

SOUTH AUSTRALIA
DEPARTMENT OF MINES AND ENERGY



OPEN FILE ENVELOPE NO. 6860

**SENRAC PROJECT 2/86 - MOOMBA AND BIG LAKE FIELDS:
LOG AND SPECIAL CORE ANALYSIS FOR IMPROVED
RESERVES ASSESSMENT**

**ANALYTICAL DATA AND PROGRESS REPORTS FOR THE
PERIOD AUGUST 1987 TO JANUARY 1989**

Submitted by
SENRAC and Amdel Ltd
1989

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ENVELOPE 6860

TENEMENT: Not applicable

TENEMENT HOLDER: Not applicable

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REPORTS:		SADME NO.
Cass, D., 1987. Results of laboratory determination of absolute grain density and cation exchange capacity (CEC) for 15 core plugs taken from Cooper Basin well cores cut in Moomba 45 and Moomba 51 (Amdel report no. F 6896/88 - Part 1, dated 6 August 1987).		6860 R 1 Pgs 3-4
Martin, R.R., Thorpe, J. and East, R., 1987. Results of laboratory determination of porosity and permeability measured at overburden conditions for 131 core plugs taken from Cooper Basin well cores cut in Big Lake 1, Big Lake 2, Big Lake 3, Moomba 10, Moomba 45 and Moomba 47 (Amdel report no. F 6896/88 - Part 2, dated 30 October 1987).		6860 R 2 Pgs 5-18
Martin, R.R., 1987. Results of laboratory determination of porosity and permeability, measured at both ambient and overburden conditions, CEC and absolute grain density for 35 core plugs taken from Cooper Basin well cores cut in Big Lake 27, Big Lake 31, Big Lake 32 and Big Lake 35 (Amdel report no. F 6896/88 - Part 3, dated 22 December 1987).		6860 R 3 Pgs 19-40
Martin, R.R., 1988. Results of laboratory determination of CEC and absolute grain density for 73 core plugs taken from Cooper Basin well cores cut in Moomba 8, Moomba 45, Moomba 52 and Moomba 53 (Amdel report no. F 6896/88 - Part 4, dated 26 February 1988).		6860 R 4 Pgs 41-63
Martin, R.R., 1988. Results of laboratory determination of absolute grain density for 116 core plugs taken from Cooper Basin well cores cut in Moomba 10, Moomba 47, Big Lake 1, Big Lake 2 and Big Lake 3 (Amdel report no. F 6896/88 - Part 5, dated 23 May 1988).		6860 R 5 Pgs 64-89
Morton, J.G.G., 1988. Moomba and Big Lake Fields: log and special core analysis for improved reserves assessment (State Energy Research Advisory Committee [SENAC] project no. 2/86). Status report to end of May 1988 - summary of analytical work performed to date and preliminary interpretation of results (SADME Oil, Gas and Coal Division submission to SENAC dated June 1988).		6860 R 6 Pgs 90-135
Martin, R.R., 1988. Results of laboratory determination of CEC for 40 core plugs taken from Cooper Basin well cores cut in Moomba 10 and Moomba 47 (Amdel report no. F 6896/88 - Part 6, dated 8 June 1988).		6860 R 7 Pgs 136-139
Martin, R.R., 1988. Results of laboratory determination of CEC for 76 core plugs taken from Cooper Basin well cores cut in Big Lake 1, Big Lake 2 and Big Lake 3 (Amdel report no. F 6896/88 - Part 5A, dated 21 July 1988).		6860 R 8 Pgs 140-144
Martin, R.R., 1989. Results of laboratory determination of multiple-salinity electrical properties on 32 selected core plugs taken from Cooper Basin well cores cut in Big Lake 2, Big Lake 3, Big Lake 32, Big Lake 35, Dirkala 2, Garrajanle 2 and Moomba 47 (Amdel report nos F 6727/87 / F 6898/87 - Final, dated 18 January 1989).		6860 R 9 Pgs 145-182

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6 August 1987

F 1/1/298
F 6896/88 - Part 1

The Director-General
South Australian Department of Mines
and Energy
PO Box 151
EASTWOOD SA 5063

REPORT F 6896/88 - Part 1

YOUR REFERENCE:	DME 192/86 TH:MG, DME 142/66 JM:DG
TITLE:	Cooper Basin Core
MATERIAL:	Core plugs
LOCALITY:	COOPER BASIN
IDENTIFICATION:	Moomba 45 and 52
WORK REQUIRED:	Absolute grain density, cation exchange capacity

Investigation and Report by: Diane Cass, Amdel Limited Chemistry Services
Manager, Petroleum Services Section: Dr Brian G. Steveson

Brian Steveson

for Dr William G. Spencer
General Manager
Applied Sciences Group

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Absolute specific gravities requested in your letter of 29 April (DME 142/66 JM:DG and DME 192/86 TH:MG) are as follows:

Moomba 45	Plug 3	2.72
	4	2.73
	5	2.70
	6	2.67
	7	2.67
	8	2.67
	9	2.72
	11	2.65
	12	2.65
	15	2.65
Moomba 52	Plug 6	2.63
	7	2.65
	11	2.65
	12	2.65
	14	2.63

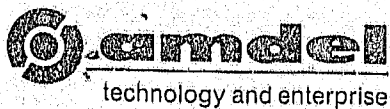
Total cation exchange capacity measurements were made on selected core plugs from Moomba 45 and Moomba 52 for which porosity and permeability had been determined. These results are given below with C.E.C. in meq/100 gm. This figure can be converted to QV (meq/ml of pore space) by the equation:

$$QV = \frac{d \times C.E.C.}{100 \left(\frac{1}{1\phi} - 100 \right)}$$

where d is the absolute grain density and ϕ is the porosity as a proportion:

Moomba 45		Moomba 52	
Sample	C.E.C.	Sample	C.E.C.
3	1.1	6	1.3
4	1.0	7	0.9
5	1.1	11	1.0
6	1.6	12	<0.1
7	0.9	14	0.9
8	0.9		
9	0.9		
11	0.6		
12	0.7		
15	0.5		

**END
OF
REPORT**



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30 October 1987

F 1/1/298
F 6896/88 - Part 2

The Director-General
South Australian Department of Mines
and Energy
PO Box 151
EASTWOOD SA 5063

REPORT F 6896/88 - Part 2

ATT. J. Morton - Di, Gas & Coal

YOUR REFERENCE: SENRAC Project 2/86
TITLE: SENRAC Project
MATERIAL: Core plugs
IDENTIFICATION: Core
WORK REQUIRED: Porosity/permeability at overburden
Cap Press Mo 45

Investigation and Report by: Russell Martin, Jim Thorpe and
Bob East

Manager, Petroleum Services Section: Dr Brian G. Steveson

Brian Steveson

for Dr William G. Spencer
General Manager
Applied Sciences Group

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Date: 30/10/87
File: F6896/88

POROSITY/PERMEABILITY

Client: Department of Mines and Energy Location: Cooper Basin
Well: Big Lake-1 Country: Australia
Field: Big Lake

Sample ID	Depth (feet)	Permeability to Air (millidarcys)	Porosity (%)	Grain Density Calculated gms/cc
1	7798.00	0.02	5.4	2.69
2	7799.60	0.05	6.7	2.68
3	7800.50	0.08	6.6	2.75
4	7801.30	0.05	7.0	2.72
5	7801.60	0.08	7.6	2.68
6	7802.10	0.07	7.5	2.68
7	7803.50	0.10	8.3	2.68
8	7807.30	0.18	10.2	2.68
9	7808.50	0.08	7.4	2.75
10	7809.20	0.01	3.7	2.69

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Date: 30/10/87
File: F6896/88

POROSITY/PERMEABILITY

Client: Department of Mines and Energy Location: Cooper Basin
Well: Big Lake-1 Country: Australia
Field: Big Lake

Overburden Pressure: 30,303 kPa

Sample ID	Depth (feet)	Permeability to Air (millidarcys)	Porosity (%)
1	7798.00	0.01	5.1
2	7799.60	0.02	6.3
3	7800.50	0.04	6.2
4	7801.30	0.02	6.5
5	7801.60	0.01	7.1
6	7802.10	0.02	6.9
7	7803.50	0.02	7.8
8	7807.30	0.07	9.5
9	7808.50	0.02	6.8
10	7809.20	0.00	3.6

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Date: 30/10/87
File: F6896/88

POROSITY/PERMEABILITY

Client: Department of Mines and Energy Location: Cooper Basin
Well: Big Lake-2 Country: Australia
Field: Big Lake

Sample ID	Depth (feet)	Permeability to Air (millidarcys)	Porosity (%)	Grain Density Calculated gms/cc
1	7453.90	0.77	10.2	2.66
2	7454.80	1.47	12.0	2.67
3	7455.80	1.11	12.2	2.67
4	7457.00	54.52	13.5	2.66
5	7461.90	9.06	12.3	2.66
6	7464.50	151.12	14.4	2.65
7	7466.70	5.22	11.6	2.67
8	7469.80	36.03	14.0	2.67
9	7472.00	306.56	18.1	2.66
10	7473.00	40.39	14.0	2.66
11	7475.00	7.40	12.6	2.66
12	7480.00	0.02	5.7	2.70
13	7483.10	0.09	8.4	2.70
14	7483.80	0.31	9.2	2.69
15	7554.30	481.96	19.1	2.66
16	7556.00	103.75	17.0	2.66
17	7557.90	340.13	18.6	2.66
18	7561.00	575.70	16.6	2.66
19	7569.00	92.13	14.2	2.66
20	7570.90	0.05	7.4	2.68
21	7573.00	3.71	11.9	2.66
22	7575.90	5.52	4.1	2.64
23	7577.30	0.60	10.6	2.67
24	7578.10	1.07	11.8	2.67
25	7580.00	0.38	9.5	2.66
26	7581.10	7.20	12.4	2.66
27	7584.00	407.76	18.0	2.66
28	7587.00	1.86	9.3	2.66
29	7590.10	20.12	12.4	2.66
30	7592.00	60.29	16.2	2.66
31	7611.80	0.13	8.4	2.71
32	7616.40	0.05	8.4	2.69
33	7617.70	0.00	1.7	2.66
34	7618.70	0.32	9.6	2.68
35	7619.10	0.36	8.8	2.67
36	7620.60	2.19	12.9	2.67
37	7621.00	21.93	15.4	2.68
38	7628.00	533.74	18.1	2.66
39	7629.30	29.23	14.9	2.66
40	7636.80	131.62	17.7	2.70

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Date: 30/10/87
File: F6896/88

POROSITY/PERMEABILITY

Client: Department of Mines and Energy Location: Cooper Basin
Well: Big Lake-1/2 Country: Australia
Field: Big Lake

Sample ID	Depth (feet)	Permeability to Air (millidarcys)	Porosity (%)	Grain Density Calculated gms/cc
41	7647.30	0.07	7.7	2.66
42	7649.00	0.02	6.5	2.68
43	7673.80	0.19	9.0	2.67
44	7677.10	0.19	9.7	2.71
45	7678.00	0.12	7.8	2.67
46	7679.10	0.47	7.2	2.67
47	7680.60	0.12	7.3	2.68
48	7681.10	0.30	8.6	2.67
49	7682.00	0.32	9.8	2.67
50	7683.70	0.62	10.6	2.67

00010

Date: 30/10/87
File: F6896/88

OVERBURDEN POROSITY/PERMEABILITY

Client: Department of Mines and Energy Location: Cooper Basin
Well: Big Lake-2 Country: Australia
Field: Big Lake

Overburden Pressure: 27,288 kPa

Sample ID	Depth (feet)	Permeability to Air (millidarcys)	Porosity (%)
1	7453.90	0.55	9.6
2	7454.80	1.04	11.2
3	7455.80	0.79	11.5
4	7457.00	51.65	13.0
5	7461.90	7.63	11.6
6	7464.50	127.70	13.7
7	7466.70	3.36	11.0
8	7469.80	33.01	13.5
9	7472.00	280.20	17.3
10	7473.00	33.76	13.6
11	7475.00	5.93	12.0
12	7480.00	0.01	5.4
13	7483.10	0.05	7.9
14	7483.80	0.11	8.7
15	7554.30	369.70	18.0
16	7556.00	77.12	16.0
17	7557.90	299.96	17.8
18	7561.00	510.51	16.0
19	7569.00	78.32	13.7
20	7570.90	0.01	6.8
21	7573.00	2.42	11.1
22	7575.90	0.29	3.7
23	7577.30	0.26	9.7
24	7578.10	0.60	11.4
25	7500.00	0.10	8.9
26	7581.10	4.87	11.5
27	7584.00	370.65	17.3
28	7587.00	0.80	8.6
29	7590.10	18.18	11.8
30	7592.00	52.19	15.5
31	7611.80	0.05	7.6
32	7616.40	0.02	8.1
33	7617.70	0.00	1.6
34	7618.70	0.14	8.9
35	7619.10	0.12	8.1
36	7620.60	1.70	12.2
37	7621.00	18.42	14.7
38	7628.00	321.93	16.4
39	7629.30	14.51	13.3
40	7636.80	95.55	16.4

.../2

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Date: 30/10/87
File: F6896/88

OVERBURDEN POROSITY/PERMEABILITY

Client: Department of Mines and Energy Location: Cooper Basin
Well: Big Lake-2 Country: Australia
Field: Big Lake

Overburden Pressure: 27,288 kPa

Sample ID	Depth (feet)	Permeability to Air (millidarcys)	Porosity (%)
41	7647.30	0.02	7.2
42	7649.00	0.01	6.1
43	7673.80	0.07	8.4
44	7677.10	0.05	9.0
45	7678.00	0.04	7.2
46	7679.10	0.11	6.7
47	7680.60	0.03	6.6
48	7681.10	0.09	8.0
49	7682.00	0.14	9.1
50	7683.70	0.36	9.9

00012

Date: 30/10/87
File: F6896/88

POROSITY/PERMEABILITY

Client: Department of Mines and Energy Location: Cooper Basin
Well: Big Lake-3 Country: Australia
Field: Big Lake

Sample ID	Depth (feet)	Permeability to Air (millidarcys)	Porosity (%)	Grain Density Calculated gms/cc
1	8251.40	3.58	13.2	2.68
2	8253.70	0.09	8.4	2.69
3	8254.00	0.05	8.8	2.90
4	8255.20	0.57	10.7	2.69
5	8256.10	0.25	9.0	2.70
6	8256.70	0.24	10.0	2.69
7	8257.60	0.07	8.6	2.70
8	8258.30	0.09	8.3	2.71
9	8261.20	0.03	7.1	2.79
10	8264.00	52.67	16.0	2.70
11	8265.00	10.09	13.1	2.68
12	8266.40	3.56	12.9	2.68
13	8267.05	46.29	14.4	2.67
14	8267.90	21.55	15.5	2.68
15	8268.90	3.87	13.5	2.67
16	8271.80	0.07	8.2	2.70

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Date: 30/10/87
File: F6896/88

OVERBURDEN POROSITY/PERMEABILITY

Client: Department of Mines and Energy Location: Cooper Basin
Well: Big Lake-3 Country: Australia
Field: Big Lake

Overburden Pressure: 27,288 kPa

Sample ID	Depth (feet)	Permeability to Air (millidarcys)	Porosity (%)
1	8251.40	2.84	12.8
2	8253.70	0.02	7.6
3	8254.00	0.01	8.1
4	8255.20	0.14	10.0
5	8256.10	0.06	8.4
6	8256.70	0.06	9.5
7	8257.60	0.03	7.8
8	8258.30	0.31	7.4
9	8261.20	0.01	6.6
10	8264.00	47.74	14.5
11	8265.00	8.92	12.8
12	8266.40	2.98	12.4
13	8267.05	40.84	13.9
14	8267.90	18.21	15.1
15	8268.90	2.74	12.9
16	8271.80	0.37	7.7

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Date: 30/10/87
File: F6896/88

POROSITY

Client: Department of Mines and Energy Location: Cooper Basin
Well: Moomba-10 Country: Australia
Field: Moomba

Sample ID	Depth (feet)	Porosity (%)	Grain Density (gm/cc)
1	7769.02	12.3	2.67
2	7770.00	13.4	2.67
3	7773.01	14.2	2.67
4	7775.02	18.1	2.67
5	7776.02	10.4	2.67
6	7777.02	12.4	2.67
7	7778.02	11.3	2.67
8	7780.02	14.2	2.66
9	7784.03	1.1	2.63
10	7786.00	1.0	2.66
11	7787.00	5.3	2.75
12	7789.00	3.5	2.57
13	7791.00	4.8	2.68
14	7792.00	6.5	2.69
15	7792.11	9.5	2.68
16	7795.00	9.6	2.68
17	7796.00	10.8	2.68
18	7798.00	11.7	2.67
19	7800.00	13.2	2.68
20	7802.02	14.0	2.71

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Date: 30/10/87
File: F6896/88

OVERBURDEN POROSITY/PERMEABILITY

Client: Department of Mines and Energy Location: Cooper Basin
Well: Moomba-10 Country: Australia
Field: Moomba

Overburden Pressure: 28,860 kPa

Sample ID	Depth (feet)	Permeability (md)	Porosity (%)
1	7769.02	2.57	11.6
2	7770.00	3.44	12.9
3	7773.01	25.8	13.7
4	7775.02	434	17.5
5	7776.02	0.904	9.8
6	7777.02	41.6	12.1
7	7778.02	5.55	10.7
8	7780.02	100	13.6
9	7784.03	>0.001	1.1
10	7786.00	>0.001	1.0
11	7787.00	0.002	5.0
12	7789.00	0.001	3.4
13	7791.00	0.006	4.4
14	7792.00	0.004	6.1
15	7792.11	0.023	8.9
16	7795.00	0.957	9.3
17	7796.00	1.36	10.6
18	7798.00	3.77	11.2
19	7800.00	6.69	12.6
20	7802.02	53.4	13.3

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Date: 30/10/87
File: F6896/88

OVERBURDEN POROSITY/PERMEABILITY

Client: Department of Mines and Energy Location: Cooper Basin
Well: Moomba-47 Country: Australia
Field: Moomba

Sample ID	Depth (feet)	Porosity (%)	Grain Density (gm/cc)
2	8225.07	9.1	2.84
3	8226.06	14.2	2.77
4	8228.00	17.3	2.66
5	8229.01	16.9	2.67
6	8230.00	16.8	2.67
7	8231.00	12.7	2.67
8	8233.00	8.9	2.67
9	8234.09	8.2	2.69
10	8236.06	5.3	2.69
11	8238.00	4.9	2.69
12	8239.08	5.0	2.71
13	8241.00	1.2	2.64
14	8242.06	0.7	2.60
15	8244.10	0.6	2.60
16	8247.01	4.5	2.68
17	8149.00	6.8	2.88
18	8253.00	7.5	2.88
19	8255.03	6.5	2.74
20	8257.00	1.4	2.66

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Date: 30/10/87
File: F4B96/BB

OVERBURDEN POROSITY/PERMEABILITY

Client: Department of Mines and Energy Location: Cooper Basin
Well: Moomba-47 Country: Australia
Field: Moomba

Overburden Pressure: 28,000 kPa

Sample ID	Depth (feet)	Permeability (md)	Porosity (%)
2	B225.07	2.26	8.8
3	B226.06	15.0	13.8
4	B228.00	121	16.8
5	B229.01	97.6	16.4
6	B230.00	40.9	16.3
7	B231.00	23.5	12.3
8	B233.00	0.183	8.6
9	B234.09	0.017	7.7
10	B236.06	0.003	5.1
11	B238.00	0.009	4.8
12	B239.08	0.008	4.9
13	B241.00	0.000	1.2
14	B242.06	0.000	0.6
15	B244.10	0.000	0.6
16	B247.01	0.006	4.2
17	B149.00	0.034	6.3
18	B253.00	0.022	7.1
19	B255.03	0.009	6.0
20	B257.00	0.000	1.3

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Date: 29/10/87
File: F6896

AIR/WATER POROUS PLATE
CAPILLARY PRESSURE 'END-POINT' SATURATIONS

Company: Department of Mines and Energy Formation: Daralingie
Well: Moomba-45 Location: Cooper Basin
Field: Moomba Country: Australia

Rw of Saturant Brine: 1.28 ohms/m

Pressure: 1470 kPa

Sample ID	Depth (feet)	Permeability To Air (md)	Porosity %	'End-Point' Saturations % Pore Volume
3	8160.2	0.29	9.8	88.7
4	8174.7	7.1	12.5	43.2
5	8173.0	0.41	9.6	88.4
6	8157.6	4.2	13.2	54.7
7	8177.2	1.2	10.0	74.8
8	8157.3	1.4	12.0	81.2
9	8175.8	6.3	12.9	46.1
11	8152.7	179	19.1	13.1
12	8155.8	440	20.0	9.7
15	8155.0	127	18.0	17.4

END

OF

REPORT



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22 December 1987

F 1/1/298
F 6896/88

The Director-General
South Australian Department of Mines
and Energy
PO Box 151
EASTWOOD SA 5063
Attention: Mr J. Morton

REPORT F 6896/88

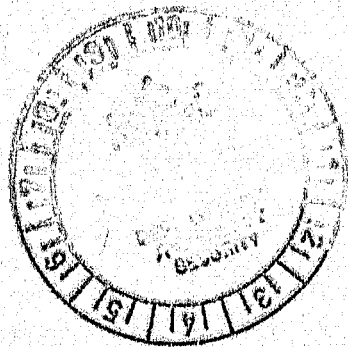
YOUR REFERENCE: DME 249/87
TITLE: SENRAC Project
MATERIAL: Core plugs
IDENTIFICATION: BIG LAKE 27, 31, 32 and 35
WORK REQUIRED: Porosity and permeability ambient and
overburden, CEC, absolute grain density

Investigation and Report by: Russell Martin
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DISCUSSION OF RESULTS AND PROCEDURES

1. INTRODUCTION

One inch diameter samples were taken at the respective depths indicated by the South Australian Department of Mines in the letter of 23 November 1987 (your ref: DME 249/87). Tap water was used as the bit lubricant and the sample faces trimmed and squared prior to being placed in a soxhlet extraction apparatus with a 3:1 chloroform/methanol mix to leach any residual hydrocarbons and salts.

The samples were placed in a conventional dry oven at 100°C prior to porosity and permeability to air measurements at ambient and net overburden pressures.

2. POROSITY AND PERMEABILITY TO AIR

Porosity measurements were made utilising the Boyles Law helium injection technique to determine grain volume and sample bulk volume was determined by mercury immersion.

Permeability to air was determined using the Jones Permeameter whereby samples were loaded into the Hassler holder and confined using a pressure of 250 psi. Air was then flowed through the sample and the differential pressure across the outlet face of the plug measured on a straight tube manometer.

3. OVERBURDEN POROSITY AND PERMEABILITY TO AIR

Samples were loaded into the overburden Hassler cell and pore volume measurements made at 250 psi confining pressure. The Hassler cell was then pressurised to the respective overburden pressure and pore volume re-determined. Overburden permeability to air was also determined at this stage.

4. ABSOLUTE GRAIN DENSITY

Offcuts from the ends of the samples were saved and crushed for absolute grain density and Cation Exchange Capacity data. Absolute grain density is determined by utilising a crushed portion of the sample and placing it into a pycnometer. Weights are recorded of the empty pycnometer and then the sample weight. The pycnometer is then filled with alcohol and the new weight recorded. Absolute grain density is determined by the pycnometer weight divided by pycnometer capacity.

5. CATION EXCHANGE CAPACITY

Cation Exchange Capacity is determined using the wet chemistry technique utilising ammonium chloride as the exchange medium. The ammonium chloride ions replace all the exchangeable cations in the crushed sample and in turn the ammonium chloride is replaced with sodium sulphide ions. Titration at the end of the test procedure determines the amount of exchangeable ions present in the sample and this value is reported as milliequivalents per 100 grams of sample.



00021

Table 0
AMDEL CORE ANALYSIS

BIG LAKE 27

Ambient

Sample	Bulk Volume	Bulk Dry Density	Apparent Grain Density	Absolute Grain Density
1	19.21	2.58	2.68	2.68
2	19.13	2.52	2.68	2.66
3	21.31	2.60	2.67	2.65
4	21.84	2.58	2.67	2.65
5	21.44	2.52	2.68	2.65



00022

Table 0
AMDEL CORE ANALYSIS

BIG LAKE 27

Ambient

Sample Depth	Permeability (md)	Porosity (%)
1 9143'1"	0.017	3.6
2 9145'1"	0.072	5.8
3 9147'8"	0.052	2.9
4 9149'1"	0.013	3.5
5 9150'6"	0.057	6.1



00023

Table 0
AMDEL CORE ANALYSIS

BIG LAKE 27

32414 kPa

Sample	Bulk Volume	Bulk Dry Density	Apparent Grain Density	Absolute Grain Density
1	19.20	2.59	2.68	2.65
2	19.11	2.53	2.68	2.66
3	21.29	2.60	2.67	2.65
4	21.83	2.58	2.67	2.65
5	21.42	2.52	2.68	2.65



00024

Table 0
AMDEL CORE ANALYSIS

BIG LAKE 27

32414 kPa

Sample	Depth	Permeability (md)	Porosity (%)
1	9143'1"	0.005	3.5
2	9145'1"	0.023	5.7
3	9147'8"	0.005	2.8
4	9149'1"	0.007	3.5
5	9158'6"	0.022	6.0



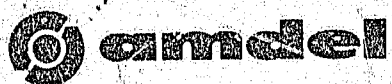
00025

Table 4
AMDEL CORE ANALYSIS

BIG LAKE 31

38310 kPa

Sample	Depth	Permeability (md)	Porosity (%)
1	9962'3"	0.228	8.0
2	9965'5"	0.107	8.1
3	9971'3"	0.071	6.5
4	9979'11"	0.151	7.9
5	9981'2"	0.046	6.7
6	9984'2"	0.182	8.3
7	9987'3"	0.228	9.0
8	10205'6"	0.010	2.6
9	10208'1"	0.001	1.9
10	10219'3"	0.082	7.4



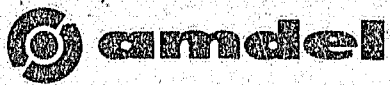
00026

Table 3
AMDEL CORE ANALYSIS

BIG LAKE 31

Ambient

Sample Depth	Permeability (md)	Porosity (%)
1 9962'3"	0.565	8.8
2 9965'5"	0.433	8.9
3 9971'3"	0.198	7.5
4 9979'11"	0.499	8.7
5 9981'2"	0.184	7.6
6 9984'2"	0.675	9.2
7 9987'3"	0.638	9.9
8 10205'6"	0.014	2.6
9 10208'1"	0.230	2.1
10 10219'3"	0.396	8.2



00027

Table 2
AMDEL CORE ANALYSIS

BIG LAKE 31

38310 kPa

Sample	Bulk Volume	Bulk Dry Density	Apparent Grain Density	Absolute Grain Density
1	20.85	2.46	2.67	2.66
2	21.33	2.46	2.68	2.66
3	20.45	2.50	2.68	2.66
4	21.34	2.47	2.68	2.66
5	19.05	2.51	2.69	2.66
6	21.95	2.46	2.68	2.65
7	19.93	2.44	2.68	2.66
8	22.66	2.62	2.69	2.67
9	20.15	2.64	2.69	2.67
10	21.17	2.49	2.68	2.66



00023

Table 1
AMDEL CORE ANALYSIS

BIG LAKE 31

Ambient

Sample	Bulk Volume	Bulk Dry Density	Apparent Grain Density	Absolute Grain Density
1	21.03	2.44	2.67	2.66
2	21.52	2.44	2.68	2.66
3	20.88	2.48	2.68	2.66
4	21.54	2.44	2.68	2.66
5	19.16	2.50	2.69	2.66
6	22.17	2.43	2.68	2.65
7	20.12	2.42	2.68	2.66
8	22.67	2.62	2.69	2.67
9	20.19	2.63	2.69	2.67
10	21.35	2.46	2.68	2.66



00029

Table 4
AMDEL CORE ANALYSIS

BIG LAKE 32

33607 kPa

Sample	Depth	Permeability (md)	Porosity (%)
1	9365'7"	4.48	13.8
2	9367'0"	0.645	11.3
3	9372'6"	1.33	10.8
4	9378'11"	1.000	10.5
5	9387'9"	5.00	14.0
6	9389'10"	2.62	13.2
7	9396'11"	0.844	11.0
8	9402'1"	1.84	11.5
9	9413'6"	17.9	14.6
10	9414'4"	0.652	10.4



00030

Table 3
AMDEL CORE ANALYSIS

BIG LAKE 32

Ambient

Sample Depth	Permeability (md)	Porosity (%)
1 9365'7"	8.00	14.7
2 9367'0"	2.13	12.1
3 9372'6"	2.74	11.9
4 9378'11"	2.78	11.7
5 9387'9"	6.30	14.5
6 9389'10"	3.87	14.0
7 9396'11"	1.10	11.5
8 9402'1"	3.32	12.3
9 9413'6"	21.9	15.4
10 9414'4"	1.16	11.0



00031

Table 2
AMDEL CORE ANALYSIS

BIG LAKE 32

33607 kPa

Sample	Bulk Volume	Bulk Dry Density	Apparent Grain Density	Absolute Grain Density
1	19.79	2.33	2.71	2.66
2	21.63	2.39	2.69	2.65
3	18.16	2.42	2.71	2.66
4	15.71	2.49	2.78	2.71
5	20.70	2.35	2.73	2.68
6	18.95	2.35	2.70	2.66
7	19.62	2.41	2.70	2.65
8	21.19	2.38	2.69	2.65
9	19.28	2.31	2.71	2.65
10	20.66	2.42	2.70	2.65



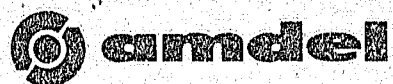
00032

Table 1
AMDEL CORE ANALYSIS

BIG LAKE 32

Ambient

Sample	Bulk Volume	Bulk Dry Density	Apparent Grain Density	Absolute Grain Density
1	19.99	2.31	2.71	2.66
2	21.81	2.37	2.69	2.65
3	18.38	2.39	2.71	2.66
4	15.93	2.45	2.78	2.71
5	20.83	2.33	2.73	2.68
6	19.13	2.32	2.70	2.66
7	19.73	2.39	2.70	2.65
8	21.40	2.36	2.69	2.65
9	19.46	2.29	2.71	2.65
10	20.82	2.40	2.70	2.65



00033

Table 1
AMDEL CORE ANALYSIS

BIG LAKE 35

Ambient

Sample	Bulk Volume	Bulk Dry Density	Apparent Grain Density	Absolute Grain Density
1	21.61	2.48	2.68	2.65
2	21.85	2.52	2.68	2.64
3	17.85	2.56	2.71	2.66
4	21.19	2.53	2.69	2.66
5	21.09	2.50	2.70	2.67
6	20.60	2.50	2.70	2.68
7	20.73	2.50	2.70	2.66
8	20.96	2.46	2.70	2.67
9	22.26	2.47	2.68	2.66
10	21.40	2.47	2.69	2.66



00034

Table 2
AMDEL CORE ANALYSIS

BIG LAKE 35

33255 kPa

Sample	Bulk Volume	Bulk Dry Density	Apparent Grain Density	Absolute Grain Density
1	21.55	2.49	2.68	2.65
2	21.77	2.53	2.68	2.64
3	17.81	2.56	2.71	2.66
4	21.15	2.53	2.69	2.64
5	20.99	2.51	2.70	2.67
6	20.54	2.51	2.70	2.68
7	20.66	2.51	2.70	2.66
8	20.80	2.48	2.70	2.67
9	22.08	2.49	2.68	2.66
10	21.32	2.48	2.69	2.66



00035

Table 3
AMDEL CORE ANALYSIS

BIG LAKE 35

Ambient

Sample Depth	Permeability (md)	Porosity (%)
1 9215'1"	0.201	7.5
2 9216'0"	0.158	5.9
3 9217'1"	0.025	5.7
4 9217'9"	0.085	5.9
5 9220'7"	0.106	7.6
6 9221'0"	0.077	7.5
7 9221'6"	0.092	7.3
8 9223'10"	0.230	9.1
9 9225'6"	0.177	7.8
10 9226'8"	0.096	7.9



00036

Table 4
AMDEL CORE ANALYSIS

BIG LAKE 35

33255 kPa

Sample	Depth	Permeability (md)	Porosity (%)
1	9215'1"	0.085	7.2
2	9216'0"	0.045	5.5
3	9217'1"	0.002	5.5
4	9217'9"	0.023	5.7
5	9220'7"	0.030	7.1
6	9221'0"	0.021	7.2
7	9221'6"	0.025	7.0
8	9223'10"	0.081	8.4
9	9225'6"	0.057	7.1
10	9226'8"	0.049	7.6

00037

CATION EXCHANGE CAPACITY

Company: Department of Mines
Well: Big Lake-27
Field: Big Lake

Formation: Patchawarra
Location: Cooper Basin

Sample ID	Depth (feet)	C.E.C. MEQ/100 grams
1	9143.1	2.40
2	9145.05	1.20
3	9147.7	1.65
4	9194.1	1.39
5	9158.5	1.28

00038

CATION EXCHANGE CAPACITY

Company: Department of Mines
Well: Big Lake-31
Field: Big Lake

Formation: Tirrawarra
Location: Cooper Basin

Sample ID	Depth (feet)	C.E.C. MEQ/100 grams
1	9962.25	1.48
2	9965.4	1.50
3	9971.3	1.50
4	9979.9	2.86
5	9981.2	3.02
6	9984.2	2.10
7	9987.3	1.44
8	10205.5	2.89
9	10208.1	10.3
10	10219.25	1.91

00039

CATION EXCHANGE CAPACITY

Company: Department of Mines
Well: Big Lake-32
Field: Big Lake

Formation: Tirrawarra
Location: Cooper Basin

Sample ID	Depth (feet)	C.E.C. MEQ/100 grams
1	9365.55	4.87
2	9366.95	4.51
3	9372.5	1.77
4	9378.85	2.58
5	9387.75	1.47
6	9389.8	2.05
7	9396.9	2.84
8	9402.1	3.96
9	9413.5	1.42
10	9414.3	2.91

00040

CATION EXCHANGE CAPACITY

Company: Department of Mines
Well: Big Lake-35
Field: Big Lake

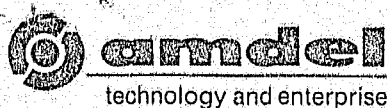
Formation: Patchawarra
Location: Cooper Basin

Sample ID	Depth (feet)	C.E.C. MEQ/100 grams
1	9215.1	1.19
2	9215.95	1.53
3	9217.1	2.04
4	9217.75	1.65
5	9220.6	2.90
6	9221.0	4.71
7	9221.5	4.15
8	9223.8	5.77
9	9225.5	5.67
10	9226.65	4.65

END

OF

REPORT



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26 February 1988

F 3/0/0
F 6896/88 - Part 4

The Director-General
South Australian Department of Mines
and Energy
PO Box 151
EASTWOOD SA 5063

Attention: Mr J. Morton

REPORT F 6896/88 - Part 4

YOUR REFERENCE: DME 249/87
TITLE: SENRAC Project 2/86 - Part 4
MATERIAL: Core plugs offcuts
WORK REQUIRED: Cation exchange capacity, absolute grain density

Investigation and Report by: Russell R. Martin
Manager, Petroleum Services Section: Dr Brian B. Stevenson

Brian Stevenson
for Dr William G. Spencer
General Manager
Applied Sciences Group

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00042

1. INTRODUCTION

On 8 January 1988 correspondence was received from the South Australian Department of Mines and Energy, (your ref: DME 249/87 JGGM:AM), detailing analyses required concerning the ongoing SENRAC Project 2/86.

The analyses required were:

- a) Cation Exchange Capacity
- b) Absolute Grain Density

All analyses were performed on the offcuts of core plugs as detailed in your letter.

2. CATION EXCHANGE CAPACITY

Cation exchange capacity (CEC) is determined on the clean, dry crushed plug offcuts using the wet chemistry technique.

Ammonium chloride (NH_4Cl) is added to a known volume of sample to exchange with the cations normally present in the clay structure. Subsequent washings in NH_4Cl ensure that the sample is saturated with ammonium chloride.

Sodium sulfate (Na_2SO_4) is then used to replace the bonded ammonium chloride ions. The residual ammonium chloride is then established by titration. Values are reported as milliequivalents per 100 grams.

3. ABSOLUTE GRAIN DENSITY

Absolute grain density is determined by pycnometry using alcohol as the reference liquid. Values of absolute grain density are reported in grams per cc.

4. CAPILLARY PRESSURE

The samples were placed in a Soxhlet extraction apparatus with methanol to remove any residual salts from the electrical properties part of the test program. The samples were then placed in a dry oven at 110°C prior to redetermining ambient porosity and permeability to air.

Samples were then placed in a high pressure saturator and evacuated before the introduction of a deaerated simulated NaCl formation brine. The simulated formation brine was constructed from the RW supplied by the Mines and Energy Department of 1.28 ohm.m at 25°C . The samples were removed from the saturator and weighed to ascertain 100 per cent brine saturation had been achieved before being placed in the porous plate cell at 1380 kPa (200 psi).

Water displacement from the cell was monitored over several days until no more water was being displaced. The samples were then removed and weights recorded. The samples were replaced in the cell and removed every second day and weights recorded until the weights stabilised which indicated capillary equilibrium had been achieved at this pressure of 1380 kPa (200 psi).



00043

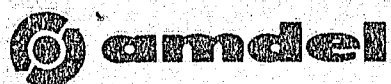
Table 1

AMDEL CORE ANALYSIS

MOOMBA 8

Ambient

Sample	Bulk Volume	Bulk Dry Density	Apparent Grain Density	Absolute Grain Density
1	17.39	2.54	2.70	2.67
2	20.81	2.47	2.67	2.65
3	15.88	2.42	2.68	2.64
4	16.75	2.48	2.67	2.64
5	18.05	2.44	2.67	2.63
6	17.18	2.48	2.66	2.64
7	14.78	2.44	2.70	2.66
8	16.26	2.44	2.70	2.67
9	18.63	2.38	2.67	2.63
10	14.95	2.35	2.68	2.64
11	18.77	2.26	2.66	2.64
12	18.83	2.46	2.67	2.65
13	18.62	2.32	2.67	2.65
14	15.99	2.34	2.67	2.65
15	18.83	2.31	2.66	2.64
16	17.81	2.11	2.67	2.64



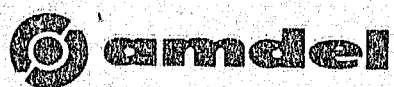
00044

Table 2
AMDEL CORE ANALYSIS

MOOMBA 8

24000 kPa

Sample	Bulk Volume	Bulk Dry Density	Apparent Grain Density
1	17.37	2.54	2.70
2	20.74	2.48	2.67
3	15.73	2.44	2.68
4	16.68	2.49	2.67
5	17.99	2.45	2.67
6	17.12	2.49	2.66
7	14.70	2.45	2.70
8	16.18	2.45	2.70
9	18.54	2.40	2.67
10	14.87	2.36	2.68
11	18.65	2.27	2.66
12	18.76	2.47	2.67
13	18.55	2.33	2.67
14	18.85	2.36	2.67
15	18.64	2.33	2.66
16	17.72	2.12	2.67



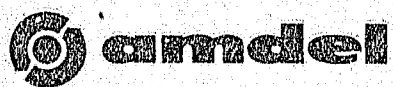
00045

Table 3
AMDEL CORE ANALYSIS

MOOMBA B

Ambient

=====			
Sample Depth		Permeability (md)	Porosity (%)
=====			
1	7811' 4"	0.075	6.0
2	7774'	0.205	7.7
3	7781' 3"	2.6	9.7
4	7777' 4"	0.305	7.3
5	7777' 11"	0.603	8.6
6	7779' 2"	0.345	6.7
7	7796'	0.800	9.7
8	7813' 1"	0.799	9.7
9	7802' 1"	2.87	10.6
10	7784' 1"	20.9	12.1
11	7800' 10"	70.1	15.3
12	7783'	0.558	7.8
13	7797' 6"	0.619	12.9
14	7785' 10"	18.5	12.5
15	7799'	314	13.4
16	7850'	345	21.0



00046

Table 4
AMDEL CORE ANALYSIS

MOOMBA B

24000 kPa

Sample	Depth	Permeability (md)	Porosity (%)
1	7811' 4"	0.015	5.9
2	7774'	0.025	7.4
3	7781' 3"	0.513	9.0
4	7777' 4"	0.066	7.0
5	7777' 11"	0.092	8.3
6	7779' 2"	0.082	6.4
7	7796'	0.046	9.2
8	7813' 1"	0.048	9.3
9	7802' 1"	1.06	10.1
10	7784' 1"	17.1	11.6
11	7800' 10"	44.8	14.8
12	7783'	0.352	7.5
13	7797' 6"	0.145	12.6
14	7785' 10"	12.8	11.7
15	7799'	216	12.5
16	7850'	270	20.6

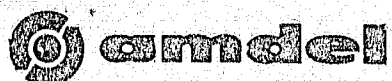
00047

CATION EXCHANGE CAPACITY

Company: Department of Mines
Well: Moomba-B
Field: Moomba

Formation:
Location: Cooper Basin

Sample ID	Depth feet	CEC meq/100 gms
1	7811'4"	5.30
2	7774'	3.35
3	7781'3"	3.33
4	7777'4"	2.73
5	7777'11"	3.49
6	7779'2"	2.31
7	7796'	3.71
8	7813'1"	4.40
9	7802'1"	2.79
10	7784'1"	2.47
11	7800'10"	3.15
12	7783'	2.92
13	7797'6"	3.07
14	7785'10"	2.01
15	7799'	1.96
16	7850'	2.34



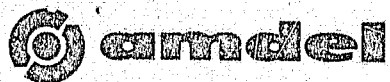
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Table 1
AMDEL CORE ANALYSIS

MOOMBA 45

Ambient

Sample	Bulk Volume	Bulk Dry Density	Apparent Grain Density	Absolute Grain Density
1	16.33	2.58	2.72	2.68
2	16.24	2.44	2.69	2.66
3	17.17	2.48	2.75	
4	18.57	2.42	2.76	
5	16.70	2.47	2.73	
6	16.15	2.34	2.69	
7	16.13	2.42	2.69	
8	17.57	2.38	2.70	
9	16.01	2.39	2.75	
10	17.71	2.32	2.68	2.65
11	16.68	2.16	2.67	
12	17.86	2.13	2.67	
13	16.73	2.16	2.68	2.66
14	17.22	2.20	2.68	2.66
15	17.52	2.19	2.68	



00049

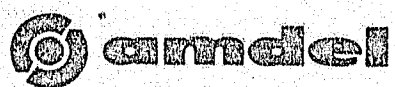
Table 2

AMDEL CORE ANALYSIS

MOOMBA 45

23990 kPa

Sample	Bulk Volume	Bulk Dry Density	Apparent Grain Density
1	16.26	2.59	2.72
2	16.17	2.45	2.69
3	17.09	2.49	2.75
4	18.48	2.43	2.76
5	16.61	2.48	2.73
6	16.07	2.35	2.69
7	16.06	2.43	2.69
8	17.48	2.39	2.70
9	15.93	2.40	2.75
10	17.63	2.33	2.68
11	16.59	2.17	2.67
12	17.74	2.15	2.67
13	16.65	2.17	2.68
14	17.13	2.21	2.68
15	17.40	2.21	2.68



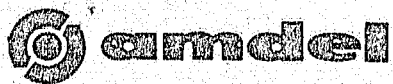
00050

Table 3
AMDEL CORE ANALYSIS

MOOMBA 45

Ambient

=====			
Sample Depth		Permeability (md)	Porosity (%)
=====			
1	8165'	0.473	5.4
2	8178'8"	0.270	9.2
3	8160'4"	0.122	9.8
4	8174'8"	6.05	12.5
5	8173'	0.282	9.6
6	8157'7"	4.84	13.2
7	8177'2"	1.10	10.0
8	8157'3"	1.21	12.0
9	8175'9"	5.38	12.9
10	8176'4"	9.05	13.5
11	8152'8"	150	19.1
12	8155'10"	357	20.0
13	8156'6"	167	19.3
14	8153'2"	151	18.1
15	8155'	106	18.0



00051

Table 4
AMDEL CORE ANALYSIS

MOOMBA 45

23990 kPa

Sample	Depth	Permeability (md)	Porosity (%)
1	8165'	0.010	5.0
2	8178' 8"	0.142	8.8
3	8160' 4"	0.069	9.4
4	8174' 8"	5.35	12.1
5	8173'	0.179	9.1
6	8157' 7"	4.36	12.8
7	8177' 2"	0.866	9.7
8	8157' 3"	0.916	11.5
9	8175' 9"	4.82	12.4
10	8176' 4"	8.18	13.1
11	8152' 8"	142	18.6
12	8155' 10"	329	19.4
13	8156' 6"	147	18.9
14	8153' 2"	139	17.6
15	8155'	96.3	17.5

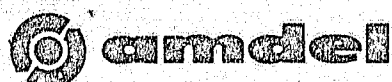
00052

CATION EXCHANGE CAPACITY

Company: Department of Mines
Well: Moomba-45
Field: Moomba

Formation:
Location: Cooper Basin

Sample ID	Depth feet	CEC meq/100 gms
1	B165'	5.27
2	B178'8"	4.62
10	B176'4"	3.42
13	B156'6"	2.17
14	B153'2"	2.19



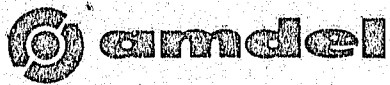
00053

Table 1
AMDEL CORE ANALYSIS

MOOMBA 52

Ambient

Sample	Bulk Volume	Bulk Dry Density	Apparent Grain Density	Absolute Grain Density
1	18.41	2.44	2.70	2.66
2	18.74	2.44	2.67	2.64
3	17.82	2.41	2.69	2.66
4	18.20	2.43	2.65	2.65
5	16.76	2.36	2.69	2.65
6	19.46	2.42	2.65	
7	16.04	2.43	2.67	
8	15.17	2.50	2.70	2.66
9	17.86	2.41	2.68	2.66
10	16.89	2.39	2.69	2.66
11	18.74	2.39	2.66	
12	17.70	2.39	2.67	
13	18.21	2.37	2.68	2.65
14	20.08	2.41	2.65	
15	21.14	2.41	2.70	2.70
16	18.75	2.42	2.67	2.66
17	16.69	2.53	2.69	2.66
18	17.06	2.54	2.69	2.68
19	17.59	2.56	2.76	2.74



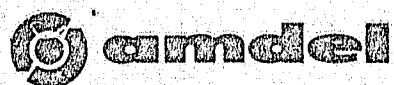
00054

Table 2
AMDEL CORE ANALYSIS

MOOMBA 52

23990 kPa

Sample	Bulk Volume	Bulk Dry Density	Apparent Grain Density
1	18.32	2.45	2.70
2	18.62	2.46	2.67
3	17.68	2.42	2.67
4	18.06	2.45	2.65
5	16.63	2.37	2.69
6	19.35	2.43	2.65
7	15.97	2.45	2.67
8	17.12	2.50	2.70
9	17.71	2.42	2.68
10	16.75	2.41	2.69
11	18.63	2.40	2.66
12	17.60	2.41	2.67
13	18.06	2.39	2.68
14	19.95	2.42	2.65
15	20.97	2.43	2.70
16	18.61	2.44	2.67
17	16.66	2.54	2.69
18	17.02	2.55	2.65
19	17.53	2.57	2.76



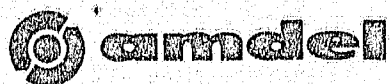
00053

Table 3
AMDEL CORE ANALYSIS

MOOMBA 52

Ambient

=====		
Sample	Depth	Permeability (md) Porosity (%)
=====		
1	7841'8"	4.53 9.6
2	7843'11"	2.42 8.8
3	7844'8"	3.58 10.4
4	7846'5"	2.63 8.3
5	7847'	4.77 12.3
6	7850'10"	2.43 8.9
7	7852'3"	0.764 8.9
8	7857'9"	0.409 7.4
9	7863'10"	2.55 10.0
10	7866'8"	1.58 11.2
11	7874'8"	6.27 10.4
12	7898'11"	1.90 10.5
13	7900'4"	4.50 11.5
14	7907'10"	3.66 9.2
15	7876'2"	6.94 10.9
16	7902'8"	3.61 9.4
17	7918'10"	0.312 5.9
18	7921'	0.277 5.5
19	7922'10"	0.506 7.2



00056

Table 4
AMDEL CORE ANALYSIS

MOOMBA 52

23990 kPa

Sample	Depth	Permeability (md)	Porosity (%)
1	7841'8"	1.76	9.1
2	7843'11"	0.704	8.2
3	7844'8"	1.28	9.7
4	7846'5"	0.211	7.6
5	7847'	2.09	11.6
6	7850'10"	0.107	8.3
7	7852'3"	0.244	8.5
8	7857'9"	0.007	7.1
9	7863'10"	0.68	9.3
10	7866'8"	0.301	10.5
11	7874'8"	4.24	9.9
12	7898'11"	0.878	10.0
13	7900'4"	1.53	10.7
14	7907'10"	1.23	8.6
15	7876'2"	3.68	10.2
16	7902'8"	2.31	8.8
17	7918'10"	0.006	5.7
18	7921'	0.044	5.3
19	7922'10"	0.007	6.8

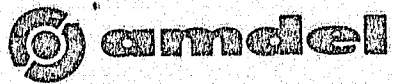
00057

CATION EXCHANGE CAPACITY

Company: Department of Mines
Well: Moomba-52
Field: Moomba

Formation:
Location: Cooper Basin

Sample ID	Depth feet	CEC meq/100 gms
1	7841'8"	1.77
2	7843'11"	1.71
3	7844'8"	1.41
4	7846'5"	3.06
5	7847'	2.11
8	7857'9"	4.02
9	7863'10"	1.57
10	7866'8"	2.61
13	7900'4"	2.10
15	7876'2"	1.91
16	7902'8"	1.82
17	7918'10"	5.11
18	7921'	4.90
19	7922'10"	3.38



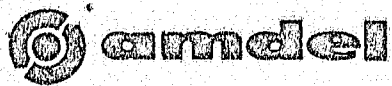
00053

Table 1
AMDEL CORE ANALYSIS

MOOMBA 53

Ambient

Sample	Bulk Volume	Bulk Dry Density	Apparent Grain Density	Absolute Grain Density
1	18.52	2.41	2.67	2.65
2	16.70	2.43	2.67	2.65
3	18.28	2.48	2.66	2.65
4	18.37	2.41	2.66	2.65
5	17.22	2.41	2.67	
6	18.97	2.38	2.66	
7	19.29	2.36	2.66	2.64
8	20.43	2.42	2.65	2.64
9	22.32	2.41	2.66	2.64
10	20.65	2.36	2.66	2.65
11	20.82	2.33	2.66	2.65
12	20.87	2.35	2.66	2.65
13	16.43	2.42	2.62	
14	18.18	2.47	2.66	2.65
15	17.12	2.46	2.69	2.66
16	18.50	2.43	2.69	2.67
17	17.54	2.46	2.70	2.67
18	19.23	2.42	2.67	2.65
19	19.34	2.46	2.71	
20	18.99	2.41	2.69	2.67
21	19.81	2.41	2.69	2.67
22	19.33	2.42	2.69	2.67
23	18.74	2.48	2.73	



00053

Table 2
AMDEL CORE ANALYSIS

MOOMBA 53

23990 kPa

Sample	Bulk Volume	Bulk Dry Density	Apparent Grain Density
1	18.41	2.42	2.67
2	16.57	2.45	2.67
3	18.32	2.49	2.66
4	18.30	2.42	2.66
5	17.10	2.43	2.67
6	18.86	2.40	2.66
7	19.17	2.37	2.66
8	20.30	2.44	2.65
9	22.20	2.43	2.66
10	20.54	2.37	2.66
11	19.60	2.47	2.66
12	19.63	2.50	2.66
13	16.36	2.43	2.62
14	18.12	2.48	2.66
15	17.03	2.47	2.69
16	18.38	2.45	2.69
17	17.41	2.48	2.70
18	19.16	2.43	2.67
19	19.23	2.47	2.71
20	18.88	2.43	2.69
21	19.65	2.43	2.69
22	19.28	2.42	2.69
23	18.63	2.50	2.73



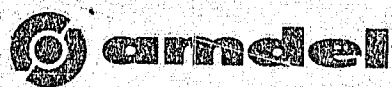
00060

Table 3
AMDEL CORE ANALYSIS

MOQMB 53

Ambient

=====			
Sample	Depth	Permeability (md)	Porosity (%)
=====			
1	7829'11"	1.09	9.7
2	7831'6"	2.53	8.9
3	7833'9"	0.783	6.8
4	7848'2"	3.60	9.3
5	7848'8"	1.65	9.8
6	7849'6"	2.19	10.3
7	7850'6"	9.40	11.2
8	7850'9"	6.03	8.8
9	7852'8"	2.00	9.2
10	7854'4"	10.2	11.5
11	7857'8"	629	12.5
12	7863'	25.8	11.6
13	7947'8"	0.464	7.7
14	7950'	0.409	7.2
15	7962'	0.436	8.8
16	7978'	0.413	9.5
17	7979'	0.952	8.8
18	7981'6"	0.582	9.3
19	7987'3"	0.969	9.5
20	7989'9"	1.29	10.3
21	7992'2"	1.38	10.3
22	7994'9"	1.34	10.1
23	7997'10"	0.652	9.1



00061

Table 4
AMDEL CORE ANALYSIS

MOOMBA 53

23990 kPa

Sample	Depth	Permeability (md)	Porosity (%)
1	7829' 11"	0.064	9.1
2	7831' 6"	1.11	8.1
3	7833' 9"	0.352	6.8
4	7848' 2"	1.77	9.0
5	7848' 8"	0.439	9.1
6	7849' 6"	0.769	9.8
7	7850' 6"	4.84	10.6
8	7850' 9"	1.50	8.2
9	7852' 8"	0.625	8.7
10	7854' 4"	6.40	11.0
11	7857' 8"	358	7.1
12	7863'	14.1	6.1
13	7947' 8"	0.007	7.3
14	7950'	0.007	6.8
15	7962'	0.058	8.3
16	7978'	0.025	8.9
17	7979'	0.017	8.2
18	7981' 6"	0.100	9.0
19	7987' 3"	0.055	9.0
20	7989' 9"	0.183	9.8
21	7992' 2"	0.121	9.6
22	7994' 9"	0.102	9.9
23	7997' 10"	0.100	8.5

00062

CATION EXCHANGE CAPACITY

Company: Department of Mines
Well: Moomba-53
Field: Moomba

Formation:
Location: Cooper Basin

Sample ID	Depth feet	CEC meq/100 gms
1	7829'11"	3.36
2	7831'6"	2.00
3	7833'9"	3.88
4	7848'2"	2.03
5	7848'8"	2.82
6	7849'6"	3.06
7	7850'6"	2.75
8	7850'9"	2.34
9	7852'8"	2.72
10	7854'4"	2.33
11	7857'8"	1.52
12	7863'	2.22
13	7947'8"	4.38
14	7950'	4.71
15	7962'	5.30
16	7978'	5.49
17	7979'	3.94
18	7981'6"	3.93
19	7987'3"	4.16
20	7879'9"	4.02
21	7992'2"	3.45
22	7994'9"	3.66
23	7997'10"	5.03

00063

AIR/WATER CAPILLARY PRESSURE

'END-POINT' SATURATIONS

Company: Department of Mines
Well: Moomba-52
Field: Moomba

Formation:
Location: Cooper Basin

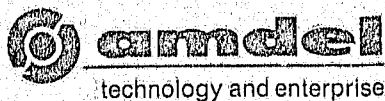
Test Method: Porous plate cell
Rw of Saturant Brine: 1.28 ohm.m @ 25°C
Pressure: 1380 kPa (200 psi)

Sample ID	Depth feet	Permeability to Air (md)	Porosity %	'End-point' Saturations % Pore Volume
6	7850'10"	2.43	8.9	48.5
7	7852'3"	0.764	8.9	68.9
11	7874'8"	6.27	10.4	36.2
12	7898'11"	1.90	10.5	58.4
14	7907'10"	3.66	9.2	41.2

END

OF

REPORT



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00064

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23 May 1988

The Director-General
South Australian Department of Mines
and Energy
PO Box 151
EASTWOOD SA 5063

REPORT F 6896/88 Part 5

YOUR REFERENCE: SENRAC 2/86, DME 249/87 JM:DG, 21 and 29
September 1987

TITLE: Core analysis

SAMPLE IDENTIFICATION: Moomba-10 & 47, Big Lake-1, 2 & 3

MATERIAL: Core plug offcuts

WORK REQUIRED: Absolute grain density

Investigation and Report by: Russell R. Martin
Manager, Petroleum Services Section: Dr Brian G. Steveson

Brian Steveson

for Dr William G. Spender
General Manager
Applied Sciences Group

cap

Offices in Sydney, Melbourne, Perth, Brisbane, Canberra, Darwin, Townsville. Represented World-wide

00065

1. INTRODUCTION

Correspondence was received at Amdel Limited on 3 October 1987 (your ref.: DME 249/87, 21 and 29 September 1987) requesting the following analyses be performed:

- Porosity and permeability to air at overburden
- Cation exchange capacity
- Absolute grain density

Results of porosity and permeability to air for the subject wells were reported in Amdel Limited report number F 6896/88 - Part 2 on 30 October 1987. Amdel Limited was initially requested not to perform cation exchange capacity measurements or absolute grain density determinations until advised by the South Australian Department of Mines and Energy. Subsequent discussions with Mr J. Morton of the Mines Department have now authorised this work to be performed.

This Part 5 report of SENRAC Project 2/86 details results of absolute grain density for Big Lake-1, 2 and 3 and Moomba-10 and 47. Cation exchange capacity determinations are currently in progress and results will be forwarded as they become available.

2. ABSOLUTE GRAIN DENSITY

Sample offcuts had been retained and were crushed to grain size. A calibrated pycnometer is weighed and a known volume of sample added. Alcohol is used as the reference liquid and values of grain density calculated at a standard temperature of 20°C. Values of grain density are reported in gms/cc.

00066

Table 1
AMDEL CORE ANALYSIS

Big Lake No. 1

Ambient

=====		
Sample Depth	Permeability (md)	Porosity (%)
=====		
1	7798'	0.019
2	7799.6'	5.4
3	7800.5'	0.047
4	7801.3'	6.7
5	7801.6'	0.079
6	7802.1'	6.6
7	7803.5'	0.051
8	7807.3'	7.0
9	7808.5'	0.081
10	7809.2'	0.065
		7.5
		0.100
		8.3
		0.181
		10.1
		0.088
		7.4
		0.012
		3.7

00067

Table 2
AMDEL CORE ANALYSIS

Big Lake No. 1

Ambient

Sample	Bulk Volume	Bulk Dry Density	Apparent Grain Density	Absolute Grain Density
1	21.42	2.55	2.69	2.68
2	23.29	2.50	2.68	2.68
3	23.71	2.57	2.75	2.76
4	23.97	2.53	2.72	2.72
5	23.31	2.48	2.68	2.67
6	23.21	2.48	2.68	2.66
7	23.27	2.46	2.68	2.66
8	21.31	2.40	2.68	2.65
9	24.60	2.55	2.75	2.75
10	23.33	2.59	2.69	2.66

00068

Table 3
AMDEL CORE ANALYSIS

Big Lake No. 1

30300 kPa

Sample	Depth	Permeability (md)	Porosity (%)
1	7798'	0.010	5.1
2	7799.6'	0.019	6.3
3	7800.5'	0.036	6.1
4	7801.3'	0.017	6.5
5	7801.6'	0.013	7.2
6	7802.1'	0.015	6.9
7	7803.5'	0.021	7.8
8	7807.3'	0.070	9.5
9	7808.5'	0.022	6.8
10	7809.2'	0.003	3.6

00063

Table 4
AMDEL CORE ANALYSIS

Big Lake No. 1

30300 kPa

=====			
Sample	Bulk Volume	Bulk Dry Density	Apparent Grain Density
=====			
1	21.35	2.55	2.69
2	23.18	2.52	2.68
3	23.59	2.58	2.75
4	23.85	2.54	2.72
5	23.20	2.49	2.68
6	23.06	2.49	2.68
7	23.14	2.47	2.68
8	21.15	2.42	2.68
9	24.46	2.56	2.75
10	23.31	2.59	2.69

00070

Table 1
AMDEL CORE ANALYSIS

Big Lake No. 2

Ambient

=====			
Sample	Depth	Permeability (md)	Porosity (%)
=====			
1	7453.9'	0.765	10.2
2	7454.8'	1.47	12.0
3	7455.8'	1.11	12.2
4	7457'	54.5	13.5
5	7461.9'	9.06	12.3
6	7464.5'	151	14.4
7	7466.7'	5.22	11.6
8	7469.8'	36.0	14.0
9	7472'	307	18.1
10	7473'	40.4	14.0
11	7475'	7.40	12.6
12	7480'	0.022	5.7
13	7483.1'	0.093	8.4
14	7583.8'	0.308	9.2
15	7554.3'	482	19.1
16	7556'	104	17.0
17	7557.9'	340	18.6
18	7561'	576	16.6
19	7569'	92.1	14.2
20	7570.9'	0.054	7.4
21	7573'	3.71	11.9
22	7575.9'	5.52	4.1
23	7577.3'	0.597	10.6
24	7578.1'	1.07	11.8
25	7580'	0.377	9.5
26	7581.1'	7.20	12.4
27	7584'	408	18.0
28	7587'	1.86	9.3
29	7590.1'	20.1	12.4
30	7592'	60.3	16.2

00071

Table 2
AMDEL CORE ANALYSIS

Big Lake No. 2

Ambient

Sample	Bulk Volume	Bulk Dry Density	Apparent Grain Density	Absolute Grain Density
1	23.39	2.39	2.66	2.66
2	22.95	2.35	2.67	2.67
3	23.07	2.35	2.67	2.66
4	22.87	2.30	2.66	2.66
5	23.97	2.34	2.67	2.66
6	22.60	2.27	2.65	2.65
7	24.05	2.36	2.67	2.66
8	22.29	2.29	2.67	2.66
9	23.81	2.18	2.66	2.66
10	22.58	2.29	2.66	2.67
11	24.59	2.33	2.66	2.66
12	23.67	2.55	2.70	2.70
13	23.89	2.47	2.70	2.69
14	23.84	2.44	2.69	2.69
15	23.95	2.15	2.66	2.66
16	21.19	2.21	2.66	2.67
17	22.95	2.17	2.66	2.66
18	23.38	2.22	2.66	2.67
19	21.90	2.28	2.66	2.66
20	23.26	2.49	2.68	2.68
21	25.25	2.35	2.67	2.67
22	21.97	2.53	2.64	2.68
23	22.65	2.39	2.67	2.67
24	21.54	2.35	2.67	2.67
25	22.86	2.59	2.86	2.84
26	23.77	2.33	2.66	2.67
27	23.75	2.18	2.66	2.66
28	21.50	2.41	2.66	2.68
29	24.42	2.33	2.66	2.66
30	24.23	2.23	2.67	2.66

Table 3
AMDEL CORE ANALYSIS

27288 kPa

Sample	Depth	Permeability (md)	Porosity (%)
1	7453.9'	0.540	9.6
2	7454.8'	1.04	11.3
3	7455.8'	0.789	11.5
4	7457'	51.6	13.0
5	7461.9'	7.63	11.6
6	7464.5'	128	13.7
7	7466.7'	3.36	11.0
8	7469.8'	33.0	13.5
9	7472'	280	17.3
10	7473'	33.8	13.6
11	7475'	5.93	12.0
12	7480'	0.009	5.4
13	7483.1'	0.045	7.9
14	7583.8'	0.110	8.7
15	7554.3'	370	18.0
16	7556'	77.1	16.0
17	7557.9'	300	17.8
18	7561'	511	16.0
19	7569'	78.3	13.7
20	7570.9'	0.014	6.8
21	7573'	2.42	11.1
22	7575.9'	0.289	3.7
23	7577.3'	0.256	9.7
24	7578.1'	0.501	11.4
25	7580'	0.181	8.9
26	7581.1'	4.87	11.5
27	7584'	371	17.3
28	7587'	0.796	8.6
29	7590.1'	18.2	10.8
30	7592'	52.2	15.5

00073

Table 4
AMDEL CORE ANALYSIS

Big Lake No. 2 27288 kPa

Sample	Bulk Volume	Bulk Dry Density	Apparent Grain Density
1	23.24	2.40	2.66
2	22.75	2.37	2.67
3	22.89	2.37	2.67
4	22.74	2.32	2.66
5	23.79	2.35	2.67
6	22.40	2.29	2.65
7	23.89	2.37	2.67
8	22.16	2.31	2.67
9	23.58	2.20	2.66
10	22.46	2.30	2.66
11	24.44	2.34	2.66
12	23.59	2.56	2.70
13	23.75	2.48	2.70
14	23.70	2.45	2.69
15	23.63	2.18	2.66
16	20.95	2.24	2.66
17	22.75	2.19	2.66
18	23.21	2.24	2.66
19	21.77	2.30	2.66
20	23.13	2.50	2.68
21	25.04	2.37	2.67
22	21.89	2.54	2.64
23	22.43	2.41	2.67
24	21.43	2.37	2.67
25	22.69	2.61	2.86
26	23.53	2.35	2.66
27	23.53	2.20	2.66
28	21.32	2.43	2.66
29	23.98	2.37	2.66
30	24.01	2.25	2.67

00074

Table 1
AMDEL CORE ANALYSIS

Big Lake No. 2

Ambient

=====		
Sample Depth	Permeability (md)	Porosity (%)
=====		
31	7611.8'	0.131
32	7616.4'	0.055
33	7617.7'	0.000
34	7618.7'	0.323
35	7619.1'	0.363
36	7620.6'	2.19
37	7621'	21.9
38	7628'	534
39	7629.3'	29.2
40	7636.8'	132
41	7647.3'	0.071
42	7649'	0.025
43	7673.8'	0.185
44	7677.1'	0.188
45	7678'	0.118
46	7679.1'	0.471
47	7680.6'	0.117
48	7681.1'	0.295
49	7682'	0.321
50	7683.7'	0.620

00075

Table 2
AMDEL CORE ANALYSIS

Big Lake No. 2 Ambient

Sample	Bulk Volume	Bulk Dry Density	Apparent Grain Density	Absolute Grain Density
31	23.89	2.48	2.71	2.71
32	22.40	2.46	2.69	2.69
33	22.90	2.61	2.65	2.69
34	23.53	2.42	2.68	2.69
35	24.48	2.43	2.67	2.67
36	24.20	2.33	2.67	2.68
37	22.85	2.27	2.68	2.68
38	25.91	2.18	2.66	2.66
39	22.02	2.26	2.66	2.66
40	24.11	2.23	2.70	2.66
41	22.07	2.46	2.66	2.67
42	24.25	2.51	2.68	2.68
43	22.04	2.43	2.67	2.68
44	25.26	2.45	2.71	2.67
45	23.31	2.47	2.67	2.67
46	21.07	2.48	2.67	2.66
47	21.97	2.48	2.68	2.68
48	22.49	2.44	2.67	2.66
49	24.10	2.41	2.67	2.67
50	23.11	2.38	2.67	2.67

00076

Table 3
AMDEL CORE ANALYSIS

Big Lake No. 2

27288 kPa

Sample	Depth	Permeability (md)	Porosity (%)
31	7611.8'	0.050	7.6
32	7616.4'	0.023	8.1
33	7617.7'	<0.001	1.6
34	7618.7'	0.137	8.9
35	7619.1'	0.119	8.1
36	7620.6'	1.70	12.2
37	7621'	18.4	14.7
38	7628'	322	16.4
39	7629.3'	14.5	13.3
40	7636.8'	95.6	16.4
41	7647.3'	0.022	7.2
42	7649'	0.014	6.1
43	7673.8'	0.066	8.4
44	7677.1'	0.049	9.0
45	7678'	0.037	7.2
46	7679.1'	0.114	6.7
47	7680.6'	0.029	6.6
48	7681.1'	0.092	8.0
49	7682'	0.136	9.1
50	7683.7'	0.864	9.9

00077

Table 4
AMDEL CORE ANALYSIS

Big Lake No. 2

27288 kPa

Sample	Bulk Volume	Bulk Dry Density	Apparent Grain Density
31	23.70	2.50	2.71
32	22.31	2.47	2.69
33	22.89	2.61	2.65
34	23.35	2.44	2.66
35	24.29	2.45	2.67
36	24.01	2.34	2.67
37	22.68	2.28	2.68
38	25.36	2.22	2.66
39	21.63	2.30	2.66
40	23.73	2.26	2.70
41	21.95	2.47	2.66
42	24.15	2.52	2.68
43	21.89	2.45	2.67
44	25.08	2.47	2.71
45	23.17	2.48	2.67
46	20.96	2.49	2.67
47	21.81	2.50	2.68
48	22.34	2.45	2.67
49	23.90	2.43	2.67
50	22.93	2.40	2.67

00078

Table 1
AMDEL CORE ANALYSIS

Big Lake No. 3

Ambient

=====			
	Sample Depth	Permeability (md)	Porosity (%)
=====			
1	8251.4'	3.58	13.1
2	8253.7'	0.089	8.4
3	8254'	0.052	8.8
4	8255.2'	0.569	10.7
5	8256.1'	0.255	9.0
6	8256.7'	0.241	10.1
7	8257.6'	0.072	8.6
8	8258.3'	0.092	8.3
9	8261.2'	0.028	7.1
10	8264'	52.7	16.0
11	8265'	10.1	13.1
12	8266.4'	3.56	12.9
13	8267.05'	46.3	14.5
14	8267.9'	21.5	15.5
15	8268.9'	3.87	13.5
16	8271.8'	0.070	8.2

00079

Table 2
AMDEL CORE ANALYSIS

Big Lake No. 3 Ambient

Sample	Bulk Volume	Bulk Dry Density	Apparent Grain Density	Absolute Grain Density
1	21.83	2.83	2.68	2.67
2	21.70	2.47	2.69	2.66
3	22.30	2.64	2.90	2.87
4	21.45	2.41	2.69	2.67
5	22.20	2.46	2.70	2.70
6	23.36	2.42	2.69	2.67
7	21.72	2.47	2.70	2.67
8	23.10	2.40	2.71	2.70
9	22.58	2.60	2.79	2.77
10	21.16	2.27	2.70	2.67
11	22.60	2.32	2.68	2.66
12	22.95	2.33	2.68	2.66
13	23.24	2.28	2.67	2.65
14	22.07	2.27	2.68	2.65
15	24.34	2.31	2.67	2.65
16	22.09	2.48	2.70	2.68

00080

Table 3
AMDEL CORE ANALYSIS

Big Lake No. 3

32345 kPa

Sample	Depth	Permeability (md)	Porosity (%)
1	8251.4'	2.84	12.8
2	8253.7'	0.023	7.6
3	8254'	0.011	8.1
4	8255.2'	0.138	10.0
5	8256.1'	0.064	8.4
6	8256.7'	0.063	9.6
7	8257.6'	0.026	7.8
8	8258.3'	0.313	7.4
9	8261.2'	0.008	6.6
10	8264'	47.7	14.5
11	8265'	8.92	12.8
12	8266.4'	2.98	12.4
13	8267.05'	40.8	13.9
14	8267.9'	18.2	15.1
15	8268.9'	2.74	12.9
16	8271.8'	0.028	7.7

00081

Table 4
AMDEL CORE ANALYSIS

Big Lake No. 3

32345 kPa

Sample	Bulk Volume	Bulk Dry Density	Apparent Grain Density
1	21.74	2.34	2.68
2	21.51	2.49	2.69
3	22.11	2.67	2.90
4	21.28	2.42	2.69
5	22.06	2.46	2.70
6	23.23	2.43	2.69
7	21.53	2.49	2.70
8	22.89	2.51	2.71
9	22.47	2.61	2.79
10	20.79	2.31	2.70
11	22.50	2.33	2.68
12	22.81	2.35	2.68
13	23.09	2.30	2.67
14	21.97	2.28	2.68
15	24.17	2.33	2.67
16	21.96	2.50	2.70

00082

Table 1
AMDEL CORE ANALYSIS

MOOMBA 10

Ambient

Sample Depth	Permeability (md)	Porosity (%)
1 7769'2'		12.3
2 7770'0'		13.4
3 7773'1"		14.2
4 7775'2"		18.1
5 7776'2"		10.4
6 7777'2"		12.4
7 7778'2"		11.3
8 7780'2"		14.2
9 7784'3"		1.1
10 7786'0"		1.0
11 7787'0"		5.3
12 7789'0"		3.5
13 7791'0"		4.8
14 7792'0"		6.5
15 7792'11"		9.5
16 7795'0"		9.6
17 7796'0"		10.8
18 7798'0"		11.7
19 7800'0"		13.2
20 7802'2"		14.0

00083

Table 2
AMDEL CORE ANALYSIS

MOOMBA 10

Ambient

Sample	Bulk Volume	Bulk Dry Density	Apparent Grain Density	Absolute Grain Density
1	23.89	2.34	2.67	2.65
2	22.70	2.31	2.67	2.65
3	23.87	2.29	2.67	2.64
4	24.33	2.18	2.67	2.64
5	23.67	2.39	2.67	2.65
6	23.73	2.34	2.67	2.65
7	23.73	2.37	2.67	2.65
8	24.41	2.29	2.66	2.63
9	24.29	2.60	2.63	2.64
10	22.99	2.63	2.66	2.64
11	23.93	2.60	2.75	2.64
12	24.15	2.48	2.57	2.65
13	23.51	2.55	2.68	2.66
14	24.88	2.51	2.69	2.66
15	21.66	2.43	2.68	2.64
16	20.63	2.42	2.68	2.66
17	24.96	2.39	2.68	2.66
18	22.81	2.36	2.67	2.65
19	22.29	2.32	2.68	2.65
20	21.75	2.33	2.71	2.65

00084

Table 3
AMDEL CORE ANALYSIS

MOOMBA 10

28860 kPa

Sample	Depth	Permeability (md)	Porosity (%)
1	7769'2"	2.57	11.6
2	7770'0"	3.44	12.9
3	7773'1"	25.8	13.7
4	7775'2"	434	17.5
5	7776'2"	0.904	9.8
6	7777'2"	41.6	12.1
7	7778'2"	5.55	10.7
8	7780'2"	100	13.6
9	7784'3"	<0.001	1.1
10	7786'0"	<0.001	1.0
11	7787'0"	0.002	5.0
12	7789'0"	0.001	3.4
13	7791'0"	0.006	4.4
14	7792'0"	0.004	6.1
15	7792'11"	0.023	8.9
16	7795'0"	0.957	9.3
17	7796'0"	1.36	10.6
18	7798'0"	3.77	11.2
19	7800'0"	6.69	12.6
20	7802'2"	53.4	13.3

00085

Table 4
AMDEL CORE ANALYSIS

MOOMBA 10

28860 kPa

Sample	Bulk Volume	Bulk Dry Density	Apparent Grain Density
1	23.70	2.36	2.67
2	22.55	2.33	2.67
3	23.73	2.30	2.67
4	24.15	2.20	2.67
5	23.53	2.41	2.67
6	23.63	2.34	2.67
7	23.59	2.38	2.67
8	24.25	2.30	2.66
9	24.28	2.61	2.63
10	22.98	2.63	2.66
11	23.86	2.61	2.75
12	24.14	2.48	2.57
13	23.41	2.56	2.68
14	24.79	2.52	2.69
15	21.53	2.44	2.68
16	20.55	2.43	2.68
17	24.92	2.30	2.68
18	22.67	2.37	2.67
19	22.15	2.34	2.68
20	21.57	2.35	2.71

00086

Table 1
AMDEL CORE ANALYSIS

MOOMBA 47

Ambient

Sample Depth	Permeability (md)	Porosity (%)
2 8225'7"		9.1
3 8226'6"		14.2
4 8228'0"		17.3
5 8229'1"		16.9
6 8230'0"		16.8
7 8231'0"		12.7
8 8233'0"		8.9
9 8234'9"		8.2
10 8236'6"		5.3
11 8238'0"		4.9
12 8239'8"		5.0
13 8241'0"		1.2
14 8242'6"		0.7
15 8244'10"		0.6
16 8247'1"		4.5
17 8149'0"		6.8
18 8253'0"		7.5
19 8255'3"		6.5
20 8257'0"		1.4

00087

Table 2
AMDEL CORE ANALYSIS

MOOMBA 47

Ambient

Sample	Bulk Volume	Bulk Dry Density	Apparent Grain Density	Absolute Grain Density
2	23.17	2.58		
3	23.40	2.38	2.84	2.83
4	23.85	2.20	2.77	2.75
5	22.82	2.22	2.66	2.65
6	22.75	2.22	2.67	2.65
7	23.99	2.33	2.67	2.65
8	24.03	2.44	2.67	2.67
9	23.99	2.47	2.67	2.66
10	23.85	2.55	2.69	2.66
11	24.25	2.56	2.69	2.68
12	24.21	2.57	2.69	2.66
13	24.20	2.60	2.71	2.68
14	23.45	2.58	2.64	2.66
15	23.15	2.58	2.60	2.62
16	23.94	2.56	2.60	2.62
17	23.79	2.68	2.68	2.65
18	22.22	2.67	2.88	2.84
19	23.33	2.56	2.88	2.86
20	23.39	2.62	2.74	2.69
			2.66	2.68

00088

Table 3
AMDEL CORE ANALYSIS

MOOMBA 47

28000 kPa

=====

Sample	Depth	Permeability (md)	Porosity (%)
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=====

2	8225'7"	2.26	8.8
3	8226'6"	15.0	13.8
4	8228'0"	121	16.8
5	8229'1"	97.6	16.4
6	8230'0"	40.9	16.3
7	8231'0"	23.5	12.3
8	8233'0"	0.183	8.6
9	8234'9"	0.017	7.7
10	8236'6"	0.003	5.1
11	8238'0"	0.009	4.8
12	8239'8"	0.008	4.9
13	8241'0"	0.000	1.2
14	8242'6"	0.000	0.6
15	8244'10"	0.000	0.6
16	8247'1"	0.006	4.2
17	8149'0"	0.034	6.3
18	8253'0"	0.022	7.1
19	8255'3"	0.009	6.0
20	8257'0"	0.000	1.3

00083

Table 4
AMDEL CORE ANALYSIS

MOOMBA 47

28000 kPa

Sample	Bulk Volume	Bulk Dry Density	Apparent Grain Density
2	23.08	2.59	2.84
3	23.29	2.39	2.77
4	23.71	2.22	2.66
5	22.69	2.23	2.67
6	22.62	2.23	2.67
7	23.88	2.35	2.67
8	23.94	2.44	2.67
9	23.87	2.48	2.69
10	23.80	2.56	2.69
11	24.22	2.56	2.69
12	24.18	2.58	2.71
13	24.19	2.60	2.64
14	23.42	2.58	2.60
15	23.13	2.59	2.60
16	23.88	2.57	2.68
17	23.68	2.69	2.88
18	22.11	2.68	2.88
19	23.20	2.57	2.74
20	23.37	2.62	2.66

END

OF

REPORT

ENV. 6860

00090

Moomba and Big Lake Fields:

Log and Special Core Analysis for Improved Reserves Assessment

State Energy Research Advisory Committee
Project No. 2/86

BY

J.G.G. MORTON
Oil, Gas and Coal Division
South Australian Department of Mines and Energy

Status Report to end MAY, 1988

00091

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SUMMARY

Over 240 core plugs from all producing formations in the Big lake and Noomba Fields (Cooper Basin) were analysed by AMDEL Ltd., for porosity and permeability (both at laboratory and reservoir pressure).

Selected plugs were analysed for cation exchange capacity (CEC), grain density, and electrical properties. Irreducible water saturations by capillary pressure were also determined on some plugs.

A simple factor has been determined which corrects porosity measured at ambient laboratory conditions to overburden conditions, and simple relationships have been derived for correcting ambient permeability data to overburden. A new porosity equation, based on the sonic log, has been developed for Cooper Basin reservoirs. This equation corrects for both shale and gas effects, and compares well with the overburden core porosity data.

Water saturation (S_w) has been calculated using a modified Waxman-Smiths equation, and used in combination with the new porosity equation, results in a lowered porosity in gas and shaley sands and a raised S_w in shaley sands, when compared to previously used standard methods. Overall, the method compares well with the standard SADME method (Northcott porosity, Indonesian S_w), but the current Unit method (Overton porosity, Simandoux S_w) appears to be too optimistic.

Work to complete the project in 1988 will concentrate on gathering more electrical properties data to refine CEC and S_w determination. The study will also attempt to derive porosity, permeability and S_w cutoffs between productive and non-productive reservoirs using RFT and PLT data. At the moment the porosity cutoff is 8.8% for all formations assuming that the permeability cutoff is 0.5 md at ambient conditions (0.18 md at overburden conditions).

1.0 INTRODUCTION

The aim of the project is to more accurately estimate porosity, permeability and water saturation and thereby derive better reserve estimates for gas reservoirs in the Moomba and Big Lake Fields (Cooper basin).

This will be achieved by:

- 1) calibrating log data by using accurate core analysis data.
- 2) develop accurate algorithms for porosity and Sw.
- 3) determine cutoffs between productive and non-productive reservoirs.

To date 245 plugs have been cut by SADME for analysis by AMDEL. The breakdown by formation is as follows:

Toolachee Formation	118
Daralingie Formation	45
Epsilon Formation	15
Patchawarra Formation	17
Tirrawarra Sandstone	40
By analysis the breakdown is:	
Porosity/permeability (Ambient and Overburden)	245
CEC and Grain Density	93
Swirr	15
Electrical Properties	5

2.0 CORE ANALYSIS PROCEDURES

2.1 Porosity and Permeability

In the past AMDEL determined porosity by:

- (1) Measurement of grain volume in a matrix cup.
- (2) Measurement of ambient pore volume in a Hassler holder at 1 000 kpa sealing pressure.
- (3) Measurement of overburden pore volume as in (2) but at overburden pressure (20-40 000 kpa)

Recent checks with CORELAB on the same plugs measured by AMDEL indicated that AMDEL's ambient and overburden measurements were giving, in general erroneously high values. This was due to a combination of 2 factors:

- (1) Sealing problems associated with the Hassler holder at 1 000 kpa causing extra pore volume for ambient porosity.
- (2) Poor plug quality (rugose sides, non square ends, too short plugs) leading to errors in measurement of pore volume.

In order to improve data quality a mercury pump was refurbished so that bulk volume could be determined at ambient conditions making redundant the error prone measurement of pore volume. The ambient pressure was increased to 2 758 kpa to eliminate sealing problems associated with the grain volume measurement.

The following procedure was adopted:

- (1) All plugs were dried at 100 degC in a drying oven and stored in a desiccator prior to core analysis measurements.

(2) Bulk volume was measured using a mercury pump, and grain volume was measured using a matrix cup (using Boyles Law helium injection technique). Subtraction of these gave the ambient pore volume (at 2 758 kpa) and hence ambient porosity (APHC). The ambient air permeability (AKHC) was measured while confined in the Hassler type core holder.

(3) The pore volume reduction between 2 758 kpa and the required overburden pressure was measured and by relating to the actual pore volume obtained in (2) above, the true overburden porosity (OPHC) could be obtained. The overburden permeability (OKHC) was also determined at this time.

This technique compares with the results of other service companies and ambient to overburden comparisons show much less scatter than previously. Consequently, AMDEL undertook to remeasure all core analyses on Cooper Basin plugs previously obtained by SADME. All permeabilities given in this report are not klinkenberg corrected.

2.2 Cation Exchange Capacity and Grain Density

Offcuts from the ends of plugs were saved, dried and crushed to grain size using a "Seib" mill. Cation exchange capacity (CEC) was measured by the wet chemistry technique, utilising ammonium chloride as the exchange medium. The ammonium chloride ions replace all the exchangeable cations in the crushed sample and in turn the ammonium chloride is replaced with sodium sulphide ions. Titration at the end of the test procedure determines the amount of exchangeable ions present in the sample and this value is reported as milli-equivalents per 100 grams of sample.

Absolute grain density (RGXC) was determined by crushing a portion of the sample to grain size and placing it into a pycnometer. Weights are recorded of the empty pycnometer and then the sample weight. The pycnometer is then filled with ethanol and the new weight recorded. Absolute grain density is determined by the pycnometer weight divided by the pycnometer capacity, and is calculated at a standard temperature of 20 degC. Values of grain density are reported in grams/cc.

2.3 Capillary pressure (at Irreducible Saturation only)

Core plugs were placed in a soxhlet extraction apparatus with a mixture of chloroform and methanol to leach out any residual hydrocarbon and salts. The plugs were then placed in a dry oven at 100 degC prior to ambient re-measurements of permeability to air and porosity by helium injection. The samples were then placed in a high pressure saturator and evacuated before the introduction of a deaerated simulated NaCl formation brine. The simulated formation brine was constructed from the R_w supplied for each well. The plugs were removed from the saturator and weighed to ascertain 100 per cent brine saturation had been achieved before being placed in the porous plate capillary pressure cell. Humidified air was then introduced to the cell at 1 470 kpa. Water displacement from the cell was monitored over several days until no more water was being displaced. The samples were then removed and the weight

loss recorded. They were replaced in the cell and removed every second day and weights recorded until stabilised weight loss indicated capillary equilibrium had been reached at 1 470 kpa.

It must be noted that these "end point" saturations may not reflect the true Water Saturation (S_w) existing in the reservoirs, as S_w depends on the height above the gas/water contact. The pressure of 1 470 kpa translates to an approximate equivalent height of 366 feet above the gas water contact, which is about the maximum observed closure in Cooper Basin gas reservoirs. In general the S_w observed in reservoirs should be higher than the laboratory irreducible saturation from capillary pressure (S_{wirr}). Also, these data are determined at laboratory temperature and pressure and it is probable that at reservoir conditions the results will differ.

2.4 Electrical Properties

Each core plug was mounted in a triaxial resistivity cell designed to hold the plug at overburden pressure while allowing the plug ends to make full contact with the cell electrodes. A synthetic brine was prepared at 4 salinities: 25 000, 10 000, 5 420, and 2 000 ppm. Formation brines in general are in the range 2 000-12 000 ppm. The resistivities of these brines (R_w) were measured using a laboratory conductivity meter. Each mounted plug was in turn evacuated and then deaerated brine was admitted into the pore space under pressure (6 000 kpa) to ensure complete saturation. Approximately 100-200 ml (50-100 pore volumes) of the brine was allowed to slowly flow through the plug while the resistance were monitored. The resistivity at 100% brine saturation (R_o) was calculated when a stable resistance reading had been obtained. Desaturation of the core plug was achieved by slowly forcing brine from the plug using a regulated supply of humidified air. The plug was left to equilibrate until a stable resistance was reached to compute the resistivity (R_t). The volume of brine expelled was measured and after allowing for the holdup volume of the cell and tubing, the saturation of the core plug (S_w) was calculated through knowledge of the overburden pore volume from previous porosity measurement. This desaturation procedure was repeated to produce a series of values for R_t at various saturations until complete air breakthrough made no further desaturation possible. The aim of these measurements was to estimate the shaliness independent saturation exponent (M^*) and shaliness independent cementation exponent (N^*) for use in the Waxman-Smiths (1968) S_w equation. F^* (shaliness independent formation factor) was calculated by plotting C_w versus C_o where F^* was the slope of the regression line, and the intercept = $B_{max}Q_v$, from which CEC could be independently calculated.

F^* can then be plotted against porosity to give M^* i.e.

$$F^* = \frac{1}{M^*} \quad (1)$$

(OPHC)

Resistivity Index (RI) was corrected for shaliness by:

00096

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$$\text{RI}_{\text{(Qv corrected)}} = \frac{((Cw + BxQv) / Sw) \times \text{RI}}{(Cw + BxQv)} \quad (2)$$

A plot of RI (Corrected) versus Sw yields a slope of N*

Where: Cw = conductivity of the equilibrating brine
 B = the equivalent conductance of sodium exchange cations
 Qv = pore volume concentration of clay exchange cations.

3.0 PRELIMINARY INTERPRETATION OF RESULTS

All laboratory analyses and petrophysical log data have been entered on SADME's MV20000 computer, and software developed by Ian Northcott and Associates Pty. Ltd. ('GPICK') has been used to correlate and manipulate data.

3.1 Ambient to Overburden Porosity

Figure 1 summarizes all plugs for which ambient and overburden porosity were measured. Ambient pressure was 2 758 kpa and overburden pressure ranged from 20-40 000 kpa. The correlation is excellent and gives a porosity reduction factor from ambient (APHC) to overburden (OPHC) of 0.95

$$\text{OPHC} = \text{APHC} \times 0.95 \quad (3)$$

3.2 Ambient to Overburden Permeability

Figure 2 summarizes all plugs to date which have ambient (AKHC) and overburden (OKHC) permeability measurements.

The correlation above one millidarcy (1md) is excellent and shows relatively little effect of overburden pressure.

For AKHC above 1md, the following equation was developed:

$$\text{OKHC} = \frac{(\text{AKHC})^{1.0207}}{1.5127} \quad \text{For AKHC} > 1\text{md} \quad (4)$$

For AKHC less than 1md the relationship is less clear but overburden pressure appears to have a much greater effect. The following relationship was established:

$$\text{OKHC} = \frac{(\text{AKHC})^{1.5618}}{1.8838} \quad \text{For AKHC} < 1\text{md} \quad (5)$$

The generally accepted permeability cutoff between reservoir and non reservoir is 0.5 md at ambient conditions for the Cooper Basin reservoirs. At overburden using equation (5) above this would correspond to 0.18 md.

3.3 Porosity/Permeability Relationships

Figure 3 shows the correlation between porosity and permeability at overburden conditions. Although there is considerable scatter there appears to be a simple relationship:

$$OKHC = 3.2745 \times 10^{((42.4242 \times OPHC) - 5)} \quad (6)$$

Using the overburden permeability cutoff of 0.18 md the overburden porosity cutoff would be 0.088 (8.8%).

3.4 Log derived Porosity

Because hole conditions are in general very poor in the Cooper Basin, and also because of gas effects, the density log is not a reliable porosity tool in this basin. The sonic log is generally considered to give better results.

The standard "Wyllie" (Wyllie et al 1956, 1958) sonic porosity equation is:

$$DT = (1 - PHIW) \times DTma + PHIW \times DTfl \quad (7)$$

or the more usual expression:

$$PHIW = \frac{DT - DTma}{DTfl - DTma} \quad (8)$$

Where:

DT = Sonic log travel time (micro secs/ft)

PHIW = Wyllie porosity (fraction)

DTma = DT of rock matrix

DTfl = DT of fluid in the pore space

Figure 4 shows the correlation of OPHC and PHIW, using an average DTma of 56.0 and a DTfl of 189 (Water). The main drawbacks with this method are that

(a) Porosities below 6% are over estimated due to shale DTma being greater than clean sand DTma.

(b) There is a great amount of scatter on the crossplot in part probably due to gas effects.

For the last 10-15 years this problem has been recognized and Porter (1976) derived a purely empirical solution ; the "Porter Equation":

$$PHIP = \frac{0.8803 \times (DT - 54.5)}{GR + 111.16} \quad (9)$$

Where GR = Gamma Ray log (API units)

PHIP = Porter porosity (Fraction)

Figure 5 shows the correlation of OPHC with PHIP.

In 1982, I.W.Northcott derived for SADME a revised version of this equation ; the "Northcott Equation":

$$PHIN = \frac{DT - 53.0}{139.71 + 0.841 \times GR} \quad (10)$$

Where PHIN = Northcott Porosity (Fraction)

For the Moomba/Big Lake Fields this was modified to account for overburden effects on porosity by subtracting 1PU from equation 10 above. Figure 6 shows the correlation with OPHC. Both the Northcott and Porter equations below 6% porosity overestimate porosity, but above this there is considerable scatter.

Recently a new empirical solution was proposed by the unit operators in the Cooper Basin ; the "Overton" equation:

$$PHIO = \frac{DT - 55.5}{(A + B \times GR) - 55.5} \quad (11)$$

Where:

A and B are empirically derived constants from a particular field or formation

and PHIO = Overton Porosity (Fraction)

Figure 7 summarizes the correlation between Overton porosity and OPHC. Again the equation over estimates porosity below 6% and there is considerable scatter in the high porosities

The Overton equation attempts to correct for shale and gas effects by making DTfl an empirical function of GR, although there is no theoretical justification for why DTfl should vary with GR. By comparison with the original "Wyllie" equation, it would appear more logical that shale would increase DTma and gas would increase DTfl. Thus a better porosity equation should be able to be developed which has DTma a function of Vsh and DTfl a function of Sw.

The standard Vsh equation is:

$$Vsh = \frac{GR - GRmin}{GRmax - GRmin} \quad (12)$$

Where:

Vsh = log derived volume of shale (fraction)
 GRmax = Maximum GR log value equivalent to 100% shale (for the Cooper basin this is 130 API)
 GRmin = Minimum GR log value equivalent to clean sandstone (for the Cooper Basin this is 20 API)
 By using Vsh above, an equation for DTma can be developed:

$$DTma = DTss + Vsh \times (DTsh - DTss) \quad (13)$$

Where:

DTss = Minimum matrix DT for clean sandstone, equivalent to a Vsh=0 and Porosity=0. For the Cooper basin this is the DT for Quartz, 56 micro secs/ft (Schlumberger, 1985)
 DTsh = Maximum matrix DT for shale, equivalent to Vsh=100% and porosity=0. For the Cooper Basin this was empirically determined at 65 micro secs/ft on average, but can vary by field or formation from 60 to 75 micro secs/ft.

Equation (13) above can be substituted into the original Wyllie equation to effectively correct for shale effects.

Although the sonic log would not normally be affected significantly by gas at the relatively low porosities encountered in the Cooper Basin, the associated Sw 's are also very low and lead to significant over estimation of porosity in gas zones; thus DTfl needs to be corrected for the effects of gas, similar to the correction normally applied to the density log for gas:

$$DTfl = Sw \times DTwater + (1 - Sw) \times DTgas \quad (14)$$

Where:

DTwater = DT of formation water at reservoir conditions
 DTgas = DT of Reservoir gas at reservoir pressure and temperature

The theoretical values for DTwater and DTgas are approximately 205 and 735 micro secs /ft respectively, however, the observed values are less than these: empirically DTwater has been determined at 189 micro secs/ft (Schlumberger, 1985) and DTgas has been determined for Cooper basin reservoirs at 240 micro secs/ft.

The following parameters are used for the Moomba/Big lake Fields and the Cooper Basin generally:

$$\begin{array}{ll} GRmin = 20.0 & GRmax = 130.0 \\ DTss = 56.0 & DTsh = 65.0 \\ DTwater = 189.0 & DTgas = 240.0 \end{array}$$

However the following exceptions were noted which may relate to poor original logs rather than true variations in rock properties:

Big Lake 2 (Toolachee)	:	DTsh=72, DTgas=205
Big Lake 1,2 (Daralingie)	:	DTgas=280
Moomba 47 (Daralingie)	:	DTgas=190

Combining equations 8, 13 and 14 a modified Wyllie equation can be developed which generally corrects for the effects of shale and gas in the Cooper Basin:

$$PHIT = \frac{DT - (56 + (9 \times Vsh))}{((Sw \times 189) + ((1 - Sw) \times 240)) - (56 + (9 \times Vsh))} \quad (15)$$

Where PHIT = modified Wyllie porosity (fraction)

PHIT must be solved iteratively as Sw is dependent on PHIT, however assuming Sw=1.0 as the initial guess for Sw, the algorithm will converge relatively quickly (usually in 2 to 3 iterations). The correlation of this equation with OPHC is shown in figure 8. Note that the equation appears to work for porosities below 6% and that there is relatively little scatter in the high porosities (> 14%). Figures 9 and 10 show the relationship between the new porosity method with Northcott porosity and Overton porosity respectively.

3.5 Cation Exchange Capacity

It was hoped that either cation exchange capacity (CEC) or the core derived pore volume concentration of clay exchange cations (QVC) would correlate well with the GR log, as the sands are relatively simple mixtures of quartz, kaolinite, and illite. However, as figures 11 and 12 show, there is very poor correlation between GR and CEC or QVC. Currently all plugs previously cut for porosity and permeability are being analysed for CEC and absolute grain density (RGXC) so that there will be sufficient data to attempt correlations with other logs. Also, CEC was calculated from the electrical properties data (see section 3.6 below) and the results to date indicate that wet chemistry measured CEC's are too large, possibly due to overgrinding the sample prior to measurement. At the moment the best method for estimating QV from logs is using the standard method below, but using formation or field measured averages for CEC and RGXC but divided by 7.8 to agree with the more accurate CEC's derived from electrical properties:

$$QV = \frac{CEC \times RGXC}{100} \quad (16)$$

$$\frac{\text{-----}}{100} = 100$$

$$1 - PHIT$$

Figure 13 shows the relatively good relationship between OPHC and QVC. The formation averages from available data so far are:

	Measured		Derived (Electrical Properties)	
	CEC	RGXC	CEC	RGXC
Toolachee Formation	3.11	2.66	0.40	2.64
Daralingie Formation	3.53	2.68	no data	
Epsilon Formation	no data		no data	
Patchawarra Formation	2.81	2.66	no data	

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Tirrawarra Sandstone	2.87	2.66	no data	
Field Average	3.08	2.66	0.40	2.64

3.6 Electrical Properties

Five plugs from the Toolachee Formation intersected in Moomba 52 were analysed for formation resistivity factor (F) and formation resistivity index (RI) at multiple salinities of 25 000 ppm, 10 000 ppm, 5 420 ppm and 2 000 ppm. These were used to determine F*, M*, N* and CEC for the five samples:

Moomba 52

Plug No.	OPHC	QV	CEC	M*	N*
6	8.3	0.29	0.99	1.98	2.38
7	8.5	0.10	0.36	2.14	1.83
11	9.9	0.02	0.10	2.13	
12	10.0	0.02	0.09	2.12	2.22
14	8.6	0.12	0.44	1.93	1.70
Averages			0.40	2.06	2.03

The results suggest that the values of M* and N* are close to the expected values of 2.00, but there is systematic variation in M*, CEC, and N* that may be able to be modelled. This will be investigated further in 1988 when more electrical properties results are available.

4.0 COMPARISON OF NEW LOG ANALYSIS METHODS WITH OLD.

Moomba no. 10 well was used to compare the effects of the new methods compared with the old on reserves. The well was tested over an interval in the Toolachee Formation and flowed gas at 9.2 mmcf/d and recovered no formation water. The interval was run using 3 methods:

- (1) Northcott porosity, Indonesian SW (Old SADME method)
- (2) Overton porosity, Simandoux SW, M=1.85 (Current Unit method)
- (3) Porosity by equation 15 above and Waxman-Smiths SW

The Waxman-Smiths SW equation used is:

$$\frac{N^*}{SW} + RW \times B \times QV \times \frac{N^*-1}{SW} - \frac{F^* \times RW}{Rt} = 0 \quad (17)$$

Where:

$$F^* = \frac{1}{\frac{M^*}{PHIT}}$$

M* = 2.06
N* = 2.03

and B is as modified by Gravestock (in press):

$$B = (1 - 0.83 \times e^{(-Cw25/20)}) \times 0.15814 \times T \quad (18)$$

Where:

Cw25 = conductivity of formation water at 25 degC (mmho/cm)
T = formation temperature in degC

The results of the 3 methods are summarized in Table 1. Pay was counted as Sw < 50% , Porosity > 8.0% and GR < 92 API. The results indicate that the new method results in a 4% decrease in hydrocarbon pore volume (HCPV) compared to the old SADME method and 17% decrease in HCPV compared to the Current Unit method. It must be stressed that these results apply only to this particular sand in this particular well, but highlight that the new methods appear to be more accurate and could have significant impact on the estimation of reserves in the Moomba and Big Lake Fields.

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6.0 Symbols and Abbreviations

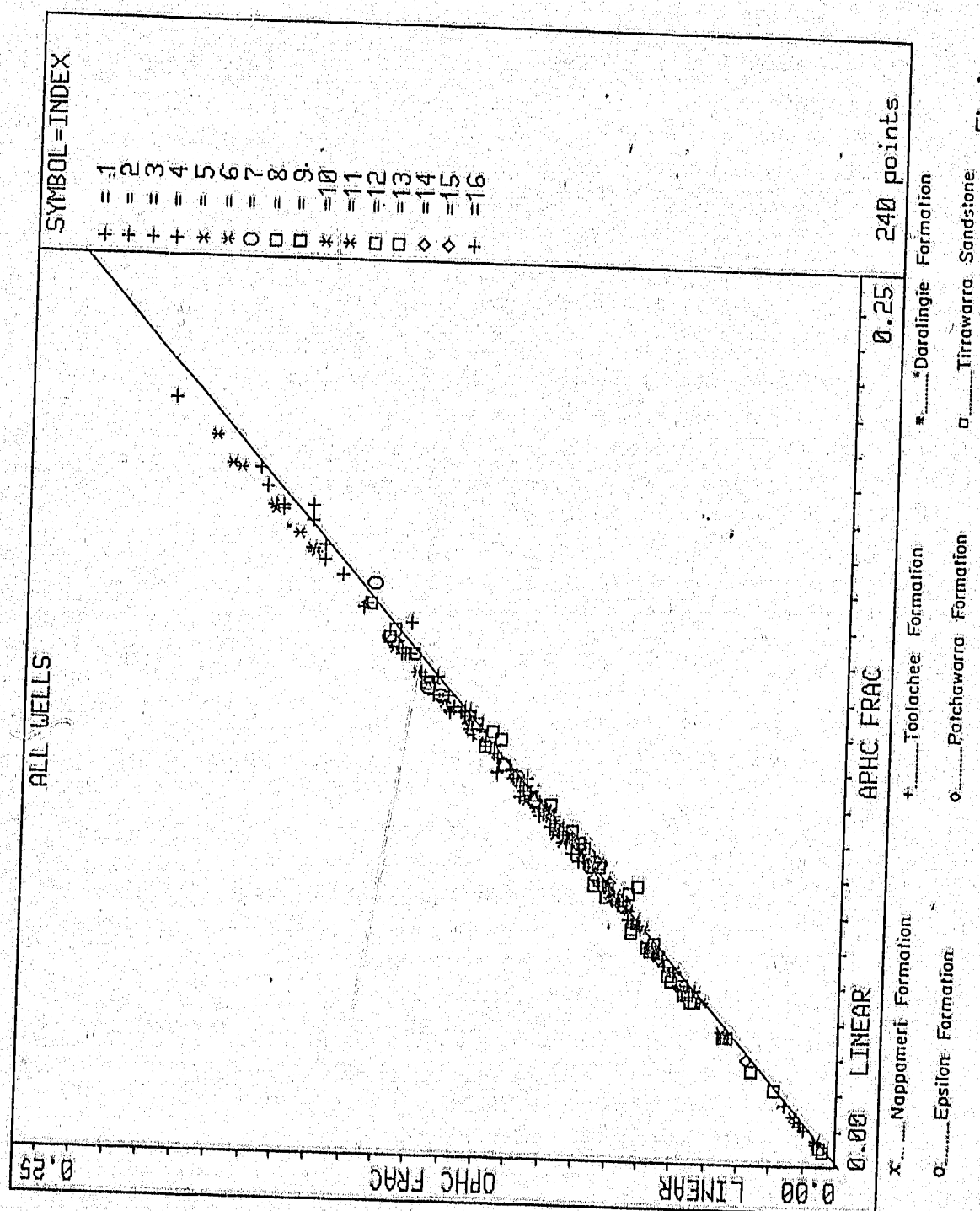
AKHC	Horizontal ambient core permeability (not klinkenberg corrected)
Ambient	Ambient (laboratory) pressure 2 758 kpa
APHC	Horizontal ambient core porosity
B	The equivalent conductance of sodium exchange cations
CEC	Cation exchange capacity (core) by wet chemistry
DT	Sonic log interval transit time (micro seconds per foot).
F	Apparent formation resistivity factor (includes clay effects)
F*	Formation resistivity factor independent of clay conductivity
GR	Gamma ray log (API units)
HCPV	Hydrocarbon pore volume, the product of average porosity, average hydrocarbon saturation (1-Sw) and thickness
md	Millidarcy, unit of permeability (1 000 md = 1 darcy)
M*	Cementation exponent associated with F*
N*	Saturation index independent of clay conductivity
OKHC	Horizontal overburden core permeability (not Klinkenberg corrected)
OPHC	Horizontal overburden core porosity
Overburden	Overburden (reservoir) pressure calculated as (average depth (feet) x 6.7 kpa) - reservoir pressure (from DST) The range used for the Cooper Basin was 20-40 000 kpa
PHIO	Log derived "Overton" porosity
PHIP	Log derived "Porter" porosity
PHIN	Log derived "Northcott" porosity
PHIT	Log derived porosity incorporating corrections for shale and gas
PHIW	Log derived "Wyllie" porosity
Qv	Pore volume concentration of clay exchange cations MEQ/ml pore space
QVC	Core derived Qv derived from CEC, OPHC, and RGXC
RGXC	Absolute grain density (core) by pycnometer
RI	Resistivity index Rt/Ro
Swirr	Irreducible water saturation (core) by porous plate capillary pressure (pressure = 1470 kpa)
Vsh	Volume of shale derived from GR log (fraction)

00104

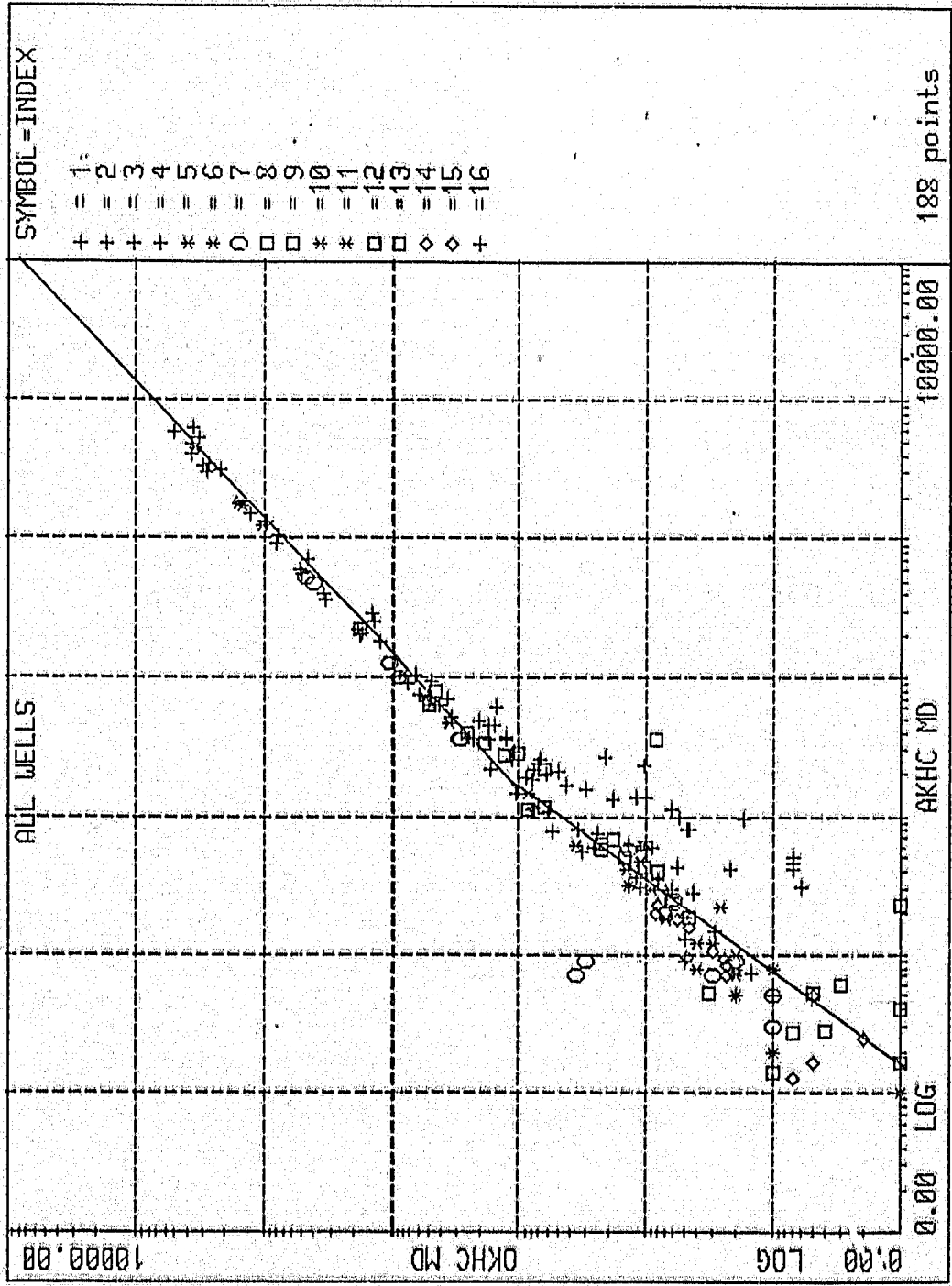
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Table 1
COMPARISON OF LOG ANALYSIS METHODS

DEPTH FEET	OLD SADME		CURRENT UNIT		NEW METHOD	
	PHIN	SW	PHIO	SW	PHIT	SW
7817	6.5	50.3	7.3	41.8	5.8	80.3
7818	7.4	50.3	8.0	41.4	6.8	66.0
7819	10.3	45.3	11.0	37.2	9.9	46.4
7820	11.9	35.1	12.8	28.9	11.5	35.1
7821	10.7	28.9	11.7	23.9	10.4	33.7
7822	9.8	32.3	10.7	26.7	9.4	35.6
7823	12.2	27.9	13.4	23.0	12.1	27.2
7824	14.5	25.9	15.9	21.3	14.5	23.8
7825	13.5	28.4	14.6	23.5	13.2	26.2
7826	14.3	31.2	15.1	26.1	13.2	28.0
7827	14.5	30.4	15.3	25.4	13.4	27.4
7828	13.4	30.3	14.1	25.3	12.3	26.5
7829	12.2	36.3	12.7	30.3	11.0	32.8
7830	11.6	37.6	12.1	31.3	10.6	35.7
7831	11.4	33.6	12.0	28.6	10.5	33.4
7832	11.6	32.8	12.3	27.0	10.8	31.7
7833	14.2	27.7	15.3	22.9	13.8	26.3
7834	18.1	22.5	19.8	18.6	18.7	21.4
7835	20.0	21.4	22.5	17.6	22.5	19.1
PAY THICKNESS:						
		16.0			16.5	16.0
AVERAGE POROSITY:		12.7			13.4	12.0
AVERAGE SW:		30.7			25.7	29.3
HCPV:		1.41			1.64	1.36



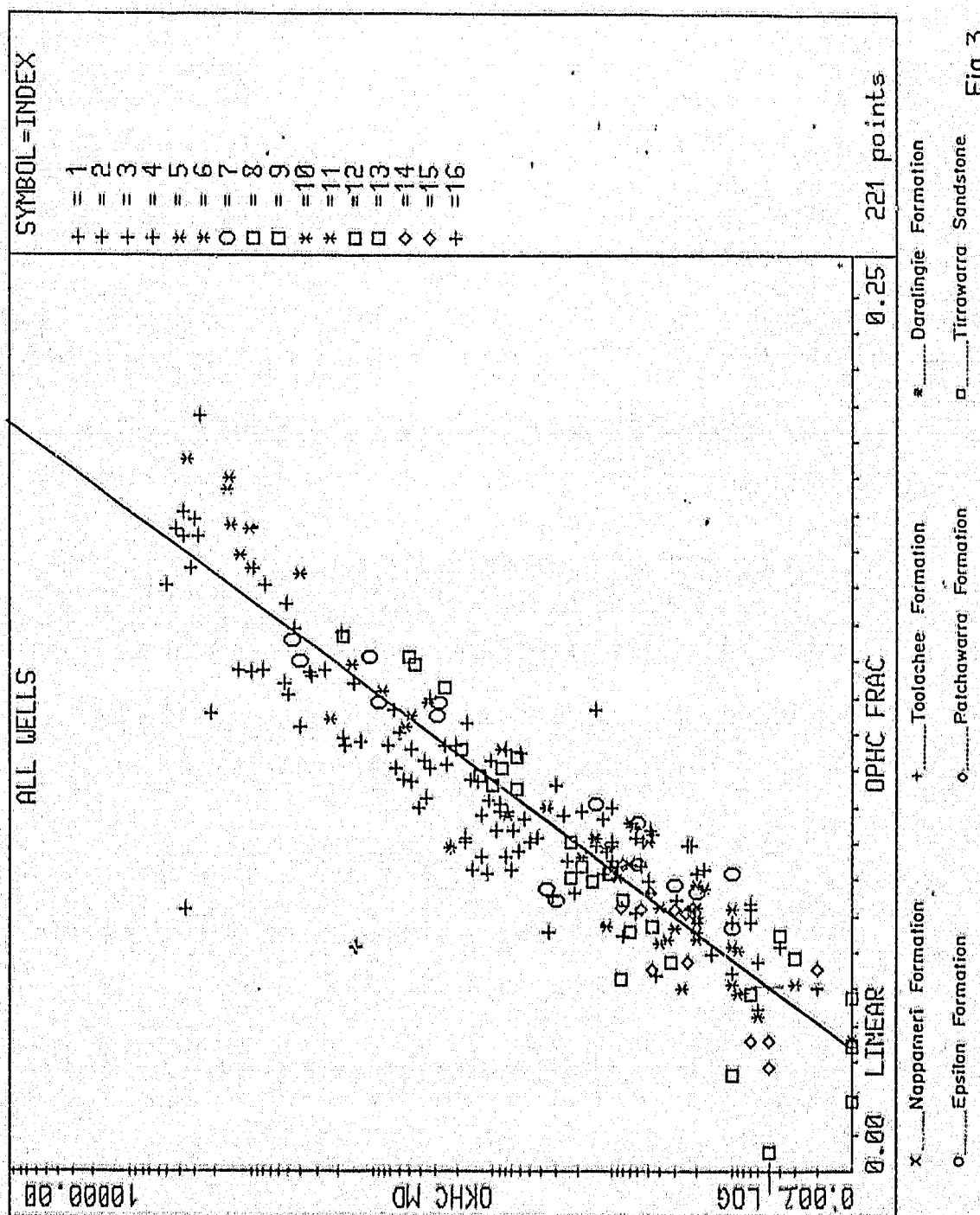
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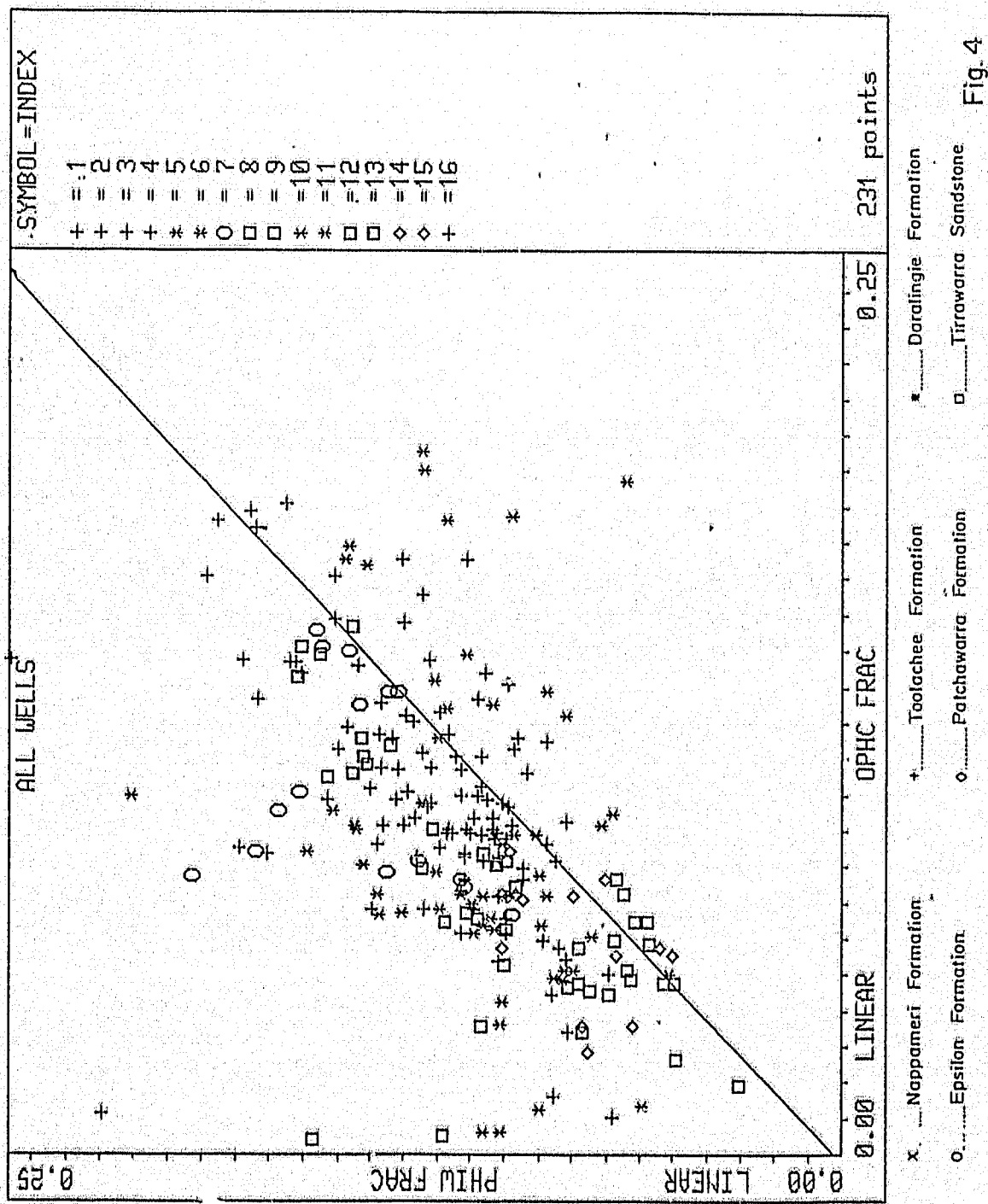


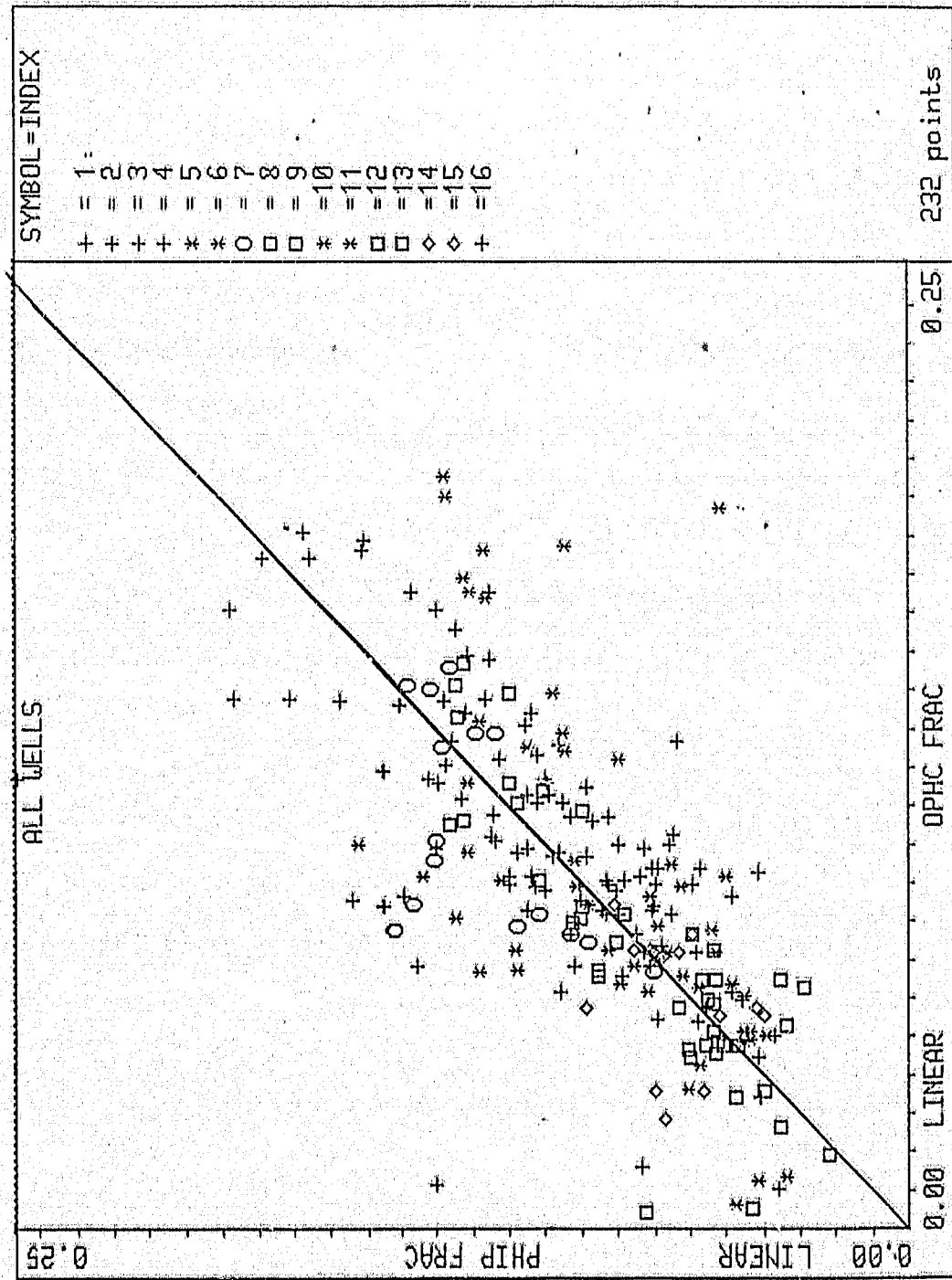
x Nappameri Formation
 0 Epsilon Formation
 + Toolachee Formation
 0 Patchawarra Formation
 * Daralingie Formation
 0 Tirrawarra Sandstone

Fig. 2

00106

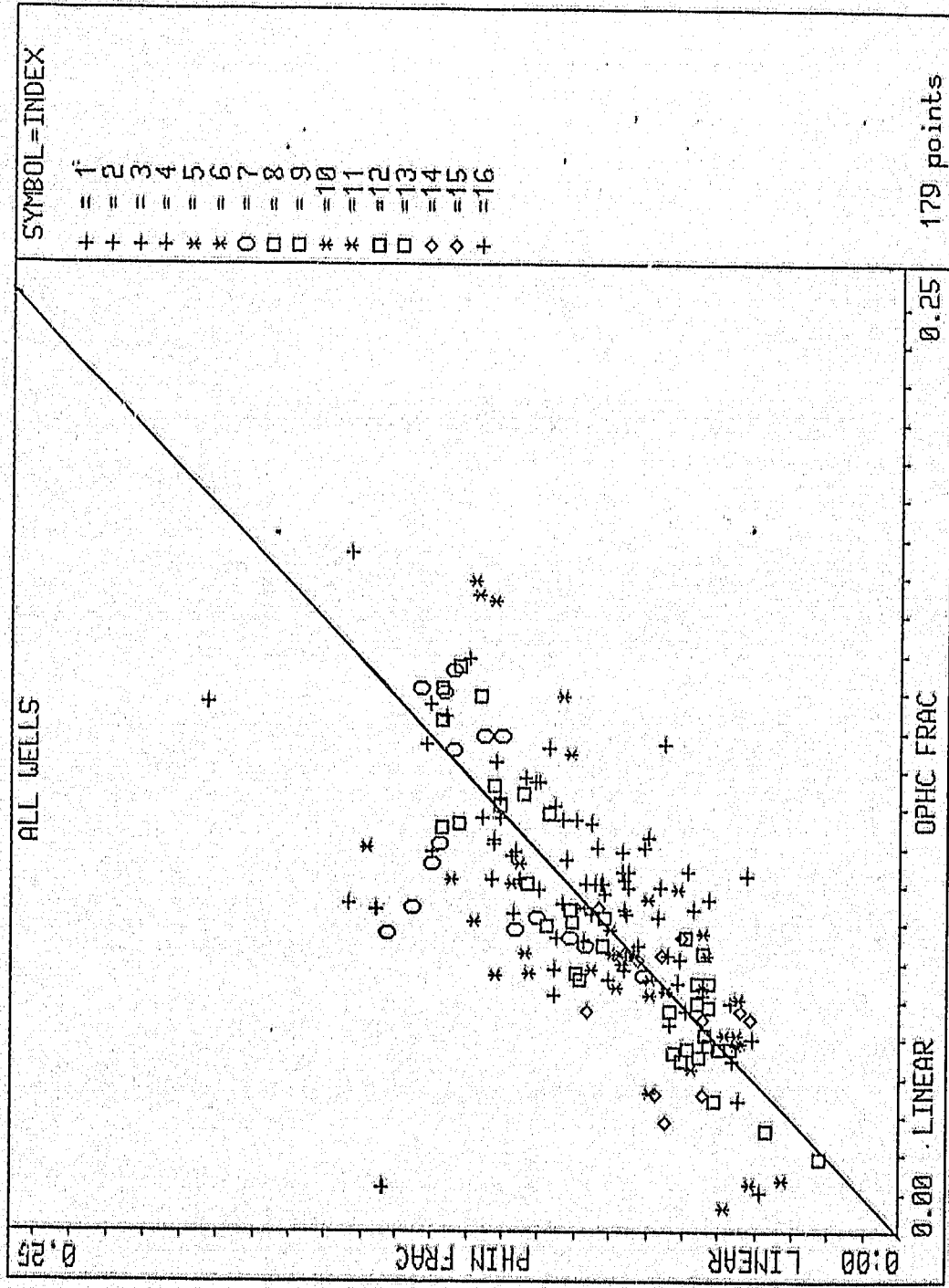






x...Nappameri Formation
o...Epsilon Formation
+...Toolachee Formation
o...Patchawarra Formation
*...Daralingie Formation
o...Tirrawarra Sandstone

Fig.5



x Nappameri Formation
 o Epsilon Formation
 + Toolachee Formation
 o Patchawara Formation
 * Daralingie Formation
 o Tirrawarra Sandstone

Fig. 6

00110

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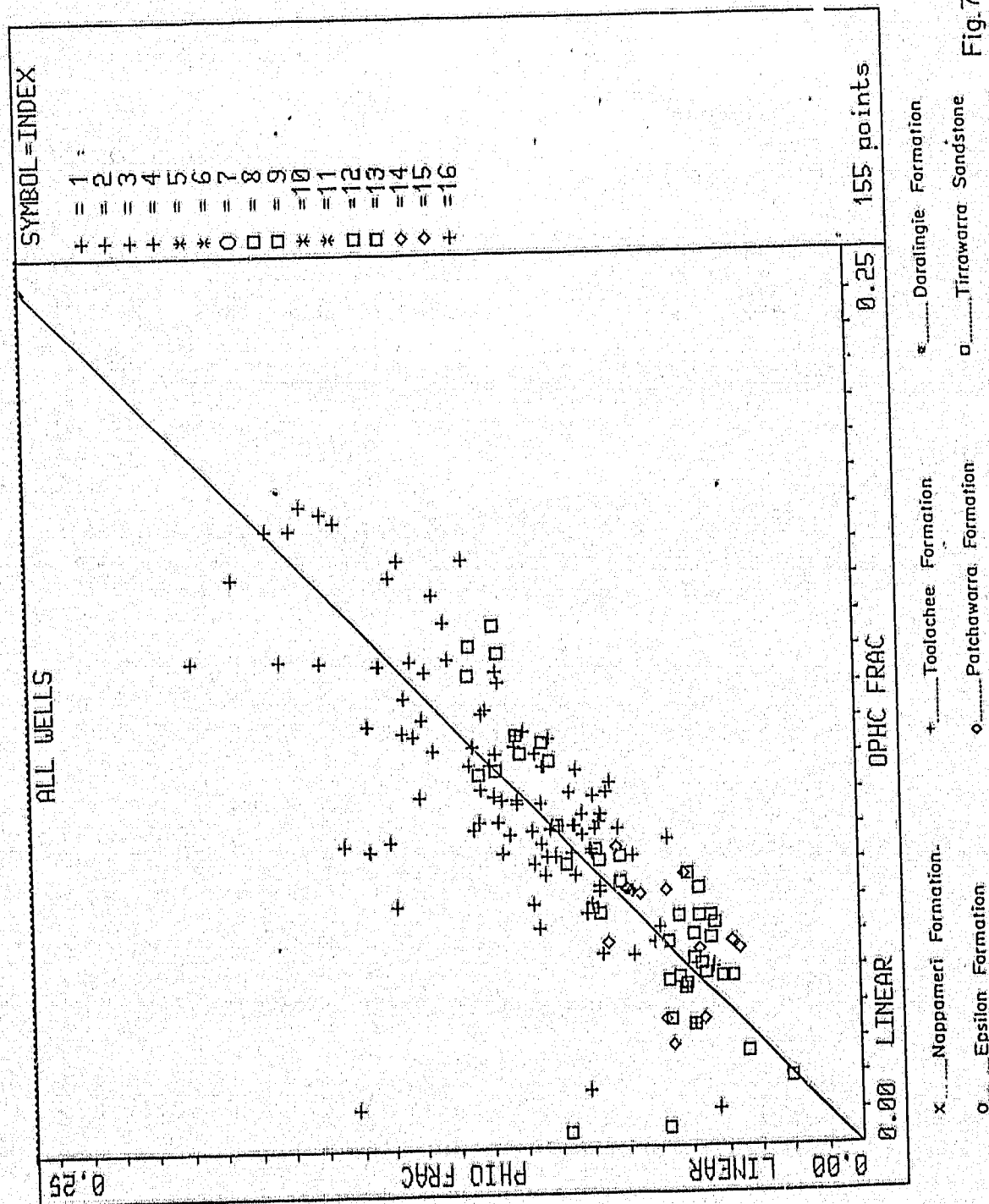
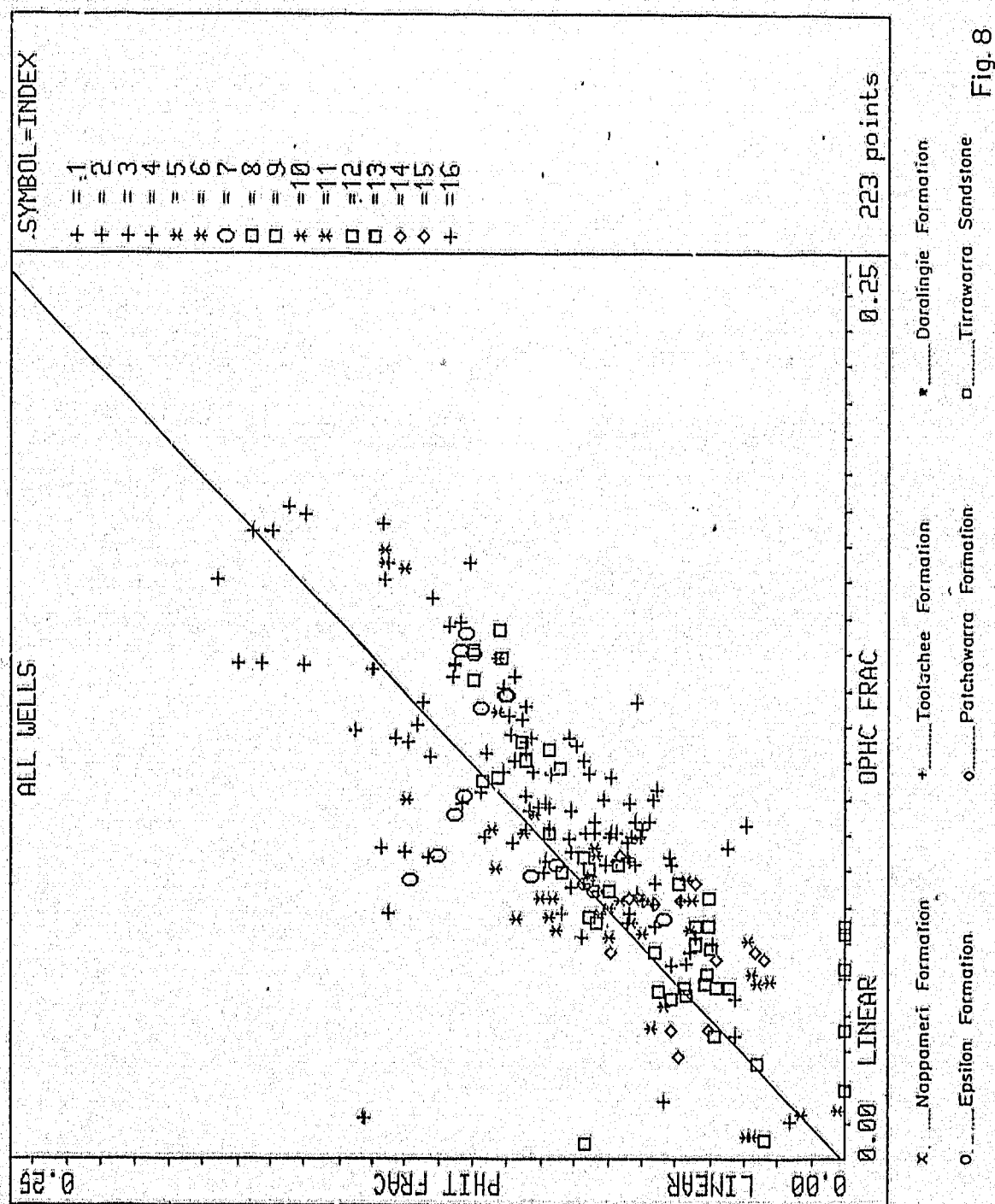


Fig. 7



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Fig. 8

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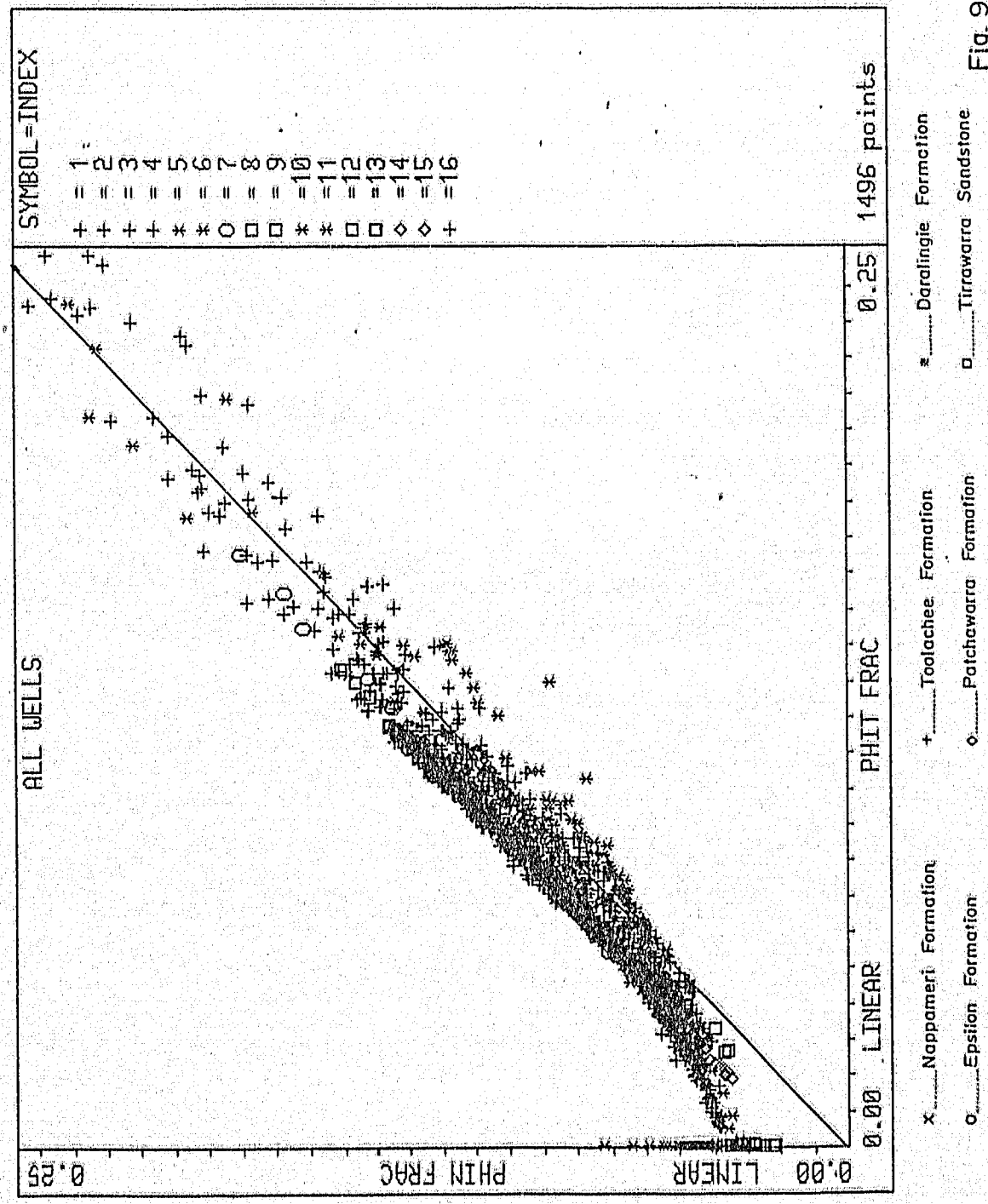
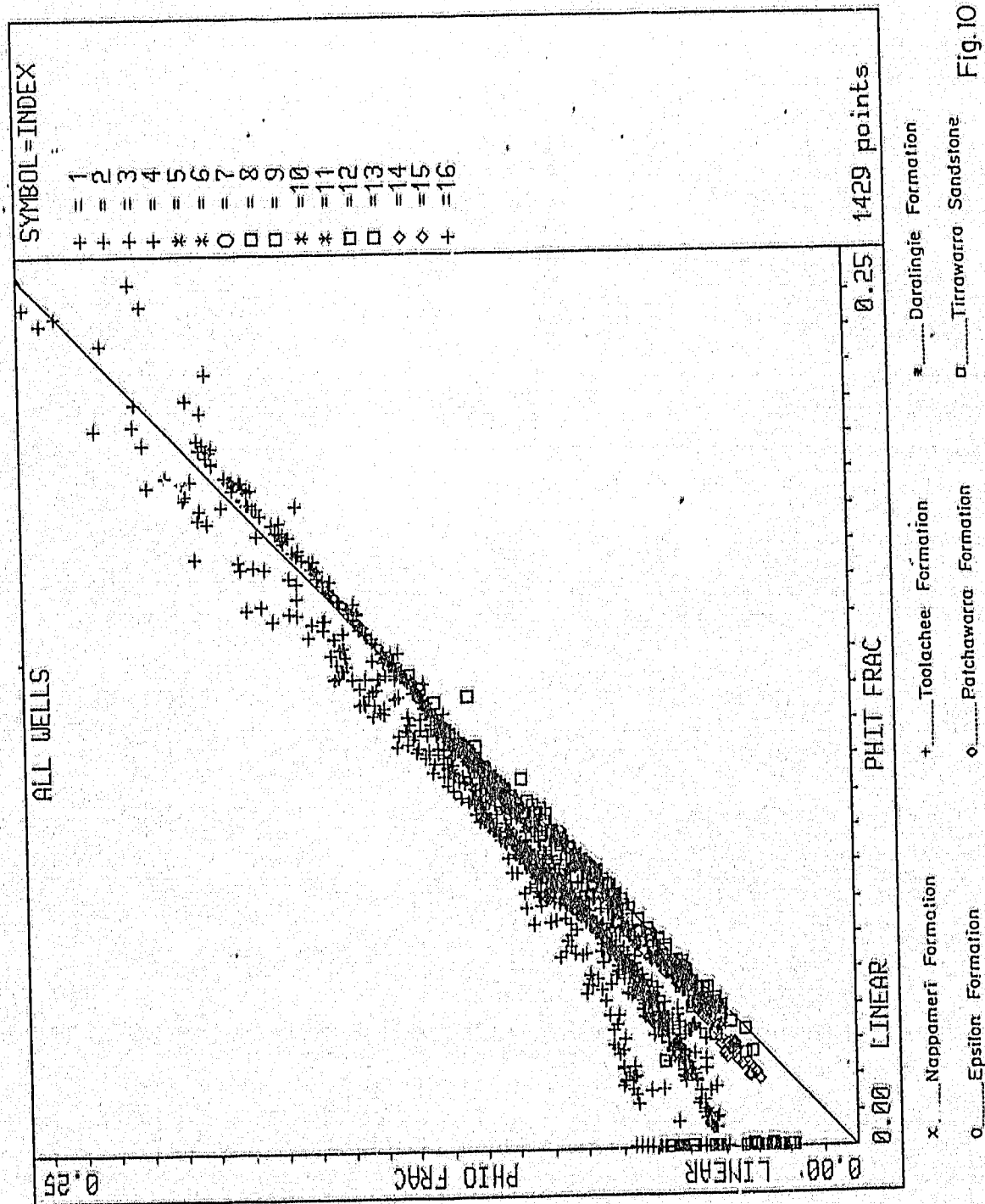
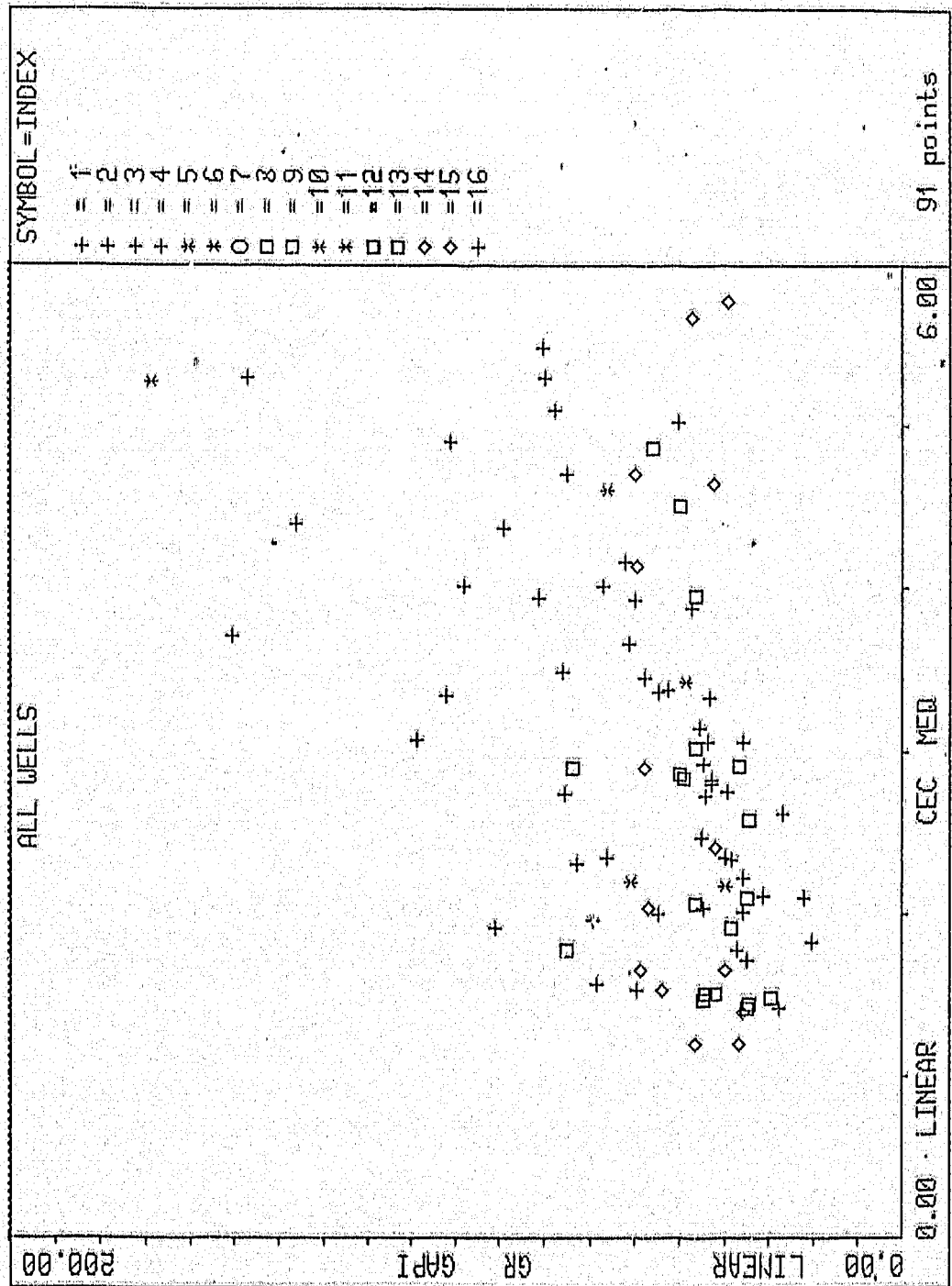


Fig. 9

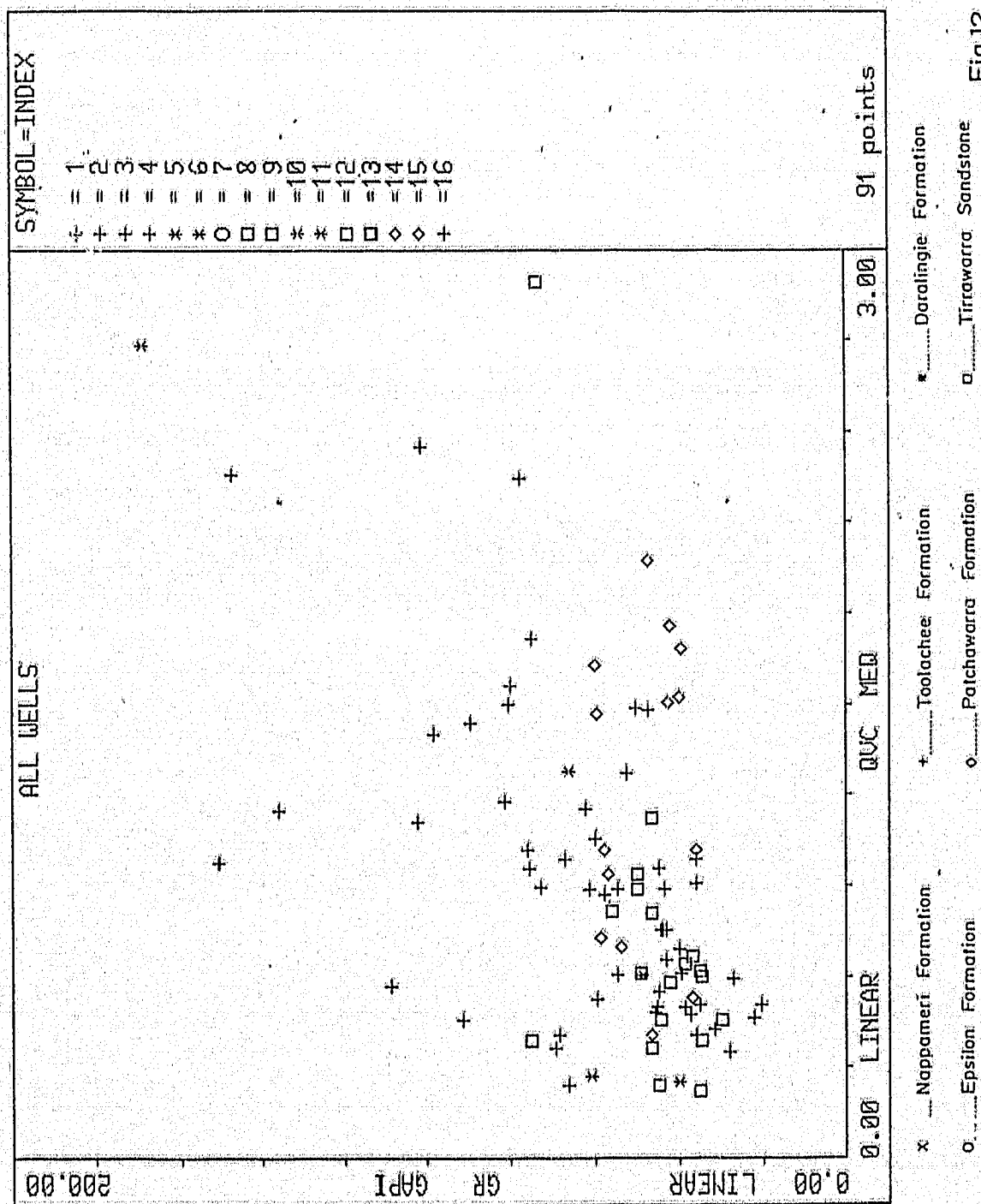
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x.....Nappameri Formation
o.....Epsilon Formation
+.....Toolachee Formation
o.....Patchawarra Formation
*.....Daralingie Formation
o.....Tirrowarra Sandstone

Fig.11



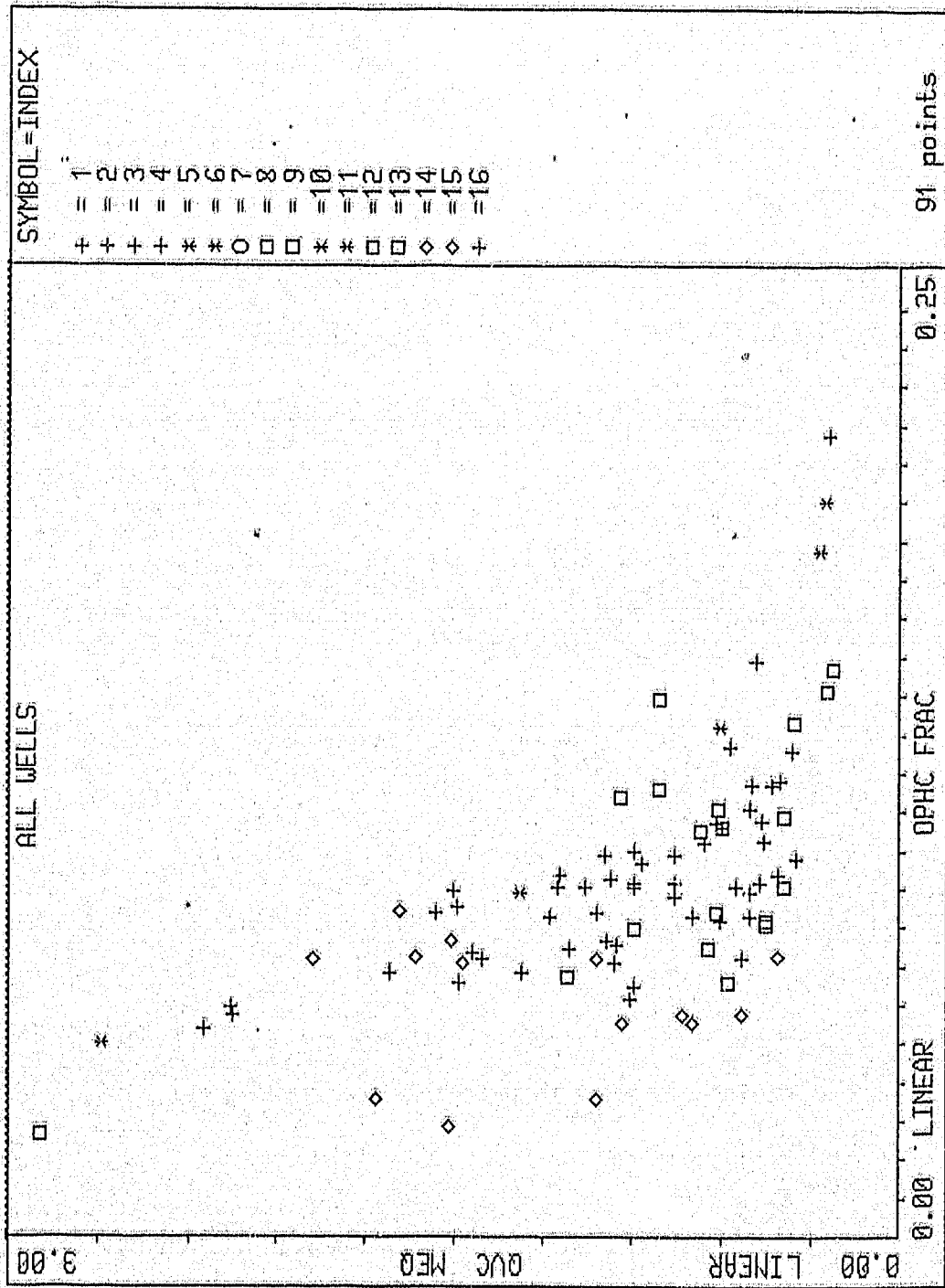


Fig.13

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GEOSCIENCE COMPUTER SYSTEMS

Field : BIG LAKE Well No : 1

Date : 20- 4-88 Page : 1

DEPTH FEET	PLUG	APHC FRAC	OPHC FRAC	AKHC MD	OKHC MD
7830.00	1.0	.054	.051	.020	.010
7831.50	2.0	.077	.063	.050	.020
7832.50	3.0	.166	.062	.080	.040
7833.00	4.0	.170	.065	.050	.020
7833.50	5.0	.176	.071	.080	.010
7834.00	6.0	.075	.069	.070	.020
7835.50	7.0	.083	.078	.100	.020
7839.50	8.0	.102	.095	.180	.070
7840.50	9.0	.074	.068	.080	.020
7841.00	10.0	.037	.036	.010	.001

00119

GEOSCIENCE COMPUTER SYSTEMS

Field : BIGLAKE Well No : 2

Date : 20- 4-88 Page : 4

DEPTH FEET	PLUG	APHC FRAC	OPHC FRAC	AKHC MD	OKHC MD
7461.50	1.0	.102	.096	.770	.550
7462.50	2.0	.120	.112	1.470	1.040
7463.50	3.0	.122	.115	1.110	.790
7464.50	4.0	.135	.130	54.520	51.650
7469.50	5.0	.123	.116	9.060	7.630
7473.00	6.0	.144	.137	151.120	127.700
7475.00	7.0	.116	.110	5.220	3.360
7478.50	8.0	.140	.135	36.030	33.010
7480.50	9.0	.181	.173	306.560	280.200
7481.50	10.0	.140	.136	40.390	33.760
7482.50	11.0	.126	.120	7.400	5.930
7495.50	12.0	.057	.054	.020	.010
7498.50	13.0	.084	.079	.090	.050
7499.50	14.0	.092	.087	.310	.110
7560.50	15.0	.191	.180	481.960	369.700
7562.00	16.0	.170	.160	103.750	77.120
7564.00	17.0	.186	.178	340.130	299.960
7565.00	18.0	.166	.160	575.700	510.510
7572.00	19.0	.142	.137	92.130	78.320
7574.00	20.0	.074	.068	.050	.010
7576.00	21.0	.119	.111	3.710	2.420
7580.50	23.0	.106	.097	.600	.260
7581.00	24.0	.118	.114	1.070	.600
7583.00	25.0	.095	.089	.380	.100
7584.00	26.0	.124	.115	7.230	4.870
7587.00	27.0	.180	.173	407.760	370.650
7590.00	28.0	.093	.086	1.860	.800
7593.00	29.0	.124	.118	20.120	18.180
7595.00	30.0	.162	.155	60.290	52.190
7613.00	31.0	.084	.076	.130	.050
7617.50	32.0	.084	.081	.050	.020
7618.50	33.0	.017	.016	.000	.000
7619.00	34.0	.096	.089	.320	.140
7619.50	35.0	.088	.081	.360	.120
7621.00	36.0	.129	.122	2.190	1.700
7621.50	37.0	.154	.147	21.930	18.420
7629.00	38.0	.181	.164	533.740	321.930
7629.50	39.0	.149	.133	29.230	14.510
7637.00	40.0	.177	.164	131.620	95.550

00120

GEOSCIENCE COMPUTER SYSTEMS

Field : BIGLAKE Well No : 2

Date : 20- 4-88 Page : 5

DEPTH FEET	PLUG	APHC FRAC	OPHC FRAC	AKHC MD	OKHC MD
7648.00	41.0	.077	.072	.070	.020
7649.50	42.0	.065	.061	.020	.010
7673.00	43.0	.090	.084	.190	.070
7676.00	44.0	.097	.090	.190	.050
7677.00	45.0	.078	.072	.120	.040
7678.00	46.0	.072	.067	.470	.110
7679.50	47.0	.073	.066	.120	.030
7680.00	48.0	.086	.080	.300	.090
7681.00	49.0	.098	.091	.320	.140
7682.50	50.0	.106	.099	.620	.360

00121

GEOSCIENCE COMPUTER SYSTEMS

Field : BIGLAKE Well No : 3

Date : 20- 4-88 Page : 6

DEPTH FEET	PLUG	APHC FRAC	OPHC FRAC	AKHC MD	OKHC MD
8259.50	1.0	.132	.128	3.580	2.840
8261.50	2.0	.084	.076	.090	.020
8262.00	3.0	.088	.081	.050	.010
8263.00	4.0	.107	.100	.570	.140
8264.00	5.0	.090	.084	.250	.060
8264.50	6.0	.100	.095	.240	.060
8265.50	7.0	.086	.078	.070	.030
8266.50	8.0	.083	.074	.090	.310
8269.00	9.0	.071	.066	.030	.010
8272.00	10.0	.160	.145	52.670	47.740
8273.00	11.0	.131	.128	10.090	8.920
8274.50	12.0	.129	.124	3.560	2.980
8275.00	13.0	.144	.139	46.290	40.840
8276.00	14.1	.145	.140	12.710	10.470
8280.00	16.0	.082	.077	.070	.370

00122

GEOSCIENCE COMPUTER SYSTEMS

Field : BIG LAKE Well No : 27

Date : 20-4-88 Page :

DEPTH FEET	PLUG	APHC FRAC	OPHC FRAC	AKHC MD	OKHC MD	CEC NEO	RGXC G/CC	QVC FRAC
9161.00	1.0	.036	.035	.017	.005	2.40	2.65	1.754
9163.00	2.0	.058	.057	.072	.023	1.20	2.66	.528
9166.00	3.0	.029	.028	.052	.005	1.65	2.65	1.518
9167.00	4.0	.035	.035	.013	.007	1.39	2.65	1.016

00123

GEOSCIENCE COMPUTER SYSTEMS

Field : BIG LAKE Well No : 27

Date : 20- 4-88 Page : 8

DEPTH FEET	PLUG	APHC FRAC	OPHC FRAC	AKHC MD	OKHC MD	CEC NEO	R6XC G/CC	QVC FRAC
9482.50	1.0	.035	.034	.041	.001	-1000.00	-1000.00	-999.999
9483.50	3.0	.048	.047	.025	-999.990	-1000.00	-1000.00	-999.999
9487.00	4.0	.048	.047	.017	.001	-1000.00	-1000.00	-999.999
9488.50	5.0	.045	.044	.033	-999.990	-1000.00	-1000.00	-999.999
9489.00	6.0	.061	.057	.053	.033	-1000.00	-1000.00	-999.999
9490.50	7.0	.047	.046	.038	-999.990	-1000.00	-1000.00	-999.999
9491.50	8.0	.045	.045	.036	.000	-1000.00	-1000.00	-999.999
9494.00	9.0	.051	.051	.025	-999.990	-1000.00	-1000.00	-999.999
9495.50	11.0	.047	.047	.035	-999.990	-1000.00	-1000.00	-999.999
9498.00	13.0	.065	.064	.063	-999.990	-1000.00	-1000.00	-999.999
9499.00	15.0	.077	.076	.137	-999.990	-1000.00	-1000.00	-999.999
9501.50	17.0	.060	.059	.083	-999.990	-1000.00	-1000.00	-999.999
9502.00	-1000.0	.050	.048	.027	.007	-1000.00	-1000.00	-999.999
9505.50	-1000.0	.074	.072	1.300	-999.990	-1000.00	-1000.00	-999.999
9507.00	-1000.0	.059		.060	.003	-1000.00	-1000.00	-999.999
9508.00	-1000.0	.065		.028	.004	-1000.00	-1000.00	-999.999

00124

GEOSCIENCE COMPUTER SYSTEMS

Field : BIG LAKE Well No : 29

Date : 20-4-88 Page : 9

DEPTH FEET	APHC FRAC	OPHC FRAC	AKHC MD	OKHC MD
9318.00	.004	.004	.054	-999.990
9322.00	.005	.005	.053	.005

00125

GEOSCIENCE COMPUTER SYSTEMS

Field : BIG LAKE Well No : 29

Date : 20- 4-88 Page : 10

DEPTH FEET	APHC FRAC	OPHC FRAC	AKHC MD	OKHC MD
9666.00	.035	.035	4.400	-999,990
9670.00	.052	.052	3.500	.084
9671.00	.064	.064	3.500	-999,990
9672.00	.077	.062	6.800	-999,990

00126

GEOSCIENCE COMPUTER SYSTEMS

Field : BIG LAKE Well No : 31

Date : 20- 4-88 Page : 11

DEPTH FEET	PLUG	APHC FRAC	OPHC FRAC	AKHC MD	OKHC MD	CEC MEQ	RGXC G/CC	QVC FRAC
9962.50	1.0	.088	.080	.565	.228	1.48	2.66	.453
9965.50	2.0	.089	.081	.433	.107	1.50	2.66	.453
9971.50	3.0	.075	.065	.198	.071	1.50	2.66	.574
9980.00	4.0	.087	.079	.499	.151	2.86	2.66	.887
9981.00	5.0	.073	.067	.184	.046	3.02	2.66	1.119
9984.00	6.0	.092	.083	.675	.182	2.10	2.65	.615
9987.50	7.0	.099	.090	.638	.228	1.44	2.66	.387

00127

GEOSCIENCE COMPUTER SYSTEMS

Field : BIG LAKE Well No : 31

Date : 20- 4-88 Page : 12

DEPTH FEET	PLUG	APHC FRAC	OPHC FRAC	AKHC MD	OKHC MD	CEC MEQ	RGXC G/CC	OVC FRAC
10202.50	8.0	.026	.026	.014	.010	2.89	2.67	2.891
10205.00	9.0	.021	.019	.230	.001	10.30	2.67	14.199
10216.50	10.0	.082	.074	.396	.082	1.91	2.66	.636

00123

GEOSCIENCE COMPUTER SYSTEMS

Field : BIG LAKE Well No : 32

Date : 20- 4-88 Page : 11

DEPTH FEET	PLUG	APHC FRAC	OPHC FRAC	AKHC MD	OKHC MD	CEC MED	RQXC G/CC	QVC FRAC
9362.50	1.0	.147	.138	8.000	4.480	4.87	2.66	.809
9364.00	2.0	.121	.113	2.130	.645	4.51	2.65	.938
9369.50	3.0	.119	.108	2.740	1.330	1.77	2.66	.389
9376.00	4.0	.117	.105	2.780	1.000	2.58	2.71	.596
9385.00	5.0	.145	.140	6.300	5.000	1.47	2.68	.242
9387.00	6.0	.140	.132	3.870	2.620	2.05	2.66	.359
9394.00	7.0	.115	.110	1.100	.844	2.84	2.65	.609
9399.00	8.0	.123	.115	3.320	1.840	3.96	2.65	.808
9410.50	9.0	.154	.146	21.900	17.900	1.42	2.65	.220
9411.50	10.0	.110	.104	1.160	.652	2.91	2.65	.664

00123

GEOSCIENCE COMPUTER SYSTEMS

Field : BIG LAKE Well No : 35

Date : 20- 4-88 Page : 14

DEPTH FEET	PLUG	APHC FRAC	OPHC FRAC	AKHC MD	OKHC MD	CEC MEQ	RGXC G/CC	OVC FRAC
9215.00	1.0	.075	.072	.201	.085	1.19	2.65	.406
9216.00	2.0	.059	.055	.158	.045	1.53	2.64	.694
9217.00	3.0	.057	.055	.025	.002	2.04	2.66	.932
9218.00	4.0	.059	.057	.085	.023	1.65	2.66	.726
9220.50	5.0	.076	.071	.106	.030	2.90	2.67	1.013
9221.00	6.0	.075	.072	.077	.021	4.71	2.68	1.627
9221.50	7.0	.073	.070	.092	.025	4.15	2.66	1.467
9224.00	8.0	.091	.084	.230	.081	5.77	2.67	1.680
9225.50	9.0	.078	.071	.177	.057	5.67	2.66	1.973
9226.50	10.0	.079	.076	.096	.049	4.65	2.66	1.504

00130

GEOSCIENCE COMPUTER SYSTEMS

Field : MOOMBA Well No : 8

Date : 20-4-88 Page : 2

DEPTH FEET	PLUG	APHC FRAC	OPHC FRAC	AKHC MD	OKHC MD	CEC MEQ	RGXC G/CC	OVC FRAC
7791.00	2.0	.077	.074	.148	.029	3.35	2.65	1.111
7794.50	4.0	.073	.070	.296	.064	2.73	2.64	.958
7795.00	5.0	.086	.083	.603	.089	3.49	2.63	1.014
7796.00	6.0	.067	.064	.345	.082	2.31	2.64	.892
7798.50	3.0	.097	.090	2.100	.499	3.33	2.64	.889
7800.00	12.0	.078	.075	.558	.323	2.92	2.65	.954
7801.00	10.0	.121	.116	20.900	17.100	2.47	2.64	.497
7803.00	14.0	.125	.117	18.500	12.800	2.01	2.65	.402
7813.00	7.0	.097	.092	.800	.046	3.71	2.66	.974
7814.50	13.0	.129	.126	.620	.141	3.07	2.65	.564
7816.00	15.0	.134	.125	315.000	216.000	1.96	2.64	.362
7818.00	11.0	.153	.148	70.000	44.800	3.15	2.64	.479
7819.00	9.0	.106	.101	2.900	1.100	2.79	2.63	.653
7828.50	1.0	.060	.059	.075	.015	5.30	2.67	2.253
7830.00	8.0	.097	.093	.799	.048	4.40	2.67	1.146
7867.00	16.0	.210	.206	345.000	270.000	2.34	2.64	.238

00131

GEOSCIENCE COMPUTER SYSTEMS

Field : MOOMBA Well No : 10

Date : 20- 4-88 Page : 29

DEPTH FEET	PLUG	APHC FPAC	OPHC FRAC	OKHC MD
7770.00	1.0	.123	.116	2.570
7771.00	2.0	.134	.129	3.440
7774.00	3.0	.142	.137	25.800
7776.00	4.0	.181	.175	434.000
7777.00	5.0	.104	.098	.904
7778.00	6.0	.124	.121	41.600
7779.00	7.0	.113	.107	5.550
7781.00	8.0	.142	.136	100.000
7785.00	9.0	.011	.011	.000
7787.00	10.0	.010	.010	.000
7788.00	11.0	.053	.050	.002
7790.00	12.0	.035	.034	.001
7792.00	13.0	.048	.044	.006
7793.00	14.0	.065	.061	.004
7794.00	15.0	.095	.089	.023
7796.00	16.0	.096	.093	.957
7797.00	17.0	.108	.106	1.360
7799.00	18.0	.117	.112	3.770
7801.00	19.0	.132	.126	6.690
7803.00	20.0	.140	.133	53.400

00132

GEOSCIENCE COMPUTER SYSTEMS

Field : MOOMBA Well No : 45

Date : 20- 4-88 Page : 30

DEPTH FEET	PLUG	APHC FRAC	OPHC FRAC	AKHC MD	OKHC MD	CEC HEO	RGXC G/CC	QVC FRAC	SWIR FRAC
8153.50	11.0	.191	.186	179.000	159.000	-1000.00	2.65	-999.999	.131
8154.50	14.0	.181	.176	173.000	149.000	2.19	2.66	.273	-10.000
8156.00	15.0	.180	.175	127.000	102.000	-1000.00	2.65	-999.999	.174
8157.00	12.0	.200	.194	440.000	349.000	-1000.00	2.65	-999.999	.097
8157.50	13.0	.192	.189	186.000	153.000	2.17	2.66	.248	-10.000
8158.00	8.0	.120	.115	1.440	.850	-1000.00	2.67	-999.999	.812
8158.50	6.0	.132	.128	4.620	3.500	-1000.00	2.67	-999.999	.567
8161.50	3.0	.098	.094	.293	.066	-1000.00	2.72	-999.999	.887
8166.00	1.0	.054	.050	.221	.026	5.27	2.68	2.683	-10.000
8174.00	5.0	.096	.091	.407	.143	-1000.00	2.70	-999.999	.884
8175.50	4.0	.125	.121	7.090	5.460	-1000.00	2.73	-999.999	.432
8177.00	9.0	.129	.124	6.250	4.930	-1000.00	2.72	-999.999	.461
8177.50	10.0	.135	.131	10.200	8.300	3.42	2.65	.601	-10.000
8178.00	7.0	.100	.097	1.180	.760	-1000.00	2.67	-999.999	.768
8179.50	2.0	.092	.088	.616	.109	4.62	2.66	1.274	-10.000

00133

GEOSCIENCE COMPUTER SYSTEMS

Field : MOOMBA Well No : 47

Date : 20-4-88 Page : 31

DEPTH FEET	PLUG	APHC FRAC	OPHC FRAC	OKHC MD
8225.50	2.0	.091	.088	2.260
8226.50	3.0	.142	.138	15.000
8228.00	4.0	.173	.168	121.000
8229.00	5.0	.169	.164	97.600
8230.00	6.0	.168	.163	40.900
8231.00	7.0	.127	.123	23.500
8233.00	8.0	.089	.086	.183
8235.00	9.0	.082	.077	.017
8236.50	10.0	.053	.051	.003
8238.00	11.0	.049	.048	.009
8239.50	12.0	.050	.049	.008
8241.00	13.0	.012	.012	.000
8242.50	14.0	.007	.006	.000
8245.00	15.0	.006	.006	.000
8247.00	16.0	.045	.042	.006
8249.00	17.0	.068	.063	.034
8253.00	18.0	.075	.071	.022
8255.00	19.0	.065	.060	.009
8257.00	20.0	.014	.013	.000

00134

GEOSCIENCE COMPUTER SYSTEMS

Field : MOOMBA Well No : 52

Date : 20- 4-88 Page : 32

DEPTH FEET	PLUG	APHC FRAC	OPHC FRAC	AKHC MD	OKHC MD	CEC MEO	RGXC G/CC	OVC FRAC	SWIR FRAC
7845.50	1.0	.096	.091	4.520	1.750	1.77	2.66	.470	-999.999
7848.00	2.0	.088	.082	2.420	.703	1.71	2.64	.505	-999.999
7848.50	3.0	.104	.097	3.580	1.280	1.41	2.66	.349	-999.999
7850.50	4.0	.083	.076	2.630	.211	3.06	2.65	.986	-999.999
7851.00	5.0	.123	.116	4.770	2.090	2.11	2.65	.426	-999.999
7855.00	6.0	.088	.083	2.300	.106	-1000.00	2.63	-999.999	.485
7856.50	7.0	.089	.085	.763	.244	-1000.00	2.65	-999.999	.689
7869.00	8.0	.074	.071	.409	.007	4.02	2.66	1.399	-999.999
7874.00	9.0	.100	.093	2.550	.677	1.57	2.66	.407	-999.999
7877.50	10.0	.112	.105	1.580	.300	2.61	2.66	.592	-999.999
7885.50	11.0	.104	.099	6.260	4.240	-1000.00	2.65	-999.999	.362
7887.00	15.0	.109	.102	6.930	3.670	1.91	2.70	.454	-999.999
7913.00	12.0	.105	.100	1.900	.877	-1000.00	2.65	-999.999	.584
7914.50	13.0	.115	.107	4.500	1.530	2.10	2.65	.464	-999.999
7916.50	16.0	.094	.088	3.610	2.310	1.82	2.66	.502	-999.999
7922.00	14.0	.092	.086	3.660	1.230	-1000.00	2.63	-999.999	.412
7928.00	17.0	.059	.057	.311	.006	5.11	2.66	2.249	-999.999
7930.00	18.0	.055	.053	.276	.044	4.90	2.68	2.346	-999.999
7932.00	19.0	.072	.068	.505	.007	3.38	2.74	1.269	-999.999

00135

GEOSCIENCE COMPUTER SYSTEMS

Field : MOOMBA Well No : 53

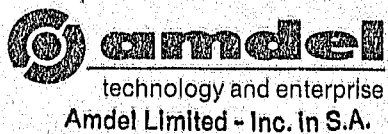
Date : 20- 4-88 Page : 33

DEPTH FEET	PLUG	APHC FRAC	OPHC FRAC	AKHC MD	OKHC MD	CEC MEO	R6XC G/CC	QVC FRAC
7836.00	1.0	.097	.091	1.090	.064	3.36	2.65	.889
7837.50	2.0	.089	.081	2.530	1.110	2.00	2.65	.601
7840.00	3.0	.068	.065	.783	.352	3.88	2.65	1.479
7855.00	4.0	.093	.090	3.600	1.770	2.03	2.65	.544
7855.50	5.0	.098	.091	1.650	.439	2.82	2.67	.752
7856.50	6.0	.103	.098	2.190	.769	3.06	2.67	.752
7857.50	7.0	.112	.106	9.400	4.840	2.75	2.64	.612
7858.00	8.0	.088	.082	6.030	1.500	2.34	2.64	.692
7859.50	9.0	.092	.087	2.000	.625	2.72	2.64	.754
7864.50	10.0	.115	.110	10.200	6.400	2.33	2.65	.500
7867.50	11.0	.125	.071	629.000	358.000	1.52	2.65	.527
7869.00	12.0	.116	.061	25.800	14.100	2.22	2.65	.906
7952.50	13.0	.077	.073	.464	.007	4.38	2.58	1.435
7955.00	14.0	.072	.068	.409	.007	4.71	2.65	1.711
7967.00	15.0	.088	.083	.436	.058	5.30	2.66	1.558
7983.00	16.0	.095	.089	.413	.022	5.49	2.67	1.500
7984.00	17.0	.088	.082	.952	.017	3.94	2.67	1.178
7986.50	18.0	.093	.090	.582	.100	3.93	2.65	1.053
7992.50	19.0	.095	.090	.969	.055	4.16	2.73	1.148
7995.00	20.0	.103	.098	1.290	.183	4.02	2.67	.988
7997.00	21.0	.103	.096	1.380	.121	3.45	2.67	.867
8000.00	22.0	.101	.099	1.340	.102	3.66	2.67	.889
8003.00	23.0	.091	.085	.652	.100	5.03	2.74	1.484

END

OF

REPORT



8 June 1988

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REPORT F 6896/88 - Part 6

YOUR REFERENCE: SENRAC 2/86, DME 249/87 JM:DG, 21 and 29
September 1987

TITLE: SENRAC Project

SAMPLE IDENTIFICATION: Moomba 10 and 47

MATERIAL: Core plug offcuts

WORK REQUIRED: Cation exchange capacity
(Invoice 77939 27 May 1988)

Investigation and Report by: Russell R. Martin
Manager, Petroleum Services Section: Dr Brian G. Steveson

for Dr William G. Spencer
General Manager
Applied Sciences Group

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Branches in Sydney, Melbourne, Perth, Brisbane, Canberra, Darwin, Townsville, Burnie. Represented world-wide

1. INTRODUCTION

Correspondence was received at Amdel Limited from the South Australian Department of Mines and Energy (your ref.: 249/87 JM:DG letters of 21 and 29 September 1987) requesting the following analyses be performed:

- Porosity and permeability at net overburden
- Cation exchange capacity
- Absolute grain density

Results of porosity and permeability to air at net overburden were reported in Amdel Limited report F6896/88 - Part 2 on 30 October 1987. Amdel Limited was initially requested not to perform cation exchange capacity determinations or absolute grain density measurements until authorised by the Mines Department.

Subsequent discussions with Mr John Morton of the Mines Department have now authorised this work to proceed. Results of absolute grain density for Big Lake 1, 2 and 3 and Moomba 10 and 47 were contained in Amdel Limited report F6896/88 - Part 5, 23 May 1988.

Results included in this part 6 report are cation exchange capacity determinations for Moomba 10 and 47. Outstanding analyses of cation exchange capacity include samples from Big Lake 1, 2 and 3. This work is currently in progress and should be available next week.

2. CATION EXCHANGE CAPACITY

Cation exchange capacity is determined on the crushed samples using the wet chemistry technique. Ammonium chloride solution is added to the sample to exchange with the clay ions. The excess ammonium chloride is then washed off. Sodium sulphide solution is then added to remove the exchanged ammonium chloride ions and the resultant solution is titrated.

Results of C.E.C. are reported in meq/100 gms and Qv (meq/ml of pore space) determined by the equation:

$$Q = \frac{d \times \text{C.E.C.}}{\left[\frac{100}{1-\phi} - 100\right]}$$

where: d = absolute grain density
 ϕ = porosity fraction

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File: F6896/88

CATION EXCHANGE CAPACITY

Company: Department of Mines
Well: Moomba-10
Field: Moomba

Formation:
Location: Cooper Basin

Sample ID	Depth feet	C.E.C. meq/100 gms
1	7769.2	2.18
2	7770	2.24
3	7773.1	1.93
4	7775.2	1.99
5	7776.2	2.43
6	7777.2	1.40
7	7778.2	2.44
8	7780.2	2.03
9	7784.3	6.60
10	7786	7.41
11	7787	4.86
12	7789	5.68
13	7791	4.38
14	7792	5.39
15	7792.11	3.49
16	7795	1.86
17	7796	2.05
18	7798	1.75
19	7800	2.33
20	7802.2	1.66

00139

File: F6896/88

CATION EXCHANGE CAPACITY

Company: Department of Mines
Well: Moomba-47
Field: Moomba

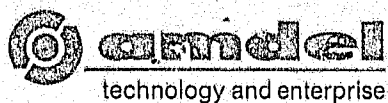
Formation:
Location: Cooper Basin

Sample ID	Depth feet	C.E.C. meq/100 gms
2	8225.7	1.66
3	8226.6	1.37
4	8228	1.53
5	8229.1	1.73
6	8230	2.22
7	8231	2.12
8	8233	2.02
9	8234.9	2.56
10	8236.6	3.81
11	8238	4.67
12	8239.8	4.76
13	8241	4.97
14	8242.6	6.49
15	8244.10	6.48
16	8247.1	7.83
17	8149	5.08
18	8253	3.16
19	8255.3	3.88
20	8257	5.33

END

OF

REPORT



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21 July 1988

The Director-General
South Australian Department of Mines
and Energy
PO Box 151
EASTWOOD SA 5063

REPORT F 6896/88 - Part 5

YOUR REFERENCE: SENRAC 2/86, DME 249/87 JM:DE, 21 and 29 September 1987

SAMPLE IDENTIFICATION: Big Lake 1, 2 and 3

MATERIAL: Core plug offcuts

WORK REQUIRED: Cation exchange capacity

Investigation and Report by: Russell R. Martin
Manager, Petroleum Services Section: Dr Brian G. Steveson

for Dr William G. Spencer
General Manager
Applied Sciences Group

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CATION EXCHANGE CAPACITY

Company: South Australian Department of Mines and Energy
Well: Big Lake 1
Field: Big Lake

Sample Number	Depth Feet	C.E.C. meq/100 gms
1	7798	3.40
2	7799.6	3.75
3	7800.5	2.62
4	7801.3	3.05
5	7801.6	3.44
6	7802.1	3.49
7	7803.5	3.82
8	7807.3	3.32
9	7808.5	2.85
10	7809.2	5.92

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CATION EXCHANGE CAPACITY

Company: South Australian Department of Mines and Energy
Well: Big Lake 2
Field: Big Lake

Sample Number	Depth Feet	C.E.C. meq/100 gms
1	7453.9	3.21
2	7454.8	2.62
3	7455.8	2.37
4	7457	2.43
5	7461.9	2.27
6	7464.5	2.41
7	7466.7	2.35
8	7469.8	2.68
9	7472	2.29
10	7473	2.44
11	7475	2.60
12	7480	3.93
13	7483.1	3.53
14	7583.8	3.43
15	7554.3	2.30
16	7556	2.09
17	7557.9	2.47
18	7561	2.93
19	7569	1.82
20	7570.9	4.07
21	7573	2.86
22	7575.9	3.21
23	7577.3	2.99

.../2

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Sample Number	Depth Feet	C.E.C. meq/100 gms
24	7578.1	2.98
25	7580	3.62
26	7581.1	2.38
27	7584	2.58
28	7587	2.66
29	7590.1	2.21
30	7592	2.42
31	7611.8	3.99
32	7616.4	3.23
33	7617.7	4.40
34	7618.7	3.59
35	7619.1	3.70
36	7620.6	2.43
37	7621	2.23
38	7628	2.32
39	7629.3	2.67
40	7636.8	2.60
41	7647.3	3.84
42	7649	3.66
43	7673.8	3.53
44	7677.1	3.60
45	7678	3.42
46	7679.1	3.08
47	7680.6	3.85
48	7681.1	3.38
49	7682	3.85
50	7683.7	3.05

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CATION EXCHANGE CAPACITY

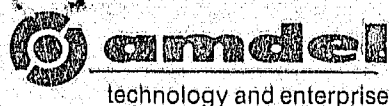
Company: South Australian Department of Mines and Energy
Well: Big Lake 3
Field: Big Lake

Sample Number	Depth Feet	C.E.C. meq/100 gms
1	8251.4	2.92
2	8253.7	4.55
3	8254	3.84
4	8255.2	3.66
5	8256.1	3.91
6	8256/7	4.06
7	8257.6	4.42
8	8258.3	3.71
9	8261.2	3.96
10	8264	2.76
11	8265	2.74
12	8286.4	2.80
13	8267.05	2.79
14	8267.9	2.64
15	8268.9	2.91
16	8271.8	2.89

END

OF

REPORT



technology and enterprise

18 January 1989

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The Director General
S.A. Department of Mines & Energy
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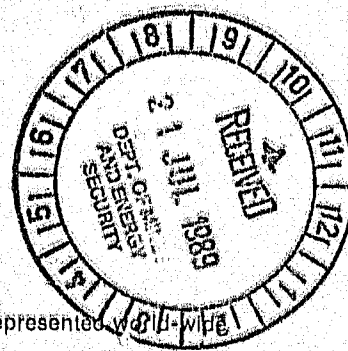
REPORT F 6727/87 / F 6898/87 - FINAL

CLIENT REFERENCE:	DME 142/86, DEM 249/87
TITLE:	SENRAC/NERDECC Projects
SAMPLE IDENTIFICATION:	Big Lake 2, 3, 32 and 35 Dirkala 2 Garanjanie 2 Moomba 47
WORK REQUIRED:	Multiple-salinity electrical properties

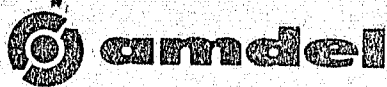
Investigation and Report by: Russell R. Martin

Dr Brian G Steveson
Manager, Petroleum Services Section

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1. INTRODUCTION

Correspondence was received by the Petroleum Services Section of Amdel Limited (your ref: DME 142/86 JGGM:AM and DME 249/87 JM:AM) requesting multiple-salinity electrical properties for the determination of; 'm', the cementation exponent, 'a', the intercept and 'n', the saturation exponent. The tests were to be performed on selected samples from the following wells;

Big Lake #'s 2, 3, 32 and 35
Dirkala #2
Garanjanie #2
Moomba #47

A total of 32 plugs were selected, 5 samples from each of the Big Lake wells, 5 samples from Moomba 47, 4 samples from Garanjanie and 3 samples from Dirkala. All samples had previously undergone porosity and air permeability determinations at ambient and applied overburden conditions. Pressures used to determine porosity and air permeability under applied overburden conditions were used during the multi-salinity electrical properties test work.

2. PROCEDURES AND RESULTS

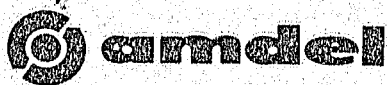
De-aerated NaCl brines in the following concentrations were constructed with resistivity and conductivity for each brine determined as follows:

Brine	Rw @ 25°C (ohm.m)	Conductivity @ 25°C (mho.cm)
25,000 ppm	0.24	0.042
10,000 ppm	0.542	0.018
5,420 ppm	1.07	0.010
2,000 ppm	2.60	0.004

Samples were evacuated and then pressure saturated with the 25,000 ppm NaCl brine. Samples were then placed on the cell electrodes with a thin silver leaf between plug endface and electrode to promote good contact. The assembly was then wrapped in teflon tape, encapsulated in a rubber sleeve and placed into the cell. The cell was then pressured to the desired overburden pressure using a mineral oil.

The plugs were then subjected to a vacuum for a short period of time and the 25,000 ppm NaCl brine introduced to the sample. Brine was slowly flushed through the samples until stable readings were obtained indicating ionic equilibrium had been achieved. Samples were left to stand for approximately 24 hours and resistivity measurements repeated to ensure equilibrium had been reached before proceeding with resistivity index determinations.

Values of resistivity index were determined by introducing humidified air to the sample and displacing some of the brine. The volume of brine displaced was collected in a receiving tube and the new saturation (Sw) calculated. Measurements of resistivity index were performed on consecutive days until a stable reading was obtained. The process of introducing humidified air to establish a new Sw for resistivity index determinations was then repeated.



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Upon completion of the formation resistivity factor and resistivity index measurements for the 25,000 ppm NaCl brine, 50 pore volumes of the 10,000 ppm NaCl brine was flushed through the sample. After 50 pore volumes of the 10,000 ppm brine had been passed through the sample resistivity measurements were again recorded until a stable reading was obtained and the new formation resistivity factor calculated.

The procedures as outlined above were repeated for the other two brine concentrations.

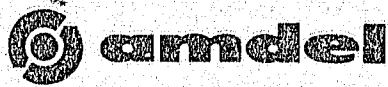
All resistivities were measured at room temperature and converted to a standard temperature of 25°C by use of the following equation developed by Hilchie:

$$R(T) = R(1) (T(1) + X)/T + X$$

and $X = 10^{(-0.340396 \log R(1) + 0.641427)}$

where:

- $R(T)$ is the water resistivity at temperature T
- T is the temperature in °C i.e. 25°C
- $R(1)$ is the water resistivity at temperature $T(1)$
- $T(1)$ is the initial temperature in °C.



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FORMATION RESISTIVITY FACTOR
AND RESISTIVITY INDEX

Company: South Australian Department of Mines and Energy

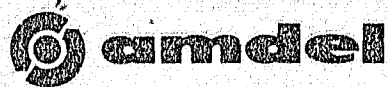
Well: Big Lake #2

Overburden Pressure 3955 psi (27288 kPa)
Saturant 25,000 ppm NaCl
Rw of saturant @ 25°C 0.24 ohm.m

Sample Number	Depth, feet	NOBP Permeability to air (md)	NOBP Porosity percent	Formation Resistivity Factor	Brine Saturation % pore space	Formation Resistivity Index
4	7457'0"	51.6	13.0	58.1	100	1.00
					72.3	1.95
					61.5	2.68
					51.0	3.99
					47.3	4.64
6	7464'6"	128	13.7	64.1	100	1.00
					79.6	1.62
					67.7	2.25
					53.9	3.66
					50.6	4.08
9	7472'0"	280	17.3	42.7	100	1.00
					79.6	1.64
					70.9	2.11
					63.8	2.67
					50.9	4.44
14	7483'10"	0.11	8.7	136.8	100	1.00
					86.0	1.34
					74.8	1.75
					69.9	2.01
					65.1	2.30
26	7581'1"	4.87	11.5	68.7	100	1.00
					74.0	1.76
					54.9	3.12
					43.5	4.85
					38.8	6.00

$$FF = \phi^{1.00/2.04}$$

$$Rt/Ro = Sw^{1.00/2.03}$$



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FORMATION RESISTIVITY FACTOR
AND RESISTIVITY INDEX

Company: South Australian Department of Mines and Energy

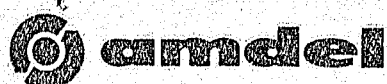
Well: Big Lake #2

Overburden Pressure 3955 psi (27288 kPa)
Saturant 10,000 ppm NaCl
Rw of saturant @ 25°C 0.542 ohm.m

Sample Number	Depth, feet	NOBP Permeability to air (md)	NOBP Porosity percent	Formation Resistivity Factor	Brine Saturation % pore space	Formation Resistivity Index
4	7457'0"	51.6	13.0	47.6	100	1.00
					75.6	1.72
					63.4	2.43
					57.7	2.90
					50.3	3.81
6	7464	128	13.7	47.6	100	1.00
					77.5	1.66
					63.3	2.48
					58.6	2.84
					49.3	4.08
9	7472'0"	280	17.3	31.7	100	1.00
					74.2	1.82
					62.2	2.59
					56.3	3.17
					44.7	5.03
14	7583'10"	0.11	8.7	76.1	100	1.00
					79.6	1.48
					63.6	2.19
					58.4	2.52
26	7581'1"	4.87	11.5	52.5	100	1.00
					73.9	1.70
					63.6	2.19
					58.4	2.56
					43.5	4.21

$$FF = \phi^{1.00/1.88}$$

$$Rt/Ro = Sw^{1.00/1.88}$$



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FORMATION RESISTIVITY FACTOR
AND RESISTIVITY INDEX

Company: South Australian Department of Mines and Energy

Well: Big Lake #2

Overburden Pressure 3955 psi (27288 kPa)
Saturant 5,420 ppm NaCl
Rw of saturant @ 25°C 1.07 ohm.m

Sample Number	Depth, feet	NOBP Permeability to air (md)	NOBP Porosity percent	Formation Resistivity Factor	Brine Saturation % pore space	Formation Resistivity Index
4	7457'0"	51.6	13.0	39.4	100	1.00
					72.3	1.84
					60.9	2.51
					55.2	3.04
					53.7	3.20
6	7464'6"	128	13.7	36.6	100	1.00
					69.9	1.96
					61.1	2.58
					54.6	3.18
					47.7	4.11
9	7472'0"	280	17.3	27.0	100	1.00
					72.4	1.76
					62.1	2.34
					57.2	2.66
					52.6	3.13
14	7583'10"	0.11	8.7	47.7	100	1.00
					75.6	1.59
					60.9	2.29
					52.1	2.87
					40.9	4.44
26	7581'1"	4.87	11.5	43.7	100	1.00
					70.5	1.77
					60.9	2.27
					56.3	2.58
					52.4	2.87

$$FF = \phi^{1.00/1.76}$$

$$Rt/Ro = Sw^{1.00/1.77}$$



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FORMATION RESISTIVITY FACTOR
AND RESISTIVITY INDEX

Company: South Australian Department of Mines and Energy

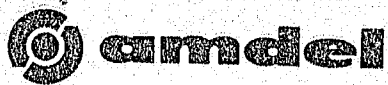
Well: Big Lake #2

Overburden Pressure 3955 psi (27288 kPa)
Saturant 2,000 ppm NaCl
Rw of saturant @ 25°C 2.60 ohm.m

Sample Number	Depth, feet	NOBP Permeability to air (md)	NOBP Porosity percent	Formation Resistivity Factor	Brine Saturation % pore space	Formation Resistivity Index
4	7457'0"	51.6	13.0	35.5	100	1.00
					72.4	1.77
					63.1	2.26
					58.8	2.55
					52.2	3.11
6	7464'6"	128	13.7	33.5	100	1.00
					73.4	1.78
					61.1	2.47
					54.7	3.03
					49.8	3.66
9	7472'0"	280	17.3	23.2	100	1.00
					72.5	1.71
					62.1	2.24
					55.7	2.67
					49.7	3.22
14	7583'10"	0.11	8.7	38.6	100	1.00
					83.1	1.31
					58.7	2.18
					48.1	2.90
26	7581'1"	4.87	11.5	37.5	100	1.00
					73.3	1.59
					68.3	1.77
					66.1	1.87
					54.7	2.46

$$FF = \phi^{1.65/1.76}$$

$$Rt/Ro = Sw^{1.65/1.68}$$



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CORE CONDUCTIVITY

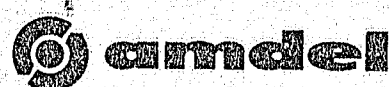
Company: South Australian Department of Mines & Energy
Well: Big Lake #2

Sample Number	NaCl Brine Concentration			
	2.5%	1.0%	0.54%	0.2%
Brine Conductivity mho.cm @ 25°C				
Core Conductivity mho.cm @ 25°C				
4	0.000717	0.000388	0.000237	0.000108
6	0.000650	0.000388	0.000255	0.000115
9	0.000976	0.000582	0.000346	0.000166
14	0.000281	0.000242	0.000196	0.000100
26	0.000607	0.000351	0.000214	0.000103

FORMATION RESISTIVITY FACTOR
AND CEMENTATION EXPONENT

Sample Number	Intercept on Brine Conductivity axis (mho.cm)	Formation Resistivity Factor*	Cementation Exponent ('m')
4	-0.00465	63.9	2.04
6	-0.00764	74.2	2.17
9	-0.00648	48.3	2.21
14	-0.03228	248.1	2.26
26	-0.00620	77.5	2.01

* Calculated from the slope of the regression line.



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FORMATION RESISTIVITY FACTOR
AND RESISTIVITY INDEX

Company: South Australian Department of Mines and Energy

Well: Big Lake #3

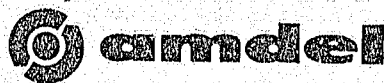
Overburden Pressure
Saturant
Rw of saturant @ 25°C

3955 psi (32345 kPa)
25,000 ppm NaCl
0.24 ohm.m

Sample Number	Depth, feet	NOBP Permeability to air (md)	NOBP Porosity percent	Formation Resistivity Factor	Brine Saturation % pore space	Formation Resistivity Index
4	8253'8"	0.023	7.6	176.3	100 82.1 76.4 70.2	1.00 1.48 1.70 2.02
5	8255'2"	0.064	8.4	153.4	100 75.8 66.1 60.1	1.00 1.72 2.27 2.73
8	8258'3"	0.313	7.4	192.6	100 77.8 70.0 66.3	1.00 1.66 2.04 2.28
10	8264'0"	47.7	14.5	52.8	100 70.8 58.3 50.6 41.0	1.00 2.04 3.03 4.08 6.14
13	8267'1"	40.8	13.9	54.1	100 72.4 65.8 56.2 45.9	1.00 1.96 2.38 3.27 4.97

$$FF = \phi^{1.00/2.03}$$

$$Rt/Ro = Sw^{1.00/2.02}$$



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FORMATION RESISTIVITY FACTOR
AND RESISTIVITY INDEX

Company: South Australian Department of Mines and Energy

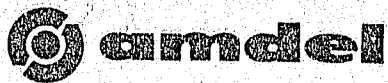
Well: Big Lake #3

Overburden Pressure 4688 psi (32345 kPa)
Saturant 10,000 ppm NaCl
Rw of saturant @ 25°C 0.542 ohm.m

Sample Number	Depth, feet	NOBP Permeability to air (md)	NOBP Porosity percent	Formation Resistivity Factor	Brine Saturation % pore space	Formation Resistivity Index
2	8253'8"	0.023	7.6	123.2	100 77.8 65.9	1.00 1.58 2.14
5	8255'2"	0.064	8.4	106.4	100 73.4 64.8 60.5	1.00 1.77 2.22 2.53
8	8258'3"	0.313	7.4	127.8	100 76.7 71.1 65.8	1.00 1.64 1.89 2.18
10	8265'0"	47.7	14.5	44.0	100 68.3 62.2 53.7 44.6	1.00 2.06 2.46 3.27 4.66
13	8267'1"	40.8	13.9	46.1	100 77.5 66.1 59.3 48.8	1.00 1.66 2.28 2.85 4.18

$$FF = \phi^{1.00/1.00}$$

$$Rt/Ro = Sw^{1.00/1.00}$$



00100

FORMATION RESISTIVITY FACTOR
AND RESISTIVITY INDEX

Company: South Australian Department of Mines and Energy

Well: Big Lake #3

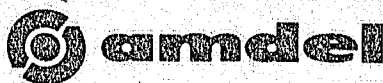
Overburden Pressure
Saturant
Rw of saturant @ 25°C

4688 psi (32345 kPa)
5,420 ppm NaCl
1.07 ohm.m

Sample Number	Depth, feet	NOBP Permeability to air (md)	NOBP Porosity percent	Formation Resistivity Factor	Brine Saturation % pore space	Formation Resistivity Index
2	8253' 8"	0.023	7.6	86.7	100	1.00
					78.1	1.52
					71.2	1.78
					66.3	2.00
5	8255' 2"	0.064	8.4	77.8	100	1.00
					82.8	1.38
					76.1	1.59
					68.0	1.93
8	8258' 3"	0.313	7.4	92.6	100	1.00
					82.3	1.40
					76.4	1.58
					71.4	1.79
10	8264' 0"	47.7	14.5	37.2	100	1.00
					72.4	1.82
					61.1	2.47
					57.9	2.74
13	8267' 1"	40.8	13.9	37.2	100	1.00
					77.1	1.61
					65.6	2.17
					62.7	2.34
					53.4	3.17

$$FF = \phi^{1.00/1.78}$$

$$Rt/Ro = Sw^{1.00/1.78}$$



00156

FORMATION RESISTIVITY FACTOR
AND RESISTIVITY INDEX

Company: South Australian Department of Mines and Energy

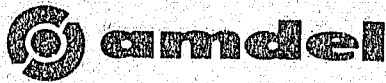
Well: Big Lake #3

Overburden Pressure 4688 psi (32345 kPa)
Saturant 2,000 ppm NaCl
Rw of saturant @ 25°C 2.60 ohm.m

Sample Number	Depth, feet	NOBP Permeability to air (md)	NOBP Porosity percent	Formation Resistivity Factor	Brine Saturation % pore space	Formation Resistivity Index
2	8253'8"	0.023	7.6	59.5	100	1.00
					79.2	1.44
					70.8	1.70
					65.3	1.93
5	8255'2"	0.064	8.4	55.5	100	1.00
					74.4	1.62
					68.7	1.81
					60.5	2.26
8	8258'3"	0.313	7.4	73.3	100	1.00
					77.5	1.53
					71.9	1.72
					65.4	2.01
10	8264'0"	47.7	14.5	31.1	100	1.00
					73.6	1.73
					65.7	2.11
					58.0	2.64
13	8267'1"	40.8	13.9	31.0	49.2	3.42
					100	1.00
					74.6	1.68
					67.1	2.02
					60.3	2.46
					52.9	3.09

$$FF = \phi^{1.00/1.68}$$

$$Rt/Ro = Sw^{1.00/1.68}$$



00157

CORE CONDUCTIVITY

Company: South Australian Department of Mines & Energy

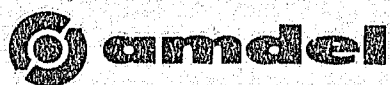
Well: Big Lake #3

Sample Number	NaCl Brine Concentration			
	2.5%	1.0%	0.54%	0.2%
	Brine Conductivity mho.cm @ 25°C			
	0.042	0.018	0.010	0.004
Core Conductivity mho.cm @ 25°C				
2	0.000236	0.000150	0.000108	0.000065
5	0.000272	0.000173	0.000120	0.000069
8	0.000216	0.000144	0.000101	0.000052
10	0.000789	0.000419	0.000251	0.000124
13	0.000770	0.000400	0.000251	0.000124

FORMATION RESISTIVITY FACTOR
AND CEMENTATION EXPONENT

Sample Number	Intercept on Brine Conductivity axis (mho.cm)	Formation Resistivity Factor*	Cementation Exponent (m')
2	-0.01382	231.5	2.11
5	-0.01239	194.9	2.13
8	-0.01308	246.3	2.11
10	-0.00445	58.0	2.10
13	-0.00460	59.8	2.07

* Calculated from the slope of the regression line.



00158

FORMATION RESISTIVITY FACTOR
AND RESISTIVITY INDEX

Company: South Australian Department of Mines and Energy

Well: Big Lake #32

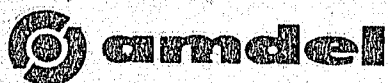
Overburden Pressure
Saturant
Rw of saturant @ 25°C

4870 psi (33607 kPa)
25,000 ppm NaCl
0.24 ohm.m

Sample Number	Depth, feet	NOBP Permeability to air (md)	NOBP Porosity percent	Formation Resistivity Factor	Brine Saturation % pore space	Formation Resistivity Index
2	9367'0"	0.645	11.3	88.8	100	1.00
					62.7	2.46
					55.8	3.08
					48.7	3.96
					40.4	5.65
4	9378'11"	1.00	10.5	120.3	100	1.00
					78.7	1.60
					68.2	2.12
					52.7	3.49
					44.6	4.83
6	9389'10"	2.62	13.2	72.5	100	1.00
					81.1	1.46
					78.7	1.55
					62.7	2.35
					53.1	3.16
8	9402'1"	1.84	11.5	90.1	100	1.00
					82.2	1.47
					66.1	2.25
					58.6	2.84
					53.6	3.35
9	9413'6"	17.9	14.6	55.3	100	1.00
					63.2	2.48
					57.3	3.00
					48.3	4.25
					40.2	6.11

$$FF = \phi^{1.00/2.16}$$

$$Rt/Ro = SW^{1.00/1.93}$$



00159

FORMATION RESISTIVITY FACTOR
AND RESISTIVITY INDEX

Company: South Australian Department of Mines and Energy

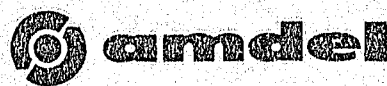
Well: Big Lake #32

Overburden Pressure 4870 psi (33607 kPa)
Saturant 10,000 ppm NaCl
Rw of saturant @ 25°C 0.542 ohm.m

Sample Number	Depth, feet	NOBP Permeability to air (md)	NOBP Porosity percent	Formation Resistivity Factor	Brine Saturation % pore space	Formation Resistivity Index
2	9367' 0"	0.645	11.3	71.0	100	1.00
					80.9	1.47
					73.0	1.77
					65.4	2.16
					57.7	2.71
4	9378' 11"	1.00	10.5	63.1	100	1.00
					73.9	1.69
					61.8	2.30
					32.3	7.02
6	9389' 10"	2.62	13.2	68.0	100	1.0
					68.7	1.95
					62.7	2.28
					53.1	3.08
					46.2	3.84
8	9402' 1"	1.84	11.5	72.1	100	1.00
					73.4	1.78
					69.9	1.96
					60.5	2.53
					55.4	3.02
9	9413' 6"	17.9	14.6	45.3	100	1.00
					73.4	1.78
					60.5	2.55
					55.4	3.02
					48.9	3.81

$$FF = \phi^{1.00/1.87}$$

$$Rt/Ro = Sw^{1.00/1.81}$$



00160

FORMATION RESISTIVITY FACTOR
AND RESISTIVITY INDEX

Company: South Australian Department of Mines and Energy

Well: Big Lake #32

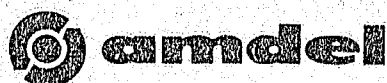
Overburden Pressure
Saturant
Rw of saturant @ 25°C

4870 psi (33067 kPa)
5,420 ppm NaCl
1.07 ohm.m

Sample Number	Depth, feet	NOBP Permeability to air (md)	NOBP Porosity percent	Formation Resistivity Factor	Brine Saturation % pore space	Formation Resistivity Index
2	9367'0"	0.645	11.3	50.7	100	1.00
					79.6	1.50
					63.7	2.17
					58.4	2.52
					47.2	3.73
4	9379'11"	1.00	10.5	56.6	100	1.00
					70.5	1.79
					64.7	2.05
					56.3	2.58
					50.2	3.13
6	9389'10"	2.62	13.2	42.8	100	1.00
					77.4	1.53
					64.7	2.05
					57.2	2.53
					50.7	3.11
8	9402'1"	1.84	11.5	47.9	100	1.00
					68.4	1.86
					60.9	2.27
					52.4	2.90
					48.1	3.34
9	9413'6"	17.9	14.6	35.5	100	1.00
					71.1	1.82
					63.7	2.20
					56.6	2.70
					47.2	3.79

$$FF = \phi^{1.55/1.82}$$

$$Rt/Ro = Sw^{1.55/1.82}$$



00161

FORMATION RESISTIVITY FACTOR
AND RESISTIVITY INDEX

Company: South Australian Department of Mines and Energy

Well: Big Lake #32

Overburden Pressure
Saturant
Rw of saturant @ 25°C

4870 psi (33067 kPa)
2,000 ppm NaCl
2.60 ohm.m

Sample Number	Depth, feet	NOBP Permeability to air (md)	NOBP Porosity percent	Formation Resistivity Factor	Brine Saturation % pore space	Formation Resistivity Index
2	9367'0"	0.645	11.3	41.4	100	1.00
					70.5	1.78
					64.7	2.05
					55.6	2.61
					49.3	3.20
4	9378'11"	1.00	10.5	39.2	100	1.00
					72.6	1.62
					63.0	2.01
					59.1	2.23
					43.6	3.46
6	9389'10"	2.62	13.2	35.8	100	1.00
					74.1	1.61
					68.7	1.81
					60.5	2.22
					55.5	2.56
8	9402'1"	1.84	11.5	40.8	100	1.00
					76.9	1.53
					69.5	1.80
					62.3	2.16
					55.6	2.59
9	9413'6"	17.9	14.6	30.8	100	1.00
					60.4	2.36
					57.3	2.58
					42.4	4.28
					39.2	4.92

$$FF = \phi^{1.00/1.72}$$

$$Rt/Ro = Sw^{1.00/1.61}$$



00162

CORE CONDUCTIVITY

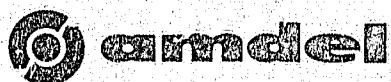
Company: South Australian Department of Mines & Energy
Well: Big Lake #32

Sample Number	NaCl Brine Concentration			
	2.5%	1.0%	0.54%	0.2%
	Brine Conductivity mho.cm @ 25°C			
	0.042	0.018	0.010	0.004
Core Conductivity mho.cm @ 25°C				
2	0.000469	0.000260	0.000184	0.000093
4	0.000346	0.000294	0.000173	0.000098
6	0.000575	0.000271	0.000218	0.000107
8	0.000462	0.000256	0.000195	0.000094
9	0.000753	0.000407	0.000263	0.000125

FORMATION RESISTIVITY FACTOR
AND CEMENTATION EXPONENT

Sample Number	Intercept on Brine Conductivity axis (mho.cm)	Formation Resistivity Factor*	Cementation Exponent (m')
2	-0.00782	104.6	2.13
4	-0.01884	163.9	2.26
6	-0.00601	83.8	2.19
8	-0.00877	108.3	2.17
9	-0.00554	62.1	2.14

* Calculated from the slope of the regression line.



00163

FORMATION RESISTIVITY FACTOR
AND RESISTIVITY INDEX

Company: South Australian Department of Mines and Energy

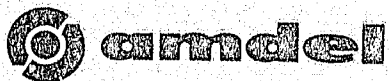
Well: Big Lake #35

Overburden Pressure 4820 psi (33255 kPa)
Saturant 25,000 ppm NaCl
Rw of saturant @ 25°C 0.24 ohm.m

Sample Number	Depth, feet	NOBP Permeability to air (md)	NOBP Porosity percent	Formation Resistivity Factor	Brine Saturation % pore space	Formation Resistivity Index
1	9215'1"	0.085	7.2	175.9	100 82.5 75.3 70.2	1.00 1.42 1.67 1.88
5	9220'7"	0.030	7.1	177.8	100 70.4 64.7 58.7 51.3	1.00 1.92 2.26 2.70 3.48
8	9223'10"	0.081	8.4	135.3	100 68.3 62.2 53.7	1.00 2.06 2.46 3.27
9	9225'6"	0.057	7.1	164.3	100 79.6 72.4 66.9	1.00 1.54 1.84 2.11
10	9226'8"	0.049	7.6	132.8	100 73.4 69.3 60.5	1.00 1.78 1.97 2.53

$$FF = \phi^{1.00/1.85}$$

$$Rt/Ro = Sw^{1.00/1.85}$$



00164

FORMATION RESISTIVITY FACTOR
AND RESISTIVITY INDEX

Company: South Australian Department of Mines and Energy

Well: Big Lake #35

Overburden Pressure
Saturant
Rw of saturant @ 25°C

4830 psi (33255 kPa)
10,000 ppm NaCl
0.542 ohm.m

Sample Number	Depth, feet	NOBP Permeability to air (md)	NOBP Porosity percent	Formation Resistivity Factor	Brine Saturation % pore space	Formation Resistivity Index
1	9215'1"	0.085	7.2	146.2	100 70.2 60.1	1.00 1.88 2.44
5	9220'7"	0.030	7.1	134.9	100 83.5 70.2 61.4	1.00 1.38 1.88 2.40
8	9223'10"	0.081	8.4	99.5	100 73.6 65.7 58.3	1.00 1.73 2.11 2.63
9	9225'6"	0.057	7.1	120.7	100 87.6 74.3	1.00 1.26 1.67
10	9226'8"	0.049	7.6	106.3	100 75.9 72.8 65.3	1.00 1.60 1.71 2.06

$$FF = \phi^{1.00/1.64}$$

$$Rt/Ro = Sw^{1.66/1.75}$$



00163

FORMATION RESISTIVITY FACTOR
AND RESISTIVITY INDEX

Company: South Australian Department of Mines and Energy

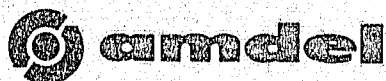
Well: Big Lake #35

Overburden Pressure 4820 psi (33255 kPa)
Saturant 5,420 ppm NaCl
Rw of saturant @ 25°C 1.07 ohm.m

Sample Number	Depth, feet	NOBP Permeability to air (md)	NOBP Porosity percent	Formation Resistivity Factor	Brine Saturation % pore space	Formation Resistivity Index
1	9215'1"	0.085	7.2	108.6	100	1.00
					73.1	1.70
					68.6	1.90
					61.4	2.26
5	9220'7"	0.030	7.1	81.0	100	1.00
					72.4	1.68
					63.9	2.03
					55.4	2.55
8	9223'10"	0.081	8.4	74.5	100	1.00
					70.8	1.75
					66.6	1.94
					58.9	2.36
9	9225'6"	0.057	7.1	84.1	100	1.00
					80.2	1.42
					76.4	1.52
					73.7	1.62
10	9226'8"	0.049	7.6	89.0	70.9	1.72
					100	1.00
					68.4	1.86
					60.9	2.26

$$FF = \phi^{1.00/1.72}$$

$$Rt/Ro = Sw^{1.00/1.62}$$



00168

FORMATION RESISTIVITY FACTOR
AND RESISTIVITY INDEX

Company: South Australian Department of Mines and Energy

Well: Big Lake #35

Overburden Pressure 4820 psi (33255 kPa)
Saturant 2,000 ppm NaCl
RW of saturant @ 25°C 2.60 ohm.m

Sample Number	Depth, feet	NOBP Permeability to air (md)	NOBP Porosity percent	Formation Resistivity Factor	Brine Saturation % pore space	Formation Resistivity Index
2	9215' 1"	0.85	7.2	84.1	100 72.4 63.9	1.00 1.66 2.03
5	9220' 7"	0.030	7.1	65.9	100 68.3 64.7 54.7	1.00 1.76 1.90 2.46
8	9223' 10"	0.081	8.4	60.6	100 85.9 73.7 60.4 58.7	1.00 1.27 1.61 2.17 2.29
9	9225' 6"	0.057	7.1	70.5	100 83.1 73.5 58.7	1.00 1.31 1.57 2.18
10	8226' 8"	0.049	7.6	67.4	100 80.2 73.7 66.2	1.00 1.40 1.61 1.90

$$FF = \phi^{1.00/1.83}$$

$$Rt/Ro = Sw^{1.00/1.82}$$



00167

CORE CONDUCTIVITY

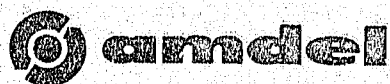
Company: South Australian Department of Mines & Energy
Well: Big Lake #35

Sample Number	NaCl Brine Concentration			
	2.5%	1.0%	0.54%	0.2%
Brine Conductivity mho.cm @ 25°C				
Core Conductivity mho.cm @ 25°C				
1	0.000237	0.000126	0.000086	0.000046
5	0.000234	0.000137	0.000121	0.000058
8	0.000308	0.000185	0.000125	0.000063
9	0.000254	0.000153	0.000111	0.000055
10	0.000314	0.000174	0.000105	0.000057

FORMATION RESISTIVITY FACTOR
AND CEMENTATION EXPONENT

Sample Number	Intercept on Brine Conductivity axis (mho.cm)	Formation Resistivity Factor*	Cementation Exponent (m')
1	-0.00665	203.3	2.02
5	-0.01374	234.7	2.06
8	-0.00900	161.6	2.05
9	-0.01031	201.2	2.01
10	-0.00585	149.9	1.94

* Calculated from the slope of the regression line.



00168

FORMATION RESISTIVITY FACTOR
AND RESISTIVITY INDEX

Company: South Australian Department of Mines and Energy

Well: Dirkaia #2

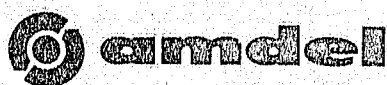
Overburden Pressure
Saturant
Rw of saturant @ 25°C

3437 psi (23717 kPa)
25,000 ppm NaCl
0.24 ohm.m

Sample Number	Depth, feet	NOBP Permeability to air (md)	NOBP Porosity percent	Formation Resistivity Factor	Brine Saturation % pore space	Formation Resistivity Index
1	6200'5"	47.1	20.2	26.8	100	1.00
					62.2	2.68
					52.8	3.76
					51.0	4.07
					48.6	4.42
2	6200'8"	34.1	19.4	30.1	100	1.00
					67.9	2.23
					55.2	3.45
					53.0	3.77
					51.7	3.96
3	6203'6"	15.1	17.5	32.1	100	1.00
					84.8	1.46
					69.7	2.15
					65.6	2.40
					60.9	2.82

FF = $\phi^{1.00/2.04}$

Rt/Ro = $S_w^{1.00/2.10}$



00169

FORMATION RESISTIVITY FACTOR
AND RESISTIVITY INDEX

Company: South Australian Department of Mines and Energy

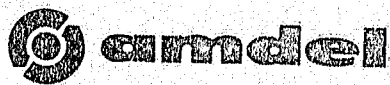
Well: Dirkala #2

Overburden Pressure 3437 psi (23717 kPa)
Saturant 10,000 ppm NaCl
Rw of saturant @ 25°C 0.542 ohm.m

Sample Number	Depth, feet	NOBP Permeability to air (md)	NOBP Porosity percent	Formation Resistivity Factor	Brine Saturation % pore space	Formation Resistivity Index
1	6200'5"	47.1	20.2	16.5	100	1.00
					70.1	1.95
					54.8	3.07
					47.3	4.03
					40.2	5.50
2	6200'8"	34.1	19.4	19.1	100	1.00
					70.4	1.93
					62.8	2.40
					53.9	3.20
					35.9	6.80
3	6203'6"	15.1	17.5	21.0	100	1.00
					80.5	1.49
					70.8	1.88
					52.8	3.22
					46.3	4.12

$$FF = \phi^{1.00/1.77}$$

$$Rt/Ro = Sw^{1.00/1.88}$$



00170

FORMATION RESISTIVITY FACTOR
AND RESISTIVITY INDEX

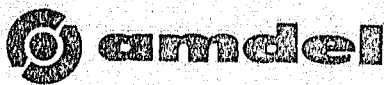
Company: South Australian Department of Mines and Energy
Well: Dirkala #2

Overburden Pressure 3437 psi (23717 kPa)
Saturant 5,420 ppm NaCl
Rw of saturant @ 25°C 1.07 ohm.m

Sample Number	Depth, feet	NOBP Permeability to air (md)	NOBP Porosity percent	Formation Resistivity Factor	Brine Saturation % pore space	Formation Resistivity Index
1	6200' 5"	47.1	20.2	13.7	100	1.00
					68.7	1.94
					59.4	2.51
					50.3	3.39
					44.4	4.22
2	6200' 8"	34.1	19.4	14.5	100	1.00
					67.5	1.95
					53.8	2.86
					47.2	3.61
					41.0	4.68
3	6203' 6"	15.1	17.5	17.7	100	1.00
					78.3	1.53
					72.2	1.75
					64.8	2.11
					50.3	3.26

$$FF = \phi^{1.00/1.64}$$

$$Rt/Ro = Sw^{1.00/1.74}$$



00171

FORMATION RESISTIVITY FACTOR
AND RESISTIVITY INDEX

Company: South Australian Department of Mines and Energy

Well: Dirkala #2

Overburden Pressure 3437 psi (23717 kPa)
Saturant 2,000 ppm NaCl
Rw of saturant @ 25°C 2.60 ohm.m

Sample Number	Depth, feet	NOBP Permeability to air (md)	NOBP Porosity percent	Formation Resistivity Factor	Brine Saturation % pore space	Formation Resistivity Index
1	6200' 5"	47.1	20.2	12.5	100	1.00
					65.7	2.02
					57.1	2.56
					52.2	2.97
					47.4	3.48
2	6200' 8"	34.1	19.4	13.0	100	1.00
					66.6	1.94
					58.9	2.36
					51.7	2.96
					44.8	3.74
3	6203' 6"	15.1	17.5	14.9	100	1.00
					76.9	1.53
					69.5	1.79
					61.0	2.21
					55.6	2.57

$$FF = \phi^{1.00/1.56}$$

$$Rt/Ro = Sw^{1.56/1.54}$$



00172

CORE CONDUCTIVITY

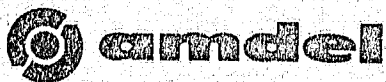
Company: South Australian Department of Mines & Energy
Well: Dirkala #2

Sample Number	NaCl Brine Concentration			
	2.5%	1.0%	0.54%	0.2%
	Brine Conductivity mho.cm @ 25°C			
	0.042	0.018	0.010	0.004
Core Conductivity mho.cm @ 25°C				
1	0.001555	0.001118	0.000682	0.000308
2	0.001384	0.000966	0.000645	0.000296
3	0.001298	0.000879	0.000528	0.000258

FORMATION RESISTIVITY FACTOR
AND CEMENTATION EXPONENT

Sample Number	Intercept on Brine Conductivity axis (mho.cm)	Formation Resistivity Factor*	Cementation Exponent (m')
1	-0.01123	32.5	2.18
2	-0.01235	37.5	2.21
3	-0.00983	38.2	2.09

* Calculated from the slope of the regression line.



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FORMATION RESISTIVITY FACTOR
AND RESISTIVITY INDEX

Company: South Australian Department of Mines and Energy

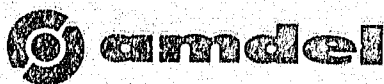
Well: Garanjanie #2

Overburden Pressure 3610 psi (24910 kPa)
Saturant 25,000 ppm NaCl
Rw of saturant @ 25°C 0.24 ohm.m

Sample Number	Depth, feet	NOBP Permeability to air (md)	NOBP Porosity percent	Formation Resistivity Factor	Brine Saturation % pore space	Formation Resistivity Index
1	6607'6"	2216	22.6	18.7	100	1.00
					60.5	2.70
					32.2	9.38
					20.2	24.25
					16.2	35.04
4	6633'1"	0.020	10.4	58.2	100	1.00
					70.4	1.92
					64.7	2.26
					59.1	2.66
					50.3	3.60
5	6633'6"	0.006	6.4	140.5	100	1.00
					85.2	1.38
					79.6	1.54
					72.4	1.84
9	6637'2"	0.149	12.3	44.5	100	1.00
					78.8	1.60
					72.8	1.84
					66.3	2.19
					60.2	2.65

$$FF = \phi^{1.60/1.88}$$

$$Rt/Ro = Sw^{1.60/1.88}$$



00174

FORMATION RESISTIVITY FACTOR
AND RESISTIVITY INDEX

Company: South Australian Department of Mines and Energy

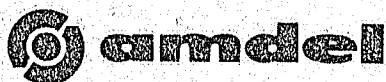
Well: Garanjanie #2

Overburden Pressure 3610 psi (24910 kPa)
Saturant 10,000 ppm NaCl
Rw of saturant @ 25°C 0.542 ohm.m

Sample Number	Depth, feet	NOBP Permeability to air (md)	NOBP Porosity percent	Formation Resistivity Factor	Brine Saturation % pore space	Formation Resistivity Index
1	6607'6"	2216	22.6	14.2	100	1.00
					53.4	3.04
					38.8	5.35
					21.8	14.60
					15.5	25.66
4	6633'1"	0.020	10.4	48.0	100	1.00
					82.1	1.41
					73.6	1.70
					66.2	2.04
					59.2	2.49
5	6633'6"	0.006	6.4	115.3	100	1.00
					83.8	1.38
					76.9	1.60
9	6637'2"	0.149	12.3	40.0	100	1.00
					82.5	1.45
					70.2	1.88
					64.9	2.17
					61.4	2.40

$$FF = \phi^{1.00/1.76}$$

$$Rt/Ro = Sw^{1.00/1.76}$$



00173

FORMATION RESISTIVITY FACTOR
AND RESISTIVITY INDEX

Company: South Australian Department of Mines and Energy

Well: Garanjanie #2

Overburden Pressure
Saturant
Rw of saturant @ 25°C

3610 psi (24910 kPa)
5,420 ppm NaCl
1.07 ohm.m

Sample Number	Depth, feet	NOBP Permeability to air (md)	NOBP Porosity percent	Formation Resistivity Factor	Brine Saturation % pore space	Formation Resistivity Index
1	6607'6"	2216	22.6	10.8	100	1.00
					62.7	2.15
					51.1	2.98
					43.3	3.91
					30.8	6.89
4	6633'1"	0.020	10.4	35.6	100	1.00
					77.8	1.50
					73.3	1.66
					65.7	2.00
					58.4	2.40
5	6633'6"	0.006	6.4	76.2	100	1.00
					86.6	1.28
					74.3	1.67
9	6637'2"	0.149	12.3	27.3	100	1.00
					80.5	1.44
					73.1	1.70
					68.6	1.87
					61.4	2.24

$$FF = \phi^{1.00/1.59}$$

$$Rt/Ro = Sw^{1.00/1.60}$$



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FORMATION RESISTIVITY FACTOR
AND RESISTIVITY INDEX

Company: South Australian Department of Mines and Energy

Well: Garanjanie #2

Overburden Pressure
Saturant
Rw of saturant @ 25°C

3610 psi (24910 kPa)
2,000 ppm NaCl
2.60 ohm.m

Sample Number	Depth, feet	NOBP Permeability to air (md)	NOBP Porosity percent	Formation Resistivity Factor	Brine Saturation % pore space	Formation Resistivity Index
1	6607'6"	2216	22.6	8.9	100 58.7 47.9 41.6 28.3	1.00 2.23 3.06 3.80 6.71
4	6633'1"	0.020	10.4	26.5	100 76.9 70.3 64.4 53.4	1.00 1.49 1.70 1.96 2.60
5	6633'6"	0.006	6.4	48.1	100 85.9 80.2 73.7	1.00 1.27 1.42 1.61
9	6637'2"	0.149	12.3	23.3	100 72.4 63.9 55.4	1.00 1.67 2.04 2.56

$$FF = \phi^{1.60/1.46}$$

$$Rt/Ro = Sw^{1.60/1.65}$$



00177

CORE CONDUCTIVITY

Company: South Australian Department of Mines & Energy

Well: Garanjanie #2

NaCl Brine Concentration

2.5%	1.0%	0.54%	0.2%
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Brine Conductivity mho.cm @ 25°C

0.042	0.018	0.010	0.004
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Sample Number

Core Conductivity mho.cm @ 25°C

1	0.002228	0.001299	0.000865	0.000432
4	0.000716	0.000384	0.000263	0.000145
5	0.000297	0.000160	0.000123	0.000080
9	0.000936	0.000461	0.000342	0.000165

FORMATION RESISTIVITY FACTOR
AND CEMENTATION EXPONENT

Sample Number	Intercept on Brine Conductivity axis (mho.cm)	Formation Resistivity Factor*	Cementation Exponent (m')
1	-0.00794	21.9	2.08
4	-0.00710	67.9	1.86
5	-0.01085	177.9	1.88
9	-0.00564	50.7	1.87

* Calculated from the slope of the regression line.



00178

FORMATION RESISTIVITY FACTOR
AND RESISTIVITY INDEX

Company: South Australian Department of Mines and Energy

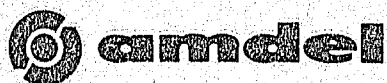
Well: Moomba #47

Overburden Pressure 4060 psi (28000 kPa)
Saturant 25,000 ppm NaCl
Rw of saturant @ 25°C 0.24 ohm.m

Sample Number	Depth, feet	NOBP Permeability to air (md)	NOBP Porosity percent	Formation Resistivity Factor	Brine Saturation % pore space	Formation Resistivity Index
3	8226'6"	15.0	13.8	55.8	100	1.00
					76.1	1.73
					63.2	2.52
					57.3	3.00
					48.3	4.33
5	8229'1"	97.6	16.4	41.4	100	1.00
					75.4	1.81
					67.3	2.30
					62.4	2.70
					55.4	3.47
7	8231'0"	23.5	12.3	71.2	100	1.00
					74.4	1.76
					67.8	2.09
					57.3	2.92
					53.6	3.35
8	8233'0"	0.183	8.6	157.4	100	1.00
					73.0	1.89
					62.2	2.59
					56.3	3.17
					47.5	4.40
10	8236'6"	0.003	5.1	283.7	100	1.00
					62.7	2.28
					53.1	3.08

$$FF = \phi^{1.00/2.02}$$

$$Rt/Ro = Sw^{1.00/1.88}$$



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FORMATION RESISTIVITY FACTOR
AND RESISTIVITY INDEX

Company: South Australian Department of Mines and Energy

Well: Moomba #47

Overburden Pressure
Saturant
Rw of saturant @ 25°C

4060 psi (28000 kPa)
10,000 ppm NaCl
0.542 ohm.m

Sample Number	Depth, feet	NOBP Permeability to air (md)	NOBP Porosity percent	Formation Resistivity Factor	Brine Saturation % pore space	Formation Resistivity Index
3	8226'6"	15.0	13.8	48.3	100	1.00
					74.1	1.77
					66.2	2.18
					53.5	3.28
					44.8	4.62
5	8229'1"	97.6	16.4	35.7	100	1.00
					62.7	2.44
					55.8	3.05
					40.4	5.63
					26.2	13.04
7	8231'0"	23.5	12.3	57.5	100	1.00
					61.2	2.42
					52.7	3.21
					44.2	4.38
					37.4	5.88
8	8233'0"	0.183	8.6	106.2	100	1.00
					71.1	1.85
					63.7	2.24
					52.0	3.21
					47.2	3.83
10	8236'6"	0.003	5.1	203.2	100	1.00
					77.4	1.53
					68.3	1.88
					57.2	2.53

$$FF = \phi^{1.00/1.81}$$

$$Rt/Ro = Sw^{1.00/1.82}$$



00180

FORMATION RESISTIVITY FACTOR
AND RESISTIVITY INDEX

Company: South Australian Department of Mines and Energy

Well: Moomba #47

Overburden Pressure
Saturant
Rw of saturant @ 25°C

4060 psi (28000 kPa)
5,420 ppm NaCl
1.07 ohm.m

Sample Number	Depth, feet	NOBP Permeability to air (md)	NOBP Porosity percent	Formation Resistivity Factor	Brine Saturation % pore space	Formation Resistivity Index
3	8226'6"	15.0	13.8	41.3	100	1.00
					86.6	1.28
					70.8	1.82
					63.6	2.19
					57.3	2.61
5	8229'1"	97.6	16.4	31.7	100	1.00
					79.6	1.48
					62.1	2.27
					58.4	2.52
					43.5	4.14
7	8231'0"	23.5	12.3	47.6	100	1.00
					72.8	1.71
					55.4	2.70
					52.0	3.03
					48.3	3.48
8	8233'0"	0.183	8.6	87.3	100	1.00
					70.5	1.77
					64.7	2.03
					56.3	2.58
					49.3	3.20
10	8236'6"	0.003	5.1	164.3	100	1.00
					72.6	1.62
					63.0	2.01

$$FF = \phi^{1.00/1.83}$$

$$Rt/Ro = Sw^{1.00/1.67}$$



00181

FORMATION RESISTIVITY FACTOR
AND RESISTIVITY INDEX

Company: South Australian Department of Mines and Energy

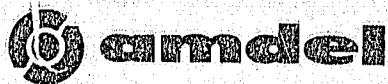
Well: Moomba #47

Overburden Pressure
Saturant
Rw of saturant @ 25°C4060 psi (28000 kPa)
2,000 ppm NaCl
2.60 ohm.m

Sample Number	Depth, feet	NOBP Permeability to air (md)	NOBP Porosity percent	Formation Resistivity Factor	Brine Saturation % pore space	Formation Resistivity Index
3	8226'6"	15.0	13.8	35.5	100	1.00
					84.4	1.30
					74.3	1.58
					65.8	1.90
					61.7	2.11
5	8229'1"	97.6	16.4	27.2	100	1.00
					78.0	1.48
					74.8	1.54
					59.1	2.23
					43.6	3.46
7	8231'0"	23.5	12.3	40.7	100	1.00
					58.7	2.18
					48.1	2.90
					41.2	3.58
					38.8	4.04
8	8233'0"	0.183	8.6	69.3	100	1.00
					73.3	1.59
					69.0	1.74
					66.1	1.83
					58.2	2.25
10	8236'6"	0.003	5.1	123.5	100	1.00
					83.1	1.31
					74.4	1.53
					68.3	1.74

$$FF = \phi^{1.00/1.78}$$

$$Rt/Ro = SW^{1.00/1.49}$$



00182

CORE CONDUCTIVITY

Company: South Australian Department of Mines & Energy
Well: Moomba #47

Sample Number	NaCl Brine Concentration			
	2.5%	1.0%	0.54%	0.2%
	Brine Conductivity mho.cm @ 25°C			
	0.042	0.018	0.010	0.004
Core Conductivity mho.cm @ 25°C				
3	0.000747	0.000382	0.000226	0.000108
5	0.001006	0.000517	0.000265	0.000141
7	0.000585	0.000321	0.000196	0.000095
8	0.000265	0.000174	0.000107	0.000056
10	0.000147	0.000091	0.000057	0.000031

FORMATION RESISTIVITY FACTOR
AND CEMENTATION EXPONENT

Sample Number	Intercept on Brine Conductivity axis (mho.cm)	Formation Resistivity Factor*	Cementation Exponent (m')
3	-0.00351	60.2	2.07
5	-0.00322	44.3	2.10
7	-0.00520	79.2	2.09
8	-0.00994	189.0	2.14
10	-0.00900	337.8	1.96

* Calculated from the slope of the regression line.

END

OF

REPORT