



EXPLORATION PERMIT FOR COAL

NO. 971 (COCKENZIE)

**REPORT FOR THE 12 MONTHS
ENDING 12 OCTOBER 2007**

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SUMMARY

This report covers the exploration activities for EPC 971 during the second 12-month period ending 12 October 2007.

Exploration Permit for Coal No. 971 (Cockenzie) was granted over 292 sub-blocks located approximately 11 km south of Nebo in Central Queensland. The EPC was granted to BHP Coal Pty Ltd for a term of five years on 13 October 2005.

During the second year of tenure, stratigraphic open hole drilling, drill chip and outcrop sampling, petrological description and palynology examination were carried out. Four chip holes 52001 to 52004 were drilled targeting reflectors on seismic lines acquired in the first year of tenure. Total meterage drilled was 1,166.75m.

Rock units intersected included Early Permian Lizzie Creek Volcanics, Back Creek Group and Tertiary Duaringa Formation and basalt flows.

No coal was intersected.

Carbonaceous drill chip samples were palynologically examined but were barren.

1. INTRODUCTION

Exploration Permit for Coal (EPC) No. 971 (Cockenzie) was granted over 292 sub-blocks (Appendix 1) located approximately 11 km south of Nebo in Central Queensland (Figure 1). The EPC was granted to BHP Coal Pty Ltd for a term of five years on 13 October 2005.

The exploration target is low volatile PCI coal, in the poorly explored eastern margin of the Bowen Basin closest to transport infrastructure.

This report describes the program of work carried out in EPC 971 over the second 12 months to 12 October 2007.

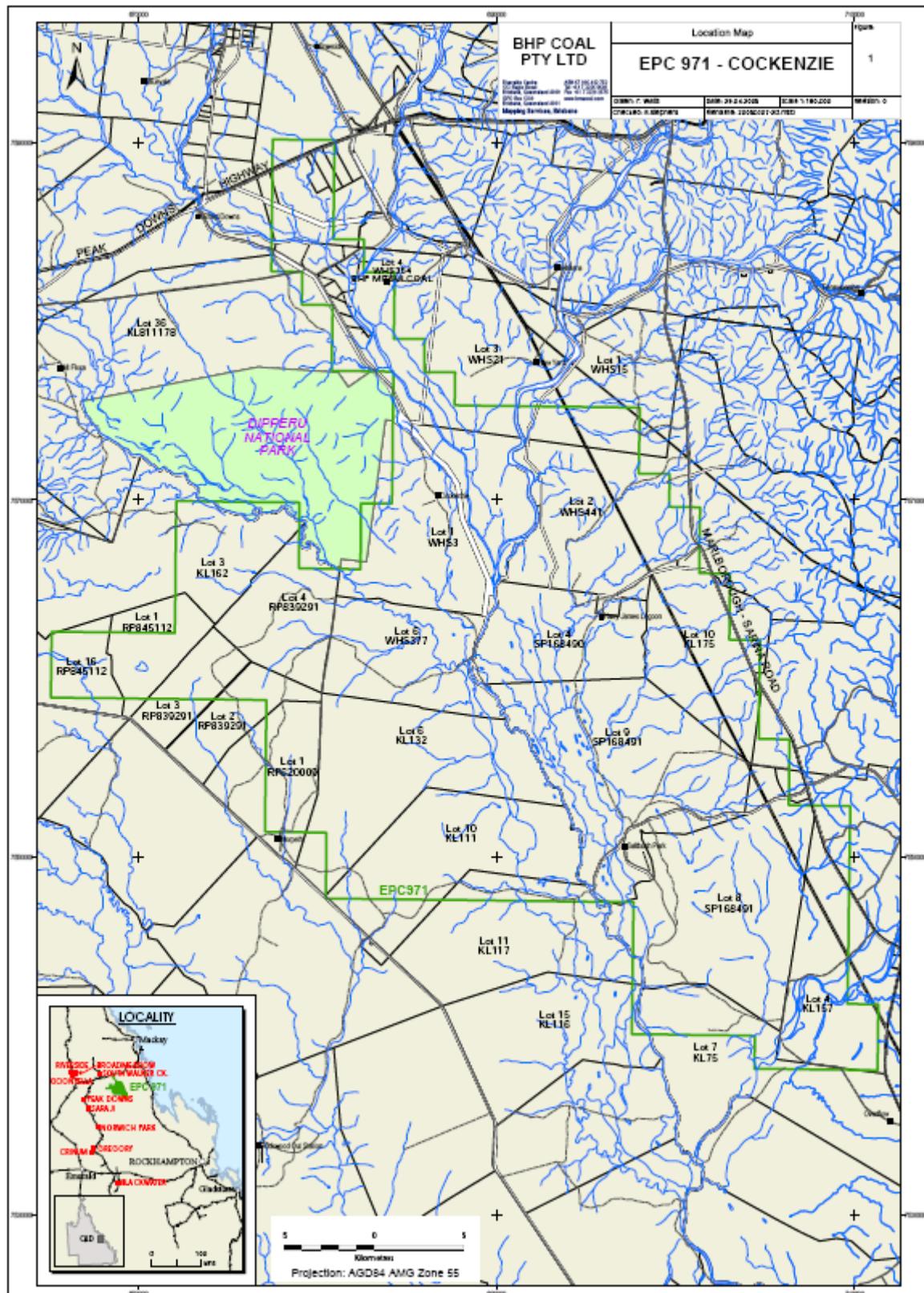


Figure 1 – Location Map

2. PREVIOUS EXPLORATION

2.1. HISTORICAL EXPLORATION

During 1968, Clutha Development Pty Ltd drilled 8 open holes within AP 51C (Clutha Development Pty Ltd, 1968). Most of these holes were drilled to 500 feet and none intersected coal.

Grimstone & Thomas (2004) conducted some 2D mini-SOSIE exploration followed by some drilling within EPC 688 before relinquishing part of the area which now occurs on the western side of the EPC 971. In 2000 to 2001, they also drilled 6 open holes between 111m and 174m deep which intersected some thin coal units of the German Creek Formation which range from 0.16m to 2.16m in thickness.

2.2. YEAR 1 OF TENURE (13 OCTOBER 2005 – 12 OCTOBER 2006)

During the first year, an interpretation of existing magnetic and gravity data, and a photogeological interpretation of colour aerial photography was carried out over EPC 971, which also included 2.5 days of field reconnaissance to ground truth the photo-interpretation.

Based on photogeological interpretation, nine seismic traverses were proposed and between 11 July and 6 August 2006 Velseis Pty Ltd recorded and processed 62.48km of 2D mini-SOSIE reflection data along six regional traverses. The other lines could not be recorded due to wet weather. Due to drilling rig unavailability and the wet weather, the planned drilling program to test prospective reflectors was rescheduled to the second period.

3. WORK PROGRAMME YEAR 2

3.1. DRILLING

The drilling campaign started in April 2007 and continued through to the end of year 2. Drilling was planned for all recorded seismic lines; however slow progress of drilling due to difficult formations, rig availability and wet weather in July – August 2007 meant not all planned sites could be drilled.

During the reporting period, four open chip holes (totalling 1,166.75m) were drilled on the seismic lines recorded in the previous tenure year. Locations of these holes are shown in Appendix 2.

Collar surveys for the holes drilled are provided in Appendix 3.

Lithological logs are presented as graphic logs in Appendix 4.

Holes were geophysically logged routinely with caliper, natural gamma, and density logs. Verticality, resistivity and dipmeter were run in selected holes. Geophysical logs are presented in Appendix 5.

Two open holes of 52001 and 52002 were drilled in the northern part of the EPC to understand the stratigraphy of the very northern subblocks of the EPC. The first hole (52001) was drilled on seismic line B, 150m from active BMA Braeside Pumping Station water well, until the depth of 108.0 m and could not be continued further due to severe drilling problems. The hole intersected a basalt flow which yielded plenty of water. After several trials, the hole could not be geophysically logged due to premature collapse.

The next hole, 52002, was drilled on seismic line A, to a depth of 266.75m intersecting several igneous rocks, mainly basaltic. This hole was geophysically logged for caliper, density and gamma through HQ rods.

Open hole 52003 was drilled in the southwestern part of the EPC on seismic line G. The hole was drilled to a depth of 351.75m and intersected highly weathered sandy clay, claystone and conglomerate to a depth of 238m, which, has been identified as Tertiary. Thereafter the sequence of claystone, conglomerate and sandstone continued until the end of the hole. A carbonated micro-diorite, possibly dyke, was intersected at the depth 300. This hole was geophysically logged for calliper, density, gamma, resistivity, sonic and verticality. Selected chips were sent to petrological and palynological consultants for analysis.

Hole 52004 was drilled in the southeastern part of the EPC falling on seismic line I. The aim of drilling line I was to understand the prominent reflectors in that particular seismic line. The drill hole 52004 was drilled to a depth of 440.25m that encountered mostly dark grey sandstone, to a depth of 425m, which identified as Back Creek Group. The lithology unit encountered after 425m is a volcanic sequence (andesitic breccia), presumed to be Lizzy Creek Volcanics. The same volcanic sequence could be traced at an exposure towards the east of the

drill-hole on the Sarina-Marlborough Highway. This hole was geophysically logged for caliper, density, gamma, resistivity, sonic, verticality and dipmeter.

3.2. PETROGRAPHY

Twelve drill chip samples and six outcrop samples were sent to Geochempet for petrological analysis. The reports are provided in Appendix 6 & 7 respectively.

3.3. PALYNOLOGY

Chip samples from three drillholes were analysed for palynology through P & R Geological Consultants Pty Ltd. However, all the samples were barren of palynomorphs; hence, age determination was not possible. The report is provided as Appendix 8.

3.4. REHABILITATION

The drilling program has complied with the Code of Environmental Compliance for Exploration and Mineral Development Projects and BMA's ISO 14001 accredited Environmental Management System Steps taken to ensure minimum environmental impact were:

- Avoiding areas of environmental significance (Endangered Regional Ecosystems)
- Utilising existing tracks, roads fence lines and cleared areas to limit cleared area
- Containing water runoff
- Prevent soil erosion by drill site design and prepared erosion controls
- Suspending field operations during wet weather

Rehabilitated holes have been capped 0.30 - 0.50m below the surface and backfilled. Remnant chips were moved or backfilled into pit to eliminate any hazards. All materials used and any rubbish has been removed from site.

4. GEOLOGY

The different stratigraphic sequence encountered in the open holes drilling is summarised below, from oldest to youngest units.

4.1. STRATIGRAPHY

The Early Permian Lizzy Creek Volcanic Group is encountered in drillhole 52004 at a depth of 425m, has been identified as andesitic breccia in sample no. 52004-07010 (Appendix 6) is probably part of Mount Bermont Volcanic unit (Snodin, 2006). This unit is identified as the basement reflector in the seismic Line I. The dip of the reflector in the seismic profile suggests its continuity as the exposed volcanic sequence to the east of the EPC on the Sarina-Marlborough Highway. Field observation and petrological analysis from rock sample at OC12 also concurs with previous report identified the unit as distinctly flow-banded, sparsely porphyritic hornblende andesite that can be considered as Mount Bermont Volcanic (Pvb) (DNRME, 2004).

The dark grey sandstone of the Back Creek Group (Pb) was intersected in drillhole 52004 (from 2.67m to 424.81m). Based on drill chips log, entire sequence from the hole can be subdivided into the following sub-units.

Depth (m)	Thickness (m)	Lithology
2.67 – 89.69	87.02	Sandstone very fine grained, dark grey consists of calcite and pyrite grains. Siltstone interbedded.
89.69 – 229.82	140.13	Sandstone very fine grained, dark grey
229.82 – 254.07	24.25	Sandstone very fine grained, dark grey, consists of rare thin quartz veins
254.07 – 329.87	75.80	Sandstone very fine grained, dark grey
329.87 – 350.32	20.45	Sandstone very fine grained, dark grey, with intercalated siderite veins
350.32 – 353.77	3.45	Igneous rock, dark greenish grey, possibly basaltic intrusion
353.77 – 424.81	71.04	Sandstone very fine grained, dark grey

Tertiary sediment, probably equivalent to Duaringa Formation (Tu), was intersected in almost every drill hole in various thicknesses. The lithologies mainly consist of claystone, siltstone, sandstone, and conglomerate. Coal fragments are found in Tertiary unit of Duaringa Fm at site 52002 (151 -155m) and interpreted as coal fragment from older Late Permian coal measures (Spring, 2007).

Tertiary basalt (Tb) was intercepted in 52001, 52002 and 52003 in various degree of alteration. Petrographic analysis on coal chips from borehole 52002 also indicated that basalt, particularly in the northern part of EPC, was likely came from a lava flow rather than intrusion as coal is not coked and there is only moderate alteration of basalt (Spring, 2007). Selected chip samples were petrologically examined (Appendix 6).

4.2. STRUCTURE

Structure in the Permian sequence is directly observable where it crops out intermittently near and straddling the EPC eastern margin. Here the regional strike in the Back Creek Group and underlying Lizzie Creek Volcanic Group is north northwesterly to northerly. Where measured in the field (Main Range Creek), at two localities in the Back Creek Group, the dips were ranging between 5° and 20° to the WSW.

Seismic lines G, H, I also indicate westerly dips. The Funnel Creek Corridor structure interpreted from photogeology is confirmed by the seismic sections. This structure divides the exploration area into two distinctive structural sets as follows:

- The eastern part is west dipping strata predominantly with thrust faults dissecting Early Permian rocks, including Lizzie Creek Group, into several blocks almost parallel with the corridor. Drillhole 52004 dipmeter log confirms this intense compressional structure as can be seen in Appendix 5.
- Flat dipping undulating strata with grabens, are most common west of the Funnel Creek Corridor.

4.3. INTRUSIONS

Site 52004 intersected 3m thickness of igneous rock at depth of 350 – 353m (Appendix 4) but no further petrological analysis available. The greenish grey color of rock chips did not indicate the rhyolite Permian intrusives (Pr) which occur in the most southern part of EPC (Snodin, 2006) but probably younger age of Cretaceous - Tertiary intrusion.

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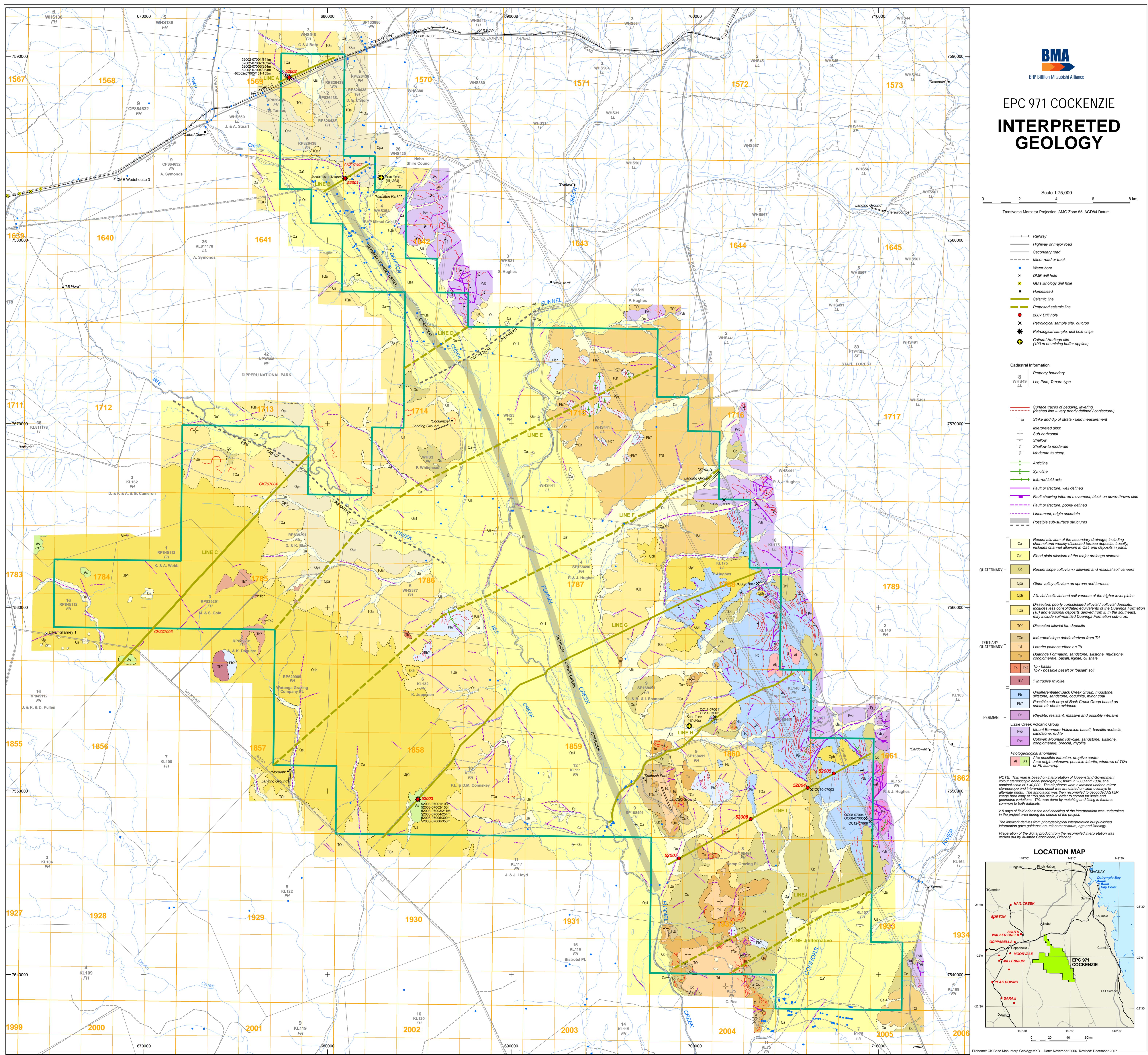
APPENDIX 1 – SUB-BLOCKS

EPC 971 SUB-BLOCKS

Block	Total	Sub-blocks
1569	6	O, P, T, U, Y, Z
1641	3	D, E, K
1642	10	A, F, G, L, M, Q, R, S, X, Y
1713	8	Q, R, S, T, V, W, X, Y
1714	17	C, D, E, H, J, K, N, O, P, R, S, T, U, W, X, Y, Z
1715	25	A, B, C, D, E, F, G, H, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z
1716	5	L, Q, R, V, W
1784	8	M, N, O, P, R, S, T, U
1785	22	A, B, C, D, E, F, G, H, J, K, L, M, N, O, P, Q, R, S, T, U, Y, Z
1786	25	A, B, C, D, E, F, G, H, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z
1787	25	A, B, C, D, E, F, G, H, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z
1788	18	A, B, C, F, G, H, L, M, N, O, Q, R, S, T, V, W, X, Y
1857	6	D, E, J, K, O, P
1858	25	A, B, C, D, E, F, G, H, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z
1859	25	A, B, C, D, E, F, G, H, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z
1860	25	A, B, C, D, E, F, G, H, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z
1861	6	L, M, Q, R, V, W
1932	21	A, B, C, D, E, F, G, H, J, K, L, M, N, O, P, Q, R, S, T, U, Z
1933	12	A, B, F, G, L, M, Q, R, S, V, W, X
Total	292	

APPENDIX 2

GEOLOGY SUMMARY MAP



APPENDIX 3

BOREHOLE COMPLETION REPORT



HOLE COMPLETION REPORT

G=Gamma, D=Density, C=Caliper, V=Sonic, Z=Vertical, N=Neutron, S=Scanner, R=Resistivity, I=Dipmeter P=Chip, C=Core, G=Geotech, L=Lox (crop), Z=Piezo, W=Water bore, B=Blast hole ACM=ACM Exploration, COL=Cole Drilling, CWD=Cap West, EVD=Evans, JDD=JD Drilling, SDR=Seis Dril

Hole Name	Site Name	Geo Int.	Hole Type	Start Date	End Date	Total Depth	Print	LAS (Y/N)	Logs Run	HOLE (m)	Geophys (m)	Survey (Y/N)	Easting	Northing	RL	Drill Co.	Rig No.	Cement	Casing Size (mm)	Casing Type (STL/PVC)	Casing Depth (m)	Photos Received	Corrected Sample Sheet Reported (Y,N,N/A)	Hard Copy (Y/N)	Filed in Compactus (Y/N)	Comments
52001	CKZ07002	NGB	P	20-Apr-07	27-Apr-07	108	Y	N	-	108	-	Y	680960.38	7583354.14	163.27	CWD	9	R		TST	75	N	Y	Y	Y	Hole not geophysically logged
52002	CKZ07001	SRB	P	29-Apr-07	21-May-07	266.75	Y	Y	CDG	266.75	149.18	Y	677913.44	7588855.18	172.94	CWD	9	R	4	TST	136.89	N	Y	Y	Y	No Pollen samples taken as no coal located. Geophysically logged through HQ rods
52003	CKZ07008	RMC	P	05-Jun-07	20-Jul-07	351.75	Y	Y	CDGRVZ	351.75	340	Y	684921.31	7549541.02	156.35	CWD	9	R	8	PVC	50	N	Y	Y	Y	Pollen samples
52004	CKZ07012	MJJ	P	20-Sep-07	04-Oct-07	440.25	Y	Y	CDGIRVZ	440.25	436	N	706155.38	7550171.82	153.93	CWD	4	Y	100	TST	282.9	N	Y	Y	Y	Planned survey

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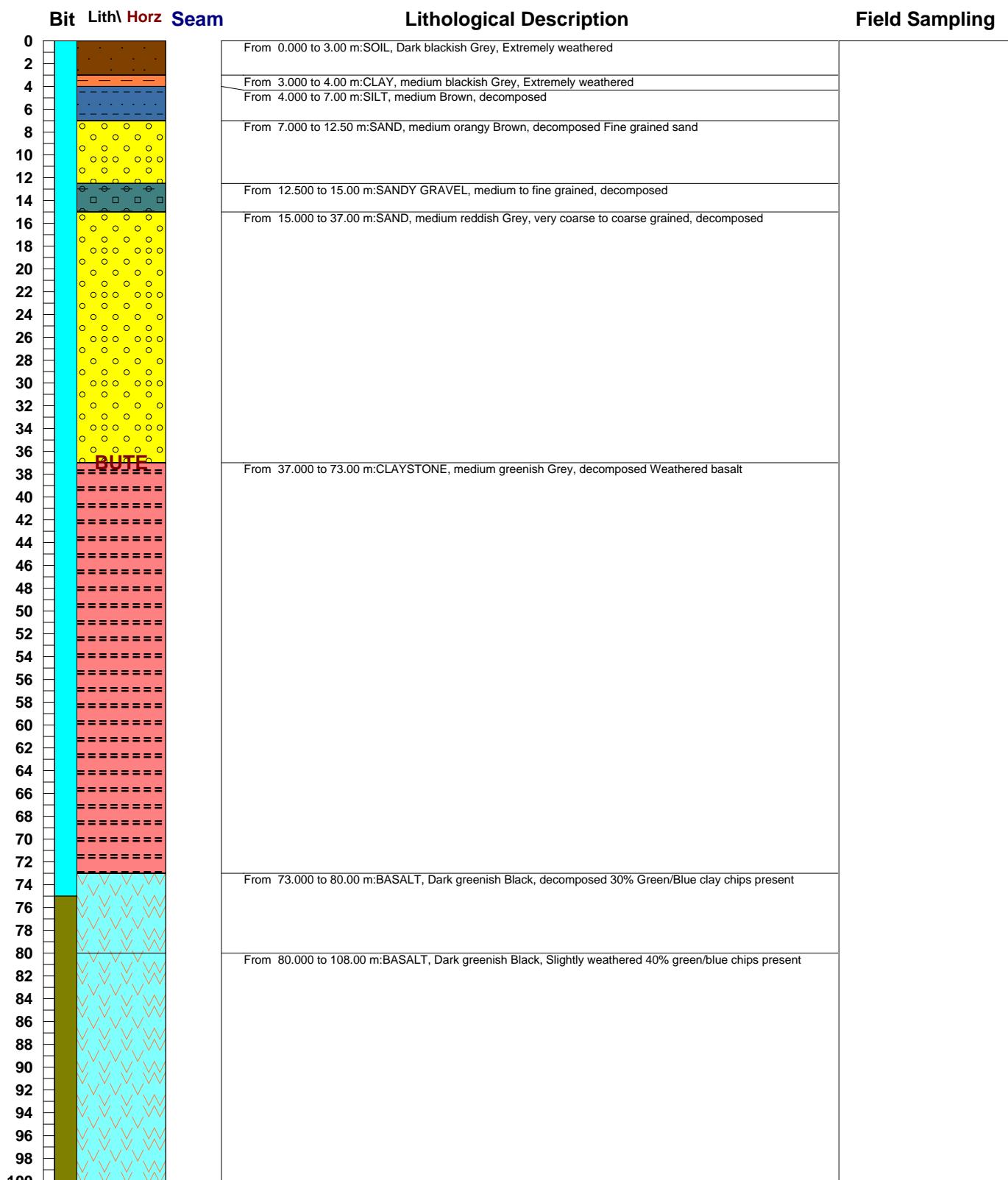
APPENDIX 4

MAIN LITHOLOGY LOGS 52001 – 52004

DRILLHOLE : 52001

Easting : 680960.38 m Elevation : 163.27 m

Northing : 7583354.14 m Final Depth : 108.00 m



Roller
Blade
Tungsten
Diamond
Hammer
Polycrystalline

BASALT	SHALE	LOST CORE
IGNEOUS ROCK	CARB SHALE	FAULT ZONE
COAL	SILTSTONE	CALCITE
CLAY	>MED SANDSTONE	CHERT
SILT	CARB SANDSTONE	TUFF
CLAYEY SAND	CONGLOMERATE	P Y PYRITE
SAND	SEDIMENTARY, undiff	S d SIDERITE
GRAVEL		ALLUVIAL

DRILLHOLE : 52001

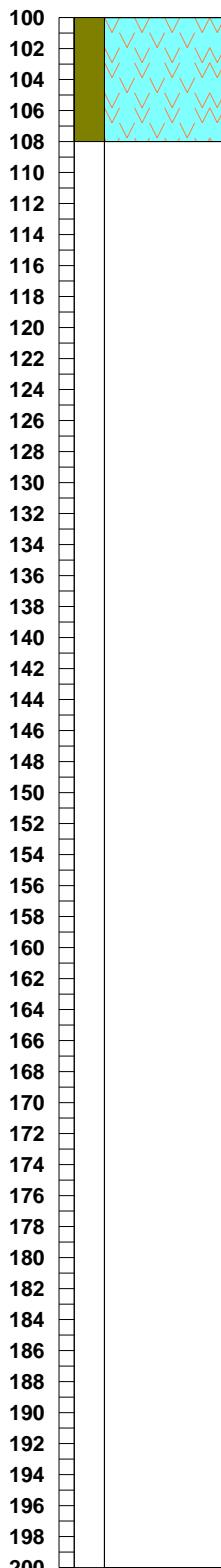
Easting : 680960.38 m Elevation : 163.27 m

Northing : 7583354.14 m Final Depth : 108.00 m

Bit Lith\ Horz Seam

Lithological Description

Field Sampling



From 80.000 to 108.00 m:BASALT, Dark greenish Black, Slightly weathered 40% green/blue chips present

Roller
Blade
Tungsten
Diamond
Hammer
Polycrystalline

BASALT	SHALE	LOST CORE
IGNEOUS ROCK	CARB SHALE	FAULT ZONE
COAL	SILTSTONE	CALCITE
CLAY	FINE SANDSTONE	CHERT
SILT	>MED SANDSTONE	TUFF
CLAYEY SAND	CARB SANDSTONE	P Y PYRITE
SAND	CONGLOMERATE	S d SIDERITE
GRAVEL	SEDIMENTARY, undiff	ALLUVIAL

DRILLHOLE : 52002

Easting : 677913.44 m

Elevation : 172.94 m

Northing : 7588855.18 m

Final Depth : 266.75 m

Bit	Lith\ Horz	Seam	Lithological Description	Field Sampling
0			From 0.000 to 1.99 m:SOIL, Dark blackish Grey, Extremely weathered	
2			From 1.990 to 5.25 m:CLAY, medium Brown, Extremely weathered	
4				
6			From 5.250 to 6.56 m:CLAYEY GRAVEL, medium Brown, decomposed	
8			From 6.560 to 8.81 m:SANDY GRAVEL, medium creamish Brown, decomposed	
10			From 8.810 to 9.23 m:SAND, decomposed	
12			From 9.230 to 10.96 m:SANDY GRAVEL, medium creamish Brown, decomposed	
14			From 10.960 to 13.94 m:CLAY, medium Brown, decomposed	
16				
18			From 13.940 to 18.23 m:SANDY GRAVEL, medium buffish Brown, medium to fine grained, decomposed	
20				
22			From 18.230 to 30.37 m:CLAYEY GRAVEL, medium creamish Brown, medium to fine grained, decomposed	
24				
26				
28				
30	BUTE			
32			From 30.370 to 32.30 m:BASALT, medium bluish Grey, decomposed	
34			From 32.300 to 71.81 m:BASALT, medium greyish Black, Slightly weathered Vesicular towards top of unit	
36				
38				
40				
42				
44				
46				
48				
50				
52				
54				
56				
58				
60				
62				
64				
66				
68				
70				
72			From 71.810 to 75.25 m:CLAYSTONE, Dark greenish Black, decomposed Weathered basalt	
74				
76			From 75.250 to 77.97 m:SANDSTONE, VERY FINE GRAINED, Dark greenish Black, medium to fine grained, decomposed	
78			From 77.970 to 80.35 m:CLAYSTONE, medium reddish Brown, decomposed	
80			From 80.350 to 84.61 m:SANDSTONE, VERY FINE GRAINED, medium Grey, decomposed Fine grained	
82				
84				
86			From 84.610 to 87.78 m:SANDSTONE, FINE GRAINED	
88				
90			From 87.780 to 90.40 m:SANDSTONE, VERY FINE GRAINED, medium Grey, decomposed Fine grained	
92			From 90.400 to 91.38 m:SANDSTONE, FINE GRAINED, medium Grey, medium to fine grained, decomposed	
94			From 91.380 to 102.44 m:CLAYSTONE, medium Grey, decomposed	
96				
98				
100				

	Roller
	Blade
	Tungsten
	Diamond
	Hammer
	Polycrystalline

	BASALT		SHALE		LOST CORE
	IGNEOUS ROCK		CARB SHALE		FAULT ZONE
	COAL		SILTSTONE		CALCITE
	CLAY		FINE SANDSTONE		CHERT
	SILT		>MED SANDSTONE		TUFF
	CLAYEY SAND		CARB SANDSTONE		PYRITE
	SAND		CONGLOMERATE		SIDERITE
	GRAVEL		SEDIMENTARY, undiff		ALLUVIAL

DRILLHOLE : 52002

Easting : 677913.44 m

Elevation : 172.94 m

Northing : 7588855.18 m

Final Depth : 266.75 m

Bit	Lith\ Horz	Seam	Lithological Description	Field Sampling
100			From 91.380 to 102.44 m:CLAYSTONE, medium Grey, decomposed	
102			From 102.440 to 104.08 m:SILTSTONE, medium greenish Grey, decomposed	
104			From 104.080 to 105.09 m:SILTSTONE, medium Grey, decomposed Medium/coarse grains	
106			From 105.090 to 109.49 m:CLAYSTONE, medium Brown, decomposed	
108				
110			From 109.490 to 110.96 m:CLAYSTONE, medium Grey, decomposed	
112			From 110.960 to 125.57 m:SILTSTONE, medium reddish Grey, Extremely weathered Interspersed red and grey siltstones with fine to medium sandstone bands.	
114				
116				
118				
120				
122				
124				
126			From 125.570 to 126.47 m:CLAYSTONE, Extremely weathered	
128			From 126.470 to 132.95 m:SILTSTONE, medium reddish Grey, Extremely weathered Interspersed red and grey siltstones with fine to medium sandstone bands.	
130				
132			From 132.950 to 135.12 m:CLAYSTONE, medium greenish Grey, decomposed	
134			From 135.120 to 144.01 m:IGNEOUS ROCK, medium greyish Black, Slightly weathered Igneous intrusion	
136				
138				
140				
142				
144			From 144.010 to 146.01 m:IGNEOUS ROCK, medium greyish Black, Slightly weathered Weathered basaltic clays	
146			From 146.010 to 148.01 m:IGNEOUS ROCK, Dark Green, Extremely weathered	
148			From 148.010 to 149.01 m:IGNEOUS ROCK, medium greenish Grey, decomposed Weathered basalt	
150			From 149.010 to 190.01 m:IGNEOUS ROCK, medium greenish Grey, decomposed pumicious chips and weathered basalt	
152				
154				
156				
158				
160				
162				
164				
166				
168				
170				
172				
174				
176				
178				
180				
182				
184				
186				
188				
190			From 190.010 to 195.01 m:IGNEOUS ROCK, medium greenish Grey, decomposed rare lignite	
192				
194				
196			From 195.010 to 203.01 m:NO SAMPLE RETURN, Slightly weathered Med/fine grained qtz/fs/lithic sand, med fine grained, blown through sieve into pit	
198				
200				

	Roller
	Blade
	Tungsten
	Diamond
	Hammer
	Polycrystalline

	BASALT		SHALE		LOST CORE
	IGNEOUS ROCK		CARB SHALE		FAULT ZONE
	COAL		SILTSTONE		CALCITE
	CLAY		FINE SANDSTONE		CHERT
	SILT		>MED SANDSTONE		TUFF
	CLAYEY SAND		CARB SANDSTONE		PYRITE
	SAND		CONGLOMERATE		SIDERITE
	GRAVEL		SEDIMENTARY, undiff		ALLUVIAL

DRILLHOLE : 52002

Easting : 677913.44 m

Elevation : 172.94 m

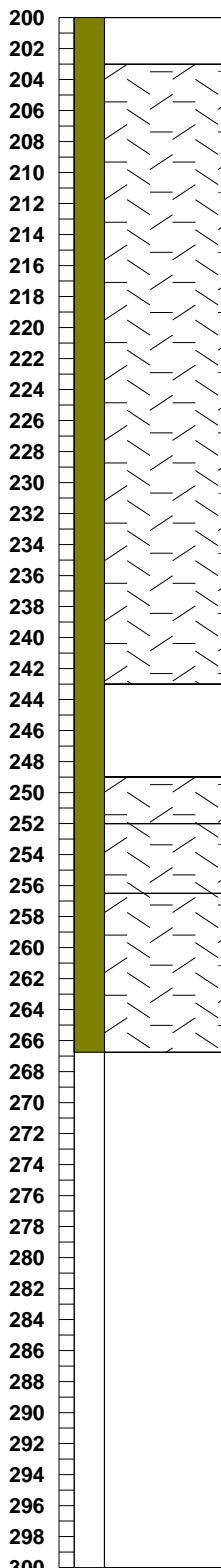
Northing : 7588855.18 m

Final Depth : 266.75 m

Bit Lith\ Horz Seam

Lithological Description

Field Sampling



200			
202			
204			
206			
208			
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298			
300			

 Roller
 Blade
 Tungsten
 Diamond
 Hammer
 Polycrystalline

 BASALT	 SHALE	 LOST CORE
 IGNEOUS ROCK	 CARB SHALE	 FAULT ZONE
 COAL	 SILTSTONE	 CALCITE
 CLAY	 FINE SANDSTONE	 CHERT
 SILT	 >MED SANDSTONE	 TUFF
 CLAYEY SAND	 CARB SANDSTONE	 PYRITE
 SAND	 CONGLOMERATE	 SIDERITE
 GRAVEL	 SEDIMENTARY, undiff	 ALLUVIAL

DRILLHOLE : 52003

Easting : 684921.31 m Elevation : 156.35 m

Northing : 7549541.02 m Final Depth : 351.75 m

Bit	Lith\ Horz	Seam	Lithological Description	Field Sampling
0			From 0.000 to 1.01 m:SAND, Light pinkish Grey, medium to fine grained, Extremely weathered	
2			From 1.010 to 2.02 m:SOIL, medium greyish Brown, medium to fine grained, Extremely weathered	
4			From 2.020 to 4.05 m:GRAVELLY SAND, Light greyish Buff, fine grained, Extremely weathered	
6			From 4.050 to 6.07 m:SANDY GRAVEL, Light yellowish Grey, coarse grained, Extremely weathered	
8			From 6.070 to 7.09 m:SANDY CLAY, Light Grey, Extremely weathered	
10			From 7.090 to 8.10 m:SANDY GRAVEL, Light pinkish Grey, very coarse to fine grained, Extremely weathered	
12			From 8.100 to 10.63 m:SANDY CLAY, Light brownish Grey, Extremely weathered	
14			From 10.630 to 12.15 m:GRAVELLY SAND, medium brownish Yellow, Extremely weathered	
16			From 12.150 to 14.17 m:SANDY CLAY, medium greyish Brown, coarse to medium grained, Extremely weathered	
18			From 14.170 to 17.21 m:CLAY, medium Grey, Extremely weathered	
20			From 17.210 to 18.73 m:CLAY, medium brownish Grey, Extremely weathered	
22			From 18.730 to 19.74 m:GRAVELLY SAND, medium yellowish Brown, coarse grained, Extremely weathered	
24			From 19.740 to 20.25 m:CLAY, medium Grey, Extremely weathered	
26			From 20.250 to 21.26 m:CLAYEY SAND, medium Brown, very coarse to medium grained, Extremely weathered	
28			From 21.260 to 26.32 m:CLAY, medium greyish Brown, Extremely weathered	
30			From 26.320 to 31.38 m:CLAY, Light yellowish Grey, Extremely weathered	
32			From 31.380 to 37.45 m:CLAY, Light Grey, Extremely weathered	
34			From 37.450 to 44.54 m:CLAY, medium reddish Grey, Extremely weathered	
36			From 44.540 to 45.55 m:SILT, medium greyish Brown, Extremely weathered	
38			From 45.550 to 47.58 m:CLAY, medium brownish Grey, Extremely weathered	
40			From 47.580 to 50.93 m:SANDY CLAY, Dark brownish Red, very fine grained, Extremely weathered	
42			From 50.930 to 57.63 m:SANDY CLAY, Light reddish Grey, very fine grained, Extremely weathered	
44			From 57.630 to 59.45 m:CLAY, medium reddish Grey, Extremely weathered red, yellow and grey clays	
46			From 59.450 to 71.30 m:CLAY, Light Grey, Extremely weathered yellow clays	
48			From 71.300 to 82.24 m:CLAY, Light Grey, Extremely weathered	
50				
52				
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90				
92				
94				
96				
98				
100				

	Roller
	Blade
	Tungsten
	Diamond
	Hammer
	Polycrystalline

	BASALT		SHALE		LOST CORE
	IGNEOUS ROCK		CARB SHALE		FAULT ZONE
	COAL		SILTSTONE		CALCITE
	CLAY		FINE SANDSTONE		CHERT
	SILT		>MED SANDSTONE		TUFF
	CLAYEY SAND		CARB SANDSTONE		PYRITE
	SAND		CONGLOMERATE		SIDERITE
	GRAVEL		SEDIMENTARY, undiff		ALLUVIAL

DRILLHOLE : 52003

Easting : 684921.31 m Elevation : 156.35 m

Northing : 7549541.02 m Final Depth : 351.75 m

Bit	Lith\ Horz	Seam	Lithological Description	Field Sampling
100			From 96.760 to 101.72 m:CLAY, Light Grey, fine to very fine grained, Extremely weathered	
102			From 101.720 to 108.67 m:CLAY, Light Grey, Extremely weathered	
104				
106				
108				
110			From 108.670 to 122.80 m:IGNEOUS ROCK, Dark bluish Grey, Extremely weathered fine grained yellow sandstone bands	
112				
114				
116				
118				
120				
122				
124			From 122.800 to 145.00 m:NO SAMPLE RETURN, Extremely weathered	
126				
128				
130				
132				
134				
136				
138				
140				
142				
144				
146			From 145.000 to 159.60 m:CLAY, mottled reddish Grey, very fine grained, Extremely weathered Grey and red clay	
148				
150				
152				
154				
156				
158				
160			From 159.600 to 161.14 m:SAND, Extremely weathered	
162			From 161.140 to 186.48 m:CLAY, mottled reddish Grey, very fine grained, Extremely weathered Grey and red clay	
164				
166				
168				
170				
172				
174				
176				
178				
180				
182				
184				
186				
188			From 186.480 to 189.84 m:SANDY CLAY, Extremely weathered	
190			From 189.840 to 198.00 m:CLAY, mottled reddish Grey, very fine grained, Extremely weathered Grey and red clay	
192				
194				
196				
198			From 198.000 to 204.02 m:SANDY CLAY, mottled reddish Grey, fine to very fine grained, Extremely weathered Similar to above unit but higher conc larger grains	
200				

	Roller
	Blade
	Tungsten
	Diamond
	Hammer
	Polycrystalline

	BASALT		SHALE		LOST CORE
	IGNEOUS ROCK		CARB SHALE		FAULT ZONE
	COAL		SILTSTONE		CALCITE
	CLAY		FINE SANDSTONE		CHERT
	SILT		>MED SANDSTONE		TUFF
	CLAYEY SAND		CARB SANDSTONE		PYRITE
	SAND		CONGLOMERATE		SIDERITE
	GRAVEL		SEDIMENTARY, undiff		ALLUVIAL

DRILLHOLE : 52003

Easting : 684921.31 m

Elevation : 156.35 m

Northing : 7549541.02 m

Final Depth : 351.75 m

Bit	Lith\ Horz	Seam	Lithological Description	Field Sampling
200				
202			From 198.000 to 204.02 m:SANDY CLAY, mottled reddish Grey, fine to very fine grained, Extremely weathered Similar to above unit but higher conc larger grains	
204			From 204.020 to 207.15 m:SAND, Extremely weathered	
206			From 207.150 to 207.68 m:SANDY CLAY, mottled reddish Grey, fine to very fine grained, Extremely weathered Similar to above unit but higher conc larger grains	
208			From 207.680 to 208.89 m:SAND, Extremely weathered	
210			From 208.890 to 209.91 m:SANDY CLAY, mottled reddish Grey, fine to very fine grained, Extremely weathered Similar to above unit but higher conc larger grains	
212			From 209.910 to 215.15 m:SAND, Extremely weathered	
214			From 215.150 to 221.00 m:SANDY CLAY, mottled reddish Grey, fine to very fine grained, Extremely weathered Similar to above unit but higher conc larger grains	
216			From 221.000 to 222.00 m:NO SAMPLE RETURN, Extremely weathered	
218			From 222.000 to 231.35 m:SANDY CLAY, mottled reddish Grey, fine to very fine grained, Extremely weathered	
220				
222				
224				
226				
228				
230				
232			From 231.350 to 234.21 m:CLAY, Extremely weathered	
234			From 234.210 to 237.99 m:SANDY CLAY, mottled reddish Grey, fine to very fine grained, Extremely weathered	
236			From 237.990 to 246.00 m:NO SAMPLE RETURN, Extremely weathered	
238	BUTE			
240				
242				
244				
246			From 246.000 to 246.78 m:CLAYSTONE, mottled reddish Grey, fine to very fine grained, Extremely weathered From 246.780 to 262.00 m:CONGLOMERATE, mottled reddish Grey, coarse to fine grained, Extremely weathered Mix of many rock types, although mainly basalt grains	
248				
250				
252				
254				
256				
258				
260				
262			From 262.000 to 264.01 m:GRANULE CONGLOMERATE, medium reddish Green, coarse to fine grained, Extremely weathered Poorly sorted, subrounded grains	
264			From 264.010 to 267.02 m:GRANULE CONGLOMERATE, medium brownish Green, medium to fine grained, Extremely weathered Poorly sorted, subrounded grains	
266			From 267.020 to 303.19 m:GRANULE CONGLOMERATE, medium brownish Green, coarse to fine grained, Extremely weathered Poorly sorted, subrounded grains	
268				
270				
272				
274				
276				
278				
280				
282				
284				
286				
288				
290				
292				
294				
296				
298				
300				

 Roller
 Blade
 Tungsten
 Diamond
 Hammer
 Polycrystalline

 BASALT	 SHALE	 LOST CORE
 IGNEOUS ROCK	 CARB SHALE	 FAULT ZONE
 COAL	 SILTSTONE	 CALCITE
 CLAY	 FINE SANDSTONE	 CHERT
 SILT	 >MED SANDSTONE	 TUFF
 CLAYEY SAND	 CARB SANDSTONE	 PYRITE
 SAND	 CONGLOMERATE	 SIDERITE
 GRAVEL	 SEDIMENTARY, undiff	 ALLUVIAL

DRILLHOLE : 52003

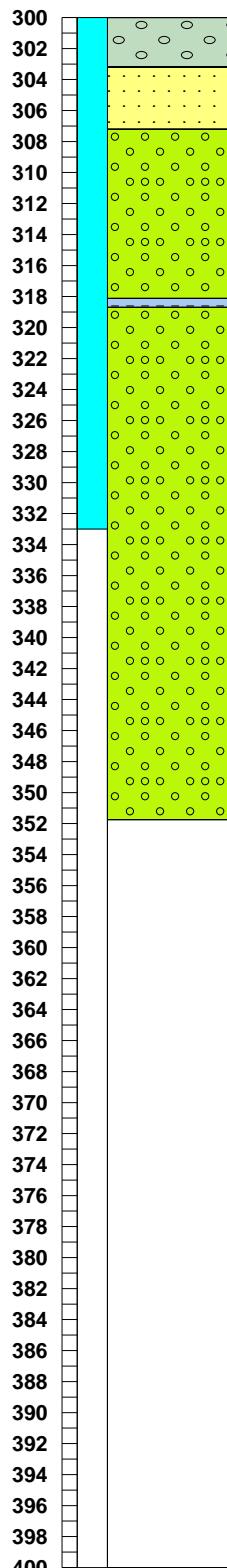
Easting : 684921.31 m Elevation : 156.35 m

Northing : 7549541.02 m Final Depth : 351.75 m

Bit Lith\ Horz Seam

Lithological Description

Field Sampling



Roller	BASALT	SHALE	LOST CORE
Blade	IGNEOUS ROCK	CARB SHALE	FAULT ZONE
Tungsten	COAL	SILTSTONE	CALCITE
Diamond	CLAY	FINE SANDSTONE	CHERT
Hammer	SILT	>MED SANDSTONE	TUFF
Polycrystalline	CLAYEY SAND	CARB SANDSTONE	P Y PYRITE
	SAND	CONGLOMERATE	S d SIDERITE
	GRAVEL	SEDIMENTARY, undiff	ALLUVIAL

DRILLHOLE : 52004

Easting : 706155.38 m Elevation : 153.93 m

Northing : 7550171.82 m Final Depth : 440.25 m

Bit	Lith\ Horz	Seam	Lithological Description	Field Sampling
0			From 0.000 to 0.70 m:CLAYEY SAND, medium orangy Brown, medium to very fine grained, Extremely weathered	
2		BUTE	From 0.700 to 2.67 m:SANDY CLAY, Light creamish Yellow, medium to very fine grained, Extremely weathered	
4			From 2.670 to 6.59 m:SANDSTONE, VERY FINE GRAINED, mottled reddish Grey, decomposed	
6				
8			From 6.590 to 10.29 m:SANDSTONE, VERY FINE GRAINED, Dark yellowish Grey, Slightly weathered weathering halos around grains give yellow colouration	
10		BHWE	From 10.290 to 19.81 m:SANDSTONE, VERY FINE GRAINED, Dark Grey, Fresh suggest matrix may be partly ash/vlocanic derived	
12		BHWE		
14				
16				
18				
20			From 19.810 to 32.16 m:SANDSTONE, VERY FINE GRAINED, Dark Grey, Fresh	
22				
24				
26				
28				
30				
32				
34			From 32.160 to 34.17 m:SANDSTONE, VERY FINE GRAINED, Dark Grey, Fresh larger calcite chips suggest vein approx 5mm	
36			From 34.170 to 38.24 m:SANDSTONE, VERY FINE GRAINED, Dark Grey, Fresh	
38				
40			From 38.240 to 40.89 m:SANDSTONE, VERY FINE GRAINED, Dark Grey, Fresh seperate pyrite grains/ chips	
42				
44			From 40.890 to 47.79 m:SANDSTONE, VERY FINE GRAINED, Dark Grey, Fresh	
46				
48				
50			From 47.790 to 51.54 m:SANDSTONE, VERY FINE GRAINED, Dark Grey, Fresh pyrite grains in chips	
52				
54			From 51.540 to 71.04 m:SANDSTONE, VERY FINE GRAINED, Dark Grey, Fresh fewer calcite grains bottom unit	
56				
58				
60				
62				
64				
66				
68				
70				
72			From 71.040 to 71.78 m:SILTSTONE, Dark Grey, Fresh possible claystone bands few finer calcite grains	
74			From 71.780 to 72.78 m:SANDSTONE, VERY FINE GRAINED, Dark Grey, Fresh	
76			From 72.780 to 76.76 m:SANDSTONE, VERY FINE GRAINED, Dark Grey, Fresh larger pyrite vein	
78				
80			From 76.760 to 87.70 m:SANDSTONE, VERY FINE GRAINED, Dark Grey, Fresh	
82				
84				
86				
88				
90			From 87.700 to 89.69 m:SANDSTONE, VERY FINE GRAINED, Dark Grey, Fresh rare 'dirty' cacite chips	
92				
94			From 89.690 to 132.45 m:SANDSTONE, VERY FINE GRAINED, Dark Grey, Fresh occasional very slight changes grainsize	
96				
98				
100				

	Roller
	Blade
	Tungsten
	Diamond
	Hammer
	Polycrystalline

	BASALT		SHALE		LOST CORE
	IGNEOUS ROCK		CARB SHALE		FAULT ZONE
	COAL		SILTSTONE		CALCITE
	CLAY		FINE SANDSTONE		CHERT
	SILT		>MED SANDSTONE		TUFF
	CLAYEY SAND		CARB SANDSTONE		PYRITE
	SAND		CONGLOMERATE		SIDERITE
	GRAVEL		SEDIMENTARY, undiff		ALLUVIAL

DRILLHOLE : 52004

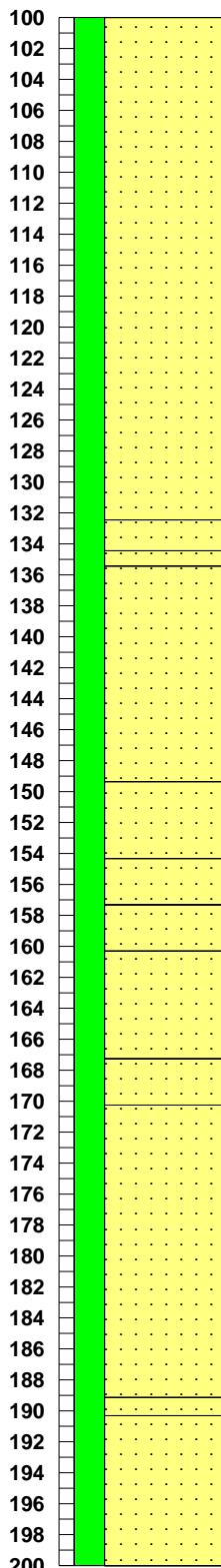
Easting : 706155.38 m Elevation : 153.93 m

Northing : 7550171.82 m Final Depth : 440.25 m

Bit Lith\ Horz Seam

Lithological Description

Field Sampling



From 89.690 to 132.45 m:SANDSTONE, VERY FINE GRAINED, Dark Grey, Fresh occasional very slight changes
grainsize

From 132.450 to 225.90 m:SANDSTONE, VERY FINE GRAINED, Dark Grey, Fresh

	Roller
	Blade
	Tungsten
	Diamond
	Hammer
	Polycrystalline

	BASALT		SHALE		LOST CORE
	IGNEOUS ROCK		CARB SHALE		FAULT ZONE
	COAL		SILTSTONE		CALCITE
	CLAY		FINE SANDSTONE		CHERT
	SILT		>MED SANDSTONE		TUFF
	CLAYEY SAND		CARB SANDSTONE		P Y PYRITE
	SAND		CONGLOMERATE		S d SIDERITE
	GRAVEL		SEDIMENTARY, undiff		ALLUVIAL

DRILLHOLE : 52004

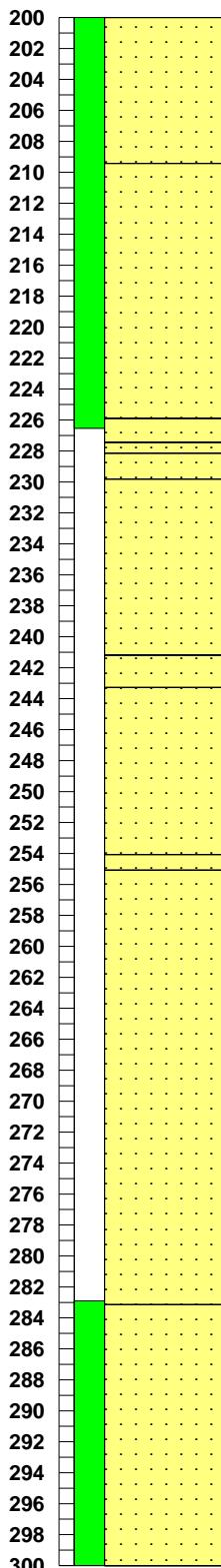
Easting : 706155.38 m Elevation : 153.93 m

Northing : 7550171.82 m Final Depth : 440.25 m

Bit Lith\ Horz Seam

Lithological Description

Field Sampling



From 132.450 to 225.90 m:SANDSTONE, VERY FINE GRAINED, Dark Grey, Fresh	
From 225.900 to 227.44 m:SANDSTONE, FINE GRAINED, Fresh	
From 227.440 to 228.15 m:SANDSTONE, VERY FINE GRAINED, Dark Grey, Fresh	
From 228.150 to 229.82 m:SANDSTONE, FINE GRAINED, Dark Grey, Fresh	
From 229.820 to 241.19 m:SANDSTONE, VERY FINE GRAINED, Dark Grey, Fresh rare thin quartz veins	
From 241.190 to 243.27 m:SANDSTONE, FINE GRAINED, Fresh	
From 243.270 to 254.07 m:SANDSTONE, VERY FINE GRAINED, Dark Grey, Fresh rare thin quartz veins	
From 254.070 to 255.07 m:SANDSTONE, VERY FINE GRAINED, Dark Grey, Fresh pyrite vein into cm's, blebs or chips	
From 255.070 to 329.87 m:SANDSTONE, VERY FINE GRAINED, Dark Grey, Fresh	

Roller
Blade
Tungsten
Diamond
Hammer
Polycrystalline

BASALT	SHALE	LOST CORE
IGNEOUS ROCK	CARB SHALE	FAULT ZONE
COAL	SILTSTONE	CALCITE
CLAY	>MED SANDSTONE	CHERT
SILT	CARB SANDSTONE	TUFF
CLAYEY SAND	CONGLOMERATE	P Y PYRITE
SAND	SEDIMENTARY, undiff	S d SIDERITE
GRAVEL		ALLUVIAL

DRILLHOLE : 52004

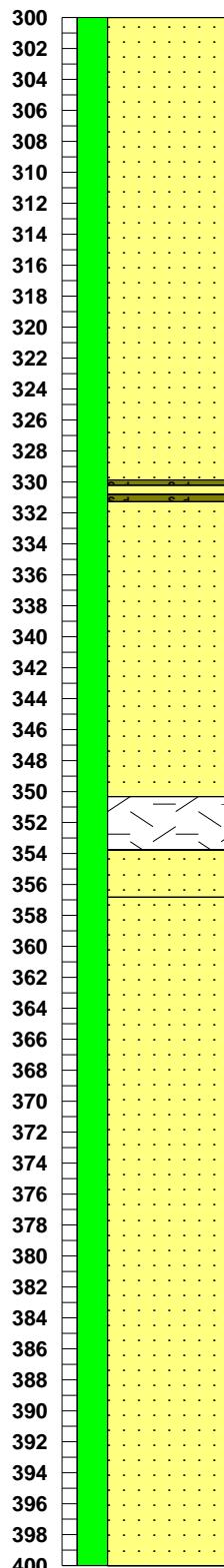
Easting : 706155.38 m Elevation : 153.93 m

Northing : 7550171.82 m Final Depth : 440.25 m

Bit Lith\ Horz Seam

Lithological Description

Field Sampling



			From 255.070 to 329.87 m:SANDSTONE, VERY FINE GRAINED, Dark Grey, Fresh	
300				
302				
304				
306				
308				
310				
312				
314				
316				
318				
320				
322				
324				
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392				
394				
396				
398				
400				

 Roller	 BASALT	 SHALE	 LOST CORE
 Blade	 IGNEOUS ROCK	 CARB SHALE	 FAULT ZONE
 Tungsten	 COAL	 SILTSTONE	 CALCITE
 Diamond	 CLAY	 FINE SANDSTONE	 CHERT
 Hammer	 SILT	 >MED SANDSTONE	 TUFF
 Polycrystalline	 CLAYEY SAND	 CARB SANDSTONE	 PYRITE
	 SAND	 CONGLOMERATE	 SIDERITE
	GRAVEL	SEDIMENTARY, undiff	ALLUVIAL

DRILLHOLE : 52004

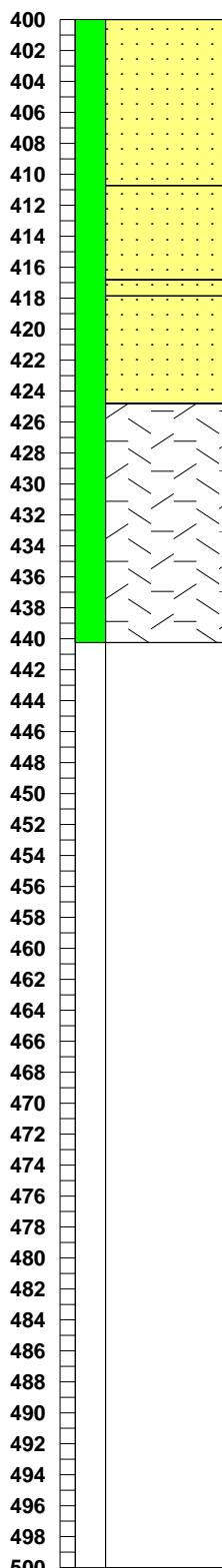
Easting : 706155.38 m Elevation : 153.93 m

Northing : 7550171.82 m Final Depth : 440.25 m

Bit Lith\ Horz Seam

Lithological Description

Field Sampling



From 353.770 to 410.73 m:SANDSTONE, VERY FINE GRAINED, Dark Grey, Fresh

From 410.730 to 416.81 m:SANDSTONE, FINE GRAINED, Dark Grey, Fresh

From 416.810 to 417.85 m:SANDSTONE, FINE GRAINED, Dark whitish Grey, Fresh

From 417.850 to 424.81 m:SANDSTONE, FINE GRAINED, Dark Grey, Fresh

From 424.810 to 440.25 m:IGNEOUS ROCK, Light greenish White, Fresh possible andesite

Roller
Blade
Tungsten
Diamond
Hammer
Polycrystalline

BASALT	SHALE	LOST CORE
IGNEOUS ROCK	CARB SHALE	FAULT ZONE
COAL	SILTSTONE	CALCITE
CLAY	>MED SANDSTONE	CHERT
SILT	CARB SANDSTONE	TUFF
CLAYEY SAND	CONGLOMERATE	P Y PYRITE
SAND	SEDIMENTARY, undiff	S d SIDERITE
GRAVEL		ALLUVIAL

APPENDIX 5

GEOPHYSICAL LOGS 52002 – 52004

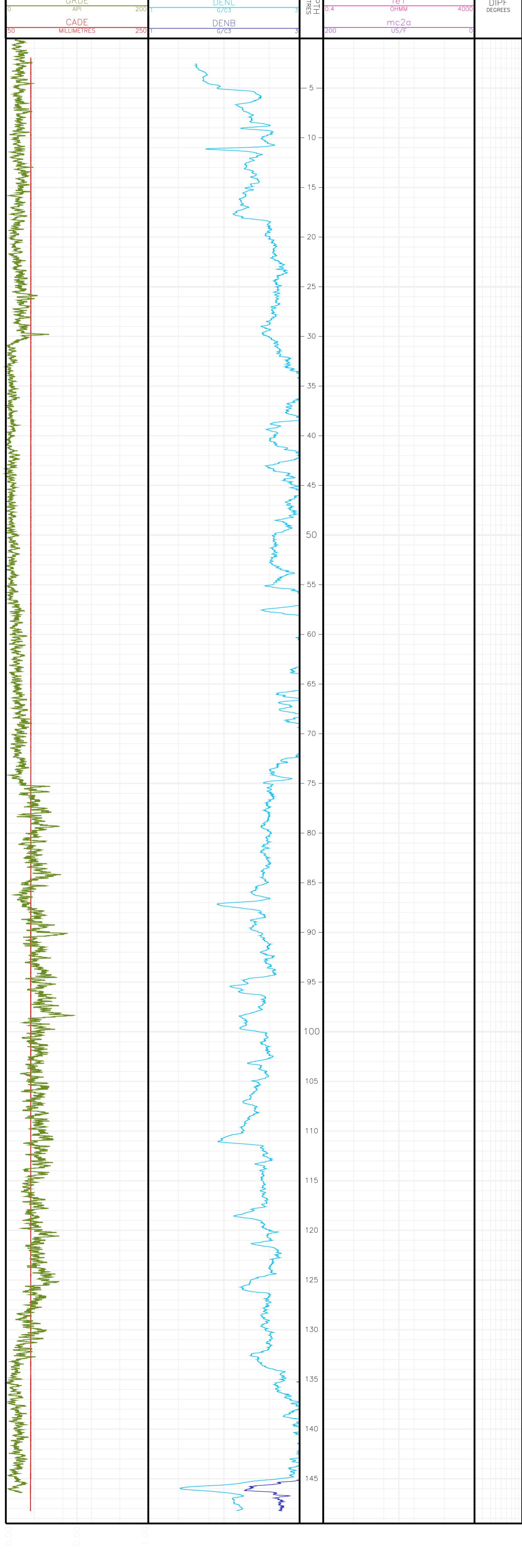
EPC971 Cockenzie



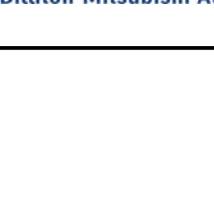
Hole: 52002

COMPANY: BMA
LOCATION: CKZ07001
LATITUDE: –
LONGITUDE: –
X COORDINATE: –

DATUM FOR ELEVATION:
SURFACE ELEVATION: –
MEASUREMENT REF.: –
ELEVATION MEAS. REF.: –
DRILLED DEPTH: –



Hole

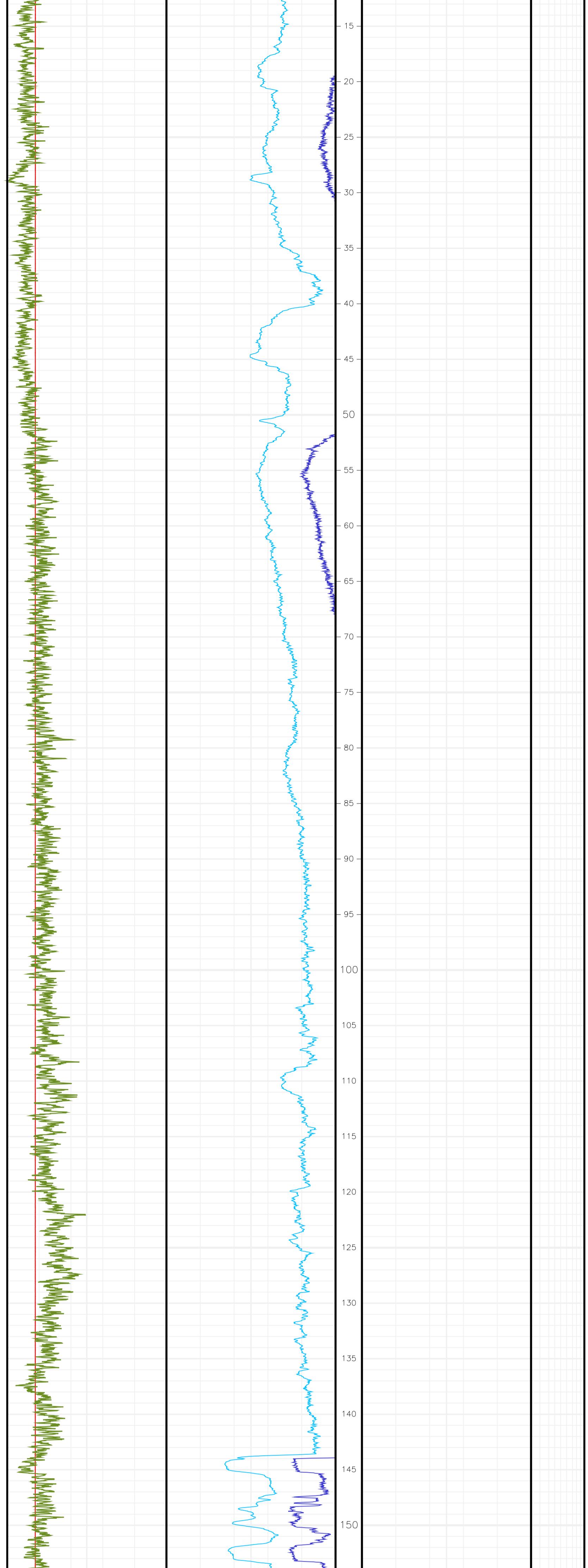


EF.:

DENL
G/C3

The graph illustrates two data series plotted against time. The vertical axis, labeled 'MILLIMETRES', spans from 0 to 100 in increments of 10. The horizontal axis represents time. The first data series, represented by green dots, shows a peak value of approximately 85 mm at a time of about 10 hours. The second data series, represented by red dots, shows a slightly higher peak of approximately 90 mm at the same time of about 10 hours.

A line graph showing a noisy signal over time. The x-axis is labeled '3' at the top left and '200' at the top right. The y-axis has labels '5' and '10' on the left side. The signal starts near 5, fluctuates between 5 and 10, and then drops sharply to around -10 before settling near -5.



EPC971 Cockenzie

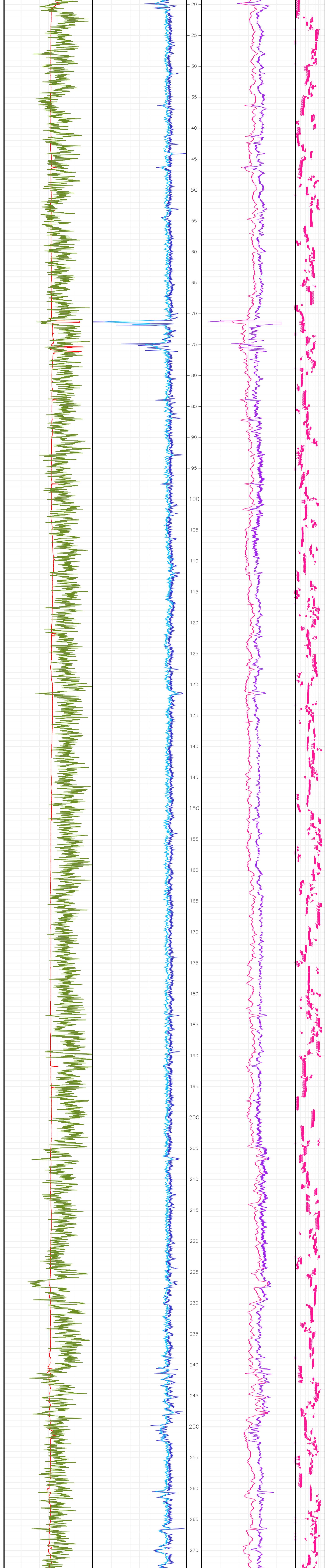
BMA

BHP Billiton Mitsubishi Alliance

Hole: 52004

COMPANY: BMA
LOCATION: CKZ07012
LATITUDE: -
LONGITUDE: -
X COORDINATE: -

DATUM FOR ELEVATION:
SURFACE ELEVATION: -
MEASUREMENT REF.: -
ELEVATION MEAS. REF.: -
DRILLED DEPTH: -



0 50 100 150 200 250 300 350 400 450

APPENDIX 6

PETROGRAPHIC REPORTS ON

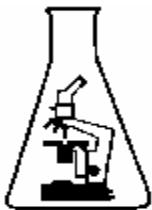
DRILL CHIP SAMPLES

GEOCHEMPET SERVICES, MALENY

Geochempet Services

ABN 980 6945 3445

PETROLOGICAL and GEOCHEMICAL CONSULTANTS



Principals: K.E. Spring B.Sc.(Hons), MAppSc
H.M. Spring B.Sc.
19 Centenary Drive
MALENY Q 4552

Telephone: (07) 5494 3288

Fax: (07) 5494 3288

Email: geochempet@bigpond.com

PETROGRAPHIC REPORTS ON TWELVE DRILL CHIP SAMPLES FROM COCKENZIE PROJECT

prepared for

**BM ALLIANCE COAL OPERATIONS PTY LTD
RESOURCE DEVELOPMENT GROUP
GEOLOGICAL SERVICES**

Order Number:

Invoice Number: 00001773

Client Ref: Noel Pranoto

Issued by

K. E. Spring B.Sc.(Hons), MAppSc
23 August 2007

GEOCHEMPET SERVICES, MALENY

Sample Number : 52001-07001 Date Sampled : Not Supplied
Drill hole : 52001 Depth : 108 m
Location : Eastern Bowen Basin Age : Permian?
BMA Coal Project : CKZ (Cockenzie - EPC971)
Work Requested : Petrographic report to identify rock type and describe mineralogy and alteration of the drill chip sample
Identification : Olivine basalt with heavy alteration to green smectite clay and brown iddingsite

Description:

The sample consisted of fine, still robust, dark-grey drill chips in a light grey clayey mixture containing a few pale grey and clear grains of quartz and feldspar sufficient to mount on a thin section.

A thin section was prepared to permit detailed microscopic examination in transmitted polarised light of the drill chips. An approximate average mineralogical composition of the rock, expressed in volume percent and based on a brief count of 100 widely spaced observation points falling within the basalt fragments, is:

Primary minerals

46%	plagioclase feldspar
14%	clinopyroxene
3%	remnant olivine
7%	opaque oxide
4%	glass and a mesostasis of glass and opaque oxide

Secondary minerals

16%	green clay of smectite style (nontronite) and slightly oxidized brown smectite clay
10%	iddingsite

In thin section the drill chips consists of a heavily altered rock type with textures of hypidiomorphic, variably intersertal, finely crystalline and formerly slightly glassy basaltic style. The grains were mainly 0.05 to 0.6 mm in size; there are indications of a interstitial mesostasis composed of brown glass with or without opaque oxide and minor late green glass partly or wholly converted to iddingsite and smectite clay.

The main framework of the rock is formed by randomly orientated, twinned laths and prisms of plagioclase (now lightly to heavily altered to green smectite clay and minor calcite). Mauve to brownish clinopyroxene (titaniferous augite) forms fresh grains. Small, equant grains of olivine are now largely pseudomorphed by green to brown smectite clay. A minor, interstitial mesostasis (brown glass with or without opaque

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oxide and late green glass) is now partly to completely altered to smectite clay and iddingsite. Small, discrete grains of opaque oxide are equant to more commonly platy.

Other grains and fragments not included in the count are mildly to moderately strained quartz, feldspar grains and granite and intensely argillized tuffaceous clasts probably derived from a labile arenite which has been intensely argillized and sericitized.

Comments and Interpretations :

The rock represented by the drill chip sample (labelled 52001-07001) at 108 m in hole 52001 from the Cockenzie Project, eastern Bowen Basin is considered to represent a slightly glassy olivine basalt of tholeiitic style. Whilst the textures are consistent with a lava flow, similar textures can be developed in a sub-volcanic dyke or sill.

The basalt now shows heavy alteration to smectite clay and iddingsite. The alteration is probably of deutereric origin i.e. formed during initial solidification and cooling. The intermediate level of intensity of the alteration may favour interpretation that the basalt crystallized in a subaerial lava flow rather than in a sub-volcanic dyke or sill (where volatiles are confined or even supplemented from “wet” host rock).

The basalt is not apparently deformed and may be interlayered with or overlain by the labile sandstone but no evidence for these associations were observed. It is possibly, based on the Permian age suggested for this sample, that it relates to an Early Permian episode of extensional subsidence with associated volcanic activity in the northern and eastern parts of the Bowen Basin. It is comprised of fine sedimentary rocks interlayered with bimodal but mafic-dominated rocks of the Lizzy Creek Volcanics probably in the early stage of volcanism.

The rock does not seem to have been weathered, although iddingsite can develop either by deutereric oxidation of nontronitic green smectite clay or by later, incipient weathering.

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Sample Number : 52002-07001 Date Sampled : Not Supplied
Drill hole : 52002 Depth : 141 m
Location : Eastern Bowen Basin Age : Permian?
BMA Coal Project : CKZ (Cockenzie - EPC971)
Work Requested : Petrographic report to identify rock type and describe mineralogy and alteration of the drill chip sample
Identification : Basalt with moderate alteration to green smectite clay and brown iddingsite

Description:

The sample consisted of fresh, hard, robust, medium dark-grey drill chips sufficient to mount on a thin section.

A thin section was prepared to permit detailed microscopic examination in transmitted polarised light of the drill chips. An approximate average mineralogical composition of the rock, expressed in volume percent and based on a brief count of 100 widely spaced observation points falling within the basalt fragments, is:

Primary minerals

58%	plagioclase feldspar
2%	K-feldspar
16%	clinopyroxene
2%	opaque oxide
4%	mesostasis of glass and opaque oxide

Secondary minerals

14%	yellowish-brown clay of smectite style and iddingsite
4%	calcite

In thin section the drill chips consists of a moderately-altered rock type with textures of aparsely porphyritic, subtly ophitic, hypidiomorphic, variably intersertal, finely crystalline and slightly glassy basaltic style. Phenocrysts range in size from 1 to 1.5 mm and groundmass grains were mainly 0.1 to 0.9 mm in size; there is a interstitial mesostasis composed of brown glass, opaque oxide and minor late green glass which is variably converted to iddingsite and smectite clay.

Phenocrysts of plagioclase form zoned stumpy grains and twinned laths. The main framework of the rock is formed by randomly orientated, twinned laths and prisms of fresh plagioclase. Pyroxene occurs probably as fresh grains of clinopyroxene as well as partly altered grains of orthopyroxene partly replaced by smectite clay and iddingsite. A minor, interstitial mesostasis (brown glass, opaque oxide and late green glass) occurs with interstitial orthoclase. Small, discrete grains of opaque oxide are equant to more commonly platy. Iddingsite also occurs in small interstitial spaces possibly after glass.

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Fracture veins (up to 0.3 mm wide) are filled by calcite and very minor smectite clay.

Comments and Interpretations :

The rock represented by the drill chip sample (labelled 52002-07001) at 141 m in hole 52002 from the Cockenzie Project, eastern Bowen Basin is considered to represent a sparsely porphyritic and slightly glassy basalt probably of calc-alkaline style. Whilst the subophitic textures are consistent with a sub-volcanic dyke or sill, similar textures can be developed within the centre of a thick lava flow.

The basalt now shows moderate alteration to smectite clay, iddingsite and calcite. The alteration is probably of deuterian origin i.e. formed during initial solidification and cooling. The basalt is fresh, moderately altered and not apparently deformed and may have been intruded into an indurated sedimentary rock. It is possibly, based on the Permian age suggested for this sample, that it intrudes Late Permian sediments, but is itself of more recent age.

The rock does not seem to have been weathered, although iddingsite can develop either by deuterian oxidation of nontronitic green smectite clay or by later, incipient weathering.

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Sample Number : 52002-07002 Date Sampled : Not Supplied

Drill hole : 52002 Depth : 183 m

Location : Eastern Bowen Basin Age : Alluvium/Tertiary

BMA Coal Project : CKZ (Cockenzie - EPC971)

Work Requested : Petrographic report to identify rock type and describe mineralogy and alteration of the drill chip sample

Identification : Polymictic pebbly conglomerate grading to sandy arenite in a heavily chloritized and carbonated condition

Description :

The sample consisted of drill chips of a rubble of mainly yellowish-grey and greenish-grey sub-rounded and rounded rock types (up to 10 mm in size) mixed with remnants of finely sandy matrix originally from a conglomerate with poorly sorted sandy and finely pebbly textures.

A thin section was prepared, incorporating a random sample of the drill chips for detailed examination in transmitted, polarised light. An approximate composition of the sample, expressed in volume percent and based on a brief count of 100 widely spaced points falling within the random sectioned drill chips, is:

43%	clasts of tuffaceous/acid volcanic rock
12%	clasts of intermediate volcanic rock (trachy-andesitic in composition)
4%	micro-diorite
1%	basalt
22%	argillized and carbonated matrix composed of labile clasts of tuffaceous origin including pumiceous fragments and vitric shards
2%	siderite as a cement
2%	clasts of carbonaceous and sericitic labile arenite
7%	clasts of quartzite and/or strained vein quartz
4%	granitoid rock
2%	epidote-albite rock of uncertain origin
1%	actinolite hornfels

In thin section the rock is seen to be variably altered pebbles of various rock types, interpreted as derived from a poorly sorted pebbly conglomerate with a sandy matrix. Numerous subrounded to rounded pebbles and coarse sand grains (variously 1 to more than 10 mm in size) were originally dispersed through a finely sandy, silty and muddy matrix.

The large clasts are mainly porphyritic, variably spherulitic acid tuffaceous/volcanic rock, variably porphyritic intermediate volcanic rock (ranging from quartz trachyte, andesite and/or latite) along with some micro-diorite, now in a heavily chloritized and variably epidotized condition and minor basalt. Less common lithic clasts are

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sericitized granitoid rock of variable grainsize and recrystallization, heavily strained quartzite and/or strained and partly recrystallized vein quartz, along with actinolite hornfels and epidote-albite rock of uncertain origin (possibly greenstone). Other clasts include carbonaceous and sericitic, labile fine arenite. The matrix material appears to be intensely argillized and sericitized tuffaceous clasts which also incorporates pumiceous fragments, vitric shards and some quartz grains. Siderite appears to act as a cement filling former cavities between some sand grains and pebbles.

Comments and Interpretations :

The rock represented by the drill chip sample (labelled 52002-07002) at 183 m in hole 52002 from the Cockenzie Project, eastern Bowen Basin are considered to represent poorly sorted polymictic pebbly conglomerate, now in a generally heavily chloritized, carbonated condition.

The rock may well be a basal conglomerate: it clearly carries fragments of metamorphic basement rock (granite, quartzite, deformed vein quartz, greenstone and hornfels), along with more abundant, rounded volcanic lithic clasts from a younger source and a few clasts of carbonaceous and sericitic labile fine arenite.

It is also possible that the conglomerate is a coarse-grained interval within a sedimentary succession of fine arenite and silstone formed as a gravity flow deposit on an unstable submarine slope probably during the Late Permian and related to onset of foreland basin subsidence.

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Sample Number : 52002-07003 Date Sampled : Not Supplied

Drill hole : 52002 Depth : 254 m

Location : Eastern Bowen Basin Age : Permian?

BMA Coal Project : CKZ (Cockenzie - EPC971)

Work Requested : Petrographic report to identify rock type and describe mineralogy and alteration of the drill chip sample

Identification : Intensely argillized and carbonated mudstone and minor labile siltstone

Description :

The sample consists of a drill chip sample of a fine grained, brownish-grey rock which appears to be variably stained brownish or pinkish.

A thin section was prepared, incorporating a random sample of the drill chips for detailed examination in transmitted, polarised light. An approximate composition of the sample, expressed in volume percent and based on a brief count of 100 widely spaced points falling within the random sectioned drill chips, is:

69%	illite/smectite layer clay
17%	carbonate (probably siderite and minor calcite)
5%	quartz grains
3%	feldspar grains
1%	fine leucoxene
5%	limonite/geothite and haematite

Microscopically the drill chips are seen to represent mainly massive assemblage of illite/smectite clay and carbonate which involves tiny rhombs (0.03 to 0.05 mm size) of siderite. In most fragments, the carbonate is finely dispersed through a matrix of illite/smectite clay which has moderately high birefringence and displays shrinkage cracks. There are also sparsely dispersed more coarsely smectitic pseudomorphs of crudely rectangular, inferred feldspar grains (about 0.1 to 2 mm in size). A few remnant quartz and feldspar phenoclasts persist but most of the feldspar is now either converted to fine clay or carbonate. The matrix was probably composed largely of reworked tuffaceous material and feldspar clasts but remnant textures are now largely obliterated by intense alteration.

Limonite appears to selectively replace some inferred grains in some clasts, as patches in other clasts and as veins in still others and is variably disseminated through the mudstone matrix probably associated with disseminated siderite.

Comments and Interpretations :

The rock represented by the drill chip sample (labelled 52002-07003) at 254 m in hole 52002 from the Cockenzie Project, eastern Bowen Basin is interpreted to have mainly

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originated from a mudstone as well as minor labile siltstone. It has carbonated and argillized by diagenetic replacement processes of a type commonly encountered in coal measures. It is possible that the matrix was reworked vitroclastic detritus, but if so then no primary textures are now preserved except for some phenoclasts.

The intensely carbonated and argillized mudstone appears to be part of a bedded sequence of labile silty and sandy sediments whereby the diagenetic process is concentrated predominantly within the mudstone layers of the feldspathic sediments and produces argillic and sideritic replacement of feldspar grains and acid tuff along with argillized cement. Limonite is commonly associated with incipiently oxidised siderite.

It is probable that the intensely carbonated and argillized sediments are of Late Permian age and associated with coal measures.

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Sample Number : 52002-07004 Date Sampled : Not Supplied

Drill hole : 52002 Depth : 264 m

Location : Eastern Bowen Basin Age : Permian?

BMA Coal Project : CKZ (Cockenzie - EPC971)

Work Requested : Petrographic report to identify rock type and describe mineralogy and alteration of the drill chip sample

Identification : Intensely carbonated and argillized mudstone and minor carbonaceous fine sandstone

Description :

The sample consists of a drill chip sample of a fine grained, pale brownish-grey rock which appears to be variably stained brownish or pinkish and some dark grey carbonaceous fine arenite.

A thin section was prepared, incorporating a random sample of the drill chips for detailed examination in transmitted, polarised light. An approximate composition of the sample, expressed in volume percent and based on a brief count of 100 widely spaced points falling within the random sectioned drill chips, is:

37%	illite/smectite layer clay
39%	carbonate (probably siderite and minor calcite)
4%	quartz grains
12%	feldspar grains
1%	detrital mica
3%	carbonaceous matter
4%	limonite/geothite and haematite

Microscopically the drill chips are seen to represent mainly massive assemblage of illite/smectite clay and carbonate which involves tiny rhombs (0.03 to 0.05 mm size) of siderite. In most fragments, the carbonate is finely dispersed through a matrix of illite/smectite clay which has moderately high birefringence and displays shrinkage cracks. There are also sparsely dispersed more coarse smectite and calcite pseudomorphs after crudely rectangular, inferred feldspar grains (mainly about 0.1 to 0.2 mm in size). A few remnant quartz and feldspar phenoclasts persist but most of the feldspar is now either converted to fine clay or carbonate. The matrix was probably composed largely of reworked tuffaceous material and feldspar clasts but remnant textures are now largely obliterated by intense alteration.

Limonite appears to selectively replace some inferred grains in some clasts, as patches in other clasts and as veins in still others and is variably disseminated through the mudstone matrix probably associated with disseminated siderite.

Some of the drill chips are seen to be fine-grained, carbonaceous labile arenite. Clasts are moderately sorted, poorly packed and cemented by fine feldspar (partly argillized) and

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sericite; they range in size from about 0.02 to 0.3 mm. Other components comprise free quartz, feldspar grains, a few fossils and wispy, coalified plant fragments.

A few clasts are of basaltic volcanic origin (chloritized and sericitized), slate and quartz and calcite vein material probably derived from the carbonaceous labile arenite.

Comments and Interpretations :

The rock represented by the drill chip sample (labelled 52002-07004) at 264 m in hole 52002 from the Cockenzie Project, eastern Bowen Basin is interpreted to have mainly originated from a mudstone as well as minor carbonaceous labile sandstone. It has been carbonated and argillized by diagenetic replacement processes of a type commonly encountered in coal measures. It is possible that the matrix was reworked vitroclastic detritus, but if so then no primary textures are now preserved except for some small phenoclasts.

The intensely carbonated and argillized mudstone appears to be part of a bedded sequence of labile silty and sandy sediments whereby the diagenetic process is concentrated predominantly within the mudstone layers of the feldspathic sediments and produces argillic and sideritic replacement of feldspar grains and acid tuff along with argillized cement. Limonite is commonly associated with incipiently oxidised siderite.

It is probable that the intensely carbonated and argillized sediments are of Late Permian age and associated with coal measures.

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Sample Number : 52002-07005 Date Sampled : Not Supplied

Drill hole : 52002 Depth : 151-155 m

Location : Eastern Bowen Basin Age : Alluvium/Tertiary

BMA Coal Project : CKZ (Cockenzie - EPC971)

Work Requested : Petrographic report to identify rock type and describe mineralogy and alteration of the drill chip sample

Identification : Coal

Description :

The sample consists of a small amount of black drill chips composed of carbonaceous matter..

A thin section was prepared, incorporating all of the drill chips for detailed examination in transmitted, polarised light. An approximate composition of the sample, expressed in volume percent and based on a brief count of 100 widely spaced points falling within the random sectioned drill chips, is:

>99%	coal fragments
<1%	quartz grains
<1%	feldspar grains
trace	siderite
trace	clay

In thin section the platy coal fragments appear to be almost pure: they are quite black and amorphous, but grade to minor translucent reddish colours, contaminated with disseminated, angular sand-sized grains of quartz (mainly 0.1 to 0.5 mm size). The coal now shows cracking which have a preferred orientation parallel to bedding, but some others form cross linkages especially normal to bedding.: most of which are empty but a few contain siderite and possibly a little clay. No woody cellular structures were observed. The coal is not coked.

Two moderately altered basalt fragments are observed which comprise plagioclase, pyroxene and yellow smectite clay filling interstitial spaces with colloform and radial textures around the rims of the patches.

Comments and Interpretations :

The rock represented by the drill chip sample (labelled 52002-07005) at 151-155 m in hole 52002 from the Cockenzie Project, eastern Bowen Basin consists of a mixture of coal and basalt. It is possible that a tensional event caused the coal to pull apart by splitting along its inherent bedding planes. As the coal was pulled apart some sideritic and possibly clay material was introduced. At a later stage, a little stretching along the coal layer (again probably in response to slight flexure) opened fine fractures, which are normal to the bedding plane. Some of the cracking may also relate to shrinkage cracks developed as the coal dries.

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It seems quite likely that the basalt has come from a lava flow rather than a sub-volcanic feeder dyke or sill. This would account for the fact that the coal is not coked and there is only moderate alteration of the basalt.

It is probable that the coal fragments are from the Late Permian coal measures and are possibly interlayered with basalt lava flows.

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Sample Number : 52003-07001 Date Sampled : Not Supplied

Drill hole : 52003 Depth : 100 m

Location : Eastern Bowen Basin Age : Alluvium/Tertiary

BMA Coal Project : CKZ (Cockenzie - EPC971)

Work Requested : Petrographic report to identify rock type and describe mineralogy and alteration of the drill chip sample

Identification : Intensely argillized, otherwise quartzose sandstone (possibly saprolite)

Description :

The sample consisted of drill chips of weak, friable, broadly yellowish-brown, clay-rich and finely sandy alluvium.

A thin section was prepared, incorporating a random sample of the drill chips for detailed examination in transmitted, polarised light. An approximate composition of the sample, expressed in volume percent and based on a brief count of 100 widely spaced points falling within the random sectioned drill chips, is:

42%	quartz grains
1%	feldspar grains
39%	clay clasts (probable smectite or illite-smectite) variably stained by 2% secondary iron oxide (limonite and haematite)
13%	lithic clasts of labile quartz sandstone (5% quartz grains and 2% acid volcanic clasts in 6% clay matrix derived from labile fragments)
3%	lithic clasts of acid volcanic rock
2%	ferruginous fragments

In thin section the drill chips are seen to consist mainly of moderately sorted angular to sub-angular, sand and silt grains (frequently around 0.4 mm, but ranging between at least 0.01 and 1 mm) thinly coated by clay. Lithic clasts include intensely argillized reworked tuff: a few are intensely ferruginized, labile quartz arenite and acid volcanic rock.

The sand and silt component is mainly simple grains of strained quartz: there are also a few composite grains of recrystallized quartz which resemble quartzite and chert. There are a very few grains of untwinned feldspar.

The clay reveals only a few hints of derivation by argillation of labile clasts (probably a rework tuff): most of it is a mildly to moderately birefringent clay (probably smectite or illite-smectite mixed layer clay), with some examples of small angular quartz grains (possibly former phenoclasts). Similar intensely argillized labile clasts now form the matrix for quartz grains and acid volcanic fragments in a labile arenite which has decomposed to release free grains of quartz and a few lithic fragments in what appears to be alluvium.

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Comments and Interpretations :

The rock represented by the drill chip sample (labelled 52003-07001) at 100 m in hole 52003 from the Cockenzie Project, eastern Bowen Basin appears to be an alluvium which seem to offer two possible interpretations. One interpretation is that a quartzose, but dominantly labile sandstone has undergone intense, texture-destructive argillization by diagenetic processes. The other possible interpretation is that the drill chips represent saprolite (i.e a soil retaining some rock textures and minerals) developed by intense weathering of a quartzose, labile sandstone.

The sediment has been deposited in a sand-dominated alluvial setting fed by quartzose material most probably in the most part from the west and appears to have incorporated reworked tuff fragments from oxidized sediments. It is most likely to be weathered and belong to the Triassic Clematis Group.

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Sample Number : 52003-07002 Date Sampled : Not Supplied

Drill hole : 52003 Depth : 150 m

Location : Eastern Bowen Basin Age : Tertiary?

BMA Coal Project : CKZ (Cockenzie - EPC971)

Work Requested : Petrographic report to identify rock type and describe mineralogy and alteration of the drill chip sample

Identification : Intensely argillized vitroclastic siltstone and claystone

Description :

The sample consisted of drill chips of weak, broadly pale yellowish-grey and pinkish mottled, clay-rich sediment.

A thin section was prepared, incorporating a random sample of the drill chips for detailed examination in transmitted, polarised light. An approximate composition of the sample, expressed in volume percent and based on a brief count of 100 widely spaced points falling within the random sectioned drill chips, is:

8%	quartz grains
1%	feldspar grains
62%	clay (probable smectite or illite-smectite)
29%	secondary iron oxide (limonite and haematite)

In thin section the drill chips are seen to consist of clasts of intensely argillized and ferruginized reworked tuffaceous sediment which is now claystone. Some appear to be derived from rock types of silty, largely vitroclastic remnant textures that have been converted largely to clay of smectitic or mixed layer appearance accompanied by haematite and a few minor feldspar and/or quartz.

The clay is a mildly to moderately birefringent clay (probably smectite or illite-smectite mixed layer clay) and most argillized clasts are intensely oxidized to secondary iron oxide (haematite and subordinate limonite). Quartz phenoclasts persist mainly unaltered; most are small and angular, but some larger grains have equi-dimensional shapes (up to 0.5 mm in size). A few feldspar grains are still preserved but mostly have been completely converted to fine sericite and/or illite clay minerals.

Comments and Interpretations :

The rock represented by the drill chip sample (labelled 52003-07002) at 150 m in hole 52003 from the Cockenzie Project, eastern Bowen Basin appears to be intensely argillized former vitroclastic siltstone and claystone. The argillation is probably diagenetic. The depositional environment is thought to be between fluvial and flood plain conditions. The vitroclastic siltstone (probably fluvial to flood plain sediment) seems to have consisted mainly of sorted, small vitric shards (probably winnowed from

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acid tuffaceous source material). The claystone is likely to represent the finest flood plain detritus.

Unevenly developed, but substantial reddening by haematite may reflect oxidation by weathering after deposition of the siltstone and claystone. This appears to represent the final stage of infilling of the Bowen Basin by volcanogenic sediments followed by uplift and thrust loading which reddened the sediment. It is most likely to belong to the Triassic reddened facies of the Rewan Group which was deposited over a well-drained alluvial landscape.

There are no indications of substantial deformation.

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Sample Number : 52003-07003 Date Sampled : Not Supplied
Drill hole : 52003 Depth : 211 m
Location : Eastern Bowen Basin Age : Permian?
BMA Coal Project : CKZ (Cockenzie - EPC971)
Work Requested : Petrographic report to identify rock type and describe mineralogy and alteration of the drill chip sample
Identification : Ferruginized and then argillized vitroclastic arenite and siltstone along with claystone

Description :

The sample consisted of drill chips of labile sediments with sandy, silty and argillaceous textures. The colours are broadly light brown with some reddish tinges.

A thin section was prepared, incorporating a random sample of the drill chips for detailed examination in transmitted, polarised light. An approximate composition of the sample, expressed in volume percent and based on a brief count of 100 widely spaced points falling within the random sectioned drill chips, is:

11%	quartz grains
2%	feldspar grains
1%	subtly haematized opaque oxide
69%	clay (probable smectite or illite-smectite)
17%	secondary iron oxide (limonite and haematite)
trace	carbonate

The drill chips consist of heavily argillized, lightly to moderately ferruginized volcanolithic arenite, ferruginized vitroclastic siltstone and intensely argillized claystone. The sectioned chips have silty to finely sandy, largely vitroclastic textures (probable after vitric shards from acid tuff) but with a few small mineral clasts of feldspar and quartz. The rock is now conspicuously pigmented by earthy limonite and haematite and the matrix is now intensely argillized; a single carbonate grain is observed. Other drill chips consist almost entirely of clay of smectitic or mixed layer appearance. They lack recognisable primary textures and are generally not ferruginized.

Both rock types have been converted largely to clay of smectitic or mixed layer appearance (moderate birefringence and with shrinkage cracks induced during thin sectioning), accompanied in some cases by limonite and haematite; they retain minor feldspar and/or quartz. The mineral clasts are feldspar, quartz and opaque oxide (now subtly haematized) ranging up to 0.5 mm in size but generally much smaller. The clasts are tightly cemented by additional clay of smectitic or mixed layer appearance. A few free and simple composite strained quartz grains are up to 1.5 mm in size.

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Comments and Interpretations :

The rock represented by the drill chip sample (labelled 52003-07003) at 211 m in hole 52003 from the Cockenzie Project, eastern Bowen Basin are interpreted to have been drawn from vitroclastic arenite, siltstone and claystone. The depositional environment is thought to have varied between fluvial and flood plain conditions. The arenite (probably fluvial) seems to have consisted of volcanic detritus and related phenoclasts drawn from probable acid tuff (and possible acid volcanic rock). The vitroclastic siltstone (probably flood plain sediment) seems to have consisted mainly of sorted, small vitric shards (probably winnowed from acid tuffaceous source material). The claystone is likely to represent the finest flood plain detritus.

Unevenly developed, but substantial colouring by secondary iron oxide may reflect oxidation by weathering after deposition of the arenite and siltstone. Intense argillization seems to have developed after the oxidation of the sediments (clasts in the arenite are ferruginized, but the clay cement generally lacks secondary iron oxide): the argillization is probably diagenetic.

There are no indications of substantial deformation. The provenance is probably mainly reworked distal acid tuff, but some of the coarser strained quartz may be derived from cratonic areas. It seems probable that the sedimentation is occurring in the Late Permian perhaps towards the Permian/Triassic boundary when the basin was overfilling with volcanic sediments.

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Sample Number : 52003-07004 Date Sampled : Not Supplied

Drill hole : 52003 Depth : 254 m

Location : Eastern Bowen Basin Age : Permian?

BMA Coal Project : CKZ (Cockenzie - EPC971)

Work Requested : Petrographic report to identify rock type and describe mineralogy and alteration of the drill chip sample

Identification : Intensely argillized vitroclastic arenite and siltstone along with claystone

Description :

The sample consisted of drill chips of labile sediments with sandy, silty and argillaceous textures. The colours are broadly pale brown with some reddish tinges.

A thin section was prepared, incorporating a random sample of the drill chips for detailed examination in transmitted, polarised light. An approximate composition of the sample, expressed in volume percent and based on a brief count of 100 widely spaced points falling within the random sectioned drill chips, is:

25%	quartz grains
2%	feldspar grains
6%	lithic clasts of granite
3%	lithic clasts of variably sericitic quartzite
2%	lithic clasts of acid volcanic rock
1%	lithic clasts of intermediate volcanic rock
1%	subtly haematized opaque oxide
49%	clay (probable smectite or illite-smectite)
10%	secondary iron oxide (limonite and haematite)
1%	carbonate cement

The drill chips consist of heavily argillized, lightly to moderately ferruginized volcanolithic arenite, ferruginized vitroclastic siltstone and intensely argillized claystone. The sectioned chips have silty to sandy, largely vitroclastic textures (probable after vitric shards from acid tuff) but with some phenoclasts of feldspar and quartz as well as coarse granite, quartzite and strained quartz and feldspar (slightly sericitized plagioclase). The rock is now variably pigmented by earthy limonite and haematite and the matrix is now intensely argillized: a few are carbonated. Other drill chips consist almost entirely of clay of smectitic or mixed layer appearance. They lack recognisable primary textures and are generally not ferruginized.

The sediment has been converted largely to clay of smectitic or mixed layer appearance (moderate birefringence), accompanied in some cases by limonite and haematite; they retain minor small feldspar and/or quartz phenoclasts. The liberated mineral clasts are coarser feldspar, quartz and opaque oxide (now subtly haematized). The lithic clasts are granite, quartzite, acid volcanic rock and a few chloritized

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intermediate volcanic rock. Numerous free and simple composite strained quartz grains are up to 2 mm in size and coated by clay cement indicating that they are liberated from the intensely argillized labile clasts.

Comments and Interpretations :

The rock represented by the drill chip sample (labelled 52003-07004) at 254 m in hole 52003 from the Cockenzie Project, eastern Bowen Basin are interpreted to have been vitroclastic arenite, siltstone and claystone. The depositional environment is thought to have varied between fluvial and flood plain conditions. The arenite (probably fluvial) seems to have consisted of volcanic detritus with related phenoclasts drawn from probable acid tuff (and acid volcanic rock and subordinate intermediate volcanic rock) and other material sourced from cratonic areas. The vitroclastic siltstone (probably flood plain sediment) seems to have consisted mainly of sorted, small vitric shards (probably winnowed from acid tuffaceous source material). The claystone is likely to represent the finest flood plain detritus.

Unevenly developed colouring by secondary iron oxide may reflect oxidation by weathering after deposition of the arenite and siltstone. Intense argillization seems to have developed after the oxidation of the sediments (clasts in the arenite are ferruginized, but the clay cement generally lacks secondary iron oxide): the argillization is probably diagenetic.

There are no indications of substantial deformation. The provenance is probably mainly reworked distal acid tuff, acid volcanic rock and lesser amounts of intermediate volcanic rock but increasing amounts of the coarser strained quartz, quartzite and granite fragments are derived from cratonic areas. It seems probable that the sedimentation is occurring in the Late Permian when the basin was filling with volcanic sediments from the resurgence of the volcanic arc in the east supplemented by quartzose cratonic material from the west.

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Sample Number : 52003-07005 Date Sampled : Not Supplied
Drill hole : 52003 Depth : 300 m
Location : Eastern Bowen Basin Age : Permian?
BMA Coal Project : CKZ (Cockenzie - EPC971)
Work Requested : Petrographic report to identify rock type and describe mineralogy and alteration of the drill chip sample
Identification : Intensely argillized labile siltstone along with carbonated micro-diorite

Description :

The sample consisted of drill chips of labile sediment with silty and argillaceous textures with broadly pale brown colour with some reddish tinges and light grey finely crystalline igneous rock.

A thin section was prepared, incorporating a random sample of the drill chips for detailed examination in transmitted, polarised light. An approximate average composition of the sample, expressed in volume percent and based on a brief count of 100 widely spaced points falling within the random sectioned drill chips, is:

12%	quartz grains
18%	plagioclase
2%	biotite
2%	opaque oxide
32%	clay (probable smectite or illite-smectite)
10%	secondary iron oxide (limonite and haematite)
11%	sericite
9%	calcite
4%	chlorite

About half of the drill chips consist of heavily argillized, lightly to moderately ferruginized labile siltstone. The sectioned chips have silty, largely acid tuffaceous textures with some phenoclasts of feldspar and quartz as well as large strained quartz grains. The rock is now variably pigmented by earthy limonite and haematite and the matrix is now intensely argillized. Woody plant fragments are observed in a few of the labile siltstone fragments.

The other half of drill chips are micro-diorite which are heavily altered, but it still retains primary textures of hypidiomorphic, finely crystalline, igneous style. The groundmass grains are up to about 0.5 mm long. The groundmass consists of randomly orientated, subhedral laths of plagioclase, opaque oxide, chloritized former pyroxene or hornblende, biotite and minor anhedral quartz; the groundmass is abundantly carbonated and sericitized.

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Comments and Interpretations :

The rock represented by the drill chip sample (labelled 52003-07005) at 300 m in hole 52003 from the Cockenzie Project, eastern Bowen Basin are interpreted to have been a mixture of intensely argillized labile siltstone and heavily altered micro-diorite.

The micro-diorite now shows heavy alteration to calcite and sericite. The alteration is probably of deutereric origin i.e. formed during initial solidification and cooling. The intensity of the alteration favours the interpretation that it crystallized in a sub-volcanic dyke or sill (where volatiles are confined or even supplemented from “wet” host rock). Its textures are consistent with crystallization in a shallow intrusion.

The micro-diorite is not apparently deformed and may well have intruded the labile siltstone but no evidence for these associations were observed in the thin section. It is possibly, based on the Permian age suggested for this sample, that the labile siltstone relates to a Late Permian phase of passive thermal subsidence in the Bowen Basin which accumulated fine-grained sediments in a shallow transgressive marine environment: it was later intruded by the micro-diorite while still in a wet condition.

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Sample Number : 52003-07006 Date Sampled : Not Supplied

Drill hole : 52003 Depth : 353 m

Location : Eastern Bowen Basin Age : Permian?

BMA Coal Project : CKZ (Cockenzie - EPC971)

Work Requested : Petrographic report to identify rock type and describe mineralogy and alteration of the drill chip sample

Identification : Slightly carbonaceous siltstone

Description :

The sample consists of a small drill chip sample of silty to finely sandy textured sedimentary rock.

A thin section was prepared to permit detailed microscopic examination in transmitted polarised light of all the drill chips. An approximate mineralogical composition, expressed in volume percent and based on a brief count of 100 widely spaced points falling within the thin section, is:

26%	quartz grains
23%	feldspar grains (variably sericitized)
2%	subtly haematized opaque oxide
1%	detrital mica (biotite and muscovite)
8%	ferruginized fragments
5%	lithic clasts of acid volcanic rock
2%	lithic clasts of intermediate volcanic rock
2%	calcite
1%	chlorite
trace	haematite
28%	sericitic clay cement (apparently illite-smectite mixed layer clay and kaolinite)
2%	coalified plant matter

In thin section the rock in the drill chip is seen to be slightly carbonaceous siltstone (mainly 0.05 to 0.2 mm grainsize): rare grains are up to 1 mm in size). Angular to commonly rounded argillized clasts are poorly sorted, moderately packed and cemented by sericite and clay; they range in size from about 0.1 to uncommonly 0.4 mm. A few of the remnant clasts are former rounded lithic clasts of acid and intermediate volcanic origin: a few others are completely ferruginized. They are now variably altered to clays and sericite. The main silty and sandy components comprise free quartz, feldspar grains (partly altered to calcite), opaque oxides (subtly haematized), detrital mica and fragments of coalified plant matter.

Silt and subordinate sand clasts are free grains of quartz, feldspar and a few randomly orientated detrital mica flakes. There are some small opaque oxide phenoclasts present.

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Other equant grains of strained quartz appear to be of clastic origin from cratonic provenance. Quartz phenoclasts persist as unchanged, angular fragments. Some feldspar grains are partly replaced by calcite and sericite.

Comments and Interpretations :

The rock represented by the drill chip sample (labelled 52003-07006) at 353 m in hole 52003 from the Cockenzie Project, eastern Bowen Basin represents rock which may be identified broadly as slightly carbonaceous siltstone. The composition and textures of this sample seem quite consistent with a marine transgression.

The siltstone is moderately argillized. The alteration is interpreted to be of diagenetic style, generated by reaction between labile rock and mineral fragments and migrating pore fluids at some stage after deposition.

The detritus was derived from a mixed source of clastic material from dominantly volcanic material shedding west across the basin and is less influenced by cratonic-derived sediments probably deposited in a transgressive marine environment. It relates to a Late Permian phase of passive thermal subsidence in the Bowen Basin which accumulated fine-grained marine strata.

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Sample Number : 52004-07010 Date Sampled : 17 & 28/10/07
Sample Type : Drill Chips Date Supplied : 02/11/07
Bore Hole No. : 52004 at site CKZ07012 Depth : 438-439 m
Location : Eastern Bowen Basin Age : Permian?
BMA Coal Project : CKZ (Cockenzie - EPC971)
Work Requested : Petrographic report to identify rock type and describe mineralogy and alteration of the rock sample
Identification : Abundantly amygdaloidal and intensely carbonated andesitic breccia

Description :

The small sample of drill chips consisted of small fragments of broadly light olive-grey to greenish-grey, intensely carbonated, fine-grained, abundantly amygdaloidal intermediate (probably andesitic) rock. The abundant spherical and ovoid amygdules are filled by calcite and chlorite and the groundmass is intensely carbonated.

A thin section was prepared to permit detailed microscopic examination in transmitted polarised light of the small hand specimen. An approximate mineralogical composition, expressed in volume percent and based on a brief count of 100 points falling within the rock, is:

6% feldspar (remnant plagioclase and albite)
72% calcite
10% sphene/leucoxene
8% chlorite
4% illite clay
<1% secondary quartz
trace haematite

In thin section the intensely carbonated rock displays vague breccia textures of former andesitic lithic clasts which are scattered through formerly quenched, scoriaceous, now amygdaloidal and altered matrix of probably andesitic primary composition.

The groundmass in the original rock contained small plagioclase laths, inferred glass, former mafic silicates and opaque oxide which has been intensely altered to calcite, sphene/leucoxene and chlorite: some remnants of small plagioclase laths are preserved: others are albitized. Very abundant ovoid to crudely spherical former vesicles (mainly around 0.05 to 0.3 mm in diameter) are filled by calcite, chlorite, remnant secondary quartz and some clay minerals (probably of illitic style). The amygdules are often rimmed by a fine dusting of iron oxide (probably haematite).

Small remnant clasts of andesite (but without amygdules) are now composed mainly of fine feldspar laths of plagioclase, sphene and some chlorite.

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The rock is intensely carbonated by mainly calcite and subordinate siderite ranging from late, coarsely recrystallized calcite grains to finely crystalline calcite and siderite in relic amygdalites which has largely obscured primary textures.

Comments and Interpretations :

This drill chip sample (labelled 52004-07010) from 438-439 m in bore hole 52004 at site CKZ07012, Cockenzie Project, Eastern Bowen Basin is interpreted to be intensely altered andesitic breccia in which clasts of finely recrystallized andesite have been incorporated by the scoriaceous quenched andesite. This type of primary texture develops near the leading edge or near the upper surface of a lava flow. The texture can also develop within a sub-volcanic feeder vent, especially if the magma is passing through wet host rocks which can contribute to the vesiculation and quenching of magma. For example, basaltic feeders cutting through sandstone, shale and coal in the Central Queensland Coalfields show similar textures, but they will usually carry clasts of the country rock.

Remnant textures indicate that this rock originated as a breccia. Some remnant small feldspar laths persist from intensely carbonated andesitic clasts. Initially it seems to have been chloritized and magnetized and it was subsequently intensely carbonated and opaques are now converted to sphene. It appears that waters enriched in dissolved carbon dioxide (possibly from nearby coal seams) percolated through the rock to form an intensely carbonated matrix.

It is possible, based on the Permian age suggested for this sample, that it relates to an Early Permian episode of crustal extensional with associated volcanic activity in the northern and eastern parts of the Bowen Basin. This phase of sedimentary accumulation was accompanied by intrusion and extrusion of a bimodal suite of basic/intermediate and acid igneous rocks probably from the Lizzy Creek Volcanics.

APPENDIX 7

PETROGRAPHIC REPORTS ON

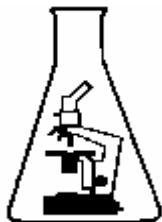
ROCK SAMPLES

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Geochempet Services

ABN 980 6945 3445

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**PETROGRAPHIC REPORTS
ON SIX ROCK SAMPLES (OC11-07001, OC11-07002, OC10-07003,
OC08-07004, OC08-07005, OC01-07006)
FROM COCKENZIE PROJECT**

prepared for

**BM ALLIANCE COAL OPERATIONS PTY LTD
RESOURCE DEVELOPMENT GROUP
GEOLOGICAL SERVICES**

Order Number:

Invoice Number: 00001803

Client Ref: Noel Pranoto

Issued by

A handwritten signature in black ink, appearing to read "K. E. Spring".

K. E. Spring B.Sc.(Hons), MAppSc
25 September 2007

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Sample Number : OC11-07001 Date Sampled : 23/08/07
Sample Type : Outcrop Sample Loc. : OC-11 near CKZ07009
Location : Eastern Bowen Basin Age : Permian?
BMA Coal Project : CKZ (Cockenzie - EPC971)
Work Requested : Petrographic report to identify rock type and describe mineralogy and alteration of the rock sample
Identification : Slightly carbonaceous labile fine arenite (mainly siltstone) of volcaniclastic origin
Description :

The sample consists of a grab sample of rocky rubble from an outcrop near CKZ07009 of silty to finely sandy textured, slightly micaceous sedimentary rock which is broadly medium dark-grey with yellowish-brown weathered overtones. The moderately robust sample can be easily scratched by steel, but not too deeply because of the presence of remnant sand grains.

A thin section was prepared to permit detailed microscopic examination in transmitted polarised light of the rock fragments. An approximate mineralogical composition, expressed in volume percent and based on a brief count of 100 widely spaced points falling within the thin section, is:

26%	quartz grains
19%	remnant feldspar grains
5%	detrital mica (muscovite and subordinate biotite)
1%	leucoxenized opaque oxides
1%	lithic clasts of acid tuff
1%	lithic clasts of quartzite
1%	sericitized clast
4%	limonite
1%	chlorite
35%	sericitic clay cement
6%	carbonaceous matter

In thin section the rock is seen to be very fine-grained, labile arenite. Clasts are poorly to moderately sorted, moderately packed and cemented by sericitic clay and minor chlorite; they range in size from about 0.05 to 0.2 mm and rarely up to 1 mm in size. Free quartz and feldspar grains (commonly slightly altered to sericite) along with randomly orientated micas comprise the main detrital components. Some sericitized clasts appear to have been labile clasts of perhaps volcanic style.

Sandy clasts are free grains of quartz, feldspar and mica (both muscovite and biotite)

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which are both former phenoclasts and detrital clastic grains. Quartz phenoclasts persist mainly unaltered; most are angular, but some have at least partly smooth, corroded and embayed shapes. Feldspar grains (perhaps mostly phenoclasts) have been partly overprinted by sericite. There are a few small opaque oxide phenoclasts or leucoxenized former oxide phenoclasts present. Other minor equant grains of strained quartz, strained quartzite, feldspar and detrital muscovite appear to be of cratonic origin.

The fine arenite is densely cemented, mainly by very fine biotite, sericitic and/or illitic clay and minor chlorite which is heavily stained by both carbonaceous matter and limonite.

Carbonaceous matter occurs as numerous fine wisps within the matrix of the fine arenite. Some fragments appear to be somewhat rounded in shape implying transportation.

Comments and Interpretations :

The rock represented by the supplied sample (labelled OC11-07001) from an outcrop near CKZ07009, Cockenzie Project, eastern Bowen Basin represents rock which may be identified broadly as slightly carbonaceous fine arenite. An alternative more specific identification would be sericitized, quartzo-feldspathic siltstone incorporating some carbonaceous material. The composition and textures of this sample seem quite consistent with a marine setting.

The cement in the rock is sericitized. Diagenetic processes have variably “sericitized” the volcanic or tuffaceous clasts, but feldspar grains have survived largely unaltered; at the same time the rock has been well cemented by additional similar “sericite” and illitic clays.

The detritus was derived from dominantly volcanic material shedding west across the basin and is less influenced by cratonic-derived sediments. It relates to a Late Permian phase of passive thermal subsidence in the Bowen Basin which accumulated fine-grained strata probably deposited in a transgressive marine setting.

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Sample Number : OC11-07002 Date Sampled : 23/08/07

Sample Type : Outcrop Sample Loc. : OC-11 near CKZ07009

Location : Eastern Bowen Basin Age : Permian?

BMA Coal Project : CKZ (Cockenzie - EPC971)

Work Requested : Petrographic report to identify rock type and describe mineralogy and alteration of the rock sample

Identification : Labile fine arenite (mainly siltstone) of volcaniclastic origin

Description :

The sample consists of a grab sample of rocky rubble from an outcrop near CKZ07009 of silty to finely sandy textured, slightly micaceous sedimentary rock which is broadly medium grey with yellowish-brown weathered overtones. The moderately robust sample can be easily scratched by steel, but not too deeply because of the presence of robust remnant sand grains.

A thin section was prepared to permit detailed microscopic examination in transmitted polarised light of the rock fragments. In the course of thin sectioning the rock behaved in a slightly water-sensitive fashion. An approximate mineralogical composition, expressed in volume percent and based on a brief count of 100 widely spaced points falling within the thin section, is:

25%	quartz grains
21%	remnant feldspar grains
2%	detrital mica (muscovite and subordinate biotite)
<1%	leucoxenized opaque oxides
3%	lithic clasts of acid tuffaceous/volcanic rock
<1%	lithic clasts of quartzite
3%	sericitized clast
3%	limonite
1%	chlorite
41%	sericitic clay cement
1%	carbonaceous matter

In thin section the rock is seen to be fine-grained, labile arenite. Clasts are poorly sorted, moderately packed and cemented by sericitic clay and minor chlorite; they range in size from about 0.05 to 0.3 mm and rarely up to 1 mm in size. A single sub-rounded clast of porphyritic acid volcanic (5 mm in size) is present. Free quartz and feldspar grains (commonly slightly altered to sericite) along with randomly orientated micas comprise the main detrital components. Some sericitized clasts appear to have been labile clasts of perhaps volcanic style, but others retain distinctly acid volcanic textures.

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Sandy clasts are free grains of quartz, feldspar and mica (both muscovite and biotite) which are both former phenoclasts and detrital clastic grains. Quartz phenoclasts persist mainly unaltered; most are angular, but some have at least partly smooth, corroded and embayed shapes. Feldspar grains (perhaps mostly phenoclasts) have been partly overprinted by sericite. There are a few small opaque oxide phenoclasts or leucoxenized former oxide phenoclasts present. Other minor equant grains of strained quartz, strained quartzite, feldspar and detrital muscovite appear to be of cratonic origin.

The fine arenite is densely cemented, mainly by very fine biotite, sericitic and/or illitic clay and minor chlorite which is lightly stained by both carbonaceous matter and limonite.

Carbonaceous matter is concentrated into thin lamination containing numerous fine wisps within the matrix of the fine arenite. Some fragments appear to be somewhat rounded in shape implying transportation.

Comments and Interpretations :

The rock represented by the supplied sample (labelled OC11-07002) from an outcrop near CKZ07009, Cockenzie Project, eastern Bowen Basin represents rock which may be identified broadly as labile fine arenite. An alternative more specific identification would be sericitized, quartzo-feldspathic siltstone with thin carbonaceous laminations. The composition and textures of this sample seem quite consistent with a marine setting.

The cement in the rock is sericitized. Diagenetic processes have variably “sericitized” the volcanic or tuffaceous clasts, but feldspar grains have survived largely unaltered; at the same time the rock has been well cemented by additional similar “sericite” and illitic clays.

The detritus was derived from dominantly volcanic material shedding west across the basin and is less influenced by cratonic-derived sediments. It relates to a Late Permian phase of passive thermal subsidence in the Bowen Basin which accumulated fine-grained strata probably deposited in a transgressive marine setting.

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Sample Number : OC10-07003 Date Sampled : 15/08/07

Sample Type : Outcrop Sample Loc. : OC-10 near CKZ07012

Location : Eastern Bowen Basin Age : Permian?

BMA Coal Project : CKZ (Cockenzie - EPC971)

Work Requested : Petrographic report to identify rock type and describe mineralogy and alteration of the rock sample

Identification : Labile fine sandstone of volcaniclastic origin

Description :

The sample consists of a grab sample of rocky rubble from an outcrop near CKZ07012 of moderately to heavily weathered, finely sandy textured, slightly micaceous sedimentary rock which is broadly light brown to brownish-grey. The moderately robust sample can be easily scratched by steel, but not too deeply because of the presence of robust remnant sand grains. It also split easily along the sedimentary layers as weathering penetrates along these weaknesses.

A thin section was prepared to permit detailed microscopic examination in transmitted polarised light of the rock fragments. In the course of thin sectioning the rock behaved in a slightly water-sensitive fashion. An approximate mineralogical composition, expressed in volume percent and based on a brief count of 100 widely spaced points falling within the thin section, is:

27%	quartz grains
19%	remnant feldspar grains
2%	detrital mica (muscovite and subordinate biotite)
1%	leucoxenized opaque oxides
3%	lithic clasts of acid tuffaceous/volcanic rock
<1%	lithic clasts of quartzite
8%	sericitized/argillized clast
6%	limonite
<1%	chlorite
34%	sericitic clay cement
<1%	carbonaceous matter

In thin section the rock is seen to be fine-grained, labile sandstone. Clasts are poorly sorted, moderately packed and cemented by sericitic clay and minor chlorite; they range in size from about 0.025 to 0.5 mm and rarely up to 1.5 mm in size. A single sub-rounded clast of acid volcanic (2 mm in size) and a coarser densely packed and tightly cemented sandstone clast (11 mm long) is present. Free quartz and feldspar grains (commonly slightly altered to sericite) along with randomly orientated micas comprise the main detrital components. Some sericitized/argillized clasts appear to

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have been labile clasts of perhaps volcanic style, but others retain distinctly acid volcanic textures.

Sandy clasts are free grains of quartz, feldspar and mica (both muscovite and biotite) which are both former phenoclasts and detrital clastic grains. Quartz phenoclasts persist mainly unaltered; most are angular to sub-angular, but some have at least partly smooth, corroded shapes. Feldspar grains (perhaps mostly phenoclasts) have been partly overprinted by sericite. There are a few small opaque oxide phenoclasts or leucoxenized former oxide phenoclasts present. Other minor equant grains of strained quartz, strained quartzite, feldspar and detrital muscovite appear to be of cratonic origin.

The fine sandstone is densely cemented, mainly by very fine biotite, sericitic and illitic clay and minor chlorite which is lightly stained by carbonaceous matter and intensely limonite-stained.

Specks of carbonaceous matter occur within the matrix of the fine sandstone.

Comments and Interpretations :

The rock represented by the supplied sample (labelled OC10-07003) from an outcrop near CKZ07012, Cockenzie Project, eastern Bowen Basin represents rock which may be identified broadly as labile fine sandstone. An alternative more specific identification would be sericitized, quartzo-feldspathic sandstone. The composition and textures of this sample seem quite consistent with deposition on a submarine slope possibly involving some mass-flow sedimentation (indicated by presence of flattened sandstone clasts).

The cement in the rock is sericitized. Diagenetic processes have variably “sericitized” the volcanic or tuffaceous clasts, but feldspar grains have survived largely unaltered; at the same time the rock has been well cemented by additional similar “sericite” and illitic clays.

The detritus was derived from dominantly volcanic material shedding west across the basin and is less influenced by cratonic-derived sediments. It relates to a Late Permian phase of flexural subsidence in the Bowen Basin which accumulated fine-grained strata probably deposited in a transgressive marine setting.

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Sample Number : OC08-07004 Date Sampled : 15/08/07

Sample Type : Upper part of outcrop

Sample Loc. : On Sarina-Marlborough Road

Location : Eastern Bowen Basin Age : Early Permian?

BMA Coal Project : CKZ (Cockenzie - EPC971)

Work Requested : Petrographic report to identify rock type and describe mineralogy and alteration of the rock sample

Identification : Labile siltstone of volcaniclastic origin

Description :

The sample consists of a grab sample of rocky rubble from the upper part of an outcrop on the Sarina-Marlborough Road of silty to finely sandy textured, slightly micaceous sedimentary rock which is broadly light brownish-grey. The moderately robust sample can be easily scratched by steel and numerous shrinkage fractures in the rock are lined by limonite

A thin section was prepared to permit detailed microscopic examination in transmitted polarised light of the rock fragments. In the course of thin sectioning the rock behaved in a water-sensitive fashion. An approximate mineralogical composition, expressed in volume percent and based on a brief count of 100 widely spaced points falling within the thin section, is:

12%	quartz grains
16%	remnant feldspar grains
3%	detrital mica (muscovite and subordinate biotite)
<1%	leucoxenized opaque oxides
23%	sericitized/argillized clast
6%	limonite
1%	chlorite
39%	sericitic clay cement
trace	carbonaceous matter

In thin section the rock is seen to be very fine-grained, labile siltstone. Clasts are poorly to moderately sorted, moderately packed and cemented by sericitic clay and minor chlorite; they range in size from about 0.02 to 0.1 mm and rarely up to 0.5 mm in size. Free quartz and feldspar grains (commonly slightly altered to sericite) along with randomly orientated micas comprise the main detrital components. Sericitized/argillized clasts appear to have been labile clasts of perhaps volcanic style. A few vaguely preserved elongate mudstone and sandstone clasts (up to 5 mm in length) are also observed.

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Sandy clasts are free grains of quartz, feldspar and mica (both muscovite and biotite) which are both former phenoclasts and detrital clastic grains. Quartz phenoclasts persist mainly unaltered; most are angular, but some have at least partly smooth, corroded shapes. Feldspar grains (perhaps mostly phenoclasts) have been partly overprinted by sericite. There are a few small opaque oxide phenoclasts or leucoxenized former oxide phenoclasts present. Other minor equant grains of strained quartz, feldspar and detrital muscovite appear to be of cratonic origin.

The siltstone is densely cemented, mainly by very fine biotite, sericitic, illite/smectite clay and minor chlorite which is heavily stained by limonite.

Specks of carbonaceous matter occur within the matrix of the siltstone.

Comments and Interpretations :

The rock represented by the supplied sample (labelled OC08-07004) from the upper of an outcrop on the Sarina-Marlborough Road, Cockenzie Project, eastern Bowen Basin represents rock which may be identified broadly as labile siltstone. An alternative more specific identification would be sericitic siltstone. The composition and textures of this sample seem quite consistent with deposition on a submarine slope possibly involving some mass-flow sedimentation (indicated by presence of flattened mudstone and sandstone clasts).

The cement in the rock is sericitized. Diagenetic processes have variably “sericitized and argillized” the volcanic or tuffaceous clasts, but feldspar grains have survived largely unaltered; at the same time the rock has been well cemented by additional similar “sericite” and illite/smectite clays.

The detritus was derived from dominantly volcanic material shedding west across the basin and is less influenced by cratonic-derived sediments. It relates to a Late Permian phase of flexural subsidence in the Bowen Basin which accumulated fine-grained strata probably deposited in a transgressive marine setting.

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Sample Number : OC08-07005 Date Sampled : 15/08/07

Sample Type : Lower part of outcrop

Sample Loc. : On Sarina-Marlborough Road

Location : Eastern Bowen Basin Age : Early Permian?

BMA Coal Project : CKZ (Cockenzie - EPC971)

Work Requested : Petrographic report to identify rock type and describe mineralogy and alteration of the rock sample

Identification : Labile siltstone of volcaniclastic origin

Description :

The sample consists of a grab sample of rocky rubble from the lower part of an outcrop on the Sarina-Marlborough Road of silty textured, slightly micaceous sedimentary rock which is broadly brownish-grey. The moderately robust sample can be easily scratched by steel and the rock displays extensively shrinkage cracks.

A thin section was prepared to permit detailed microscopic examination in transmitted polarised light of the rock fragments. In the course of thin sectioning the rock behaved in a water-sensitive fashion. An approximate mineralogical composition, expressed in volume percent and based on a brief count of 100 widely spaced points falling within the thin section, is:

5%	quartz grains
11%	remnant feldspar grains
3%	detrital mica (muscovite and biotite)
<1%	leucoxenized opaque oxides
3%	lithic clasts of acid tuff
2%	lithic clasts of intermediate volcanic rock
30%	sericitized/argillized clast
4%	limonite
<1%	chlorite
41%	sericitic clay cement
1%	carbonaceous matter

In thin section the rock is seen to be very fine-grained, labile siltstone. Clasts are poorly to moderately sorted, moderately packed and cemented by sericitic clay and minor chlorite; they range in size from about 0.02 to 0.2 mm and rarely up to 0.5 mm in size. Free quartz and feldspar grains (commonly slightly altered to sericite) along with randomly orientated micas comprise the main detrital components. Sericitized/argillized clasts appear to have been labile clasts of perhaps volcanic style.

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Sandy clasts are free grains of quartz, feldspar and mica (both muscovite and biotite) which are both former phenoclasts and detrital clastic grains. Quartz phenoclasts persist mainly unaltered; most are angular, but some have at least partly smooth, corroded shapes. Feldspar grains (perhaps mostly phenoclasts) have been partly overprinted by sericite. There are a few small opaque oxide phenoclasts or leucoxenized former oxide phenoclasts present. Other minor equant grains of strained quartz, feldspar and detrital muscovite appear to be of cratonic origin.

The siltstone is densely cemented, mainly by very fine biotite, sericitic, illite/smectite clay and minor chlorite which is heavily stained by limonite.

Specks of carbonaceous matter occur within the matrix of the siltstone.

Comments and Interpretations :

The rock represented by the supplied sample (labelled OC08-07005) from the lower of an outcrop on the Sarina-Marlborough Road, Cockenzie Project, eastern Bowen Basin represents rock which may be identified broadly as labile siltstone. An alternative more specific identification would be sericitic siltstone. The composition and textures of this sample seem quite consistent with deposition on a submarine slope.

The cement in the rock is sericitized. Diagenetic processes have variably “sericitized and argillized” the volcanic or tuffaceous clasts, but some feldspar grains have survived unaltered; at the same time the rock has been well cemented by additional similar “sericite” and illite/smectite clays.

The detritus was derived from dominantly volcanic material shedding west across the basin and is less influenced by cratonic-derived sediments. It relates to a Late Permian phase of flexural subsidence in the Bowen Basin which accumulated fine-grained strata probably deposited in a transgressive marine setting.

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Sample Number : OC01-07006 Date Sampled : 15/08/07

Sample Type : Outcrop

Sample Loc. : OC-01 near Denison Creek

Location : Eastern Bowen Basin Age : Permian?

BMA Coal Project : CKZ (Cockenzie - EPC971)

Work Requested : Petrographic report to identify rock type and describe mineralogy and alteration of the rock sample

Identification : Sparsely porphyritic rhyolite

Description :

The sample consists of a grab sample of small hand specimens from an outcrop near Denison Creek of weathered yellowish-grey igneous rock. The hard, robust rock can only be lightly scratched by steel. Superficial weathering on exposed surfaces consist of black manganese oxide and pale yellowish-orange limonite.

A thin section was prepared to permit detailed microscopic examination in transmitted polarised light of slices of the small hand specimens. An approximate mineralogical composition, expressed in volume percent and based on a brief count of 100 points falling within sectioned fragments, is:

Durable Minerals

1%	feldspar phenocrysts (K-feldspar and plagioclase)
68%	microcrystalline feldspar (mainly potassic but with subordinate plagioclase) and about a third is quartz grains
3%	fine feldspar in intermediate volcanic and sub-volcanic lithic clasts
3%	epidote
1%	leucoxene and opaque oxide
trace	zircon

Soft, Weak or Non-Durable Component

12%	sericite
1%	chlorite
8%	limonite
3%	manganese oxide

In a thin section, the acid volcanic rock displays very sparsely porphyritic, hypidiomorphic, finely crystalline textures. The sparse phenocrysts (about 1%) are feldspar which range from 0.2 to 1 mm in size. The finely quartzofeldspathic groundmass consist of grains about 0.005 to 0.1 mm in size. Lithic clast of dominate intermediate volcanic or sub-volcanic origin and subordinate acid volcanic rock range up to 6 mm in size.

GEOCHEMPET SERVICES, MALENY

The phenocrysts comprise anhedral K-feldspar (now slightly clouded by incipient weathering), slightly sericitized subhedral, finely twinned, tabular plagioclase feldspar (also lightly clouded) and minor possible former mafic minerals (now completely altered to epidote or leucoxene). The groundmass is dominated by subtly annealed, anhedral K-feldspar grains and subordinate, poorly but finely twinned, lath-shaped plagioclase as well as anhedral quartz. The lithic clasts (about 3%) are of intermediate volcanic to sub-volcanic rocks (trachytic to microdioritic in style) which consist of feldspar laths and quartz grains and remnant opaque oxide (mafic silicate grains are now completely altered to epidote and yellowish sericite) along with porphyritic rhyolite: some appear to be spherulitic in texture.

Limonitic occurring in small patches (probably after sphene) and dentitic manganese oxide are dispersed through the fine groundmass.

Comments and Interpretations :

The rock represented by the supplied sample (labelled OC01-07006) from an outcrop near Denison Creek, Cockenzie Project, eastern Bowen Basin represents rock which may be identified broadly as sparsely porphyritic rhyolite with some lithic clasts of mainly intermediate volcanic and sub-volcanic rock types: a lack of flow banding may lend some support to the suggestion of a dyke.

The rhyolite is not apparently deformed and it is not possible to discriminate with confidence between whether the rock represents extrusive lava or a sub-volcanic dyke (or similarly small intrusion). It is possible, based on the Permian age suggested for this sample, that it relates to an Early Permian episode of crustal extensional with associated volcanic activity in the northern and eastern parts of the Bowen Basin. This phase of sedimentary accumulation was accompanied by intrusion and extrusion of a bimodal suite of basaltic and rhyolitic igneous rocks probably from the Lizzy Creek Volcanics.

The rock is not deformed or metamorphosed.

APPENDIX 8

PALYNOLOGY REPORT

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PALYNOLogy REPORT

EPC971 COCKENZIE PROJECT **QUEENSLAND**

by

ROBYN PURCELL

For: BHPBilliton Mitsubishi Alliance

September 2007

PALYNOLOGY REPORT

EPC971 COCKENZIE PROJECT QUEENSLAND

1 INTRODUCTION

Three cuttings samples from EPC 971 Cockenzie Project were submitted for palynological examination. The samples were examined to determine the palynological zonation and age of the sample.

2 PALYNOSTRATIGRAPHY

2.1 Sample reliability

Contamination of cutting samples by both drilling fluid and caving can be common. It is difficult to assess the presence and extent of the contamination. Hence, there is the possibility that the samples are older if there has been any contamination in the samples from overlying sequences.

2.2 Palynostratigraphic data

52002-001: 260 m

The organic matter recovered from this sample is composed of vascular and other plant tissue, and rare charcoal and resin. Palynomorphs are common and well-preserved.

The presence of *Corsinipollenites oculus noctis* and *Azolla* sp. indicate that the assemblage is Tertiary in age, possibly Eocene. Both these species have been recorded from oil shale samples from the Yaamba Basin in Queensland, dated as Eocene (Foster, 1982).

52003-001: 300 m

Very little organic matter was recovered. It is composed of vascular tissue and very rare fragments of charcoal.. The sample appears barren of palynomorphs and an age determination is not possible.

52003-002: 350 m

The organic matter recovered is composed of small fragments of charcoal, vascular tissue and rare fungal material. The sample appears barren of palynomorphs and an age determination is not possible.

3

REFERENCES

Foster, C.B., 1982, Illustrations of Early Tertiary (Eocene) plant microfossils from the Yaamba Basin, Queensland. Geol. Survey Qld, Pub. 381.