# HYDROCARBON SOURCE-ROCK EVALUATION

FOR

PANCONTINENTAL PETROLEUM LTD

WELL: WALLABY-1

AMADEUS BASIN

AUSTRALIA

**ONSHORE**

Geochemical Services

24A LIM TECK BOO ROAD, SINGAPORE 1953 • 2821222 • RS21423

12 November 1981

**CORE LABORATORIES**
Geochemical Services

Mr. John D. Gorter
PanContinental Petroleum Ltd
50, Bridge Street
Sydney, NSW 2000
AUSTRALIA.

Subject: Hydrocarbon Source-Rock Evaluation
Well: Wallaby-1
Amadeus Basin
Australia
Our File No. GCS 81096

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Dear Mr. Gorter,

The following report contains the results of our source-rock evaluation of the forty-one (41) samples from the Wallaby No. 1 well. In general, the samples lacked sufficient organic richness to justify further analysis beyond total organic carbon (TOC) screening. Two samples, however, were above the 0.20 percent TOC level we discussed as a cut-off for Rock-Eval Pyrolysis and were analyzed.

We appreciate the opportunity to be of service to PanContinental Petroleum Ltd. Should you have any questions concerning these data and/or interpretation, please do not hesitate to contact us.

Yours very truly
CORE LABORATORIES INTERNATIONAL LTD

D. Kirk Cromer

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Manager - Geochemical Services
Eastern Hemisphere

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# INTERPRETATION

## I. SUMMARY

The forty (40) cutting samples and one core piece from the PanContinental Petroleum Ltd. Wallaby No. 1 well were subjected to standard geochemical techniques for evaluation of hydrocarbon source potential. Data from these analyses were used to determine the capacity of these sediments to generate liquid and/or gaseous hydrocarbons.

These forty-one (41) well samples consisted primarily of siltstone and limestone. Lesser amounts of dolomite, shale and sandstone are also present. (Table 1)

In general, the hydrocarbon source potential for the Wallaby No. 1 well is very poor. The mean total organic carbon (TOC) content of the analyzed samples is 0.08 percent. The TOC values range from a low of 0.01 percent to a high of 0.41 percent.

Rock-Eval Pyrolysis were run on two (2) samples (3910-3920 feet and 5920-5930 feet) to provide general indications of thermal maturity and kerogen type. The pyrolysis Tmax values indicate these sediments to be thermally immature. The Hydrogen and Oxygen Indices indicate the kerogen present is gas prone. Even if thermally mature, these sediments would not generate significant quantities of hydrocarbons due to their being organic lean.

## II. ANALYTICAL PROCEDURES

### SAMPLE PREPARATION

Cutting samples are thoroughly washed to remove drilling mud, and if necessary, are placed in a solvent to float off contaminants, such as coals or drilling additives. The samples are then air-dried and are examined under binocular microscope to remove any remaining contaminants. A magnet is used to remove any metal which may be present. The outside surface of sidewall and conventional core samples is removed and then the samples are thoroughly washed with water and allowed to air dry.

### LITHOLOGY

The lithology of each sample is examined under a binocular microscope. All obvious cave material is removed and the sample submitted for total organic carbon analysis. The description includes an examination for migrated hydrocarbons under ultraviolet light.

### TOTAL ORGANIC CARBON ANALYSIS (TOC)

Total organic carbon analysis measures the organic richness of a rock in weight percent organic carbon. Organic richness is the first requirement for an oil or gas source rock. The analysis is also used as a screening technique to determine which samples merit more detailed analysis. The dried rock samples are pulverized and treated with hot and cold hydrochloric acid to remove carbonates (inorganic carbon). After acid treatment, the organic carbon content is determined by combustion of the sample in a Leco WR-12 Carbon Analyzer. Blanks, standards and duplicates are routinely run to insure highly reliable results.

## ROCK-EVAL PYROLYSIS

The Rock-Eval Instrument provides a rapid (25 min./sample) source rock analysis on a small (90 - 130mg) sample of rock by heating over a temperature range of 250°C - 550°C. This analysis quickly evaluates the concentration of volatile or soluble organic matter, the amount of pyrolyzable organic matter, thermal maturity, and the oxygen content of the kerogen. The results identify possible source and reservoir intervals on which more detailed analyses may be performed.

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Table 1

Geochemical Data Summary

| | Depth (ft) | Lithology | TOC (wt.%) | H Index | Tmax |
|---|---|---|---|---|---|
| Goyder Fm. | 2380-2390 | Sandstone | 0.08/0.09 | | |
| | 2400-2410 | Shale | 0.10 | | |
| | 2430-2440 | Siltstone | 0.09 | | |
| | 2440-2450 | Siltstone | 0.09 | | |
| | 2540-2550 | Sandstone | 0.07 | | |
| | 2550-2560 | Siltstone/Sandstone | 0.08 | | |
| | 2580-2590 | Sandstone | 0.07 | | |
| | 2820-2830 | Sandstone | 0.07 | | |
| Shannon Fm. | 3030-3040 | Limestone | 0.04/0.03 | | |
| | 3150-3160 | Limestone | 0.06 | | |
| | 3160-3170 | Limestone | 0.06 | | |
| | 3230-3240 | Limestone | 0.07 | | |
| | 3240-3250 | Limestone | 0.06 | | |
| | 3250-3280 | Limestone | 0.05 | | |
| | 3280-3310 | Limestone/Siltstone | 0.07 | | |
| | 3310-3340 | Limestone | 0.06 | | |

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Geochemical Data Summary

| | Depth (ft) | Lithology | TOC (wt.%) | H Index | Tmax |
|---|---|---|---|---|---|
| Shannon Fm. | 3340-3370 | Limestone | 0.07/0.06 | | |
| | 3370-3400 | Limestone | 0.08 | | |
| | 3400-3430 | Limestone/Siltstone | 0.06 | | |
| | 3430-3460 | Limestone/Siltstone | 0.04 | | |
| | 3460-3490 | Limestone/Siltstone | 0.04 | | |
| | 3490-3520 | Limestone | 0.05 | | |
| Hugh R. Shale | 3520-3550 | Limestone/Siltstone | 0.06 | | |
| | 3550-3600 | Limestone | 0.07 | | |
| | 3600-3650 | Limestone | 0.06 | | |
| | 3700-3750 | Limestone | 0.06 | | |
| | 3800-3850 | Limestone | 0.11/0.08 | | |
| | 3850-3900 | Limestone/Siltstone | 0.10 | | |
| | 3910-3920 | Siltstone | 0.21 | 2.4 | 391 |
| | 4040-4050 | Siltstone | 0.07 | | |
| Gibbs CR Fm. | 4980-5000 | Siltstone | 0.04 | | |
| | 5080-5090 | Siltstone | 0.08 | | |

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Table 1

Geochemical Data Summary

| | Depth (ft) | Lithology | TOC (wt.%) | H Index | Tmax |
|---|---|---|---|---|---|
| Giles CR Dm. | 5115' 9" | Shale | 0.04 | | |
| | 5190-5200 | Shale | 0.06 | | |
| | 5240-5250 | Dolomite/Siltstone | 0.03/0.04 | | |
| | 5320-5350 | Dolomite | 0.02 | | |
| | 5350-5370 | Dolomite | 0.15 | | |
| | 5840-5850 | Dolomite | 0.07 | | |
| Chandler LS? | 5920-5930 | Limestone | 0.40/0.41 | 134.1 | 414 |
| Arundel SS | 6610-6640 | Siltstone | 0.01 | | |

Table 2

Total Organic Carbon Results and Gross Lithologic Descriptions

| Depth (ft) | Sample Type | Gross Lithologic Description | TOC* (wt %) |
|---|---|---|---|
| 2380-2390 | ctgs | 70% Ss: wh, lt gy, vf gn, sub ang-sub rnd, w srtd, fri, sl calc<br>20% Dol: gy pk, mod pk, vf-mic xln, ahrl, frm<br>10% Sltst: m-m dk gy, gy rd, n calc, occ cl incl, sft<br>Tr: gyp | 0.08/0.09 |
| 2400-2410 | ctgs | 80% Sh: m dk-dk gy, n calc, mica, slty, sft<br>20% Dol: gy pk, mod pk, vf-mic xln, ahrl, frm<br>Pres: ss<br>Tr: lst, gyp | 0.10 |
| 2430-2440 | ctgs | 70% Sltst: grn gy, brn gy, m gy, n calc, sl dol, occ mica, occ carb, p ind<br>30% Dol: lt gy, vf-mic xln, ahrl, frm<br>Pres: ss<br>Tr: gyp | 0.09 |
| 2440-2450 | ctgs | 90% Sltst: gy rd, grn gy, n calc, sl dol, mica, p-mod ind<br>10% Dol: lt gy, vf-mic xln, ahrl, frm | 0.09 |
| 2540-2550 | ctgs | 80% Ss: wh-v lt gy, vf gn, ang-sub ang, w srtd, fri, cmtd w/dol<br>20% Sltst: gy rd, grn gy, n calc, sl dol, mica, p-mod ind<br>Tr: dol | 0.07 |
| 2550-2560 | ctgs | 50% Sltst: gy rd, grn gy, n calc, sl dol, mica, p-mod ind<br>50% Ss: wh-v lt gy, vf gn, ang-sub ang, w srtd, fri, cmtd w/dol<br>Tr: gyp, dol | 0.08 |

* TOC = Total Organic Carbon

Table 2

Total Organic Carbon Results and Gross Lithologic Descriptions

| Depth (ft) | Sample Type | Gross Lithologic Description | TOC* (wt %) |
|---|---|---|---|
| 2580-2590 | ctgs | 70% Ss: wh-v lt gy, vf gn, ang-sub ang, w srtd, fri, cmtd w/dol<br>30% Sltst: gy rd, grn gy, n calc, sl dol, mica, p-mod ind<br>Tr: dol, gyp | 0.07 |
| 2820-2830 | ctgs | 80% Ss: wh-v lt gy, vf gn, ang-sub ang, w srtd, fri, cmtd w/dol<br>20% Sltst: gy rd, grn gy, n calc, sl dol, mica, p-mod ind<br>Pres: dol | 0.07 |
| 3030-3040 | ctgs | 80% Ls: wh, v lt gy, mic xln, p-mod ind<br>20% Sltst: m-m dk gy, n calc, occ sl carb, mica, p-mod ind<br>Tr: dol | 0.04/0.03 |
| 3150-3160 | ctgs | 70% Ls: wh, v lt gy, mic xln, p-mod ind<br>30% Sltst: m-m dk gy, n calc, occ sl carb, mica, p-mod ind | 0.06 |
| 3160-3170 | ctgs | 90% Ls: wh, v lt gy, mic xln, p-mod ind<br>10% Sltst: m-m dk gy, n calc, occ sl carb, mica, p-mod ind | 0.06 |
| 3230-3240 | ctgs | 90% Ls: wh, v lt gy, mic xln, p-mod ind<br>10% Sltst: m-m dk gy, n calc, occ sl carb, mica, p-mod ind | 0.07 |
| 3240-3250 | ctgs | 90% Ls: wh, v lt gy, mic xln, p-mod ind<br>10% Sltst: m dk gy, n calc, occ mica, p-mod ind<br>Tr: ss | 0.06 |

* TOC = Total Organic Carbon

Table 2

Total Organic Carbon Results and Gross Lithologic Descriptions

| Depth (ft) | Sample Type | Gross Lithologic Description | TOC* (wt %) |
|---|---|---|---|
| 3250-3280 | ctgs | 80% Ls: wh, v lt gy, mic xln, p-mod ind<br>20% Sltst: gy rd, n calc, sl dol, occ mica, p-mod ind<br>Tr: gyp | 0.05 |
| 3280-3310 | ctgs | 60% Ls: wh, v lt gy, mic xln, p-mod ind<br>40% Sltst: gy rd, m dk gy, n calc, sl dol, occ mica, p-mod ind | 0.07 |
| 3310-3340 | ctgs | 80% Ls: wh, v lt gy, mic xln, p-mod ind<br>20% Sltst: gy rd, m dk gy, n calc, sl dol, occ mica, p-mod ind | 0.06 |
| 3340-3370 | ctgs | 90% Ls: wh, v lt gy, mic xln, p-mod ind<br>10% Sltst: gy rd, m dk gy, n calc, sl dol, occ mica, p-mod ind<br>Tr: gyp | 0.07/0.06 |
| 3370-3400 | ctgs | 70% Ls: wh, v lt gy, mic xln, p-mod ind<br>30% Sltst: m gy, gy rd, n calc, occ mica, p-mod ind | 0.08 |
| 3400-3430 | ctgs | 60% Ls: wh, v lt gy, mic xln, p-mod ind<br>40% Sltst: m gy, gy rd, n calc, occ mica, p-mod ind | 0.06 |
| 3430-3460 | ctgs | 60% Sltst: m gy, gy rd, n calc, occ mica, p-mod ind<br>40% Ls: wh, v lt gy, mic xln, p-mod ind | 0.04 |

* TOC = Total Organic Carbon

Table 2

Total Organic Carbon Results and Gross Lithologic Descriptions

| Depth (ft) | Sample Type | Gross Lithologic Description | TOC* (wt %) |
|---|---|---|---|
| 3460-3490 | ctgs | 60% Sltst: m gy, gy rd, n calc, occ mica, p-mod ind<br>40% Ls: wh, v lt gy, mic xln, p-mod ind | 0.04 |
| 3490-3520 | ctgs | 80% Ls: wh, v lt gy, mic xln, p-mod ind<br>20% Sltst: m gy, gy rd, n calc, occ mica, p-mod ind | 0.05 |
| 3520-3550 | ctgs | 60% Sltst: m-m dk gy, gy rd, n calc, sl dolc, occ mica, p-mod ind<br>40% Ls: wh, v lt gy, mic xln, p-mod ind<br>Pres: calct<br>Tr: sh | 0.06 |
| 3550-3600 | ctgs | 70% Ls: wh, v lt gy, mic xln, p-mod ind<br>30% Sltst: m-m dk gy, gy rd, n calc, sl dolc, occ mica, p-mod ind<br>Pres: calct | 0.07 |
| 3600-3650 | ctgs | 70% Ls: wh, v lt gy, mic xln, p-mod ind<br>30% Sltst: m-m dk gy, gy rd, n calc, sl dolc, occ mica, p-mod ind<br>Pres: calct | 0.06 |
| 3700-3750 | ctgs | 80% Ls: wh, v lt gy, mic xln, fe ox stn, p-mod ind<br>20% Sltst: m-m dk gy, gy rd, n calc, sl dolc, occ mica, p-mod ind<br>Tr: sh, calct | 0.06 |

* TOC = Total Organic Carbon

Table 2

Total Organic Carbon Results and Gross Lithologic Descriptions

| Depth (ft) | Sample Type | Gross Lithologic Description | TOC* (wt %) |
|---|---|---|---|
| 3800-3850 | ctgs | 70% Ls: wh, v lt gy, mic xln, fe ox stn, p-mod ind<br>30% Sltst: m-m dk gy, gy rd, n calc, sl dolc, occ mica, p-mod ind<br>Tr: sh, calct | 0.11/0.08 |
| 3850-3900 | ctgs | 50% Ls: wh, v lt gy, mic xln, p-mod ind<br>40% Sltst: brn gy, m gy, n calc, sl dolc, occ sl mica, p ind<br>10% Sh: dk gy, n calc, mica, sft, fss | 0.10 |
| 3910-3920 | ctgs | 80% Sltst: brn gy, m gy, n calc, sl dolc, occ sl mica, p ind<br>20% Ls: wh, v lt gy, mic xln, p-mod ind<br>Pres: sh | 0.21 |
| 4040-4050 | ctgs | 90% Sltst: brn gy, sl calc, dolc, occ mica, p ind<br>10% Ls: wh, v lt gy, mic xln, p-mod ind | 0.07 |
| 4980-5000 | ctgs | 80% Sltst: brn gy, m lt gy, sl calc, dolc, occ mica, p ind<br>20% Dol: wh, lt gy, mic xln, ahrl, sl calc, sft-frm | 0.04 |
| 5080-5090 | ctgs | 70% Sltst: m gy-m dk gy, brn gy, n calc, occ carb?, p ind<br>30% Dol: wh, lt gy, mic xln, ahrl, sl calc, sft-frm<br>Tr: ls | 0.08 |

* TOC = Total Organic Carbon

Table 2

Total Organic Carbon Results and Gross Lithologic Descriptions

| Depth (ft) | Sample Type | Gross Lithologic Description | TOC* (wt %) |
|---|---|---|---|
| 5115' 9" | Core | Sh: m dk-dk gy, n calc, sl dolc, mica, frm, fss | 0.04 |
| 5190-5200 | ctgs | 80% Sh: m dk-dk gy, n calc, sl dolc, mica, frm, fss<br>20% Dol: wh, lt gy, mic xln, ahrl, sl calc, sft-frm<br>Tr: sltst<br>(fibre cntmn removed) | 0.06 |
| 5240-5250 | ctgs | 60% Dol: dk grn gy, wh, mic xln, p ind<br>40% Sltst: gy rd, n calc, p ind<br>Tr: sh, ls | 0.03/0.04 |
| 5320-5350 | ctgs | 60% Dol: dk grn gy, wh, mic xln, p ind<br>30% Sltst: gy rd, n calc, p ind<br>10% Sh: m dk-dk gy, n calc, sl dolc, mica, frm, fss | 0.02 |
| 5350-5370 | ctgs | 80% Dol: dk grn gy, wh, mic xln, p ind<br>20% Sh: m dk-dk gy, n calc, sl dolc, mica, frm, fss<br>Tr: sltst | 0.15 |
| 5840-5850 | ctgs | 90% Dol: dk grn gy, wh, mic xln, p ind<br>10% Sltst: gy rd, n calc, p ind<br>Tr: sh, ls | 0.07 |
| 5920-5930 | ctgs | Ls: lt brn, calclnt, slty, sl carb, p ind | 0.40/0.41 |
| 6610-6640 | ctgs | 90% Sltst: gy rd, lt gy, n calc, dolc, mica, p ind<br>10% Dol: wh, f xln, sdy, sl calc, fri<br>Tr: sh | 0.01 |

* TOC = Total Organic Carbon

Table 2

Total Organic Carbon Results and Gross Lithologic Descriptions

| Depth (ft) | Sample Type | Gross Lithologic Description | TOC* (wt %) |
|---|---|---|---|
| 6730-6760 | ctgs | 90% Sltst: gy rd, lt gy, n calc, dolc, mica, p ind<br>10% Dol: wh, f xln, sdy, sl calc, fri | 0.05 |

* TOC = Total Organic Carbon

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Table 3

Rock-Eval Pyrolysis

| Depth (ft) | TOC (wt.%) | mg/gm rock S1 | S2 | S3 | Hydrogen Index | Oxygen Index | Oil or Gas Shows | Oil & Gas Potential | Transformation Ratio | Tmax (°C) |
|---|---|---|---|---|---|---|---|---|---|---|
| 3910-3920 | 0.21 | 0.06 | 0.005 | 0.54 | 2.4 | 257.1 | 0.06 | 0.07 | 0.86 | 391 |
| 5920-5930 | 0.41 | 0.17 | 0.55 | 0.65 | 134.1 | 158.5 | 0.17 | 0.72 | 0.24 | 414 |