CORE ANALYSIS FINAL REPORT
of
VARIOUS WELLS
for
PETROFRONTIER CORP
by
WEATHERFORD LABORATORIES (AUSTRALIA) PTY LTD
23rd June, 2011

PetroFrontier Corp
Level 30, 91 King William Street
ADELAIDE SA 5000

Attention: Erik Vik

FINAL REPORT: 0508-02

MATERIAL: Slabbed Core

LOCALITY: Baldwin-1, MacIntyre-1, Hunt-1, Owen-2, Hacking-1, Lucy-1 and Ross-1

WORK REQUIRED: Core Analysis

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

Kevin Flynn
General Manager
SCAL Technical Director

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CHAPTER 1

INTRODUCTION
1. INTRODUCTION

This final report presents the results from a core analysis study of selected sections of core from Baldwin-1, MacIntyre-1, Hunt-1, Owen-2, Hacking-1, Lucy-1 and Ross-1. The samples utilised were retrieved from the Northern Territory core storage facility in Alice Springs. Weatherford personnel travelled to Alice Springs from 22nd September to 23rd September 2010 and 1st October to 2nd October to retrieve core samples. On 16th January 2011 a Geologist travelled to Alice Springs to perform spectral core gamma on selected core sections.

Following discussions between Rodinia Oil, PetroFrontier and Weatherford Laboratories, samples were selected for porosity, permeability, grain density, absolute grain density, thin section, X-ray diffraction, rock strength and Rock-Eval. On inspection of the samples they were deemed too small to perform rock strength analysis. The subsequent chapter contains descriptions of test procedures and test results. The Appendices includes the thin section and X-ray diffraction report.
CHAPTER 2

SAMPLE PREPARATION AND ANALYSIS

2.1 Test and Calculation Procedures
2. SAMPLE PREPARATION AND ANALYSIS

2.1 Test and Calculation Procedures

2.1.1 Spectral Core Gamma

The core was laid out according to depth markings and analysed using a GF Instruments portable gamma surveyor to measure potassium (K), gamma-equivalent uranium (eU) and gamma-equivalent thorium (eTh). The terms eU and eTh stand for ‘gamma-equivalent’ U and Th respectively and indicate that measurements are made of the gamma-ray emitting daughters of these two isotopes. Measurements were made on the core at 10cm increments. Due to the variations in the size of the core slab this has been recorded onto the core plot.

2.1.2 Sample Drilling and Preparation

Due to the size of the provided core section only a limited number of 1” diameter core samples were possible to be drilled from the provided core sections. A set of samples were selected for rock strength analysis but due to the limited amount of sample this was not possible. All samples were trimmed to suitable size and length using a diamond impregnated cutting blade.

2.1.3 Cleaning and Drying

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

2.1.4 Porosity

The non–fractured, clean and dry samples were sealed in a matrix cup and a known volume of helium at 100 psi reference pressure was introduced to the cup. From the resultant pressure the unknown volume, i.e. the grain volume, was calculated using Boyles Law.

The bulk volume of each sample was determined by Archimedes' Principle. The difference between the grain volume and the bulk volume is the pore volume. The porosity was calculated as the volume percentage of pore space with respect to the bulk volume.
\[ P_1 V_1 = P_2 V_2 \]
\[ P_1 V_r = P_2 (V_r + V_c - V_g) \]
\[ V_p = V_b - V_g \]

Ambient Porosity % = \( \frac{V_p}{V_b} \times 100\% \)

where
- \( P_1 \) = initial pressure (psig)
- \( P_2 \) = final pressure (psig)
- \( V_r \) = reference cell volume (cm\(^3\))
- \( V_c \) = matrix cup volume (cm\(^3\))
- \( V_g \) = grain volume (cm\(^3\))
- \( V_p \) = pore volume (cm\(^3\))
- \( V_b \) = bulk volume (cm\(^3\))

2.1.5 Permeability

Due to the irregular nature of the ¼ HQ core sections each section needed to be trimmed and mounted in a resin block. This allows the samples to be mounted into the hassler cell that can only accommodate right cylinders. Only samples with a porosity of greater than 1.0% were selected for permeability.

The samples were placed in a Hassler cell at a confining pressure of 300 psig. This pressure was used to prevent bypassing of air around the sample when the measurement is made.

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

\[
K_a = \frac{2000 \cdot BP \cdot \mu \cdot q \cdot L}{(P_1^2 - P_2^2) \cdot A}
\]

where
- \( K_a \) = air permeability (milliDarcy's)
- \( BP \) = barometric pressure (atmospheres)
- \( \mu \) = gas viscosity (cP)
- \( q \) = flow rate (cm\(^3\)/s) at barometric pressure
- \( L \) = sample length (cm)
- \( P_1 \) = upstream pressure (atmospheres)
- \( P_2 \) = downstream pressure (atmospheres)
- \( A \) = sample cross sectional area (cm\(^2\))
2.1.6 Apparent Grain Density

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

\[ \rho = \frac{W_t}{V_g} \]

where
- \( \rho \) = grain density (g/cm^3)
- \( W_t \) = weight of sample (g)
- \( V_g \) = grain volume (cm^3)

2.1.7 Absolute Grain Density

Due to the possibility of occluded pores a selection of samples were crushed to grain size. The crushed sample was then placed into a matrix cup (as described in section 2.1.4) and grain volume determined. The absolute grain density was calculated by dividing the weight of the crushed sample by the grain volume determined.

\[ \rho = \frac{W_t}{V_g} \]

where
- \( \rho \) = grain density (g/cm^3)
- \( W_t \) = weight of sample (g)
- \( V_g \) = grain volume (cm^3)

2.1.8 Rock-Eval

TOC and pyrolysis analysis (commonly referred to as RockEval™ pyrolysis) are the two most common analysis methods for evaluating the quantity and type of organic material present in rocks.

TOC is determined by combustion. Carbonates were removed from the selected samples with hydrochloric acid before combustion. TOC analyses were then run in a Leco carbon analyzer which combusts a 140-mg sample of powdered rock at 1,300 °F in the presence of a large excess of oxygen. All organic carbon is converted to carbon dioxide which is trapped within the instrument and released into a detector once combustion is complete. The amount of carbon dioxide measured is proportional to the total organic carbon content.

Pyrolysis mimics the natural hydrocarbon generation process that occurs over geologic time frames at much lower temperatures. Roughly 50 to 100 mg of sample were heated slowly in the absence of oxygen from 300 °C to 550 °C. Exclusion of oxygen insures that only thermal decomposition reactions occur.
During heating, the first volume of hydrocarbon is released when heated at a temperature of 300 °C for three minutes. These hydrocarbons are analogous to solvent-extractible bitumen. The hydrocarbon volume was monitored by a detector and a peak referred to as S1 is recorded. High S1 values indicate large volumes of bitumen in an active source rock or the presence of migrated hydrocarbons.

The temperature is then increased by 25 °C per minute to a maximum of 600 °C. A second volume of produced hydrocarbon is referred to as S2 and represents the hydrocarbon volume generated by thermal decomposition of kerogen. S2 is the most important indicator of the present-day ability of the kerogen to generate hydrocarbons. The temperature at which the S2 peak occurred is referred to as Tmax. Tmax may not be reliable when S2 is less than about 0.2 mg/g.

Carbon dioxide is also released from the kerogen during pyrolysis and recorded by the CO2 detector as a peak referred to as S3 in the temperature range of 300 to 390°C. The amount of carbon dioxide released is generally believed to be related to the oxygen content of the kerogen. High oxygen content is considered a negative indicator of source rock potential.

In summary, the four parameters obtained from pyrolysis are as follows.

1. S1: bitumen content of the source rock, mg per gram of rock,
2. S2: future hydrocarbon generating potential of the source rock, mg per gram of rock
3. S3: CO2 generated by thermal decomposition, mg per gram of rock, and
4. Tmax: the temperature at which maximum hydrocarbon generation occurs, °C.

These four parameters were evaluated to determine the thermal maturity and source rock characteristics of the organic material. Waples1 defines three source rock types.

1. Effective source rock: any sedimentary rock that has already generated and expelled hydrocarbons.

2. Possible source rock: any sedimentary rock whose source potential has not been evaluated but may have generated and expelled hydrocarbons.

3. Potential source rock: any immature sedimentary rock known to be capable of generating and expelling hydrocarbons if the level of thermal maturity were greater.

Kerogen type and thermal maturation are characterized by two indices: the hydrogen index, (HI) and the oxygen index (OI).

---

\[ HI = \frac{S2}{w_{toc}} \]

\[ OI = \frac{S3}{w_{toc}} \]

where:

- **HI**: hydrogen index, mg of hydrocarbons per gram of total organic carbon
- **OI**: oxygen index, mg of CO\(_2\) per gram of total organic carbon
- **\( w_{toc} \)**: total organic carbon, weight fraction

Type I kerogen is mainly aliphatic in nature and is derived from fresh water algal lipids (usually lacustrine in origin) and can have very high oil or gas generating potential. Type II kerogen is predominately naphthenic in nature and is usually formed from marine organic matter (plankton) in an oxygen-free environment. The oil generating potential of Type II kerogen is high although less than for Type I. Type III kerogen is mainly aromatic in nature and is formed by decomposition of terrestrial plants. This type of kerogen is similar to vitrinite in humic coals. The oil generating potential of Type III kerogen is low and the gas generated is primarily methane. Type IV kerogen is essentially inert carbon and has no oil or gas generating potential. As thermal maturity increases, one cannot determine the source of the organic material as all merge together in the Type IV category.

Besides the HI and OI values, there are other combinations of the raw pyrolysis data that are useful. Kerogen is converted to bitumen during hydrocarbon generation. At greater maturity, the S2 values decrease while the S1 values increase. The ratio of S1 to the sum of S1 and S2 is referred to as the production index (PI) or transformation ratio defined by:

\[ PI = \frac{S1}{S1 + S2} \]

This ratio increases with increasing maturity to a point. When the thermal maturity progresses further into the gas window, S1 will decrease as the bitumen is converted to gas. Until S1 is converted to gas, the guideline for estimating thermal maturity from the production index is as follows. These numbers are dimensionless.

- **PI < 0.08**: immature
- **0.08 \( \leq \) PI \( \leq \) 0.50**: oil window
- **PI > 0.5**: gas window

Thermal maturation can be related to Tmax, which often increases with depth. Tmax is also dependent on kerogen type which can cause Tmax values to not increase with depth as expected. Therefore, isolated Tmax values are not considered representative. The thermal maturity is classified as follows.

- **400 °C \( \leq \) Tmax < 430 °C**: immature
- **430 °C \( \leq \) Tmax < 470 °C**: potential source rock for oil;
Tmax $\geq 470 \, ^{\circ}C$  

potential source rock for gas

Adding the S1 and S2 parameters yields a useful parameter for source rock potential. The evaluation guidelines are as follows:

- S1+S2 $> 6$ mg/g: good potential source rock for oil
- $2$ mg/g $\leq$ S1+S2 $\leq 6$ mg/g: moderate potential source rock for oil
- S1 $< 2$ mg/g: poor potential source rock for oil, greater source rock potential for gas
CHAPTER 2

SAMPLE PREPARATION AND ANALYSIS

2.2 Test Results

2.2.1 Spectral Core Gamma
Client: PetroFrontier Corp.
Well: Baldwin-1
Core Gamma
API Units
Dose Rate
Rolling Average

Depth (m)

Thermium ppm
Uranium ppm
Potassium Percent
Core Size HQ
Core Slab Size

CORE PLOT
Client: PetroFrontier Corp.
Well: Macintyre-1

Core Gamma
API Units
Dose Rate
Rolling Average

Depth (m)

Thorium ppm
Uranium ppm
Potassium Percent
Core Size HQ
Core Slab Size

CORE PLOT
Client: PetroFrontier Corp.
Well: Macintyre-1

Core Gamma
API Units

Dose Rate
Rolling Average

Thorium
Th
Uranium
U
Potassium
K
Core Size
HQ
Core Slab Size

Depth (m)

CORE PLOT
Client: PetroFrontier Corp.
Well: Hunt-1

Core Gamma
API Units
Dose Rate
Rolling Average

Core Size
HQ

Thorium
ppm
Uranium
ppm
Potassium
Percent
Core Slab Size

Depth (m)
Client: PetroFrontier Corp.
Well: Hunt-1

Core Gamma
API Units
Dose Rate
Rolling Average

Thorium ppm
Uranium ppm
Potassium Percent

Core Size
HQ

Core Slab Size

CORE PLOT

Depth (m)

0 10 20 30 40
0 5 10 15 20 0 5 10 15 20
0 1 0.2 0.3 0.4
0 0.5 1 1.5 2 2.5 3 3.5 4 4.5

0 1/4 1/2 3/4 1

350
355
360
365
370
375
380
385
390
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CHAPTER 2

SAMPLE PREPARATION AND ANALYSIS

2.2 Test Results

2.2.2 Ambeint Base Parameters
**CORE ANALYSIS REPORT**

**Client**: PetroFrontier Corp.  
**Date**: 29/04/2011  
**Well**: Baldwin-1  
**File**: 0508-02  
**Analysts**: lw, kw, as, cm

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Only samples with porosity greater than 1.0% were selected for Permeability Analysis.  
All samples required resination before permeability analysis.  
Due to size of ¼ slab core, all permeability samples have a length < diameter.
**CORE ANALYSIS REPORT**

Client: PetroFrontier Corp.  
Well: MacIntyre-1  
Date: 29/04/2011  
File: 0508-02  
Analysts: lw, kw, as, cm

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Only samples with porosity greater than 1.0% were selected for Permeability  
All samples required resination before permeability analysis  
Due to size of ¼ slab core, all permeability samples have a length < diameter
**CORE ANALYSIS REPORT**

Client: PetroFrontier Corp.  
Well: Hunt-1  
Date: 29/04/2011  
File: 0508-02  
Analysts: lw, kw, as, cm

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Only samples with porosity greater than 1.0% were selected for Permeability  
All samples required resination before permeability analysis  
Due to size of $\frac{1}{4}$ slab core, all permeability samples have a length $< $ diameter
### CORE ANALYSIS REPORT

Client: PetroFrontier Corp.  
Well: Owen-2  
Date: 29/04/2011  
File: 0508-02  
Analysts: AS

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Only samples with porosity greater than 1.0% were selected for Permeability  
All samples required resination before permeability analysis  
Due to size of ¼ slab core, all permeability samples have a length < diameter
# CORE ANALYSIS REPORT

**Client**: PetroFrontier Corp.  
**Well**: Hacking-1  
**Date**: 29/04/2011  
**File**: 0508-02  
**Analysts**: JC, AS

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<th>Permeability to Air (mD)</th>
<th>Remarks</th>
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Only samples with porosity greater than 1.0% were selected for Permeability analysis. All samples required resination before permeability analysis. Due to size of ¼ slab core, all permeability samples have a length < diameter.
# CORE ANALYSIS REPORT

**Client**: PetroFrontier Corp.  
**Well**: Lucy-1  
**Date**: 29/04/2011  
**File**: 0508-02  
**Analysts**: JC, AS

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All samples were 1" diameter core plugs  
Due to size of ¼ slab core, all permeability samples have a length < diameter
**CORE ANALYSIS REPORT**

**Client**: PetroFrontier Corp.  
**Date**: 29/04/2011  
**Well**: Ross-1  
**File**: 0508-02  
**Analysts**: JC, AS

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Only samples with porosity greater than 1.0% were selected for Permeability  
All samples required resination before permeability analysis  
Due to size of ¼ slab core, all permeability samples have a length < diameter
CHAPTER 2

SAMPLE PREPARATION AND ANALYSIS

2.2 Test Results

2.2.3 Absolute Grain Density
# ABSOLUTE GRAIN DENSITY

Client: PetroFrontier Corp.  
Well: Baldwin-1  
Date: 25/02/2011  
File: 0508-02  
Analysts: as

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<th>Absolute Grain Density (g/cm³)</th>
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CHAPTER 2
SAMPLE PREPARATION AND ANALYSIS

2.2 Test Results

2.2.4 Rock-Eval
# ROCK-EVAL PYROLYSIS & TOTAL ORGANIC CARBON REPORT

**Client**  PetroFrontier Corp.

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<th>S2-HC Generating Potential</th>
<th>S3-Organic Carbon Dioxide</th>
<th>S1 + S2-Potential Yield</th>
<th>P1-Production Index</th>
<th>PC-Pryolysized Carbon</th>
<th>HI-Hydrogen Index</th>
<th>OI-Oxygen Index</th>
<th>Total Organic Carbon</th>
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HYDROGEN INDIx vs Tmax

Client  PetroFrontier Corp.
Well    Owen-2 and Baldwin-1

---

0
100
200
300
400
500
600
700
800
900
1000

380 400 420 440 460 480 500 520

Hydrogen Index

Tmax ° C

III

I

VR = 1.35%

VR = 0.5%

Owen-2 1063.6m
Baldwin-1 882.0m
PETROLOGY REPORT

of

BALDWIN-1, MACINTYRE-1 and OWEN-2

for

PETROFRONTIER CORP

by

WEATHERFORD LABORATORIES (AUSTRALIA) PTY LTD
29th April, 2011

PetroFrontier (Australia) Pty Ltd
Level 30, 91 King William Street
ADELAIDE SA 5000

Attention: Erik Vik

PETROLOGY REPORT - 0508-02

MATERIAL: Core Sections
LOCALITY: Baldwin-1, MacIntyre-1 and Owen-2
WORK REQUIRED: Thin Section and X-Ray Diffraction Analysis

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

KEVIN FLYNN
General Manager
SCAL Technical Director

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PETROLOGICAL ANALYSIS OF
SAMPLES FROM THE BALDWIN-1, MACINTYRE-1
AND OWEN-2 WELLS

A report prepared for

Weatherford Laboratories Ltd

by

BRIAN G. JONES Ph.D.

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1. **INTRODUCTION**

A petrological study was carried out on three core samples from the Baldwin-1 and MacIntyre-1 wells. The prime purpose of the study was to describe composition, texture and porosity of the three samples. Nine samples were also analysed for mineralogical composition using quantitative X-ray diffraction analysis from the Baldwin-1, MacIntyre-1 and Owen-2 wells.

2. **ANALYTICAL PROGRAM**

2.1 **Thin-Section Analysis**

Thin-sections were cut in water and impregnated with blue-dyed epoxy resin to aid porosity recognition. Mineral composition and visible porosity were estimated and described for each thin-section.

2.2 **X-Ray Diffraction Analysis**

Bulk-rock X-ray diffraction (XRD) analysis was carried out on nine samples in order to determine qualitative mineral abundance from the Baldwin-1, MacIntyre-1 and Owen-2 wells. The XRD analysis used a finely ground whole rock powder sample. Traces and UPDSM processing techniques were used to determine mineral presence. Quantification of the XRD trace was carried out using SIROQUANT software.

3. **THIN-SECTION DESCRIPTIONS**

3.1 **Baldwin-1 #21 437.2 m**

Massive recrystallised carbonate with a few joints partly filled with coarse euhedral spar carbonate (Figs 1 & 2).

No framework grains (apart from one partially dissolved micritic grain) could be detected in this sample although scattered rounded finer crystalline ghosts possibly represent original micritic grains. No ghosts of fossil material were detected. In part of the thin section the recrystallised carbonate appears slightly cloudy which possibly represents original slightly clayey micrite (Fig. 1).

Recrystallisation has affected almost the entire sample. However crystal size is irregular with some patches having 0.01 mm crystals that pass gradationally into larger areas with an average crystal size of 0.05 mm (Fig. 2). These inturn pass into an irregular network of coarser recrystallised carbonate with crystals commonly up to 0.2 mm. Almost all these small to large size crystals are anhedral. Most of the smaller crystals are cloudy suggesting an original fine grained carbonate (Fig. 2) whereas some of the larger crystals are clear as though they have grown into primary or secondary voids (Fig. 1).
The sample has been fractured with a number of partly open joints (Fig. 1). These joints are characterised by the presence of large (0.25 mm) euhedral dolomite crystals growing out from the sides of the joints. Many of these crystals show zoned crystal growth suggesting slow precipitation of carbonate cement in the joints (and probably slow water movement; Fig. 2).

Porosity is sparse in this sample and is mainly associated with the partly open joints (Fig. 1). These joints may be interconnected in 3D but the large zoned crystals suggest little overall in situ permeability. Within the recrystallised portion of the sample porosity is rare and isolated (Fig. 2). Rare pores produced by dissolution are present in the very fine micritic portions of the sample. A few small pores are also present in the coarser recrystallised portions where they may represent the remains of voids. Total porosity is about 2% but permeability is probably very low apart from along some of the joints.
Figure 1. Photomicrographs from Baldwin-1 #21 showing recrystallised dolomite with large zoned crystals adjacent to an open porous joint. The surrounding carbonate is cloudy suggesting recrystallisation replacing a fine micritic matrix.
Figure 2. Photomicrographs from Baldwin-I #21 showing recrystallised dolomite with a patchy development of larger crystals that may reflect crystallisation in large secondary pores.
3.2 Baldwin-1 #23  879.55 m

Recrystallised carbonate containing abundant small phosphatic nodules.

A characteristic feature of this sample is the common occurrence of small phosphatic nodules (~30%) fairly uniformly spaced throughout the sample. These nodules range in size from about 0.03 mm to 0.1 mm for the more equant nodules. These nodules appear to have replaced or grown around a clayey micritic carbonate. However, a significant number of nodules that enclose shell fragments are elongate and up to 0.3 mm long (very rare to 0.7 mm). Many of the shell fragments are very thin shelled. The larger shell fragments are roughly aligned which may indicate original bedding. One of the small fossil fragments is infilled with chert. The phosphatic material appears to be almost amorphous cellophane with its typical yellowish brown colour and isotropic character. Very rare silt-size quartz and feldspar grains are present as a trace component scattered through the sample.

The matrix consists of uniform finely crystalline carbonate with an average crystal size of <0.01 mm. The matrix contains no secondary porosity.

Porosity is very low (<0.5%) in this sample and is confined to partial dissolution of the centres of some of the phosphatic nodules. The pores are all isolated and the sample would have very low permeability.
Figure 3. Photomicrographs from Baldwin-1 #23 showing phosphatised (collophane or fluorapatite) fossil and pelletal material set in a finely crystalline carbonate matrix. Calcite is the dominant carbonate with only minor recrystallisation to dolomite.
Figure 4. Photomicrographs from Baldwin-1 #23 showing phosphatised (collophane or fluorapatite) fossil and pelletal material set in a finely crystalline carbonate matrix. Calcite is the dominant carbonate with only minor recrystallisation to dolomite. Minor secondary porosity caused by dissolution of collophane.
3.3 MacIntyre-1 #27 638.5 m

Massive recrystallised carbonate with scattered large voids partly filled with coarse euhedral spar carbonate (Fig. 5).

No framework grains could be detected in this sample and it all consists of crystalline carbonate (Fig. 6). Very rare small angular quartz silt is scattered through the section. Possible traces of clay occur in small patches of finer crystalline carbonate.

Recrystallisation has affected almost the entire sample. However crystal size ranges from 0.02 mm to 0.25 mm crystals generally with gradational boundaries between coarser and finer crystalline patches (Figs 5 & 6). Most of the crystals are anhedral but the larger crystals adjacent to voids are clear and some are euhedral (Fig. 5). This suggests that the larger crystals may have grown into primary or secondary voids. Compositional zoning in the carbonate crystals was not observed.

Porosity is present in about 10% of this sample but has a patchy distribution. The majority of the porosity is secondary (Fig. 5) and in one place appears to be due to dissolution of a micritic grain. However most of the pores are not related to any distinctive feature in the rock and they have irregular outlines that do not appear to follow any structural trend. The pores are currently isolated but some may be interconnected in 3D. The lack of zoned crystals suggests little in situ permeability and changes in water chemistry during the precipitation of the carbonate crystals (Fig. 5).
Figure 5. Photomicrographs from MacIntyre-1 #27 showing recrystallised dolomite with large clear dolomite crystals adjacent to the large open secondary pores. The clear crystals suggest little change in water chemistry during their growth.
Figure 6. Photomicrographs from MacIntyre-1 #27 showing recrystallised dolomite with a patchy development of larger crystals that may reflect crystallisation in large secondary pores. A few small secondary pores are still visible.
4. **X-RAY DIFFRACTION ANALYSES**

**Table 1**

<table>
<thead>
<tr>
<th>Well</th>
<th>Sample</th>
<th>Depth (m)</th>
<th>Chi square</th>
<th>Quartz</th>
<th>Calcite</th>
<th>Dolomite</th>
<th>Ankerite</th>
<th>Albite</th>
<th>Orthoclase</th>
<th>Illite</th>
<th>Kaolinite</th>
<th>Chlorite</th>
<th>Apatite, hydoxy</th>
<th>Apatite, fluor,</th>
<th>Pyrite</th>
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<td>Baldwin-1</td>
<td>#21</td>
<td>437.2</td>
<td>4.39</td>
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<td>0.3</td>
<td>99.4</td>
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<td></td>
<td></td>
<td>0.1</td>
<td>0.2</td>
<td>0.5</td>
<td>0.2</td>
<td>0.1</td>
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<tr>
<td>Baldwin-1</td>
<td>#23</td>
<td>879.55</td>
<td>3.32</td>
<td>1.5</td>
<td>80.1</td>
<td>2.1</td>
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<td></td>
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<td></td>
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<td>1.7</td>
<td>15.3</td>
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<td>5.28</td>
<td>0.6</td>
<td>0.5</td>
<td>98.1</td>
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<td>2.1</td>
<td>0.6</td>
<td>15.3</td>
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<td>6.51</td>
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<td>99.5</td>
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<td>0.2</td>
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Figure 7a  Baldwin-1 #21 437.2m

Bulk rock

Counts

Degrees 2-theta

0 50 100 150 200 250 300 350 400 450 500 550 600 650 700

D D D D D D

Q
Figure 7b  Baldwin-1 #23 879.55m
Bulk rock
Figure 7c  Baldwin-1 #25 891.2m

Bulk rock

Counts vs. Degrees 2-theta
Figure 8a  MacIntyre-1 #27 638.5m

Bulk rock

Counts

Degrees 2-theta

0 10 20 30 40 50 60 70

D D D D D D D D D D D D D D D D D

Q
Figure 8b

MacIntyre-1 #28 804.65m

Bulk rock

Counts

Degrees 2-theta

Q  D  F  Q  C  F  D  C  F  D  D  D  D  D  D

0  50  100  150  200  250  300  350  400  450  500  550  600  650  700
Figure 8c  

MacIntyre-1 #29 807.5m  

Bulk rock  

Counts  

Degrees 2-theta
Figure 8d  MacIntyre-1 #30 808.95m
Bulk rock
Figure 9a  **Owen-2 #19 1063.6m**

Bulk rock

Counts

Degrees 2-theta

0 10 20 30 40 50 60 70

0 100 200 300 400 500 600 700 800 900 1000
Figure 9b  Owen-2 #21 1065.55m

Bulk rock

Counts vs. Degrees 2-theta
APPENDIX II

EQUIPMENT SCHEMATICS
SOXHLET CLEANING APPARATUS

Condensor

Cap

Vapour Tube

Syphon Tube

Body Containing Samples

Flask Containing Solvent

Heating Mantle
POROSIMETER SCHEMATIC

P1.V1 (reference) = P2.V2 (sample)
GAS PERMEAMETER SCHEMATIC (Hassler)

End Cap

Fixed End Platen

Regulated Supply of Air

Rubber Sleeve

Confining Pressure and Vacuum Port

Hassler Cell

Sample

Differential Pressure Transducer

Moveable End Platen

Flow Meter