W970. IONA-1. W.C.R. VOL 2 OF 2.

BEACH PETROLEUM N.L.

(Incorporated in South Australia)

PEP 108
OTWAY BASIN

IONA NO. 1

WELL COMPLETION REPORT
APPENDICES

BY
A. BUFFIN
OCTOBER
1988

APPENDIX 6

VITRINITE REFLECTANCE - TOC

IONA NO. 1

KK No.	Depth (m)	TOC
x8277	1240	1.10%
x8278	1287	0.73%
x8279	1383	0.30%
x8280	1423	0.34%
x8281	1481	0.24%

K.K. No.	Depth (m)	$\bar{R}_v max$	Range	N	Description Including Exinite Fluorescence
					Belfast Mudstone
x8277	1240 SWC 22	0.43	0.30-0.54	15	Sparse phytoplankton and liptodetrinite, greenish yellow and yellow to orange, rare ?Botryococcus related telalginite, bright yellow. (Glauconitic claystone. Dom abundant, I>E>V. Inertinite common, exinite and vitrinite sparse. Diffuse organic matter common. Glauconite dominant. Iron oxide rare. Pyrite abundant, mostly framboidal.)
					Waarre Formation
x8278	1287 SWC 18	0.44	0.32-0.56	26	Rare phytoplankton, greenish yellow and yellow to orange, rare sporinite, yellow. (Carbonate>calcareous claystone>>glauconitic claystone. Dom common, I>V>E. Inertinite common, vitrinite sparse, exinite rare. Glauconite rare. Iron oxide common. Carbonate has isolated saccharoidal texture. Pyrite sparse to common.)
					Eumeralla Formation
x8279	1383 SWC 8	0.42	0.40-0.46	6	Rare to spare phytoplankton and liptodetrinite, greenish yellow and yellow to orange, rare sporinite, yellow, rare resinite, green. (Claystone>calcareous sandstone>coal. Coal rare, V. Vitrite. Dom spare to common, I>E>V. Inertinite and exinite sparse, vitrinite rare. Inertinite consists of very fine inertodetrinite. Iron oxide rare. Pyrite major.)
x8280	1423 SWC 4	0.41	0.33-0.48	27	Rare phytoplankton and liptodetrinite, greenish yellow and yellow to orange, rare cutinite, yellow. (Siltstone>>coal. Coal sparse, V. Vitrite. Dom common, V>I>E. Vitrinite sparse to common, inertinite sparse, exinite rare to sparse. Rare canneloid shale grains in siltstone, probably reworked. Rare thucholites. Weak brown fluorescence from desmocollinite. Rare yellow oil droplets. Iron oxide rare. Pyrite sparse.)
x8281	1481 SWC 1	0.47	0.37-0.53	4	Rare phytoplankton and liptodetrinite, greenish yellow and yellow to orange. (Calcareous claystone>siltstone.
	$\bar{R}_I$	0.95	0.84-1.04	6	Dom common, I>E>V. Inertinite common, exinite rare to sparse, vitrinite rare. Dom mainly consists of very fine inertodetrinite. Rare thucholites. Iron oxide rare to sparse. Pyrite rare.)

VITRINITE REFLECTANCE WORKSHEET

WELL NAME: Iona # 1 SAMPLE NO. X 8277 DEPTH: 1[illegible]40m TYPE: Swc.

FGV = First Generation Vitrinite I = Inertinite

Ro %	No. Read	Pop Rnge	Pop Type	Ro %	No. Read	Pop Rnge	Pop Type	Ro %	No. Read	Pop Rnge	Pop Type	Ro %	No. Read	Pop Rnge	Pop Type	Ro %	No. Read	Pop Rnge	Pop Type	Ro %	No. Read	Pop Rnge	Pop Type
.10				.46				.82				1.18				1.54				1.90			
.11				.47				.83				1.19				1.55				1.91			
.12				.48	3			.84				1.20				1.56				1.92			
.13				.49	2			.85				1.21				1.57				1.93			
.14				.50		FGY		.86				1.22				1.58				1.94			
.15				.51				.87				1.23				1.59				1.95			
.16				.52				.88				1.24				1.60				1.96			
.17				.53				.89				1.25				1.61				1.97			
.18				.54	1			.90				1.26				1.62				1.98			
.19				.55				.91				1.27				1.63				1.99			
.20				.56				.92				1.28				1.64				2.00			
.21				.57				.93				1.29				1.65							
.22				.58				.94				1.30				1.66							
.23				.59				.95				1.31				1.67							
.24				.60				.96				1.32				1.68							
.25				.61				.97				1.33				1.69							
.26				.62				.98				1.34				1.70							
.27				.63				.99				1.35				1.71							
.28				.64				1.00				1.36				1.72							
.29				.65				1.01				1.37				1.73							
.30	1			.66				1.02				1.38				1.74							
.31				.67				1.03				1.39				1.75							
.32	1			.68				1.04				1.40				1.76							
.33				.69				1.05				1.41				1.77							
.34	1			.70				1.06				1.42				1.78							
.35				.71				1.07				1.43				1.79							
.36				.72				1.08				1.44				1.80							
.37				.73				1.09				1.45				1.81							
.38	1			.74				1.10				1.46				1.82							
.39				.75				1.11				1.47				1.83							
.40				.76				1.12				1.48				1.84							
.41	2			.77				1.13				1.49				1.85							
.42				.78				1.14				1.50				1.86							
.43				.79				1.15				1.51				1.87							
.44	1			.80				1.16				1.52				1.88							
.45	2			.81				1.17				1.53				1.89							

Organic matter Comp. (%)

Exinite	Alginite
0.2	0
Vitrinite	**Inertinite**
0.1	1.8

Kelraville Konsultants Pty Ltd.

VITRINITE REFLECTANCE WORKSHEET

WELL NAME: Iona # 1 SAMPLE NO. X8278 DEPTH 127[illegible] m TYPE Swc.

FGV = First Generation Vitrinite I = Inertinite

Ro %	No. Read	Pop Rnge	Pop Type	Ro %	No. Read	Pop Rnge	Pop Type	Ro %	No. Read	Pop Rnge	Pop Type	Ro %	No. Read	Pop Rnge	Pop Type	Ro %	No. Read	Pop Rnge	Pop Type	Ro %	No. Read	Pop Rnge	Pop Type
.10				.46	2			.82				1.18				1.54				1.90			
.11				.47				.83				1.19				1.55				1.91			
.12				.48				.84				1.20				1.56				1.92			
.13				.49	1			.85				1.21				1.57				1.93			
.14				.50	2			.86				1.22				1.58				1.94			
.15				.51	1			.87				1.23				1.59				1.95			
.16				.52				.88				1.24				1.60				1.96			
.17				.53	1			.89				1.25				1.61				1.97			
.18				.54	1			.90				1.26				1.62				1.98			
.19				.55	1			.91				1.27				1.63				1.99			
.20				.56	2			.92				1.28				1.64				2.00			
.21				.57				.93				1.29				1.65							
.22				.58				.94				1.30				1.66							
.23				.59				.95				1.31				1.67							
.24				.60				.96				1.32				1.68							
.25				.61				.97				1.33				1.69							
.26				.62				.98				1.34				1.70							
.27				.63				.99				1.35				1.71							
.28				.64				1.00				1.36				1.72							
.29				.65				1.01				1.37				1.73							
.30				.66				1.02				1.38				1.74							
.31				.67				1.03				1.39				1.75							
.32	1			.68				1.04				1.40				1.76							
.33				.69				1.05				1.41				1.77							
.34	1			.70				1.06				1.42				1.78							
.35				.71				1.07				1.43				1.79							
.36	1			.72				1.08				1.44				1.80							
.37	4			.73				1.09				1.45				1.81							
.38				.74				1.10				1.46				1.82							
.39				.75				1.11				1.47				1.83							
.40	4			.76				1.12				1.48				1.84							
.41	1			.77				1.13				1.49				1.85							
.42	1			.78				1.14				1.50				1.86							
.43	1			.79				1.15				1.51				1.87							
.44				.80				1.16				1.52				1.88							
.45	1			.81				1.17				1.53				1.89							

Organic matter Comp. (%)

Exinite	Alginite
<0.1	0
Vitrinite	**Inertinite**
0.4	1.0

Keiraville Konsultants Pty Ltd.

VITRINITE REFLECTANCE WORKSHEET

WELL NAME: Jona #1 SAMPLE NO. X 8279 DEPTH 1[illegible]3m TYPE SWC.

FGV = First Generation Vitrinite I = Inertinite

Ro %	No. Read	Pop Rnge	Pop Type	Ro %	No. Read	Pop Rnge	Pop Type	Ro %	No. Read	Pop Rnge	Pop Type	Ro %	No. Read	Pop Rnge	Pop Type	Ro %	No. Read	Pop Rnge	Pop Type	Ro %	No. Read	Pop Rnge	Pop Type
.10				.46	1	↓		.82				1.18				1.54				1.90			
.11				.47				.83				1.19				1.55				1.91			
.12				.48				.84				1.20				1.56				1.92			
.13				.49				.85				1.21				1.57				1.93			
.14				.50				.86				1.22				1.58				1.94			
.15				.51				.87				1.23				1.59				1.95			
.16				.52				.88				1.24				1.60				1.96			
.17				.53				.89				1.25				1.61				1.97			
.18				.54				.90				1.26				1.62				1.98			
.19				.55				.91				1.27				1.63				1.99			
.20				.56				.92				1.28				1.64				2.00			
.21				.57				.93				1.29				1.65							
.22				.58				.94				1.30				1.66							
.23				.59				.95				1.31				1.67							
.24				.60				.96				1.32				1.68							
.25				.61				.97				1.33				1.69							
.26				.62				.98				1.34				1.70							
.27				.63				.99				1.35				1.71							
.28				.64				1.00				1.36				1.72							
.29				.65				1.01				1.37				1.73							
.30				.66				1.02				1.38				1.74							
.31				.67				1.03				1.39				1.75							
.32				.68				1.04				1.40				1.76							
.33				.69				1.05				1.41				1.77							
.34				.70				1.06				1.42				1.78							
.35				.71				1.07				1.43				1.79							
.36				.72				1.08				1.44				1.80							
.37				.73				1.09				1.45				1.81							
.38				.74				1.10				1.46				1.82							
.39				.75				1.11				1.47				1.83							
.40	1	↑		.76				1.12				1.48				1.84							
.41	2			.77				1.13				1.49				1.85							
.42	2			.78				1.14				1.50				1.86							
.43				.79				1.15				1.51				1.87							
.44		FGV		.80				1.16				1.52				1.88							
.45				.81				1.17				1.53				1.89							

Organic matter Comp.(%)

Exinite	Alginite
0.2	0
Vitrinite	**Inertinite**
<0.1	0.3

Keiraville Konsultants Pty Ltd.

VITRINITE REFLECTANCE WORKSHEET

WELL NAME: Iona #1 SAMPLE NO. X 8280 DEPTH 14[illegible]3 m TYPE SWC.

FGV = First Generation Vitrinite I = Inertinite

Ro %	No. Read	Pop Rnge	Pop Type	Ro %	No. Read	Pop Rnge	Pop Type	Ro %	No. Read	Pop Rnge	Pop Type	Ro %	No. Read	Pop Rnge	Pop Type	Ro %	No. Read	Pop Rnge	Pop Type	Ro %	No. Read	Pop Rnge	Pop Type
.10				.46	3			.82				1.18				1.54				1.90			
.11				.47	1			.83				1.19				1.55				1.91			
.12				.48	1			.84				1.20				1.56				1.92			
.13				.49				.85				1.21				1.57				1.93			
.14				.50				.86				1.22				1.58				1.94			
.15				.51				.87				1.23				1.59				1.95			
.16				.52				.88				1.24				1.60				1.96			
.17				.53				.89				1.25				1.61				1.97			
.18				.54				.90				1.26				1.62				1.98			
.19				.55				.91				1.27				1.63				1.99			
.20				.56				.92				1.28				1.64				2.00			
.21				.57				.93				1.29				1.65							
.22				.58				.94				1.30				1.66							
.23				.59				.95				1.31				1.67							
.24				.60				.96				1.32				1.68							
.25				.61				.97				1.33				1.69							
.26				.62				.98				1.34				1.70							
.27				.63				.99				1.35				1.71							
.28				.64				1.00				1.36				1.72							
.29				.65				1.01				1.37				1.73							
.30				.66				1.02				1.38				1.74							
.31				.67				1.03				1.39				1.75							
.32				.68				1.04				1.40				1.76							
.33	1			.69				1.05				1.41				1.77							
.34	1			.70				1.06				1.42				1.78							
.35	1			.71				1.07				1.43				1.79							
.36	3			.72				1.08				1.44				1.80							
.37	1			.73				1.09				1.45				1.81							
.38	1			.74				1.10				1.46				1.82							
.39	3			.75				1.11				1.47				1.83							
.40		FGV		.76				1.12				1.48				1.84							
.41	4			.77				1.13				1.49				1.85							
.42	2			.78				1.14				1.50				1.86							
.43	1			.79				1.15				1.51				1.87							
.44	1			.80				1.16				1.52				1.88							
.45	3			.81				1.17				1.53				1.89							

Organic matter Comp.(%)

Exinite	Alginite
0.1	0
Vitrinite	**Inertinite**
0.6	6.3

Keiraville Konsultants Pty Ltd.

VITRINITE REFLECTANCE WORKSHEET

WELL NAME: IONA - 1 SAMPLE NO. X 8281 DEPTH 1481 m TYPE SWC

FGV = First Generation Vitrinite I = Inertinite

Ro %	No. Read	Pop Rnge	Pop Type
.10			
.11			
.12			
.13			
.14			
.15			
.16			
.17			
.18			
.19			
.20			
.21			
.22			
.23			
.24			
.25			
.26			
.27			
.28			
.29			
.30			
.31			
.32			
.33			
.34			
.35			
.36			
.37	1	↑	
.38			
.39			
.40			
.41			
.42			
.43			
.44			
.45			

Ro %	No. Read	Pop Rnge	Pop Type
.46	1		
.47			
.48			
.49		FGY	
.50			
.51			
.52	1		
.53	1	↓	
.54			
.55			
.56			
.57			
.58			
.59			
.60			
.61			
.62			
.63			
.64			
.65			
.66			
.67			
.68			
.69			
.70			
.71			
.72			
.73			
.74			
.75			
.76			
.77			
.78			
.79			
.80			
.81			

Ro %	No. Read	Pop Rnge	Pop Type
.82			
.83			
.84	1	↑	
.85			
.86	1		
.87			
.88			
.89			
.90			
.91			
.92	1		
.93			
.94			
.95			
.96		INERTINITE	
.97			
.98			
.99			
1.00			
1.01			
1.02	1		
1.03			
1.04	2	↓	
1.05			
1.06			
1.07			
1.08			
1.09			
1.10			
1.11			
1.12			
1.13			
1.14			
1.15			
1.16			
1.17			

Ro %	No. Read	Pop Rnge	Pop Type
1.18			
1.19			
1.20			
1.21			
1.22			
1.23			
1.24			
1.25			
1.26			
1.27			
1.28			
1.29			
1.30			
1.31			
1.32			
1.33			
1.34			
1.35			
1.36			
1.37			
1.38			
1.39			
1.40			
1.41			
1.42			
1.43			
1.44			
1.45			
1.46			
1.47			
1.48			
1.49			
1.50			
1.51			
1.52			
1.53			

Ro %	No. Read	Pop Rnge	Pop Type
1.54			
1.55			
1.56			
1.57			
1.58			
1.59			
1.60			
1.61			
1.62			
1.63			
1.64			
1.65			
1.66			
1.67			
1.68			
1.69			
1.70			
1.71			
1.72			
1.73			
1.74			
1.75			
1.76			
1.77			
1.78			
1.79			
1.80			
1.81			
1.82			
1.83			
1.84			
1.85			
1.86			
1.87			
1.88			
1.89			

Ro %	No. Read	Pop Rnge	Pop Type
1.90			
1.91			
1.92			
1.93			
1.94			
1.95			
1.96			
1.97			
1.98			
1.99			
2.00			

Organic matter Comp. (%)	
Exinite	Alginite
0.1	0
Vitrinite	Inertinite
<0.1	1.0

Keiraville Konsultants Pty Ltd.

APPENDIX 13

ROUTINE CORE ANALYSIS

OP6276

amdel
technology and enterprise

Amdel Limited
(Incorporated in S.A.)
31 Flemington Street,
Frewville, S.A. 5063

Telephone: (08) 372 2700

P.O. Box 114,
Eastwood, S.A. 5063

Telex: AA82520
Facsimile: (08) 79 6623

25 March 1988

F 3/0/0
F 5179/88

Beach Petroleum NL
PO Box 360
CAMBERWELL VIC 3124

Attention: Mr J. Foster

REPORT F 5179/88

YOUR REFERENCE:	Verbal request
TITLE:	Routine core analysis
MATERIAL:	Core plugs
IDENTIFICATION:	IONA-1
DATE RECEIVED:	18 March 1988
WORK REQUIRED:	Porosity, air permeability, grain density

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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1. INTRODUCTION

On 18 March 1988 a conventional core (1305.5 m-1314.5 m) from Beach Petroleum's Iona-1 well was received at Amdel Limited's Adelaide Laboratory. A verbal request from Beach Petroleum's representative was received concerning the nature of analysis to be performed. The analysis included:

Porosity - ambient conditions only
Air Permeability - ambient conditions only
Grain Density - calculated

2. SAMPLE PREPARATION

The core was laid out according to depth and the core examined. After attempting to drill one-and-one-half-inch diameter plugs in the conventional manner, i.e. tap water as the bit lubricant, it was found that representative samples could not be taken.

Sections of core were packed in dry ice for a period of twelve hours. At which time individual samples were removed and one-and-one-half-inch diameter samples taken using liquid nitrogen as the bit lubricant. Samples were trimmed and faced square while still frozen and mounted in lead sleeves. Weights of the encapsulating lead and screens were recorded.

The samples were then placed in a hassler type cell and pressured to 500 psig to squeeze the lead sleeve to conform to the shape of the sample.

Samples were then placed in a soxhlet extraction apparatus with a 3:1 chloroform/methanol mix to leach any residual hydrocarbons and salts.

Upon completion the extraction samples were placed in a conventional dry oven at 110°C.

3. HELIUM INJECTION POROSITY

Porosity is determined using the Boyles Law helium injection technique to determine sample grain volume. Sample pore volume, in the case of lead sleeve, is determined by loading the samples into a hassler type cell and confining the sample with an external pressure of 400 psig. Helium is again injected and pore volume recorded.

Porosity is then calculated and expressed as a percentage value.

4. PERMEABILITY TO AIR

Permeability to air is also determined whilst the sample is confined in the hassler type cell at 400 psig. A known air pressure is passed through the sample and the differential pressure at the outlet face of the sample is monitored utilising a calibrated orifice and straight tube manometer.

In the majority of cases the samples exceeded the maximum accurate operating limits of the permeameter and are expressed as greater than 8000 millidarcys.

Sample offcuts were retained and a brief lithological description concludes this report.

Amdel Limited would like to thank Beach Petroleum for the opportunity to have been of service with this study. Should you have any questions, or if Amdel Limited can be of further service please do not hesitate to contact us.

LITHOLOGICAL DESCRIPTION

Company: Beach Petroleum
Well: IONA-1
Field: IONA

1	No offcut
2	Sst: Lt gry, med-v.crs. gr, cln, p. cmt, sbang-ang, p. srt, v. fri, v. rr cl mtrx, no vis fluor, no cut, pale wh ring.
3	No offcut
4	Sst: Lt gry, med-occ. v.crs. gr, cln, p. cmt, sbang-ang w. crs, p. srt, v. fri, sps cl mtrx, fluor and cut a/a.
5	Sst: lt gry, dom. med-rr crs gr, cln, p. cmt, sbrnd-sbang, p. srt, v. fri, v. sps cl mtrx, fluor and cut a/a.
6	As above.
7	Sst: Lt gry, rr f-occ. crs gr, cln, p. cmt, sbang, p. srt, v. fri rr qtz ovgth, carb spk, fluor and cut a/a.
8	Sst: Lt gry, rr f-occ crs gr, cln, p. cmt, sbang, p. srt, fri, rr qtz ovgth, carb spk, tr pyr carb mat, fluor and cut a/a.
9	Sst: Lt gry, dom med-v. crs grn, cln, p. cmt, sbang, p. srt, v. fri, sps cl mtrx, fluor and cut a/a.
10	Sst: As above. dom crs gr.
11	Sst: As above. dom crs-v. crs gr.
12	Sst: As above. no vis fluor, v. slow milky wh cut.
13	Sst: Lt gry, dom crs-v.crs gr, cln, p. cmt, sbang, v. fri, p. srt, v. sps mtrx, no vis fluor, v. slow milky wh cut.
14	Sst: Lt gry, f-med intbd, crs gr, cln, p. cmt, sbrnd-sbang, mod srt, fri, sps mtrx, carb spk, fluor and cut a/a.
15	Sst: As above.
16	Sst: Lt gry, dom med-occ crs gr, cln, p. cmt, sbrnd, mod srt, v. fri, sps mtrx, fluor and cut a/a.

17	Sst: wh-lt gry, fn med gr, mod cmt, sbrnd, mod srt, fri, sps mtrx, abd carb lam, dull yell fluor along carb lam, instant bright wh cut.
18	Sst: Lt gry, med-dom crs gr, p. cmt, sbang, p. srt, v. fri, v. sps mtrx, carb lam, dull yell fluor along carb lam, instant bright wh cut.
19	Sst: Lt gry, med-dom crs v. crs gr, p. cmt, sbang, p. srt, v. fri, v. sps mtrx, carb spk, rr dull yell p.p. fluor, slow milky cut.
20	Sst: As above.
21	Sst: As above.
22	Sst: As above.
23	Sst: As above.
24	Slst dk gry, v. f gr. sst intbd, pyr lam, no vis fluor, instant milky wh cut.

Table 1

AMDEL CORE ANALYSIS

IONA No. 1 Ambient

Sample	Depth	Permeability (md)	Porosity (%)
1	1305.81	7216	23.0
2	1306.23	>8000	24.4
3	1306.43	>8000	24.3
4	1306.57	>8000	23.4
5	1306.71	>8000	25.7
6	1307.23	>8000	27.1
7	1307.54	>8000	27.2
8	1307.84	>8000	26.4
9	1308.20	>8000	23.3
10	1308.45	>8000	28.7
11	1308.80	>8000	25.9
12	1309.10	>8000	27.5
13	1309.40	>8000	26.6
14	1309.70	7407	26.6
15	1310.00	>8000	26.8
16	1310.3	>8000	25.0
17	1310.60	5149	28.6
18	1310.90	>8000	23.5
19	1311.20	>8000	24.6
20	1311.50	>8000	24.7
21	1311.80	>8000	25.5
22	1312.02	6264	21.0
23	1312.40	>8000	23.0
24	1312.70	6.13	10.7

Table 2

AMDEL CORE ANALYSIS

IONA No. 1 Ambient

Sample	Bulk Volume	Bulk Dry Density	Apparent Grain Density	Absolute Grain Density
1	49.81	2.10	2.72	
2	57.99	2.09	2.76	
3	35.12	2.03	2.68	
4	52.64	2.05	2.67	
5	56.30	1.98	2.66	
6	48.75	1.95	2.68	
7	56.73	1.95	2.68	
8	55.72	1.97	2.67	
9	58.32	2.05	2.67	
10	57.15	1.90	2.67	
11	57.48	1.98	2.67	
12	57.73	1.95	2.68	
13	57.63	1.96	2.67	
14	63.64	1.96	2.67	
15	61.81	1.95	2.67	
16	58.07	1.99	2.65	
17	52.07	1.77	2.48	
18	62.86	2.05	2.67	
19	65.13	2.01	2.67	
20	53.58	2.01	2.67	
21	59.94	1.99	2.67	
22	59.51	2.11	2.67	
23	52.65	2.05	2.67	
24	58.11	2.44	2.73	

APPENDIX 15

FORMATION RESISTIVITY FACTOR

RESISTIVITY INDEX

technology and enterprise

Amdel Limited
(Incorporated in S.A.)
31 Flemington Street,
Frewville, S.A. 5063

Telephone: (08) 372 2700

P.O. Box 114,
Eastwood, S.A. 5063

Telex: AA82520
Facsimile: (08) 79 6623

27 May 1988

Beach Petroleum NL
PO Box 360
CAMBERWELL VIC 3124

Attention: Mr J. Foster

REPORT F 7197/88

YOUR REFERENCE:	Fax No. 72/4, 19 April 1988
TITLE:	Special core analysis
SAMPLE IDENTIFICATION:	IONA-1
MATERIAL:	Core plugs
WORK REQUIRED:	Formation resistivity factor and resistivity index

Investigation and Report by: Russell R. Martin

Manager, Petroleum Services Section: Dr Brian G. Steveson

Brian Steveson.

for Dr William G. Spencer
General Manager
Applied Sciences Group

cap

1. INTRODUCTION

Correspondence was received by Amdel Limited on 19 April 1988 (your ref.: facsimile no. 72/4 19 April 1988) requesting the following analyses be performed:

- Formation resistivity factor
- Formation resistivity index

on selected samples from Iona-1 well.

The three samples selected had previously undergone routine core analysis conducted by Amdel Limited and porosity at a net overburden pressure of 13,800 kPa (2000 psi).

2. PROCEDURES AND RESULTS

The samples were frozen prior to removing the encapsulating lead sleeve and screens, then wrapped in teflon tape and encapsulated in a rubber sleeve before loading into the electrical properties cells. The required overburden pressure of 13,800 kPa (2000 psi) was then applied using a mineral oil to the outside of the sample.

Samples were then evacuated and the simulated formation brine consisting of 80% NaCl, 10% $CaCl_2$ and 10% KCl was introduced to the sample. Brine was slowly flushed through the sample until a stable resistivity reading was obtained indicating ionic equilibrium had been achieved.

Samples were allowed to stand for approximately 24 hours to ensure equilibrium had been attained.

Humidified air was then introduced to the sample to displace some of the brine and establish the first saturation point from which to commence resistivity index measurements.

Resultant plots of formation resistivity factor versus porosity fraction yield a value for `m', the cementation exponent of 1.74.

Archie reported that the cementation exponent probably ranged from 1.8 to 2.0 for clean consolidated sandstones and as low as 1.3 for clean unconsolidated sands.

Pirson[1] adapted Archie's work to produce a family of curves for formation factor versus porosity percent for various reservoir characteristics or cementation classes.

From Pirson's work slightly cemented sands fall in the range of 1.55 to approximately 1.75 for `m', the cementation exponent.

The samples from Iona-1 range from very slightly cemented to moderately cemented across the cored interval and the measured value of `m' for this formation falls within the slightly cemented class as described by Pirson.

Resultant plots of formation resistivity index yield values for `n', the saturation exponent of between 1.99 and 2.17. The composite plot yields a value for `n' of 2.08.

Cation exchange capacity measurements are generally performed on shaly sand formations to refine electric log data and provide values of F*, m* and a*. Cation exchange capacity values can also be used for better correlation with Rw data. Bearing in mind that the brine used to determine `m', `n' and `a' for Iona is not the actual brine concentration present in the reservoir but of one close by, values may need to be adjusted slightly. However, as Iona is a relatively homogeneous clean sand the adjustment in `m' and `n' because of a different brine concentration will in all probability be minimal.

As Iona is a very clean sand and based on the petrographic work carried out, very low values for cation exchange capacity would be expected for this reservoir sand which would not influence the calculation of F*, m* and a* to any significant extent. Therefore, cation exchange capacity determinations in this case are probably unnecessary.

3. REFERENCES

(1) PIRSON, S.J. "Oil Reservoir Engineering". McGraw Hill Book Company.

FORMATION RESISTIVITY FACTOR AS A FUNCTION OF OVERBURDEN

Company: Beach Petroleum
Well: Iona-1
Field: Iona

Formation:
Location:

Overburden pressure: 2000 psi
Saturant: 25000 ppm
Rw of saturant: 0.26 ohm.m @ 25°

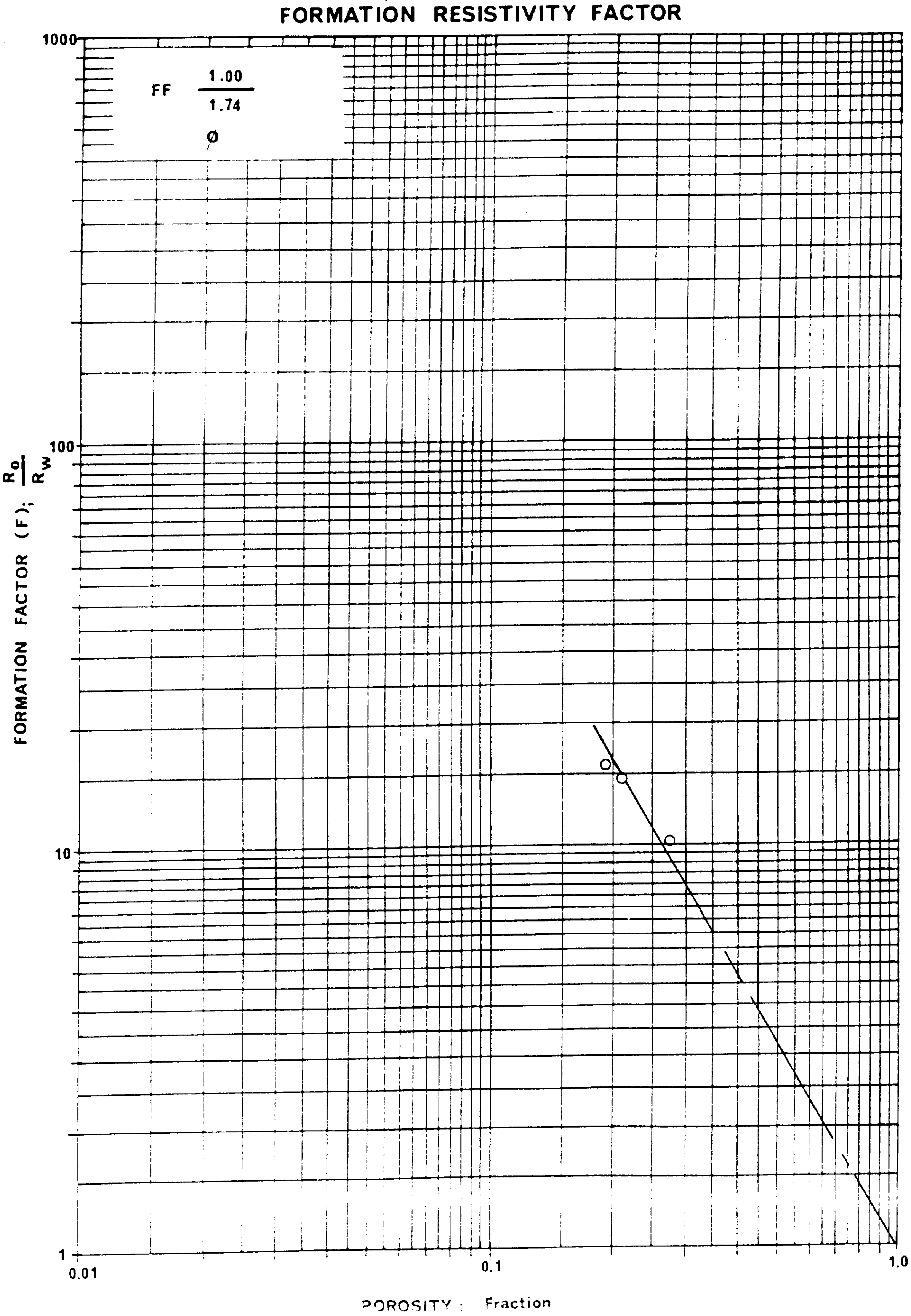
Sample ID	Depth m	Permeability to Air millidarcys	Porosity %	Formation Resistivity Factor
1	1305.81	7216	21.0	14.7
10	1308.45	>8000	27.1	10.1
22	1312.02	6264	19.5	16.5

Company: Beach Petroleum
Well: Iona-1
Field: Iona

Formation:
Location:

Saturant: 25,000 ppm
Overburden Pressure: 2000 psi

FORMATION RESISTIVITY FACTOR



FORMATION RESISTIVITY INDEX AS A FUNCTION OF OVERBURDEN

Company: Beach Petroleum
Well: Iona-1
Field: Iona

Formation:
Location:

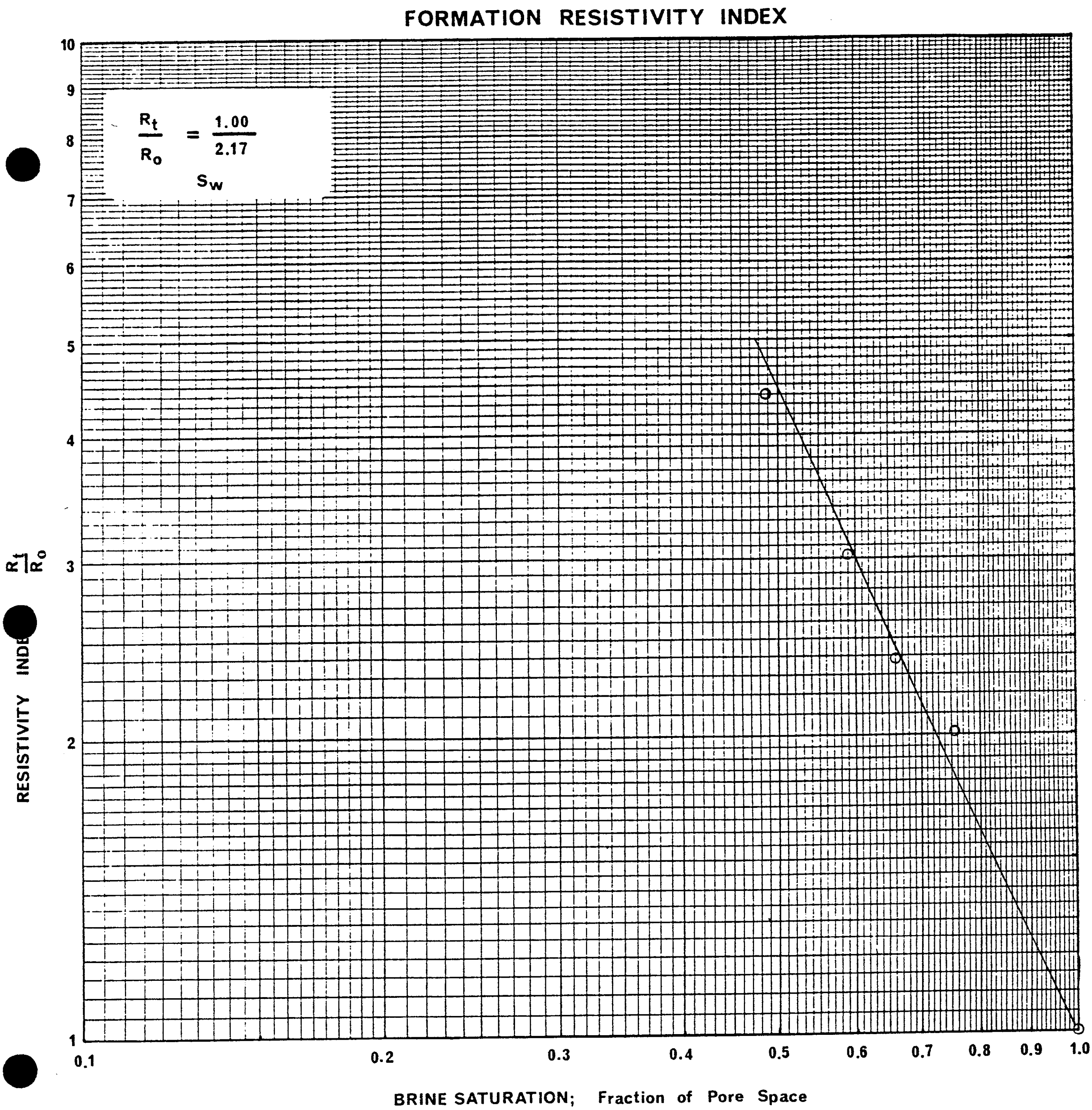
Overburden pressure: 2000 psi
Saturant: 25000 ppm
Rw of saturant: 0.26 ohm.m @ 25°

Sample ID	Depth m	Permeability to Air, millidarcys	Porosity %	Formation Resistivity Factor	Brine Saturation % Pore Space	Formation Resistivity Index
1	1305.81	7216	21.0	14.7	100.0	1.00
					75.1	1.89
					63.8	2.47
					56.7	3.16
					45.6	4.84
10	1308.45	>8000	27.1	10.1	100.0	1.00
					75.3	2.01
					65.9	2.37
					58.8	3.02
					48.7	4.40
22	1312.02	6264	19.5	16.5	100.0	1.00
					75.2	1.90
					64.0	2.35
					54.3	3.19
					42.1	5.21

Company: Beach Petroleum
Well: Iona-1
Field: Iona

Formation:
Location:

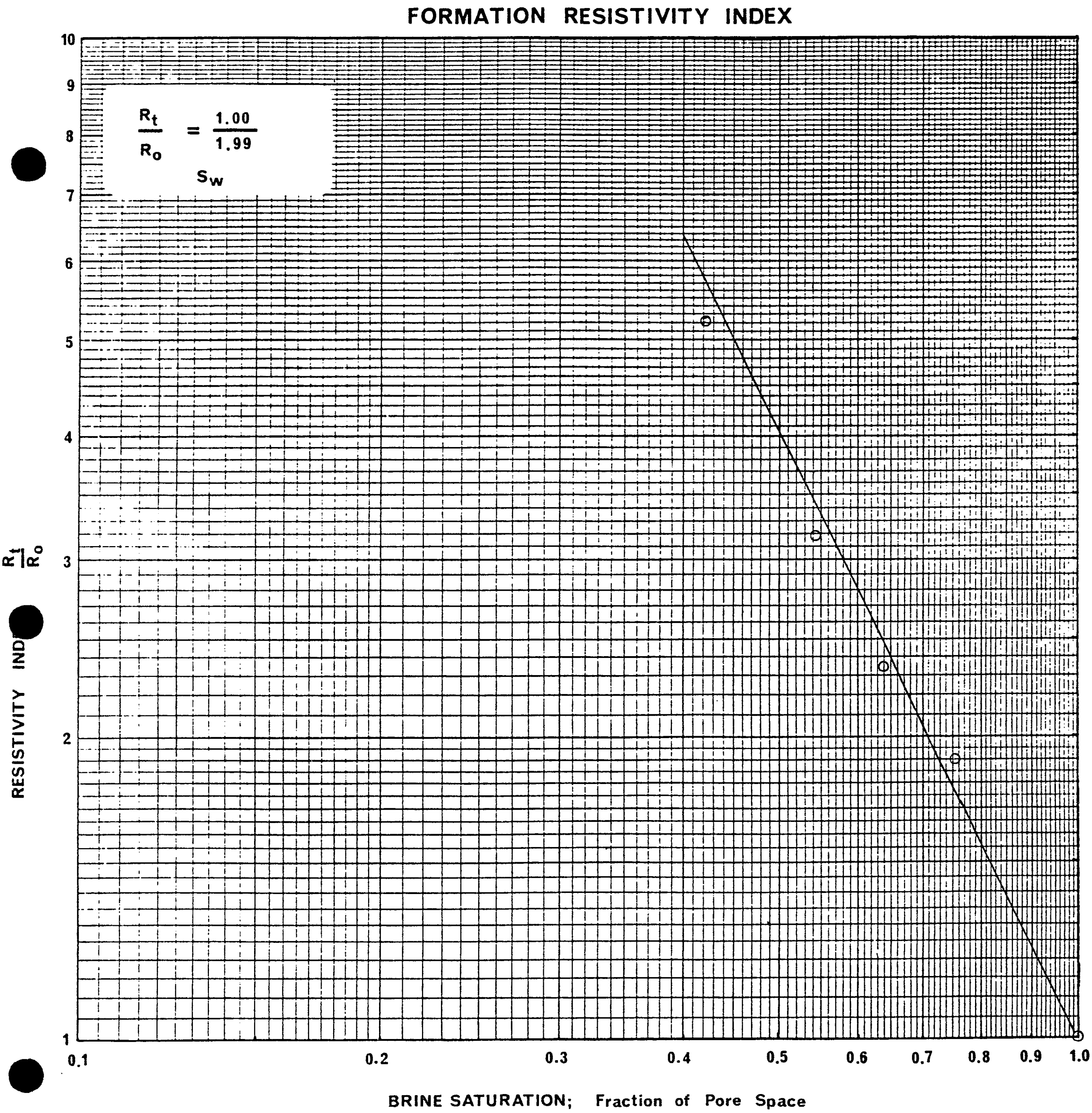
Sample No. 10
Saturant: 25,000 ppm
Overburden Pressure: 2000 psi



Company: Beach Petroleum
Well: Iona-1
Field: Iona

Formation:
Location:

Sample No. 22
Saturant: 25,000 ppm
Overburden Pressure: 2000 psi

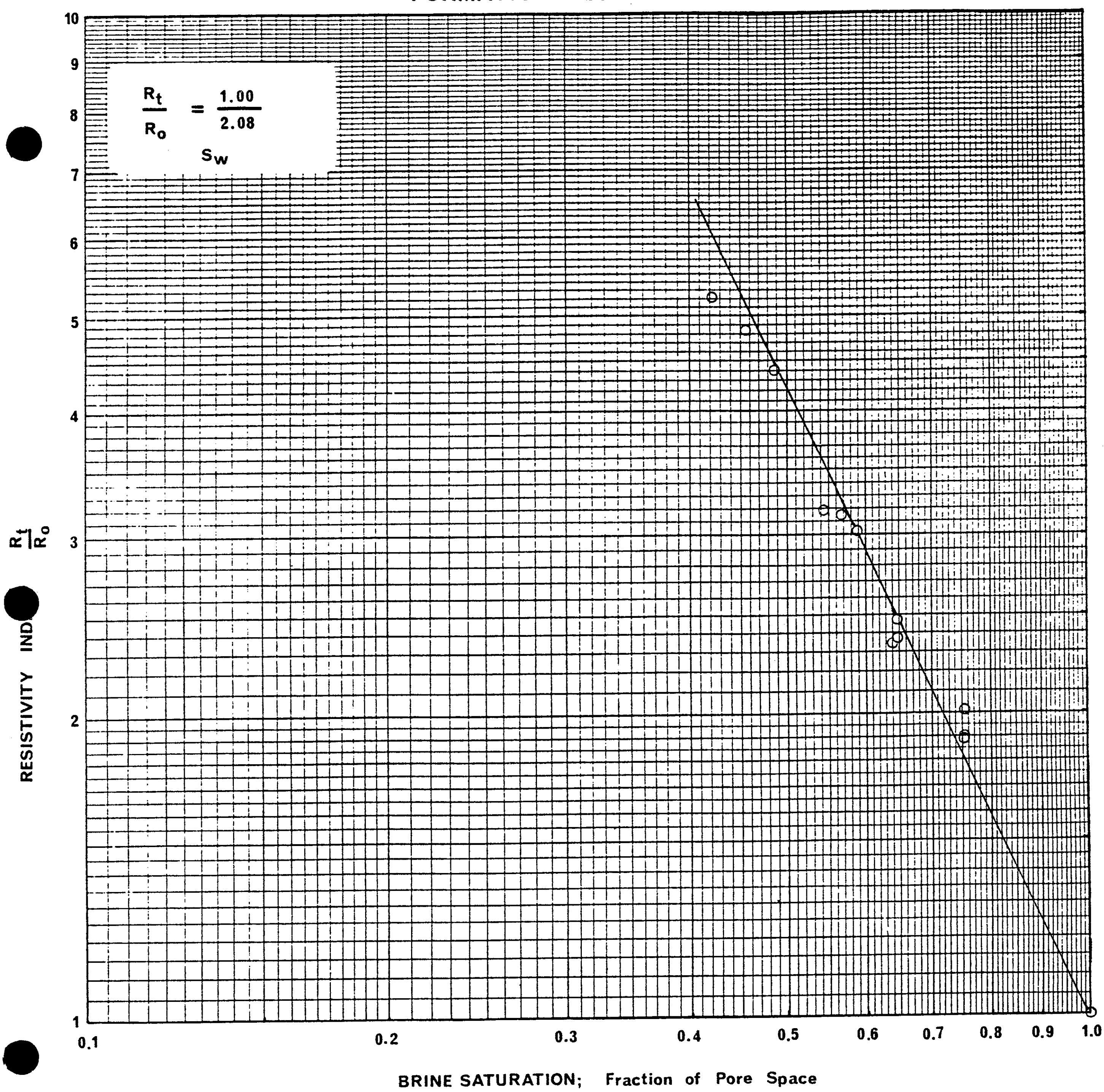


Company: Beach Petroleum
Well: Iona-1
Field: Iona

Formation:
Location:

Composite
Saturant: 25,000 ppm
Overburden Pressure: 2000 psi

FORMATION RESISTIVITY INDEX



APPENDIX 16

RESIDUAL GAS ANALYSIS

BEACH PETROLEUM

IONA #1

SPECIAL CORE ANALYSIS

Western Atlas International
A Litton/Dresser Company

CORE LABORATORIES

July 13, 1989

Beach Petroleum
GPO Box 7096
Sydney NSW 2001

Attention: Mr. A. Buffin

Subject : Special Core Analysis
Well : Iona #1
File : 318-88004

Dear Sir,

Core Laboratories was requested by Mr. A. Buffin of Beach Petroleum to perform residual gas determination on samples from the subject well.

Preliminary data was sent via telex on the 19th July 1988. This report finalizes all data.

Core Laboratories thanks you for the opportunity to have been of service with this study. If you have any questions, please feel free to call.

Yours sincerely
CORE LABORATORIES

p/

Peter Lane
Petrophysical Laboratory Supervisor

PRL:jc

TABLE OF CONTENTS

SUMMARY

Residual gas saturations determined tend to have a relationship with initial gas saturation. The highest residual gas saturation recorded corresponded to the highest initial gas saturation.

RECOMMENDATIONS

Capillary Pressure : Drainage capillary pressure tests will help in determining the water saturation profile in the reservoir.

Water-Gas Relative Permeability : Relative permeability data is necessary to properly model the reservoir performance.

SUMMARY OF DATA

IONA #1

		Max	Min	Ave.
Porosity, percent	Ø	24.6	21.0	22.7
Permeability to air, millidarcies	Ka	10,000	7,000	8,930
Residual Gas Saturation, percent pore volume	Sgr	38.6	28.9	32.4
Gas Recovered, percent pore space	Sgm	61.9	55.2	59.6

DISCUSSION OF LABORATORY PROCEDURES AND RESULTS

SAMPLE PREPARATION

Three one-and-one-half inch diameter samples were received at our laboratory in Perth for testing. Two were enclosed in lead sleeves and the third wrapped in teflon tape. The teflon tape was removed from the sample prior to cleaning in hot toluene and methanol with the other two samples. The samples were then dried at 115°C to constant weight. Permeability to air and porosity were determined.

REDISUAL GAS SATURATION : COUNTER CURRENT IMBIBITION METHOD (Page 4)

After the initial room conditions permeability and porosity were determined, the samples were evacuated under toluene and then reduced to the desired "irreducible water saturation" by controlled drying. Each of the samples was then suspended under toluene and weight gain monitored as a function of time. Each test was terminated when there was negligible change in weight versus time. The residual gas saturations were calculated from these data and are tabulated on page 4.

The residual gas saturation obtained for the samples show a trend. The sample with the most initial gas in place has the greatest residual gas saturation.

RESIDUAL GAS SATURATION BY COUNTER CURRENT IMBIBITION

Company : Beach Petroleum
Well : Iona #1

Sample I.D.	Depth, meters	Permeability to Air, millidarcys	Porosity, percent	Initial Liquid Saturation, percent pore space	Residual Gas Saturation, percent pore space	Gas Recovered	
						percent pore space	percent gas in place
10	1308.45	9800	21.0	8.7	29.6	61.7	67.6
16	1310.30	7000	24.6	6.2	38.6	55.2	58.8
23	1312.40	10000	22.4	9.2	28.9	61.9	67.4