SPECIAL CORE ANALYSIS FINAL REPORT

of

SNAPPER-A21a

for

ESSO AUSTRALIA PTY LTD

by

WEATHERFORD LABORATORIES (AUSTRALIA) PTY LTD

Weatherford LABORATORIES

31st December, 2009

Esso Australia Pty Ltd
12 Riverside Quay
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Attention: Julien Celerier
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FINAL REPORT - 0537-08
SNAPPER-A21a

CLIENT REFERENCE: 1230/4500557314/30-Mar-2009

MATERIAL: 1½″ Core Plugs

WORK REQUIRED: Special Core Analysis

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

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CHAPTER 1

INTRODUCTION

1. INTRODUCTION

This final report presents the results from a special core analysis study of the Snapper-A21a core. Samples utilised were 1½″ diameter core plugs originally drilled for a routine core analysis study (performed by Weatherford Laboratories) on the same well.

Following discussions between Esso Australia and Weatherford Laboratories representatives the test program was refined to that detailed in Chapter 2 of this report. The subsequent chapters encompass descriptions of procedures and test results. The Appendices include ancillary information pertinent to the study.

CHAPTER 2

SUMMARY OF TEST PROGRAM

TEST SCHEDULE

Client:	Esso Australia Pty Ltd	F	=	failed
Well/Project:	Snapper-A21a	C	=	cancelled
File No:	0537-08	P	=	pending

		Test Sequence																		
Sample	***Depth***	***CT Scan***	***Humidity Oven Dry***	***Ambient Base Parameters***	***Sample Saturation***	***Formation Factor***	***Multi-Salinity Formation Factor***	***Air-Brine Pc Drainage to 800psi @ OB***	***Resistivity Index***	***Resistivity Index at Various Frequencies***	***Effective Permeability to Gas***	***Capillary Pressure Imbibition***	***Basic Waterflood***	***Soxhlet Clean and Humidity Oven Dry***	***Sample Saturation***	***Formation Factor @ Various Frequencies***	***Post Testing Base Parameters***	***Thin Section, XRD and SEM***	***Mercury Injection Capillary Pressure***	***Cation Exchange Capacity***
3A	2931.65	X	X	X	X	X		C						X				X	X	X
5A	2932.05	X	X	X	X	X		C						X				X	X	X
10A	2933.31	X	X	X	X	X	X	X	X		X	C	C	X			C	X	X	X
18A	2935.30	X	X	X	X	X		C						X				X	X	X
24A	2936.77	X	X	X																
25A	2937.05	X	X	X																
26A	2937.26	X	X	X	X	X	X	X	X	X	X	C	C	X	X	X	C	X	X	X
34A	2939.27	X	X	X	X	X	X	X	X	X	X	C	C	X	X	X	C	X	X	X
47A	2942.56	X	X	X																
48A	2942.78	X	X	X	X	X	X	X	X		X	C	C	X			C	X	X	X
49A	2943.05	X	X	X	X	X	X	X	X		X	C	C	X			C	X	X	X
51A	2943.53	X	X	X																
55A	2944.52	X	X	X	X	X	X	X	X	X	X	C	C	X	X	X	C	X	X	X
72A	2948.77	X	X	X	X	X		C						X				X	X	X
	Total	14	14	14	10	10	6	6	6	3	6	0	0	10	3	3	0	10	10	10

CHAPTER 3

SAMPLE PREPARATION AND BASE PARAMETER DETERMINATIONS

3.1 Test and Calculation Procedures

3. SAMPLE PREPARATION AND BASE PARAMETERS DETERMINATIONS

3.1 Test and Calculation Procedures

3.1.1 CT Scanning

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

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

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

Prior to analysis, an arbitrary orientation line was inscribed onto the sample using a marker to facilitate subsequent re-orientation. The sample was placed vertically within the scanner, with the orientation arrow left to right, and a longitudinal section image obtained. The sample was then rotated through exactly 90° to the initial orientation, and another section image recorded. These two images are labeled '0' and '90' on the prints.

All images are presented here in standard Weatherford format.

3.1.2 Cleaning and Drying

Cleaning was performed in a modified soxhlet system (Appendix II) using a 3:1 chloroform:methanol azeotrope. Cleaning continued until tests for oil (fluorescence under UV light) and salt (silver nitrate precipitation) showed negative. The clean samples were dried to constant weight in a humidity oven at 60°C and 40% relative humidity. Once dry, the samples were cooled to room temperature in an airtight chamber.

3.1.3 Base Parameters

All base parameter analysis was performed during the routine core analysis study. Selected samples underwent ambient porosity and permeability as a quality control measure before starting the special core analysis study.

Porosity

Porosity was determined in two stages. Initially each sample was placed in a sealed matrix cup. Helium held at 100 psi reference pressure was then introduced to the cup. From the resultant pressure drop the unknown grain volume was determined from Boyle's Law.

$$P_1V_1 = P_2V_2$$
$$\Rightarrow P_1Vr = P_2 (Vr + Vc + Vl + Vg)$$

where
P_1 = *initial pressure (psig)*
Vr = *reference cell volume (cm^3)*
Vc = *matrix cup volume (cm^3)*
Vl = *line volume (cm^3)*
Vg = *grain volume (cm^3)*
P_2 = *final pressure (psig)*

and

$$\rho = \frac{Wt}{Vg}$$

where
ρ = *grain density (g/cm^3)*
Wt = *weight of sample (g)*
Vg = *grain volume (cm^3)*

Bulk volume was determined by Archimedes principle.

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

$$Vp = Vb - Vg$$

$$\text{Ambient Porosity \%} = \frac{Vp}{Vb} x\, 100$$

$$\text{Overburden Porosity \%} = \frac{Vp - \Delta Vp}{Vb - \Delta Vp} x\, 100$$

where
Vp = *ambient pore volume (cm^3)*
Vb = *ambient bulk volume (cm^3)*
Vg = *grain volume (cm^3)*
ΔVp = *change in pore volume (cm^3)*

Permeability to Air

The samples were placed into a hydrostatic cell (Appendix II) with an ambient confining pressure of 400 psi applied. The confining pressure was used to prevent bypassing of air around the sample when the measurement was made. In order to determine permeability a known air pressure was applied to the upstream face of each sample, creating a flow of air through the core plug. Air permeability for each core sample was calculated using Darcy's Law through knowledge of the upstream pressure, flow rate, viscosity of air and sample dimensions.

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

where	Ka	=	*air permeability (milliDarcy's)*
	BP	=	*barometric pressure (atmospheres)*
	μ	=	*gas viscosity (cP)*
	q	=	*flow rate (cm^3/s)*
	L	=	*sample length (cm)*
	P_1	=	*upstream pressure (atmospheres)*
	P_2	=	*downstream pressure (atmospheres)*
	A	=	*sample cross sectional area (cm^2)*

The confining pressure was then increased to overburden pressure and the above procedure repeated to give permeability at overburden conditions.

3.1.4 Sample Saturation

A synthetic formation brine was prepared by Weatherford Laboratories (composition as supplied in Appendix I) and pre-filtered to 0.45 µm.

The selected samples were initially vacuum saturated with synthetic formation brine followed by pressure saturation at 2000 psi for a minimum of 12 hours. To determine complete saturation the pore volume of each sample was ascertained by mass balance and compared with that determined by porosimetry. In all cases saturations were within ± 2% (of 100%) and therefore deemed suitable to proceed with the test schedule.

CHAPTER 3

SAMPLE PREPARATION AND
BASE PARAMETER DETERMINATIONS

3.2 Test Results

BASE PARAMETERS

Client : ESSO Australia Pty Ltd
Well : Snapper A21a
Field : Snapper

Overburden Pressure: 4000 psi

Sample Number	Depth (m)	Dir	Ambient Porosity (percent)	OB1 Porosity (percent)	Grain Density (g/cm^3)	Ambient Permeability (mD)	OB1 Permeability (mD)	Remarks
3A	2931.65	H	6.3	4.7	2.69	1.75	0.15	
5A	2932.05	H	5.3	3.4	2.71	1.40	0.09	
10A	2933.31	H	6.6	5.1	2.68	2.32	0.22	
18A	2935.30	H	6.1	4.6	2.68	1.98	0.11	
24A	2936.77	H	9.1	7.8	2.66	0.71	0.06	Lam
25A	2937.05	H	9.1	7.6	2.67	0.58	0.06	
26A	2937.26	H	8.7	7.3	2.68	0.99	0.16	
34A	2939.27	H	7.9	6.6	2.66	1.46	0.09	
47A	2942.56	H	10.5	8.8	2.66	0.79	0.12	
48A	2942.78	H	11.7	10.0	2.66	3.29	0.51	
49A	2943.05	H	9.6	8.1	2.66	1.47	0.21	
51A	2943.53	H	8.6	7.2	2.66	0.41	0.05	
55A	2944.52	H	11.2	9.2	2.65	2.89	0.43	
72A	2948.77	H	5.4	3.8	2.67	1.79	0.08	

BASE PARAMETERS
Quality Control

Client : ESSO Australia Pty Ltd
Well : Snapper A21a
Field : Snapper

Sample Number	Depth (m)	Dir	Ambient Porosity (percent)	Grain Density (g/cm^3)	Ambient Permeability (mD)	Quality Control before SCA Testing: Ambient Porosity (percent)	Quality Control before SCA Testing: Grain Density (g/cm^3)	Quality Control before SCA Testing: Ambient Permeability (mD)	Remarks
3A	2931.65	H	6.3	2.69	1.75	6.4	2.70	1.32	
5A	2932.05	H	5.3	2.71	1.40	5.1	2.70	0.89	
10A	2933.31	H	6.6	2.68	2.32	6.5	2.69	1.60	
18A	2935.30	H	6.1	2.68	1.98	5.9	2.68	1.54	
24A	2936.77	H	9.1	2.66	0.71	8.9	2.66	0.68	Lam
25A	2937.05	H	9.1	2.67	0.58	9.3	2.68	0.60	
26A	2937.26	H	8.7	2.68	0.99	8.7	2.69	0.93	
34A	2939.27	H	7.9	2.66	1.46	7.9	2.66	1.40	
47A	2942.56	H	10.5	2.66	0.79	10.4	2.66	0.81	
48A	2942.78	H	11.7	2.66	3.29	11.8	2.67	3.30	
49A	2943.05	H	9.6	2.66	1.47	9.5	2.66	1.39	
51A	2943.53	H	8.6	2.66	0.41	8.4	2.66	0.46	
55A	2944.52	H	11.2	2.65	2.89	11.0	2.66	2.91	
72A	2948.77	H	5.4	2.67	1.79	5.5	2.67	1.68	

CHAPTER 4

ELECTRICAL PROPERTIES AND CAPILLARY PRESSURE

4.1 Test and Calculation Procedures

4. ELECTRICAL PROPERTIES AND CAPILLARY PRESSURE

4.1 Test and Calculation Procedures

4.1.1 Formation Factor

On completion of base parameter and pressure saturation (with synthetic formation brine), ten samples were selected for formation factor analyses.

Each fully brine saturated sample was sandwiched between a pair of stainless steel core holder platens. These platens also act as the current carrying and potential electrodes. A thin silver leaf was also placed between the plug endfaces and electrodes, to ensure electrical contact. A strongly hydrophilic membrane was placed at the bottom end of the sample. This assembly was placed into a snugly fitting rubber overburden sleeve and then loaded into a hydrostatic type core holder. A confining pressure of 4000 psi was gradually applied as an effective overburden pressure (see Appendix II for schematic).

Synthetic brine (evacuated and filtered) was slowly flowed through each sample at a rate of 0.5 cm^3/min. During this process sample resistance was monitored on a digi-bridge capable of measuring resistance to 0.001 (ohms) accuracy. In each case the current frequency was selected to yield minimum phase angles, thus ensuring maximum electrical contact (between each sample and the current carrying and potential electrodes). Values of sample resistance (Rc) and effluent brine resistivity (Rw) were recorded daily. Each sample was deemed to be at ionic equilibrium when three consecutive daily readings were recorded within 1%.

From these stable data, the following results were recorded:

$$Ro = \frac{A.Rc}{100.L}$$

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

Formation factor was calculated using the following equations:

$$FF = \frac{a}{\Phi^m}$$

and

$$FF = \frac{Ro}{Rw}$$

where Rw = *brine resistivity (ohm.m)*
a = *intercept (assumed = 1)*
m = *cementation exponent*

and Φ = *porosity (fraction)*

The brine resistivity (Rw) was accurately determined by a NATA certified fluids laboratory.

4.1.2 Multi-Salinity Formation Factor

On completion of formation factor, a series of brines of various salinities (therefore conductivities) were flowed through each sample in the following sequence: 70,000 ppm, 130,000 ppm, 200,000 ppm, and synthetic formation brine. Each sample was connected in turn to a resistivity digi-bridge capable of measuring sample resistance to an accuracy of 10^{-3} ohms. In each case the current frequency was selected to yield a minimum phase angle, ensuring maximum electrical contact between each sample and the current carrying and potential electrode. Values of sample resistance (Rc) and effluent brine resistivity (Rw) were recorded daily. Each sample was deemed to be at ionic equilibrium when three consecutive readings were recorded within 1%.

$$Ro = \frac{A.Rc}{100.L}$$

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

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

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

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

where Cw = *conductivity of saturant (mho/m)*
Rw = *resistivity of brine (ohm.m)*

This process was then repeated with all brines scheduled.

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

$$y = mx + c$$

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

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

On completion of multi-salinity analyses the samples remained fully saturated with formation brine and continued directly with the next stage of the test program (RI/Pc).

4.1.3 Resistivity Index and Capillary Pressure

Upon completion of the preceding formation factor analyses, six samples were selected for resistivity index analyses in conjunction with drainage capillary pressure curves. The top endface port was connected to a supply of humidified air and the bottom port connected to a graduated receiving tube (Appendix II). The samples were desaturated by gradually increasing the displacing fluid pressure to the samples.

A small amount of oil was placed into the collection tubes to prevent any potential brine loss by evaporation. Sample resistances (Rt) were measured at successive decreasing brine saturations, which were calculated from the following equation:

$$\text{Water Saturation (\%)} = \frac{\text{Pore Volume @ OB}\left(cm^3\right) - \text{Brine Expelled}\left(cm^3\right)}{\text{Pore Volume @ OB}\left(cm^3\right)} \text{ x } 100$$

Capillary pressure curves plot water saturation (x-axis) against applied displacing fluid pressure. The ratio of the sample resistance (Rc) values to the previously determined FF values (at 100% saturation) were used to calculate the formation resistivity indices.

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

where	*Rc*	=	*sample resistance (ohms)*
	Rt	=	*resistivity of a partially brine saturated sample (ohm.m)*
	100	=	*units conversion*

and $$RI = \frac{Rt}{Rw.FF}$$

where	*RI*	=	*resistivity index*
	Rw	=	*resistivity of brine (ohm.m)*
	FF	=	*formation factor*

(modified from standard Archie equation to include Rw)

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

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

4.1.4 Effective Permeability to Air at Residual Water Saturation

On completion of Capillary Pressure desaturation the samples at Residual Water Saturation (Swr) underwent effective permeability to air. Each sample was individually placed into a hydrostatic cell with an overburden pressure of 4000 psi applied. A known pressure of humidified air was applied to the upstream face of each sample, creating a flow of air through the core plug. Effective permeability to air was calculated using Darcy's Law through knowledge of the upstream pressure, flow rate, viscosity of air and sample dimensions.

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

where Keg = *effective permeability to air @ Swr (milliDarcy's)*
BP = *barometric pressure (atmospheres)*
μ = *gas viscosity (cP)*
q = *flow rate* (cm^3/s)
L = *sample length (cm)*
P_1 = *upstream pressure (atmospheres)*
P_2 = *downstream pressure (atmospheres)*
A = *sample cross sectional area* (cm^2)

4.1.5 Cation Exchange Capacity

Cation exchange capacity was determined on approximately 5 grams of sample (off-cuts) using the wet chemistry method. The samples were first washed with an ammonium chloride solution to exchange ions with the available clay cations. An exchange reagent was then washed through the sample and the resultant solution titrated. Where a smaller sample is used the limit of detection becomes greater and a minimum value is reported.

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

$$Qv = \frac{CEC\ (1 - \Phi)\rho}{100\ \Phi}$$

where ρ = *grain density* (g/cm^3)

Φ	=	*porosity (fraction)*
Qv	=	*volume concentration of clay exchange cations (meq/cm^3 pore space)*
CEC	=	*cation exchange capacity (meq/100g dry sample)*

Based on these CEC/Q*v* data, values of shaly sand equivalent Formation Factor (FF*), Cementation Factor (m*) and Saturation Exponent (n*) were calculated using the following equations:

$$FF^* = FF.(1+B.Qv.Rw)$$

$$m^* = \frac{\log FF^*}{-\log \Phi}$$

$$n^* = \frac{\log\left[\dfrac{1+Rw.B.Qv}{1+Rw.B.Qv/Sw}\right] - \log RI}{\log Sw}$$

where

FF	=	*formation factor*
*FF**	=	*shaly sand equivalent formation factor*
*m**	=	*shaly sand equivalent cementation factor*
Φ	=	*porosity (fraction)*
*n**	=	*shaly sand equivalent saturation exponent*
Rw	=	*brine resistivity (ohm-m @ 25° C)*
Qv	=	*volume concentration of clay exchange cations (meq/cm^3 pore space)*
Sw	=	*brine saturation (fraction)*
B	=	*equivalent conductance of clay exchange cations (mho/m.cm^3.meq^{-1})*
RI	=	*resistivity index*

CHAPTER 4

ELECTRICAL PROPERTIES AND CAPILLARY PRESSURE

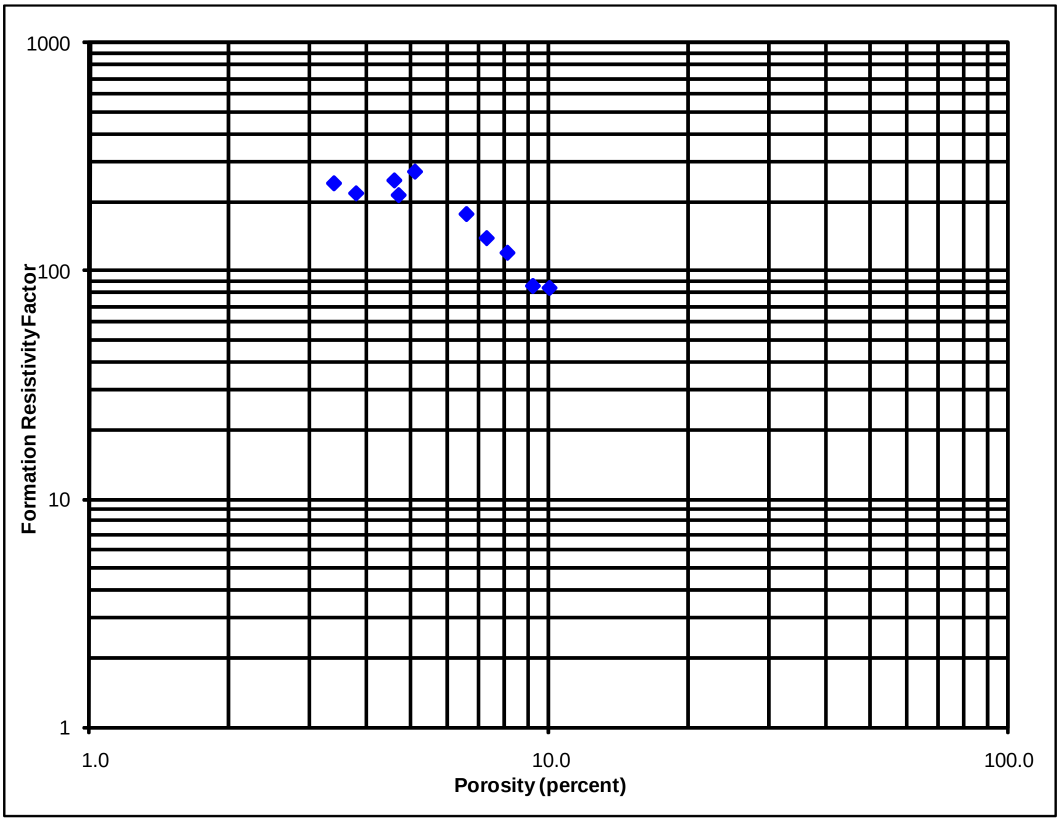
4.2 Test Results

4.2.1 Formation Factor

FORMATION RESISTIVITY FACTOR

Client	ESSO Australia Pty Ltd	**Saturant**	Formation Brine
Well	Snapper-A21a	**Rw of Saturant**	0.210 at 25ºC
		Overburden	4000 psi
		Average m	1.81

Sample Number	Depth (metres)	Permeability to Air (milliDarcy's)	Porosity (percent)	Formation Factor FF	Cementation Exponent m
3A	2931.65	0.15	4.7	214	1.75
5A	2932.05	0.09	3.4	241	1.62
10A	2933.31	0.22	5.1	271	1.88
18A	2935.30	0.11	4.6	248	1.79
26A	2937.26	0.16	7.3	139	1.89
34A	2939.27	0.09	6.6	177	1.90
48A	2942.78	0.51	10.0	84.3	1.93
49A	2943.05	0.21	8.1	120	1.90
55A	2944.52	0.43	9.2	86.0	1.87
72A	2948.77	0.08	3.8	218	1.65



CHAPTER 4

ELECTRICAL PROPERTIES AND CAPILLARY PRESSURE

4.2 Test Results

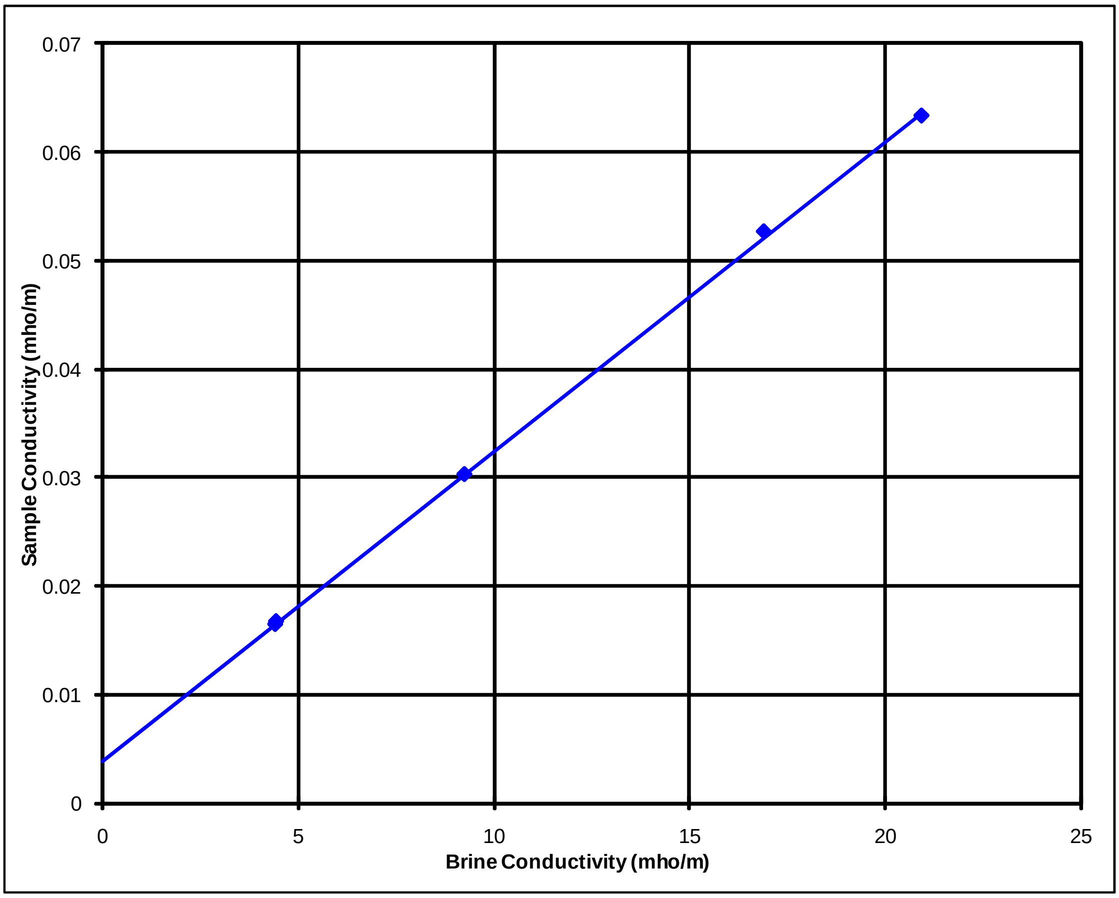
4.2.2 Multi-Salinity Formation Factor

MULTI-SALINITY RESISTIVITY ANALYSES

Client	ESSO Australia Pty Ltd		
Well	Snapper-A21a		
Sample	10A	**Air Permeability**	0.22 mD
Depth	2933.31 m	**Porosity**	5.1 %
Overburden	4000 psi		

Formation Factor, FF	271	**Shaly Sand Equivalent FF***	348
Cementation Exponent, m	1.88	**Shaly Sand Equivalent m***	1.97

Brine	Brine Resistivity, Rw (ohm.m)	Sample Resistivity, Ro (ohm.m)	Brine Conductivity, Cw (mho/m)	Sample Conductivity, Co (mho/m)
Formation	0.224	60.8	4.46	0.016
70000 ppm	0.108	33.0	9.26	0.030
130000 ppm	0.059	19.0	16.9	0.053
200000 ppm	0.048	15.8	20.8	0.063
Formation	0.223	59.8	4.48	0.017

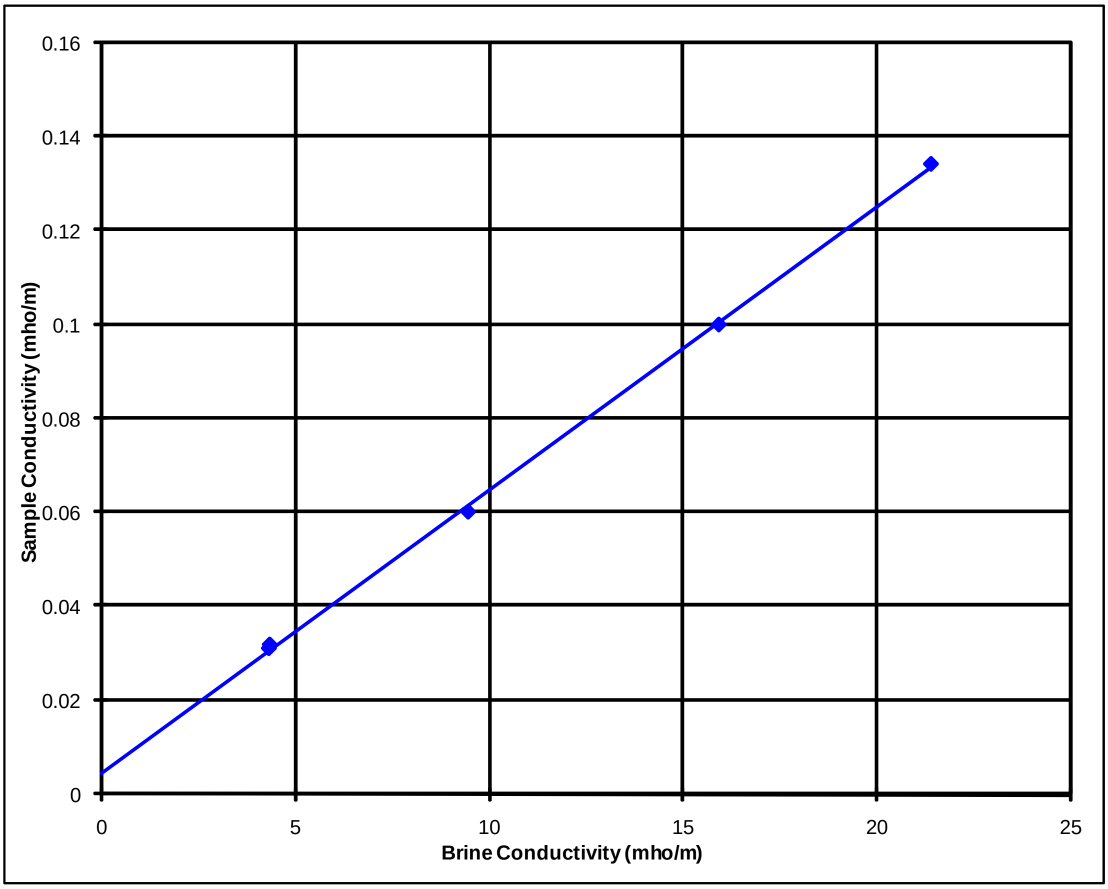


MULTI-SALINITY RESISTIVITY ANALYSES

Client	ESSO Australia Pty Ltd		
Well	Snapper-A21a		
Sample	26A	**Air Permeability**	0.16 mD
Depth	2937.26 m	**Porosity**	7.3 %
Overburden	4000 psi		

Formation Factor, FF	139	**Shaly Sand Equivalent FF***	162
Cementation Exponent, m	1.89	**Shaly Sand Equivalent m***	1.94

Brine	Brine Resistivity, Rw (ohm.m)	Sample Resistivity, Ro (ohm.m)	Brine Conductivity, Cw (mho/m)	Sample Conductivity, Co (mho/m)
Formation	0.232	32.3	4.31	0.031
70000 ppm	0.106	16.6	9.43	0.060
130000 ppm	0.063	9.99	15.9	0.100
200000 ppm	0.047	7.44	21.3	0.134
Formation	0.231	31.5	4.33	0.032

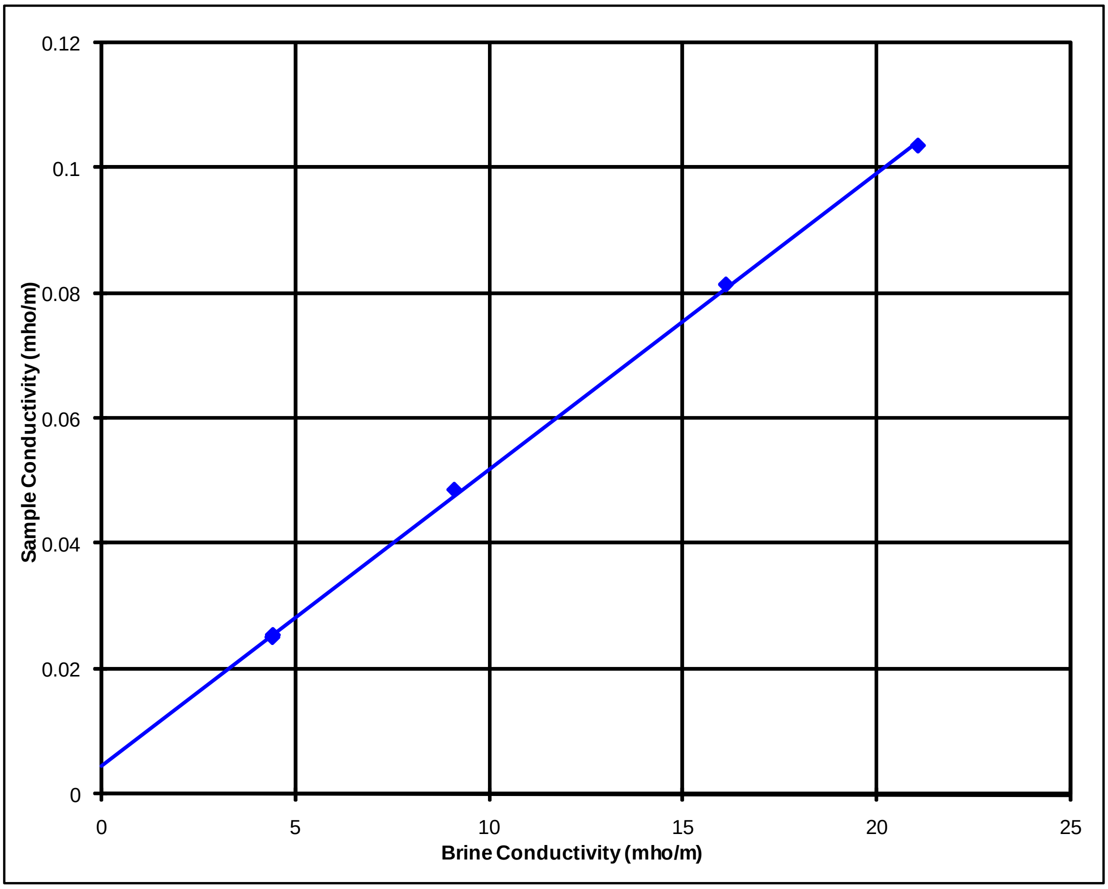


MULTI-SALINITY RESISTIVITY ANALYSES

Client	ESSO Australia Pty Ltd		
Well	Snapper-A21a		
Sample	34A	**Air Permeability**	0.09 mD
Depth	2939.27 m	**Porosity**	6.6 %
Overburden	4000 psi		

Formation Factor, FF	177	**Shaly Sand Equivalent FF***	214
Cementation Exponent, m	1.90	**Shaly Sand Equivalent m***	1.97

Brine	Brine Resistivity, Rw (ohm.m)	Sample Resistivity, Ro (ohm.m)	Brine Conductivity, Cw (mho/m)	Sample Conductivity, Co (mho/m)
Formation	0.225	39.9	4.44	0.025
70000 ppm	0.109	20.6	9.17	0.049
130000 ppm	0.062	12.3	16.1	0.081
200000 ppm	0.047	9.64	21.3	0.104
Formation	0.224	39.3	4.46	0.025

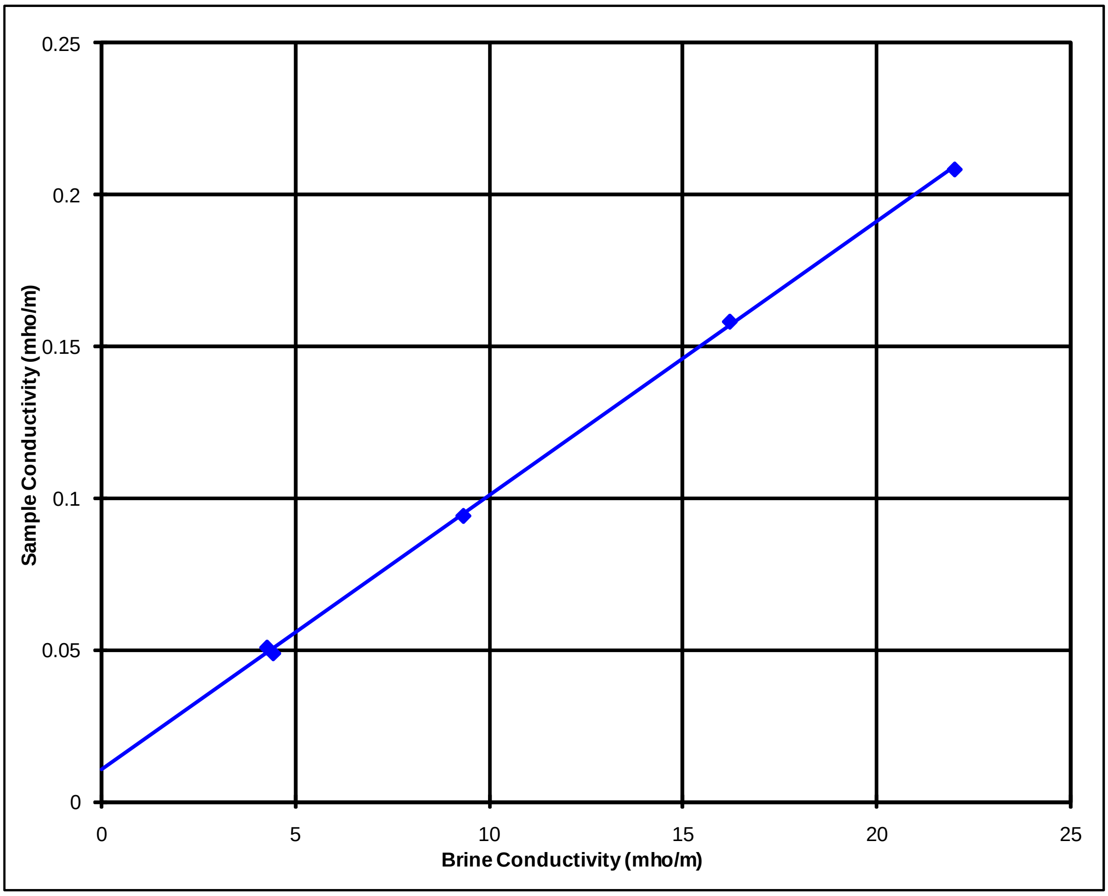


MULTI-SALINITY RESISTIVITY ANALYSES

Client	ESSO Australia Pty Ltd		
Well	Snapper-A21a		
Sample	48A	**Air Permeability**	0.51 mD
Depth	2942.78 m	**Porosity**	10.0 %
Overburden	4000 psi		

Formation Factor, FF	84.3	**Shaly Sand Equivalent FF***	105
Cementation Exponent, m	1.93	**Shaly Sand Equivalent m***	2.02

Brine	Brine Resistivity, Rw (ohm.m)	Sample Resistivity, Ro (ohm.m)	Brine Conductivity, Cw (mho/m)	Sample Conductivity, Co (mho/m)
Formation	0.233	19.6	4.29	0.051
70000 ppm	0.107	10.6	9.35	0.094
130000 ppm	0.062	6.32	16.1	0.158
200000 ppm	0.045	4.80	22.2	0.208
Formation	0.224	20.4	4.46	0.049

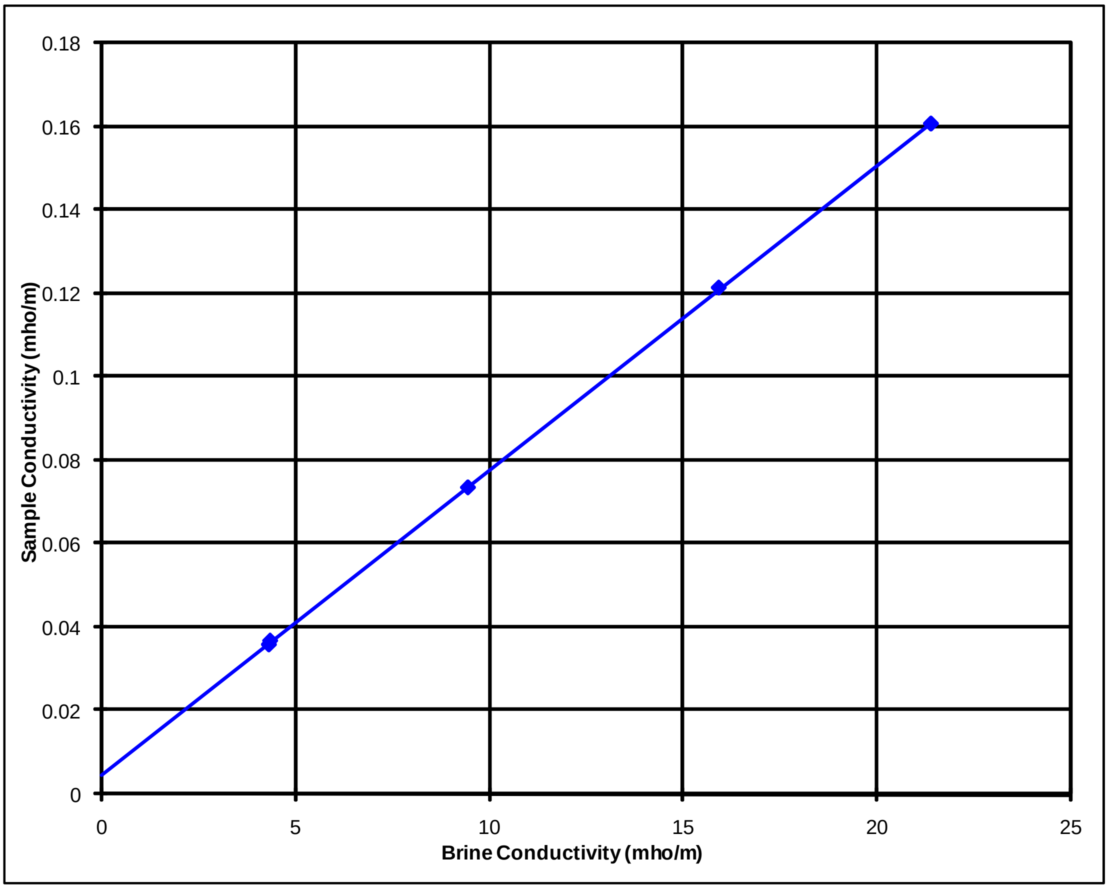


MULTI-SALINITY RESISTIVITY ANALYSES

Client	ESSO Australia Pty Ltd		
Well	Snapper-A21a		
Sample	49A	**Air Permeability**	0.21 mD
Depth	2943.05 m	**Porosity**	8.1 %
Overburden	4000 psi		

Formation Factor, FF	120	**Shaly Sand Equivalent FF***	137
Cementation Exponent, m	1.91	**Shaly Sand Equivalent m***	1.96

Brine	Brine Resistivity, Rw (ohm.m)	Sample Resistivity, Ro (ohm.m)	Brine Conductivity, Cw (mho/m)	Sample Conductivity, Co (mho/m)
Formation	0.231	27.8	4.33	0.036
70000 ppm	0.106	13.6	9.43	0.074
130000 ppm	0.063	8.24	15.9	0.121
200000 ppm	0.047	6.22	21.3	0.161
Formation	0.229	27.1	4.37	0.037

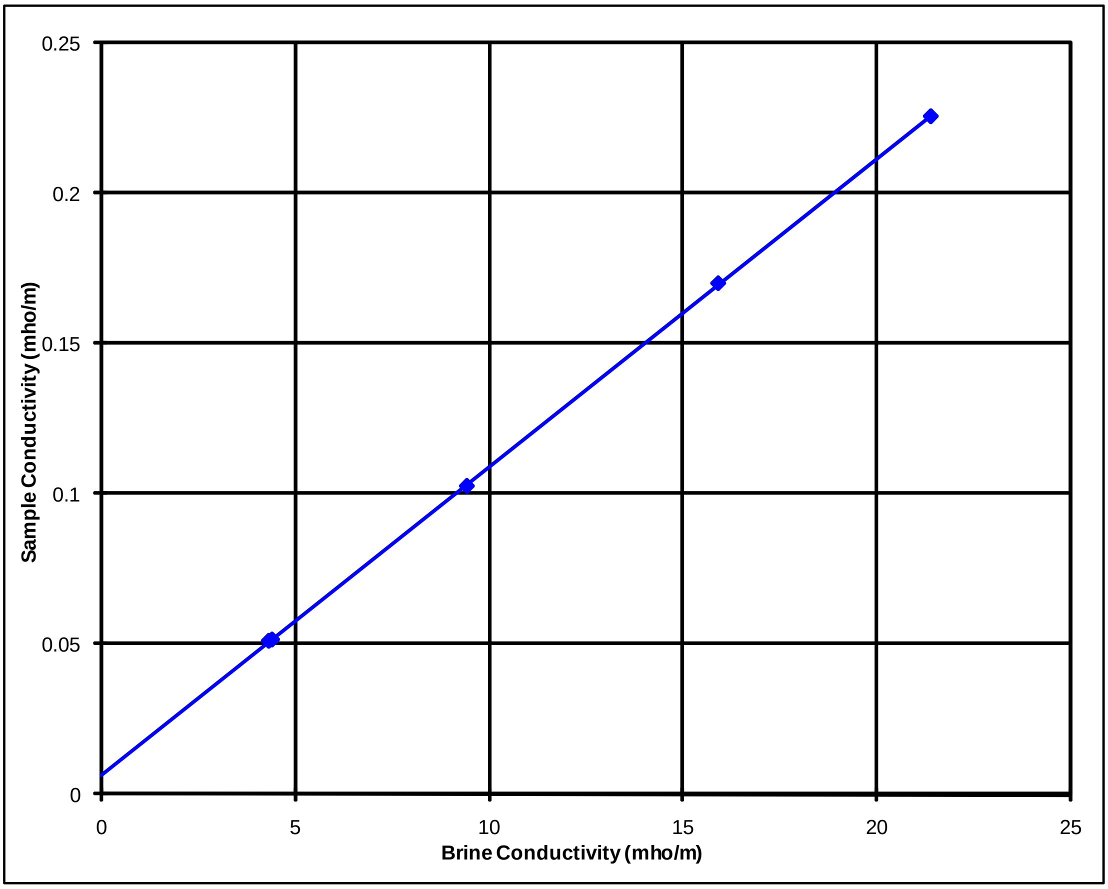


MULTI-SALINITY RESISTIVITY ANALYSES

Client	ESSO Australia Pty Ltd			
Well	Snapper-A21a			
Sample	55A		**Air Permeability**	0.43 mD
Depth	2944.52 m		**Porosity**	9.2 %
Overburden	4000 psi			

Formation Factor, FF	86.0	**Shaly Sand Equivalent FF***	96.9
Cementation Exponent, m	1.87	**Shaly Sand Equivalent m***	1.92

Brine	Brine Resistivity, Rw (ohm.m)	Sample Resistivity, Ro (ohm.m)	Brine Conductivity, Cw (mho/m)	Sample Conductivity, Co (mho/m)
Formation	0.225	19.3	4.44	0.052
70000 ppm	0.106	9.73	9.43	0.103
130000 ppm	0.063	5.88	15.9	0.170
200000 ppm	0.047	4.43	21.3	0.226
Formation	0.229	19.5	4.37	0.051



CHAPTER 4

ELECTRICAL PROPERTIES AND CAPILLARY PRESSURE

4.2 Test Results

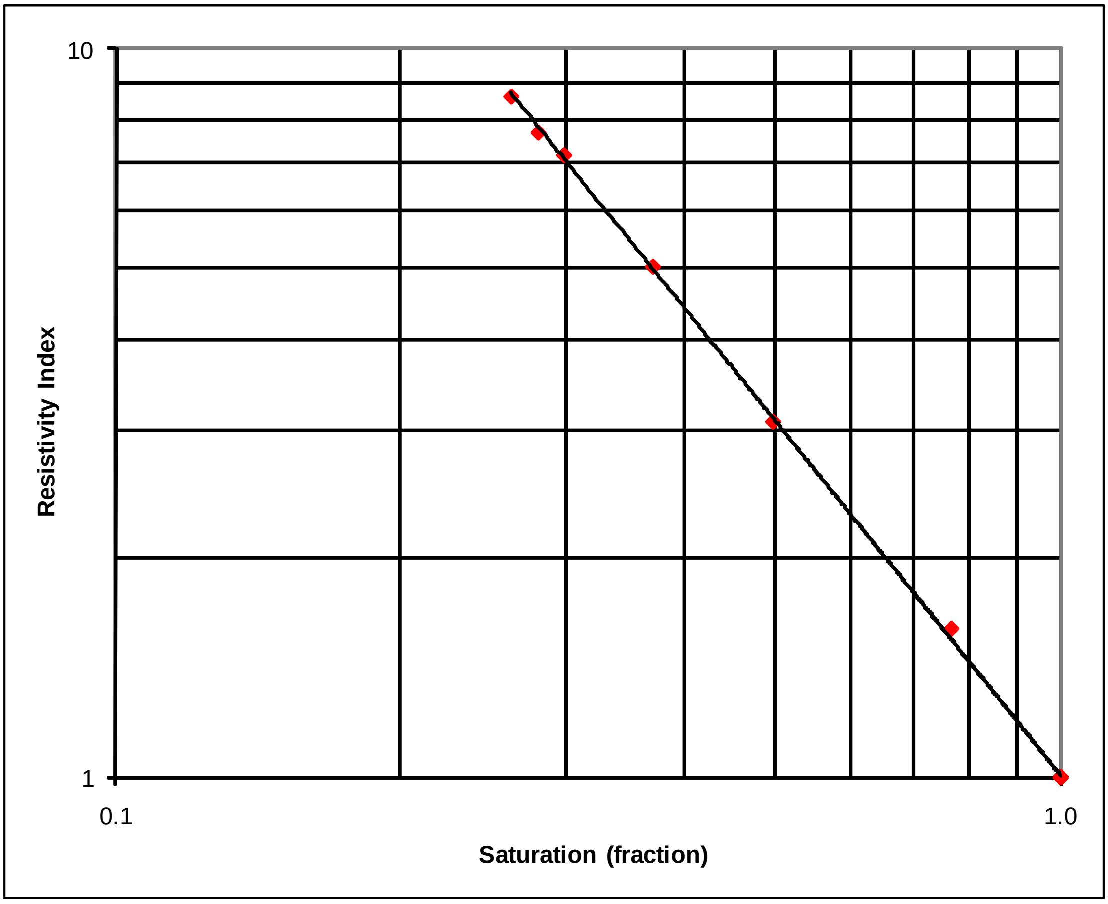
4.2.3 Resistivity Index

RESISTIVITY INDEX

Client ESSO Australia Pty Ltd
Well Snapper-A21a

Rw of Saturant 0.21 at 25ºC
Method Air/Brine Porous Plate @ Overburden

Sample Number	Depth (metres)	Permeability to Air (milliDarcy's)	Porosity (percent)	Formation Factor FF	Brine Saturation (fraction)	Resistivity Index RI	Saturation Exponent n
10A	2933.31	0.22	5.1	271	1.000	1.00	
					0.766	1.60	
					0.496	3.08	
					0.370	5.03	
					0.298	7.16	
					0.280	7.69	
					0.262	8.62	1.61

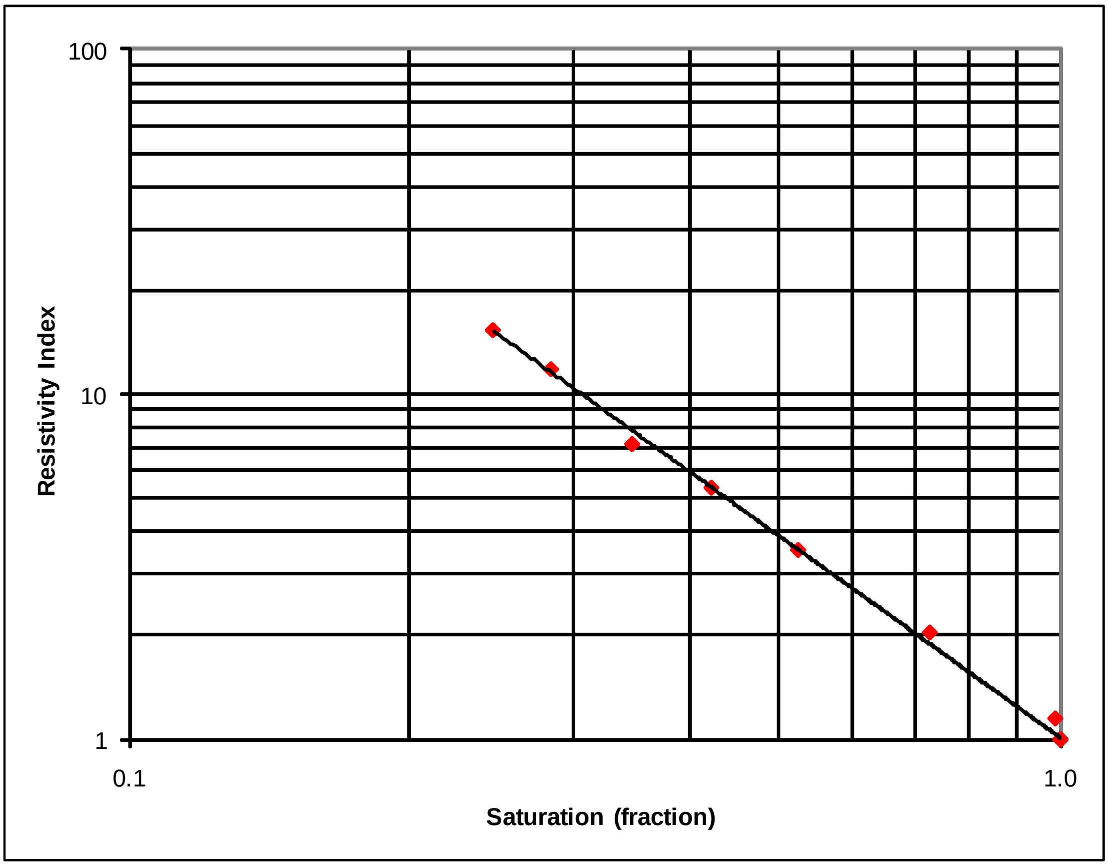


RESISTIVITY INDEX

Client ESSO Australia Pty Ltd
Well Snapper-A21a

Rw of Saturant 0.21 at 25ºC
Method Air/Brine Porous Plate @ Overburden

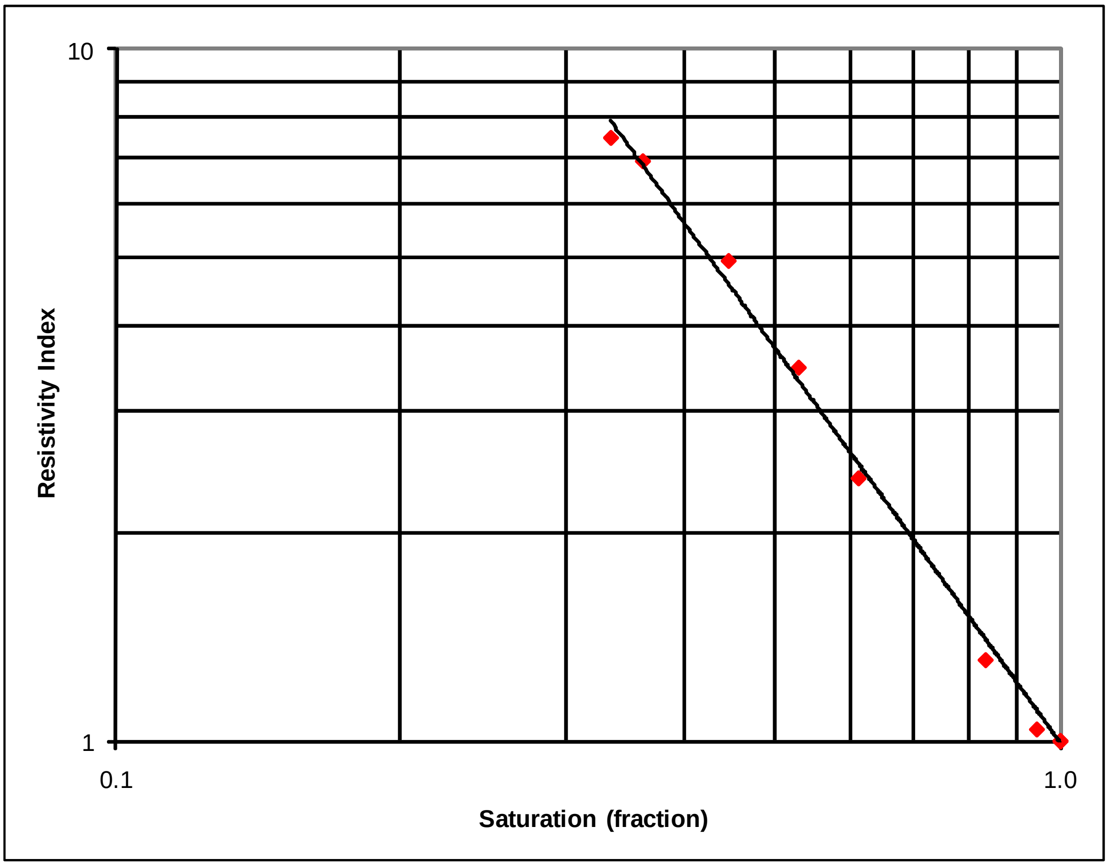
Sample Number	Depth (metres)	Permeability to Air (milliDarcy's)	Porosity (percent)	Formation Factor FF	Brine Saturation (fraction)	Resistivity Index RI	Saturation Exponent n
26A	2937.26	0.16	7.3	139	1.000	1.00	
					0.987	1.15	
					0.724	2.04	
					0.523	3.54	
					0.422	5.36	
					0.347	7.17	
					0.284	11.8	
					0.246	15.3	1.94



RESISTIVITY INDEX

Client	ESSO Australia Pty Ltd
Well	Snapper-A21a
Rw of Saturant	0.21 at 25ºC
Method	Air/Brine Porous Plate @ Overburden

Sample Number	Depth (metres)	Permeability to Air (milliDarcy's)	Porosity (percent)	Formation Factor FF	Brine Saturation (fraction)	Resistivity Index RI	Saturation Exponent n
34A	2939.27	0.09	6.6	177	1.000	1.00	
					0.944	1.04	
					0.833	1.31	
					0.611	2.40	
					0.528	3.47	
					0.445	4.95	
					0.361	6.90	
					0.334	7.46	1.88

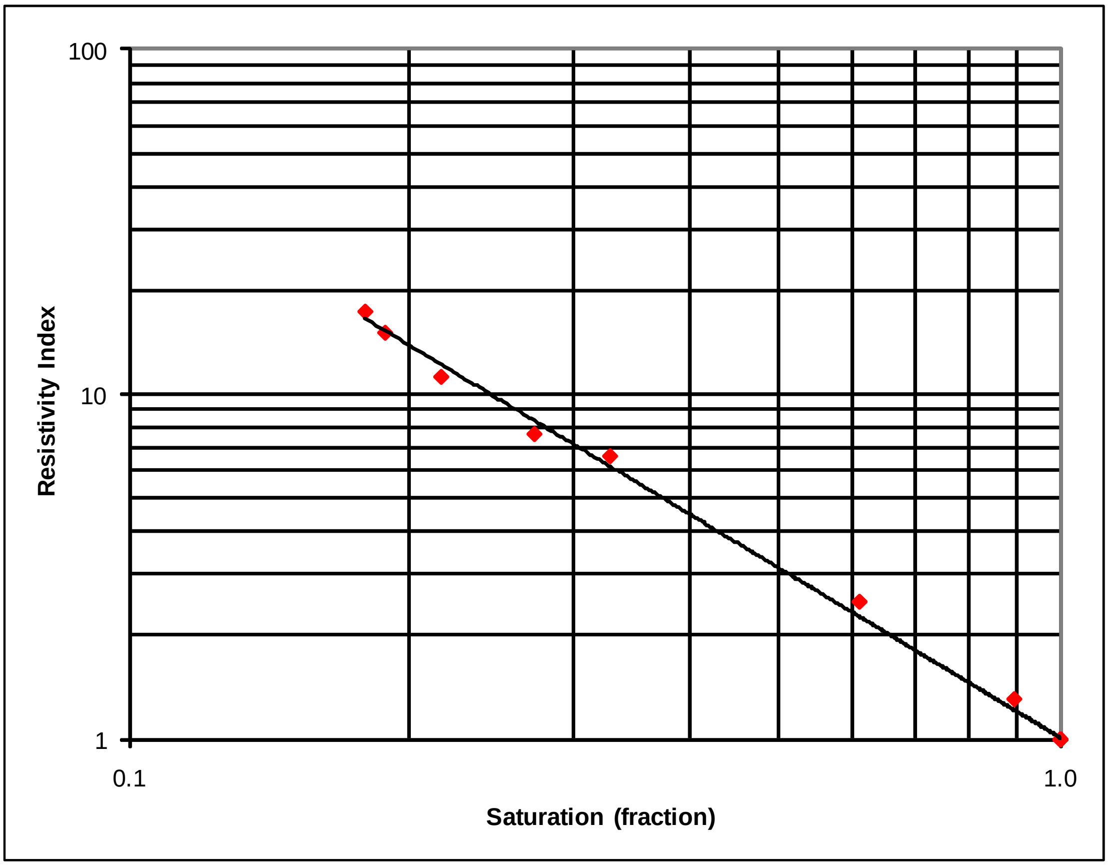


RESISTIVITY INDEX

Client ESSO Australia Pty Ltd
Well Snapper-A21a

Rw of Saturant 0.21 at 25ºC
Method Air/Brine Porous Plate @ Overburden

Sample Number	Depth (metres)	Permeability to Air (milliDarcy's)	Porosity (percent)	Formation Factor FF	Brine Saturation (fraction)	Resistivity Index RI	Saturation Exponent n
48A	2942.78	0.51	10.0	84.3	1.000	1.00	
					0.892	1.31	
					0.608	2.51	
					0.328	6.64	
					0.272	7.70	
					0.216	11.3	
					0.188	15.2	
					0.179	17.5	1.63

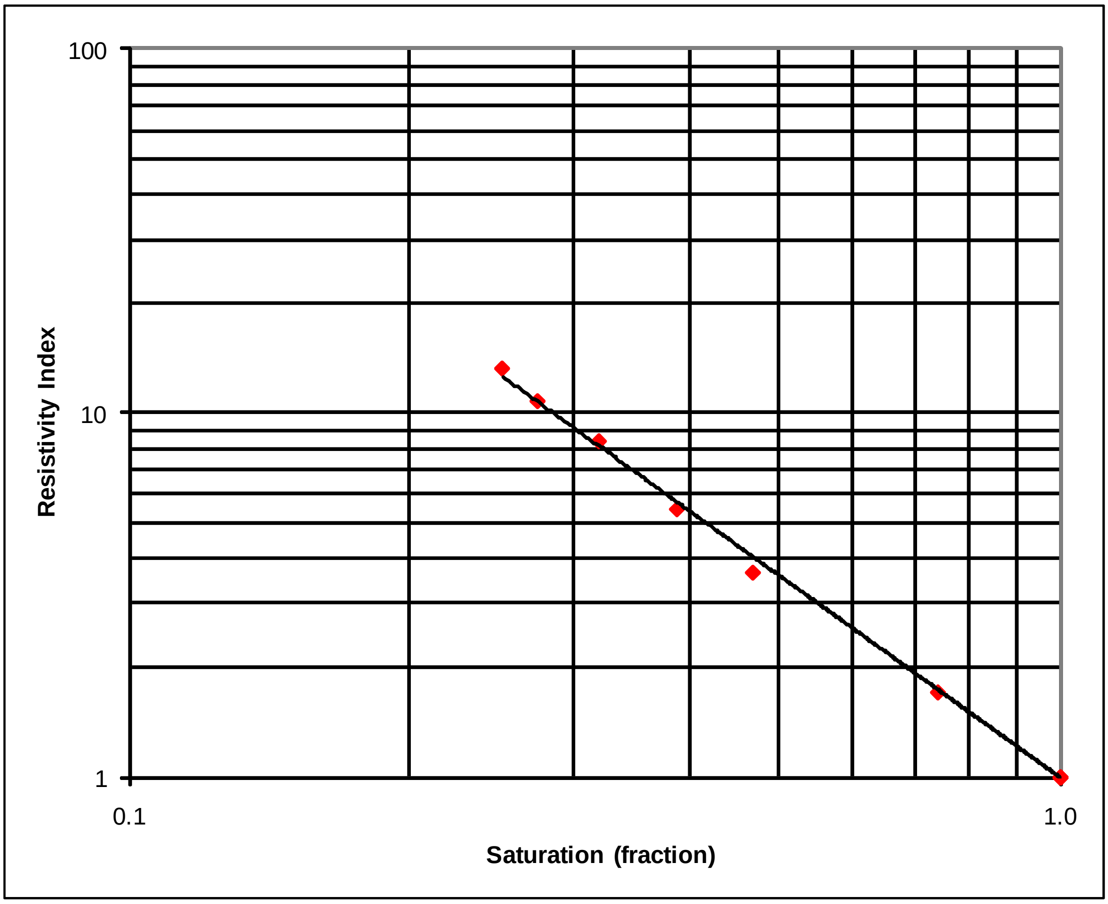


RESISTIVITY INDEX

Client ESSO Australia Pty Ltd
Well Snapper-A21a

Rw of Saturant 0.21 at 25ºC
Method Air/Brine Porous Plate @ Overburden

Sample Number	Depth (metres)	Permeability to Air (milliDarcy's)	Porosity (percent)	Formation Factor FF	Brine Saturation (fraction)	Resistivity Index RI	Saturation Exponent n
49A	2943.05	0.21	8.1	120	1.000	1.00	
					0.739	1.71	
					0.468	3.64	
					0.388	5.43	
					0.320	8.34	
					0.275	10.7	
					0.252	13.2	1.83

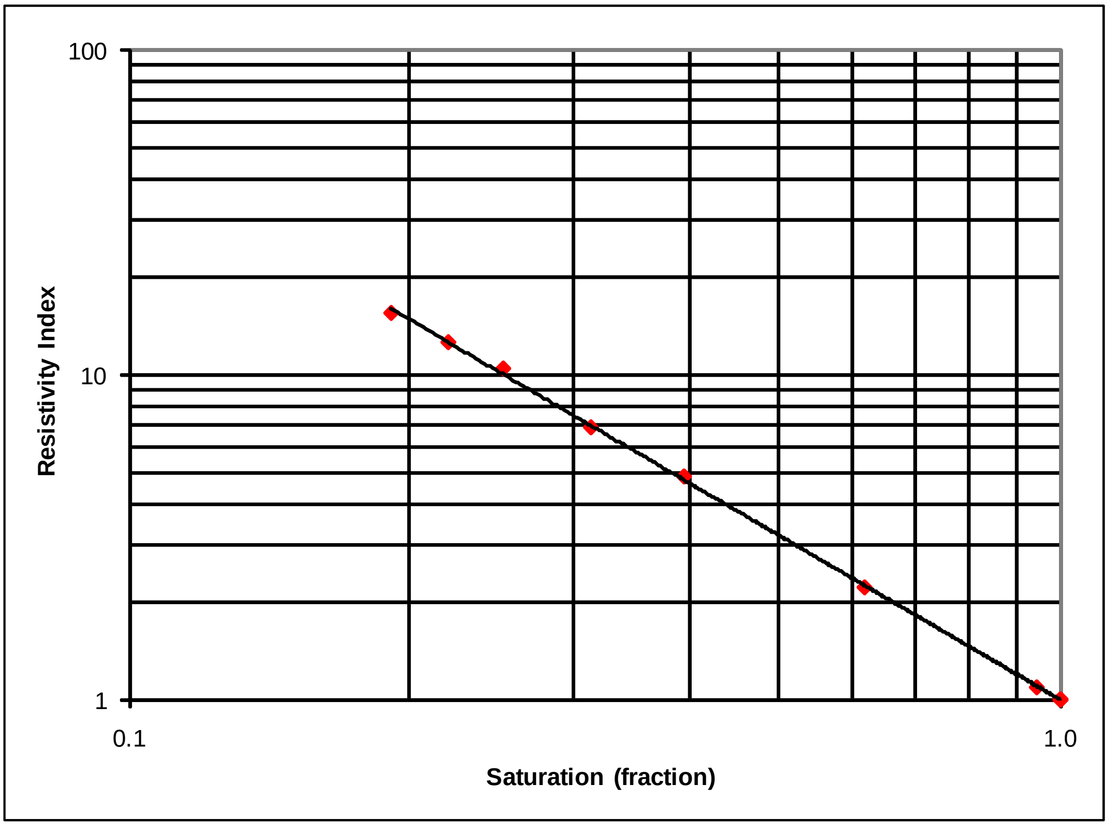


RESISTIVITY INDEX

Client ESSO Australia Pty Ltd
Well Snapper-A21a

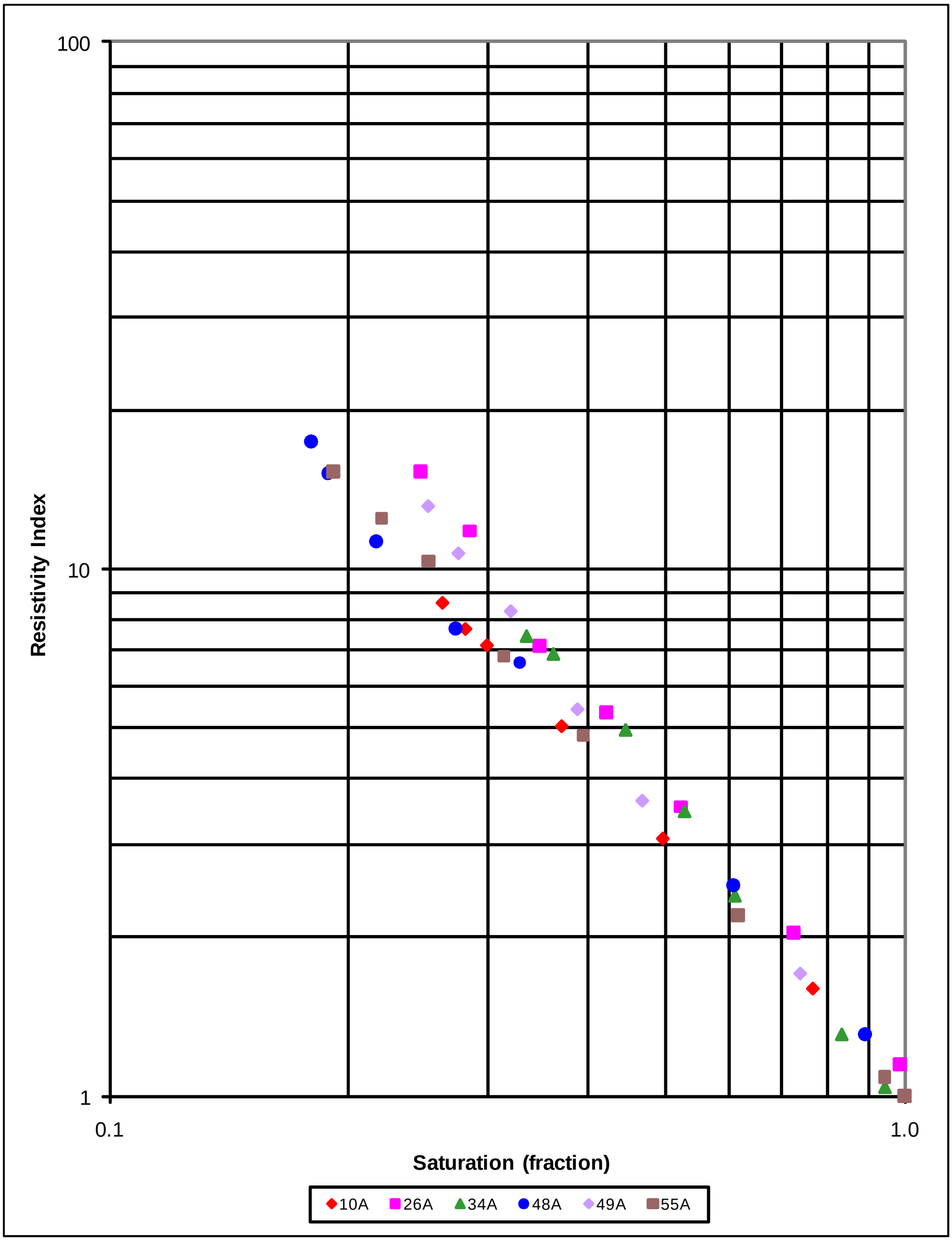
Rw of Saturant 0.21 at 25ºC
Method Air/Brine Porous Plate @ Overburden

Sample Number	Depth (metres)	Permeability to Air (milliDarcy's)	Porosity (percent)	Formation Factor FF	Brine Saturation (fraction)	Resistivity Index RI	Saturation Exponent n
55A	2944.52	0.43	9.2	86.0	1.000	1.00	
					1.000	1.00	
					0.943	1.09	
					0.616	2.21	
					0.394	4.84	
					0.313	6.85	
					0.252	10.4	
					0.220	12.5	
					0.191	15.4	1.67



RESISTIVITY INDEX

Client	ESSO Australia Pty Ltd
Well	Snapper-A21a
Rw of Saturant	0.21 at 25ºC
Method	Air/Brine Porous Plate @ Overburden



CHAPTER 4

ELECTRICAL PROPERTIES AND CAPILLARY PRESSURE

4.2 Test Results

4.2.4 Capillary Pressure

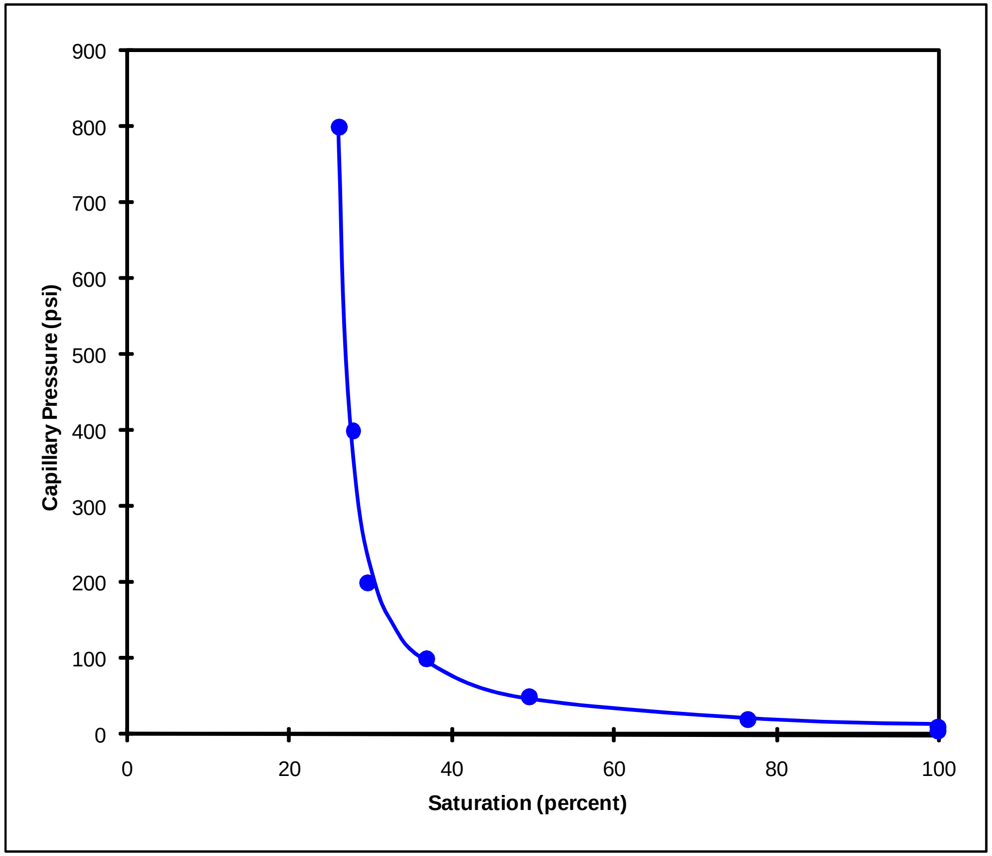
CAPILLARY PRESSURE
Overburden

Client	ESSO Australia Pty Ltd	**Air Permeability**	0.22 milliDarcy's
Well	Snapper-A21a	**Porosity**	5.1 percent

Sample 10A
Depth 2933.31 metres

Test Method Air/Brine Porous Plate @ Overburden
Overburden 4000 psi

Capillary Pressure (psi)	Brine Saturation (percent)
5.0	100.0
10	100.0
20	76.6
50	49.6
100	37.0
200	29.8
400	28.0
800	26.2



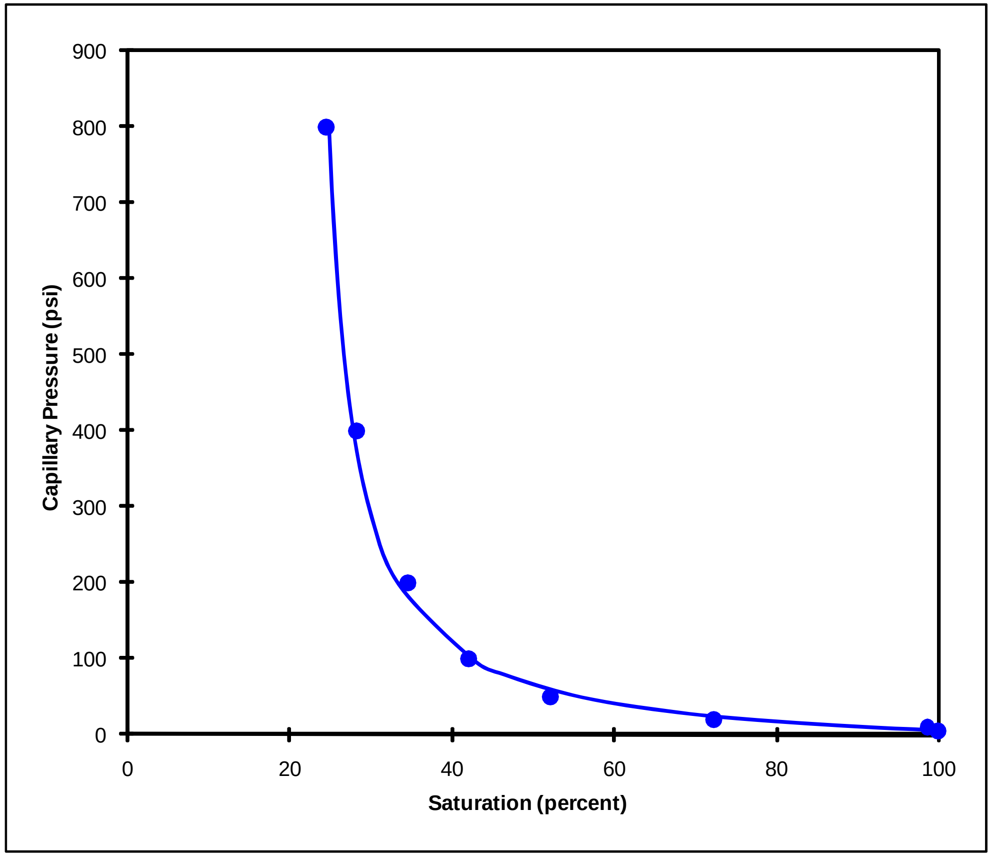
CAPILLARY PRESSURE
Overburden

Client	ESSO Australia Pty Ltd	**Air Permeability**	0.16 milliDarcy's
Well	Snapper-A21a	**Porosity**	7.3 percent

Sample 26A
Depth 2937.26 metres

Test Method Air/Brine Porous Plate @ Overburden
Overburden 4000 psi

Capillary Pressure (psi)	Brine Saturation (percent)
5.0	100.0
10	98.7
20	72.4
50	52.3
100	42.2
200	34.7
400	28.4
800	24.6



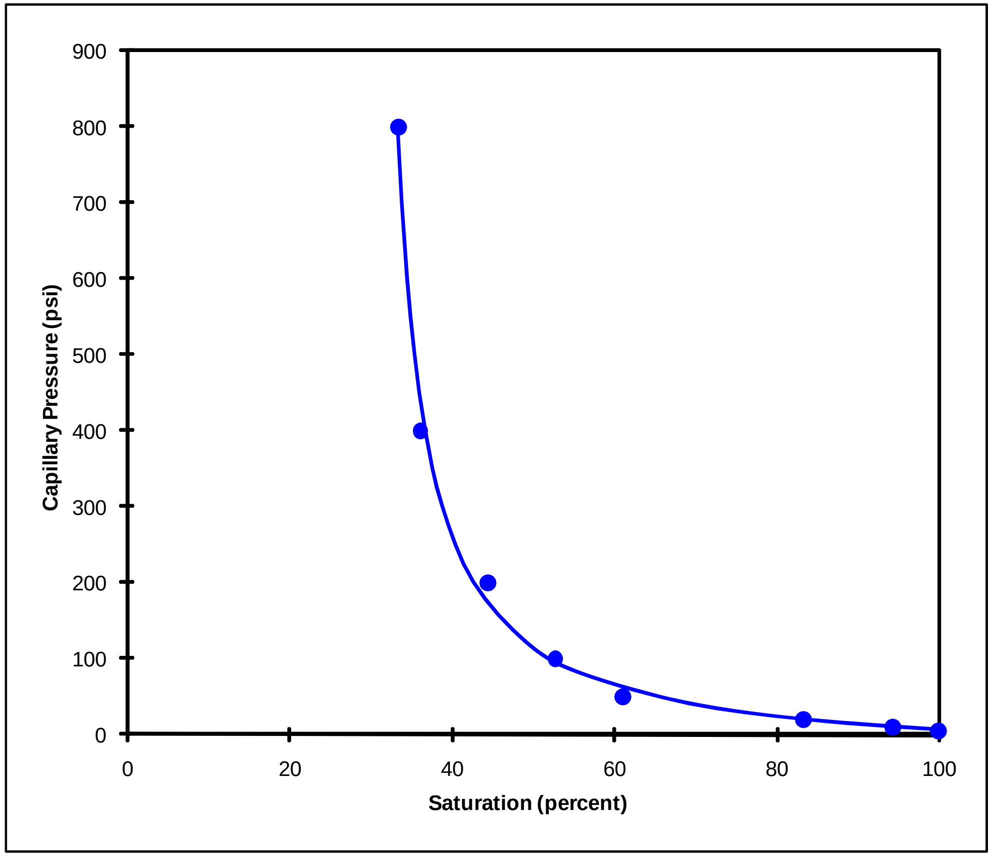
CAPILLARY PRESSURE
Overburden

Client	ESSO Australia Pty Ltd	**Air Permeability**	0.09 milliDarcy's
Well	Snapper-A21a	**Porosity**	6.6 percent

Sample 34A
Depth 2939.27 metres

Test Method Air/Brine Porous Plate @ Overburden
Overburden 4000 psi

Capillary Pressure (psi)	Brine Saturation (percent)
5.0	100.0
10	94.4
20	83.3
50	61.1
100	52.8
200	44.5
400	36.1
800	33.4

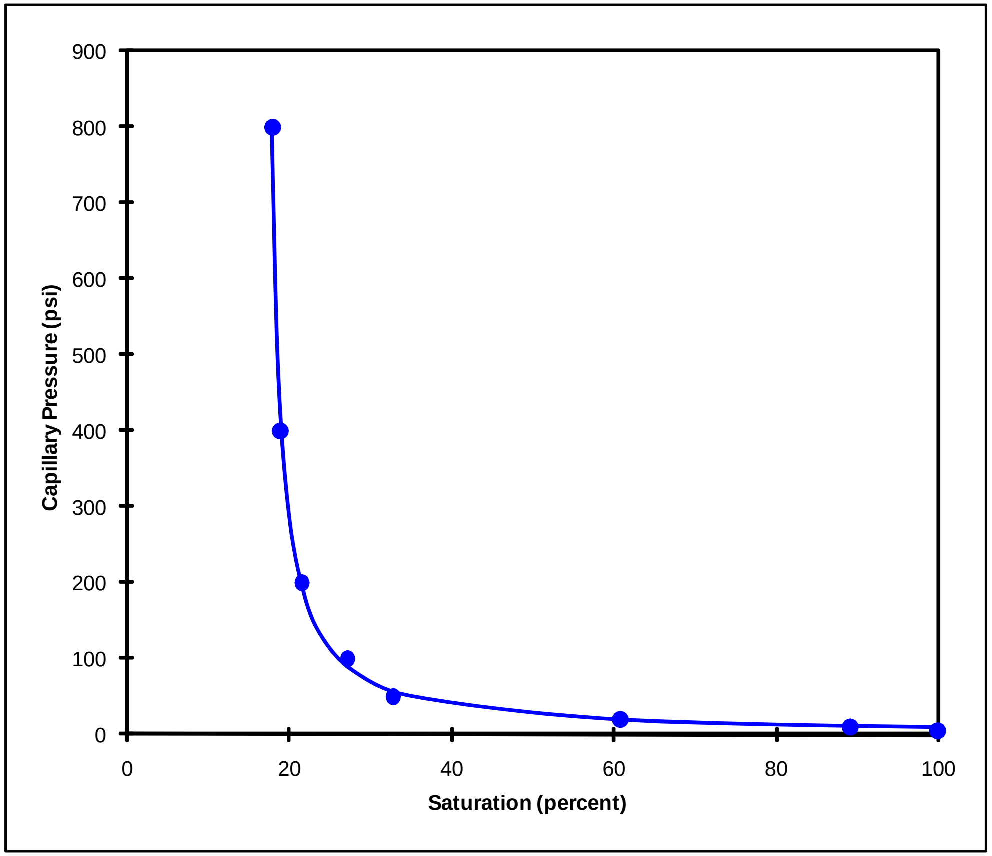


CAPILLARY PRESSURE
Overburden

Client	ESSO Australia Pty Ltd	**Air Permeability**	0.51 milliDarcy's
Well	Snapper-A21a	**Porosity**	10.0 percent

Sample	48A
Depth	2942.78 metres
Test Method	Air/Brine Porous Plate @ Overburden
Overburden	4000 psi

Capillary Pressure (psi)	Brine Saturation (percent)
5.0	100.0
10	89.2
20	60.8
50	32.8
100	27.2
200	21.6
400	18.8
800	17.9



CAPILLARY PRESSURE
Overburden

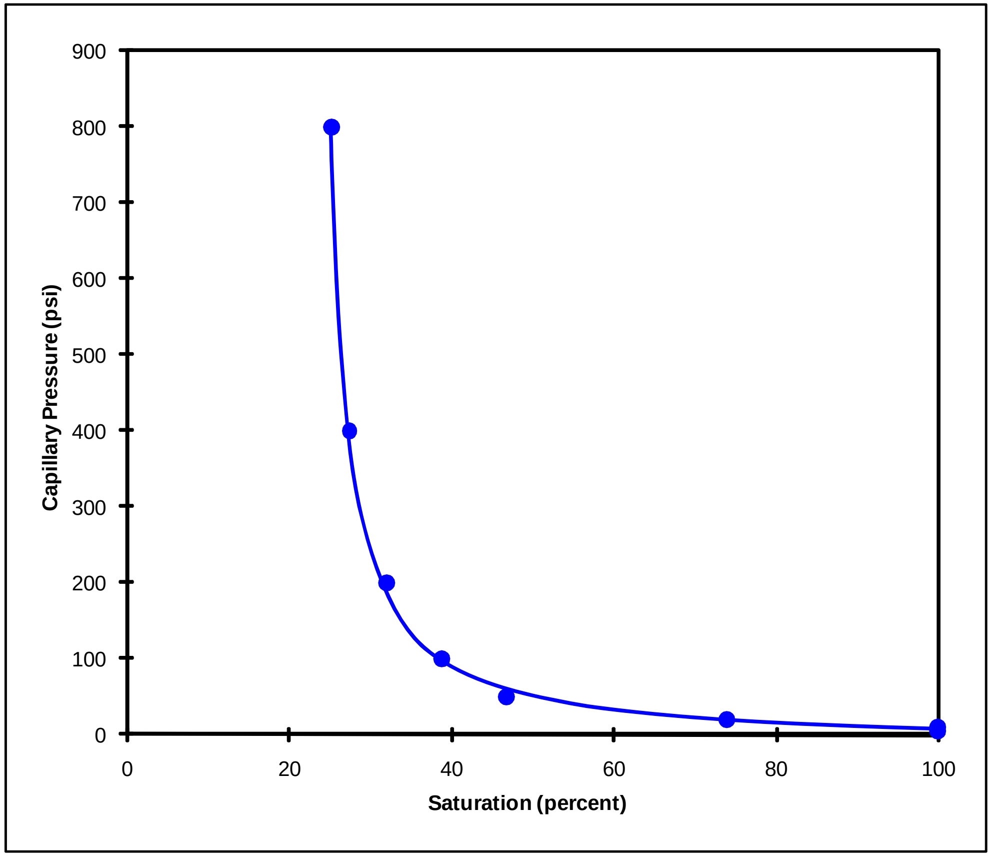
Client ESSO Australia Pty Ltd
Well Snapper-A21a

Air Permeability 0.21 milliDarcy's
Porosity 8.1 percent

Sample 49A
Depth 2943.05 metres

Test Method Air/Brine Porous Plate @ Overburden
Overburden 4000 psi

Capillary Pressure (psi)	Brine Saturation (percent)
5.0	100.0
10	100.0
20	73.9
50	46.8
100	38.8
200	32.0
400	27.5
800	25.2

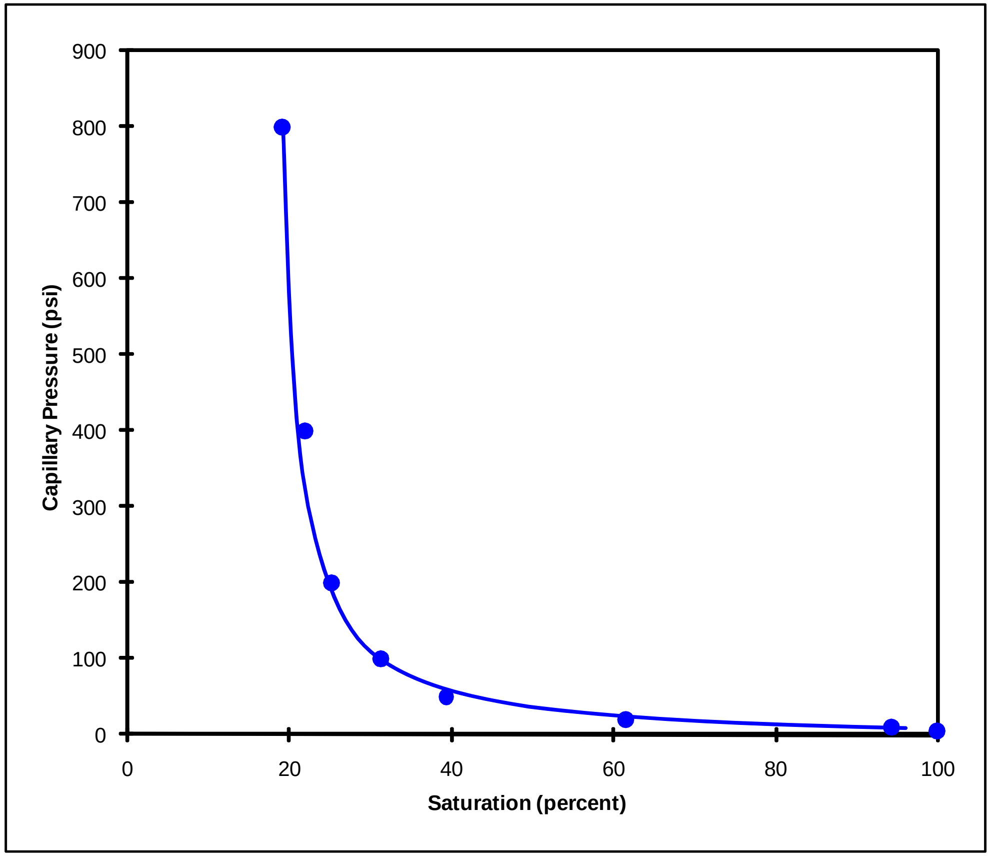


CAPILLARY PRESSURE
Overburden

Client	ESSO Australia Pty Ltd	**Air Permeability**	0.43 milliDarcy's
Well	Snapper-A21a	**Porosity**	9.2 percent

Sample	55A
Depth	2944.52 metres
Test Method	Air/Brine Porous Plate @ Overburden
Overburden	4000 psi

Capillary Pressure (psi)	Brine Saturation (percent)
5.0	100.0
10	94.3
20	61.6
50	39.4
100	31.3
200	25.2
400	22.0
800	19.1

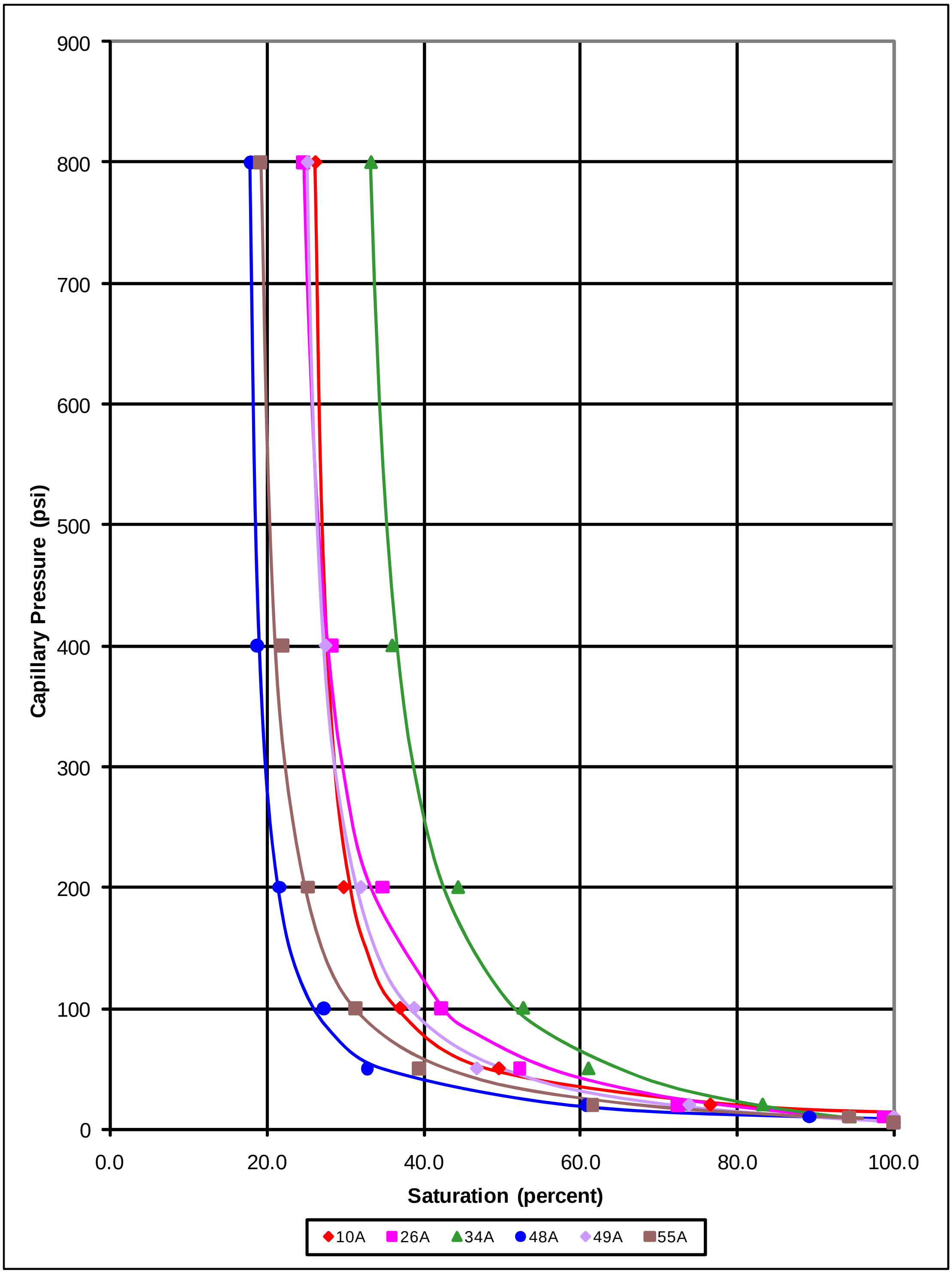


Weatherford Laboratories (Australia)
ABN: 81 008 273 005

CAPILLARY PRESSURE

Client ESSO Australia Pty Ltd
Well Snapper-A21a

Method Air/Brine Porous Plate @ Overburden



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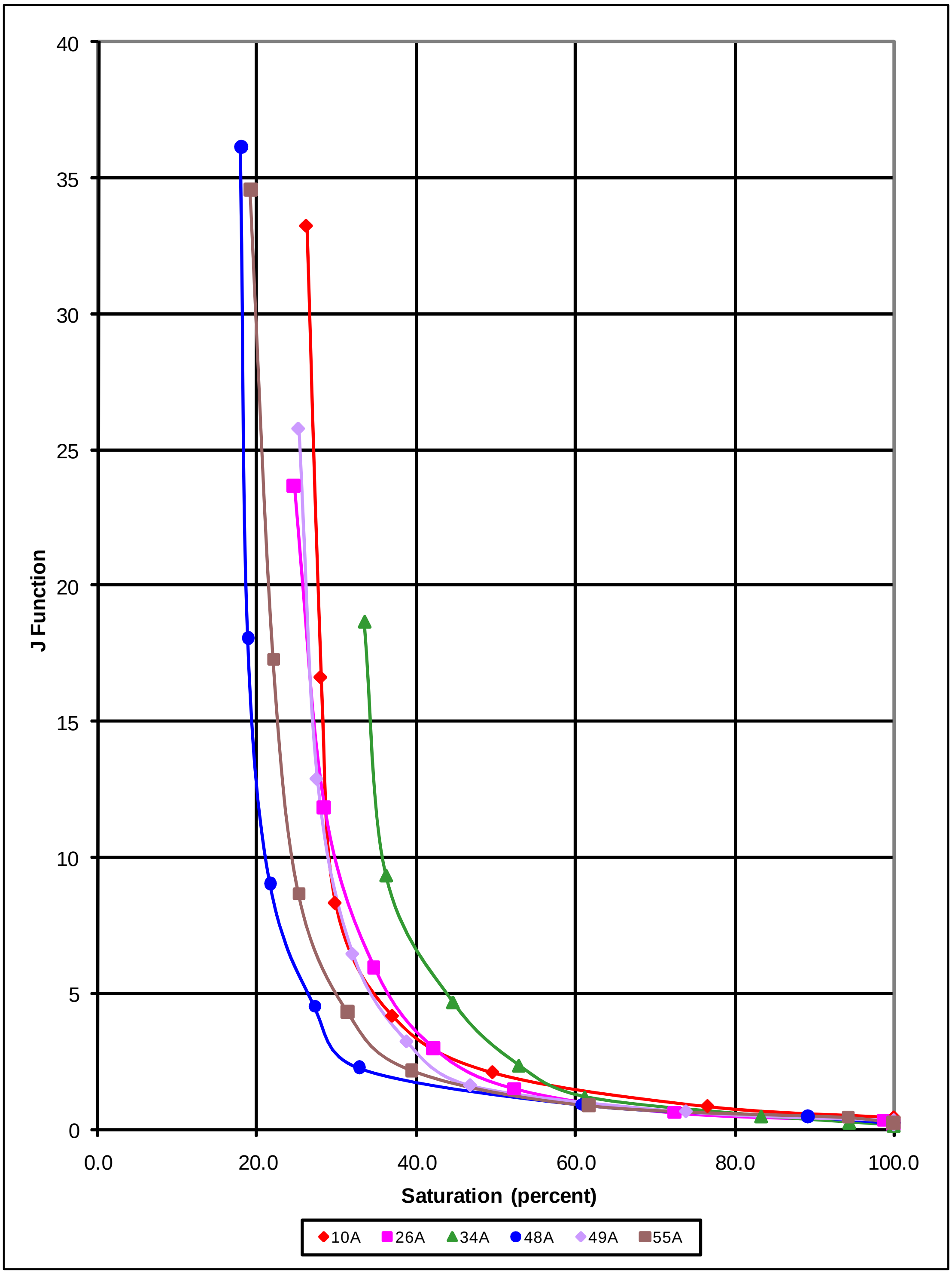
Client ESSO Australia Pty Ltd
Well Snapper-A21a

Method Air/Brine Porous Plate @ Overburden



CHAPTER 4

ELECTRICAL PROPERTIES AND CAPILLARY PRESSURE

4.2 Test Results

4.2.5 Cation Exchange Capacity

CATION EXCHANGE CAPACITY

Client ESSO Australia Pty Ltd
Well Snapper-A21a

Sample Number	Depth (metres)	Porosity (percent)	Grain Density (g/cm^3)	Cation Exchange Capacity (meq/100g) Uncrushed	Crushed	Quantity of Cation Exchangeable Clay Qv (meq/cm^3) Uncrushed	Crushed
3A	2931.65	6.3	2.69	0.20	0.26	0.08	0.10
5A	2932.05	5.3	2.71	0.19	0.21	0.09	0.10
10A	2933.31	6.6	2.68	0.17	0.18	0.06	0.07
18A	2935.30	6.1	2.68	0.19	0.20	0.08	0.08
26A	2937.26	8.7	2.68	0.33	0.47	0.09	0.13
34A	2939.27	7.9	2.66	0.37	0.48	0.11	0.15
48A	2942.78	11.7	2.66	0.24	0.34	0.05	0.07
49A	2943.05	9.6	2.66	0.35	0.43	0.09	0.11
55A	2944.52	11.2	2.65	0.27	0.38	0.06	0.08
72A	2931.65	5.4	2.67	0.20	0.29	0.09	0.13

CHAPTER 4

ELECTRICAL PROPERTIES AND CAPILLARY PRESSURE

4.2 Test Results

4.2.6 Electrical Properties Summary

ELECTRICAL PROPERTIES SUMMARY

Client ESSO Australia Pty Ltd
Well Snapper-A21a

Rw of Saturant 0.210 at 25ºC
Overburden 4000 psi

							Shaley Sand Equivalent ‡		
Sample Number	Depth (metres)	Permeability to Air (milliDarcy's)	Porosity (percent)	Formation Factor FF	Cementation Exponent m	Saturation Exponent n	Formation Factor FF*	Cementation Exponent m*	Saturation Exponent n*
3A	2931.65	0.15	4.7	214	1.75				
5A	2932.05	0.09	3.4	241	1.62				
10A	2933.31	0.22	5.1	271	1.88	1.61	348	1.97	1.97
18A	2935.30	0.11	4.6	248	1.79				
26A	2937.26	0.16	7.3	139	1.89	1.94	162	1.94	2.18
34A	2939.27	0.09	6.6	177	1.90	1.88	214	1.97	2.14
48A	2942.78	0.51	10.0	84.3	1.93	1.63	105	2.02	2.00
49A	2943.05	0.21	8.1	120	1.90	1.83	137	1.96	2.05
55A	2944.52	0.43	9.2	86.0	1.87	1.67	96.9	1.92	1.89
72A	2948.77	0.08	3.8	218	1.65				

‡ Calculated from Multi-Salinity Formation Factor

ELECTRICAL PROPERTIES SUMMARY

Client ESSO Australia Pty Ltd
Well Snapper-A21a

Rw of Saturant 0.210 at 25ºC
Overburden 4000 psi

							Shaley Sand Equivalent †		
Sample Number	Depth (metres)	Permeability to Air (milliDarcy's)	Porosity (percent)	Formation Factor FF	Cementation Exponent m	Saturation Exponent n	Formation Factor FF*	Cementation Exponent m*	Saturation Exponent n*
3A	2931.65	0.15	4.7	214	1.75		228	1.78	
5A	2932.05	0.09	3.4	241	1.62		264	1.65	
10A	2933.31	0.22	5.1	271	1.88	1.61	286	1.90	1.71
18A	2935.30	0.11	4.6	248	1.79		265	1.81	
26A	2937.26	0.16	7.3	139	1.89	1.94	149	1.91	2.06
34A	2939.27	0.09	6.6	177	1.90	1.88	193	1.94	2.02
48A	2942.78	0.51	10.0	84.3	1.93	1.63	87.5	1.94	1.72
49A	2943.05	0.21	8.1	120	1.90	1.83	128	1.93	1.96
55A	2944.52	0.43	9.2	86.0	1.87	1.67	90.0	1.89	1.77
72A	2948.77	0.08	3.8	218	1.65		238	1.67	

† Calculated from Cation Exchange Capacity

CHAPTER 4

ELECTRICAL PROPERTIES AND CAPILLARY PRESSURE

4.2 Test Results

4.2.7 Effective Permeability to Gas

EFFECTIVE PERMEABILITY

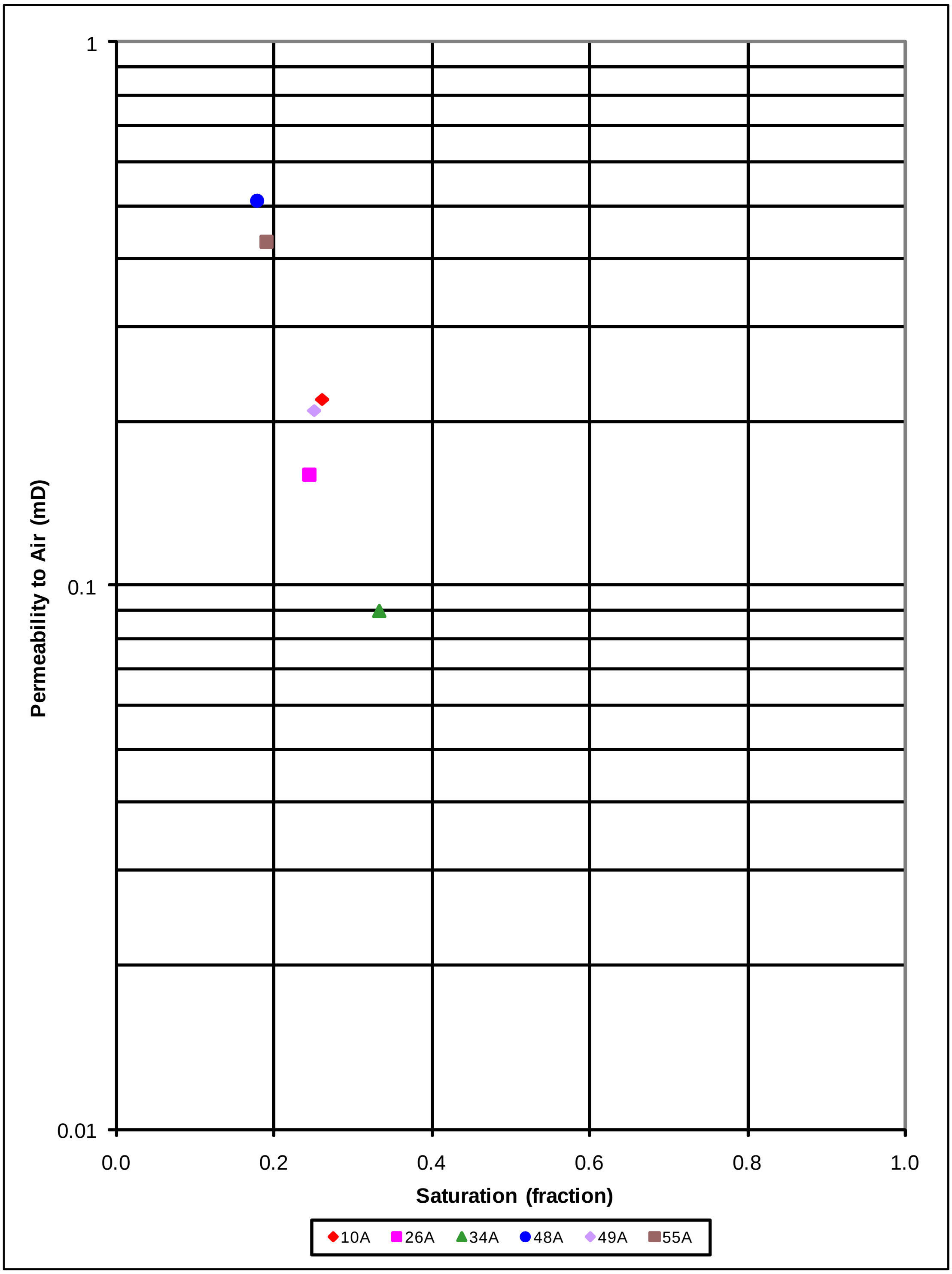
Client ESSO Australia Pty Ltd
Well Snapper-A21a

Sample Number	Depth (metres)	Permeability to Air (milliDarcy's)	Porosity (percent)	Brine Saturation (percent)	Effective Permeability to Air (milliDarcy's)
3A	2931.65	0.15	4.7		
5A	2932.05	0.09	3.4		
10A	2933.31	0.22	5.1	26.2	0.08
18A	2935.30	0.11	4.6		
26A	2937.26	0.16	7.3	24.6	0.12
34A	2939.27	0.09	6.6	33.4	0.05
48A	2942.78	0.51	10.0	17.9	0.23
49A	2943.05	0.21	8.1	25.2	0.04
55A	2944.52	0.43	9.2	19.1	0.30
72A	2948.77	0.08	3.8		

RESIDUAL SATURATION

Client ESSO Australia Pty Ltd
Well Snapper-A21a

Method Air/Brine Porous Plate @ Overburden



CHAPTER 5

MERCURY INJECTION CAPILLARY PRESSURE

5.1 Test and Calculation Procedures

5. MERCURY INJECTION CAPILLARY PRESSURE

5.1 Test and Calculation Procedures

Sample off-cuts of sufficient volume to fill the sample chamber (circa 2 cm^3) were utilised for capillary pressure determinations by the mercury injection technique. The mercury injection apparatus used was semi-automatic Micromeritics Autopore IV 9520, which can operate up to a pressure of 60,000 psia, and can measure intrusions as small as 0.0001 cm^3.

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

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

The results of saturation as a function of pressure are presented ‘unconformed’ and ‘conformed’. The conformance correction aims to back out the effects of surface conformance of the mercury into sample surface features, which, if left unconformed, is seen as actual sample penetration. Mercury-Air displacement pressures were estimated by extrapolation of curve plateaus (Schowalter 1979).

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

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

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

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

Calculation of the hydrocarbon column that a given rock pore system can seal, is accomplished by using the equation of Smith (1966):

$$H = \frac{(PdB - PdR)}{(\rho_w - \rho_h) x 0.433}$$

where H = *maximum vertical hydrocarbon column in feet above the 100% water level that can be sealed*

PdB = *subsurface hydrocarbon-water displacement pressure (psi) of the boundary or sealing bed*

PdR = *subsurface hydrocarbon-water displacement pressure (psi) of the reservoir rock*

ρ_w = *subsurface density (g/cc) of water*

ρ_h = *subsurface density (g/cc) of hydrocarbon*

0.433 = *unit's conversion factor*

The parameters used to calculate the hydrocarbon column heights all listed in the data report tables.

Definitions:

- Entry pressure is the first pressure interpreted as actual mercury penetration of the sample.
- Displacement pressure as defined by Leverett (1940) is the minimum pressure required for the non-wetting fluid, (oil or gas) to begin displacing the wetting fluid (water) from the largest pores.
- Threshold pressure is deemed where the mercury presents a continuous phase and is interpreted as 10% Hg Saturation.

CHAPTER 5

MERCURY INJECTION CAPILLARY PRESSURE

5.2 Test Results

INTERPRETED CAPILLARY PRESSURE

Client ESSO Australia Pty Ltd
Well Snapper-A21a

Test Method Air/Mercury Capillary Pressure Drainage

Sample 3A
Depth 2931.65

Ambient Permeability 1.19 milliDarcy's
Ambient Porosity 5.8 percent
pore radius (µm) 3.55

Density Gradients, psi/foot		**Conversion Parameters**			
	Typical		air/water	air/oil	oil/water
Water:	0.440	Laboratory Theta	0.0	0.0	30.0
Oil:	0.330	Laboratory IFT	72.0	24.0	48.0
Gas:	0.100	Reservoir Theta	0.0		30.0
		Reservoir IFT	50.0		30.0
		Laboratory TcosTheta	72.0	24.0	42.0
		Reservoir TcosTheta	50.0		26.0

	Entry Pressure (psia)		Displacement Pressure (psia)		Threshold Pressure (psia)	
System	Lab	Res Con	Lab	Resv	Lab	Resv
A-Hg	30.0	-	45.2	-	61.0	-
G-W	5.88	4.08	8.86	6.15	12.0	8.33
O-W	1.96	2.12	2.95	3.19	3.98	4.30

Pressure (psia)	Raw Data Intrusion (percent)	Raw Data Saturation (percent)	Conformance Corrected Intrusion (percent)	Conformance Corrected Saturation (percent)	Pore Diameter (µm)	Equivalent Air/Brine Lab (psi)	Injection Pressures Air/Brine Res Con (psi)	Oil/Brine Lab Conditions (psi)	Oil/Brine Reservoir Conditions (psi)	Height Above Free Water Oil-Water (feet)	Height Above Free Water Gas-Water (feet)
1.06	0.0	0.0	0.0	0.0	201	0.21	0.14	0.12	0.07	0.68	0.42
2.02	1.8	1.8	0.0	0.0	105	0.40	0.28	0.23	0.14	1.30	0.81
2.76	0.8	2.5	0.0	0.0	76.9	0.54	0.38	0.32	0.20	1.78	1.11
3.21	0.3	2.9	0.0	0.0	66.0	0.63	0.44	0.37	0.23	2.06	1.29
3.75	0.3	3.2	0.0	0.0	56.5	0.74	0.51	0.43	0.27	2.42	1.50
4.40	0.3	3.5	0.0	0.0	48.2	0.86	0.60	0.50	0.31	2.84	1.76
5.20	0.3	3.9	0.0	0.0	40.8	1.02	0.71	0.60	0.37	3.35	2.08
6.00	0.3	4.2	0.0	0.0	35.4	1.18	0.82	0.69	0.43	3.86	2.41
7.00	0.3	4.5	0.0	0.0	30.3	1.37	0.95	0.80	0.50	4.51	2.80
8.30	0.3	4.8	0.0	0.0	25.6	1.63	1.13	0.95	0.59	5.35	3.32
10.0	0.4	5.2	0.0	0.0	21.2	1.96	1.36	1.14	0.71	6.42	4.00
11.5	0.3	5.5	0.0	0.0	18.4	2.25	1.56	1.32	0.82	7.43	4.59
13.5	0.4	5.9	0.0	0.0	15.7	2.65	1.84	1.54	0.95	8.66	5.41
15.5	0.5	6.4	0.0	0.0	13.7	3.04	2.11	1.77	1.10	10.0	6.21

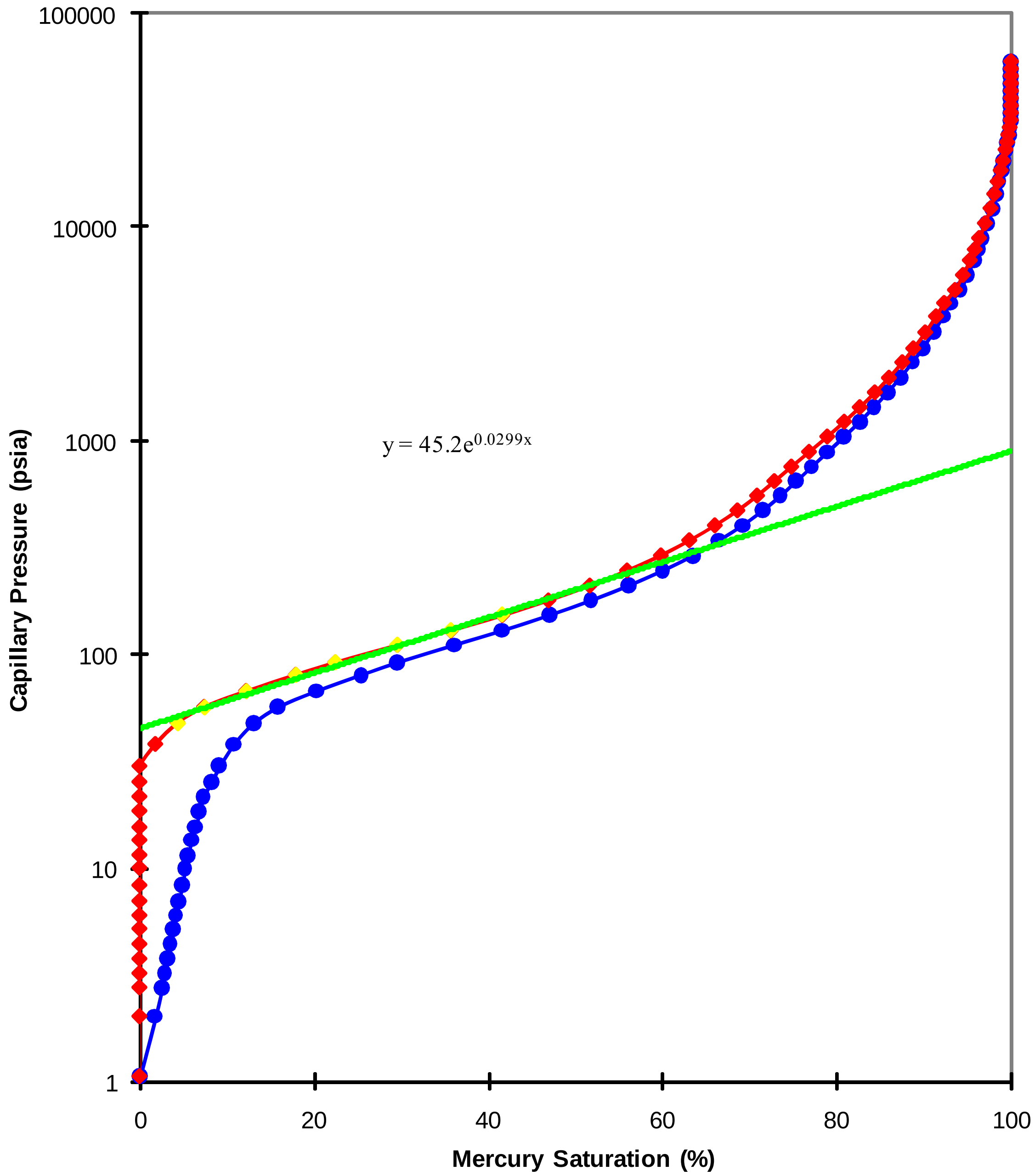
Pressure (psia)	Raw Data Intrusion (percent)	Raw Data Saturation (percent)	Conformance Corrected Intrusion (percent)	Conformance Corrected Saturation (percent)	Pore Diameter (μm)	Equivalent Air/Brine Lab (psi)	Injection Pressures Air/Brine Res Con (psi)	Oil/Brine Lab Conditions (psi)	Oil/Brine Reservoir Conditions (psi)	Height Above Free Water Oil-Water (feet)	Height Above Free Water Gas-Water (feet)
18.5	0.5	6.8	0.0	0.0	11.5	3.63	2.52	2.12	1.31	11.9	7.41
21.6	0.5	7.3	0.0	0.0	9.82	4.24	2.94	2.47	1.53	13.9	8.65
25.3	0.9	8.2	0.0	0.0	8.38	4.96	3.44	2.90	1.80	16.4	10.1
30.0	0.9	9.2	0.0	0.0	7.07	5.88	4.08	3.43	2.12	19.3	12.0
38.0	1.7	10.8	1.8	1.8	5.58	7.45	5.17	4.35	2.69	24.5	15.2
47.9	2.3	13.1	2.5	4.4	4.43	9.39	6.52	5.48	3.39	30.8	19.2
56.7	2.8	15.9	3.1	7.4	3.74	11.1	7.71	6.49	4.02	36.5	22.7
67.4	4.4	20.3	4.8	12.2	3.15	13.2	9.17	7.71	4.77	43.4	27.0
80.2	5.2	25.4	5.7	17.9	2.64	15.7	10.9	9.18	5.68	51.6	32.1
91.8	4.1	29.6	4.5	22.5	2.31	18.0	12.5	10.5	6.50	59.1	36.8
111	6.5	36.0	7.1	29.6	1.92	21.8	15.1	12.7	7.86	71.5	44.4
129	5.6	41.6	6.2	35.7	1.64	25.3	17.6	14.8	9.16	83.3	51.8
153	5.4	47.0	5.9	41.6	1.39	30.0	20.8	17.5	10.8	98.2	61.2
179	4.8	51.8	5.3	46.9	1.19	35.1	24.4	20.5	12.7	115	71.8
210	4.3	56.1	4.7	51.7	1.01	41.2	28.6	24.0	14.9	135	84.1
247	3.9	60.0	4.3	55.9	0.858	48.4	33.6	28.3	17.5	159	98.8
290	3.5	63.5	3.9	59.8	0.730	56.9	39.5	33.2	20.6	187	116
342	3.0	66.5	3.3	63.1	0.619	67.1	46.6	39.1	24.2	220	137
402	2.7	69.1	2.9	66.0	0.528	78.8	54.7	46.0	28.5	259	161
472	2.4	71.5	2.6	68.6	0.449	92.5	64.2	54.0	33.4	304	189
554	2.0	73.5	2.3	70.9	0.383	109	75.7	63.4	39.2	356	223
648	1.8	75.3	2.0	72.8	0.327	127	88.2	74.2	45.9	417	259
757	1.8	77.1	2.0	74.8	0.280	148	103	86.6	53.6	487	303
888	1.8	78.9	2.0	76.8	0.239	174	121	102	63.1	574	356
1047	1.9	80.8	2.1	78.9	0.202	205	142	120	74.3	675	418
1229	1.8	82.6	1.9	80.9	0.172	241	167	141	87.3	794	491
1437	1.6	84.2	1.8	82.6	0.148	282	196	164	102	927	576
1687	1.6	85.8	1.7	84.4	0.126	331	230	193	119	1082	676
1973	1.5	87.3	1.6	86.0	0.107	387	269	226	140	1273	791

Pressure (psia)	Raw Data Intrusion (percent)	Raw Data Saturation (percent)	Conformance Corrected Intrusion (percent)	Conformance Corrected Saturation (percent)	Pore Diameter (μm)	Equivalent Air/Brine Lab (psi)	Injection Pressures Air/Brine Res Con (psi)	Oil/Brine Lab Conditions (psi)	Oil/Brine Reservoir Conditions (psi)	Height Above Free Water Oil-Water (feet)	Height Above Free Water Gas-Water (feet)
2332	1.4	88.7	1.5	87.5	0.0909	457	317	267	165	1500	932
2709	1.2	89.8	1.3	88.8	0.0782	531	369	310	192	1745	1085
3221	1.2	91.1	1.4	90.2	0.0658	632	439	369	228	2073	1291
3831	1.1	92.2	1.2	91.4	0.0553	751	522	438	271	2464	1535
4418	0.8	93.0	0.9	92.3	0.0480	866	601	506	313	2845	1768
5087	1.1	94.2	1.2	93.6	0.0417	997	692	582	360	3273	2035
5978	0.8	95.0	0.9	94.5	0.0355	1172	814	684	423	3845	2394
7009	0.7	95.7	0.8	95.3	0.0302	1374	954	802	496	4509	2806
7875	0.5	96.2	0.6	95.8	0.0269	1544	1072	901	558	5073	3153
8906	0.5	96.7	0.5	96.3	0.0238	1746	1213	1019	631	5736	3568
10446	0.6	97.3	0.7	97.0	0.0203	2048	1422	1195	740	6727	4182
12284	0.6	97.9	0.6	97.6	0.0173	2409	1673	1406	870	7909	4921
14333	0.4	98.3	0.4	98.1	0.0148	2810	1951	1640	1015	9227	5738
16383	0.3	98.6	0.4	98.5	0.0129	3212	2231	1875	1161	10555	6562
18478	0.3	98.9	0.4	98.8	0.0115	3623	2516	2115	1309	11900	7400
20482	0.2	99.2	0.3	99.1	0.0104	4016	2789	2344	1451	13191	8203
23148	0.3	99.4	0.3	99.4	0.0092	4539	3152	2649	1640	14909	9271
25065	0.2	99.6	0.2	99.5	0.0085	4915	3413	2868	1775	16136	10038
27136	0.1	99.7	0.1	99.7	0.0078	5321	3695	3105	1922	17473	10868
29376	0.2	99.9	0.2	99.8	0.0072	5760	4000	3362	2081	18918	11765
31804	0.1	100.0	0.1	100.0	0.0067	6236	4331	3640	2253	20482	12738
34424	0.0	100.0	0.0	100.0	0.0062	6750	4688	3940	2439	22173	13788
37197	0.0	100.0	0.0	100.0	0.0057	7294	5065	4257	2635	23955	14897
40343	0.0	100.0	0.0	100.0	0.0053	7910	5493	4617	2858	25982	16156
43593	0.0	100.0	0.0	100.0	0.0049	8548	5936	4989	3088	28073	17459
47292	0.0	100.0	0.0	100.0	0.0045	9273	6440	5412	3350	30455	18941
51168	0.0	100.0	0.0	100.0	0.0041	10033	6967	5856	3625	32955	20491
55386	0.0	100.0	0.0	100.0	0.0038	10860	7542	6338	3924	35673	22182
59877	0.0	100.0	0.0	100.0	0.0035	11741	8153	6852	4242	38564	23979

CAPILLARY PRESSURE

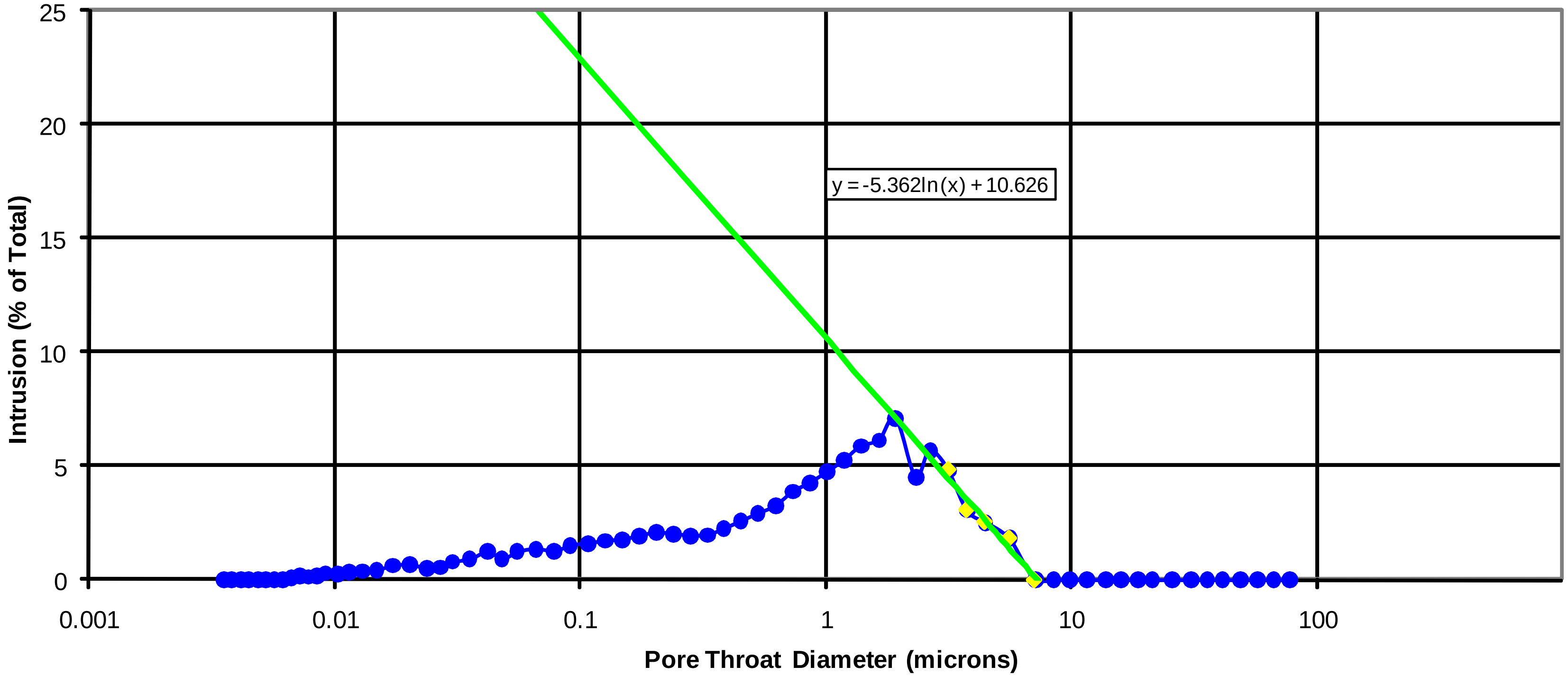
Client	ESSO Australia Pty Ltd
Well	Snapper-A21a
Test Method	Air/Mercury Capillary Pressure Drainage

Sample	3A	**Ambient Permeability**	1.19 milliDarcy's
Depth	2931.65	**Ambient Porosity**	5.8 percent



PORE SIZE DISTRIBUTION

Client	ESSO Australia Pty Ltd		
Well	Snapper-A21a		
Test Method	Air/Mercury Capillary Pressure Drainage		
Sample	3A	**Ambient Permeability**	1.19 milliDarcy's
Depth	2931.65	**Ambient Porosity**	5.8 percent



INTERPRETED CAPILLARY PRESSURE

Client ESSO Australia Pty Ltd
Well Snapper-A21a

Test Method Air/Mercury Capillary Pressure Drainage

Sample 5A
Depth 2932.05

Ambient Permeability 0.88 milliDarcy's
Ambient Porosity 4.7 percent
pore radius (µm) 2.12

Density Gradients, psi/foot	Typical
Water:	0.440
Oil:	0.330
Gas:	0.100

Conversion Parameters	air/water	air/oil	oil/water
Laboratory Theta	0.0	0.0	30.0
Laboratory IFT	72.0	24.0	48.0
Reservoir Theta	0.0		30.0
Reservoir IFT	50.0		30.0
Laboratory TcosTheta	72.0	24.0	42.0
Reservoir TcosTheta	50.0		26.0

	Entry Pressure (psia)		Displacement Pressure (psia)		Threshold Pressure (psia)	
System	Lab	Res Con	Lab	Resv	Lab	Resv
A-Hg	50.2	-	62.1	-	85.6	-
G-W	9.85	6.84	12.2	8.47	16.8	11.7
O-W	3.28	3.56	4.06	4.41	5.60	6.08

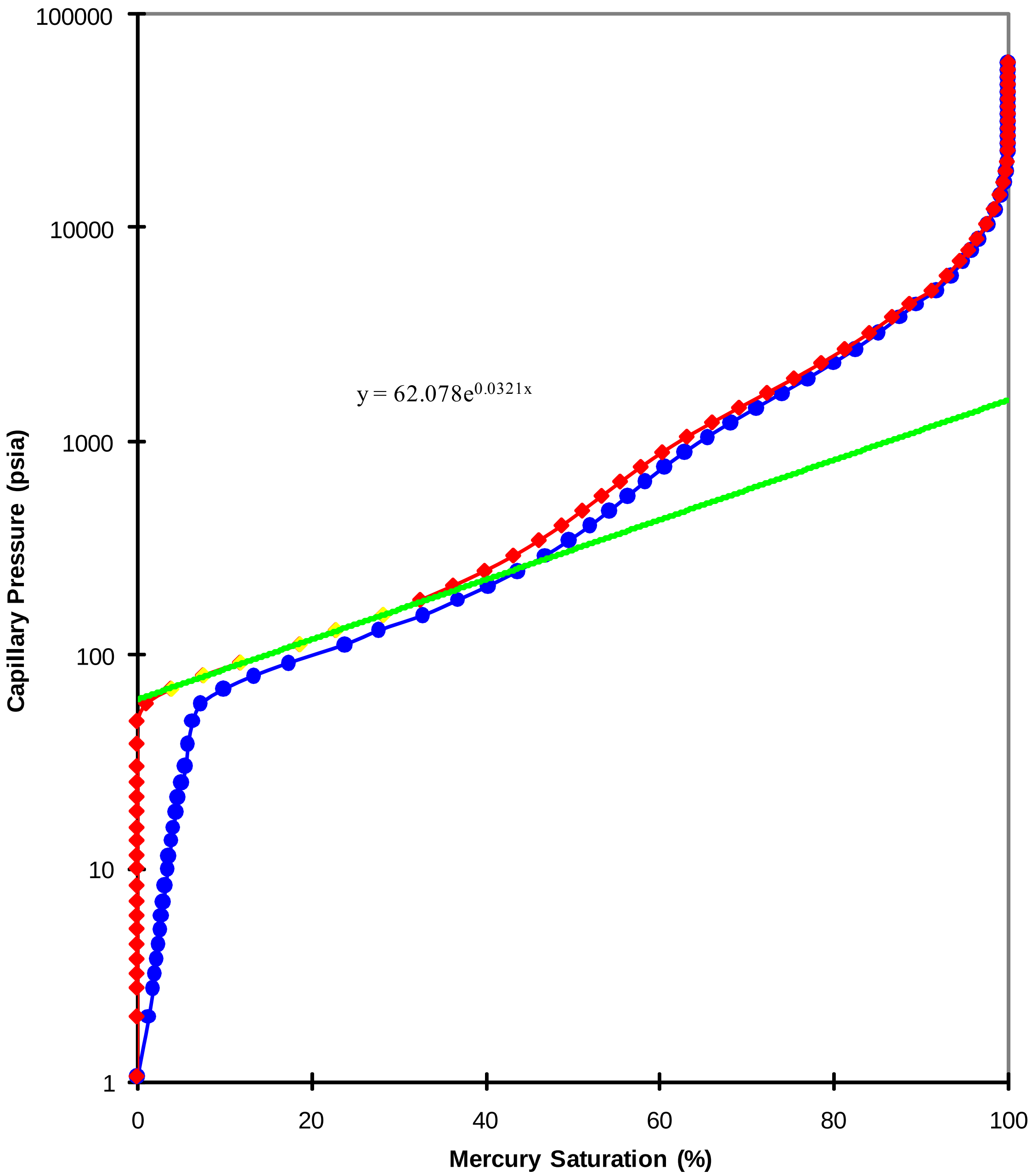
	Raw Data		Conformance Corrected			Equivalent	Injection Pressures	Oil/Brine	Oil/Brine	Height Above	Height Above
Pressure (psia)	Intrusion (percent)	Saturation (percent)	Intrusion (percent)	Saturation (percent)	Pore Diameter (µm)	Air/Brine Lab (psi)	Air/Brine Res Con (psi)	Lab Conditions (psi)	Reservoir Conditions (psi)	Free Water Oil-Water (feet)	Free Water Gas-Water (feet)
1.06	0.0	0.0	0.0	0.0	201	0.21	0.14	0.12	0.07	0.68	0.42
2.02	1.3	1.3	0.0	0.0	105	0.40	0.28	0.23	0.14	1.30	0.81
2.75	0.5	1.8	0.0	0.0	77.0	0.54	0.37	0.32	0.20	1.77	1.10
3.21	0.2	2.0	0.0	0.0	66.1	0.63	0.44	0.37	0.23	2.06	1.29
3.75	0.2	2.3	0.0	0.0	56.5	0.74	0.51	0.43	0.27	2.42	1.50
4.40	0.2	2.5	0.0	0.0	48.2	0.86	0.60	0.50	0.31	2.84	1.76
5.20	0.2	2.6	0.0	0.0	40.8	1.02	0.71	0.60	0.37	3.35	2.08
6.00	0.2	2.8	0.0	0.0	35.3	1.18	0.82	0.69	0.43	3.86	2.41
7.00	0.2	3.0	0.0	0.0	30.3	1.37	0.95	0.80	0.50	4.51	2.80
8.30	0.2	3.2	0.0	0.0	25.6	1.63	1.13	0.95	0.59	5.35	3.32
9.99	0.3	3.5	0.0	0.0	21.2	1.96	1.36	1.14	0.71	6.42	4.00
11.5	0.2	3.7	0.0	0.0	18.4	2.25	1.56	1.32	0.82	7.43	4.59
13.5	0.2	3.9	0.0	0.0	15.7	2.65	1.84	1.54	0.95	8.66	5.41
15.5	0.2	4.1	0.0	0.0	13.7	3.04	2.11	1.77	1.10	10.0	6.21

Pressure (psia)	Raw Data Intrusion (percent)	Raw Data Saturation (percent)	Conformance Corrected Intrusion (percent)	Conformance Corrected Saturation (percent)	Pore Diameter (μm)	Equivalent Air/Brine Lab (psi)	Injection Pressures Air/Brine Res Con (psi)	Oil/Brine Lab Conditions (psi)	Oil/Brine Reservoir Conditions (psi)	Height Above Free Water Oil-Water (feet)	Height Above Free Water Gas-Water (feet)
18.5	0.3	4.4	0.0	0.0	11.5	3.63	2.52	2.12	1.31	11.9	7.41
21.6	0.2	4.7	0.0	0.0	9.82	4.24	2.94	2.47	1.53	13.9	8.65
25.3	0.5	5.1	0.0	0.0	8.38	4.96	3.44	2.90	1.80	16.4	10.1
30.0	0.4	5.6	0.0	0.0	7.07	5.88	4.08	3.43	2.12	19.3	12.0
38.3	0.2	5.8	0.0	0.0	5.54	7.51	5.22	4.38	2.71	24.6	15.4
48.9	0.5	6.3	0.0	0.0	4.34	9.59	6.66	5.60	3.47	31.5	19.6
59.1	1.0	7.3	1.1	1.1	3.58	11.6	8.06	6.76	4.18	38.0	23.7
69.4	2.7	10.0	2.8	3.9	3.05	13.6	9.44	7.94	4.92	44.7	27.8
80.2	3.5	13.5	3.7	7.6	2.64	15.7	10.9	9.18	5.68	51.6	32.1
92.0	4.0	17.4	4.3	11.9	2.31	18.0	12.5	10.5	6.50	59.1	36.8
112	6.4	23.8	6.8	18.7	1.89	22.0	15.3	12.8	7.92	72.0	45.0
130	3.9	27.7	4.2	22.8	1.63	25.5	17.7	14.9	9.22	83.8	52.1
153	5.1	32.8	5.4	28.3	1.38	30.0	20.8	17.5	10.8	98.2	61.2
181	4.0	36.8	4.2	32.5	1.17	35.5	24.7	20.7	12.8	116	72.6
211	3.5	40.3	3.8	36.3	1.00	41.4	28.8	24.1	14.9	135	84.7
247	3.4	43.7	3.6	39.9	0.857	48.4	33.6	28.3	17.5	159	98.8
292	3.1	46.8	3.3	43.2	0.727	57.3	39.8	33.4	20.7	188	117
344	2.7	49.6	2.9	46.2	0.616	67.5	46.9	39.4	24.4	222	138
404	2.4	52.0	2.6	48.8	0.525	79.2	55.0	46.2	28.6	260	162
474	2.2	54.2	2.4	51.1	0.448	92.9	64.5	54.2	33.6	305	190
555	2.1	56.3	2.2	53.4	0.382	109	75.7	63.5	39.3	357	223
648	2.0	58.3	2.1	55.5	0.327	127	88.2	74.2	45.9	417	259
760	2.2	60.5	2.4	57.8	0.279	149	103	87.0	53.9	490	303
889	2.3	62.8	2.5	60.3	0.239	174	121	102	63.1	574	356
1052	2.6	65.5	2.8	63.1	0.201	206	143	120	74.3	675	421
1228	2.7	68.2	2.9	66.0	0.173	241	167	141	87.3	794	491
1439	2.9	71.1	3.1	69.1	0.147	282	196	165	102	927	576
1688	3.0	74.1	3.2	72.3	0.126	331	230	193	119	1082	676
1974	2.9	77.0	3.1	75.4	0.107	387	269	226	140	1273	791

Pressure (psia)	Raw Data Intrusion (percent)	Raw Data Saturation (percent)	Conformance Corrected Intrusion (percent)	Conformance Corrected Saturation (percent)	Pore Diameter (μm)	Equivalent Air/Brine Lab (psi)	Injection Pressures Air/Brine Res Con (psi)	Oil/Brine Lab Conditions (psi)	Oil/Brine Reservoir Conditions (psi)	Height Above Free Water Oil-Water (feet)	Height Above Free Water Gas-Water (feet)
2330	2.9	79.9	3.1	78.6	0.0910	457	317	267	165	1500	932
2710	2.5	82.4	2.7	81.2	0.0782	531	369	310	192	1745	1085
3221	2.6	85.1	2.8	84.1	0.0658	632	439	369	228	2073	1291
3831	2.4	87.5	2.6	86.7	0.0553	751	522	438	271	2464	1535
4416	1.9	89.4	2.0	88.7	0.0480	866	601	505	313	2845	1768
5087	2.4	91.8	2.5	91.2	0.0417	997	692	582	360	3273	2035
5981	1.6	93.4	1.7	93.0	0.0354	1173	815	684	423	3845	2397
7012	1.4	94.8	1.5	94.5	0.0302	1375	955	802	496	4509	2809
7875	0.9	95.7	1.0	95.4	0.0269	1544	1072	901	558	5073	3153
8906	0.9	96.6	1.0	96.4	0.0238	1746	1213	1019	631	5736	3568
10452	1.0	97.6	1.1	97.5	0.0203	2049	1423	1196	740	6727	4185
12283	0.8	98.5	0.9	98.3	0.0173	2408	1672	1406	870	7909	4918
14331	0.6	99.1	0.7	99.0	0.0148	2810	1951	1640	1015	9227	5738
16382	0.4	99.5	0.4	99.4	0.0129	3212	2231	1875	1161	10555	6562
18476	0.2	99.7	0.3	99.7	0.0115	3623	2516	2114	1309	11900	7400
20482	0.2	99.9	0.2	99.9	0.0104	4016	2789	2344	1451	13191	8203
23149	0.1	100.0	0.1	100.0	0.0092	4539	3152	2649	1640	14909	9271
25065	0.0	100.0	0.0	100.0	0.0085	4915	3413	2868	1775	16136	10038
27137	0.0	100.0	0.0	100.0	0.0078	5321	3695	3106	1923	17482	10868
29377	0.0	100.0	0.0	100.0	0.0072	5760	4000	3362	2081	18918	11765
31804	0.0	100.0	0.0	100.0	0.0067	6236	4331	3640	2253	20482	12738
34423	0.0	100.0	0.0	100.0	0.0062	6750	4688	3939	2438	22164	13788
37191	0.0	100.0	0.0	100.0	0.0057	7292	5064	4256	2635	23955	14894
40345	0.0	100.0	0.0	100.0	0.0053	7911	5494	4617	2858	25982	16159
43594	0.0	100.0	0.0	100.0	0.0049	8548	5936	4989	3088	28073	17459
47294	0.0	100.0	0.0	100.0	0.0045	9273	6440	5412	3350	30455	18941
51168	0.0	100.0	0.0	100.0	0.0041	10033	6967	5856	3625	32955	20491
55386	0.0	100.0	0.0	100.0	0.0038	10860	7542	6338	3924	35673	22182
59879	0.0	100.0	0.0	100.0	0.0035	11741	8153	6853	4242	38564	23979

CAPILLARY PRESSURE

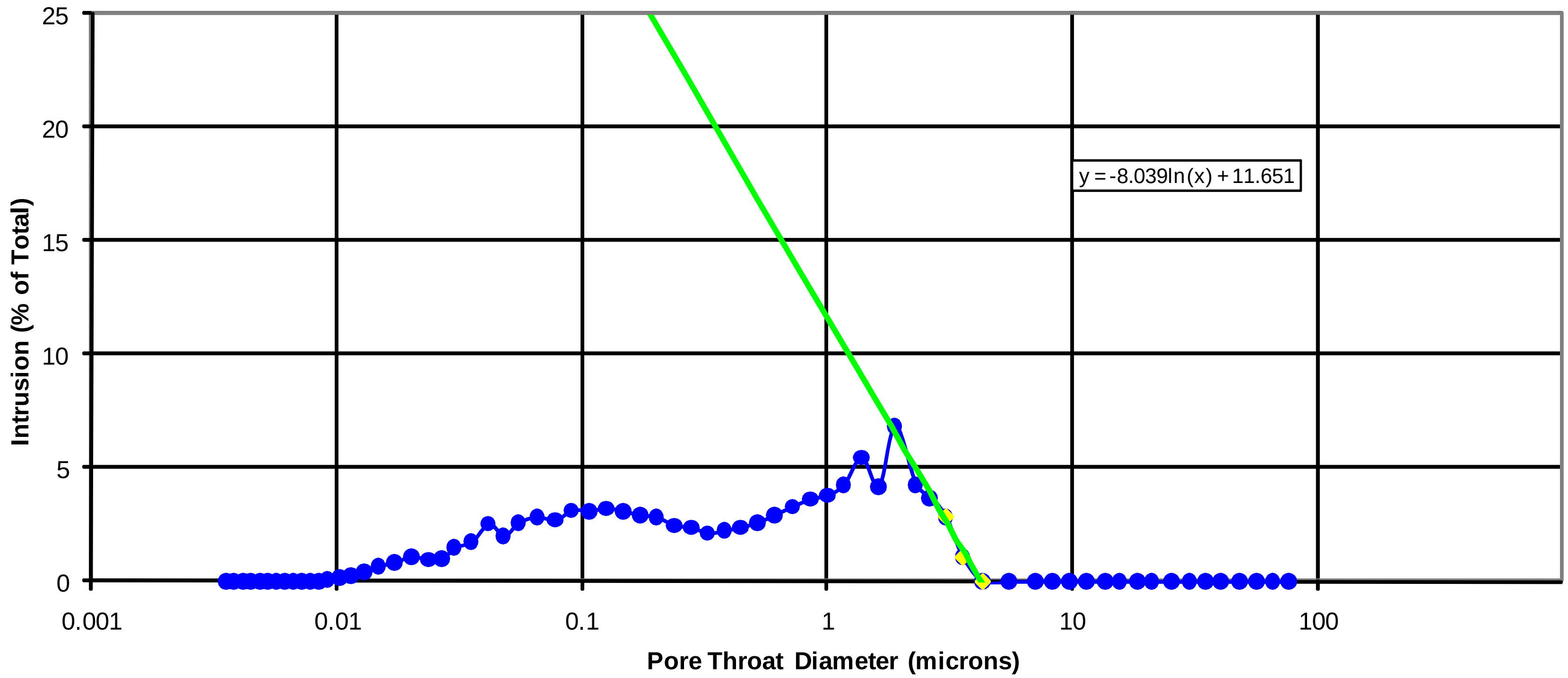
Client	ESSO Australia Pty Ltd		
Well	Snapper-A21a		
Test Method	Air/Mercury Capillary Pressure Drainage		
Sample	5A	**Ambient Permeability**	0.88 milliDarcy's
Depth	2932.05	**Ambient Porosity**	4.7 percent



PORE SIZE DISTRIBUTION

Client	ESSO Australia Pty Ltd
Well	Snapper-A21a
Test Method	Air/Mercury Capillary Pressure Drainage

Sample	5A	**Ambient Permeability**	0.88 milliDarcy's
Depth	2932.05	**Ambient Porosity**	4.7 percent



INTERPRETED CAPILLARY PRESSURE

Client ESSO Australia Pty Ltd
Well Snapper-A21a

Test Method Air/Mercury Capillary Pressure Drainage

Sample 10A
Depth 2933.31

Ambient Permeability 1.49 milliDarcy's
Ambient Porosity 5.8 percent
pore radius (µm) 3.55

Density Gradients, psi/foot		**Conversion Parameters**			
	Typical		air/water	air/oil	oil/water
Water:	0.440	Laboratory Theta	0.0	0.0	30.0
Oil:	0.330	Laboratory IFT	72.0	24.0	48.0
Gas:	0.100	Reservoir Theta	0.0		30.0
		Reservoir IFT	50.0		30.0
		Laboratory TcosTheta	72.0	24.0	42.0
		Reservoir TcosTheta	50.0		26.0

	Entry Pressure (psia)		Displacement Pressure (psia)		Threshold Pressure (psia)	
System	Lab	Res Con	Lab	Resv	Lab	Resv
A-Hg	30.0	-	45.3	-	59.8	-
G-W	5.88	4.08	8.88	6.16	11.7	8.12
O-W	1.96	2.12	2.96	3.20	3.91	4.23

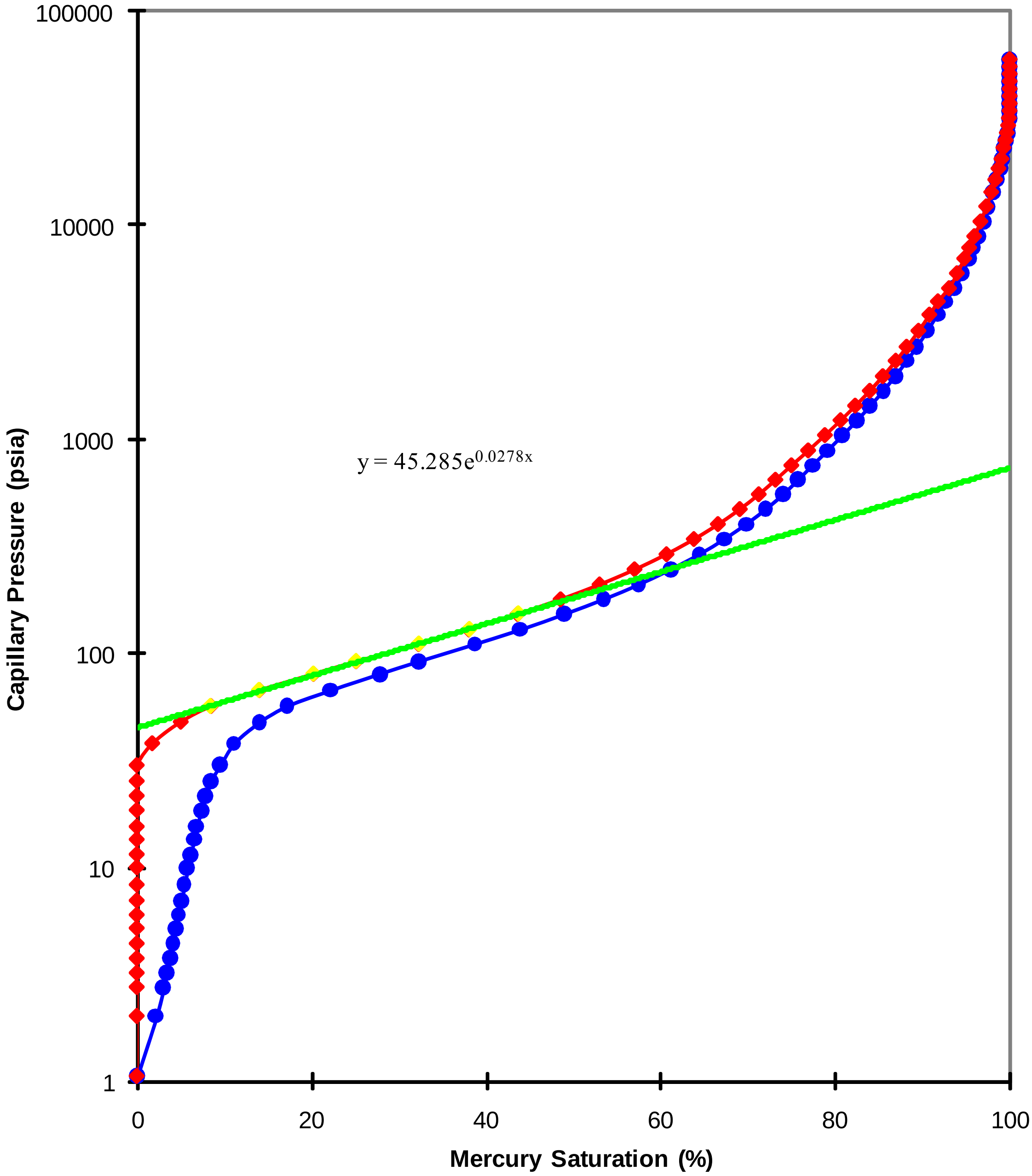
Pressure (psia)	Raw Data Intrusion (percent)	Raw Data Saturation (percent)	Conformance Corrected Intrusion (percent)	Conformance Corrected Saturation (percent)	Pore Diameter (µm)	Equivalent Air/Brine Lab (psi)	Injection Pressures Air/Brine Res Con (psi)	Oil/Brine Lab Conditions (psi)	Oil/Brine Reservoir Conditions (psi)	Height Above Free Water Oil-Water (feet)	Height Above Free Water Gas-Water (feet)
1.06	0.0	0.0	0.0	0.0	201	0.21	0.14	0.12	0.07	0.68	0.42
2.02	2.2	2.2	0.0	0.0	105	0.40	0.28	0.23	0.14	1.30	0.81
2.76	0.8	3.0	0.0	0.0	76.9	0.54	0.38	0.32	0.20	1.78	1.11
3.21	0.3	3.4	0.0	0.0	66.0	0.63	0.44	0.37	0.23	2.06	1.29
3.75	0.4	3.8	0.0	0.0	56.5	0.74	0.51	0.43	0.27	2.42	1.50
4.40	0.3	4.1	0.0	0.0	48.2	0.86	0.60	0.50	0.31	2.84	1.76
5.20	0.3	4.4	0.0	0.0	40.8	1.02	0.71	0.60	0.37	3.35	2.08
6.00	0.4	4.8	0.0	0.0	35.4	1.18	0.82	0.69	0.43	3.86	2.41
7.00	0.3	5.1	0.0	0.0	30.3	1.37	0.95	0.80	0.50	4.51	2.80
8.30	0.4	5.4	0.0	0.0	25.6	1.63	1.13	0.95	0.59	5.35	3.32
10.0	0.4	5.8	0.0	0.0	21.2	1.96	1.36	1.14	0.71	6.42	4.00
11.5	0.3	6.1	0.0	0.0	18.4	2.25	1.56	1.32	0.82	7.43	4.59
13.5	0.4	6.5	0.0	0.0	15.7	2.65	1.84	1.54	0.95	8.66	5.41
15.5	0.3	6.8	0.0	0.0	13.7	3.04	2.11	1.77	1.10	10.0	6.21

Pressure (psia)	Raw Data Intrusion (percent)	Raw Data Saturation (percent)	Conformance Corrected Intrusion (percent)	Conformance Corrected Saturation (percent)	Pore Diameter (μm)	Equivalent Air/Brine Lab (psi)	Injection Pressures Air/Brine Res Con (psi)	Oil/Brine Lab Conditions (psi)	Oil/Brine Reservoir Conditions (psi)	Height Above Free Water Oil-Water (feet)	Height Above Free Water Gas-Water (feet)
18.5	0.5	7.4	0.0	0.0	11.5	3.63	2.52	2.12	1.31	11.9	7.41
21.6	0.5	7.9	0.0	0.0	9.82	4.24	2.94	2.47	1.53	13.9	8.65
25.3	0.5	8.4	0.0	0.0	8.38	4.96	3.44	2.90	1.80	16.4	10.1
30.0	1.1	9.5	0.0	0.0	7.07	5.88	4.08	3.43	2.12	19.3	12.0
38.0	1.6	11.1	1.8	1.8	5.58	7.45	5.17	4.35	2.69	24.5	15.2
47.9	3.0	14.1	3.3	5.0	4.43	9.39	6.52	5.48	3.39	30.8	19.2
56.7	3.1	17.2	3.5	8.5	3.74	11.1	7.71	6.49	4.02	36.5	22.7
67.3	5.0	22.2	5.6	14.1	3.15	13.2	9.17	7.70	4.77	43.4	27.0
80.2	5.6	27.8	6.2	20.3	2.64	15.7	10.9	9.18	5.68	51.6	32.1
91.7	4.4	32.2	4.9	25.1	2.31	18.0	12.5	10.5	6.50	59.1	36.8
110	6.5	38.7	7.2	32.3	1.92	21.6	15.0	12.6	7.80	70.9	44.1
129	5.2	43.9	5.8	38.0	1.64	25.3	17.6	14.8	9.16	83.3	51.8
153	5.0	49.0	5.6	43.6	1.39	30.0	20.8	17.5	10.8	98.2	61.2
179	4.5	53.4	4.9	48.6	1.19	35.1	24.4	20.5	12.7	115	71.8
210	4.0	57.5	4.5	53.0	1.01	41.2	28.6	24.0	14.9	135	84.1
247	3.6	61.1	4.0	57.0	0.858	48.4	33.6	28.3	17.5	159	98.8
291	3.3	64.4	3.7	60.7	0.730	57.1	39.7	33.3	20.6	187	117
342	2.8	67.3	3.1	63.8	0.619	67.1	46.6	39.1	24.2	220	137
402	2.5	69.8	2.8	66.6	0.528	78.8	54.7	46.0	28.5	259	161
472	2.3	72.0	2.5	69.1	0.449	92.5	64.2	54.0	33.4	304	189
554	2.0	74.0	2.2	71.3	0.383	109	75.7	63.4	39.2	356	223
648	1.7	75.7	1.9	73.2	0.327	127	88.2	74.2	45.9	417	259
757	1.7	77.4	1.8	75.0	0.280	148	103	86.6	53.6	487	303
888	1.7	79.1	1.9	76.9	0.239	174	121	102	63.1	574	356
1047	1.7	80.8	1.9	78.8	0.202	205	142	120	74.3	675	418
1229	1.6	82.5	1.8	80.6	0.172	241	167	141	87.3	794	491
1437	1.5	84.0	1.7	82.3	0.147	282	196	164	102	927	576
1687	1.5	85.5	1.7	84.0	0.126	331	230	193	119	1082	676
1974	1.4	86.8	1.5	85.5	0.107	387	269	226	140	1273	791

Pressure (psia)	Raw Data Intrusion (percent)	Raw Data Saturation (percent)	Conformance Corrected Intrusion (percent)	Conformance Corrected Saturation (percent)	Pore Diameter (μm)	Equivalent Air/Brine Lab (psi)	Injection Pressures Air/Brine Res Con (psi)	Oil/Brine Lab Conditions (psi)	Oil/Brine Reservoir Conditions (psi)	Height Above Free Water Oil-Water (feet)	Height Above Free Water Gas-Water (feet)
2332	1.3	88.2	1.5	86.9	0.0909	457	317	267	165	1500	932
2709	1.1	89.3	1.2	88.2	0.0782	531	369	310	192	1745	1085
3221	1.2	90.5	1.4	89.6	0.0658	632	439	369	228	2073	1291
3831	1.1	91.7	1.3	90.8	0.0553	751	522	438	271	2464	1535
4418	0.9	92.6	1.0	91.8	0.0480	866	601	506	313	2845	1768
5088	1.2	93.7	1.3	93.0	0.0417	998	693	582	360	3273	2038
5978	0.8	94.5	0.9	94.0	0.0355	1172	814	684	423	3845	2394
7009	0.8	95.3	0.8	94.8	0.0302	1374	954	802	496	4509	2806
7875	0.5	95.8	0.6	95.4	0.0269	1544	1072	901	558	5073	3153
8906	0.5	96.3	0.6	95.9	0.0238	1746	1213	1019	631	5736	3568
10446	0.7	97.0	0.7	96.7	0.0203	2048	1422	1195	740	6727	4182
12284	0.6	97.6	0.7	97.3	0.0173	2409	1673	1406	870	7909	4921
14333	0.5	98.1	0.6	97.9	0.0148	2810	1951	1640	1015	9227	5738
16383	0.4	98.5	0.5	98.4	0.0129	3212	2231	1875	1161	10555	6562
18478	0.3	98.8	0.4	98.7	0.0115	3623	2516	2115	1309	11900	7400
20482	0.3	99.1	0.3	99.1	0.0104	4016	2789	2344	1451	13191	8203
23148	0.2	99.4	0.2	99.3	0.0092	4539	3152	2649	1640	14909	9271
25065	0.2	99.6	0.2	99.5	0.0085	4915	3413	2868	1775	16136	10038
27136	0.1	99.7	0.2	99.7	0.0078	5321	3695	3105	1922	17473	10868
29376	0.1	99.8	0.1	99.8	0.0072	5760	4000	3362	2081	18918	11765
31804	0.1	99.9	0.1	99.9	0.0067	6236	4331	3640	2253	20482	12738
34424	0.1	100.0	0.1	100.0	0.0062	6750	4688	3940	2439	22173	13788
37197	0.0	100.0	0.0	100.0	0.0057	7294	5065	4257	2635	23955	14897
40343	0.0	100.0	0.0	100.0	0.0053	7910	5493	4617	2858	25982	16156
43593	0.0	100.0	0.0	100.0	0.0049	8548	5936	4989	3088	28073	17459
47292	0.0	100.0	0.0	100.0	0.0045	9273	6440	5412	3350	30455	18941
51168	0.0	100.0	0.0	100.0	0.0041	10033	6967	5856	3625	32955	20491
55386	0.0	100.0	0.0	100.0	0.0038	10860	7542	6338	3924	35673	22182
59877	0.0	100.0	0.0	100.0	0.0035	11741	8153	6852	4242	38564	23979

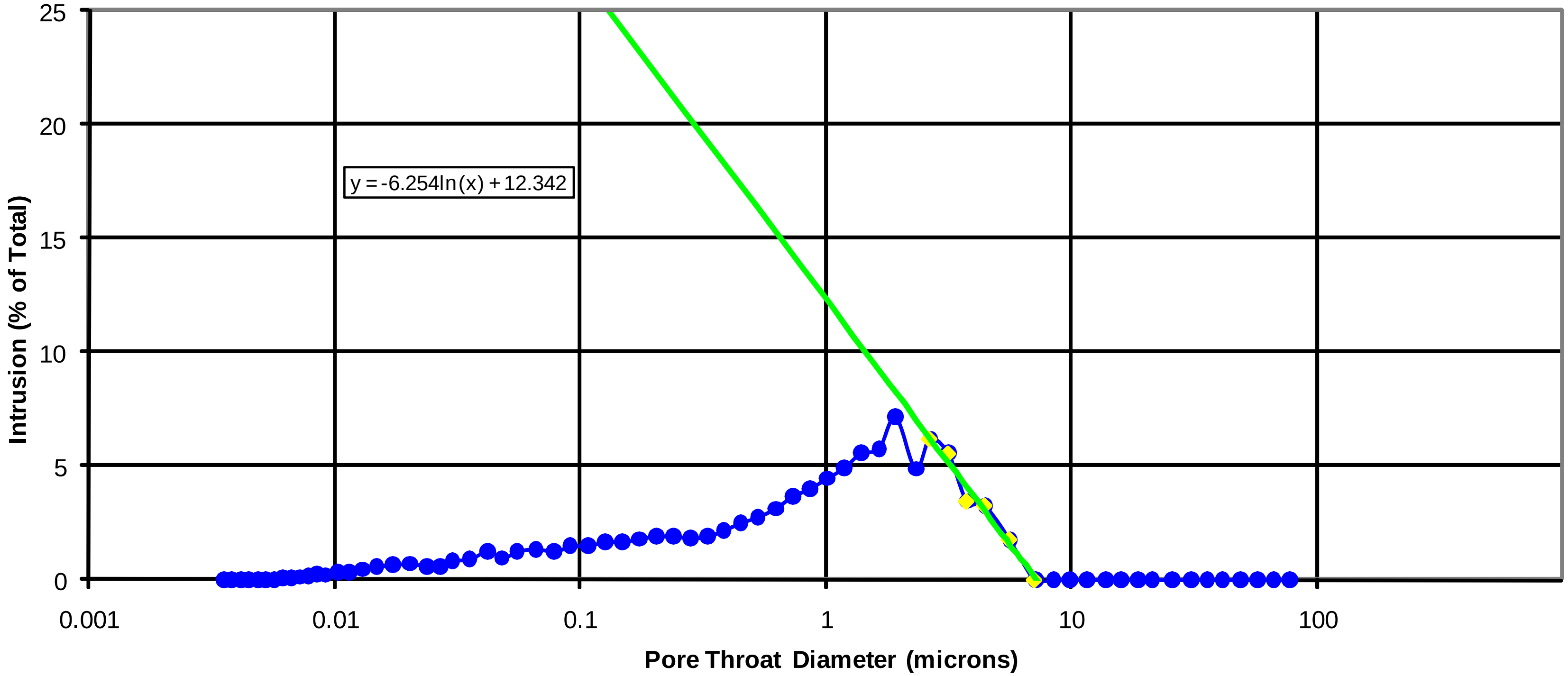
CAPILLARY PRESSURE

Client	ESSO Australia Pty Ltd		
Well	Snapper-A21a		
Test Method	Air/Mercury Capillary Pressure Drainage		
Sample	10A	**Ambient Permeability**	1.49 milliDarcy's
Depth	2933.31	**Ambient Porosity**	5.8 percent



PORE SIZE DISTRIBUTION

Client	ESSO Australia Pty Ltd		
Well	Snapper-A21a		
Test Method	Air/Mercury Capillary Pressure Drainage		
Sample	10A	**Ambient Permeability**	1.49 milliDarcy's
Depth	2933.31	**Ambient Porosity**	5.8 percent



INTERPRETED CAPILLARY PRESSURE

Client ESSO Australia Pty Ltd
Well Snapper-A21a

Test Method Air/Mercury Capillary Pressure Drainage

Sample 18A
Depth 2935.30

Ambient Permeability 1.47 milliDarcy's
Ambient Porosity 6.0 percent
pore radius (µm) 3.46

Density Gradients, psi/foot	
	Typical
Water:	0.440
Oil:	0.330
Gas:	0.100

Conversion Parameters	air/water	air/oil	oil/water
Laboratory Theta	0.0	0.0	30.0
Laboratory IFT	72.0	24.0	48.0
Reservoir Theta	0.0		30.0
Reservoir IFT	50.0		30.0
Laboratory TcosTheta	72.0	24.0	42.0
Reservoir TcosTheta	50.0		26.0

	Entry Pressure (psia)		Displacement Pressure (psia)		Threshold Pressure (psia)	
System	Lab	Res Con	Lab	Resv	Lab	Resv
A-Hg	30.8	-	44.6	-	60.2	-
G-W	6.03	4.19	8.73	6.07	11.8	8.20
O-W	2.01	2.18	2.91	3.16	3.93	4.27

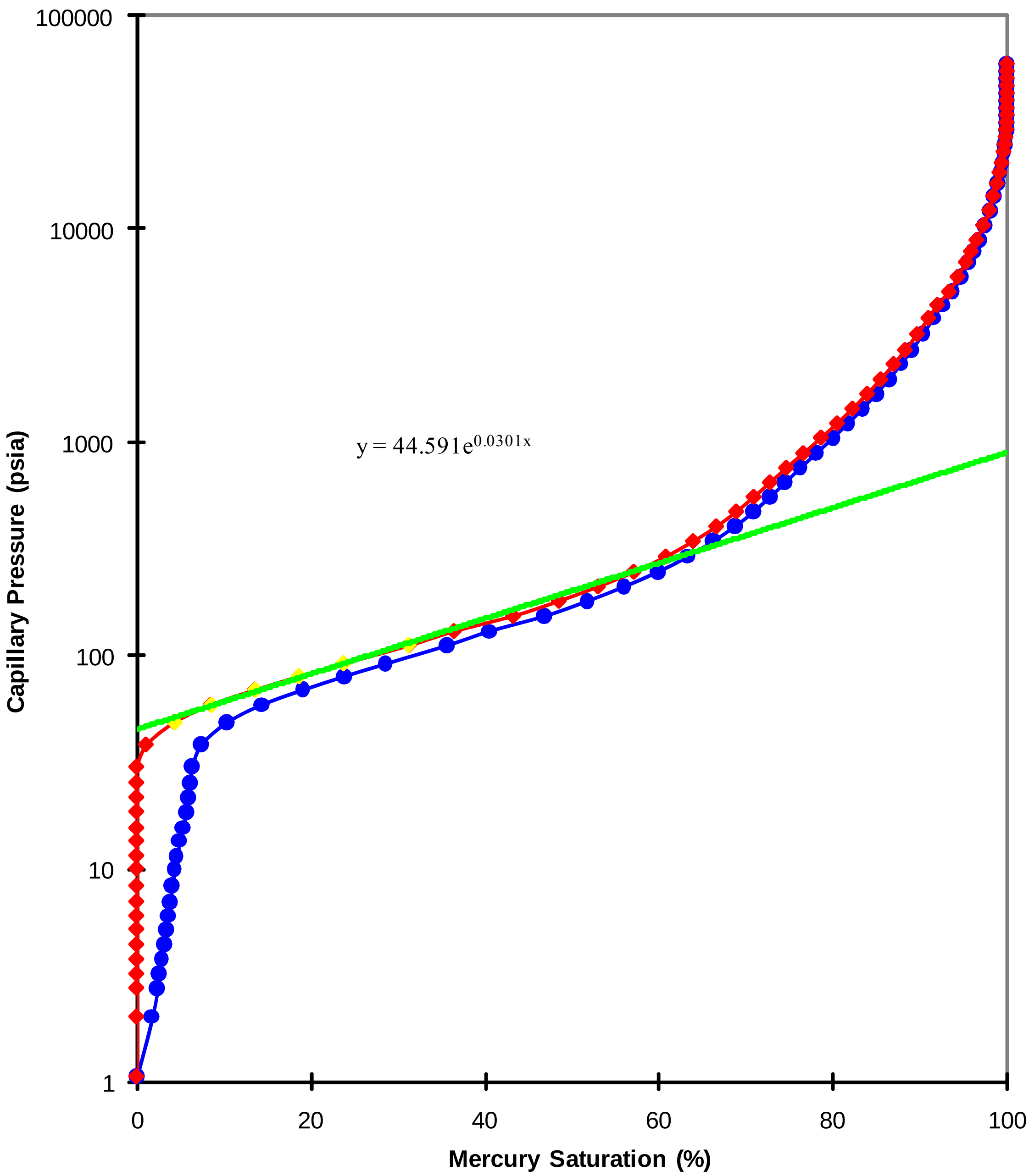
Pressure (psia)	Raw Data Intrusion (percent)	Raw Data Saturation (percent)	Conformance Corrected Intrusion (percent)	Conformance Corrected Saturation (percent)	Pore Diameter (µm)	Equivalent Air/Brine Lab (psi)	Injection Pressures Air/Brine Res Con (psi)	Oil/Brine Lab Conditions (psi)	Oil/Brine Reservoir Conditions (psi)	Height Above Free Water Oil-Water (feet)	Height Above Free Water Gas-Water (feet)
1.06	0.0	0.0	0.0	0.0	201	0.21	0.14	0.12	0.07	0.68	0.42
2.02	1.8	1.8	0.0	0.0	105	0.40	0.28	0.23	0.14	1.30	0.81
2.75	0.6	2.4	0.0	0.0	77.0	0.54	0.37	0.32	0.20	1.77	1.10
3.21	0.2	2.6	0.0	0.0	66.1	0.63	0.44	0.37	0.23	2.06	1.29
3.75	0.3	2.9	0.0	0.0	56.5	0.74	0.51	0.43	0.27	2.42	1.50
4.40	0.2	3.1	0.0	0.0	48.2	0.86	0.60	0.50	0.31	2.84	1.76
5.20	0.2	3.4	0.0	0.0	40.8	1.02	0.71	0.60	0.37	3.35	2.08
6.00	0.2	3.6	0.0	0.0	35.3	1.18	0.82	0.69	0.43	3.86	2.41
7.00	0.2	3.8	0.0	0.0	30.3	1.37	0.95	0.80	0.50	4.51	2.80
8.30	0.2	4.1	0.0	0.0	25.6	1.63	1.13	0.95	0.59	5.35	3.32
9.99	0.3	4.3	0.0	0.0	21.2	1.96	1.36	1.14	0.71	6.42	4.00
11.5	0.2	4.6	0.0	0.0	18.4	2.25	1.56	1.32	0.82	7.43	4.59
13.5	0.4	4.9	0.0	0.0	15.7	2.65	1.84	1.54	0.95	8.66	5.41
15.5	0.3	5.3	0.0	0.0	13.7	3.04	2.11	1.77	1.10	10.0	6.21

Pressure (psia)	Raw Data Intrusion (percent)	Raw Data Saturation (percent)	Conformance Corrected Intrusion (percent)	Conformance Corrected Saturation (percent)	Pore Diameter (μm)	Equivalent Air/Brine Lab (psi)	Injection Pressures Air/Brine Res Con (psi)	Oil/Brine Lab Conditions (psi)	Oil/Brine Reservoir Conditions (psi)	Height Above Free Water Oil-Water (feet)	Height Above Free Water Gas-Water (feet)
18.5	0.5	5.7	0.0	0.0	11.5	3.63	2.52	2.12	1.31	11.9	7.41
21.6	0.2	5.9	0.0	0.0	9.82	4.24	2.94	2.47	1.53	13.9	8.65
25.3	0.2	6.1	0.0	0.0	8.38	4.96	3.44	2.90	1.80	16.4	10.1
30.0	0.2	6.3	0.0	0.0	7.07	5.88	4.08	3.43	2.12	19.3	12.0
38.2	1.0	7.4	1.1	1.1	5.56	7.49	5.20	4.37	2.71	24.6	15.3
48.7	3.0	10.4	3.2	4.3	4.36	9.55	6.63	5.57	3.45	31.4	19.5
58.7	3.9	14.3	4.2	8.5	3.61	11.5	7.99	6.72	4.16	37.8	23.5
69.0	4.8	19.1	5.1	13.6	3.07	13.5	9.38	7.90	4.89	44.5	27.6
79.7	4.7	23.8	5.1	18.7	2.66	15.6	10.8	9.12	5.65	51.4	31.8
91.5	4.8	28.6	5.1	23.8	2.32	17.9	12.4	10.5	6.50	59.1	36.5
111	7.0	35.7	7.5	31.3	1.90	21.8	15.1	12.7	7.86	71.5	44.4
130	4.8	40.5	5.2	36.5	1.63	25.5	17.7	14.9	9.22	83.8	52.1
153	6.4	46.9	6.8	43.3	1.39	30.0	20.8	17.5	10.8	98.2	61.2
180	4.9	51.8	5.3	48.5	1.18	35.3	24.5	20.6	12.8	116	72.1
210	4.2	56.0	4.5	53.0	1.01	41.2	28.6	24.0	14.9	135	84.1
247	3.8	59.9	4.1	57.2	0.860	48.4	33.6	28.3	17.5	159	98.8
291	3.4	63.3	3.7	60.8	0.729	57.1	39.7	33.3	20.6	187	117
343	2.9	66.2	3.1	64.0	0.617	67.3	46.7	39.3	24.3	221	137
403	2.5	68.7	2.7	66.6	0.526	79.0	54.9	46.1	28.5	259	161
473	2.1	70.9	2.3	68.9	0.448	92.7	64.4	54.1	33.5	305	189
555	1.9	72.8	2.0	70.9	0.382	109	75.7	63.5	39.3	357	223
648	1.7	74.5	1.9	72.8	0.327	127	88.2	74.2	45.9	417	259
759	1.8	76.3	1.9	74.7	0.279	149	103	86.9	53.8	489	303
888	1.8	78.1	1.9	76.6	0.239	174	121	102	63.1	574	356
1052	1.9	80.0	2.0	78.7	0.202	206	143	120	74.3	675	421
1227	1.7	81.7	1.9	80.5	0.173	241	167	140	86.7	788	491
1438	1.6	83.4	1.8	82.3	0.147	282	196	165	102	927	576
1687	1.6	85.0	1.7	84.0	0.126	331	230	193	119	1082	676
1974	1.4	86.4	1.5	85.5	0.107	387	269	226	140	1273	791

Pressure (psia)	Raw Data Intrusion (percent)	Raw Data Saturation (percent)	Conformance Corrected Intrusion (percent)	Conformance Corrected Saturation (percent)	Pore Diameter (μm)	Equivalent Air/Brine Lab (psi)	Injection Pressures Air/Brine Res Con (psi)	Oil/Brine Lab Conditions (psi)	Oil/Brine Reservoir Conditions (psi)	Height Above Free Water Oil-Water (feet)	Height Above Free Water Gas-Water (feet)
2330	1.4	87.8	1.5	87.0	0.0910	457	317	267	165	1500	932
2710	1.2	89.0	1.3	88.3	0.0782	531	369	310	192	1745	1085
3220	1.3	90.3	1.4	89.7	0.0658	631	438	369	228	2073	1288
3831	1.2	91.6	1.3	91.0	0.0553	751	522	438	271	2464	1535
4416	1.0	92.5	1.0	92.0	0.0480	866	601	505	313	2845	1768
5087	1.3	93.8	1.3	93.4	0.0417	997	692	582	360	3273	2035
5981	0.9	94.7	1.0	94.4	0.0354	1173	815	684	423	3845	2397
7012	0.9	95.6	0.9	95.3	0.0302	1375	955	802	496	4509	2809
7875	0.6	96.2	0.6	95.9	0.0269	1544	1072	901	558	5073	3153
8906	0.6	96.7	0.6	96.5	0.0238	1746	1213	1019	631	5736	3568
10451	0.7	97.5	0.8	97.3	0.0203	2049	1423	1196	740	6727	4185
12283	0.7	98.1	0.7	98.0	0.0173	2408	1672	1406	870	7909	4918
14331	0.4	98.5	0.4	98.4	0.0148	2810	1951	1640	1015	9227	5738
16382	0.4	98.9	0.4	98.9	0.0129	3212	2231	1875	1161	10555	6562
18476	0.3	99.2	0.3	99.2	0.0115	3623	2516	2114	1309	11900	7400
20481	0.2	99.4	0.2	99.4	0.0104	4016	2789	2344	1451	13191	8203
23149	0.2	99.7	0.2	99.6	0.0092	4539	3152	2649	1640	14909	9271
25065	0.1	99.8	0.1	99.8	0.0085	4915	3413	2868	1775	16136	10038
27137	0.1	99.9	0.1	99.9	0.0078	5321	3695	3106	1923	17482	10868
29377	0.1	99.9	0.1	99.9	0.0072	5760	4000	3362	2081	18918	11765
31804	0.0	100.0	0.0	100.0	0.0067	6236	4331	3640	2253	20482	12738
34423	0.0	100.0	0.0	100.0	0.0062	6750	4688	3939	2438	22164	13788
37191	0.0	100.0	0.0	100.0	0.0057	7292	5064	4256	2635	23955	14894
40345	0.0	100.0	0.0	100.0	0.0053	7911	5494	4617	2858	25982	16159
43594	0.0	100.0	0.0	100.0	0.0049	8548	5936	4989	3088	28073	17459
47294	0.0	100.0	0.0	100.0	0.0045	9273	6440	5412	3350	30455	18941
51167	0.0	100.0	0.0	100.0	0.0041	10033	6967	5856	3625	32955	20491
55386	0.0	100.0	0.0	100.0	0.0038	10860	7542	6338	3924	35673	22182
59878	0.0	100.0	0.0	100.0	0.0035	11741	8153	6853	4242	38564	23979

CAPILLARY PRESSURE

Client	ESSO Australia Pty Ltd		
Well	Snapper-A21a		
Test Method	Air/Mercury Capillary Pressure Drainage		
Sample	18A	**Ambient Permeability**	1.47 milliDarcy's
Depth	2935.30	**Ambient Porosity**	6.0 percent



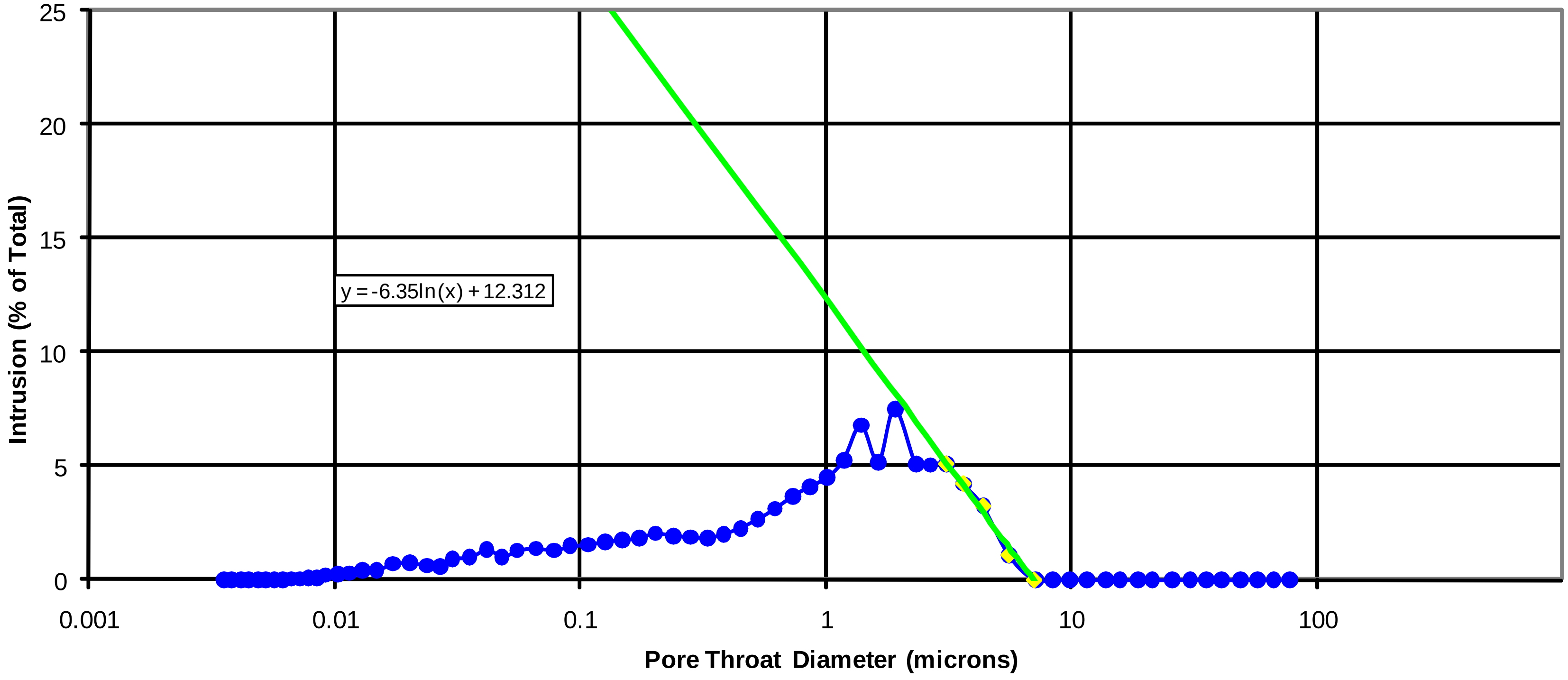
PORE SIZE DISTRIBUTION

Client ESSO Australia Pty Ltd
Well Snapper-A21a

Test Method Air/Mercury Capillary Pressure Drainage

Sample 18A
Depth 2935.30

Ambient Permeability 1.47 milliDarcy's
Ambient Porosity 6.0 percent



INTERPRETED CAPILLARY PRESSURE

Client ESSO Australia Pty Ltd
Well Snapper-A21a

Test Method Air/Mercury Capillary Pressure Drainage

Sample 26A
Depth 2937.26

Ambient Permeability 0.85 milliDarcy's
Ambient Porosity 8.7 percent
pore radius (µm) 2.32

Density Gradients, psi/foot	
	Typical
Water:	0.440
Oil:	0.330
Gas:	0.100

Conversion Parameters	air/water	air/oil	oil/water
Laboratory Theta	0.0	0.0	30.0
Laboratory IFT	72.0	24.0	48.0
Reservoir Theta	0.0		30.0
Reservoir IFT	50.0		30.0
Laboratory TcosTheta	72.0	24.0	42.0
Reservoir TcosTheta	50.0		26.0

	Entry Pressure (psia)		Displacement Pressure (psia)		Threshold Pressure (psia)	
System	Lab	Res Con	Lab	Resv	Lab	Resv
A-Hg	45.9	-	52.9	-	68.5	-
G-W	9.00	6.25	10.4	7.22	13.5	9.37
O-W	3.00	3.25	3.46	3.75	4.48	4.86

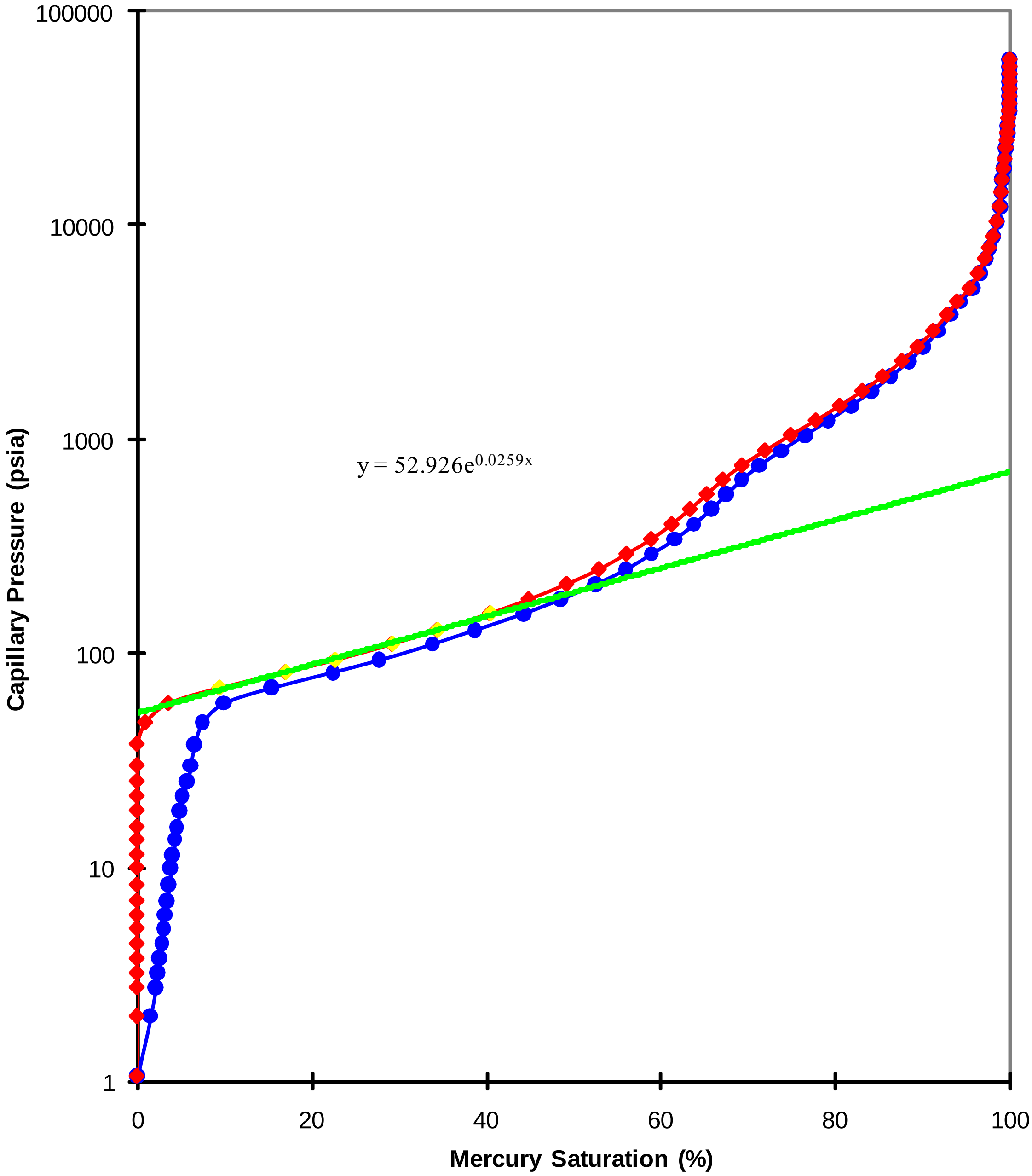
	Raw Data		Conformance Corrected			Equivalent	Injection Pressures	Oil/Brine	Oil/Brine	Height Above	Height Above
Pressure (psia)	Intrusion (percent)	Saturation (percent)	Intrusion (percent)	Saturation (percent)	Pore Diameter (µm)	Air/Brine Lab (psi)	Air/Brine Res Con (psi)	Lab Conditions (psi)	Reservoir Conditions (psi)	Free Water Oil-Water (feet)	Free Water Gas-Water (feet)
1.06	0.0	0.0	0.0	0.0	200	0.21	0.14	0.12	0.07	0.68	0.42
2.02	1.5	1.5	0.0	0.0	105	0.40	0.28	0.23	0.14	1.30	0.81
2.75	0.6	2.1	0.0	0.0	77.0	0.54	0.37	0.32	0.20	1.77	1.10
3.21	0.3	2.4	0.0	0.0	66.1	0.63	0.44	0.37	0.23	2.06	1.29
3.75	0.2	2.6	0.0	0.0	56.5	0.74	0.51	0.43	0.27	2.42	1.50
4.40	0.2	2.8	0.0	0.0	48.2	0.86	0.60	0.50	0.31	2.84	1.76
5.20	0.2	3.1	0.0	0.0	40.8	1.02	0.71	0.60	0.37	3.35	2.08
6.00	0.2	3.2	0.0	0.0	35.4	1.18	0.82	0.69	0.43	3.86	2.41
6.99	0.2	3.4	0.0	0.0	30.3	1.37	0.95	0.80	0.50	4.50	2.80
8.30	0.2	3.6	0.0	0.0	25.6	1.63	1.13	0.95	0.59	5.35	3.32
9.99	0.2	3.9	0.0	0.0	21.2	1.96	1.36	1.14	0.71	6.42	4.00
11.5	0.2	4.1	0.0	0.0	18.4	2.25	1.56	1.32	0.82	7.43	4.59
13.5	0.3	4.3	0.0	0.0	15.7	2.65	1.84	1.54	0.95	8.66	5.41
15.5	0.2	4.5	0.0	0.0	13.7	3.04	2.11	1.77	1.10	10.0	6.21

Pressure (psia)	Raw Data Intrusion (percent)	Raw Data Saturation (percent)	Conformance Corrected Intrusion (percent)	Conformance Corrected Saturation (percent)	Pore Diameter (μm)	Equivalent Air/Brine Lab (psi)	Injection Pressures Air/Brine Res Con (psi)	Oil/Brine Lab Conditions (psi)	Oil/Brine Reservoir Conditions (psi)	Height Above Free Water Oil-Water (feet)	Height Above Free Water Gas-Water (feet)
18.5	0.3	4.9	0.0	0.0	11.5	3.63	2.52	2.12	1.31	11.9	7.41
21.6	0.3	5.2	0.0	0.0	9.82	4.24	2.94	2.47	1.53	13.9	8.65
25.3	0.6	5.8	0.0	0.0	8.38	4.96	3.44	2.90	1.80	16.4	10.1
30.0	0.3	6.1	0.0	0.0	7.07	5.88	4.08	3.43	2.12	19.3	12.0
37.8	0.5	6.6	0.0	0.0	5.61	7.41	5.15	4.33	2.68	24.4	15.1
47.7	0.9	7.5	1.0	1.0	4.45	9.35	6.49	5.46	3.38	30.7	19.1
58.6	2.5	9.9	2.6	3.6	3.62	11.5	7.99	6.71	4.15	37.7	23.5
69.1	5.5	15.4	5.9	9.5	3.07	13.5	9.38	7.91	4.90	44.5	27.6
81.8	7.1	22.5	7.6	17.1	2.59	16.0	11.1	9.36	5.79	52.6	32.6
93.2	5.3	27.8	5.6	22.7	2.27	18.3	12.7	10.7	6.62	60.2	37.4
111	6.1	33.9	6.5	29.2	1.91	21.8	15.1	12.7	7.86	71.5	44.4
129	4.8	38.7	5.2	34.4	1.65	25.3	17.6	14.8	9.16	83.3	51.8
154	5.6	44.4	6.0	40.4	1.38	30.2	21.0	17.6	10.9	99.1	61.8
179	4.2	48.5	4.4	44.9	1.18	35.1	24.4	20.5	12.7	115	71.8
211	4.1	52.6	4.3	49.2	1.00	41.4	28.8	24.1	14.9	135	84.7
247	3.5	56.0	3.7	52.9	0.857	48.4	33.6	28.3	17.5	159	98.8
292	3.0	59.0	3.2	56.1	0.726	57.3	39.8	33.4	20.7	188	117
342	2.6	61.6	2.8	58.9	0.620	67.1	46.6	39.1	24.2	220	137
402	2.2	63.8	2.4	61.3	0.528	78.8	54.7	46.0	28.5	259	161
472	2.0	65.8	2.1	63.4	0.449	92.5	64.2	54.0	33.4	304	189
555	1.8	67.6	1.9	65.3	0.382	109	75.7	63.5	39.3	357	223
649	1.7	69.3	1.9	67.1	0.326	127	88.2	74.3	46.0	418	259
757	2.0	71.3	2.2	69.3	0.280	148	103	86.6	53.6	487	303
888	2.5	73.8	2.6	72.0	0.239	174	121	102	63.1	574	356
1049	2.7	76.5	2.9	74.9	0.202	206	143	120	74.3	675	421
1228	2.7	79.2	2.9	77.8	0.173	241	167	141	87.3	794	491
1438	2.6	81.8	2.7	80.5	0.147	282	196	165	102	927	576
1687	2.4	84.2	2.6	83.1	0.126	331	230	193	119	1082	676
1972	2.2	86.4	2.3	85.4	0.107	387	269	226	140	1273	791

Pressure (psia)	Raw Data Intrusion (percent)	Raw Data Saturation (percent)	Conformance Corrected Intrusion (percent)	Conformance Corrected Saturation (percent)	Pore Diameter (μm)	Equivalent Air/Brine Lab (psi)	Injection Pressures Air/Brine Res Con (psi)	Oil/Brine Lab Conditions (psi)	Oil/Brine Reservoir Conditions (psi)	Height Above Free Water Oil-Water (feet)	Height Above Free Water Gas-Water (feet)
2330	2.1	88.5	2.2	87.6	0.0910	457	317	267	165	1500	932
2709	1.7	90.1	1.8	89.4	0.0783	531	369	310	192	1745	1085
3221	1.7	91.8	1.8	91.2	0.0658	632	439	369	228	2073	1291
3831	1.5	93.3	1.6	92.8	0.0553	751	522	438	271	2464	1535
4418	1.1	94.4	1.2	94.0	0.0480	866	601	506	313	2845	1768
5086	1.3	95.7	1.4	95.4	0.0417	997	692	582	360	3273	2035
5981	0.9	96.6	1.0	96.3	0.0354	1173	815	684	423	3845	2397
7011	0.8	97.3	0.8	97.1	0.0302	1375	955	802	496	4509	2809
7875	0.4	97.8	0.5	97.6	0.0269	1544	1072	901	558	5073	3153
8909	0.4	98.2	0.5	98.1	0.0238	1747	1213	1020	631	5736	3568
10453	0.4	98.6	0.4	98.5	0.0203	2050	1424	1196	740	6727	4188
12282	0.3	98.9	0.3	98.8	0.0173	2408	1672	1406	870	7909	4918
14331	0.1	99.0	0.2	99.0	0.0148	2810	1951	1640	1015	9227	5738
16380	0.1	99.2	0.2	99.1	0.0129	3212	2231	1875	1161	10555	6562
18481	0.1	99.3	0.1	99.3	0.0115	3624	2517	2115	1309	11900	7403
20481	0.1	99.5	0.1	99.4	0.0104	4016	2789	2344	1451	13191	8203
23148	0.1	99.6	0.1	99.5	0.0092	4539	3152	2649	1640	14909	9271
25065	0.1	99.7	0.1	99.6	0.0085	4915	3413	2868	1775	16136	10038
27137	0.0	99.7	0.0	99.7	0.0078	5321	3695	3106	1923	17482	10868
29378	0.1	99.8	0.1	99.8	0.0072	5760	4000	3362	2081	18918	11765
31803	0.0	99.8	0.0	99.8	0.0067	6236	4331	3640	2253	20482	12738
34424	0.1	99.9	0.1	99.9	0.0062	6750	4688	3940	2439	22173	13788
37191	0.1	100.0	0.1	100.0	0.0057	7292	5064	4256	2635	23955	14894
40343	0.0	100.0	0.0	100.0	0.0053	7910	5493	4617	2858	25982	16156
43594	0.0	100.0	0.0	100.0	0.0049	8548	5936	4989	3088	28073	17459
47294	0.0	100.0	0.0	100.0	0.0045	9273	6440	5412	3350	30455	18941
51168	0.0	100.0	0.0	100.0	0.0041	10033	6967	5856	3625	32955	20491
55386	0.0	100.0	0.0	100.0	0.0038	10860	7542	6338	3924	35673	22182
59880	0.0	100.0	0.0	100.0	0.0035	11741	8153	6853	4242	38564	23979

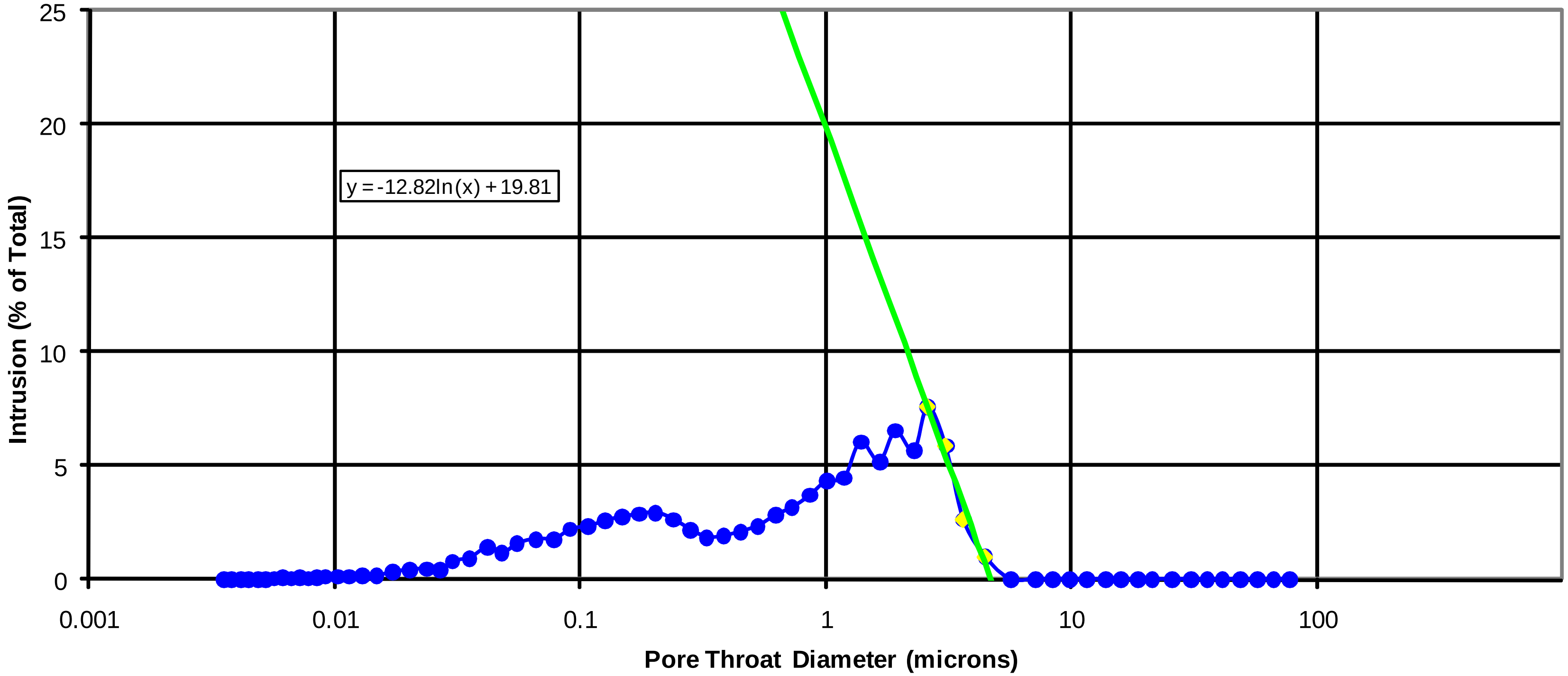
CAPILLARY PRESSURE

Client	ESSO Australia Pty Ltd		
Well	Snapper-A21a		
Test Method	Air/Mercury Capillary Pressure Drainage		
Sample	26A	**Ambient Permeability**	0.85 milliDarcy's
Depth	2937.26	**Ambient Porosity**	8.7 percent



PORE SIZE DISTRIBUTION

Client	ESSO Australia Pty Ltd		
Well	Snapper-A21a		
Test Method	Air/Mercury Capillary Pressure Drainage		
Sample	26A	**Ambient Permeability**	0.85 milliDarcy's
Depth	2937.26	**Ambient Porosity**	8.7 percent



INTERPRETED CAPILLARY PRESSURE

Client ESSO Australia Pty Ltd
Well Snapper-A21a

Test Method Air/Mercury Capillary Pressure Drainage

Sample 34A
Depth 2939.27

Ambient Permeability 1.27 milliDarcy's
Ambient Porosity 7.9 percent
pore radius (μm) 3.11

Density Gradients, psi/foot	Typical
Water:	0.440
Oil:	0.330
Gas:	0.100

Conversion Parameters	air/water	air/oil	oil/water
Laboratory Theta	0.0	0.0	30.0
Laboratory IFT	72.0	24.0	48.0
Reservoir Theta	0.0		30.0
Reservoir IFT	50.0		30.0
Laboratory TcosTheta	72.0	24.0	42.0
Reservoir TcosTheta	50.0		26.0

	Entry Pressure (psia)		Displacement Pressure (psia)		Threshold Pressure (psia)	
System	Lab	Res Con	Lab	Resv	Lab	Resv
A-Hg	34.2	-	45.0	-	59.4	-
G-W	6.71	4.66	8.83	6.13	11.7	8.12
O-W	2.24	2.42	2.95	3.19	3.89	4.21

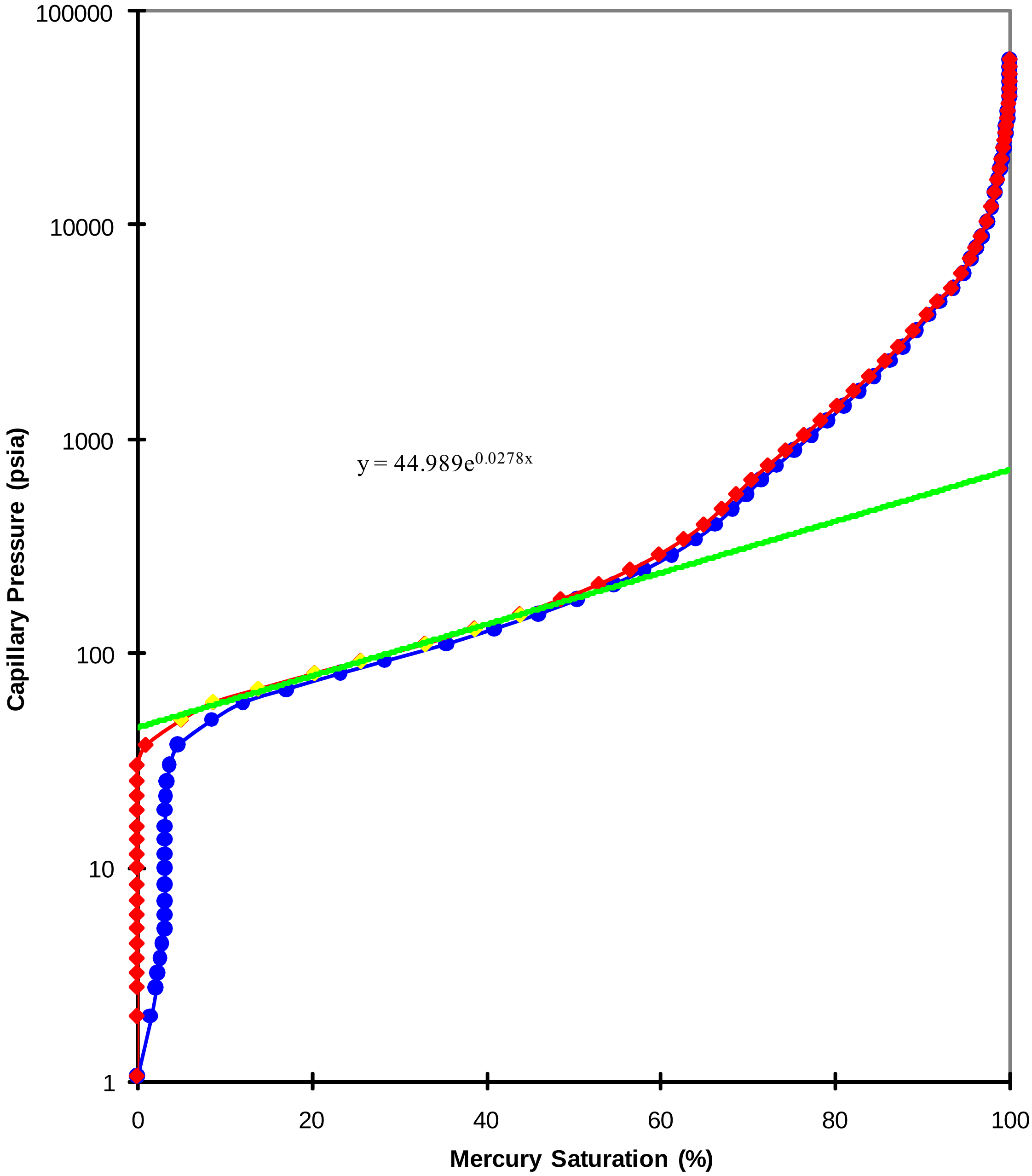
Pressure (psia)	Raw Data Intrusion (percent)	Raw Data Saturation (percent)	Conformance Corrected Intrusion (percent)	Conformance Corrected Saturation (percent)	Pore Diameter (μm)	Equivalent Air/Brine Lab (psi)	Injection Pressures Air/Brine Res Con (psi)	Oil/Brine Lab Conditions (psi)	Oil/Brine Reservoir Conditions (psi)	Height Above Free Water Oil-Water (feet)	Height Above Free Water Gas-Water (feet)
1.06	0.0	0.0	0.0	0.0	201	0.21	0.14	0.12	0.07	0.68	0.42
2.01	1.6	1.6	0.0	0.0	105	0.39	0.27	0.23	0.14	1.29	0.81
2.76	0.6	2.2	0.0	0.0	76.9	0.54	0.38	0.32	0.20	1.78	1.11
3.21	0.3	2.4	0.0	0.0	66.1	0.63	0.44	0.37	0.23	2.06	1.29
3.75	0.2	2.7	0.0	0.0	56.5	0.74	0.51	0.43	0.27	2.42	1.50
4.40	0.2	2.9	0.0	0.0	48.2	0.86	0.60	0.50	0.31	2.84	1.76
5.20	0.3	3.2	0.0	0.0	40.8	1.02	0.71	0.60	0.37	3.35	2.08
6.00	0.0	3.2	0.0	0.0	35.3	1.18	0.82	0.69	0.43	3.86	2.41
7.00	0.0	3.2	0.0	0.0	30.3	1.37	0.95	0.80	0.50	4.51	2.80
8.30	0.0	3.2	0.0	0.0	25.6	1.63	1.13	0.95	0.59	5.35	3.32
10.0	0.0	3.2	0.0	0.0	21.2	1.96	1.36	1.14	0.71	6.42	4.00
11.5	0.0	3.2	0.0	0.0	18.4	2.25	1.56	1.32	0.82	7.43	4.59
13.5	0.0	3.2	0.0	0.0	15.7	2.65	1.84	1.54	0.95	8.66	5.41
15.5	0.0	3.2	0.0	0.0	13.7	3.04	2.11	1.77	1.10	10.0	6.21

Pressure (psia)	Raw Data Intrusion (percent)	Raw Data Saturation (percent)	Conformance Corrected Intrusion (percent)	Conformance Corrected Saturation (percent)	Pore Diameter (μm)	Equivalent Air/Brine Lab (psi)	Injection Pressures Air/Brine Res Con (psi)	Oil/Brine Lab Conditions (psi)	Oil/Brine Reservoir Conditions (psi)	Height Above Free Water Oil-Water (feet)	Height Above Free Water Gas-Water (feet)
18.5	0.0	3.2	0.0	0.0	11.5	3.63	2.52	2.12	1.31	11.9	7.41
21.6	0.1	3.3	0.0	0.0	9.82	4.24	2.94	2.47	1.53	13.9	8.65
25.3	0.1	3.4	0.0	0.0	8.38	4.96	3.44	2.90	1.80	16.4	10.1
30.0	0.3	3.7	0.0	0.0	7.07	5.88	4.08	3.43	2.12	19.3	12.0
37.3	1.0	4.7	1.0	1.0	5.68	7.31	5.08	4.27	2.64	24.0	14.9
49.0	3.9	8.6	4.1	5.1	4.33	9.61	6.67	5.61	3.47	31.5	19.6
59.0	3.5	12.1	3.7	8.7	3.59	11.6	8.06	6.75	4.18	38.0	23.7
68.2	5.0	17.1	5.2	13.9	3.11	13.4	9.31	7.80	4.83	43.9	27.4
80.8	6.2	23.3	6.5	20.4	2.62	15.8	11.0	9.25	5.73	52.1	32.4
92.1	5.1	28.4	5.3	25.6	2.30	18.1	12.6	10.5	6.50	59.1	37.1
111	7.1	35.5	7.4	33.0	1.91	21.8	15.1	12.7	7.86	71.5	44.4
131	5.5	40.9	5.7	38.7	1.62	25.7	17.8	15.0	9.29	84.5	52.4
152	5.0	45.9	5.2	43.9	1.39	29.8	20.7	17.4	10.8	98.2	60.9
179	4.5	50.5	4.7	48.6	1.18	35.1	24.4	20.5	12.7	115	71.8
211	4.2	54.7	4.4	52.9	1.01	41.4	28.8	24.1	14.9	135	84.7
246	3.5	58.1	3.6	56.5	0.862	48.2	33.5	28.2	17.5	159	98.5
290	3.2	61.3	3.3	59.8	0.732	56.9	39.5	33.2	20.6	187	116
342	2.7	64.0	2.8	62.6	0.620	67.1	46.6	39.1	24.2	220	137
400	2.2	66.2	2.3	64.9	0.530	78.4	54.4	45.8	28.4	258	160
474	2.0	68.2	2.1	67.0	0.448	92.9	64.5	54.2	33.6	305	190
555	1.6	69.8	1.7	68.7	0.382	109	75.7	63.5	39.3	357	223
647	1.7	71.5	1.7	70.4	0.328	127	88.2	74.0	45.8	416	259
756	1.8	73.3	1.9	72.3	0.280	148	103	86.5	53.5	486	303
888	2.0	75.3	2.0	74.3	0.239	174	121	102	63.1	574	356
1048	2.0	77.3	2.1	76.4	0.202	205	142	120	74.3	675	418
1226	1.8	79.1	1.9	78.3	0.173	240	167	140	86.7	788	491
1436	1.8	80.9	1.9	80.2	0.148	282	196	164	102	927	576
1688	1.8	82.8	1.9	82.1	0.126	331	230	193	119	1082	676
1971	1.7	84.5	1.8	83.9	0.108	386	268	226	140	1273	788

Pressure (psia)	Raw Data Intrusion (percent)	Raw Data Saturation (percent)	Conformance Corrected Intrusion (percent)	Conformance Corrected Saturation (percent)	Pore Diameter (μm)	Equivalent Air/Brine Lab (psi)	Injection Pressures Air/Brine Res Con (psi)	Oil/Brine Lab Conditions (psi)	Oil/Brine Reservoir Conditions (psi)	Height Above Free Water Oil-Water (feet)	Height Above Free Water Gas-Water (feet)
2329	1.7	86.2	1.8	85.7	0.0910	457	317	267	165	1500	932
2708	1.5	87.7	1.5	87.2	0.0783	531	369	310	192	1745	1085
3220	1.6	89.3	1.7	88.9	0.0658	631	438	369	228	2073	1288
3831	1.5	90.8	1.6	90.5	0.0553	751	522	438	271	2464	1535
4417	1.2	92.0	1.2	91.7	0.0480	866	601	505	313	2845	1768
5087	1.5	93.5	1.6	93.3	0.0417	997	692	582	360	3273	2035
5979	1.1	94.6	1.1	94.4	0.0355	1172	814	684	423	3845	2394
7009	1.0	95.6	1.0	95.4	0.0302	1374	954	802	496	4509	2806
7872	0.6	96.2	0.6	96.1	0.0269	1544	1072	901	558	5073	3153
8905	0.6	96.8	0.6	96.7	0.0238	1746	1213	1019	631	5736	3568
10451	0.7	97.4	0.7	97.3	0.0203	2049	1423	1196	740	6727	4185
12280	0.5	97.9	0.5	97.9	0.0173	2408	1672	1405	870	7909	4918
14331	0.4	98.3	0.4	98.3	0.0148	2810	1951	1640	1015	9227	5738
16379	0.3	98.6	0.3	98.6	0.0129	3212	2231	1874	1160	10545	6562
18479	0.3	98.9	0.3	98.8	0.0115	3623	2516	2115	1309	11900	7400
20482	0.2	99.1	0.2	99.0	0.0104	4016	2789	2344	1451	13191	8203
23148	0.2	99.3	0.2	99.2	0.0092	4539	3152	2649	1640	14909	9271
25063	0.1	99.4	0.1	99.4	0.0085	4914	3413	2868	1775	16136	10038
27136	0.1	99.5	0.1	99.5	0.0078	5321	3695	3105	1922	17473	10868
29378	0.1	99.6	0.1	99.6	0.0072	5760	4000	3362	2081	18918	11765
31803	0.1	99.7	0.1	99.7	0.0067	6236	4331	3640	2253	20482	12738
34422	0.1	99.8	0.1	99.8	0.0062	6749	4687	3939	2438	22164	13785
37192	0.1	99.9	0.1	99.9	0.0057	7293	5065	4256	2635	23955	14897
40340	0.1	99.9	0.1	99.9	0.0053	7910	5493	4617	2858	25982	16156
43591	0.0	100.0	0.0	100.0	0.0049	8547	5935	4989	3088	28073	17456
47295	0.0	100.0	0.0	100.0	0.0045	9274	6440	5413	3351	30464	18941
51170	0.0	100.0	0.0	100.0	0.0041	10033	6967	5856	3625	32955	20491
55385	0.0	100.0	0.0	100.0	0.0038	10860	7542	6338	3924	35673	22182
59879	0.0	100.0	0.0	100.0	0.0035	11741	8153	6853	4242	38564	23979

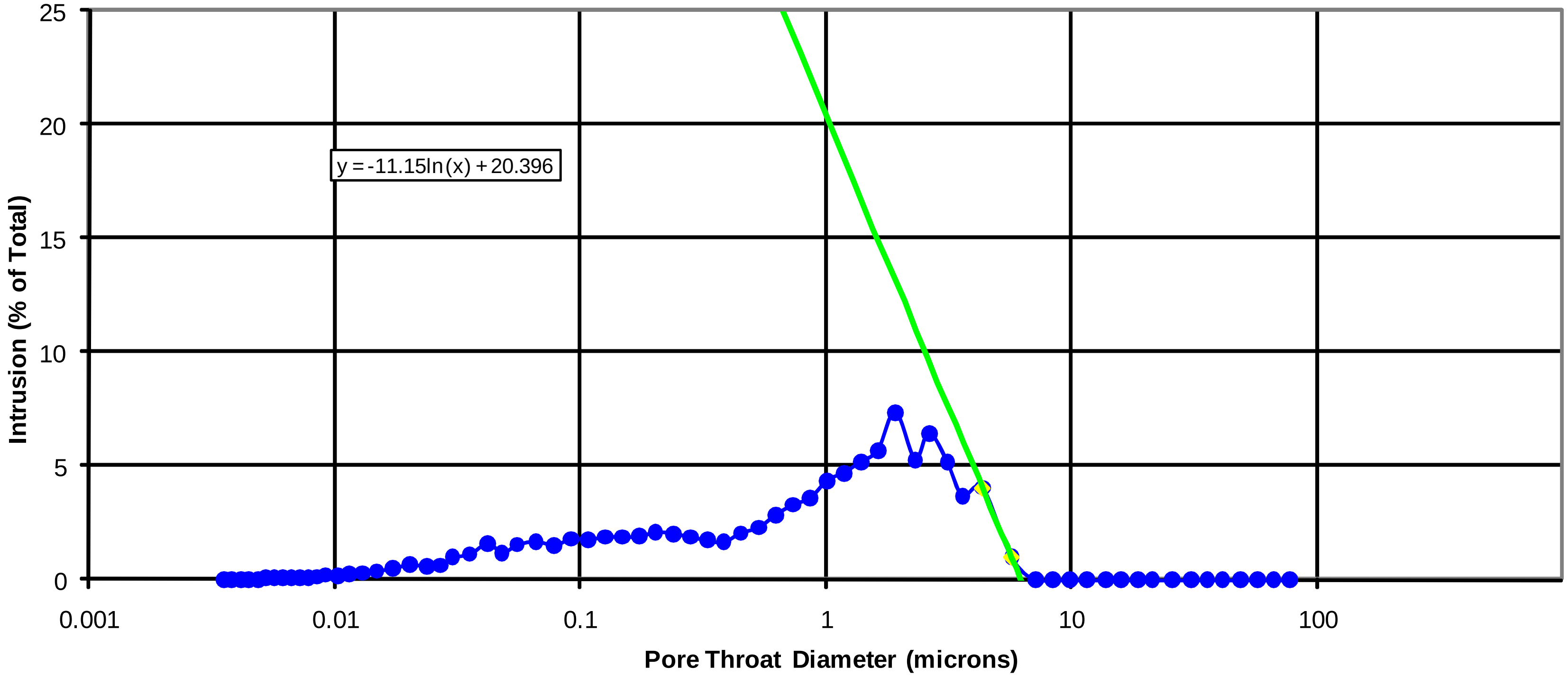
CAPILLARY PRESSURE

Client	ESSO Australia Pty Ltd		
Well	Snapper-A21a		
Test Method	Air/Mercury Capillary Pressure Drainage		
Sample	34A	**Ambient Permeability**	1.27 milliDarcy's
Depth	2939.27	**Ambient Porosity**	7.9 percent



PORE SIZE DISTRIBUTION

Client	ESSO Australia Pty Ltd		
Well	Snapper-A21a		
Test Method	Air/Mercury Capillary Pressure Drainage		
Sample	34A	**Ambient Permeability**	1.27 milliDarcy's
Depth	2939.27	**Ambient Porosity**	7.9 percent



INTERPRETED CAPILLARY PRESSURE

Client	ESSO Australia Pty Ltd
Well	Snapper-A21a
Test Method	Air/Mercury Capillary Pressure Drainage
Sample	48A
Depth	2942.78
Ambient Permeability	2.71 milliDarcy's
Ambient Porosity	11.8 percent
pore radius (μm)	3.09

Density Gradients, psi/foot	Typical
Water:	0.440
Oil:	0.330
Gas:	0.100

Conversion Parameters	air/water	air/oil	oil/water
Laboratory Theta	0.0	0.0	30.0
Laboratory IFT	72.0	24.0	48.0
Reservoir Theta	0.0		30.0
Reservoir IFT	50.0		30.0
Laboratory TcosTheta	72.0	24.0	42.0
Reservoir TcosTheta	50.0		26.0

	Entry Pressure (psia)		Displacement Pressure (psia)		Threshold Pressure (psia)	
System	Lab	Res Con	Lab	Resv	Lab	Resv
A-Hg	34.4	-	47.4	-	64.5	-
G-W	6.76	4.69	9.31	6.46	12.7	8.81
O-W	2.25	2.44	3.10	3.36	4.22	4.57

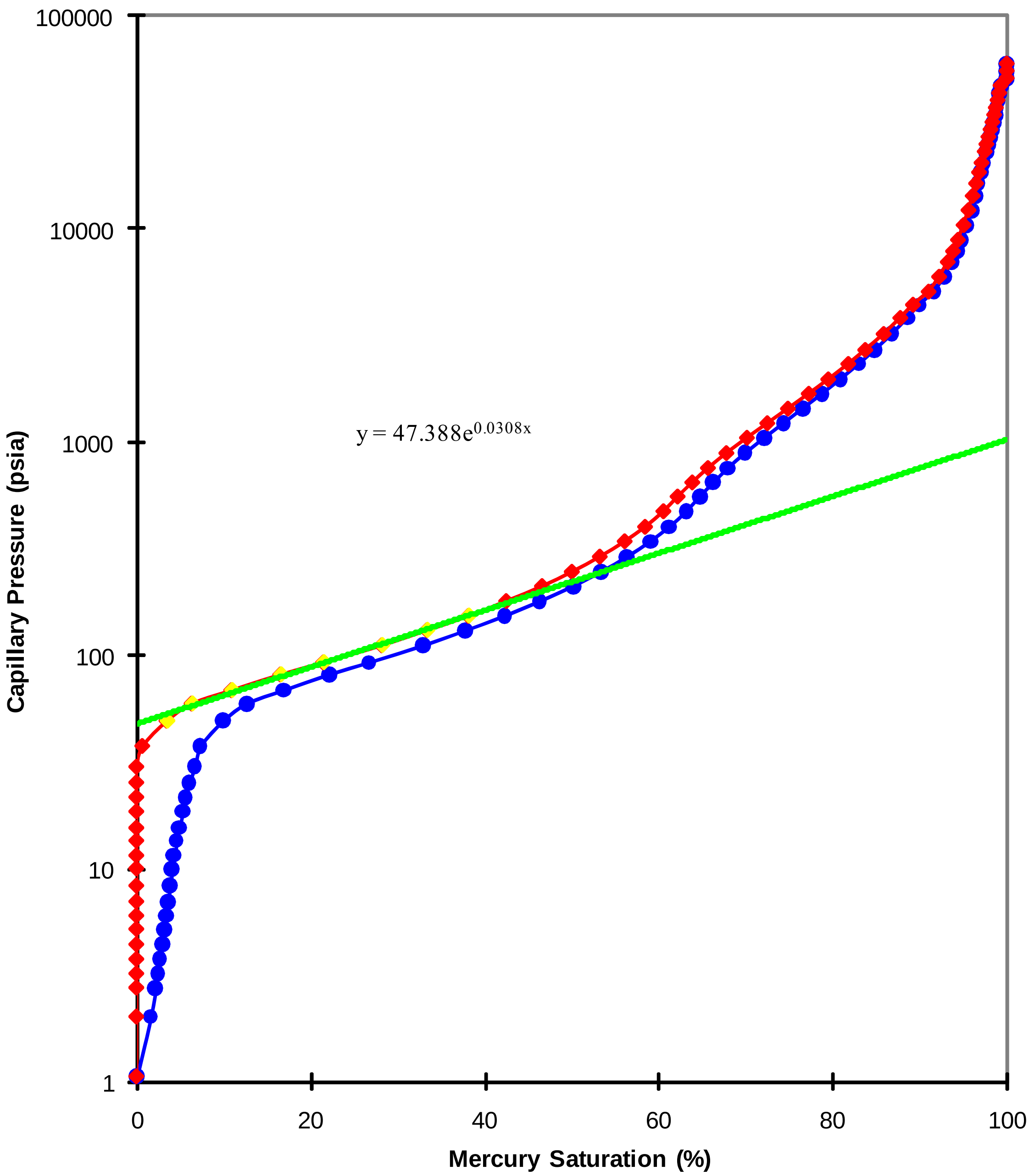
Pressure (psia)	Raw Data Intrusion (percent)	Raw Data Saturation (percent)	Conformance Corrected Intrusion (percent)	Conformance Corrected Saturation (percent)	Pore Diameter (μm)	Equivalent Air/Brine Lab (psi)	Injection Pressures Air/Brine Res Con (psi)	Oil/Brine Lab Conditions (psi)	Oil/Brine Reservoir Conditions (psi)	Height Above Free Water Oil-Water (feet)	Height Above Free Water Gas-Water (feet)
1.06	0.0	0.0	0.0	0.0	201	0.21	0.14	0.12	0.07	0.68	0.42
2.01	1.6	1.6	0.0	0.0	105	0.39	0.27	0.23	0.14	1.29	0.81
2.76	0.6	2.2	0.0	0.0	76.9	0.54	0.38	0.32	0.20	1.78	1.11
3.21	0.3	2.4	0.0	0.0	66.1	0.63	0.44	0.37	0.23	2.06	1.29
3.75	0.2	2.7	0.0	0.0	56.5	0.74	0.51	0.43	0.27	2.42	1.50
4.40	0.3	2.9	0.0	0.0	48.2	0.86	0.60	0.50	0.31	2.84	1.76
5.20	0.2	3.2	0.0	0.0	40.8	1.02	0.71	0.60	0.37	3.35	2.08
6.00	0.2	3.4	0.0	0.0	35.3	1.18	0.82	0.69	0.43	3.86	2.41
7.00	0.2	3.6	0.0	0.0	30.3	1.37	0.95	0.80	0.50	4.51	2.80
8.30	0.2	3.8	0.0	0.0	25.6	1.63	1.13	0.95	0.59	5.35	3.32
10.0	0.3	4.1	0.0	0.0	21.2	1.96	1.36	1.14	0.71	6.42	4.00
11.5	0.2	4.3	0.0	0.0	18.4	2.25	1.56	1.32	0.82	7.43	4.59
13.5	0.3	4.6	0.0	0.0	15.7	2.65	1.84	1.54	0.95	8.66	5.41
15.5	0.3	4.9	0.0	0.0	13.7	3.04	2.11	1.77	1.10	10.0	6.21

Pressure (psia)	Raw Data Intrusion (percent)	Raw Data Saturation (percent)	Conformance Corrected Intrusion (percent)	Conformance Corrected Saturation (percent)	Pore Diameter (μm)	Equivalent Air/Brine Lab (psi)	Injection Pressures Air/Brine Res Con (psi)	Oil/Brine Lab Conditions (psi)	Oil/Brine Reservoir Conditions (psi)	Height Above Free Water Oil-Water (feet)	Height Above Free Water Gas-Water (feet)
18.5	0.4	5.3	0.0	0.0	11.5	3.63	2.52	2.12	1.31	11.9	7.41
21.6	0.3	5.6	0.0	0.0	9.82	4.24	2.94	2.47	1.53	13.9	8.65
25.3	0.4	6.0	0.0	0.0	8.38	4.96	3.44	2.90	1.80	16.4	10.1
30.0	0.6	6.7	0.0	0.0	7.07	5.88	4.08	3.43	2.12	19.3	12.0
37.5	0.6	7.3	0.7	0.7	5.65	7.35	5.10	4.29	2.66	24.2	15.0
49.3	2.6	9.9	2.8	3.5	4.30	9.67	6.72	5.64	3.49	31.7	19.8
59.3	2.7	12.6	2.9	6.4	3.57	11.6	8.06	6.79	4.20	38.2	23.7
68.6	4.3	16.9	4.6	10.9	3.09	13.5	9.38	7.85	4.86	44.2	27.6
81.3	5.3	22.1	5.6	16.5	2.61	15.9	11.0	9.30	5.76	52.4	32.4
92.6	4.6	26.7	4.9	21.5	2.29	18.2	12.6	10.6	6.56	59.6	37.1
111	6.3	33.0	6.7	28.2	1.90	21.8	15.1	12.7	7.86	71.5	44.4
131	4.8	37.8	5.2	33.4	1.62	25.7	17.8	15.0	9.29	84.5	52.4
153	4.5	42.3	4.8	38.1	1.39	30.0	20.8	17.5	10.8	98.2	61.2
180	4.1	46.3	4.3	42.5	1.18	35.3	24.5	20.6	12.8	116	72.1
211	3.8	50.2	4.1	46.6	1.00	41.4	28.8	24.1	14.9	135	84.7
247	3.2	53.4	3.4	50.0	0.860	48.4	33.6	28.3	17.5	159	98.8
290	3.0	56.4	3.2	53.2	0.730	56.9	39.5	33.2	20.6	187	116
343	2.7	59.0	2.9	56.1	0.619	67.3	46.7	39.3	24.3	221	137
401	2.2	61.2	2.3	58.4	0.529	78.6	54.6	45.9	28.4	258	161
474	2.0	63.2	2.1	60.6	0.447	92.9	64.5	54.2	33.6	305	190
556	1.5	64.7	1.6	62.2	0.381	109	75.7	63.6	39.4	358	223
648	1.6	66.3	1.7	63.9	0.327	127	88.2	74.2	45.9	417	259
757	1.7	68.0	1.8	65.7	0.280	148	103	86.6	53.6	487	303
889	2.0	69.9	2.1	67.8	0.239	174	121	102	63.1	574	356
1049	2.2	72.2	2.4	70.2	0.202	206	143	120	74.3	675	421
1227	2.2	74.3	2.3	72.5	0.173	241	167	140	86.7	788	491
1437	2.2	76.5	2.4	74.9	0.148	282	196	164	102	927	576
1689	2.2	78.8	2.4	77.3	0.126	331	230	193	119	1082	676
1972	2.1	80.9	2.2	79.5	0.108	387	269	226	140	1273	791

Pressure (psia)	Raw Data Intrusion (percent)	Raw Data Saturation (percent)	Conformance Corrected Intrusion (percent)	Conformance Corrected Saturation (percent)	Pore Diameter (μm)	Equivalent Air/Brine Lab (psi)	Injection Pressures Air/Brine Res Con (psi)	Oil/Brine Lab Conditions (psi)	Oil/Brine Reservoir Conditions (psi)	Height Above Free Water Oil-Water (feet)	Height Above Free Water Gas-Water (feet)
2330	2.1	83.0	2.3	81.8	0.0910	457	317	267	165	1500	932
2709	1.8	84.8	1.9	83.7	0.0783	531	369	310	192	1745	1085
3221	2.0	86.8	2.1	85.9	0.0658	632	439	369	228	2073	1291
3831	1.8	88.6	1.9	87.8	0.0553	751	522	438	271	2464	1535
4417	1.4	90.0	1.5	89.2	0.0480	866	601	505	313	2845	1768
5088	1.7	91.6	1.8	91.0	0.0417	998	693	582	360	3273	2038
5980	1.1	92.8	1.2	92.2	0.0355	1173	815	684	423	3845	2397
7009	0.9	93.7	1.0	93.2	0.0302	1374	954	802	496	4509	2806
7873	0.6	94.2	0.6	93.8	0.0269	1544	1072	901	558	5073	3153
8906	0.5	94.8	0.6	94.4	0.0238	1746	1213	1019	631	5736	3568
10452	0.6	95.4	0.7	95.1	0.0203	2049	1423	1196	740	6727	4185
12281	0.5	95.9	0.6	95.6	0.0173	2408	1672	1405	870	7909	4918
14332	0.4	96.4	0.5	96.1	0.0148	2810	1951	1640	1015	9227	5738
16380	0.4	96.7	0.4	96.5	0.0129	3212	2231	1875	1161	10555	6562
18480	0.3	97.0	0.3	96.8	0.0115	3624	2517	2115	1309	11900	7403
20483	0.3	97.3	0.3	97.1	0.0104	4016	2789	2344	1451	13191	8203
23148	0.3	97.6	0.4	97.5	0.0092	4539	3152	2649	1640	14909	9271
25063	0.2	97.8	0.2	97.7	0.0085	4914	3413	2868	1775	16136	10038
27137	0.2	98.0	0.2	97.9	0.0078	5321	3695	3106	1923	17482	10868
29379	0.2	98.3	0.2	98.1	0.0072	5761	4001	3362	2081	18918	11768
31804	0.2	98.5	0.2	98.4	0.0067	6236	4331	3640	2253	20482	12738
34423	0.2	98.6	0.2	98.5	0.0062	6750	4688	3939	2438	22164	13788
37193	0.2	98.8	0.2	98.7	0.0057	7293	5065	4256	2635	23955	14897
40340	0.2	99.0	0.2	98.9	0.0053	7910	5493	4617	2858	25982	16156
43591	0.2	99.2	0.2	99.1	0.0049	8547	5935	4989	3088	28073	17456
47296	0.2	99.3	0.2	99.3	0.0045	9274	6440	5413	3351	30464	18941
51171	0.7	100.0	0.7	100.0	0.0041	10034	6968	5856	3625	32955	20494
55385	0.0	100.0	0.0	100.0	0.0038	10860	7542	6338	3924	35673	22182
59880	0.0	100.0	0.0	100.0	0.0035	11741	8153	6853	4242	38564	23979

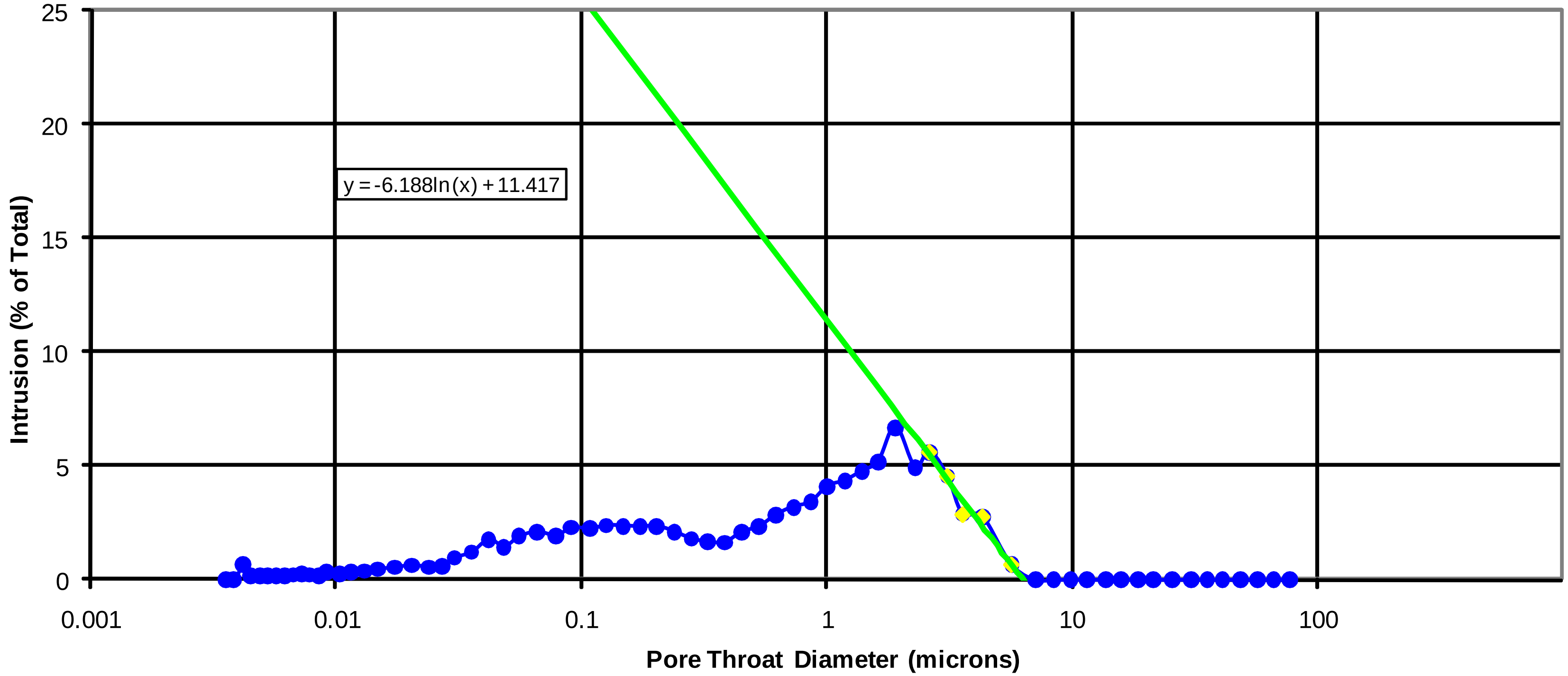
CAPILLARY PRESSURE

Client	ESSO Australia Pty Ltd		
Well	Snapper-A21a		
Test Method	Air/Mercury Capillary Pressure Drainage		
Sample	48A	**Ambient Permeability**	2.71 milliDarcy's
Depth	2942.78	**Ambient Porosity**	11.8 percent



PORE SIZE DISTRIBUTION

Client	ESSO Australia Pty Ltd		
Well	Snapper-A21a		
Test Method	Air/Mercury Capillary Pressure Drainage		
Sample	48A	**Ambient Permeability**	2.71 milliDarcy's
Depth	2942.78	**Ambient Porosity**	11.8 percent



INTERPRETED CAPILLARY PRESSURE

Client ESSO Australia Pty Ltd
Well Snapper-A21a

Test Method Air/Mercury Capillary Pressure Drainage

Sample 49A
Depth 2943.05

Ambient Permeability 1.26 milliDarcy's
Ambient Porosity 9.5 percent
pore radius (μm) 2.52

Density Gradients, psi/foot	
	Typical
Water:	0.440
Oil:	0.330
Gas:	0.100

Conversion Parameters	air/water	air/oil	oil/water
Laboratory Theta	0.0	0.0	30.0
Laboratory IFT	72.0	24.0	48.0
Reservoir Theta	0.0		30.0
Reservoir IFT	50.0		30.0
Laboratory TcosTheta	72.0	24.0	42.0
Reservoir TcosTheta	50.0		26.0

	Entry Pressure (psia)		Displacement Pressure (psia)		Threshold Pressure (psia)	
System	Lab	Res Con	Lab	Resv	Lab	Resv
A-Hg	42.2	-	48.4	-	64.4	-
G-W	8.29	5.75	9.51	6.60	12.7	8.81
O-W	2.76	2.99	3.17	3.43	4.22	4.57

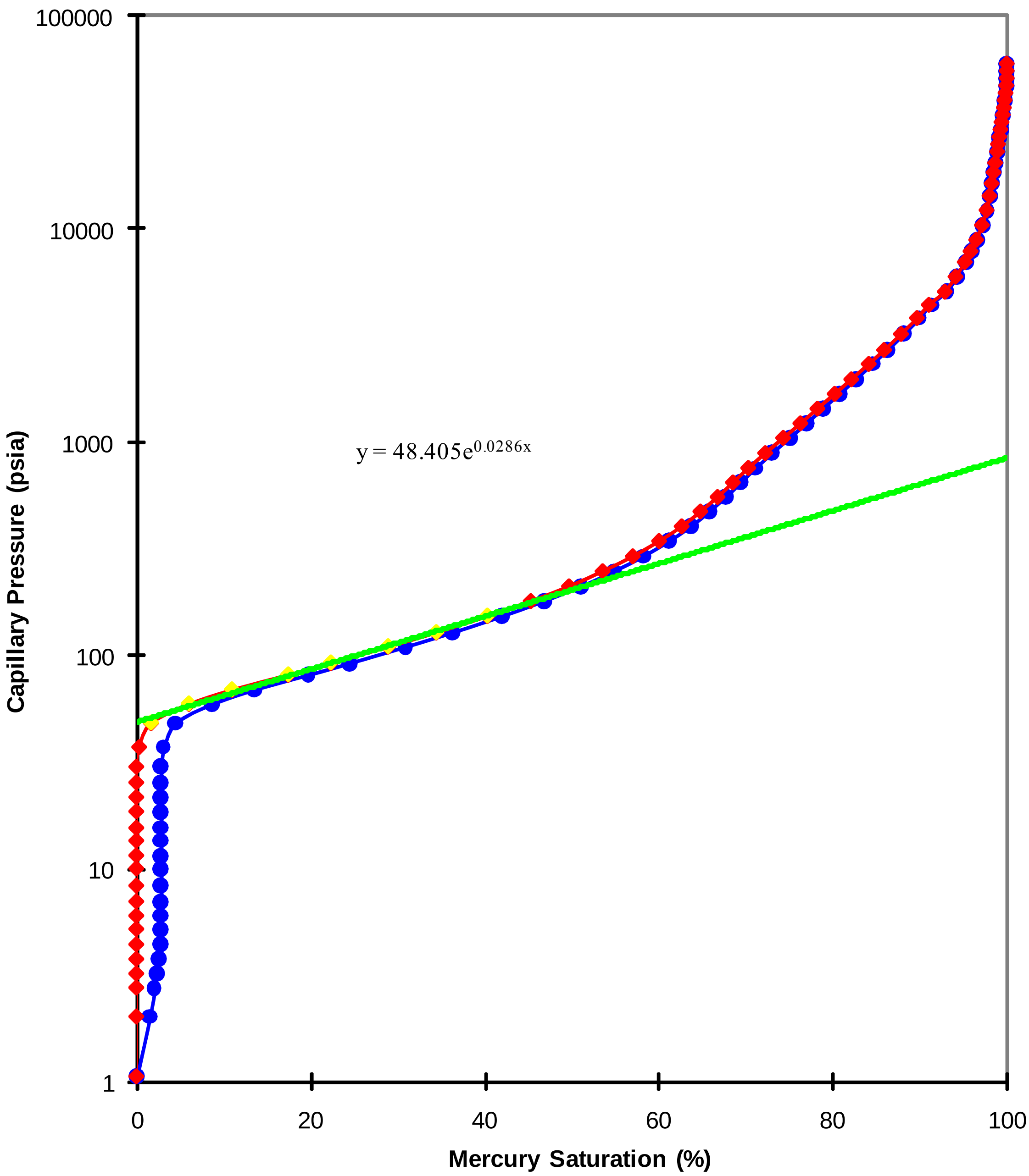
Pressure (psia)	Raw Data Intrusion (percent)	Raw Data Saturation (percent)	Conformance Corrected Intrusion (percent)	Conformance Corrected Saturation (percent)	Pore Diameter (μm)	Equivalent Air/Brine Lab (psi)	Injection Pressures Air/Brine Res Con (psi)	Oil/Brine Lab Conditions (psi)	Oil/Brine Reservoir Conditions (psi)	Height Above Free Water Oil-Water (feet)	Height Above Free Water Gas-Water (feet)
1.06	0.0	0.0	0.0	0.0	201	0.21	0.14	0.12	0.07	0.68	0.42
2.02	1.5	1.5	0.0	0.0	105	0.40	0.28	0.23	0.14	1.30	0.81
2.76	0.6	2.1	0.0	0.0	76.9	0.54	0.38	0.32	0.20	1.78	1.11
3.21	0.2	2.3	0.0	0.0	66.1	0.63	0.44	0.37	0.23	2.06	1.29
3.75	0.3	2.6	0.0	0.0	56.5	0.74	0.51	0.43	0.27	2.42	1.50
4.40	0.2	2.8	0.0	0.0	48.2	0.86	0.60	0.50	0.31	2.84	1.76
5.20	0.0	2.8	0.0	0.0	40.8	1.02	0.71	0.60	0.37	3.35	2.08
6.00	0.0	2.8	0.0	0.0	35.4	1.18	0.82	0.69	0.43	3.86	2.41
7.00	0.0	2.8	0.0	0.0	30.3	1.37	0.95	0.80	0.50	4.51	2.80
8.30	0.0	2.8	0.0	0.0	25.5	1.63	1.13	0.95	0.59	5.35	3.32
10.0	0.0	2.8	0.0	0.0	21.2	1.96	1.36	1.14	0.71	6.42	4.00
11.5	0.0	2.8	0.0	0.0	18.4	2.25	1.56	1.32	0.82	7.43	4.59
13.5	0.0	2.8	0.0	0.0	15.7	2.65	1.84	1.54	0.95	8.66	5.41
15.5	0.0	2.8	0.0	0.0	13.7	3.04	2.11	1.77	1.10	10.0	6.21

Pressure (psia)	Raw Data Intrusion (percent)	Raw Data Saturation (percent)	Conformance Corrected Intrusion (percent)	Conformance Corrected Saturation (percent)	Pore Diameter (μm)	Equivalent Air/Brine Lab (psi)	Injection Pressures Air/Brine Res Con (psi)	Oil/Brine Lab Conditions (psi)	Oil/Brine Reservoir Conditions (psi)	Height Above Free Water Oil-Water (feet)	Height Above Free Water Gas-Water (feet)
18.5	0.0	2.8	0.0	0.0	11.5	3.63	2.52	2.12	1.31	11.9	7.41
21.6	0.0	2.8	0.0	0.0	9.82	4.24	2.94	2.47	1.53	13.9	8.65
25.3	0.0	2.8	0.0	0.0	8.38	4.96	3.44	2.90	1.80	16.4	10.1
30.0	0.0	2.8	0.0	0.0	7.07	5.88	4.08	3.43	2.12	19.3	12.0
37.1	0.3	3.1	0.3	0.3	5.72	7.27	5.05	4.25	2.63	23.9	14.9
48.0	1.3	4.4	1.4	1.7	4.42	9.41	6.53	5.49	3.40	30.9	19.2
59.1	4.2	8.7	4.3	6.0	3.59	11.6	8.06	6.76	4.18	38.0	23.7
68.8	4.8	13.5	5.0	11.0	3.08	13.5	9.38	7.87	4.87	44.3	27.6
80.9	6.3	19.8	6.5	17.5	2.62	15.9	11.0	9.26	5.73	52.1	32.4
91.9	4.8	24.5	4.9	22.4	2.31	18.0	12.5	10.5	6.50	59.1	36.8
110	6.4	30.9	6.6	28.9	1.93	21.6	15.0	12.6	7.80	70.9	44.1
128	5.4	36.3	5.5	34.5	1.66	25.1	17.4	14.6	9.04	82.2	51.2
153	5.7	42.0	5.9	40.3	1.39	30.0	20.8	17.5	10.8	98.2	61.2
180	4.8	46.8	5.0	45.3	1.18	35.3	24.5	20.6	12.8	116	72.1
211	4.3	51.1	4.4	49.7	1.01	41.4	28.8	24.1	14.9	135	84.7
248	3.7	54.9	3.9	53.6	0.854	48.6	33.8	28.4	17.6	160	99.4
291	3.4	58.2	3.5	57.0	0.727	57.1	39.7	33.3	20.6	187	117
344	2.9	61.2	3.0	60.1	0.617	67.5	46.9	39.4	24.4	222	138
403	2.5	63.7	2.6	62.7	0.526	79.0	54.9	46.1	28.5	259	161
473	2.1	65.8	2.2	64.8	0.448	92.7	64.4	54.1	33.5	305	189
553	1.9	67.7	2.0	66.8	0.383	108	75.0	63.3	39.2	356	221
648	1.7	69.4	1.8	68.5	0.327	127	88.2	74.2	45.9	417	259
757	1.7	71.1	1.8	70.3	0.280	148	103	86.6	53.6	487	303
889	1.9	73.0	1.9	72.3	0.238	174	121	102	63.1	574	356
1048	2.0	75.0	2.1	74.3	0.202	205	142	120	74.3	675	418
1227	1.9	77.0	2.0	76.3	0.173	241	167	140	86.7	788	491
1437	1.9	78.9	2.0	78.3	0.148	282	196	164	102	927	576
1687	1.9	80.8	2.0	80.2	0.126	331	230	193	119	1082	676
1974	1.9	82.6	1.9	82.1	0.107	387	269	226	140	1273	791

Pressure (psia)	Raw Data Intrusion (percent)	Raw Data Saturation (percent)	Conformance Corrected Intrusion (percent)	Conformance Corrected Saturation (percent)	Pore Diameter (μm)	Equivalent Air/Brine Lab (psi)	Injection Pressures Air/Brine Res Con (psi)	Oil/Brine Lab Conditions (psi)	Oil/Brine Reservoir Conditions (psi)	Height Above Free Water Oil-Water (feet)	Height Above Free Water Gas-Water (feet)
2331	1.9	84.6	2.0	84.1	0.0910	457	317	267	165	1500	932
2710	1.7	86.3	1.8	85.9	0.0782	531	369	310	192	1745	1085
3221	1.9	88.2	1.9	87.9	0.0658	632	439	369	228	2073	1291
3830	1.8	90.0	1.8	89.7	0.0554	751	522	438	271	2464	1535
4416	1.3	91.3	1.4	91.0	0.0480	866	601	505	313	2845	1768
5087	1.8	93.1	1.8	92.9	0.0417	997	692	582	360	3273	2035
5982	1.2	94.3	1.2	94.1	0.0354	1173	815	685	424	3855	2397
7011	1.0	95.3	1.1	95.2	0.0302	1375	955	802	496	4509	2809
7876	0.7	96.0	0.7	95.8	0.0269	1544	1072	901	558	5073	3153
8908	0.6	96.6	0.6	96.5	0.0238	1747	1213	1019	631	5736	3568
10450	0.6	97.2	0.7	97.1	0.0203	2049	1423	1196	740	6727	4185
12284	0.5	97.7	0.5	97.7	0.0173	2409	1673	1406	870	7909	4921
14332	0.3	98.1	0.3	98.0	0.0148	2810	1951	1640	1015	9227	5738
16379	0.2	98.3	0.3	98.3	0.0129	3212	2231	1874	1160	10545	6562
18479	0.2	98.5	0.2	98.5	0.0115	3623	2516	2115	1309	11900	7400
20482	0.2	98.7	0.2	98.7	0.0104	4016	2789	2344	1451	13191	8203
23148	0.2	98.9	0.2	98.9	0.0092	4539	3152	2649	1640	14909	9271
25063	0.1	99.0	0.1	99.0	0.0085	4914	3413	2868	1775	16136	10038
27137	0.1	99.2	0.1	99.1	0.0078	5321	3695	3106	1923	17482	10868
29376	0.1	99.3	0.1	99.3	0.0072	5760	4000	3362	2081	18918	11765
31802	0.1	99.4	0.1	99.4	0.0067	6236	4331	3639	2253	20482	12738
34422	0.1	99.6	0.1	99.5	0.0062	6749	4687	3939	2438	22164	13785
37193	0.1	99.7	0.1	99.7	0.0057	7293	5065	4256	2635	23955	14897
40344	0.1	99.8	0.1	99.8	0.0053	7911	5494	4617	2858	25982	16159
43594	0.1	99.9	0.1	99.9	0.0049	8548	5936	4989	3088	28073	17459
47294	0.1	99.9	0.1	99.9	0.0045	9273	6440	5412	3350	30455	18941
51171	0.0	100.0	0.1	100.0	0.0041	10034	6968	5856	3625	32955	20494
55385	0.0	100.0	0.0	100.0	0.0038	10860	7542	6338	3924	35673	22182
59880	0.0	100.0	0.0	100.0	0.0035	11741	8153	6853	4242	38564	23979

CAPILLARY PRESSURE

Client	ESSO Australia Pty Ltd		
Well	Snapper-A21a		
Test Method	Air/Mercury Capillary Pressure Drainage		
Sample	49A	**Ambient Permeability**	1.26 milliDarcy's
Depth	2943.05	**Ambient Porosity**	9.5 percent



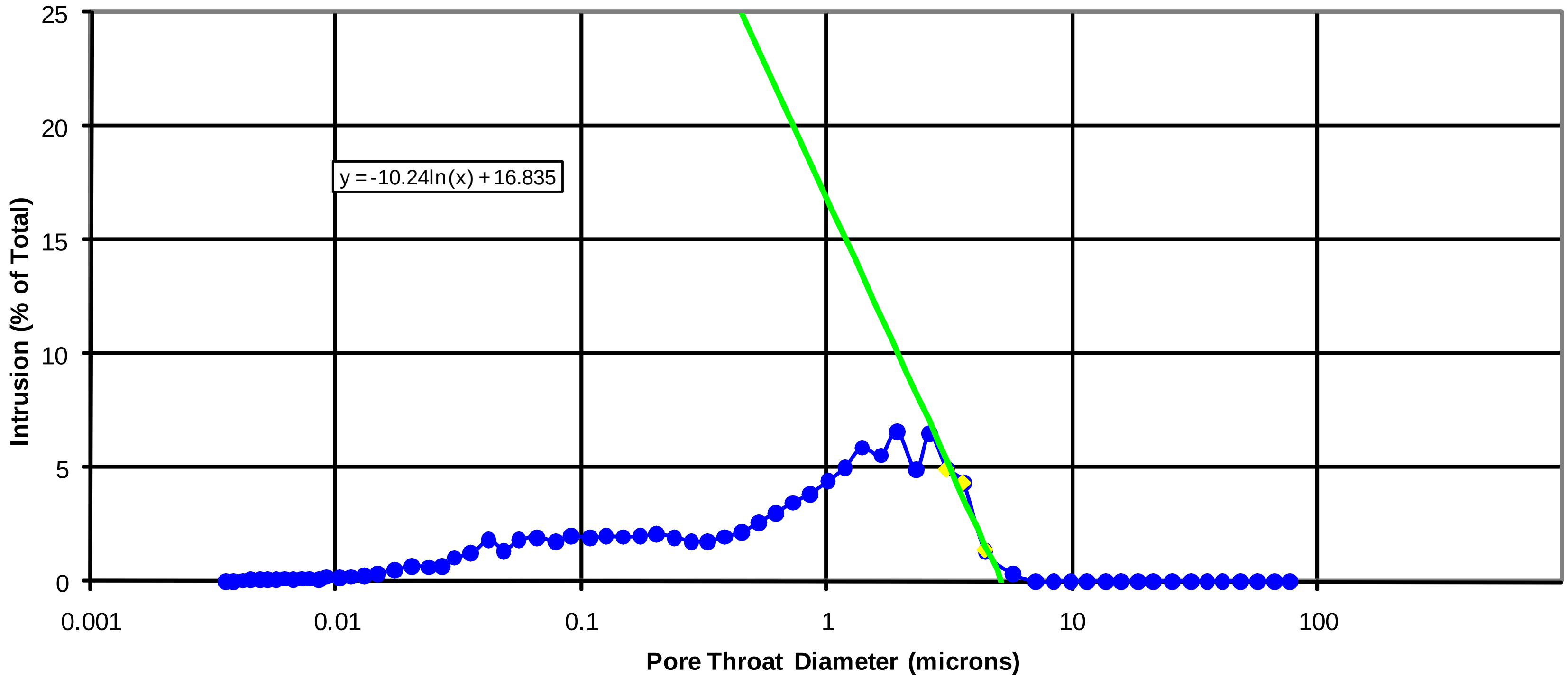
PORE SIZE DISTRIBUTION

Client ESSO Australia Pty Ltd
Well Snapper-A21a

Test Method Air/Mercury Capillary Pressure Drainage

Sample 49A
Depth 2943.05

Ambient Permeability 1.26 milliDarcy's
Ambient Porosity 9.5 percent



INTERPRETED CAPILLARY PRESSURE

Client ESSO Australia Pty Ltd
Well Snapper-A21a

Test Method Air/Mercury Capillary Pressure Drainage

Sample 55A
Depth 2944.52

Ambient Permeability 2.42 milliDarcy's
Ambient Porosity 11.0 percent
pore radius (μm) 3.39

Density Gradients, psi/foot	Typical
Water:	0.440
Oil:	0.330
Gas:	0.100

Conversion Parameters	air/water	air/oil	oil/water
Laboratory Theta	0.0	0.0	30.0
Laboratory IFT	72.0	24.0	48.0
Reservoir Theta	0.0		30.0
Reservoir IFT	50.0		30.0
Laboratory TcosTheta	72.0	24.0	42.0
Reservoir TcosTheta	50.0		26.0

	Entry Pressure (psia)		Displacement Pressure (psia)		Threshold Pressure (psia)	
System	Lab	Res Con	Lab	Resv	Lab	Resv
A-Hg	31.4	-	46.0	-	62.4	-
G-W	6.16	4.28	9.02	6.27	12.2	8.48
O-W	2.05	2.22	3.00	3.25	4.07	4.41

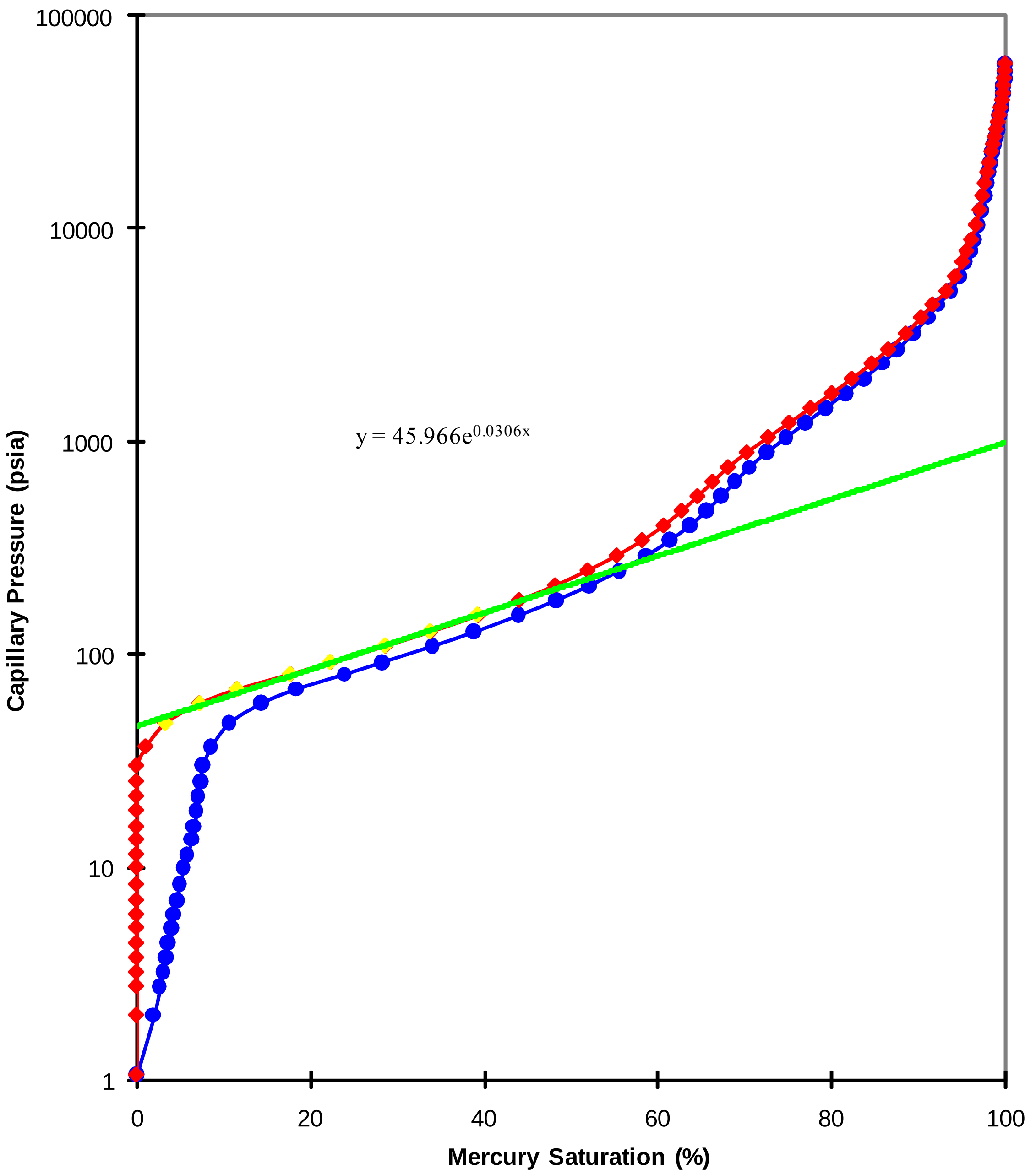
Pressure (psia)	Raw Data Intrusion (percent)	Raw Data Saturation (percent)	Conformance Corrected Intrusion (percent)	Conformance Corrected Saturation (percent)	Pore Diameter (μm)	Equivalent Air/Brine Lab (psi)	Injection Pressures Air/Brine Res Con (psi)	Oil/Brine Lab Conditions (psi)	Oil/Brine Reservoir Conditions (psi)	Height Above Free Water Oil-Water (feet)	Height Above Free Water Gas-Water (feet)
1.06	0.0	0.0	0.0	0.0	201	0.21	0.14	0.12	0.07	0.68	0.42
2.02	2.0	2.0	0.0	0.0	105	0.40	0.28	0.23	0.14	1.30	0.81
2.76	0.7	2.7	0.0	0.0	76.9	0.54	0.38	0.32	0.20	1.78	1.11
3.21	0.4	3.1	0.0	0.0	66.1	0.63	0.44	0.37	0.23	2.06	1.29
3.75	0.3	3.4	0.0	0.0	56.5	0.74	0.51	0.43	0.27	2.42	1.50
4.40	0.3	3.7	0.0	0.0	48.2	0.86	0.60	0.50	0.31	2.84	1.76
5.20	0.3	4.0	0.0	0.0	40.8	1.02	0.71	0.60	0.37	3.35	2.08
6.00	0.3	4.3	0.0	0.0	35.4	1.18	0.82	0.69	0.43	3.86	2.41
7.00	0.3	4.6	0.0	0.0	30.3	1.37	0.95	0.80	0.50	4.51	2.80
8.30	0.3	5.0	0.0	0.0	25.5	1.63	1.13	0.95	0.59	5.35	3.32
10.0	0.5	5.4	0.0	0.0	21.2	1.96	1.36	1.14	0.71	6.42	4.00
11.5	0.4	5.8	0.0	0.0	18.4	2.25	1.56	1.32	0.82	7.43	4.59
13.5	0.6	6.4	0.0	0.0	15.7	2.65	1.84	1.54	0.95	8.66	5.41
15.5	0.2	6.6	0.0	0.0	13.7	3.04	2.11	1.77	1.10	10.0	6.21

Pressure (psia)	Raw Data Intrusion (percent)	Raw Data Saturation (percent)	Conformance Corrected Intrusion (percent)	Conformance Corrected Saturation (percent)	Pore Diameter (μm)	Equivalent Air/Brine Lab (psi)	Injection Pressures Air/Brine Res Con (psi)	Oil/Brine Lab Conditions (psi)	Oil/Brine Reservoir Conditions (psi)	Height Above Free Water Oil-Water (feet)	Height Above Free Water Gas-Water (feet)
18.5	0.2	6.9	0.0	0.0	11.5	3.63	2.52	2.12	1.31	11.9	7.41
21.6	0.2	7.1	0.0	0.0	9.82	4.24	2.94	2.47	1.53	13.9	8.65
25.3	0.2	7.4	0.0	0.0	8.38	4.96	3.44	2.90	1.80	16.4	10.1
30.0	0.2	7.6	0.0	0.0	7.07	5.88	4.08	3.43	2.12	19.3	12.0
36.9	1.0	8.6	1.1	1.1	5.75	7.24	5.03	4.22	2.61	23.7	14.8
47.6	2.1	10.7	2.2	3.3	4.45	9.33	6.48	5.45	3.37	30.6	19.1
58.8	3.7	14.3	4.0	7.3	3.60	11.5	7.99	6.73	4.17	37.9	23.5
68.6	4.0	18.3	4.3	11.6	3.09	13.5	9.38	7.85	4.86	44.2	27.6
80.7	5.7	24.0	6.1	17.7	2.63	15.8	11.0	9.24	5.72	52.0	32.4
91.8	4.3	28.2	4.6	22.3	2.31	18.0	12.5	10.5	6.50	59.1	36.8
110	5.9	34.1	6.4	28.7	1.93	21.6	15.0	12.6	7.80	70.9	44.1
128	4.8	38.9	5.2	33.9	1.66	25.1	17.4	14.6	9.04	82.2	51.2
153	5.1	44.0	5.5	39.4	1.39	30.0	20.8	17.5	10.8	98.2	61.2
180	4.3	48.3	4.7	44.1	1.18	35.3	24.5	20.6	12.8	116	72.1
211	3.8	52.2	4.1	48.2	1.01	41.4	28.8	24.1	14.9	135	84.7
248	3.5	55.6	3.7	52.0	0.855	48.6	33.8	28.4	17.6	160	99.4
291	3.1	58.7	3.3	55.3	0.728	57.1	39.7	33.3	20.6	187	117
344	2.7	61.4	2.9	58.2	0.617	67.5	46.9	39.4	24.4	222	138
403	2.3	63.7	2.5	60.7	0.526	79.0	54.9	46.1	28.5	259	161
473	1.9	65.6	2.1	62.8	0.448	92.7	64.4	54.1	33.5	305	189
553	1.7	67.3	1.8	64.6	0.383	108	75.0	63.3	39.2	356	221
648	1.6	68.9	1.7	66.3	0.327	127	88.2	74.2	45.9	417	259
757	1.7	70.5	1.8	68.1	0.280	148	103	86.6	53.6	487	303
889	2.0	72.5	2.2	70.3	0.238	174	121	102	63.1	574	356
1048	2.3	74.8	2.5	72.7	0.202	205	142	120	74.3	675	418
1227	2.2	77.0	2.4	75.1	0.173	241	167	140	86.7	788	491
1437	2.3	79.3	2.5	77.6	0.148	282	196	164	102	927	576
1687	2.3	81.6	2.4	80.0	0.126	331	230	193	119	1082	676
1974	2.1	83.7	2.3	82.3	0.107	387	269	226	140	1273	791

Pressure (psia)	Raw Data Intrusion (percent)	Raw Data Saturation (percent)	Conformance Corrected Intrusion (percent)	Conformance Corrected Saturation (percent)	Pore Diameter (μm)	Equivalent Air/Brine Lab (psi)	Injection Pressures Air/Brine Res Con (psi)	Oil/Brine Lab Conditions (psi)	Oil/Brine Reservoir Conditions (psi)	Height Above Free Water Oil-Water (feet)	Height Above Free Water Gas-Water (feet)
2331	2.1	85.8	2.3	84.6	0.0910	457	317	267	165	1500	932
2709	1.8	87.6	1.9	86.5	0.0782	531	369	310	192	1745	1085
3221	1.9	89.4	2.0	88.6	0.0658	632	439	369	228	2073	1291
3830	1.6	91.1	1.8	90.3	0.0554	751	522	438	271	2464	1535
4416	1.2	92.3	1.3	91.6	0.0480	866	601	505	313	2845	1768
5086	1.5	93.7	1.6	93.2	0.0417	997	692	582	360	3273	2035
5982	0.9	94.7	1.0	94.2	0.0354	1173	815	685	424	3855	2397
7011	0.8	95.5	0.8	95.1	0.0302	1375	955	802	496	4509	2809
7876	0.4	95.9	0.5	95.6	0.0269	1544	1072	901	558	5073	3153
8908	0.5	96.4	0.5	96.1	0.0238	1747	1213	1019	631	5736	3568
10450	0.5	96.9	0.5	96.6	0.0203	2049	1423	1196	740	6727	4185
12284	0.4	97.3	0.4	97.0	0.0173	2409	1673	1406	870	7909	4921
14332	0.3	97.6	0.3	97.4	0.0148	2810	1951	1640	1015	9227	5738
16379	0.2	97.8	0.3	97.6	0.0129	3212	2231	1874	1160	10545	6562
18479	0.3	98.1	0.3	98.0	0.0115	3623	2516	2115	1309	11900	7400
20482	0.2	98.3	0.2	98.2	0.0104	4016	2789	2344	1451	13191	8203
23148	0.2	98.5	0.3	98.4	0.0092	4539	3152	2649	1640	14909	9271
25063	0.2	98.7	0.2	98.6	0.0085	4914	3413	2868	1775	16136	10038
27137	0.2	98.9	0.2	98.8	0.0078	5321	3695	3106	1923	17482	10868
29376	0.2	99.1	0.2	99.0	0.0072	5760	4000	3362	2081	18918	11765
31802	0.2	99.2	0.2	99.2	0.0067	6236	4331	3639	2253	20482	12738
34422	0.2	99.4	0.2	99.3	0.0062	6749	4687	3939	2438	22164	13785
37193	0.1	99.5	0.1	99.5	0.0057	7293	5065	4256	2635	23955	14897
40344	0.2	99.7	0.2	99.6	0.0053	7911	5494	4617	2858	25982	16159
43594	0.1	99.8	0.1	99.8	0.0049	8548	5936	4989	3088	28073	17459
47294	0.0	99.8	0.0	99.8	0.0045	9273	6440	5412	3350	30455	18941
51171	0.1	99.9	0.1	99.9	0.0041	10034	6968	5856	3625	32955	20494
55385	0.1	100.0	0.1	100.0	0.0038	10860	7542	6338	3924	35673	22182
59880	0.0	100.0	0.0	100.0	0.0035	11741	8153	6853	4242	38564	23979

CAPILLARY PRESSURE

Client	ESSO Australia Pty Ltd		
Well	Snapper-A21a		
Test Method	Air/Mercury Capillary Pressure Drainage		
Sample	55A	**Ambient Permeability**	2.42 milliDarcy's
Depth	2944.52	**Ambient Porosity**	11.0 percent



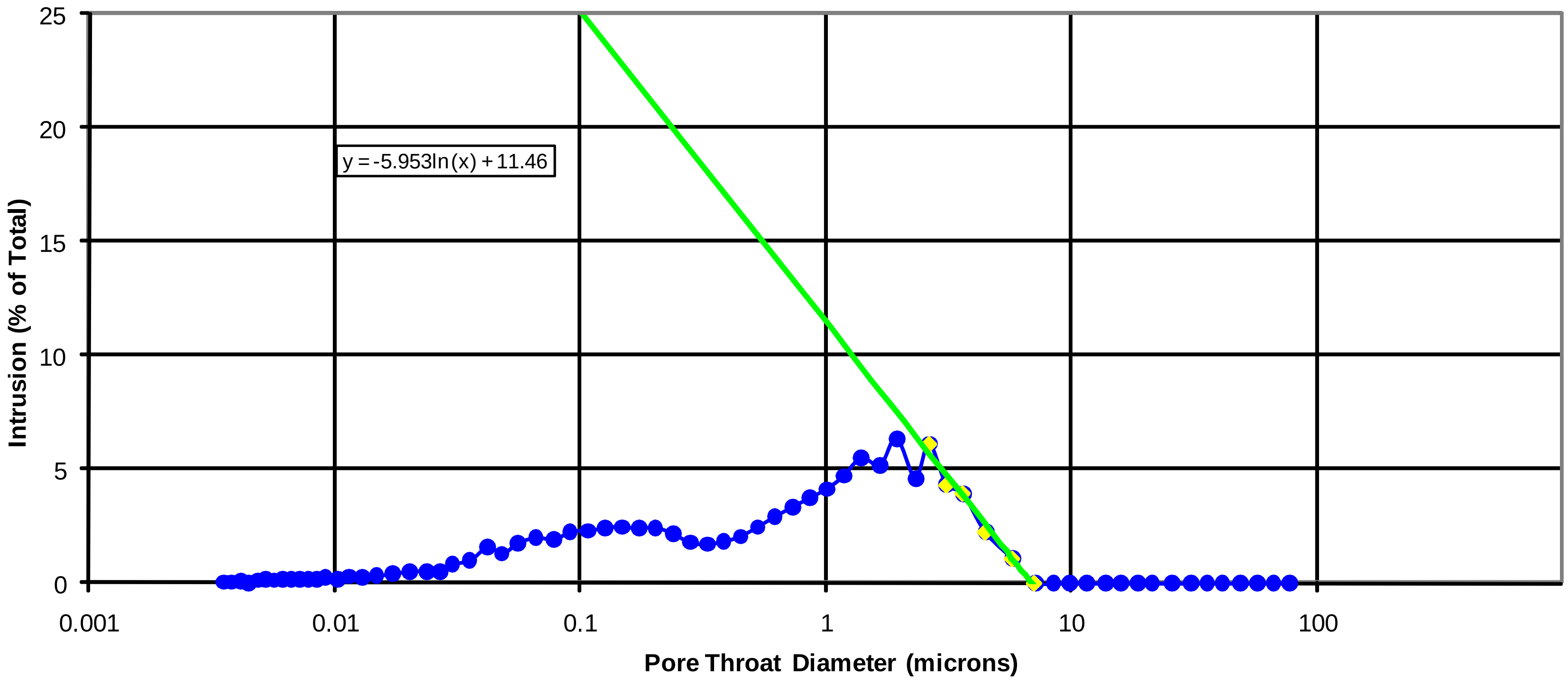
PORE SIZE DISTRIBUTION

Client ESSO Australia Pty Ltd
Well Snapper-A21a

Test Method Air/Mercury Capillary Pressure Drainage

Sample 55A
Depth 2944.52

Ambient Permeability 2.42 milliDarcy's
Ambient Porosity 11.0 percent



INTERPRETED CAPILLARY PRESSURE

Client ESSO Australia Pty Ltd
Well Snapper-A21a

Test Method Air/Mercury Capillary Pressure Drainage

Sample 72A
Depth 2948.77

Ambient Permeability 1.41 milliDarcy's
Ambient Porosity 5.1 percent
pore radius (µm) 3.37

Density Gradients, psi/foot		
	Typical	
Water:	0.440	
Oil:	0.330	
Gas:	0.100	

Conversion Parameters	air/water	air/oil	oil/water
Laboratory Theta	0.0	0.0	30.0
Laboratory IFT	72.0	24.0	48.0
Reservoir Theta	0.0		30.0
Reservoir IFT	50.0		30.0
Laboratory TcosTheta	72.0	24.0	42.0
Reservoir TcosTheta	50.0		26.0

	Entry Pressure (psia)		Displacement Pressure (psia)		Threshold Pressure (psia)	
System	Lab	Res Con	Lab	Resv	Lab	Resv
A-Hg	31.6	-	53.1	-	76.6	-
G-W	6.20	4.30	10.4	7.21	15.0	10.4
O-W	2.07	2.24	3.48	3.77	5.02	5.44

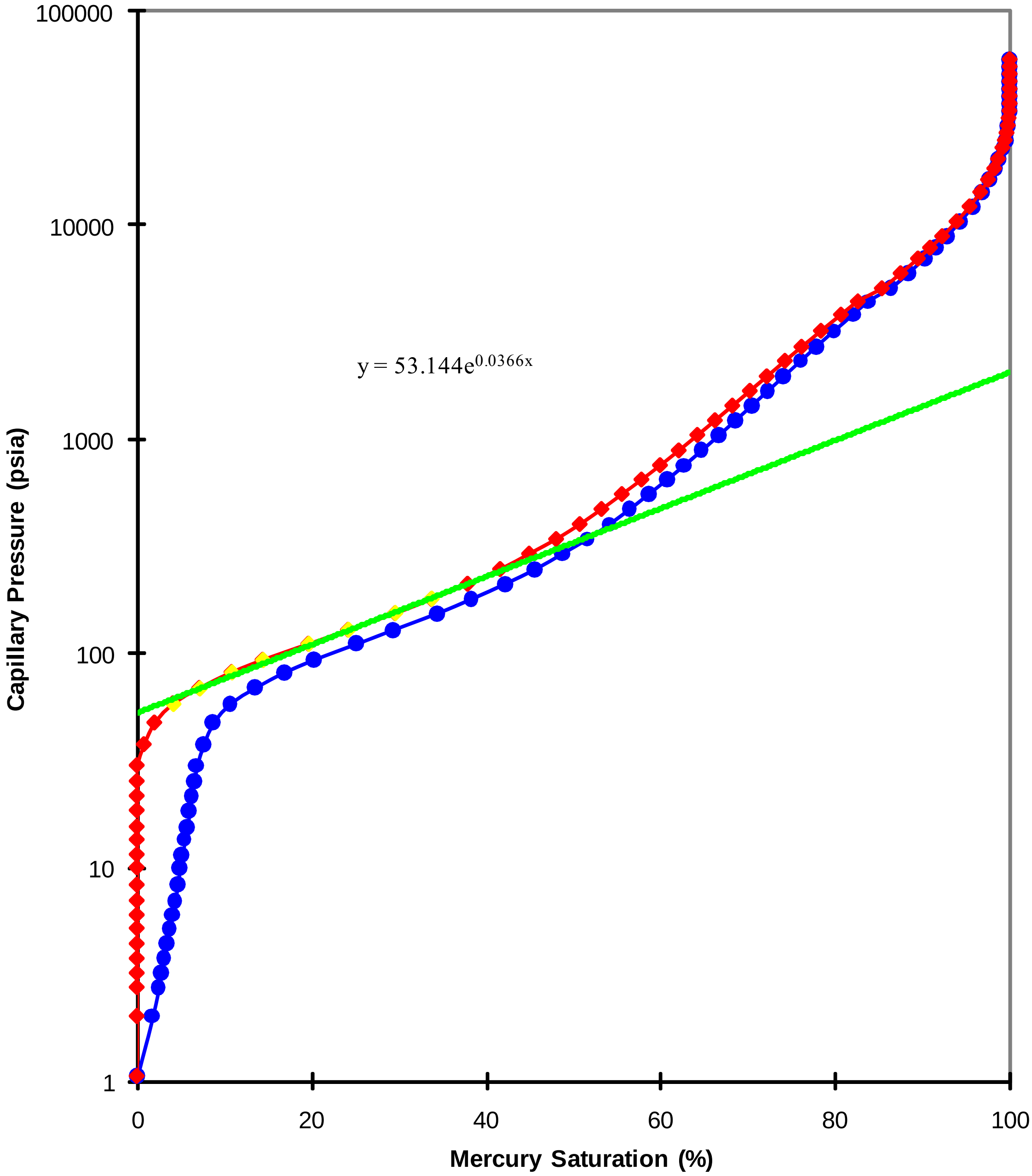
Pressure (psia)	Raw Data Intrusion (percent)	Raw Data Saturation (percent)	Conformance Corrected Intrusion (percent)	Conformance Corrected Saturation (percent)	Pore Diameter (µm)	Equivalent Air/Brine Lab (psi)	Injection Pressures Air/Brine Res Con (psi)	Oil/Brine Lab Conditions (psi)	Oil/Brine Reservoir Conditions (psi)	Height Above Free Water Oil-Water (feet)	Height Above Free Water Gas-Water (feet)
1.06	0.0	0.0	0.0	0.0	200	0.21	0.14	0.12	0.07	0.68	0.42
2.02	1.8	1.8	0.0	0.0	105	0.40	0.28	0.23	0.14	1.30	0.81
2.75	0.7	2.5	0.0	0.0	77.0	0.54	0.37	0.32	0.20	1.77	1.10
3.21	0.3	2.8	0.0	0.0	66.1	0.63	0.44	0.37	0.23	2.06	1.29
3.75	0.3	3.1	0.0	0.0	56.5	0.74	0.51	0.43	0.27	2.42	1.50
4.40	0.3	3.4	0.0	0.0	48.2	0.86	0.60	0.50	0.31	2.84	1.76
5.20	0.3	3.8	0.0	0.0	40.8	1.02	0.71	0.60	0.37	3.35	2.08
6.00	0.3	4.0	0.0	0.0	35.4	1.18	0.82	0.69	0.43	3.86	2.41
6.99	0.3	4.3	0.0	0.0	30.3	1.37	0.95	0.80	0.50	4.50	2.80
8.30	0.3	4.6	0.0	0.0	25.6	1.63	1.13	0.95	0.59	5.35	3.32
9.99	0.3	4.9	0.0	0.0	21.2	1.96	1.36	1.14	0.71	6.42	4.00
11.5	0.3	5.2	0.0	0.0	18.4	2.25	1.56	1.32	0.82	7.43	4.59
13.5	0.3	5.4	0.0	0.0	15.7	2.65	1.84	1.54	0.95	8.66	5.41
15.5	0.3	5.7	0.0	0.0	13.7	3.04	2.11	1.77	1.10	10.0	6.21

Pressure (psia)	Raw Data Intrusion (percent)	Raw Data Saturation (percent)	Conformance Corrected Intrusion (percent)	Conformance Corrected Saturation (percent)	Pore Diameter (μm)	Equivalent Air/Brine Lab (psi)	Injection Pressures Air/Brine Res Con (psi)	Oil/Brine Lab Conditions (psi)	Oil/Brine Reservoir Conditions (psi)	Height Above Free Water Oil-Water (feet)	Height Above Free Water Gas-Water (feet)
18.5	0.3	6.0	0.0	0.0	11.5	3.63	2.52	2.12	1.31	11.9	7.41
21.6	0.3	6.3	0.0	0.0	9.82	4.24	2.94	2.47	1.53	13.9	8.65
25.3	0.3	6.6	0.0	0.0	8.38	4.96	3.44	2.90	1.80	16.4	10.1
30.0	0.3	6.8	0.0	0.0	7.07	5.88	4.08	3.43	2.12	19.3	12.0
37.6	0.8	7.6	0.8	0.8	5.64	7.37	5.12	4.30	2.66	24.2	15.1
47.5	1.1	8.7	1.2	2.0	4.46	9.31	6.47	5.44	3.37	30.6	19.0
58.4	2.0	10.7	2.1	4.1	3.63	11.5	7.99	6.68	4.14	37.6	23.5
69.0	2.8	13.5	3.0	7.2	3.07	13.5	9.38	7.90	4.89	44.5	27.6
81.8	3.4	17.0	3.7	10.9	2.59	16.0	11.1	9.36	5.79	52.6	32.6
93.4	3.3	20.3	3.6	14.4	2.27	18.3	12.7	10.7	6.62	60.2	37.4
111	4.9	25.1	5.2	19.7	1.91	21.8	15.1	12.7	7.86	71.5	44.4
129	4.2	29.4	4.5	24.2	1.64	25.3	17.6	14.8	9.16	83.3	51.8
154	5.0	34.4	5.4	29.6	1.38	30.2	21.0	17.6	10.9	99.1	61.8
180	3.9	38.3	4.2	33.8	1.18	35.3	24.5	20.6	12.8	116	72.1
211	3.9	42.1	4.1	37.9	1.00	41.4	28.8	24.1	14.9	135	84.7
248	3.5	45.6	3.7	41.6	0.856	48.6	33.8	28.4	17.6	160	99.4
292	3.1	48.7	3.3	45.0	0.725	57.3	39.8	33.4	20.7	188	117
342	2.9	51.6	3.1	48.0	0.619	67.1	46.6	39.1	24.2	220	137
402	2.5	54.1	2.7	50.7	0.527	78.8	54.7	46.0	28.5	259	161
473	2.3	56.4	2.5	53.2	0.448	92.7	64.4	54.1	33.5	305	189
556	2.2	58.6	2.3	55.6	0.382	109	75.7	63.6	39.4	358	223
650	2.1	60.7	2.2	57.8	0.326	127	88.2	74.4	46.1	419	259
758	2.0	62.7	2.1	59.9	0.280	149	103	86.7	53.7	488	303
889	2.0	64.7	2.1	62.1	0.239	174	121	102	63.1	574	356
1050	2.0	66.7	2.1	64.2	0.202	206	143	120	74.3	675	421
1228	1.9	68.5	2.0	66.2	0.173	241	167	141	87.3	794	491
1439	1.9	70.4	2.0	68.2	0.147	282	196	165	102	927	576
1687	1.9	72.3	2.0	70.2	0.126	331	230	193	119	1082	676
1973	1.8	74.1	1.9	72.2	0.107	387	269	226	140	1273	791

Pressure (psia)	Raw Data Intrusion (percent)	Raw Data Saturation (percent)	Conformance Corrected Intrusion (percent)	Conformance Corrected Saturation (percent)	Pore Diameter (μm)	Equivalent Air/Brine Lab (psi)	Injection Pressures Air/Brine Res Con (psi)	Oil/Brine Lab Conditions (psi)	Oil/Brine Reservoir Conditions (psi)	Height Above Free Water Oil-Water (feet)	Height Above Free Water Gas-Water (feet)
2331	1.9	76.0	2.1	74.3	0.0910	457	317	267	165	1500	932
2710	1.8	77.8	1.9	76.2	0.0782	531	369	310	192	1745	1085
3221	2.1	79.9	2.2	78.4	0.0658	632	439	369	228	2073	1291
3832	2.1	82.0	2.3	80.7	0.0553	751	522	439	272	2473	1535
4419	1.8	83.8	1.9	82.6	0.0480	866	601	506	313	2845	1768
5086	2.6	86.4	2.8	85.4	0.0417	997	692	582	360	3273	2035
5982	2.0	88.4	2.1	87.5	0.0354	1173	815	685	424	3855	2397
7011	1.9	90.2	2.0	89.5	0.0302	1375	955	802	496	4509	2809
7876	1.3	91.5	1.4	90.9	0.0269	1544	1072	901	558	5073	3153
8909	1.3	92.8	1.4	92.3	0.0238	1747	1213	1020	631	5736	3568
10453	1.5	94.3	1.7	93.9	0.0203	2050	1424	1196	740	6727	4188
12283	1.4	95.7	1.5	95.4	0.0173	2408	1672	1406	870	7909	4918
14331	1.1	96.9	1.2	96.6	0.0148	2810	1951	1640	1015	9227	5738
16380	0.8	97.7	0.9	97.5	0.0129	3212	2231	1875	1161	10555	6562
18481	0.7	98.4	0.7	98.2	0.0115	3624	2517	2115	1309	11900	7403
20481	0.4	98.8	0.4	98.7	0.0104	4016	2789	2344	1451	13191	8203
23148	0.5	99.2	0.5	99.2	0.0092	4539	3152	2649	1640	14909	9271
25065	0.3	99.5	0.3	99.4	0.0085	4915	3413	2868	1775	16136	10038
27137	0.2	99.7	0.2	99.6	0.0078	5321	3695	3106	1923	17482	10868
29378	0.1	99.8	0.1	99.8	0.0072	5760	4000	3362	2081	18918	11765
31803	0.1	99.9	0.1	99.9	0.0067	6236	4331	3640	2253	20482	12738
34424	0.1	100.0	0.1	100.0	0.0062	6750	4688	3940	2439	22173	13788
37192	0.0	100.0	0.0	100.0	0.0057	7293	5065	4256	2635	23955	14897
40344	0.0	100.0	0.0	100.0	0.0053	7911	5494	4617	2858	25982	16159
43595	0.0	100.0	0.0	100.0	0.0049	8548	5936	4989	3088	28073	17459
47294	0.0	100.0	0.0	100.0	0.0045	9273	6440	5412	3350	30455	18941
51168	0.0	100.0	0.0	100.0	0.0041	10033	6967	5856	3625	32955	20491
55386	0.0	100.0	0.0	100.0	0.0038	10860	7542	6338	3924	35673	22182
59881	0.0	100.0	0.0	100.0	0.0035	11741	8153	6853	4242	38564	23979

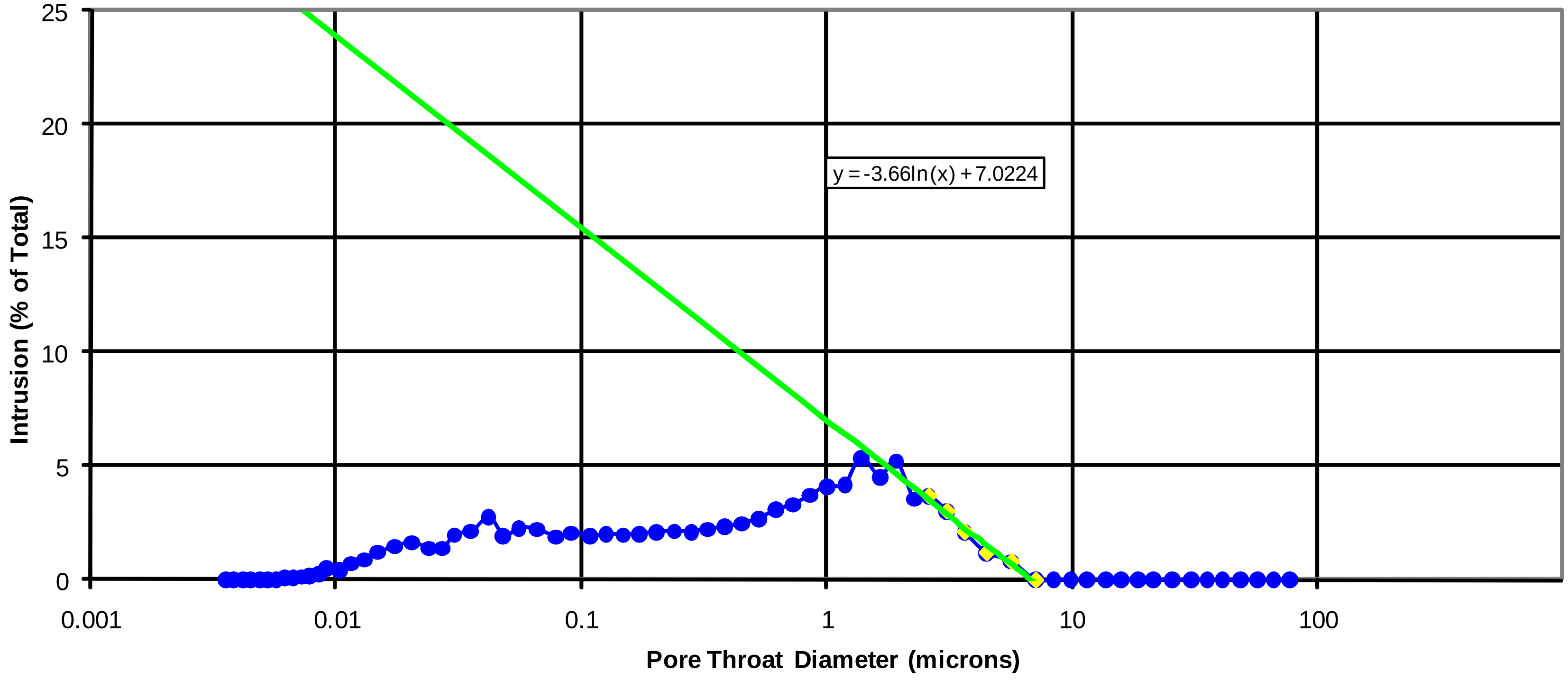
CAPILLARY PRESSURE

Client	ESSO Australia Pty Ltd		
Well	Snapper-A21a		
Test Method	Air/Mercury Capillary Pressure Drainage		
Sample	72A	**Ambient Permeability**	1.41 milliDarcy's
Depth	2948.77	**Ambient Porosity**	5.1 percent



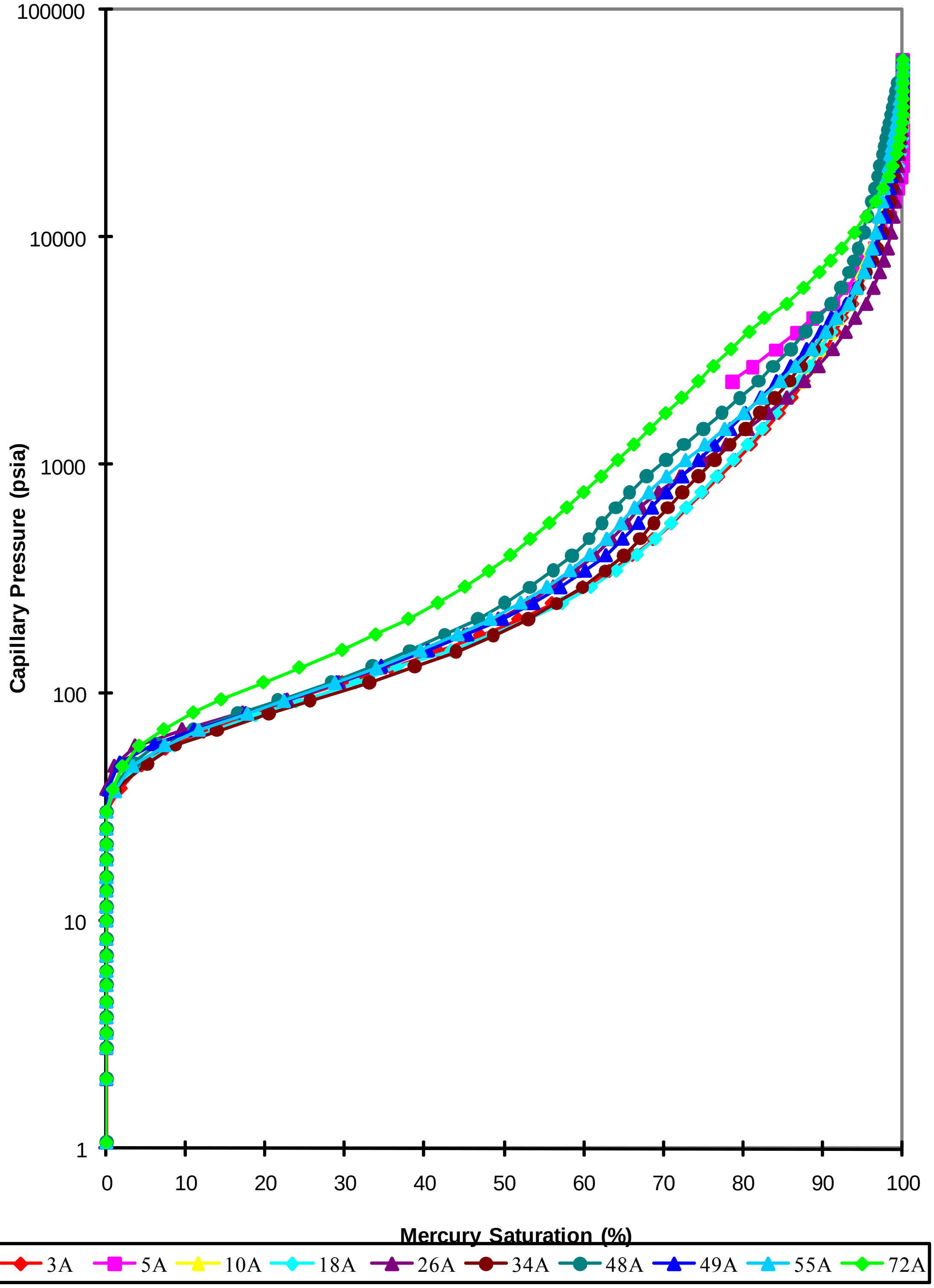
PORE SIZE DISTRIBUTION

Client	ESSO Australia Pty Ltd		
Well	Snapper-A21a		
Test Method	Air/Mercury Capillary Pressure Drainage		
Sample	72A	**Ambient Permeability**	1.41 milliDarcy's
Depth	2948.77	**Ambient Porosity**	5.1 percent



COMPOSITE CAPILLARY PRESSURE

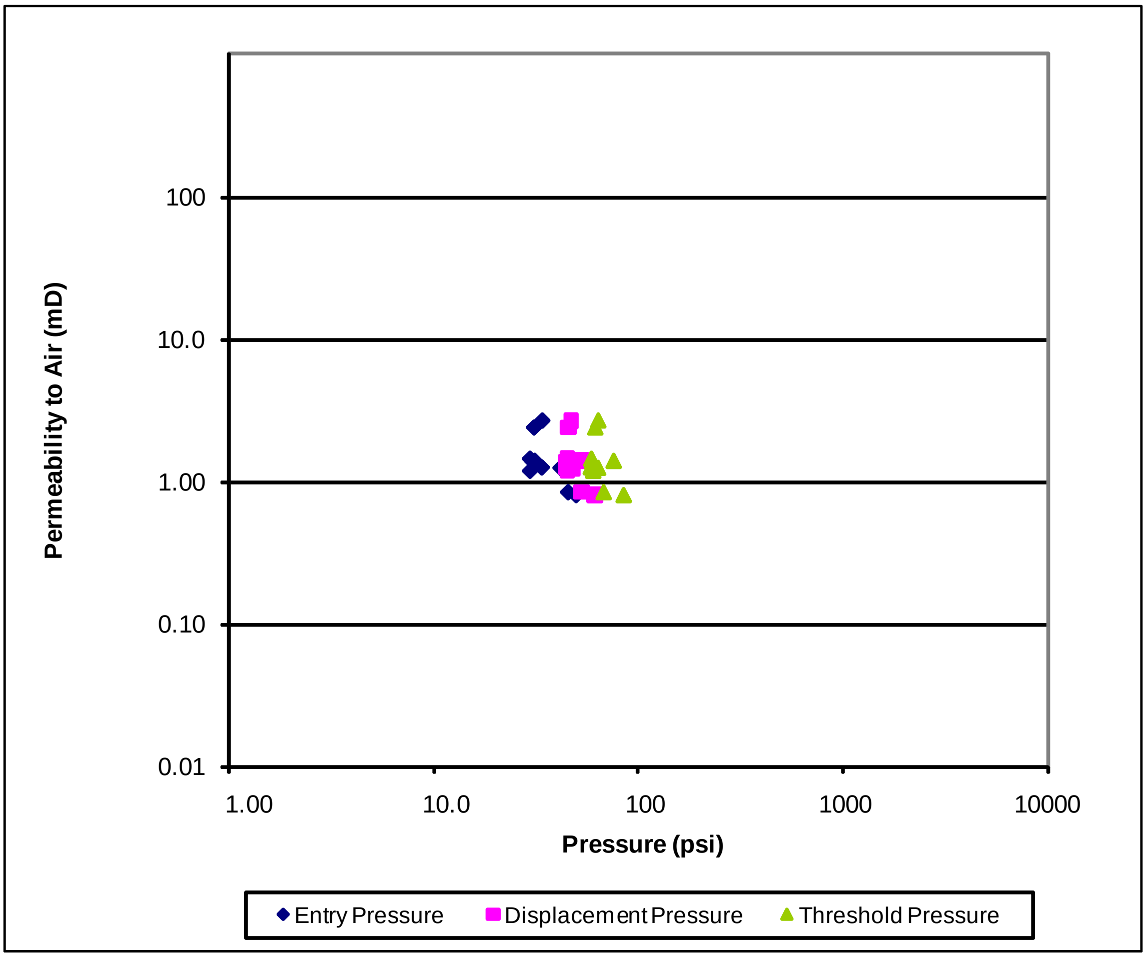
Client	ESSO Australia Pty Ltd
Well	Snapper-A21a
Test Method	Air/Mercury Capillary Pressure Drainage



SUMMARY

Client : ESSO Australia Pty Ltd
Well : Snapper-A21a

Sample Number	Depth (metres)	Porosity (percent)	Permeability to Air (mD)	Pore Radius (µm)	Air-Mercury Entry Pressure (psi)	Air-Mercury Displacement Pressure (psi)	Air-Mercury Threshold Pressure (psi)
3A	2931.65	6.4	1.20	3.55	30.0	45.2	61.0
5A	2932.05	5.1	0.81	2.12	50.2	62.1	85.6
10A	2933.31	6.5	1.46	3.55	30.0	45.3	59.8
18A	2935.30	5.9	1.40	3.46	30.8	44.6	60.2
26A	2937.26	8.7	0.85	2.32	45.9	52.9	68.5
34A	2939.27	7.9	1.27	3.11	34.2	45.0	59.4
48A	2942.78	11.8	2.71	3.09	34.4	47.4	64.5
49A	2943.05	9.5	1.26	2.52	42.2	48.4	64.4
55A	2944.52	11.0	2.42	3.39	31.4	46.0	62.4
72A	2948.77	5.1	1.41	3.37	31.6	53.1	76.6



APPENDIX I

FLUID PROPERTIES

FLUID PROPERTIES

Synthetic Formation Brine (composition as supplied)

Cations	mg/L	Anions	mg/L
Sodium	9600	Chloride	17000
Calcium	1400	Hydrogen Carbonate	439
Magnesium	200	Sulphate	30
Potassium	500	Carbonate	0

Density = 1.01 g/cm^3 @ 25°C
Resistivity = 0.210 ohm.m @ 25°C

Multi Salinity Brines

70,000 ppm NaCl equivalent
Resistivity = 0.098 ohm.m @ 25°C

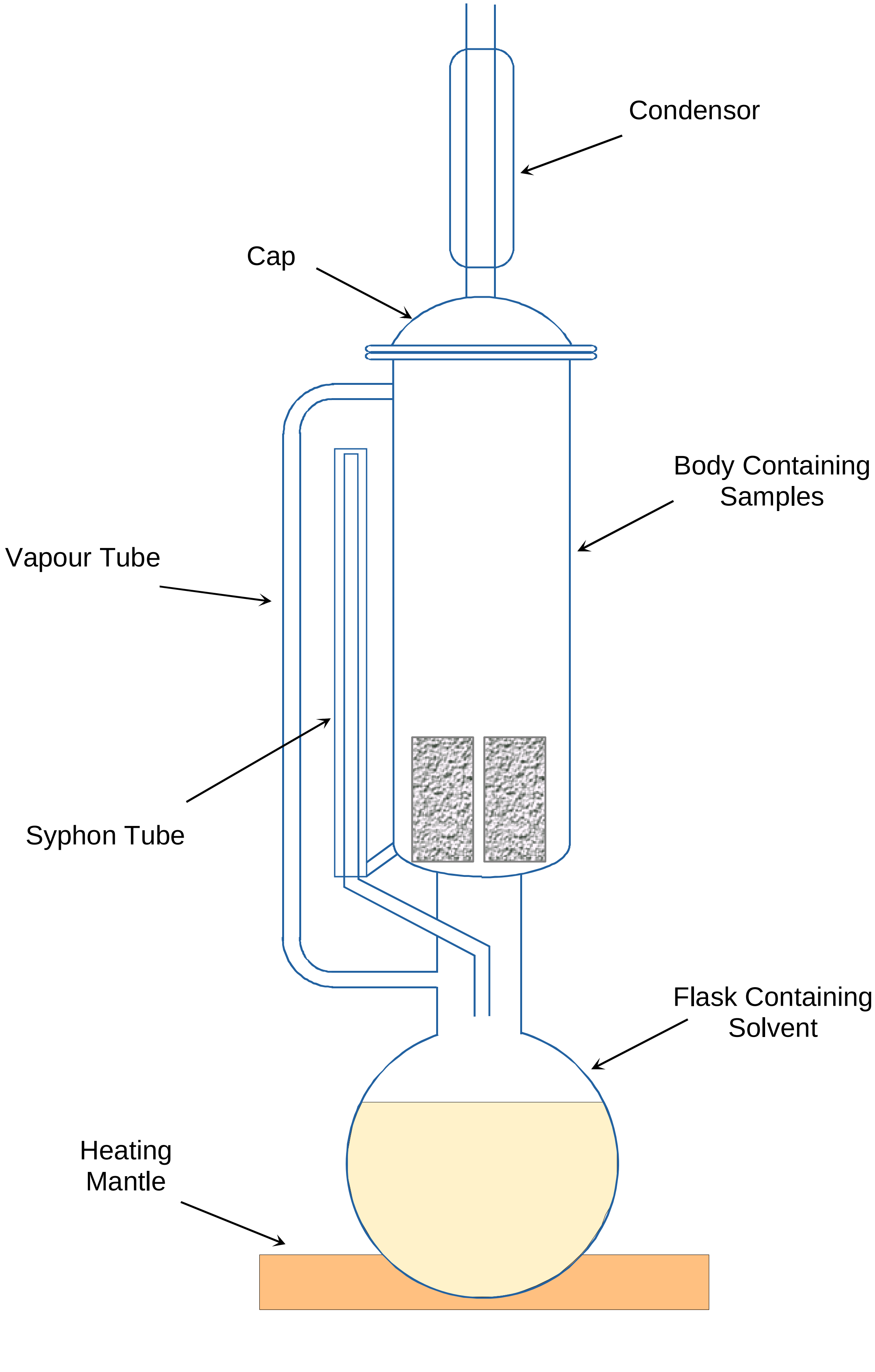
130,000 ppm NaCl equivalent
Resistivity = 0.058 ohm.m @ 25°C

200,000 ppm NaCl equivalent
Resistivity = 0.043 ohm.m @ 25°C

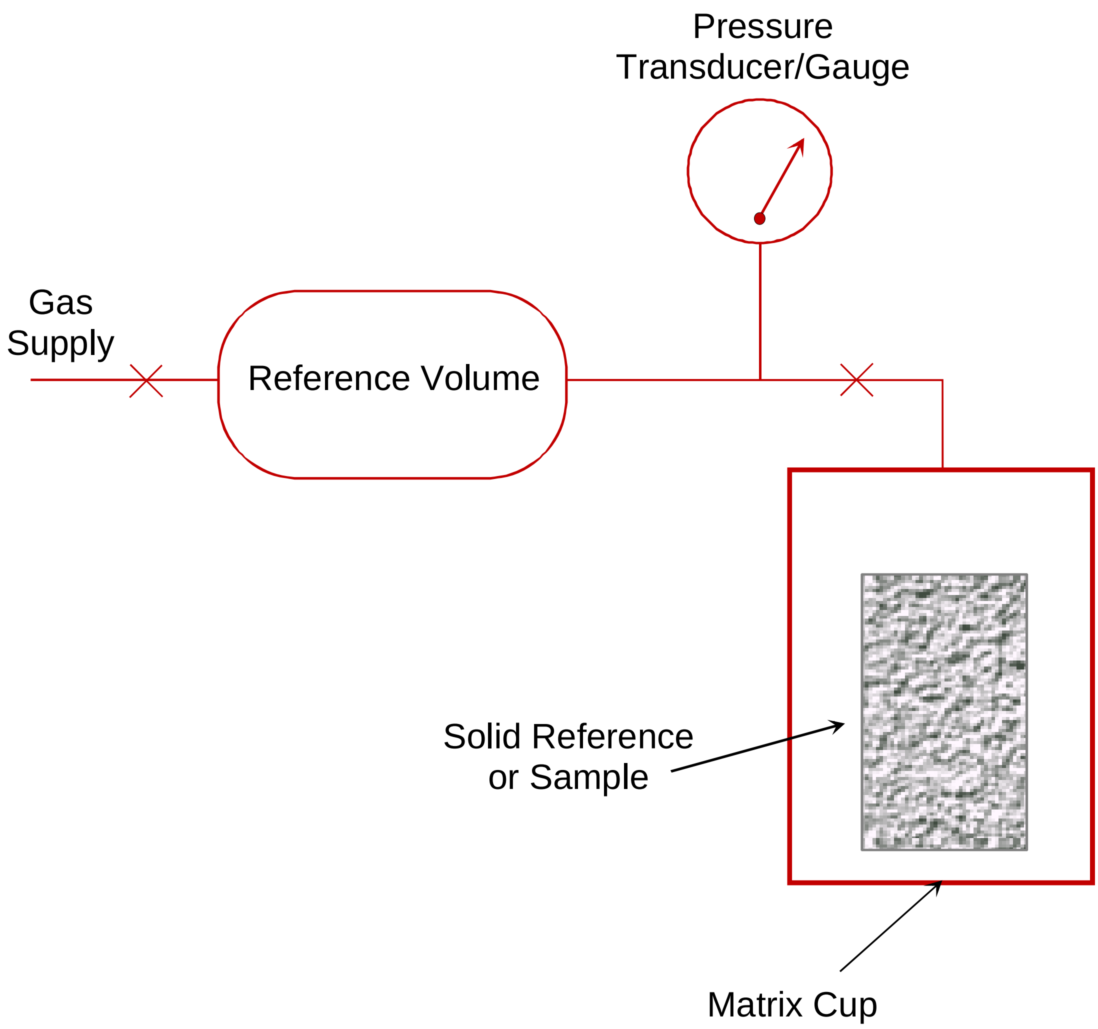
APPENDIX II

EQUIPMENT SCHEMATICS

SOXHLET CLEANING APPARATUS

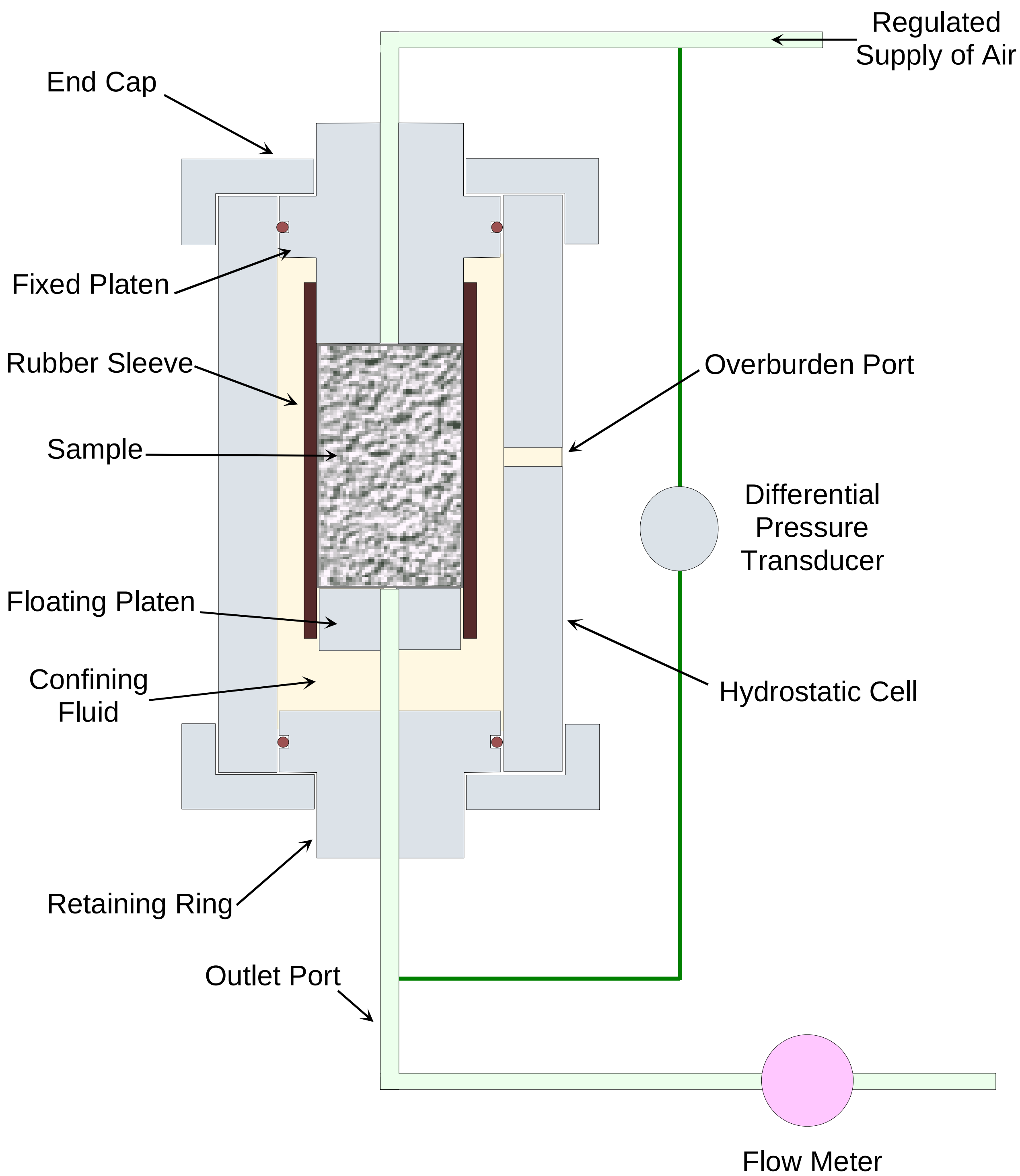


POROSIMETER SCHEMATIC



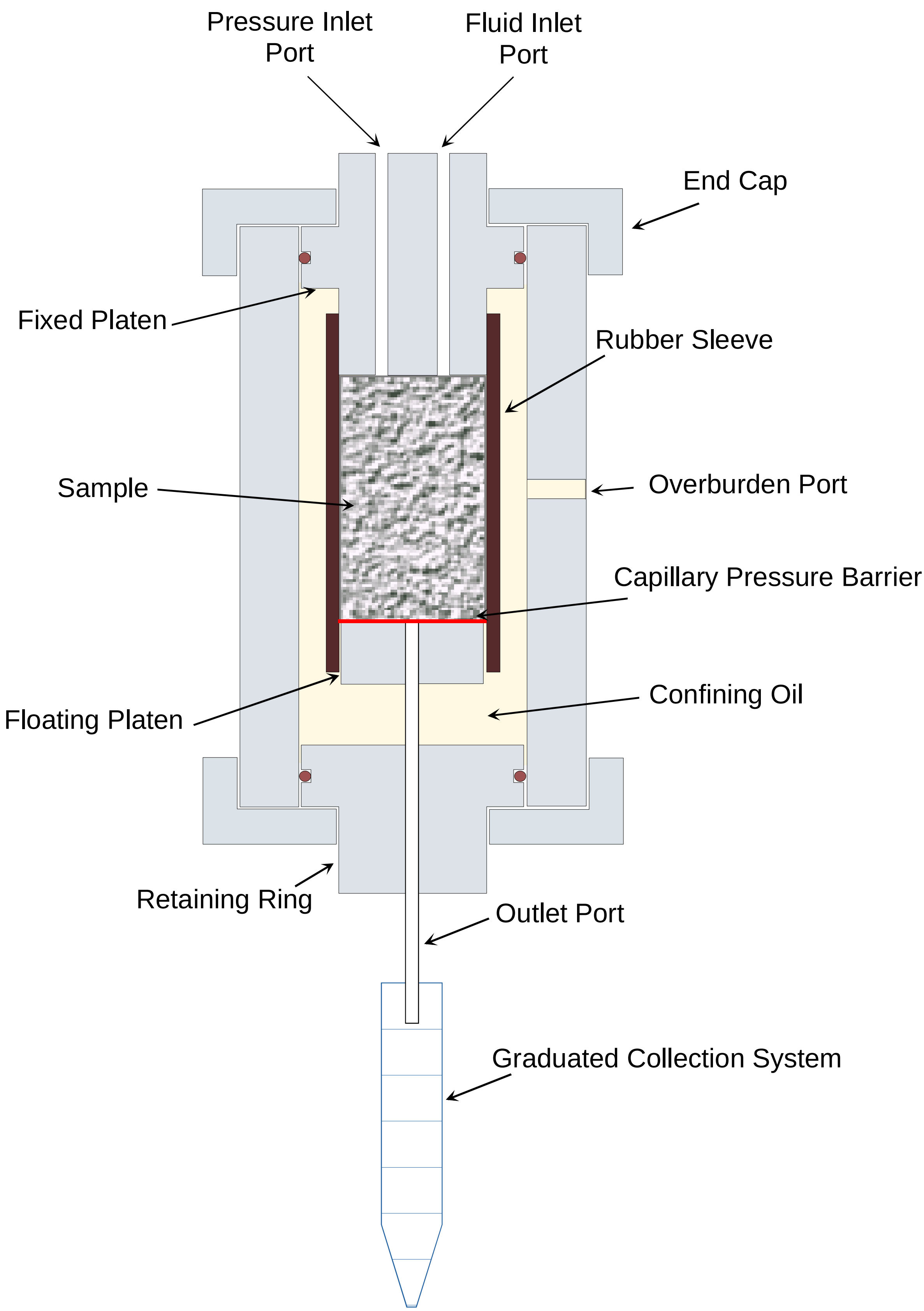
P1.V1 (reference) = P2.V2 (sample)

GAS PERMEAMETER SCHEMATIC (Hydrostatic)

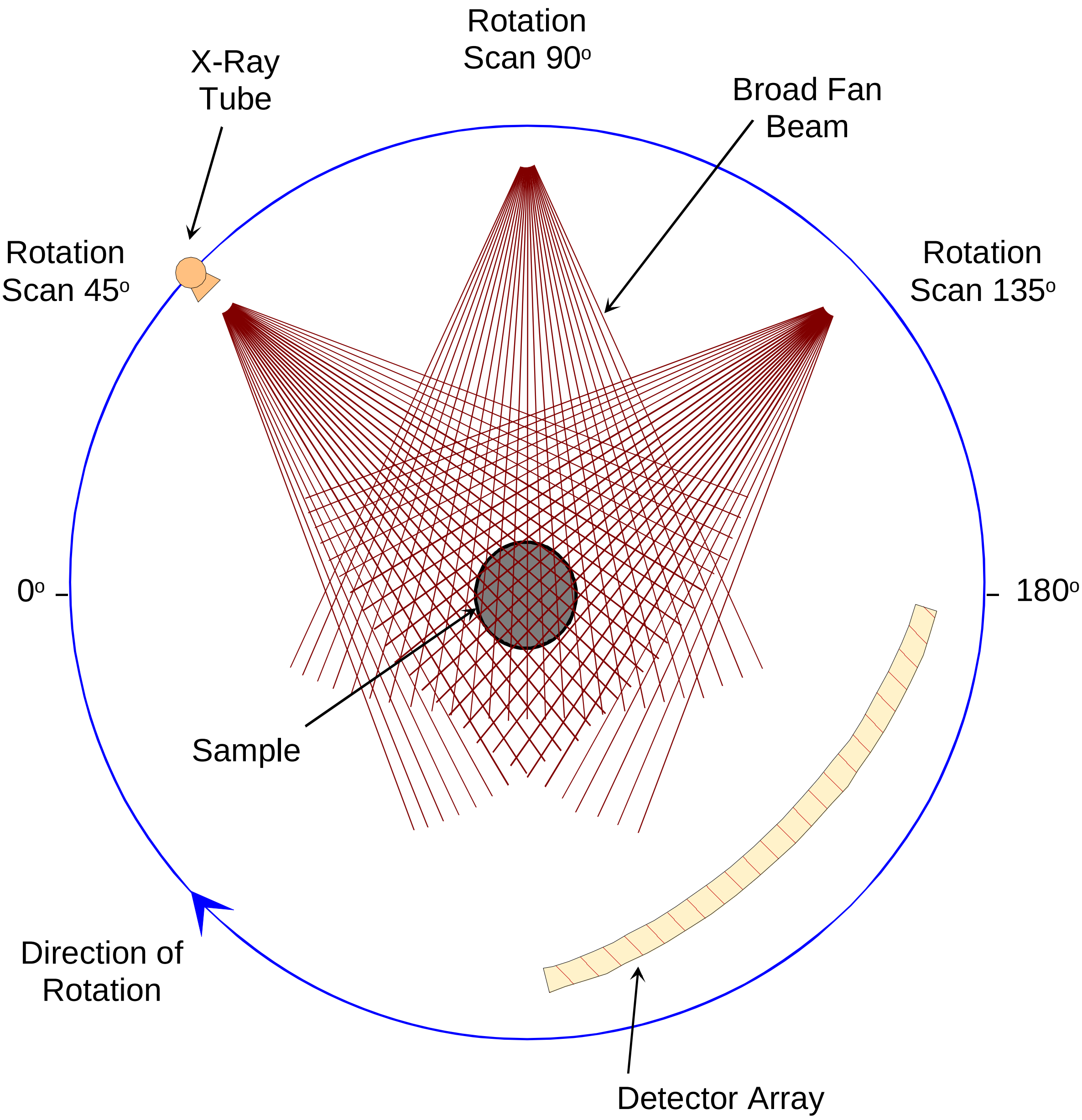


HYDROSTATIC CAPILLARY PRESSURE CELL

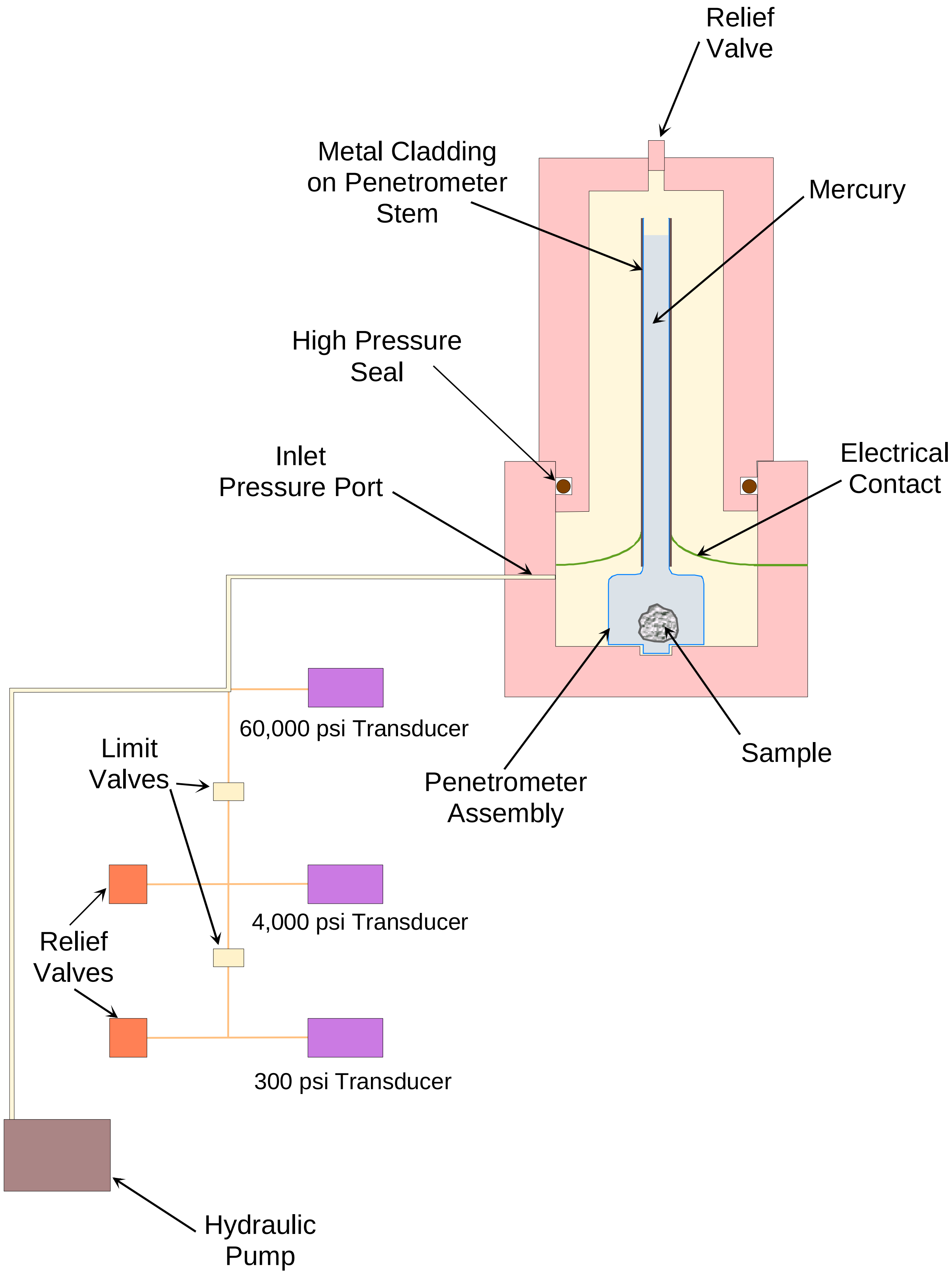
Weatherford LABORATORIES



CT SCANNER SCHEMATIC



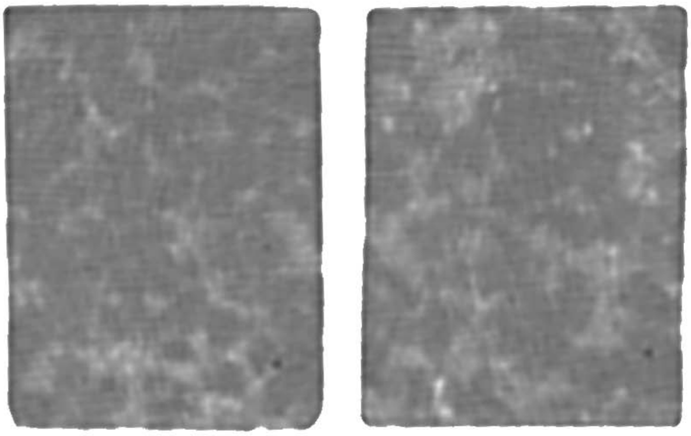
MERCURY INJECTION SCHEMATIC

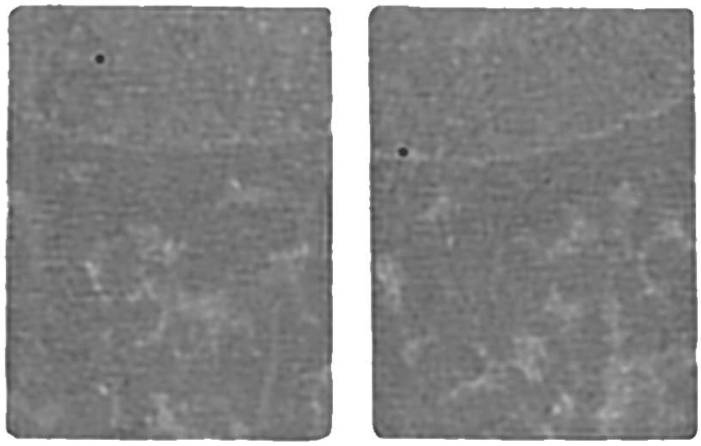


APPENDIX III

CT SCANNING IMAGES

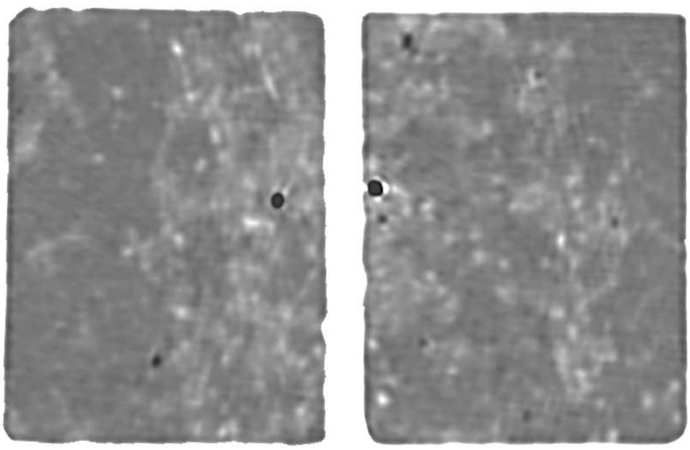
Snapper A21a
C.T. Scans

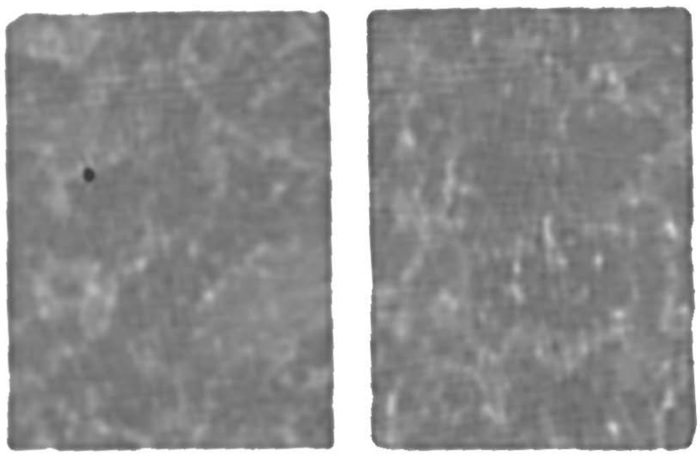




Sample No.:	3A
Depth:	2931.65 m
Permeability:	1.75 mD
Porosity:	6.3 %

Sample No:	5A
Depth:	2932.05 m
Permeability:	1.40 mD
Porosity:	5.3 %

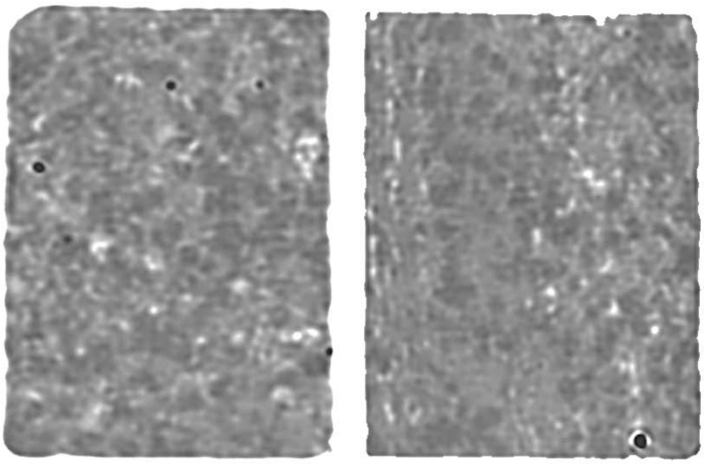




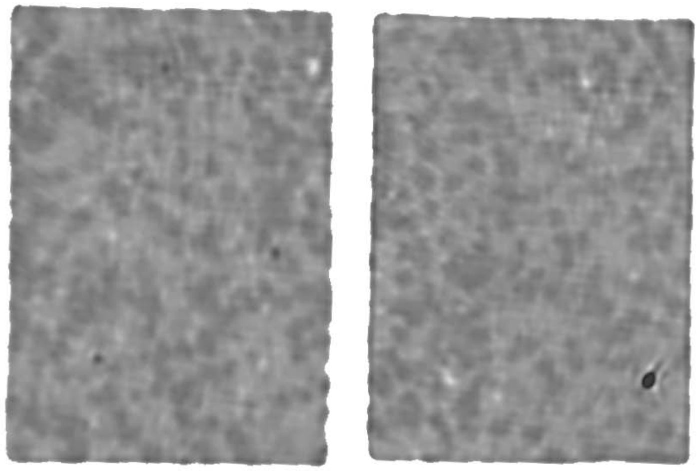
Sample No.:	10A
Depth:	2933.31 m
Permeability:	2.32 mD
Porosity:	6.6 %

Sample No.:	18A
Depth:	2935.30 m
Permeability:	1.98 mD
Porosity:	6.1 %

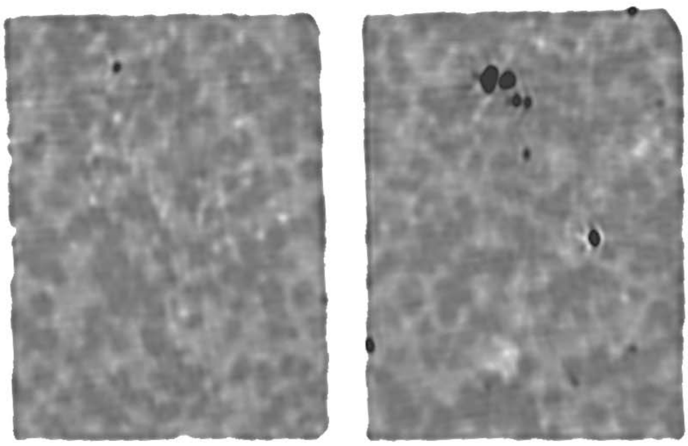
Snapper A21a
C.T. Scans



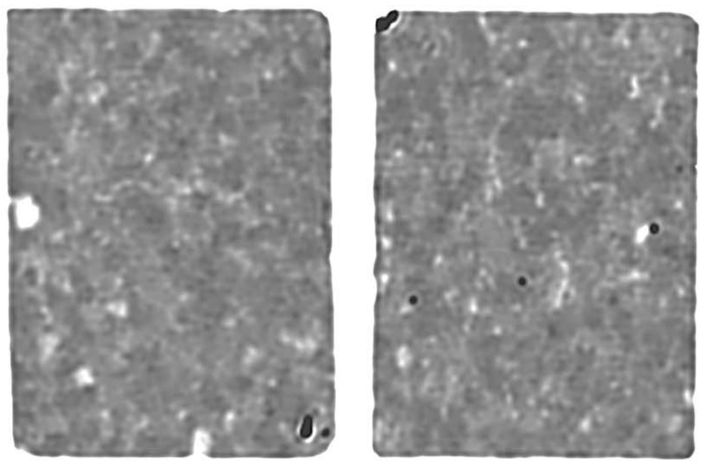
Sample No.:	24A
Depth:	2936.77 m
Permeability:	0.71 mD
Porosity:	9.1 %



Sample No:	25A
Depth:	2937.05 m
Permeability:	0.58 mD
Porosity:	9.1 %

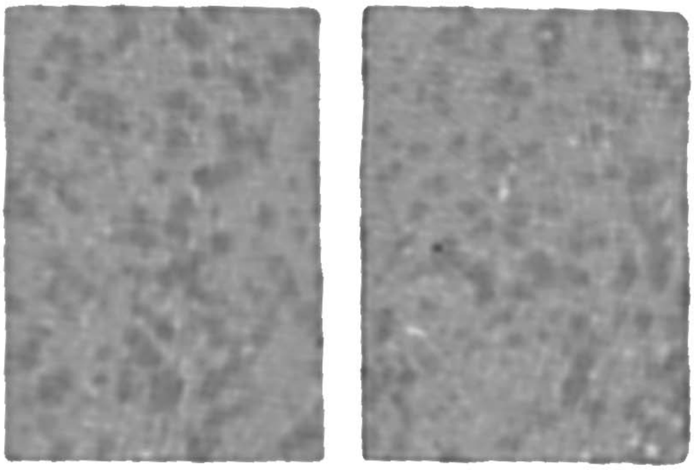


Sample No.:	26A
Depth:	2937.26 m
Permeability:	0.99 mD
Porosity:	8.7 %

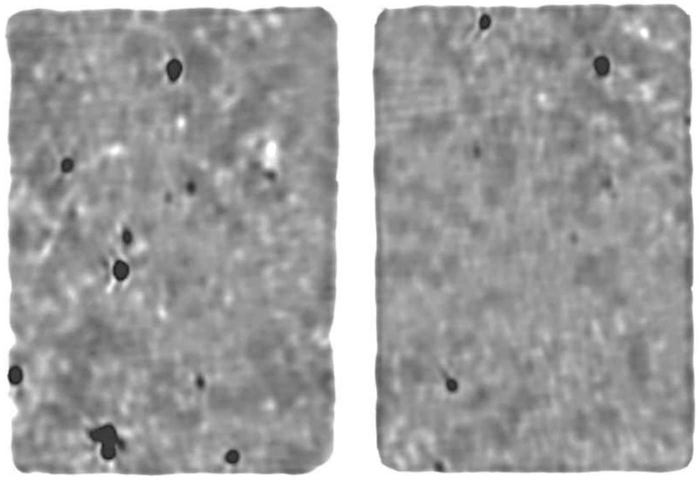


Sample No.:	34A
Depth:	2939.27 m
Permeability:	1.46 mD
Porosity:	7.9 %

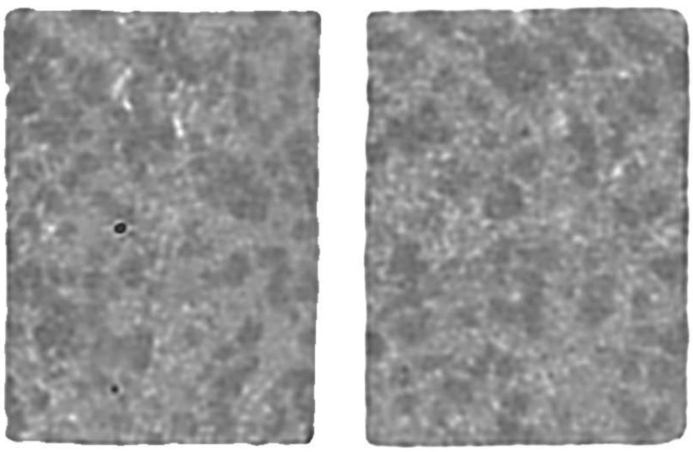
Snapper A21a
C.T. Scans



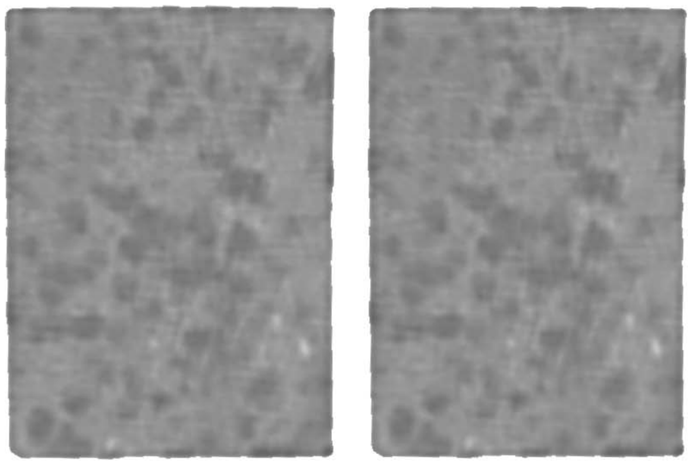
Sample No.:	47A
Depth:	2942.56 m
Permeability:	0.79 mD
Porosity:	10.5 %



Sample No:	48A
Depth:	2942.78 m
Permeability:	3.29 mD
Porosity:	11.7 %

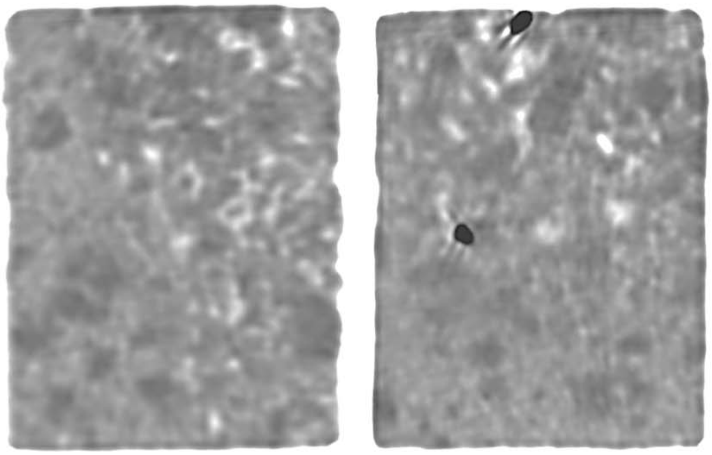


Sample No.:	49A
Depth:	2943.05 m
Permeability:	1.47 mD
Porosity:	9.6 %

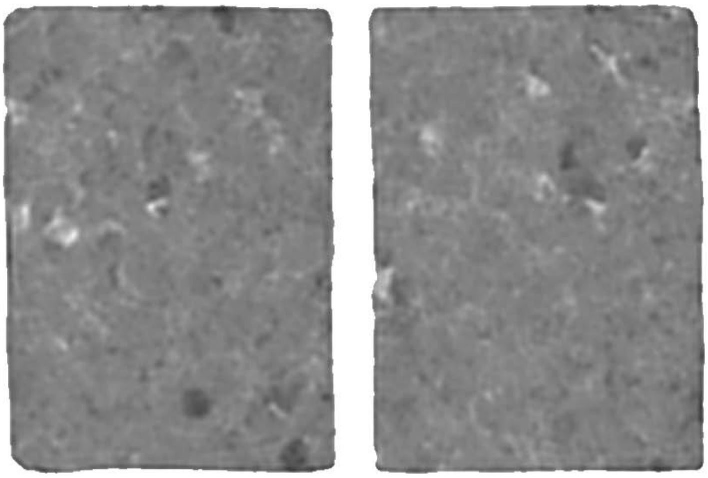


Sample No.:	51A
Depth:	2943.53 m
Permeability:	0.41 mD
Porosity:	8.6 %

Snapper A21a
C.T. Scans



Sample No.:	55A
Depth:	2944.52 m
Permeability:	2.89 mD
Porosity:	11.2 %



Sample No:	72A
Depth:	2948.77 m
Permeability:	1.79 mD
Porosity:	5.4 %

APPENDIX IV

PETROLOGY REPORT

PETROLOGY

of

SNAPPER-A21a CORE SAMPLES

by

WEATHERFORD LABORATORIES (AUSTRALIA) PTY LTD

24th August, 2009

Esso Australia Pty Ltd
12 Riverside Quay
SOUTHBANK VIC 3006

Attention: Julien Celerier
Andrew A Mills

REPORT: 0537-08 – Snapper-A21a

CLIENT REFERENCE:	PO Number 4500464621 / 29 Feb 2008
MATERIAL:	Ten core plug samples
LOCALITY:	Snapper-A21a
WORK REQUIRED:	Petrology

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

KEVIN H. FLYNN
General Manager
SCAL Technical Director

Head Office: 8 Cox Road, Windsor Qld 4030, Australia
☎: 61 7 3357 1133 Facsimile: 61 7 3357 1100
E-mail: info@weatherfordlabs.com
Weatherford Laboratories (Australia) Pty Ltd
ABN: 81 008 273 005

CONTENTS

CONTENTS (cont.)

EXECUTIVE SUMMARY

A petrological study was carried out on ten core plug samples from 2931.65-2948.77m in Snapper-A21a. Analytical techniques used were thin-section analysis and quantitative bulk-rock/fine-fraction X-ray diffraction analysis.

Samples are variably sorted, coarse to very coarse grained subarkoses and a sublitharenite in which framework grains are mainly quartz, K-feldspar, sedimentary rock fragments and metasedimentary rock fragments.

Clay is almost entirely authigenic kaolin and subordinate illite that result from labile grain alteration.

Sandstones have been severely affected by diagenesis, with the main diagenetic processes being dolomite cementation, authigenic clay formation, grain contact dissolution and physical compaction.

Visible macroporosity is consistently very low due to the deleterious effects of advanced diagenesis and is all secondary K-feldspar dissolution porosity.

Sandstones have poor reservoir quality, with all intergranular spaces being filled with dolomite cement, authigenic clay, compacted ductile grains and localised quartz overgrowth cement.

1. INTRODUCTION

A petrological study was carried out on ten core plug samples from 2931.65-2948.77m in Snapper-A21a in order to determine texture, mineralogy, diagenetic effects, and controls on reservoir quality. Sample depths are listed in Table 1. The study complements an earlier petrological study of the section at Snapper-A21a (2875.0-3316.5m) by ACS Laboratories Pty Ltd (2008).

2. ANALYTICAL PROGRAM

2.1 Thin-Section Analysis

Thin-sections were cut in kerosene, impregnated with blue-dyed epoxy resin to aid porosity recognition, and stained with sodium cobaltinitrite to aid feldspar identification. In each thin-section, mineral composition and visible porosity were determined by a count of 400 points, and mean grain size and sorting were estimated with the aid of an eyepiece graticule. Photomicrographs were taken of each thin-section to illustrate texture, composition, diagenetic effects and porosity.

2.2 X-Ray Diffraction Analysis

Bulk-rock X-ray diffraction (XRD) analysis was carried out on all samples in order to quantify mineral abundance. The XRD analysis used a finely ground whole rock powder sample and the SIROQUANT processing technique was used to calculate mineral abundance.

XRD analysis was carried out on the fine fraction of all samples in order to precisely determine clay mineralogy. Fine fractions were separated by disaggregation and settling in distilled water and were air dried on glass discs to produce oriented specimens for XRD analysis. Samples were analysed in air dried condition and also following treatment with ethylene glycol.

3. TEXTURE

Thin-section texture is given in Table 2, and annotated micrographs are presented in Appendix 3. Samples are clean, grain/cement-supported, very poorly to moderately-well sorted, coarse to very coarse grained sandstones with a mean quartz grain size of 0.58-1.68mm.

Samples #18A (2935.30m), #48A (2942.78m) and #49A (2943.05m) have bedding and, in the case of #18A, thin laminae that are defined by grain size variation, whereas the other seven sandstones are massive.

Sandstones are variably cemented by widespread/patchy, coarsely-crystalline/poikilotopic carbonate. Where carbonate cement is absent, framework grain packing density has been significantly increased by ductile grain compactional

TABLE 1. ANALYSES PERFORMED

Sample #	Depth (m)	PETROLOGICAL ANALYSES		
		MA	XRD	PM
3A	2931.65	X	X	X
5A	2932.05	X	X	X
10A	2933.31	X	X	X
18A	2935.30	X	X	X
26A	2937.26	X	X	X
34A	2939.27	X	X	X
48A	2942.78	X	X	X
49A	2943.05	X	X	X
55A	2944.52	X	X	X
72A	2948.77	X	X	X

MA = modal analysis; XRD = quantitative bulk-rock & fine-fraction X-ray diffraction analysis; PM = photomicroscopy

TABLE 2. THIN-SECTION ANALYSES

Sample # **Depth (m)**	3A 2931.65	5A 2932.05	10A 2933.31	18A 2935.30	26A 2937.26	34A 2939.27	48A 2942.78
Quartz (monocrystalline)	54.1	54.5	53.9	53.6	55.9	60.4	52.3
Quartz (polycrystalline)	2.9	2.2	3.4	3.6	2.4	4.3	5.5
Quartz overgrowths	-	-	-	-	0.7	1.1	0.7
Chert	-	0.3	0.3	0.3	0.3	0.7	0.3
K-feldspar	6.7	8.4	8.8	9.8	5.3	5.1	10.3
Plagioclase	-	-	-	-	-	-	-
Granitic rock fragments	-	-	-	-	-	0.3	0.3
Volcanic rock fragments	-	-	-	0.3	0.3	-	0.3
Metamorphic rock fragments	0.7	0.7	1.4	0.7	1.1	1.4	3.3
Sedimentary rock fragments	1.4	1.7	1.1	2.5	1.7	3.3	5.4
Mica	0.3	-	-	-	0.3	0.3	0.3
Heavy minerals	-	-	-	-	-	-	-
Dolomite (pore fill)	26.9	26.2	26.0	21.3	24.8	14.1	7.8
Dolomite (replacement)	4.2	2.6	2.8	4.0	1.6	2.8	3.1
FeS_2 (pore fill)	1.1	1.1	-	0.3	-	-	-
FeS_2 (replacement)	-	-	-	-	-	-	0.7
Authigenic kaolin (pore fill)	-	-	-	-	0.7	1.4	2.1
Authigenic kaolin (replacement)	1.7	2.0	1.7	3.3	3.2	4.2	6.2
Authigenic illite (replacement)	-	-	-	-	0.3	-	0.7
Primary porosity	-	-	-	-	-	-	-
Secondary porosity (intergran.)	-	-	-	-	-	-	-
Secondary porosity (mouldic)	-	-	0.3	-	0.3	0.3	-
Secondary porosity (intragran.)	-	0.3	0.3	0.3	1.1	0.3	0.7
Q (quartz + chert)	86.6	84.1	83.6	81.3	87.6	86.8	75.0
F (feldspar)	10.2	12.4	12.8	13.8	7.8	6.7	13.1
R (rock fragments)	3.2	3.5	3.6	4.9	4.6	6.5	11.9
Mean grain size (mm)	0.70	0.58	0.82	0.77	0.67	1.07	0.95
Mean grain size (class)	coarse	coarse	coarse	coarse	coarse	v. coarse	coarse
Sorting (class)	mod	md-well	poor	poor	mod	poor	poor

TABLE 2. THIN-SECTION ANALYSES (cont.)

Sample #	49A	55A	72A
Depth (m)	2943.05	2944.52	2948.77
Quartz (monocrystalline)	57.6	62.6	58.7
Quartz (polycrystalline)	2.4	2.1	4.8
Quartz overgrowths	0.7	2.1	0.3
Chert	-	-	0.3
K-feldspar	11.6	8.7	4.8
Plagioclase	-	-	-
Granitic rock fragments	-	-	-
Volcanic rock fragments	-	0.3	-
Metamorphic rock fragments	1.1	0.3	8.0
Sedimentary rock fragments	2.7	2.4	2.0
Mica	0.3	0.3	0.7
Heavy minerals	-	0.3	-
Dolomite (pore fill)	10.1	10.2	11.3
Dolomite (replacement)	3.8	2.8	4.3
FeS_2 (pore fill)	-	-	-
FeS_2 (replacement)	-	-	-
Authigenic kaolin (pore fill)	1.7	1.1	0.7
Authigenic kaolin (replacement)	5.9	5.5	3.4
Authigenic illite (replacement)	0.7	0.3	0.7
Primary porosity	-	-	-
Secondary porosity (intergran.)	-	-	-
Secondary porosity (mouldic)	0.7	0.3	-
Secondary porosity (intragran.)	0.7	0.7	-
Q (quartz + chert)	79.8	85.1	81.2
F (feldspar)	15.2	11.1	6.1
R (rock fragments)	5.0	3.8	12.7
Mean grain size (mm)	0.70	0.60	1.68
Mean grain size (class)	coarse	coarse	v. coarse
Sorting (class)	mod	md-well	v. poor

deformation and by grain contact dissolution (pressure solution) to form long, embayed and rare sutured grain contacts. Patchy/dispersed authigenic clay pseudomatrix results from the alteration of K-feldspar and micaceous/argillaceous rock fragments. K-feldspar grains are locally compactionally fractured and crushed, and there are common quartz grains in which microfractures are healed by dolomite cement. Artificial microfractures are common. Quartz grains are angular to subrounded (mainly subangular) and have low to moderate sphericity.

4. THIN-SECTION COMPOSITION

4.1 Framework Grains

Thin-section composition is given in Table 2, and sandstone QFR composition is plotted in Figure 1. Raw point count data are given in Appendix 1.

Sandstones are subarkoses and a sublitharenite with a mean QFR ratio of 83:11:6 and in which framework grains are mainly quartz, K-feldspar, sedimentary rock fragments and metasedimentary rock fragments.

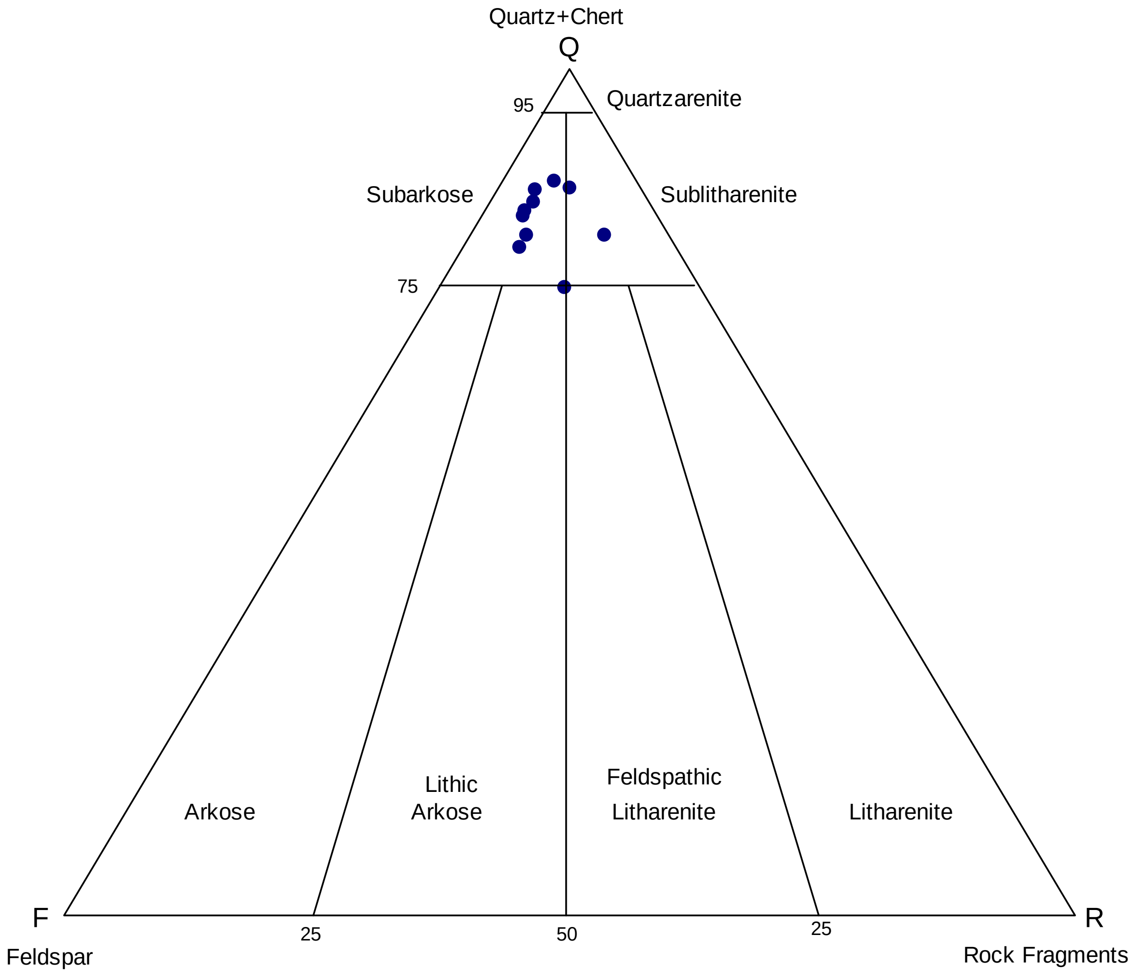
Detrital quartz content is 56.7-64.7% and averages 59.7%. Most quartz is monocrystalline. Polycrystalline quartz includes recrystallised metamorphic quartz, schistose metamorphic quartz, quartzite, metaquartzite and granitic quartz. Quartz grains are thinly enveloped by authigenic quartz overgrowths where interstitial areas are not filled with clay, compacted ductile grains and carbonate cement.

Feldspar content is 4.8-11.6% and averages 8.0%. Feldspar is entirely granitic K-feldspar (orthoclase, microcline) that is fresh to moderately altered (turbid) and commonly etched, partly dissolved and compactionally fractured and crushed. Remnant precursor K-feldspar is commonly included within authigenic kaolin.

Rock fragment content is 2.1-10.0% and averages 4.5%. Lithic grains are mainly strongly indurated siliciclastic sedimentary rock fragments (shale, illitic siltstone, illitic/micaceous sandstone, quartzose sandstone) (1.1-5.4%) and low-grade metasedimentary rock fragments (illitic meta-argillite, meta-sandstone, phyllite, quartz-muscovite/illite schist, micaceous/illitic quartzite) (0.3-8.0%) and also include silicified felsic and vitric volcanic rock fragments (tuffs and lavas) (<0.4%) and granitic rock fragments (micrographically and coarsely intergrown quartz and K-feldspar) (<0.4%). There is complete gradation between sedimentary and metasedimentary rock fragments. Micaceous/argillaceous rock fragments are commonly compactionally deformed around adjacent rigid grains, and many labile rock fragments have partly altered to kaolin and illite.

Other framework grains include chert, mica (variably altered biotite, muscovite) and accessory heavy minerals (tourmaline, zircon, monazite, garnet, anatase, leucoxene).

FIGURE 1. QFR COMPOSITION



Provenance: Detrital grain assemblages indicate a nearby polymictic provenance dominated by granitic rocks, siliciclastic sedimentary rocks and low-grade metasedimentary rocks and which also included felsic and vitric volcanic rocks.

4.2 Clays

Clay ranges up to 9.0% and is mainly authigenic kaolin that forms scattered patches, patchy/dispersed pseudomatrix and deformed, mica-like grains where K-feldspar, mica and micaceous/argillaceous rock fragments have altered. Micaceous/illitic grains and feldspar are commonly partly altered to kaolin, and illitic remnants of micaceous/illitic precursor grains are commonly associated with kaolin.

The other authigenic clay is illite, which occurs mainly as an intermediate decomposition product of micaceous/argillaceous grains and forms patchy and thinly dispersed pseudomatrix that is commonly intimately associated with authigenic kaolin. There is complete gradation between slightly compacted and illitised metasedimentary/sedimentary rock fragments, illitic clay pseudomatrix and, the final decomposition product, kaolin.

4.3 Cements

Sandstones are cemented by 10.9-31.1%, patchy/widespread, coarsely-crystalline/poikilotopic dolomite that tightly fills intergranular pores, replaces labile grains and authigenic clay, and fills intragranular fractures. Dolomite content exceeds 25% at 2931.65- 2937.26m and is below 17% at 2939.27- 2948.77m.

Quartz overgrowth content does not exceed 2.1%. Between most quartz grains, quartz overgrowth cementation was prevented or inhibited by dolomite cement, authigenic clay and compacted ductile grains.

Very minor (<1.2%) iron sulphide (marcasite as shown by XRD) forms disseminated fine euhedral intergrowths and small cement patches that fill intergranular pores, replace framework grains, are associated with authigenic clays and are enclosed by later-formed dolomite cement.

4.4 Visible Porosity

Visible macroporosity does not exceed 1.4%. With intergranular porosity having been completely destroyed by the deleterious effects of advanced diagenesis, particularly dolomite cementation, authigenic clay formation, grain contact dissolution and compaction, all visible porosity is secondary mouldic and intragranular porosity that results from partial dissolution of K-feldspar grains.

5. X-RAY DIFFRACTION ANALYSES

Quantitative bulk-rock and fine-fraction XRD analyses were carried out on all samples. Quantitative XRD analyses are given in Table 3, fine-fraction clay mineralogy is given in Table 4, and annotated XRD traces are presented in Appendix 2.

Quantitative XRD analyses complement the thin-section analyses, but cannot be compared directly. This is because thin-section clay includes microporosity, and therefore thin-section clay is elevated relative to other components. In addition, dolomite commonly has a patchy distribution, hence dolomite content of XRD and thin-section splits from the same sample can differ significantly. Finally, thin-section rock fragments include quartz, K-feldspar, mica/illite and kaolin that are recorded as these phases by XRD.

Quantitative bulk-rock XRD analyses: Sandstones are composed almost entirely of quartz (57.1-70.9%), K-feldspar (4.6-10.4%), clay minerals (5.1-11.9%) and dolomite (9.3-27.7%). Clay minerals are kaolin (dickite) (3.9-8.7%) and illite/mica (1.1-3.8%). Other detected minerals are very minor (1.1%) marcasite (iron sulphide) and trace contaminant halite.

Fine-fraction XRD analyses: Clay minerals detected in the fine fraction of all samples are kaolin and subordinate illite (Table 4). Sample #26A (2937.26m) also contains trace illitic mixed-layer illite/smectite, and #26A (2937.26m) and #48A (2942.78m) also contain trace to very minor contaminant smectite.

Detected kaolin occurs mainly as a labile grain alteration product, whereas detected illite is not only a product of labile grain alteration, but also occurs as fine detrital mica and as an original constituent of micaceous/illitic metasedimentary and sedimentary rock fragments.

TABLE 3. BULK-ROCK XRD ANALYSES (weight %)

Sample #	Depth (m)	Qtz	KF	Ka	I/M	Dol	Mar	Ha
3A	2931.65	58.6	7.2	4.4	2.1	27.7	-	-
5A	2932.05	57.1	8.8	4.8	2.2	27.1	-	-
10A	2933.31	65.9	8.4	3.9	1.2	20.6	-	-
18A	2935.30	59.8	7.3	4.8	1.1	25.9	1.1	-
26A	2937.26	69.4	4.6	4.5	2.3	19.2	-	-
34A	2939.27	68.8	7.4	6.3	3.3	14.2	-	-
48A	2942.78	69.1	9.8	8.7	3.1	9.3	-	-
49A	2943.05	64.2	10.4	8.1	3.8	13.2	-	0.3
55A	2944.52	70.5	8.5	7.8	2.0	11.2	-	-
72A	2948.77	70.9	6.6	5.2	3.2	14.1	-	-

Qtz = quartz; KF = K-feldspar; Ka = kaolin (dickite); I/M = illite/mica; Dol = dolomite; Mar = marcasite; Ha = halite (contaminant)

TABLE 4. FINE-FRACTION CLAY MINERALOGY

Sample #	Depth (m)	Ka	I/M	I/S	Sm	Chl
3A	2931.65	M	m	-	-	-
5A	2932.05	M	m	-	-	-
10A	2933.31	M	m	-	-	-
18A	2935.30	M	m	-	-	-
26A	2937.26	M	m	T	vm	-
34A	2939.27	M	m	-	-	-
48A	2942.78	M	m	-	T	-
49A	2943.05	M	m	-	-	-
55A	2944.52	M	vm	-	-	-
72A	2948.77	M	m	-	-	-

Ka = kaolin; I/M = illite/mica; I/S = illitic mixed-layer illite/smectite; Sm = smectite; Chl = chlorite

A = abundant; M = major; m = minor; vm = very minor; T = trace

6. DIAGENESIS

Sandstones have been severely affected by diagenesis, with the main diagenetic processes being dolomite cementation, authigenic clay formation, grain contact dissolution and physical compaction.

Dolomite occurs throughout the sampled section as a widespread/patchy, coarsely-crystalline/poikilotopic cement that tightly fills intergranular pores, replaces labile grains and authigenic clay, and fills intragranular fractures (Plates 1-10).

Authigenic clay is mainly kaolin (dickite) that forms scattered patches, patchy/dispersed pseudomatrix and deformed, mica-like grains where K-feldspar, mica and micaceous/argillaceous rock fragments have altered (Plates 2, 3, 5, 6-10). Micaceous/illitic grains and K-feldspar are commonly partly altered to kaolin, and illitic remnants of micaceous/illitic precursor grains are commonly associated with kaolin.

Authigenic illite forms patchy and thinly dispersed pseudomatrix that is commonly intimately associated with authigenic kaolin. Illite appears to be an intermediate decomposition product of micaceous/illitic grains, with kaolin being the final alteration product.

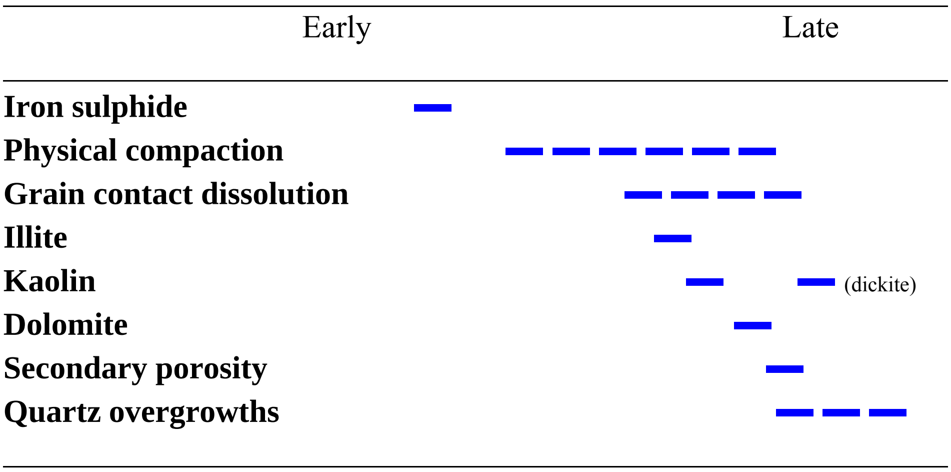
Framework grain packing density was increased by **grain contact dissolution** to form long, embayed and rare sutured grain contacts between juxtaposed quartzose and K-feldspar grains (Plates 1-4, 6, 9). Quartz grains have also dissolved where they are in contact with micaceous/illitic rock fragments.

Framework grain packing density was also increased by **physical compaction**, which resulted in the deformation and dispersion of argillaceous/micaceous rock fragments between adjacent rigid grains, commonly to form pseudomatrix. In addition, authigenic clay has compacted to form common patchy and dispersed pseudomatrix that is highly effective in filling intergranular spaces, and there are K-feldspar grains that are compactionally fractured and crushed and quartz grains in which intragranular fractures are filled with dolomite cement. Physical compaction and grain contact dissolution have both been inhibited by dolomite cement, with non-dolomite-cemented parts of the sandstones being significantly more compacted than dolomite-cemented parts.

Other diagenetic effects include very minor quartz overgrowth cementation, K-feldspar dissolution to form secondary mouldic and intragranular porosity (Plates 2, 3, 8, 9), and iron sulphide (marcasite) precipitation.

<u>Paragenetic timing:</u> The diagenetic paragenesis shown in Figure 2 is taken from ACS Laboratories Pty Ltd (2008) and is based on a detailed petrographic study of the section at Snapper-A21a (2875.0-3316.5m). Textural relationships used to interpret this diagenetic paragenesis are described in ACS Laboratories Pty Ltd (2008). All textural relationships observed in the current study are consistent with this diagenetic paragenesis.

FIGURE 2. DIAGENETIC PARAGENESIS



7. RESERVOIR QUALITY

Samples are clean, variably sorted, coarse to very coarse grained sandstones that consistently have poor reservoir quality due to complete intergranular pore filling by dolomite cement and, where dolomite cement is absent, authigenic clay, compacted argillaceous/micaceous rock fragments and, of much lesser importance, quartz overgrowth cement. It is evident that, had dolomite cement been absent, permeabilities would still be low due to the effects of advanced authigenic clay formation, compaction, grain contact dissolution and localised quartz overgrowth cementation. The control of texture on reservoir quality is completely masked by deleterious diagenetic effects.

A reservoir quality summary for each sample is given in Table 5.

TABLE 5. RESERVOIR QUALITY SUMMARY

Sample #	Depth (m)	Comments
3A	2931.65	Massive, moderately sorted, coarse grained sandstone in which intergranular areas are completely filled with extensively-developed dolomite cement and, where dolomite is absent, authigenic kaolin pseudomatrix, compacted argillaceous/micaceous grains and trace quartz overgrowth cement. Porosity was also reduced by grain contact dissolution. Trace secondary intragranular porosity results from K-feldspar dissolution. Very low permeability.
5A	2932.05	Massive, moderately-well sorted, coarse grained sandstone in which intergranular areas are completely filled with extensively-developed dolomite cement and, where dolomite is absent, authigenic kaolin pseudomatrix, compacted argillaceous/micaceous grains and trace quartz overgrowth cement. Porosity was also reduced by grain contact dissolution. Trace secondary intragranular porosity results from K-feldspar dissolution. Very low permeability.
10A	2933.31	Massive, poorly sorted, coarse grained sandstone in which intergranular areas are completely filled with extensively-developed dolomite cement and, where dolomite is absent, authigenic kaolin pseudomatrix, compacted argillaceous/micaceous grains and trace quartz overgrowth cement. Porosity was also reduced by grain contact dissolution. Trace secondary intragranular and mouldic porosity results from K-feldspar dissolution. Very low permeability.
18A	2935.30	Poorly sorted, coarse grained sandstone with bedding and thin laminae defined by grain size variation and in which intergranular areas are completely filled with dolomite cement, authigenic kaolin pseudomatrix, trace quartz overgrowth cement and, particularly in finer areas, compacted argillaceous/micaceous grains. Porosity was also reduced by grain contact dissolution. Trace secondary intragranular porosity results from K-feldspar dissolution. Very low permeability.
26A	2937.26	Massive, moderately sorted, coarse grained sandstone in which intergranular areas are completely filled with patchy dolomite cement and, between dolomite patches, authigenic kaolin pseudomatrix, compacted argillaceous/micaceous grains and very minor quartz overgrowth cement. Porosity was also reduced by grain contact dissolution. Trace secondary intragranular and mouldic porosity results from K-feldspar dissolution. Very low permeability.
34A	2939.27	Massive, poorly sorted, very coarse grained sandstone in which intergranular areas are completely filled with widespread dolomite cement and, where dolomite is absent, authigenic kaolin pseudomatrix, compacted argillaceous/micaceous grains and very minor quartz overgrowth cement. Porosity was also reduced by grain contact dissolution. Trace secondary intragranular and mouldic porosity results from K-feldspar dissolution. Very low permeability.
48A	2942.78	Poorly sorted, coarse grained sandstone with bedding defined by grain size variation and in which intergranular areas are completely filled with patchy dolomite cement and, where dolomite is absent, authigenic kaolin pseudomatrix, compacted argillaceous/micaceous grains and very minor quartz overgrowth cement. Porosity was also reduced by grain contact dissolution. Trace secondary intragranular porosity results from K-feldspar dissolution. Very low permeability.
49A	2943.05	Moderately sorted, coarse grained sandstone with bedding defined by grain size variation and in which intergranular areas are completely filled with patchy dolomite cement and, where dolomite is absent, authigenic kaolin, compacted argillaceous/micaceous grains and very minor quartz overgrowth cement. Porosity was also reduced by grain contact dissolution. Trace secondary intragranular and mouldic porosity results from K-feldspar dissolution. Very low permeability.
55A	2944.52	Massive, moderately-well sorted, coarse grained sandstone in which intergranular areas are completely filled with patchy dolomite cement and, where dolomite is absent, authigenic kaolin pseudomatrix, compacted argillaceous/micaceous grains and very minor quartz overgrowth cement. Porosity was also reduced by grain contact dissolution. Trace secondary intragranular and mouldic porosity results from K-feldspar dissolution. Very low permeability.
72A	2948.77	Massive, very poorly sorted, very coarse grained sandstone in which intergranular areas are completely filled with widespread dolomite cement and, where dolomite is absent, authigenic kaolin pseudomatrix, compacted argillaceous/micaceous grains and trace quartz overgrowth cement. Porosity was also reduced by grain contact dissolution. Trace secondary intragranular and mouldic porosity results from K-feldspar dissolution. Very low permeability.

8. SUMMARY AND CONCLUSIONS

- Samples from 2931.65-2948.77m in Snapper-A21a are variably sorted, coarse to very coarse grained subarkoses and a sublitharenite in which framework grains are mainly quartz, K-feldspar, sedimentary rock fragments and metasedimentary rock fragments.

- Clay is mainly authigenic kaolin (dickite) that forms scattered patches, patchy/dispersed pseudomatrix and deformed, mica-like grains where micaceous/argillaceous grains and feldspar have completely altered. Clay also includes authigenic illite that occurs as an intermediate decomposition product of micaceous/argillaceous grains.

- Sandstones have been severely affected by diagenesis, with the main diagenetic processes being dolomite cementation, authigenic clay formation, grain contact dissolution and physical compaction.

- Visible macroporosity does not exceed 1.4% and, with intergranular porosity having been completely destroyed by the deleterious effects of advanced diagenesis, is all ineffective secondary mouldic and intragranular porosity that results from K-feldspar dissolution.

- Sandstones have poor reservoir quality, with all intergranular spaces being filled with dolomite cement, authigenic clay, compacted ductile grains and localised quartz overgrowth cement.

REFERENCES

ACS Laboratories Pty Ltd., 2008, Petrology of Snapper-A21a samples. Report to Esso Australia Pty Ltd

APPENDIX I

RAW POINT COUNT DATA

KEY TO PETROGRAPHIC CATEGORIES

EXXON PRODUCTION RESEARCH COMPANY

ABBR.	CATEGORY
	Grains
GRUN	Grain, undifferentiated or unknown
GCUN	Clay grain, undifferentiated
	Quartz
QZUN	Quartz, undifferentiated
QZMO	Quartz, monocrystalline
QZPO	Quartz, polycrystalline
QZEX	Quartz, other
	Feldspar
FSUN	Feldspar, undifferentiated
FSPL	Plagioclase feldspar
FSKF	Potassium feldspar
FSIG	Feldspar intergrowth
FSEX	Feldspar, other
	Rock Fragments
RFUN	Rock fragment, undifferentiated
FSPR	Plutonic rock fragment
RSUN	Sedimentary rock fragment, undifferentiated
RSCT	Chert
RSQZ	Quartz-rich sedimentary fragment
RSCL	Clay-rich sedimentary fragment
RSCB	Carbonate rock fragment
RSEX	Sedimentary fragment, other
RVUN	Volcanic rock fragment, undifferentiated
RVFS	Felsic volcanic fragment
RVMF	Mafic/intermediate volcanic fragment
RVTF	Tuff/glass fragment
RVEX	Volcanic fragment, other
RMUN	Metamorphic fragment, undifferentiated
RMMP	Mica-poor metamorphic fragment
RMMR	Mica-rich metamorphic fragment
RMEX	Metamorphic fragment, other

ABBR.	CATEGORY
	Pore Fill
PFUN	Pore fill, undifferentiated
	Matrix
MXUN	Matrix, undifferentiated
MXCL	Clay matrix
MXSI	Siliceous matrix
MXCB	Carbonate matrix
MXOR	Organic matrix
MXEX	Matrix, other
	Authigenic Cement & Clay
CMUN	Cement, undifferentiated
CBUN	Carbonate cement, undifferentiated
CBCA	Calcite cement
CBDO	Dolomite cement
CBSD	Siderite cement
CBAK	Ankerite cement
CBEX	Carbonate cement, other
CMQZ	Quartz overgrowth
CMSI	Silica cement, other
CMFS	Feldspar overgrowth
CMPY	Pyrite/marcasite cement
CMFE	Iron oxide cement
CMZE	Zeolite cement
CMAN	Anhydrite cement
CMHC	Hydrocarbon pore fill
CMXA	Cement, other 1
CMXB	Cement, other 2
CLUN	Authigenic clay, undifferentiated
CLCH	Chlorite cement
CLKT	Kaolinite cement
CLIS	Illite, smectite, or I/S cement
CLEX	Authigenic clay, other

	Other Grains
OMUN	Mica, undifferentiated
OMMS	Muscovite
OMBT	Biotite
OGGL	Glauconite
OGPH	Phosphatic grain
OGFL	Fossil fragment
OGPL	Plant/wood fragment
OGHV	Heavy mineral or opaque
OGEX	Grain, other

	Porosity
PVUN	Visible porosity, undifferentiated
PVIG	Intergranular primary porosity
PVSC	Intragranular secondary porosity
PVPR	Intragranular primary porosity
PVSE	Intergranular secondary porosity
PVFR	Fracture porosity
PVEX	Porosity, other

	Replacement
IRUN	Replacement, undifferentiated
ICUN	Carbonate replacement, undifferentiated
ICCA	Calcite replacement
ICDO	Dolomite replacement
ICSD	Siderite replacement
ICAK	Ankerite replacement
ICEX	Carbonate replacement, other
IRSI	Siliceous replacement
IRPY	Pyrite/marcasite replacement
IRZE	Zeolite replacement
IRCL	Clay replacement, undifferentiated
IRCH	Chlorite replacement
IRKT	Kaolinite replacement
IRIS	Illite, smectite, or I/S replacement
IRXA	Replacement, other 1
IRXB	Replacement, other 2

	Subtotals
QZTO	Total quartz
FSTO	Total feldspar
RFTO	Total rock fragments
RSTO	Total sedimentary rock fragments
RVTO	Total volcanic rock fragments
RMTO	Total metamorphic rock fragments
OGTO	Total other grains

	Subtotals
MXTO	Total matrix
CBTO	Total carbonate cement
CLTO	Total clay
CMTO	Total cement & clay
ICTO	Total carb. replacement
IRTO	Total replacement
PVTO	Total porosity
GFTO	Total grains
PFTO	Total pore fill

Sample #	Depth (m)	GRUN	GCUN	QZUN	QZMO	QZPO	QZEX	FSUN	FSPL	FSKF	FSIG	FSEX	RFUN	FSPR
3A	2931.65	0.0	0.0	0.0	54.1	2.9	0.0	0.0	0.0	6.7	0.0	0.0	0.0	0.0
5A	2932.05	0.0	0.0	0.0	54.5	2.2	0.0	0.0	0.0	8.4	0.0	0.0	0.0	0.0
10A	2933.31	0.0	0.0	0.0	53.9	3.4	0.0	0.0	0.0	8.8	0.0	0.0	0.0	0.0
18A	2935.30	0.0	0.0	0.0	53.6	3.6	0.0	0.0	0.0	9.8	0.0	0.0	0.0	0.0
26A	2937.26	0.0	0.0	0.0	55.9	2.4	0.0	0.0	0.0	5.3	0.0	0.0	0.0	0.0
34A	2939.27	0.0	0.0	0.0	60.4	4.3	0.0	0.0	0.0	5.1	0.0	0.0	0.0	0.3
48A	2942.78	0.0	0.0	0.0	52.3	5.5	0.0	0.0	0.0	10.3	0.0	0.0	0.0	0.3
49A	2943.05	0.0	0.0	0.0	57.6	2.4	0.0	0.0	0.0	11.6	0.0	0.0	0.0	0.0
55A	2944.52	0.0	0.0	0.0	62.6	2.1	0.0	0.0	0.0	8.7	0.0	0.0	0.0	0.0
72A	2948.77	0.0	0.0	0.0	58.7	4.8	0.0	0.0	0.0	4.8	0.0	0.0	0.0	0.0

Sample #	Depth (m)	RSUN	RSCT	RSQZ	RSCL	RSCB	RSEX	RVUN	RVFS	RVMF	RVTF	RVEX	RMUN	RMMP
3A	2931.65	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0
5A	2932.05	1.7	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0
10A	2933.31	1.1	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0
18A	2935.30	2.5	0.3	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.7	0.0
26A	2937.26	1.7	0.3	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	1.1	0.0
34A	2939.27	3.3	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0
48A	2942.78	5.4	0.3	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	3.3	0.0
49A	2943.05	2.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0
55A	2944.52	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.3	0.0
72A	2948.77	2.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.0	0.0

Sample #	Depth (m)	RMMR	RMEX	OMUN	OMMS	OMBT	OGGL	OGPH	OGFL	OGPL	OGHV	OGEX	PFUN	MXUN
3A	2931.65	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5A	2932.05	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10A	2933.31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18A	2935.30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26A	2937.26	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
34A	2939.27	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
48A	2942.78	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
49A	2943.05	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
55A	2944.52	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0
72A	2948.77	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Sample #	Depth (m)	MXCL	MXSI	MXCB	MXOR	MXEX	CMUN	CBUN	CBCA	CBDO	CBSD	CBAK	CBEX	CMQZ
3A	2931.65	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.9	0.0	0.0	0.0	0.0
5A	2932.05	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.2	0.0	0.0	0.0	0.0
10A	2933.31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.0	0.0	0.0	0.0	0.0
18A	2935.30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.3	0.0	0.0	0.0	0.0
26A	2937.26	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	24.8	0.0	0.0	0.0	0.7
34A	2939.27	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.1	0.0	0.0	0.0	1.1
48A	2942.78	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.8	0.0	0.0	0.0	0.7
49A	2943.05	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.1	0.0	0.0	0.0	0.7
55A	2944.52	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.2	0.0	0.0	0.0	2.1
72A	2948.77	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.3	0.0	0.0	0.0	0.3

Sample #	Depth (m)	CMSI	CMFS	CMPY	CMFE	CMZE	CMAN	CMHC	CMXA	CMXB	CLUN	CLCH	CLKT	CLIS
3A	2931.65	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5A	2932.05	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10A	2933.31	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18A	2935.30	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26A	2937.26	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0
34A	2939.27	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0
48A	2942.78	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.1	0.0
49A	2943.05	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7	0.0
55A	2944.52	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0
72A	2948.77	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0

Sample #	Depth (m)	CLEX	IRUN	ICUN	ICCA	ICDO	ICSD	ICAK	ICEX	IRSI	IRPY	IRZE	IRCL	IRCH
3A	2931.65	0.0	0.0	0.0	0.0	4.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5A	2932.05	0.0	0.0	0.0	0.0	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10A	2933.31	0.0	0.0	0.0	0.0	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18A	2935.30	0.0	0.0	0.0	0.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26A	2937.26	0.0	0.0	0.0	0.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
34A	2939.27	0.0	0.0	0.0	0.0	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
48A	2942.78	0.0	0.0	0.0	0.0	3.1	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0
49A	2943.05	0.0	0.0	0.0	0.0	3.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
55A	2944.52	0.0	0.0	0.0	0.0	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
72A	2948.77	0.0	0.0	0.0	0.0	4.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Sample #	Depth (m)	IRKT	IRIS	IRXA	IRXB	PVUN	PVIG	PVSC	PVPR	PVSE	PVFR	PVEX	QZTO	FSTO
3A	2931.65	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	57.0	6.7
5A	2932.05	2.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	56.7	8.4
10A	2933.31	1.7	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	57.3	8.8
18A	2935.30	3.3	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	57.2	9.8
26A	2937.26	3.2	0.3	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.0	58.3	5.3
34A	2939.27	4.2	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	64.7	5.1
48A	2942.78	6.2	0.7	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	57.8	10.3
49A	2943.05	5.9	0.7	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.0	60.0	11.6
55A	2944.52	5.5	0.3	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	64.7	8.7
72A	2948.77	3.4	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	63.5	4.8

Sample #	Depth (m)	RSTO	RVTO	RMTO	OGTO	RFTO	MXTO	CBTO	CLTO	CMTO	ICTO	IRTO	PVTO	GFTO	PFTO
3A	2931.65	1.4	0.0	0.7	0.0	2.1	0.0	26.9	0.0	28.0	4.2	5.9	0.0	66.1	28.0
5A	2932.05	1.7	0.0	0.7	0.3	2.4	0.0	26.2	0.0	27.3	2.6	4.6	0.3	67.8	27.3
10A	2933.31	1.1	0.0	1.4	0.3	2.5	0.0	26.0	0.0	26.0	2.8	4.5	0.6	68.9	26.0
18A	2935.30	2.5	0.3	0.7	0.3	3.5	0.0	21.3	0.0	21.6	4.0	7.3	0.3	70.8	21.6
26A	2937.26	1.7	0.3	1.1	0.3	3.1	0.0	24.8	0.7	25.5	1.6	5.1	1.4	68.0	25.5
34A	2939.27	3.3	0.0	1.4	1.0	5.0	0.0	14.1	1.4	15.5	2.8	7.0	0.6	76.9	15.5
48A	2942.78	5.4	0.3	3.3	0.6	9.3	0.0	7.8	2.1	9.9	3.1	10.7	0.7	78.7	9.9
49A	2943.05	2.7	0.0	1.1	0.0	3.8	0.0	10.1	1.7	11.8	3.8	10.4	1.4	76.4	11.8
55A	2944.52	2.4	0.3	0.3	0.0	3.0	0.0	10.2	1.1	11.3	2.8	8.6	1.0	79.1	11.3
72A	2948.77	2.0	0.0	8.0	0.3	10.0	0.0	11.3	0.7	12.0	4.3	8.4	0.0	79.6	12.0

APPENDIX II

X-RAY DIFFRACTOGRAMS

Key to abbreviations:

Do = dolomite

Ha = halite (contaminant)

I = illite/mica

I/S = illitic mixed-layer illite/mica

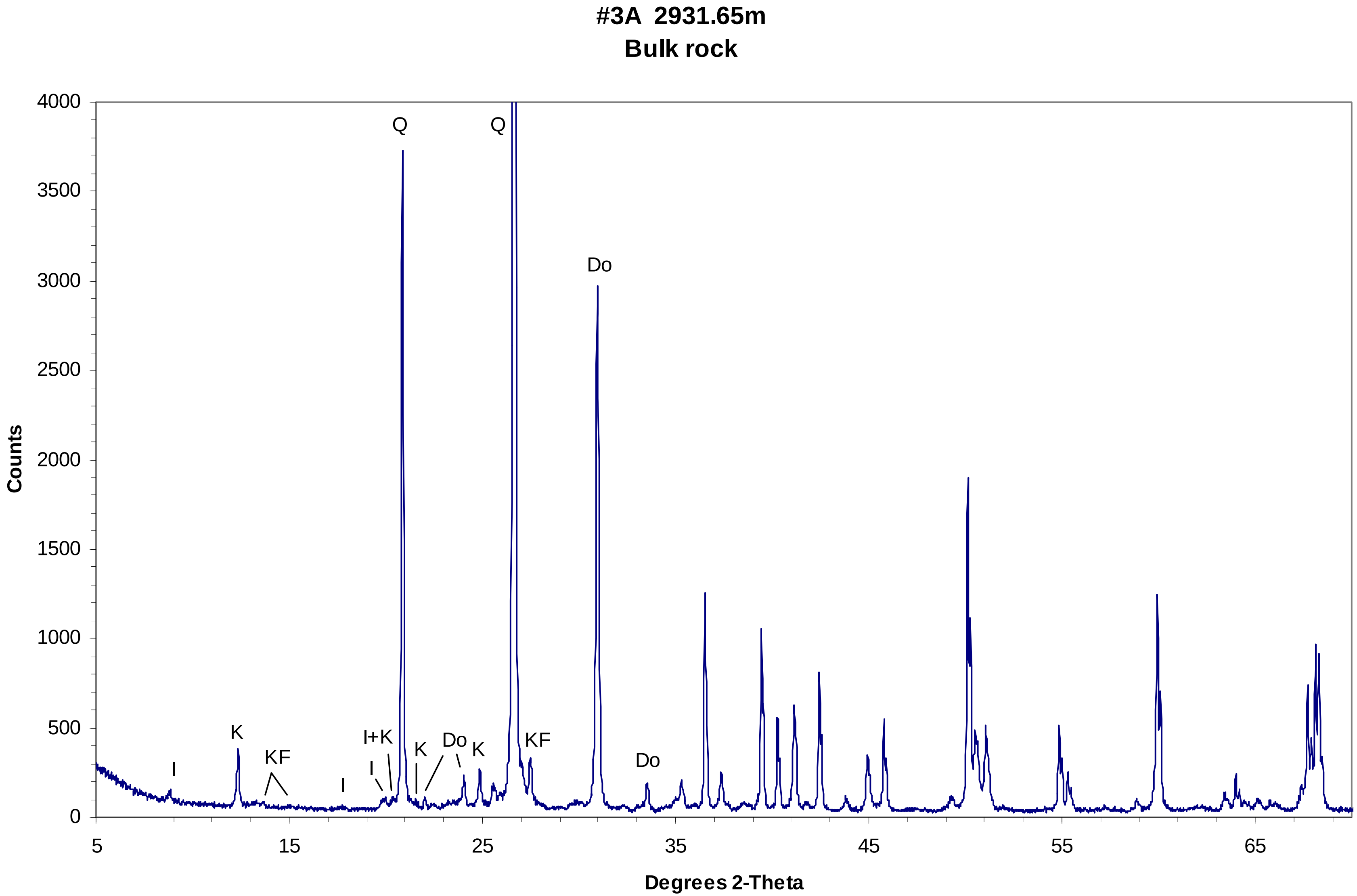
K = kaolin

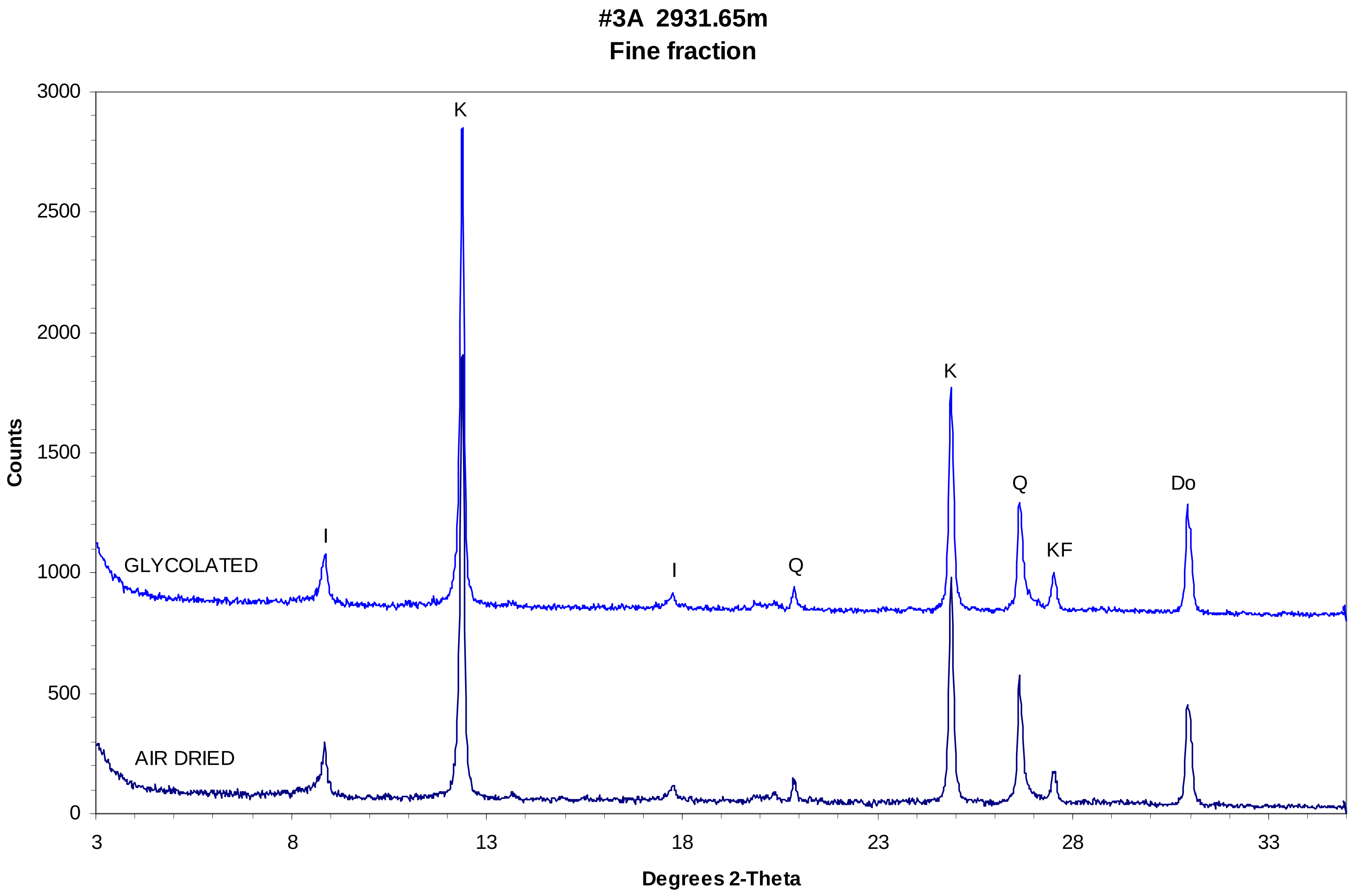
KF = K-feldspar

M = marcasite

Q = quartz

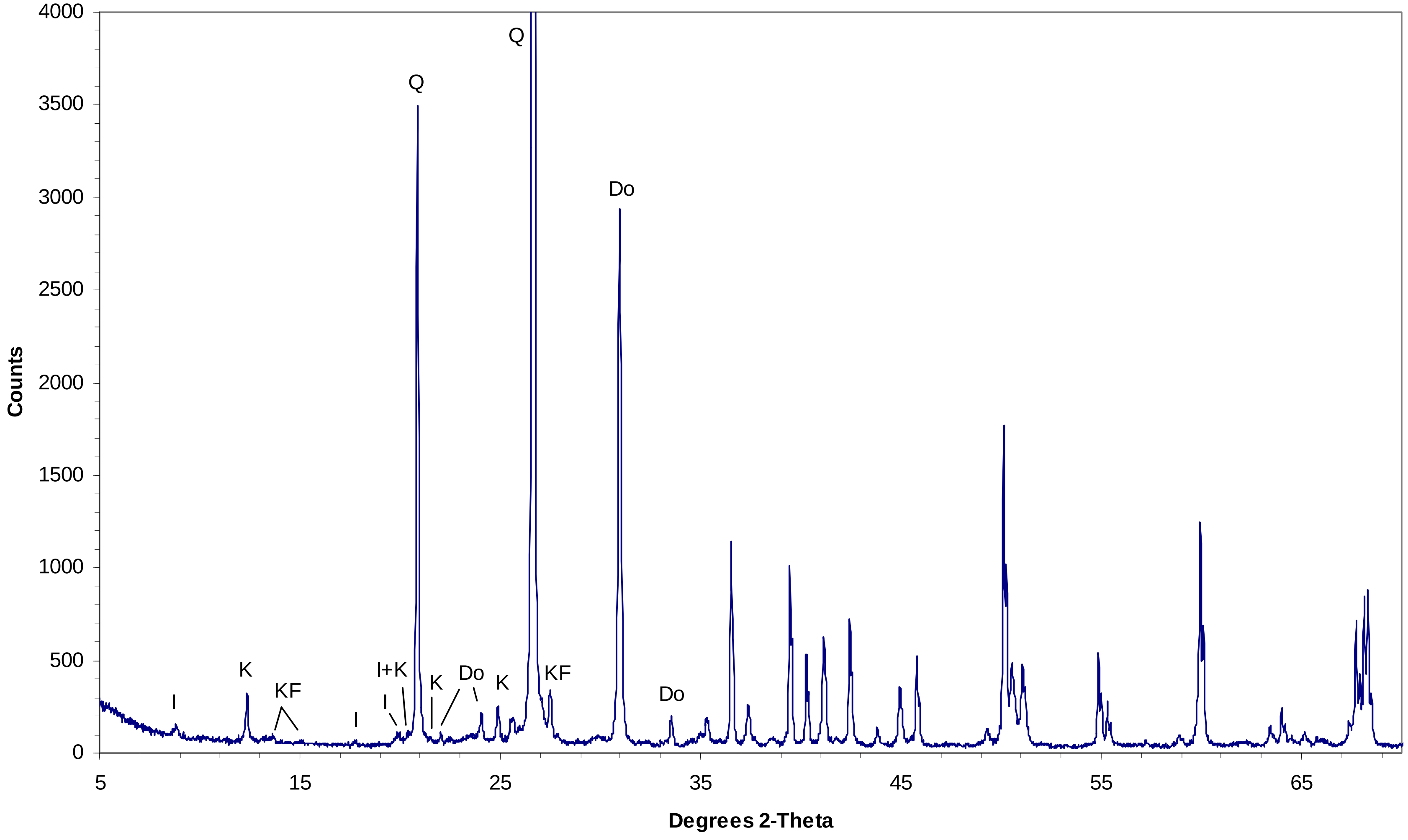
Sm = smectite (contaminant)

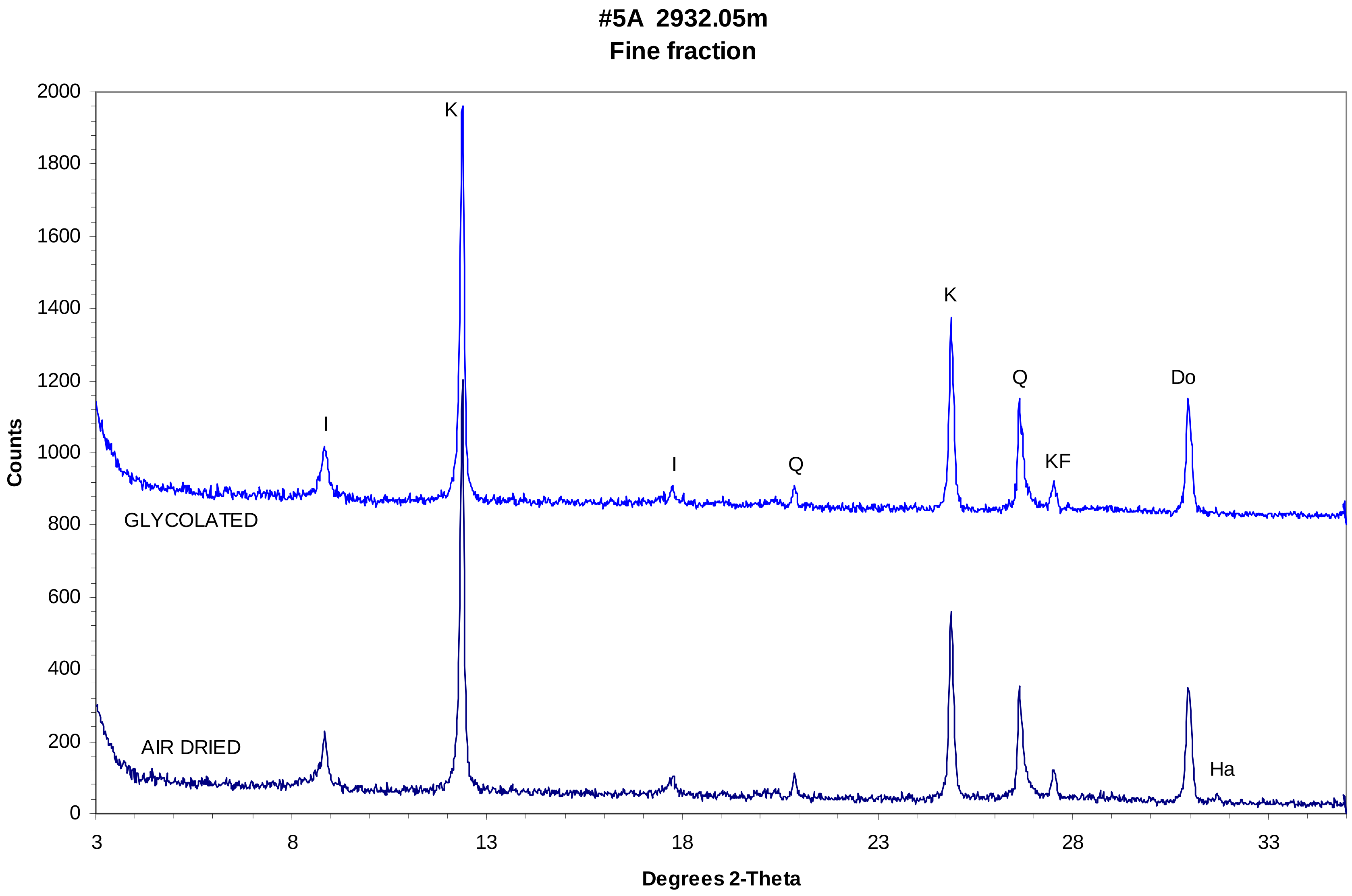

#3A 2931.65m
Bulk rock
Counts
Degrees 2-Theta
4000
3500
3000
2500
2000
1500
1000
500
0
5
15
25
35
45
55
65
Q
Q
Do
I
K
KF
I
I+K
I
K
Do
K
KF
Do

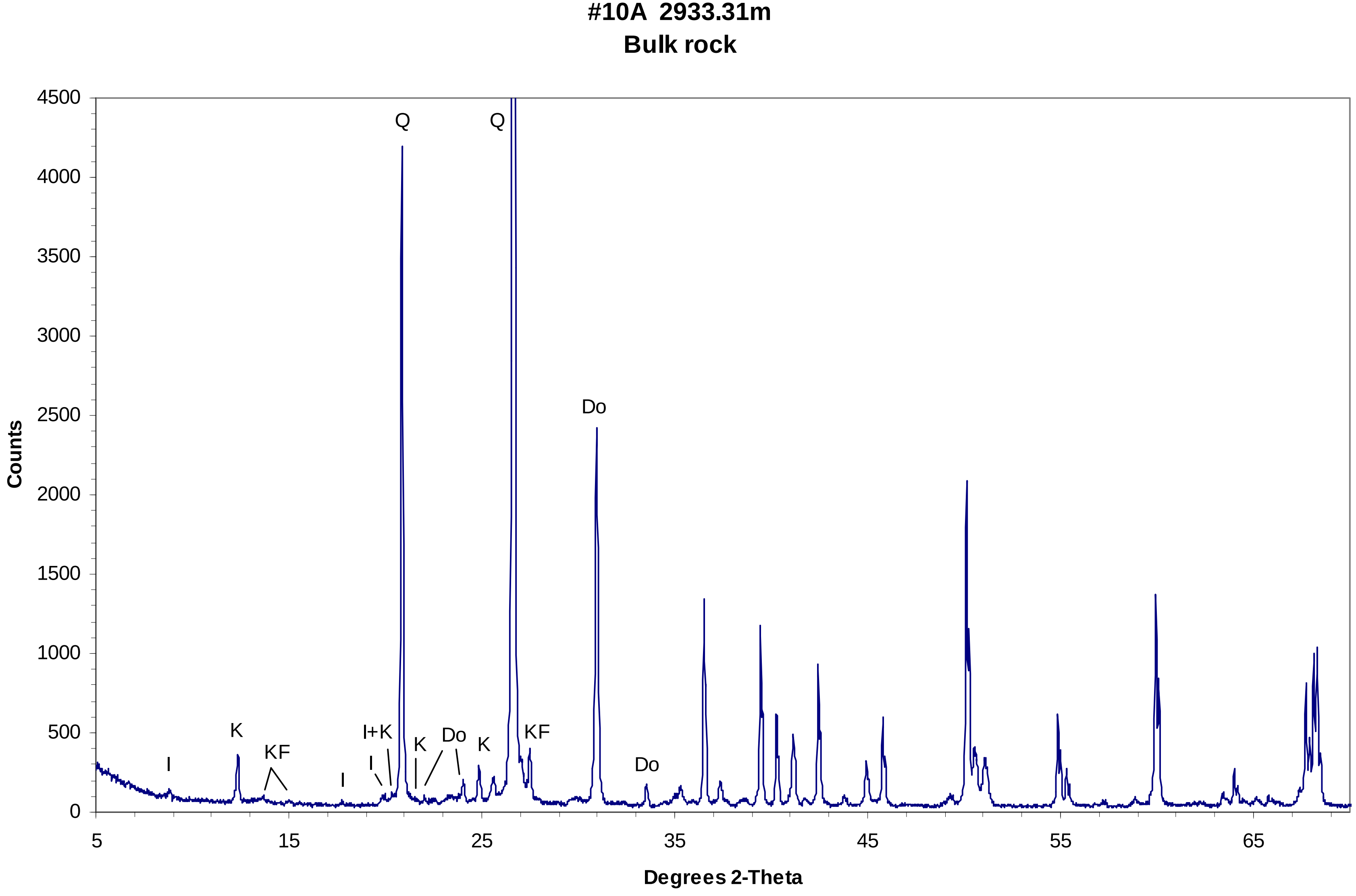


#3A 2931.65m
Fine fraction
Counts
3000
2500
2000
1500
1000
500
0
3
8
13
18
23
28
33
Degrees 2-Theta
K
K
I
I
Q
Q
KF
Do
GLYCOLATED
AIR DRIED

#5A 2932.05m
Bulk rock

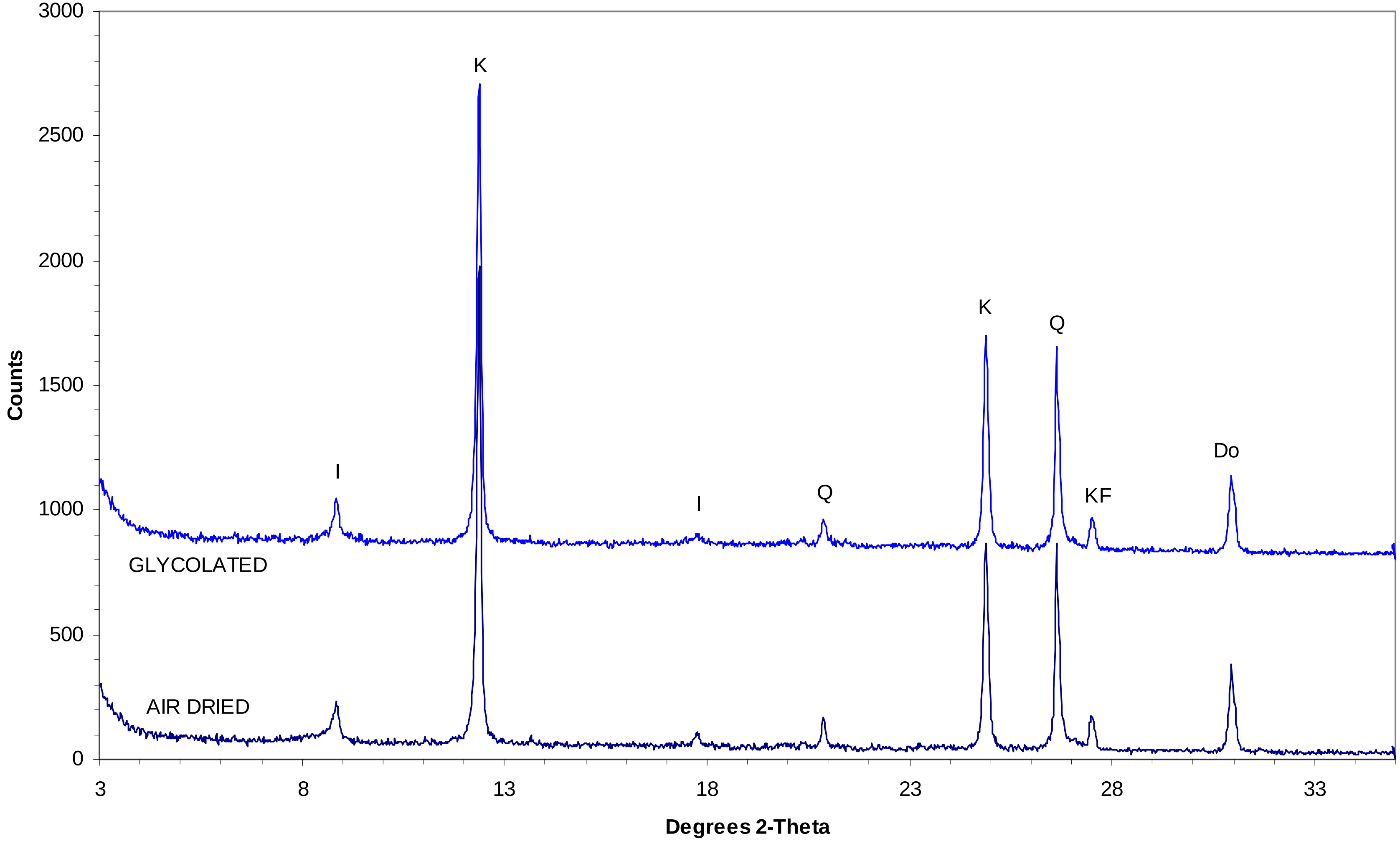



#5A 2932.05m
Fine fraction
Counts
Degrees 2-Theta
GLYCOLATED
AIR DRIED
I
K
I
Q
K
Q
KF
Do
Ha
0
200
400
600
800
1000
1200
1400
1600
1800
2000
3
8
13
18
23
28
33

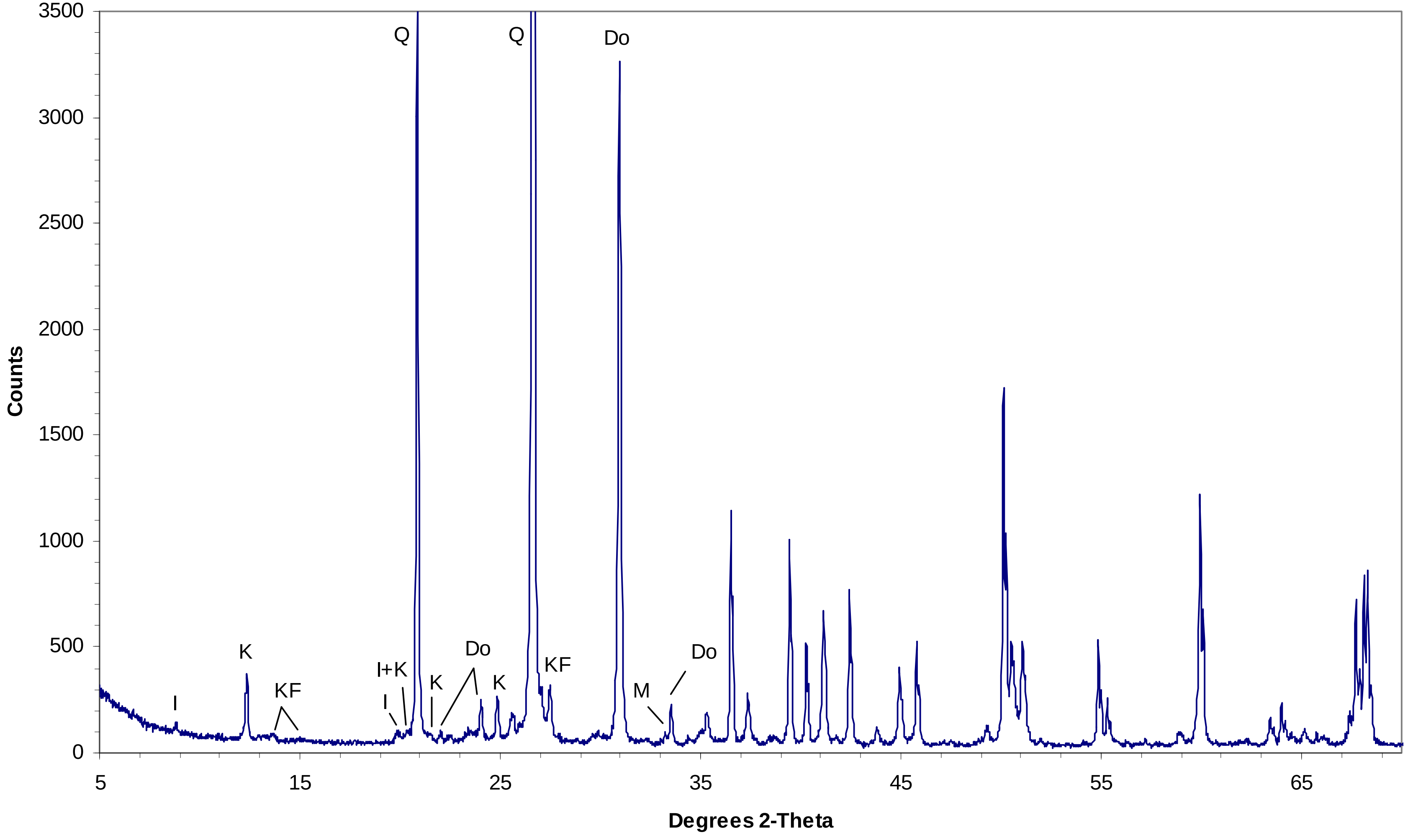


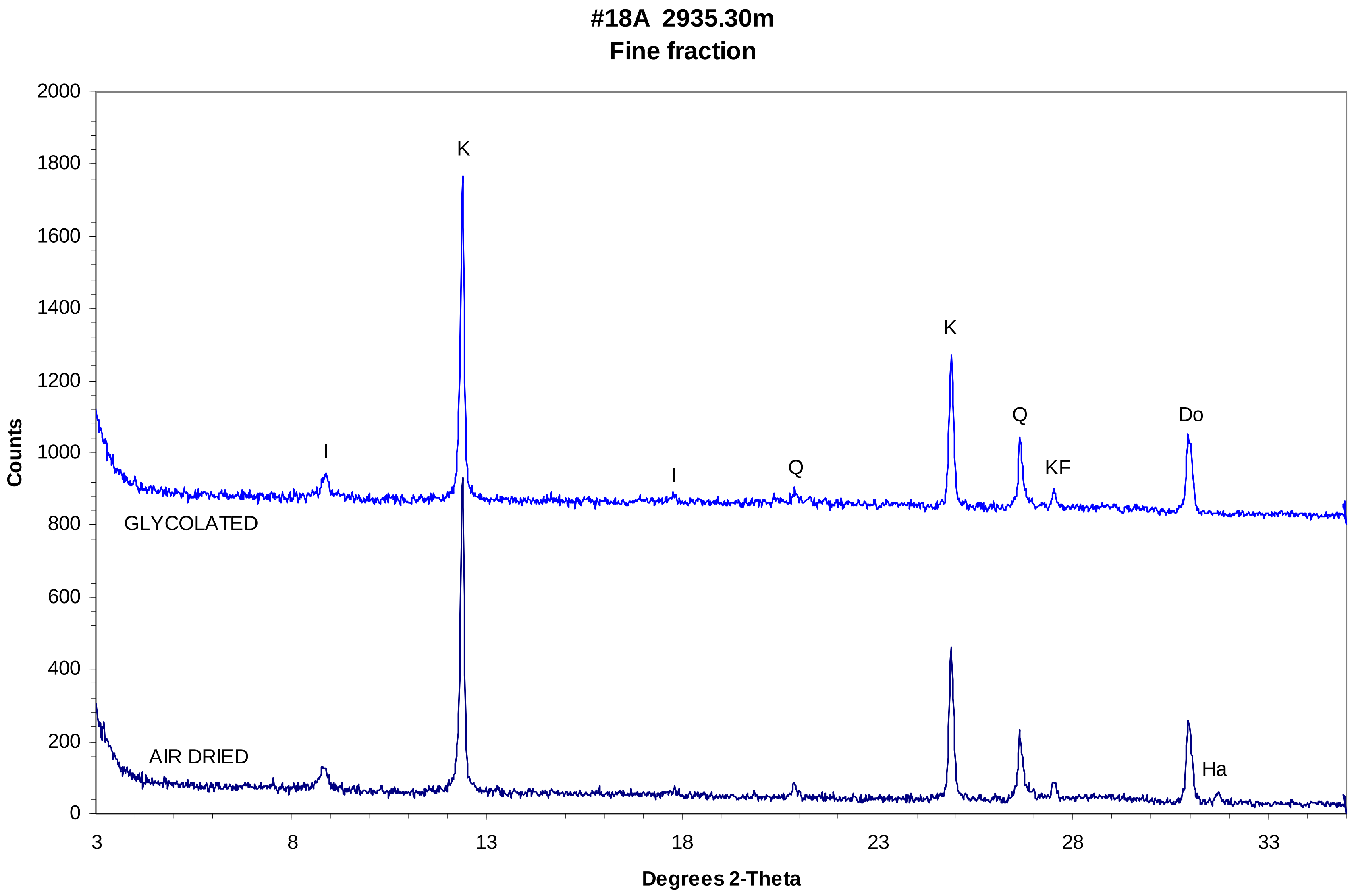
#10A 2933.31m
Bulk rock
Counts
4500
4000
3500
3000
2500
2000
1500
1000
500
0
5
15
25
35
45
55
65
Degrees 2-Theta
Q
Q
Do
I
K
KF
I
I+K
I
K
Do
K
KF
Do

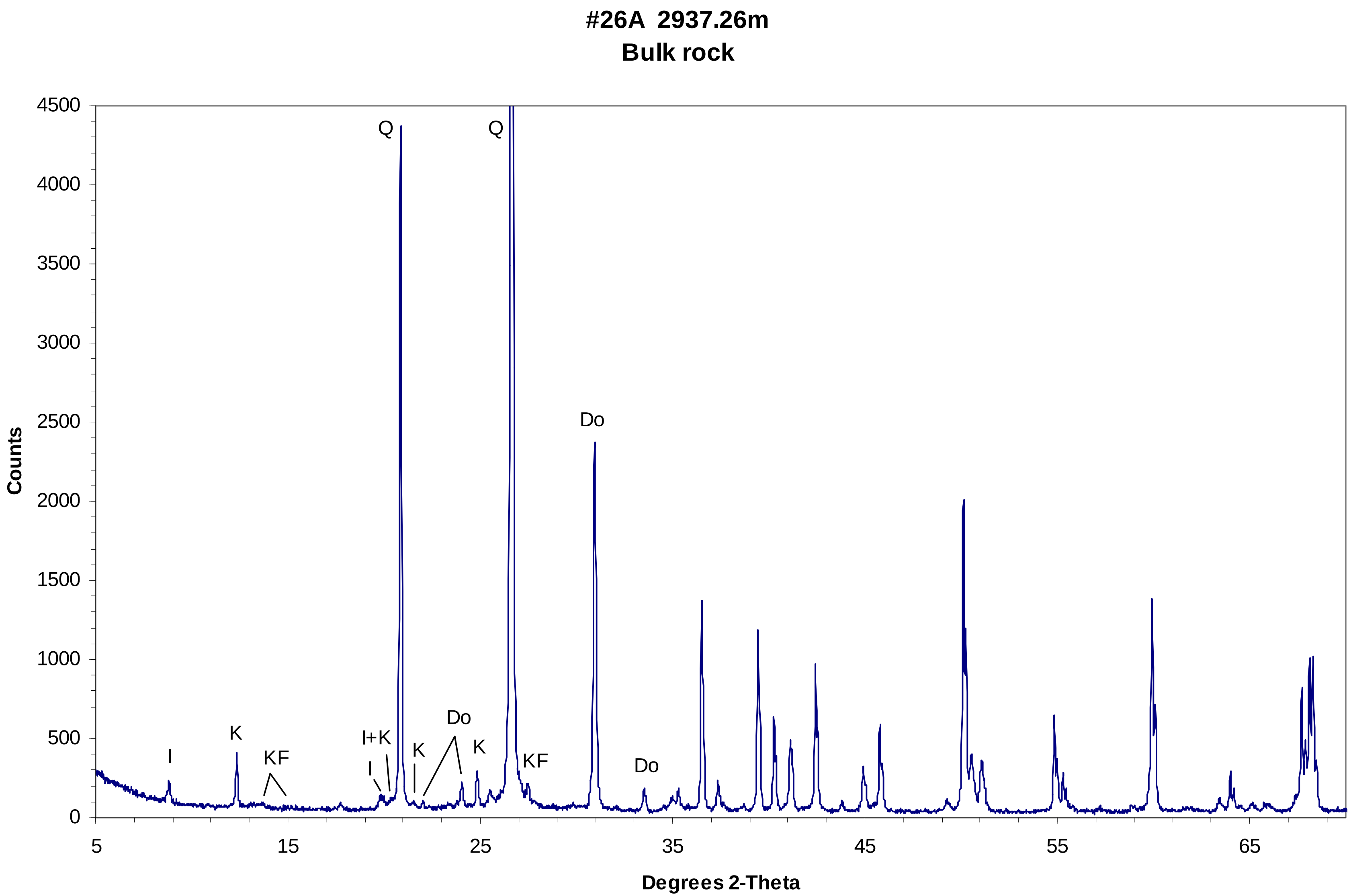
#10A 2933.31m
Fine fraction

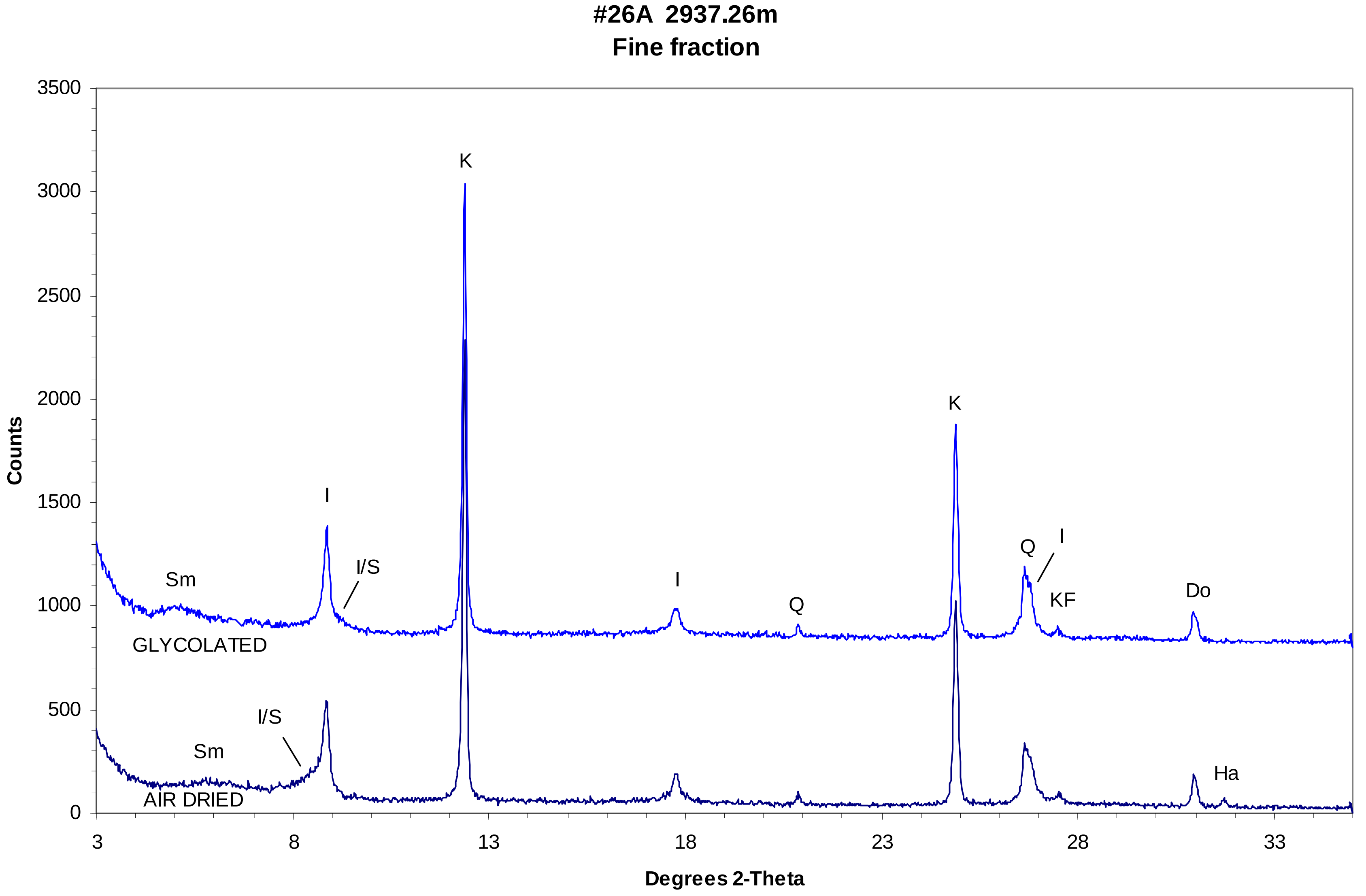


#18A 2935.30m
Bulk rock

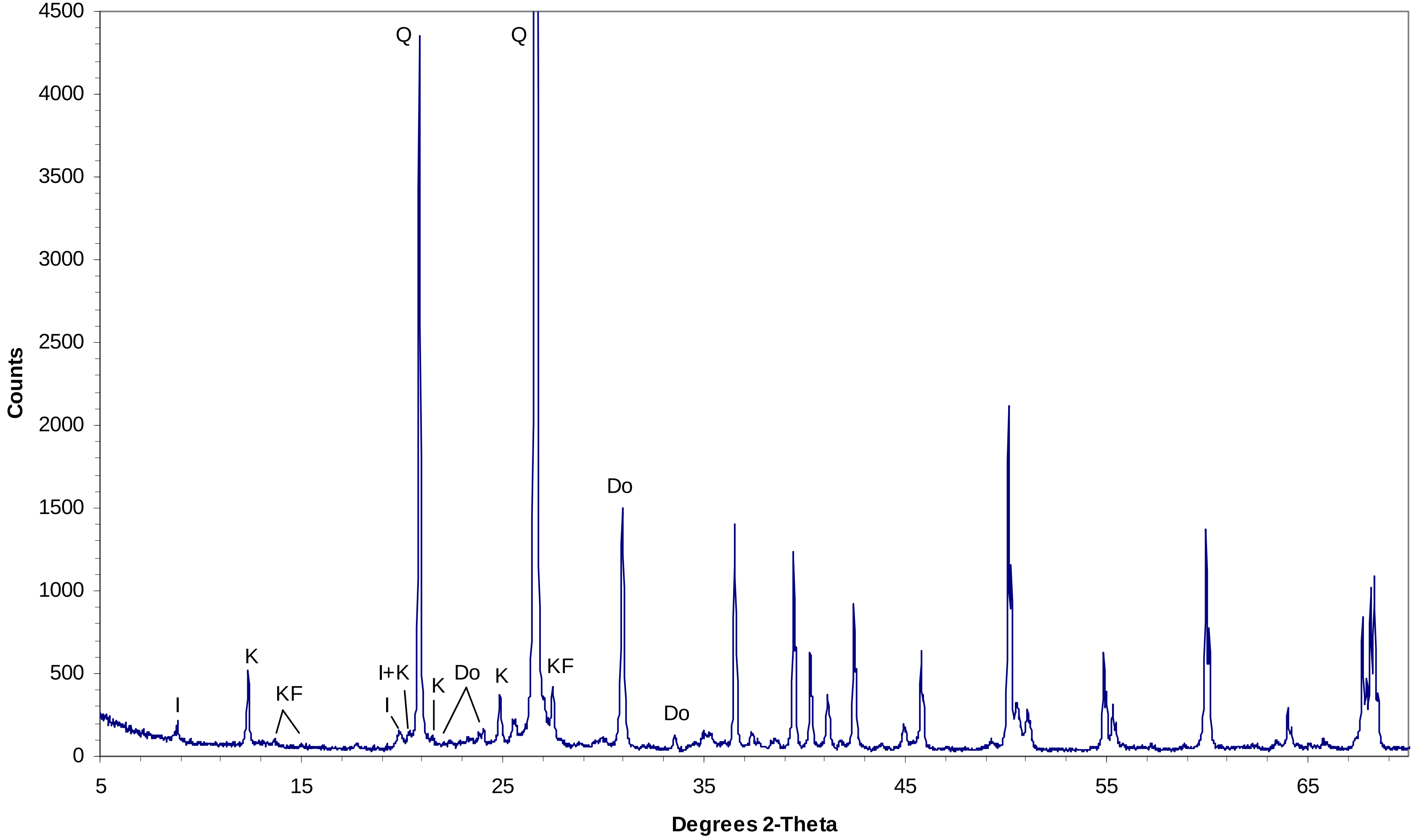


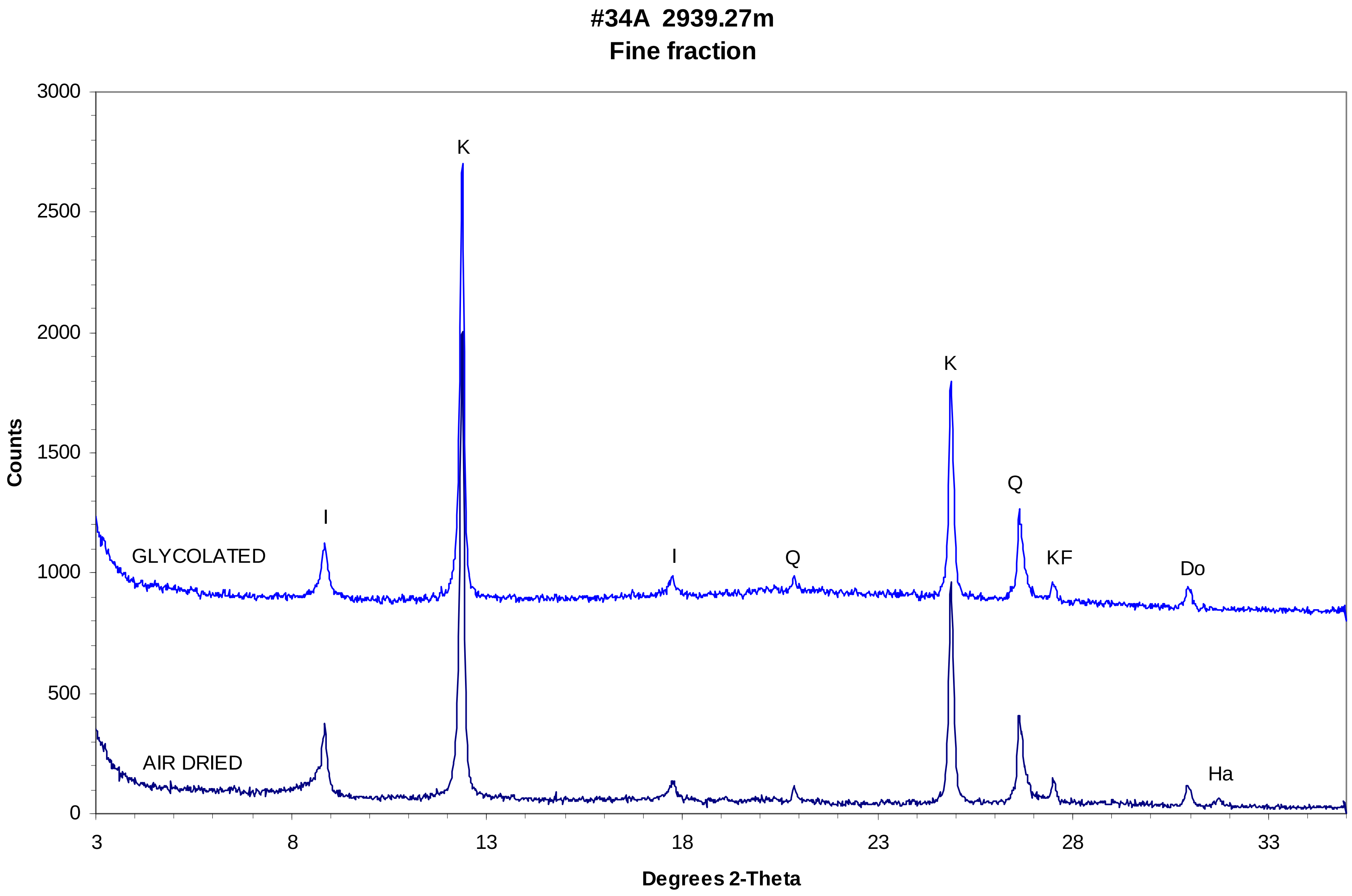

#18A 2935.30m
Fine fraction
Counts
2000
1800
1600
1400
1200
1000
800
600
400
200
0
3
8
13
18
23
28
33
Degrees 2-Theta
K
I
I
Q
K
Q
KF
Do
GLYCOLATED
AIR DRIED
Ha


#26A 2937.26m
Bulk rock
Counts
Degrees 2-Theta
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5
15
25
35
45
55
65
Q
Q
Do
Do
Do
I
K
KF
I+K
I
K
K
KF

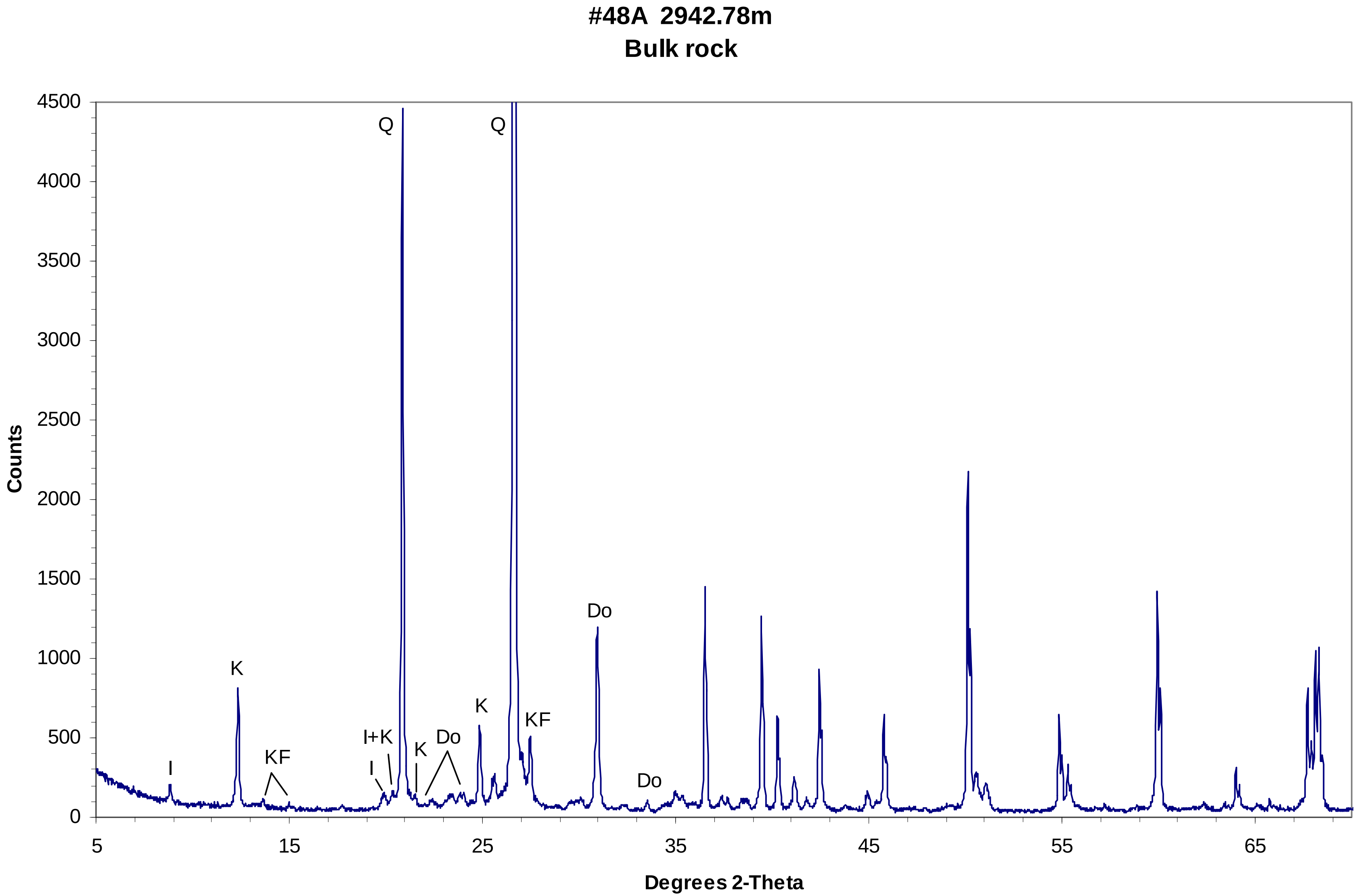

#26A 2937.26m
Fine fraction
Counts
Degrees 2-Theta
3500
3000
2500
2000
1500
1000
500
0
3
8
13
18
23
28
33
K
I
I/S
Sm
GLYCOLATED
I
Q
K
Q
I
KF
Do
I/S
Sm
AIR DRIED
Ha

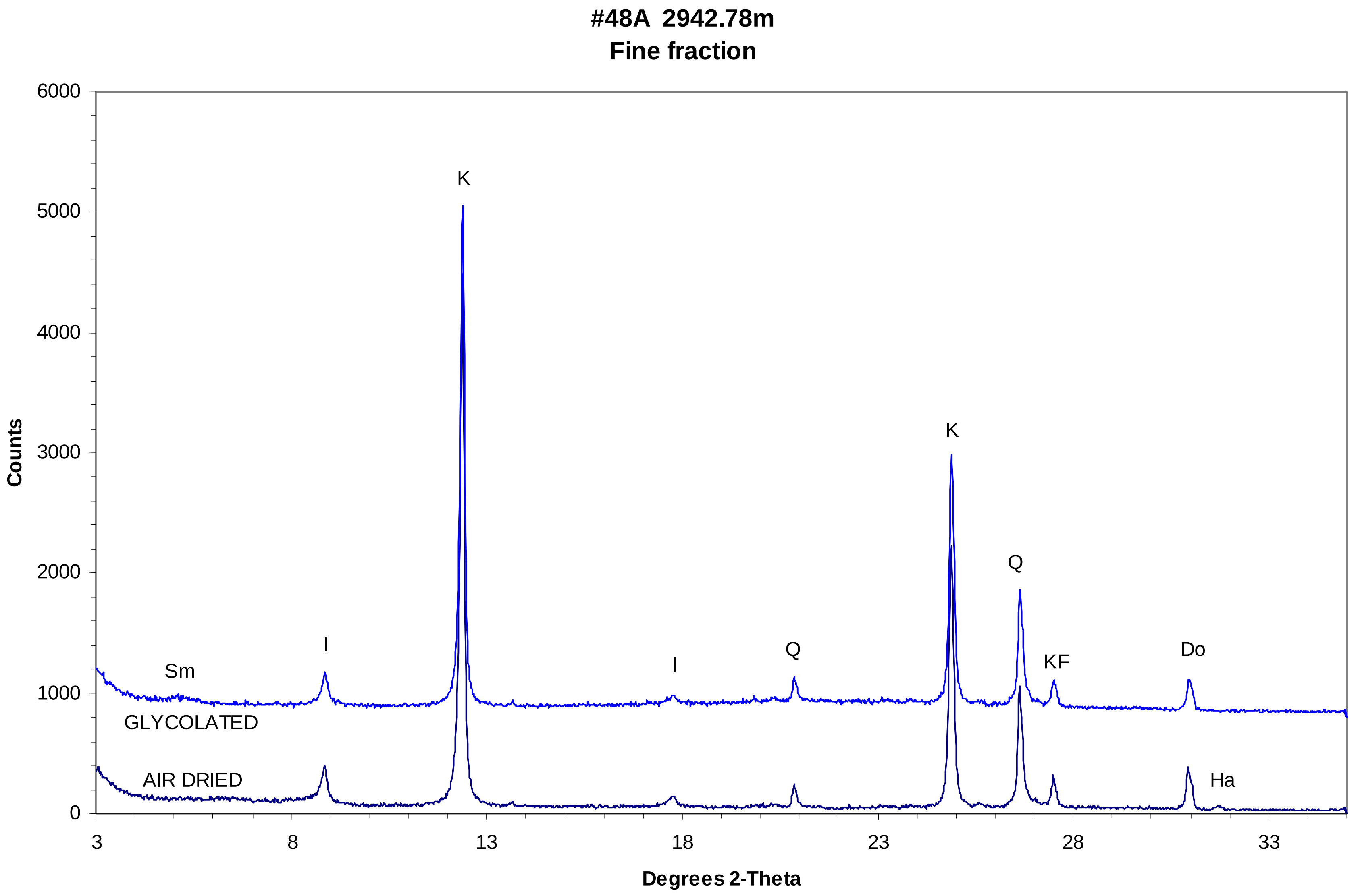
#34A 2939.27m
Bulk rock



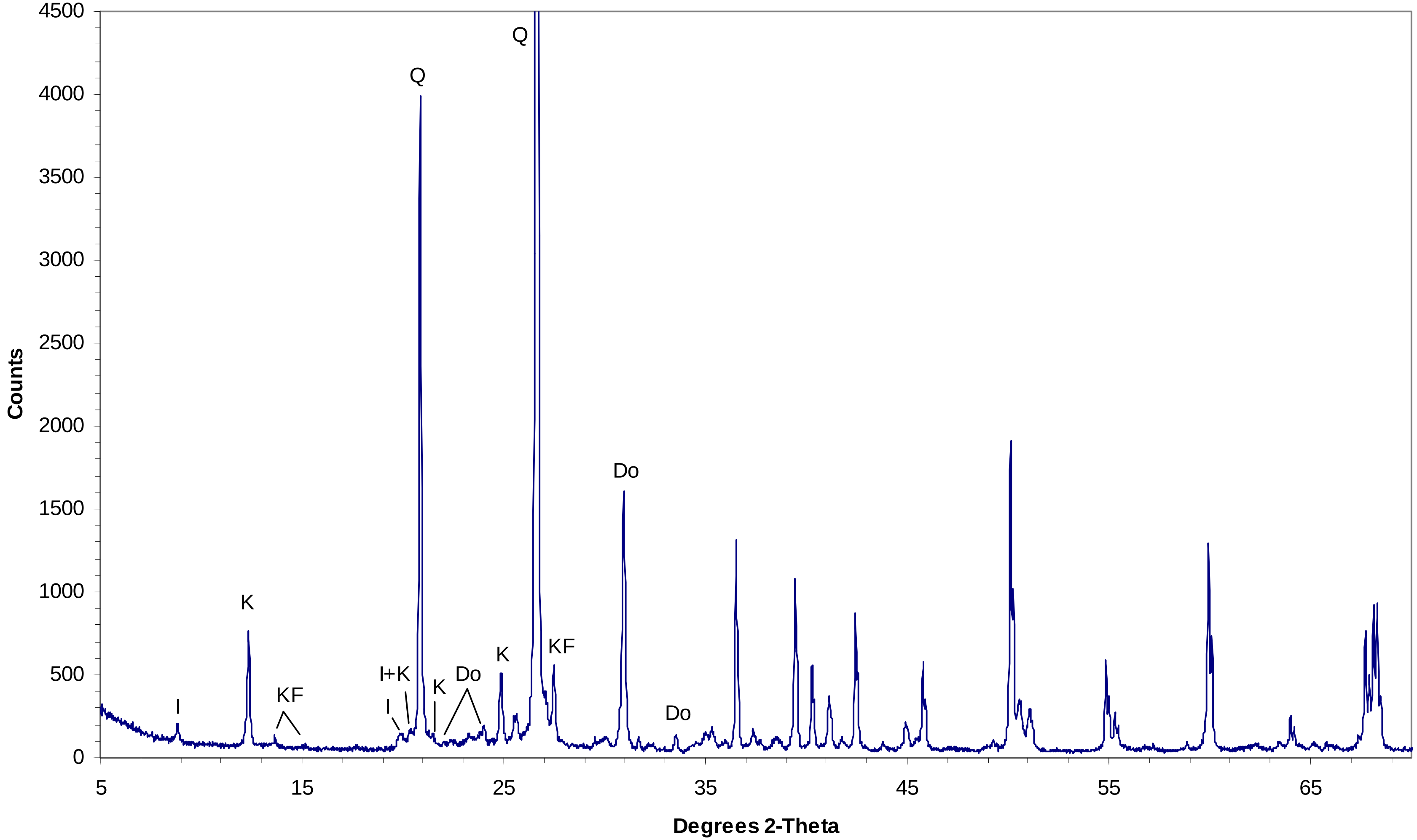


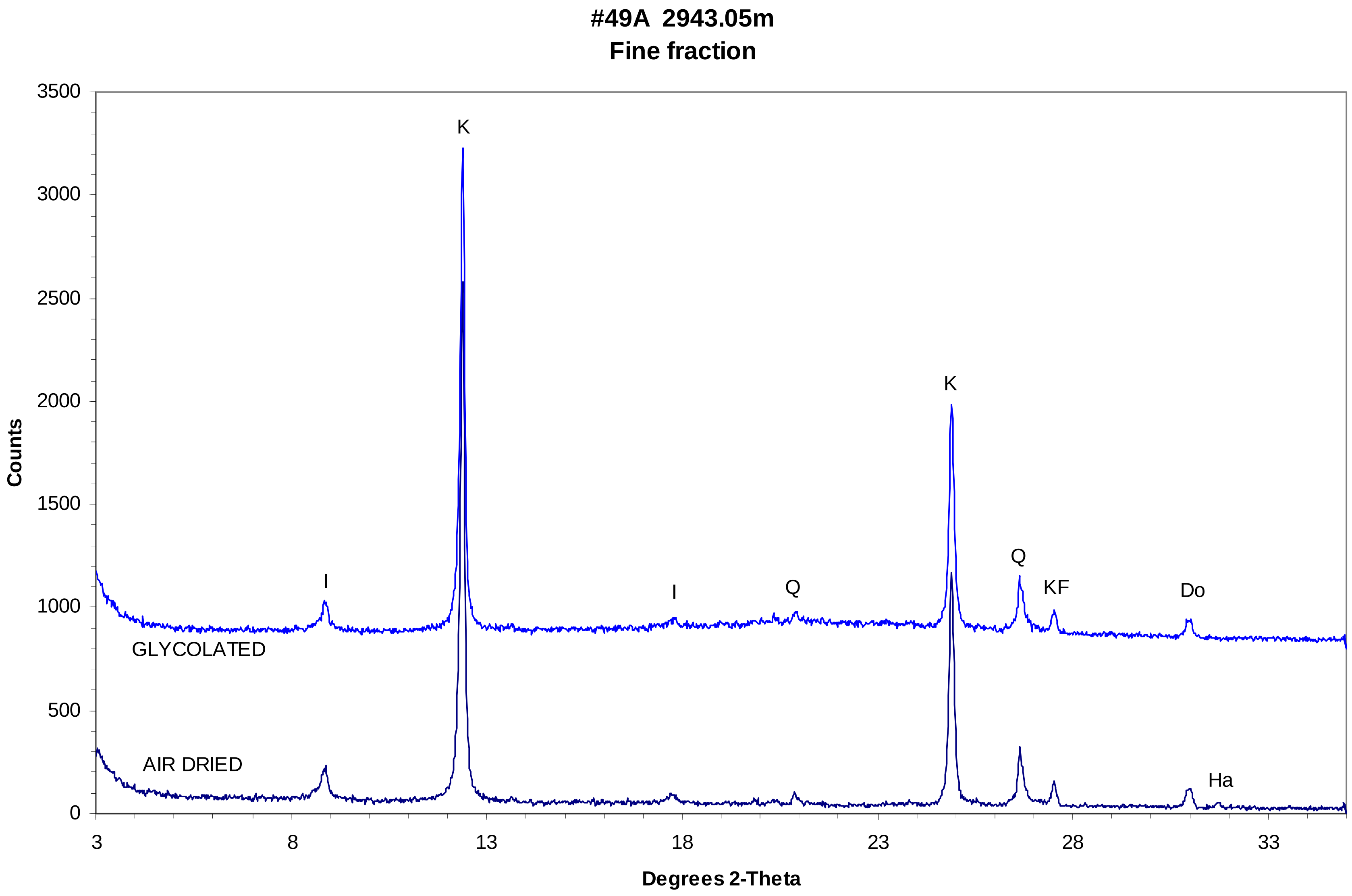
#34A 2939.27m
Fine fraction
Counts
3000
2500
2000
1500
1000
500
0
3
8
13
18
23
28
33
Degrees 2-Theta
GLYCOLATED
AIR DRIED
K
I
K
Q
I
Q
KF
Do
Ha

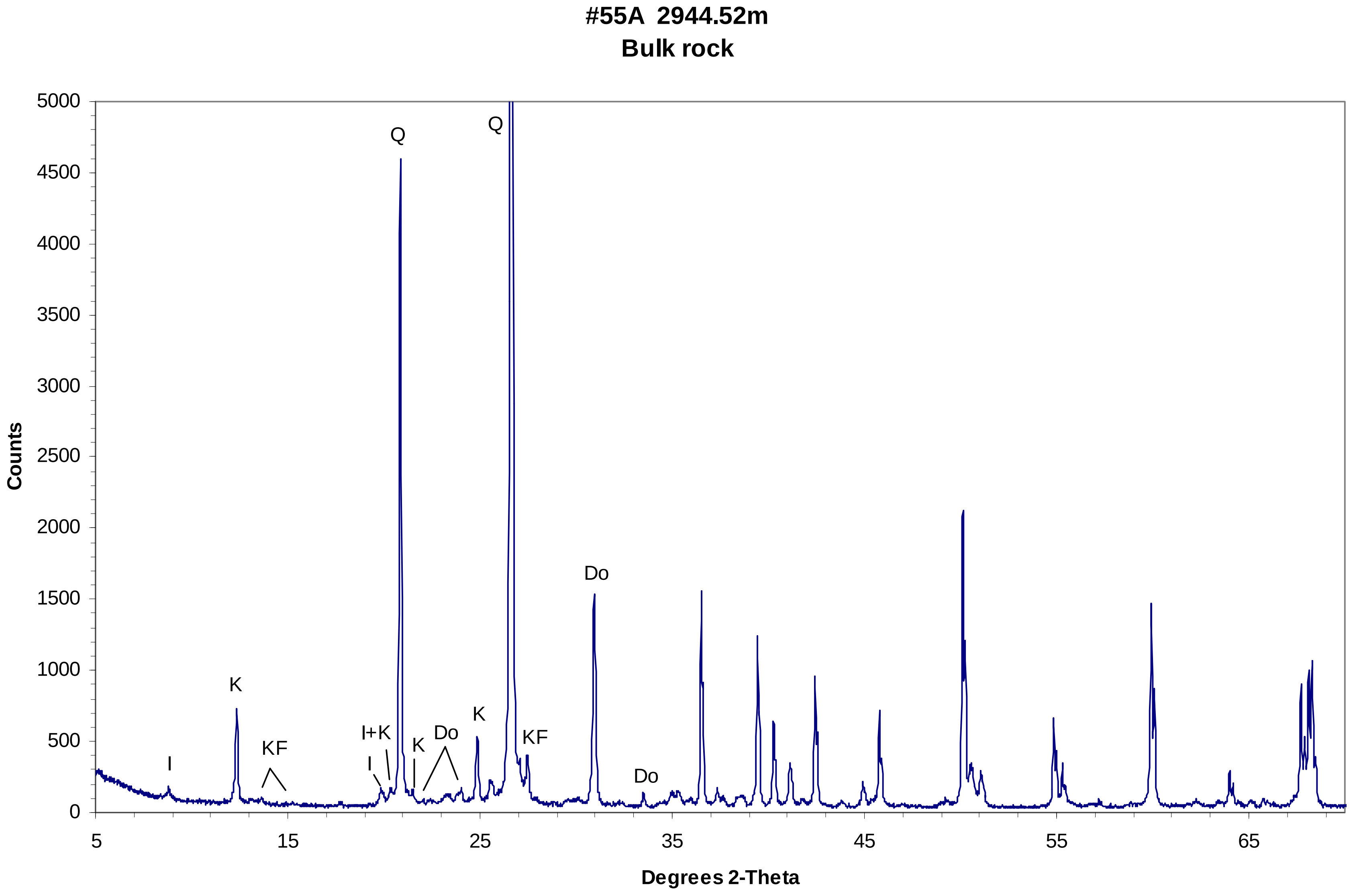

#48A 2942.78m
Bulk rock
Counts
Degrees 2-Theta
4500
4000
3500
3000
2500
2000
1500
1000
500
0
5
15
25
35
45
55
65
Q
Q
Do
K
K
KF
I+K
K
Do
I
KF
I
Do

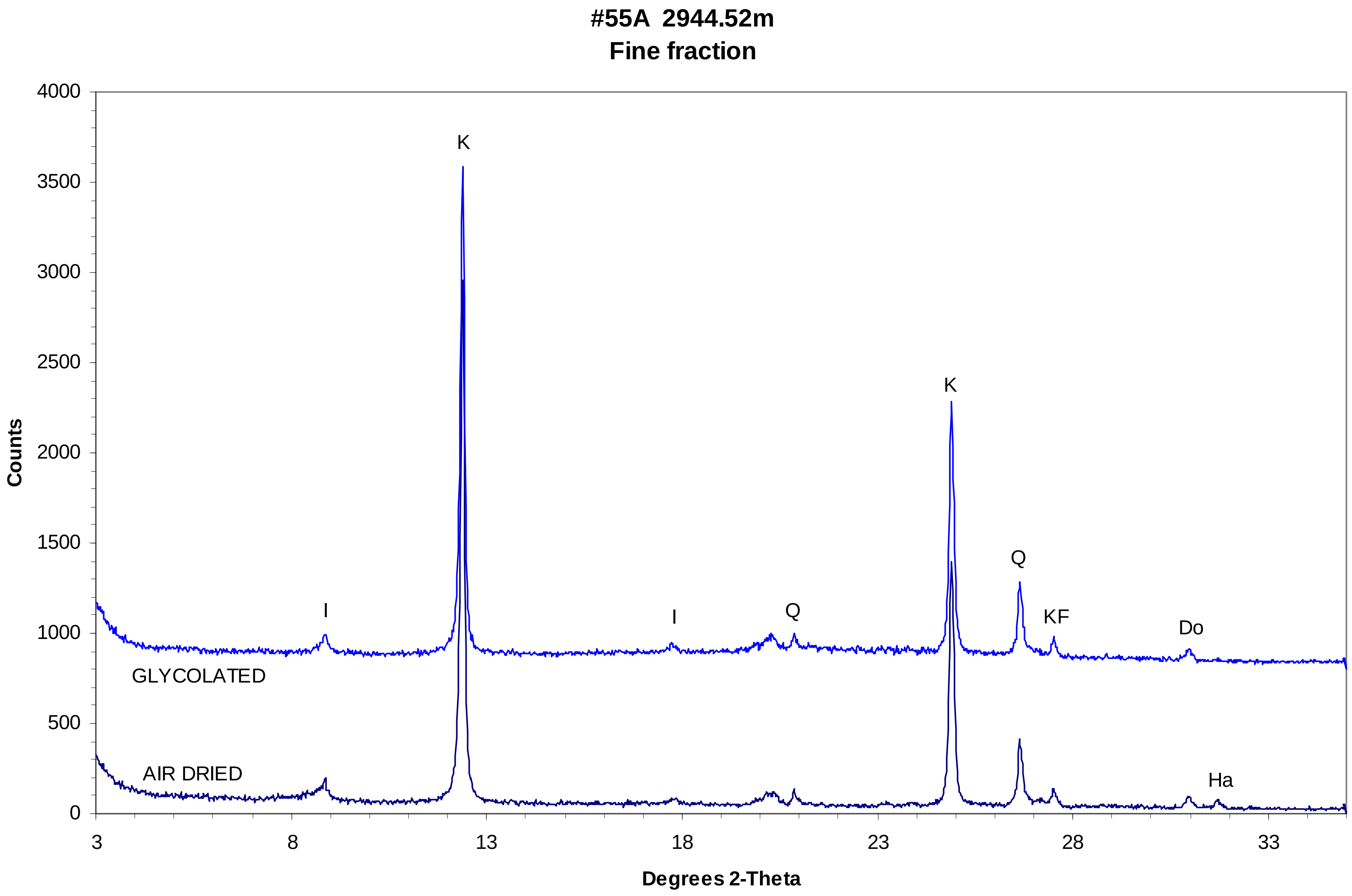

#48A 2942.78m
Fine fraction
Counts
6000
5000
4000
3000
2000
1000
0
3
8
13
18
23
28
33
Degrees 2-Theta
K
K
Q
I
I
Q
Sm
KF
Do
GLYCOLATED
AIR DRIED
Ha

#49A 2943.05m
Bulk rock



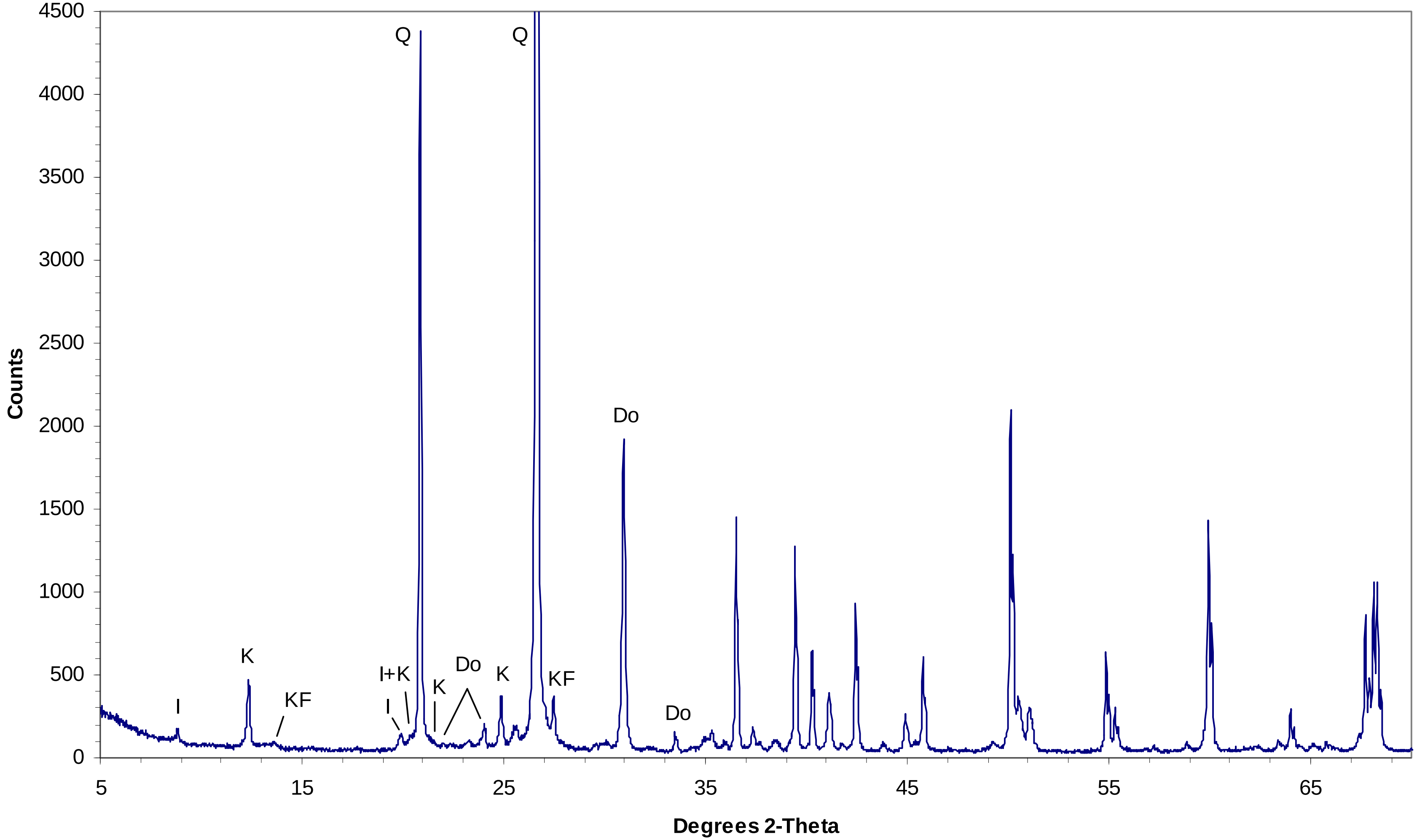

#49A 2943.05m
Fine fraction
Counts
3500
3000
2500
2000
1500
1000
500
0
3
8
13
18
23
28
33
Degrees 2-Theta
K
K
I
I
Q
Q
KF
Do
Ha
GLYCOLATED
AIR DRIED

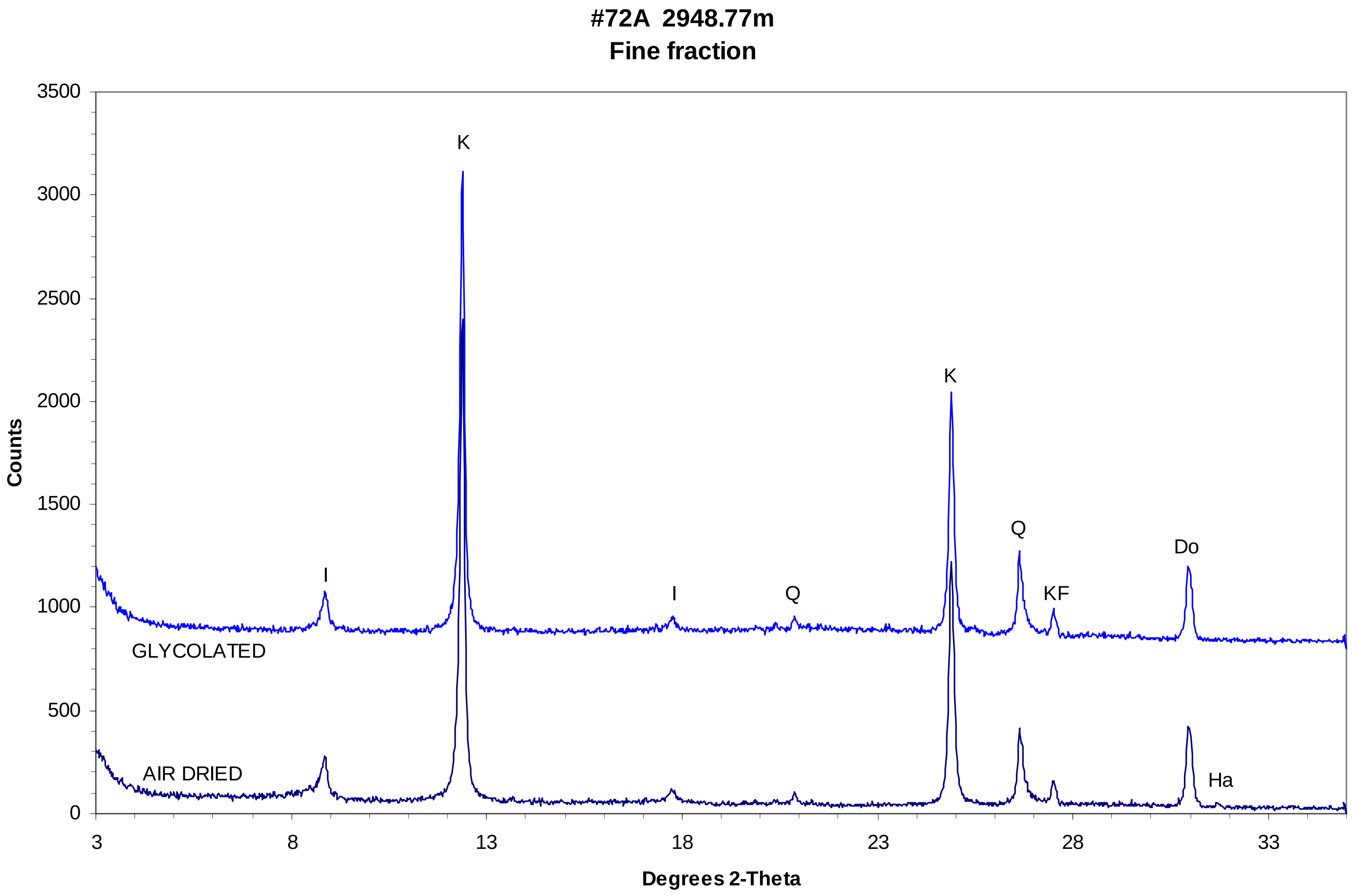

#55A 2944.52m
Bulk rock
Counts
Degrees 2-Theta
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
5
15
25
35
45
55
65
Q
Q
K
I
KF
I+K
I
K
Do
K
KF
Do
Do



#55A 2944.52m
Fine fraction
Counts
Degrees 2-Theta
0
500
1000
1500
2000
2500
3000
3500
4000
3
8
13
18
23
28
33
K
K
I
I
Q
Q
KF
Do
Ha
GLYCOLATED
AIR DRIED

#72A 2948.77m
Bulk rock





#72A 2948.77m
Fine fraction
Counts
3500
3000
2500
2000
1500
1000
500
0
3
8
13
18
23
28
33
Degrees 2-Theta
K
I
I
Q
K
Q
KF
Do
Ha
GLYCOLATED
AIR DRIED

APPENDIX III

MICROGRAPHS

KEY TO PLATES IN APPENDIX 3

Sample #	Depth (m)	Plate #
3A	2931.65	1
5A	2932.05	2
10A	2933.31	3
18A	2935.30	4
26A	2937.26	5
34A	2939.27	6
48A	2942.78	7
49A	2943.05	8
55A	2944.52	9
72A	2948.77	10

PLATE 1 #3A 2931.65m

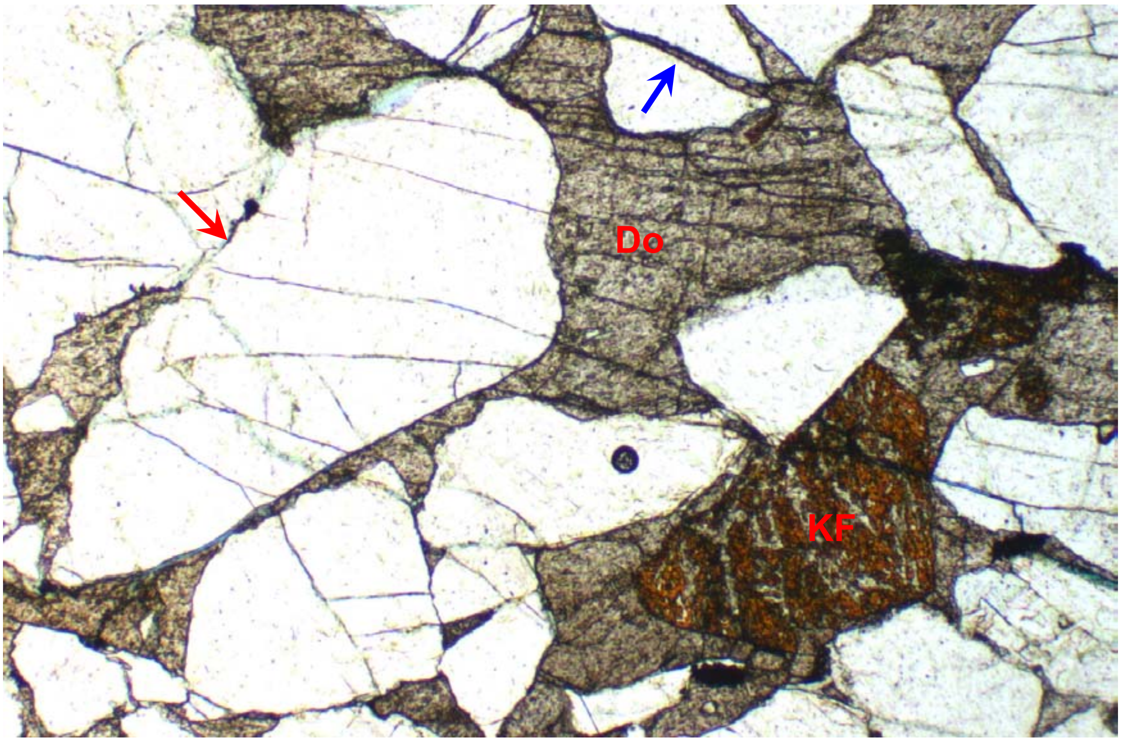
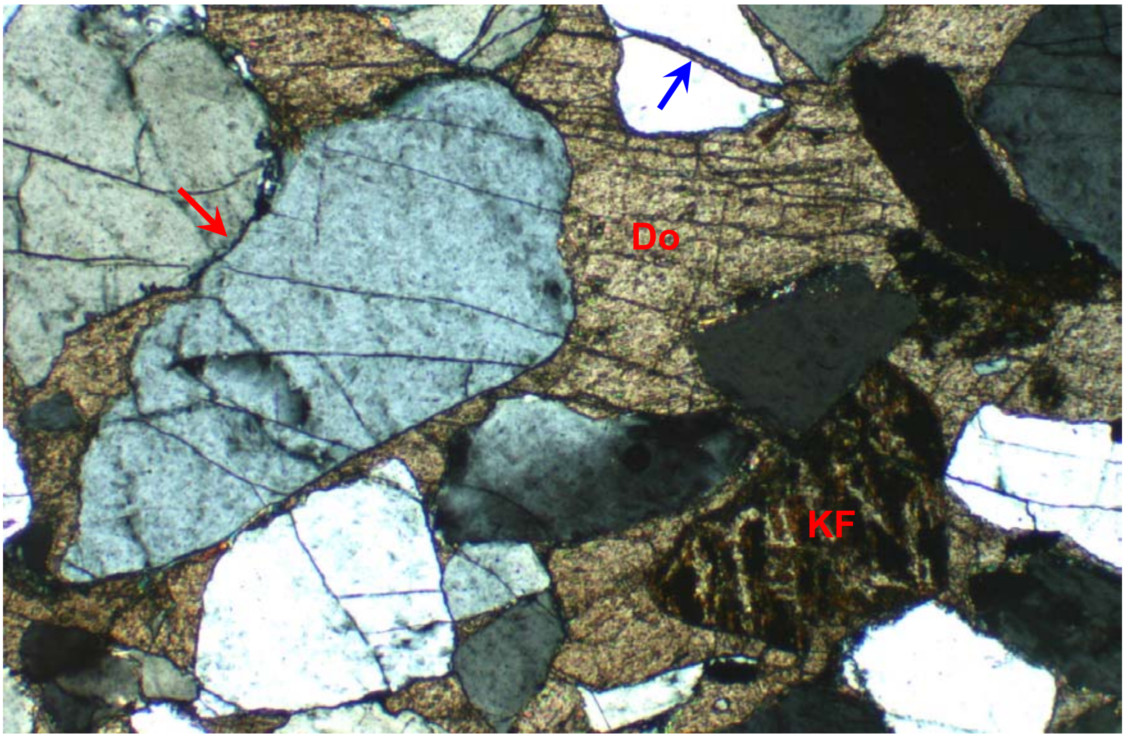


FIGURE 1 Plane polarised light
FIGURE 2 Crossed polarisers

0.4 mm



Coarse grained sandstone. Do = dolomite cement; KF = K-feldspar (stained brown); red arrow = welded grain contact between quartz grains resulting from grain contact dissolution; blue arrow = intragranular fracture filled with dolomite cement. (Thin-section micrographs)

PLATE 2 #5A 2932.05m

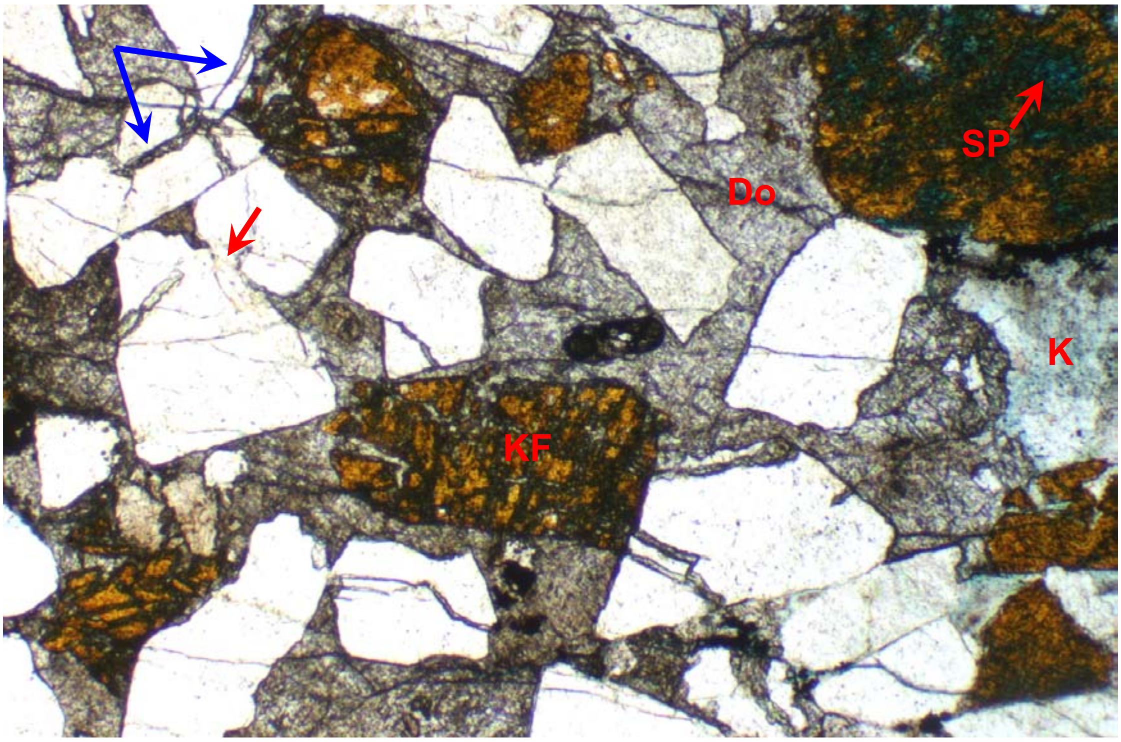
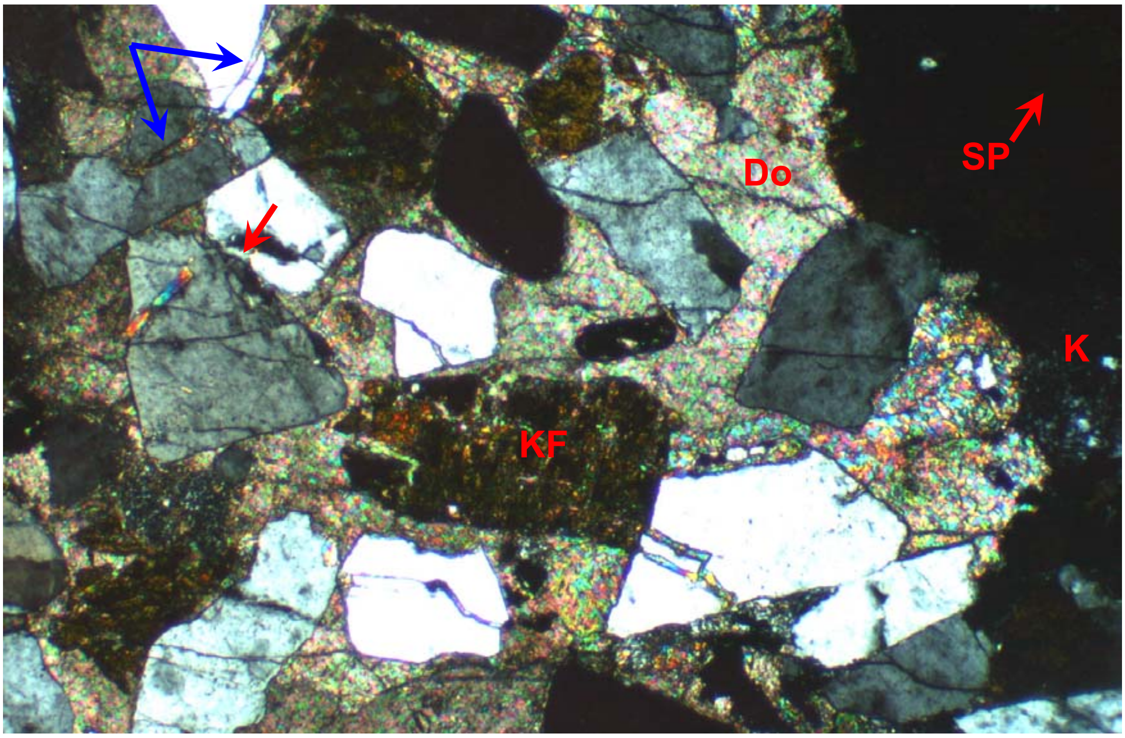


FIGURE 1 Plane polarised light
FIGURE 2 Crossed polarisers

0.4 mm



Coarse grained sandstone. Do = dolomite cement; K = authigenic kaolin; KF = K-feldspar (stained brown); SP = intragranular porosity resulting from K-feldspar dissolution; red arrow = welded grain contact between quartz grains resulting from grain contact dissolution; blue arrows = intragranular fracture filled with dolomite cement. (Thin-section micrographs)

PLATE 3 #10A 2933.31m

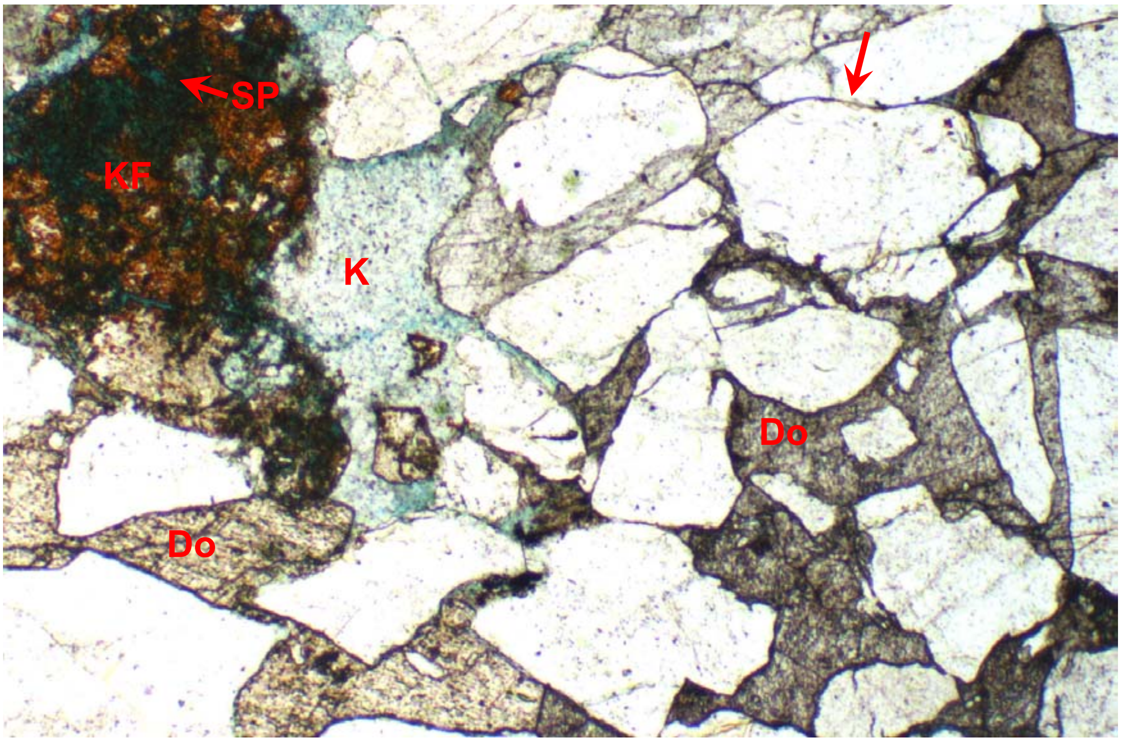
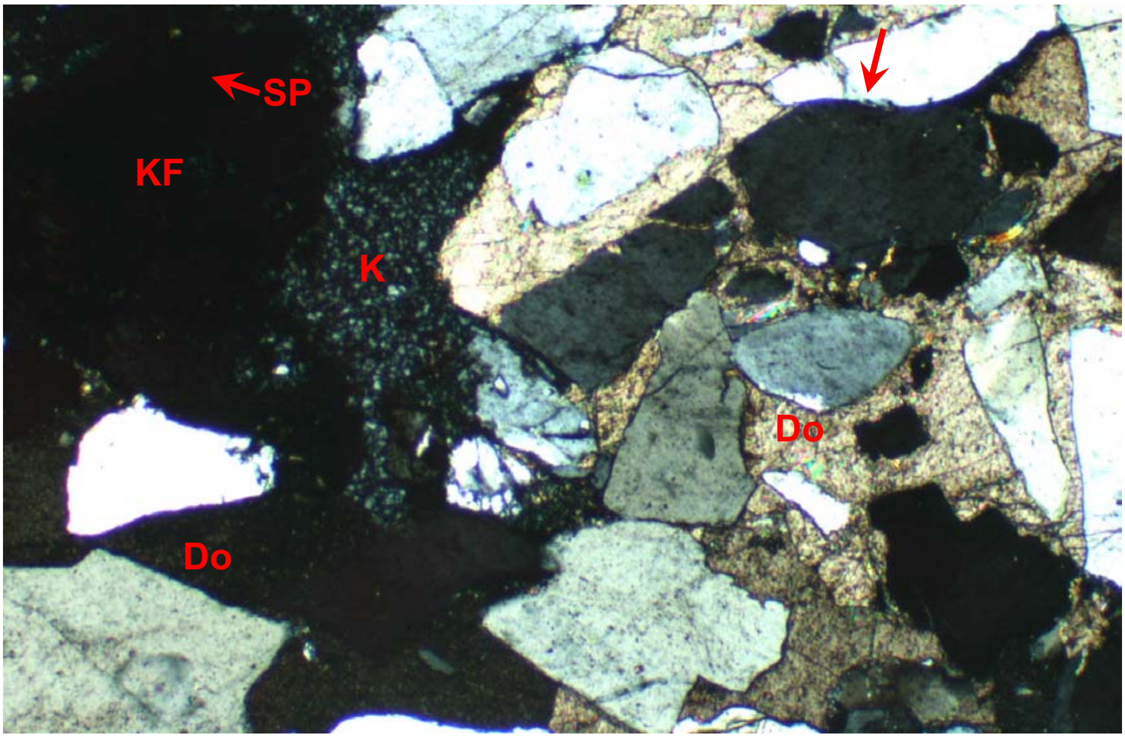


FIGURE 1 Plane polarised light
FIGURE 2 Crossed polarisers

0.4 mm



Coarse grained sandstone. Do = dolomite cement; K = microporous (as shown by blue hue) authigenic kaolin formed by K-feldspar alteration; KF = K-feldspar (stained brown); SP = intragranular porosity resulting from K-feldspar dissolution; arrow = welded grain contact between quartz grains resulting from grain contact dissolution. (Thin-section micrographs)

PLATE 4 #18A 2935.30m

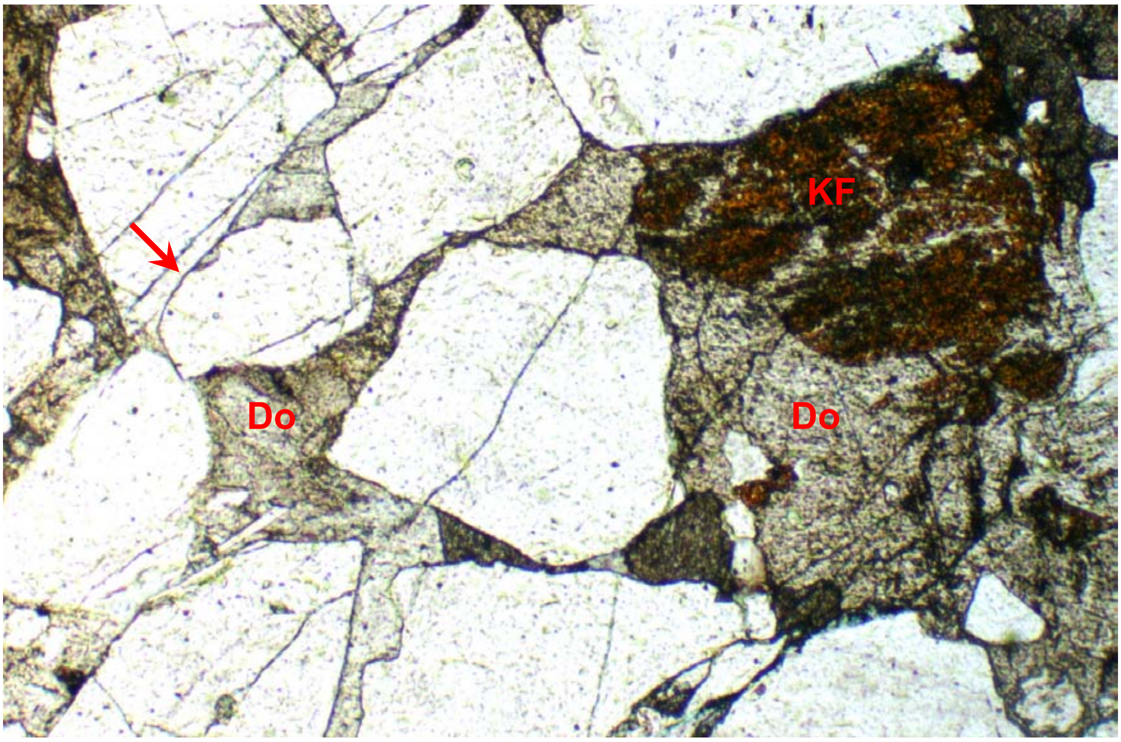
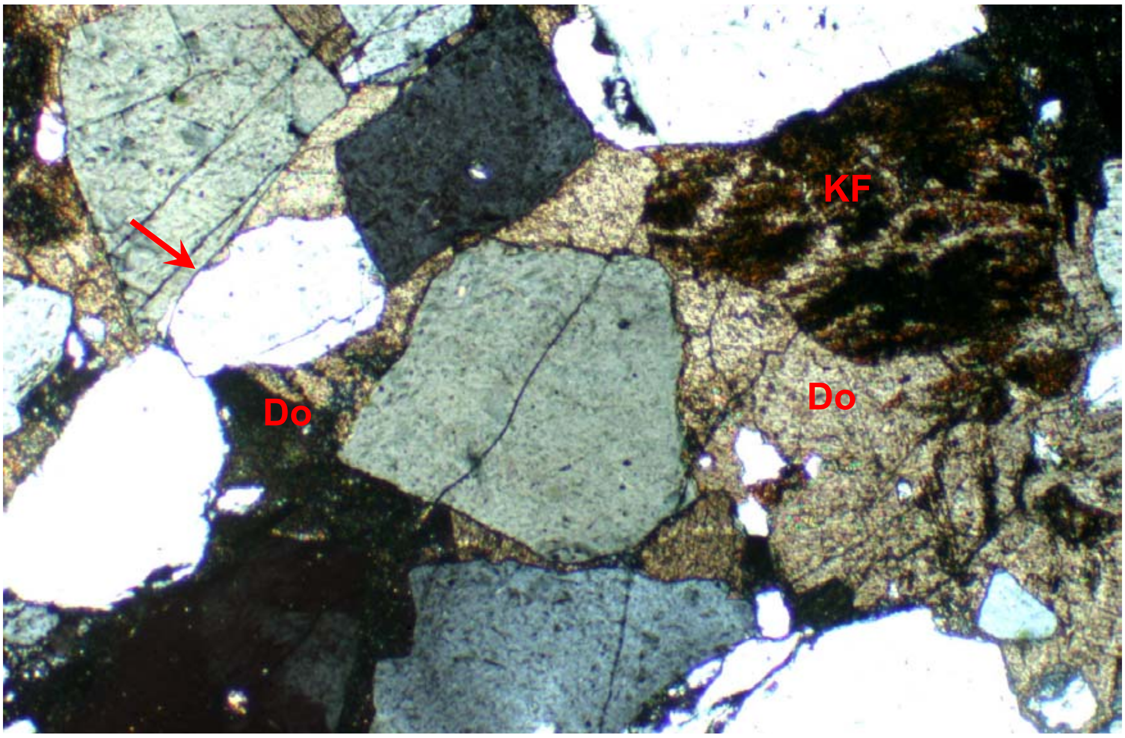


FIGURE 1 Plane polarised light
FIGURE 2 Crossed polarisers

0.4 mm



Coarse grained sandstone. Do = dolomite cement; KF = K-feldspar (stained brown); arrow = welded grain contact between quartz grains resulting from grain contact dissolution. (Thin-section micrographs)

PLATE 5 #26A 2937.26m

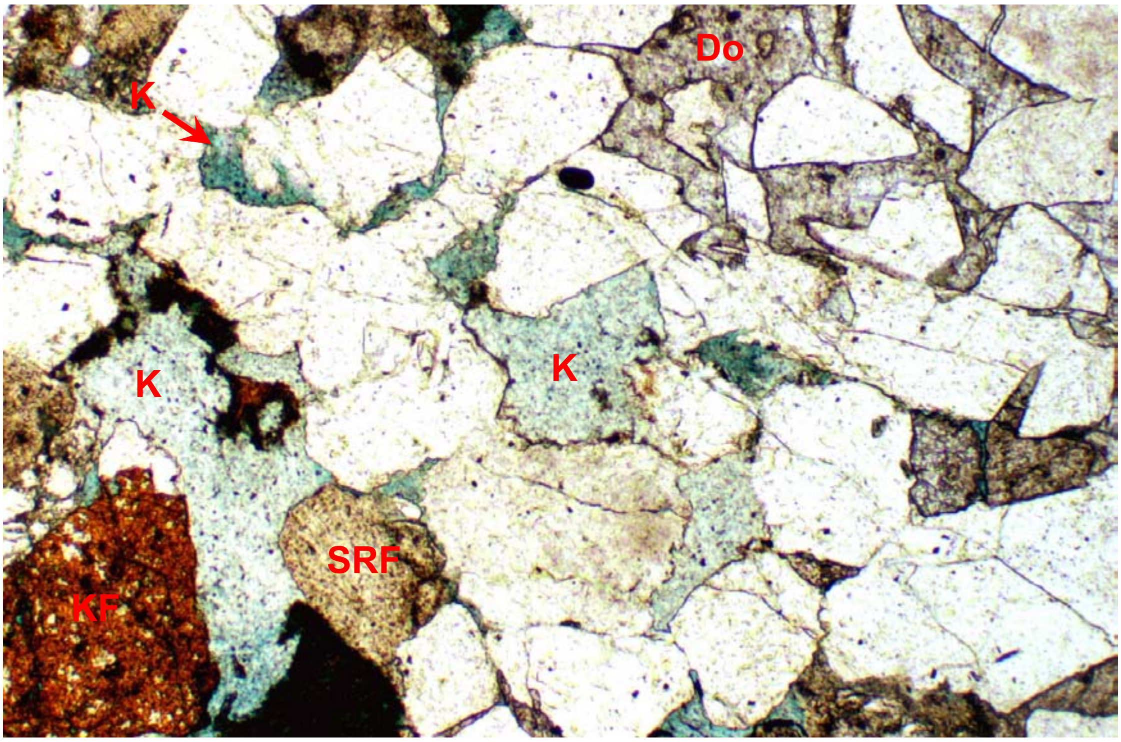
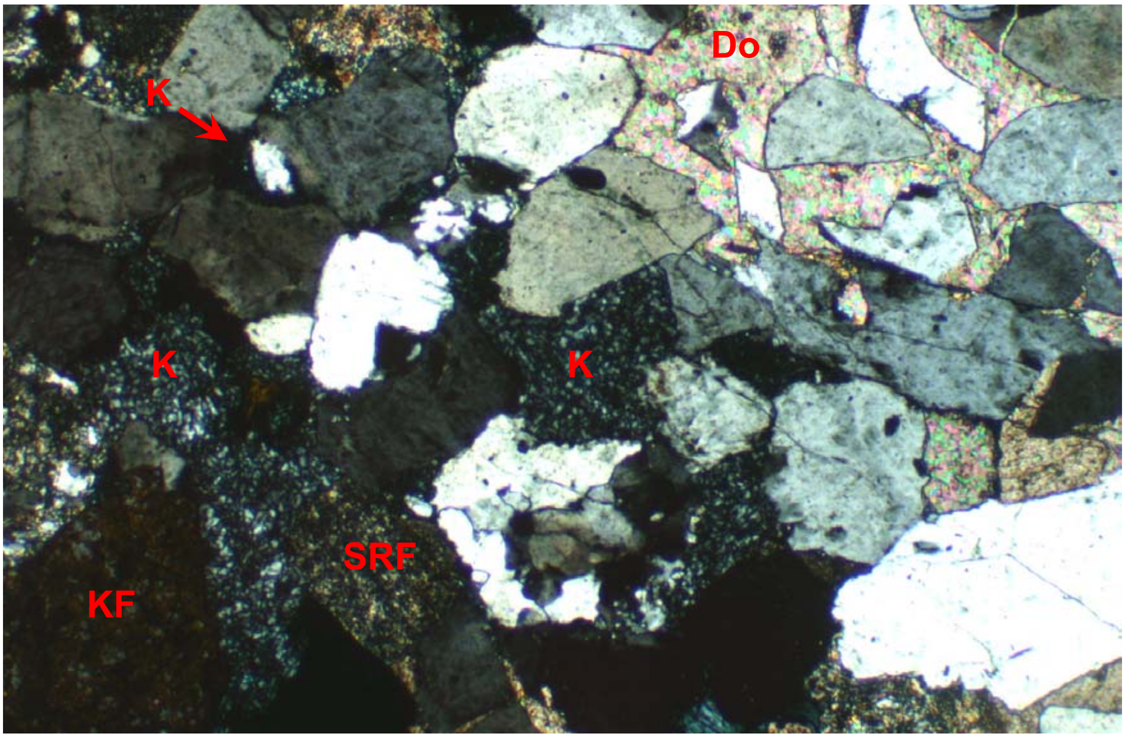


FIGURE 1 Plane polarised light
FIGURE 2 Crossed polarisers

0.4 mm



Coarse grained sandstone. Do = dolomite cement; K = microporous (as shown by blue hue) authigenic kaolin; KF = K-feldspar (stained brown); SRF = argillaceous sedimentary rock fragment. (Thin-section micrographs)

PLATE 6 #34A 2939.27m

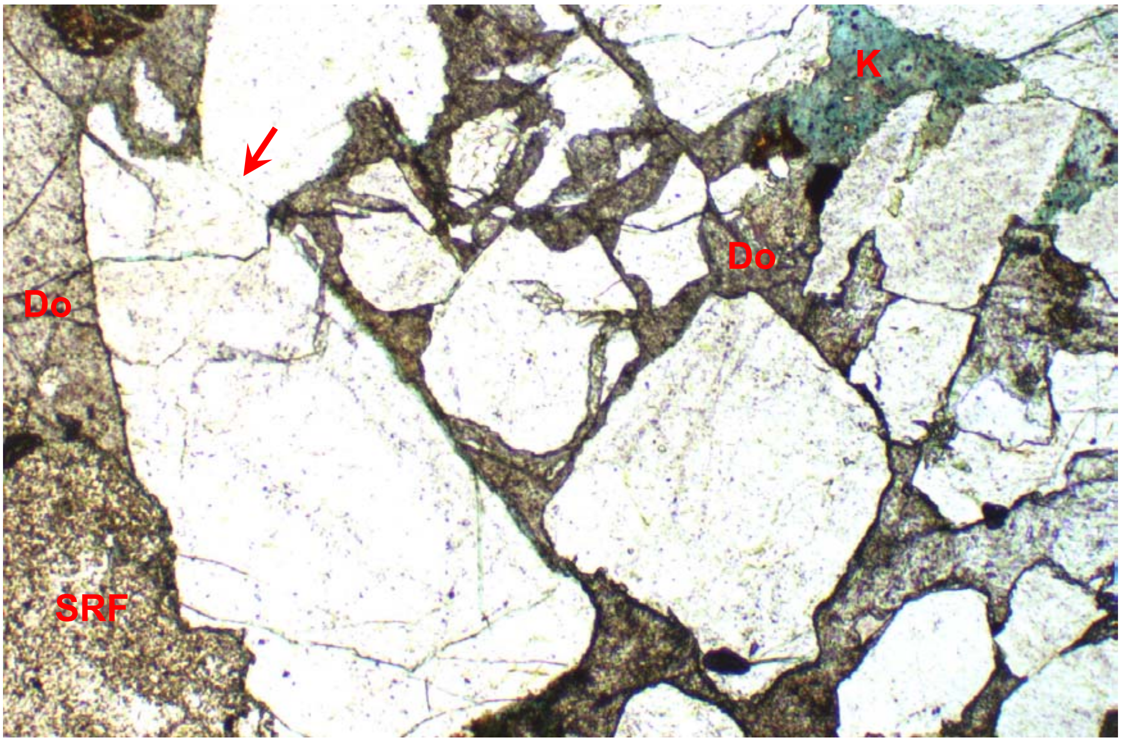
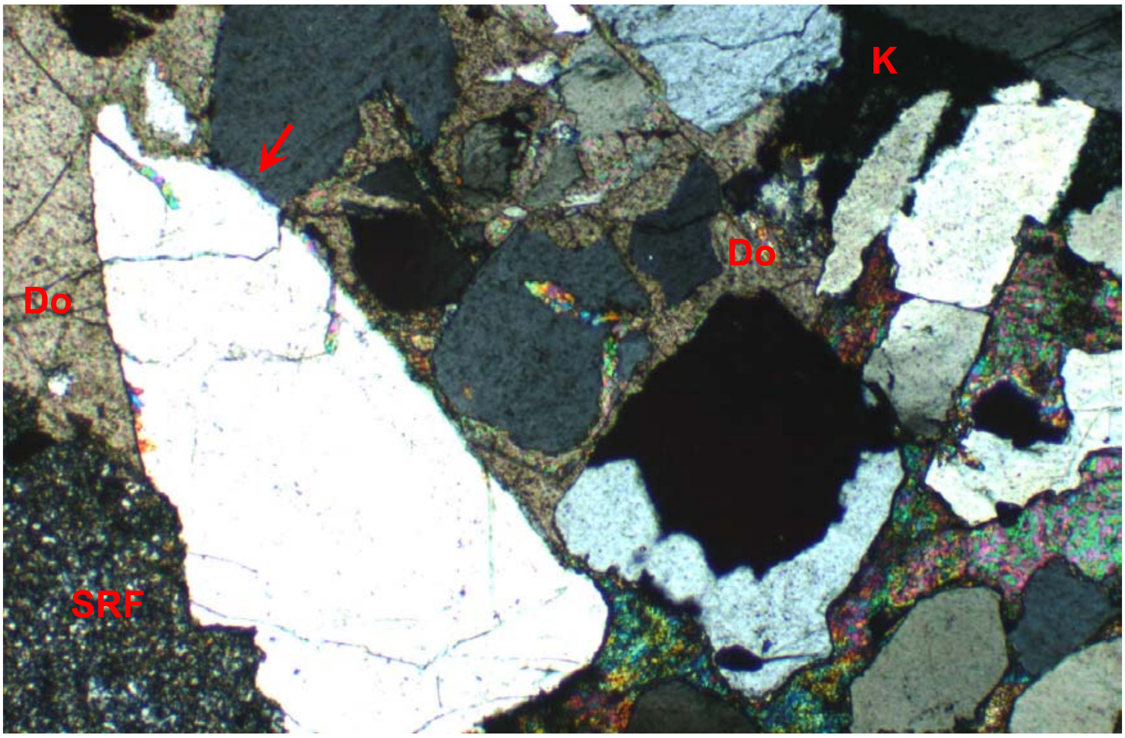


FIGURE 1 Plane polarised light
FIGURE 2 Crossed polarisers

0.4 mm



Very coarse grained sandstone. Do = dolomite cement; K = microporous (as shown by blue hue) authigenic kaolin; SRF = argillaceous sedimentary rock fragment; arrow = welded grain contact between quartz grains resulting from grain contact dissolution. (Thin-section micrographs)

PLATE 7 #48A 2942.78m

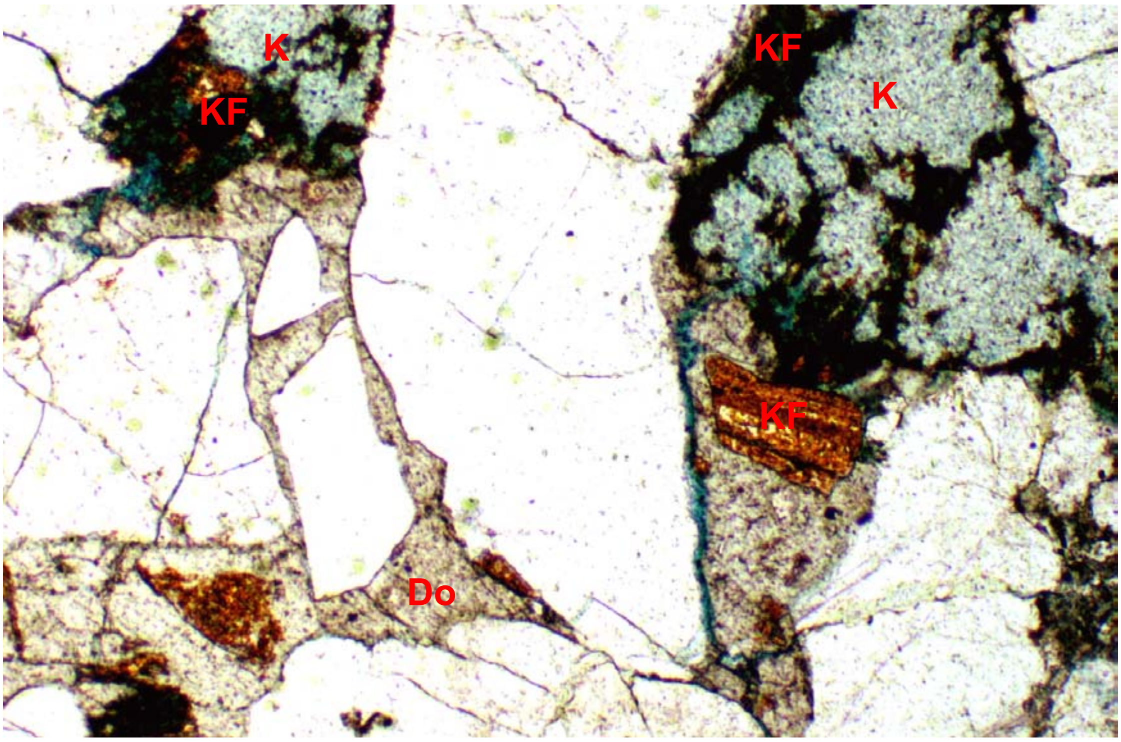
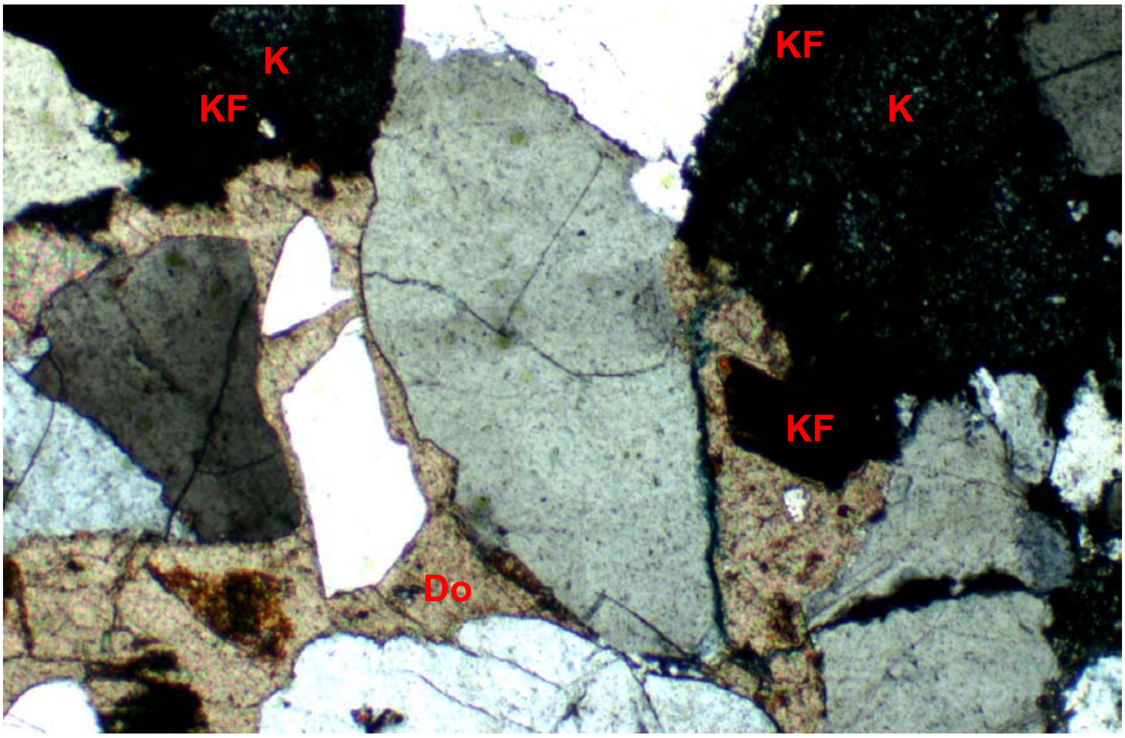


FIGURE 1 Plane polarised light
FIGURE 2 Crossed polarisers

0.4 mm



Coarse grained sandstone. Do = dolomite cement; K = microporous (as shown by blue hue) authigenic kaolin formed by K-feldspar alteration; KF = K-feldspar (stained brown). (Thin-section micrographs)

PLATE 8 #49A 2943.05m

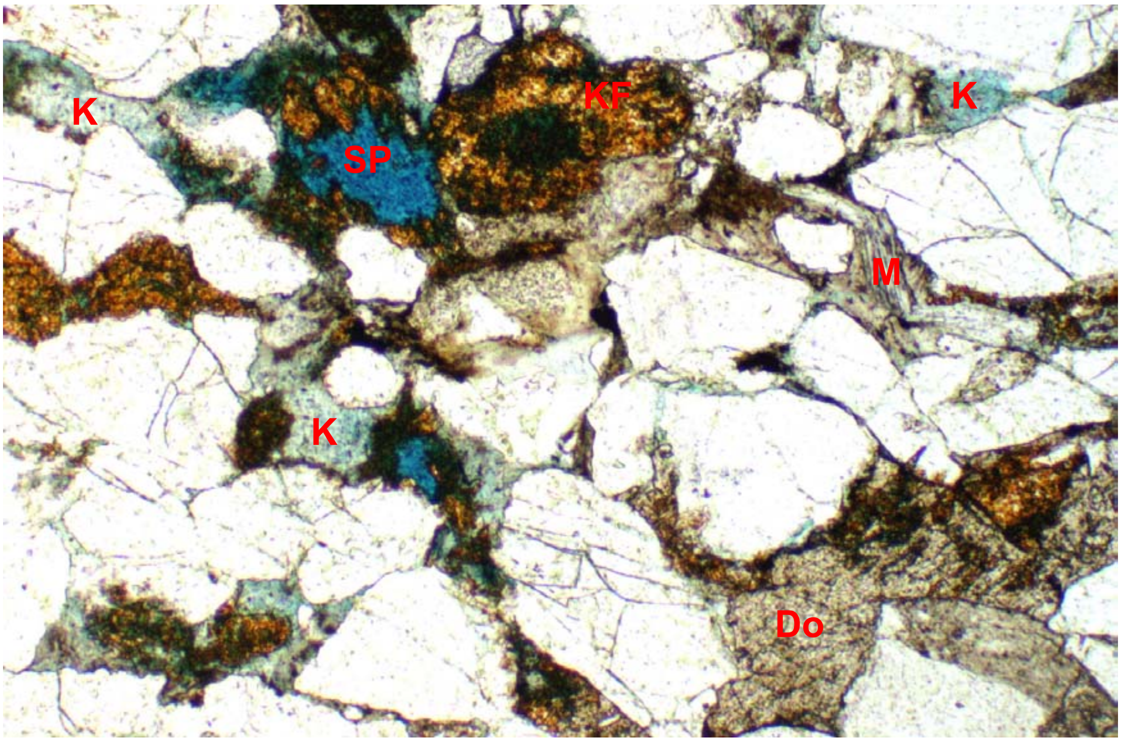
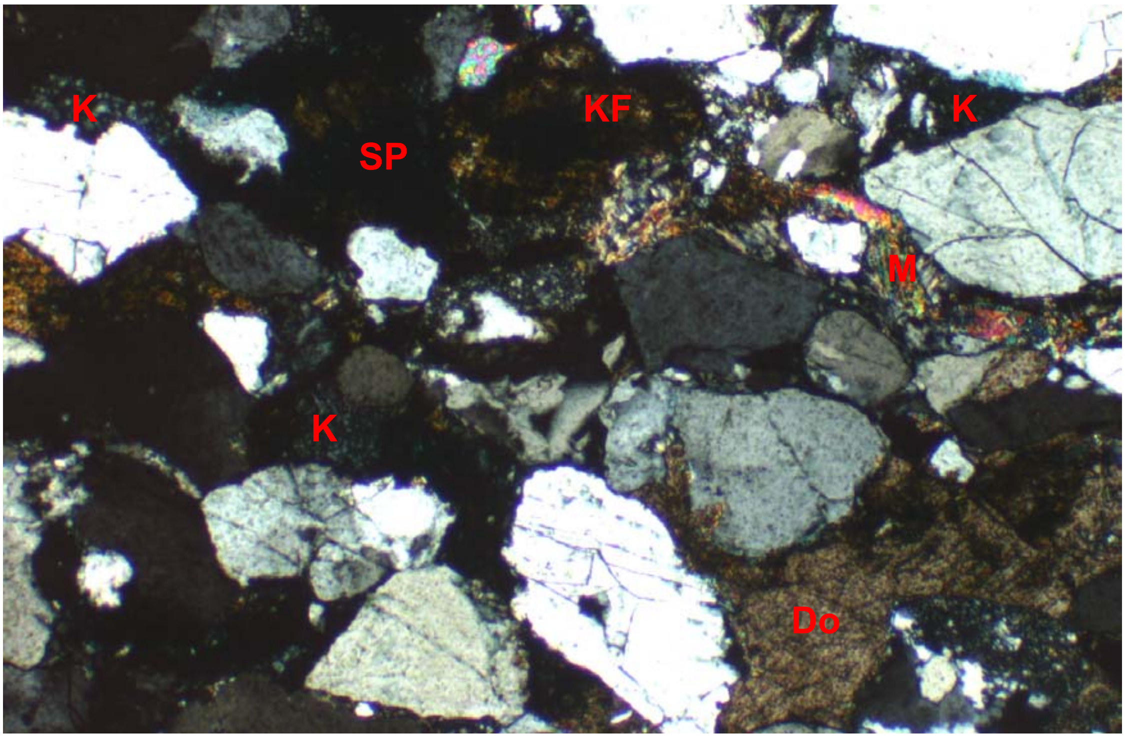


FIGURE 1 Plane polarised light
FIGURE 2 Crossed polarisers

0.4 mm



Coarse grained sandstone. Do = dolomite cement; K = microporous (as shown by blue hue) authigenic kaolin; KF = K-feldspar (stained brown); M = mica; SP = isolated secondary K-feldspar dissolution pore. (Thin-section micrographs)

PLATE 9 #55A 2944.52m

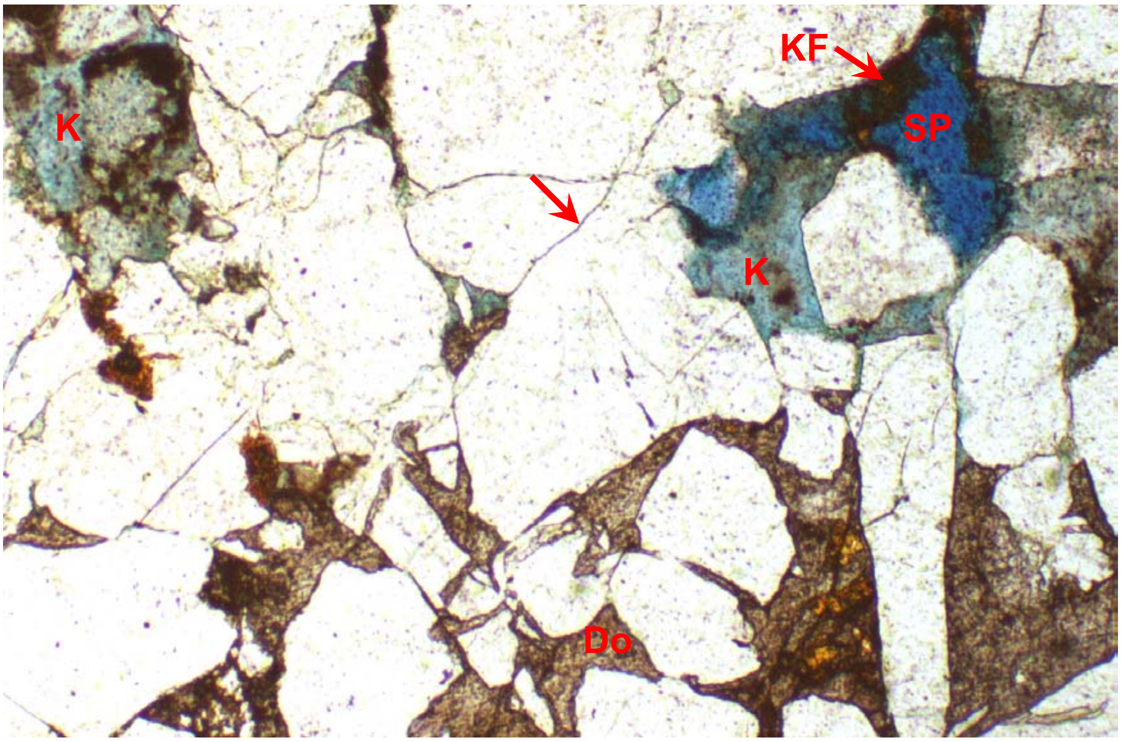
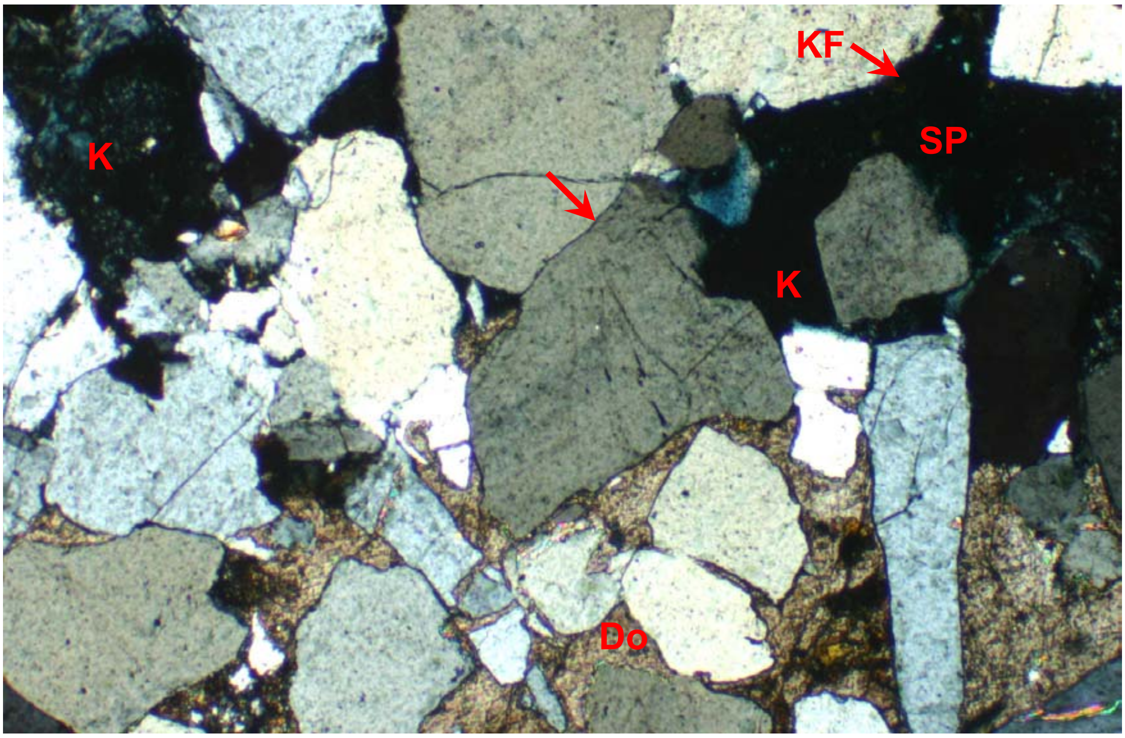


FIGURE 1 Plane polarised light
FIGURE 2 Crossed polarisers

0.4 mm



Coarse grained sandstone. Do = dolomite cement; K = microporous (as shown by blue hue) authigenic kaolin; KF = K-feldspar (stained brown); SP = isolated secondary K-feldspar dissolution pore; arrow = welded grain contact between quartz grains resulting from grain contact dissolution. (Thin-section micrographs)

PLATE 10 #72A 2948.77m

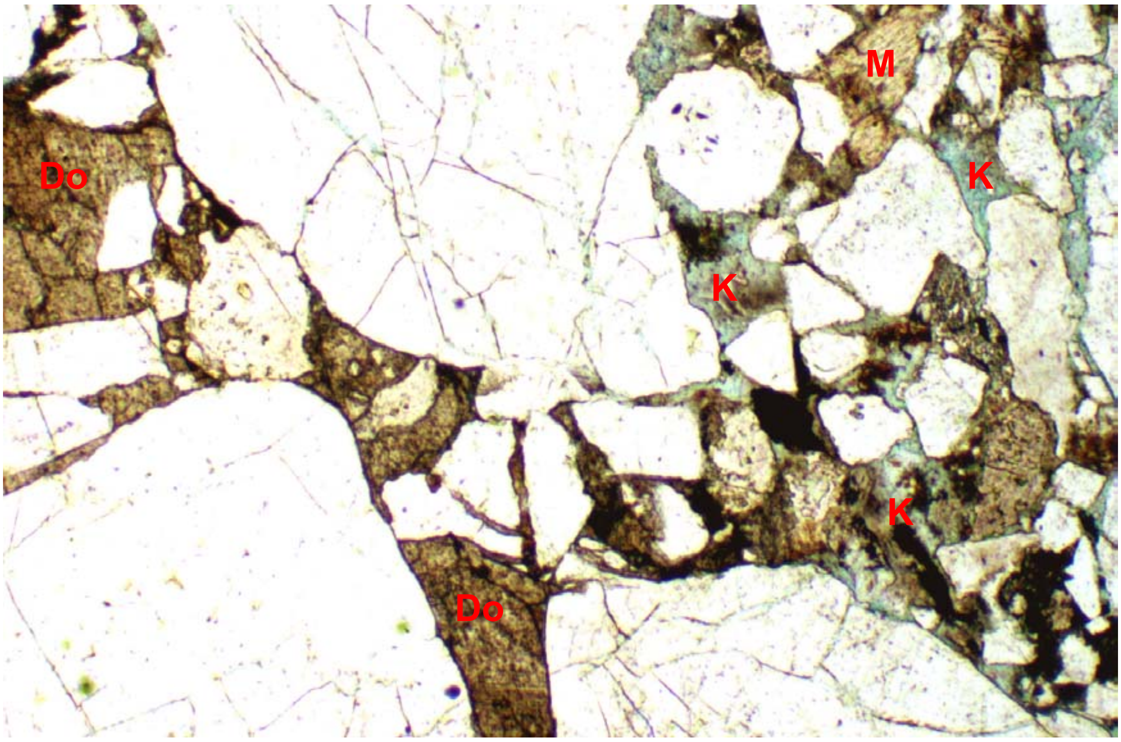
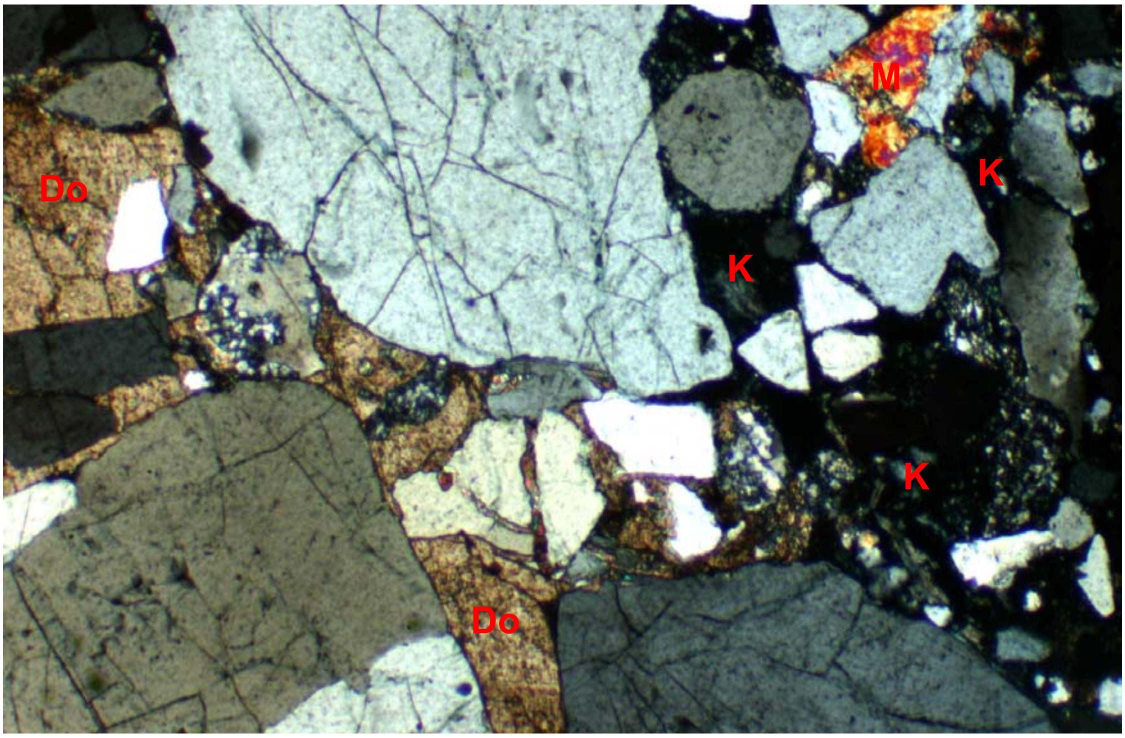


FIGURE 1 Plane polarised light
FIGURE 2 Crossed polarisers

0.4 mm



Very coarse grained sandstone. Do = dolomite cement; K = microporous (as shown by blue hue) authigenic kaolin; M = mica. (Thin-section micrographs)

 Weatherford Laboratories (Australia) Pty Ltd
ABN: 81 008 273 005

APPENDIX V

ABBREVIATIONS

ABBREVIATIONS for CORE PROPERTIES

a	Intercept (assumed = 1)
A	Sample Cross Sectional Area (cm^2)
ABPc	Air-Brine Capillary Pressure
Amb	Ambient Conditions (No Overburden Pressure)
B	Equivalent Conductance of Clay Exchange Cations ($mho/m.cm^2.meq^{-1}$)
β	Beta Factor (ft^{-1})
BF	Basic Flood
BHN	Brinell Hardness Number (kg/mm^2)
BP	Barometric Pressure (atm)
CEC	Cation Exchange Capacity (meq/100g dry sample)
Cent	Centrifuge
Co	Conductivity of Fully Brine Saturated Sample (mho/m)
cP	Centipoise
Cw	Conductivity of Brine (mho/m)
Dr	Drainage (i.e. draining of the wetting fluid - usually brine)
Φ	Porosity
FF	Formation Factor
*FF**	Shaly Sand Equivalent Formation Factor
g	grams
HeInj	Helium Injection
HgInj	Mercury Injection Capillary Pressure
Imb	Imbibition (i.e. imbibition of the wetting fluid - usually brine)
K	Permeability (mD)
Ka	Air Permeability (mD)
Keg	Effective Permeability to Gas (mD)
Keo	Effective Permeability to Oil (mD)
Kew	Effective Permeability to Water (mD)
Kg	Gas Permeability (mD)
KgKo	Gas-Oil Relative Permeability

KgKw	Gas-Water Relative Permeability
Klink or Kl	Klinkenberg Permeability (mD)
Ko	Oil Permeability (mD)
Krg	Relative Gas Permeability
Kro	Relative Oil Permeability
Krw	Relative Water Permeability
Kw	Brine Permeability (mD)
KwKo	Oil-Water Relative Permeability
L	Sample Length (cm)
m	Cementation Factor
*m**	Shaly Sand Equivalent Cementation Factor
mD	milliDarcy's
n	Saturation Exponent
*n**	Shaly Sand Equivalent Saturation Exponent
OB	Overburden Pressure (psig)
OBPc	Oil-Brine Capillary Pressure
P	Pressure (psi)
Pc	Capillary Pressure (psig)
PP	Porous Plate
PvComp	Pore Volume Compressibility
PVR	Pore Volume Reduction (cm^3)
ρ	Density (g/cm^3)
q	Flow Rate (cm^3/s)
θ	Contact Angle (degrees)
Qv	Volume Concentration of Clay Exchange Cations (meq/cm^3)
r	Radius (cm)
Rc	Sample Resistance (ohm)
RCA	Routine Core Analysis
ResCon	Reservoir Conditions
RI	Resistivity Index

RICP	Resistivity Index & Capillary Pressure
Ro	Resistivity of Fully Brine Saturated Sample (ohm.m)
Rt	Resistivity of Partially Saturated Sample (ohm.m)
Rw	Resistivity of Brine (ohm.m)
S	Saturation
s	Seconds
SCA	Special Core Analysis
Sg	Gas Saturation
Sgr	Residual Gas Saturation
SngPt	Single Point
So	Oil Saturation
Sor	Irreducible Oil Saturation (or Residual Oil Saturation)
SS	Steady State
Sw	Brine Saturation
Swi	Initial Water Saturation
Swir	Irreducible Water Saturation
Swr	Residual Water Saturation
T	Temperature (^{o}C)
USS	Unsteady State
μ	Viscosity (cP)
Vb	Bulk Volume (cm^3)
Vg	Grain Volume (cm^3)
Vp	Pore Volume (cm^3)
ω	Angular Velocity (rad/s)
Wett	Wettability
Wt	Weight (g)