size: NQ
 Hole Angle: } no details
 Hole Azimuth: }

Casing Left in Hole:
 Geologist Depth
 Logged by: C. Bickford 17.3 to 391.47

Final Depth: 391.47 Depth to top of cored section: 17.3m

FORMATION/MEMBER	DEPTH	THICKNESS	ELEVATION
GATES			
SUKUNKA			
MOOSEBAR	38.75	21.45+	1192.70
GETHING: UPPER	136.41	97.66	1095.04
MIDDLE	210.06	73.65	1021.39
LOWER		181.41+	

SEAMS	DEPTH	THICKNESS	%RECOVERY	ELEVATION
Bird	41.20	1.30	78.46%	1190.25
U. Chamberlain	80.22	2.79 (split)	36.20%	1151.23
L. Chamberlain	87.90	2.04	39.22%	1143.55
LOWER GETHING:				
"A"	211.65	1.59 (mudstone)	100%	1019.80
"B"	232.42	3.70	14.86%	999.03
LOWER "B"	235.96	1.02	35.29%	995.49
"C"	275.14	2.34	71.37%	956.31
LOWER "C"	288.76	4.15	77.11%	942.69
"D"	323.86	3.26	72.55%	907.59
"E"	360.76	2.21 (mudstone)	98.19%	870.69

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Dip °	DEPTH m	THICKNESS m	DESCRIPTION
	17.3	17.3	OVERBURDEN - no core Start Core - drillers depth 17.3 m
			MOOSEBAR FORMATION
3° at	36.9 26.38	19.6	MUDSTONE - dark grey, slightly silty, non-calcareous. pyritised worm burrows from 30.75 m to base. Core broken throughout, with overbore and grinding marks. Locally weathered, especially at top; sporadic calcite films on joints. Rubbly. Ferruginous band from 24.31 to 24.38 fragmental texture. 0.01 m band of light grey, fine-grained sandstone, burrowed at base, grading upwards to siltstone; non-calcareous; from 25.72 to 25.73. Bentonite, hard, olive grey, with 50% dark grey mudstone, churned together, from 28.45 to 28.47. Bentonite, soft, crumbly, olive grey, appears reworked, burrowed, from 29.22 to 29.23 m. Bentonite soft, crumbly, olive grey, burrowed, from 34.50 to 34.52 m. Bentonite, soft, crumbly, olive grey, burrowed, appears reworked, from 35.64 to 35.65 m. Bentonite, sheared, crumbly, light grey calcite-impregnated, with large and small burrows, (filled with dark grey mudstone) at top; from 36.37 to 36.55 m. Bentonite, basal 0.02 and top 0.05 m hard, olive grey, fragmental; rest is soft, crumbly, swelling, light olive grey, with a greasy texture; from 36.47 to 36.90 m. Abrupt.
	38.75	1.85	SANDSTONE - fining-upward sequence, from coarse-grained at base to mudstone with disseminated fine sand grains (10%) at top. Dark grey, with glauconite throughout interval, giving a greenish cast to the rock. Lower 0.64 m is coarse-grained with 10 to 20% sub-rounded granules of light and dark grey chert, with scattered worm burrows to 0.004 m, and sporadic silty lenses; grading upwards to medium-grained up to 1.05 m above base; grading upwards to fine-grained sandstone with increasing amount of silty and muddy matrix until sandy mudstone is reached at top of unit. Pyrite common as flecks and blebs in top 1.0 metre. Sorting throughout generally good within the framework, but silty-muddy matrix throughout results in overall poor sorting and low porosity. Erosional.
	MOOSEBAR UPPER GETHING 39.90	1.15	SANDSTONE - fine-grained to coarse-grained with granular phases. Light to medium grey; clean and well-sorted throughout. Top 0.30 m is a coarsening-downward sequence, from medium-grained at top to coarse-grained at base, with 60% sub-rounded granules of dark grey, brown, and light grey chert in basal 0.05 m.
3° at 4° at	39.27 39.87		

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Dip °	DEPTH m	THICKNESS m	DESCRIPTION
			Erosional. Underlain by dominantly fine-grained, low-angle cross-laminated sandstone with less than 5% dark grey mudstone bands and intraclasts. Upper 0.24 m of interval contains a "finger" of overlying interval, suggesting channeling and slumping of the fine-grained interval, followed by deposition of the coarse-grained sandstone into open cracks, perpendicular to bedding. Scattered horizontal dark-rimmed worm burrows (0.002 to 0.005 m) and vertical pelecypod-type burrows (up to 0.010 m). Medium to coarse-grained phase 0.12 to 0.37 m above base, marked by high-angle cross-lamination. Base of unit ground out. Unit weakly calcareous throughout.
			TOP OF BIRD SEAM
	39.96	0.06	MUDSTONE - dark grey, hard, intensely listricated; abundant carbonized plant fragments. Broken stick. BP 53/BD/1
	39.98	0.02	COAL - dull, metallic lustre. Broken
	40.07	0.09	COAL - dull, metallic lustre. Pyrite flecks.
	40.10	0.03	COAL - dull banded, metallic lustre. Stick. BP 53/BD/2
	40.16	0.06	COAL - dull, metallic lustre, sheared
	40.17	0.01	COAL - dull banded. Stick
	40.20	0.03	COAL - dull, metallic lustre, sheared. Pyrite flecks.
	40.23	0.03	COAL - dull. Stick
	40.28	0.05	COAL - dull, sheared, pyrite flecks. Stick.
	40.34	0.06	COAL - dull, metallic lustre, sheared, stick
	40.38	0.04	COAL - dull, metallic lustre, stick
	40.43	0.05	COAL - dull, metallic lustre, sheared, stick
	40.49	0.06	COAL - dull, metallic lustre, with pyrite blebs. Stick.
	40.57	0.08	COAL - dull, metallic lustre, sheared and listricated. Stick.
	40.66	0.09	COAL - dull, metallic lustre, sheared and listricated. Some pyrite flecks. Broken and pulverised.
	40.94	(0.28)	CORE LOSS - coal DD 41.8
	40.97	0.03	COAL - dull banded, metallic lustre, sheared. Broken stick.

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Dip °	DEPTH m	THICKNESS m	DESCRIPTION
	41.20	0.230	MUDSTONE - dark grey, abundant carbonised plant fragments, minor listrication. Broken stick.
			BASE OF BIRD SEAM
	59.32	18.12	SANDSTONE - dominantly fine-grained, grading down to very fine-grained at base. Fine to medium-grained from top to 47.72; grading down to medium to very coarse sandstone with granules at base, with erosional basal contact with underlying fine-grained sandstone at 47.83.
3° at 7° at 6° at 2° at	43.28 44.38 47.26 48.29		Ubiquitous large-scale low-angle cross-lamination, except near top, where bioturbation has destroyed or obscured lamination, resulting in "mottled" appearance (top to 43.37, very intense, and less intense down to 43.94). "Pin Prick" burrows recognisable locally from top to 42.59, and sporadically to 43.94. Abundant small (0.001 m) horizontal burrows from 42.76 to 43.34; local concentrations of faint, dark-rimmed "Gates-type" burrows (0.003 to 0.005 m) from 48.32 to 50.32 and from 54.56 to 54.74.
			Upper 0.27 m of unit contains listricated coaly wisps and carbonaceous matrix, increasing to top. Slickensided carbonaceous mudstone parting at 41.66 (52° CA). Sheared carbonaceous mudstone parting at 43.28 (87° CA). Slickensides and calcite at 44.03 and 44.23 (77° and 77° CA). Coaly smudge on broken surfaces of core between 44.03 and 44.23 may be cavings from Bird Seam. Sheared coaly parting at 44.38 (83° CA). Rough rusty joints with calcite and faint slickensides at 44.91 (83° CA) and 45.10 (87° CA). Core ground and rolled, probable overbore, from 45.20 to 46.92. Listricated and broken dark grey mudstone from 47.46 to 47.49. Mudstone bands and 0.001 m lens of bright coal from 48.27 to 48.32. Slickensides and calcite at 51.09 (78° CA). Rounded dark chert pebbles (0.005 to 0.012 m) at 51.61. Rough, rusty, curved joints at 0° to 20° CA, from 56.31 to 56.63, 57.31 to 57.49, 58.36 to 58.50, and 58.73 to 58.93. Slickensides and calcite at 57.18 (77° CA). Abrupt at base; unit non-calcareous at top, increasing to weakly calcareous at 41.96 and strongly calcareous from 43.41 down to base.
	64.30	4.98	MUDSTONE/SANDSTONE, very fine-grained (45:55) - interbedded medium grey, low-angle cross-laminated, argillaceous, strongly calcareous sandstone, and dark grey, silty, moderately calcareous mudstone. Sandstones commonly scoured at base, grading up to mudstones. Occasional carbonised "bark chips" in mudstones. Some slumping and load casting of sandstones. Ubiquitous

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Dip °	DEPTH m	THICKNESS m	DESCRIPTION
2° at	63.57		small, dark worm burrows in mudstones, medium (0.002 m) to large (0.005 m) sand-filled worm burrows and large (0.01 m diameter, 0.20 m long) vertical pelecypod burrows throughout. Lamination and bedding is well-preserved, despite burrowing. Rough, calcite filled joint from 59.36 to 59.49 m (25°CA). Slickensides and calcite at 59.62 (85°CA), 59.71 (80°CA), and 59.94 (74°CA). Slickensides at 60.54 (60°CA). Core broken, rough, rusty, with calcite, from 60.63 to 60.90 (7° to 12°CA). Slickensides and calcite at 64.29 (85°CA). Abrupt. Pelecypod at 62.88 (Specimen BP 53/F1)
	65.16	0.86	SANDSTONE - fine-grained, light to medium grey, clean, well-sorted, strongly calcareous. Fine-grained with 60% medium-grained phases in top 0.15 m. Low-angle cross-lamination. Sporadic large (0.004 m) dark-rimmed worm burrows. Abrupt and listricated.
0° to 2°	68.03	2.87	SANDSTONE, very fine-grained/SILTSTONE/MUDSTONE (50:30:20) - interlaminated medium grey argillaceous ripple-laminated sandstone, dark grey siltstone and dark grey, silty mudstone, strongly calcareous throughout. Mudstones generally pyritic, with pyrite as flecks and aggregates. Top 0.72 m is mudstone/siltstone (50:50); basal 1.22 m is mudstone/siltstone (90:10). In both cases strongly calcareous throughout, and interlaminated as before. Top 0.48 m is intensely bioturbated and slumped. Top 0.10 m slightly carbonaceous with listricated, carbonised plant fragments. Basal 0.09 m slightly calcareous, listricated throughout, with carbonised plant fragments. Abrupt.
4° at	71.26	9.40	SANDSTONE - fine-grained from top to 72.48; fine-to medium-grained to 75.70 m; fine-grained to 76.12 m; medium-grained to 76.41 m; medium to coarse-grained to 77.12 m; fine to medium-grained to base. Clean, well-sorted, light to medium grey. Strongly calcareous from top to 4.07 m below top; weakly calcareous to base. Coaly bands at 71.94 m and 71.86 m (0.010 m thick); sporadic coaly stringers from 71.99 to 75.43, (0.001 to 0.003 m thick), and locally abundant from 75.43 to base (0.001 to 0.010 m thick). Sporadic dark-rimmed worm burrows (0.003 to 0.004 m) from 74.33 to 75.11 and 76.09 to 76.22.
			TOP OF UPPER CHAMBERLAIN SEAM
	77.57	(0.14)	CORE LOSS - coal
	77.63	0.06	MUDSTONE - dark grey, carbonaceous with thin bright coal bands. Gradational.

BP53/CHU/1

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Dip °	DEPTH m	THICKNESS m	DESCRIPTION
18°	77.76	0.13	SILTSTONE - argillaceous, medium to dark grey, with a few thin bright coal bands. Gradational.
	77.80	0.04	MUDSTONE - dark grey, carbonaceous, with slickensides and calcite (61°CA). Broken stick.
	77.84	0.04	COAL - dull, metallic lustre. Stick.
	77.85	0.01	COAL - dull, metallic lustre. Broken
	77.91	0.06	COAL - dull. Stick
	77.97	0.06	COAL - dull and bright. Broken.
	78.04	0.07	COAL - dull and bright. Broken stick.
	79.36	(1.32)	CORE LOSS - coal
	79.63	0.27	SILTSTONE - medium to dark grey, argillaceous. Top 0.02 m with laminae of carbonaceous mudstone; basal 0.06 m consists of interlaminated siltstone and mudstone (50:50). Abundant large carbonized plant fragments throughout. Slickensides and calcite (45°CA), in basal 0.06 m. Stick.
	79.66	0.03	MUDSTONE - dark grey, carbonaceous. Few small carbonized plant fragments. Stick.
	79.69	0.03	MUDSTONE - dark grey, carbonaceous, very hard, with calcite at 75°CA.
	79.72	0.03	COAL - dull, sheared. Broken stick.
	79.76	0.04	COAL - dull, sheared. Broken stick.
	79.80	0.04	COAL - dull and bright. Broken stick.
79.86	0.06	COAL - dull and bright. Stick.	
79.90	0.04	COAL - dull banded, sheared. Stick.	
80.22	(0.32)	CORE LOSS - Coal	
			DD 80.2
			DD 81.1
			BASE OF UPPER CHAMBERLAIN SEAM
	81.53	1.31	MUDSTONE/SILTSTONE, argillaceous (70:30) - dark grey non-calcareous mudstone with abundant carbonised plant fragments and interbeds of medium grey argillaceous, moderately calcareous siltstone. Mudstone, slightly carbonaceous, listricated, abundant carbonised plant fragments, but no siltstone in top 0.18 m. Possible seatearth. Unit abrupt.

BP 53/CHU/1

BP 53/CHU/2

BP 53/CHU/3

BP 53/CHU/4

BP 53/CHU/5

BP 53/CHU/6

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Dip °	DEPTH m	THICKNESS m	DESCRIPTION
2°	81.75	0.22	SANDSTONE - very fine-grained, silty, medium to dark grey, poorly sorted. Abundant argillaceous laminae. Parallel and ripple cross-lamination. Strongly calcareous throughout. Abrupt.
3° at	82.45 82.23	0.70	SILTSTONE/SANDSTONE, very fine-grained/MUDSTONE (60:20:20) - interlaminated, medium to dark grey, moderately calcareous, ripple-laminated siltstone, medium grey, strongly calcareous sandstone, and dark grey, weakly calcareous mudstone. Dominantly sandstone in basal 0.15 m; sandstone otherwise as thin lenticles, up to 0.003 m thick. Ripple cross-sets to 0.04 m thick in basal sandy interval, with load casts; minor slumping in rest of unit, but lamination essentially parallel. Abrupt.
2° at	83.23	0.78	SILTSTONE/MUDSTONE (90:10 at top, grading to 50:50 at base) - interlaminated medium to dark grey, moderately calcareous siltstone and dark grey, non-calcareous mudstone. Lamination parallel throughout. Gradational.
2° except from 85.79 to 85.84 m where lamination is not visible, but core breaks easily at 30° to 40° dip; possible "sigmoidal laminite" horizon	85.86 85.79 to 85.84 m	2.63	MUDSTONE/SILTSTONE (80:20 at top, grading to 95:5 at base) - interlaminated mudstone and siltstone, as above, but overall finer-grained sequence. Slickensides and calcite from 83.61 to 83.84 (65° to 75° CA) and from 84.55 to 85.11 (75° to 85° CA). Core loss (0.17m) below 85.11; core locally broken from 7° to 21° CA. Basal 0.23 m of unit is pure, dark grey mudstone. Abrupt and listricated at base.
5° at base			
			TOP OF LOWER CHAMBERLAIN SEAM
	85.95	0.09	MUDSTONE, carbonaceous, listricated and broken
	86.28	(0.33)	CORE LOSS - rock
	86.39	(0.11)	CORE LOSS - coal
	86.44	0.05	COAL - dull banded. Broken.
	86.46	0.02	COAL - dull banded. Core ground at top. Stick.
	86.50	0.04	COAL - dull and bright. Stick
	86.53	0.03	COAL - dull banded. Stick.
	86.58	0.05	COAL - dull banded, sheared. Stick.
	87.00	(0.42)	CORE LOSS - coal
	87.05	0.05	COAL - bright banded. Stick.

10 cm roof sample
BP 53/CHL/R

BP 53/CHL/1

BP 53/CHL/2

DD 87.5

BP 53/CHL/3

BH Nos. BP 53

Dip °	DEPTH m	THICKNESS m	DESCRIPTION
	87.13 87.44 87.53	0.08 (0.31) 0.09	COAL - bright banded. Stick. CORE LOSS - coal COAL - dull and bright. Broken stick.
	87.61	0.08	COAL - dull and bright. Broken stick.
	87.74	0.13	COAL - dull and bright. Broken.
	87.78	0.04	COAL - dull banded. Stick
			DD 88.7
	87.85 87.90	(0.07) 0.05	CORE LOSS - coal COAL - dull and bright. Two sooty bands, 0.001 and 0.002 m thick; in basal 0.01 m. Core ground at top. Stick. Base of seam dips 5°.
			BASE OF LOWER CHAMBERLAIN SEAM
3° at	110.0 92.11	22.10	SANDSTONE - medium-grained from top to 90.74, medium to coarse-grained to 91.97; medium-grained to 94.36; fine to medium-grained to 94.97; medium-grained, coarsening down to very coarse-grained, with scattered granules at 95.03; fine to very fine-grained to 95.49; fine to medium-grained to 100.56; very fine-grained to base. Clean and well-sorted throughout. Dark grey at top, lightening downwards to medium grey. Dark grey to black with carbonaceous matrix, in top 0.10 m, and from 95.49 to 95.63. Abundant coaly inclusions in top 0.24 m, and from 95.49 to 95.76. Sandstone is medium to large-scale, low-angle cross-laminated throughout, except in top 0.95 m, and from 89.90 to 90.19, where intense bioturbation has resulted in a mottled appearance, and from 96.73 to 97.49, where abundant small (0.001 m), dominantly horizontal dark-rimmed burrows have replaced lamination. Sporadic large (0.004 to 0.005 m), dark-rimmed burrows from 91.11 to 93.71. Faint large dark-rimmed burrows from 94.05 to 94.14, medium (0.002 to 0.003 m) and large dark-rimmed burrows from 100.55 to 100.70. Unit non-calcareous to weakly calcareous, from top to 97.38; moderately to strongly calcareous to base. Slickensides (58°CA) at 94.91; slickensides and calcite (75°CA) at 96.26; at 99.72 (87°CA); at 99.74 (82°CA), Unit abrupt.
3° at	101.46		
3° at	112.88 0.42 m below top	2.88	SANDSTONE, very fine-grained/MUDSTONE (60:40) - dark grey, silty, strongly calcareous mudstone with lenticular interbeds (0.01 m) of medium grey, silty, strongly calcareous sandstone, abrupt at base and grading up into mudstone. Dominantly sandstone,

BP 53/CHL/3

BP 53/CHL/4

BP 53/CHL/5

BH Nos. BP 53

Dip °	DEPTH m	THICKNESS m	DESCRIPTION
			cleaner than above, from 110.92 to 110.98, from 111.02 to 111.20, and from 111.92 to 112.59. These intervals are medium-scale cross-laminated, similar to the thick sandstone unit forming the floor of the Lower Chamberlain Seam, but sorting is not as good. The remainder of the sandstone component in this unit is as flaser-type lenses, with ripple cross-lamination. Few medium-sized (0.003 to 0.004 m) worm burrows in sandy intervals; ubiquitous small dark burrows in mudstones. Joint at 0° to 10° CA from 110.01 to 110.09; fracture with flaky calcite filling (at 20° CA) from 110.27 to 110.41; joint at 30° CA from 110.58 to 110.63.
	116.0	3.12	MUDSTONE/SILTSTONE (50:50) - thinly interbedded and lenticular medium grey ripple- and low-angle cross-laminated strongly calcareous siltstone and dark grey, strongly calcareous silty mudstone. Bioturbated, with ubiquitous small burrows in mudstone, and a few vertical pelecypod burrows. Core broken and listricated at 0° to 20° CA, in top 0.10 m. Joint at 16° CA, from 113.14 to 113.27; at 20° CA from 113.87 to 113.95; and at 5° CA from 114.18 to 114.20. Slickensides and calcite at 115.51 (90° CA) and 115.69 (87° CA). Abrupt. Fossils: pelecypod at 114.88 (BP 53/F2); ?cephalopod at 114.68 (BP 53/F3), cross-sections only; poor specimen.
3° at	1.94 m below top		
	116.09	0.09	SANDSTONE - medium to very coarse-grained; 50% mudstone matrix in top 0.05 m; rest is clean sand. Framework sorting is good; coarsening-downward sequence. Moderately calcareous; abrupt.
	136.41	20.32	SANDSTONE - fine-grained in upper 4.54 m; fine to very fine-grained to base. Clean, well-sorted throughout, except basal 1.35 m, which contains laminae of argillaceous sandstone. Strongly calcareous throughout. Large-scale cross-lamination throughout. Scattered bands of intraclasts in basal 6.34 m, and large rounded intraclasts from 133.33 to 133.41. Siltstone/mudstone phases from 130.38 to 130.41 (listricated at top and base), 135.10 to 135.25, 135.38 to 135.40, 135.85 to 135.88, 135.96 to 136.01. Scattered medium and large (0.003 to 0.005 m) dark-rimmed ("Gates-type") worm burrows, in upper 18.90 m of unit. Carbonised plant fragments at 117.23. Slickensides and calcite (77° CA) at 118.37. Flat, rounded intraclasts at 122.84. Thick, discontinuous calcite from 123.16 to 123.31 (80° to 85° CA); slickensides and calcite at 123.28 (20° CA); slickensides and calcite at 123.49 (87° CA). Calcite from 123.62 to 123.70 (45° CA); 1 cm true thickness, filled with "floating" inclusions of sandstone. Calcite from 123.77 to 124.17 (65° to 90° CA; dominantly from 80° to 85° CA), closely spaced fractures.
2° at 4° at	133.32 135.87		

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Dip °	DEPTH m	THICKNESS m	DESCRIPTION
			Slickensides at 124.09 (72°CA). Joint from 130.79 to 131.09 (0° to 20°CA). Core broken, with calcite at 85°CA, from 135.04 to 135.06. Joint with flaky calcite film (15°CA) from 134.96 to 135.15. Slickensides and calcite (75°CA) at 135.30. Abrupt. Possible Fault 118-135.30
			Upper Gething
			Middle Gething
	137.23	0.82	SANDSTONE, very fine-grained/MUDSTONE (40:60) - dark grey, silty, moderately calcareous mudstone with lenses and interbeds (to 0.07 m) of medium grey, strongly calcareous, low-angle cross-laminated sandstone. Scattered flecks of pyrite in mudstone, possibly small pyritised worm burrows. Basal 0.23 m marked by pelecypod burrows. Abrupt.
	138.08	0.85	SANDSTONE - very fine-grained, slightly argillaceous, light to medium grey; strongly calcareous throughout. Large-scale low-angle cross-lamination. Few shaly intraclasts. Slickensides and calcite, (85°CA) at 137.95. Rough joint at 42°CA, from 137.31 to 137.37. Concentration of large muddy intraclasts in basal 0.13 m; erosional.
	142.28	4.20	SANDSTONE, very fine-grained/MUDSTONE (50:50) - dark grey, silty, strongly calcareous mudstone with lenses and interbeds (to 0.30 m) of light to medium grey, slightly argillaceous, strongly calcareous sandstone with medium to small-scale low-angle cross-lamination and occasional intraclasts. Sandstones abrupt at base, gradational at top; local slumping and minor load structures at base of thick sandstones. Ubiquitous small, dark worm burrows in mudstones; abundant large pelecypod burrows, disrupting lamination. Locally intense bioturbation has destroyed lamination completely. Massive pyrite concretion with radiating texture, from 140.21 to 140.26. Abrupt. Slickensides and calcite at 139.24 m (82°CA); joints at 0° to 20°CA from 141.01 to 141.13 m; at 20° to 35°CA from 141.80 to 141.88; at 60°CA from 141.89 to 141.92. Slickensides and calcite at 142.04 (90°CA). Possible Fault 138-142
	146.95	4.67	SILTSTONE/MUDSTONE/SANDSTONE (60:35:5) - medium grey, strongly calcareous siltstone and dark grey, strongly calcareous mudstone, intimately mixed and churned together due to intense bioturbation, with churned lenses of very fine-grained sandstone. Largely devoid of lamination except for occasional small-scale low-angle cross-lamination in siltstone and sandstone lenses. Bedding defined by abrupt bases of siltstone and sandstone beds,

Bil Nos. BP 53

Dip °	DEPTH m	THICKNESS m	DESCRIPTION
2° to 4°			grading upward to mudstones. Ubiquitous small dark burrows, and occasional pelecypod burrows. Joints from 142.88 to 143.18 (10°CA); from 144.09 to 144.13 (60°CA); from 144.50 to 144.57 (28°CA); and 144.62 to 144.64 (60°CA) Gradational.
	152.96	6.01	MUDSTONE/SILTSTONE/SANDSTONE, very fine-grained (60:35:5) - strongly calcareous, churned medium to dark grey siltstone and mudstone, with occasional interbeds (to 0.10 m) of medium grey silty sandstone. Intensely bioturbated throughout, with ubiquitous small, dark burrows and occasional pelecypod burrows. Calcite at 151.22 (87°CA); open joint at 18°CA, from 151.24 to 151.31. Joint at 0° to 20°CA, from 152.63 to 152.91. Abrupt. Fossil: 149.02: BP 53/F4 (large pelecypod, intersected by edge of core).
1° at	151.59		
	157.02	4.06	MUDSTONE/SILTSTONE (95:5) - moderately calcareous dark grey slightly silty mudstone with laminae of churned, medium grey siltstone. Ubiquitous small dark burrows. Core broken parallel to core axis from 154.89 to 155.49. Core broken parallel to core axis, from 153.23 to 153.39. Joint from 154.66 to 154.69 (37°CA), and from 154.76 to 154.78 (45°CA). Flaky calcite from 156.04 to 156.15. (23°CA). Joint from 156.34 to 156.42 (20°CA). Gradational Pelecypod fragment at 154.08 (BP 53/F5), and at 154.21 (BP 53/F6).
	163.77	6.75	MUDSTONE/SANDSTONE, very fine-grained/SILTSTONE (40:20:40) - dark grey, moderately calcareous mudstone with ubiquitous small dark worm burrows and scattered pyritic flecks, interbedded with strongly calcareous medium grey siltstone and sandstone, generally churned, but locally preserved small-scale cross-lamination. Scattered large (0.004 m) worm burrows, and local pelecypod burrows. Core badly broken from 157.93 to 160.25. Core loss 2.04 m in this interval. Core ground, probable redrill from 163.25 to 163.73 m. Calcite (84°CA) at 160.31. Joint (15°CA) from 163.04 to 163.16. Joint (25°CA) at base of redrilled interval. Basal 1.68 m of unit is sandstone/siltstone/mudstone (40:40:20) Abrupt.
	164.64	0.87	MUDSTONE/SILTSTONE (95:5) - moderately calcareous dark grey mudstone with lenses of medium grey mudstone; overall intense bioturbation and ubiquitous small dark worm burrows. Abrupt. Pelecypod fragment at 164.48. (BP 53/F7)
	168.02	3.38	SANDSTONE, very fine-grained/SILTSTONE/MUDSTONE (55:25:20) - interbedded, intensely bioturbated, pyritic siltstone/mudstone with undisturbed, medium-scale

BH Nos. BP 53

Dip °	DEPTH m	THICKNESS m	DESCRIPTION
			<p>low-angle cross-laminated sandstone. Strongly calcareous throughout. Sandstones 0.20 to 0.30 m thick, with abrupt to scoured bases, with occasional load structures and intraclasts. Upper contacts of sandstones with siltstone/mudstones are churned, with occasional large worm burrows near top of sandstones; Ubiquitous small dark worm burrows in siltstone/mudstones, and some pelecypod burrows. Slickensides and calcite at 165.12 (88° CA). Calcite at 166.05 (88° CA); 166.16 (73° CA); and at 166.37 (84° CA, some slickensides). Core badly broken, parallel to CA, from 167.57 to 167.68. Crystalline calcite and pyrite at 168.00 (87° CA). Erosional. Pelecypod fossil at 167.50. (BP 53/F8)</p>
	180.05	12.03	<p>MUDSTONE - dark grey, silty, moderately calcareous. Occasional flecks of pyrite. Bioturbated, churned interbeds of siltstone and occasional very-fine-grained sandstone, in top 4.15 m; grading from 30% of rock at top to 5% at 172.17. Only minor siltstone lenses to base (less than 5% of rock). Vague low-angle cross-lamination in siltstone/sandstone intervals; general bioturbation has obscured most structures. Ubiquitous small, dark burrows throughout. Joints from 168.70 to 168.90 (13° CA). Rough joint from 0° to 20° CA, from 171.92 to 172.14. Joint (0° to 20° CA) from 175.52 to 175.72. Joint (5° CA) and core broken from 177.39 to 177.61. Joint (7° CA) from 178.48 to 178.74. Core broken from 178.92 to 179.08, with joints at 10° CA. Joint (14° CA) from 179.44 to 179.60. Basal 0.27 m of unit increasingly glauconitic (from 5% to 20%) gradational basal contact with glauconitic sandstone below. Pelecypod (BP 53/F9) at 168.24. Pyritised pelecypod (BP 53/F10) at 172.98). Two pelecypod valves partially intersected by core, at 176.49 (not sampled). Pelecypod (BP 53/F11) at 177.36. Pelecypod (BP 53/F12) at 177.69. Pelecypod (BP 53/F13) at 177.72. Pelecypod fragments (similar to BP 53/F13), throughout unit, including glauconitic interval below.</p>
3° at	3.51 below top.		<p>SANDSTONE - fine-grained, poorly-sorted, abundant muddy matrix. Dark Green, 30% glauconite. Bioturbated throughout; filling burrows 0.02 to 0.05 cm below base, into underlying sandstone. Non-calcareous. Slickensides and calcite at 180.31 (83° CA) Abrupt.</p>
	180.81	0.76	<p>SANDSTONE - fine-grained, poorly-sorted, abundant muddy matrix. Dark Green, 30% glauconite. Bioturbated throughout; filling burrows 0.02 to 0.05 cm below base, into underlying sandstone. Non-calcareous. Slickensides and calcite at 180.31 (83° CA) Abrupt.</p>
	181.13	0.32	<p>SANDSTONE, very fine-grained/MUDSTONE (50:50) - interbedded, medium grey, argillaceous sandstone and dark grey silty mudstone. Moderately to strongly calcareous. Joints at 14° CA; calcite at 60° to 90° CA. Core broken throughout. Abrupt.</p>

BH Nos. BP 53

Dip °	DEPTH m	THICKNESS m	DESCRIPTION
0° at	182.52	1.39	SANDSTONE, fine to very fine-grained - medium grey, argillaceous, general poor sorting. Vague low-angle and ripple cross-lamination; obscured by drill marks and mottling. Faint medium-sized (0.002 to 0.003 m) dark-rimmed burrows scattered throughout. Fine to medium-grained phase from 181.70 to 182.19. Scattered muddy intraclasts towards base. Slickensides and calcite at 181.17 (89°CA); 181.24 (83°CA); 181.26 (69°CA); 181.30 (80°CA). Calcite at 181.41 (82°CA); crystalline calcite and slickensides at 181.64 (81°CA). Calcite at 181.68 (90°CA). Core broken with calcite (78°CA) from 182.23 to 182.43. Gradational.
1° at	181.73		
	200.4	17.88	SANDSTONE, very fine-grained/MUDSTONE (50:50) - medium grey, strongly calcareous sandstone and dark grey, moderately calcareous silty mudstone. Upper 7.50 m generally intensely bioturbated and churned so that lamination and bedding are indistinguishable. Locally preserved low-angle cross-lamination in sandstone phases; occasional vague worm burrows and concentrations of muddy intraclasts. Slump structure, with vertical and overturned lamination, from 184.52 to 184.58. Remainder of unit is generally undisturbed, consisting of 0.05 to 0.35 m interbeds of clean, small to medium-scale cross-laminated sandstone and mudstone with thin sandstone lenses. Sandstone intervals abrupt at base, grading upwards (often churned together) to mudstone intervals. Ubiquitous small, dark worm burrows, scattered medium (0.003m) sand-filled worm burrows, and pelecypod burrows. Mudstones locally pyritic. Sandstones become thinner and less frequent towards base of unit. Slickensides and calcite at 186.88 (45°CA), and 189.97 (89°CA). Calcite at 190.52 (90°CA and 0° to 40°CA) to 190.62; and 190.89 (87°CA). Joints (15° to 25°CA) from 192.76 to 192.87 below top, with some films of calcite. Slickensides and calcite at 195.03 m (82°CA), 195.21 m (74°CA); 195.6 m (74°CA); 195.7 m (76°CA). Abrupt.
	193.82		
	210.06	9.66	MUDSTONE/SILTSTONE (95:5) - dark grey, slightly silty, weakly to moderately calcareous mudstone with lenses of medium grey, strongly calcareous siltstone. Pyrite flecks in basal 4.30 m. Ubiquitous small dark worm burrows. Basal 0.27 m consists of dark grey mudstone with 50% medium to very coarse-grained sand and well-rounded pebbles of medium grey chert, to 0.015 m diameter. Abrupt. Joint (21°CA) from 206.24 to 206.32m below top. Pelecypod, poorly preserved (BP 53/F14), 204.45. Pelecypod, (BP 53/F15), 204.55. Pelecypod (BP 53/F16), 207.60. Pelecypod (BP 53/F17), 209.16.
Middle	Gething	X	
Lower	Gething	X	

BH Nos. BP 53

Dip °	DEPTH m	THICKNESS m	DESCRIPTION
	211.65	1.59	MUDSTONE - dark grey to black, carbonaceous in part. "A" Coaly Horizon. Abundant carbonized and pyritized plant fragments. A few thin (0.001 to 0.002 m) coaly bands towards top and base. Core badly broken throughout. Abrupt.
3° at	220.98	9.33	SANDSTONE - fine-grained (very fine-grained in basal 1.40 m), light to medium grey, generally argillaceous and moderately calcareous, but locally clean and strongly calcareous. Medium to large-scale low-angle cross-lamination throughout, with ripple cross-lamination from 212.15 to 214.44. Top 0.17 m contains abundant carbonaceous inclusions, with disturbed bedding; probable rootlet bed. Scattered finely broken plant fragments in upper 1.0 m of unit. Mudstone bands make up 15% of basal 1.70 m, commonly erosional, indicated by sandy inclusions at base of mudstones and mudstone intraclasts within sandstone, within this interval. Scattered medium (0.002 to 0.003 m) dark-rimmed worm burrows throughout. Slickensides and calcite at 216.65 (42° CA), at 217.19 (40° CA), from 217.3 to 217.35 (0.006 m thick, crystalline calcite at 70° CA; slickensides at 45° and 80° CA); 217.61 (87° CA); 217.68 (90° CA); 217.72 (89° CA). Core broken with calcite veinlets and minor breccia, from 217.74 to 217.93 m. Core broken with calcite from 218.13 to 218.21 (65° to 72° CA). <u>Fault, possible.</u> Calcite from 218.30 to 218.37 (65° to 75° CA). Slickensides and calcite at 218.37 (85° CA). Core badly broken with calcite, from 218.37 to 218.48. Calcite from 218.50 to 218.59 (85° to 90° CA). Slickensides and calcite at 218.80 (86° CA) and 218.83 (82° CA). Joint (40° CA) with flaky calcite from 219.00 to 219.03. Slickensides and calcite at 219.22 (86° CA), 219.25 (84° CA); 219.52 (89° CA); 219.62 (87° CA); 220.02 (87° CA) and 220.05 (85° CA). Abrupt.
	213.51		
	224.36	3.38	SANDSTONE, very fine-grained/SILTSTONE/MUDSTONE (40:30:30 at top, grading down to 10:25:65 at base) - interbeds (to 0.15 m) and lenses of light to medium grey, low-angle cross-laminated argillaceous sandstone, medium grey siltstone and dark grey, silty mudstone. Local flecks of pyrite; ubiquitous small dark worm burrows and pelecypod burrows. Siltstones and mudstones moderately to intensely bioturbated, but sandstones only locally bioturbated, mainly as the result of pelecypod burrowing. Unit moderately calcareous throughout. Slickensides and calcite at 221.10 (89° CA); 221.80 (62° CA). Joint (22° CA) with patches of pyrite, from 222.25 to 222.34. From 222.47 to 222.90 concentration of slickensides and calcite at 0.04 to 0.10 m spacing. Dominantly at 70° to 75° CA, with slickensides and
4° at 3° at	221.33 224.36		

BH Nos. BP 53

Dip °	DEPTH m	THICKNESS m	DESCRIPTION
	228.72	4.36	calcite also at 0° to 15° CA, and at 85° CA. Slickensides and calcite near parallel to CA, and at 85° to 90° CA, with accompanying listrication, from 223.19 to 223.34. Gradational.
1° at	2.16 m below top		MUDSTONE/SILTSTONE (95:5) - dark grey to black, weakly calcareous mudstone with lenses and wisps of medium grey, moderately calcareous siltstone. Occasional flecks and blebs of pyrite. Scattered carbonized, finely macerated plant debris in basal 1.0 m. Abundant shell fragments from 226.96 to 226.97. Probable lag deposit. <u>Abrupt. Pelecypod (BP 53/F18), 228.22.</u> <i>10 cm roof sample: BP 53/B/R</i>
			TOP OF LOWER GETHING "B" SEAM
	228.77	0.05	COAL - dull, metallic lustre. Stick.
	228.79	0.02	COAL - dull banded, metallic lustre. Broken stick.
	228.84	0.05	COAL - dull, metallic lustre. Stick.
	228.85	0.01	COAL - dull banded, Stick.
	228.91	0.06	COAL - dull banded. Stick.
	229.00	0.09	COAL - dull banded, with 0.005 m (altogether) of carbonaceous mudstone in thin laminae. Stick.
	229.02	0.02	COAL - dull banded. Broken.
	229.13	0.11	COAL - dull banded. Stick.
	229.20	(0.07)	CORE LOSS - coal
	229.26	0.06	COAL - dull. Stick.
	229.27	0.01	MUDSTONE - black, carbonaceous, with thin bright coal bands. Stick.
	229.31	0.04	COAL - dull. Stick
	229.68	(0.37)	CORE LOSS - coal
	229.79	(0.11)	CORE LOSS - rock
	229.82	0.03	SILTSTONE - dark brown, with disseminated fine sand grains. 0.005 m carbonaceous mudstone, with bright coal bands, at base;
	230.48	(0.66)	CORE LOSS - coal
	231.22	(0.74)	CORE LOSS - rock
	232.42	(1.20)	CORE LOSS - coal
			BASE OF LOWER GETHING "B" SEAM

BP 53/B/1

BP 53/B/2

Bl Nos. BP 53

Dip °	DEPTH m	THICKNESS m	DESCRIPTION
	233.00	0.58	MUDSTONE - dark grey, silty. Core badly broken and ground. 20% fragments of medium grey, very argillaceous, medium-grained sandstone. Weakly calcareous throughout. Core loss, 0.29 m, within this unit.
	233.74	0.74	MUDSTONE/SILTSTONE (90:10) - dark grey, non-calcareous mudstone with wisps and lenses of medium to dark grey, weakly calcareous siltstone. Scattered small, dark worm burrows. 0.002 m coaly band at 233.01. Top 0.15 m slightly carbonaceous, with abundant carbonized plant fragments. Lustrated; possible seatearth.
	234.82	1.08	MUDSTONE - dark grey to black; carbonaceous, locally canneloid, in top 0.50 m. From 234.24 to 234.53, disseminated silt and sand grains. Basal 0.23 m of unit very carbonaceous to coaly mudstone. Abrupt. <u>10 cm roof sample:</u> <u>BP 53/BL/R1</u>
4° at top	234.94	0.12	SANDSTONE, very fine-grained - light grey to cream. Ashy texture; greasy when broken and mixed with water. Probable ash band, less altered than the Moosebar "bentonites". Abrupt, adhering. <u>roof sample:</u> <u>BP 53/BL/R2</u>
			TOP OF LOWER GETTING "LOWER B" SEAM
	234.97	0.03	COAL - dull banded. Stick.
	234.98	0.01	COAL - dull and bright.
	235.01	0.03	COAL - bright. Stick.
	235.21	(0.20)	CORE LOSS - coal <u>BP 53/BL/1</u>
	235.225	0.015	MUDSTONE - black, carbonaceous, with bright coal bands to 0.004 m thick. Broken stick. <u>BP 53/BL/2</u>
	235.26	0.035	MUDSTONE - black, carbonaceous, as above. Stick.
	235.29	0.03	MUDSTONE - black, carbonaceous, as above. Broken stick.
	235.32	0.03	MUDSTONE - black, carbonaceous, splintery, with abundant thin (0.001 m) bright coal bands. Broken stick.
	235.34	(0.02)	CORE LOSS - rock
	235.37	0.03	COAL - dull banded. Broken stick. <u>BP 53/BL/3</u>
	235.58	(0.21)	CORE LOSS - coal
	235.81	(0.23)	CORE LOSS - rock
	235.87	0.06	MUDSTONE - black, carbonaceous, with thin (0.001 to 0.002 m) bright coal bands. Abundant in basal 0.01 m. Broken stick. <u>BP 53/BL/4</u> <u>BP 53/BL/5</u>
	235.89	0.02	COAL - dull banded. Attached and abrupt basal contact with mudstone.
	235.96	0.07	MUDSTONE - black, canneloid, with bright coal bands (0.001 to 0.004 m) <u>BP 53/BL/6</u>

BH Nos. BP 53

Dip °	DEPTH m	THICKNESS m	DESCRIPTION
			BASE OF LOWER GETHING "LOWER B" SEAM
	241.85	5.89	MUDSTONE - dark grey. Silty with occasional carbonaceous intervals from top to 236.69 . MUDSTONE, silty/SILTSTONE, argillaceous (50:50) - from 236.69 to 238.57, with occasional lenses of very fine-grained sandstone. Slumping in centre of this interval, with dips to 45°. Carbonaceous, with plant fragments and silty laminae from 238.57 to 238.85. Ferruginous concretion at 238.77 to 238.80 below top. MUDSTONE/SILTSTONE (40:60) grading down to sandstone, very fine-grained/mudstone (90:10), with well-defined ripple cross-lamination, and plant fragments throughout, from 238.85 to 239.18. Mudstone, locally carbonaceous/siltstone, argillaceous (70:30) - interbedded and interlaminated from 239.18 to base. (Core loss 1.21 m.) Core badly broken throughout. Abundant plant fragments. Throughout unit, sandstone and siltstone components are moderately to strongly calcareous, while mudstones are non-calcareous. Gradational at base. Slickensides and calcite at 237.23 (82° CA); 237.45 (84° CA); Occasional listrication in mudstone bands; abundant in broken ground at base of unit.
7° at	237.31		
7° at	237.64		
12° at	238.85		
	246.90	5.05	SILTSTONE, argillaceous - medium to dark grey, moderately calcareous, devoid of lamination. Occasional faint large and small burrows suggest intense bioturbation. Two ferruginous bands, at 243.40 - 243.45 and at 244.77 - 244.84. Gradational.
	251.20	4.30	SILTSTONE/SANDSTONE, very fine-grained/MUDSTONE (50:40:10) - devoid of lamination at top, but lamination better defined towards base. Interbedded and interlaminated light grey, small-scale low-angle and ripple cross-laminated, strongly calcareous sandstone and low-angle to parallel laminated medium to dark grey, strongly calcareous siltstone with occasional dark grey mudstone phases. Rythmic fining-upward sequences at base; sandstones, abrupt at base, grading upward to siltstones. Occasional joints near base; very irregular and curving near parallel to core axis, and listricated. Possible compactional features. Gradational.
	265.45	14.25	SANDSTONE - medium to very coarse-grained, light to medium grey, dominantly quartzose. Medium to large-scale low-angle cross-lamination and occasional ripples throughout. Rapid alternation of grain size and secondary components such as mudstone and carbonized plant fragments which are locally abundant, and characteristically thick, up to 0.005 m. Unit strongly calcareous.

BH Nos. BP 53

Dip °	DEPTH m	THICKNESS m	DESCRIPTION
			debris. Top 0.12 and basal 0.06 m intensely listricated Top 0.12 m broken; remainder stick. DD 321.9
	321.61 321.71	(0.38) 0.10	CORE LOSS - rock MUDSTONE - black, carbonaceous, with abundant thin bright coal bands. Minor listrication. Core broken and ground. BP 53/D/1 BP 53/D/2
	321.76	0.05	MUDSTONE - black, very carbonaceous, with abundant very thin bright coal bands. Easily split parallel to core axis. "Bone".
	321.84	0.08	MUDSTONE - black, carbonaceous with thin bright coal bands and abundant carbonised plant debris. Broken stick.
	322.01	0.17	MUDSTONE - dark grey, very silty, slightly carbonaceous, with occasional thin coaly bands and carbonised plant fragments. Stick. BP 53/D/3 BP 53/D/4
	322.22	0.21	MUDSTONE - black, very carbonaceous, with abundant thin bright coal bands. Basal 0.06 m with silvery lustre. Easily split parallel to core axis. "Bone" Gradational at base. Broken stick.
	322.42 322.53	(0.20) 0.11	CORE LOSS - coal COAL - dull, lustrous, hard. Broken stick. BP 53/D/5
	322.56	0.03	COAL - dull and dull lustrous, mixed fragments. Core badly broken and ground.
	322.61	0.05	COAL - dull, lustrous, hard. Stick.
	322.73	0.12	MUDSTONE - ("Bone")black, very carbonaceous with abundant very thin bright coal bands and some thicker coal bands (up to 0.002 m). Easily split parallel to core axis. Slight silvery lustre, decreasing at base. Gradational at base. Stick. BP 53/D/6
	322.78	0.05	MUDSTONE - black, carbonaceous. Abundant thin bright coal bands. Stick. BP 53/D/7
			DD 323.2
	322.985 322.99	(0.205) 0.005	CORE LOSS - coal MUDSTONE - black, carbonaceous, listricated, stick.
	323.03	0.04	COAL - dull and bright, broken stick. BP 53/D/8
	323.16	0.13	MUDSTONE - black, carbonaceous, intensely listricated at 70° to 90° CA. Broken Stick. BP 53/D/9

BH Nos. BP 53

Dip o	DEPTH m	THICKNESS m	DESCRIPTION
	273.41	(0.03)	CORE LOSS - rock
	273.56	0.15	COAL - dull. Stick.
	273.65	0.09	COAL - dull. Stick.
	273.80	0.15	COAL - dull banded, sheared.
	273.89	0.09	COAL - bright banded. Stick.
	274.01	(0.12)	CORE LOSS - coal
	274.07	0.06	SILTSTONE - medium to dark grey, with disseminated fine sand grains. Broken stick.
	274.13	(0.06)	CORE LOSS - rock
	274.16	(0.03)	CORE LOSS - coal
	274.17	0.01	COAL - dull banded, sheared. Broken stick.
	274.21	0.04	COAL - dull, sheared. Broken Stick.
	274.22	0.01	COAL - dull, metallic lustre, with lenses of carbonaceous mudstone. Stick.
	274.25	0.03	COAL - dull and bright. Broken Stick.
	274.28	0.03	COAL - bright banded. Broken stick.
	274.32	0.04	COAL - sheared, coal type indistinguishable.
	274.36	0.04	COAL - sheared, some fragments of dull coal. Broken and pulverised.
			DD 275.3
	274.40	0.04	COAL - sheared, coal type unrecognisable. Broken.
	274.43	0.03	COAL - with 50% carbonaceous mudstone bands. Broken stick.
	274.51	(0.08)	CORE LOSS - coal
	274.545	0.035	COAL - bright banded. Broken stick.
	274.55	0.005	MUDSTONE - carbonaceous, lustrated. Stick.
	274.62	0.07	COAL - bright banded, stick.
	274.66	0.04	MUDSTONE - carbonaceous, with 50% bright coal bands. Broken stick. Sheared coal at base.
	274.70	0.04	COAL - dull and bright. Stick.
	274.73	0.03	COAL - bright banded. Broken stick.
	274.74	0.01	MUDSTONE - carbonaceous. Stick.
			DD 275.6
	274.78	0.04	MUDSTONE - carbonaceous, few thin (0.001 m) bright coal bands in basal 0.01 m. Broken stick.

BP 53/C/4BP 53/C/5

DD 274.7

BP 53/C/6

BII Nos. BP53

Dip °	DEPTH m	THICKNESS m	DESCRIPTION
	274.84	0.06	MUDSTONE - carbonaceous, with a few thin (0.001 m) bright coal bands.
	274.85 275.14	0.01 (0.29)	COAL - bright. Broken. CORE LOSS - coal.
			BASE OF LOWER GETHING "C" SEAM
	275.70	0.56	MUDSTONE - dark grey to black, carbonaceous, with occasional concentrations of thin (0.001 to 0.002 m) bright coal bands. Locally abundant carbonized plant fragments. Very carbonaceous, with abundant very thin bright coal bands, from 275.58 to 275.60 m. Gradational.
	280.83	5.13	MUDSTONE/SILTSTONE (80:20) - interbedded and interlaminated dark grey to black carbonaceous mudstone with medium grey, moderately calcareous siltstone. Listericated at top (40° to 45° CA); abundant hairline calcite veinlets at 70° to 90° CA. Core badly broken, and 0.65 m core lost, from 275.94 to 276.71. Carbonaceous to canneloid mudstone, with 25% bands of bright coal, from 275.75 to 275.95. Gradational.
5° at	282.55	1.72	SILTSTONE, argillaceous/SANDSTONE, very fine-grained (70:30) - interlaminated, ripple-laminated medium to dark grey, siltstone and light to medium grey sandstone. Strongly calcareous throughout. Lamination generally obliterated by intense bioturbation. Large (0.004 to 0.005 m) worm burrows and occasional pelecypod burrows. Locally abundant carbonized plant debris. Calcite at 281.38 (82° CA); 281.69 (75° CA) and 281.73 (80° CA). Gradational.
	280.93		
	283.39	0.84	MUDSTONE - dark grey, silty, strongly calcareous in top 0.43 m, grading down to black, carbonaceous, in basal 0.41 m. Calcite veinlets associated with bright coaly bands, with calcite filling cleat in bands (0.001 m thick). Abundant plant debris throughout. Abrupt.
	284.61	1.22	SILTSTONE, argillaceous/MUDSTONE (90:10), grading down to SANDSTONE, fine-grained/SILTSTONE, argillaceous (80:20) - coarsening-downward interlaminated sequence. Low-angle, medium-scale cross-lamination, occasional ripples and slumps. Strongly calcareous throughout, except for mudstones (non-calcareous). Dominantly fine-grained, light grey, quartzose sandstone from 284.09 to base. Abundant calcite in basal 0.16 m, at : 90° CA (crystals up to 0.005 m), 40° CA, and 45° CA. ABRUPT.

BP53/C/7
BP 53/C/8

BH Nos. BP 53

Dip °	DEPTH m	THICKNESS m	DESCRIPTION
			TOP OF LOWER GETHING "LOWER C" SEAM
	285.01	0.40	MUDSTONE - black, carbonaceous to canneloid. Finely broken carbonised plant debris and thin coaly stringers throughout. Locally listricated.
	285.05	0.04	COAL - sheared and pulverised. Coal type indistinguishable.
	285.29	(0.24)	CORE LOSS - coal and rock
	285.41	(0.12)	CORE LOSS - rock
	286.02	0.61	MUDSTONE - dark grey; abundant carbonised plant fragments.
	286.04	0.02	MUDSTONE - black, carbonaceous. Stick. <u>10cm roof sample: BP 53/CL/R</u>
	286.16	0.12	MUDSTONE - black, very carbonaceous, lustrous, with abundant thin coal bands. "Bone". Easily split parallel to CA. Broken stick.
	286.20	(0.04)	CORE LOSS - coal and rock. <u>BP 53/CL/1</u>
	286.23	0.03	COAL - sheared, pulverised. Coal type undistinguishable.
	286.28	0.05	MUDSTONE - black, carbonaceous, with abundant large carbonised plant fragments. Stick.
	286.36	0.08	MUDSTONE, carbonaceous, with thin coal bands/COAL, dull and bright (60:40) - broken; fragments mixed together with drilling mud.
	286.45	(0.09)	CORE LOSS - rock
	286.53	0.08	MUDSTONE - black, carbonaceous, with thin coal bands. Core baked on outside and ground at top. Stick.
	286.56	0.03	MUDSTONE - black, carbonaceous, ground, as above.
	286.66	0.10	MUDSTONE - black, very carbonaceous, with abundant thin coal bands. "Bone". Lustrous, easily split parallel to CA. Stick.
	286.67	0.01	MUDSTONE - black, very carbonaceous, lustrous, "bone" as above. Broken.
	286.68	0.01	COAL - bright. Broken.
	286.70	0.02	MUDSTONE - black, very carbonaceous, abundant thin coal bands, lustrous, "Bone"
	286.74	0.04	COAL - dull, metallic lustre. Stick. <u>BP 53/CL/2</u>
	286.92	(0.18)	CORE LOSS - coal and rock
	287.07	0.15	COAL - dull, metallic lustre, sheared. Broken and broken stick.
	287.12	0.05	COAL - sheared and pulverised. Coal type undistinguishable.

Bl. Nos. *BP 53*

Dip °	DEPTH m	THICKNESS m	DESCRIPTION
	287.15	0.03	COAL - dull and bright.
	287.21	0.06	COAL - dull banded. Stick.
	287.25	0.04	COAL - dull and bright. Broken.
	287.28	0.03	COAL - bright banded.
	287.32	0.04	COAL - dull. Stick.
	287.33	0.01	COAL - dull and bright
	287.41	0.08	COAL - dull
	287.53	0.12	COAL - dull banded. Stick.
			DD 288.1
	287.55	0.02	COAL - dull banded. Stick.
			<i>BP 53/CL/2</i>
			<i>BP 53/CL/3</i>
	287.56	0.01	MUDSTONE - black, carbonaceous, with thin bright coal bands. Broken Stick.
	287.59	0.03	MUDSTONE - black, carbonaceous, with thin bright coal bands. Stick.
			<i>BP 53/CL/4</i>
	287.64	0.05	COAL - dull banded. Broken and pulverised.
	287.68	(0.04)	CORE LOSS - coal
	287.69	0.01	COAL - dull and bright.
	287.70	0.01	COAL - dull banded. Stick.
	287.85	(0.15)	CORE LOSS - coal and rock
	287.93	0.08	COAL - broken and pulverised. Coal type indistinguishable
			<i>BP 53/CL/5</i>
	287.94	0.01	COAL - bright, with 50% bands of black, carbonaceous mudstone. Stick.
	287.96	0.02	MUDSTONE - black, carbonaceous, with thin bright coal band. Broken stick.
	288.02	0.06	COAL and MUDSTONE - pulverised, mixed together.
			DD288.7
	288.04	0.02	MUDSTONE - black, carbonaceous, with thin bright coal bands. Stick.
	288.30	0.26	MUDSTONE - dark grey, very silty, with scattered carbonised plant fragments. Locally lustrated. Erosional at base.
	288.38	0.08	MUDSTONE - black, very carbonaceous, lustrous, with abundant very thin bright coal bands. "Bone". Stick.
	288.41	0.03	MUDSTONE - black, carbonaceous, with bright coal bands up to 0.002 m thick.

BH Nos. BP53

Dip °	DEPTH m	THICKNESS m	DESCRIPTION
	288.43	0.02	MUDSTONE - black, carbonaceous, with thin (0.001 m) bright coal bands. Stick. <u>BP 53/CL/5</u>
	288.47	0.04	COAL - dull and bright. Stick.
	288.51	0.04	COAL - dull banded, metallic lustre. Stick.
	288.55	(0.04)	CORE LOSS - coal <u>BP 53/CL/6</u>
	288.60	(0.05)	CORE LOSS - rock
	288.64	0.04	MUDSTONE - black, carbonaceous, with thin silty stringers. Stick.
	288.72	0.08	MUDSTONE - black, very carbonaceous, lustrous, "bone", with one bright coal band (0.004 m) and one dull, lustrous coal band (0.005 m). Broken.
	288.74	0.02	SANDSTONE - fine to medium-grained, medium grey, quartzose, calcareous; welded. Tough and hard. Broken stick. DD 289.3
	288.76	0.02	MUDSTONE - black, very carbonaceous, with 40% bright coal bands (0.003 m thick). Stick.
			BASE OF LOWER GETHING "LOWER C" SEAM
	288.86	0.10	MUDSTONE - dark grey, listricated, with abundant carbonised plant fragments.
	290.99	2.13	MUDSTONE - dark grey, silty, locally carbonaceous. Top 0.30 m and basal 0.61 m listricated. Ground and broken from 290.81 to 290.91. Abrupt.
	291.60	0.61	SILTSTONE - argillaceous, light to medium grey, "greasy" lustre. <u>High gamma response</u> , possibly bentonitic ash band. Graded laminae of silt and clay, suggesting reworking. Abundant large carbonised plant fragments. A few laminae of very fine-grained sandstone. Slickensides (64°CA) at 291.29. Abrupt.
	293.73	2.13	MUDSTONE - dark grey to black, very silty, slightly carbonaceous. Occasional bright coaly bands. Listricated throughout, except from 292.52 to 292.78 where it grades into argillaceous siltstone. Gradational.
	296.72	2.99	MUDSTONE - black, carbonaceous to canneloid throughout. Abundant carbonised plant fragments. Occasional thin (0.001 to 0.002 m) bright coaly lenses; abundant from 296.26 to 296.38. <u>Coal</u> , dull, metallic lustre, from 294.79 to 294.87; <u>coal</u> , dull banded from 294.87 to 294.94. <u>Coal</u> , dull and bright, from 296.52 to 296.54. Local listrication throughout unit. Abrupt.

BII Nos. 8053

Dip °	DEPTH m	THICKNESS m	DESCRIPTION
	298.22	1.50	SILTSTONE - medium to dark grey, argillaceous. Abundant carbonised plant fragments. Dark grey, silty mudstone from 297.03 to 297.17; interval intensely listricated near parallel to core axis. Black carbonaceous mudstone with coaly bands, from 297.17 to 297.46. Basal 0.26 m badly ground by drill.
	299.00	0.78	MUDSTONE - dark grey to black, alternately silty and carbonaceous, with a few (0.001 m) thin bright coaly bands. Bright coal/mudstone (50:50) from 298.67 to 298.70. Top 0.20 m slightly carbonaceous, very silty, gradational at base. Occasional listrication. Gradational.
	299.38	0.38	SILTSTONE - grading occasionally to very fine-grained sandstone. Very argillaceous. Medium grey. Medium (0.002 to 0.003 m) worm burrows. Sandstone dominant at base. Intensely bioturbated throughout. Non-calcareous. Gradational.
	302.13	2.75	MUDSTONE - black, carbonaceous. Slightly silty in top 0.10 m. Occasional thin (0.001 m) bright coaly bands. Occasional listrication, dominantly at 40° to 50° CA. Sheared and pulverised from 300.84 to 302.07. Core loss 1:18. Gradational.
	305.27	3.14	SANDSTONE, very fine-grained/SILTSTONE/MUDSTONE (50:30:20) - churned, bioturbated, interbedded light grey, siliceous sandstone and medium to dark grey siltstone and mudstone. Poorly preserved low-angle and ripple cross-lamination in sandstones; scattered faintly dark-rimmed, large (0.004 to 0.005 m) worm burrows and occasional pelecypod burrows in sandstones. Dominantly siltstone/mudstone from 303.21 to base, with sandstone interbeds from 303.40 to 303.52; 304.15 to 304.33; 304.40 to 304.48; 305.11 to 305.15. Gradational.
1° at	304.77		
	307.33	2.06	MUDSTONE - black, carbonaceous, homogeneously silty, with 10% churned silty laminae in basal 0.44 m. Bioturbation evident at base; abundant small to medium worm burrows (0.001 to 0.003 m). Locally abundant carbonised plant fragments. Local listrication concentrated in basal 0.40 m. Medium grey, non-carbonaceous mudstone band, intensely burrowed, from 305.81 to 305.83. Base of unit is churned and burrowed.
	308.96	1.63	SANDSTONE - fine to very-fine-grained, silty, poorly sorted, medium grey, non-calcareous. Locally intensive bioturbation; some medium (0.003 m) worm burrows. Top 0.90 m generally devoid of lamination; ripple cross-lamination from 308.23 to 308.66, parallel and
4° at	308.86		

BH Nos. EP53

Dip °	DEPTH m	THICKNESS m	DESCRIPTION
	312.57	3.61	ripple cross-lamination to base. Abrupt. SANDSTONE - medium to very coarse-grained, generally well-sorted, with abundant argillaceous and carbonaceous laminae. Medium grey, siliceous. Grains welded together; distinctive overall "cooked" appearance. Rapid vertical changes in grain size (medium to coarse to locally granular) and in abundance of laminae. Abundant granular phases towards base. Basal 1.80 metres characterised by better overall sorting; dominantly coarse-grained, with fewer coaly wisps and laminae. Large-scale low-angle cross-laminated. Remainder much more "chaotic" with abundant wisps and laminae, characterised by closely-spaced scours. Abrupt.
	317.66	5.09	SILTSTONE/SANDSTONE, very fine-grained/MUDSTONE (40:30:30) - interbedded and interlaminated, moderately calcareous, medium grey siltstone and sandstone, with dark grey mudstone. Sorting poor throughout; generally bioturbated with abundant worm and pelecypod burrows. Some remnant small-scale low-angle cross-lamination in basal 1.10 m. Carbonaceous mudstone phases from 314.87 to 315.02 and from 315.51 to 315.54 and 315.81 to 316.03. Abrupt phases of medium to coarse-grained, siliceous sandstone, similar to the overlying unit, from 314.13 to 314.23, 314.39 to 314.47, and 314.73 to 314.87. Abrupt.
4° at	313.60		
	318.95	1.29	SILTSTONE ; dark grey, argillaceous, carbonaceous, with abundant finely broken plant debris. Gradational.
	319.61	0.66	MUDSTONE - black, carbonaceous, with abundant thin bright coal bands and finely broken plant debris. Abrupt.
	320.60	0.99	SANDSTONE, very fine to fine-grained/SILTSTONE (65:35) - interbedded and interlaminated, moderately calcareous, silty, medium grey sandstone and argillaceous, non-calcareous, slightly carbonaceous dark grey siltstone. Abundant ripple lamination and slumping in sandstone. Gradational.
			TOP OF LOWER GETHING "D" SEAM
	320.96	0.36	MUDSTONE - black, carbonaceous, with 20% silty lenses and abundant finely broken, carbonised plant debris throughout. Gradational at base. Broken stick.
	321.23	0.27	MUDSTONE - black, carbonaceous, with abundant thin bright coal bands, and finely broken, carbonised plant

BH Nos. BP 53

Dip °	DEPTH m	THICKNESS m	DESCRIPTION
			debris. Top 0.12 and basal 0.06 m intensely listricated Top 0.12 m broken; remainder stick. DD 321.9
	321.61 321.71	(0.38) 0.10	CORE LOSS - rock MUDSTONE - black, carbonaceous, with abundant thin bright coal bands. Minor listrication. Core broken and ground. BP 53/D/1 BP 53/D/2
	321.76	0.05	MUDSTONE - black, very carbonaceous, with abundant very thin bright coal bands. Easily split parallel to core axis. "Bone".
	321.84	0.08	MUDSTONE - black, carbonaceous with thin bright coal bands and abundant carbonised plant debris. Broken stick.
	322.01	0.17	MUDSTONE - dark grey, very silty, slightly carbonaceous, with occasional thin coaly bands and carbonised plant fragments. Stick. BP 53/D/3 BP 53/D/4
	322.22	0.21	MUDSTONE - black, very carbonaceous, with abundant thin bright coal bands. Basal 0.06 m with silvery lustre. Easily split parallel to core axis. "Bone" Gradational at base. Broken stick.
	322.42 322.53	(0.20) 0.11	CORE LOSS - coal COAL - dull, lustrous, hard. Broken stick. BP 53/D/5
	322.56	0.03	COAL - dull and dull lustrous, mixed fragments. Core badly broken and ground.
	322.61	0.05	COAL - dull, lustrous, hard. Stick.
	322.73	0.12	MUDSTONE - ("Bone")black, very carbonaceous with abundant very thin bright coal bands and some thicker coal bands (up to 0.002 m). Easily split parallel to core axis. Slight silvery lustre, decreasing at base. Gradational at base. Stick. BP 53/D/6
	322.78	0.05	MUDSTONE - black, carbonaceous. Abundant thin bright coal bands. Stick. BP 53/D/7
			DD 323.2
	322.985 322.99	(0.205) 0.005	CORE LOSS - coal MUDSTONE - black, carbonaceous, listricated, stick.
	323.03	0.04	COAL - dull and bright, broken stick. BP 53/D/8
	323.16	0.13	MUDSTONE - black, carbonaceous, intensely listricated at 70° to 90° CA. Broken Stick. BP 53/D/9

BH Nos. BP 53

Dip °	DEPTH m	THICKNESS m	DESCRIPTION
	323.19	0.03	MUDSTONE - black, carbonaceous, with abundant thin bright coal bands. BP 53/D/9
	323.20	0.01	COAL/MUDSTONE (50:50) - interlaminated black, carbonaceous mudstone and bright coal. BP 53/D/10
	323.22 323.28	0.02 0.06	COAL/MUDSTONE (50:50) - as above COAL - dull and bright. Stick. BP 53/D/11
	323.33 323.41 323.43	0.05 (0.08) 0.02	COAL - bright. Large and small fragments. * CORE LOSS - coal MUDSTONE - black, carbonaceous, with thin bright coal bands. Large * fragments. BP 53/D/12
			* Note - these fragments were found partially mixed in core box. Large size of most pieces, and the fact that the mudstone was underneath the coal fragments in the box, suggests that the coal and mudstone are from discrete beds, and that the bright coal overlies the mudstone. (C.B.)
	323.73	0.30	MUDSTONE - black, carbonaceous with abundant carbonised plant fragments. Top 0.08 m slightly lustrated. Abrupt at base. Broken stick.
	323.78	0.05	MUDSTONE - black, very carbonaceous with abundant very thin bright coal bands. Core splits at approximately 15° CA. "Bone". Stick. BP 53/D/13
	323.83	0.05	MUDSTONE - black, very carbonaceous, with abundant very thin bright coal bands and some thicker coal bands (up to 0.003 m) Broken "Bone".
	323.86	(0.03)	CORE LOSS - rock
			BASE OF LOWER GETHING "D" SEAM
	326.80	2.94	SILTSTONE/MUDSTONE (50:50) - interbedded and interlaminated poorly sorted and locally slumped sequence of medium to dark grey, very argillaceous, locally carbonaceous, strongly calcareous. Siltstone and dark grey, silty, locally carbonaceous, non-calcareous mudstone. Occasional pelecypod burrows. Some ripple lamination in cleaner siltstone phases. Locally abundant carbonised plant fragments and thin bright coal bands. Gradational.
	333.43	6.63	SILTSTONE/SANDSTONE, very fine to fine-grained/MUDSTONE (40:30:30) - interbedded dark grey silty mudstone, medium to dark grey, weakly calcareous, argillaceous siltstone, and medium grey, strongly calcareous, argillaceous sandstone. Beds from 0.15 to 0.90 m thick.

BH Nos. BP 53

Dip °	DEPTH m	THICKNESS m	DESCRIPTION
3° at base			Sandstones and some siltstones are ripple-laminated. Siltstones and mudstones generally intensely bioturbated. Locally abundant worm and pelecypod burrows. Locally abundant carbonised plant fragments. Local slumping. Abrupt.
0°	333.94	0.51	MUDSTONE/SILTSTONE (50:50) - interlaminated dark grey mudstone and argillaceous siltstone. Siltstone laminae are strongly calcareous. Mudstone non-calcareous. Abrupt at base.
	337.12	3.18	MUDSTONE - dark grey to black, silty throughout. Locally black, carbonaceous, with thin bright coal bands. Locally very silty, and badly "stacked" and crumbling in core box. Core loss in this unit, 0.82 m. Abrupt.
	338.40	1.28	SANDSTONE - very fine-grained, very silty, and argillaceous non-calcareous, intensely bioturbated. Medium to dark grey. Gradational.
	339.57	1.17	SANDSTONE - very fine-grained, argillaceous, medium grey. Ripple-laminated throughout, with two carbonaceous silty mudstone phases, aggregating 0.12 m. Non-calcareous, stylolites in basal 0.06 m. Abrupt.
	346.10	6.53	SANDSTONE - <u>clean</u> , well-sorted. Top 0.25 m fine-grained; medium to coarse-grained to 340.73; fine to medium-grained, (with occasional coarse-grained stringers, coaly wisps, and intraclasts) to 342.96; coarse to very coarse-grained to base, with abundant granules and pebbles, up to 0.030 m (average 0.005 to 0.010 m). Occasional coaly wisps, mudstone blebs and stylolites in basal 3.0 m. Unit distinctively light grey, very siliceous, patchily calcareous. Medium to large-scale low-angle cross-laminated in top 4.0 m; massive to base. Abrupt.
0° to 5°	355.73	9.63	MUDSTONE/SILTSTONE/SANDSTONE, very fine-grained (70:15:15) - mudstone, dark grey to black, slightly silty and slightly carbonaceous throughout (with abundant finely broken plant debris), with interbeds of medium to dark grey, ripple-laminated, argillaceous siltstone and sandstone. Locally bioturbated and slumped. Occasional <u>quartz</u> veinlets in sandstone phases. Silty mudstone comprises the entire section between 346.25 and 348.75; 349.80 and 351.40, and basal 2.00 m. Core loss 0.87 m within this unit. Abrupt.
	357.89	2.16	SANDSTONE, very fine to fine-grained/SILTSTONE/MUDSTONE (40:40:20) - interbedded and interlaminated medium grey argillaceous sandstone and siltstone with dark

BH Nos. BP 53

Dip °	DEPTH m	THICKNESS m	DESCRIPTION
8°at	357.84		grey mudstone. Weakly to moderately calcareous. Medium-scale low-angle and ripple cross-laminated. Overall poorly sorted sequence. Locally abundant carbonised plant fragments.
	358.55	0.66	MUDSTONE - dark grey to black, silty. Rusty, with disseminated pyrite in basal 0.25 m; abundant calcite in basal 0.08; probably diagenetic, associated with replacement. Abrupt.
			TOP OF LOWER GETHING "E" SEAM
	358.61	0.06	MUDSTONE - dark grey, carbonaceous, abundant plant fragments, stick.
	358.68	0.07	COAL - dull, lustrous, hard, stick. BP 53/E/1
	358.80	0.12	COAL - dull, lustrous, hard, stick. (Core broken at 46°CA).
	358.84	0.04	MUDSTONE - black, very carbonaceous, with abundant very thin bright coal bands, easily split parallel to core axes. ("Bone"). Stick.
			DD 360.1
	359.09	0.25	MUDSTONE - dark grey to black, carbonaceous, listricated. Abundant plant fragments at top. Broken stick.
	359.20	0.11	MUDSTONE - dark grey, slightly carbonaceous, listricated. Core broken and ground.
	359.45	0.25	MUDSTONE - dark grey; slightly carbonaceous, listricated in top 0.10 m. Scattered finely broken plant debris. Gradational at base. Stick.
	359.59	0.14	MUDSTONE - dark grey to black, carbonaceous, abundant carbonised finely broken plant debris. Broken stick.
	359.67	0.08	MUDSTONE - dark grey to black, as above, with thin bright coal bands. Badly broken and ground.
	359.71	(0.04)	CORE LOSS - rock.
	359.82	0.11	MUDSTONE - black, carbonaceous with thin bright coal bands and abundant carbonised plant debris. Broken stick.
	359.88	0.06	MUDSTONE/COAL (80:20) - black, carbonaceous mudstone and bright coal, pulverised and mixed in box.
	359.94	0.06	MUDSTONE - black, carbonaceous with bright coaly inclusions
	359.97	0.03	MUDSTONE - black, very carbonaceous, with abundant very thin bright coal bands. Easily split parallel to core

BH Nos. BP 53

Dip °	DEPTH m	THICKNESS m	DESCRIPTION
	360.03	0.06	axis. ("Bone") . Stick MUDSTONE - black, carbonaceous, broken and ground.
	360.42	0.39	MUDSTONE - dark grey, slightly carbonaceous, listricated. Broken stick.
	360.76	0.34	DD 362 MUDSTONE - dark grey, slightly carbonaceous at top, grading downward to black, carbonaceous with thin bright coal bands in basal 0.11 m. Listricated throughout.
			BASE OF LOWER GETHING "E" SEAM
	363.95	3.19	SILTSTONE - dark grey, argillaceous grading to sandstone, very fine-grained, silty, argillaceous, at base. Poorly sorted sequence; top 1.25 m is intensely bioturbated remainder to base is medium-scale low-angle cross- laminated with occasional ripples. Contorted near - vertical carbonaceous stringers in top 1.25 m - <u>possible rootlets. Gradational!</u>
	369.84	5.89	SANDSTONE - argillaceous with locally abundant carbonaceous laminae. Top 0.61 m is fine to very fine-grained, medium-scale low-angle and ripple-laminated, locally slumped. From 364.56 to 365.72, fine to medium-grained, small to medium-scale low-angle, and locally ripple- laminated, with occasional scours; fine-grained, ripple- laminated to 367.47, fine to medium-grained (occasional coarse-grained phases) with abundant (locally pyritised)- coaly wisps, medium scale low-angle and locally ripple- laminated, with occasional scours, to base. Basal 0.22 m strongly calcareous. Erosional, with intraclasts.
	370.40	0.56	SANDSTONE, fine to medium-grained/MUDSTONE (50:50) - three erosional, fining-upward cycles of low-angle cross-laminated, intraclast-rich strongly calcareous sandstone, grading up to dark grey, silty mudstone. Erosional.
	371.38	0.98	MUDSTONE, dark grey to black, slightly silty, carbonaceous, with abundant plant fragments. Abrupt, listricated at base.
0° to 2°	373.72	2.34	SANDSTONE, very fine-grained/SILTSTONE (50:50) - interbedded light to medium grey sandstone and medium to dark grey siltstone, argillaceous and poorly sorted throughout. Overall, intensely bioturbated. Moderately to strongly calcareous in basal 0.8 m. Abrupt.

Bl-Nos. BP 53

Dip °	DEPTH m	THICKNESS m	DESCRIPTION
	374.55	0.83	SANDSTONE - fine-grained, argillaceous, otherwise well-sorted, medium grey, strongly calcareous, ripple-laminated throughout. Erosional.
	376.00	1.45	SANDSTONE - fine to medium-grained, argillaceous, poorly sorted, abundant coaly wisps. Strongly calcareous. Medium to large-scale low-angle, cross-laminated. Occasional intraclast horizons in basal 0.30 m. Very abundant intraclasts in basal 0.10 m; erosional.
	379.60	3.60	SILTSTONE/MUDSTONE (80:20) - Siltstone: black, very argillaceous, slightly carbonaceous to carbonaceous throughout; local carbonaceous, silty mudstone phases; strongly calcareous in top 2.10 m, and in basal 0.59 m.
	381.54	1.94	MUDSTONE - black, silty, carbonaceous in top 0.99 m and basal 0.44 m. Abrupt.
	389.08	7.54	SILTSTONE/SANDSTONE, very fine-grained/MUDSTONE (60:30:10) - thinly interbedded, intensely bioturbated and locally slumped, poorly-sorted sequence of medium to dark grey siltstone, medium grey sandstone and dark grey silty mudstone. Some remnant medium-scale low-angle cross-lamination; generally devoid of lamination due to bioturbation and slumping. A few faint small, dark and medium, dark-rimmed worm burrows. Distinctively non-calcareous. Occasional carbonised plant fragments, both small and large (bark chips?). Churned basal contact.
5° to 7°	391.47	2.39	SANDSTONE - very fine to fine-grained, argillaceous, poorly sorted. Small-scale low-angle and ripple cross-laminated throughout. Medium grey, moderately calcareous throughout.
BASE OF HOLE			DD 392.4
			$ \begin{array}{r} 11772 \\ 11772 \\ \hline 12944.2 \end{array} $

PR - SUKUNKA 78 (3)A.

SUKUNKA 1978 EXPLORATION

PROGRAM

BP-60

(DDH)

665

Contractor: CMS

Co-ordinates: 61 21476.369 N

Commenced: 4 August, 1978

5 89047.611 E

Completed: 9 August, 1978

Surface Elevation: 1128.32 m

Core Size: NQ

Casing Left in Hole:

Hole Angle: }
Hole Azimuth: } no details

Geologist Depth

Logged by: C. Bickford 10.0 - 129.52

Final Depth: 129.52

Depth to top of cored section: 10.0 m

FORMATION/MEMBER	DEPTH	THICKNESS	ELEVATION
GATES			
SUKUNKA			
MOOSEBAR	31.20	10.8	1097.12
GETTING: UPPER		10.4 + UP 38.32 + LP	
MIDDLE			
LOWER			

SEAMS	DEPTH	THICKNESS	%RECOVERY	ELEVATION
Bird	31.24	0.04 (horizon)	[too thin to estimate]	1097.08
U. Chamberlain	111.76	2.48 (split)	34.27%	1016.56
L. Chamberlain	121.06	2.64	7.95%	1007.26

BH-Rosa BP60

Dip °	DEPTH m	THICKNESS m	DESCRIPTION
	10.0	10.0	Casing - no core. Drillers depth 10.0m
	20.4	10.4	<p style="text-align: center;">UPPER GETTING</p> <p>(NOTE- ESTIMATED 28m BELOW LOWER CHAMBERLAIN SEAM FLOOR HORIZON).</p> <p>SANDSTONE - medium grey, locally rusty-brown weathered. Top 0.06m coarse to very coarse-grained; remainder is fine-grained. Clean, well-sorted; strongly calcareous at top, decreasing to moderately calcareous at base. Large-scale low-angle cross laminated throughout. Large (0.006m), dark-rimmed worn burrows at 13.49. Calcite (dominantly 15° to 30°, locally up to 70° CA) occasional in upper 2.67m of unit, but core recovery appears to be high. Abundant calcite from here down to base with local badly broken ground and some calcite filled breccia; concentrated between 13.60 and 15.40. Fractures from 35° to 65° CA; dominantly at 55° CA. Core loss through basal 7.33m : 3.09m. Faulted at base.</p> <p style="text-align: center;">FAULT, ESTABLISHED.</p>
29° at 10.89 10° at 13.49 85°-90° at 14.85 52° at 15.45 45° at 19.95	MOOSEBAR 29.32 38° at 26.02 30° at 27.47 31.20 40° at top	8.92	<p>MUDSTONE - dark grey, slightly silty, with occasional flecks and blebs of pyrite. Three bands of slightly calcareous, dark brownish-grey, unconsolidated mud in upper 1.0m. (Probably drilling mud, as they contain recognisable core fragments.) Bentonite: 0.003m thick, crumbly, white, dip 38° at 26.02; crumbly, white, fragments in box at 27.37; hard, greasy, off white, core ground, partly swelled, from 28.04 to 28.08; crumbly, off-white, partly swelled at top, and hard, olive-green, broken at base, from 29.16 to 29.32. Glauconitic, dark green, fine-grained sandstone stringer (0.001m) at 27.47. Slickensides and calcite abundant in top 2.26m, dominantly 45° to 55° CA. From 22.26 to 22.56, slickensides and calcite, closely spaced near-parallel to core axis (0° to 15° CA). Slickensides and calcite at 24.18 (40° CA). Rough, slightly rusty and chalky joints in basal 3.35m, from 15° to 30° CA. Gradational.</p> <p>SANDSTONE- fine-grained; dark greenish grey. Unit distinctively glauconitic and very weakly calcareous throughout. Top 0.45m is sandy (5% disseminated sand grains) mudstone, grading down to very argillaceous (30% to 50% mudstone matrix and laminae) sandstone, to base. Occasional medium-grained phases towards base. Unit is bioturbated throughout, with occasional recognisable large (0.005m) worm burrows. Rough, rusty joints (20° to 30° CA) from 30.91 to 31.12. Abrupt.</p>
		0.01	<p style="text-align: center;">MOOSEBAR</p> <p style="text-align: center;">UPPER GETTING</p> <p style="text-align: center;">TOP OF BIRD SEAM</p> <p>MUDSTONE- hard, dark brown to black, very carbonaceous, listricated, core ground out. Thickness estimated.</p>

Dip °	DEPTH m	THICKNESS m	DESCRIPTION
		0.02 to 0.03 0.003 (maximum)	Sandstone- fine-grained, dark grey, with carbonaceous matrix. Coal-sheared, bright. Abrupt.
36°	31.24	0.04 (overall)	— BASE OF BIRD SEAM —
46° 44° 33° 30°	52.80 at 39.47 at 40.41 at 41.08 at 48.54	21.56	SANDSTONE- fine to medium-grained from top to 36.49, fine-grained to 37.92; fine to medium-grained to 41.03; with coarse-grained phases from 39.40 to 39.47 and 40.09 to 40.12; pebbly from 40.41 to 40.49. Coarse-grained to granular from 41.03 to 41.08; fine to very fine-grained to base. Weakly calcareous in top 3.95m; moderately calcareous to 40.49; strongly to very strongly calcareous to base. Clean, well-sorted throughout. Top 0.03m dark grey to black, with carbonaceous matrix, and a few coaly inclusions. Top 3.26m is intensely bioturbated and mottled, with occasional concentrations of very small (Pin prick) worm burrows. Remainder of unit is large-scale low-angle cross-laminated. Abundant small (0.001 to 0.002m) dark-rimmed worm burrows from 33.91 to 34.13 and 34.99 to 35.69. Faint, dark-rimmed medium (0.002 to 0.003m) burrows, locally concentrated from 42.09 to 43.09 and 49.79 to 51.19. Calcite, generally with slickensides, common in top 10.80m; concentrated from 36.69 to 40.79. Core recovery high throughout, with no badly broken ground. Dominant orientations 35° to 55° CA, (60° to 80° to bedding planes), thickness from hairline to 0.04m. Possible minor fault at 36.99, based on calcite-filled breccia from 36.95 to 37.04, and possible repeat of thin argillaceous partings in sandstone. Throw approximately 0.50m. Core badly ground from 34.09 to 35.54; with 1.25m core loss. Basal contact of unit ground out.
35° 26°	57.01 at 53.35 at 56.71	4.21	SANDSTONE, very fine-grained /MUDSTONE (50:50)- grading to sandstone, very fine-grained/siltstone (50:50) at base. Thinly interbedded, medium grey, low-angle cross-laminated sandstone and dark grey siltstone or mudstone. Strongly calcareous throughout. Bioturbated throughout, with abundant very small and small (0.001m) dark burrows, pyritised in top 1.0 metre, and occasional pelecypod burrows. Rough rusty joint from 54.45 to 54.51, (32° CA). Calcite-filled breccia from 53.96 to 54.02 (62° to bedding). Top 0.13m of unit badly broken and mixed with dark brown, slightly calcareous mud (drilling mud?). Abundant swelling, bentonitic chips and some fragments of orange-weathered sandstone (Probable caving from top of hole?); 0.88m of mud in core box. Base of unit abrupt.
	57.97	0.96	SANDSTONE- fine to medium-grained, with coarse-grained phases and mudstone bands at top. Otherwise clean and well-sorted. Strongly calcareous throughout. Medium grey. Medium-scale low-angle cross-laminated, except at top where devoid of lamination (bioturbated), with faint small

Dip °	DEPTH m	THICKNESS m	DESCRIPTION
			(0.001 to 0.002m) dark-rimmed worm burrows. Some calcite and rough, rusty joints (8° and 28° CA). Abrupt.
20° at	58.46 58.06	0.49	MUDSTONE/SILTSTONE (80:20)- dark grey, weakly calcareous mudstone with thin wispy laminae of siltstone, and abundant pyritised worm burrows. Medium-scale low-angle cross-laminated. Core ground at top of unit. One rough, rusty joint (17° CA). Ground out at base.
20° at	59.08 58.82	0.62	SANDSTONE- fine to medium-grained, medium grey, clean, well-sorted, with sparse, thin dark slickensided argillaceous laminae. Low-angle, large-scale cross-laminated. Weakly calcareous. Brecciated, porous, with abundant calcite, from 0.33 to 0.46m below top. Calcite veinlets throughout, at 35° to 65° CA (60° to 90° to bedding). Sheared and listricated at base; possible fault contact.
70° to	60.00 90° to 105° (overturned)	0.92	SANDSTONE, very fine-grained/MUDSTONE (50:50)- Medium grey silty sandstone with thinly interbedded dark grey mudstone. Distinctive small and very small dark worm burrows. Rock very weakly calcareous but abundant short calcite veinlets at 60° to 90° to bedding (extensional fractures?). Unit intensely sheared, listricated and broken in top 0.18 and basal 0.33m. Very steep dips and shearing suggests drag fold adjacent to fault. Sheared at base.
			FAULT, ESTABLISHED CORE LOSS
53° at 15° to 20° at 17° at 16° at	62.83 86.60 62.95 67.03 71.23 72.83	(2.83) 23.77	SANDSTONE- fine to medium-grained from top to 69.47; fine-grained to 71.99, with m-cg pebbly phase from 71.14 to 71.21; fine to medium-grained from 71.99 to 72.83, with granular bands at 72.06, 72.13, 72.63, and 72.69. Medium to very coarse-grained from 72.83 to 72.89. Fine to very fine-grained to base; low-angle, large-scale cross-laminated throughout, except in upper 5.34m (devoid of lamination, mottled with locally recognisable "Pin Prick" burrows.) Abundant small (0.001 to 0.002m) dark-rimmed burrows (marker) from 67.60 to 68.17. Large, dark-rimmed burrows from 72.93 to 73.07, and from 77.01 to 77.08. Local concentrations of faint, dark-rimmed medium (0.003m) burrows throughout unit. Top 0.15m with sheared coaly inclusions; sandstone is dark grey to black, with carbonaceous matrix in top 0.10m; a few small fragments of bright coal and very carbonaceous mudstone in box. (Probable Bird Seam horizon). Sheared coaly inclusions from 66.08 to 66.20. Sandstone, dark grey to black, with carbonaceous matrix from 66.08 to 66.14. Abundant calcite veinlets, forming a net work, and local brecciation in top 3.40m. Dominantly at 15° and 65° CA. Abrupt.
(Non to weakly calcareous from top to 68.58; moderately calcareous to 71.23; strongly calcareous to base.)			

Dip °	DEPTH m	THICKNESS m	DESCRIPTION
12° at	92.45 86.74	5.85	SILTSTONE/SANDSTONE, very fine-grained/MUDSTONE (0:50:50)- at top, grading downward to (40:30:30) at base- thinly interbedded medium grey sandstone, siltstone, and dark grey mudstone. Strongly calcareous throughout. Sandstones generally abrupt at base, small-scale cross-laminated, and fining-upwards. Abundant small and very small dark burrows; commonly pyritised. Occasional pelecypod burrows. Occasional slickensides and calcite (55° to 85° CA, dominantly 70° to 80° CA). Pelecypod (BP60/F1) at 92.01.
10° at	93.69 93.34	1.24	SANDSTONE- fine to medium-grained, with 50% mudstone laminae in top 0.07m and with medium to coarse-grained phases from 92.68 to 92.84. Light to medium grey, clean, well-sorted and strongly calcareous throughout. Small to medium-scale low-angle cross-laminated. Occasional slickensides and calcite at 50° to 75° CA; generally subparallel to bedding. Abrupt.
	94.46	0.77	————— SHELL COAL HORIZON ————— MUDSTONE- dark grey to black, slightly silty at top. Basal 0.30m carbonaceous, with pyrite blebs and sheared dirty coal from 94.18 to 94.23. Abrupt.
25° at	109.28 95.11	14.82	SANDSTONE- fine to medium-grained, medium grey, weakly to moderately calcareous, clean, well-sorted, medium to large-scale low-angle cross-laminated. A few sheared coaly inclusions from 100.36 to 100.51. Large, dark-rimmed worm burrows (0.005m) at top; and scattered concentrations of medium (0.003m), faint dark-rimmed burrows throughout unit. Slickensides and calcite abundant in top 1.15m; dominantly at 10° to 25° and 55° to 60° to core axis. Slickensides with calcite and pyrite (77° CA) at 102.86. Occasional slickensiding throughout unit, parallel to lamination. Core loss throughout unit: 1.60m. Basal contact ground out
22° at base			————— TOP OF UPPER CHAMBERLAIN SEAM —————
	109.39	0.11	MUDSTONE- dark brown to black, carbonaceous. Broken stick. (Equivalent to Rider Coal). BP60/CHU/1
	109.42	0.03	MUDSTONE- dark brown to black, carbonaceous, with silty laminae. Abundant fine-grained pyrite and thin coal bands. Pronounced H ₂ S odor when broken. Broken.
	109.54	0.12	MUDSTONE- dark grey; with 50% disseminated silt. Abundant plant fragments. Lustrated, with pyrite films on lustric surfaces. Few thin laminae of carbonaceous mudstone. Broken stick. BP60/CHU/2
	109.68	0.14	COAL- sheared and broken. Coal type indistinguishable. BP60/CHU/3

BH Nos. BP60

Dip °	DEPTH m	THICKNESS m	DESCRIPTION
	109.695	0.015	COAL- dull, metallic lustre. Broken. BP60/CHU/3
	109.735	0.04	COAL- dull banded, sheared, with slight H ₂ S odor when broke. Stick.
	109.785	0.05	COAL- dull banded, sheared. Stick. BP60/CHU/4
	109.825	0.04	COAL- sheared, coal type indistinguishable. Stick.
	109.87	0.045	COAL- dull banded, sheared. Broken.
	109.95	0.08	COAL- dull banded, sheared. Stick.
	110.01	0.06	COAL- sheared, coal type indistinguishable. Broken and pulverised.
	110.07	0.06	COAL- dull, sheared. Stick.
	110.13	0.06	COAL- dull banded, sheared. Stick.
	111.09	(0.96)	CORE LOSS- coal.
	111.47	(0.38)	CORE LOSS- rock.
	111.60	(0.13)	CORE LOSS- coal/rock.
31°	111.76	0.16	MUDSTONE- dark grey, carbonaceous, with 30% silty laminae. Lustricated, with pyrite and coaly smudge at top. Large and small carbonised plant fragments and pyrite throughout. Abrupt at base.
BASE OF UPPER CHAMBERLAIN SEAM			
	117.0	5.24	SILTSTONE/MUDSTONE (40:60)- interlaminated, parallel-laminated, weakly calcareous medium grey siltstone and dark grey mudstone, with interbeds (50%) of bioturbated, medium grey very fine-grained sandstone from 112.39 to 113.02 and from 115.14 to 115.99. Abundant finely broken plant debris in top 0.40m. Core broken sub-parallel to bedding (68° to 72° CA), at 0.01 to 0.05m intervals, from 113.86 to 114.60 and from 115.60 to 116.39. Breccia, calcite-filled, from 113.45 to 113.50 and from 116.50 to 116.58. Gradational.
18° to 22° from to 114.60 16° at base	113.86		
	118.42	1.42	MUDSTONE/SILTSTONE (80:20 grading to 100:0 at base)- dark grey mudstone with thin laminae of medium-grey siltstone. Non-calcareous throughout. Parallel-laminated. Core badly broken and ground.
			CORE LOSS- 0.87m
			10cm Roof sample: BP/CHL/R

Dip °	DEPTH m	THICKNESS m	DESCRIPTION
			TOP OF LOWER CHAMBERLAIN SEAM
	118.87	(0.45)	CORE LOSS- rock- "bone"
		0.07	COAL-sheared coal type indistinguishable. Broken.
		0.015	COAL- dull, sheared. Stick BP60/CHL/1
		0.025	COAL- sheared, coal type indistinguishable. Broken stick.
		0.04	COAL- dull and bright, sheared. Stick.
		0.06	COAL- sheared, coal type indistinguishable. Broken.
	121.06	0.21 (recovered)	CORE LOSS (not located due to poor recovery) - coal- 1.98m
			BASE OF LOWER CHAMBERLAIN SEAM
15°	at 123.68	8.46	SANDSTONE- top 2.11m medium-grained; fine to medium-grained to base. Medium to dark grey, clean, well-sorted. Top 0.07m dark grey to black with carbonaceous matrix and sheared carbonaceous inclusions. Large-scale low-angle cross-laminated throughout, except top 1.60m, where intense burrowing has resulted in a mottled texture, with local faintly recognizable medium (0.003m) dark-rimmed worm burrows. Local concentrations of medium dark-rimmed worm burrows from 124.46 to 125.36; large (0.005m) dark-rimmed burrows from 125.74 to 126.16. Occasional calcite at 10° to 25° CA.
(Top 2.50m non-calcareous; weakly to moderately calcareous to 124.26; strongly calcareous to base.)			
	129.52		BASE OF HOLE. DD 130.2

PR - SUNKKA 78 (3)A.

SUKUNKA 1978 EXPLORATION

PROGRAM

BP-63

(DDH)

665

SUKUNKA 1978

B.H.No. BP 63

Contractor: CMS

Co-ordinates: 61 21535.640 N

Commenced: 10. August, 1978

5 89339.901 E

Completed: 15. August, 1978

Surface Elevation: 1102.18 m

Core Size: NQ

Casing Left in Hole:

Hole Angle:

Geologist

Depth

Hole Azimuth:

} no details

Logged by:

C. Bickford 9.8 to 114.14

Final Depth: 114.14

Depth to top of cored section: 9.8

FORMATION/MEMBER	DEPTH	THICKNESS	ELEVATION
GATES			
SUKUNKA			
MOOSEBAR	43.64	33.84+	1058.54
GETHING: UPPER		70.50+	
MIDDLE			
LOWER			

SEAMS	DEPTH	THICKNESS	%RECOVERY	ELEVATION
Bird	44.44	0.80 (split)	12.50 %	1057.74
U. Chamberlain	101.63	3.22 (split)	91.30 %	1000.55
L. Chamberlain	107.32	2.12	66.04 %	994.86

Dip o	DEPTH m	THICKNESS m	DESCRIPTION
	9.8		Overburden- no core. two pebbles, sandstone and quartzite in box.
			MOOSEBAR FORMATION
	41.88	32.08	MUDSTONE- dark grey, slightly silty, locally weathered, broken, commonly with calcitic rusty rough joints near parallel to core axis. Slickensides (48°CA) calcite and pyrite from 19.87 to 19.98; associated with ferruginous band. Ferruginous, rusty-weathering bands with calcite veinlets at: 26.38 to 26.42 27.25 to 27.36 27.90 to 27.99 29.68 to 29.76 "Bentonite" bands at: 18.12 to 18.21- white, fragmented, weathered, swelled. 33.43 to 33.45- light grey-white, hard, greasy lustre, burrowed. 41.60 to 41.88- light olive grey, hard, greasy lustre, partly broken and swelled. 40.37 to 40.38- light grey, burrowed, probably reworked. 39.88 to 39.91 light grey, hard, fragmented, burrowed, probably reworked. 39.35 to 39.36- light brownish grey, crumbly, burrowed, probably reworked, sheared. 40.84 to 41.04- light olive grey, hard, greasy lustre, slightly swelled, burrowed. Abrupt at base.
	42.56	0.68	MUDSTONE- dark grey to black, very hard, pyritic. Gradational at base.
	43.64	1.08	MUDSTONE, PYRITIC, GLAUCONITIC, GRADING DOWN TO SANDSTONE, MEDIUM-GRAINED, GLAUCONITIC- dark greenish-grey to black, very hard and strong. Sandstone contains scattered pebbles and granules, and abundant argillaceous matrix and laminae. Bioturbated throughout. Mudstone contains disseminated sand grains. Abrupt at base.
	MOOSEBAR		
	UPPER GETTING		TOP OF BIRD SEAM
	43.67	0.03	COAL- dull, sheared and listricated. Broken stick.
	44.00	(0.33)	CORE LOSS- coal. BP63/BD/1
	44.07	0.07	MUDSTONE- dark brown to black, carbonaceous, rusty-stained, sheared and listricated. Broken
	44.21	(0.14)	CORE LOSS- rock BP63/BD/2
	44.44	(0.23)	CORE LOSS- coal

9m
 2m
 2.8m
 1m
 3m
 1m
 2.0m

Dip °	DEPTH m	THICKNESS m	DESCRIPTION
			BASE OF BIRD SEAM
	62.72	18.28	<p>SANDSTONE- fine to medium-grained to 49.85; medium to coarse-grained, with scattered granules, to 50.01; fine to very-fine grained to 50.33; coarse-grained to granular, with scattered pebbles, to 50.76; fine to very fine-grained to base, with a pebble band from 52.11 to 52.12. Medium grey, clean, well-sorted throughout, with large-scale low-angle cross-lamination. Top 0.28m dark grey, with carbonaceous matrix in tip 0.10m and sheared coaly inclusions throughout interval. Non-calcareous in top 1.90m; weakly to moderately calcareous to base. Top 1.50m mottled, intensely bioturbated, with some faint very small worm burrows ("Pin Pricks"). Abundant small (0.002m) worm burrows (marker) from 45.94 to 46.64. Locally abundant, faint dark-rimmed medium (0.003m) worm burrows from 46.64 to 51.34. Muddy intraclasts from 59.28 to 59.31. Rough rusty joints near parallel to core axis from 45.44 to 46.94. One 0.02m ground piece of mudstone, dark grey, slightly silty, similar to Moosebar, at 49.00 to 49.09. Mud contains rounded pieces of sandstone with brass-colored, metallic markings, probably from drill bit. Probably drilling mud with some ground core. Deeply weathered sandstone from 50.72 to 50.82; dark brown sticky mud with chips of weathered sandstone from 50.82 to 50.92. Abundant calcite (10° to 15° CA) from 50.96 to 50.99. Occasional rough, rusty joints (5° to 10° CA) and calcite (30° to 40° CA) from 56.14 to 61.59. Abundant calcite veinlets (0° to 80° CA, dominantly 30° to 40° CA), with minor calcite-filled breccias, from 61.59 to base. Dips increasing in this interval, from 5° to vertical and 80° (overturned), at base. Rough, rusty joints from 53.94 to 56.11, associated with calcite and general slight rusty staining of core. Dominantly 10° to 15° CA.</p>
4° at	50.69		
6° at	54.71		
5° at	59.29		
5° at	61.59		
45° at	61.94		
70° at	62.44		
90° at	62.56		
80° (overturned)		at base.	
	80.15	17.43	<p>SANDSTONE- fine to medium-grained to 68.00, medium to coarse grained to 69.02, with 50% granules and pebbles at 68.91 to 68.95 and 68.14 to 68.29. Medium-grained from 69.02 to 69.33 (erosional). Fine to very fine-grained to base. Medium grey, clean, well-sorted, large-scale low-angle cross-laminated throughout. Top 0.50m intensely bioturbated, mottled, devoid of lamination. Abundant small (0.002m) worm burrows (marker) from 63.22 to 63.63; burrows in local concentrations throughout. Muddy intraclasts at 76.07 and 76.15. Top 2.80m weakly to moderately calcareous. Strongly to very strongly calcareous from 65.52 to base. Abundant calcite veinlets in top 0.25m. No preferred orientation. Occasional calcite down to 64.92 (dominantly</p>
40° at	62.82		
35° at	62.97		
26° at	63.42		
24° at	63.76		
25° at	64.47		
11° at	66.57		
17° at	77.75		

Dip °	DEPTH m	THICKNESS m	DESCRIPTION
			30° to 50° CA). Occasional slickensides from 64.92 to 69.22 (70° to 80° CA). Mud, dark brown; from 68.46 to 68.57. Firm, uniform consistency, with 1cm stick of dark brown mudstone, within mud band. Rough, rusty joints and calcite from 74.76 to 76.25. Calcite dominantly at 30° CA; rusty joints parallel to calcite, and also at 110 to 120° to calcite. No evidence of movement except minor calcite-filled breccia from 76.20 to 76.23. Occasional rusty joints from 78.60 to base (10° to 50° CA) Abrupt.
	85.52	5.37	SANDSTONE, very fine-grained/SILTSTONE/MUDSTONE (30:20:50, grading down to 10:40:50)- thinly interbedded, medium grey sandstone, siltstone and dark grey mudstone. Sandstones abrupt, sometimes scoured at base, gradational upwards to mudstones. Abundant small, medium and large worm burrows; occasional pelecypod burrows. Locally intense bioturbation in basal 2.0m. Pyritised burrows and pyrite specks common. Sandstones small-scale low-angle and ripple cross-laminated. Moderately to strongly calcareous throughout. Occasional slickensiding in basal 1.28m (77° to 87° CA). Abrupt.
	86.08	0.56	SANDSTONE- coarse-grained (with shell fragments at base) in top 0.23m. Remainder to base is fine to medium-grained low-angle cross-laminated. Well-sorted, clean, strongly calcareous, medium grey throughout. Scattered carbonised plant fragments toward base. Abrupt.
	86.60	0.52	MUDSTONE- dark grey, silty, with pyritised worm burrows. Slightly carbonaceous throughout. Basal 0.13m consists of fine-grained sandstone: strongly calcareous, churned and slumped at top. Abrupt.
	86.75	0.15	COAL- broken and ground. "Shell Coal". 0.13m core loss. BP63/SC/1
	98.41	11.66	SANDSTONE- fine to medium-grained from top to 88.78; fine-grained to 91.00; medium-grained to 91.21; fine to medium-grained to 95.69; medium-grained to base. Medium grey, clean, well-sorted throughout. Locally abundant coaly wisps from 96.37 to base, and from 92.24 to 92.37. Medium to large-scale, low-angle cross-laminated throughout. Ripple lamination from 90.45 to 91.80. Weakly calcareous from top to 92.80. Non-calcareous to base. Occasional slickensides and calcite (15° to 35° CA), throughout; occasional calcite in top 1.5m, at 22° and 28° CA. Rough, rusty joints at 95.05 (12° CA), and at 96.35 (12° CA). Local concentration of medium (0.003m) faintly dark-rimmed worm burrows. Abrupt.
6° at 7° at	90.45 91.21		
			TOP OF UPPER CHAMBERLAIN SEAM
	98.43	0.02	MUDSTONE- black, very carbonaceous, with abundant very thin bright coal bands. "Bone". Broken. (Equivalent to Rider) BP63/CHU/1

Dip °	DEPTH m	THICKNESS m	DESCRIPTION
	98.52	(0.09)	CORE LOSS- (coal/rock)
	98.61	0.09	MUDSTONE- black, carbonaceous, with abundant carbonised plant fragments and some pyrite flecks. Listericated at top. Stick. (Rider parting) <u>BP63/CHU/2</u>
	98.65	(0.04)	CORE LOSS-coal
	98.66	0.01	COAL- sheared, coal type indistinguishable.
	98.72	0.06	COAL- dull, sheared. <u>BP63/CHU/3</u>
	98.79	0.07	COAL- dull banded.
	98.81	0.02	COAL - dull and bright.
	98.84	0.03	COAL- dull banded.
	98.86	0.02	COAL -dull. Stick.
	98.90	0.04	COAL- dull. Broken.
	98.97	0.07	COAL- dull banded, sheared. Stick.
	99.01	0.04	COAL- dull, sheared in part. Broken.
	99.05	0.04	COAL- dull, stick.
	99.09	0.04	COAL- dull and bright, sheared at base. Stick.
	99.12	0.03	COAL- dull.
	99.23	0.11	COAL- dull banded.
	99.27	0.04	COAL-dull. <u>BP63/CHU/3</u>
	99.28	0.01	COAL- dull and bright, sheared <u>BP63/CHU/4</u>
	99.32	0.04	COAL- sheared, coal type indistinguishable <u>BP63/CHU/5</u>
	99.36	0.04	COAL - dull banded.
	99.40	0.04	COAL- dull, slightly sheared.
	99.41	0.01	COAL- bright
	99.45	0.04	COAL- dull banded.
	99.48	0.03	COAL - dull, sheared.
	99.52	0.04	COAL - dull and bright, sheared.

Dip °	DEPTH m	THICKNESS m	DESCRIPTION
	99.54	0.02	COAL - dull, sheared.
	99.59	0.05	COAL- bright banded, sheared
	99.61	0.02	COAL- dull.
	99.64	0.03	COAL- dull and bright, sheared
	99.70	0.06	COAL- dull, sheared BP63/CHU/5
	99.79	0.09	COAL- sheared coal type indistinguishable BP63/CHU/6
	99.82	0.03	COAL- dull banded sheared. BP63/CHU/7
	99.88	0.06	COAL-dull, sheared.
	99.92	0.04	COAL-dull and bright, sheared
	99.95	0.03	COAL-dull, sheared.
	100.00	0.05	COAL- dull and bright, sheared. Stick
	100.13	(0.13)	CORE LOSS- coal
	100.22	0.09	COAL-sheared and listricated, coal type indistinguishable. Broken. BP63/CHU/8
	100.24	0.02	COAL- sheared and listricated, coal type indistinguishable, with calcite veinlets. Broken stick.
	100.26	(0.02)	CORE LOSS- rock.
	100.39	0.13	SILTSTONE- dark grey. Abundant carbonised plant fragments Argillaceous, grading upward to carbonaceous mudstone in top 0.01m. Abrupt.
9° at	101.23 101.03	0.84	SANDSTONE_ very fine-grained, dark grey, silty, large-scale low-angle cross-laminated, abrupt.
	101.63	0.40	MUDSTONE- dark grey, carbonaceous, with abundant, carbonised and scattered pyritised plant fragments. (lower Leaf of Upper Chamberlain Seam.) Dark brown, plastic mud with mudstone chips from 101.36 to 101.49 and 101.53 to 101.58. Abrupt.
—BASE OF UPPER CHAMBERLAIN SEAM—			
10° at 12° at	102.28 101.95 base.	0.65	SILTSTONE/SANDSTONE, very fine-grained (70:30)- interlaminated, medium grey, intensely bioturbated in upper 0.28m; ripple laminated to base. Gradational at base.

Dip o	DEPTH m	THICKNESS m	DESCRIPTION
	105.20	2.92	SILTSTONE/MUDSTONE (80:20, grading to 5:95 at base.)- Interlaminated medium grey siltstone and dark grey mudstone Siltstone dominant in top 0.74m; mudstone dominant to base. Locally carbonaceous in basal 0.21m. Slickensides and calcite abundant, dominantly parallel to lamination, but some at 30° to lamination. Abundant calcite veining, (approaching breccia locally, with rotated rock fragments set in calcite at 102.58 to 102.83, 102.89 to 103.07, and 103.69 to 104.80. Probable minor faulting in these intervals. Abrupt at base. 10cm. Roof sample: BP63/CHL/R
9° at	102.38		
8° at	102.50		
15 to 30° at	102.50 to 102.56	50 to 102.56	
16° at	102.86		
11° at	103.15		
30° at	103.44		
17° at	103.52		
15° at	103.65		
10° at	104.06		
10° at	104.53		
			TOP OF LOWER CHAMBERLAIN SEAM
	105.71	(0.51)	CORE LOSS- coal BP63/CHL/1
	105.82	0.11	COAL- Pulverised, coal type indistinguishable.
	105.84	0.02	COAL- dull, with 50% calcite veinlets. Stick.
	105.89	0.05	COAL- pulverised, coal type indistinguishable. DD 106.1
	105.96	0.07	COAL- pulverised, coal type indistinguishable.
	105.98	0.02	MUDSTONE- dark grey, very carbonaceous, lustrous. Stick. BP63/CHL/2
	106.16	0.18	COAL- dull and bright, sheared and lustricated. Broken.
	106.17	0.01	COAL- dull, sheared. Stick.
	106.19	0.02	COAL- dull and bright, sheared, stick.
	106.22	0.03	COAL - bright banded, sheared, broken stick.
	106.23	0.01	COAL- dull and bright, sheared, stick.
	106.26	0.03	COAL- dull and bright, sheared, stick. DD106.7
	106.27	0.01	COAL- dull and bright, broken.
	106.30	0.03	COAL- dull banded, sheared. Stick.
	106.32	0.02	COAL- dull banded, sheared. Stick.
	106.34	0.02	COAL- dull banded, sheared. Broken. BP63/CHL/3
	106.37	0.03	COAL- bright banded, sheared. Stick, ground at top.
	106.42	0.05	COAL- bright banded, sheared. Stick.
	106.44	(0.02)	CORE LOSS - rock LOST

Dip o	DEPTH m	THICKNESS m	DESCRIPTION
	106.50	(0.06)	CORE LOSS- coal DD107.0 <u>LOST</u>
	106.51	0.01	COAL- sheared, coal type indistinguishable. Stick. BP63/CHL/4
	106.59	0.08	COAL- dull and bright, broken.
	106.60	0.01	COAL- sheared, coal type indistinguishable. Stick.
	106.62	0.02	COAL- dull banded, sheared. Stick.
	106.64	0.02	COAL - sheared, coal type indistinguishable.
	106.66	0.02	COAL- dull banded, sheared.
	106.70	0.04	COAL- dull, sheared.
	106.72	0.02	COAL- dull, banded.
	106.77	0.05	COAL- dull and bright, sheared, broken stick.
	106.80	0.03	COAL- dull and bright, stick
	106.81	0.01	COAL- dull banded, broken
	106.85	0.04	COAL- dull and bright, sheared, stick. DD 107.6..
	106.88	0.03	COAL- bright banded, sheared, stick
	106.89	0.01	COAL- dull banded, sheared, stick
	106.95	(0.06)	CORE LOSS- coal
	106.99	0.04	COAL- sheared, coal type indistinguishable, stick
	107.02	0.03	COAL- sheared, bright banded, broken.
	107.03	0.01	MUDSTONE- black carbonaceous, with thin bright coal bands. lustricated. Stick. <u>BP63/CHL/5</u>
	107.05	0.02	COAL- dull and bright, sheared. Stick. BP63/CHL/6
	107.07	0.02	COAL- dull and bright, sheared. Stick.
	107.08	0.01	COAL- dull and bright, sheared.
	107.11	0.03	COAL- dull banded, sheared.
	107.15	0.04	COAL- bright banded, sheared, broken stick.
	107.17	0.02	COAL- dull and bright, sheared, stick

Dip °	DEPTH m	THICKNESS m	DESCRIPTION
	107.19	0.02	COAL- bright banded, sheared, stick
	107.23	0.04	COAL- bright banded, sheared, stick. <u>BP63/CHL/6</u>
	107.25	0.02	COAL/ MUDSTONE/SANDSTONE- bright coal and carbonaceous mudstone, interlaminated, with wisps of fine-grained sandstone. Core badly broken.
	107.32	(0.07)	CORE LOSS- coal and rock <u>BP63/CHL/7</u>
			BASE OF LOWER CHAMBERLAIN SEAM
7° at 6° at	114.14 110.97 113.92	6.82	SANDSTONE- fine-grained, dark grey to black, with abundant coaly stringers in top 0.05m and carbonaceous matrix, in top 0.23m; fine to medium-grained to 108.01; medium-grained to 108.82 fine to medium-grained to 110.77, fine-grained to base. Medium to dark grey, becoming slightly lighter in basal 1.5m. Clean, well-sorted. Non-calcareous in top 3.15m; weakly to moderately calcareous to 111.57; strongly calcareous to base. Large-scale low-angle cross-laminated throughout, except in top 1.46m, which is mottled and devoid of lamination. Abundant large (0.004 to 0.005m) dark-rimmed worm burrows from 111.57 to 112.87. Locally abundant faintly dark-rimmed medium (0.002 to 0.003m) worm burrows throughout. Occasional slickensides and calcite (60° to 80° CA).
			BASE OF HOLE. DD114.9m

PR-SUKUNKA 78 (3)A.

SUKUNKA 1978 EXPLORATION

PROGRAM

BP-65

(Christensen Core)

665

Contractor: HI-RATE

Co-ordinates: 61 19552.914 N
5 88324.543 E

Commenced: 14. August, 1978

Surface Elevation: 1269.86m

Completed: 19. August, 1978

Core Size: 58.74 mm (Christensen barrel)

Casing Left in Hole:

Hole Angle:

Geologist

Depth

Hole Azimuth:

} details
on next page

Logged by: C. Bickford 221.22 to 245.60 ±

Final Depth: 268.8m

Depth to top of cored section: 221.22m

FORMATION/MEMBER	DEPTH	THICKNESS	ELEVATION
GATES			
SUKUNKA			
MOOSEBAR			
GETHING: UPPER	72.4	72.4+	1197.46
MIDDLE	205.6	133.2	1064.26
LOWER		63.2+	

<u>SEAMS</u>	<u>DEPTH</u>	<u>THICKNESS</u>	<u>%RECOVERY</u>	<u>ELEVATION</u>
Upper Chamberlain:	20.61	3.94 (split)	[not cored]	1249.25
Lower Chamberlain:	33.52	2.89	[not cored]	1236.34
Lower Gething B zone:				
upper plate:	243.40	9.11	low- see log	1026.46
lower plate:	264.68	8.93	[not cored]	1005.18



BPB INSTRUMENTS (CANADA) LTD

P.O. BOX 5638, POSTAL STATION "A", CALGARY, ALBERTA

19 August 1978

BP#65 - Sukunka 1978

<u>Depth</u>	<u>Tilt</u>	<u>Azimuth</u>
50m.	2° -	N 30° E
100m.	3° -	N 72° W
150m.	5° 45'	N 10° W
200m.	9° -	N 15° E
250m.	10° -	N 15° E
265m.	10° 15'	N 20° E

-0000000-

BH Nos. BP65

Dip °	DEPTH m	THICKNESS m	DESCRIPTION
	221.22		Start coring at drillers' depth 220m Lower Gething, above B zone
	230.87	9.65	SANDSTONE- fine-grained, medium to dark grey, argillaceous poorly sorted. Locally intense bioturbation, with abundant large pelecypod and worm burrows. Locally slumped, especially from 222.87 to 222.47 and in basal 2.0m. Strongly calcareous throughout. Occasional mudstone laminae; abundant carbonised plant fragments throughout top 4.5m. Unit devoid of lamination (due to bioturbation/slumping) except for clean, ripple-laminated sandstone in top 0.47m, and clean, small scale low-angle cross-laminated sandstone from 224.50 to 225.87 and 227.67 to 228.07 and 228.72 to 228.90. Abundant thin bright coaly lenses from 222.63 to 224.04. Slickensides and calcite abundant from 222.62 to 230.17 (ranging from 50° to 75° CA; dominantly at 70° CA). Calcite filled breccia from 230.12 to 230.13, no evidence of significant displacement. Gradational at base. Abundant churned mudstone phases in basal 1.30m.
5° at	221.57		
5° at	222.37		
25° at	222.74		
38° at	223.08		
18° at	223.23		
14° at	223.37		
20° at	223.97		
22° at	224.27		
7° at	226.85		
6° at	227.97		
4° at	228.77		
6° at base.			
	231.86	0.99	SILTSTONE- dark grey, argillaceous slightly carbonaceous. Abundant finely broken plant fragments. Devoid of lamination. Abrupt.
	233.66	1.80	SANDSTONE, very fine-grained/ SILTSTONE/MUDSTONE (40:30:30) - churned and slumped together; devoid of lamination. Moderately calcareous. Abundant finely broken plant fragments. Calcite (85° CA) at base. Gradational.
	234.29	0.63	MUDSTONE/SILTSTONE (95:5)- dark grey mudstone with siltstone, wisps and disseminated silt. Small dark worm burrows. Churned at base, gradational. 10cm. Roof Sample <u>BP65/B/R1</u>
			TOP OF B zone
	234.38	0.09	MUDSTONE- black, carbonaceous, becoming very carbonaceous at base. Calcite veinlets (85° CA). Listericated at base. <u>BP65/B/R2</u>
	234.46	(0.08)	CORE LOSS- coal/rock.
	234.60	0.14	COAL- sheared, coal type indistinguishable. Broken, large fragments. Friable. <u>BP65/B/1</u>
12° at top.	235.49	0.89	MUDSTONE- very silty, dark grey. Faint small dark worm burrows. Top 0.10m heavily listericated with calcite veinlets; probable seatearth. Coal- mudstone contact at top is abrupt. Freely parting. Contact dip 12°. Broken

BH Nos. BP65

Dip °	DEPTH m	THICKNESS m	DESCRIPTION
			stick. BP65/B/2
	235.50	(0.01)	CORE LOSS- rock.
	235.52	0.02	MUDSTONE- black, carbonaceous. Gradational at base.
	235.57	0.05	COAL- dull, with abundant calcite at 65° to 70°CA. Stick. BP65/B/3
	235.65	0.08	COAL- dull, slightly sheared, broken. Calcite veinlet at top (75°CA).
	235.93	0.28	COAL- dull slightly sheared, broken stick.
	236.06	0.13	COAL- dull, banded, slightly sheared, stick.
	236.15	0.09	COAL- dull, slightly sheared, stick. BP65/B/4 (Two bags)
	236.27	0.12	COAL- dull banded, stick.
	236.36	0.09	COAL- dull banded, slightly sheared, stick.
	236.43	0.07	COAL- dull banded, slightly sheared, broken. BP65/B/4
			DD235
	236.48	0.05	COAL and MUDSTONE, CARBONACEOUS.- Small ground chips in box. BP65/B/5
			Core cannot be reconciled to geophysics below 236.48
			SEE NOTE AT END OF LOG re CORE RECOVERY
		0.10	MUDSTONE- black, carbonaceous. Lustrated, with some thin bright coal bands. Core ground; interval represented by four sticks of core. NOT SAMPLED
		0.29	MUDSTONE- dark grey, carbonaceous, very silty, with abundant well-preserved plant fragments, including leaves. Siltier and less carbonaceous towards base. Few bright coal lenses in upper half. Abrupt. Stick.
		1.59	SILTSTONE- dark grey, argillaceous, moderately calcareous. Slumped phases of very fine to fine-grained, light grey sandstone, from 1.10 to 1.42m below top. Basal 0.07m gradational to carbonaceous mudstone. Small dark worm burrows in basal 0.20 m. Abrupt.
		0.06	COAL- dull. Stick. BP65/B/6
		0.09	COAL- dull banded, slightly sheared. Stick. BP65/B/7

BH Nos. - BP65

Dip °	DEPTH m	THICKNESS m	DESCRIPTION
		0.10	COAL- dull banded, stick. Abrupt, adhering to underlying mudstone.
		0.13	MUDSTONE- black, carbonaceous, with abundant thin bright coal bands. Gradational at base.
		0.24	SILTSTONE- dark brown, argillaceous, with abundant disseminated fine sandgrains. Gradational at base. <u>BP65/B/7</u>
		0.01	MUDSTONE- carbonaceous, silty. Black. Gradational at base.
		0.01	MUDSTONE- black, carbonaceous. Abrupt.
		0.06	COAL- dull, stick. <u>BP65/B/8</u>
		0.05	COAL- dull banded, strongly cleated, stick.
13°		0.07	SILTSTONE, dark brown, argillaceous, with disseminated fine sandgrains/ MUDSTONE, black, carbonaceous (50:50)- thinly interbedded, with occasional bright coal lenses. Lustrated at base.
		0.03	MUDSTONE- black, carbonaceous. Two sticks. Core ground. <u>BP65/B/9</u>
8° at 0.06m below top.		0.36	MUDSTONE- black, carbonaceous, with thin (0.001 to 0.003m) bright coal bands. Gradational at base.
		0.03	COAL/MUDSTONE (60:40)- interlaminated bright coal and black, carbonaceous mudstone. Abrupt.
		0.06	COAL- bright, stick. <u>BP65/B/10</u>
		2.24	SILTSTONE/SANDSTONE, very fine-grained (80:20)- thinly interbedded, medium-scale, low-angle cross-laminated locally intensely bioturbated and churned. Top 0.79m is gradational from carbonaceous, argillaceous siltstone at base to dark grey, silty mudstone at top, with coaly lenses in top 0.03m. Basal 0.25m consists of dark grey, carbonaceous, silty mudstone with abundant finely broken plant fragments. Abrupt at base.
		0.10	CLAYSTONE- beige, ashy texture, greasy when wetted. Probable ash band, similar to Moosebar "bentonites" but less altered. Well-preserved plant fossils in top 0.04m. Core ground at base. <u>Marker.</u>

BH Nos. BP65

Dip °	DEPTH m	THICKNESS m	DESCRIPTION
		0.03	MUDSTONE- dark grey, slightly carbonaceous; listricated. Thin sandstone stringer towards base. Scoured at base.
		1.18	SILTSTONE/MUDSTONE (50:50)- interbedded medium to dark grey, argillaceous siltstone and dark grey silty mudstone with scattered plant fragments. From 0.92 to 0.97m below top, interbed of fine to medium-grained, light to medium grey low-angle cross-laminated sandstone. Large sand-filled burrows and sandy wisps in top 0.04m.
	245.60±		<p>———— BASE OF CORED SECTION. DRILLERS DEPTH 244m ————</p> <p>CORE RECOVERY: below 236.48m, the recovered core cannot be correlated to the detailed geophysical logs. This is due to one or more of the following circumstances:</p> <ol style="list-style-type: none"> 1. low core recovery. 2. mishandling (jumbling) of individual core runs. 3. accidental mixing of different core runs. <p>The thicknesses given below 236.48m represent the <u>recovered</u> core thicknesses. No core losses have been assigned.</p> <p>"B" zone (from geophysics) is from 234.29 to 243.40. Thickness (from geophysics) is 9.11m including rock bands.</p>

PR - SUKUNKA 78(3)A.

SUKUNKA 1978 EXPLORATION

PROGRAM

BP-66

(DDH)

665

Contractor: CMS

Co-ordinates: 61 20758.675 N
5 89694.610 E
Surface Elevation: 1146.01m

Commenced: 17 August, 1978

Completed: 21 August, 1978

Core Size: NQ

Casing Left in Hole:

Hole Angle: } see details
Hole Azimuth: } next page

Geologist Depth

Logged by: C. Bickford 6.0 to 172.32

Final Depth: 172.32

Depth to top of cored section: 6.0m

FORMATION/MEMBER	DEPTH	THICKNESS	ELEVATION
GATES			
SUKUNKA			
MOOSEBAR			
THING: UPPER	106.12	100.12+	1039.89
MIDDLE		66.20+	
LOWER			

SEAMS	DEPTH	THICKNESS	%RECOVERY	ELEVATION
U. Chamberlain	54.79	3.64 (split)	62.64%	1091.22
L. Chamberlain	61.72	2.12	66.51%	1084.29
Sub-Chamberlain	66.60	0.99 (split)	26.26%	1079.41



BPB INSTRUMENTS (CANADA) LTD

P.O. BOX 5638, POSTAL STATION "A", CALGARY, ALBERTA

20 August 1978

BP#66 - Sukunka 1978

<u>Depth</u>	<u>Tilt</u>	<u>Azimuth</u>
50m.	1° -	N 36° W
100m.	1° 15'	N 25° W
150m.	2° -	N 05° E
170m.	2° -	N 15° E

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BH Nos. BP 66

Dip °	DEPTH m	THICKNESS m	DESCRIPTION
	6.0	6.0	Overburden - no core
	23.50	17.50	GETHING FORMATION SANDSTONE - medium grained from top to 8.25; fine to medium-grained to 9.29; medium to coarse grained to 9.59; fine to medium-grained to 11.50; coarse-grained, with 25% pebbles, to 11.89m; fine-grained to 13.52 (with silty and muddy phases from 12.02 to 12.09, 12.36 to 12.46, and 12.68 to 12.85, and pebbles at 12.20, 12.29, and 12.43). Fine to very fine-grained to base. Medium grey, clean, well-sorted. Darker in top 1.50m. Dark grey to black in top 0.04m, similar to immediate floor of Bird Seam. Large-scale low-angle cross-lamination throughout, except in mottled interval (top 1.41m). Abundant small (0.001m) worm burrows, <u>marker</u> , from 7.41 to 8.46. Locally abundant faint dark-rimmed medium (0.003m) burrows throughout. Well-defined large, (0.006m) dark-rimmed worm burrows at 17.08. Weakly to moderately calcareous in top 4.20m; strongly calcareous to base. Sporadic calcite from 12.50 to 14.00 (70° to 75° CA); and from 20.10 to base (30° to 40° CA). Core badly broken and ground from 21.39 to 21.94. Core loss 0.37. Abrupt.
14° at	7.70		
17° at	12.75		
23° at	15.06		
17° at	18.60		
	29.19	5.69	SILTSTONE/SANDSTONE, very fine-grained/MUDSTONE (60:30:10) - thinly interbedded medium grey siltstone, sandstone and dark grey mudstone. Sandstones small-scale low-angle cross-laminated, erosional at base, gradational upwards to siltstone and occasional mudstone. Abundant small worm burrows; occasional pelecypod burrows. Pyrite common near top of unit. Strongly calcareous throughout. Calcite, sporadic, from 30° to 75° CA, in top 0.33m. Abrupt.
22° at	24.77		
22° at	25.54		
20° at	29.14		
	29.36	0.17	SANDSTONE, coarse-grained/very fine-grained/MUDSTONE - interlaminated, with basal 0.05m consisting of clean, trough cross-bedded sandstone. Remainder of unit is small-scale, low-angle cross-laminated. Mudstone is black, carbonaceous, in two 0.01m bands. Basal contact ground out.
10° at	29.21		
17° at	29.32		
	32.40	3.04	SANDSTONE, very fine-grained/SILTSTONE (60:40) - interlaminated, grading down to siltstone/mudstone (50:50) at base, Low-angle cross-laminated; occasionally convoluted. Occasional pyrite blebs. Top 0.19m is siltstone/mudstone: basal 0.49m is mudstone; carbonaceous at base. Medium-grained sandstone phase from 30.55 to 30.61. Moderately to strongly calcareous except basal carbonaceous mudstone.
18° at	30.66		

BH Nos. BP 66

Dip °	DEPTH m	THICKNESS m	DESCRIPTION	
	51.15	18.75	Core broken subparallel to core axis from 29.91 to 30.55. Calcite at 24° CA, at 31.73. Basal carbonaceous mudstone is locally listricated. Abrupt	
15° at	33.10		SANDSTONE- fine-grained throughout except: medium-grained from 34.37 to 34.78; and medium-grained from 49.99 to base. Medium grey, clean, well-sorted throughout, except between 36.37 and 46.77, in which interval there are abundant argillaceous and carbonaceous laminae, and sandstone is locally argillaceous and poorly sorted.	
21° at	33.55			
16° at	34.35			
19° at	38.15			
22° at	38.42			
40° at	38.70			
105° (overturned) at	38.79			
90° at	38.83			
35° at	38.90			
22° at	39.40			
23° at	40.38			
23° at	41.22			
35° at	41.90			
35° to				
65° at	42.29 to 42.51		Large-scale low-angle cross-lamination except from 36.37 to 46.77, with ripple lamination. Occasional carbonaceous partings in basal 2.05m of unit, and in top 2.70m. Occasional dark-rimmed medium (0.003m) worm burrows throughout. Weakly to moderately calcareous in top 3.55m; moderately	
12° at	43.90		to strongly calcareous to 50.55; weakly calcareous to base.	
19° at	45.60		Occasional slickensides and calcite	
13° at	46.60		in top 1.95m (30° CA). Locally abundant calcite	
22° at	49.50		from 34.35 to 38.35. Concentrated from	
20° at	50.60		38.35 to 39.25 (15° to 75° CA; broken	
12° at	51.66		ground from 38.35 to 38.60, with calcite crystals up to 0.003m; dips from 32° to 105° (overturned) in interval from 38.60 to 38.90. (<u>Established fault at 38.60</u>), and from 41.25 to 44.16 (no preferred orientation to calcite, but dips locally reach 65°, with abundant calcite veining). Soft brown mud from 43.10 to 43.24, with sticks of sandstone core up to 0.04m long. Core badly broken and ground, with abundant calcite, from 43.28 to 44.19; core loss 0.70m; <u>possible fault</u>). From 46.05 to 50.40, occasional calcite at 20° and 45° CA, and rough, rusty joints at 20° to 25° CA. Abrupt, irregular, freely parting basal contact.	
			TOP OF UPPER CHAMBERLAIN SEAM	
	51.22	0.07	COAL - dull banded	BP 66/ CHU/1
	51.26	0.04	COAL - dull, hard. Stick	
	51.27	0.01	MUDSTONE - dark grey to black, carbonaceous, with thin bright coal bands. Broken stick.	BP 66/ CHU/2
	51.31	0.04	COAL - dull, lustrous	BP 66/ CHU/3

BH Nos. BP 66

Dip o	DEPTH m	THICKNESS m	DESCRIPTION	
	51.48	0.17	MUDSTONE - dark grey, carbonaceous, listricated, with abundant carbonised and pyritised plant fragments. Stick.	BP66/ CHU/4
	51.50	0.02	COAL - dull, lustrous. Stick.	BP66/ CHU/5
	51.54 51.55	0.04 0.01	COAL - dull, lustrous. Ground at top COAL - dull banded, sheared, stick	
	51.56	0.01	COAL - dull, stick.	
	51.58	0.02	COAL - dull banded, sheared, stick.	
	51.61	0.03	COAL - dull, lustrous, scattered pyrite flecks, stick.	
	51.63	0.02	COAL - dull, lustrous, scattered pyrite flecks, stick.	
	51.70	0.07	COAL - dull banded, listricated, locally sheared. Broken	
	51.76	0.06	COAL - dull, minor pyrite flecks., stick.	
	51.80	0.04	COAL - dull, intensely listricated at base. Stick	
	51.84 51.95	0.04 (0.11)	COAL - dull, hard, listricated. Stick. Core loss - coal	DD 52.4
	52.00	0.05	COAL - dull, sheared, listricated and broken	
	52.04	(0.04)	Core loss - rock	BP66/ CHU/6
	52.05	0.01	MUDSTONE - dark grey, carbonaceous, listricated, broken stick.	
	52.08	0.03	COAL - dull, sheared, broken stick	
	52.12	0.04	COAL -dull banded, sheared stick	BP66/ CHU/7
	52.15	0.03	COAL - dull, stick	
	52.21 53.00	0.06 (0.79)	COAL - sheared, coal type indistinguishable. Stick. Core loss - coal	
	53.11	0.11	MUDSTONE - medium grey, slightly carbonaceous, with abundant carbonised and pyritised plant fragments. Upper contact with coal is abrupt, listricated, dipping 20°. Stick. Ground at base.	
	53.22	0.11	SILTSTONE - medium grey, argillaceous. Scattered carbonised plant fragments. Gradational. Stick	
	53.57	0.35	SANDSTONE, very fine-grained/SILTSTONE (60:40) - interlaminated, rippled, medium grey, moderately calcareous. Stick. Gradational.	

BH Nos. BPGG

Dip °	DEPTH m	THICKNESS m	DESCRIPTION
	54.08	0.51	MUDSTONE/SILTSTONE (20:80 grading down to 80:20) - interlaminated, medium grey siltstone and dark grey mudstone. Rippled in top 0.15; medium-scale low-angle to parallel-laminated to base. Easily broken parallel to lamination. Core broken with slickensides and calcite at 0.22 to 0.26m (63° to 70° CA); and 0.41 to 0.44m below top (40° to 55° CA) Stick and broken stick.
	54.40	(0.32)	Core loss-rock
	54.57	0.17	MUDSTONE - medium to dark grey, homogeneous, stick, listricated at base.
	54.67	(0.10)	Core loss-rock
	54.74	0.07	MUDSTONE - black, carbonaceous, abundant thin bright coal bands. Broken stick.
	54.79	0.05	MUDSTONE - black, carbonaceous, listricated, with abundant carbonised plant fragments. Broken stick.
	BASE OF UPPER CHAMBERLAIN SEAM		
	54.97	0.18	FLOOR - mudstone, brownish-grey, slightly carbonaceous, listricated, abundant carbonised plant fragments. Gradational to interlaminated siltstone/mudstone/sandstone.
	55.63	0.66	SILTSTONE/MUDSTONE/SANDSTONE, very fine-grained - (65:30:5) - interlaminated, churned dark grey siltstone and mudstone with lenses of medium grey sandstone. Sandstone moderately calcareous; siltstone weakly calcareous; mudstone non-calcareous. Abundant carbonised plant fragments; especially in to 0.10m. Gradational.
	57.18	1.55	SANDSTONE, very fine-grained/SILTSTONE/MUDSTONE, (60:30:10) - interlaminated;
14° at	57.10		small-side low-angle cross-lamination throughout, with occasional ripples. Occasional slickensides and calcite (30° to 70° CA). Sandstone is strongly calcareous, siltstone is moderately calcareous; mudstone non-calcareous. Common scours at bases of sandstones. Gradational.
10° to 12°	57.51	0.33	MUDSTONE/SILTSTONE/SANDSTONE, very fine-grained (50:40:10) interlaminated, parallel-laminated. Core easily broken, locally listricated, parallel to lamination. Gradational.
	59.60	2.09	MUDSTONE/SILTSTONE, (90:10) - interlaminated, parallel-laminated

BH Nos. BP66

Dip °	DEPTH m	THICKNESS m	DESCRIPTION
21° at 20° at 20° at	57.89 58.86 59.47		dark brownish-grey mudstone and medium to dark grey siltstone. Core badly broken and listricated, with calcite in top 0.63m. (Recovery 0.31m), and from 58.73 to 59.41 (Recovery 0.36m). Total core loss 0.64m. No "sigmoidal laminate" horizon recovered. From 59.40 to 59.55, 75% siltstone. Basal 0.05m is dark grey, silty mudstone. Abrupt.
			TOP OF LOWER CHAMBERLAIN SEAM (See note re: recovery at end of seam details)
		0.04	COAL - sheared, coal type indistinguishable. Stick. BP66/CHL/1
		0.03	COAL - sheared, coal type indistinguishable. Broken stick.
		0.02	MUDSTONE - dark grey, carbonaceous, listricated, stick. BP66/CHL/2
		0.04	COAL - sheared, coal type indistinguishable. Stick BP66/CHL/3
		0.01	COAL - sheared, coal type indistinguishable. Stick
		0.03	COAL - sheared, coal type indistinguishable. Broken stick.
		0.03	COAL - sheared, coal type indistinguishable. Stick
		0.07	COAL - dull, lustrous, sheared, broken stick. BP66/CHL/4
		0.03	COAL - dull, lustrous, sheared, Stick.
		0.11	COAL - dull, lustrous, sheared, Stick.
		0.06	COAL - sheared, coal type indistinguishable. Broken stick. BP66/CHL/5
		0.05	COAL - sheared, coal type indistinguishable. (45° CA) Stick Listricated
		0.12	COAL - sheared, coal type indistinguishable. Listricated (45° CA) Stick.
		0.06	COAL - sheared, coal type indistinguishable. Listricated (45° CA) with calcite films on shear surfaces. Stick.
		0.03	COAL - dull lustrous, sheared. Stick BP66/CHL/6
		0.02	SANDSTONE - dark grey to black, fine-grained, abundant carbonaceous matrix and listricated coaly inclusions. Irregular stick, listricated on both ends. Non-calcareous. Resembles Bird Seam or Lower Chamberlain Seam floor.
		0.12	COAL - dull and bright, sheared and broken. Large and small fragments. BP66/CHL/7 BP66/CHL/8

BH Nos: BP 66

Dip °	DEPTH m	THICKNESS m	DESCRIPTION
		0.03	SANDSTONE - dark grey to black, fine-grained; carbonaceous matrix; coaly inclusions. Similar to Bird Seam or Lower Chamberlain Seam floor. Four fragments in box; volume recovery less than 0.01m equivalent, but one fragment is 0.03m long, showing curved outer surface of core. BP 66/CHL/9
		0.16	COAL - dull, lustrous, hard, sheared. Broken stick. BP 66/CHL/10
		0.07	COAL - sheared, coal type indistinguishable. Broken and broken stick. BP 66/CHL/11
		0.13	COAL - sheared, coal type indistinguishable. Stick. DD 61.3
		0.06	COAL - sheared, coal type indistinguishable. Stick.
		0.05	COAL - sheared, coal type indistinguishable. Stick
		0.04	COAL - dull banded, sheared. Stick BP 66/CHL/12
	61.72	(0.71)	Core loss (coal) - not allocated due to high degree of shearing of seam, rendering geophysical correlation impossible.
			BASE OF LOWER CHAMBERLAIN SEAM
12° at	65.61 65.00	3.89	FLOOR - sandstone, medium-grained, clean, well-sorted, with abundant sheared coaly inclusions in top 0.09m. Medium-grained in top 1.58m; medium to coarse-grained to base. Clean, well-sorted, large-scale low-angle cross-laminated except in top 1.72m, where sandstone is mottled and devoid of lamination. Locally abundant faint dark-rimmed medium (0.003m) worm burrows. Unit medium to dark grey throughout. Non-calcareous; occasional calcite (5° to 15° CA) from 65.02 to base. Erosional, adhering to coal at base.
			TOP OF SUB-CHAMBERLAIN SEAM
	65.69	0.08	COAL - dull and bright BP 66/CHS/1
	65.71	0.02	COAL - bright
	65.74	0.03	COAL - dull and bright, stick
	65.79	0.05	COAL - dull and bright, sheared, stick
	65.815	0.025	COAL - dull banded, with one 0.002m sooty band DD 66
	65.83	0.015	COAL - bright, stick
	65.87	0.04	COAL - sheared, coal type indistinguishable; broken
	66.20	(0.33)	Core loss - rock
	66.60	(0.40)	Core loss - coal
			BASE OF SUB-CHAMBERLAIN SEAM

BH Nos.:BP66

Dip °	DEPTH m	THICKNESS m	DESCRIPTION
17° at	79.15 70.86	12.55	FLOOR - sandstone, fine to medium-grained to 68.38; fine-grained to 71.10; fine to very fine-grained to base. Clean, well-sorted, medium to dark grey, throughout. Large-scale low-angle cross-laminated throughout, except from 66.60 to 67.46, where unit is mottled and devoid of lamination. Locally abundant faint dark-rimmed medium (0.003m) worm burrows. Unit medium to dark grey throughout, with abundant sheared coaly inclusions from 66.60 to 66.85. Top 3.01m non-calcareous; weakly to moderately calcareous to 70.70; strongly calcareous to base. Occasional mudstone bands from 69.46 to 70.36. Occasional calcite (5° to 15° CA) from top to 70.64. Slickensides and calcite (0.03 to 0.18m apart, at 75° to 90° CA) from 73.38 to 73.72. Abrupt.
12° at 11° at 14° at	83.15 79.40 81.17 82.75	4.00	SANDSTONE, very fine-grained/MUDSTONE (60:40) - interbedded dark grey mudstone and medium grey, low-angle cross-laminated, sandstone. Abundant very small worm burrows. Sandstone beds are 0.02 to 0.40m thick; Mudstone beds 0.02 to 0.30m thick; commonly with 20% sandstone as ripples and thin laminae. Mudstone is weakly calcareous; sandstone is clean, well-sorted, strongly calcareous. Sandstone beds abrupt or scoured at base; gradational at top. Occasional calcite at 30° CA. Gradational at base (unit base taken at base of last clean sandstone bed).
	86.67	3.52	SILTSTONE/MUDSTONE/SANDSTONE, very fine-grained (60:35:5) - thinly interbedded, medium grey siltstone and dark grey mudstone with occasional laminae of medium grey sandstone. Cyclic repetition of erosional siltstones or sandstones, fining upward to mudstone over an 0.02 to 0.03m interval.
12° at 9° at	84.19 85.65		Abundant very small dark worm burrows; occasional pelecypod burrows. Moderately to strongly calcareous throughout. Basal 0.61m includes 40% medium-grained sandstone and granules; <u>marker</u> . Abrupt.
	106.12	19.45	SANDSTONE - fine grained in top 3.69m; fine to very fine-grained to base. Clean, medium grey, well-sorted throughout. Strongly calcareous throughout. Large-scale low-angle cross-laminated. Occasional mudstone laminae and large muddy intraclasts from 100.37 to base; making up 15% of this interval. Faint, dark-rimmed medium (0.003m) worm burrows scattered throughout unit. Occasional slickensides and calcite throughout unit (at 5° to 85° CA; dominantly at 75° to 80° CA), and abundant coarsely crystalline calcite veins, dominantly at 45° CA.

BH Nos. BP 66

Dip °	DEPTH m	THICKNESS m	DESCRIPTION
18° at 20° at 19° at	93.87 102.72 104.71		Broken core with coarsely crystalline calcite near parallel to core axis, from 100.62 to 100.92. Occasional listrication parallel to mudstone laminae in basal part of unit. No evidence of significant displacements. Basal 0.25m contains 50% muddy intraclasts; erosional.
	109.62	UPPER GETTING MIDDLE GETTING 3.50	
13° at 11° at 16° at 40° at 50° to 78° at 30° at	106.30 108.16 108.91 109.07 109.12 109.16		MUDSTONE/SANDSTONE, very fine-grained (40:60) - interbedded dark grey, silty mudstone and medium grey, small to medium-scale low-angle cross-laminated, clean sandstone. Strongly calcareous throughout. Occasional pelecypod burrows. Occasional coarsely crystalline calcite (15° to 45° CA); some slickensides parallel to bedding in mudstones.
10° at	base		Calcite-filled breccia from 108.95 to 108.98; bedding contorted with high dips and abundant calcite from 108.98 to 109.25; <u>fault, probable</u> . Displacement probably not more than 1 metre. Slickensides and calcite abundant from 109.25 to base (50° to 85° CA). Abrupt.
5° at	117.45 112.60	7.83	SANDSTONE, very fine-grained/SILTSTONE/MUDSTONE (50:40:10) - interbedded, fining-upward cycles of strongly calcareous, medium grey, medium-scale low-angle cross-laminated sandstone, dark grey siltstone and silty mudstone. Sandstones silty, erosional at base. Occasional very small worm burrows, and pelecypod burrows. Abundant scours. Moderately to strongly calcareous throughout. Occasional calcite throughout, with some slickensides at 70° to 85° CA, also occasional coarsely crystalline calcite at 40° to 45° CA, from 110.75 to 111.02. Gradational.
18° at	116.72		
	119.68	2.23	MUDSTONE/SILTSTONE/SANDSTONE, very fine-grained (50:45:5) - dark grey, churned and bioturbated silty mudstone and siltstone with occasional thin interbeds (0.01 to 0.06m) of silty medium grey, low-angle cross-laminated sandstone. Strongly calcareous throughout. Abundant small and medium (0.001 to 0.003) worm burrows, and occasional pelecypod burrows. Gradational
	121.61	1.93	MUDSTONE/SILTSTONE (50:50) - medium to dark grey, intensely bioturbated, strongly calcareous, with abundant small dark worm burrows. Occasional remnant bases of siltstone. Abrupt.
	123.40	1.79	SILTSTONE/MUDSTONE/SANDSTONE, very fine-grained (60:30:10) - medium to dark grey, intensely bioturbated mudstone and siltstone, with 30% remnant beds of low-angle

BH Nos. BP 66

Dip °	DEPTH m	THICKNESS m	DESCRIPTION
	128.23	4.83	cross-laminated, medium grey siltstone and occasional silty sandstone. Strongly calcareous throughout. Abundant small dark worm burrows. One coarsely crystalline calcite-filled fracture at 18° CA; two, slickensided with calcite, at 72° and 78° CA. Abrupt.
	128.64	0.41	MUDSTONE/SILTSTONE (85:15, at top, grading down to 95:5 at base) - dark grey, silty mudstone with occasional lenses of medium grey siltstone. Intensely bioturbated, with abundant small dark worm burrows, occasionally pyritised. Strongly calcareous throughout. One slickensided calcite vein at 85° CA. Gradational.
	133.08	4.44	SANDSTONE, very fine-grained/SILTSTONE (50:50) - fining-upward interval, with silty sandstone at base, grading up to argillaceous siltstone at top. Interbedded; low-angle cross-laminated, strongly calcareous throughout. Erosional.
	133.08	4.44	SILTSTONE/MUDSTONE/SANDSTONE, very fine-grained (40:40:20) - thinly interbedded dark grey silty mudstone and siltstone, locally intensely bioturbated, with occasional interbeds (0.01 to 0.11m) of medium grey, low-angle cross-laminated sandstone, with abrupt bases and gradational tops. Abundant small and medium worm burrows, occasionally pyritised. Occasional pelecypod burrows. Strongly calcareous throughout. Occasional coarsely crystalline calcite at 60° to 90° CA. Gradational.
10° at	131.71		
15° at	132.69		
	134.07	0.99	MUDSTONE/SILTSTONE (95:5) - dark grey, silty mudstone with occasional churned lenses of medium grey siltstone. Strongly calcareous; abrupt.
	136.83	2.76	SANDSTONE, very fine-grained/MUDSTONE (65:35) - medium grey, silty, low-angle cross-laminated (occasionally rippled) sandstone with interbeds of dark grey silty mudstone. Occasional worm and pelecypod burrows in mudstones (defined by disruption of sandy laminae). Local concentration of very small, dark worm burrows in sandstones. Strongly calcareous throughout. Abrupt.
	140.79	3.96	SILTSTONE/SANDSTONE, very fine-grained/(70:30) - interbedded, intensely bioturbated medium to dark grey argillaceous siltstone and medium grey, silty, small-scale low-angle cross-laminated sandstone. Occasional muddy intraclast bands in sandstones. Abundant worm and pelecypod burrows. Abundant slickensides and calcite sub-parallel to core axis, from

BH Nos. BP 66

Dip °	DEPTH m	THICKNESS m	DESCRIPTION
12° at 10° at	137.77 140.69		137.81 to 138.13. No dip changes throughout this interval. Unit abrupt.
	151.90	11.11	MUDSTONE - dark grey, homogenously silty, (with 5% siltstone lenses in top 2.20m). Abundant pyrite-filled worm burrows. Strongly calcareous throughout. Basal 0.43m is glauconitic, grading from trace at top of interval to estimated 30% at base. Unit is gradational at base, to underlying glauconitic sandstone. Occasional calcite (45° CA), from 147.33 to 149.82.
	153.05	1.15	SANDSTONE - fine to medium grained, dark greenish grey, estimated 30% glauconite (marker). Top 0.15m contains abundant argillaceous laminae. Intensely bioturbated throughout. Weakly calcareous. Erosional.
	158.90	5.85	SANDSTONE, very fine-grained/SILTSTONE (50:50) - interbeds (0.03 to 0.45m thick) of medium grey, low-angle cross-laminated sandstone and medium to dark grey, intensely bioturbated argillaceous siltstone. Abundant stumping in basal 1.90m. Interval from 153.52 to 155.02 is composed of 95% sandstone, 5% siltstone. Remainder is (50:50) interbeds. Strongly calcareous throughout. From 153.65 to 155.15, locally abundant coarsely crystalline calcite; with slickensides in siltstone interbeds, all at 85° to 90° CA (subparallel to bedding). From 156.35 to base, occasional coarsely crystalline calcite (at 10°, 25°, 40°, 75° CA)
5° at	156.51		Abrupt at base.
	172.32	13.42	SILTSTONE/MUDSTONE/SANDSTONE, very fine-grained (40:35:25) - Interbedded (0.05 to 0.70m; dominantly 0.20 to 0.30m) dark grey silty mudstone and medium grey siltstone and silty, low-angle cross-laminated sandstone. Common fining-upward cycles, composed of abrupt to erosional sandstone, grading up to siltstone and mudstone. Many siltstone-mudstone couplets. Occasional load structures at base of sandstones, and muddy intraclasts within sandstones. Scattered small worm burrows.
10° at 8° at 13° at 15° at 15° at 45° at 50° at 60° to 85°	159.47 162.90 167.45 168.92 170.40 170.95 171.15 in basal	0.20m	Unit strongly calcareous throughout. Occasional calcite throughout (dominantly 10° and 50° CA); abundant from 169.95 to base, with intense listrication and local brecciation below 170.60. Dips increase markedly below 170.90, (from 15° to 45°, reaching 85° at base of hole). <u>Fault, established</u> in this interval.
			BASE OF HOLE DD 172.6

PR- SOKUNKA 78 (3)A .

SOKUNKA 1978 EXPLORATION

PROGRAM

BP-68

(DDH)

665

Contractor: CMS

Co-ordinates: 61 21243N
5 89314E

Commenced: 25. August, 1978

Surface Elevation: 1157.30

Completed: 28. August, 1978

Core Size: NQ

Casing Left in Hole:

Hole Angle: } no details
Hole Azimuth: }

Geologist Depth

Logged by: P.M. Caine and K. Kim 6.38 to 156.7

Final Depth: 156.7

Depth to top of cored section: 6.38

FORMATION/MEMBER	DEPTH	THICKNESS	ELEVATION
GATES			
SUKUNKA			
MOOSEBAR			
GETHING: UPPER		150.32+	
MIDDLE			
LOWER			

SEAMS	DEPTH	THICKNESS	%RECOVERY	ELEVATION
U. Chamberlain	100.52 UP	4.70 (split)	28.72%	1056.78
	129.82 LP	3.94 (split)	58.12%	1027.48
L. Chamberlain	150.22 LP	1.62	8.02%	1007.08

Dip o	DEPTH m	THICKNESS m	DESCRIPTION
	6.38	6.38	NO CORE
			UPPER GETTING
20°	14.30 at 7.80 m	7.92	SANDSTONE - grey, medium grained, well sorted, medium bedded, non calcareous. Worm burrows to 9.76 m. Fractures at 25° CA. No slickensides, occasional calcite infillings.
28°	14.47	0.17	SANDSTONE - grey, fine grained, thinly bedded, calcareous, occasionally cross bedded, occasional fractures at 40° CA. Gradational contact below.
20°	14.90	0.43	SILTSTONE - dark grey, with lenses of fine grained, micaceous, weakly calcareous sandstone.
30°	28.0 at 19.0	13.1	SANDSTONE - grey, fine grained, well sorted, clean, thinly bedded, strongly calcareous, occasional calcite filled, fractures. (25° CA). Worm burrows from 24.70 to 24.57.
15°	33.83	5.83	SILTSTONE - dark grey, interbedded with fine grained sandstone worm burrows throughout, slump bedded, throughout calcareous. Bird Marine Band.
20°	34.43	0.60	SANDSTONE - grey, medium to coarse grained, poorly sorted, calcite filled fractures (30° CA). Thinly bedded, strongly calcareous. Bird Marine Band.
20°	35.5	1.07	SILTSTONE - grey, slightly sandy in top 12 cm. Calcareous. Bird Marine Band
25°	44.26	8.76	SANDSTONE - grey, medium to coarse grained, Poorly sorted thinly bedded occasional thin coal streaks from 38.88 to 39.17. Clean and strongly calcareous. Orange staining on fracture.
30°	45.04	0.78	SANDSTONE - grey, medium grained, poorly sorted, thinly bedded, disturbed and cross bedded, siltstone on bedding. Moderately calcareous.
40°	47.60	2.56	SANDSTONE - grey, medium grained, thinly bedded top 27 cm coarse grained, calcite veining. Weakly calcareous. Established Fault at 47.60.
	49.15	1.55	SILTSTONE - dark grey, thin lenses of grey sandstone. disturbed bedding, badly fractured and slickensided (20° CA) calcareous, rare pin burrows.
	51.96	2.81	SANDSTONE - grey fine grained, massive, badly fractured, and slickensided, with calcite (20° to 20° CA). Moderately calcareous to 50.6.

Dip o	DEPTH m	THICKNESS m	DESCRIPTION
	55.22	3.26	SILTSTONE - grey, becoming sandy to base, 10 cm of sandstone at 53.10 fine-medium grained, slickensided at 22° CA. Siltstone, badly sheared with slickensides from top to 58.85. Weakly calcareous, bioturbated in basal 50 cm.
	57.43	2.21	SANDSTONE - grey, fine grained, massive badly fractured and broken with calcite veining. (15° CA). Calcareous. Contact below 20° CA.
	58.06	0.63	SANDSTONE - coarse grained, very badly sorted, sub angular, clasts of fine grained sandstone. Calcareous. Massive, abrupt contact.
60° at 58.8	59.58	1.52	SANDSTONE - grey medium-coarse-grained, poorly sorted, thinly bedded, basal 40 cm highly fractured (parallel to CA). Calcareous.
60°	75.20	15.62	MUDSTONE - dark grey/black, silty, worm burrows throughout, strongly calcareous. Thin sandstone bands from 61.8 to 62.0 fine grained, calcareous, well sorted, large tension fracture (10° CA) from 72 to 72.50 highly slickensided.
60°	83.25	8.0	MUDSTONE - black/dark grey, silty with very fine grained sandstone bands throughout. 0.20 pyritic sandstone at 78.5 Occasional high angle (20° CA) slickensided fractures. Strongly calcareous. Worm burrows throughout. 20 cm sandstone medium grained at 82.9 sub vertical calcite veins Dip changes from 60° - 5° at 78.9 with no apparent change in lithology. 8 cm of badly broken and sheared mudstone.
15° at 83.	83.40	0.15	MUDSTONE - dark grey very highly sheared and listricated, numerous calcite veins. FAULT ESTABLISHED
10°	95.82	12.42	SANDSTONE - grey, medium grained, thinly bedded, with occasional cross bedding, Weakly calcareous with rare calcareous bands. - basal 10 cm slightly carbonaceous.
			TOP OF UPPER CHAMBERLAIN SEAM UPPER PLATE
	95.96	(0.14)	CORE LOSS - coal
	95.98	0.02	MUDSTONE - black, carbonaceous
	96.13	(0.15)	CORE LOSS - probably rock
	96.26	0.13	COAL - bright and dull banded - not sampled.
	98.55	(2.29)	CORE LOSS - coal
	98.68	0.13	MUDSTONE - grey, slightly silty, plant remains in top highly carbonaceous. 5 cm.
15°	99.31	0.63	SANDSTONE - grey, very fine grained, thinly bedded to

Dip o	DEPTH m	THICKNESS m	DESCRIPTION
15°	99.73	0.42	laminated, cross bedded, non calcareous. MUDSTONE - grey, laminated with siltstone, especially in top 30 cm.
	99.76	(0.03)	CORE LOSS - rock
	100.37	(0.61)	CORE LOSS - probably coaly to carbonaceous mudstone.
	100.52	0.15	MUDSTONE - carbonaceous, with plant remains.
— BASE OF UPPER CHAMBERLAIN SEAM —			
15°	101.84	1.32	SANDSTONE - grey, very fine grained, thinly bedded, cross bedded, throughout, occasional very silty to siltstone bands up to 15 cm, slightly calcareous. FLOOR OF UPPER CHAMBERLAIN
	104.13	2.29	MUDSTONE - grey, very thinly laminated with laminations of sandstone and siltstone. Calcareous.
75°	105.30	1.17	MUDSTONE - grey/black, slightly silty, slightly calcareous, horizontal slickensides at base.
35°	108.65	3.35	MUDSTONE - grey, very thinly laminated with sandstone and siltstone, calcareous with occasional calcite veins. Top 5 cm gouge zone with much calcite - Probable fault.
15°	112.80	4.15	MUDSTONE - grey/black, slightly silty. Core badly broken and slickensided. No preferred direction of slickensides or fractures. ESTABLISHED FAULT AT 112.8
5°	125.88	13.08	SANDSTONE - grey, medium grained, unbedded in top 97 cm. becoming thinly bedded, plant remains in top 30 cm. Occasional high angle calcite fractures. Non calcareous.
— TOP OF UPPER CHAMBERLAIN SEAM - LOWER PLATE —			
5°	126.69	(0.81)	CORE LOSS - coal
	127.10	0.41	SANDSTONE - grey, fine grained, thinly bedded non calcareous
	127.23	(0.13)	CORE LOSS - rock
	127.72	0.49	MUDSTONE - grey/black, very silty at top. Slickensided on bedding. Non calcareous.
	127.81	(0.09)	CORE LOSS - coaly mudstone

Dip °	DEPTH m	THICKNESS m	DESCRIPTION
	127.88 127.95 128.22	0.07 (0.07) 0.27	COAL - dull badly sheared. NOT SAMPLED CORE LOSS - rock MUDSTONE - grey black, core broken and sheared, non calcareous
	128.36	(0.14)	CORE LOSS - probably coaly to carbonaceous mudstone.
	128.39	0.03	MUDSTONE - black, coaly soft sheared.
	128.93	0.54	MUDSTONE - grey, highly sheared and listricated throughout
	129.09	(0.16)	CORE LOSS - slightly carbonaceous mudstone (?)
	129.12	0.03	MUD - black, sheared.
	129.57	0.45	MUDSTONE - highly sheared, slightly carbonaceous - soft.
	129.82	(0.25)	CORE LOSS - probably coaly to carbonaceous mudstone.
			— BASE OF UPPER CHAMBERLAIN SEAM —
70°	130.92	1.10	SILTSTONE - grey, thinly bedded, with sandstone laminations sheared throughout.
	132.53	1.61	CORE LOSS - rock
40°	133.66	1.13	SANDSTONE - grey, fine grained, thinly bedded with siltstone and mudstone laminations - non calcareous, occasional calcite fractures. (70° CA).
50°	135.1	1.44	MUDSTONE - grey/black, silty with sandy laminations in top 10 cm. Core badly sheared and slickensided 0.44 from top fractures at 45° CA. Possible "sigmoidal laminite!"
50°	137.2	2.10	SANDSTONE - grey, very fine grained, thinly bedded occasionally slumped, core badly broken with high angle fractures (20° CA). Numerous calcite veins and tension fractures. Non-calcareous.
60° at 140 55° at 145 40° at 147 70° at 148	148.21	11.01	MUDSTONE - dark grey, very highly sheared and slickensided with many high angle fractures and shears (5 - 10° CA). Occasional very thin silty bands. Rare shears calcite on fractures non calcareous. - 3.81 m core loss.
15°	148.60	0.39	MUDSTONE - grey/black, slightly silty. Thinly bedded-non-calcareous.
			— TOP OF LOWER CHAMBERLAIN SEAM —
	150.09	(1.49)	CORE LOSS - coal
	150.22	0.13	COAL - very highly sheared, coal type undeterminable. Not Sampled.

Dip o	DEPTH m	THICKNESS m	DESCRIPTION
			————— BASE OF LOWER CHAMBERLAIN SEAM —————
	152.92	2.70	SANDSTONE - grey, medium grained, carbonaceous in top 20 cm plant remains, massive.
5°	153.60	0.68	SANDSTONE - grey, medium grained, thinly bedded, micaceous, non-calcareous.
	154.73	1.13	SANDSTONE - grey, medium grained thin bedding, disturbed by large worm burrows, calcareous.
6°	156.7	1.97	SANDSTONE - grey, fine to medium grained, thinly bedded, with high angle fractures (20° CA) in basal 30 cm.
			————— END OF HOLE —————