

# The Shell Company of Australia Limited

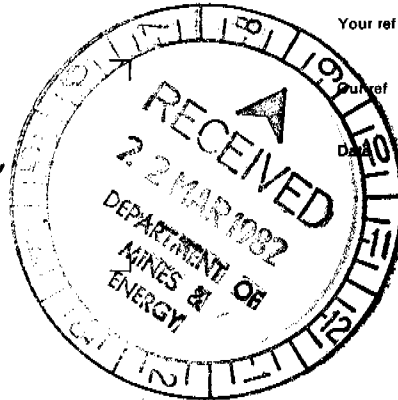
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The Chief Geologist,  
Geological Survey,  
Dept. of Mines and Energy,  
P.O. Box 2901,  
DARWIN. N.T. 5794



Dear Sir,

RE: DRILL CORE SAMPLING - GLYDE RIVER AREA


Please find attached copies of oil yield analyses and a report covering source rock properties of core samples collected from drill holes completed by Amoco in the Glyde River area.

Further assessment of the base metal potential of this area is currently in progress. Results of any work undertaken on additional samples obtained from the department as part of this programme will be forwarded to you when available.

We would also be happy to discuss this work with you anytime.

Yours faithfully,

FOR THE SHELL COMPANY OF AUSTRALIA LIMITED

  
N.J. CRASE  
SUPERVISING GEOLOGIST

DME LIBRARY

02 AUG 1995

SCANNED

CR 82/140

May 1981.

RKER 81.087

ANALYSIS OF SOURCE ROCK PROPERTIES  
OF SELECTED PROTEROZOIC CORE SAMPLES  
FROM THE GLYDE RIVER AREA, AUSTRALIA

by

P. IMMERZ

code: 774.103

Investigation

9.12.431

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**KONINKLIJKE SHELL/EXPLORATIE EN PRODUKTIE LABORATORIUM**

**RIJSWIJK, THE NETHERLANDS**

(Shell Research B.V.)

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Table I: Source rock properties

Table II: Maceral descriptions

## I INTRODUCTION

A source rock evaluation has been carried out on 17 selected Proterozoic core samples from several mineral bores in the Glyde River area, Northern Territory, Australia (see figures 1 and 2).

Source rock evaluation commonly comprises determination of:

1. the presence (or absence) of hydrocarbons source material in the rock samples;
2. the quality of the organic matter as well as the distribution of its specific constituents;
3. the degree of organic metamorphism (= level of maturity).

A source rock is identified by measuring the amount of temperature reactive ("live") organic matter present, i.e. the amount of organic matter that yields hydrocarbons upon pyrolysis. The method excludes any ("dead") organic matter such as inertinites.

In addition, the total organic carbon content can be determined which gives the sum of "live" and "dead" organic carbon. Rocks containing less than 0.5 % organic carbon are not considered to have a potential for commercial oil accumulations.

The source rock indications (SRI), which are a measure of the amount of pyrolysable organic matter, are determined on the original samples and in certain cases also after extraction with organic solvents. A systematically lower value after extraction is due to the presence of extractable hydrocarbons. These may consist of trapped oil, oil generated in situ by a source rock, or e.g. gasoil used in the drilling fluid.

In general, samples with source rock indications of 30 or less do not represent (immature or mature) source rocks. Values between 30 and 100 generally indicate marginal source rocks, while values above 100 commonly indicate good source rocks.

Intervals or samples with high source rock indications are investigated under a microscope to ensure that the high values indicate genuine source rock properties and are not due to contaminants of an<sup>in</sup> organic nature such as lost circulation material.

The quality of a source rock for oil/gas generation depends on the type of organic matter present. Five categories of organic matter can be distinguished, viz.: humic, mainly humic, mixed, mainly kerogenous, kerogenous. This classification

is based on the hydrogen content of the organic matter.

Source rocks with organic matter of kerogenous, mainly kerogenous and/or mixed type generate predominantly oil. Organic matter of humic type generates gas only. Strata with organic matter of mainly humic quality generate either gas, or gas and oil.

In addition to the type and the concentration of the organic matter, the source rock quality is also characterised by the distribution of the typical organic constituents, or macerals<sup>1</sup>, in the sediments. The maceral distribution can be used to further qualify the source rock, especially when mainly humic quality is found. For this purpose a microscopic investigation on polished rock fragments is carried out.

The maturity of source rocks is expressed in terms of degree of organic metamorphism. With increasing degree of organic metamorphism the organic matter is gradually carbonised while generating hydrocarbons. With increased carbonification the light reflectance of vitrinite, one of the coal macerals, increases. The degree of organic metamorphism can be assessed by measuring this reflectance.

- 1) maceral: an organic constituent which can be recognised with the microscope (with objectives 25x to 50 x).

## II RESULTS

Sample numbers, according well names and depths, and the results of the chemical analyses are detailed in table I. The results of the microscopic investigations are given in table II. The results can be summarized as follows:

### a) Source rock indications (SRI)

Most of the samples show significant - partly, however, only marginal - SRI-values. Occasionally excellent values of more than 900 units are encountered.

### b) Type of organic matter

The type of organic matter has been determined in seven samples. It ranges from "mixed to mainly kerogenous" to "kerogenous". According to the maceral composition one would expect the type being always "kerogenous". It has been shifted in some cases by maturity and/or oxidation.

### c) Organic carbon content and Cr/Ct-ratio

The organic carbon content has been measured in ten samples. The highest encountered value is 5.5 %. In samples 57601 and 57602 the Cr/Ct-ratio has been determined. As oxidation features occur in these samples, the obtained values cannot be regarded as reliable tools for maturity determinations.

d) Maceral analyses

Maceral analyses have been carried out on nine samples. The only organic constituents in the samples are sapropelic organic matter (SOM), an algal origin of which can often be recognized, and liptodetrinite of most probably also algal origin. Besides in almost every sample exsudatinite occurs. Sometimes solid hydrocarbons are encountered in small amounts. In several samples the SOM shows conversion features. Some samples also show oxidation features.

A number of samples contains micrinite.



### III DISCUSSION AND CONCLUSIONS

#### 1) Source rock qualities

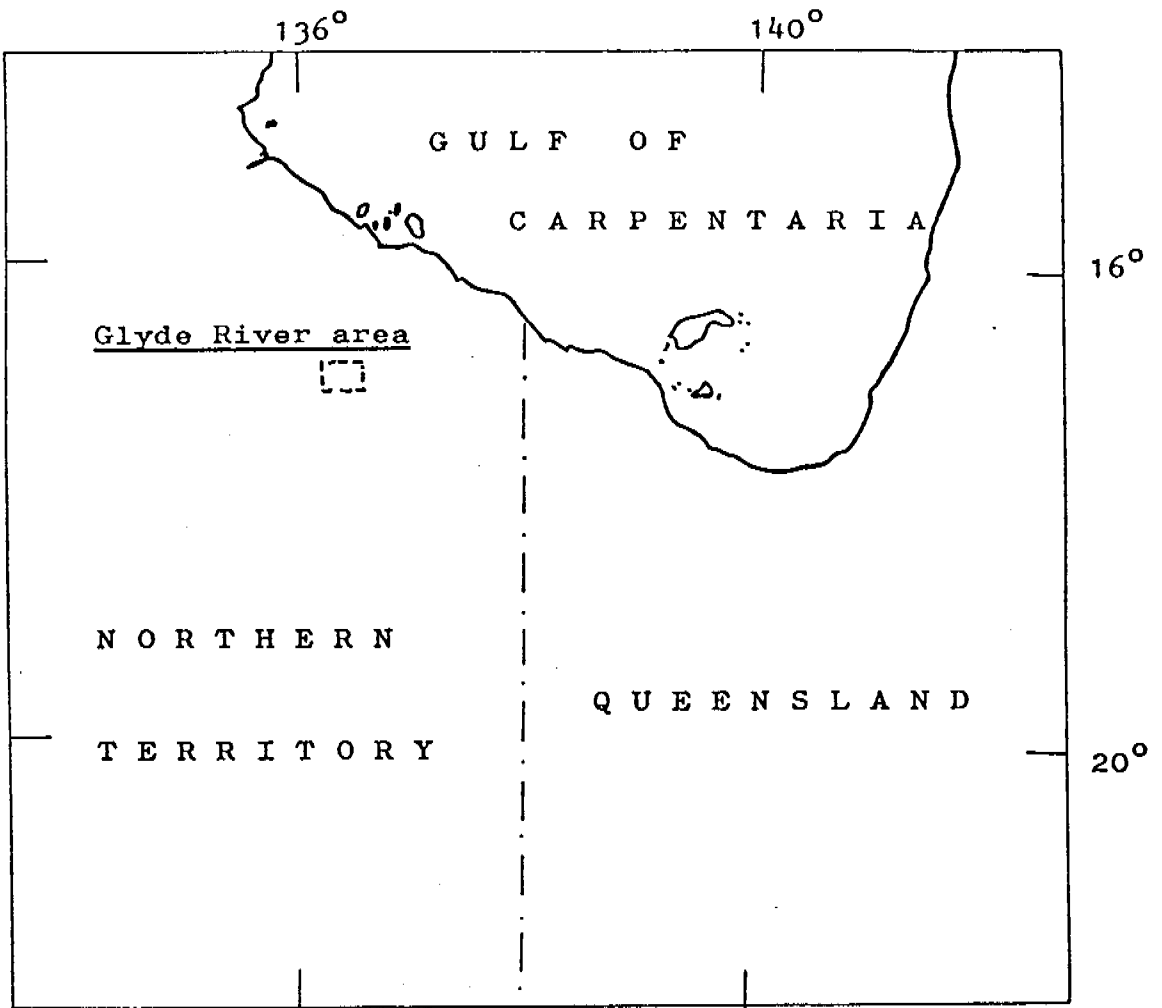
Although only "kerogenous" macerals occur in the samples, their amount and habitat is not always favourable for oil generation. Accordingly some samples are source rocks not only for oil but for oil and gas or even only gas. Taking into consideration also the SRI-values and organic carbon contents, the source rocks encountered in the various wells can be characterized as follows:

well GRNT-79-1: good source rock for oil;  
well GRNT-79-3: fair source rock for gas;  
well GRNT-79-4: good source rock for oil;  
well GRNT-79-5: marginal source rock for gas;  
well GRNT-79-7: marginal source rock for gas;  
well GRNT-79-8: marginal source rock for gas;  
well GRNT-79-9: marginal to good source rocks for gas  
and occasionally oil as well;  
well MANT-79-3: source rock for gas and some oil;

#### 2) Degree of organic metamorphism

A trial has been made to estimate the degree of organic metamorphism in the various wells according to the degree of conversion of the SOM. However, if oxidation features are observed, conversion is not necessarily due to an advanced maturity level. Besides, oxidation is not always obvious under the microscope. These reservations have to be kept in mind for the following conclusions, especially because no sequences have been examined:

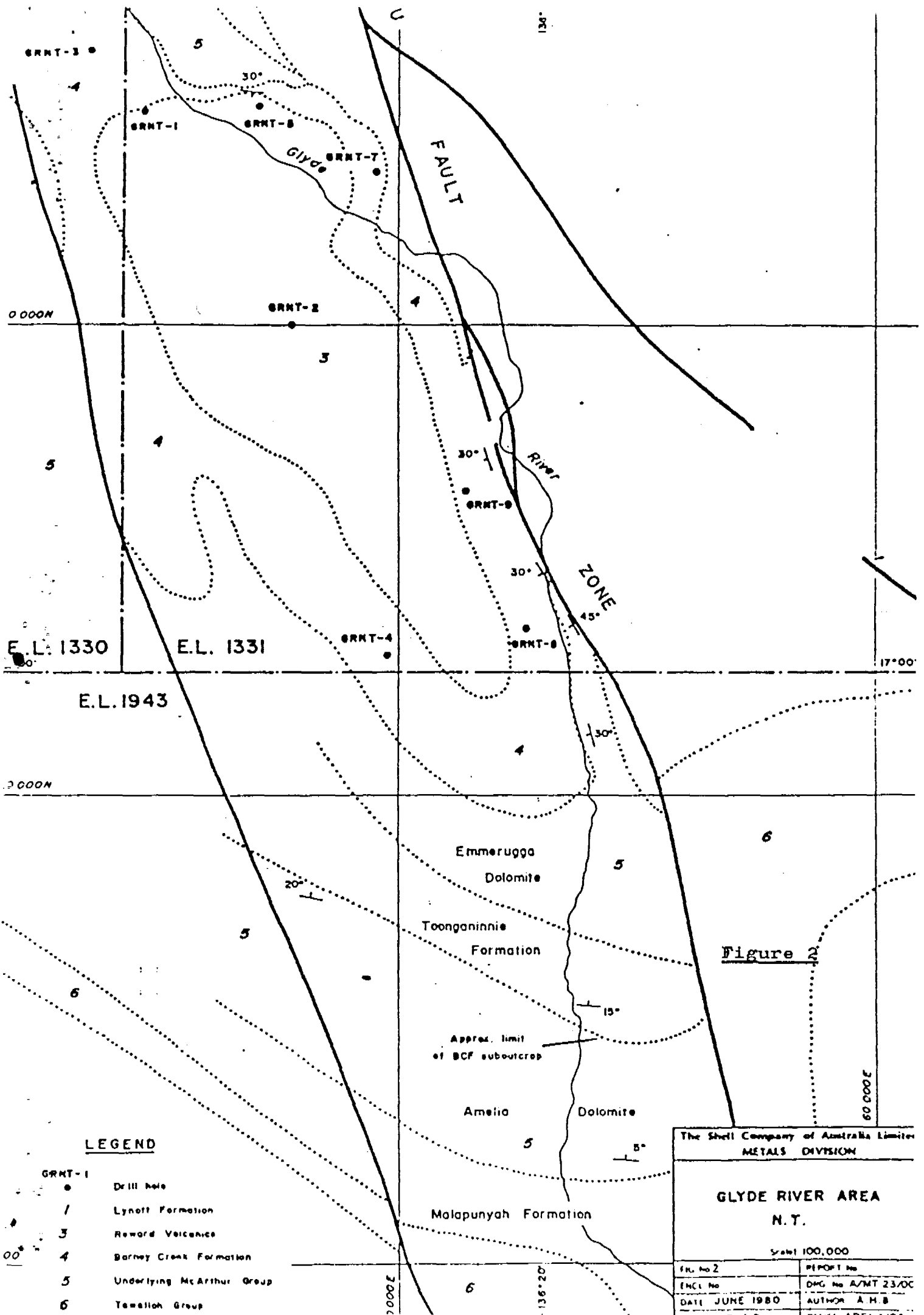
- well GRNT-79-1: possibly slightly mature for oil generation (slightly oxidized !);
- well GRNT-79-3: probably still immature for oil generation;
- well GRNT-79-4: possibly slightly mature for oil generation;
- well GRNT-79-5: possibly slightly mature for oil generation;
- well GRNT-79-7: probably still immature for oil generation;
- well GRNT-79-8: probably still immature for oil generation;
- well GRNT-79-9: probably still immature for oil generation;
- well MANT-79-3: probably almost - or even completely - postmature for oil generation;



Location map

1 : 6 969 600

Figure 1



**LEGEND**

- GRNT-1 ● Drill hole
- 1 / Lynell Formation
- 3 3 Reward Volcanics
- 4 4 Barney Creek Formation
- 5 5 Underlying McArthur Group
- 6 6 Temellan Group

The Shell Company of Australia Limited METALS DIVISION	
<b>GLYDE RIVER AREA N.T.</b>	
Scale 100,000	
FIG. No 2	REPORT No
ENCL No	DWG No A/MT 23/00
DATE JUNE 1980	AUTHOR A.H.B.
PREPARED BY	DRIVE AFFAIRS

T A B L E I

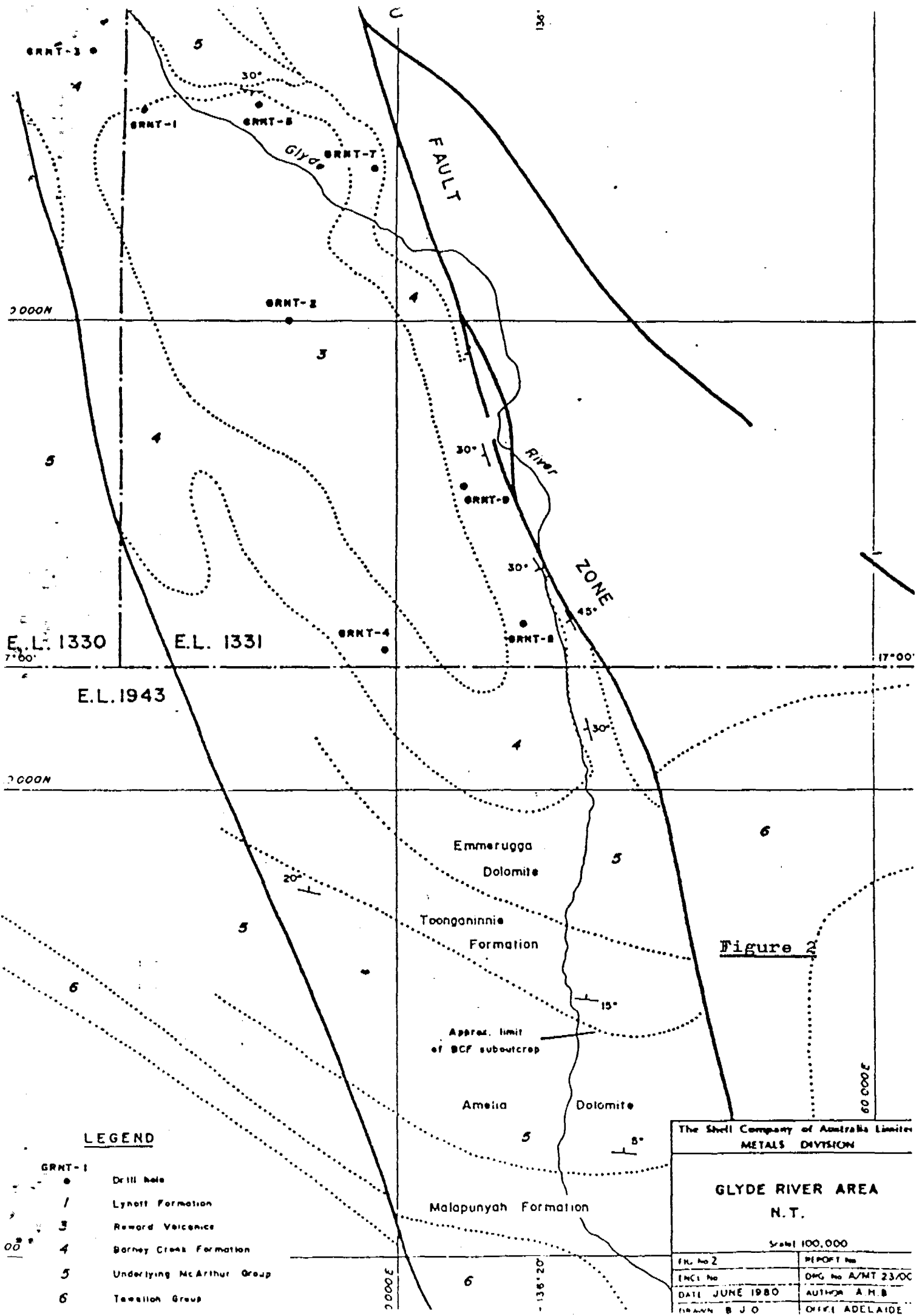
WELL/DEPTH (M)	AGE	SAMPLE	SOURCE ROCK BEFORE EXTRACTION	INDICATION AFTER EXTRACTION	ORGANIC CARBON CONTENT %weight	TYPE OF ORGANIC MATTER	CR/CT	REMARKS/CONCLUSIONS
GRNT-79-1: 306	PE	57601	> 900	> 900	5.5/5.5	K	0.85	
GRNT-79-3: 146	PE	57602	230	190	1.0	K	0.70	
150	PE	57603	155	150				
157	PE	57604	75	75				
GRNT-79-4: 132	PE	57605	> 900	> 900	3.9	K		
GRNT-79-5: 501	PE	57606	90	90	0.6	M/MK		
GRNT-79-7: 191	PE	57607	150	80	0.7	MK/M		
469	PE	57608	45	45				
612.7	PE	57609	80	40				
GRNT-79-8: 221	PE	57610	65	60	0.4	MK		
GRNT-79-9: 100.5	PE	57611	90	85				
107	PE	57612	> 900	> 900	2.3	K		
161	PE	57613	520	165	1.7			
181	PE	57614	80	80				
483	PE	57615	5	-				
491.85	PE	57616	55	40	0.2			

T A B L E I

WELL/DEPTH (M)	AGE	SAMPLE	SOURCE ROCK BEFORE EXTRACTION	INDICATION AFTER EXTRACTION	ORGANIC CARBON CONTENT %weight	TYPE OF ORGANIC MATTER	CR/CT	REMARKS/CONCLUSIONS
MANT-79-3: 117	PE	57617	35	30	1.0			

MACERAL DESCRIPTIONS OF NINE SAMPLES FROM THE  
GLYDE RIVER AREA:

- sample 57601: abundant sapropelic organic matter (SOM);  
common liptodetrinite and micrinite;  
few exsudatinite;  
rare solid hydrocarbons;  
laminated algal SOM partly bacterially  
transformed;  
SOM slightly converted;  
sample slightly oxidized;
- sample 57602: common SOM and liptodetrinite;  
few exsudatinite;  
rare solid hydrocarbons;  
laminated algal SOM partly bacterially  
transformed;  
pyrite shows oxidation features;
- sample 57605: common SOM, liptodetrinite, and micrinite;  
few exsudatinite and solid hydrocarbons;  
SOM slightly converted;  
laminated algal SOM partly bacterially  
transformed;
- sample 57606: common, slightly converted SOM;  
few exsudatinite and micrinite;  
rare liptodetrinite;  
few fluid inclusions;
- sample 57607: few SOM and exsudatinite;  
common liptodetrinite;  
laminated algal SOM partly bacterially  
transformed;  
sample slightly oxidized;
- sample 57610: few SOM and liptodetrinite;  
rare exsudatinite;
- sample 57612: common SOM and liptodetrinite;  
few exsudatinite;  
rare solid hydrocarbons;  
laminated algal SOM partly bacterially  
transformed;  
sample slightly oxidized;
- sample 57613: common SOM and liptodetrinite;  
rare exsudatinite and solid hydrocarbons;  
laminated algal SOM partly bacterially  
transformed;  
sample slightly oxidized;
- sample 57617: common, converted SOM;  
common micrinite;



**LEGEND**

- GRNT-1 ● Drill hole
- 1 / Lynett Formation
- 3 3 Reward Volcanic
- 4 4 Barney Creek Formation
- 5 5 Underlying McArthur Group
- 6 6 Tawallah Group

**Figure 2**

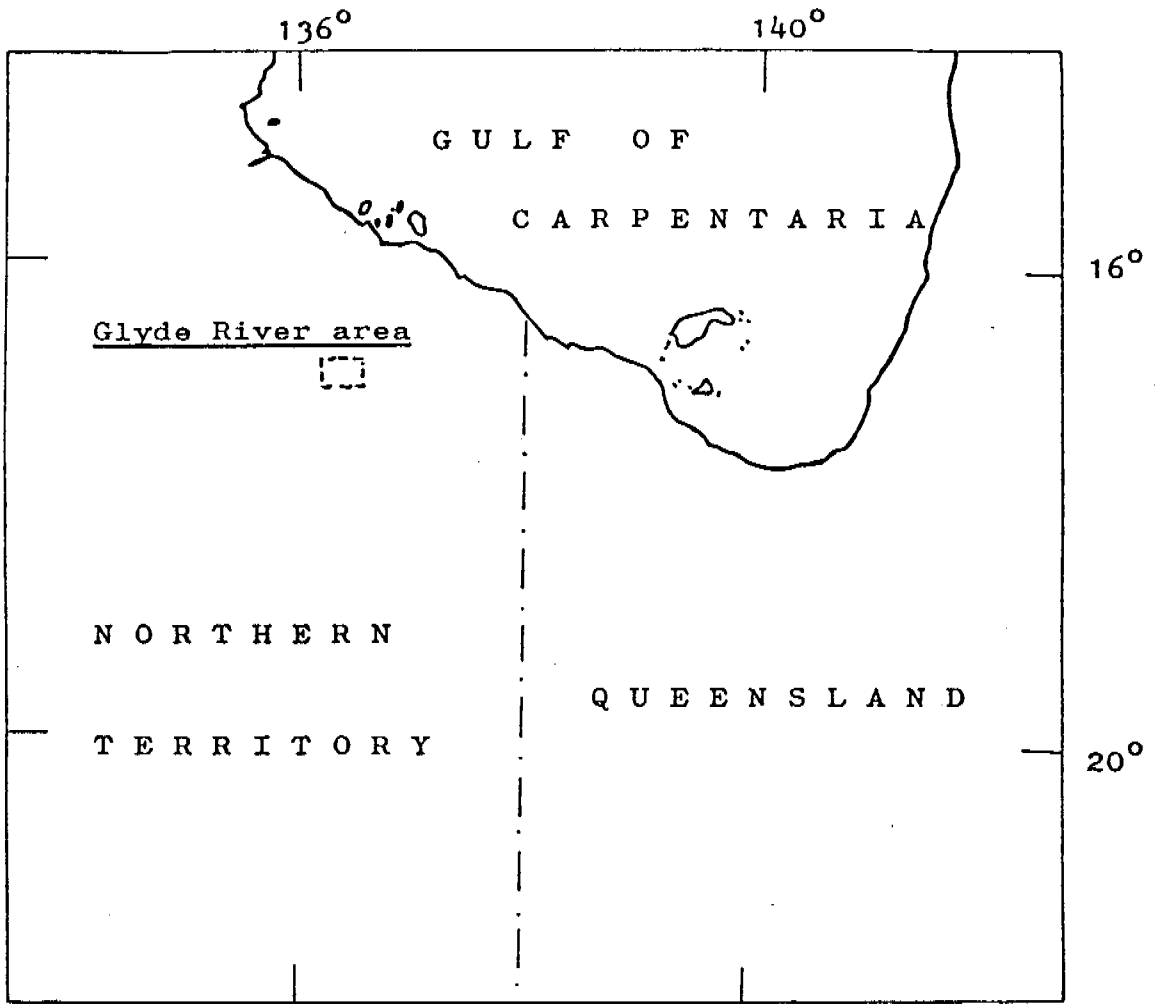
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METALS DIVISION

**GLYDE RIVER AREA  
N.T.**

Scale 100,000

FILE No 2	REPORT No
ENC1 No	DMG No A/MT 23/00
DATE JUNE 1980	AUTHOR A.M.B.
DRAWN B.J.O.	CHECK ADELAIDE





Location map

1 : 6 969 600

Figure 1



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3/114/0-AC 2930/81

## NATA CERTIFICATE

30 December 1980

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Senior Geologist Research  
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### REPORT AC 2930/81

YOUR REFERENCE: DMH/11:DH:YG

IDENTIFICATION: As listed

DATE RECEIVED: 1 December 1980

SAMPLE MARK	OIL YIELD l/tonne	ANALYSIS			SPENT SHALE Wt%
		WATER CONTENT Wt%	GAS + LOSS Wt%	SPENT SHALE Wt%	
57601	21	1.6	1.2	95.4	

Method: Modified Fischer Distillation

D.K.Rowley  
Manager  
Analytical Chemistry Division

*S.B. Bowditch*

for Norton Jackson  
Managing Director

mb



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Perth

ANALYSIS  
l/tonne

GLYDE RIVER N.T.

SAMPLE MARK	OIL YIELD	Abk. No.	Interval (m)
57601	>15	GRNT-79-1	306.0-308.0
602	5-15	GRNT 79-3	146.0-148.0
603	5-15	" " "	150.0-152.0
604	5-15	" " "	157.0-159.0
605	5-15	GRNT-79-4	132-134
606	1.5-5	GRNT-79-5	501-503
607	5-15	GRNT-79-7	191-193
608	0.5-1.5	" " "	469-471
609	0.5-1.5	" " "	612.7-614.7
610	0.5-1.5	GRNT-79-8	221-223
611	5-15	GRNT-79-9	100.5-103.2
612	5-15	" " "	107-109
613	5-15	" " "	161-163
614	1.5-5	" " "	181-183
615	0.5-1.5	" " "	483-485
616	0.5-1.5	" " "	491.85-493.85
617	1.5-5	MANNT-79-3	117-118
618	0.5-1.5	Wagley #1	410-420
619	0.5-1.5	" "	490-500
620	0.5-1.5	" "	587-588
621	0.5-1.5	#2	300-310
622	1.5-5	" "	428-430
623	0.5-1.5	" "	520-520
624	1.5-5	" "	720-730

Method: Oil Yield Estimate