Skull Creek West-1 (W1180)

BASIN OIL N.L.
ACN 000 628 017

Well Completion Report

SKULL CREEK WEST-1

PPL 1
Onshore Otway Basin
VICTORIA

Volume 1
Text and Appendices

December 1997

Compiled By: L J Scarsbrook

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WELL COMPLETION REPORT

SKULL CREEK WEST-1

December 1997

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ENCLOSURES

PE907573

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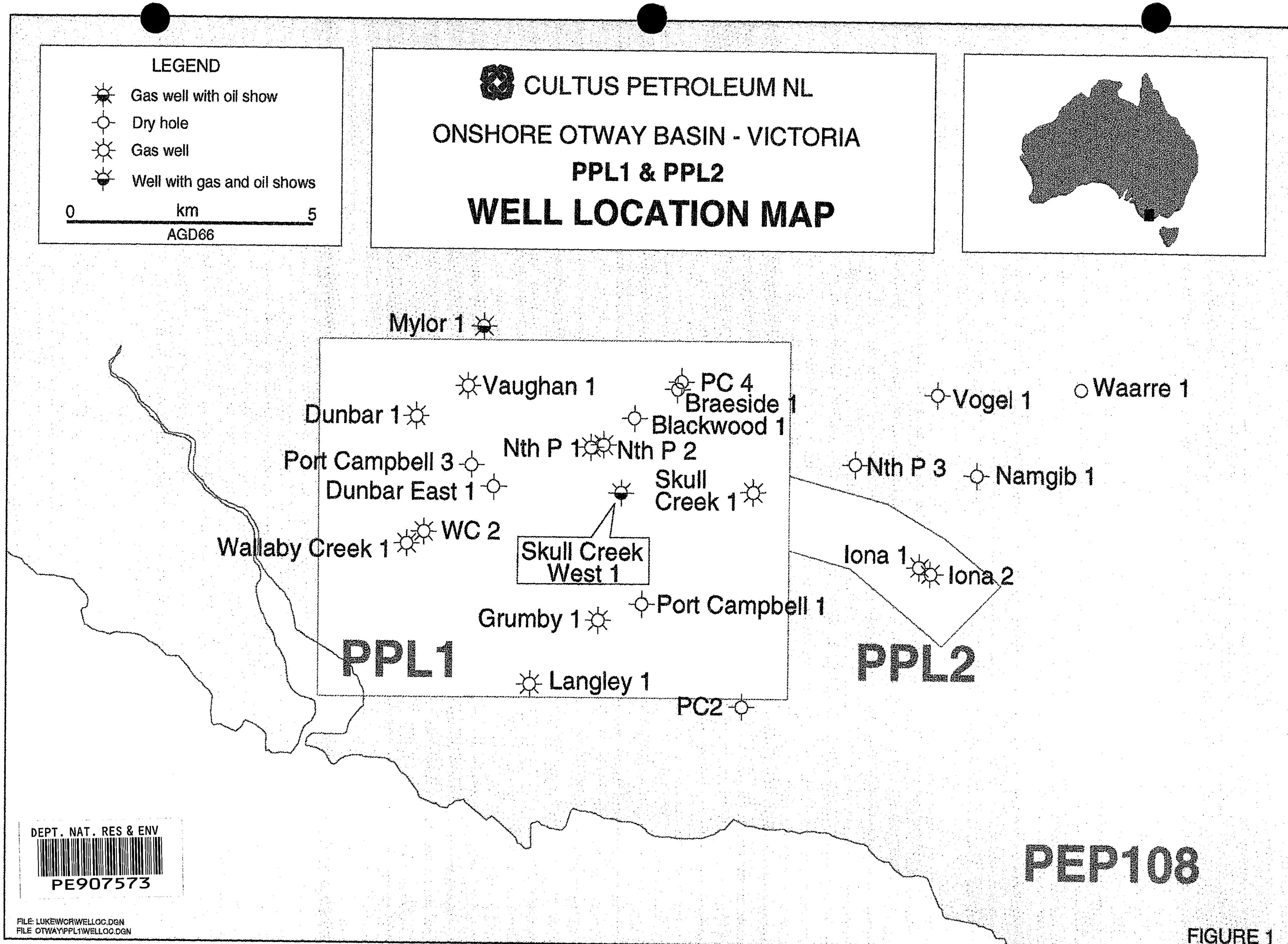
(Inserted by DNRE - Vic Govt Mines Dept)


LEGEND
Gas well with oil show
Dry hole
Gas well
Well with gas and oil shows
0 km 5
AGD66
CULTUS PETROLEUM NL
ONSHORE OTWAY BASIN - VICTORIA
PPL1 & PPL2
WELL LOCATION MAP
Mylor 1
Vaughan 1
PC 4
Braeside 1
Dunbar 1
Blackwood 1
Vogel 1
Waarre 1
Nth P 1
Nth P 2
Port Campbell 3
Dunbar East 1
Skull Creek 1
Nth P 3
Namgib 1
WC 2
Wallaby Creek 1
Skull Creek West 1
Iona 1
Iona 2
Grumby 1
Port Campbell 1
PPL1
PPL2
Langley 1
PC2
PEP108
DEPT. NAT. RES & ENV
PE907573
FILE: LUKEWCR\WELLOC.DGN
FILE OTWAY\PPL1\WELLOC.DGN
FIGURE 1

WELL:	**SKULL CREEK WEST #1**	**SPUD:**	1400 hours, 12-02-97
WELL TYPE:	EXPLORATION	**TD REACHED:**	2000 hours, 23-02-97
BLOCK/LICENCE::	PPL1 Otway Basin Victoria	**RIG RELEASED:**	2400 hours, 02-03-97
RIG:	ODE 30	**COMPLETED:**	
LATITUDE:	38 33' 13.5" S	**STATUS::**	Plugged & abandoned exploration well with gas & oil recovery
LONGITUDE:	142 57' 37.5" E	**TYPE COMPLETION::**	Plugged & abandoned
X coord:	670 814.18 mE	**TYPE STRUCTURE:**	Horst
Y coord:	5 730 350.70 mN		
SEISMIC STATION:	Waarre 3D Xline 2830 inline 8440	**ZONE(S):**	
ELEVATION GL:	96 m AHD	**REMARKS:**	
RT:	100.3 m AHD		
TD:	2002.0 **m MD (Logr Ext)** 2000.0 **m MD (Drlr)**		

CASING SIZE	SHOE DEPTH (mRT)	TYPE
16"	5.3	
9 5/8"	721.5	

AGE	FORMATION OR ZONE TOPS	DEPTH (m) LOGGERS MD	DEPTH (m) SUBSEA TVD	THICKNESS (metres)	HIGH (H) LOW (L)	TWT (msec)
TERTIARY	PORT CAMPBELL LIMESTONE	4.3	+95.7	43.7	AP	
TERTIARY	GELLIBRAND MARL	48	+52	281	NP	
TERTIARY	CLIFTON FORMATION	329	-229	19	22m H	254
TERTIARY	NARRAWATURK MARL	348	-248	67	NP	271.3
TERTIARY	MEPUNGA FORMATION	415	-315	57	14m H	334.2
TERTIARY	DILWYN FORMATION	472	-372	198	20m H	387.8
TERTIARY	PEMBER MUDSTONE	670	-570	77	62m H	553.4
TERTIARY	PEBBLE POINT FORMATION	747	-647	59	45m H	612.6
LATE CRETACEOUS	PAARATTE FORMATION	806	-706	309	20m H	658
LATE CRETACEOUS	SKULL CREEK MUDSTONE	1115	-1015	84	3m H	882
LATE CRETACEOUS	NULLAWARRE GREENSAND	1199	-1099	27	33m L	938.6
LATE CRETACEOUS	BELFAST MUDSTONE	1226	-1126	59	14m L	956.8
LATE CRETACEOUS	WAARRE FORMATION: UNIT C	1285	-1185	6	6mL*	999.6
LATE CRETACEOUS	UNIT B	1291	-1191	15	13mL	1003.6
LATE CRETACEOUS	UNIT A	1306	-1206	20	NP	1013.2
EARLY CRETACEOUS	EUMERALLA FORMATION	1327.5	-1227.5	674.5	23.5m H*	1027.8
	T.D. (LOGR. EXTRAP.)	2002	-1902	-	AP	1431
* Geophysical prognosis						

LOG INTERPRETATION (Interval Averages)

ZONE	INTERVAL m MD	THICKNESS	NP m	POR %	SW %
No pay is mapped					

PERFORATIONS (4 shots/ft)

ZONE	INTERVAL m MD

CORES

ZONE	NO.	INTERVAL m MD	CUT m	REC m
Waarre	1	1290.7-1292.0 D 1291.7-1293.0 L	1.3	1.3
Waarre	2	1292.0-1310.3 D 1293.0-1311.3 L	18.3	18.3
Eumeralla	3	1748.0-1766.3 D 1749.0-1767.3 L	18.3	18.3

LOG (BPB)	RUN	INTERVAL mRT	BHT/TIME	LOG	RUN	INTERVAL mRT	BHT/TIME
GR-	1	2000-surface	67°C/7.0hrs	Waveform Sonic	6	2000-1150	
-DLS-SP-CAL-DT-		2000-721		SRS (vel survey)	7	1990-surface 19 levels	
-MLL-ML	1	2000-1150		GR-CCL (DST 1)	8	1527.0-1531.0	
PDS-CNL-GR-CAL-NGT	2	1150.0-1701.4	63°C/12.0hrs	GR-CCL (DST 2)	9	1311.0-1315.0	
Crocker FET	3	1319-1286 10 PT, 8 valid, 2 sc, tool failed	52°C				
PSD (dipmeter)	4	1350-1050	55°C/23.5hrs				
RFS	5	1287-1767 18 PT, 13 valid, 5 plugged, 1 sample					

FORMATION TESTS										
NO.	**INTERVAL (mRT)**	**FORMATION**	**FLOW (mins)**	**SHUT IN (mins)**	**BOTTOM GAUGE IP/FP (psia)**	**SIP**	**MAX SURF PRESS (psia)**	**FLUID TO SURF (mins)**	**TC/ BC**	**REMARKS**
1	1527.0-1531.0L 1526.0-1530.0D	Eumeralla Fm Infl strad w/ GR-CCL	5/182	39/180	77/77 88/132	1667 1848	NFTS	NFTS	1/4" 3/4"	Rec: 1.6 bbl oil (45.2 API@15°C) & 0.5 bbl MW (total rec 90m)
2	1311.0-1315.0L 1310.0-1314.0D	Waarre Unit A Infl strad w/ GR-CCL	4/122	42/123	139/139 243/595	1688 1666	TSTM	GTS 77 mins	1/4" 3/4"	GTS @ RTSTM Rec: 17.2 bbl water & MW (Rw 0.4 @ 25°C)

SUMMARY:

Skull Creek West 1 was drilled as an exploration well in Victoria, onshore Otway Basin, PPL 1. It was located 2.75 km west of the Skull Creek 1 Waarre/Eumeralla gas discovery well, 0.4 km east of the North Paaratte production station and 190 km WSW of Melbourne.

Skull Creek West was designed to test the central Skull Creek Horst Block, 62m downdip (at top Waarre Formation) of Skull Creek 1. Primary targets included the Waarre Formation and Eumeralla Formation as both formations produced gas on DST in the discovery well.

The well reached a total depth of 2002m (Logr Extrap) Eumeralla Formation. The top Waarre Formation (14m low) and top Eumeralla Formation (25m high) the main target horizons, were intersected close to prognosis. The Waarre Unit C was lost due to erosion, hence the Waarre Formation was thinner than anticipated. Tertiary formations were intersected high to prognosis as a result of slower velocities than were apparent in Skull Creek 1.

3 cores were cut. Core 1 (1.3m) in the top Waarre Formation was abandoned due to poor penetration rate. Core 2 (18.3m) intersected the top Waarre Unit A and has reasonable reservoir characteristics (Av por 21.0%; k 3 to 46md). Core 3 (18.3m) was cut through a basal Eumeralla Formation sandstone to ascertain reservoir quality at this depth. Preliminary core analysis data indicates this zone has better than expected reservoir quality (Av por 20.5%; k 1 to 865md).

A gas show of 74 units was recorded in the Waarre Unit A (1307-1325m) when drilling commenced after core 2. RFS and FET data failed to conclusively define a gas gradient through this sand. DST 2 tested the show flowing GTS at RTSTM and recovering 17.2 bbl of formation water.

An oil show was also recorded at 1529-1530m in the Eumeralla Formation. RFS data indicated the zone had some permeability and a sample was taken at 1530.2m. 2 chambers were filled: the 10 litre dump chamber contained negligible gas, 0.4 litres of oil and 9 litres of water; the 3.8 litre chamber contained 4.5 litres of gas and 0.015 litres of oil. DST 1 tested this zone and recovered 1.6 bbl of oil (45.2° API @ 15°C) and 0.5 bbl of water.

Skull Creek West 1 was plugged and abandoned. Three cement plugs were set as follows:

Plug 1: 1306m to 1216m; Plug 2: 752m to 690m; Plug 3: 20 sack surface plug

1.0 INTRODUCTION

Skull Creek West-1 is an exploration well located in production license PPL 1 in the onshore Victorian section of the Otway Basin approximately 190km west-southwest of Melbourne. It is situated in the Port Campbell Embayment (Figure 2), within which are several hydrocarbon producing fields, including Grumby, Iona, Mylor, North Paaratte, Skull Creek and Wallaby Creek.

The Operator and sole participant, with a 100% interest in Skull Creek West-1, is Basin Oil, a wholly owned subsidiary of Cultus.

The Skull Creek West prospect is a seismically defined central horst fault block on the upthrown side of two major faults. It is situated down dip and east of Skull Creek-1. The well was designed to test the down-dip hydrocarbon potential of the Waarre Formation Sandstone and Intra-Eumeralla Formation Sandstones identified at Skull Creek-1.

The well was spudded at 1400hrs on 12 February 1997 and reached a total depth of 2000mMD at 2000hrs on 23 February 1997. OD & E Rig 30 was released at 2400hrs on 2 March 1997, 18.5 days after spud.

Skull Creek West-1 was plugged and abandoned with gas and oil recovery.

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     CLIENT_OP_CO = BASIN OIL NL
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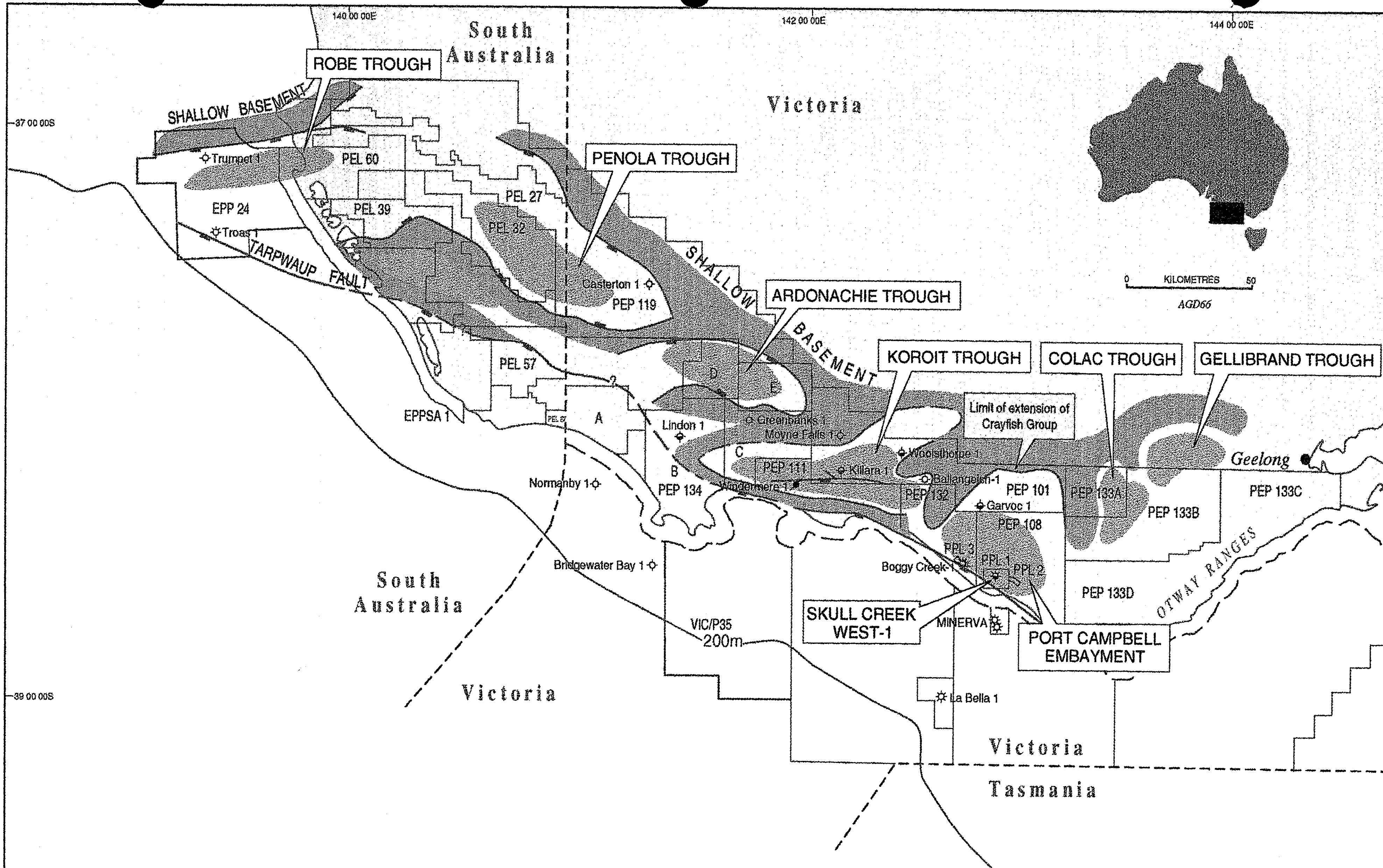
(Inserted by DNRE - Vic Govt Mines Dept)



DEPT. NAT. RES & ENV
PE907574

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FILE: OTWAY\PPL\STRUCTEL.DGN

CULTUS PETROLEUM N.L.

OTWAY BASIN

BASIC STRUCTURAL ELEMENTS

FIGURE 2

2.0 PRE-DRILLING SUMMARY

2.1 Regional Geology

The Otway Basin, including that of South Australia, covers an area of approximately 140,000km^2 onshore and offshore (of which 40,000 km^2 lies onshore), extending just into Tasmanian waters.

The Otway Basin formed as a result of the Mesozoic separation of Australia and Antarctica. The tensional forces produced a complex of localised intra-cratonic sub-basins (GFE, 1994). The separation involved two main tectonic phases, a Late Jurassic to Early Cretaceous rift phase marked by extension and rapid subsidence, and a Late Cretaceous to Recent post-rift or drift phase characterised by slower subsidence, and at times compression (Abele *et al*, 1995 - Geol. Rpt. 103).

The Otway Basin consists of four major sedimentary sequences (Figure 3), each deposited during different phases of separation of southern Australia from Antarctica.

The earliest sequence consists of terrestrial sediments deposited in localised intra-cratonic grabens and half grabens, during the Late Jurassic to Early Cretaceous while extension was active. Organic-rich non marine sediments were deposited in the deeper parts of the grabens or more marginal low energy settings.

The second major sequence occured with the continuation of non marine sedimentation in an intra-cratonic sag basin, without significant extension.

The third sequence developed towards the beginning of the Late Cretaceous in response to the eventual separation of Australia from Antarctica. Although terrestrial sediments continued to be deposited, marine rocks formed an important part of the sequence for the first time.

A major period of erosion followed uplift in the Late Cretaceous, forming an unconformity surface that is regionally mappable throughout the basin. Sedimentation resumed with the deposition of largely non marine sediments, with minor marine influences. As the separation of Australia and Antarctica rapidly increased, more marine sedimentation and the outbuilding of coastal plain and shelf deposits occured (GFE, 1994). This process is continuing to the present day.

2.2 Previous Drilling

Since the 1860s the Otway Basin has been recognised as a potential petroleum province. It was the location for Australia's first oil exploration well, Salt Creek, at Alfred Flat, South Australia, in 1866 (Sprigg, 1986). Discovery of bitumen strandings, seepages and oil scums led to the onset of exploration in the basin. Over 150 wells have since been drilled in the Otway Basin, both onshore and offshore, with the greatest number of discoveries of hydrocarbons in the coastal region between Port Campbell and Mt. Gambier.

Mapping of anticlinal structures and intermittent drilling of shallow wells took place between the early 1890s and late 1950s, however no discoveries were made during this period. It was not until 1959, when Frome-Broken Hill drilled Port Campbell-1, that a discovery was made. It flowed gas from the Late Cretaceous Waarre Formation at an initial rate of 1.5mmcfd, however it was deemed non commercial as the rate declined rapidly. Shell initiated drilling offshore in the Victorian section of the basin in 1967, followed closely by Esso, though there were no large successes. It wasn't until 1979 that the first commercial hydrocarbon gas, from the Waarre Formation, was discovered by Beach Petroleum at North Paaratte-1. The field was brought on stream in 1986. Following North Paaratte-1, Wallaby Creek and Grumby were two more fields discovered by Beach, (also the

Waarre Formation) in 1981. Subsequent exploration resulted in the establishment, by Beach, of the Iona gas field in 1988, then the Boggy Creek CO_2 field, by GFE Resources, in late 1991. The first offshore success was with BHP Petroleum's Minerva-1, in 1993, just off Port Campbell. The Mylor (Bridge/GFE) field was discovered in 1994, marking the first recovery of oil from the Waarre Formation (Foster and Hodgson, 1995). The Langley (GFE) field was also discovered in 1994. The most recent discovery in the area was made by Basin Oil in 1996 when the Skull Creek field was discovered.

All of the commercial discoveries in the Victorian section of the Otway Basin are located within the Port Campbell region. There are two production licences adjacent to PEP 108, PPL 1 and 2, where the following fields are located :- North Paaratte, Wallaby Creek, Grumby, Iona and Skull Creek with Mylor just to the north of the boundary of PPL1 (Figure 4). Boggy Creek, a CO_2 producing field is situated approximately five kilometres west in PPL3.

Given the modest cost of exploration and development in the region and the ready market for any discoveries, this area, especially PPL 1, has excellent potential to produce profitable returns (Traviati and Smith, 1994).

2.3 Drilling Rationale

Skull Creek West-1 was drilled on the Skull Creek Horst to appraise the areal extent of the gas discovery in the Upper Cretaceous Waarre Formation at Skull Creek-1, and to explore the hydrocarbon potential of the Lower Cretaceous Eumeralla Formation. In the Port Campbell Embayment the Waarre Formation is a proven hydrocarbon reservoir, with Skull Creek-1 producing gas at a combined rate of 22.1mmcfd from three tests in the Waarre Formation. Significant gas flow from a test in the Upper Eumeralla Formation was recorded at Skull Creek-1 at a rate of 1.1mmcfd. Both formations were primary targets in Skull Creek West-1.

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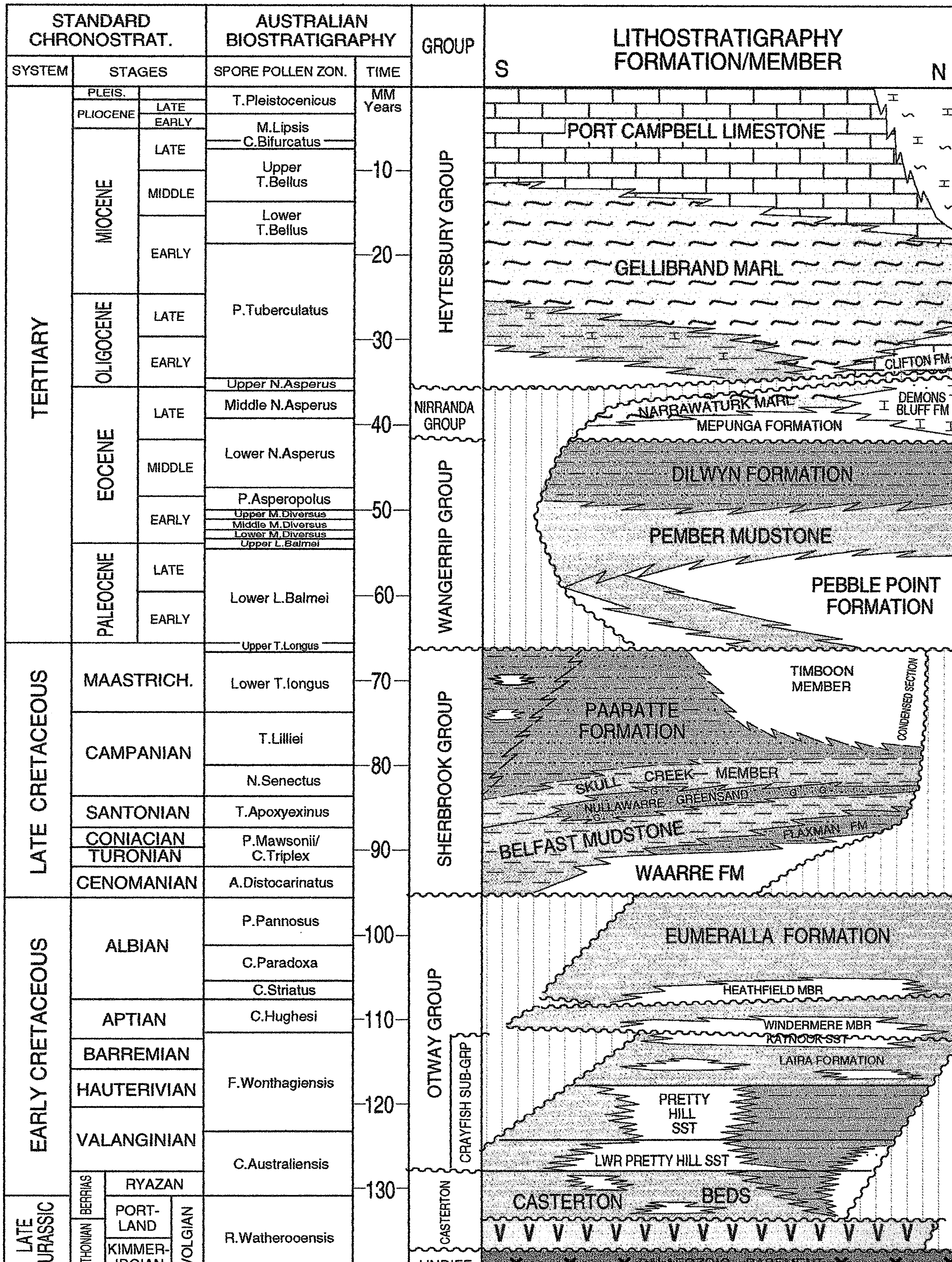
CULTUS PETROLEUM N.L. **OTWAY BASIN - VICTORIA**

DEPT. NAT. RES & ENV

PE907575

SCHEMATIC STRATIGRAPHIC TABLE



REVISED February 1997 after ABELE et al 1995 file:luke\wcr\stratble.dgn

FIGURE 3

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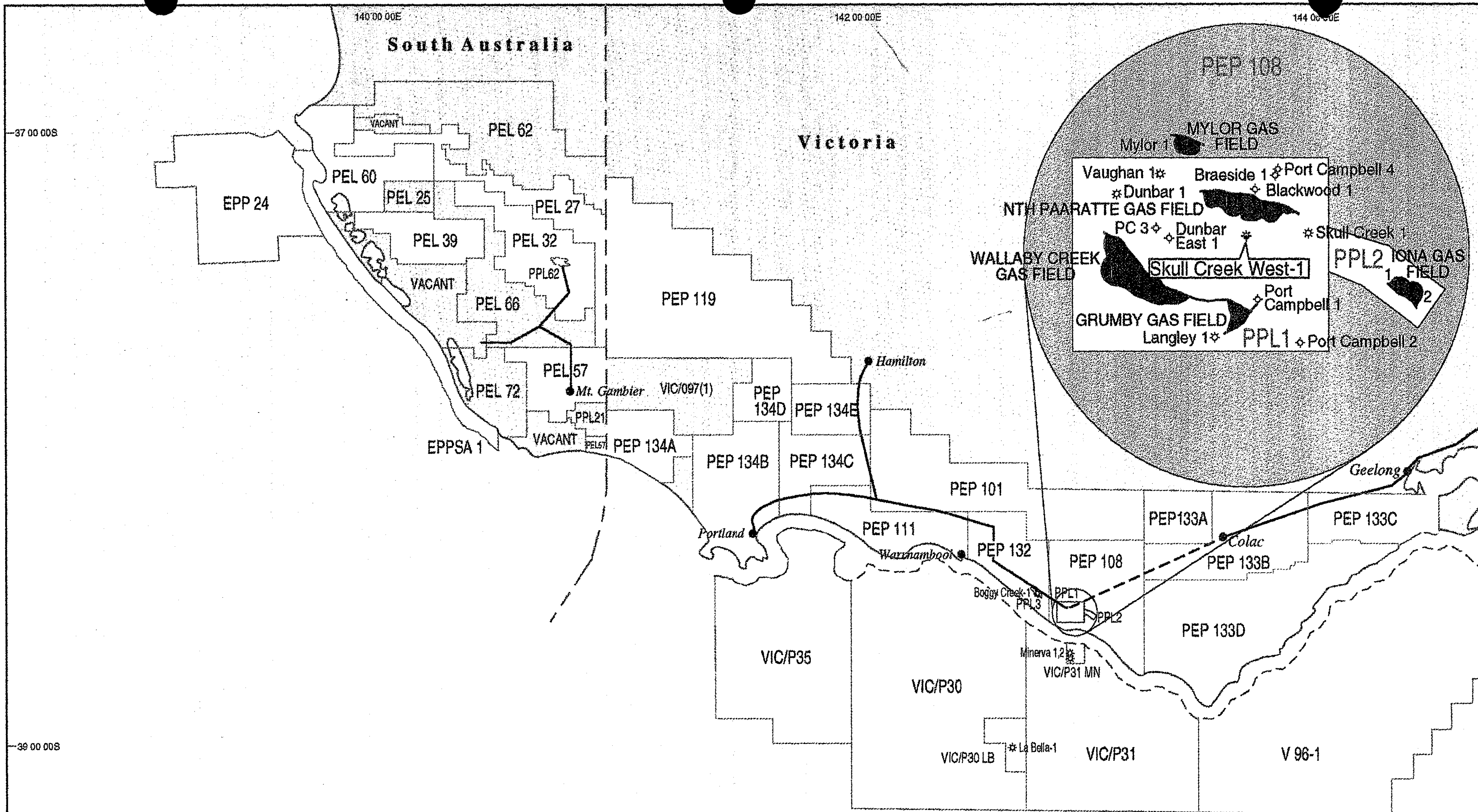
(Inserted by DNRE - Vic Govt Mines Dept)



LEGEND

Cultus tenement

Pipeline

Proposed Pipeline

0 km 100

AGD66

FILE: LUKE\WCR\PPL1LOC.DGN

CULTUS PETROLEUM N.L.

OTWAY BASIN
PPL1 - LOCATION MAP

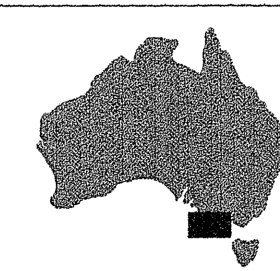


FIGURE 4

3.0 RESULTS OF DRILLING

3.1 Stratigraphic Summary

Below is a summary of the lithological units observed in Skull Creek West-1. They were compiled from the descriptions made by the wellsite geologist, from the mudlog, and from the electric logs that were run. A graphical representation of the prognosed verses actual stratigraphy can be seen in figure 5.

TABLE 1
SKULL CREEK WEST-1 FORMATION TOPS AND THICKNESSES

Formation Tops	Prognosed (mKB)	Actual (mKB)	Actual TVD (mSS)	Difference (m High/Low)	Thickness (m)
Port Campbell Limestone	4.3	4.3	+96	As Predicted	44
Gellibrand Marl	-	48	+52	Not Predicted	281
Clifton Formation	351	329	-229	22 High	19
Narrawaturk Marl	-	348	-248	Not Predicted	67
Mepunga Formation	429	415	-315	14 High	57
Dilwyn Formation	492	472	-372	20 High	198
Pember Mudstone	732	670	-570	62 High	77
Pebble Point Formation	792	747	-647	45 High	59
Paaratte Formation	826	806	-706	20 High	309
Skull Creek Mudstone	1118	1115	-1015	3 High	84
Nullawaarre Formation	1166	1199	-1099	33 Low	27
Belfast Mudstone	1212	1226	-1126	14 Low	59
Waarre Fm. Unit "D"	1271	Absent	Absent	Not Present	Not Present
Waarre Fm. Unit "C"	1279	1285	-1185	6 Low	6
Waarre Fm. Unit "B"	1304	1291	-1191	13 High	15
Waarre Fm. Unit "A"	1336	1306	-1206	30 High	21.5
Eumeralla Formation	1351	1327.5	-1227.5	23.5 High	674.5
1400m Eumeralla Sand	1474	1496	-1396	22 Low	22
Intra Eumeralla Sand	1780	Not Present	Not Present	Not Present	Not Present
T.D	2000	2000	-1900	As Predicted	

The Eumeralla Formation, the youngest formation in the Late Jurassic to Early Cretaceous Otway Group, is a thick megasequence of volcanogenic sandstone and mudstone and represents the early sedimentary fill of the rifted Otway Basin. Sediments making up the Eumeralla Formation were deposited by braided rivers in a variety of environments ranging from high-energy fluviatile to low-energy lacustrine (Abele *et al*, 1995 - Geol. Rpt. 103).

The first marine incursion is marked by the Late Cretaceous Sherbrook Group. Sedimentation began in fluviatile to coastal environments on the upper and lower delta plain forming the Waarre Formation. Progressive deepening allowed the deposition of offshore mud to form the Belfast Mudstone. The Nullawarre Greensand was deposited in a shallow marine environment due to a sudden fall in sealevel (Abele *et al*, 1995 - Geol. Rpt. 103). A rising sealevel led to the deposition of the Skull Creek Mudstone in a pro-delta environment. The sediments of the Paaratte Formation were deposited in a prograding deltaic environment culminating in a shallow marine to fluviatile environment. The Sherbrook Group unconformably overlies the Otway Group, and is unconformably overlain by the Wangerrip Group.

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CONTRACTOR =	CULTUS PETROLEUM NL
CLIENT_OP_CO =	BASIN OIL NL

(Inserted by DNRE - Vic Govt Mines Dept)

BASIN OIL N.L.

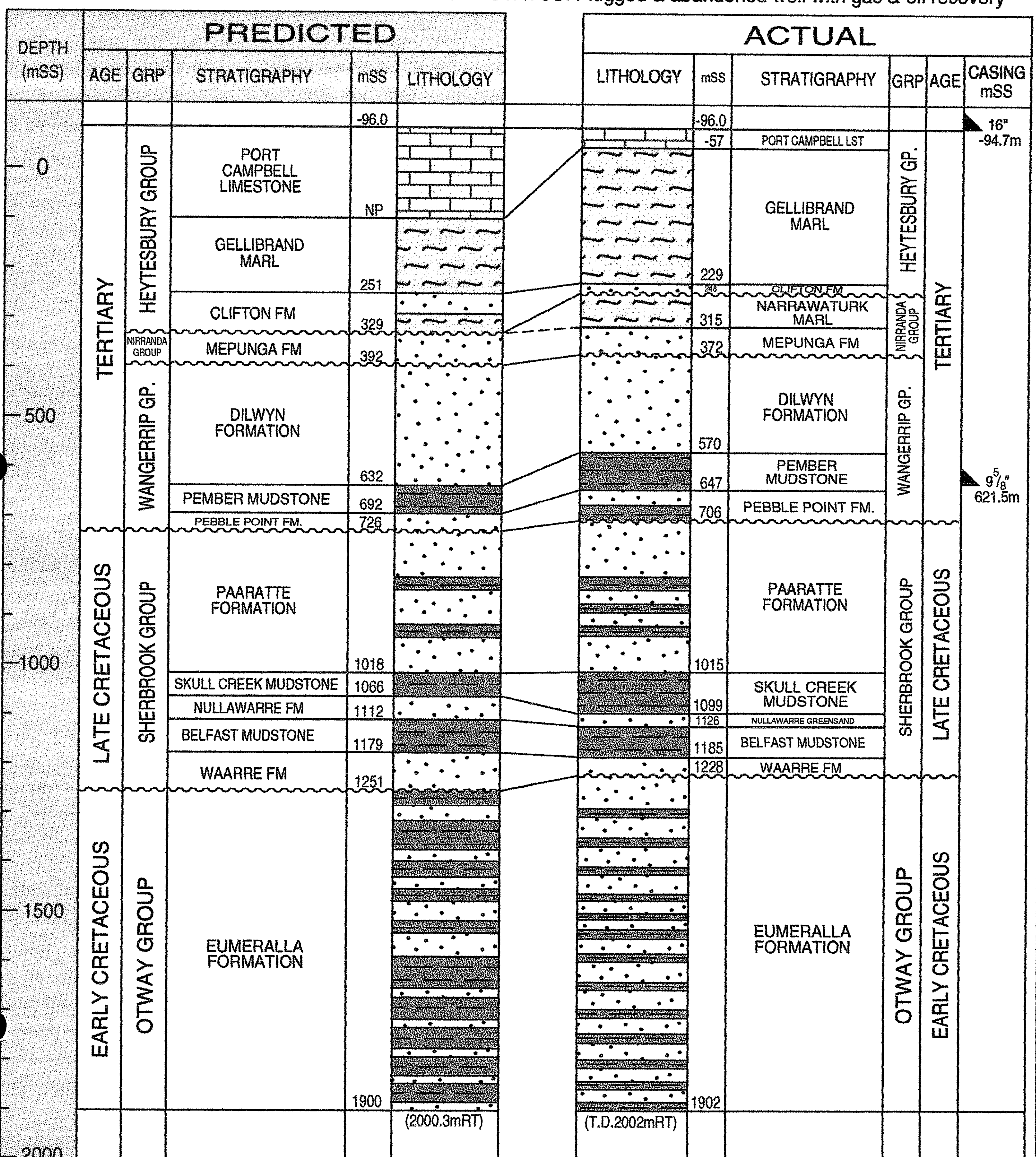
ONSHORE OTWAY BASIN

PPL 1

SKULL CREEK WEST-1

PREDICTED v ACTUAL STRATIGRAPHIC SECTION

LAT: 38°33'13.5"S GL:96mAHD SPUD: 1400hrs 12/2/97
LONG: 142°57'37.5"E RT: 100.3m AHD RIG RELEASE: 2400hrs 2/3/97
LOCATION: WAARRE 3D XLine 2830 Inline 8440 STATUS: Plugged & abandoned well with gas & oil recovery



AUTHOR: LJS DRAWN: MAC DATE: DECEMBER 1997 FILE NAME: PPL1/SCWSTPVA.DGN

FIGURE 5

The Palaeocene to Early Eocene Wangerrip Group was deposited in shallow marine and deltaic environments, also with a predominantly non marine source. The oldest formation, the Pebble Point, reflects the initial transgression. As the water deepened, a deltaic sequence prograded out into the basin, with the Pember Mudstone and the Dilwyn Formation representing the pro-delta and lower delta plain deposits respectively (Tickell, *et al.*, 1992 - Geol. Rpt. 95).

The succeeding Middle Eocene to Early Oligocene Nirranda Group is predominantly marine with a mixed terrigenous/carbonate source, and was deposited in estuarine and coastal settings. The Mepunga Formation disconformably overlying the Dilwyn, is interpreted as a beach barrier system conformably overlain by the open marine Narrawaturk Marl (Blake, 1980).

Finally, the Late Oligocene to Late Miocene Heytesbury Group marks the first major development of shelf carbonates, with only a minor terrigenous sediment input. The group is made up of the Clifton Formation, a shallow marine sheet of carbonate sand, the Gellibrand Marl, deposited in a low energy, continental shelf environment, and the overlying Port Campbell Limestone, in a moderate continental shelf region, above fair weather base (Abele *et al*, 1995 - Geol. Rpt. 103).

3.2 Geophysical Analysis

3.2.1 Seismic Coverage

The Skull Creek West-1 structure was identified from the Waarre 3D Seismic Survey. The Waarre 3D was conducted by Gas & Fuel Corporation of Victoria on behalf of Bridge Oil Limited and the acquisition contractor was Schlumberger-Geco Prakla Australia. The 3-Dimensional multiplicity of the recorded data was 12-fold in 12.5 x 12.5 metre bins.

Data quality around the Skull Creek West-1 prospect is good with reasonable continuity of reflectors at the Waarre level.

3.2.2 Pre-Drill Mapping

Two-way time structure maps were generated at the Top Waarre Formation, Top Eumeralla Formation, 1400 metre gas Sand and the Intra Eumeralla Sandstone.

The Top Waarre Formation pick is based on the Top of the Waarre Formation Unit 'C'. The pick was tied to the seismic through generation of synthetics for each of the wells within the Waarre 3D. The sharp kick of the gamma ray log at the Belfast Mudstone - Waarre Formation boundary is clearly evident in all the wells within the Waarre 3D. Production of synthetics on these wells show a large peak (normal polarity) in amplitude for the interface between the clean sandstone of the Waarre Formation and the overlying mudstone of the Belfast. It was this large peak that was mapped as the Top Waarre Formation at Skull Creek West-1 and carried throughout the Waarre 3D. The pre-drill two-way time structure map (Figure 6) showed structural closure at the Waarre Formation level. A depth map of the prospect was produced using the GFE Resources regional time/depth curve. These values are displayed in Table 2.

PE907578

This is an enclosure indicator page.
The enclosure PE907578 is enclosed within the container PE907572 at this location in this document.

The enclosure PE907578 has the following characteristics:

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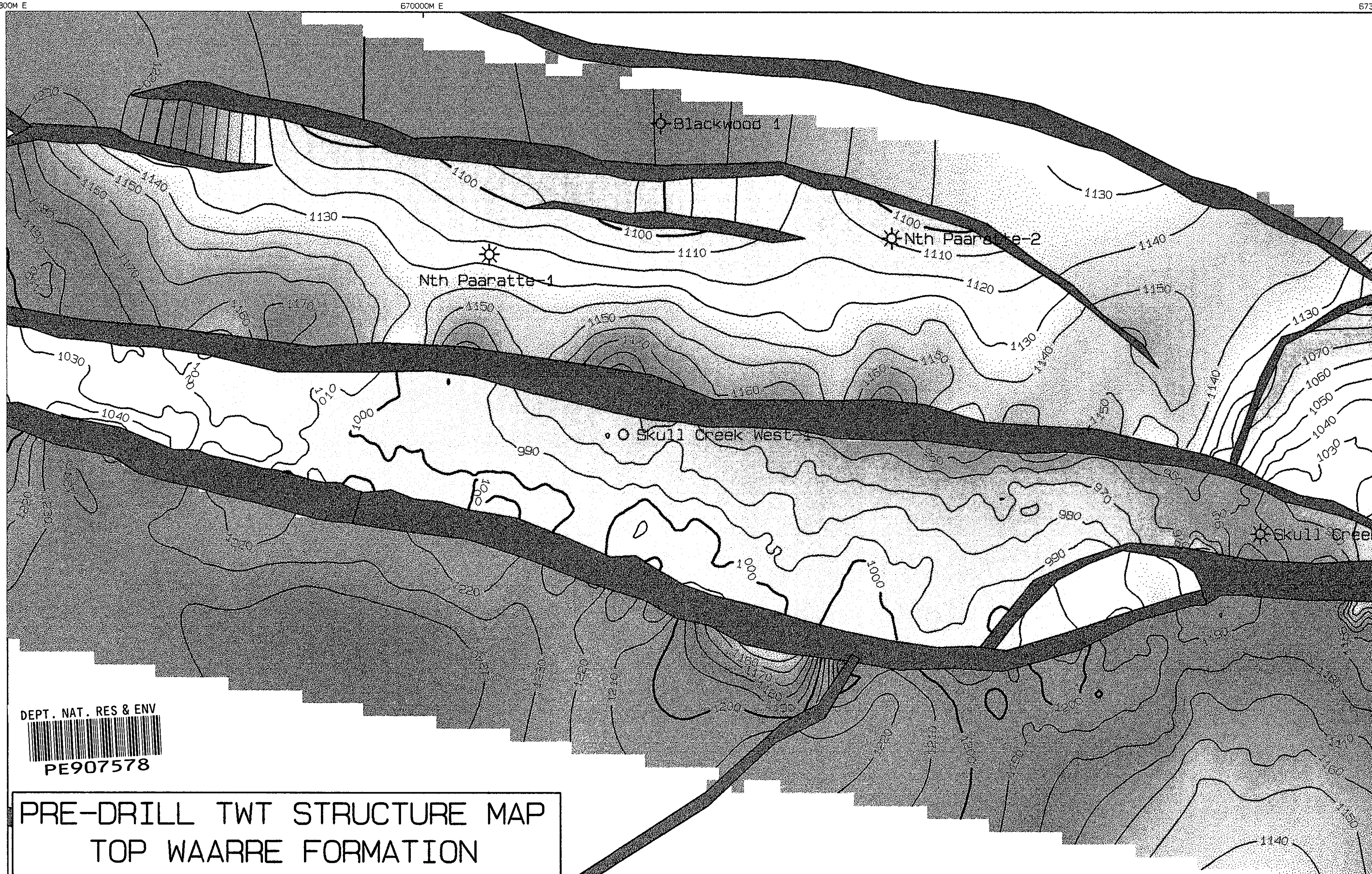
BASIN =	OTWAY
PERMIT =	PPL/1
TYPE =	SEISMIC
SUBTYPE =	HRZN_CNTR_MAP
DESCRIPTION =	Pre-Drill TWT structure Map, Top Waarre Formation (Figure 6 from WCR vol.1) for Skull Creek West-1
REMARKS =	
DATE_CREATED =	
DATE_RECEIVED =	30/04/98
W_NO =	W1180
WELL_NAME =	SKULL CREEK WEST-1
CONTRACTOR =	CULTUS PETROLEUM NL
CLIENT_OP_CO =	BASIN OIL NL

(Inserted by DNRE - Vic Govt Mines Dept)

SKULL CREEK WEST-1



PRE-DRILL TWT STRUCTURE MAP
TOP WAARRE FORMATION

FIGURE 6

TABLE 2
TIME DEPTH TABLE USED BY GFE RESOURCES.

Depth (mSS)	TWT (below SRD = 0m ASL)
100	104
200	205
300	307
400	409
500	491
600	575
700	653
800	720
900	788
1000	861
1100	930
1200	1004
1300	1073
1400	1137
1500	1204
1600	1268
1700	1329
1800	1386
1900	1444

3.2.3 Post-Drill Mapping

The actual top of the Waarre Formation Unit 'C' came in 6 m low. This minimal difference at the Waarre Unit 'C' level did not affect the integrity of the structure.

3.2.4 Velocities

The well velocity survey showed the variation of prognosed to actual depth (Enclosure 4). The velocities used for the prognosed depth at the Waarre Formation level were based on the Skull Creek-1 well. The difference in pre and post-drill seismic velocities and depth conversions are shown in Table 3.

At the Waarre Formation level the velocities of the check shot data for Skull Creek-1 were used to calculate the predicted depths at Skull Creek West-1. The two wells proved to have similar velocities at the Waarre Formation level as there was only a 6 metre difference between predicted and actual depths.

TABLE 3
TIME-DEPTH RELATIONSHIPS FOR SKULL CREEK WEST-1

Horizon	Predicted			Actual			Diff rence	
	Depth mSS	TWT msec	Vint m/s	Depth mSS	TWT msec	Vint m/s	TWT (A vs P)	Vint (A vs P)
Clifton	251	262		229	254		-8	
			2108			2145		+37
Mepunga	329	336		315	334.2		-1.8	
			2250			2127		-123
Dilwyn	392	392		372	387.8		-4.2	
			2667			2391		-276
Pember	632	572		570	553.4		-18.6	
'			2609			2601		-8
Pebble Point	692	618		647	612.6		-5.4	
			2429			2599		+170
Paaratte	726	646		706	658		+12	
			2607			2760		+153
Skull Creek	1018	870		1015	882		+12	
			3200			2968		-232
Nullawarre	1066	900		1099	938.6		+38.6	
			2706			2967		+261
Belfast	1112	934		1126	956.8		+22.8	
			3045			2757		-288
Waarre*	1179	978		1185	999.6		+21.6	
			2769			3014		+245
Eumeralla*	1251	1030		1227.5	1027.8		-2.2	
			3000			3297		+297
1400m Sand	1374	1112		1396	1130		+18	
			3207			3349		+142
TD	1900	1440		1900	1431		-9	

* Principal Seismic Horizons

3.3 Hydrocarbons

The Skull Creek West prospect is located on the Skull Creek horst block bounded by two major faults trending approximately East-West (Figures 7 & 8). These two deep faults represent migration pathways for hydrocarbons trapped in Skull Creek-1. Gas peaks were encountered when the Dunbar East-1 well path crossed the southern fault into the horst block.

The primary objectives were the Late Cretaceous Waarre Formation and the Early Cretaceous intra-Eumeralla Formation sands.

Haliburton Energy Services provided the mudlogging services for Skull Creek West-1. Whilst drilling, cuttings and gas levels were carefully monitored. Cuttings were examined under ultra-violet light to detect any hydrocarbon fluorescence. Gas equipment used by Haliburton in the monitoring of gas levels comprised an FID Gas Chromatograph and an FID Total Gas Detector.

The Waarre Formation has been recognised as the major gas reservoir within the Port Campbell Embayment. Skull Creek-1 flowed gas at a combined rate of 22.1mmcfd from the Waarre

Formation. Consequently this became the primary target in Skull Creek West-1. Generally the Waarre Formation has excellent reservoir properties with porosities in excess of 25% and multi-Darcy permeabilities (Smith, 1988). At Skull Creek West-1 the Waarre Formation was intersected at 1285mKB and its sands are described as very poorly sorted, fine to coarse grained, with moderate silica cement. Log analysis results indicate good inferred porosity (Appendix 4c).

A gas show of 74 units was recorded in the Waarre Formation Unit A (1307 - 1325m) when drilling commenced after Core 2 where the gas consisted of 12800ppm of C1 and 12ppm of C2. Core 2 was taken over the interval 1293.9m(L) to 1311.3m(L). Porosities exhibited in this core ranged from 16% to 24% and permeabilities ranged between 2md and 46md. DST 2 tested the show flowing GTS at RTSTM and recovering 17.2bbls of formation water (Rw 0.4ohmm @ 25°C) and is therefore interpreted to be water saturated. Such results are also consistent with the log analysis results (av.por = 23.9%, av.Sw = 80%).

The Belfast Mudstone provides a basin-wide seal for the Waarre Formation. It was deposited under low-energy marine conditions below the storm wave base. The Belfast Mudstone at Skull Creek West-1 was intersected at 1226mKB and is 59m thick providing adequate top and lateral seal for the Waarre Formation.

The Eumeralla Formation, intersected at 1328mKB, produced gas updip at Skull Creek-1 at a combined rate of 1.1mmcfd, indicating commercial deliverability of its sandstones. It consists of interbedded siltstone, claystone, sandstone and minor coal. The sands are thin, fine to coarse grained, and are dominantly composed of volcanogenic lithics. The sand is moderately argillaceous and has poor visual porosity, which is likely due to the moderate to abundant amount of siliceous and calcareous cement (Abele *et al*, 1995 - Geol. Rpt. 103). Examination of cuttings samples at Skull Creek West-1 show that the intra-Eumeralla Formation sands are tight. This is confirmed by the RFT pressure survey (Appendix 6).

A small gas peak of 38 units was observed at 1529mKB within the Eumeralla Formation. This peak was associated with a live oil show. Gas consisted of 30500ppm of C1, 632ppm of C2, 292ppm of C3, 103ppm of C4, and 15ppm of C5. The oil show continued over an interval of 1m from 1529-1530mKB where the sandstone produced a 5% bright, solid yellow-white fluorescence giving a weak, milky white crush cut and a thin, very pale yellow ring residue. DST 1 tested this show recovering 1.6bbl oil (45.2API @ 15°C) and 0.5bbl formation water (Rw 0.4ohmm @ 25°C). Log analysis results failed to highlight this zone as a significant oil pool and its exact nature is uncertain. Appart from the oil show at 1529-1530mKB, only small gas peaks were recorded throughout the Eumeralla Formation, however no fluorescence was associated with them. Total gas at these peaks ranged from 25 units to 31 units with up to 31ppm of C5 at 1955mKB.

Core 3 was taken over the interval 1749.0m(L) to 1767.3m(L). Core porosities over this interval averaged 20.5% which are consistant with log analysis results over the same interval. The average porosity based on the log analysis for the Eumeralla Formation is 20.1%. Permeabilities exhibited over the cored interval are anomolously high (k = 1 to 865md). Core petrology (Appendix 3) and log analysis (Appendix 4c) do not support the high apparent permeabilities indicating that the Eumeralla Formation may have high total porosity but low effective porosity and permeability being shaly in nature.

The intra-Eumeralla Formation sands rely on the lateral extensitivity of the intra-Eumeralla Formation siltstones and claystones to act as seals. The sand layer that produced the live oil show in Skull Creek West-1 is immediately overlain by a 7m thick claystone.

PE907579

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BASIN = OTWAY
PERMIT = PPL/1
TYPE = WELL
SUBTYPE = MAP
DESCRIPTION = Skull Creek Horst at Top of Waarre (Figure 7 from WCR vol.1) for Skull Creek West-1
REMARKS =
DATE_CREATED = 12/01/98
DATE_RECEIVED = 30/04/98
W_NO = W1180
WELL_NAME = SKULL CREEK WEST-1
CONTRACTOR =
CLIENT_OP_CO = BASIN OIL NL

(Inserted by DNRE - Vic Govt Mines Dept)

DEPT. NAT. RES & ENV
PE907579

Skull Creek Horst at top Waarre

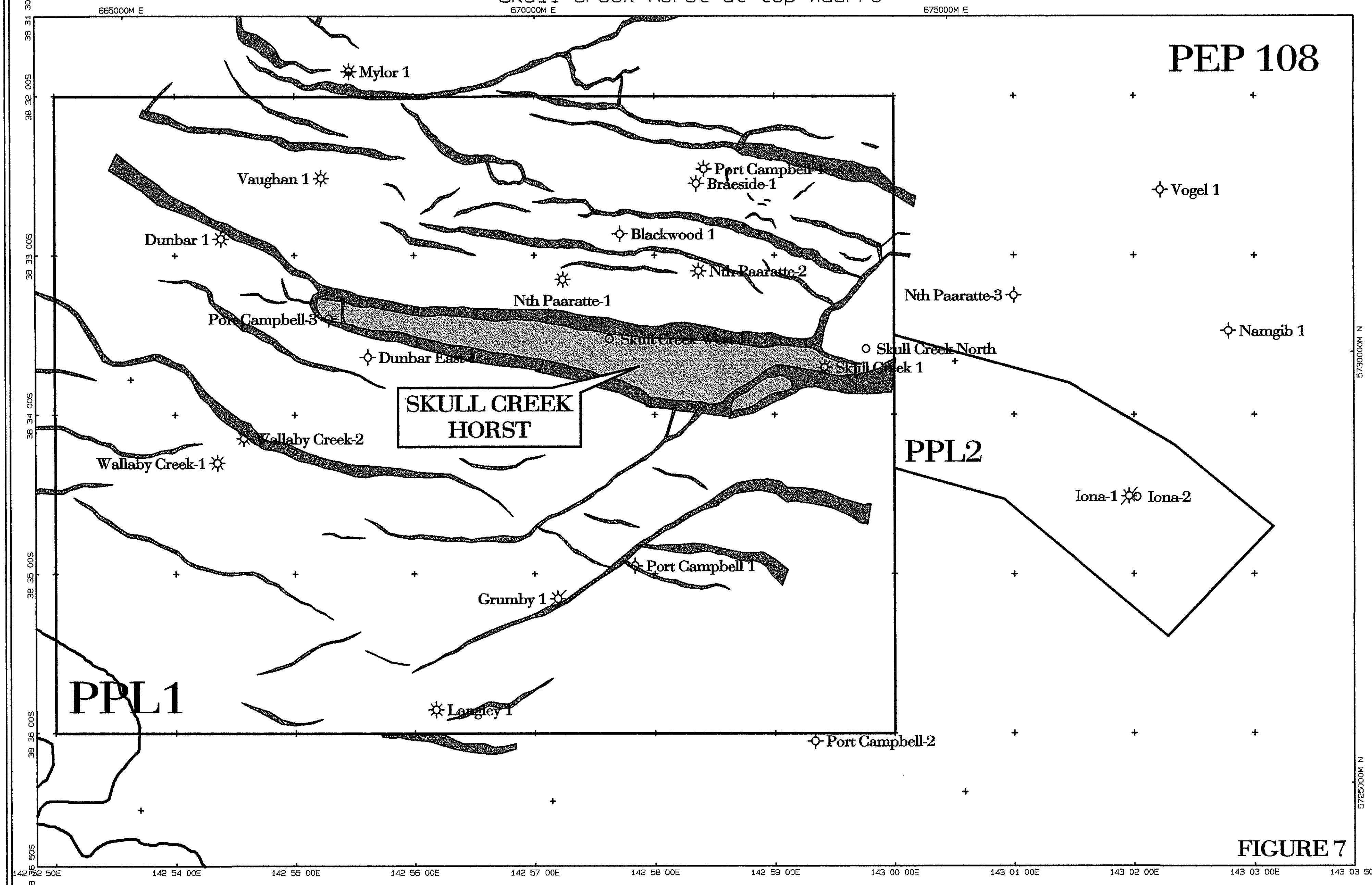

FIGURE 7

User : lukelm File : px1642.hpgl Date : January 12, 1998

PE907580

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The enclosure PE907580 is enclosed within the container PE907572 at this location in this document.

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           SUBTYPE = SECTION
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                     vol.1) for Skull Creek West-1
           REMARKS =
      DATE_CREATED =
     DATE_RECEIVED = 30/04/98
              W_NO = W1180
         WELL_NAME = SKULL CREEK WEST-1
        CONTRACTOR =
      CLIENT_OP_CO = BASIN OIL NL
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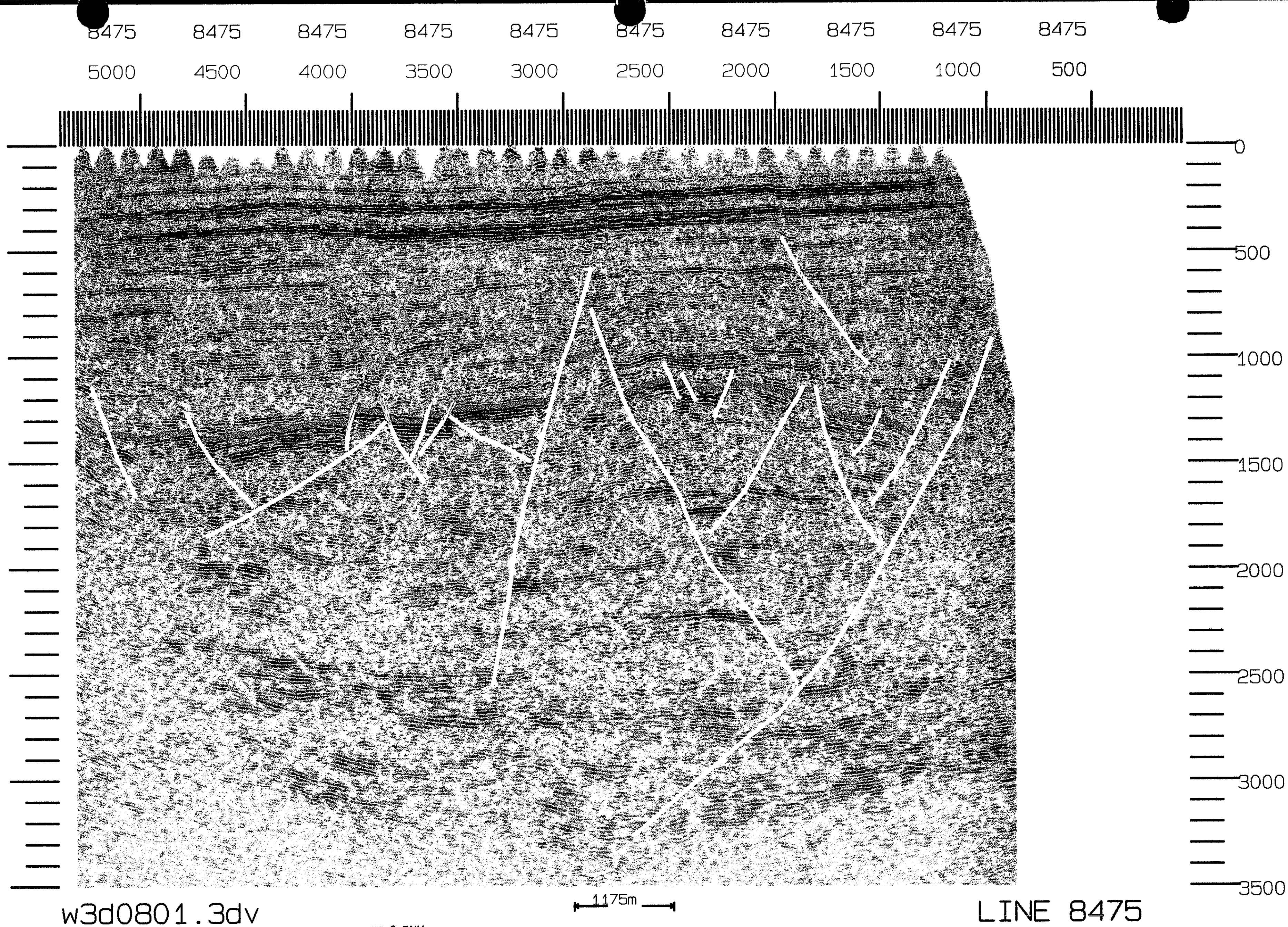
(Inserted by DNRE - Vic Govt Mines Dept)



8475 8475 8475 8475 8475 8475 8475 8475 8475 8475
5000 4500 4000 3500 3000 2500 2000 1500 1000 500
0
500
1000
1500
2000
2500
3000
3500
1175m
w3d0801.3dv
S
LINE 8475
N

FIGURE 8

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APPENDIX 1

LITHOLOGICAL DESCRIPTIONS

HEYTESBURY GROUP (Surface - 348.0 metres)

PORT CAMPBELL LIMESTONE (Surface - 48.0 metres)

Calcarenite: light grey, yellow orange at top and iron oxide rich, very fine to dominantly fine grained, moderate calcareous cement, slightly argillaceous, trace very fine to grit frosted quartz sand grains, trace fine black carbonaceous matter, trace to common bryozoa and shell fragments, trace glauconite, rare pyrite, moderately hard, poor visual porosity.

GELLIBRAND MARL (48.0 - 329.0 metres)

Marl: medium olive grey, abundant fossil fragments including bryozoa, shell fragments, forams, echinoid spines and sponge spicules,trace glauconite, rare very fine black carbonaceous matter, rare pyrite, very soft, sticky, non fissile.

CLIFTON FORMATION (329.0 - 348.0 metres)

Sandstone: orange brown, very fine to pebble, dominantly very coarse, subrounded to rounded, very poorly sorted, weak to moderate calcareous and iron oxide cements, abundant fossil fragments - grades to coquinal calcarenite, abundant dark brown iron oxide pellets, trace to abundant orange brown stained quartz grains, trace to abundant dark green to black glauconite, friable, fair inferred porosity.

NIRRANDA GROUP (348.0 - 472.0 metres)

NARRAWATURK MARL (348.0 - 415.0 metres)

Marl: medium green grey to occasionally medium brown grey, abundant fossil fragments including bryozoa, shell fragments, forams, echinoid spines and sponge spicules, trace to common glauconite, rare very fine black carbonaceous matter, very soft, sticky, non fissile.

MEPUNGA FORMATION (415.0 - 472.0 metres)

Sandstone: medium brown, very fine to grit, dominantly fine and coarse, subrounded to rounded, very poorly sorted, very strong calcareous cement in part, abundant medium brown argillaceous and silt matrix, strong brown stain on quartz grains, common dark brown iron oxide pellets, trace glauconite, trace fossil fragments, friable to occasionally hard, poor visual porosity, interbedded with and grading to:
Claystone: dark brown, very silty, often abundant dispersed very fine to grit quartz sand grains, occasionally moderately calcareous, trace micromica, very soft, very dispersive, non fissile.

WANGERRIP GROUP (472.0 - 816.0 metres)

DILWYN FORMATION (472.0 - 670.0 metres)

Sandstone: light grey, very fine to grit, dominantly medium to coarse angular to subrounded, moderately sorted, weak silica cement, common medium brown grey argillaceous and silt matrix, trace yellow to red quartz grains, trace quartz muscovite flakes, trace to common pyrite, friable, good inferred porosity, with minor interbedded and in part grading to:
Claystone: medium to dark brown grey to dark grey, moderately to very silty, abundant dispersed very fine to very coarse quartz sand grains in part, slightly to moderately carbonaceous, trace micromica, trace to common pyrite, soft, very dispersive, slightly subfissile.

PEMBER MUDSTONE (670.0 - 732.0 metres)

Claystone: medium to dark brown grey to very dark green grey, moderately to very silty, slightly to moderately calcareous, common glauconite, common dispersed very fine quartz sand grains in part, trace medium brown cryptocrystalline dolomite, trace fossil fragments, trace pyrite, trace micromica, soft, very dispersive, non fissile, with minor interbedded:
Sandstone: very light brown, very fine to occasionally fine, subangular to subrounded, well sorted, very weak silica cement, common to abundant silty matrix, trace very fine carbonaceous detritus, friable, poor inferred porosity.

PEBBLE POINT FORMATION (732.0 - 816.0 metres)

Claystone: medium grey to medium green grey, very silty, abundant dispersed very fine to dominantly very coarse to grit quartz sand grains, common glauconite, trace pyrite, trace micromica, soft, very dispersive, non fissile at top grading with depth to:
Sandstone: medium yellow brown, very fine to pebble, dominantly very coarse to grit, subangular to subrounded, very poorly sorted, very weak silica cement, abundant medium grey to occasionally medium brown grey argillaceous and silt matrix - matrix supported, common yellow quartz grains, trace glauconite at top, trace pyrite, friable, poor inferred porosity, intermixed with and grading to:
Claystone: yellow orange brown, iron oxide rich, very silty, common dispersed very fine to grit yellow quartz grains, trace green glauconitic clay, soft, very dispersive, non fissile.

SHERBROOK GROUP (816.0 - 1326.0 metres)

PAARATTE FORMATION (816.0 - 1115.0 metres)

Sandstone: light grey to light brown grey, very fine to grit, dominantly grit, subangular to subrounded, very poorly sorted, weak silica cement, abundant medium grey and occasionally white argillaceous and silt matrix - matrix supported, common yellow quartz grains, trace multicoloured volcanogenic lithics, trace black carbonaceous detritus, friable, very poor inferred porosity, grading to:

Claystone: medium to dark grey, very silty, occasionally abundant dispersed very fine to grit quartz sand grains, trace to common black carbonaceous flecks and rare detritus, trace pyrite, trace micromica, soft, very dispersive, non to slightly subfissile.
Sandstone: light grey, very fine to grit, dominantly fine in parts, dominantly coarse in parts, angular to subrounded, dominantly subangular, poorly sorted, weak to occasionally moderate silica cement, trace pyrite cement at top, trace white argillaceous matrix where coarse, abundant white argillaceous matrix where fine, trace yellow quartz grains decreasing with depth, trace grey green cherty lithics, trace to common black carbonaceous detritus, friable, poor to good visual porosity, interbedded with:
Claystone: medium to dark grey, very silty, trace very fine quartz and partially altered feldspar laminae in part, common dispersed very fine to grit quartz sand grains in part, trace to common black carbonaceous flecks and detritus, trace to common pyrite, trace to common micromica, soft, very dispersive, non to slightly subfissile.

SKULL CREEK MUDSTONE (1115.0 - 1199.0 metres)

Sandstone: light grey, very fine to medium, dominantly fine, occasionally coarse to grit, angular to subrounded, dominantly subangular, moderately to well sorted, moderate to rarely strong silica cement, weak calcareous cement, common to abundant white argillaceous matrix, trace black coaly detritus, trace pyrite, friable to moderately hard, poor to fair visual porosity, interbedded and laminated with:
Claystone: medium brown grey to medium grey, moderately to very silty, often very finely arenaceouswith quartz and partially altered feldspar grains, trace carbonaceous detritusand flecks, trace pyrite, trace micromica, soft, very dispersive, slightly subfissile.

NULLAWARRE GREENSAND (1199.0 - 1226.0 metres)

Sandstone: light yellow green, very fine to medium, dominantly fine, subangular to subrounded, moderately sorted, weak silica and calcareous cements, abundant green argillaceous and silt matrix - matrix supported, abundant yellow green quartz grains, trace glauconite, friable, poor inferred porosity, grading to:
Claystone: medium green, very silty, abundant dispersed very fine to medium clear-yellow-green quartz sand grains, trace glauconite, trace pyrite, soft, very dispersive, non fissile.

BELFAST MUDSTONE (1226.0 - 1285.0 metres)

Claystone: medium to dark grey, medium brown grey, moderately to very silty, occasional dispersed very fine to fine quartz and altered feldspar sand grains, trace black carbonaceous flecks, trace to abundant glauconite - increases with depth, trace medium brown cryptocrystalline dolomite - increases with depth, trace pyrite, trace micromica, firm very dispersive, slightly subfissile.

WAARRE FORMATION (1285.0 - 1326.0 metres)

Unit B (1285.0 - 1306.0 metres)

Sandstone: off white to light grey, very fine to grit, dominantly coarse to very coarse, angular to subrounded, poor to moderately sorted, weak silica cement, strong dolomite cement in part, trace to abundant white argillaceous matrix, clear quartz grains, trace pyrite, friable to hard, poor to dominantly very good inferred porosity.

Sandstone: off white to light grey, very fine to grit, dominantly fine to medium, angular to subrounded, dominantly subangular, very poorly sorted, weak to moderate silica cement, trace white argillaceous matrix, clear to opaque quartz grains, friable, good inferred porosity.
Sandstone: light grey, very fine to occasionally fine grained, angular to subrounded, dominantly subangular, well sorted, moderate silica cement, trace to weak calcareous cement, common white argillaceous and silt matrix, abundant altered feldspar grains, common fine black carbonaceous detritus, trace green lithics, moderately hard, poor visual porosity, with 80% at top decreasing to 25% at base of flat wavy laminations (occasionally convoluted) of:
Claystone: dark grey, very silty, common black carbonaceous flecks and detritus, common fine to medium grained muscovite flakes, common micromica, abundant dispersed very fine quartz, and altered feldspar grains in part, moderately hard, slightly subfissile.

Unit A (1306.0 - 1326.0 metres)

Sandstone: light grey, very fine to occasionally fine grained, angular to subrounded, dominantly subangular, well sorted, moderate silica cement, trace weak calcareous cement, common white argillaceous and silt matrix, abundant altered feldspar grains, common fine black carbonaceous detritus, trace green lithics, trace mica flakes, moderately hard, poor visual porosity, with minor medium brown silty to finely arenaceous lamina of:
Carbonaceous Siltstone: very dark grey to black, very argillaceous grading to claystone, common very fine partially altered feldspar grains, trace amber, trace micromica, moderately hard, subfissile, and interbedded and laminated:
Silty Claystone: very dark brown grey, moderately to very carbonaceous, common black coaly detritus, trace amber, trace micromica, firm to hard, subfissile.

OTWAY GROUP (1326.0 - 2000.0 metres)

EUMERALLA FORMATION (1326.0- 2000.0 metres)

Sandstone: light to medium green grey, very fine to coarse, dominantly medium, subangular, moderately to well sorted, weak silica and calcareous cements, common to abundant white argillaceous matrix, abundant grey green lithics and off white altered feldspar grains, common brown and red lithics, trace black coal detritus, trace brown mica flakes, trace pyrite, friable, poor visual porosity with minor interbedded:
Claystone: light to medium brown, off white to occasionally light green, medium grey, very silty in part, abundant dispersed very fine partially altetred feldspar grains in part, trace to common fine black carbonaceous matter, trace pyrite, trace brown mica flakes, trace micromica, firm, very dispersive, slightly subfissile.

APPENDIX 2

CORE DATA

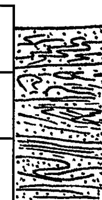
APPENDIX 2a

CORE DESCRIPTIONS

CULTUS PETROLEUM NL

CORE REPORT FORM

WELL INFORMATION									
WELL NAME:	Skull Creek West -1			CORE NO:	1		DATE:	11/3/97	
CORE INTERVAL:	1290.7 - 1292.0		m (Drlr)	FORMATION CORED:			Waarre		
			m (Logr)	TYPE (CONV./SLEEVED)					
CORE RESULTS	CUT:	1.3	(m)	RECOVERED:	1.3	(m)	RECOVERY:	100	(%)

TG (U)	Ø (%)	K (mD)	SO (%)	DEPTH (m)	SPLE FOR ANAL	ROP mins/m	FLUOR Tr	Pr	Fr	Gd	LITH	DESCRIPTION MP-Mounted Plug CP-Core Plug PS-Preserved Sample
				DESCRIBE ANY LITH SYMBOLS USED:								
				1290.7 1291		85.71						1290.7 - 1292.0 **Sandstone:** light grey, very fine to occ. fine grained, angular to subrounded, dominantly angular, well
						100.00						sorted, moderate silica cement, weak calcareous cement, common white arg and silt matrix, abundant altered feldspar
				1292		85.71m						grains, common fine black carbonaceous detritus, trace grn lithics, moderately hard, poor visual porosity, no oil fluor.
												hummocky cross stratified, rippled and interbedded with **Silty Claystone:** dark grey, common black carb detritus,
												common fine to medium grained muscovite flakes, common micromica, abundant dispersed very fine quartz and altered
												feldspar grains in part, moderately hard, slightly subfissile, heavily convoluted and becoming contorted at 1291 and at
												1291.7-1291.8 Heavily contorted and micro faulted 1291.85-1291.94 Hummocky cross stratified, very fine
												sandstone as above but with lenticular carbonaceous detrits and trace disseminated pyrite.
												1291.4-1292 Dominantly silty claystone 10mm thick then very fine interbedded, dominantly carbonaceous banded
												sandstone with rare minor convolutions.

CULTUS PETROLEUM NL

CORE REPORT FORM

WELL INFORMATION

WELL NAME:	Skull Creek West -1			**CORE NO:**	2		**DATE:**	11/3/97
CORE INTERVAL:	1292-1310.3		**m (Drlr)**	**FORMATION CORED:**			Warre	
			m (Logr)	**TYPE (CONV./SLEEVED)**				
CORE RESULTS	**CUT:**	18.3	**(m)**	**RECOVERED :**	18.3	**(m)**	**RECOVERY:100**	**(%)**

CORE ANALYSIS				DEPTH (m)	SPLE FOR ANAL	ROP mins/m	FLUOR Tr Pr Fr Gd	LITH	DESCRIPTION MP-Mounted Plug CP-Core Plug PS-Preserved Sample
TG (U)	Ø (%)	K (mD)	SO (%)	DESCRIBE ANY LITH SYMBOLS USED:					
				1292		85.71			
	19.9	3.31			1R				1292-1294.7 **Sandstone:** light brown grey, very fine to
						20.00			dominantly fine grained, angular to subrounded
1.80									dominantly subangular, moderate silica and weak
1.05				1293		21.98			calcareous cements, abundant altered feldspar grains,
									common fine black carbonaceous detritus, trace mica,
1.05	17.4	3.36			2R	21.98			moderately hard, poor visual porosity, cross bedded up
									to 20 degrees, commonly convoluted with common
1.03	17.0	5.9		1294	3R	12.00			dewatering structures,and occasional rip up mud clasts
	9.4	0.13			3V				at base, interbedded with
0.87						17.14			**Siltstone:** very dark grey, often very finely arenaceous,
									very carbonaceous, trace amber, common micromica,
1.19				1295		18.46			firm to hard,very finely laminated
									1294.7-1297.45 **Carbonaceous Siltstone**: very dark
1.81						19.23			grey to black, very argillaceous, common fine partially
							ZF	F	altered feldspar, coaly lenses, nodular and fracture fill
0.75				1296		20.83			pyrite, trace amber, trace micromica, moderately hard,
									subfisslie, grading downwards to
1.00						24.00			**Claystone:** very dark brown grey, moderately to very
									silty, moderately carbonaceous, trace micromica,
1.00				1297		16.00			fractured, firm (1295.5 Possible fault plane)
									1297.45-1306.1 **Bioturbated and convoluted Silty**
0.81						15.00			**Claystone:** very dark brown grey, moderately to very
									carbonaceous, trace amber, trace micromica, firm to
0.85				1298		22.06			hard, subfissile with wavy and lenticular finely interbed
									Sandstone: light grey, very fine, angular to subrounded,
0.91						26.91			well sorted, moderate silica cement, weak calcareous
									cement, common white argillaceous matrix, abundant
1.03				1299		28.85			partially altered feldspar grains, trace brown lithics,
									moderately hard, very poor porosity,no oil fluorescence
1.75						13.99			Low angle cross bedding not exceeding 20 degrees.
									1301 downwards, less bioturbated to occasionally
1.51				1300		20.00			heavily convoluted.
									1301.5 Elongate sandstone boulder with silty claystone
2.62						21.98			contorted around.
1.31				1301		26.67	UC		
1.81						16.09			
1.91				1302		12.90			

CULTUS PETROLEUM NL

CORE REPORT FORM

WELL INFORMATION									
WELL NAME:	Skull Creek West -1			CORE NO:	2		DATE:	11/3/97	
CORE INTERVAL:	1292 - 1310.3		m (Drlr)	FORMATION CORED:			Waarre		
			m (Logr)	TYPE (CONV./SLEEVED)					
CORE RESULTS	CUT:	18.3	(m)	RECOVERED :	18.3	(m)	RECOVERY:	100	(%)

CORE ANALYSIS				DEPTH (m)	SPLE FOR ANAL	ROP mins/m	FLUOR Tr Pr Fr Gd	LITH
TG (U)	Ø (%)	K (mD)	SO (%)	DESCRIBE ANY LITH SYMBOLS USED: 1302				
2.02						12.00		
2.82				1303		8.00		
2.82						16.44		
2.51				1304		8.00		
2.32						6.40		
1.81				1305		7.40		
3.22						6.00		
8.06				1306		7.59		
	20.3	17.4			4R			
						5.60		
				1307		10.00		
	18.3	3.85			5R			
	19.2	2.55			5V	10.17		
				1308		8.00		
	23.8	46.3			6R			
						7.00		
	17.2	3.45		1309	7R	6.40		
						5.60		
	22.6	19.5			8R			
16.0	23.6	35.4		1310	9R	4.55		
	21.7	7.0			9V			

DESCRIPTION
MP-Mounted Plug CP-Core Plug PS-Preserved Sample

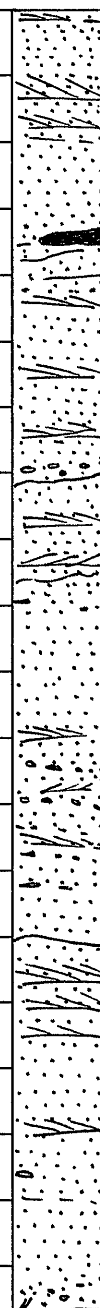
1306.1-1310.3 **Sandstone:** light grey brown, very fine to fine, dominantly fine, angular to subrounded, well sorted, moderate silica cement, weak calcareous cement, common white argillaceous matrix, common partially altered feldspar grains, common brown lithics, common cross laminae of carbonaceous matter, moderately hard, very poor visual porosity, no oil fluor except at 1308.5 trace patchy dull yellow residual oil fluorescence giving a very weak pale crush cut, interbedded with **Silty Claystone**: dark grey brown, common carbonaceous detritus, trace pyrite, trace micromica, firm to moderately hard, slightly subfissile, wavey cross bedding, dominantly laminar.
1307.8 Carbonaceous laminae and disseminated pyrite rare rip up mud clasts, dewatering and worm burrows.
1308.5 Abundant elongate mud clasts <2cm. Thin 10mm light brown altered clay bands and carbonaceous laminae.
1309 downwards, Wavey cross bedded sandstone, hummocky cross stratification, ripples, minor carbonaceous laminae, very minor convolution
1310.21310.3 Rare to occasional mud clasts.

CULTUS PETROLEUM NL

CORE REPORT FORM

WELL INFORMATION								
WELL NAME:	Skull Creek West -1			CORE NO:	3		DATE:	11/3/97
CORE INTERVAL:	1748.0 - 1766.3		m (Drlr)	FORMATION CORED:			Eumeralla	
			m (Logr)	TYPE (CONV./SLEEVED)				
CORE RESULTS	CUT:	18.3	(m)	RECOVERED :	18.3	(m)	RECOVERY:	100 (%)

CORE ANALYSIS				DEPTH (m)	SPLE FOR ANAL	ROP (mins/m) (m/hr)	FLUOR				LITH	DESCRIPTION MP-Mounted Plug CP-Core Plug PS-Preserved Sample
TG (U)	Ø (%)	K (mD)	SO (%)	DESCRIBE ANY LITH SYMBOLS USED: 1748			Tr	Pr	Fr	Gd		
4.00	20.5	2.78			10R							1748-1762.2 100% Sandstone: medium green grey,
	21.5	3.19			10V	26.09						fine to coarse, dominantly med,subangular,
												well sorted, weak to moderate silica cement, trace light green
				1749		46.15						white argillaceous matrix, abundant grey green cherty lithic
	23.2	372			11R							common altered feldspar grains, trace brown red lithics, trace
						28.57						coarse brown mica flakes, friable, fair intergranular porosity,
												no oil fluorscence, cross bedded up to 30 degrees interbedded
4.40				1750		12.00						with massive structureless beds < 1.0m thick. Beds are
	20.5	19.2			12R							graded, fining upwards with sharp erosional base contacts.
						13.95						Coarse grained sandstone at base of beds commonly occur
												with clay clasts <3cm length
2.00				1751		20.00						1749.6 Discontinuous carbonaceous bed. Probable tree
	23.2	685			13R							trunk/branch 6cm thick, black, silty subvitreous lustre.
	23.7	483			13V	18.18						1751.25 Coarser grained and graded mud clasts fining up.
												1751.7 Angular unconformity. Fine grained cross bedded
3.20				1752		12.00						sandstone with carbonaceous laminae below.
	22.1	66.8			14R							1752.3 Angular unconformity. Coarse grained more
						12.00						massive sandstone below contact.
1.80				1753		18.18						
	20.8	14.3			15R							1753.5 Minor cross bedding
						24.00						
1.80				1754		25.97						1754.15 Rare clay clasts greenish grey with cherty texture.
	22.4	89.8			16R							1754.4 ubvitreous carbonaceous and clay elongate clasts
	19.1	3.54			16V	24.00						graded fining upwards. Low angle cross bedded sandstone
												coarse at base.Cay clasts < 1.5cm in bands every 5cm.
3.20				1755		17.14						
	19.6	2.01			17R							1755.25 Angular UC on massive cross bedded sandstone w
						12.00						5-20cm foresets and cross beds < 40 degrees.
3.00				1756		10.00						1756.5 Minor carbonaceous rip up clasts
												Sandstone: as above, cross bedded with minor influxes of
	20.9	3.65			18R	17.14						carbonaceous detritus every 0.5m and rare mud clasts
2.70				1757		15.79						
	19.0	1.30			19R							
	19.1	0.13			19V	13.95						1757.8 Coarse to very coarse sandstone graded with clay
												clasts on top of an angular UC
2.00				1758		13.95						Very fine grained sandstone below



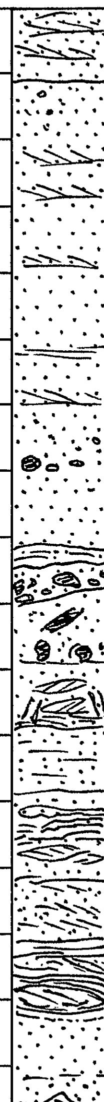
CULTUS PETROLEUM NL

CORE REPORT FORM

WELL INFORMATION

WELL NAME:	Skull Creek West -1		CORE NO:	3	DATE:	11/3/97	
CORE INTERVAL:	1748.0 - 1766.3	m (Drlr)	FORMATION CORED:		Eumeralla		
		m (Logr)	TYPE (CONV./SLEEVED)				
CORE RESULTS	CUT: 18.3 (m)		RECOVERED :	18.3 (m)	RECOVERY:	100	(%)

CORE ANALYSIS				DEPTH (m)	SPLE FOR ANAL	ROP mins/m	FLUOR (Tr Pr Fr Gd)	LITH
TG (U)	Ø (%)	K (mD)	SO (%)	DESCRIBE ANY LITH SYMBOLS USED:				
				1758				
	20.9	50.8			20R			
				1759				
	19.8	18.0			21R			
				1760				
	19.4	0.31			22R			
	19.3	0.16			22V			
				1761				
	19.8	5.4			23R			
				1762				
	23.5	865			24R			
				1763				
	16.1	0.32			25V			
	14.5	0.34			25R			
				1764				
				1765				
	17.9	0.03			26V			
	19.9	0.12		1766	26R			



DESCRIPTION
MP-Mounted Plug CP-Core Plug PS-Preserved Sample

1758.1 Fine to medium grained sandstone as above grades to coarse grained cross bedded with clay clasts at base

1758.55 Angular UC with coarse grained sandstone below. Sandstone is medium to coarse to 1759.95 then dominantly fine to medium cross bedded to 1760.6

1760.6-1760.75 Very finely interbedded fine grained sandstone and carbonaceous detritus

Medium grained sandstone to 1761, Medium to coarse sand to 1761, conglomeratic at 1761.45. Fair to good inferred porosity.

1762.2 Angular contact

1762.2 Minor carbonaceous laminae on very angular contactLarge mud clasts < 3cm and smaller carbonaceous <1.5cm clasts.

1762.5 Claystone lense. 1762.5-1766.3 Sandstone: very fine to dominantly fine grained, occasionally coarse, silty, subangular, well sorted, moderate silica cement, common white argillaceous and silt matrix, abundant off white to light brown altered feldspar grains, trace fine mica flakes, friable to moderately hard, very poor intergranular porosity no oil flouorescence. Graded and cross bedded.

1762.8 Angular UC with dewatering of siltstone into overlying sandstone. Minor carbonaceous detritus

1763.35 Silty Sandstone on angular UC, very fine grained, hummocky cross stratification <10mm

1764-1766.3Sandstone as above interbedded with Siltstone: medium to dark grey, very finely arenaceous, moderately siliceous, slightly argillaceous, common extremely fine off white to light brown altered feldspar, trace fine mica flakes, friable to moderately hard, no visual porosity, convoluted bedding, dewatering structures, some rare minor clay clasts. Siltstone grades to silty sandstone with sharp unconformable bases.

1765.1-1765.3 Coarse cross bedded sandstone

1765.3-1766.3 Finely laminated cross bedded siltstone and sandstone, convoluted crossbedding at mm scale.

APPENDIX 2b

CORE ANALYSIS RESULTS

PE907581

This is an enclosure indicator page.
The enclosure PE907581 is enclosed within the container PE907572 at this location in this document.

The enclosure PE907581 has the following characteristics:

ITEM_BARCODE =	PE907581
CONTAINER_BARCODE =	PE907572
NAME =	Core Analysis Final Report
BASIN =	OTWAY
PERMIT =	PPL/1
TYPE =	WELL
SUBTYPE =	REPORT
DESCRIPTION =	Routine Core Analysis Final Report of Skull Creek West-1 for Cultus Petroleum NL by ACS Laboratories Pty Ltd(Appendix 2b from WCR vol.1) for Skull Creek West-1
REMARKS =	
DATE_CREATED =	26/06/97
DATE_RECEIVED =	30/04/98
W_NO =	W1180
WELL_NAME =	SKULL CREEK WEST-1
CONTRACTOR =	ACS LABORATORIES PTY LTD
CLIENT_OP_CO =	CULTUS PETROLEUM NL

(Inserted by DNRE - Vic Govt Mines Dept)

ACS

LABORATORIES

PTY. LTD.

ROUTINE CORE ANALYSIS FINAL REPORT
of
SKULL CREEK WEST No. 1
for
CULTUS PETROLEUM NL.
by
ACS LABORATORIES PTY. LTD.

26th June, 1997.

Cultus Petroleum NL.,
Level 4, 828 Pacific Highway,
GORDON. N.S.W. 2072

Attention: Mr. Andy Ion.

FINAL REPORT: 0250-02 - WELL NAME: SKULL CREEK WEST NO. 1

CLIENT REFERENCE:	PO 10402 ACS/QA/174
MATERIAL:	4" diameter Whole Core
LOCALITY:	PPL-1, Otway
WORK REQUIRED:	Routine Core Analysis

Please direct technical inquiries regarding this work to the signatory below under whose supervision the work was conducted.

IAN MANGELSDORF
Domestic Operations Supervisor
on behalf of ACS Laboratories Pty. Ltd.

ijm/rgh

Address: P.O. Box 396, Chermside, Qld. 4032 Australia
Telephone: 61 7 3350 1222 Facsimile: 61 7 3359 0666
E-mail: acs.bris@acslabs.com.au
ACS Laboratories Pty. Ltd.
ACN: 008 273 005

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CHAPTERS

APPENDICES

CHAPTER 1

LOGISTICS AND INTRODUCTION

1. LOGISTICS

Skull Creek West No. 1, core numbers 1, 2 and 3 were delivered to ACS Laboratories, Brisbane on the 27th February, 1997.

Core No. 1	1290.70m - 1292.00m
Core No. 2	1292.00m - 1310.22m
Core No. 3	1748.00m - 1766.08m

Note that approximately 10 cm. of core was missing from one core section in Core No. 3 (1756.50m - 1756.60m).

INTRODUCTION

The following report includes tabular data of Dean and Stark residual fluid saturations, ambient permeability to air, ambient helium injection porosity and density determinations. Data presented graphically includes a core log plot of the above and porosity versus permeability to air plots.

CHAPTER 2

STUDY AIMS

2. STUDY AIMS

The analyses were performed with the following aim:

1. To provide depth correlation through the provision of a continuous core gamma log over the cored interval.
2. To provide residual water saturation (Sw), air permeability, helium injection porosity and density data.
3. To investigate the directional control on permeability through provision of vertical permeability data.

CHAPTER 3

SAMPLING

3. SAMPLING

3.1 Dean and Stark Analysis Samples

1½" diameter plugs for Dean and Stark residual fluid saturation determinations were drilled with air at points selected by Cultus. These samples were trimmed to a right cylinder and later used for routine core measurements after the Dean and Stark analysis was completed.

3.2 Routine Core Analysis Samples

1½" diameter horizontal plug samples were cut at 1 metre intervals throughout the core using brine (15,000 PPM) as the bit lubricant. 1½" diameter vertical samples were cut at approximately 3m intervals using brine as the bit lubricant. All plugs were trimmed to right cylinders. The offcuts were labelled and bagged for possible future analysis.

3.3 1/3 : 2/3 Core Slab

On completion of the sampling, the core was slabbed longitudinally into two sections (1/3:2/3) using water as the blade cooling and lubricating medium.

CHAPTER 4

SAMPLE PREPARATION

4. SAMPLE PREPARATION

4.1 Sample Extraction

After sampling, as described earlier, the plugs were initially dried at 60°C for 2 hours. The plugs were then placed in a soxhlet extractor to remove residual pore fluids. The solvent used was chloroform-methanol and when it was no longer discoloured, the core plugs were removed and checked under ultra-violet light to ensure all hydrocarbons had been removed. A sample of solvent from the soxhlet chamber was tested with silver nitrate to ensure all salt had been removed.

4.2 Sample Drying

After cleaning, all plugs were dried to constant weight in a controlled humidity environment of 40% relative humidity at 60°C. Once dried, the plugs were stored in an airtight plastic container and allowed to cool to room temperature before analysis.

CHAPTER 5

TEST PROCEDURES

5. TEST PROCEDURES

5.1 Continuous Core Gamma

The core was laid out according to depth markings, and a continuous core gamma trace produced by passing the core beneath a gamma radiation detector. The detector is protected from extraneous radiation by a lead tunnel. The detector signal is amplified and digitised to produce a gamma trace for comparison with the down hole log.

5.2 Dean and Stark Residual Fluid Saturations

The sample is suspended above a reservoir of boiling toluene so that the vapors extract pore fluids. The vapours, together with the extracted pore fluids, are condensed at the top of the glassware and the water collected in a calibrated side arm. Oil and toluene are collected in the reservoir and continue boiling so that clean toluene vapor continues extracting pore fluids. The process is continued until the water production ceases.

From the collected water volume and the latter determined pore volume of the sample, water saturation is calculated as follows.

$$Sw = (\text{Water Volume} / \text{Pore Volume}) \times 100\%$$

5.3 Helium Injection Porosity

The plugs were sealed in a matrix cup and a known volume of helium at 100 psi reference pressure introduced to the cup. From the resultant pressure the unknown volume i.e. the grain volume, was calculated using Boyles Law, where $P_1V_1 = P_2V_2$.

The bulk volume of the plugs was determined by mercury immersion. The difference between the grain volume and the bulk volume is the pore volume. The porosity is calculated as the volume percentage of pore space with respect to the bulk volume. The porosity calculated using this technique is an effective porosity.

5.4 Air Permeability

The plugs are placed in a Hassler cell at a confining pressure of 250 psig (1720 kpa). This pressure is used to prevent bypassing of air around the sample when the measurement is made.

During the measurement a known air pressure is applied to the upstream face of the sample, creating a flow of air through the sample. Permeability for each sample is then calculated using Darcy's Law through knowledge of the upstream pressure and flow rate during the test, the viscosity of air and the plug dimensions.

5.5 Apparent Grain Density

The apparent grain density is determined by dividing the weight of the plug by the grain volume determined from the helium injection porosity measurement.

5.6 Core Photography

The core photography was carried out on the 2/3 slab of core.

Photographs were taken of the core in a 5 metre format under white light. The film was then digitally scanned, mastered and printed.

CHAPTER 6

SAMPLE DISTRIBUTION AND STORAGE

6. SAMPLE DISTRIBUTION and STORAGE

The 2/3 slab of core was shipped to Geophysical Magnetic, Annandale on 3rd April, 1997.

All routine plugs and offcuts are stored at ACS Laboratories, Brisbane.

The 1/3 slab of core will be shipped to the Victorian Mines Department when they have moved into their new premises.

APPENDIX I

AMBIENT HORIZONTAL TEST RESULTS

ACS LABORATORIES PTY. LTD.
ACN 008-273-005
Petroleum Reservoir Engineering Data

CORE ANALYSIS FINAL REPORT

Company	:	Cultus Petroleum NL.	Date	:	12/5/97
Well	:	Skull Creek West No. 1	File	:	0250-02
Field	:		Location	:	PPL-1, Otway
Core Int.	:	C#1: 1290.70 m. - 1292.00 m.	ACS Lab.	:	Brisbane
Core Int.	:	C#2: 1292.00 m - 1310.22 m.	Analysts	:	WJD/ISS
Core Int.	:	C#3: 1748.00 m - 1766.08 m			

Sample Number	Depth	Dir	Porosity % He Inj	Density ND	Density GD	Permeability (mD) Ka	Summation of Fluids H_2O %	Remarks
1	1292.15	R	19.9		2.86	3.31		C#2
2	1293.33	R	17.4		2.68	3.36		
3	1294.00	R	17.0		2.68	5.9		
4	1306.08	R	20.3	2.30	2.69	17.4	77.7	
5	1307.31	R	18.3	2.34	2.68	3.85	93.9	
6	1308.10	R	23.8	2.18	2.66	46.3	69.4	
7	1308.99	R	17.2	2.33	2.66	3.45	81.0	
8	1309.61	R	22.6	2.24	2.67	19.5	81.9	
9	1310.14	R	23.6	2.19	2.66	35.4	67.0	
10	1748.43	R	20.5		2.65	2.78		C#3
11	1749.43	R	23.2		2.67	372		
12	1750.44	R	20.5		2.66	19.2		
13	1751.38	R	23.2		2.67	685		
14	1752.42	R	22.1		2.67	66.8		
15	1753.44	R	20.8		2.66	14.3		
16	1754.36	R	22.4		2.65	89.8		
17	1755.41	R	19.6		2.67	2.01		
18	1756.40	R	20.9		2.66	3.65		
19	1757.41	R	19.0		2.66	1.30		
20	1758.41	R	20.9		2.67	50.8		
21	1759.39	R	19.8		2.67	18.0		
22	1760.42	R	19.4		2.67	0.31		
23	1761.29	R	19.8		2.67	5.4		
24	1762.05	R	23.5		2.66	865		
25	1763.47	R	14.5		2.62	0.34		
26	1765.88	R	19.9		2.67	0.12		

VF = Vertical Fracture; HF = Horizontal Fracture; MP = Mounted Plug; SP = Short Plug
C# = Top of Core; B# = Bottom of Core; OWC = Probable Oil/Water Contact
Tr = Probable Transition Zone; GC = Probable Gas Cap; NS = Not suitable for SCAL

APPENDIX II

AMBIENT VERTICAL TEST RESULTS

ACS LABORATORIES PTY. LTD.

ACN 008-273-005

Petroleum Reservoir Engineering Data

CORE ANALYSIS FINAL REPORT

Company	:	Cultus Petroleum NL.	Date	:	12/5/97
Well	:	Skull Creek West No. 1	File	:	0250-02
Field	:		Location	:	PPL-1, Otway
Core Int.	:	C#1: 1290.70 m. - 1292.00 m.	ACS Lab.	:	Brisbane
Core Int.	:	C#2: 1292.00 m - 1310.22 m.	Analysts	:	WJD/ISS
Core Int.	:	C#3: 1748.00 m - 1766.08 m			

Sample Number	Depth	Dir	Porosity % He Inj	Density GD	Permeability (mD) Ka	Remarks
3	1294.17	V	9.4	2.70	0.13	C#2
5	1307.37	V	19.2	2.64	2.55	
5	1310.00	V	21.7	2.67	7.0	
10	1748.48	V	21.5	2.65	3.19	C#3
13	1751.46	V	23.7	2.66	483	
16	1754.47	V	19.1	2.66	3.54	
19	1757.47	V	19.1	2.66	0.13	
22	1760.47	V	19.3	2.67	0.16	
25	1763.40	V	16.1	2.62	0.32	
26	1765.82	V	17.9	2.65	0.03	

VF = Vertical Fracture; HF = Horizontal Fracture; MP = Mounted Plug; SP = Short Plug
C# = Top of Core; B# = Bottom of Core; OWC = Probable Oil/Water Contact
Tr = Probable Transition Zone; GC = Probable Gas Cap; NS = Not suitable for SCAL

APPENDIX III

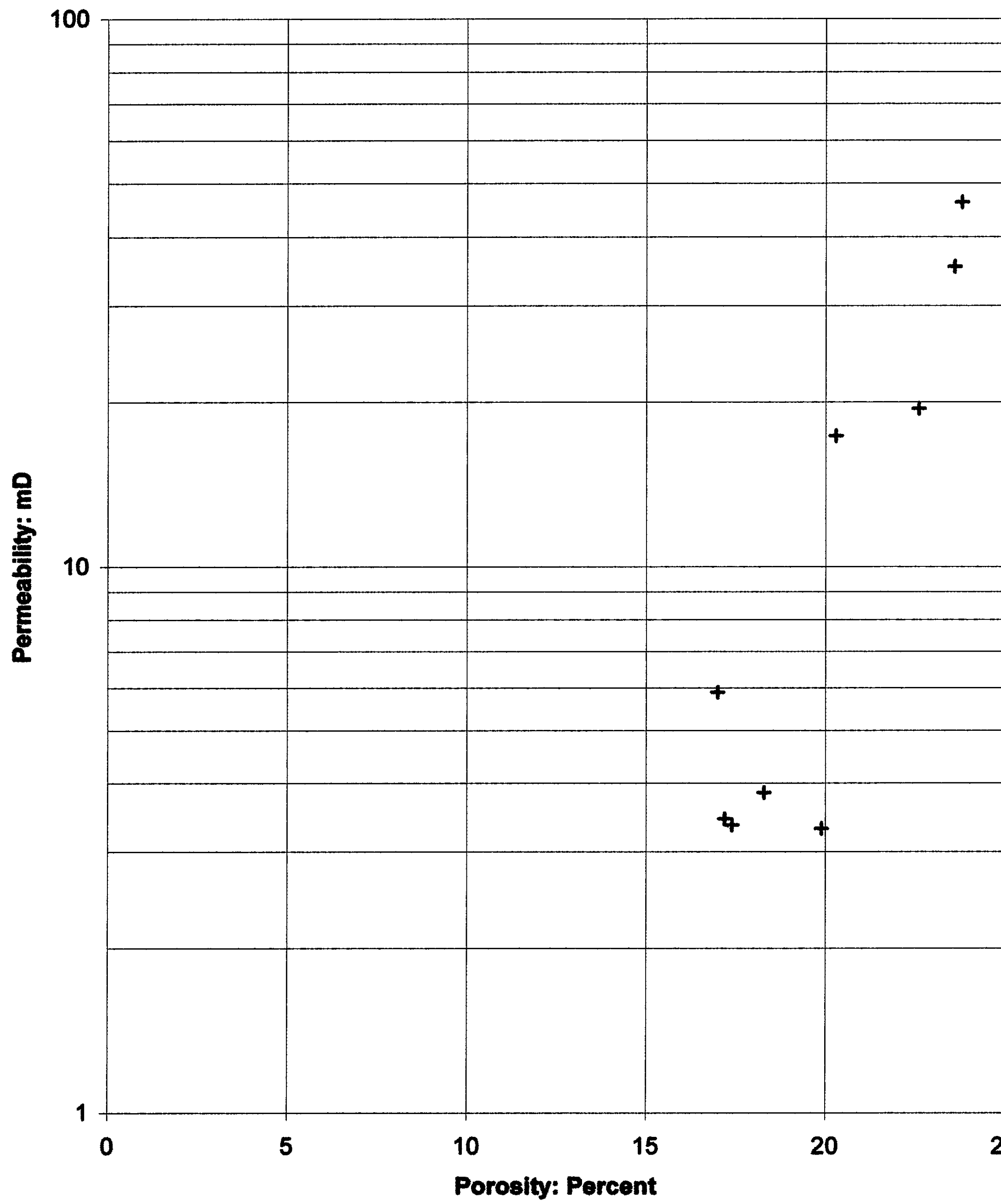
AMBIENT POROSITY vs. PERMEABILITY PLOT

POROSITY vs PERMEABILITY

CULTUS
PETROLEUM NL

ACS
LABORATORIES
PTY. LTD.

Client: Cultus Petroleum NL
Well: Skull Creek West No.1
Depth: 1292.00m - 1310.30m

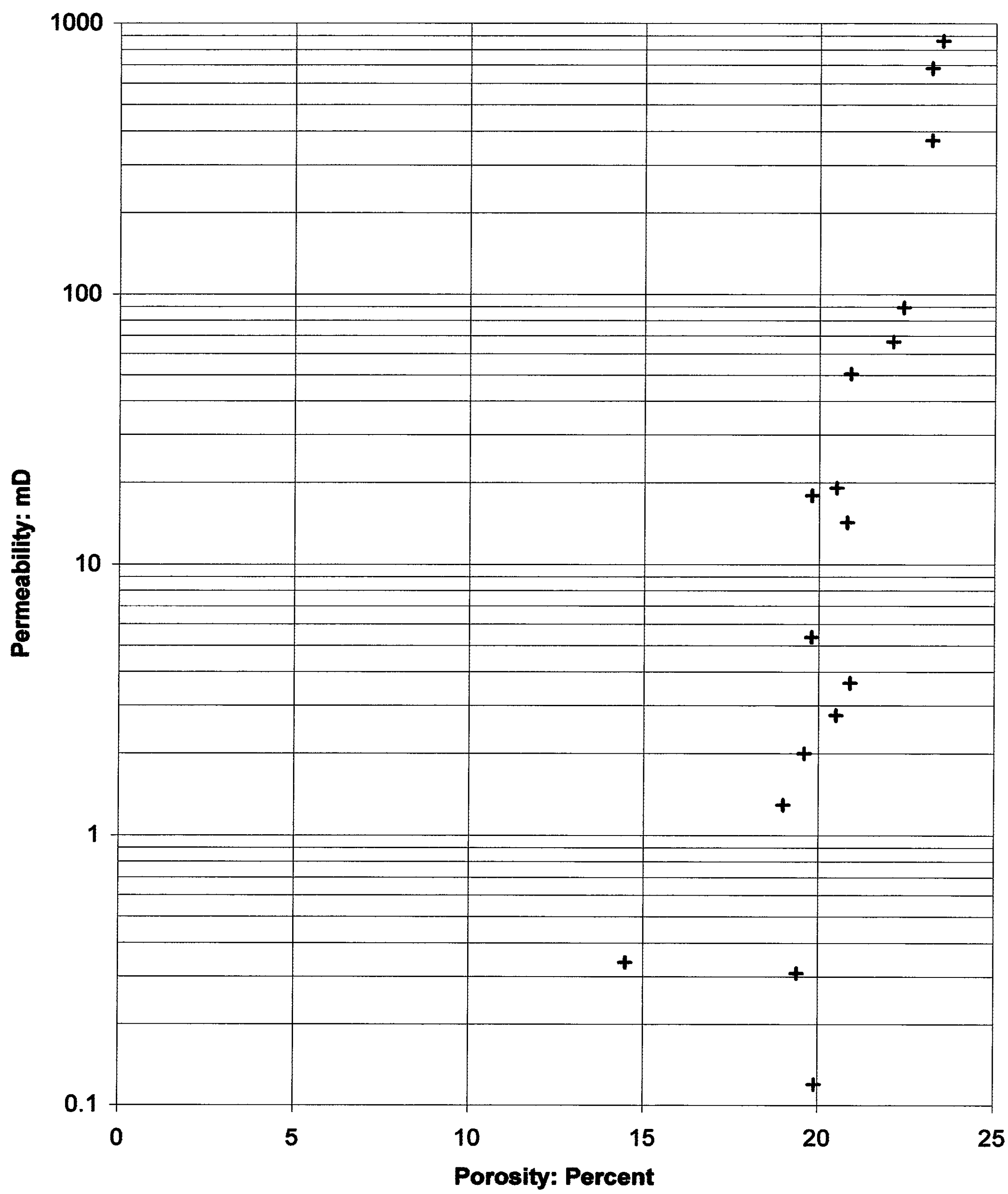


CULTUS
PETROLEUM NL

POROSITY vs PERMEABILITY

ACS
LABORATORIES
PTY. LTD.

Client: Cultus Petroleum NL
Well: Skull Creek West No.1
Depth: 1748.00m - 1768.30m



APPENDIX IV

CORE LOG PLOT

PE907582

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The enclosure PE907582 is enclosed within the container PE907581 at this location in this document.

The enclosure PE907582 has the following characteristics:

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CONTAINER_BARCODE =	PE907581
NAME =	Core Plot
BASIN =	OTWAY
PERMIT =	PPL/1
TYPE =	WELL
SUBTYPE =	WELL_LOG
DESCRIPTION =	Core Plot, 1290m-1350m, (enclosure from appendix 2b-Core Analysis Final Report- from WCR vol.1) for Skull Creek West-1
REMARKS =	
DATE_CREATED =	26/06/97
DATE_RECEIVED =	30/04/98
W_NO =	W1180
WELL_NAME =	SKULL CREEK WEST-1
CONTRACTOR =	ACS LABORATORIES PTY LTD
CLIENT_OP_CO =	CULTUS PETROLEUM NL

(Inserted by DNRE - Vic Govt Mines Dept)

PE907583

This is an enclosure indicator page.
The enclosure PE907583 is enclosed within the container PE907581 at this location in this document.

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CONTAINER_BARCODE = PE907581
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            BASIN = OTWAY
           PERMIT = PPL/1
             TYPE = WELL
          SUBTYPE = WELL_LOG
      DESCRIPTION = Core Plot, 1740m-1800m, (enclosure from
                    appendix 2b-Core Analysis Final Report-
                    from WCR vol.1) for Skull Creek West-1
          REMARKS =
     DATE_CREATED = 26/06/97
    DATE_RECEIVED = 30/04/98
             W_NO = W1180
        WELL_NAME = SKULL CREEK WEST-1
       CONTRACTOR = ACS LABORATORIES PTY LTD
     CLIENT_OP_CO = CULTUS PETROLEUM NL
```

(Inserted by DNRE - Vic Govt Mines Dept)

ACS LABORATORIES PTY LTD
A.C.N. 008 273 005
P.O. BOX 396
CHERMSIDE QLD 4032
TEL: 61 7 3350 3999

Transmittal
No: 4249

TO: Cultus Petroleum NL
Level 4, 828 Pacific Highway
GORDON NSW 2072

Date: 26-6-97
Attention: Mr Andy Ion

The accompanying documents, listed below are forwarded for your attention.
Please acknowledge their receipt by signing and returning pink copy.

Two bound (2) copies, one (1) unbound copy of Skull Creek West #1 report #U0250-02

Sent via: Ansett Air Freight
Con. Note No: A142991L
Sent on behalf of A.C.S. Pty Ltd.: Robin Holt
Date: 26-6-97
Received by:
Date:

APPENDIX 2c

CORE PHOTOGRAPHS

PE907584

This is an enclosure indicator page.
The enclosure PE907584 is enclosed within the container PE907572 at this location in this document.

The enclosure PE907584 has the following characteristics:

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CONTAINER_BARCODE =	PE907572
NAME =	Core Photo
BASIN =	OTWAY
PERMIT =	PPL/1
TYPE =	WELL
SUBTYPE =	CORE_PHOTOS
DESCRIPTION =	Core Photographs, 1290.7-1294.5m, (Appendix 2c from WCR vol.1) for Skull Creek West-1
REMARKS =	
DATE_CREATED =	
DATE_RECEIVED =	30/04/98
W_NO =	W1180
WELL_NAME =	SKULL CREEK WEST-1
CONTRACTOR =	ACS LABORATORIES PTY LTD
CLIENT_OP_CO =	CULTUS PETROLEUM NL

(Inserted by DNRE - Vic Govt Mines Dept)

PE907585

This is an enclosure indicator page.
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CONTAINER_BARCODE = PE907572
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BASIN = OTWAY
PERMIT = PPL/1
TYPE = WELL
SUBTYPE = CORE_PHOTOS
DESCRIPTION = Core Photographs, 1295.5-1299.5m, (Appendix 2c from WCR vol.1) for Skull Creek West-1
REMARKS =
DATE_CREATED =
DATE_RECEIVED = 30/04/98
W_NO = W1180
WELL_NAME = SKULL CREEK WEST-1
CONTRACTOR = ACS LABORATORIES PTY LTD
CLIENT_OP_CO = CULTUS PETROLEUM NL

(Inserted by DNRE - Vic Govt Mines Dept)

PE907586

This is an enclosure indicator page.
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The enclosure PE907586 has the following characteristics:

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            BASIN = OTWAY
           PERMIT = PPL/1
             TYPE = WELL
          SUBTYPE = CORE_PHOTOS
      DESCRIPTION = Core Photographs, 1300.5-1304.5m,
                    (Appendix 2c from WCR vol.1) for Skull
                    Creek West-1
          REMARKS =
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    DATE_RECEIVED = 30/04/98
             W_NO = W1180
        WELL_NAME = SKULL CREEK WEST-1
       CONTRACTOR = ACS LABORATORIES PTY LTD
     CLIENT_OP_CO = CULTUS PETROLEUM NL
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(Inserted by DNRE - Vic Govt Mines Dept)

PE907587

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          SUBTYPE = CORE_PHOTOS
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                    Creek West-1
          REMARKS =
     DATE_CREATED =
    DATE_RECEIVED = 30/04/98
             W_NO = W1180
        WELL_NAME = SKULL CREEK WEST-1
       CONTRACTOR = ACS LABORATORIES PTY LTD
     CLIENT_OP_CO = CULTUS PETROLEUM NL
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(Inserted by DNRE - Vic Govt Mines Dept)

PE907588

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PERMIT =	PPL/1
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DATE_RECEIVED =	30/04/98
W_NO =	W1180
WELL_NAME =	SKULL CREEK WEST-1
CONTRACTOR =	ACS LABORATORIES PTY LTD
CLIENT_OP_CO =	CULTUS PETROLEUM NL

(Inserted by DNRE - Vic Govt Mines Dept)

PE907589

This is an enclosure indicator page.
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           SUBTYPE = CORE_PHOTOS
       DESCRIPTION = Core Photographs, 1752.2-1756.5m,
                     (Appendix 2c from WCR vol.1) for Skull
                     Creek West-1
           REMARKS =
      DATE_CREATED =
     DATE_RECEIVED = 30/04/98
              W_NO = W1180
         WELL_NAME = SKULL CREEK WEST-1
        CONTRACTOR = ACS LABORATORIES PTY LTD
      CLIENT_OP_CO = CULTUS PETROLEUM NL
```

(Inserted by DNRE - Vic Govt Mines Dept)

PE907590

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            BASIN = OTWAY
           PERMIT = PPL/1
             TYPE = WELL
          SUBTYPE = CORE_PHOTOS
      DESCRIPTION = Core Photographs, 1757.5-1761.5m,
                    (Appendix 2c from WCR vol.1) for Skull
                    Creek West-1
          REMARKS =
     DATE_CREATED =
    DATE_RECEIVED = 30/04/98
             W_NO = W1180
        WELL_NAME = SKULL CREEK WEST-1
       CONTRACTOR = ACS LABORATORIES PTY LTD
     CLIENT_OP_CO = CULTUS PETROLEUM NL
```

(Inserted by DNRE - Vic Govt Mines Dept)

PE907591

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BASIN =	OTWAY
PERMIT =	PPL/1
TYPE =	WELL
SUBTYPE =	CORE_PHOTOS
DESCRIPTION =	Core Photographs, 1762.5-1765.5m, (Appendix 2c from WCR vol.1) for Skull Creek West-1
REMARKS =	
DATE_CREATED =	
DATE_RECEIVED =	30/04/98
W_NO =	W1180
WELL_NAME =	SKULL CREEK WEST-1
CONTRACTOR =	ACS LABORATORIES PTY LTD
CLIENT_OP_CO =	CULTUS PETROLEUM NL

(Inserted by DNRE - Vic Govt Mines Dept)

PE907592

This is an enclosure indicator page.
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                    for Skull Creek West-1
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             W_NO = W1180
        WELL_NAME = SKULL CREEK WEST-1
       CONTRACTOR = ACS LABORATORIES PTY LTD
     CLIENT_OP_CO = CULTUS PETROLEUM NL
```

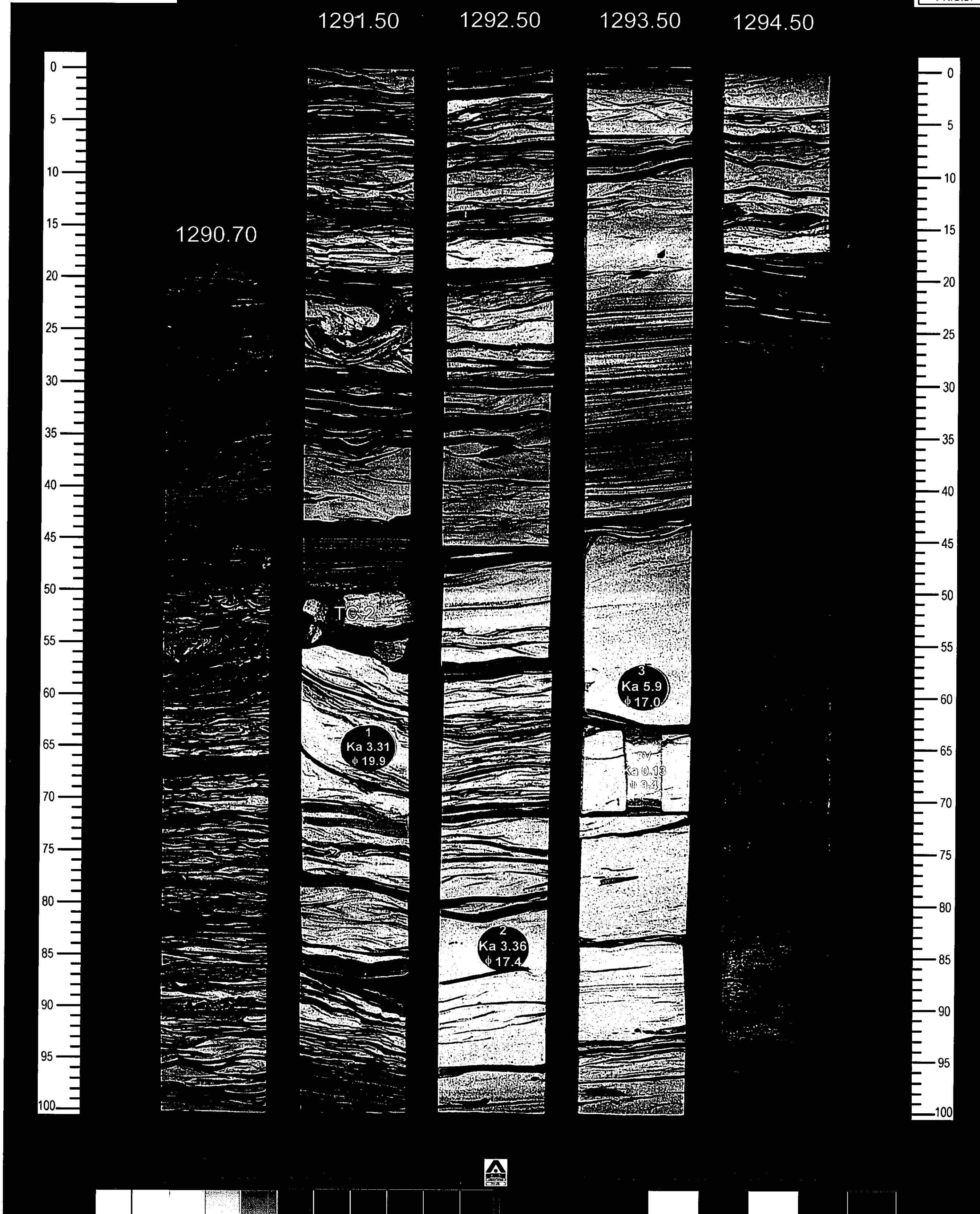
(Inserted by DNRE - Vic Govt Mines Dept)

CULTUS
PETROLEUM NL

SKULL CREEK WEST No.1

CORE No. 1 & 2

ACS
LABORATORIES
PTY. LTD.



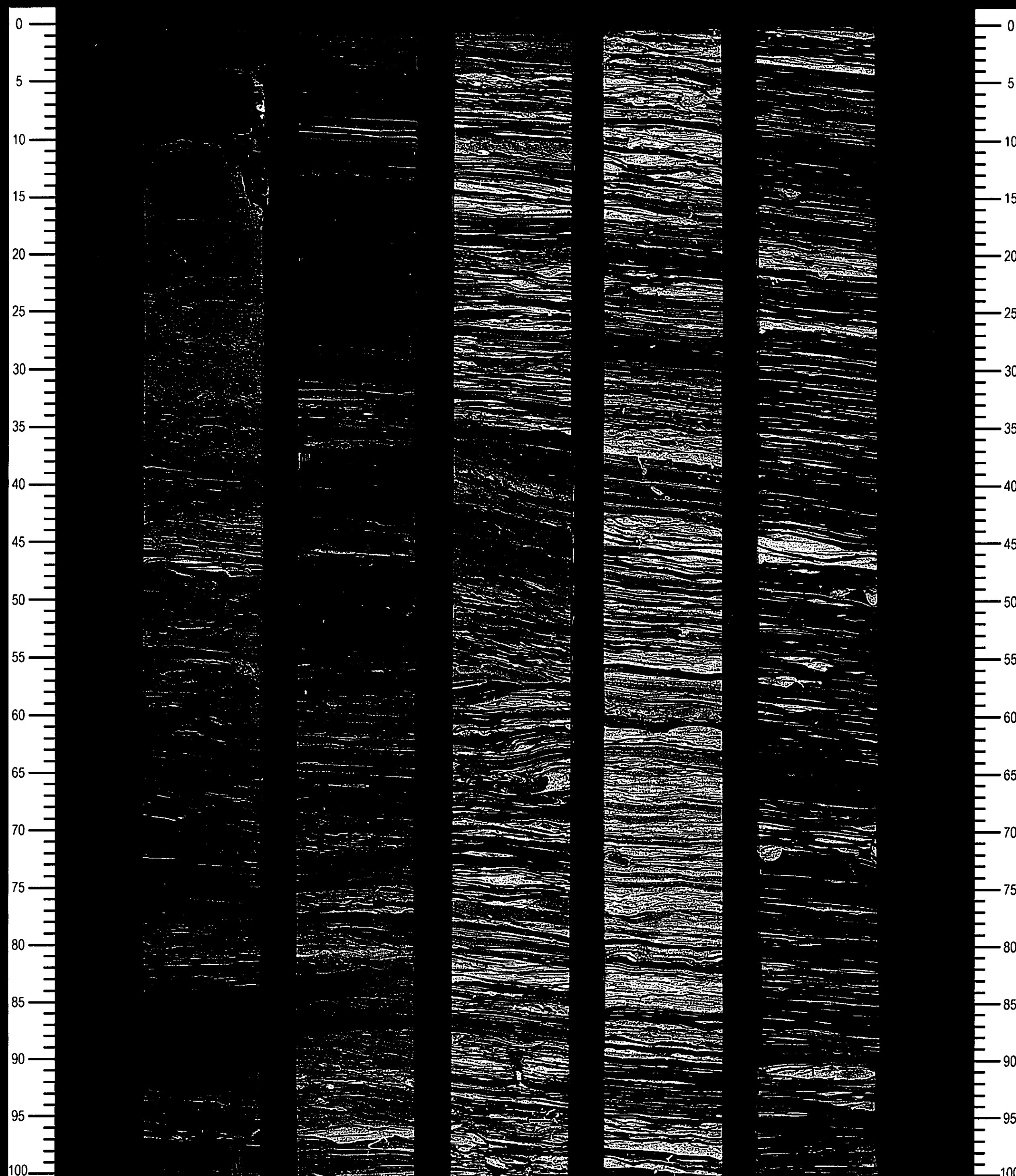
CULTUS PETROLEUM NL

SKULL CREEK WEST No.1

CORE No. 2

ACS LABORATORIES PTY. LTD.

1295.50 1296.50 1297.50 1298.50 1299.50



CULTUS PETROLEUM NL

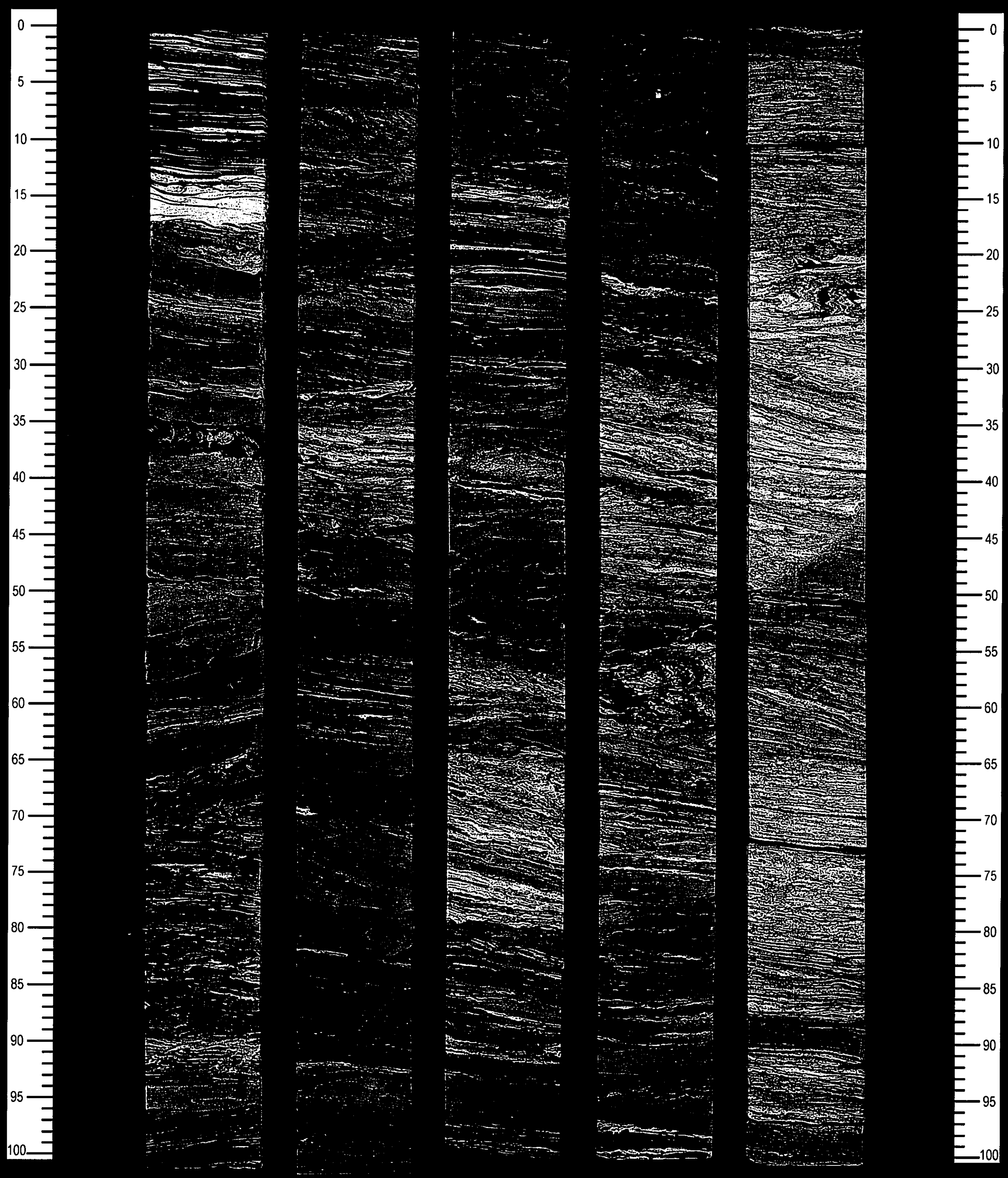
SKULL CREEK WEST No.1

CORE No. 2

ACS LABORATORIES PTY. LTD.

DEPT. NAT. RES & ENV PE907586

1300.50	1301.50	1302.50	1303.50	1304.50

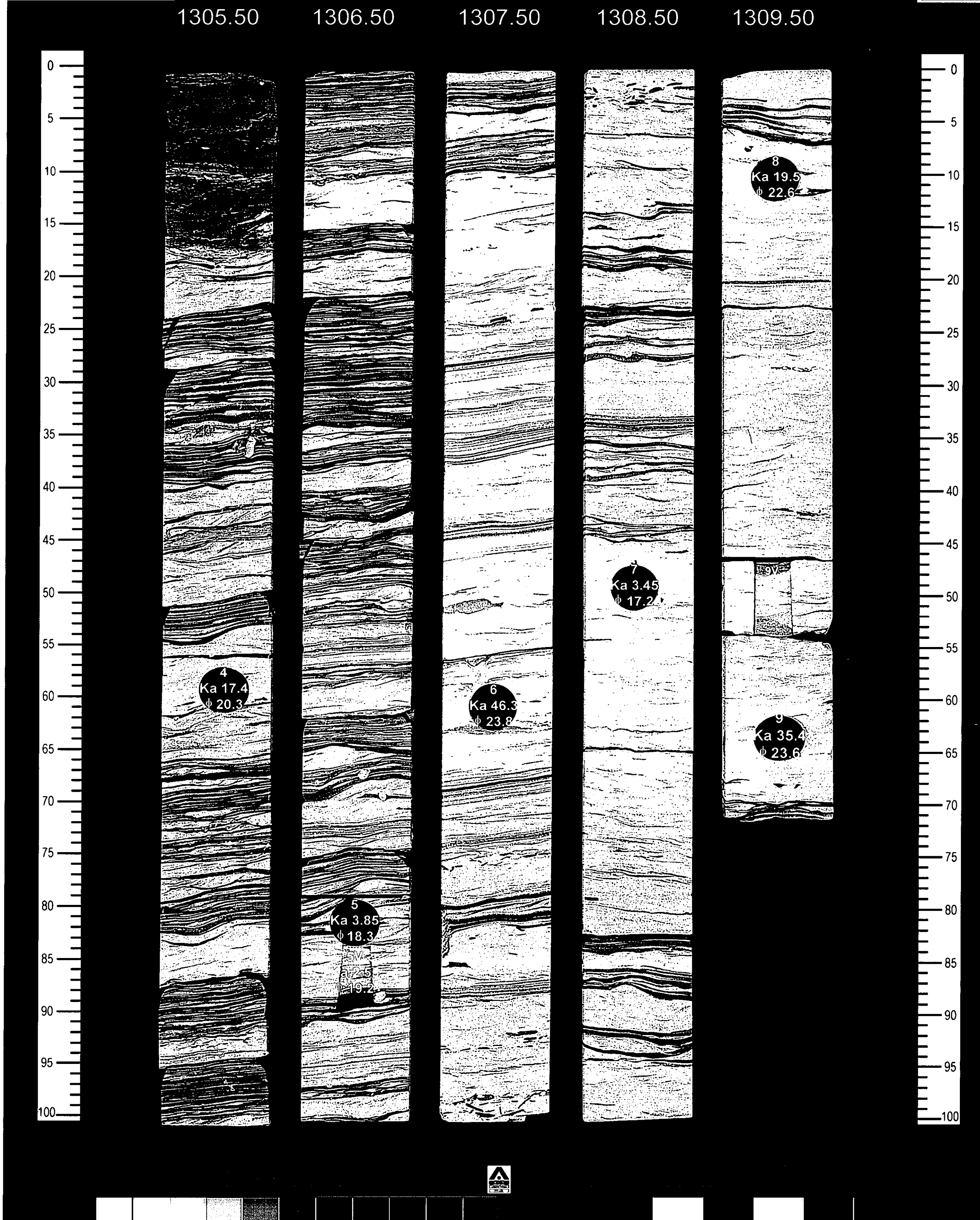


CULTUS
PETROLEUM NL

SKULL CREEK WEST No.1

CORE No.2

ACS
LABORATORIES
PTY. LTD.

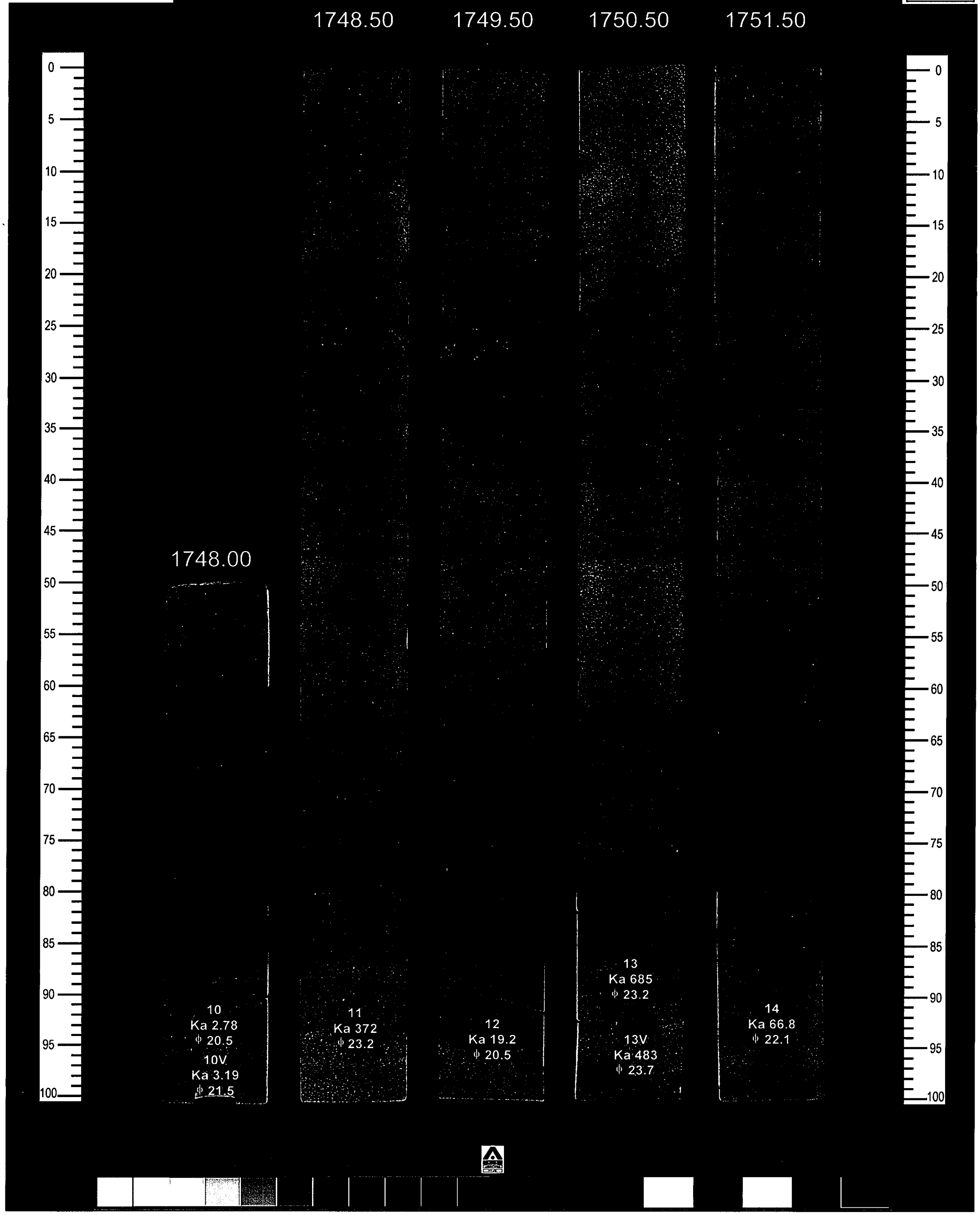


CULTUS
PETROLEUM NL

SKULL CREEK WEST No.1

CORE No.3

ACS
LABORATORIES
PTY. LTD.



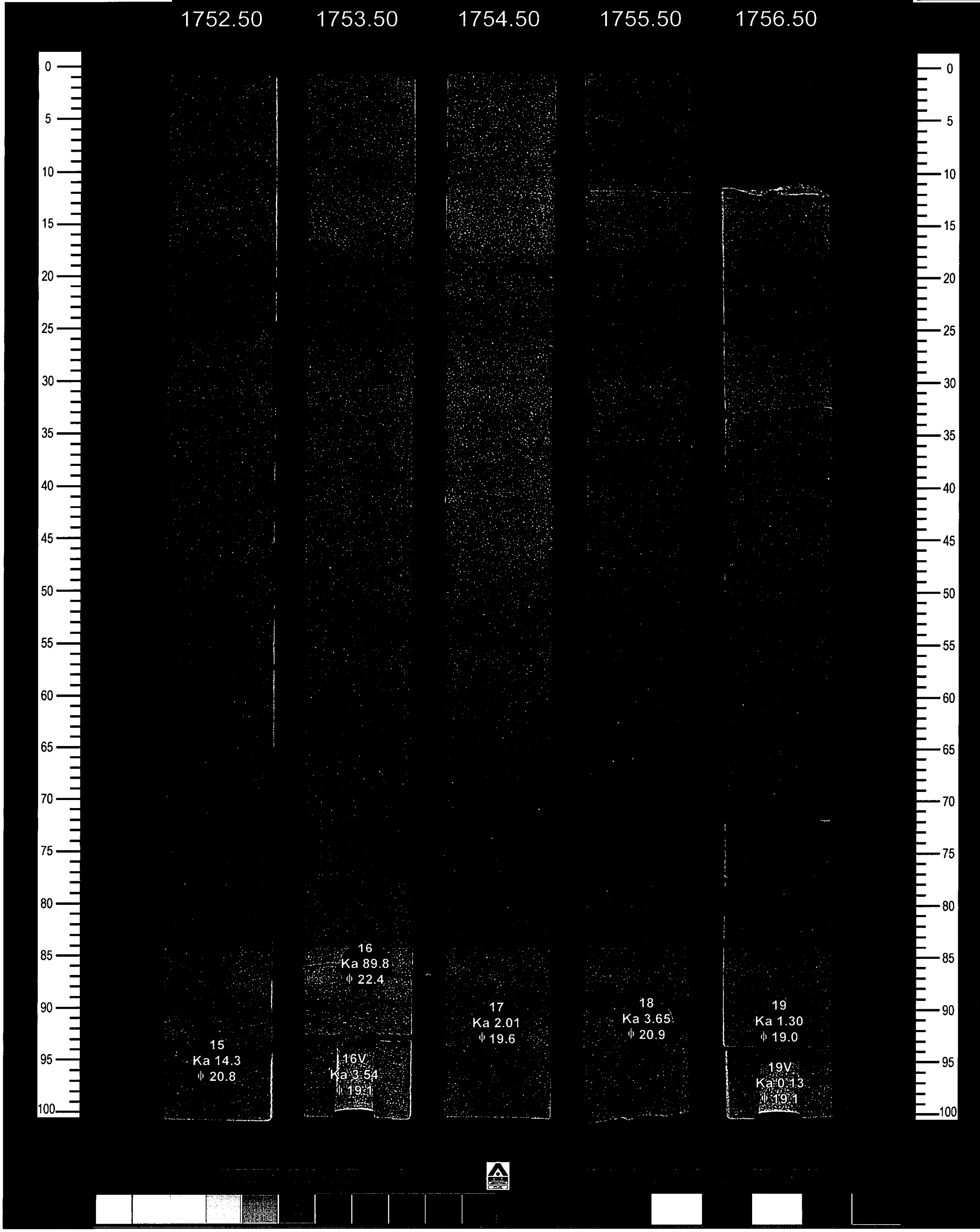
CULTUS
PETROLEUM NL

SKULL CREEK WEST No.1

CORE No. 3

ACS
LABORATORIES
PTY. LTD.

DEPT. NAT. RES & ENV
PE907589



CULTUS
PETROLEUM NL

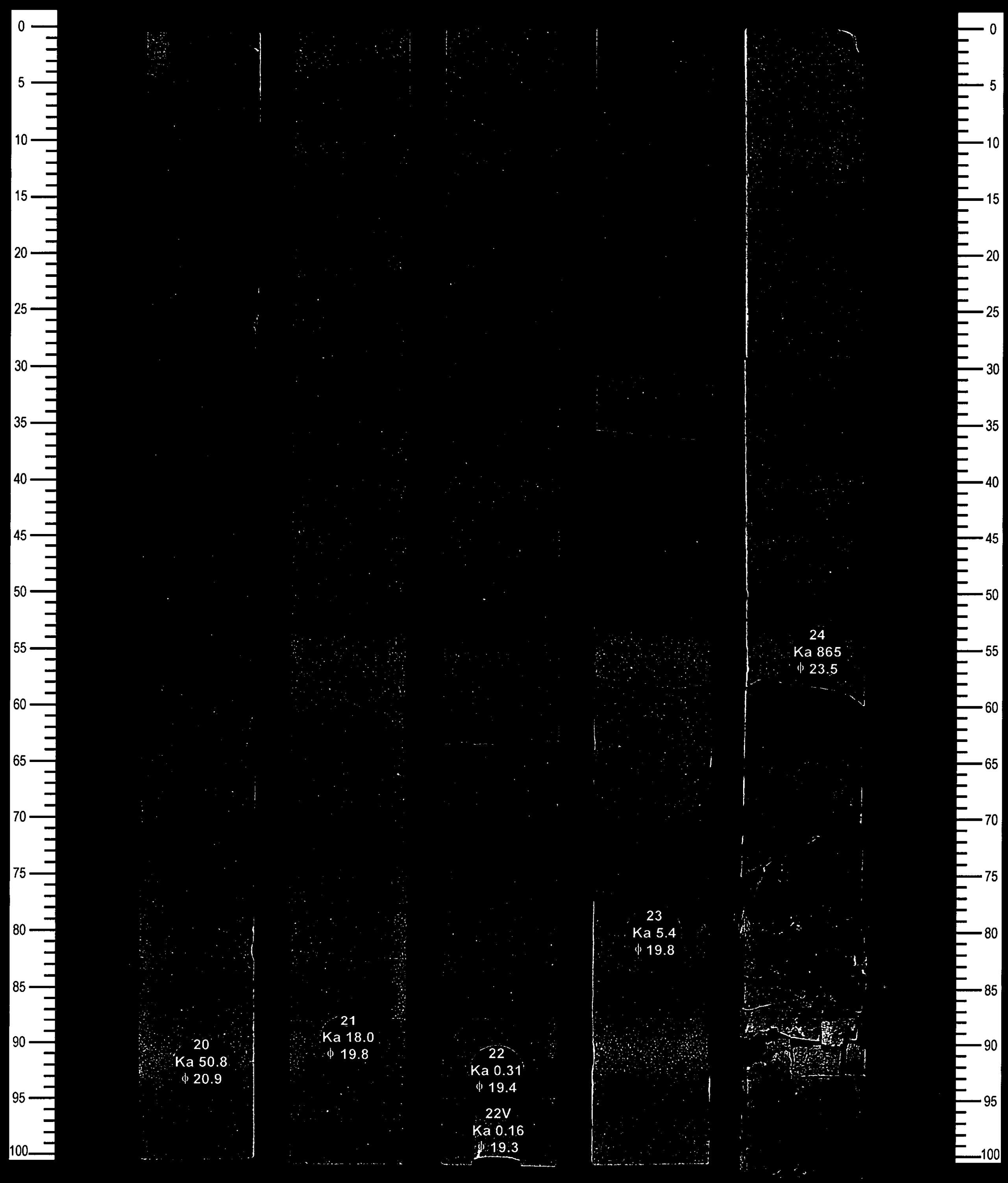
SKULL CREEK WEST No.1

CORE No. 3

ACS
LABORATORIES
PTY. LTD.

DEPT. NAT. RES & ENV
PE907590

1757.50	1758.50	1759.50	1760.50	1761.50



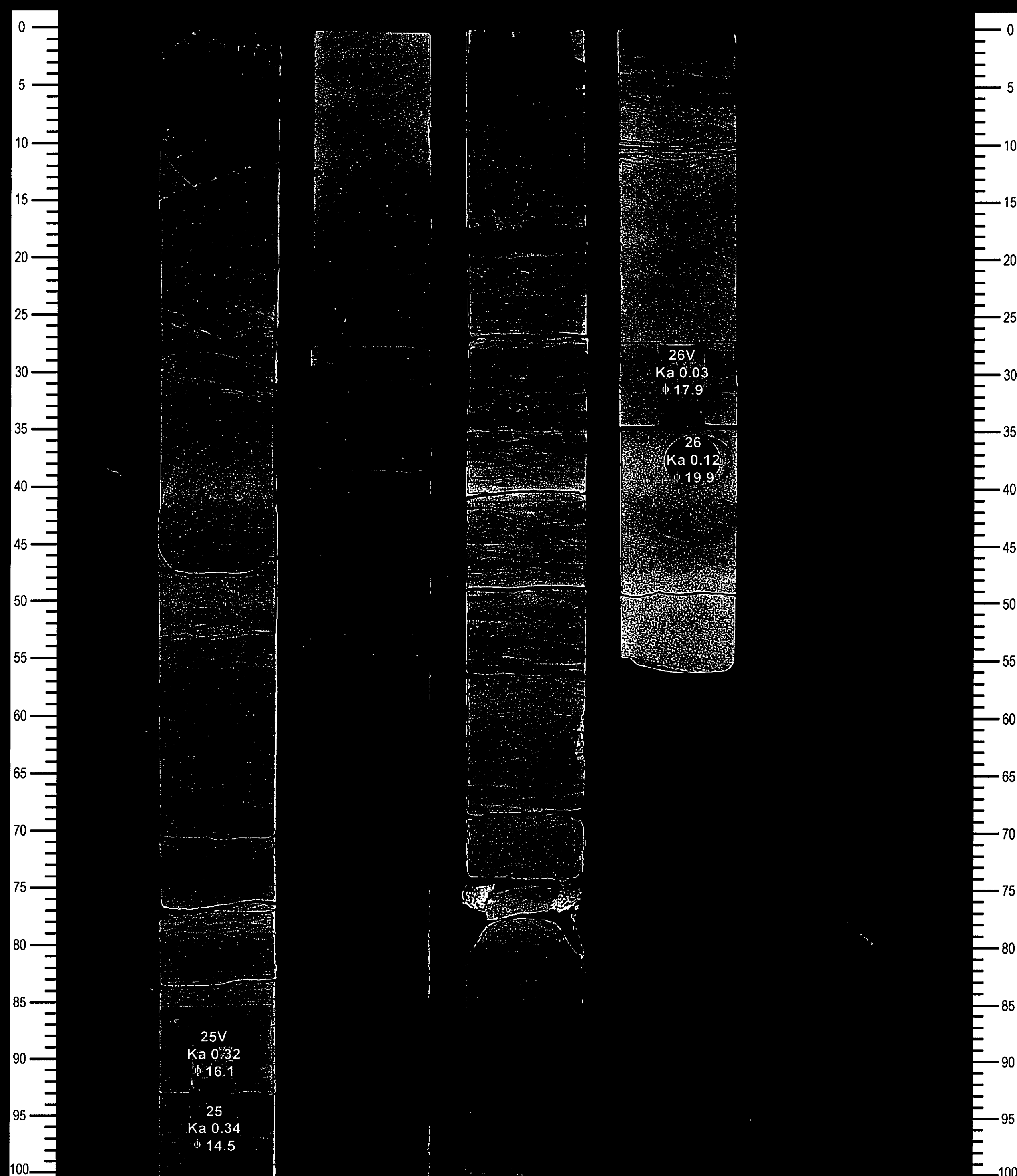
CULTUS PETROLEUM NL

SKULL CREEK WEST No.1

CORE No.3

ACS LABORATORIES PTY. LTD.

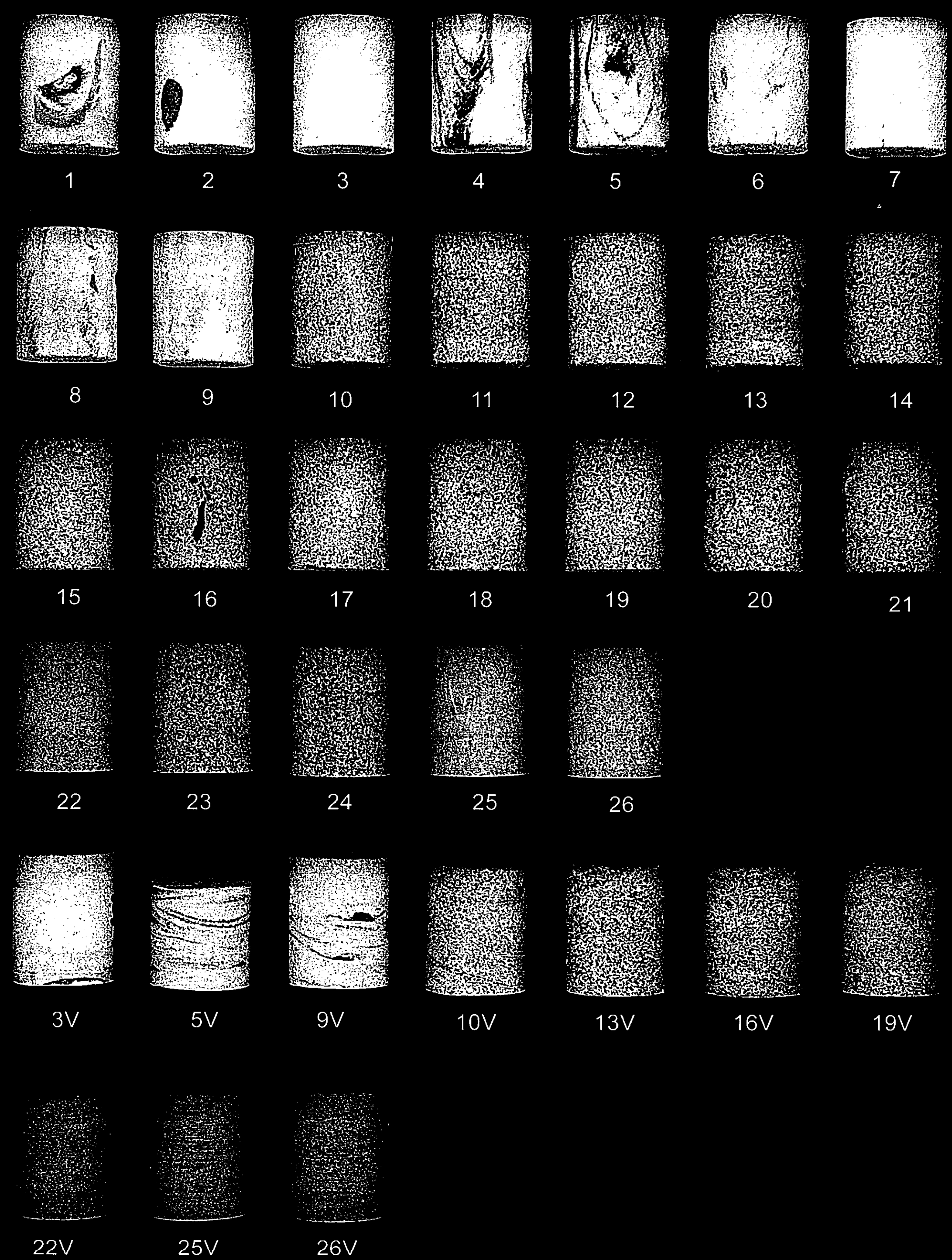
1762.50 1763.50 1764.50 1765.50



CULTUS
PETROLEUM NL

SKULL CREEK WEST No.1

ACS
LABORATORIES
PTY. LTD.



APPENDIX 2d

SPECIAL CORE ANALYSIS REPORT

APPENDIX 2d

SPECIAL CORE ANALYSIS REPORT

ACS
LABORATORIES
PTY. LTD.

SPECIAL CORE ANALYSIS FINAL REPORT

of

SKULL CREEK WEST 1

for

CULTUS PETROLEUM NL

by

ACS LABORATORIES PTY LTD

16 September, 1997

ACS LABORATORIES PTY. LTD.

Cultus Petroleum NL
Level 4
828 Pacific Highway
GORDON NSW 2072

Attention: Andy Ion

REPORT: 0386-08

CLIENT REFERENCE:	Purchase Order 10402
MATERIAL:	Core Plugs
LOCALITY:	Skull Creek West 1
WORK REQUIRED:	Special Core Analysis

Please direct technical enquiries regarding this work to the signatories below under whose supervision the work was carried out.

KEVIN H FLYNN
Manager
Special Core Analysis & Geological Services

ANTHONY M DRAKE
Laboratory Supervisor
Special Core Analysis

Brisbane Laboratory: P.O. Box 396, Chermside Qld 4032, Australia
☎: 61 7 3350 1222 Facsimile: 3359 0666
E-mail: acs.bris@acslabs.com.au
ACS Laboratories Pty Ltd
ACN: 008 273 005

CONTENTS

CONTENTS (cont.)

CHAPTER 1

INTRODUCTION

1. INTRODUCTION

This final report presents the results from a special core analysis study of the Skull Creek West 1 core. The samples utilised were 1½ inch diameter core plugs, originally drilled for a routine core analysis study (performed by ACS Laboratories) on the same well.

A facsimile was presented by Cultus Petroleum NL on 14 February 1997 detailing a special core analysis study. Following discussions between Cultus Petroleum and ACS Laboratories, the test program was developed to that presented in summary format in Chapter 2 of this report. The subsequent chapters encompass descriptions of procedures and test results. The Appendices include ancillary information pertinent to the study.

CHAPTER 2

SUMMARY OF TEST PROGRAM

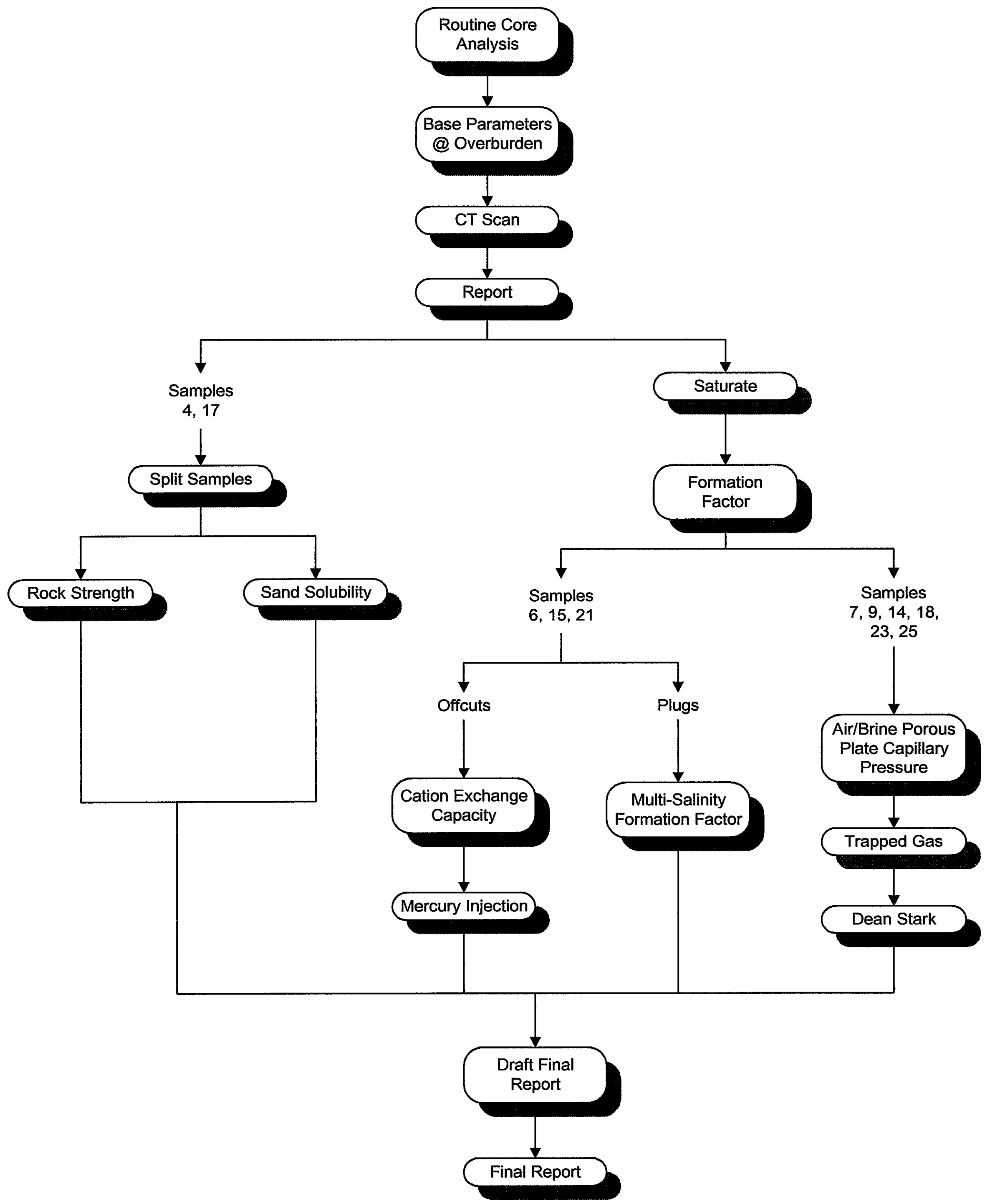
TEST SCHEDULE

Company: Cultus Petroleum NL
Well: Skull Creek West 1

F = failed
C = cancelled

Sample	Well	Depth (metres)	Test Sequence: Ø & K @ OB	CT Scan	FRF	FRI & Pc @ OB	CEC (Offcuts)	Co/Cw	Hg Inj (Offcuts)	Trapped Gas	Rock Strength	Sand Solubility	Mud Leakoff & Regain
4	Skull Creek West 1	1306.08	4	4							4	4	
6	Skull Creek West 1	1308.10	6	6	6		6	6	6				
7	Skull Creek West 1	1308.99	7	7	7	7				7			
9	Skull Creek West 1	1310.14	9	9	9	F							C
14	Skull Creek West 1	1752.42	14	14	14	14				14			
15	Skull Creek West 1	1753.44	15	15	15		15	15	15				
17	Skull Creek West 1	1755.41	17	17							17	17	
18	Skull Creek West 1	1756.40	18	18	18	18				18			C
21	Skull Creek West 1	1759.39	21	21	21		21	21	21				
23	Skull Creek West 1	1761.29	23	23	23	23				23			
25	Skull Creek West 1	1763.47	25	25	25	25				25			

FLOW CHART



Routine Core Analysis
Base Parameters @ Overburden
CT Scan
Report
Samples 4, 17
Saturate
Split Samples
Formation Factor
Rock Strength
Sand Solubility
Samples 6, 15, 21
Samples 7, 9, 14, 18, 23, 25
Offcuts
Plugs
Air/Brine Porous Plate Capillary Pressure
Cation Exchange Capacity
Multi-Salinity Formation Factor
Trapped Gas
Mercury Injection
Dean Stark
Draft Final Report
Final Report

CHAPTER 3

SAMPLE PREPARATION AND BASE PARAMETER DETERMINATIONS

3. SAMPLE PREPARATION AND BASE PARAMETER DETERMINATIONS

3.1 Test and Calculation Procedures

As ACS Laboratories performed a routine core analysis study on the subject samples, the porosity and permeability had previously been determined at ambient conditions. These values were utilised to determine the porosity and permeability at overburden conditions.

3.1.1 Porosity

The samples were placed into a thick walled rubber sleeve and the assembly loaded into a hydrostatic cell. With an ambient pressure applied (400 psi) to the sample, helium held at 100 psi reference pressure was released into the sample's pore volume. The confining pressure was then increased to the overburden pressures of 2550 psi (Top Eumeralla) and 3345 psi (Bottom Eumeralla). The resultant pressure change in internal pore pressure was monitored and used to determine pore volume at overburden conditions.

$$\textit{Ambient Porosity \%} = \frac{PV}{BV} x\,100\%$$

$$\textit{Overburden Porosity \%} = \frac{PV - \Delta PV}{BV - \Delta PV} x\,100\%$$

where PV = *ambient pore volume*
BV = *ambient bulk volume*

3.1.2 Permeability to Air

Samples were placed into a hydrostatic cell (Appendix IV) with an overburden pressure of either 2550 or 3345 psi applied. To determine permeability a known air pressure was applied to the upstream face of each sample, creating a flow of air through the core plug. Air permeability for each core sample was calculated using Darcy's Law through knowledge of the upstream pressure, flow rate, viscosity of air and sample dimensions.

$$Ka = \frac{2000.BP.\mu.q.L}{(P_1^2 - P_2^2).A}$$

where Ka = *air permeability (milliDarcy's)*
BP = *barometric pressure (atmospheres)*
μ = *gas viscosity (cP)*
q = *flow rate (cm³/s)*
L = *sample length (cm)*

P_1	=	*upstream pressure (atmospheres)*
P_2	=	*downstream pressure (atmospheres)*
A	=	*sample cross sectional area (cm^2)*

3.1.3 CT Scanning

CT Scanning was undertaken in order that internal inhomogeneities and/or drilling fluid invasion zones may be noted. Typical inhomogeneities may be clasts, bedding sedimentary structures, cementation, fractures and any other discontinuities that may not be readily visible to the naked eye.

The principle of CT Scanning and its applications is presented by Hove et al, 1987 and Wellington and Vinegar, 1987.

CT Scanners generate cross-sectional image slices through the sample by revolving an X-ray tube around the sample and obtaining projections at many different angles (Appendix IV). From these image slices, a cross-sectional image was reconstructed by a back projection algorithm in the scanner's computer.

Prior to analysis, arbitrary orientation lines were inscribed onto the sample using a permanent marker to facilitate subsequent re-orientation. The sample was placed longitudinally within the scanner, with the 'horizontal' orientation mark uppermost, and an axial section image (longitudinal) obtained. The sample was then rotated through exactly 90° and another axial section image recorded. These two images were labelled '0' and '90' on the prints. The CT Scans generated are reported in Appendix II of this report.

CHAPTER 3

SAMPLE PREPARATION AND BASE PARAMETER DETERMINATIONS

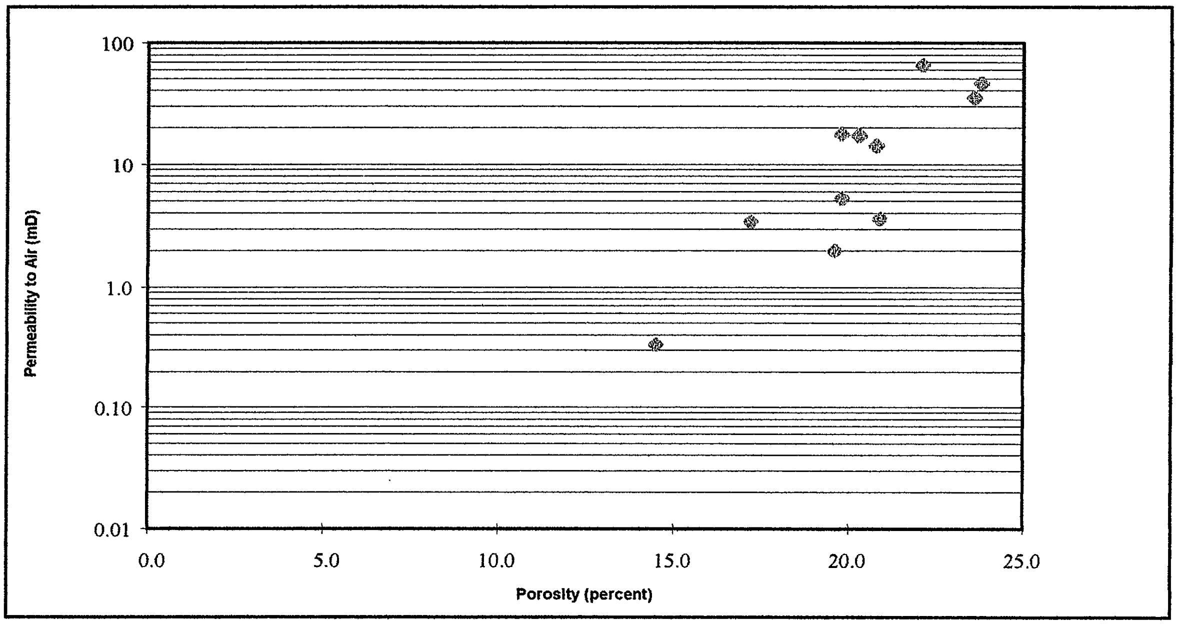
3.2 Test Results

POROSITY AND AIR PERMEABILITY

Company Cultus Petroleum NL
Well Skull Creek West 1

Ambient

Sample Number	Depth (metres)	Permeability to Air (milliDarcy's)	Porosity (percent)	Grain Density (g/cm^3)
4	1306.08	17	20.3	2.69
6	1308.10	46	23.8	2.66
7	1308.99	3.5	17.2	2.66
9	1310.14	35	23.6	2.66
14	1752.42	67	22.1	2.67
15	1783.44	14	20.8	2.66
17	1755.41	2.0	19.6	2.67
18	1756.40	3.7	20.9	2.66
21	1759.39	18	19.8	2.67
23	1761.29	5.4	19.8	2.67
25	1763.47	0.34	14.5	2.62

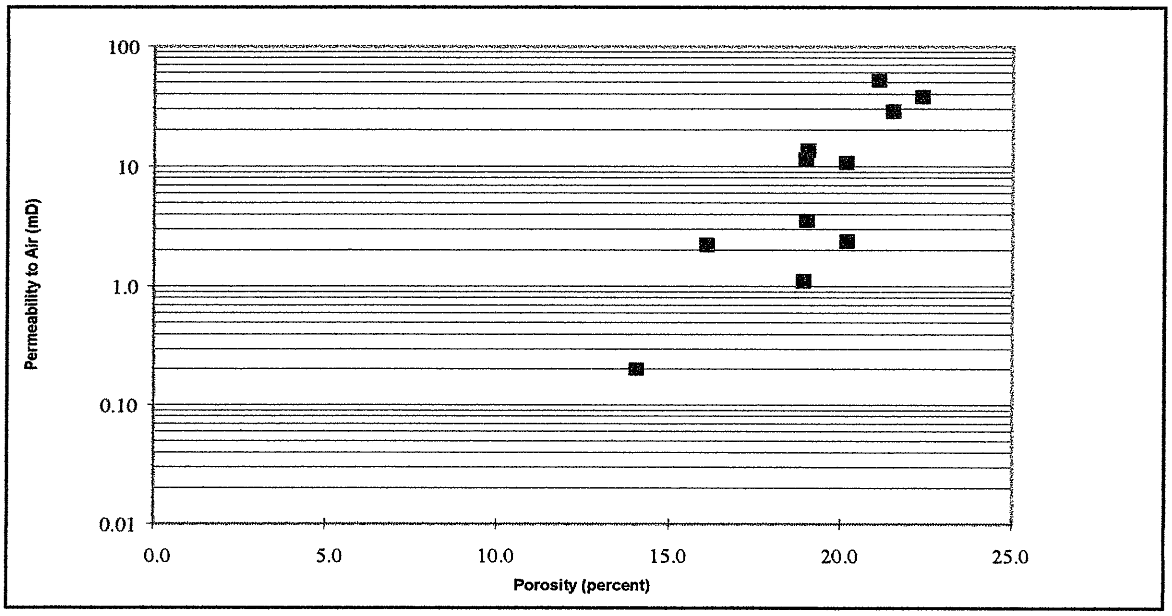


POROSITY AND AIR PERMEABILITY

Company Cultus Petroleum NL
Well Skull Creek West 1

Overburden 2550 & 3345 psi

Sample Number	Depth (metres)	Permeability to Air (milliDarcy's)	Porosity (percent)	Grain Density (g/cm^3)
4	1306.08	12	19.0	2.69
6	1308.10	38	22.4	2.66
7	1308.99	2.2	16.1	2.66
9	1310.14	29	21.5	2.66
14	1752.42	52	21.1	2.67
15	1783.44	11	20.1	2.66
17	1755.41	1.1	18.9	2.67
18	1756.40	2.4	20.2	2.66
21	1759.39	14	19.0	2.67
23	1761.29	3.5	19.0	2.67
25	1763.47	0.20	14.1	2.62



PE907593

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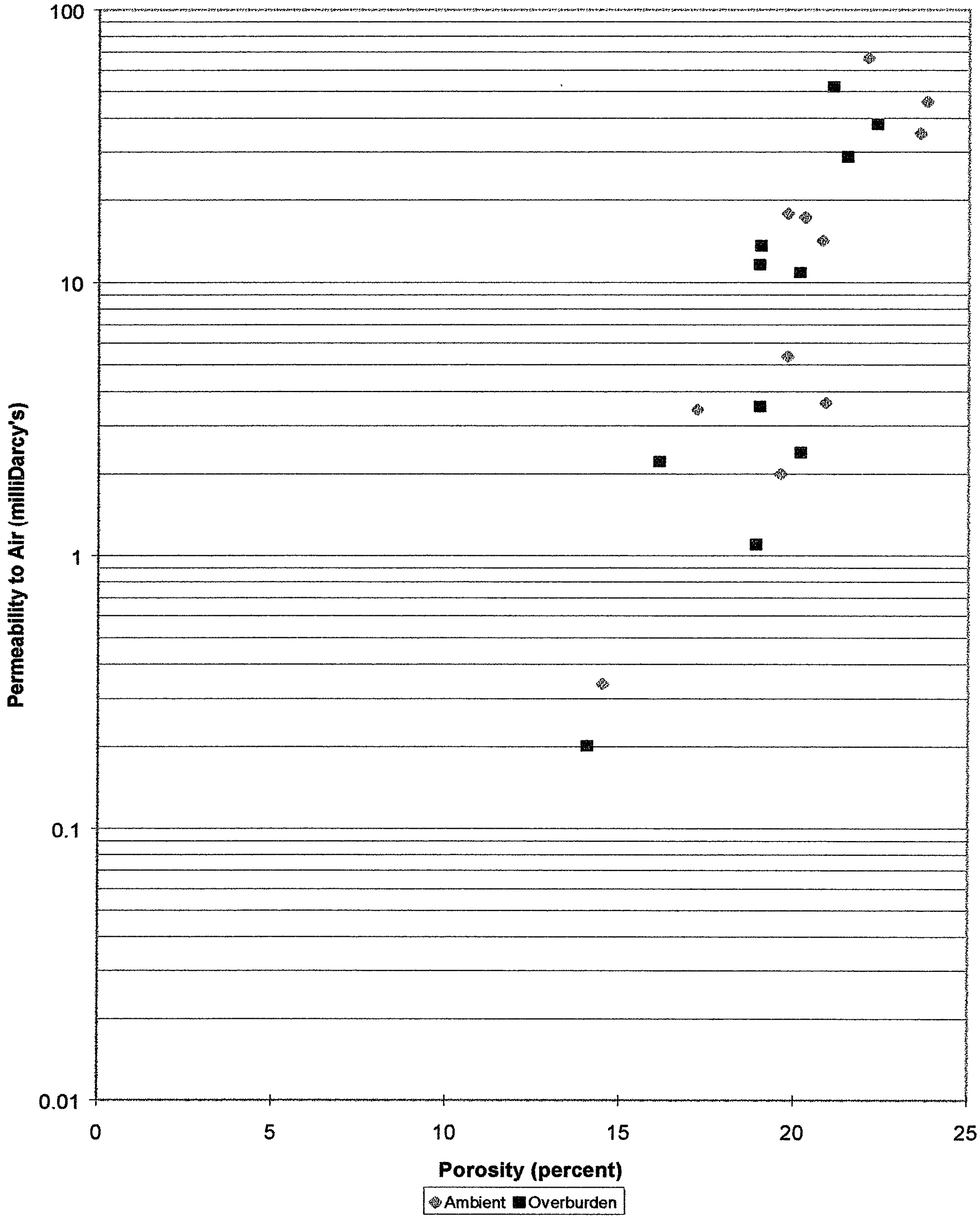
BASIN = OTWAY
PERMIT = PPL/1
TYPE = WELL
SUBTYPE = DIAGRAM
DESCRIPTION = Porosity vs. Permeability Plot (enclosure from appendix 2d of WCR vol.1) for Skull Creek West-1
REMARKS =
DATE_CREATED =
DATE_RECEIVED = 30/04/98
W_NO = W1180
WELL_NAME = SKULL CREEK WEST-1
CONTRACTOR = ACS LABORATORIES PTY LTD
CLIENT_OP_CO = CULTUS PETROLEUM NL

(Inserted by DNRE - Vic Govt Mines Dept)

POROSITY vs PERMEABILITY

Company: Cultus Petroleum NL
Well: Skull Creek West 1



CHAPTER 4

FORMATION RESISTIVITY FACTOR

4.1 Test and Calculation Procedures

4. FORMATION RESISTIVITY FACTOR

4.1 Test and Calculation Procedures

Samples were initially vacuum saturated with synthetic formation brine (Appendix I) followed by pressure saturation at 2000 psi for a minimum of 12 hours to ensure complete saturation. To verify this, the pore volume of each sample was ascertained by mass balance and compared with that of porosimetry.

Samples were placed on the cell electrodes with a thin silver leaf between the plug end-faces and electrode, to ensure electrical contact. A strongly hydrophilic membrane was placed at the bottom end of the sample for capillary pressure analyses. This assembly was then loaded into a hydrostatic type core holder (Appendix IV). A pressure of 2550 psi (samples 6 - 9) and 3345 psi (samples 14 - 25) was applied as an effective overburden pressure.

As brine slowly flowed through each sample (1 cc/min), a resistivity digi-bridge capable of measuring resistance to 0.001 accuracy, was connected across the assembly. In each case the frequency was selected to yield a minimum phase angle, thus ensuring maximum electrical contact between each sample and the current carrying and potential electrode. Values of sample resistance (Rc) and effluent brine resistivity (Rw) were recorded daily.

From these stable data, the following results were recorded:

$$Ro = \frac{A / L \times Rc}{100}$$

where
Ro = *sample resistivity (ohm-metres)*
Rc = *sample resistance (ohms)*
L = *electrode gap (sample length - cm)*
A = *sample cross sectional area (cm^2)*

Each sample was deemed to be fully saturated and at ionic equilibrium when three consecutive readings of Ro were recorded within 1%.

Formation factor was calculated using the following equations:

$$FF = \frac{a}{\phi^m} \quad \text{and} \quad FF = \frac{Ro}{Rw}$$

where
FF = *formation resistivity factor*
a = *intercept (assumed = 1)*
ϕ = *porosity (fraction)*
m = *cementation exponent*

There appears to be two distinct lithological groups and subsequent m values within this suite of samples (ie, 6 - 9 and 25, and 14 - 23). Separate average m values have been determined for each group as identified by lines of best fit on FF graphs.

CHAPTER 4

FORMATION RESISTIVITY FACTOR

4.2 Test Results

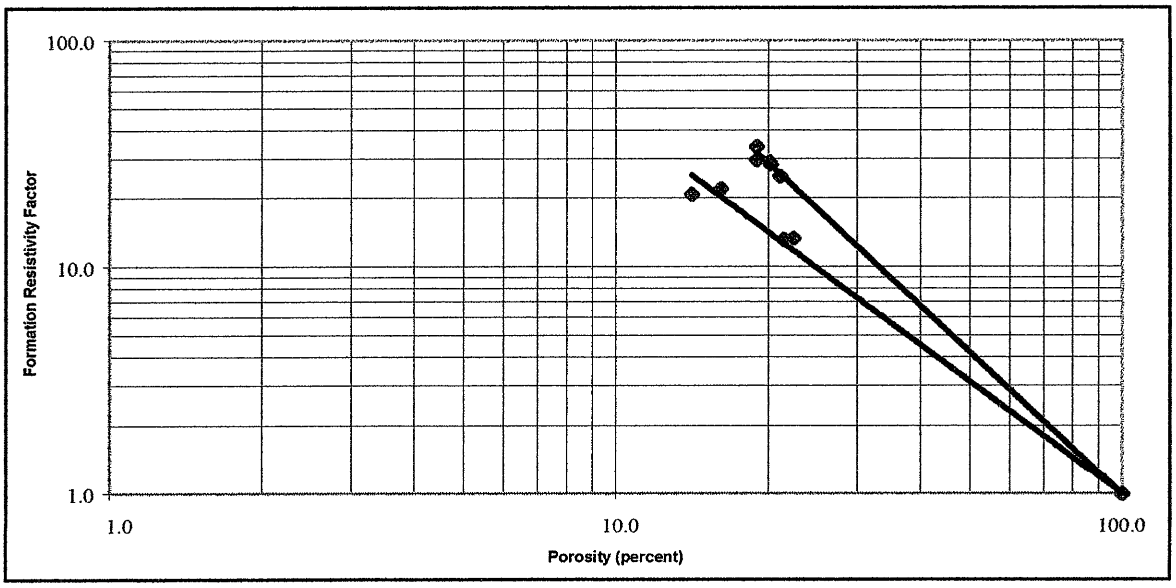
FORMATION RESISTIVITY FACTOR

Company Cultus Petroleum NL
Well Skull Creek West 1

Rw of Saturant 0.46 at 25°C
Overburden 2550 & 3345 psi

Average m 1.66 and 2.09

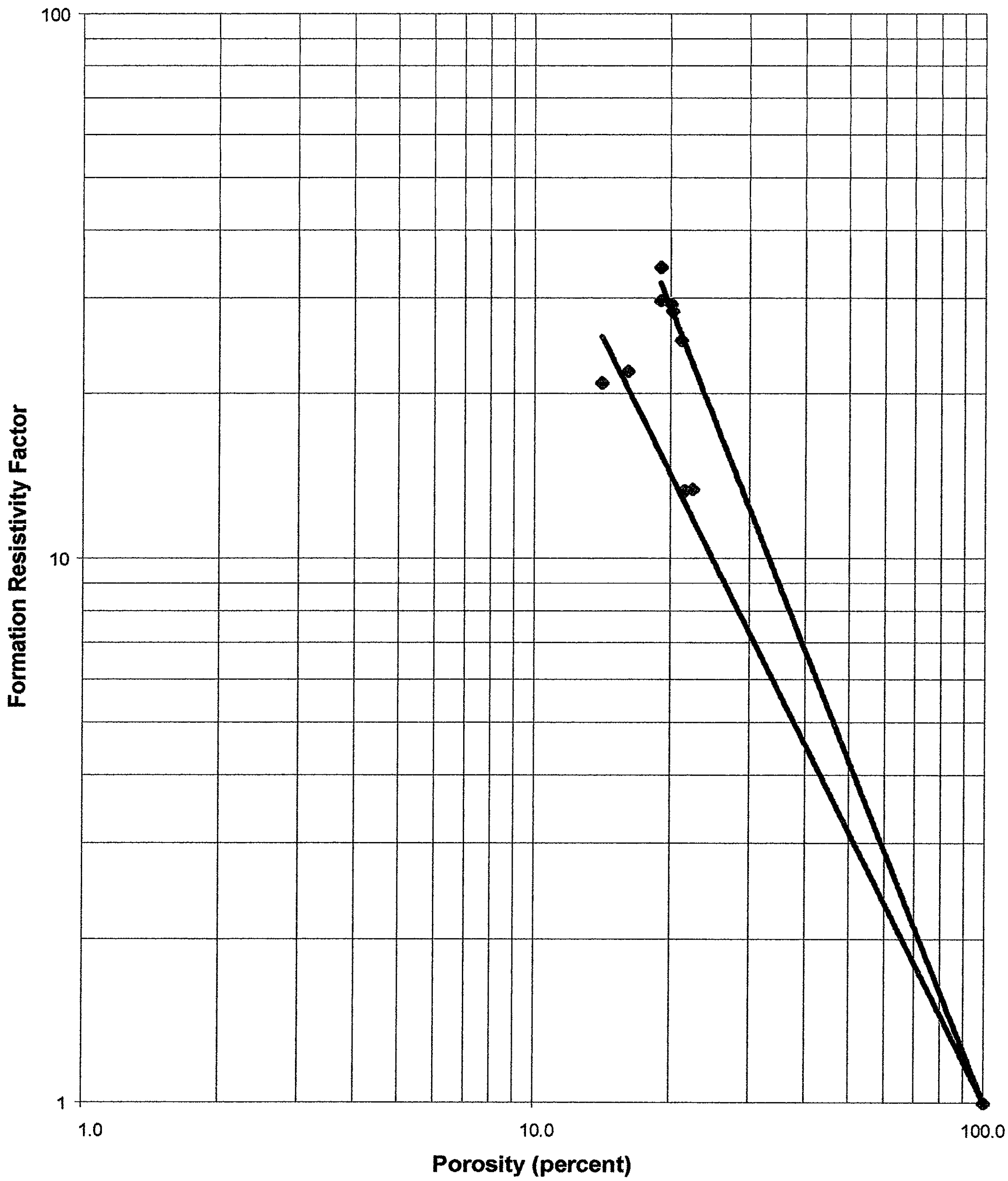
Sample Number	Depth (metres)	Permeability to Air (milliDarcy's)	Porosity (percent)	Formation Factor FF	Cementation Exponent m
6	1308.10	38	22.4	13.4	1.73
7	1308.99	2.2	16.1	22.0	1.69
9	1310.14	29	21.5	13.3	1.68
14	1752.42	52	21.1	25.1	2.07
15	1783.44	11	20.1	29.3	2.11
18	1756.40	2.4	20.2	28.4	2.09
21	1759.39	14	19.0	29.7	2.04
23	1761.29	3.5	19.0	34.2	2.13
25	1763.47	0.20	14.1	21.0	1.55



FORMATION RESISTIVITY FACTOR

Company: Cultus Petroleum NL
Well: Skull Creek West 1

Overburden Pressure: 2550 & 3345 psi
Average m: 1.66 and 2.09



CHAPTER 5

MULTI-SALINITY RESISTIVITY ANALYSES

5.1 Test and Calculation Procedures

5. MULTI-SALINITY RESISTIVITY ANALYSES

5.1 Test and Calculation Procedures

On completion of formation resistivity factor, a series of brines of various salinities (therefore conductivities) were flowed through selected samples (6, 15 and 21) in the following sequence: 5,500 ppm; 20,000 ppm; 50,000 ppm; 100,000 ppm and 150,000 ppm. Each sample was connected in turn to a resistivity digi-bridge capable of measuring sample resistance to 0.001 accuracy. In each case the current frequency was selected to yield a minimum phase angle, thus ensuring maximum electrical contact between each sample and the current carrying and potential electrode. Values of sample resistance (Rc) and effluent brine resistivity (Rw) were recorded daily. Each sample was deemed to be at ionic equilibrium when three consecutive readings were recorded within 1%.

$$Ro = \frac{Rc \times A}{EL \times 100}$$

where	*Ro*	=	*resistance of fully brine saturated sample (ohm-m)*
	Rc	=	*resistivity of fully brine saturated sample (ohm)*
	A	=	*sample cross sectional area (cm^2)*
	EL	=	*electrode gap, sample length (cm)*
	100	=	*units conversion*

also, $$Co = \frac{1}{Ro}$$

where Co = *conductivity of fully brine saturated sample (m.mho)*

and, $$Cw = \frac{1}{Rw}$$

where Cw = *conductivity of saturant (mho)*

This process was then repeated with all brines scheduled.

The entire data set of multi-salinity resistivity data were plotted on linear graphs and a 'best-fit' (least squares) line was placed through the data set. As per standard practices, brines <20,000 ppm were excluded from the trend line. The equation of the resulting line was calculated as:

$$y = mx + c$$

where	*y*	=	*Co data points*
	x	=	*Cw data points*
	m	=	*gradient*
	c	=	*intercept*

From the x-axis negative intercept a shaly sand equivalent value of formation resistivity factor (FRF *) and cementation factor (m *) were calculated for each of the samples, in accordance with Waxman-Thomas.

On completion of multi-salinity analyses the samples were dismounted, cleaned and dried.

CHAPTER 5

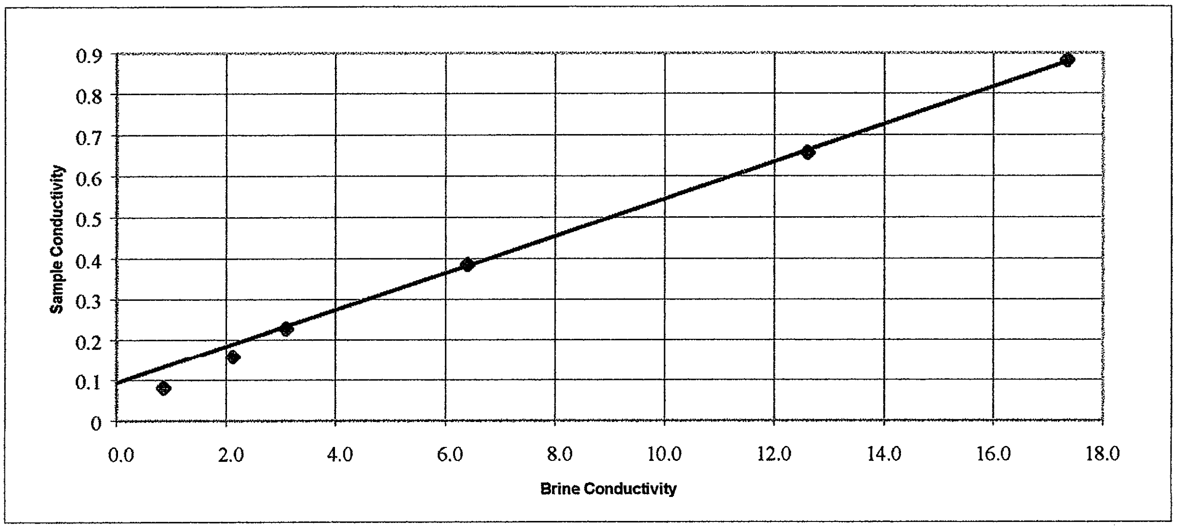
MULTI-SALINITY RESISTIVITY ANALYSES

5.2 Test Results

MULTI-SALINITY RESISTIVITY ANALYSES

Company	Cultus Petroleum NL
Well	Skull Creek West 1
Sample Number	6
Depth	1308.10 m
Air Permeability	38
Porosity	22.4
FF	13.4
m	-1.73
FF*	22.1
m*	-2.07

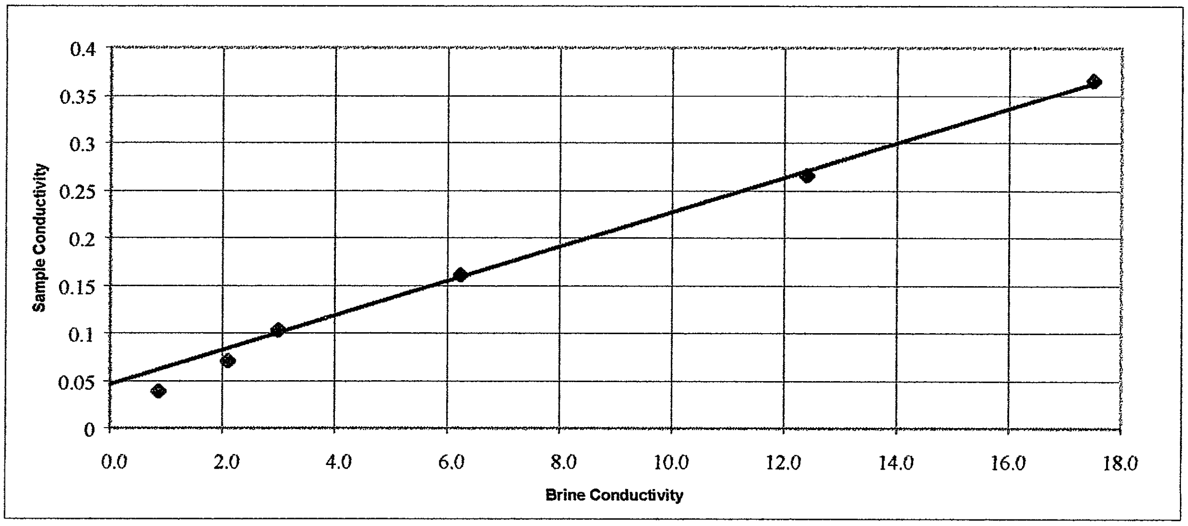
Brine	Brine Resistivity Rw	Sample Resistivity Ro	Sample Conductivity Co	Brine Conductivity Cw
Formation	0.471	6.3	0.159	2.12
5 500 ppm	1.17	12.3	0.081	0.853
20 000 ppm	0.323	4.38	0.228	3.09
50 000 ppm	0.156	2.59	0.387	6.40
100 000 ppm	0.079	1.52	0.659	12.6
150 000 ppm	0.058	1.13	0.883	17.3



MULTI-SALINITY RESISTIVITY ANALYSES

Company	Cultus Petroleum NL
Well	Skull Creek West 1
Sample Number	15
Depth	1783.44 m
Air Permeability	11
Porosity	20.1
FF	29.3
m	-2.11
FF*	55.2
m*	-2.50

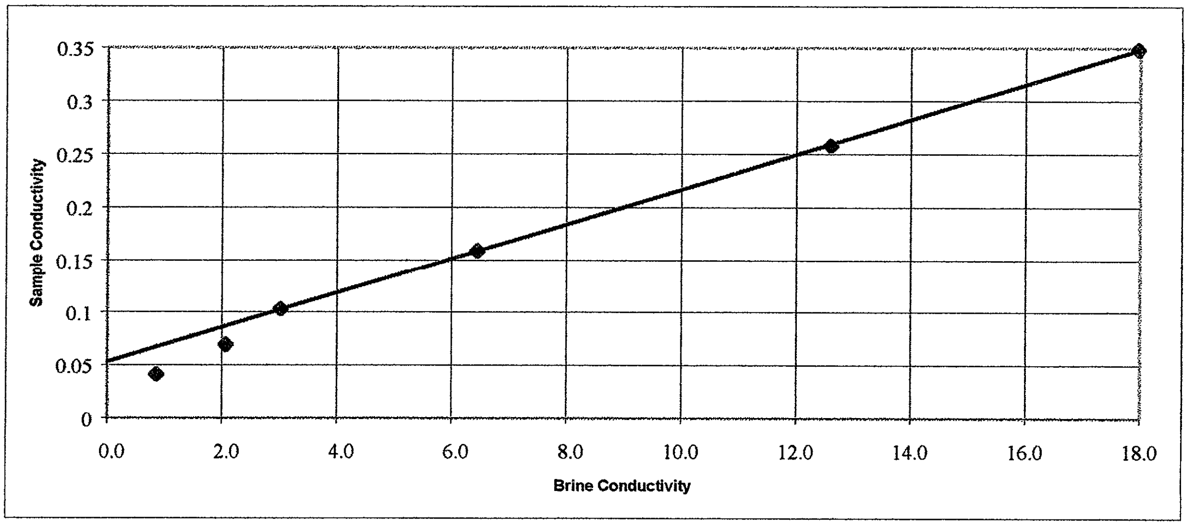
Brine	Brine Resistivity Rw	Sample Resistivity Ro	Sample Conductivity Co	Brine Conductivity Cw
Formation	0.476	14.0	0.072	2.10
5 500 ppm	1.16	25.4	0.039	0.862
20 000 ppm	0.334	9.64	0.104	2.99
50 000 ppm	0.160	6.17	0.162	6.24
100 000 ppm	0.081	3.75	0.267	12.4
150 000 ppm	0.057	2.73	0.366	17.5



MULTI-SALINITY RESISTIVITY ANALYSES

Company	Cultus Petroleum NL
Well	Skull Creek West 1
Sample Number	21
Depth	1759.39 m
Air Permeability	14
Porosity	19.0
FF	29.7
m	-2.04
FF*	60.9
m*	-2.47

Brine	Brine Resistivity Rw	Sample Resistivity Ro	Sample Conductivity Co	Brine Conductivity Cw
Formation	0.484	14.4	0.070	2.07
5 500 ppm	1.16	23.9	0.042	0.860
20 000 ppm	0.332	9.69	0.103	3.01
50 000 ppm	0.155	6.26	0.160	6.45
100 000 ppm	0.079	3.86	0.259	12.6
150 000 ppm	0.056	2.87	0.349	18.0



CHAPTER 6

RESISTIVITY INDEX AND CAPILLARY PRESSURE

6.1 Test and Calculation Procedures

6. RESISTIVITY INDEX AND CAPILLARY PRESSURE

6.1 Test and Calculation Procedures

Upon completion of the preceding formation factor analysis, the six scheduled samples (7, 9, 14, 18, 23 and 25) continued immediately for resistivity index analyses, combined with an air-brine drainage capillary pressure curve.

At the time of loading, a strongly hydrophilic membrane was placed at the bottom end-face port to act as a capillary pressure barrier. The top end-face port was connected to a supply of humidified air and the bottom port connected to a graduated receiving tube. The samples were desaturated by incrementally increasing the gas pressure to the samples. The pressures utilised were inversely proportional to the individual sample permeability data. A small amount of oil was placed into the receiving tubes to prevent any potential brine loss by evaporation. Sample resistances (Rc) were measured at successive decreasing brine saturations, or conversely increasing capillary pressure. The saturation values were calculated from the following equation based on produced volumes.

$$\text{Water Saturation} = \frac{\text{Pore Volume} - \text{Brine Expelled}}{\text{Pore Volume}} \times 100\%$$

The ratio of the sample resistance (Rc) values to the previously determined FRF values (at 100% saturation) were used to calculate the formation resistivity indices (i.e. comparing the resistivity of the partially saturated to that of the fully saturated samples).

$$Rt = \frac{A / L\ Rc}{100}$$

where Rt = *resistivity of partially brine saturated sample (ohm-metres)*
Rc = *sample resistance (ohms)*

and

$$RI = \frac{Rt / Rw}{FF}$$

where RI = *resistivity index*
Rw = *resistivity of brine (ohm-metres)*

(This equation was modified from the standard Archie equation to incorporate the variable brine resistivity which is temperature dependant).

These RI values (for each sample) were plotted against brine saturation (Sw) on graphs with logarithmic axes and the gradient of the best-fit line through the co-ordinate (1.0, 1.0) was calculated. Each gradient was quoted as the saturation exponent (n) for that sample, in accordance with Archie's formula:

$$RI = \frac{1}{Sw^n}$$

Each of the stable capillary pressures were plotted against brine saturation (on a linear scale) to produce an air-brine drainage curve.

During the course of the resistivity index/capillary pressure curve, sample 9, failed (lost integrity) and could not continue a full suite of pressures. Consequently no meaningful data was collected and cannot be reported. This sample was originally scheduled for residual gas saturation (trapped gas) analyses, however, sample 18 was available and substituted for sample 9.

CHAPTER 6

RESISTIVITY INDEX AND CAPILLARY PRESSURE

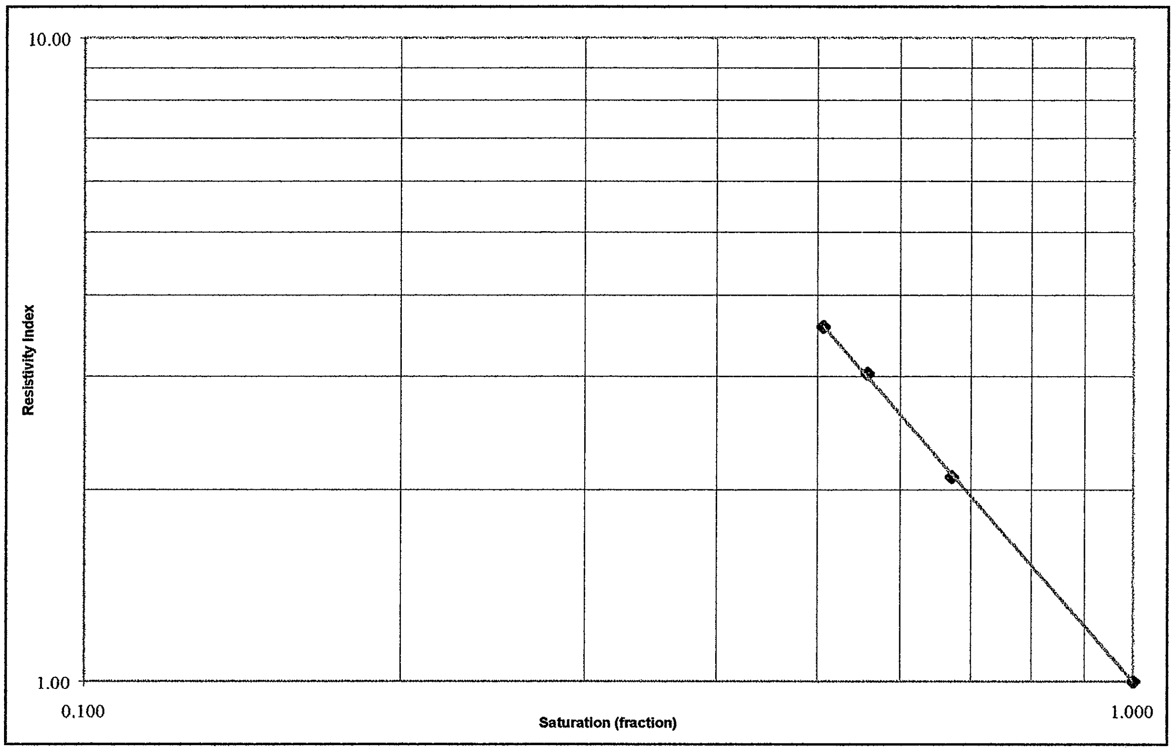
6.2 Resistivity Index Test Results

RESISIVITY INDEX

Company: Cultus Petroleum NL
Well: Skull Creek West 1

Rw of Saturant: 0.46 ohm-m @ 25°C
Method: Air/Brine Porous Plate @ Overburden

Sample Number	Depth (metres)	Permeability to Air (milliDarcy's)	Porosity (percent)	Formation Factor FF	Brine Saturation (fraction)	Resistivity Index RI	Saturation Exponent n
7	1308.99	2.2	16.1	22.0	1.000	1.00	
					1.000	1.00	
					1.000	1.00	
					1.000	1.00	
					0.670	2.09	
					0.557	3.03	
					0.506	3.57	-1.87

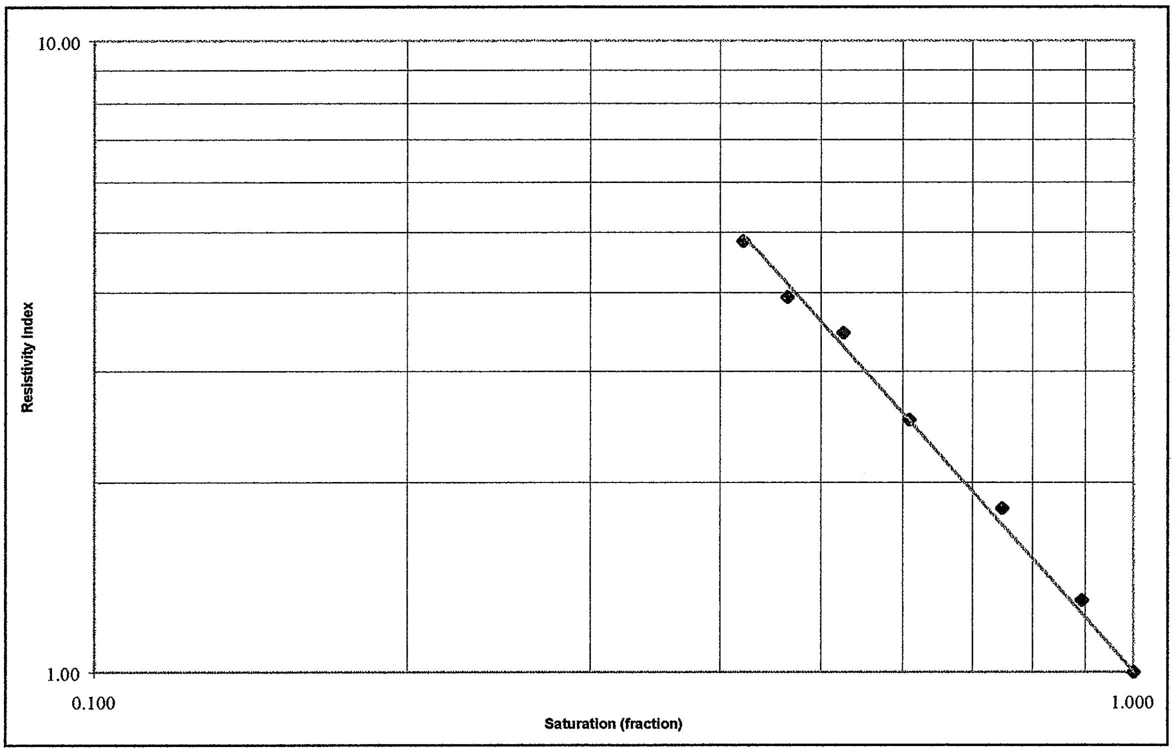


RESISIVITY INDEX

Company: Cultus Petroleum NL
Well: Skull Creek West 1

Rw of Saturant: 0.46 ohm-m @ 25°C
Method: Air/Brine Porous Plate @ Overburden

Sample Number	Depth (metres)	Permeability to Air (milliDarcy's)	Porosity (percent)	Formation Factor FF	Brine Saturation (fraction)	Resistivity Index RI	Saturation Exponent n
14	1752.42	52	21.1	25.1	1.000	1.00	
					0.891	1.30	
					0.747	1.82	
					0.608	2.51	
					0.525	3.45	
					0.464	3.93	
					0.421	4.84	-1.83

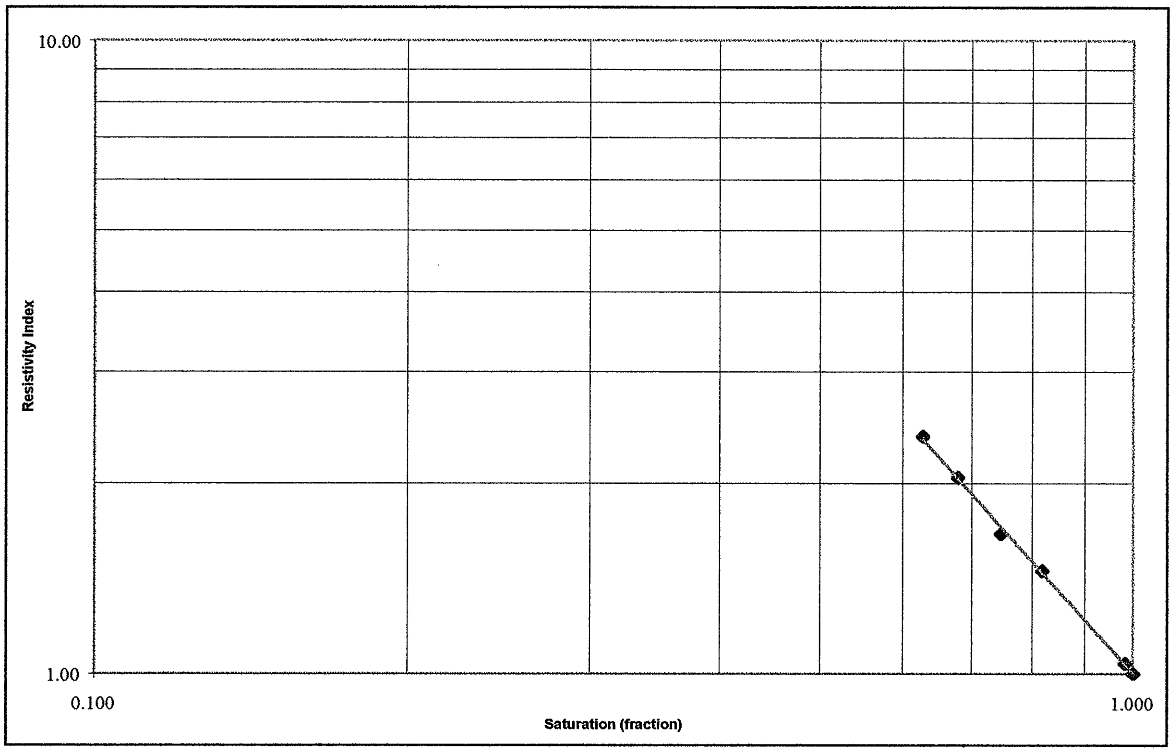


RESISIVITY INDEX

Company: Cultus Petroleum NL
Well: Skull Creek West 1

Rw of Saturant: 0.46 ohm-m @ 25°C
Method: Air/Brine Porous Plate @ Overburden

Sample Number	Depth (metres)	Permeability to Air (milliDarcy's)	Porosity (percent)	Formation Factor FF	Brine Saturation (fraction)	Resistivity Index RI	Saturation Exponent n
18	1756.40	2.4	20.2	28.4	1.000	1.00	
					1.000	1.00	
					0.982	1.04	
					0.818	1.46	
					0.745	1.67	
					0.677	2.04	
					0.627	2.37	-1.83

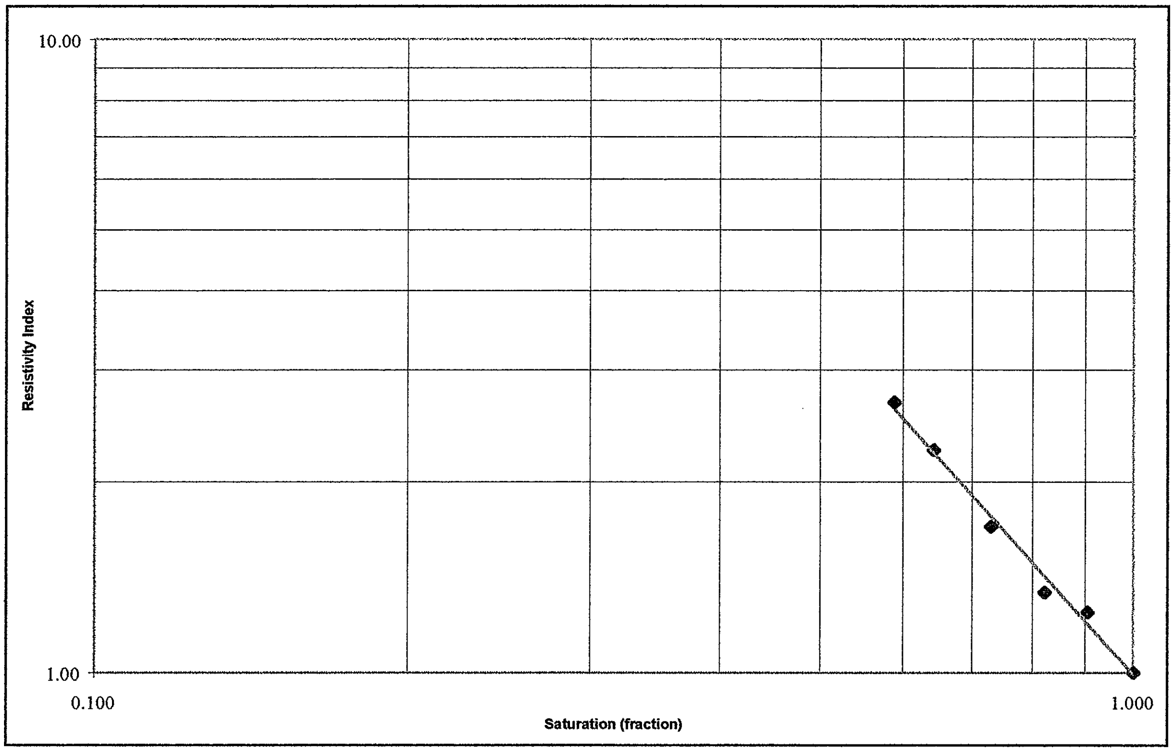


RESISIVITY INDEX

Company: Cultus Petroleum NL
Well: Skull Creek West 1

Rw of Saturant: 0.46 ohm-m @ 25°C
Method: Air/Brine Porous Plate @ Overburden

Sample Number	Depth (metres)	Permeability to Air (milliDarcy's)	Porosity (percent)	Formation Factor FF	Brine Saturation (fraction)	Resistivity Index RI	Saturation Exponent n
23	1761.29	3.5	19.0	34.2	1.000	1.00	
					1.000	1.00	
					0.903	1.25	
					0.821	1.34	
					0.729	1.70	
					0.642	2.25	
					0.589	2.67	-1.80

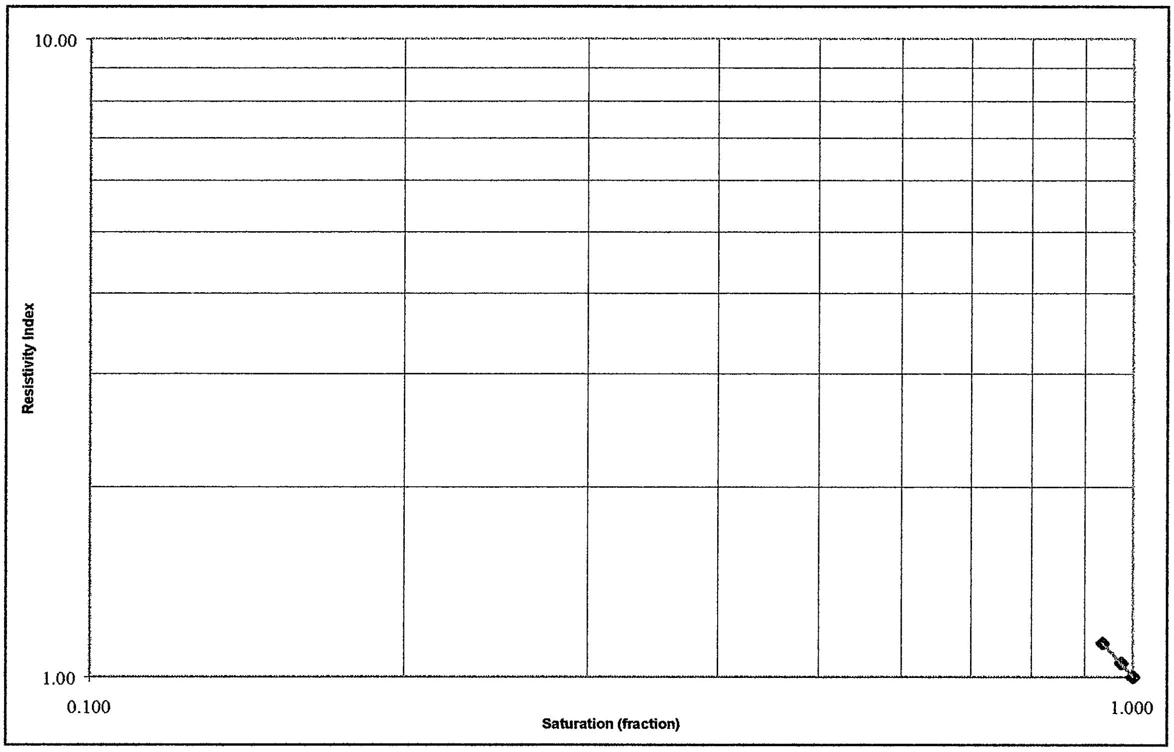


RESISIVITY INDEX

Company: Cultus Petroleum NL
Well: Skull Creek West 1

Rw of Saturant: 0.46 ohm-m @ 25°C
Method: Air/Brine Porous Plate @ Overburden

Sample Number	Depth (metres)	Permeability to Air (milliDarcy's)	Porosity (percent)	Formation Factor FF	Brine Saturation (fraction)	Resistivity Index RI	Saturation Exponent n
25	1763.47	0.20	14.1	21.0	1.000	1.00	
					1.000	1.00	
					1.000	1.00	
					1.000	1.00	
					1.000	1.00	
					0.974	1.05	
					0.935	1.13	-1.83



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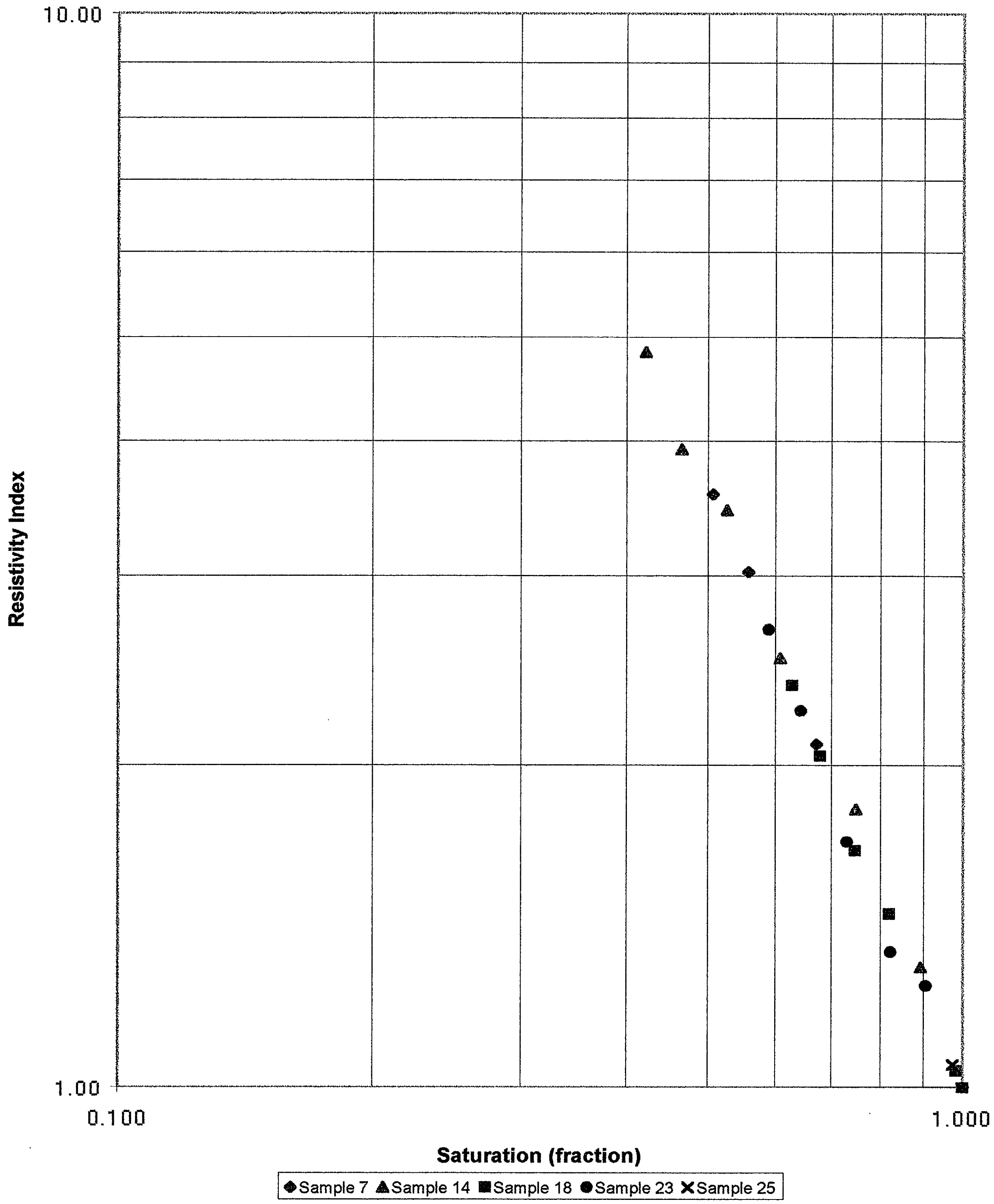
(Inserted by DNRE - Vic Govt Mines Dept)

RESISIVITY INDEX

Company: Cultus Petroleum NL
Well: Skull Creek West 1
Rw of Saturant: 0.46 ohm-m @ 25°C
Method: Air/Brine Porous Plate @ Overburden



CHAPTER 6

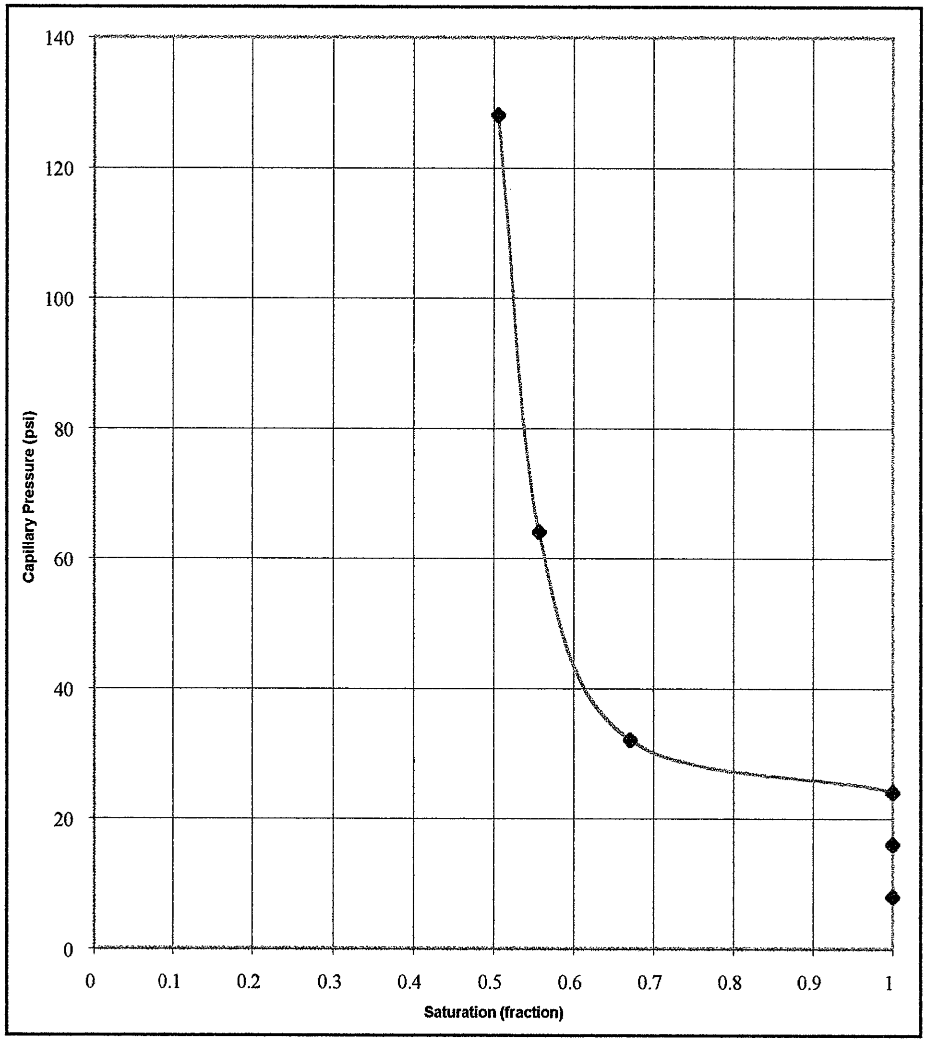
RESISTIVITY INDEX AND CAPILLARY PRESSURE

6.3 Capillary Pressure Test Results

CAPILLARY PRESSURE

Company	Cultus Petroleum NL
Well	Skull Creek West 1
Sample	7
Depth (m)	1308.99
Permeability (mD)	2.2
Porosity (%)	16.1
Method	Air/Brine Porous Plate @ Overburden

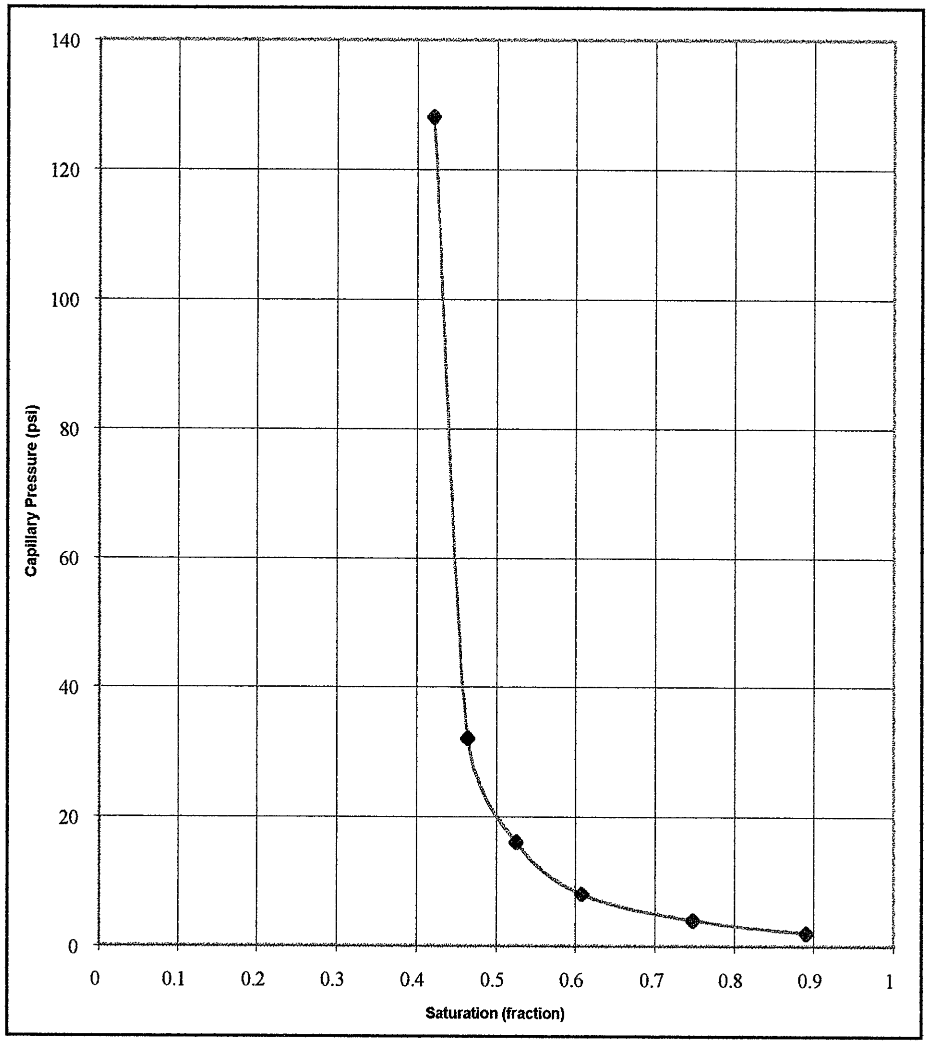
Capillary Pressure (psi)	Saturation (fraction)
8.0	1.000
16.0	1.000
24.0	1.000
32.0	0.670
64.0	0.557
128.0	0.506



CAPILLARY PRESSURE

Company	Cultus Petroleum NL
Well	Skull Creek West 1
Sample	14
Depth (m)	1752.42
Permeability (mD)	52
Porosity (%)	21.1
Method	Air/Brine Porous Plate @ Overburden

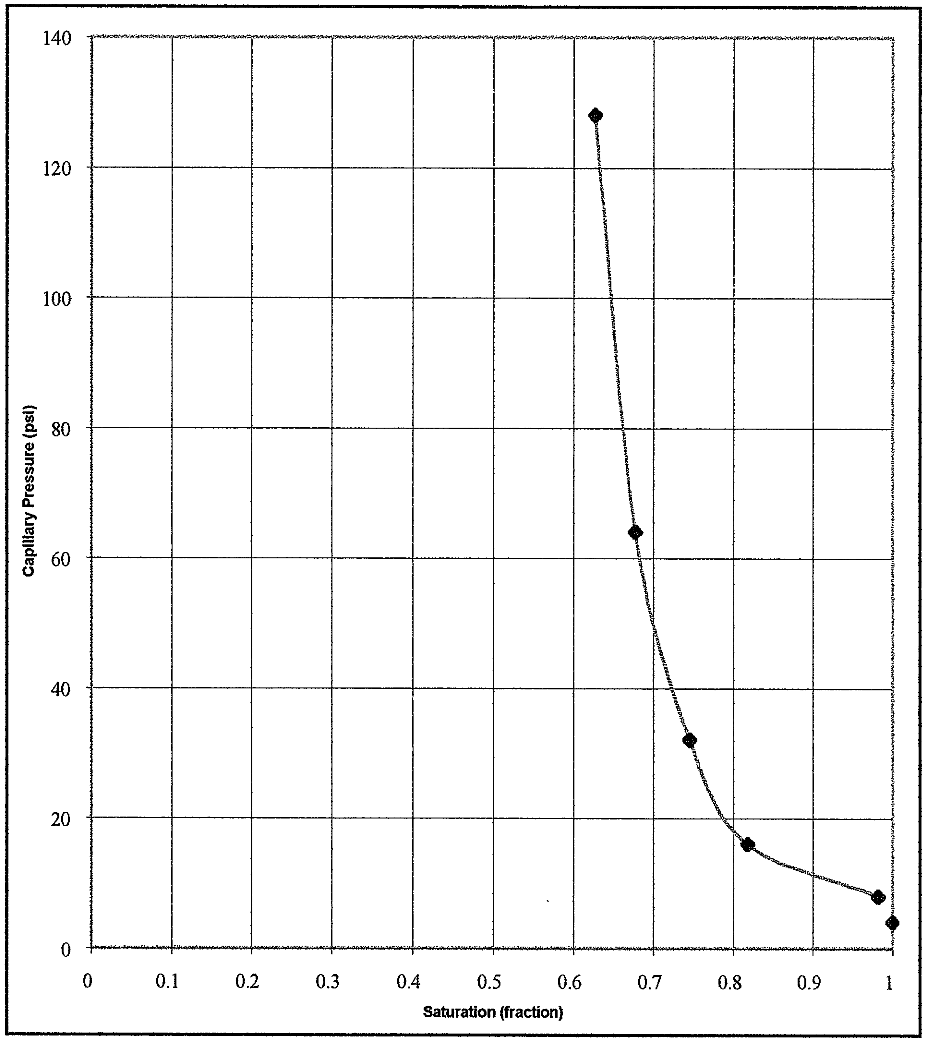
Capillary Pressure (psi)	Saturation (fraction)
2.0	0.891
4.0	0.747
8.0	0.608
16.0	0.525
32.0	0.464
128.0	0.421



CAPILLARY PRESSURE

Company	Cultus Petroleum NL
Well	Skull Creek West 1
Sample	18
Depth (m)	1756.40
Permeability (mD)	2.4
Porosity (%)	20.2
Method	Air/Brine Porous Plate @ Overburden

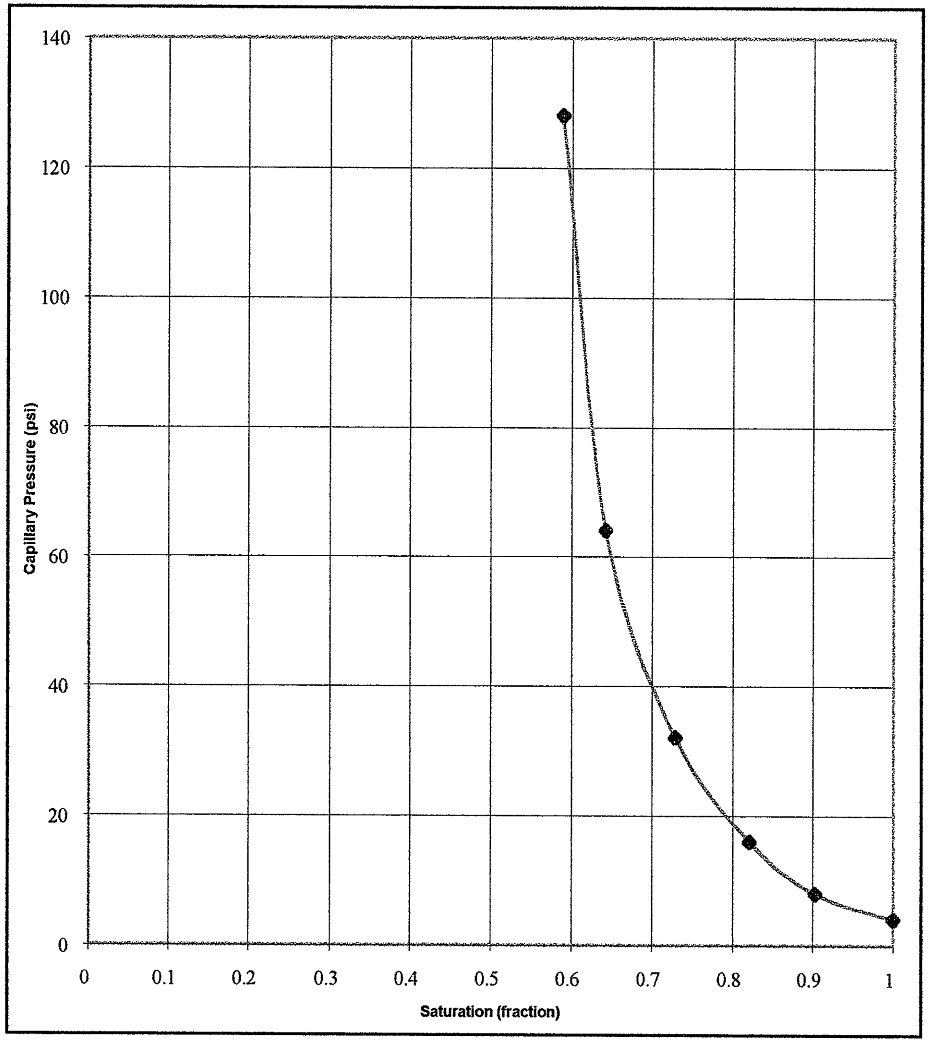
Capillary Pressure (psi)	Saturation (fraction)
4.0	1.000
8.0	0.982
16.0	0.818
32.0	0.745
64.0	0.677
128.0	0.627



CAPILLARY PRESSURE

Company	Cultus Petroleum NL
Well	Skull Creek West 1
Sample	23
Depth (m)	1761.29
Permeability (mD)	3.5
Porosity (%)	19.0
Method	Air/Brine Porous Plate @ Overburden

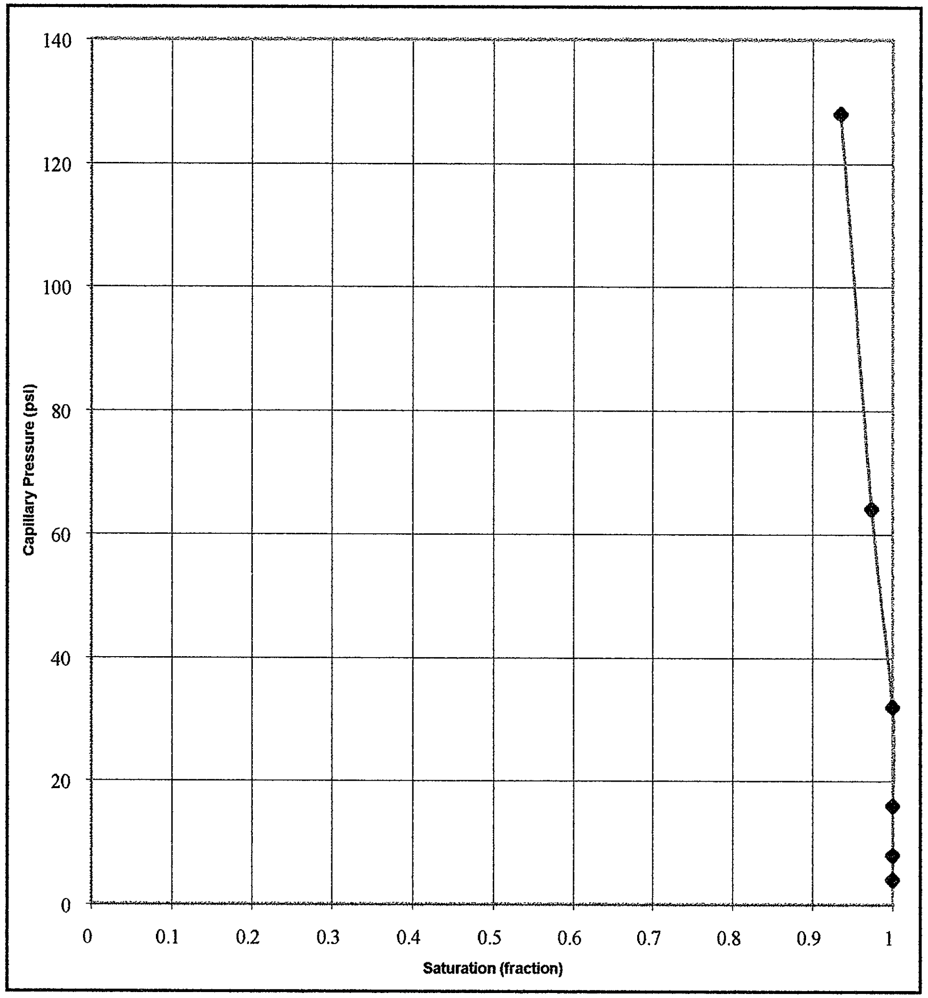
Capillary Pressure (psi)	Saturation (fraction)
4.0	1.000
8.0	0.903
16.0	0.821
32.0	0.729
64.0	0.642
128.0	0.589



CAPILLARY PRESSURE

Company	Cultus Petroleum NL
Well	Skull Creek West 1
Sample	25
Depth (m)	1763.47
Permeability (mD)	0.20
Porosity (%)	14.1
Method	Air/Brine Porous Plate @ Overburden

Capillary Pressure (psi)	Saturation (fraction)
4.0	1.000
8.0	1.000
16.0	1.000
32.0	1.000
64.0	0.974
128.0	0.935



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                     Creek West-1
           REMARKS =
      DATE_CREATED =
     DATE_RECEIVED = 30/04/98
              W_NO = W1180
         WELL_NAME = SKULL CREEK WEST-1
        CONTRACTOR = ACS LABORATORIES PTY LTD
      CLIENT_OP_CO = CULTUS PETROLEUM NL
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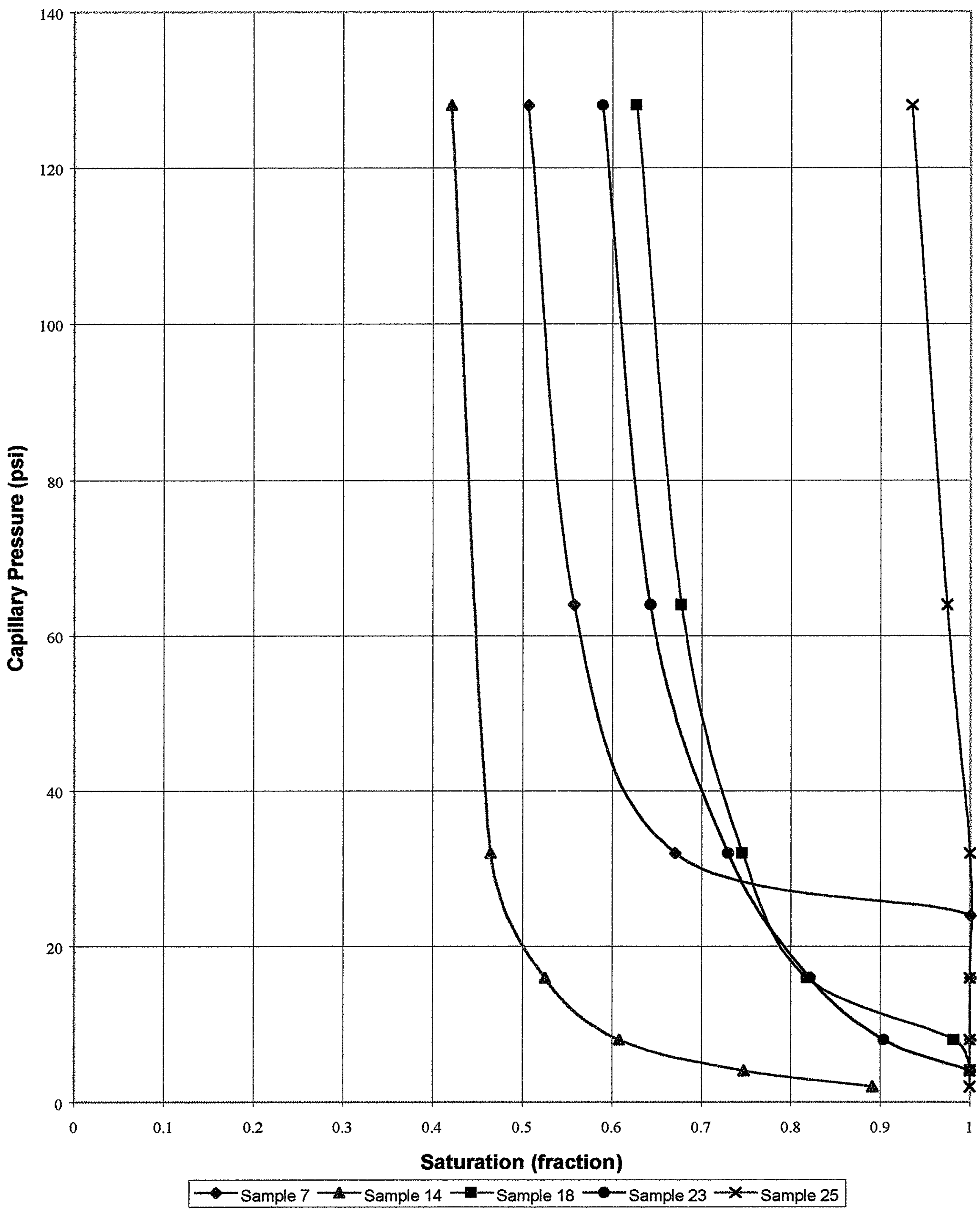
(Inserted by DNRE - Vic Govt Mines Dept)

CAPILLARY PRESSURE

DEPT. NAT. RES & ENV
PE907595

Company: Cultus Petroleum NL
Well: Skull Creek West 1
Method: Air/Brine Porous Plate @ Overburden



CHAPTER 7

TRAPPED GAS

7.1 Test and Calculation Procedures

7. TRAPPED GAS

7.1 Test and Calculation Procedures

On completion of the preceding air-brine capillary pressure analysis, the selected samples (7, 14, 18, 23, 25) were broken down and the membrane removed. Each sample was then placed into rubber sleeves and loaded into hydrostatic cells where an overburden pressure of 2550 or 3345 psi was applied. A waterflood to residual gas saturation (Sgr) was performed with synthetic formation brine at a constant flooding rate of 4 cm^3/hr. During the flood incremental volumes of gas produced were monitored. Stable saturation was defined by no further production of gas. These volumes were recorded and the sample's saturation calculated. On completion, the brine permeability at residual gas (Sgr) was determined using Darcy's Law through knowledge of the upstream pressure, fluid flow rates, viscosity of the fluid and sample dimensions.

$$Kw\ @\ Sgr = \frac{14696\,.\,Q.\,L.\,\mu T}{\Delta\rho\,.\,A}$$

where:

where:	*14696*	=	*unit conversion*
	L	=	*sample length (cm)*
	A	=	*sample cross sectional area (cm^2)*
	Q	=	*brine flow rate (cm^3/s)*
	$\Delta\rho$	=	*differential flooding pressure across the sample (psi)*
	μT	=	*brine viscosity (cP) temperature (^{o}C)*

A secondary bump flood was then performed at 4cm^3/min whilst measuring any gas produced. Once stable, permeability was measured using procedures as described above. Upon completion, final saturations were confirmed by Dean-Stark analysis (Appendix IV).

CHAPTER 7

TRAPPED GAS

7.1 Test Results

TRAPPED GAS

Company Cultus Petroleum NL
Well Skull Creek West 1

Overburden 2550 & 3345 psi

					Low Rate Flood ($4cm^3/hr$)		High Rate Flood ($4cm^3/min$)	
Sample Number	Depth (metres)	Permeability to Air (milliDarcy's)	Porosity (percent)	Initial Gas Saturation (fraction)	Gas Saturation (fraction)	Effective Permeability to Brine (milliDarcy's)	Gas Saturation (fraction)	Effective Permeability to Brine (milliDarcy's)
7	1308.99	2.2	16.1	0.494	0.222	0.186	0.131	0.256
14	1752.42	52	21.1	0.579	0.227	1.11	0.177	9.38
18	1756.40	2.4	20.2	0.373	0.255	0.165	0.170	0.578
23	1761.29	3.5	19.0	0.411	0.127	0.11	0.118	0.78
25	1763.47	0.20	14.1	0.065	0.043	0.0008	0.041	0.005

CHAPTER 8

CATION EXCHANGE CAPACITY

8.1 Test and Calculation Procedures

8. CATION EXCHANGE CAPACITY

8.1 Test and Calculation Procedures

Selected offcuts from the samples that underwent multi-salinity resistivity analyses (6, 15, 21) were utilised for CEC testing. They were first extracted to remove any hydrocarbons, and salts then air dried before analyses (performed before and after crushing to grain size). Cation exchange capacity was determined on approximately 5 grams of sample using the wet chemistry technique. The samples were first washed with an ammonium chloride solution to exchange ions with the available clay cations. An exchange reagent was then washed through the sample and the resultant solution titrated.

Values of exchangeable cations (theoretical minimum of zero) present in the samples are reported as milliequivalents per 100 grams of dry sample (meq/100g). Values of Q_v have been calculated using the following equation:

$$Q_v = \frac{CEC\,(1-\phi)\,\rho}{100\,\phi}$$

where ρ = *grain density (g/cm^3)*

ϕ = *porosity (fraction)*

Q_v = *volume concentration of clay exchange cations (meq/cm^3 pore space)*

CEC = *cation exchange capacity (meq/100g dry sample)*

CHAPTER 8

CATION EXCHANGE CAPACITY

8.2 Test Results

CATION EXCHANGE CAPACITY

Company Cultus Petroleum NL
Well Skull Creek West 1

Sample Number	Depth (metres)	Porosity (percent)	Grain Density (g/cm^3)	Cation Exchange Capacity (meq/100g) Uncrushed	Cation Exchange Capacity (meq/100g) Crushed	Quantity of Cation Exchangeable Clay Qv (meq/cm^3) Uncrushed	Quantity of Cation Exchangeable Clay Qv (meq/cm^3) Crushed
6	1308.10	23.8	2.66	3.31	3.37	0.28	0.29
15	1783.44	20.8	2.66	3.83	5.11	0.39	0.52
21	1759.39	19.8	2.67	4.50	5.50	0.49	0.59

CHAPTER 9

MERCURY INJECTION

9.1 Test and Calculation Procedures

9. MERCURY INJECTION

9.1 Test and Calculation Procedures

Sample offcuts (6, 15, 21) of sufficient volume to fill the sample chamber (circa 2 cm^3) were utilised for capillary pressure determinations by the mercury injection technique. The mercury injection apparatus used was a semi-automatic Micromeritics Autopore 9200 which can operate up to a pressure of 40,000 psia, and can measure intrusions as small as 0.0001 cm^3.

The Micromeritics Autopore records mercury intrusion by measuring the capacitance change between the capillary of mercury contained in the penetrometer and an outer metal sheath as mercury invades the samples. For pressures up to 24 psia, air pressure was used. Hydraulic oil was used to achieve the higher pressures. No volume corrections for pressure effects were made, since below 24 psia they are negligible, whilst for higher pressures the penetrometer experiences equal external and internal pressures and mercury compression is offset by penetrometer compression.

All samples were dried in a humidity oven and placed into calibrated glass penetrometers. These consist of a sample chamber and attached precision bore capillary. Once the samples were placed into the penetrometer a vacuum was applied until less than 50 micrometres of mercury had been achieved. Mercury was then introduced into the penetrometer and the run commenced along pre-defined pressure points on a logarithmic scale. After equilibration at each pressure point a capacitance reading was taken which was then converted into an equivalent intrusion volume.

Pore throat diameter for intrusion pressure can be calculated as such:

$$D = \frac{4\,T\cos\theta\;C}{P_c}$$

where	D	=	*pore throat diameter (microns)*
	T	=	*interfacial tension (dynes/cm)*
	θ	=	*contact angle (degrees)*
	P_c	=	*capillary pressure (psi)*
	C	=	*conversion constant*
		=	145×10^{-3}

Any apparent inconsistencies between the reported values of Intrusion (percent) and Saturation (percent) are a rounding effect. All intrusion however cumulates to 100% saturation at maximum pressure.

Displacement or breakthrough pressure can be determined by two methods. From the capillary pressure curves where the saturation tends to plateau, a point on the pressure axis can be read as indicated on the plots provided. Similarly, from an intrusion plot, the diameter at which breakthrough occurs can be read off the x-axis also as indicated. Both techniques are interpretative only.

CHAPTER 9

MERCURY INJECTION

9.2 Test Results

CAPILLARY PRESSURE

Company Cultus Petroleum NL
Well Skull Creek West 1

Test Method Air/Mercury Capillary Pressure

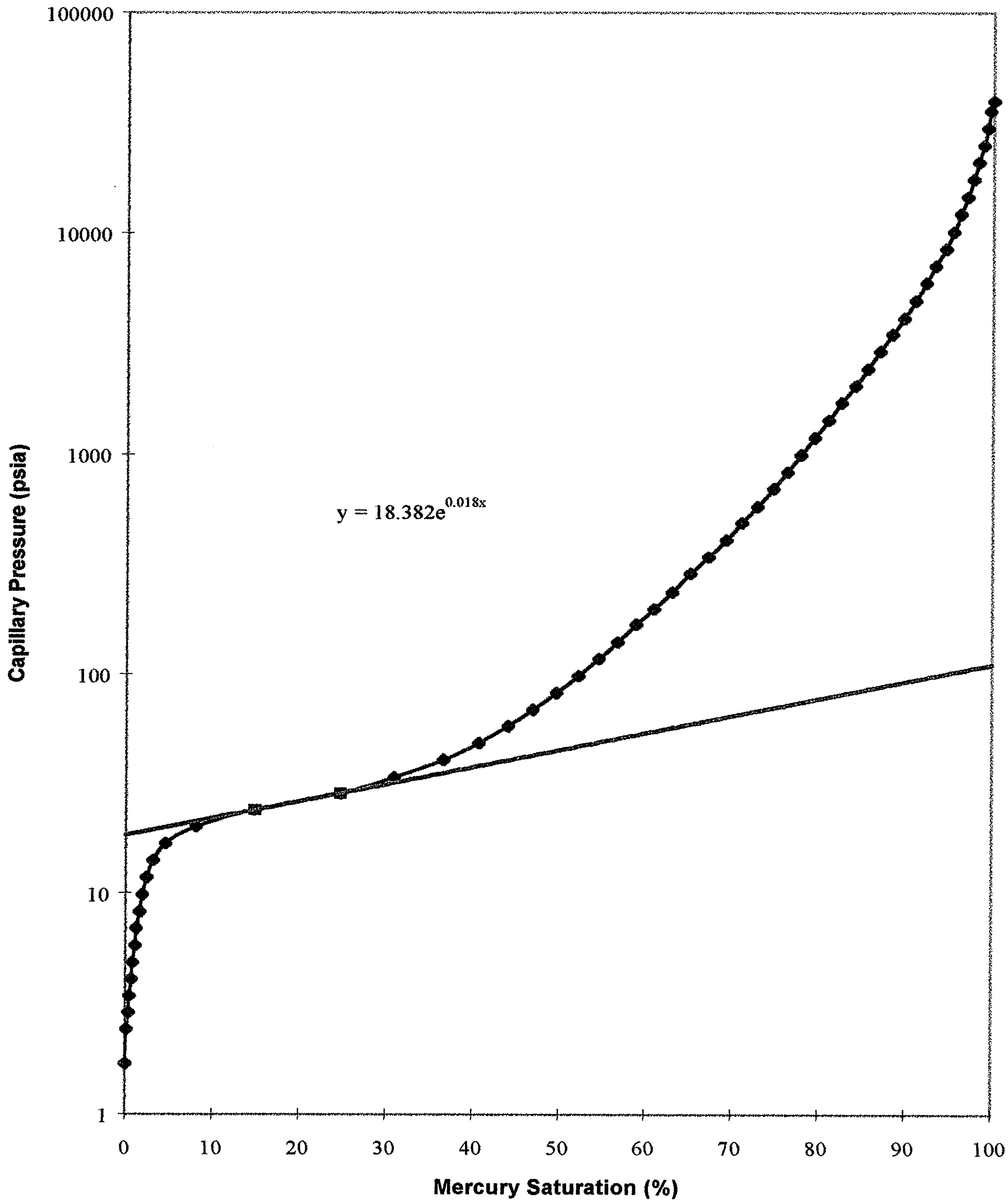
Sample 6
Depth 1308.10 m

Pressure (psia)	Intrusion (percent)	Saturation (percent)	Pore Diameter (μm)
1.71	0.0	0.0	124
2.45	0.1	0.1	86.5
2.92	0.2	0.3	72.6
3.46	0.1	0.5	61.3
4.12	0.2	0.7	51.5
4.90	0.1	0.8	43.3
5.85	0.3	1.1	36.2
6.97	0.1	1.2	30.4
8.32	0.3	1.6	25.5
9.93	0.3	1.9	21.3
11.8	0.5	2.4	17.9
14.1	0.8	3.2	15.0
16.9	1.4	4.5	12.6
20.1	3.5	8.1	10.5
24.0	6.8	14.9	8.82
28.7	9.9	24.8	7.38
34.1	6.2	30.9	6.22
40.9	5.7	36.6	5.18
48.8	4.1	40.7	4.35
58.3	3.4	44.1	3.64
69.4	2.8	47.0	3.06
82.8	2.7	49.7	2.56
98.8	2.5	52.2	2.15

Pressure (psia)	Intrusion (percent)	Saturation (percent)	Pore Diameter (μm)
118	2.4	54.6	1.79
141	2.2	56.7	1.50
170	2.2	58.9	1.24
200	2.0	60.9	1.06
239	2.0	63.0	0.886
291	2.2	65.1	0.729
346	2.0	67.2	0.614
414	2.0	69.2	0.512
495	1.8	71.0	0.428
583	1.8	72.9	0.363
705	1.8	74.7	0.301
834	1.6	76.3	0.254
998	1.6	77.9	0.212
1194	1.6	79.4	0.178
1430	1.6	81.0	0.148
1711	1.5	82.5	0.124
2048	1.6	84.1	0.104
2447	1.5	85.6	0.0866
2927	1.4	86.9	0.0724
3509	1.5	88.4	0.0604
4147	1.4	89.8	0.0511
4968	1.2	91.0	0.0427
5994	1.2	92.3	0.0354
7160	1.0	93.3	0.0296
8534	1.2	94.5	0.0248
10213	0.9	95.5	0.0208
12219	0.8	96.3	0.0174
14635	0.8	97.0	0.0145
17493	0.7	97.7	0.0121
20945	0.6	98.3	0.0101
24983	0.6	98.9	0.0085
29842	0.5	99.3	0.0071
35727	0.3	99.7	0.0059
39652	0.3	100.0	0.0053

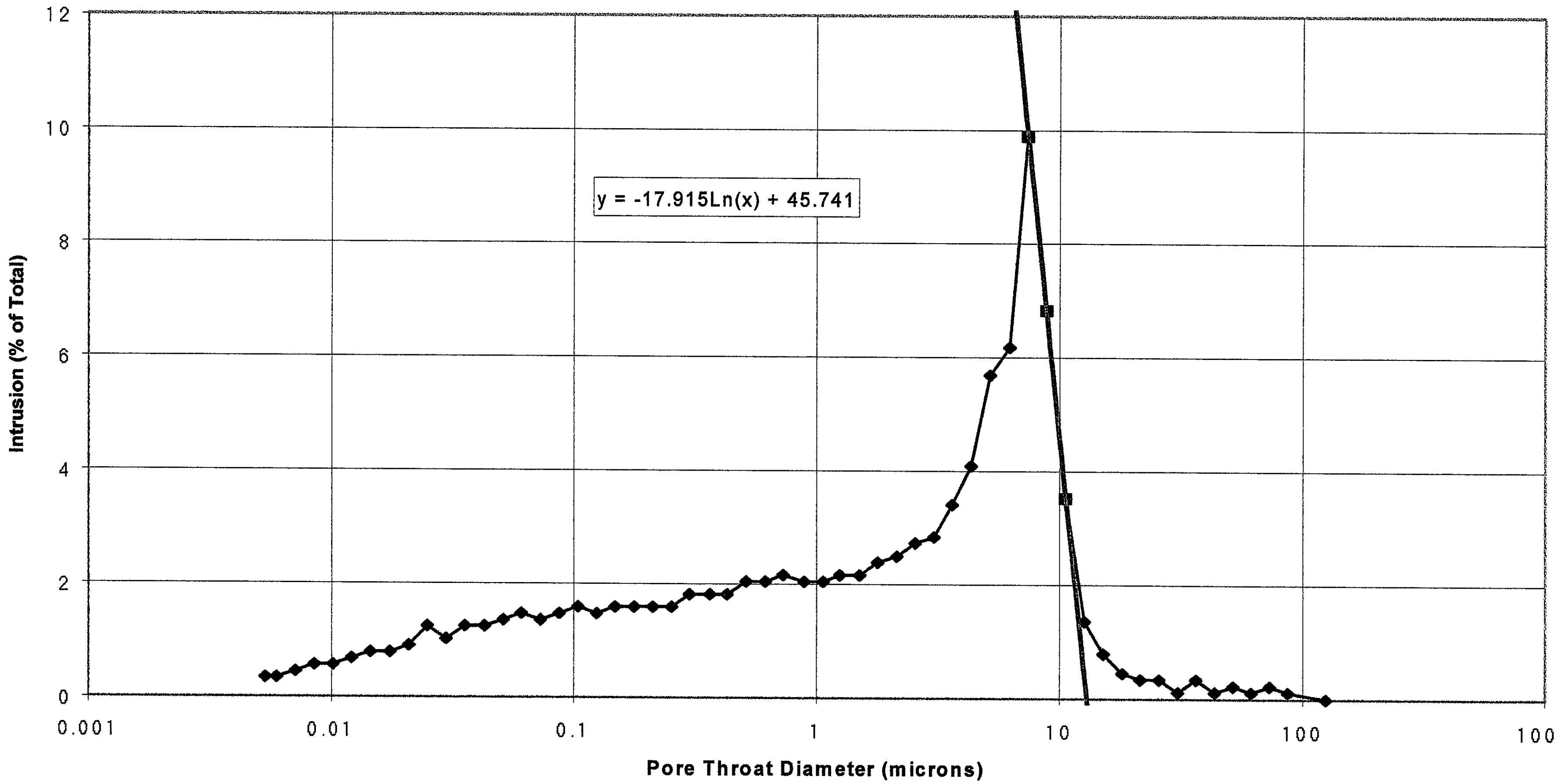
CAPILLARY PRESSURE vs SATURATION

Company: Cultus Petroleum NL
Well: Skull Creek West 1
Sample No: 6



INCREMENTAL INTRUSION vs PORE THROAT DIAMETER

Company: Cultus Petroleum NL
Well: Skull Creek West 1
Sample No: 6



CAPILLARY PRESSURE

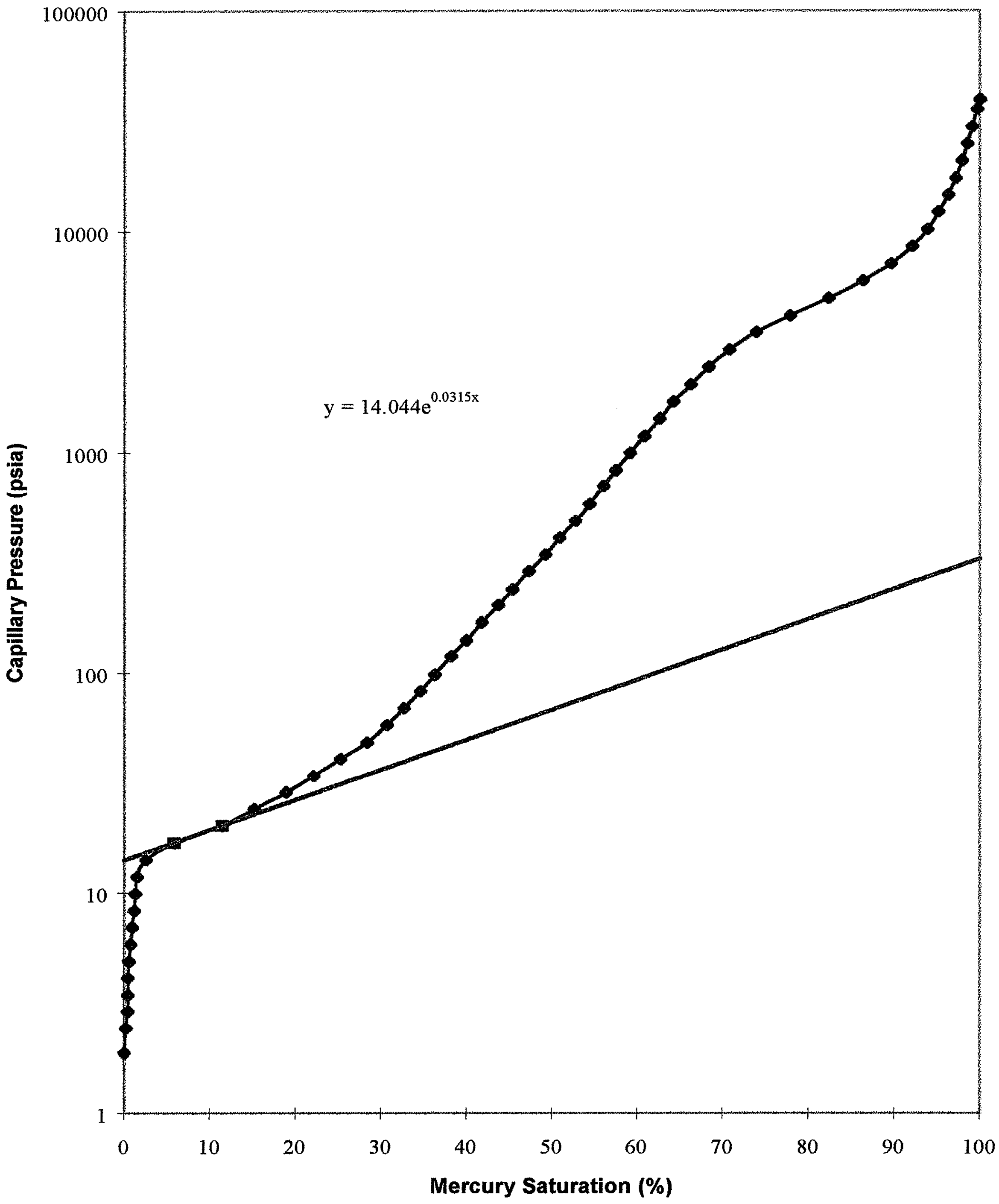
Company	Cultus Petroleum NL
Well	Skull Creek West 1
Test Method	Air/Mercury Capillary Pressure
Sample	15
Depth	1783.44 m

Pressure (psia)	Intrusion (percent)	Saturation (percent)	Pore Diameter (µm)
1.88	0.0	0.0	113
2.45	0.2	0.2	86.5
2.93	0.2	0.4	72.4
3.46	0.0	0.4	61.3
4.12	0.0	0.4	51.5
4.91	0.1	0.5	43.2
5.85	0.2	0.7	36.2
6.97	0.2	1.0	30.4
8.32	0.2	1.2	25.5
9.93	0.1	1.3	21.3
11.8	0.2	1.5	17.9
14.1	1.1	2.5	15.0
16.9	3.3	5.8	12.6
20.1	5.6	11.4	10.5
24.1	3.8	15.2	8.81
28.7	3.7	18.9	7.38
34.1	3.2	22.1	6.23
40.8	3.2	25.3	5.20
48.4	3.1	28.4	4.38
58.0	2.3	30.7	3.65
69.2	2.0	32.7	3.06
82.6	1.9	34.6	2.57
98.4	1.7	36.3	2.15

Pressure (psia)	Intrusion (percent)	Saturation (percent)	Pore Diameter (µm)
119	1.9	38.2	1.78
141	1.8	40.0	1.51
170	1.8	41.8	1.25
203	1.9	43.7	1.04
239	1.7	45.4	0.886
290	1.9	47.3	0.731
344	1.9	49.2	0.616
412	1.7	50.9	0.515
492	1.8	52.7	0.431
588	1.7	54.3	0.361
706	1.6	55.9	0.300
833	1.5	57.4	0.254
997	1.7	59.1	0.213
1192	1.7	60.8	0.178
1426	1.8	62.6	0.149
1709	1.6	64.2	0.124
2043	2.0	66.2	0.104
2444	2.1	68.3	0.0868
2923	2.4	70.7	0.0725
3507	3.2	73.9	0.0605
4140	3.9	77.8	0.0512
4974	4.5	82.4	0.0426
5952	4.0	86.4	0.0356
7128	3.3	89.6	0.0297
8538	2.4	92.1	0.0248
10215	1.8	93.9	0.0208
12213	1.3	95.1	0.0174
14623	1.2	96.3	0.0145
17479	0.8	97.1	0.0121
20939	0.7	97.9	0.0101
25006	0.6	98.5	0.0085
29867	0.5	99.0	0.0071
35734	0.6	99.7	0.0059
39676	0.3	100.0	0.0053

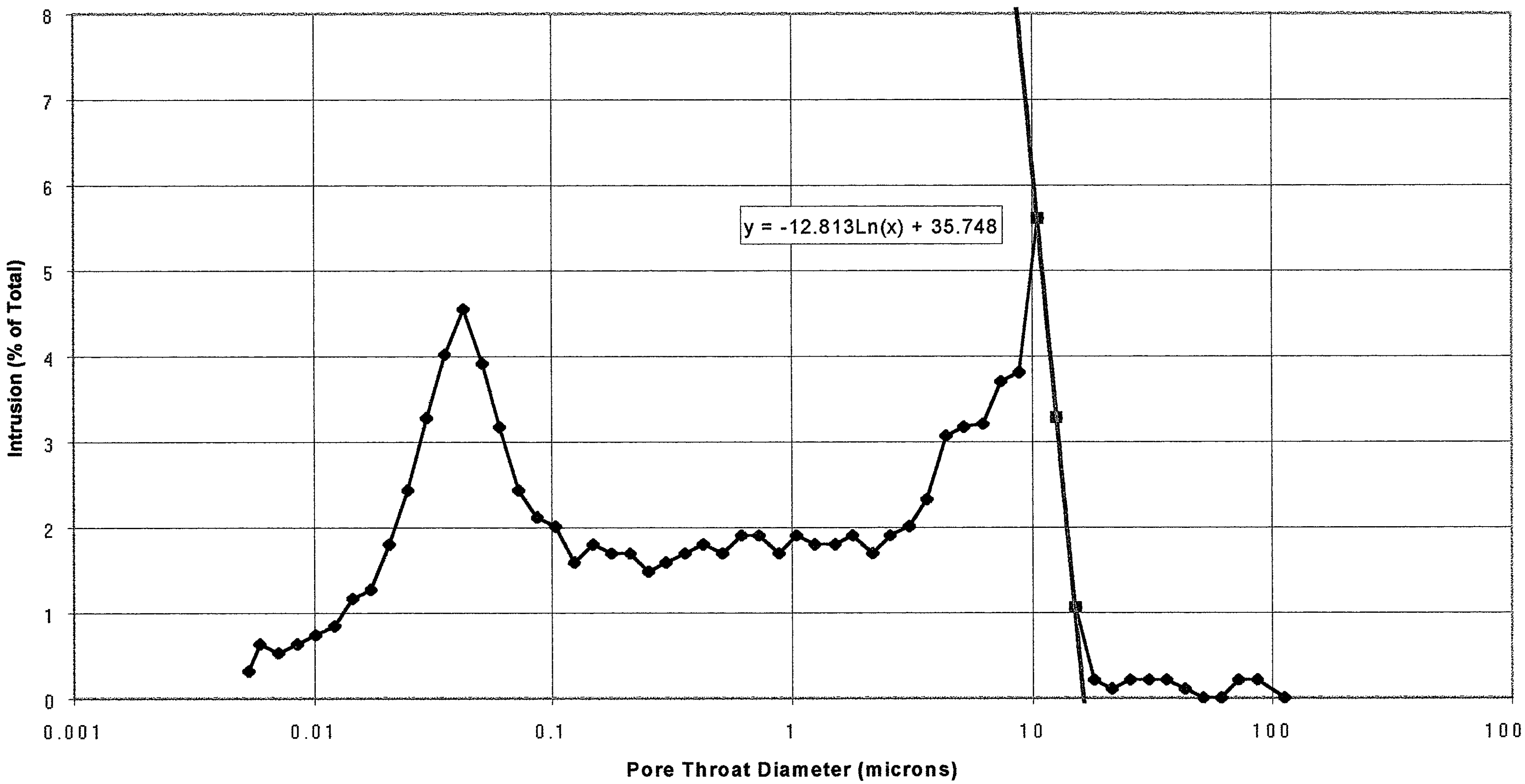
CAPILLARY PRESSURE vs SATURATION

Company: Cultus Petroleum NL
Well: Skull Creek West 1
Sample No: 15



INCREMENTAL INTRUSION vs PORE THROAT DIAMETER

Company: Cultus Petroleum NL
Well: Skull Creek West 1
Sample No: 15



CAPILLARY PRESSURE

Company Cultus Petroleum NL
Well Skull Creek West 1

Test Method Air/Mercury Capillary Pressure

Sample 21

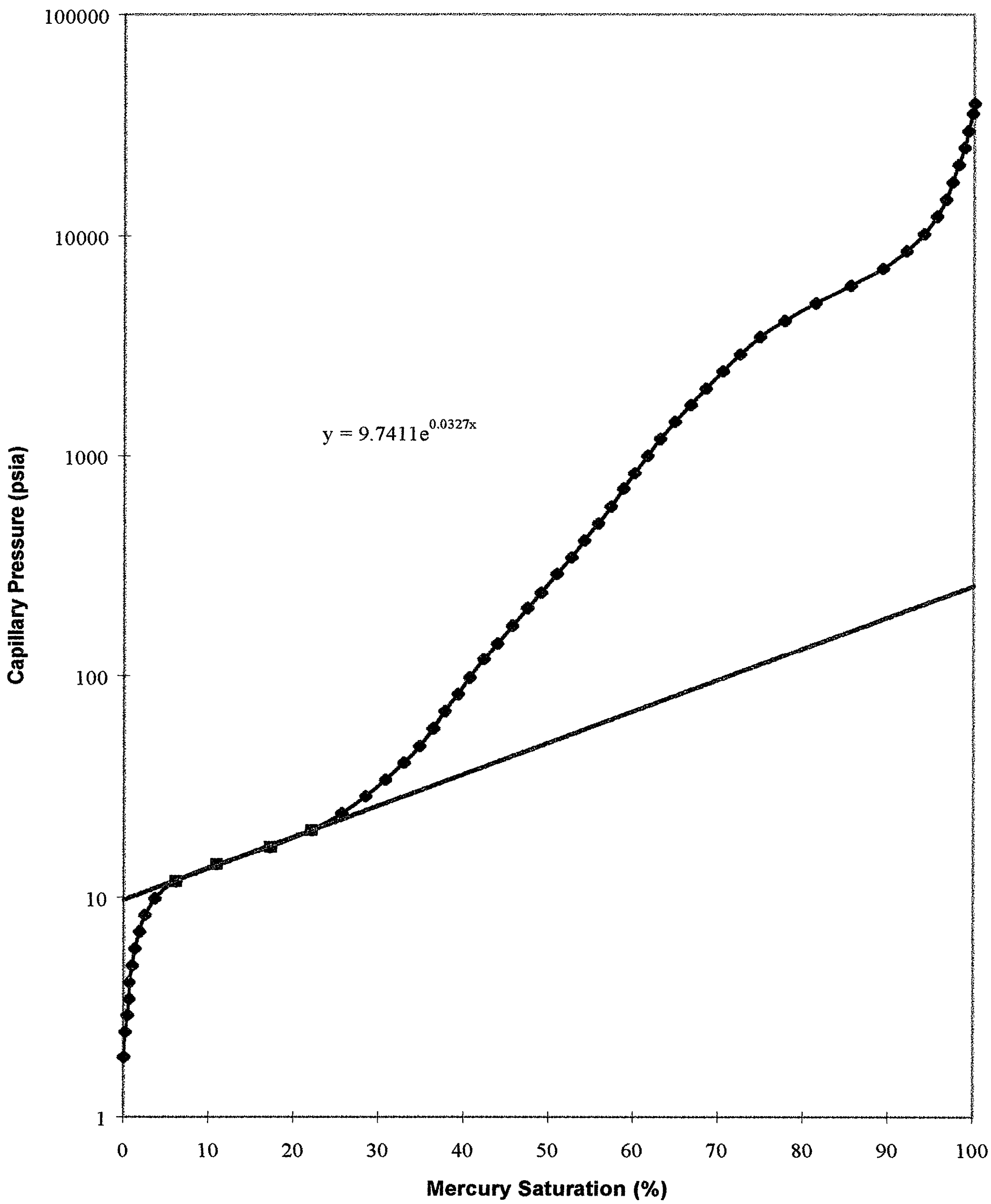
Depth 1759.39m

Pressure (psia)	Intrusion (percent)	Saturation (percent)	Pore Diameter (μm)
1.88	0.0	0.0	113
2.45	0.2	0.2	86.5
2.93	0.2	0.4	72.4
3.46	0.2	0.6	61.3
4.12	0.0	0.6	51.5
4.91	0.3	1.0	43.2
5.85	0.3	1.3	36.2
6.97	0.5	1.8	30.4
8.32	0.6	2.5	25.5
9.93	1.2	3.7	21.3
11.8	2.5	6.1	17.9
14.1	4.7	10.9	15.0
16.9	6.4	17.2	12.6
20.1	4.8	22.1	10.5
24.1	3.6	25.6	8.81
28.7	2.8	28.4	7.38
34.1	2.3	30.8	6.23
40.8	2.2	32.9	5.20
48.4	1.8	34.7	4.38
58.0	1.6	36.4	3.65
69.2	1.4	37.8	3.06
82.6	1.5	39.3	2.57

Pressure (psia)	Intrusion (percent)	Saturation (percent)	Pore Diameter (μm)
98.4	1.4	40.7	2.15
119	1.6	42.3	1.78
141	1.6	43.9	1.51
170	1.7	45.6	1.25
203	1.8	47.5	1.04
239	1.6	49.1	0.886
290	1.8	50.9	0.731
344	1.7	52.6	0.616
412	1.5	54.1	0.515
492	1.6	55.7	0.431
588	1.5	57.3	0.361
706	1.5	58.8	0.300
833	1.3	60.1	0.254
997	1.5	61.6	0.213
1192	1.5	63.1	0.178
1426	1.7	64.8	0.149
1709	1.8	66.6	0.124
2043	1.8	68.5	0.104
2444	1.9	70.4	0.0868
2923	2.0	72.4	0.0725
3507	2.4	74.8	0.0605
4140	2.9	77.7	0.0512
4974	3.7	81.4	0.0426
5952	4.1	85.5	0.0356
7128	3.8	89.2	0.0297
8538	2.8	92.0	0.0248
10215	2.0	94.1	0.0208
12213	1.5	95.6	0.0174
14623	1.1	96.7	0.0145
17479	0.8	97.4	0.0121
20939	0.8	98.2	0.0101
25006	0.6	98.8	0.0085
29867	0.4	99.2	0.0071
35734	0.5	99.8	0.0059
39676	0.2	100.0	0.0053

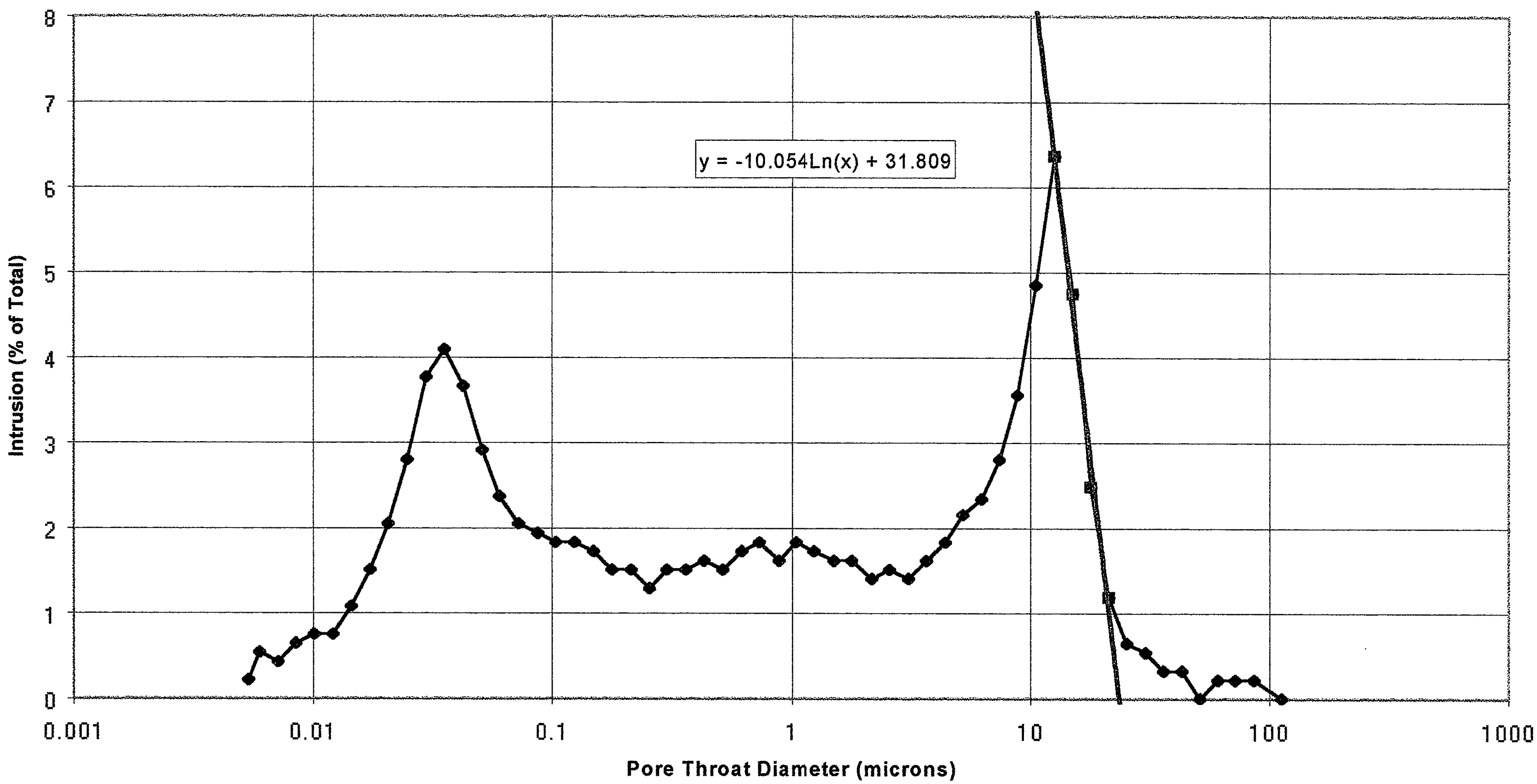
CAPILLARY PRESSURE vs SATURATION

Company: Cultus Petroleum NL
Well: Skull Creek West 1
Sample No: 21



INCREMENTAL INTRUSION vs PORE THROAT DIAMETER

Company: Cultus Petroleum NL
Well: Skull Creek West 1
Sample No: 21



CHAPTER 10

ROCK STRENGTH

10.1 Test and Calculation Procedures

10. ROCK STRENGTH

10.1 Test and Calculation Procedures

Selected plug samples (4 and 17) were initially cut into two pieces such that one half could be used for these analysis and a second portion utilised for sand solubility testing. This was necessary as both tests are destructive. These analyses were performed according to the International Society for Rock Mechanics Commission of the Standardisation of Laboratory and Field Tests (1979) - *Suggested Methods for Determining the Uniaxial Compressive Strength and Deformability of Rock Minerals.* The equipment used included an Instron load frame (Type TT-DM) and a Schlumberger LVDT (DG5).

An average diameter and length were recorded before analysis. A total of four electrical resistance strain gauges were attached to each core. Two gauges were attached parallel to the major axis mid-way along the sample, and two were placed perpendicular to the major axis to monitor tangential strain. The load was then applied to each sample at a constant rate. During testing, the average axial deformation of each sample was monitored with a load cell. (The outputs from the transducers were recorded on an XY plotter). The axial force yield was recorded and from this the uniaxial compressive strength was calculated. Average Young's Modulus was determined from the slope of the 'straight line' portion of the axial stress vs axial strain curve. Poisson's ratio was also determined, as follows:

$$\nu = \frac{\textit{slope of axial stress} - \textit{axial strain curve}}{\textit{slope of axial stress} - \textit{tangential strain curve}}$$

where ν = *Poisson's ratio*

$$UCS = \frac{F}{A}$$

where UCS = *unconfined compressive strength (Pa)*
F = *force (N)*
A = *cross sectional area of sample* (m^2)

Moisture content is required as part of the test procedure and is determined from the ratio between the mass differential (Mw - Md) and the dry mass (Md) of the rock at the time of testing.

CHAPTER 10

ROCK STRENGTH

10.2 Test Results

MECHANICAL PROPERTIES

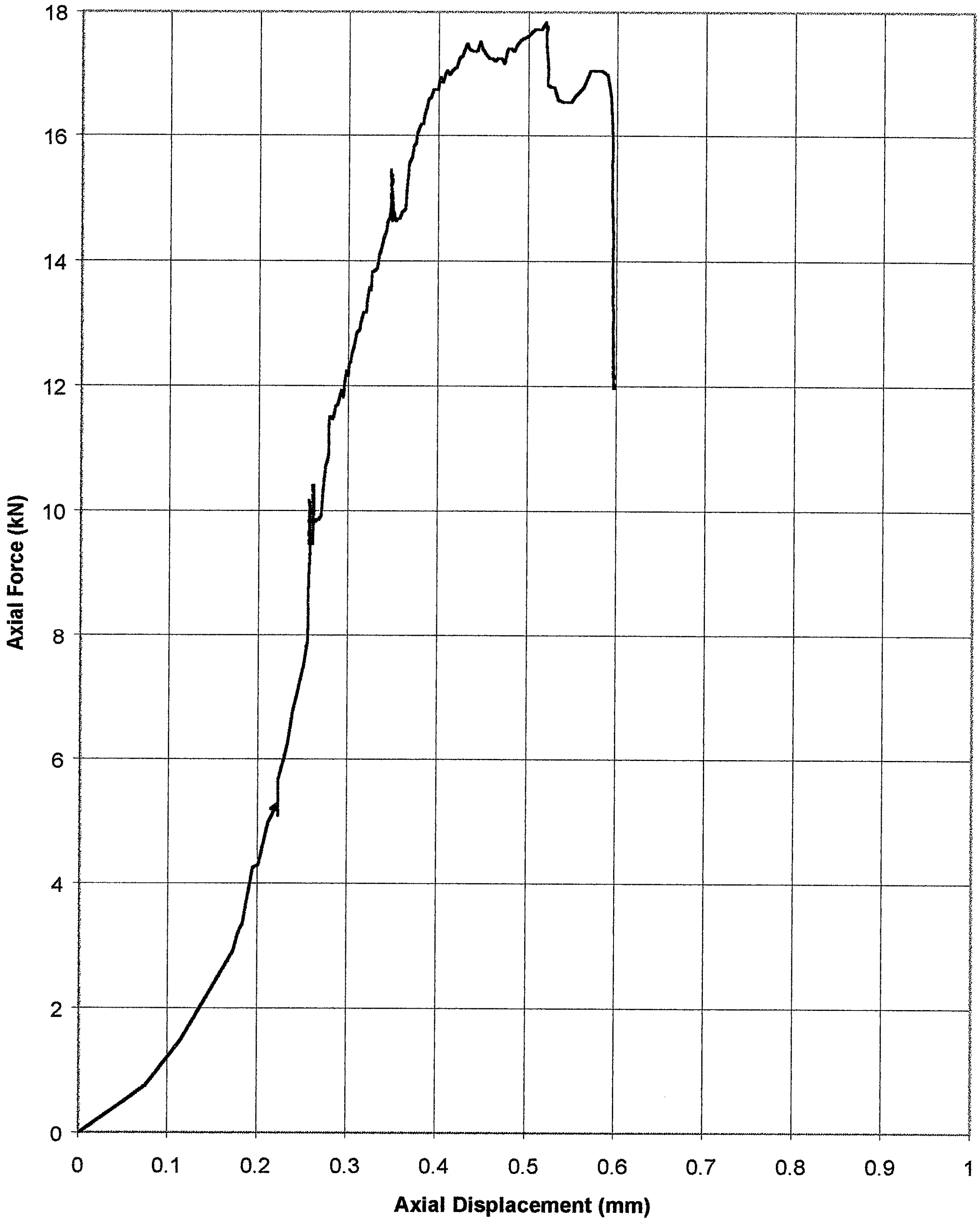
Company Cultus Petroleum NL
Well Skull Creek West 1

Sample	Depth (metres)	Wet Mass (grams)	Dry Mass (grams)	Axial Force at Yield (kN)	Failure Mechanism
4	1306.08	90.7	85.6	17.8	multi-plane shear
17	1755.41	20.0	19.4	32.5	multi-plane shear

Sample	Depth (metres)	Moisture Content (percent)	Young's Modulus (G Pa)	Poisson's Ratio ν	Uniaxial Compressive Strength (M Pa)
4	1306.08	2.9	4.4	0.28	15.8
17	1755.41	3.1	6.0	0.27	30.0

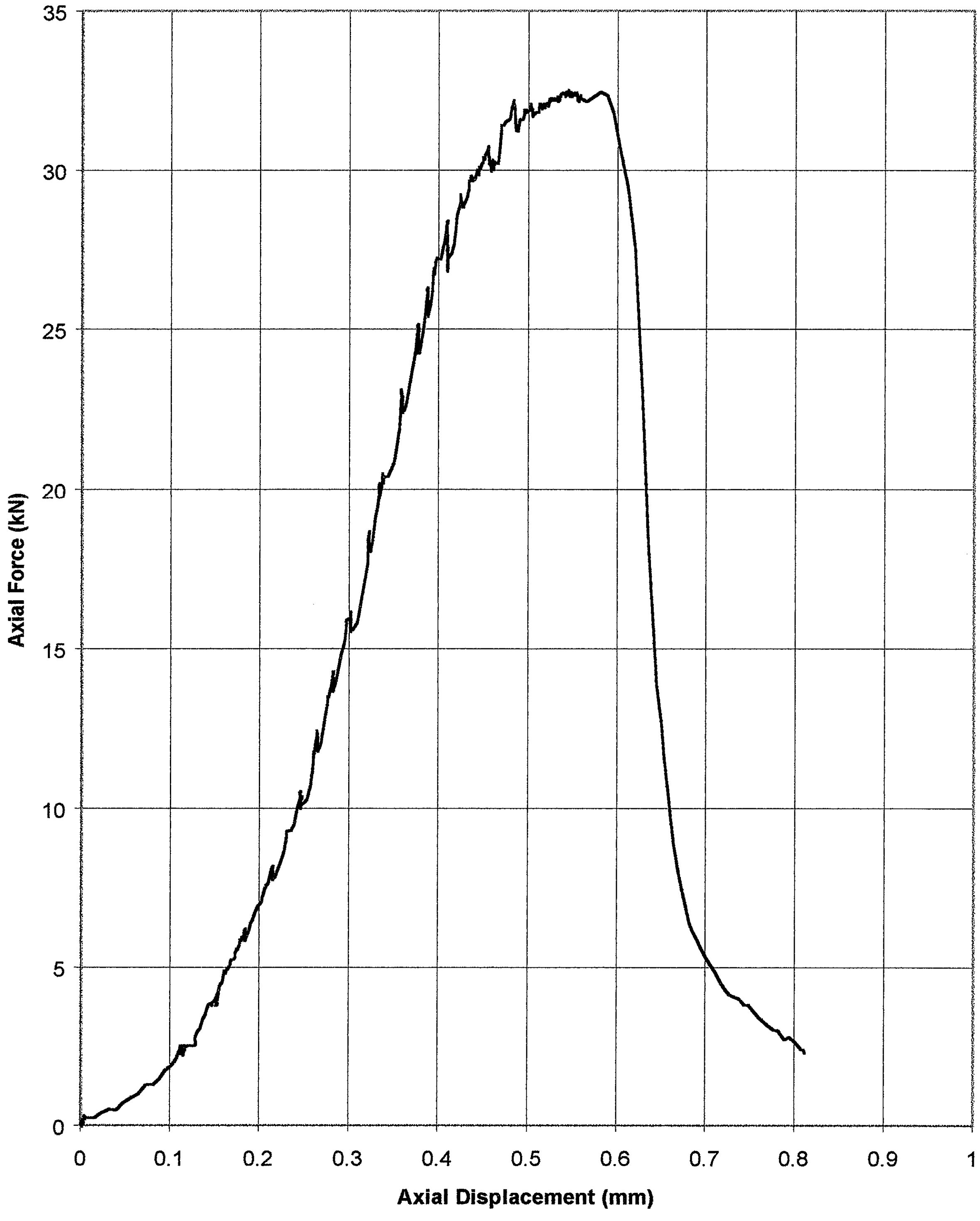
UNIAXIAL COMPRESSIVE STRENGTH

Company: Cultus Petroleum NL
Well: Skull Creek West 1
Sample: 4



UNIAXIAL COMPRESSIVE STRENGTH

Company: Cultus Petroleum NL
Well: Skull Creek West 1
Sample: 17



CHAPTER 11

SAND SOLUBILITY

11.1 Test and Calculation Procedures

11. SAND SOLUBILITY

11.1 Test and Calculation Procedures

The two samples (4 and 17) scheduled for this analysis were not ground prior to analysis, as the analysis should be performed on the unaltered sample. Before analysis each sample was dried to constant weight in an oven at 105°C and stored in a desiccator. Each sample (approximately 5 gram) was then immersed in a solution of 100 mL 12% HCl. After one hour the sample and acid mixture was filtered through a pre-weighed filter ensuring all particles were transferred. The sample was then washed with distilled water and the filter paper and sample dried in an oven at 105°C to constant weight. Solubility to acid was calculated as follows:

$$S = \frac{Ws + Wt - Wts}{Ws} . 100\%$$

where S = *solubility (weight percent)*
Ws = *initial sample weight (g)*
Wt = *filter paper weight (g)*
Wts = *filter paper and sample weight (g)*

CHAPTER 11

SAND SOLUBILITY

11.2 Test Results

SAND SOLUBILITY

Company Cultus Petroleum NL
Well Skull Creek West 1

Sample	Depth (metres)	Solubility in Acid (percent)
4	1306.08	1.94
17	1755.41	0.07

APPENDIX I

FLUIDS

FLUIDS

Formation Brine

Cation	Symbol	mg/L	Anion	Symbol	mg/L
Sodium	Na	4750	Chloride	Cl	7050
Potassium	K	190	Bicarbonate	HCO_3	1160
Calcium	Ca	91	Sulphate	SO_4	333
Magnesium	Mg	45			

Measured Values:

Formation Brine
- Rw @ 25°C = 0.460 ohm.m
- Density @ 25°C = 1.005 g/cm^3
- Viscosity @ 25°C = 0.995 cP

5,500 ppm
- Rw @ 25°C = 1.10 ohm.m

20,000 ppm
- Rw @ 25°C = 0.313 ohm.m

50,000 ppm
- Rw @ 25°C = 0.149 ohm.m

100,000 ppm
- Rw @ 25°C = 0.079 ohm.m

150,000 ppm
- Rw @ 25°C = 0.054 ohm.m

APPENDIX II

CT SCANS

CULTUS PETROLEUM NL

Cultus Petroleum NL
Skull Creek West No.1
C.T. Scans

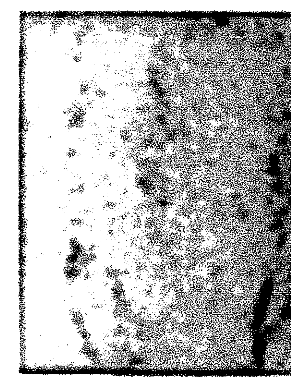
ACS LABORATORIES PTY. LTD.

0°

90°

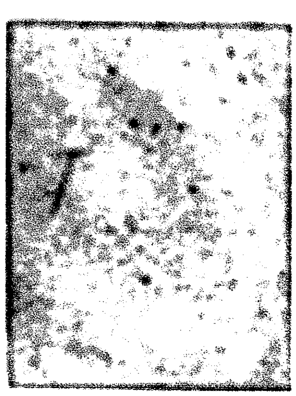
Sample No:	**6**
Depth:	**1308.10 m**
Permeability:	**38 mD**
Porosity:	**22.4 %**

0°



90°

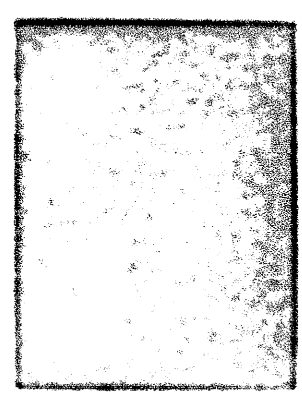
Sample No:	**7**
Depth:	**1308.99 m**
Permeability:	**2.2 mD**
Porosity:	**16.1 %**



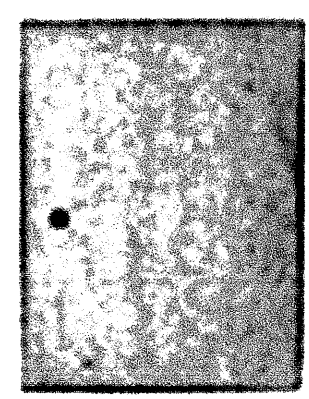
0°

90°

Sample No:	**9**
Depth:	**1310.14 m**
Permeability:	**29 mD**
Porosity:	**21.5 %**



0°



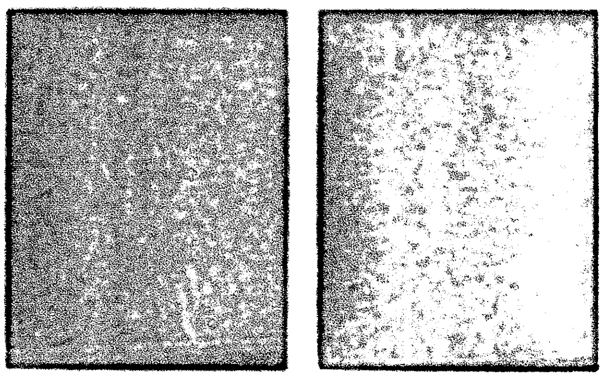
90°

Sample No:	**14**
Depth:	**1752.42 m**
Permeability:	**52 mD**
Porosity:	**21.1 %**

CULTUS
PETROLEUM NL

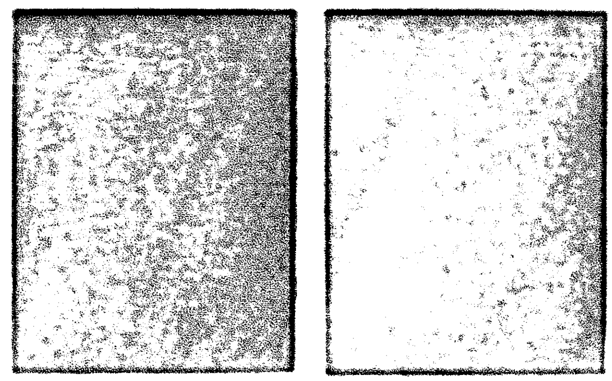
Cultus Petroleum NL
Skull Creek West No.1
C.T. Scans

ACS
LABORATORIES
PTY. LTD.



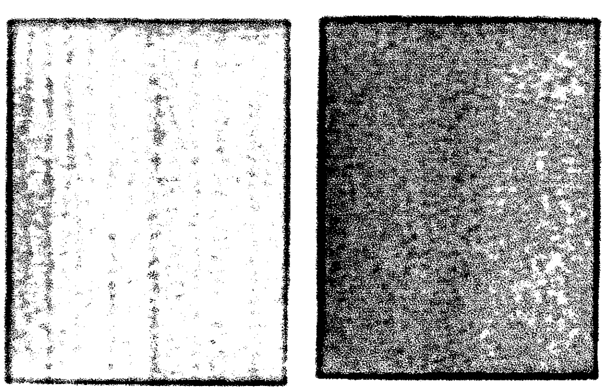
0° 90°

Sample No:	15
Depth:	1783.44 m
Permeability:	11 mD
Porosity:	20.1 %



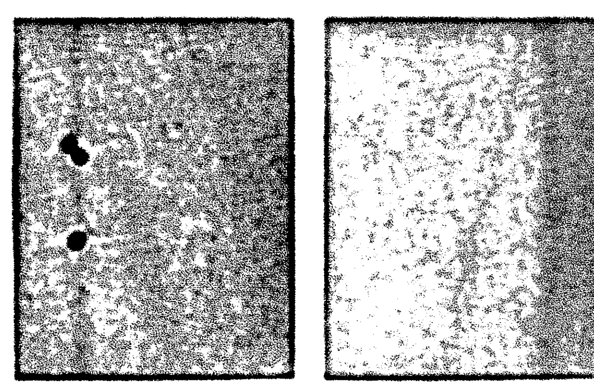
0° 90°

Sample No:	18
Depth:	1756.40 m
Permeability:	2.4 mD
Porosity:	20.2 %



0° 90°

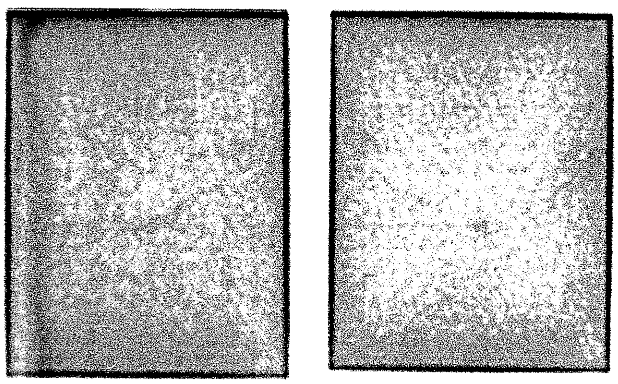
Sample No:	21
Depth:	1759.39 m
Permeability:	14 mD
Porosity:	19.0 %



0° 90°

Sample No:	23
Depth:	1761.29 m
Permeability:	3.5 mD
Porosity:	19.0 %

Cultus Petroleum NL
Skull Creek West No.1
C.T. Scans



0°　　90°

Sample No:	**25**
Depth:	**1763.47 m**
Permeability:	**0.20 mD**
Porosity:	**14.1 %**

APPENDIX III

UNCONFINED COMPRESSIVE STRENGTH REPORT

FACULTY OF ENGINEERING
AND THE ENVIRONMENT
MINING ENGINEERING
RESEARCH GROUP

UNIVERSITY OF SOUTH AUSTRALIA

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Facsimile: (08) 8302 3379
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Email: a.meyers@unisa.edu.au
Address: Levels Campus
POORAKA
SA 5095

TESTING CERTIFICATE

CLIENT ACS Laboratories
PO Box 396
CHERMSIDE QLD 4032

ATTENTION Anthony Drake
CON. NOTE NO. A081639L
PROJECT NUMBER 0386-08
DATE OF TEST 18 April 1997

SERVICE

The Uniaxial Compressive Strength (σ_c), Young's modulus (E) and Poisson's ratio (v) of 2 core specimens was required. Test were carried out according to the method detailed in the ISRM Suggested Methods for Determining the Uniaxial Compressive Strength and Deformability of Rock Materials.

TYPE OF ROCK

Core Number	Depth (m)	Discontinuity orientation(1) (degrees)	Description
A	unknown	massive	fine grained moderately well consolidated quartz sand/siltstone
B	unknown	massive	medium to fine grained poorly consolidated quartz sand/siltstone

(1) A discontinuity is any surface that has a lower tensile strength than the surrounding rock material along which displacement can occur. The surface is independent of age or origin and may include bedding, cleavage, schistosity, jointing, fractures, foliation, cracks etc.

DIMENSIONS

Core Number	Length (mm)	Mean Diameter (mm)	L/D ratio	Mean cross sectional area ($x10^{-3}m^2$)	Volume ($x10^{-5}m^3$)
A	36.8	37.8	1.0	1.12	4.14
B	35.6	37.2	1.0	1.08	3.86

SPECIMEN PREPARATION

Specimens were supplied as core. The ends of each core were faced, made parallel with each other and perpendicular to the sides with a core preparation lathe. The ends were then polished slightly on a rotating table using carborundum powder.

EQUIPMENT

- ELE load frame with digital load indicator, Type 2000, S/N. 1147-6-337.
- PICO Data logger and Microbits 486 PC
- Schlumberger LVDT, Model DG5, S/N. 118705.
- Chyo Jupiter micro-balance, Model PT3-1200D, S/N. 25538.
- Mitutoyo digital calliper, Accuracy 0.02mm.
- Baroid core drying oven, Model 702-40
- Bruel and Kjaer strain indicator, Type 1526, Serial No. 887715.

TEST PROCEDURE

1. Three diameters of each core were measured at 120° to each other along the length of the core. An average diameter was determined from these values and the cross sectional area (A_i) of each core determined. The length of each core was also measured enabling its volume (V_i) and length:diameter (l:d) ratio to be determined. All values are included in the "Dimensions" table above.
2. Four electrical resistance strain gauges were attached to each core. Two gauges to monitor axial strain were attached parallel to the major axis of the specimen midway along the axis and two were attached perpendicular to the major axis of the specimen midway along the axis to monitor tangential strain. The gauges were wired into the strain indicator.
3. A core was placed in the load frame and spherical seats were placed on its upper surface.
4. Three cycles of a 5kN axial loading were applied to relieve any stresses within the core. The load was then removed.
5. Data logging was initiated. The average axial deformation of the core was monitored with the LVDT and the axial force was monitored with the pressure transducer installed in the load frame. The outputs from both transducers were recorded on the data logger. The axial force was also indicated on the digital readout. The axial load vs axial deformation plot is attached to this report.
6. Axial load was then applied at a constant rate. At load intervals of approximately 5 kN, the load was held stable and the strains were allowed to stabilise. Once stabilised, the axial load, axial strain and circumferential strain were sequentially read from the strain indicator and recorded.
7. Staged loading continued until the core failed. The failure mechanism was noted and is recorded in the "Results" table. The axial force (F_a) at failure is also recorded in this table.
8. At the completion of each test, a piece of intact rock was obtained from near the centre of the failed core. The wet mass (M_w) of this rock was recorded, it was dried and its dry mass (M_d) was again recorded.

COMMENTS

- The average diameter of each core was approximately 37mm. This size is less than the minimum diameter of 54mm recommended by the ISRM. The ISRM does, however, recommend that the diameter be at least 10 times the largest grain size and this requirement was achieved.
- The length:diameter ratio of each core was 1.0. This ratio is less than that of 2.5-3.0 recommended by the ISRM. A specimen having a ratio lower than that recommended can display a higher value for the UCS than one having a ratio within the correct range.
- Moisture can have a significant effect on the deformability of the test specimens (ISRM 1979). For this reason the ISRM recommends that *in situ* moisture conditions be preserved until the time of the test. The handling of the core prior to it arriving at the laboratory means that it is highly unlikely that this condition was achieved.
- The ISRM recommends that a minimum of 5 specimens of a particular rock type be instrumented and tested. It must be noted that only two cores were available for testing.
- Core A appeared to have several small voids filled with what appeared to be filler. During testing, the core failed at a lower than expected strength. Without further testing on similar material, it cannot be ascertained whether the filler contributed to the core having a lower strength than it would have, had the core been homogeneous. The result of the premature failure was that stain gauge readings were only obtained at 4 stages of loading. The ISRM recommends that readings be taken at a minimum of 10 stages. Therefore, the values of E and ν obtained for this core must be assumed to be approximate.

CALCULATIONS

1. For each core, at each load interval,
   - the two axial strains and the two circumferential strains were averaged, and
   - the axial stress on the specimen was determined as the ratio between the load and the mean cross sectional area of the specimen.
2. Plots are attached showing,
   - the axial stress plotted in terms of the averaged axial strain and
   - the axial stress plotted in terms of the averaged tangential strain.
3. Average Young's modulus (E_{ave}) was determined from the slope of the more-or-less straight line portion of the axial stress-axial strain curve.
4. Poisson's ratio (ν) was determined using the relationship:

$$\nu = \frac{\text{slope of axial stress-axial strain curve}}{\text{slope of axial stress-tangential strain curve}}$$

   where the slope of the axial stress-tangential strain curve was determined as in Step 3.
5. The ratio between the axial force at failure (F_a) and the mean cross sectional area (A_i) of the specimen represents the Uniaxial Compressive Strength (UCS).

6. The ratio between the mass differential (M_w - M_d) and the dry mass (M_d) of the rock represents the moisture content (W_c) at the time of testing.

RESULTS

Core Number	Wet mass M_w (gms)	Dry mass M_d (gms)	Axial force at yield F_a (kN)	Failure mechanism
A	90.7	85.6	17.8	Multi-plane shear (cup/cone)
B	20.0	19.4	32.5	Multi-plane shear (cup/cone)

Core Number	Moisture content W_c (%)	Young's modulus E_{ave} (GPa)	Poisson's ratio ν	Uniaxial compressive strength (UCS) (MPa)
A	2.9	4.4	0.28	15.8
B	3.1	6.0	0.27	30.0

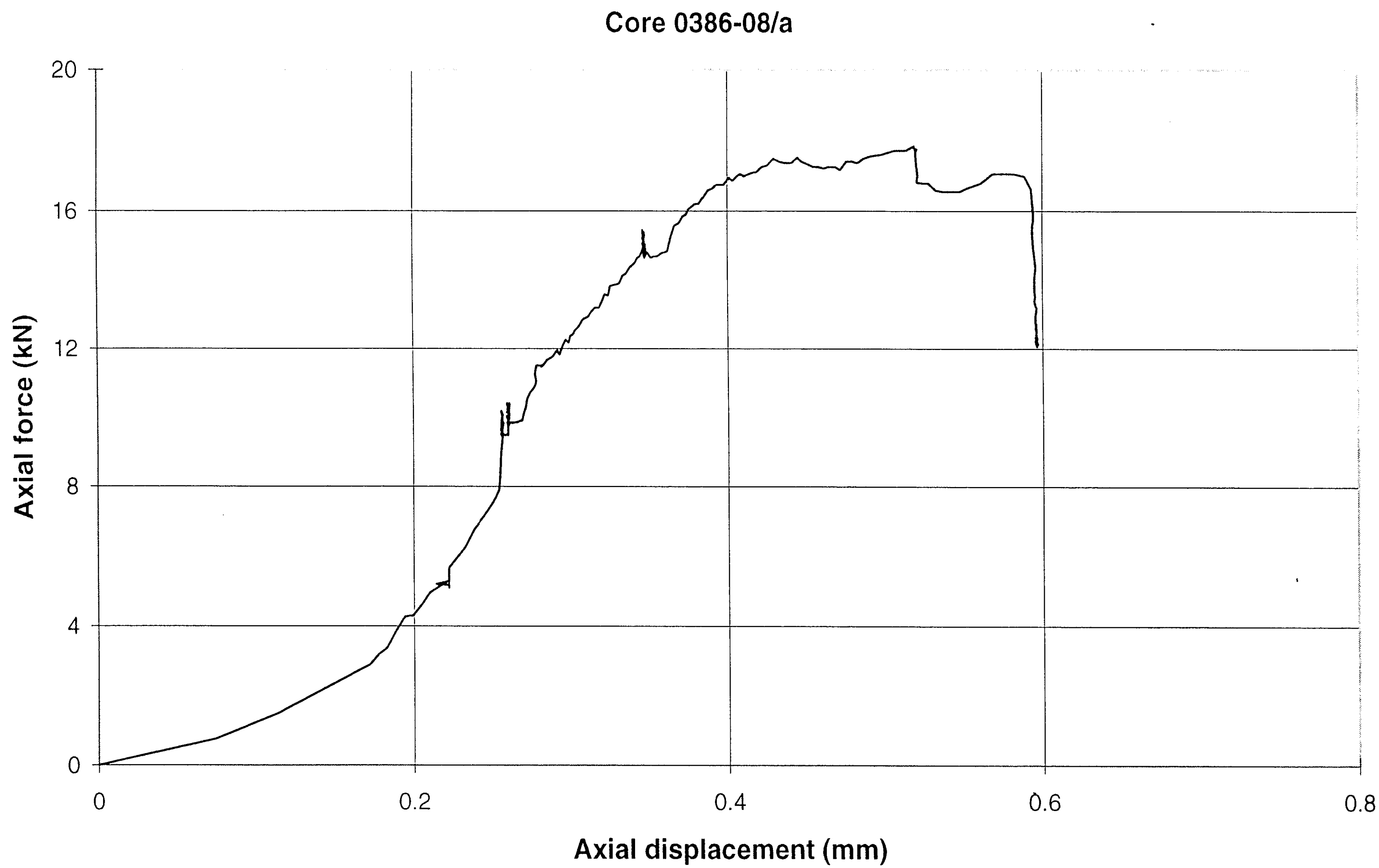
REFERENCE

International Society for Rock Mechanics Commission on the Standardisation of Laboratory and Field Tests (1979) Suggested Methods for Determining the Uniaxial Compressive Strength and Deformability of Rock Materials. Int. J. Rock Mech. Min. Sci. & Geomech. Abstr. Vol.16, No.2 pp.135-141.

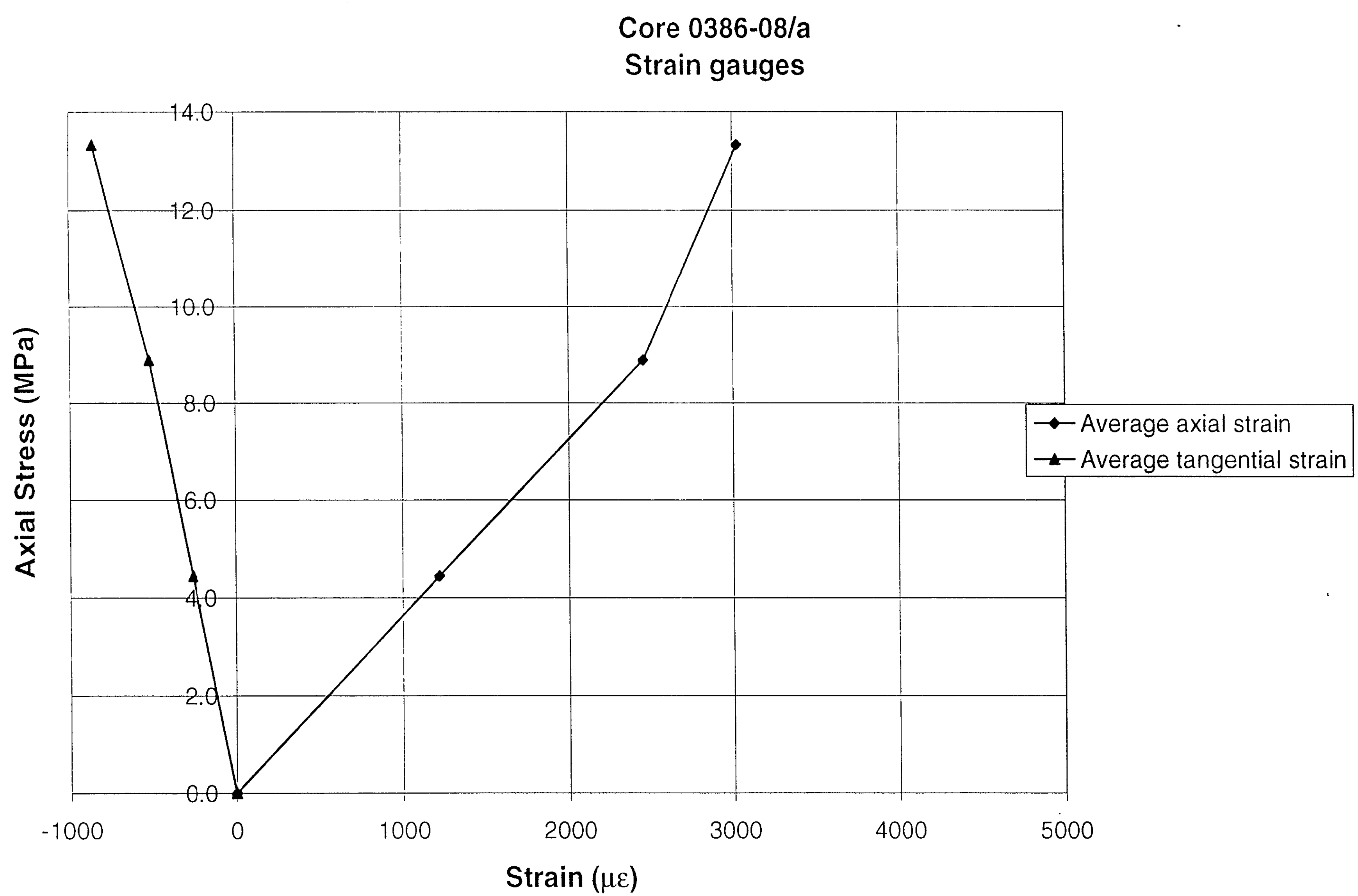
ENGINEER

DATE OF REPORT 21/04/97

Dr Anthony Meyers (MIEaust, CPEng-NPER-3, MAusIMM)
Head
Mining Engineering Research Group



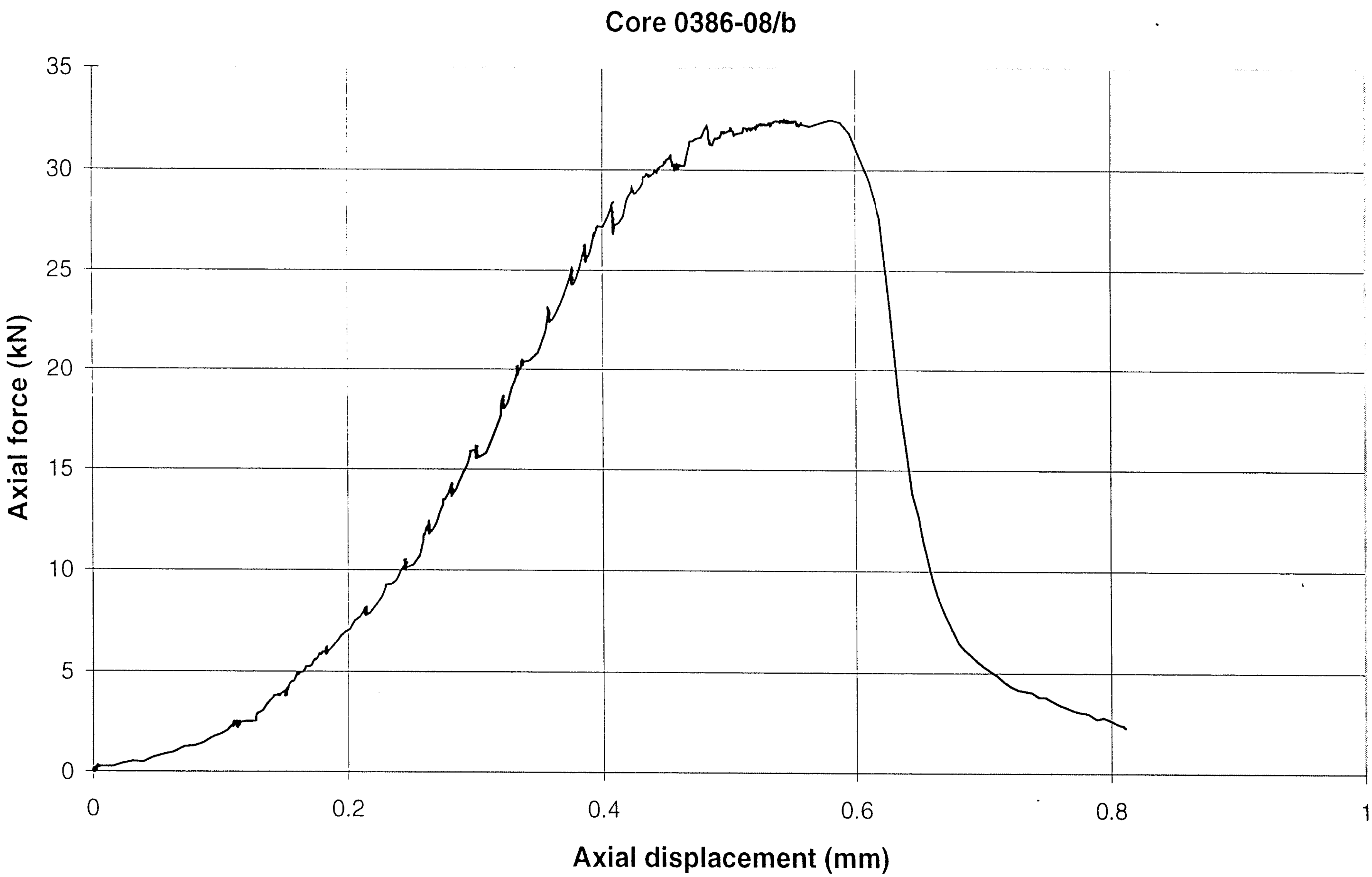
Core 0386-08/a
Axial force (kN)
20
16
12
8
4
0
0
0.2
0.4
0.6
0.8
Axial displacement (mm)

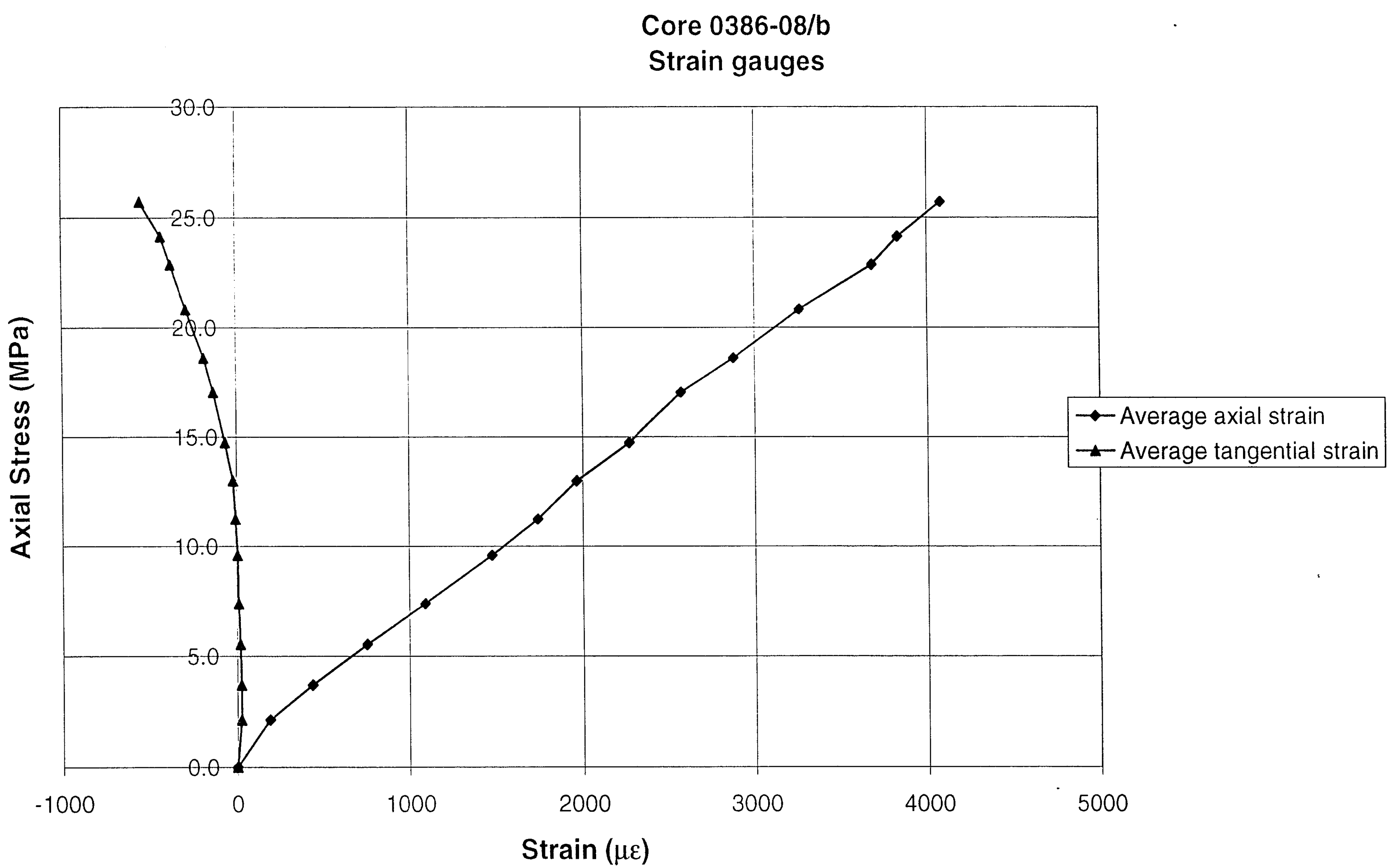


Core 0386-08/a
Strain gauges
Axial Stress (MPa)
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
-1000
0
1000
2000
3000
4000
5000
Strain (με)
Average axial strain
Average tangential strain

Core 0[illegible]6-08/a

Diam 1	Diam 2	Diam 3	Ave diam	Wi	Wf	Moist (%)	
37.90	**37.77**	**37.88**	37.85	88.10	85.60	2.92%	
l:d	Length	Area	Volume	UCS			
1.0	**36.83**	1.125E-03	4.14E-05	15.82			
Force (kN)	Axial 1	Axial 2	Tang 1	Tang 2	Stress (MPa)	Ave Axial	Ave Tang
0.0	0	0	0	0	0.0	0	0
5.0	1290	1155	-320	-200	4.4	1223	-260
10.0	2590	2320	-650	-390	8.9	2455	-520
15.0	3050	3010	-1030	-690	13.3	3030	-860
					Slope axial	4.4E+09	
					Slope tang	-1.6E+10	
					Poissons	0.28	


Core 0386-08/b
Axial force (kN)
35
30
25
20
15
10
5
0
0
0.2
0.4
0.6
0.8
1
Axial displacement (mm)



Core 0386-08/b
Strain gauges
Axial Stress (MPa)
30.0
25.0
20.0
15.0
10.0
5.0
0.0
-1000
0
1000
2000
3000
4000
5000
Strain (με)
Average axial strain
Average tangential strain

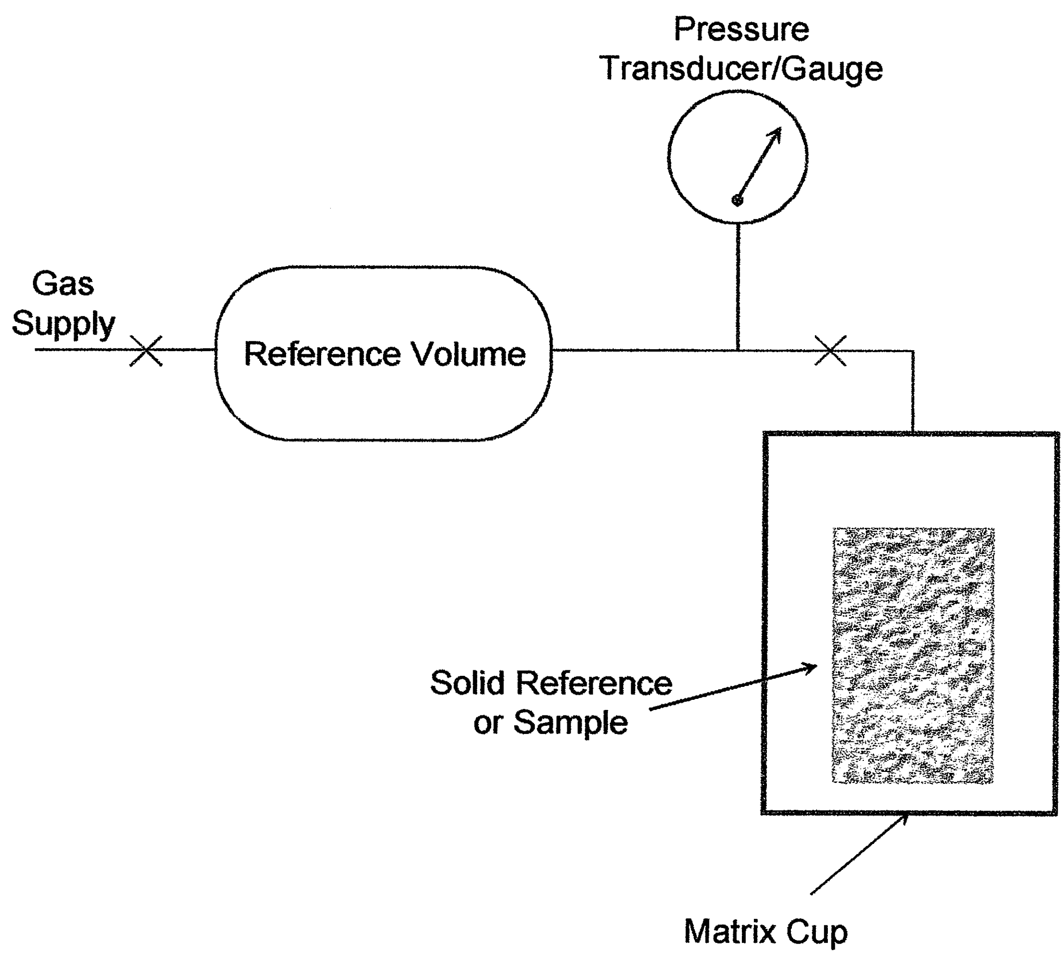
Core 0386-08/b

Diam 1	Diam 2	Diam 3	Ave diam	Wi	Wf	Moist (%)		
37.05	**37.04**	**37.43**	37.17	20.00	19.40	3.09%		
l:d	Length	Area	Volume	UCS				
1.0	**35.56**	1.085E-03	3.86E-05	29.95				
Force (kN)	Axial 1	Axial 2	Tang 1	Tang 2	Stress (MPa)	Ave Axial	Ave Tang	
0.0	0	0	0	0	0.0	0	0	
2.3	330	50	30	20	2.1	190	25	
4.0	770	100	20	30	3.7	**435**	25	
6.0	1240	260	0	40	5.5	750	20	
8.0	1750	430	-10	30	7.4	1090	10	
10.4	2250	700	-20	30	9.6	1475	5	
12.2	2550	930	-30	20	11.2	1740	-5	
14.1	2820	1110	-40	0	13.0	1965	-20	
16.0	3090	1450	-120	-10	14.7	2270	-65	
18.5	3360	1790	-220	-40	17.0	2575	-130	
20.2	3560	2200	-310	-60	18.6	2880	**-185**	
22.6	3810	2710	-470	-100	20.8	3260	-285	
24.8	4010	3360	-620	-130	22.9	3685	-375	
26.2	4100	3570	-700	-160	24.1	3835	**-430**	
27.9	4210	3950	-890	-210	25.7	**4080**	-550	
30.6	3450	4800	-1290	-290	28.2	4125	-790	
						Slope tang	-2.3E+10	
						Slope axial	6.04E+09	
						Poissons	0.27	

APPENDIX IV

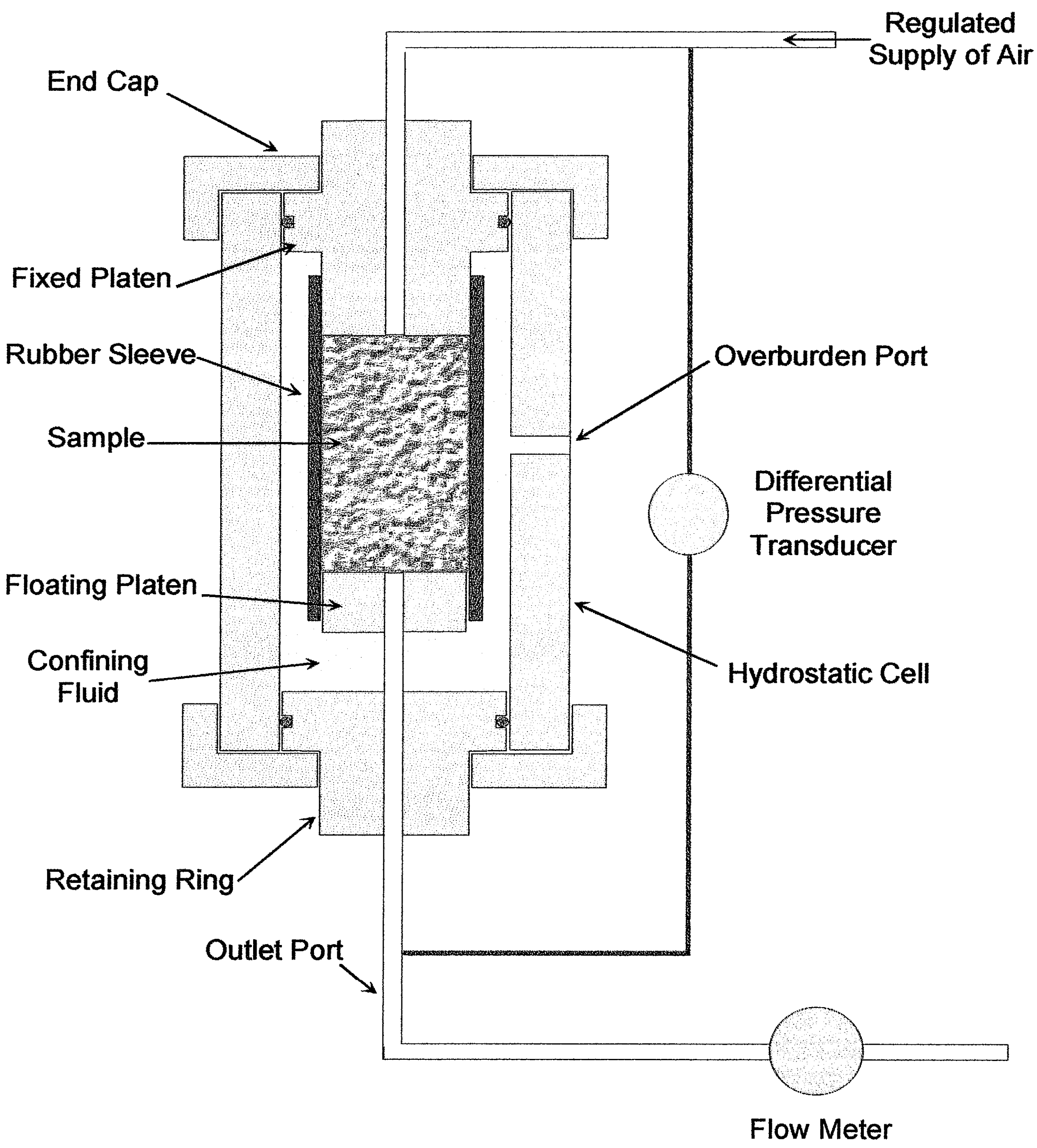
TECHNICAL DRAWINGS

POROSIMETER SCHEMATIC

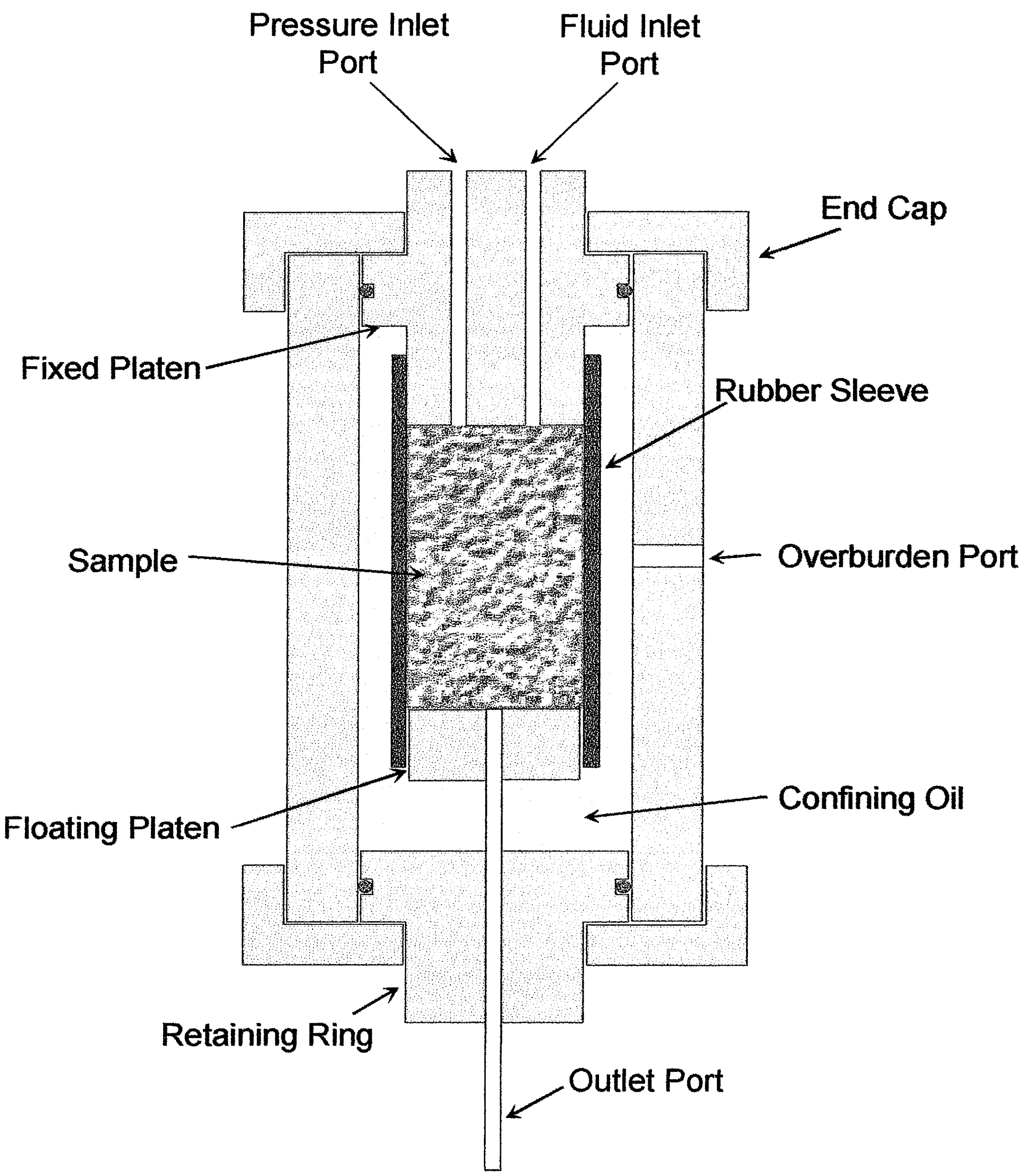


P1.V1 (reference) = P2.V2 (sample)

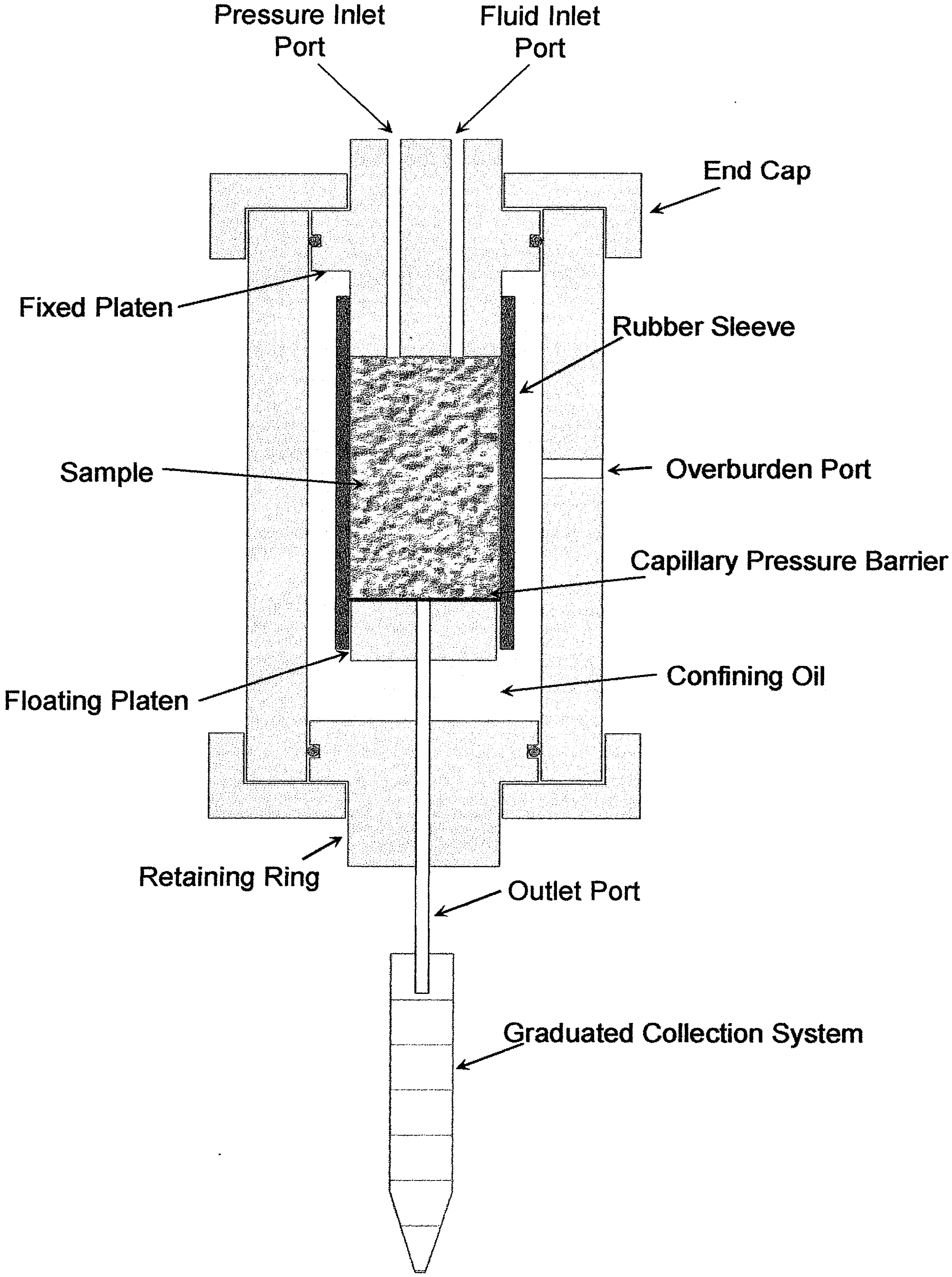
GAS PERMEAMETER SCHEMATIC (Hydrostatic)



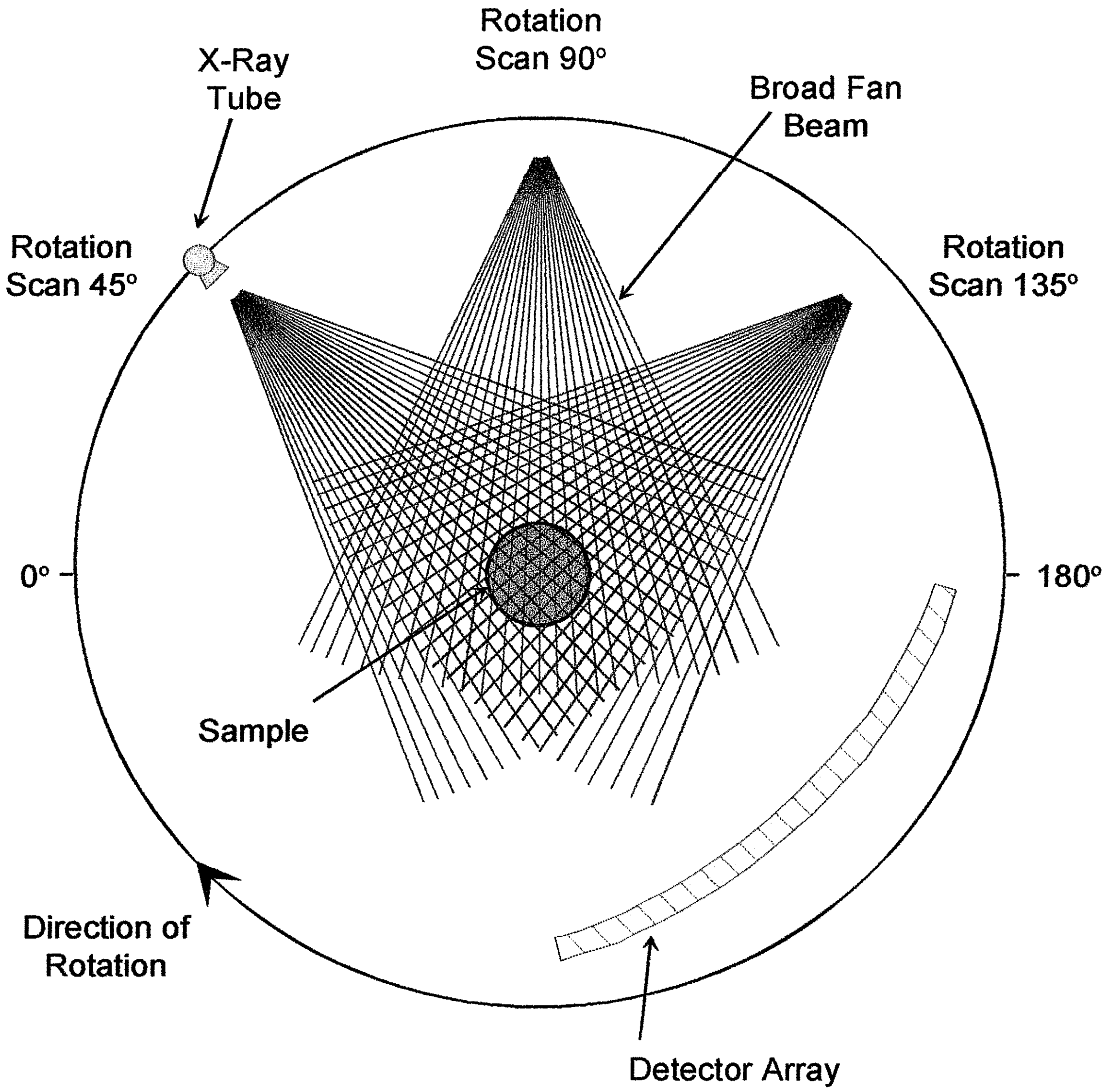
HYDROSTATIC CORE HOLDER



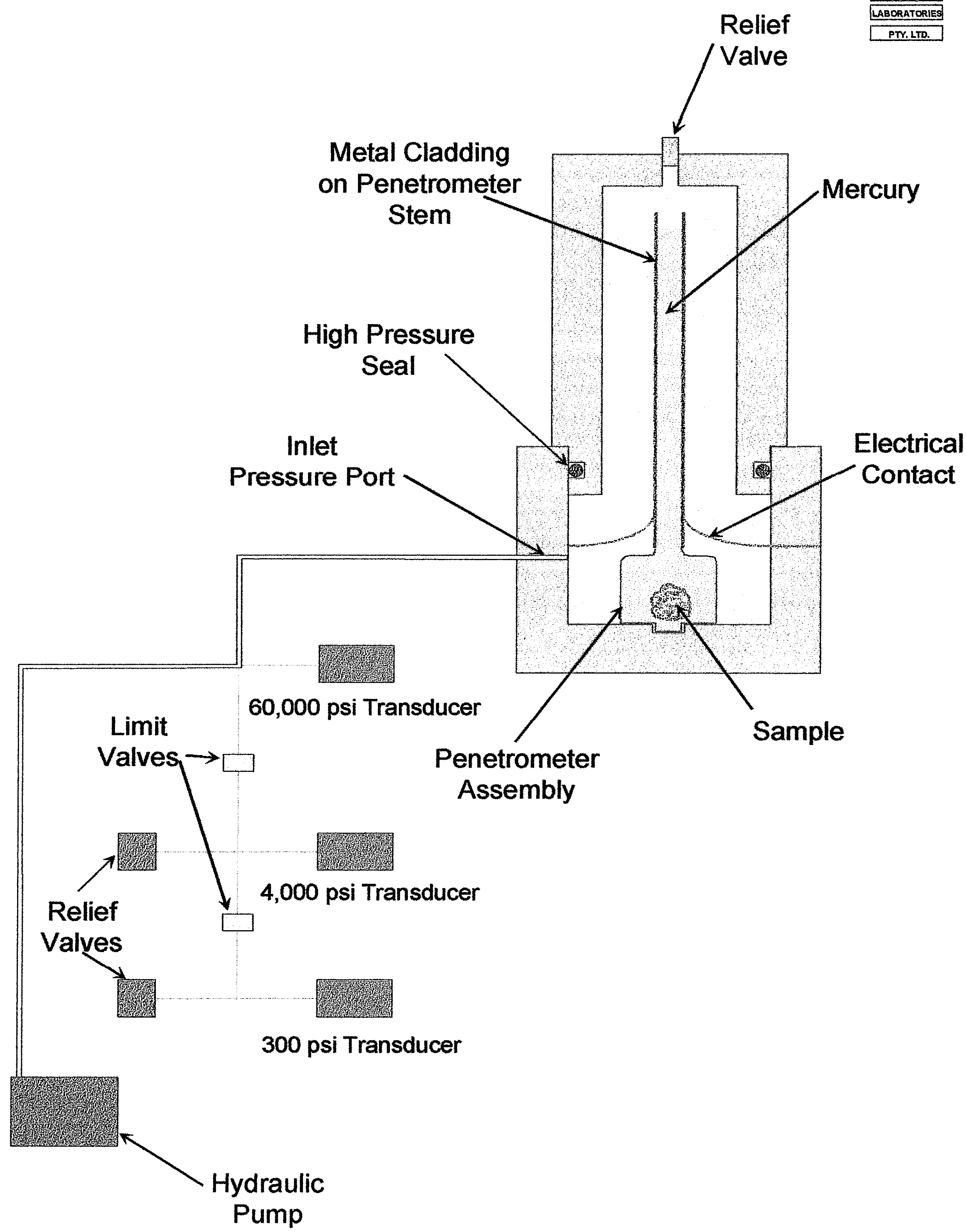
HYDROSTATIC CAPILLARY PRESSURE CELL



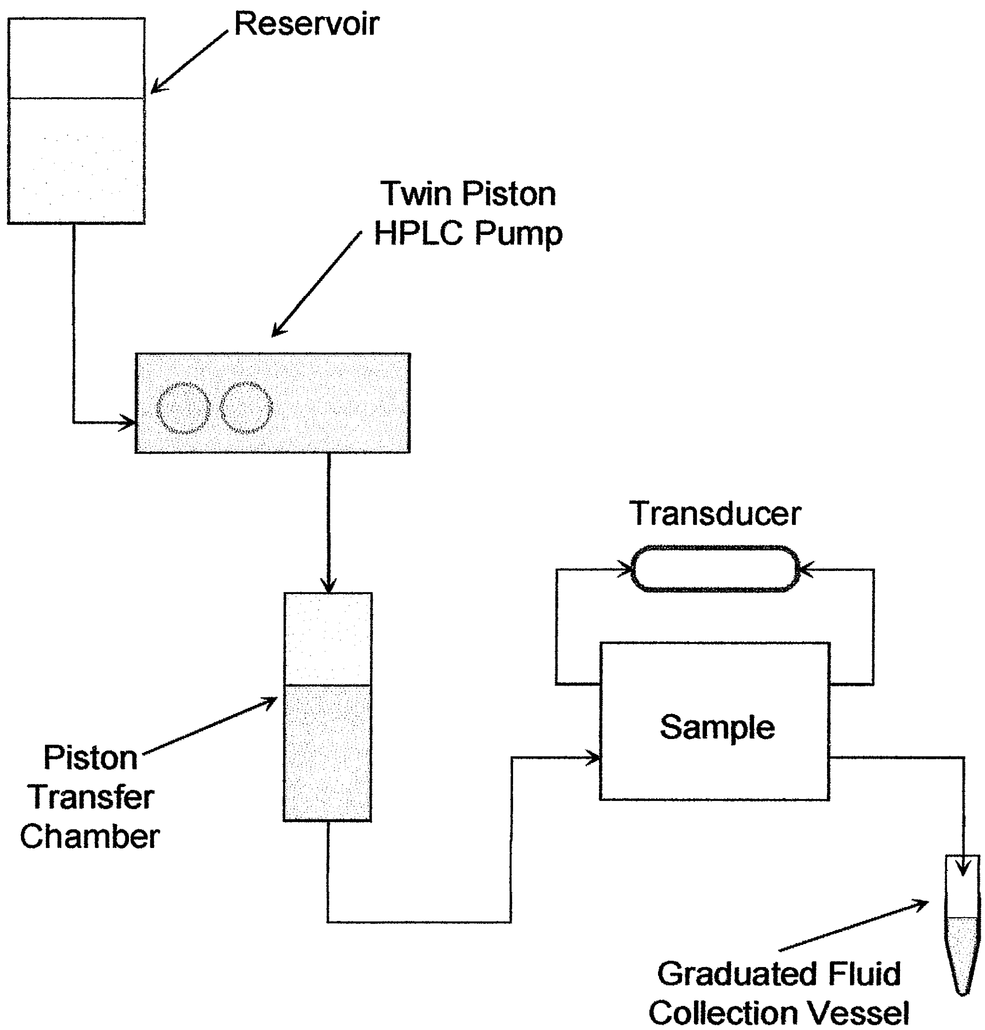
CT SCANNER SCHEMATIC



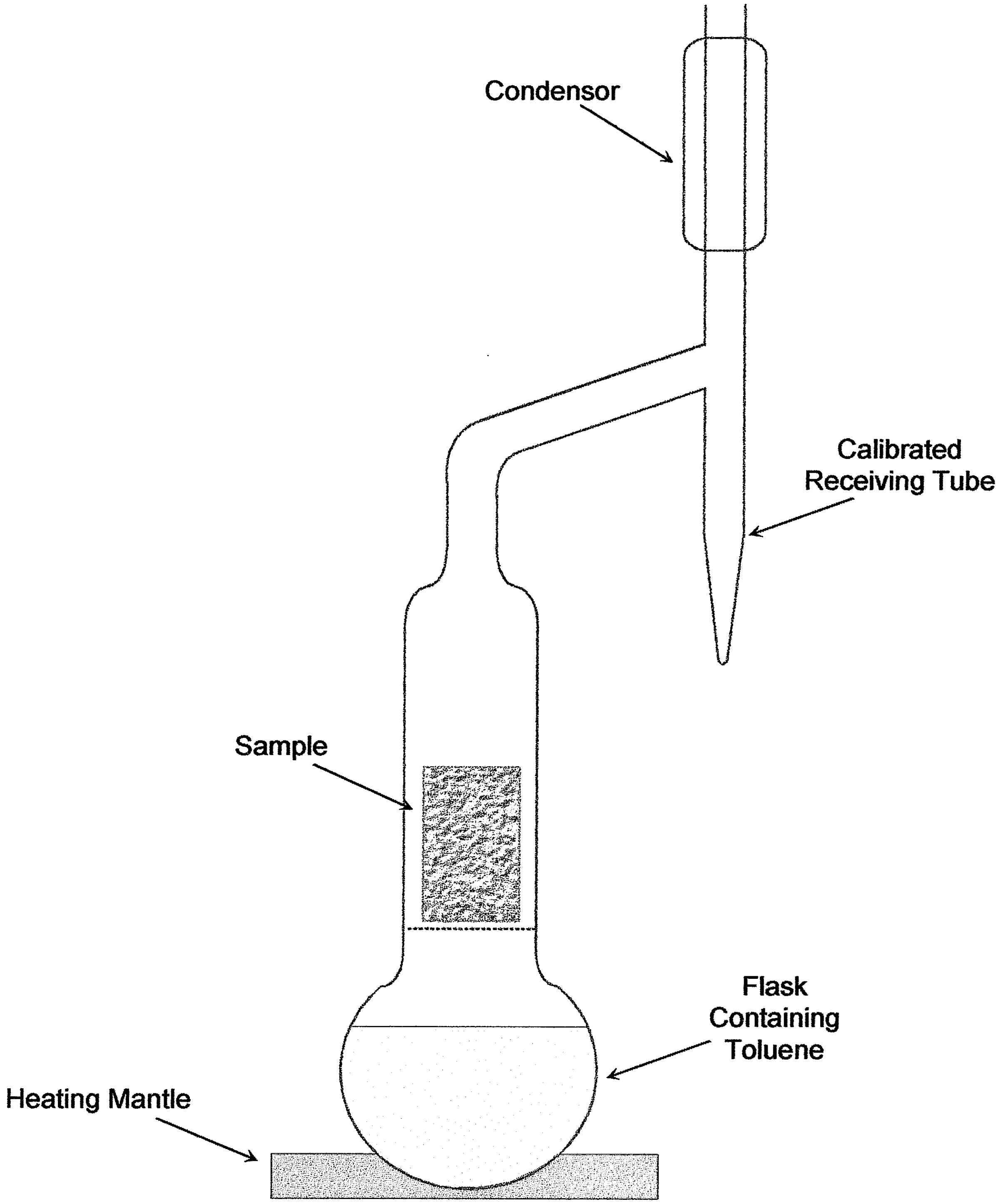
MERCURY INJECTION SCHEMATIC



LIQUID PERMEABILITY SCHEMATIC



DEAN-STARK APPARATUS



APPENDIX V

QUALITY CONTROL

ACS SPECIAL CORE ANALYSES PROJECT
SUMMARY QUALITY CONTROL SHEET:

Client: Cultus Petroleum **Project No:** 038608 **Well:** Skull Creek West 1

Data QC by (name and initials): Anthony Drake AMD.

Data Set:	Initials:	Date:	Comments:
1. SAMPLE PREP			
1.1 Base Parameters	AD	15/4	
1.2 CT Scanning	AMD	25/4	
1.3 Saturation	AMD	29/4	
2. Electrical Properties			
2.1 FF	AMD.	2/5	Note different lithologies!
2.2 Pc / RI	AMD	22/9/97	
2.3 CEC	✓	✓	
2.4 Co/Cw	AMD	9.7.97	
3. MERCURY INJECTION	AMD	22/5	
4 TRAPPED GAS	AMD	18/8/97	Check. #7. Rerun 1/9/97.
	AMD	1/9/97	#7 ✓.
5. ROCK STRENGTH	AMD	21/4	
6. SAND SOLUBILITY	AMD	12/6	
7. MUD LEAKOFF AND REGAIN		CANCELLED	

APPENDIX VI

FINAL STATUS REPORT

ACS LABORATORIES PTY LTD.

ACS LABORATORIES PTY LTD: SPECIAL CORE ANALYSIS STATUS REPORT

Status Report Number 11

Company: **Cultus Petroleum**

Well/Work: **Skull Creek West 1**

Attention: **Andy Ion**

Fax No.: **(02) 9418 1504**

Copy to:

Fax No.:

Date: **5 September 97**

ACS File No.: **0386 08**

Analysis	No	Date Started	Number Complete	Completion Dates Expected	Completion Dates Actual	Invoice Number	Details	Comments
Sample Preparation	11	8 Apr 97	11	end April	29 Apr 97	1252		Complete
Base Parameters	11	8 Apr 97	11	15 Apr 97	15 Apr 97	1252		Complete
CT Scanning	9	16 Apr 97	9	26 Apr 97	25 Apr 97	1252		Complete
Saturation	9	28 Apr 97	9	end April	29 Apr 97	1252		Complete
Electrical Properties								
Formation Factor	6	29 Apr 97	6	mid May	2 May 97	1288		Complete
Res Index & Cap Pressure	5	2 May 97	5	June		1329, 1379		Complete See note 1
Cation Exchange Capacity	3	15 Apr 97	3	early May	9 Apr 97	1252		Complete
Multi-Salinity FF	3	1 May 97	3	June	24 Jun 97	1288		Complete
Mercury Injection	3	15 Apr 97	3	mid May	16 May 97	1288		Complete
Trapped Gas	5	30 Jun 97	5	July	28 Aug 97	1379, 1415		Complete
Rock Strength	2	11 Apr 97	2	mid May	21 Apr 97	1252		Complete
Sand Solubility	2	28 Apr 97	2	mid May	16 May 97	1288		Complete
Mud Leakoff and Regain	0							Cancelled

Additional Comments/Notes:

1. Sample 9 failed during Pc/RI due to friable nature and will not be suitable for further analyses. We suggest replacing with sample 18 for Trapped Gas analyses as advised 4 July 1997.
2. Draft final report dispatched 3 September 1997.

ANTHONY M DRAKE
Supervisor
Special Core Analysis
Ph: 07 3350 1222
Fax: 07 3359 0666
Email: acs.bris@acslabs.com.au

APPENDIX VII

ABBREVIATIONS

BASIC LIST OF SPECIAL CORE ANALYSIS ABBREVIATIONS

a:	Intercept	KwKo:	Oil-Water Relative Permeability
ABPc:	Air-Brine Capillary Pressure	m:	Cementation Factor
Amb:	Ambient Conditions (no Overburden Pressure)	n:	Saturation Exponent
BF:	Basic Flood	OB:	Overburden Pressure (psi)
Bv:	Bulk Volume (cc)	OBPc:	Oil-Brine Capillary Pressure
CEC:	Cation Exchange Capacity	Ø	Porosity (%)
Cent:	Centrifuge	Pc:	Capillary Pressure
D:	Drainage (i.e. draining of the wetting fluid - usually brine)	PP:	Porous Plate
FRF:	Formation Resistivity Factor	Pv:	Pore Volume (cc)
FRI:	Formation Resistivity Index	PvComp:	Pore Volume Compressibility
Gv:	Grain Volume (cc)	Ro:	Resistivity of a Fully (Brine) Saturated Sample
HgInj:	Mercury Injection Capillary Pressure	Rt:	Resistivity of a Partially Saturated Sample (ohm - metres)
I:	Imbibition (i.e. imbibition of the wetting fluid - usually brine)	Rw:	Resistivity of the Brine
K:	Permeability (mD)	S:	Saturation (%)
Ka:	Air Permeability	SngPnt:	Single Point
Kg:	Gas Permeability	So:	Oil Saturation
KgKo:	Gas-Oil Relative Permeability	Sor:	Irreducible Oil Saturation (or Residual Oil Saturation)
KgKw:	Gas-Water Relative Permeability	Sg:	Gas Saturation
Klink:	Klinkenberg Permeability	Sgr:	Residual Sg
Ko:	Oil Permeability	SS:	Steady State
Krg:	Relative Gas Permeability	Sw:	Brine Saturation
Kro:	Relative Oil Permeability	Swir:	Irreducible Sw
Krw:	Relative Water Permeability	USS:	Unsteady State
Kw:	Brine Permeability	Wett:	Wettability

APPENDIX 3

PETROLOGY REPORT

7 April, 1997

ACS
LABORATORIES
PTY. LTD.

↑ → GON

Cultus Petroleum NL
Level 4
828 Pacific Highway
GORDON NSW 2072

Attention: Andy Ion

REPORT: 0372-01

CLIENT REFERENCE: Purchase Order No. 10402

MATERIAL: Core Plug Samples

LOCALITY: Skull Creek

WORK REQUIRED: Detailed Petrology

Please direct technical enquiries regarding this work to the signatories below under whose supervision the work was carried out.

Stuart Tye

KEVIN H FLYNN
Manager
Special Core Analysis & Geological Services

DR STUART TYE
Petrologist

ACS
LABORATORIES
PTY. LTD.

PETROLOGY and RESERVOIR QUALITY

of

SKULL CREEK CORE PLUG SAMPLES

for

CULTUS PETROLEUM NL

by

ACS LABORATORIES PTY LTD

ACS
LABORATORIES
PTY. LTD.

PETROLOGY and RESERVOIR QUALITY

of

SKULL CREEK SAMPLES

Skull Creek West 1

A final report prepared for Cultus Petroleum Ltd.

by

DR STUART TYE

March 1997

Brisbane Laboratory: P.O. Box 396, Chermside Qld 4032, Australia
☎: 61 7 3350 1222 Facsimile: 3359 0666
E-mail: acs.bris@acslabs.com.au

ACS Laboratories Pty Ltd
ACN: 008 273 005

This report is divided into two parts:

Part A presents an executive summary (Chapter 1), introduces this investigation (Chapter 2), describes methodology (Chapter 3), summarises the main results (Chapter 4) and presents an integrated model which discusses sediment provenance, environment of deposition and reservoir character (Chapter 5). Photomicrographs referenced in the text are located at the end of Part A.

Part B presents detailed thin section descriptions. Representative photomicrographs are provided with each description.

Sample	Depth (Drlr)	Fm
3	1294.0	Waarre
17	1755.4	Eum
25	1763.47	Eum.

CONTENTS

PART A

PART B

THIN SECTION DESCRIPTIONS

1. EXECUTIVE SUMMARY

- Cultus Petroleum NL submitted three core plug samples for petrographic analysis involving detailed thin section description and SEM analysis. This study was performed as a pre-study to special core analysis and two samples were examined from each core plug; one sample uncleaned and one cleaned. This was undertaken in order to ascertain the affect of cleaning upon clay structure (i.e. preservation/damage) within the samples.

- Sample 3 is a massive, grain-supported, fine-grained, well sorted, subangular to subrounded lithic arkose. Sample 17 is a massive, grain-supported, fine- to medium-grained, moderately sorted, subangular to well rounded feldspathic litharenite. Sample 25 is a bedded, matrix- to grain-supported, very fine-grained, moderately sorted, subangular to subrounded feldspathic litharenite.

- Lithic grains (volcanic, sedimentary and quartz-mica schistose grains) are the dominant components of samples 17 and 25 and a major component of sample 3. Quartz grains are a dominant component of sample 3 and a major component of samples 17 and 25. Feldspar (K-feldspar and plagioclase) is a major component of all samples. Polycrystalline quartz and accessory material (organic matter, muscovite, biotite and zircon) are very minor to minor components.

- Detrital matrix (dominantly illite and kaolinite) is a minor component of samples 3 and 17 and is a dominant component of sample 25. Detrital clay matrix within sample 25 has partially altered to authigenic illite.

- Authigenic mineralisation comprises major Fe-dolomite, minor pyrite, illite and siderite within sample 3; major chlorite in sample 17; minor illite and chlorite in sample 25. Chlorite forms a pervasive pore lining and pore fill within sample 17.

- Sample 3 contains low to moderately preserved (5%) visible secondary porosity (due to dissolution of dolomite cement). Sample 17 also contains low to moderately preserved (6%) intergranular porosity. Chlorite cement within this sample may contain significant amounts of microporosity. Sample 25 contains negligible visible porosity but may contain some microporosity associated with the detrital matrix.

- Diagenesis has involved precipitation of pyrite, chlorite cementation, moderate compaction, alteration of detrital clay to coarse-crystalline illite (sericite), dolomitisation (within sample 3) and partial dissolution of dolomite cement in sample 3 and lithic grains in sample 17.

- The sample appears to have low to moderate reservoir potential. Both SEM and thin section analysis suggest that the cleaning affects are negligible and there is no notable degradation of clay structure as a result of cleaning.

2. INTRODUCTION

Cultus Petroleum NL submitted 3 core plugs from Skull Creek for a petrographic study involving detailed thin section description and SEM analysis. A total of 3 pairs of samples were scheduled for analysis as follows:-

- Subset Suite A: Samples 3, 17 and 25 (examined prior to cleaning)
- Subset Suite B: Samples 3B, 17B and 25B (examined following cleaning)

A summary of the major aims follows:-

- Undertake thin section descriptions to include sediment classification, description of texture and composition, diagenesis, reservoir potential and environment of deposition.

- Characterise clay type and distribution using scanning electron microscopy. Discuss the effect that sample cleaning has had upon clay structure.

- Present an integrated model detailing lithology, sediment provenance and environment of deposition, style and extent of diagenetic modification and reservoir potential.

3. METHODS

Thin Section Preparation
Samples were impregnated with blue-stained araldite prior to thin section preparation in order to facilitate description of porosity and permeability. Thin sections were made using standard techniques and stained with sodium cobaltinitrate for K-feldspar identification and a mixed solution of Alizarin Red-S and potassium ferricyanide for carbonate identification.

Scanning Electron Microscopy
A small piece of the cleaned and freshly broken sample was mounted on a pin-type aluminium stub using 5-minute araldite and dried in a vacuum desiccator for twelve hours. Dried samples were splutter coated with gold (approx. 20 nm) prior to viewing in a Jeol JSM-6400F scanning electron microscope. Samples were studied at 20 kV with a beam spot size of 30-50 nm and a working distance of 15-25 nm. Mineral identification was based on a combination of morphology and elemental composition as determined by energy dispersive spectroscopy (EDS) using a link light element, high purity germanium detector at 15kV accelerating voltage and 100 seconds collection time.

4. RESULTS

A summary of lithology (Fig. 1), texture (Table 1) and diagenesis is presented over. Photomicrographs referred to in the text are presented at the end of Part A. A representative photomicrograph of each sample is presented with the relevant thin section description in Part B.

Lithology (Fig. 1)
Sample 3 is a lithic arkose (Fig. 2) and samples 17 (Fig. 3) and 25 (Fig. 4) are feldspathic litharenites.

Texture
Sample 3 is a massive, grain-supported, fine-grained, well sorted, subangular to subrounded lithic arkose and contains pervasive Fe-dolomite cement. Sample 17 is a massive, grain-supported, fine- to medium-grained, moderately sorted, subangular to well rounded feldspathic litharenite and contains pervasive chlorite as pore lining and pore-fill. Sample 25 is a bedded, matrix- to grain-supported, very fine-grained, moderately sorted, subangular to subrounded feldspathic litharenite.

Composition (Table 2)
Monocrystalline quartz forms a dominant component of sample 3 (44%) and a major component (15 - 16%) of the other two samples. Monocrystalline quartz displays straight to strongly undulose extinction. Lithic grains comprise a dominant component of sample 17 (36%) and a major component of the other two samples (10 - 13%). Lithic grains comprise altered volcanic chert, fine sandstone, siltstone, shale, chert and quartz-mica schistose grains. Volcanic grains are the most dominant component of the lithic fraction within sample 17 (Fig. 3). Some lithic grains have been partially dissolved and display corroded textures. K-feldspar (1 - 10%) and plagioclase (1 - 21%) are present within all samples. Plagioclase is a significant component of sample 17. Polycrystalline quartz (1 - 2%) and accessory material (2 - 5%) are a minor component of all samples. Accessory material consists of organic matter, muscovite, biotite and zircon.

Detrital clay matrix is a significant component of sample 25 (53%) and a minor component (2%) of samples 3 and 17. Where present it appears to consist of a mixture of kaolinite, illite and illite/smectite (Fig. 5). Kaolinite forms well defined booklet morphologies which may be authigenic (Fig. 6). Illite displays flaky textures (Fig. 7).

The dominant authigenic minerals identified were Fe-dolomite cement (identified via staining; 16%; Fig. 2) within sample 3 and pervasive chlorite pore linings (14%; Fig. 8) within sample 17. Other authigenic minerals identified were minor micritic calcite (sample 3), pyrite, authigenic illite (sericite) and trace quartz cement in the form of grain overgrowths.

Low to moderate porosity (5 - 6%) was preserved within samples 3 and 17. In sample 3 porosity is preserved as secondary pores (Fig. 2) which have resulted from the dissolution of Fe-dolomite cement. Intergranular primary porosity is dominant within sample 17. Sample 25 contains negligible visible porosity. There may be significant amounts of microporosity associated with detrital clay matrix (particularly within sample 25) and chlorite cement (sample 17; Fig. 9).

Diagenesis

Only the major diagenetic events are summarised below and the reader is referred to the thin section descriptions in Part B for a more detailed discussion. As far as possible, diagenetic processes are discussed in chronological order, although it should be noted that some processes overlap and that the timing of others is poorly constrained.

- It is possible that aragonite entered sample 3 during early diagenesis. Although there is no aragonite preserved within the sample the loose detrital framework suggests precipitation prior to compaction. This aragonite has subsequently been completely replaced by Fe-dolomite cement. This cement has significantly occluded intergranular porosity within this sample.

- Very minor micritic calcite is associated with altered lithic grains and organic matter within sample 3. It probably was precipitated during early diagenesis.

- Trace amounts of anhedral pyrite are associated with the alteration of some lithic grains and organic matter within sample 25. The timing of pyrite formation is difficult to constrain but pyrite with this type of morphology is typically early diagenetic. Euhedral pyrite was also identified within sample 3 (Fig. 2) where it forms large euhedral masses and small (approx. 10μm) cubic and octahedral crystalloids. Pyrite with this type of morphology probably entered the sample during late diagenesis.

- Pervasive chlorite cement has formed pore linings (5-10μm thick; Fig. 8) and rarer pore fills within sample 17. Minor chlorite is also present within samples 3 and 25 where it has replaced detrital clay matrix.

- Moderate compaction has resulted in a closely packed grain framework in samples 17 and 25 (Fig. 4). in which muscovite fragments and lithic grains have become deformed. There are also a few planar and concavo-convex pressure solution contacts preserved. Compaction has significantly occluded primary intergranular porosity.

- Coarse-crystalline authigenic illite (sericite) has partially replaced detrital clay matrix in all samples.

- Trace amounts of quartz cement in the form of grain overgrowths are present in sample 3, as indicated by euhedral grain boundary terminations. Quartz overgrowths are clearly draped by euhedral Fe-dolomite cement suggesting that quartz cementation predates dolomitisation within this sample.

- Precursor aragonite cement? has been completely replaced by Fe-dolomite cement (identified via staining; Fig. 2). Much of the dolomite has a euhedral morphology and forms crystalloids within open pore spaces. The euhedral nature of the dolomite suggests that it is late stage and is not an early diagenetic product.

- Dissolution has partially removed lithic grains (resulting in oversized pore spaces) and Fe-dolomite cement (in sample 3; Fig. 2). Dissolution accounts for most of the visible porosity observed within sample 3.

SEM Results

SEM analysis was carried out on two samples from each core plug. One sample was analysed prior to cleaning and the other subsequent to cleaning. This was undertaken to ascertain the degree of clay damage or degradation that may have occurred as a result of cleaning. The following was noted for each sample:-

<u>Sample 3:</u> Clay morphologies examined indicated the presence of both authigenic kaolinite (not observed in thin section) and illite. Kaolinite forms small booklets (approx. 10μm max.; Fig. 6) and was observed in close association with the illite (suggesting kaolinite has formed as a result of replacement). Illite is the most dominant clay type within the sample and forms flaky, disordered masses (Fig. 7). There does not appear to have been any difference in the clay structures between the cleaned and uncleaned samples. As the illite is flaky and packed in dense masses it may be more robust than more delicate filamentous illite morphologies.

<u>Sample 17:</u> Chlorite was by far the most abundant clay (Fig. 9) identified within the sample (as indicated by thin section analysis). Chlorite forms well formed pore linings (Fig. 8) and has a characteristic flower-type, disordered, morphology. Close-up analysis of the chlorite structure shows that it is closely associated with flaky illite and illite/smecitite within some pores. There does not appear to be any difference between clay morphologies in the cleaned and uncleaned samples.

<u>Sample 25:</u> The clay fraction of the samples comprises a mass of detrital illite, illite/smectite and kaolinite (Fig. 5). Clays appear densely packed within pore spaces and do not appear to be ordered. Kaolinite displays characteristic hexagonal plates and illite is dominantly flaky and poorly organised There was no significant difference observed between the cleaned and uncleaned samples.

Sample	Lithology
3	<u>Lithic Arkose:</u> Massive, grain-supported, fine-grained, well sorted, subangular to subrounded sandstone. The sample contains pervasive Fe-dolomite cementation.
17	<u>Feldspathic Litharenite:</u> Massive, grain-supported, fine- to medium-grained, moderately sorted, subangular to well rounded sandstone.
25	<u>Feldspathic Litharenite:</u> Bedded, matrix- to grain-supported, very fine-grained, moderately sorted, subangular to subrounded sandstone. Bedding is defined by clay laminations and aligned elongate grains.

Table 1: Summary of lithological descriptions of Skull Creek samples. Detailed descriptions are given in Part A.

Well		Skull Creek		
Sample		3	17	25
Lithology		Lithic arkose	Feldspathic litharenite	Feldspathic litharenite
Grain size		Fine	Fine-med	Very fine
Sorting		Well	Moderate	Moderate
Framework Grains				
Quartz				
	Monocrystalline	44	16	15
	Polycrystalline	1	2	2
Feldspar				
	K-feldspar	10	1	6
	Plagioclase	1	21	5
Rock Fragments				
	Sedimentary	8	12	4
	Metamorphic	2	3	4
	Volcanic		21	5
	Undiff.			
Accessory Grains				
	Organic Matter	5	1	3
	Heavy/Opaque	tr	tr	tr
	Muscovite	tr	1	2
	Glauconite			
Total Porefill				
Matrix				
	Detrital Matrix	2	2	53
	Authigenic Clay	3		
Porefill Cements				
	Calcite/Dolomite	16		
	Siderite	1		
	Quartz	tr		
	Kaolinite			
	Chlorite	tr	14	1
	Pyrite			
	Undiff.			
Replacement				
	Carbonate			
	Silica			
	Clays			
	Pyrite	2	tr	
	Other			
Porosity				
Prim. interparticle			6	
Prim. intraparticle				
Fracture				
Secondary intergranular		5		
Secondary intragranular				
Drilling Mud				

Table 2: Composition of Skull Creek samples. All values are volume percent.

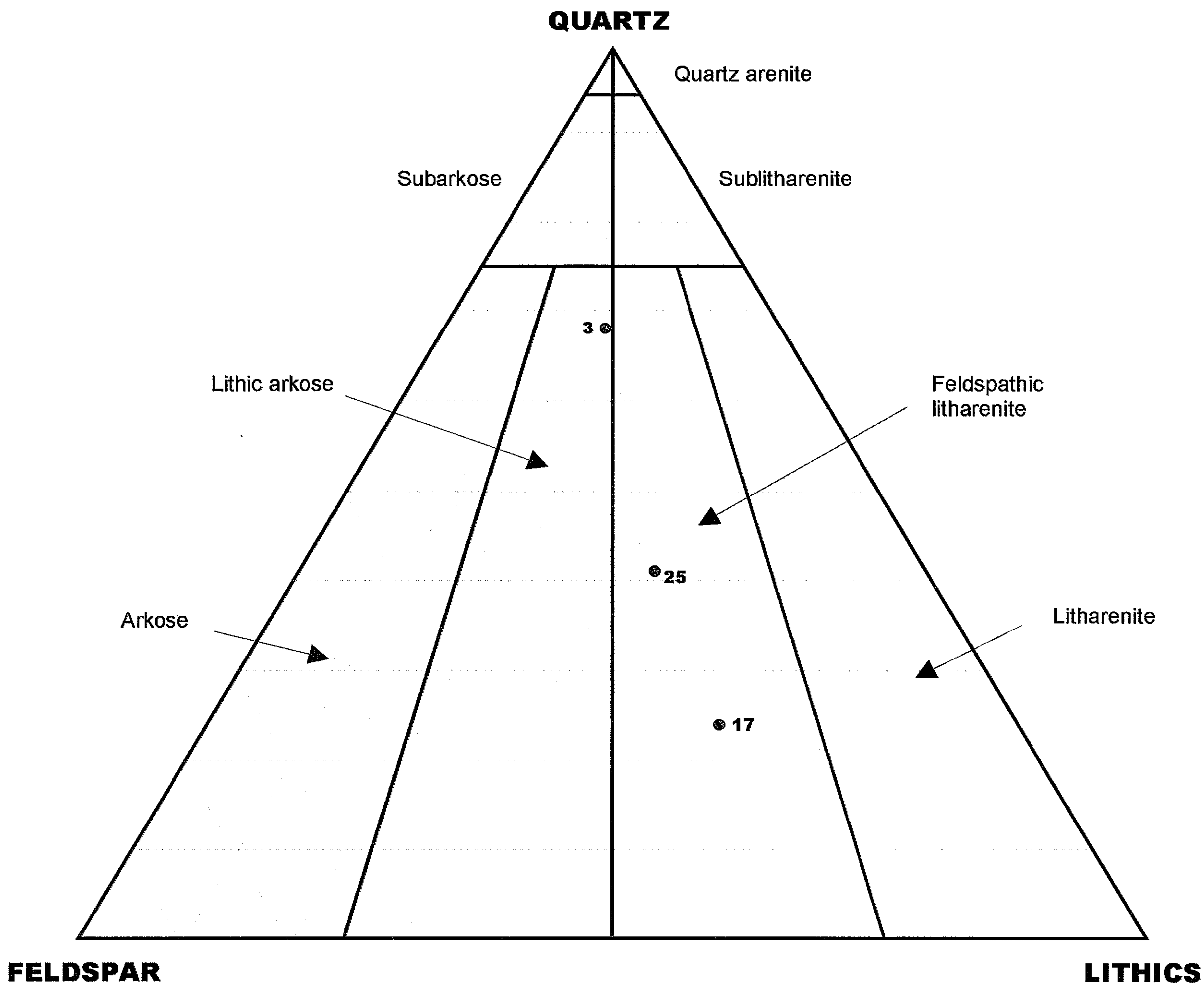


Figure 1: Folk (1974)[1] classification scheme showing position of Skull Creek samples. Classification involves the removal of matrix, mica and cement, and recalculation of components (quartz, feldspar, lithics) to 100%.

1 Folk, R.L. (1974), "Petrology of Sedimentary Rocks", Hempill, Gudgeon

5. SUMMARY AND CONCLUSIONS

5.1 SEDIMENT PROVENANCE

The detrital component of sample 3 appears to be quite different from that of samples 17 and 25. Sample 3 is dominated by monocrystalline quartz displaying straight to strongly undulose extinction. The lithic component of this sample comprises volcanic chert and quartz-mica schistose grains. Polycrystalline quartz comprises both fine-crystalline and coarse-crystalline equant to subequant morphologies. The feldspar component within this sample is dominated by K-feldspar. K-feldspar is typically associated with felsic igneous complexes and is a common component in granites, granodiorites, syenites and pegmatites.

Samples 17 and 25 are dominated by lithic grains comprising volcanic chert, quartz-mica schists, fine sandstone and siltstone/shale. Monocrystalline quartz is a major component (approx. 15%) of both samples and displays similar textures to that identified within sample 3. In contrast to sample 3, the feldspar component of these samples is dominated by plagioclase.

The detrital component of sample 3 suggests the mixing of two sediment sources; a quartz-rich source with continental affinities comprising quartzose rocks with associated felsic igneous complexes and a volcanic source comprising extrusive igneous rocks of apparent intermediate composition. The relative abundance of the quartzose component suggests that the volcanic source may be derived from a more distal provenance.

The abundance of volcanic detritus within samples 17 and 25 suggests that an intermediate volcanic provenance is the dominant source area. This also accounts for the abundance of plagioclase feldspar within these samples which is a common component with these types of rocks. The presence of quartz, quartz-mica meta-fragments and sedimentary grains suggests there has been some mixing with detritus from a source area with more continental affinities. The observed differences between sample 3 and samples 17 and 25 may be explained by the relative proximity of the intermediate volcanic provenance responsible for the volcanic component within the samples or, alternatively, the relative level of volcanic activity within the source area.

5.2 ENVIRONMENT OF DEPOSITION

The absence of diagnostic sedimentary structures makes it difficult to interpret depositional environment alone. The fine- to medium grained nature of samples 3 and 17 suggests deposition in a moderate energy environment. The very fine-grained clay-rich nature of sample 25 suggests deposition in a low energy environment. The compositionally immature nature of samples 17 and 25 suggests possible deposition quite close to the provenance area.

5.3 RESERVOIR POTENTIAL

Samples 3 and 17 have low to moderate reservoir potential as a result of Fe-dolomite and chlorite cementation. The abundance of clay within these samples will also affect permeability. Sample 25 is very fine-grained and contains abundant detrital clay. As a result it has very low reservoir potential. The sample may contain some microporosity as indicated by SEM analysis but the sample is likely to be highly impermeable.

5.4 EFFECT OF CLEANING UPON CLAY STRUCTURE

There does not appear to have been any significant effect upon clay structure within the samples as a result of cleaning. For the most part the clay structures appear to be robust and are not likely to be significantly affected by this type of procedure (reference section 4.0 for further details).

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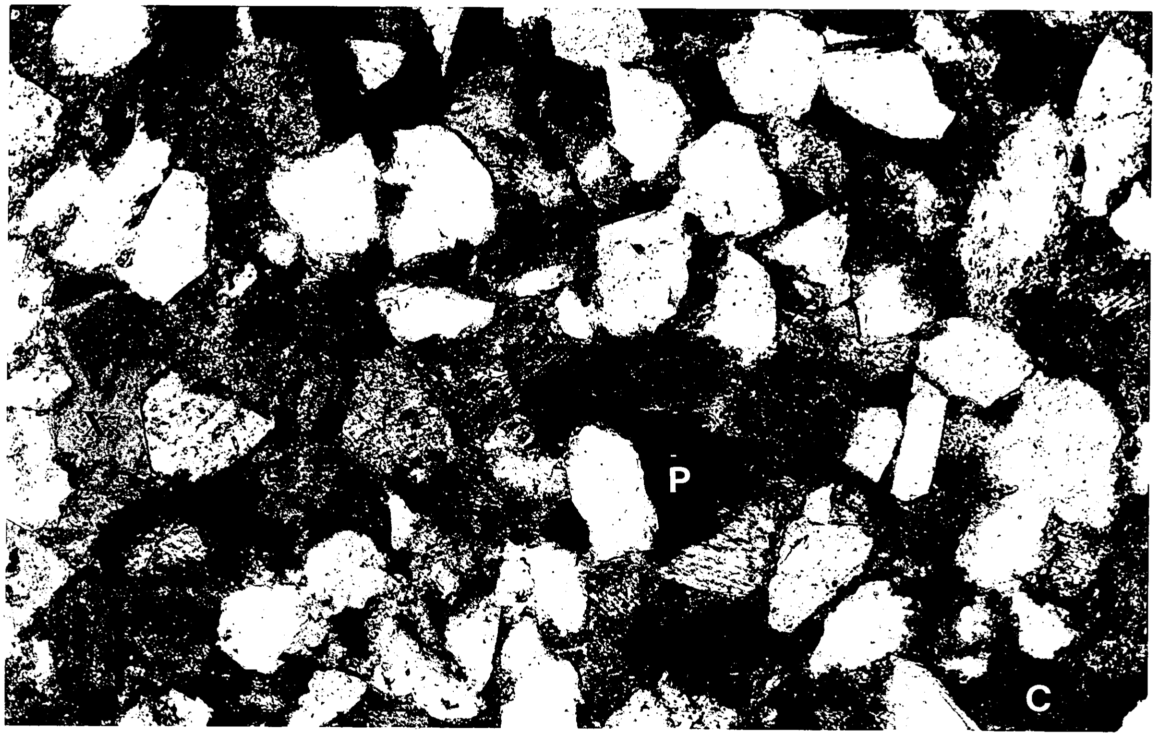

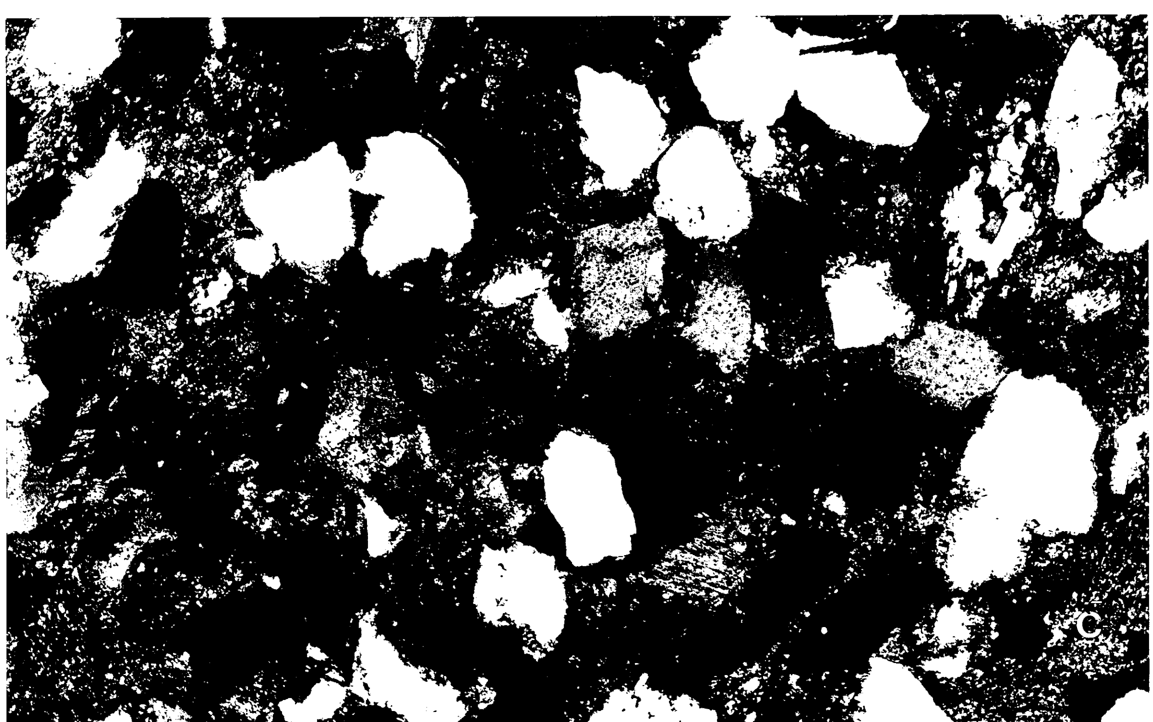

Figure 2: Sample 3: Plain light (upper) and cross-polarised (lower) photomicrograph of fine-grained, well sorted lithic arkose. Photomicrograph shows pervasive Fe-dolomite cement (C), pyrite (P) and oversized pore space containing partially corroded euhedral dolomite crystalloids (X). Long axis of photomicrographs is 1.25mm.

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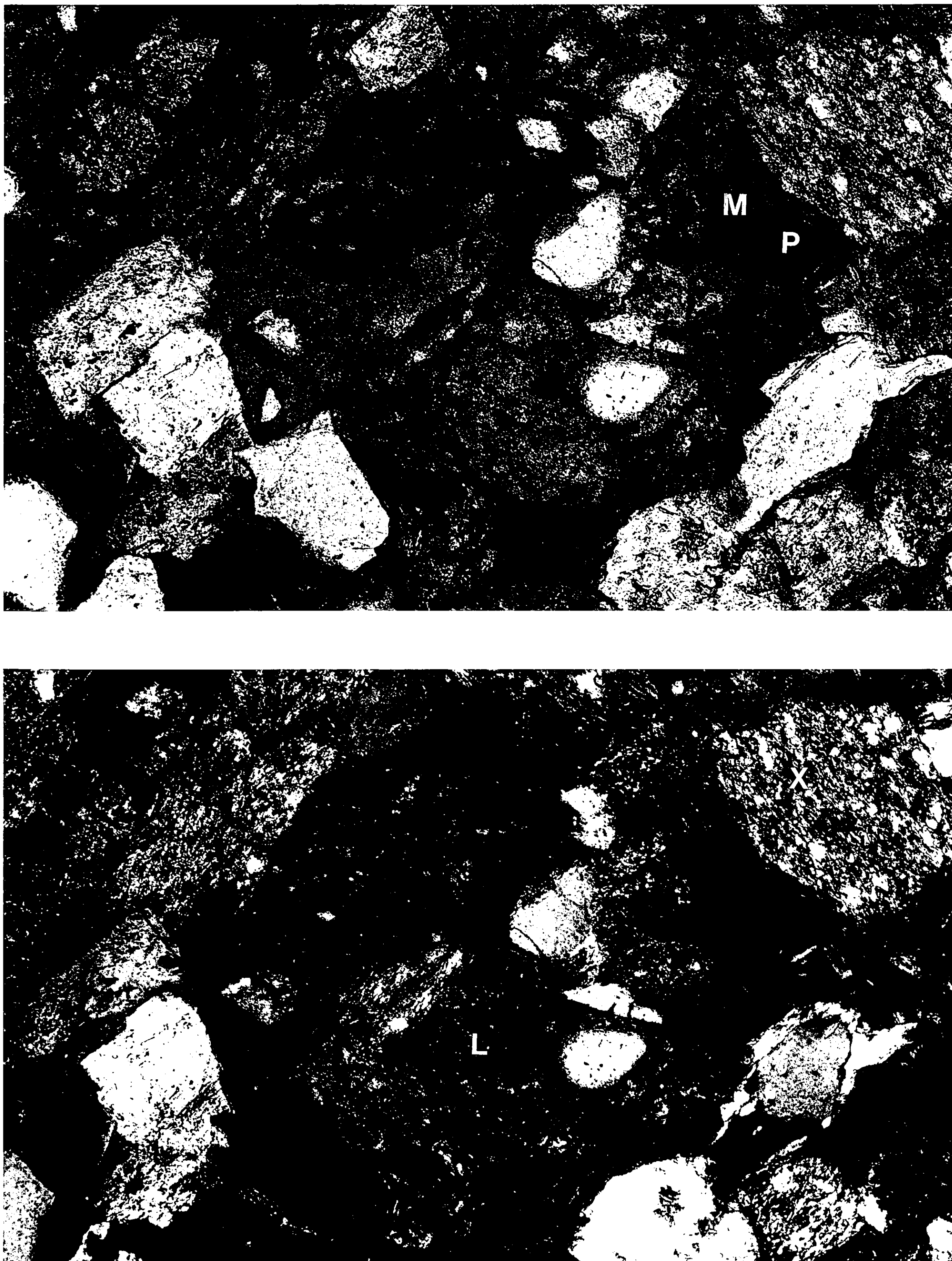

Figure 3: Sample 17: Plain light (upper) and cross-polarised (lower) photomicrograph of fine- to medium-grained, moderately sorted feldspathic litharenite. Photomicrograph shows abundant volcanic chert (L), sedimentary grains (X), pyrite (P) and detrital clay matrix (M). Long axis of photomicrographs is 1.25mm.

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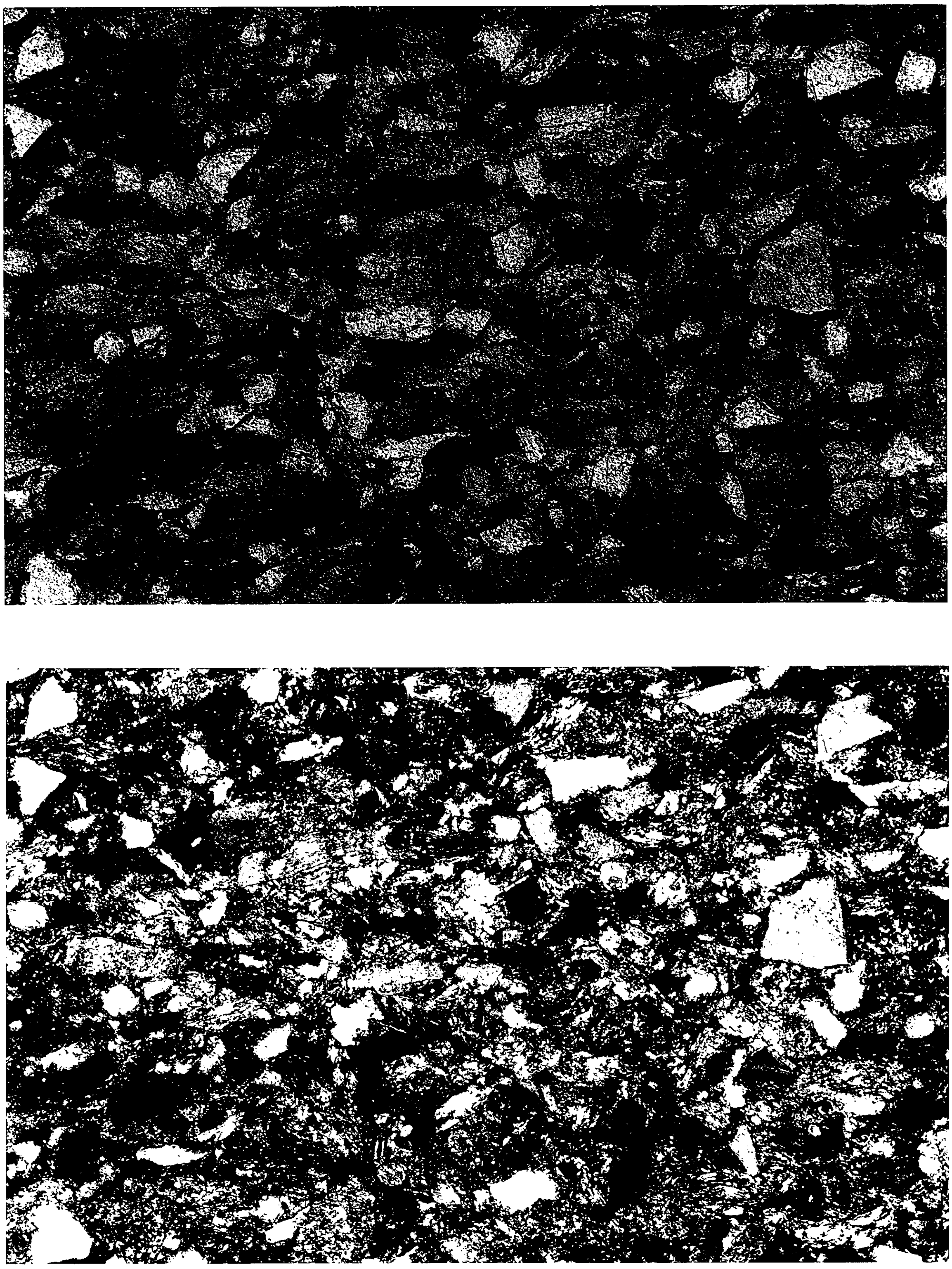

Figure 4: Sample 25: Plain light (upper) and cross-polarised (lower) photomicrograph of very fine-grained, moderately sorted feldspathic litharenite. Photomicrograph shows highly compacted clay-rich, lithic nature of the sample. Long axis of photomicrographs is 1.25mm.

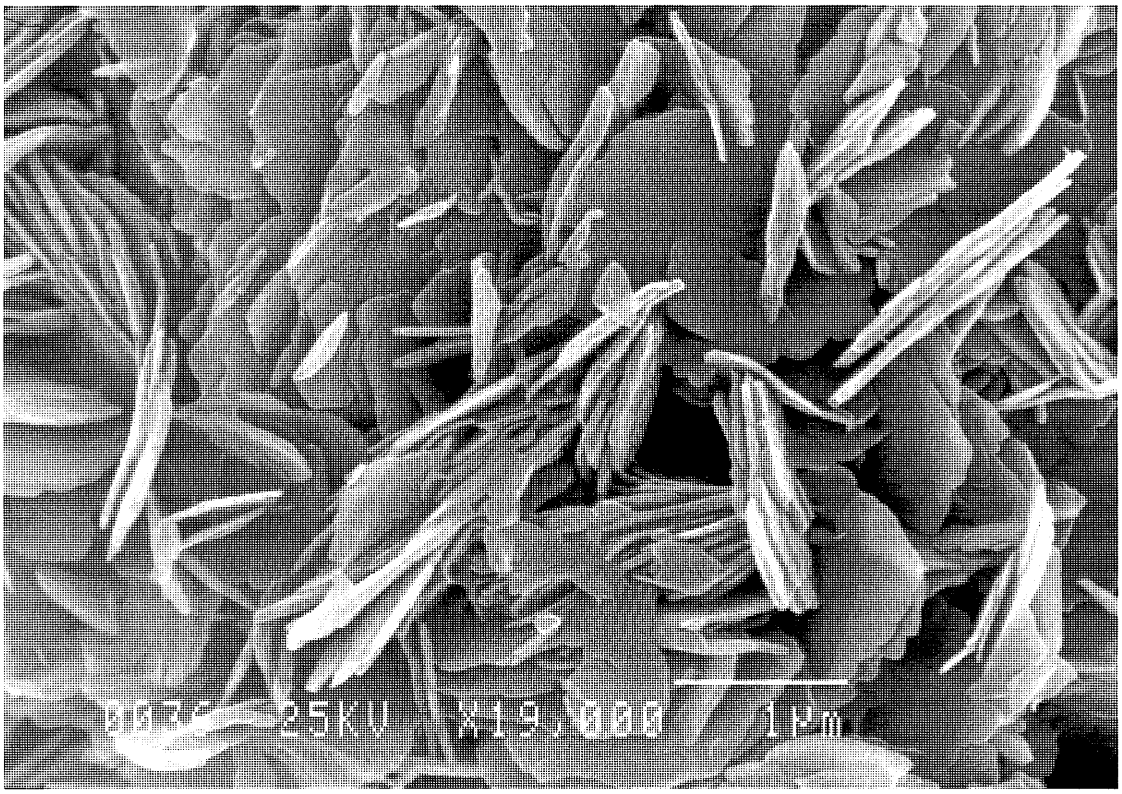

Figure 5: Sample 25B: SEM photomicrograph of disordered kaolinite and illite within pore space. Note microporosity between clay particles. Scale bar is 1 μm.

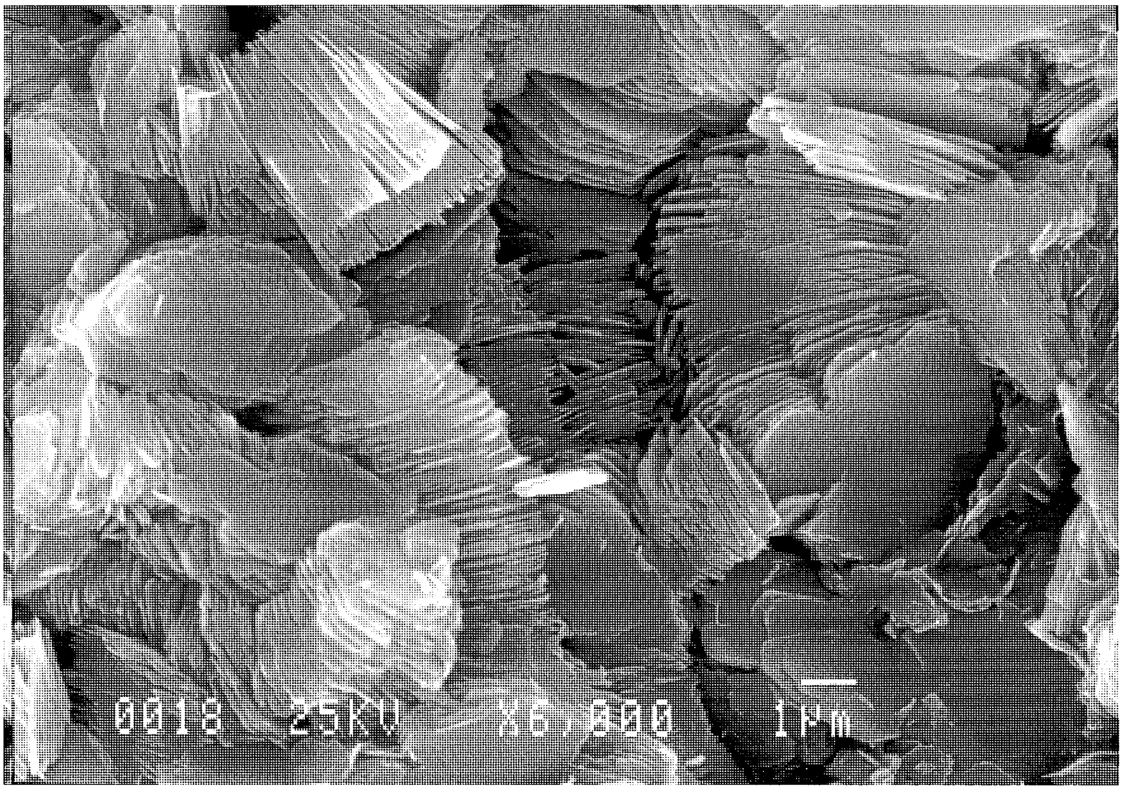

Figure 6: Sample 3: SEM photomicrograph of well formed authigenic kaolinite booklets. Scale bar is 1 μm.

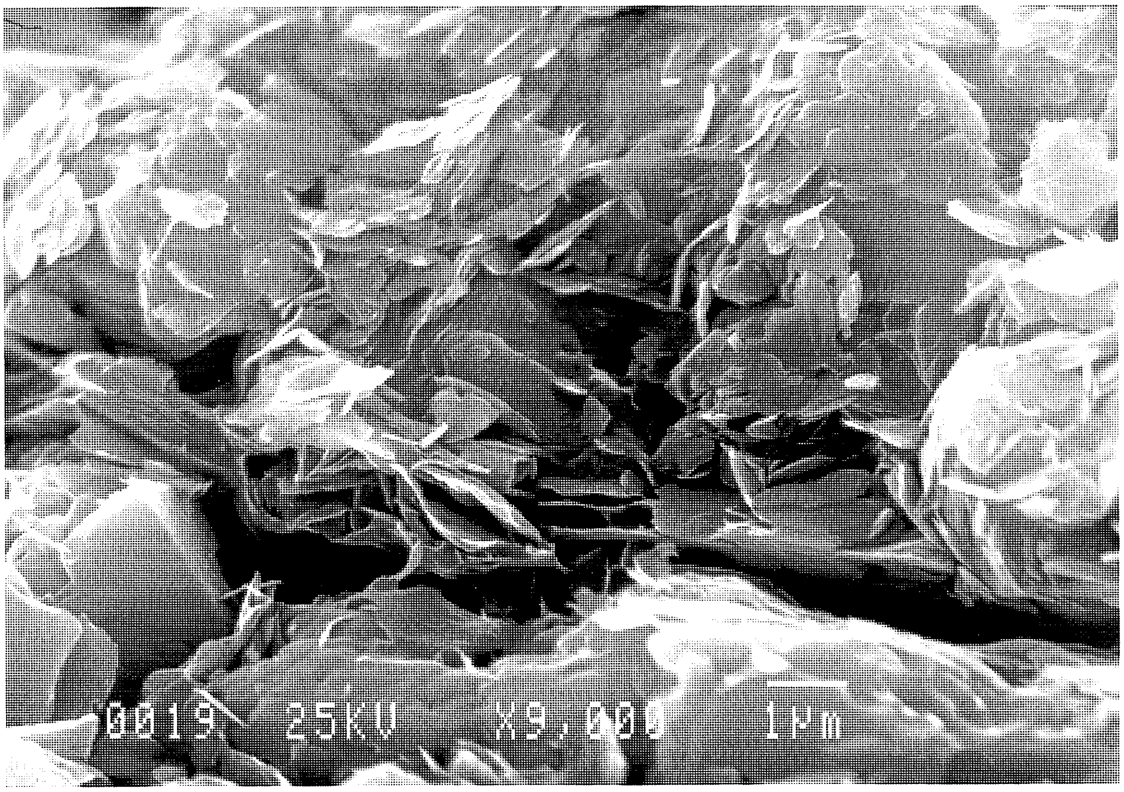

Figure 7: Sample 3: SEM photomicrograph of flaky illite within pore space. Scale bar is 1 μm.

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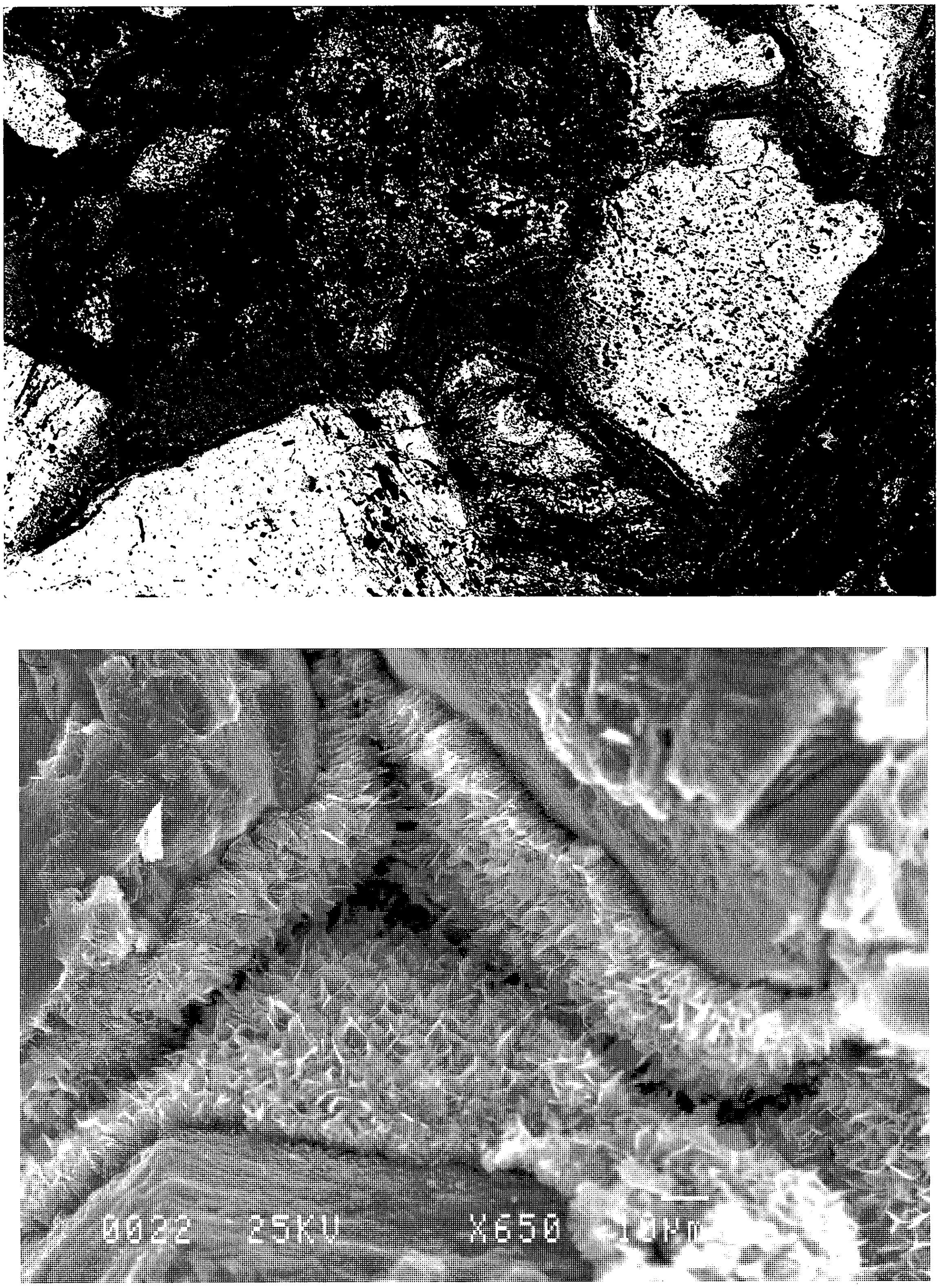

Figure 8: Sample 17: Plain light (upper) and SEM (lower) photomicrograph of chlorite pore lining within feldspathic litharenite. Long axis of upper photomicrograph is 0.62mm and scale bar in lower photomicrograph is 10 μm.

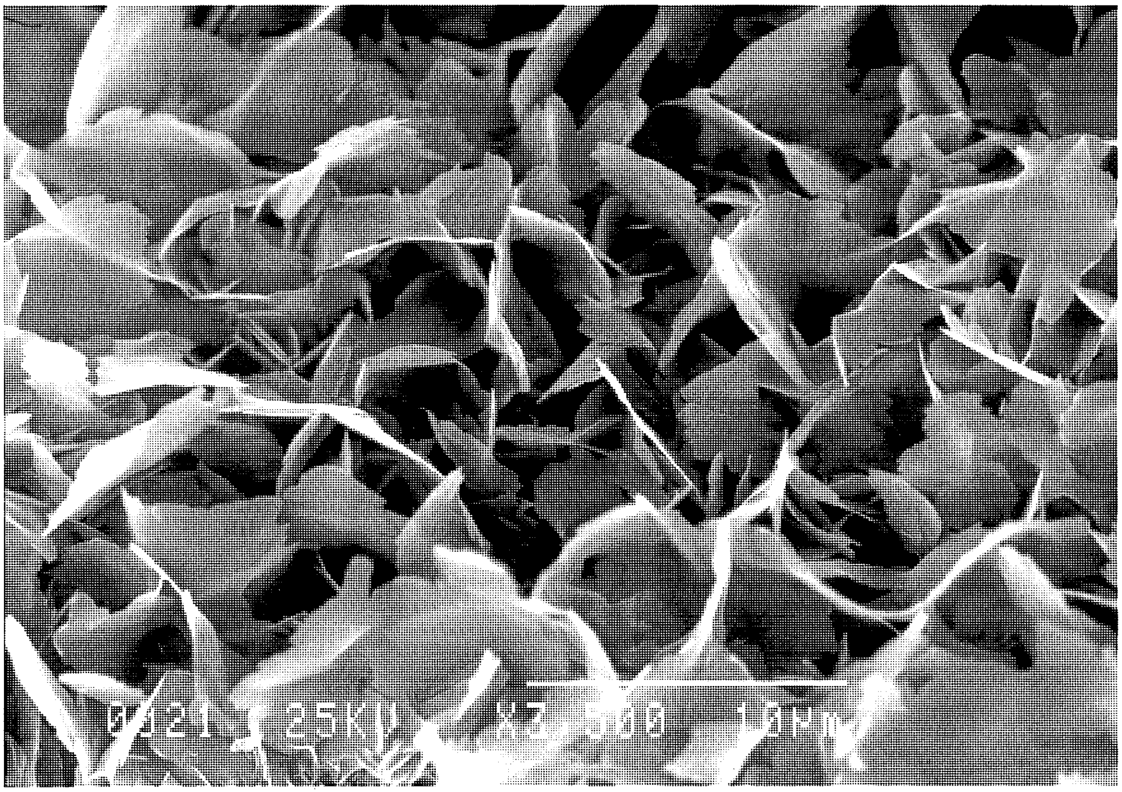

Figure 9: Sample 17: SEM photomicrograph of characteristic chlorite structure and associated illite. Scale bar is 10 μm.

PART B

THIN SECTION DESCRIPTIONS

Sample: SCW #1/ #3 and #3B

Lithology: Lithic arkose

Texture: Massive, grain-supported, fine-grained, well sorted, subangular to subrounded sandstone (Figs. 2 and 10). The sample contains pervasive Fe-dolomite cementation.

Composition: Dominated by monocrystalline quartz (44.0%); K-feldspar (10%), lithic fragments (10%); minor accessory material (5%); very minor plagioclase (1%) and polycrystalline quartz (1%). Detrital clay is a minor component (2%) and is patchily preserved within intergranular areas. Authigenic mineralisation consists of major Fe-dolomite cement (16%); minor illite (3%), pyrite (2%); very minor siderite (1%); trace chlorite and quartz cement. Porosity is moderately preserved (5%) and comprises secondary intergranular types which has resulted from the removal of Fe-dolomite cement.

Monocrystalline quartz grains display straight to strongly undulose extinction with many grains containing numerous inclusions and inclusion trains. Polycrystalline quartz consists of both fine- and coarse-crystalline morphologies with equant to subequant crystals. The lithic component comprises altered volcanic grains (chert; 8%), quartz-mica schist grains (2%) and trace chert and shale. Accessory material consists dominantly of organic matter with trace muscovite and zircon.

SEM Data: Clay morphologies examined indicated the presence of both authigenic kaolinite (not observed in thin section) and illite (Figs. 11 and 12). Kaolinite forms small booklets (approx. 10μm max.; Fig. 6) and was observed in close association with the illite (suggesting kaolinite has formed as a result of replacement). Illite is the most dominant clay type within the sample and forms flaky, disordered masses (Fig. 7). There does not appear to have been any difference in the clay structures between the cleaned and uncleaned samples. As the illite is flaky and packed in apparent dense masses it may be more robust than more delicate filamentous illite morphologies.

Diagenesis:

- It is probable that aragonite entered the sample during early diagenesis as suggested by a loose detrital framework in carbonate cemented zones. This formed a pervasive cement which was later completely replaced by Fe-dolomite cement. This cement has largely occluded primary porosity.

- Very minor micritic calcite is associated with altered lithic grains and organic matter.
- Trace amounts of chlorite are present as a result of the alteration of volcanic lithic grains.
- Moderate compaction has resulted in a closely packed grain framework in which muscovite fragments and lithic grains have become deformed. There are also a few planar and concavo-convex pressure solution contacts preserved.
- Trace amounts of chlorite are present as a result of the alteration of volcanic lithic grains.
- Coarse-crystalline illite (sericite) has replaced the detrital clay matrix and labile lithic grains.
- Trace amounts of quartz cement in the form of grain overgrowths are present as indicated by euhedral grain boundary terminations. Quartz overgrowths are clearly draped by euhedral Fe-dolomite cement suggesting that quartz cementation predates dolomitisation.
- Precursor aragonite cement? has been completely replaced by Fe-dolomite cement (Fig.2). Much of the dolomite has a euhedral morphology and forms crystalloids within open pore spaces.
- Late stage dissolution has partially removed some Fe-dolomite cement and labile framework grains (lithic and feldspar grains).
- Euhedral pyrite has probably entered the sample during late diagenesis. Pyrite forms large euhedral masses and small (approx. 10μm) cubic and octahedral crystalloids.

Reservoir Pot.: The sample has moderately preserved secondary porosity. Porosity has been largely occluded by carbonate cementation which has significantly reduced pore interconnectivity. Possible formation damage may result from the mobilisation of illite, organic material and partially corroded dolomite. Many open pore spaces contain abundant remnant carbonate material. There does not appear to be any difference between sample 3 and 3B.

Env. of Deposition: The sample is fine-grained indicating deposition in a moderate energy environment.

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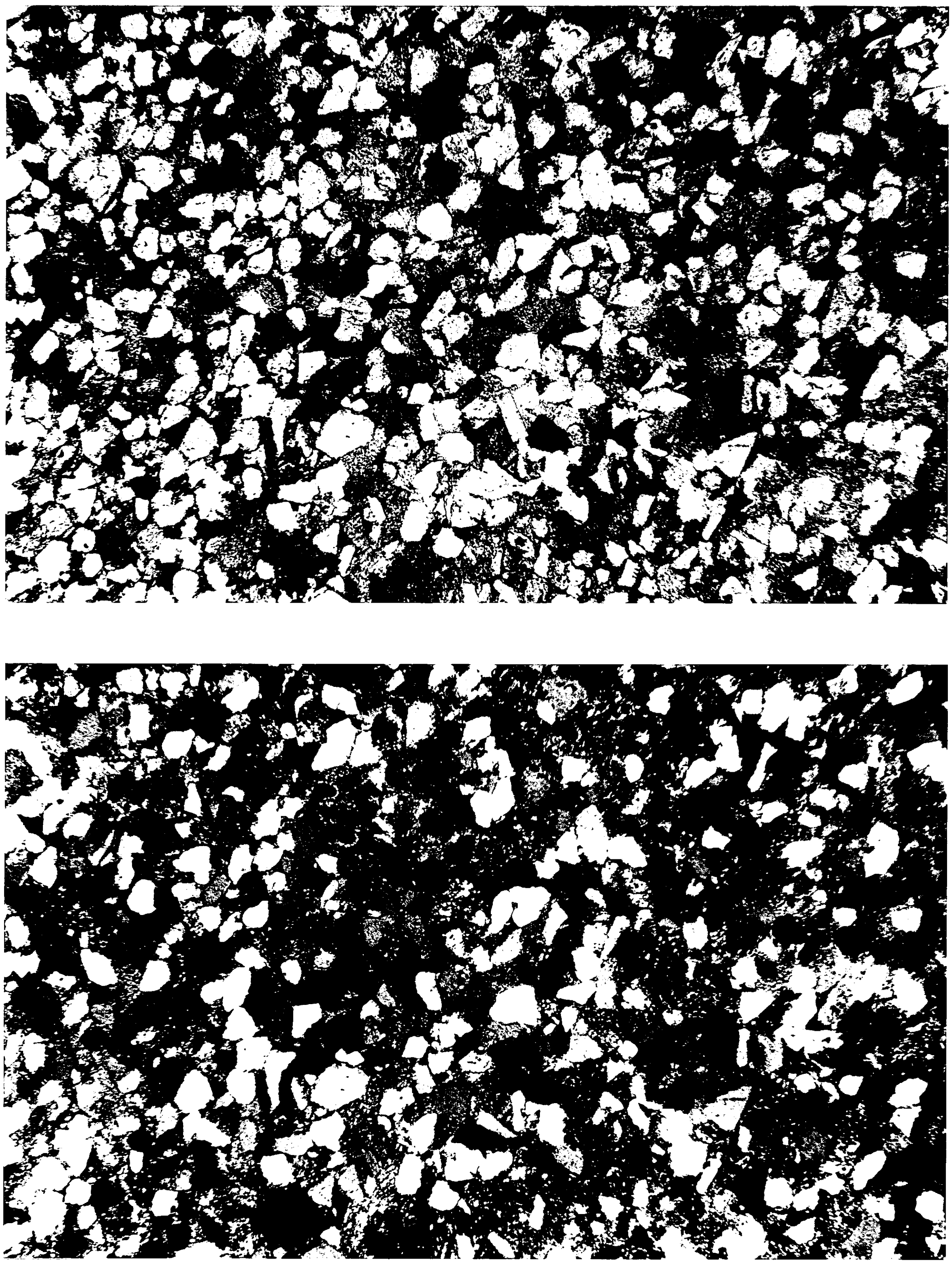

Figure 10: Sample 3: Plain light (upper) and cross-polarised (lower) photomicrograph of fine-grained, well sorted lithic arkose. Long axis of photomicrograph is 3.95mm.

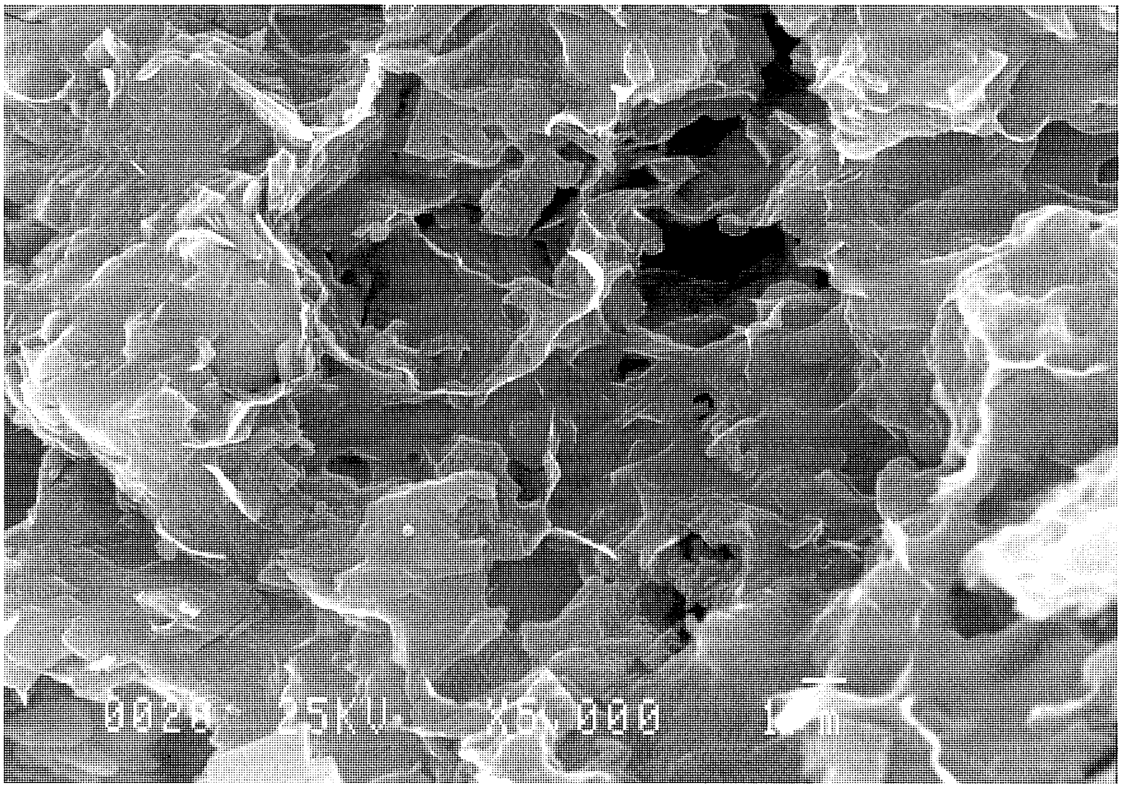

Figure 11: Sample 3: SEM photomicrograph of illite/smectite clay structure. Scale bar is 1 μm.

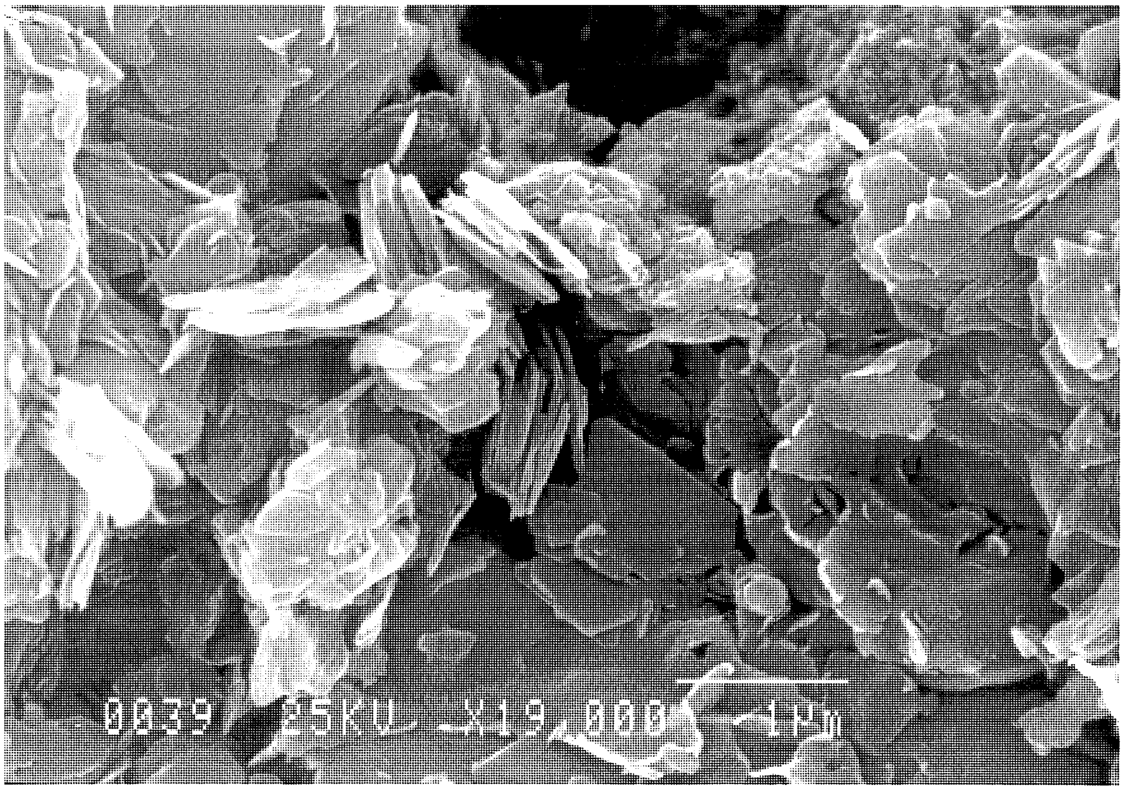

Figure 12: Sample 3B: SEM photomicrograph of disordered kaolinite, illite and Fe-dolomite cement. There does not appear to have been any affect on the sample as a result of cleaning. Scale bar is 1μm.

Sample: SCW #1/ #17 and #17B

Lithology: Feldspathic Litharenite

Texture: Massive, grain-supported, fine- to medium-grained, moderately sorted, subangular to well rounded sandstone (Figs. 3 and 13).

Composition: Dominated by lithic grains (36%), plagioclase (21%); monocrystalline quartz (16%); minor polycrystalline quartz (2%), accessory minerals (2%) and very minor K-feldspar (1%). Matrix is a minor component and forms patchy pore fill (2%). Detrital clay appears to be dominated by illite. Authigenic mineralisation is dominated by chlorite (14%) and trace pyrite. Authigenic illite is also present as a pervasive alteration product of many labile lithic grains. Porosity comprises small primary intergranular pores and larger, oversized secondary pores. In general porosity is moderately preserved (6%) and poorly interconnected due to pervasive chlorite cementation.

Monocrystalline quartz grains are dominated by straight to slightly undulose extinction with many grains containing numerous inclusions and inclusion trains. Polycrystalline quartz is dominated by fine crystalline-foliated morphologies. The lithic component comprises altered volcanic grains (21%), siltstone (9%), quartz-mica schist (3%), sandstone (2%) and chert (1%). Volcanic grains comprise chert and fine-crystalline aggregates of plagioclase (indicating probable intermediate composition; andesite). Accessory minerals comprise muscovite, biotite, zircon and organic matter.

SEM Data: Chlorite was by far the most abundant clay (Fig. 9) identified within the sample (as indicated by thin section analysis). Chlorite forms well developed pore linings (Fig. 8) and has a characteristic flower-type, disordered morphology. Close-up analysis of the chlorite structure shows that it is closely associated with flaky illite (Fig. 15) and illite/smecitite (Fig. 14) within some pores. There does not appear to be any difference between clay morphologies in the cleaned and uncleaned samples.

Diagenesis:

- Trace amounts of anhedral pyrite (Fig. 3) are associated with the alteration of some lithic grains and organic matter. The timing of pyrite formation is difficult to constrain but pyrite with this type of morphology is typically early diagenetic.

- Moderate compaction is indicated by a close packed detrital framework. There has been minor deformation of lithic grains.

- Chlorite is the most abundant diagenetic mineral within the sample. Chlorite forms a pervasive pore lining (5-10μm thick; Fig. 8) and pore fill. It has significantly occluded intergranular porosity.

- Authigenic illite (sericite) has replaced labile lithic (mainly volcanic) grains.

- There appears to have been some removal of labile framework grains as indicated by the presence of several oversized pore spaces.

Reservoir Pot.: The sample has moderately preserved combined primary and secondary porosity. Pore spaces have been lined (5-10μm thick) and filled by authigenic chlorite and represents the major concern for formation damage. Illite is typically associated with the alteration of lithic grains and is not abundant within pore spaces. There appears to be no difference between sample 17 and 17B. Cleaning of the sample does not appear to have affected pore composition.

Env. of Deposition: The sample is fine-grained indicating deposition in a moderate energy environment.

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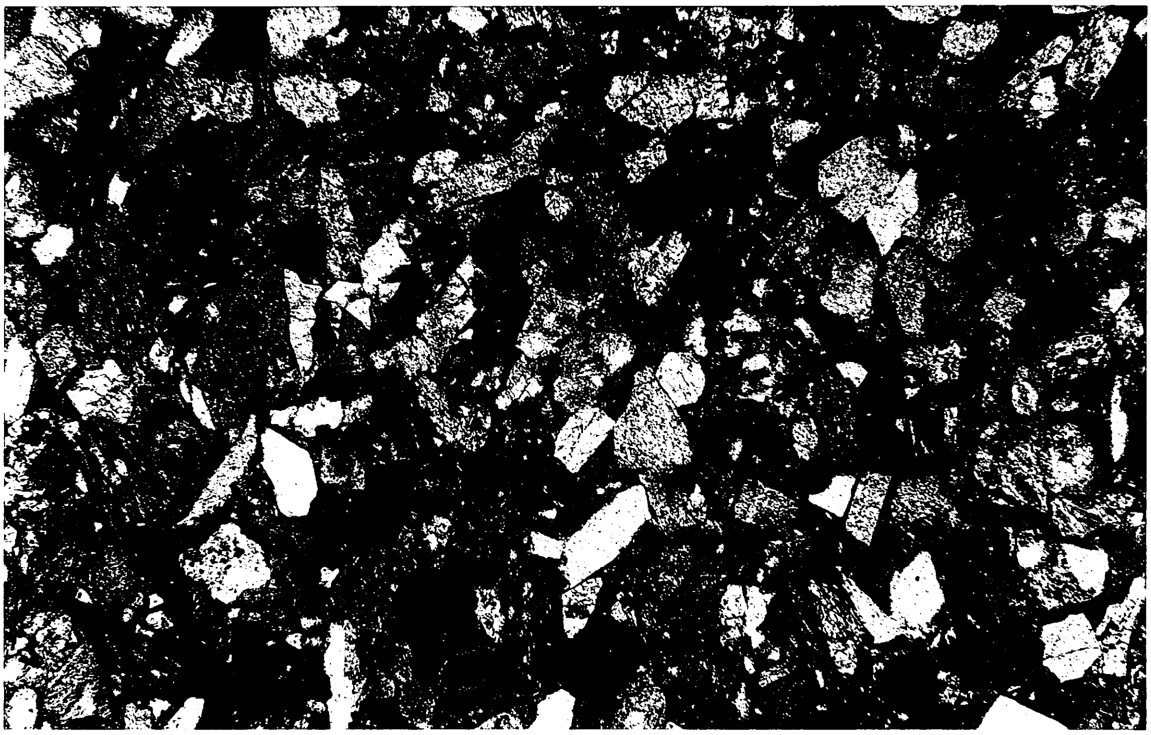

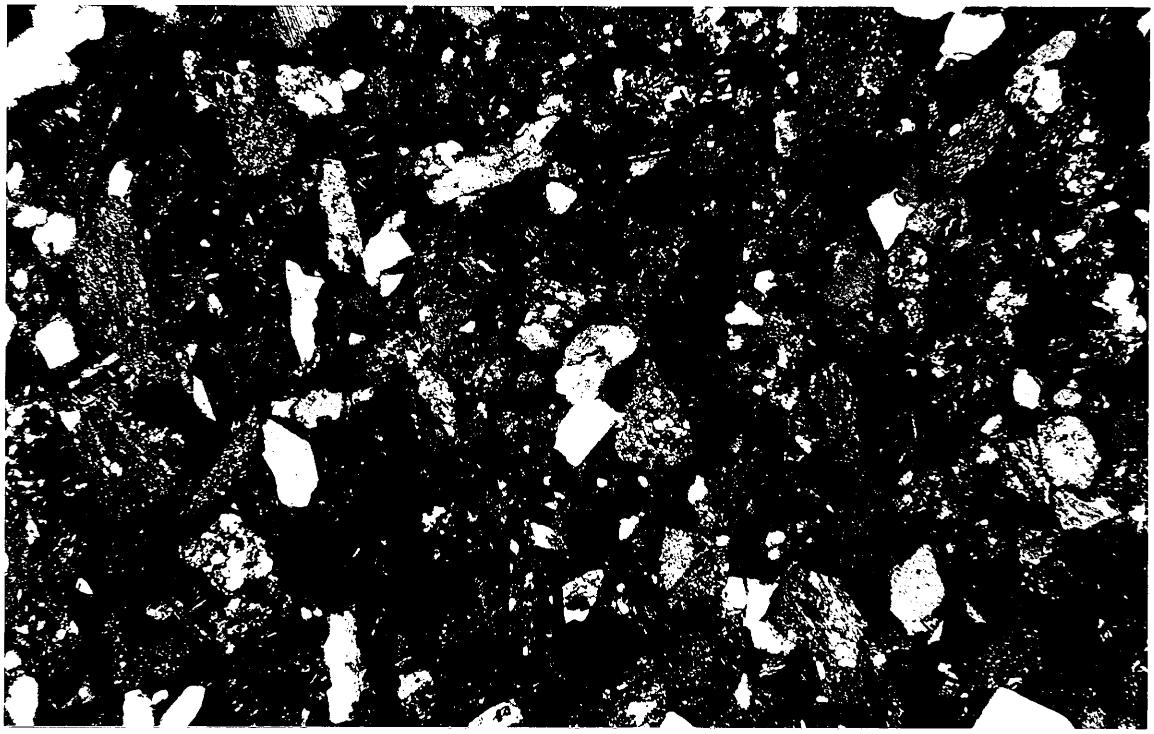

Figure 13: Sample 17: Plain light (upper) and cross-polarised (lower) photomicrograph of fine- to medium-grained, moderately sorted feldspathic litharenite. Photomicrograph shows abundant lithic grains and oversized pore spaces (P). Long axis of photomicrographs is 3.95mm.

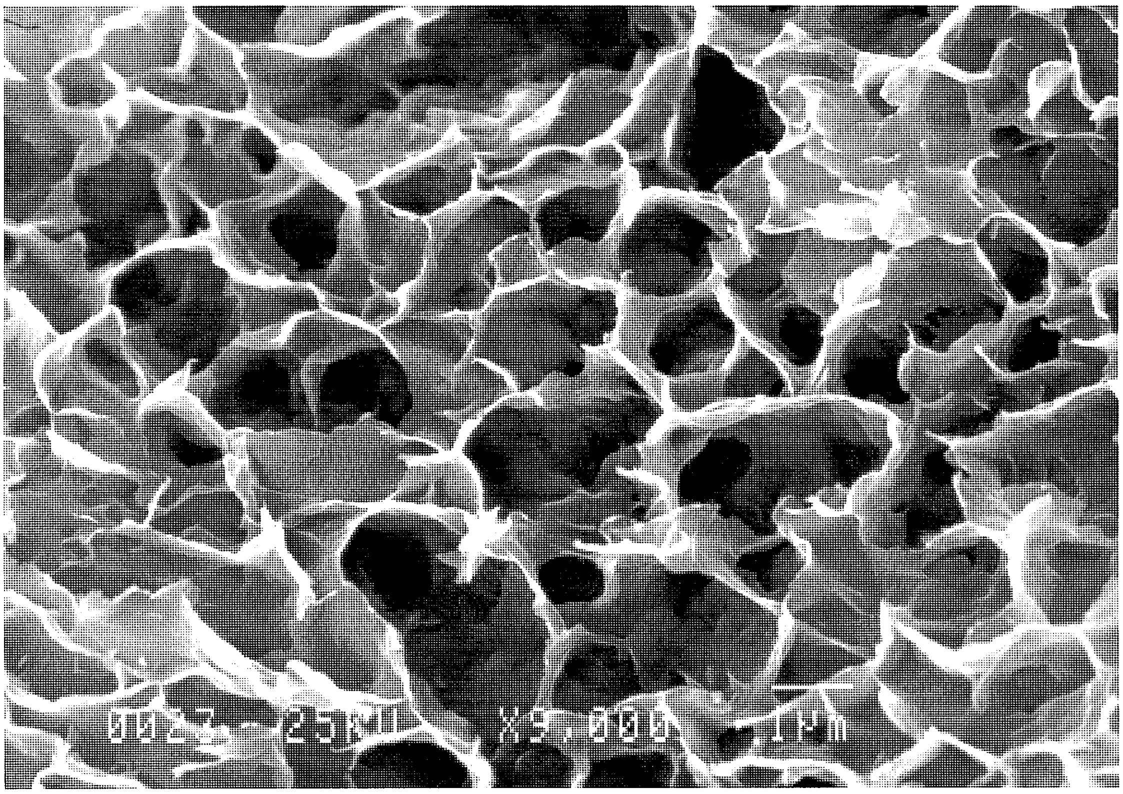

Figure 14: Sample 17: SEM photomicrograph of illite/smectite clay structure. Scale bar is 1 μm.

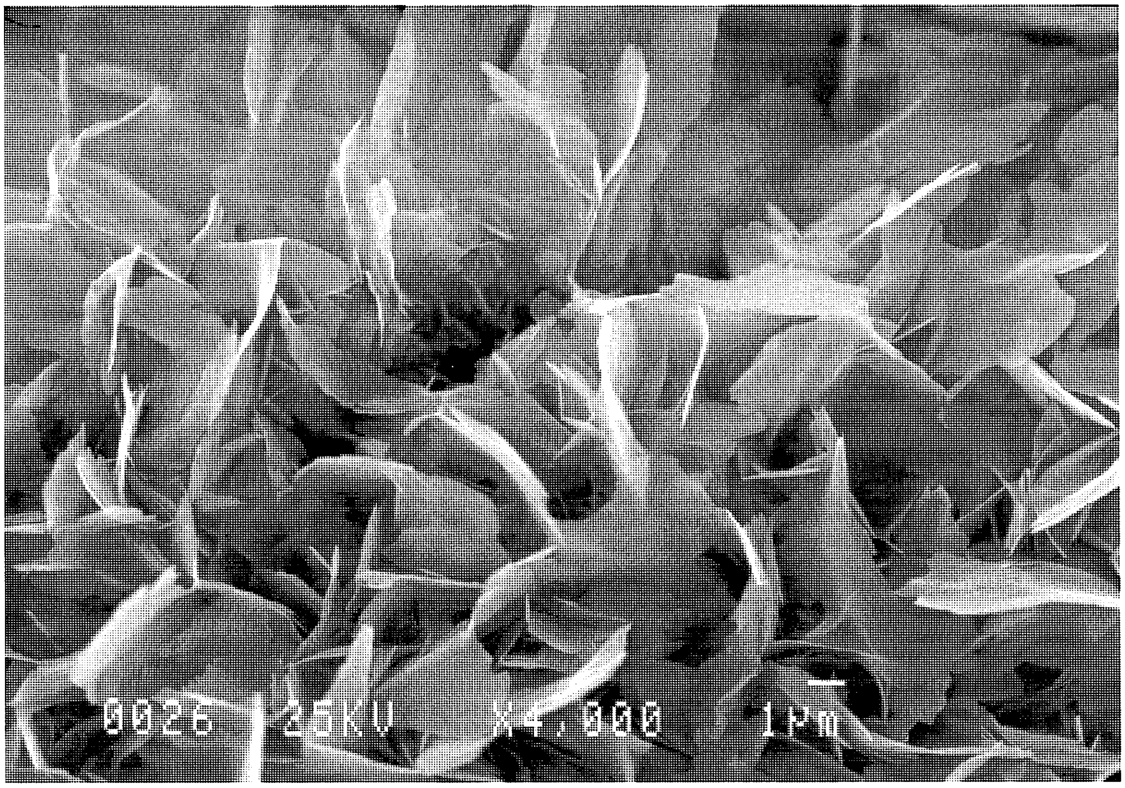

Figure 15: Sample 17B: SEM photomicrograph of flaky illite structure. Scale bar is 1 μm.

Sample: SCW #1/ #25 and #25B

Lithology: Feldspathic litharenite

Texture: Bedded, matrix- to grain-supported, very fine-grained, moderately sorted, subangular to subrounded sandstone (Figs. 4 and 16). Bedding is defined by clay laminations and aligned elongate grains.

Composition: Dominated by monocrystalline quartz (16%), lithic grains (13%); minor K-feldspar (6%), plagioclase (5%), accessory material (5%) and polycrystalline quartz (2%). Detrital matrix is abundant within the sample (53%) and appears to comprise dominantly illite. Authigenic minerals comprise chlorite (1%) and illite. Coarse-crystalline illite (sericite) is associated with the detrital clay matrix. There is negligible visible porosity within the sample due to the pervasiveness of the detrital matrix. There may be some microporosity associated with this clay mineralisation. Sample 25B does show some very minor visible porosity.

Monocrystalline quartz grains are dominated by straight to strongly undulose extinction with many grains containing numerous inclusions and inclusion trains. Polycrystalline quartz is dominated by fine-crystalline morphologies. The lithic component comprises altered volcanic chert grains (5%), quartz-mica schist (4%) and very fine-grained sedimentary fragments (4%). Accessory minerals comprise muscovite, biotite, zircon and organic matter.

SEM Data: The clay fraction of the samples comprises a mass of detrital illite, illite/smectite and kaolinite (Fig. 5). Clays appear densely packed within pore spaces and do not appear to be ordered. Kaolinite displays characteristic hexagonal plates and illite is dominantly flaky and poorly organised There was no significant difference observed between the cleaned and uncleaned samples (Fig. 17).

Diagenesis:

- Significant compaction is indicated by a close packed detrital framework showing many deformed mica flakes. Compaction has totally occluded all visible porosity.
- There has been very minor precipitation of chlorite within the detrital clay matrix.
- Detrital clay matrix has altered to authigenic coarse-crystalline illite (sericite).

Reservoir Pot.: The abundance of detrital matrix and the fine-grained nature of the sample has significantly affected reservoir quality. The sample has very poor reservoir potential. There does not appear to be any difference between sample 25 and 25B.

Env. of Deposition: The sample is very fine-grained indicating deposition in a low energy environment. The bedded nature of the sample suggests deposition from traction currents.

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     CLIENT_OP_CO = CULTUS PETROLEUM NL
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(Inserted by DNRE - Vic Govt Mines Dept)

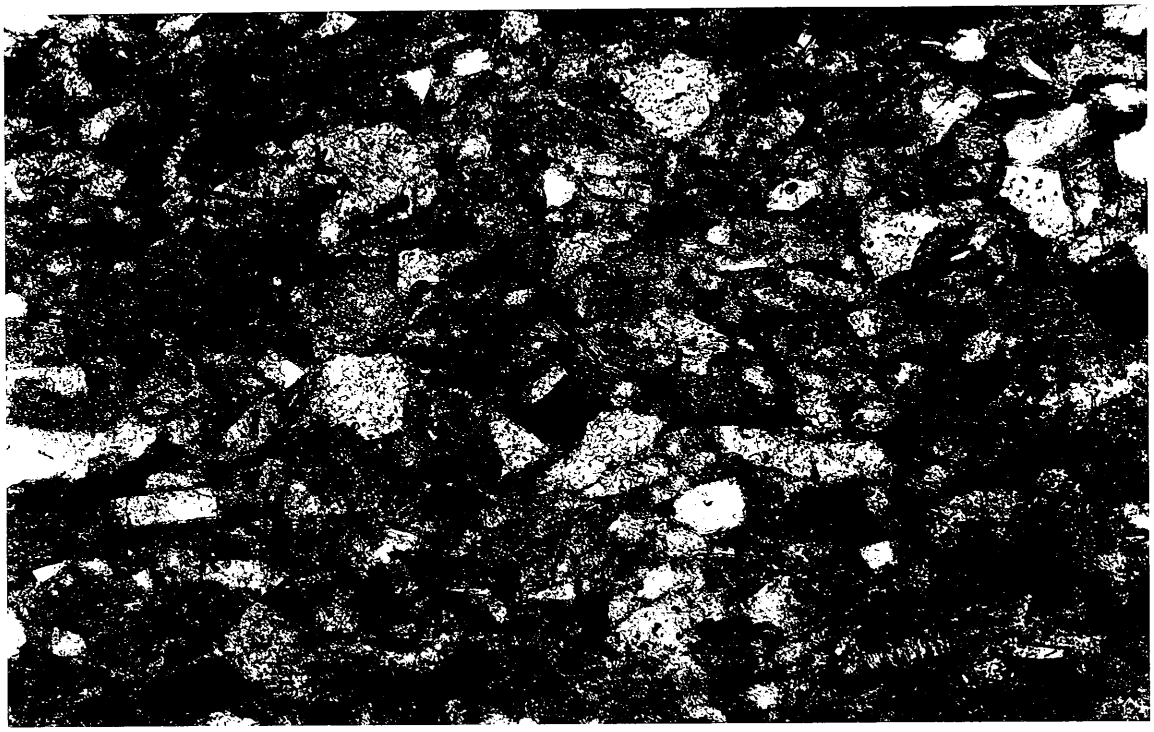
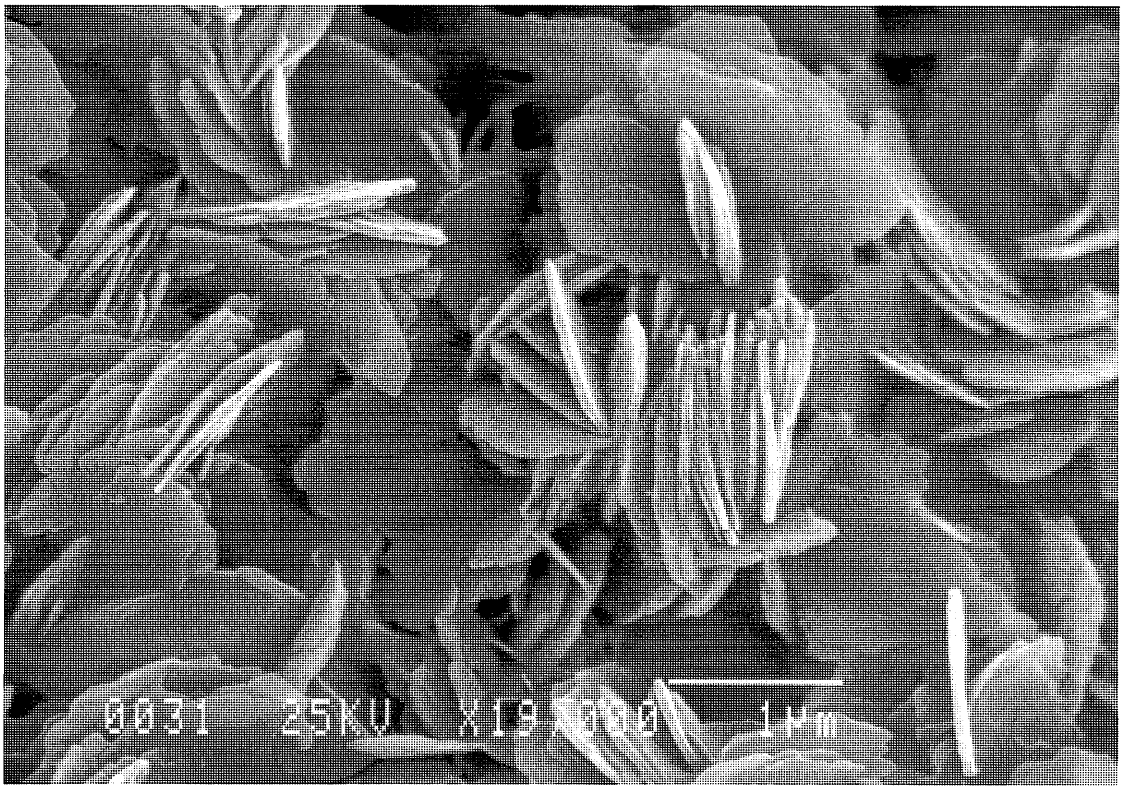


Figure 16: Sample 25: Plain light photomicrograph of very fine-grained, moderately sorted feldspathic litharenite. Long axis of photomicrograph is 1.25mm.



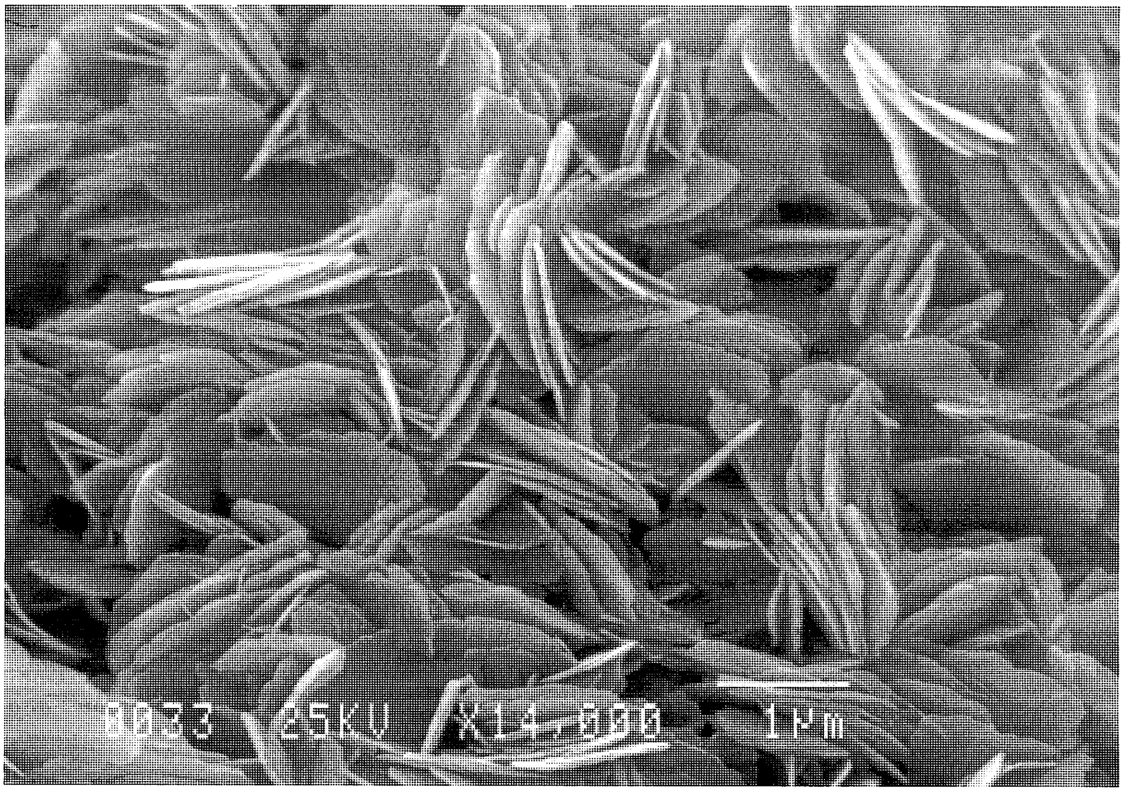


Figure 17: Samples 3 (upper) and 3B (lower): SEM photomicrographs of illite and kaolinite within pore space. The comparison between these two photomicrographs shows that cleaning has not degraded clay structure. Scale bars are 1 µm.

APPENDIX 4

ELECTRIC LOG DATA

APPENDIX 4a

FIELD ELECTRIC LOG REPORT

CULTUS PETROLEUM N.L.
ELECTIC LOGGING REPORT SHEET

SKULL CREEK WEST #1.

Well Name: SCW #1 Permit: Observer: D.H, R.H. Date: 24 FEB 97 [redacted] TO 2 MAR 97.

TIME	OPERATION
13:15 24/2	SAFETY MEETING
13:20	RIG UP RUN #1 DLS, MLS, CSS.
18:20	RIG DOWN RUN #1
18:20	RIG UP RUN #2 SGS, CNS, PDS
22:30	RIG DOWN RUN #2.
22:30	RIG UP RUN #3 CROCKER FET
05:00 25/2	RIG DOWN RUN #3.
06:10	RIG UP RUN #4 PSD.
09:15	RIG DOWN RUN #4.
10:20	RIG UP RUN #5 RFT
18:30	[redacted] OUT HOLE RUN #5
	WAITING ON RIG.
22:30	RIG DOWN RUN #5.
12:45 26/2	RIG UP RUN #6 LSS/WAVEFORM.
19:15	RIG DOWN RUN #6
19:15	RIG UP V.D. CHECK SHOT. RUN #7
23:45	RIG DOWN RUN #7.
06:50 27/2	RIG UP GR/CCL RUN #8
10:30	RIG DOWN RUN #8
08:20 28/2	RIG UP RUN #9 GR/CCL.
09:35	RIG DOWN RUN #9.
12:10	RIG UP RUN #9.
14:30	RIG DOWN RUN #9
07:30 2/3	WELL TO BE P.A. - END LOGGING

APPENDIX 4b

ELECTRIC LOG SUMMARY

Electric Log Summary

One suite of electric logs was run by BPB, at total depth as detailed below.

Run	Log	Interval mRT	Comments
1	GR CAL-DT-DLS-SP MLL-ML	2000 - surface 2000 - 721 2000 - 1150	67.0^{0}C @ 2000 mRT, 7 hours since circ.
2	NGT-PDS-CNS-CAL	1700 - 1150	63.0^{0}C @ 1350 mRT, 12 hours since circ.
3	Crocker FET	1319 - 1286	52.0^{0}C @ 1350 mRT 10 points, 8 valid, 2 supercharged tool failed
4	PSD (dipmeter)	1350 - 1050	55^{0}C @ 1350 mRT, 23.5 hours since circ.
5	RFS	1767 - 1287	18 points, 13 valid, 5 plugged
6	Waveform sonic	2000 - 1150	
7	Checkshot survey	1990 - surface	19 levels
8	GR-CCL		DST 1 correlation
9	GR-CCL		DST 2 correlation

APPENDIX 4c

LOG ANALYSIS RESULTS

PPL1

SKULL CREEK WEST 1

FINAL ELECTRIC LOG INTERPRETATION

WAARRE FORMATION
&
EUMERALLA FORMATION

G. O'Neill
Cultus Petroleum
Exploration Department
November, 1997

SKULL CREEK WEST 1 ELECTRIC LOG INTERPRETATION

CONTENTS

TABLES

APPENDICES

ENCLOSURES

1. EXECUTIVE SUMMARY

Skull Creek West 1 was drilled as an exploration well in Victoria, onshore Otway Basin, PPL 1. It was located 2.75 km west of the Skull Creek 1 Waarre/Eumeralla gas discovery well, 0.4 km east of the North Paaratte production station and 190 km WSW of Melbourne.

Skull Creek West-1 was designed to test the central Skull Creek Horst Block, 62m downdip (at top Waarre Formation) of Skull Creek 1. Primary targets included the Waarre Formation and Eumeralla Formation as both formations produced gas on DST in the discovery well.

The well reached a total depth of 2000m in the basal Eumeralla Formation. The top Waarre Formation (14m low) and top Eumeralla Formation (25m high) were intersected close to prognosis.

3 cores were cut. Core 1 (1.3m) in the top Waarre Formation was abandoned due to poor penetration rate. Core 2 (18.3m) intersected the top Waarre Unit A and has reasonable reservoir characteristics (Av por 21.0%; k 3 to 46 md). Core 3 (18.3m) was cut through a basal Eumeralla Formation sandstone to ascertain reservoir quality at this depth. Core analysis data indicates this zone has better than expected reservoir quality (Av por 20.5%; k 1 to 865 md). The core petrography and log analysis do not support the high apparent permeabilities indicating the Eumeralla Formation may have high total porosity but low effective porosity and permeability being shaly in nature.

A gas show of 74 units was recorded in the Waarre Unit A (1307-1325m) when drilling commenced after core 2. RFS and FET data failed to conclusively define a gas gradient through this sand. DST 2 tested the show flowing GTS at RTSTM and recovering 17.2 bbl of formation water (Rw 0.4 ohm-m at 25^{0}C).

An oil show was also recorded while drilling at 1529-1530m in the Eumeralla Formation. RFS data indicated the zone had some permeability and 0.4 litres of oil was recovered from 1530.2m. DST 1 tested this zone and recovered 1.6 bbl of oil (45.2 API @ 15^{0}C) and 0.5 bbl of water. Log analysis failed to highlight this zone as a significant oil pool and its exact nature (residual, local source etc.) is uncertain.

Skull Creek West 1 was plugged and abandoned.

2. PAY SUMMARY

No net pay is mapped in Skull Creek West 1 with all potential reservoir sections interpreted to be water saturated.

Cut-off parameters used to derive the net reservoir and pay were as follows:

Vsh	<= 40%
Phit	>= 10%
Sw	<= 70%.

Enclosure 1, the Log Evaluation Plot, visually presents these data.

Appendix 2 details the net reservoir intervals.

The **Waarre Formation** contains 11.4 metres of net reservoir (Phit 23.9%, Vsh 27.1%) through 41 metres of section. The net to gross ratio for this interval is 28%.

The **Eumeralla Formation** contains a large section of shaly sandstone.

3. MUDLOG SHOWS

A gas show of 74 units was recorded in the Waarre Unit A (1307-1325m) when drilling commenced after core 2.

An oil show was also recorded at 1529-1530m in the Eumeralla Formation.

4. ELECTRIC LOGGING

One suite of electric logs was run by BPB, at total depth as detailed in Table 1 below.

TABLE 1: ELECTRIC LOGGING SUMMARY

Run	Log	Interval mRT	Comments
1	GR CAL-DT-DLS-SP MLL-ML	2000 - surface 2000 - 721 2000 - 1150	67.0°C @ 2000 mRT, 7 hours since circ.
2	NGT-PDS-CNS-CAL	1700 - 1150	63.0°C @ 1350 mRT, 12 hours since circ.
3	Crocker FET	1319 - 1286	52.0°C @ 1350 mRT 10 points, 8 valid, 2 supercharged tool failed
4	PSD (dipmeter)	1350 - 1050	55°C @ 1350 mRT, 23.5 hours since circ.
5	RFS	1767 - 1287	18 points, 13 valid, 5 plugged; Sample at 1530.2m, recovery: see section 8.
6	Waveform sonic	2000 - 1150	
7	Checkshot survey	1990 - surface	19 levels
8	GR-CCL		DST 1 correlation
9	GR-CCL		DST 2 correlation

5. CORING

3 full hole cores were cut as detailed in Table 2.

TABLE 2: FULL HOLE CORE SUMMARY

ZONE	NO.	INTERVAL m MD	CUT m	REC m
Waarre	1	1290.7-1292.0 D 1291.7-1293.0 L	1.3	1.3
Waarre	2	1292.0-1310.3 D 1293.0-1311.3 L	18.3	18.3
Eumeralla	3	1748.0-1766.3 D 1749.0-1767.3 L	18.3	18.3

Core 1 (1.3m) in the top Waarre Formation was abandoned due to poor penetration rate.

Core 2 (18.3m) intersected the top Waarre Unit A and has reasonable reservoir characteristics (Av por 21.0%; k 3 to 46 md).

Core 3 (18.3m) was cut through a basal Eumeralla Formation sandstone to ascertain reservoir quality at this depth. Core analysis data indicates this zone has better than expected reservoir quality (Av por 20.5%; k 1 to 865 md). Log and core petrography data do not support these high apparent permeabilities.

Core analysis data are presented on the log analysis plots. The density porosity (Phit) was tied to the overburden corrected core porosity.

SCAL data were also reviewed and the following parameters were used in the log analysis:

cementation exponent	m
saturation exponent	n
cation exchange capacity	CEC

Values for these parameters are presented in Tables 5 & 6, Key Evaluation Techniques and Parameters.

6. RESERVOIR PETROLOGY

Three core plugs were sent to ACS Laboratories Pty Ltd and were examined using thin section petrography and SEM analysis. The core plug samples are listed in Table 3.

TABLE 3: PETROGRAPHY SAMPLES

Sample	Depth Drlr (metres)	Depth Logger (metres)	Formation	Lithology
3	1294.0	1295.0	Waarre	lithic arkose
17	1755.4	1757.2	Eumeralla	feldspathic litharenite
25	1763.47	1765.27	Eumeralla	feldspathic litharenite

The Waarre sample is:

- Late Cretaceous in age,
- grain supported, well sorted, fine grained, subangular to subrounded lithic arkose,
- dominantly quartz composition (44%),
- K feldspar is a major component (11%),
- Fe-dolomite identified as a dominant authigenic mineral (16%),
- mixed continental quartzose igneous rocks & intermediate volcanic source,
- a moderate energy environment of deposition, and
- moderate reservoir potential, decreased permeability by clay.

The Eumeralla samples are:

- Early Cretaceous in age,
- matrix to grain supported, moderately sorted, fine to medium grained, feldspathic litharenite,
- dominantly quartz composition (20%),
- feldspar (plagioclase) is a major component (>10%)
- detrital clay matrix & rock fragments are a dominant component,
- intermediate volcanic source,
- a low energy environment of deposition given grainsize & immature composition,
- very poor (sample 25) to moderate (sample 17) reservoir potential, and
- detrital clay significantly reduces permeability.

7. DRILL STEM TESTS

Two post logging drill stem tests were conducted in Skull Creek West 1 as detailed in Table 4 below:

TABLE 4: DRILL STEM TEST SUMMARY

NO.	INTERVAL (mRT)	FORMATION	FLOW (mins)	SHUT IN (mins)	BOTTOM GAUGE IP/FP (psia)	SIP	FLUID TO SURF (mins)	TC/ BC	REMARKS
1	1527.0-1531.0L 1526.0-1530.0D	Eumeralla Fm Infl strad w/ GR-CCL	5/182	39/180	77/77 88/132	1667 1848	NFTS	1/4" 3/4"	Rec: 1.6 bbl oil (45.2 API@60F) & 0.5 bbl MW (total rec 90m)
2	1311.0-1315.0L 1310.0-1314.0D	Waarre Unit A Infl strad w/ GR-CCL	4/122	42/123	139/139 243/595	1688 1666	GTS 77 mins	1/4" 3/4"	GTS @ RTSTM Rec: 17.2 bbl water & MW

8. FET/RFS DATA

The Crocker FET tool was run in Skull Creek West 1 attempting 10 pretests before it failed.

The BPB RFS tool was then run in hole attempting 18 pretests and 1 sample.

A gas show of 74 units was recorded in the Waarre Unit A (1307-1325m) when drilling commenced after core 2. RFS and FET data failed to conclusively define a gas gradient through this sand. DST 2 tested the show flowing GTS at RTSTM and recovering 17.2 bbl of formation water.

An oil show was also recorded at 1529-1530m in the Eumeralla Formation. RFS data indicated the zone had some permeability and a sample was taken at 1530.2m. 2 chambers were filled: the 10 litre dump chamber contained negligible gas, 0.4 litres of oil and 9 litres of water; the 3.8 litre chamber contained 4.5 litres of gas and 0.015 litres of oil. DST 1 tested this zone and recovered 1.6 bbl of oil (45.2 API @ 15C) and 0.5 bbl of water.

FET & RFS data are contained in Appendix 3.

9. HOLE SUMMARY

Electric logs were acquired in a 8.5" borehole. Hole conditions through the Waarre Formation are fair apart from the top Waarre Formation where cores 1 & 2 were cut.

Hole quality through the Eumeralla Formation is fair.

Badhole is flagged on the log interpretation plot based on the following criteria:

Drho	> 1.5 gm/cc	(density correction)
Dcal	> 2"	(differential caliper)

The Wyllie sonic equation was used for porosity evaluation where badhole was interpreted.

10. MUD DATA

The mud data while recording electric logs were as follows:

Mud type:	KCl PHPA polymer
Mud weight:	9.2 ppg
Mud resistivity:	0.646 ohm-m at 20.4^{0}C
Mud filtrate resistivity:	0.556 ohm-m at 20.4^{0}C
Mud cake resistivity:	0.733 ohm-m at 20.4^{0}C
Bottom hole temperature:	67.0^{0}C (DLS logging run)

11. INTERPRETATION PROCEDURES

Standard environmental corrections were applied to the electric logging measurements using Mincom's Geolog deterministic program. Key evaluation parameters and techniques are listed in Tables 5 & 6.

Shale Volume

The GR log was used to derive shale volume.

Porosity

The density equation was used to derive matrix porosity (Phit) and this was tied to the core porosity. The Wyllie sonic equation was used to derive matrix porosity (Phit) in poor hole conditions.

Water Saturation

The Waxman-Smits equation was used to derive values of water saturation.

A Rw of 0.4 ohm-m at 25^{0}C (15 000 ppm NaCl eq) was used for both the Waarre and Eumeralla Formations. This value was derived from analysis of a water sample collected in Skull Creek West 1, DST 2 in the Waarre Formation.

Clean Eumeralla water sample data are unknown.

11. REFERENCES

Cultus, 1997 Skull Creek West 1 Preliminary Data Report- unpublished.

TABLE 5: KEY EVALUATION PARAMETERS & TECHNIQUES

WAARRE FORMATION

	Waarre Formation	Source
Interval	1285 - 1326	
Vsh equation	GR	
GR matrix	25 API	Xplot
GR shale	120 API	Xplot
Porosity equation	Density	
Rho matrix	2.66 g/cc	core data
Rho shale	2.43 g/cc	logs
Rho fluid	1.005 g/cc	saline fluid
Bad hole Porosity	Wyllie	
DT fluid	189 us/ft	
DT matrix	55.5 us/ft	quartz
DT shale	100 us/ft	Xplot
Sw equation	Waxman-Smits	
Rw	0.4 ohm-m @ 25C	DST 2
CEC	0.037 meq/g	SCAL
a	1	standard
m	1.70	SCAL
n	1.85	SCAL
Cutoff Parameters		
Vsh cutoff	0.4	
Net sand porosity cutoff	0.03	
Net res porosity cutoff	0.10	
Sw cutoff	0.7	
Min net sand	1 metre	
Min net reservoir	1 metre	
Min net pay	1 metre	

TABLE 6: KEY EVALUATION PARAMETERS & TECHNIQUES

EUMERALLA FORMATION

	Eumeralla Formation	Source
Interval	1326 - 1820	
Vsh equation	GR	
GR matrix	40 API	Xplot
GR shale	120 API	Xplot
Porosity equation	Density	
Rho matrix	2.66 g/cc	core data
Rho shale	2.43 g/cc	logs
Rho fluid	1.005 g/cc	saline fluid
Bad hole Porosity	Wyllie	
DT fluid	189 us/ft	
DT matrix	55.5 us/ft	quartz
DT shale	95 us/ft	Xplot
Sw equation	Waxman-Smits	
Rw	0.4 ohm-m @ 25C	DST 2
CEC	0.055 meq/g	SCAL
a	1	standard
m	1.82	SCAL
n	2.09	SCAL
Cutoff Parameters		
Vsh cutoff	0.4	
Net sand porosity cutoff	0.01	
Net res porosity cutoff	0.10	
Sw cutoff	0.7	
Min net sand	1 metre	
Min net reservoir	1 metre	
Min net pay	1 metre	

APPENDIX 1: CROSS PLOTS

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(Inserted by DNRE - Vic Govt Mines Dept)

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Intervals: WAARRE FM. UNIT B WAARRE FM. UNIT A

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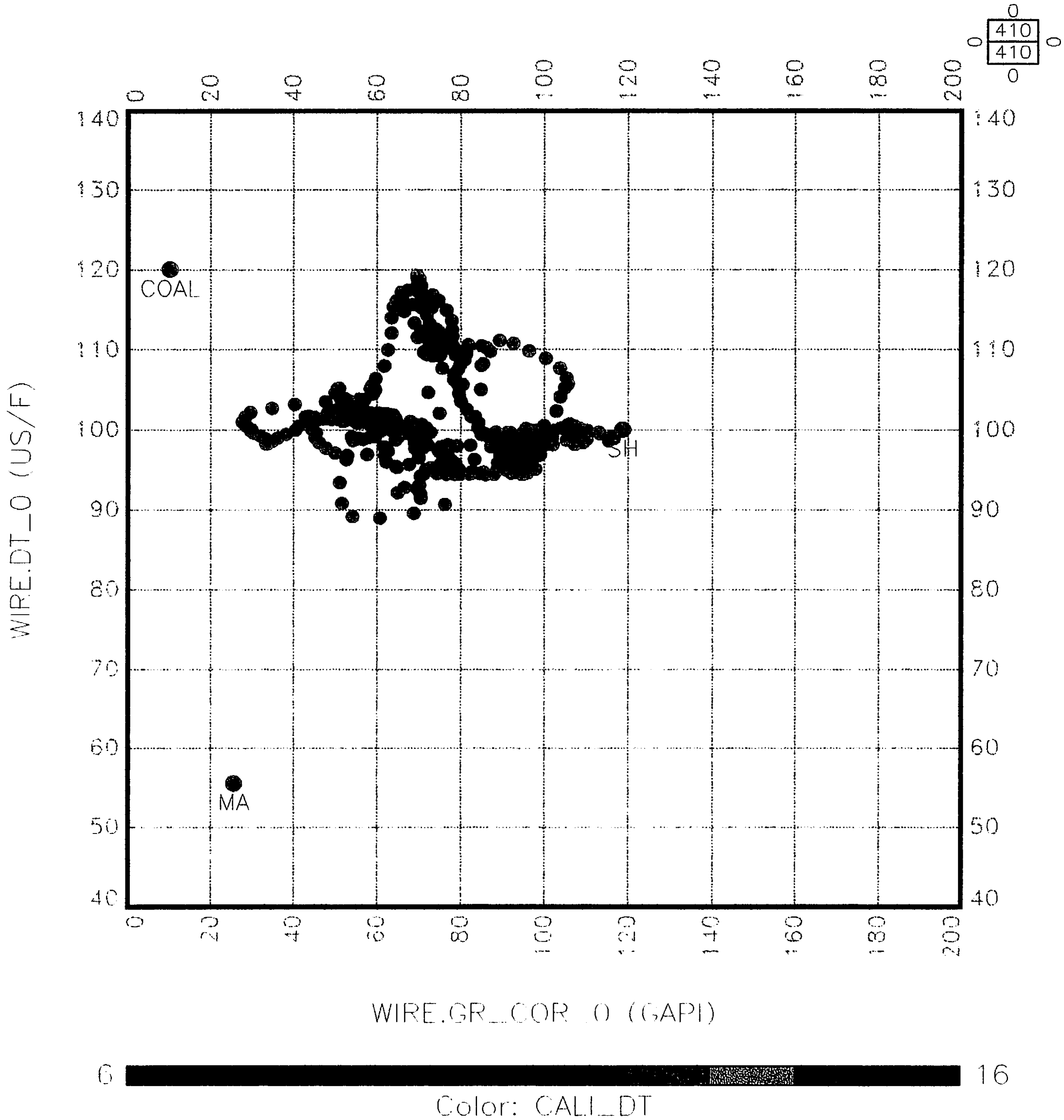

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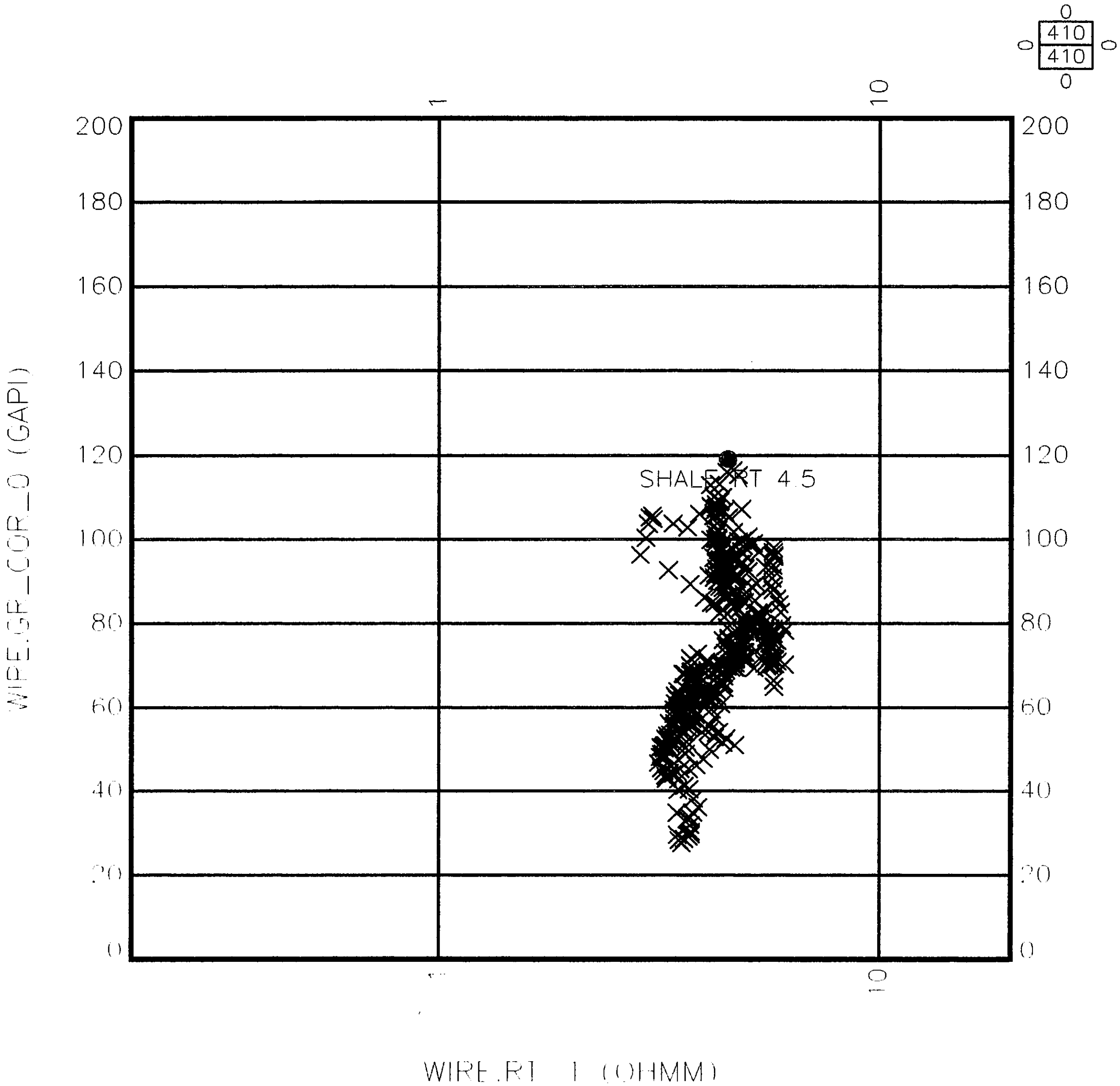

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CONTRACTOR =	ACS LABORATORIES PTY LTD
CLIENT_OP_CO =	CULTUS PETROLEUM NL

(Inserted by DNRE - Vic Govt Mines Dept)

PHIT vs. RT Crossplot

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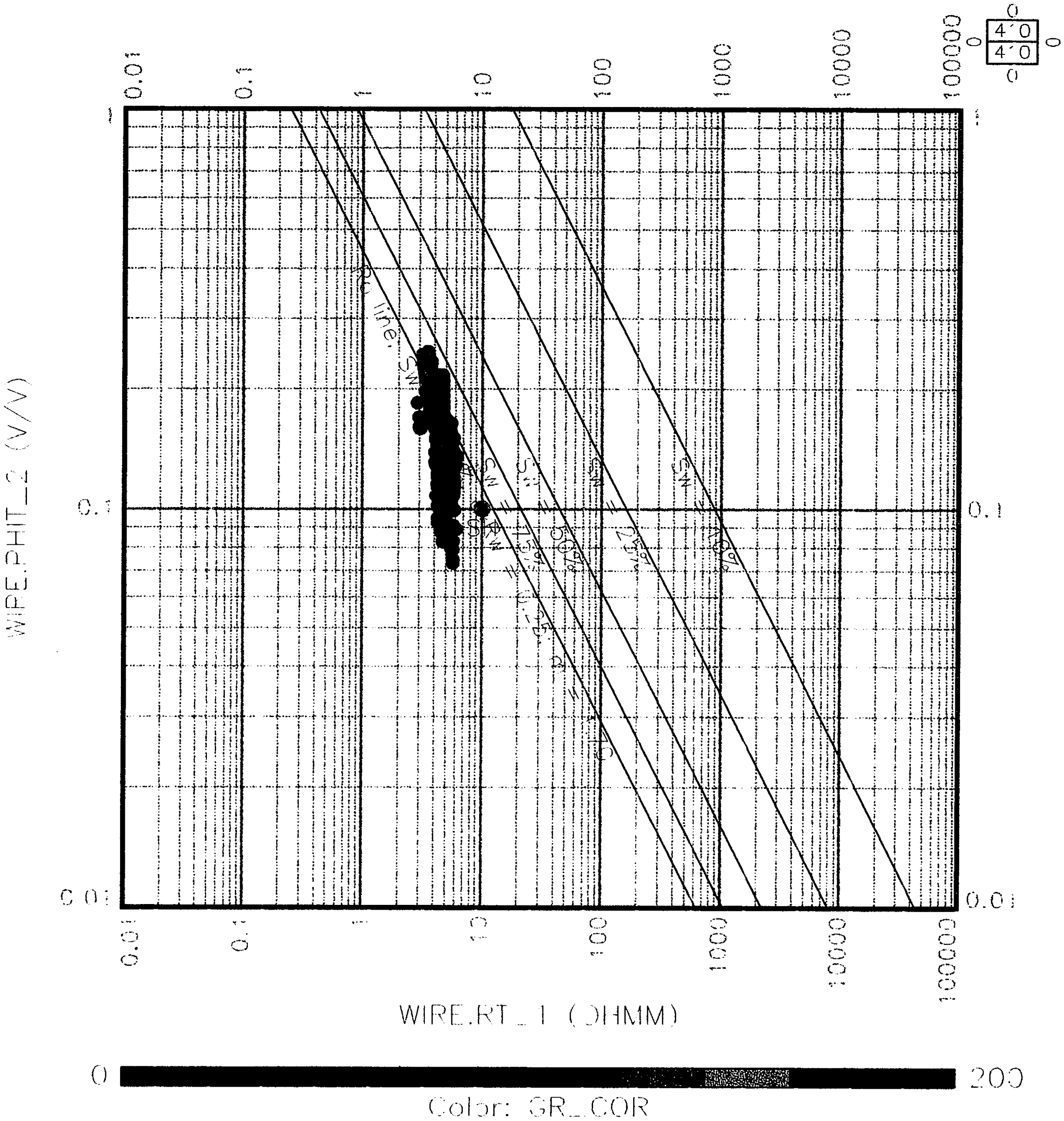

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(Inserted by DNRE - Vic Govt Mines Dept)

DT vs. GR Crossplot

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Intervals: EUMERALLA FORMATION

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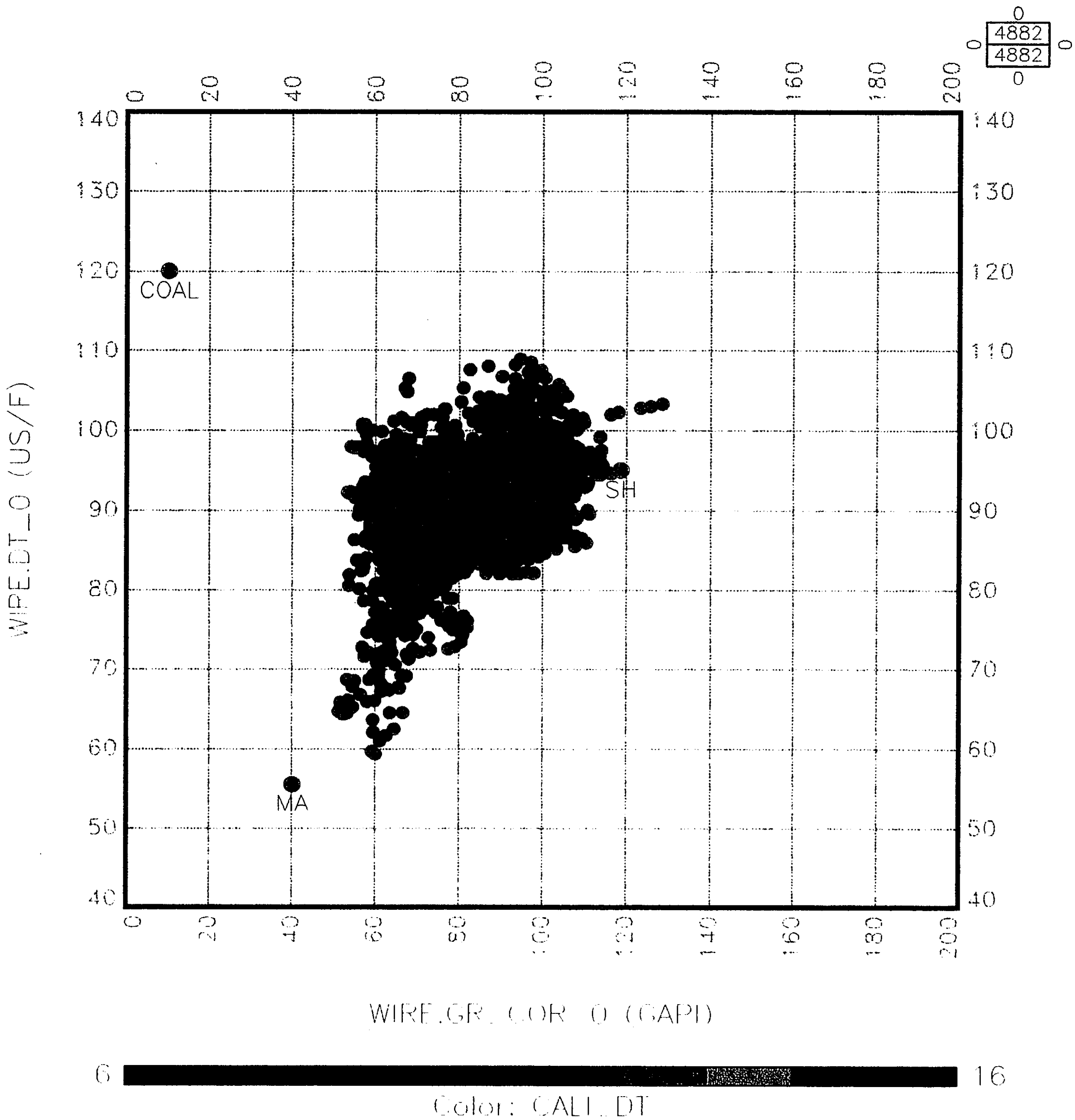

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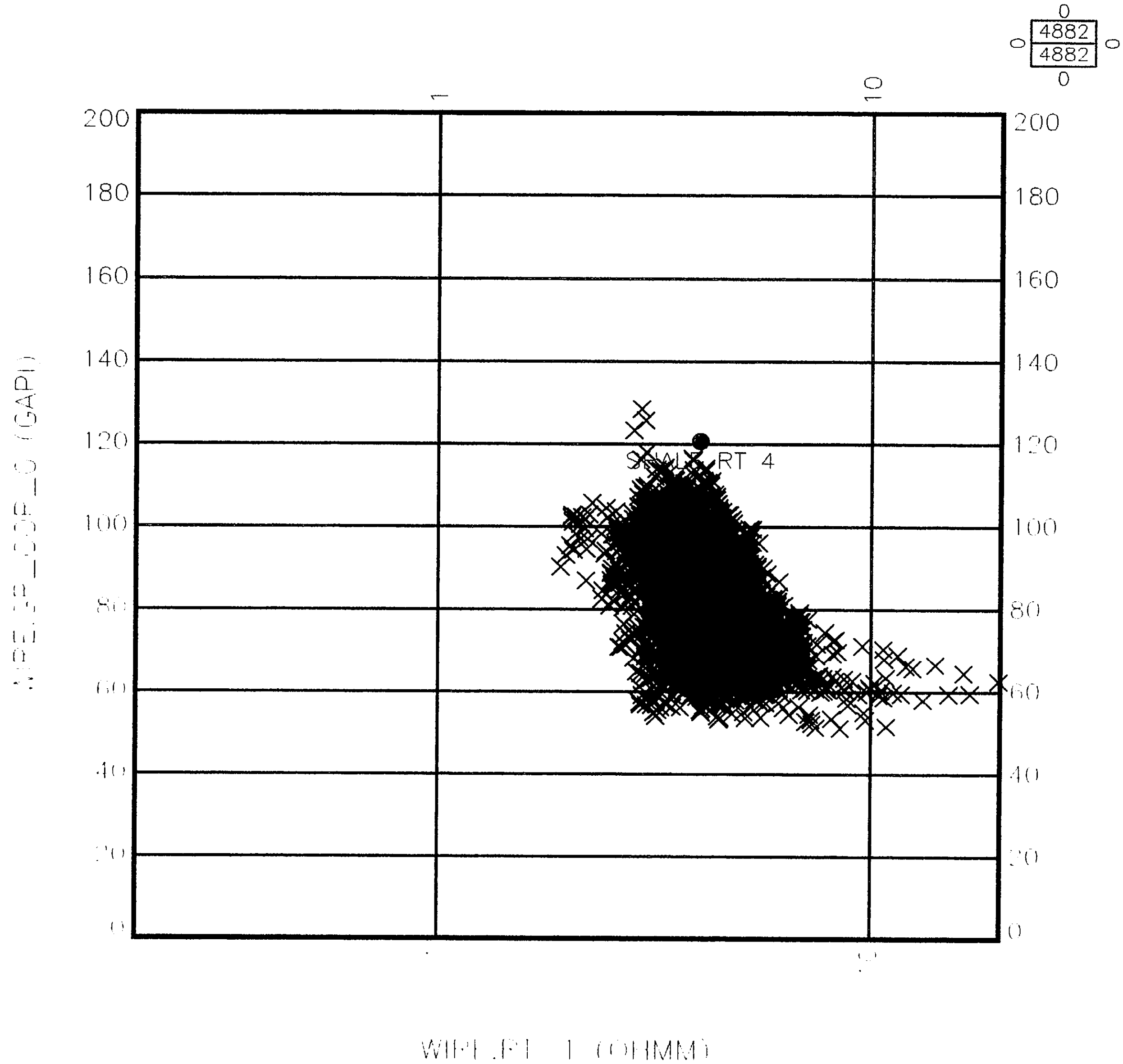

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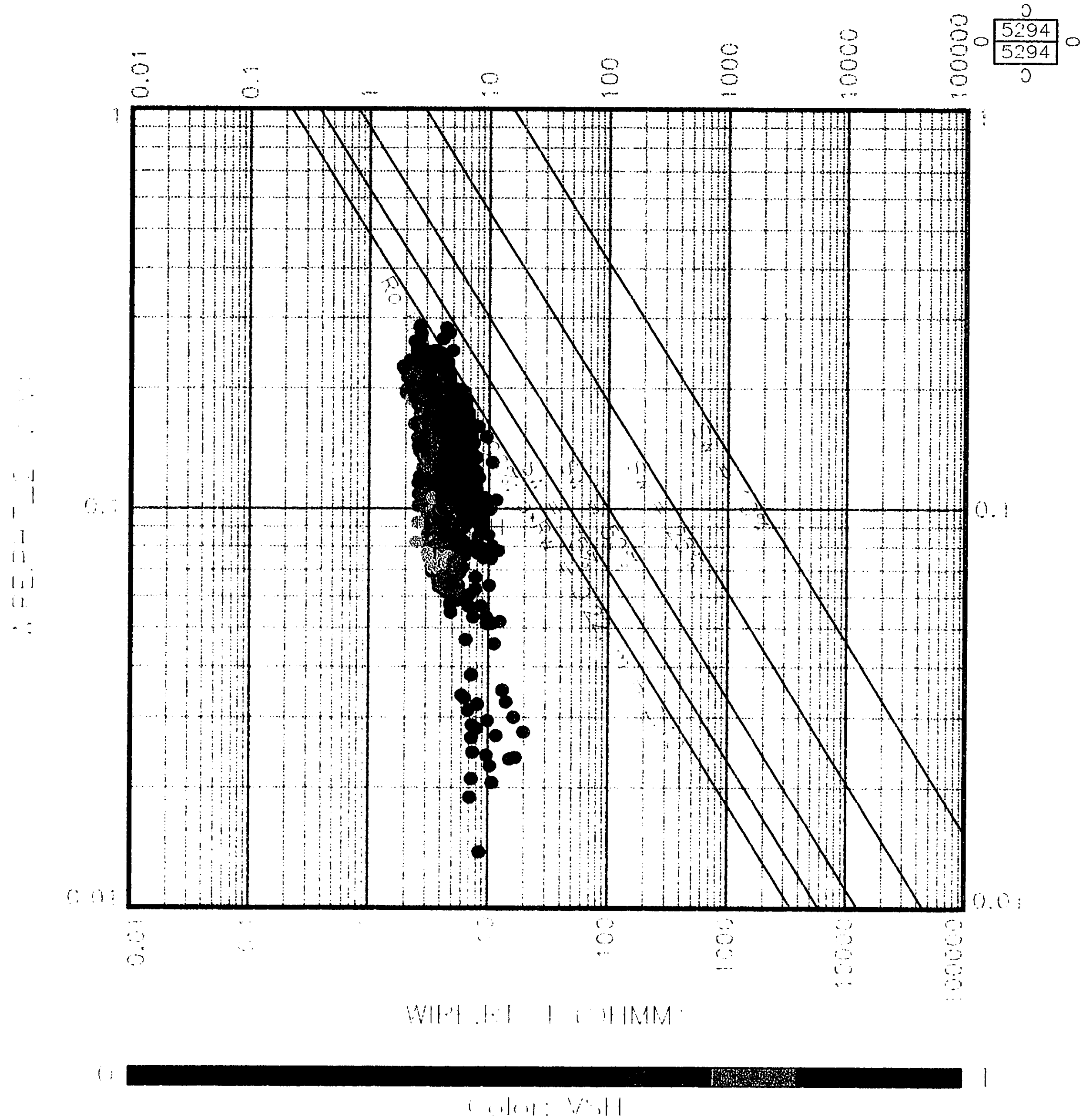
      DESCRIPTION = PHIT vs. RT Cross Plot, Waarre
                    Formation Unit B; Waarre Formation Unit
                    A to Eumeralla Formation, (enclosure
                    from appendix 2d of WCR vol.1) for
                    Skull Creek West-1
          REMARKS =
     DATE_CREATED =
    DATE_RECEIVED = 30/04/98
             W_NO = W1180
        WELL_NAME = SKULL CREEK WEST-1
       CONTRACTOR = ACS LABORATORIES PTY LTD
     CLIENT_OP_CO = CULTUS PETROLEUM NL
```

(Inserted by DNRE - Vic Govt Mines Dept)

PHIT vs. RT Crossplot

Well: SKULL_CREEK_WEST-1

Intervals: WAARRE FM. UNIT B WAARRE FM. UNIT A EUMERALLA FORMATION
Filter:



Functions:

APPENDIX 2: NET RESERVOIR SUMMARY REPORT

Page 1
WELL: SKULL_CREEK_WEST-1

Interval name : WAARRE FM. UNIT B
Interval top : 1285.000000 METRES
Interval bottom : 1306.000000 METRES

Cutoff Expression:
phit>=0.1 & vsh<=0.4

Minimum pay thickness : 1.000000 METRES

Maximum pay separation : 1.000000 METRES

Depth listing for pay depths.
Summation type is zone.

	Cutoff Logs			Summation			Averages		
Depth	PHIT	SWT_WS	VSH	PHIT	BVW	VSH	PHIT	SWT_WS	VSH
1285.100	0.211	0.798	0.395	0.021	0.017	0.039	0.211	0.798	0.395
1285.200	0.165	1.014	0.335	0.038	0.034	0.073	0.188	0.893	0.365
1285.300	0.132	1.290	0.288	0.051	0.051	0.102	0.169	0.996	0.339
1285.400	0.125	1.306	0.277	0.063	0.067	0.130	0.158	1.057	0.324
1285.500	0.139	1.087	0.273	0.077	0.082	0.157	0.154	1.063	0.314
1285.600	0.169	1.022	0.289	0.094	0.099	0.186	0.157	1.055	0.310
1285.700	0.206	0.883	0.302	0.115	0.117	0.216	0.164	1.024	0.308
1285.800	0.235	0.809	0.313	0.138	0.137	0.247	0.173	0.988	0.309
1285.900	0.251	0.792	0.323	0.163	0.156	0.280	0.182	0.958	0.311
1286.000	0.261	0.801	0.322	0.189	0.177	0.312	0.189	0.936	0.312
1286.100	0.265	0.787	0.321	0.216	0.198	0.344	0.196	0.918	0.313
1286.200	0.270	0.782	0.284	0.243	0.219	0.372	0.202	0.903	0.310
1286.300	0.268	0.797	0.236	0.270	0.241	0.396	0.207	0.892	0.305
1286.400	0.264	0.825	0.159	0.296	0.262	0.412	0.212	0.886	0.294
1286.500	0.256	0.860	0.102	0.322	0.284	0.422	0.215	0.884	0.281
1286.600	0.252	0.883	0.047	0.347	0.307	0.427	0.217	0.884	0.267
1286.700	0.246	0.850	0.033	0.371	0.328	0.430	0.219	0.882	0.253
1286.800	0.242	0.846	0.026	0.396	0.348	0.433	0.220	0.880	0.240
1286.900	0.238	0.914	0.036	0.419	0.370	0.436	0.221	0.882	0.230
1287.000	0.238	0.906	0.042	0.443	0.391	0.440	0.222	0.883	0.220
1287.100	0.237	0.906	0.049	0.467	0.413	0.445	0.222	0.884	0.212
1287.200	0.238	0.904	0.047	0.491	0.434	0.450	0.223	0.885	0.204
1287.300	0.239	0.900	0.053	0.515	0.456	0.455	0.224	0.886	0.198
1287.400	0.238	0.897	0.069	0.538	0.477	0.462	0.224	0.886	0.193
1287.500	0.234	0.811	0.081	0.562	0.496	0.470	0.225	0.883	0.188
1287.600	0.228	0.844	0.081	0.585	0.515	0.478	0.225	0.882	0.184
1287.700	0.224	0.864	0.081	0.607	0.535	0.486	0.225	0.881	0.180
1287.800	0.221	0.872	0.087	0.629	0.554	0.495	0.225	0.881	0.177
1287.900	0.222	0.808	0.101	0.651	0.572	0.505	0.225	0.878	0.174
1288.000	0.227	0.904	0.116	0.674	0.593	0.517	0.225	0.879	0.172
1288.100	0.233	0.887	0.138	0.697	0.613	0.531	0.225	0.879	0.171
1288.200	0.240	0.869	0.161	0.721	0.634	0.547	0.225	0.879	0.171
1288.300	0.245	0.863	0.170	0.746	0.655	0.564	0.226	0.878	0.171
1288.400	0.249	0.859	0.187	0.771	0.677	0.582	0.227	0.878	0.171
1288.500	0.248	0.809	0.219	0.796	0.697	0.604	0.227	0.876	0.173
1288.600	0.247	0.861	0.262	0.820	0.718	0.630	0.228	0.875	0.175

WELL: SKULL_CREEK_WEST-1

1288.700	0.248	0.855	0.290	0.845	0.739	0.659	0.228	0.875	0.178
1288.800	0.250	0.795	0.296	0.870	0.759	0.689	0.229	0.872	0.181
1288.900	0.252	0.849	0.289	0.895	0.781	0.718	0.230	0.872	0.184
1289.000	0.256	0.792	0.269	0.921	0.801	0.745	0.230	0.869	0.186
1289.100	0.259	0.785	0.251	0.947	0.821	0.770	0.231	0.867	0.188
1289.200	0.263	0.777	0.243	0.973	0.842	0.794	0.232	0.865	0.189
1289.300	0.265	0.771	0.249	1.000	0.862	0.819	0.233	0.862	0.190
1289.400	0.267	0.768	0.243	1.026	0.882	0.843	0.233	0.860	0.192
1289.500	0.268	0.769	0.227	1.053	0.903	0.866	0.234	0.857	0.192
1289.600	0.267	0.776	0.214	1.080	0.924	0.887	0.235	0.855	0.193
1289.700	0.264	0.784	0.208	1.106	0.944	0.908	0.235	0.854	0.193
1289.800	0.260	0.796	0.195	1.132	0.965	0.928	0.236	0.852	0.193
1289.900	0.256	0.798	0.187	1.158	0.986	0.946	0.236	0.851	0.193
1290.000	0.252	0.808	0.192	1.183	1.006	0.966	0.237	0.850	0.193
1290.100	0.249	0.807	0.202	1.208	1.026	0.986	0.237	0.849	0.193
1290.200	0.248	0.809	0.199	1.233	1.046	1.006	0.237	0.849	0.193
1290.300	0.247	0.812	0.200	1.258	1.066	1.026	0.237	0.848	0.194
1290.400	0.246	0.806	0.203	1.282	1.086	1.046	0.237	0.847	0.194
1290.500	0.244	0.804	0.212	1.307	1.106	1.067	0.238	0.846	0.194
1290.600	0.240	0.789	0.210	1.331	1.125	1.088	0.238	0.845	0.194
1290.700	0.238	0.828	0.220	1.354	1.144	1.110	0.238	0.845	0.195
1290.800	0.233	0.758	0.236	1.378	1.162	1.134	0.238	0.843	0.195
1290.900	0.227	0.754	0.259	1.400	1.179	1.160	0.237	0.842	0.197
1291.000	0.222	0.756	0.289	1.423	1.196	1.189	0.237	0.841	0.198
1291.100	0.219	0.778	0.339	1.444	1.213	1.222	0.237	0.840	0.200
1291.200	0.214	0.772	0.391	1.466	1.229	1.262	0.236	0.839	0.203
6.200				1.466	1.229	1.262	0.236	0.839	0.203

WELL: SKULL_CREEK_WEST-1

Totals for interval : WAARRE FM. UNIT B
Interval top : 1285.000000 METRES
Interval bottom : 1306.000000 METRES

Net pay thickness : 6.200000
Gross thickness : 21.000000
Ratio (net/gross) : 0.295238

		Summation			Averages		
Thickness	Hydrocarbon	PHIT	BVW	VSH	PHIT	SWT_WS	VSH
6.200	0.236	1.466	1.229	1.262	0.236	0.839	0.203

WELL: SKULL_CREEK_WEST-1

Interval name : WAARRE FM. UNIT A
Interval top : 1306.000000 METRES
Interval bottom : 1326.000000 METRES

Cutoff Expression:
phit>=0.1 & vsh<=0.4

Minimum pay thickness : 1.000000 METRES

Maximum pay separation : 1.000000 METRES

Depth listing for pay depths.
Summation type is zone.

	Cutoff Logs			Summation			Averages		
Depth	PHIT	SWT_WS	VSH	PHIT	BVW	VSH	PHIT	SWT_WS	VSH
1316.400	0.256	0.742	0.395	0.026	0.019	0.039	0.256	0.742	0.395
1316.500	0.254	0.771	0.386	0.051	0.039	0.078	0.255	0.757	0.391
1316.600	0.254	0.780	0.364	0.076	0.058	0.115	0.255	0.764	0.382
1316.700	0.256	0.781	0.354	0.102	0.078	0.150	0.255	0.769	0.375
1316.800	0.259	0.780	0.351	0.128	0.099	0.185	0.256	0.771	0.370
1316.900	0.260	0.781	0.352	0.154	0.119	0.220	0.256	0.773	0.367
1317.000	0.261	0.782	0.362	0.180	0.139	0.256	0.257	0.774	0.366
1317.100	0.259	0.777	0.363	0.206	0.159	0.293	0.257	0.774	0.366
1317.200	0.256	0.780	0.357	0.231	0.179	0.328	0.257	0.775	0.365
1317.300	0.251	0.793	0.335	0.257	0.199	0.362	0.257	0.777	0.362
1317.400	0.244	0.810	0.329	0.281	0.219	0.395	0.255	0.780	0.359
1317.500	0.236	0.830	0.321	0.305	0.239	0.427	0.254	0.784	0.356
1317.600	0.229	0.727	0.339	0.327	0.255	0.461	0.252	0.780	0.354
1317.700	0.225	0.733	0.363	0.350	0.272	0.497	0.250	0.777	0.355
1317.800	0.224	0.740	0.405	0.372	0.288	0.538	0.248	0.774	0.358
1317.900	0.225	0.691	0.445	0.395	0.304	0.582	0.247	0.770	0.364
1318.000	0.228	0.774	0.483	0.417	0.321	0.630	0.246	0.770	0.371
1318.100	0.232	0.774	0.502	0.441	0.339	0.681	0.245	0.770	0.378
1318.200	0.236	0.673	0.491	0.464	0.355	0.730	0.244	0.765	0.384
1318.300	0.240	0.798	0.451	0.488	0.374	0.775	0.244	0.767	0.387
1318.400	0.243	0.821	0.391	0.513	0.394	0.814	0.244	0.769	0.388
1318.500	0.247	0.844	0.329	0.537	0.415	0.847	0.244	0.773	0.385
1318.600	0.250	0.852	0.276	0.562	0.436	0.874	0.244	0.776	0.380
1318.700	0.255	0.845	0.263	0.588	0.458	0.901	0.245	0.779	0.375
1318.800	0.258	0.838	0.267	0.613	0.480	0.927	0.245	0.782	0.371
1318.900	0.262	0.832	0.273	0.640	0.501	0.955	0.246	0.784	0.367
1319.000	0.261	0.839	0.269	0.666	0.523	0.981	0.247	0.786	0.364
1319.100	0.258	0.842	0.269	0.692	0.545	1.008	0.247	0.788	0.360
1319.200	0.254	0.853	0.266	0.717	0.567	1.035	0.247	0.790	0.357
1319.300	0.249	0.859	0.274	0.742	0.588	1.062	0.247	0.793	0.354
1319.400	0.245	0.864	0.289	0.766	0.609	1.091	0.247	0.795	0.352
1319.500	0.244	0.860	0.299	0.791	0.630	1.121	0.247	0.797	0.350
1319.600	0.244	0.852	0.295	0.815	0.651	1.151	0.247	0.799	0.349
1319.700	0.245	0.834	0.305	0.840	0.671	1.181	0.247	0.800	0.347
1319.800	0.245	0.816	0.329	0.864	0.692	1.214	0.247	0.800	0.347
1319.900	0.245	0.797	0.370	0.889	0.711	1.251	0.247	0.800	0.347

3.600				0.889	0.711	1.251	0.247	0.800	0.347
1324.200	0.251	0.718	0.399	0.914	0.729	1.291	0.247	0.798	0.349
1324.300	0.248	0.722	0.378	0.939	0.747	1.329	0.247	0.796	0.350
1324.400	0.247	0.718	0.382	0.963	0.765	1.367	0.247	0.794	0.350
1324.500	0.247	0.702	0.375	0.988	0.782	1.404	0.247	0.791	0.351
1324.600	0.248	0.782	0.389	1.013	0.801	1.443	0.247	0.791	0.352
1324.700	0.248	0.777	0.385	1.038	0.821	1.482	0.247	0.791	0.353
1324.800	0.247	0.773	0.397	1.062	0.840	1.522	0.247	0.790	0.354
1324.900	0.246	0.774	0.387	1.087	0.859	1.560	0.247	0.790	0.355
1325.000	0.242	0.719	0.377	1.111	0.876	1.598	0.247	0.789	0.355
1325.100	0.235	0.729	0.363	1.135	0.893	1.634	0.247	0.787	0.355
1325.200	0.226	0.765	0.349	1.157	0.911	1.669	0.246	0.787	0.355
1325.300	0.218	0.793	0.332	1.179	0.928	1.702	0.246	0.787	0.355
1325.400	0.212	0.804	0.307	1.200	0.945	1.733	0.245	0.787	0.354
1325.500	0.209	0.774	0.307	1.221	0.961	1.764	0.244	0.787	0.353
1325.600	0.211	0.865	0.321	1.242	0.979	1.796	0.244	0.788	0.352
1325.700	0.213	0.848	0.362	1.264	0.997	1.832	0.243	0.789	0.352
1.600				0.375	0.286	0.581	0.234	0.764	0.363

WELL: SKULL_CREEK_WEST-1

Totals for interval : WAARRE FM. UNIT A
Interval top : 1306.000000 METRES
Interval bottom : 1326.000000 METRES

Net pay thickness : 5.200000
Gross thickness : 20.000000
Ratio (net/gross) : 0.260000

		Summation			Averages		
Thickness	Hydrocarbon	PHIT	BVW	VSH	PHIT	SWT_WS	VSH
5.200	0.266	1.264	0.997	1.832	0.243	0.789	0.352

WELL: SKULL_CREEK_WEST-1

Interval name : EUMERALLA FORMATION
Interval top : 1326.000000 METRES
Interval bottom : 1814.000000 METRES

Cutoff Expression:
phit>=0.1 & vsh<=0.4

Minimum pay thickness : 1.000000 METRES

Maximum pay separation : 1.000000 METRES

Totals for interval : EUMERALLA FORMATION
Interval top : 1326.000000 METRES
Interval bottom : 1814.000000 METRES

Net pay thickness : 227.900000
Gross thickness : 488.000000
Ratio (net/gross) : 47%

		Summation			Averages		
Thickness	Hydrocarbon	PHIT	BVW	VSH	PHIT	SWT_WS	VSH
227.900	-2.169	45.900	48.069	79.415	0.201	1.047	0.348

APPENDIX 3: FET/RFS DATA

ATTN CRAIG
GREG

CULTUS PETROLEUM NL

RFT - PRESSURE TEST REPORT SHEET

WELL NAME: SCW-1	PERMIT: PPC-1	OBSERVER: R. HARRIS	DATE: 25/2/97

TEST NO	FILE NO	DEPTH mKB.	SEAT Y	SEAT N	HYDROSTATIC PRESSURE INITIAL psia	HYDROSTATIC PRESSURE FINAL psia	FORMATION PRESSURE (PSIA) QUARTZ GAUGE psia.	FORMATION PRESSURE (PSIA) STRAIN GAUGE psia	PERMEABLE TIGHT	SAMPLE Y	SAMPLE N	FORMATION/REMARKS
CROCKER.												
1		1286.5	✓		2087.6	~~2088.3~~ 2088.4	1833.5		TIGHT		✓	OVER PRESSURED
2		1287.0	✓		2089.1	2089.5	1730.5		GOOD 452mD		✓	Pumped @ 0.6 CC/min dP = 36.5 psi. Bp = 0.43 WATER.
3		1288.0	✓		2090.9	2091.1	1731.9		Good 227mD		✓	Q = 0.5 l/min dP = 60.6 k = 227 mD.
4		1290.0	✓		2094.1	2094.3	1734.7		Good		✓	No drawdown.
5		1294.7	✓		2101.6	2102.1 ~~1788.7~~	1768.7		TIGHT		✓	SUPERCHARGED
6		1294.9	✓		2102.2	2102.3	1749.0		V. Tight		✓	Press still increasing. S. Charged.
7		1309.0	✓		2124.9	2125.5	1780.8		Good BU		✓	STABILISED 5.4 mD.
8		1311.0	✓		2128.5	2128.9	1820.0		V. Tight		✓	Still building.
9		1315.1	✓		2136.3	2135.7	1772.6		Tight. BU OK.		✓	Stabilised BU. Drawdown 4.6 C FILTRATE.
10		1318.9			2141.7		1776.7		Good BU			Stab BU. 134 mD
BPB												
1	T1	1287.0	✓		2088.3	2088.5 ~~1728.1~~	1728.1	1729.7	Good BU		✓	STABILISED
2.	T2	1313.0	✓		2130.6	2131.4	1768.0	1769.2	Good Bu.		✓	STABILISED 9:34 mins.
3	T3	1316.5	✓		2137.0	2137.0	1770.7	1772.1	GOOD BU		✓	STABILISED 2:00 mins.
4	T4	1318.9	✓		2141.0	2141.3.	1778.9	1775.6.	Ex BU		✓	STAB 10 sec.
5	T5	1324.5	✓		2150.4	2150.7	1782.3	1783.7	Good BU		✓	STAB 60 sec
6	T6	1531.0	✓		2484.4	2484.6	30		No Perm.		✓	Abort
7	T7	1531.5	✓		2485.1	2485.7	17		No Perm		✓	Abort
8	T8	1530.2	✓		2483.6	2484.1	2125.8	2126.9	Tight: VALID		✓	Stab. 10 mins.
9	T9	1529.9	✓		2483.1	2483.5	16.		No Perm.		✓	Abort
10	T10.	1530.2	✓		2484.0	2484.9	2124.3	2124.9	Tight	✓		Still Building. Both chambers filled.

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ATTN: CRAIG
GREG

CULTUS PETROLEUM NL

RFT - PRESSURE TEST REPORT SHEET

WELL NAME: SCW-1	PERMIT: PPL-1	OBSERVER: R. HARRIS	DATE: 25/2/97

TEST NO	FILE NO	DEPTH	SEAT Y	SEAT N	HYDROSTATIC PRESSURE INITIAL	HYDROSTATIC PRESSURE FINAL	FORMATION PRESSURE (PSIA) QUARTZ GAUGE	FORMATION PRESSURE (PSIA) STRAIN GAUGE	PERMEABLE TIGHT	SAMPLE Y	SAMPLE N	FORMATION/REMARKS
BPB-1		mKB			psia	psia	psia	psia				
11.	T11	1751.0	✓		2844.3	2842.8	2409.0	2411.3	Lowperm		✓	Overpressure + bleedoff during B.U.
12.	T12.	1758.5	✓		2850.0	2860.3	2415.7	2416.9	Low k.		✓	Oscillating 2418-2415 psi.
13	T13	1766.5	✓		2866.7	2867.4	1981.4	1988.2	low k		✓	Building slowly. Extrapolate.
14	T14	1486.0	✓		2411.6	2412.1	291	—	V.TIGHT Nok		✓	Abort.
15	T15	1491.8	✓		2421.5	2422.2	130.5	—	V.Tight Nok.		✓	Abort. IS TOOL PLUGGED?
16	T16	1424.8	✓		2314.3	2314.4	135.0	—	V.Tight Nok.		✓	Abort
17	T17	1201.0	✓		1946.5	1944.3	112.0	—	Nok.		✓	Abort
18	T18	1206.5			1955.6	1957.7	103	—	Nok		✓	Abort

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CULTUS PETROLEUM

Skull Creek West-1

RFT fluid sample - results and discussion

ATTN: Victor Dauzacker/Greg Oneill/Craig Martin

RFT sample collected at 1530.2m. Initial draw down with tool about 200PSI indicating fair to good permeability. Higher depths indicated poorer permeability (see RFT data sheet). Sample was flowed to large sample chamber in tool, when filled the flow was diverted to the small sample chamber in order to obtain a cleaner sample for analysis. The large sample chamber was opened at the rig to determine fluid composition. This chamber was initially opened to a gas bomb to obtain a sample to be used as back-up in case of loss of the small sample chamber or contents (currently this gas bomb is being retained at the rig). The sample chamber then was opened and contained a small quantity of gas (a small balloon full) approximately 9 litres of water (analysis indefinite as to whether it was pure mud filtrate or contained a proportion of formation water), and approximately 0.4 litres of oil (light to medium gravity - insufficient volume for wellsite determination of gravity). The small sample chamber which should contain the most representative sample of formation fluid type was not opened. This small sample chamber and approximately half the recovered volume of oil and water recovered from the large sample chamber should arrive at Amdel Adelaide early today (0800hrs 26-2-97). Ric Jason has with him a mud sample which should be more representative of the filtrate invasion fluid than the sample sent with the chamber. Should results from the tests prove inconclusive this sample should be analysed also.

Formation discussion: Due to the almost impossibility of seeing gas on the electric logs in the Eumeralla, accurate definition for oil could only be considered as a figment of imagination. From logging across the show interval, the oil DID NOT extend below the hard band visible on the drill rate at 1530m (CF. 1531/1532m electric logs) The gas peak recorded on the drill rate charts was very sharp. From cuttings the interval above 1526m drill depth (1527m logs) was claystone with very tight sand laminae (caprock), with sand quality improving down to 1530m (drill depth). The sand 1526-1528 approximately appeared probably too tight for hydrocarbon accumulation. Hence the best of the show interval was at the base of the sand above 1530m (drill depth). This was underlain by a tight calcified band, below which was better quality sand which definitely displayed no oil fluorescence or associated gas response.
OIL/WATER CONTACT IS NOT DEEPER THAN 1530m (drillers depth).
Recommended open hole test interval: 1526-1531m (logs) 1525-1530m (driller)

I hope this may help you in the formulation of our future plans,

Regards, David

ATTN: GREG ONEILL

Samples sent to Amdel, Adelaide.

1: small pressurised sample chamber
2: small quantity of oil (large sample chamber)
3: 1 litre recovered water (large sample chamber)
4: 12 ml mud filtrate

Samples retained at rig:

1: gas bomb (pressurised) from initial opening of tool
2: approx 8 litres recovered water
3: small quantity of oil

Samples sent special trip via Nelson Transport and should arrive Amdel Adelaide by approx 0800hr this morning (26-2-97), other modes of transport would have taken over 24 hours from here.

CULTUS PETROLEUM NL - RFT SAMPLE TEST REPORT

WELL: SCW-1 OBSERVER: R. HARRIS DATE: 25-2-97 RUN NO: BPB-1

SEAT NO 10		CHAMBER 1 2.75 gal. 10.4(L lit)		CHAMBER 2 1 US gal. 3.8(L lit)	
DEPTH		1530.2 m KB		1530.2 m KB	m
A	RECORDING TIMES				
	Tool Set	14:35	hrs		hrs
	Chamber Open	14:41	hrs	14:58	hrs
	Chamber Full	14:58	hrs	15:10	hrs
	Fill Time	17	mins	12	mins
	Finish Build Up	—	hrs	15:15	hrs
	Build Up Time	—	mins	3.	mins
	Tool Retract	—	hrs	15:15	hrs
	Total Time	—	mins	40	mins
B	SAMPLE PRESSURE				
	Initial Hydrostatic	2484.0	psia/g	—	psia/g
	Initial Form'n Pres	2124.0	psia/g	—	psia/g
	Initial Flowing Pres	60 → 230	psia/g	100	psia/g
	Final Flowing Pres	~~1837~~ 214	psia/g	450	psia/g
	Final Form'n Pres	1937	psia/g	2009.	psia/g
	Final Hydrostatic	—	psia/g	2484.9	psia/g
C	TEMPERATURE				
	Max Tool Depth	1766.5	m	1766.5	m
	Max Rec Temp	68	°C	68.	°C
	Length of Circ	1	hrs	1	hrs
	Time/Date Circ Stopped	0800 hrs 24 / 2 / 97		0800 hrs 24 / 2 / 97	
	Time since Circ	30:3 hrs / /		30:3 hrs / /	
D	SAMPLE RECOVERY				
	Surface Pressure	< 5.	psig		psig
	Amount Gas	negligible	cu ft		cu ft
	Amount Oil	0.400	L		L
	Amount Water (Total)	~ 9.0	L		L
	Amount OPthers		L		L
E	SAMPLE PROPERTIES				
	Gas Composition				
	C1	45 %	ppm		ppm
	C2	35 %	ppm		ppm
	C3	13 %	ppm		ppm
	C4	7 %	ppm		ppm
	C5	—	ppm		ppm
	C6+	—	ppm		ppm
	CO2/H2S	NIL / NIL	%ppm		%ppm
	Oil Properties	— °API@ —	°C	°API@	°C
	Colour	BROWN			
	Fluorescence	bright pale yellow white			
	GOR	—			
	Pour Point				
	Water Properties				
	Resistivity	0.469 ohm-m@ 62.2	°C	ohm-m@	°C
	NaCl Equivalent	—	ppm		ppm
	Cl-titrated	9500	ppm		ppm
	Tritium/NO_3	—	DPM/ppm		DPM/ppm
	pH	7.0 SO_3 80			
	Estimated Water Type	Pf/mf 0 / 0.8 CA 880			
F	MUD FILTRATE PROP				
	Resistivity	ohm-m	°C	ohm-m	°C
	NaCl Equivalent		ppm		ppm
	Cl-titrated		ppm		ppm
	pH				
	Tritium/NO_3	— —	DPM/ppm		DPM/ppm
G	GENERAL CALIBRATION				
	Mud Weight		ppg		ppg
	Calc Hydrostatic		psi		psi
	Serial No (Preserved)				
	Choke Size/Probe Type				
REMARKS				SENT CORDER - M. NELSON.	

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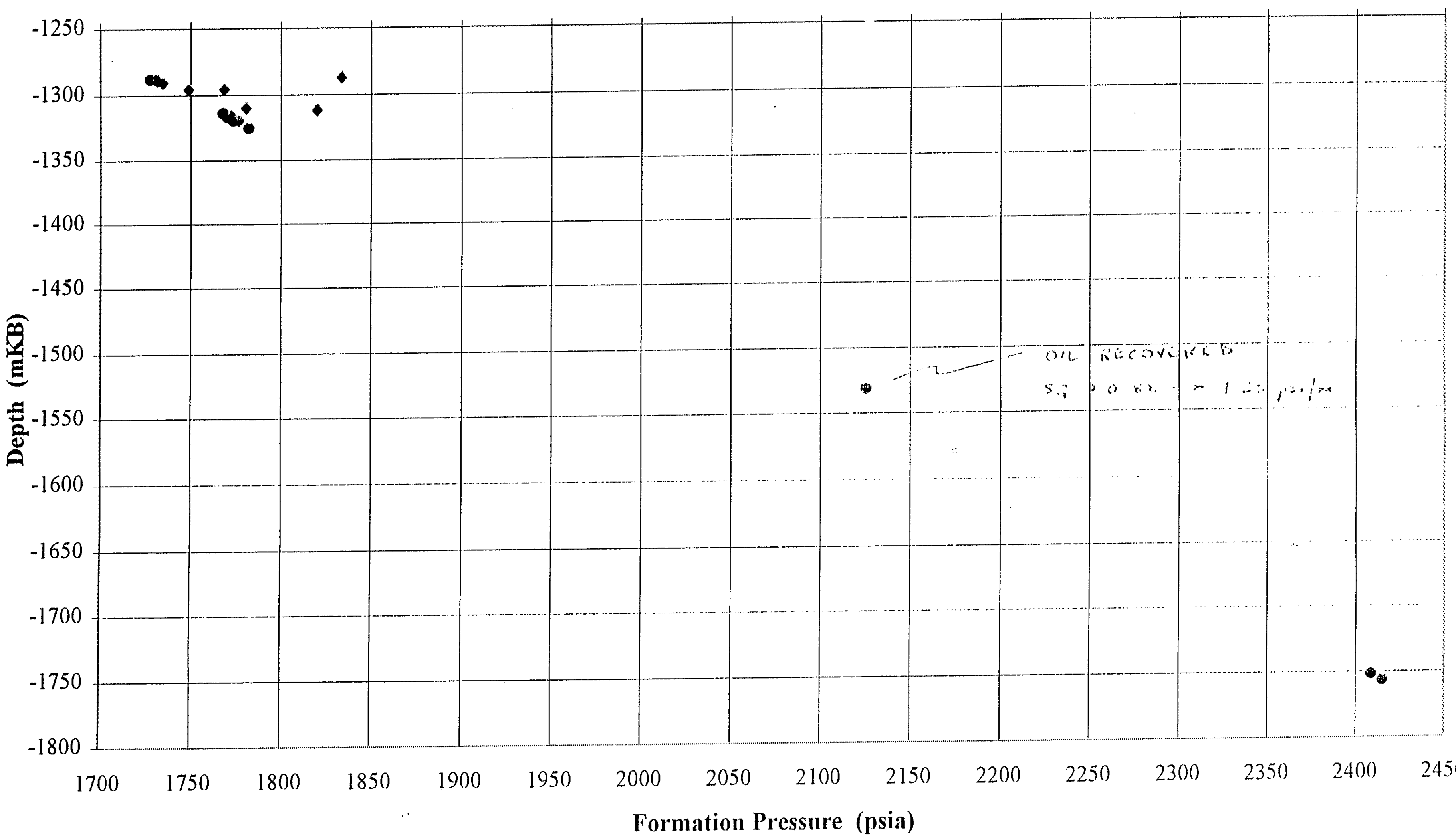
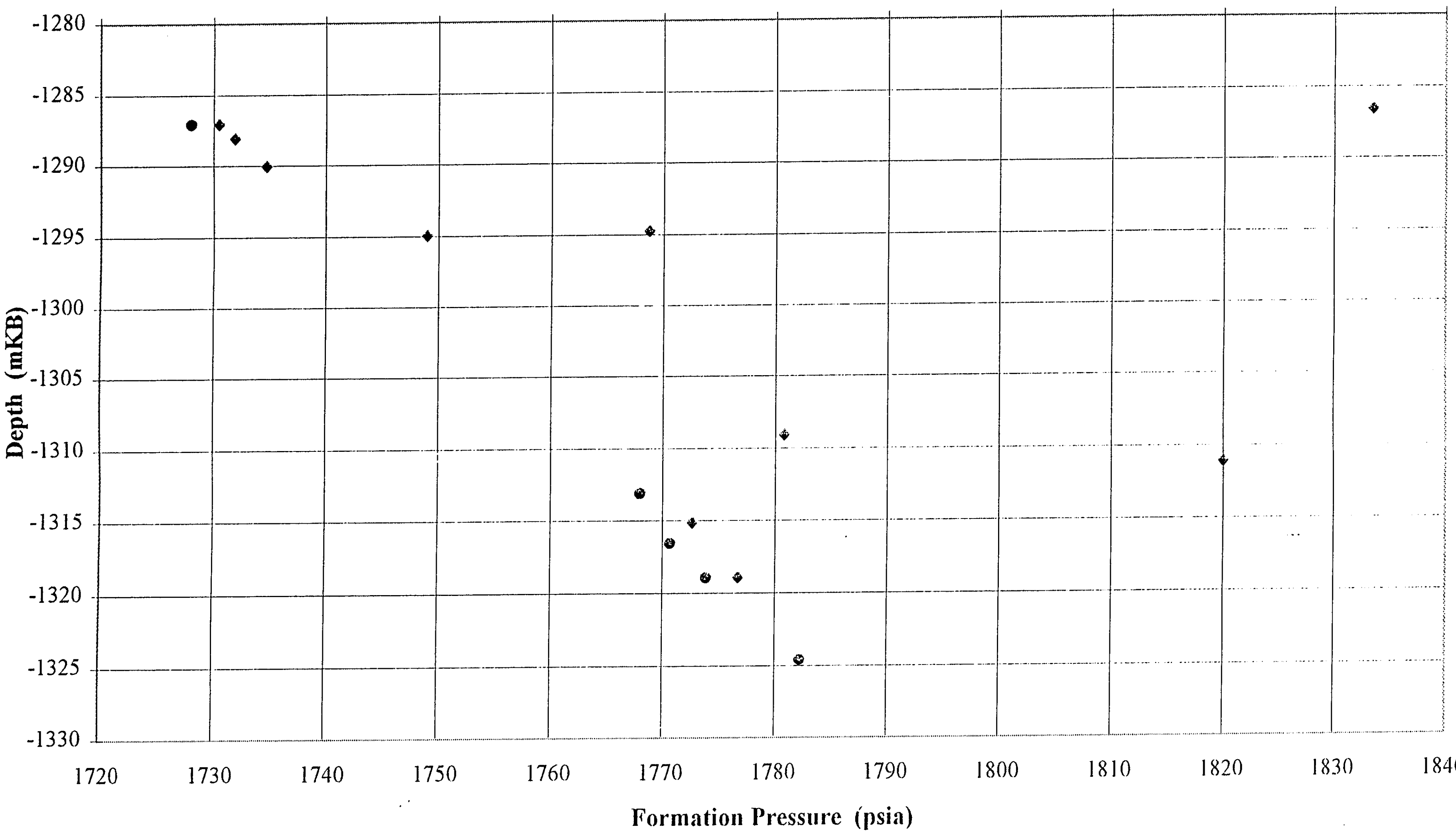
SKULL CREEK WEST-1 RFT SURVEY

All Points



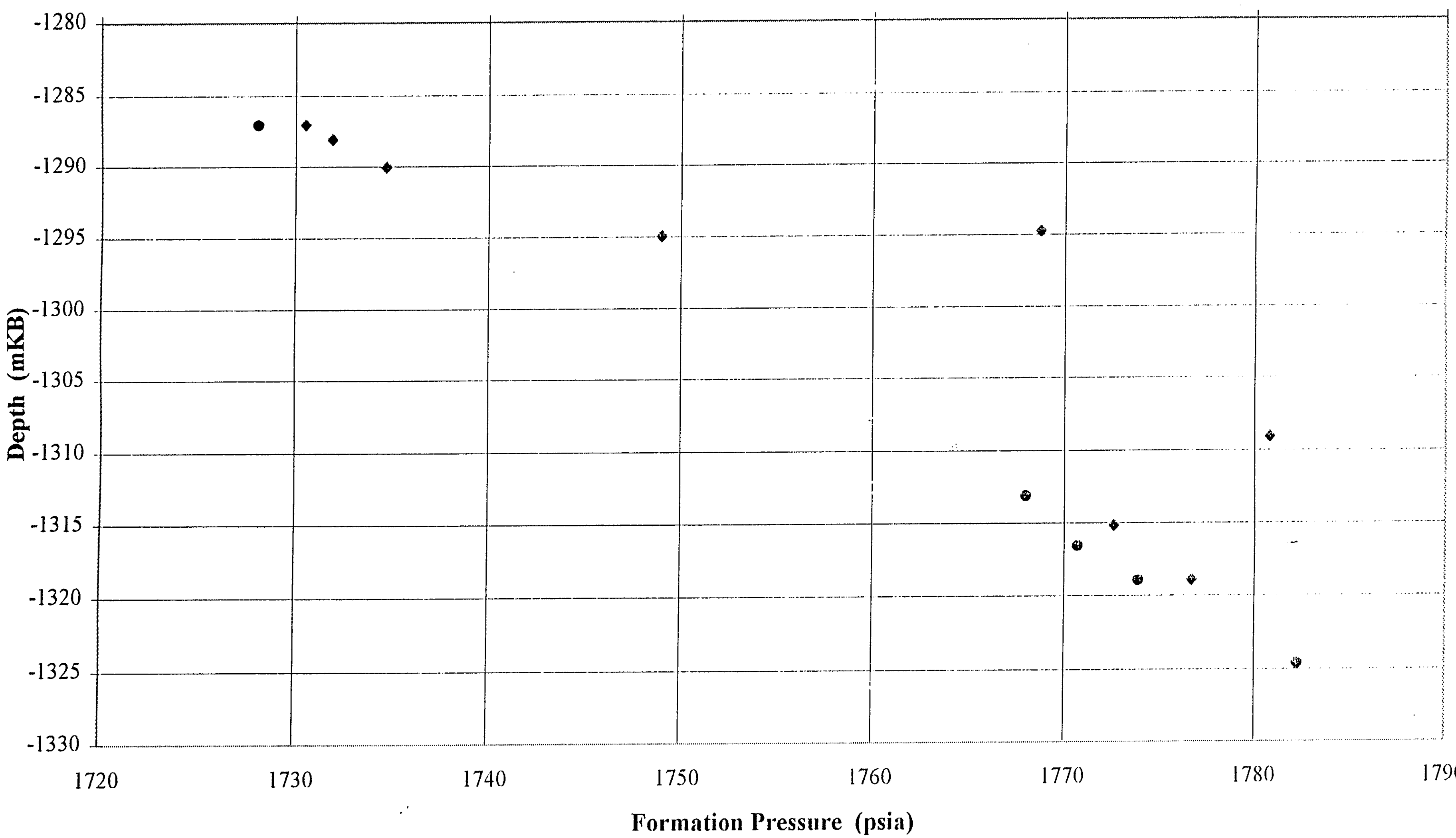
SKULL CREEK WEST-1 RFT SURVEY

Waarre Points Only



SKULL CREEK WEST-1 RFT SURVEY

Waarre Points Only (uncorrected)



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26/02/97 2:12 PM

BLUE = Crocker
RED = BPB

SKULL CREEK WEST-1 RFT SURVEY