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LINDON NO. 1

MATURITY AND SOURCE POTENTIAL OF THE OTWAY  
GROUP COALS IN LINDON NO. 1

P.C. Mason,  
BP Research Centre, 1985

LINDON-1  
Maturity and Source Potential  
of Otway Group coals  
(W841)

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MARCH 1985

GEOCHEMISTRY BRANCH

MATURITY AND SOURCE POTENTIAL OF THE OTWAY GROUP COALS  
IN THE WELL LINDON-1, OTWAY BASIN, AUSTRALIA

by

P.C. Mason

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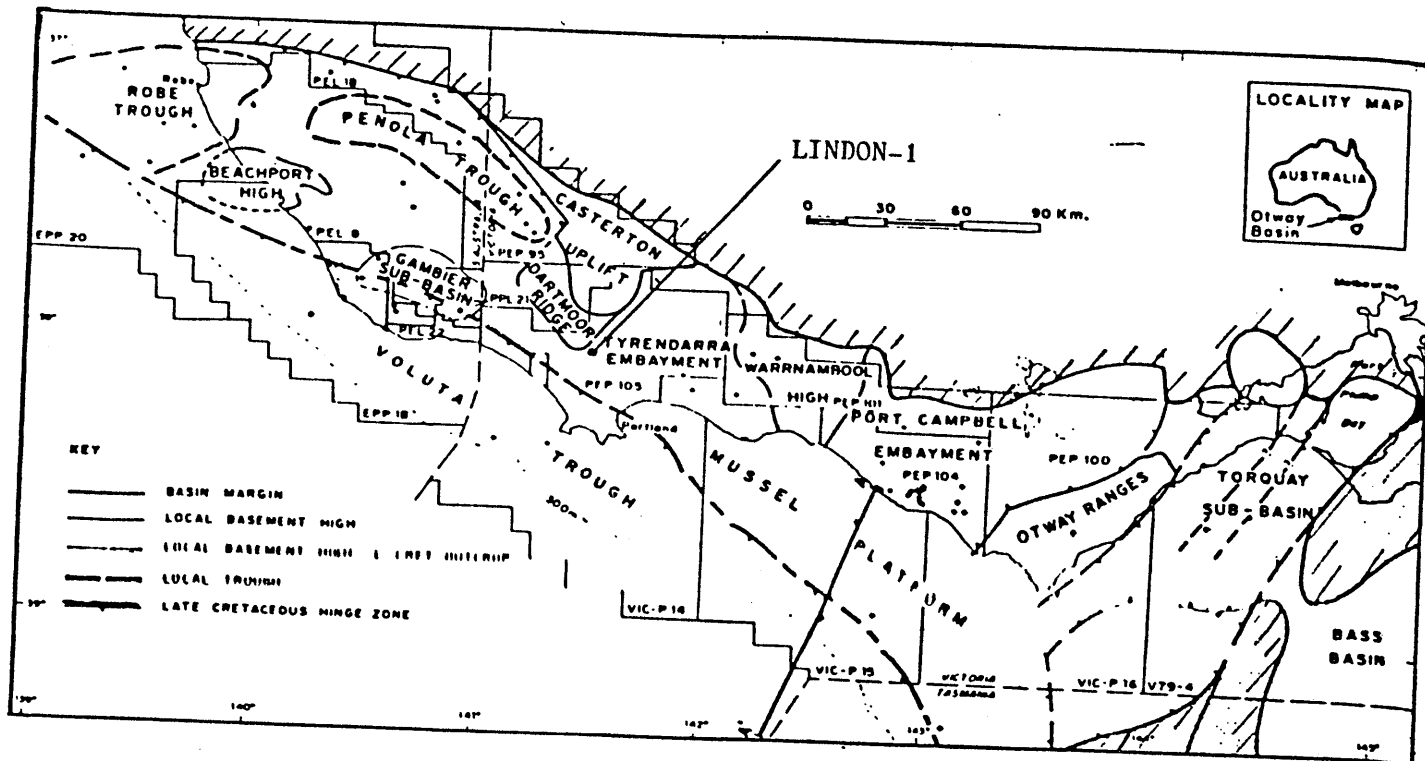
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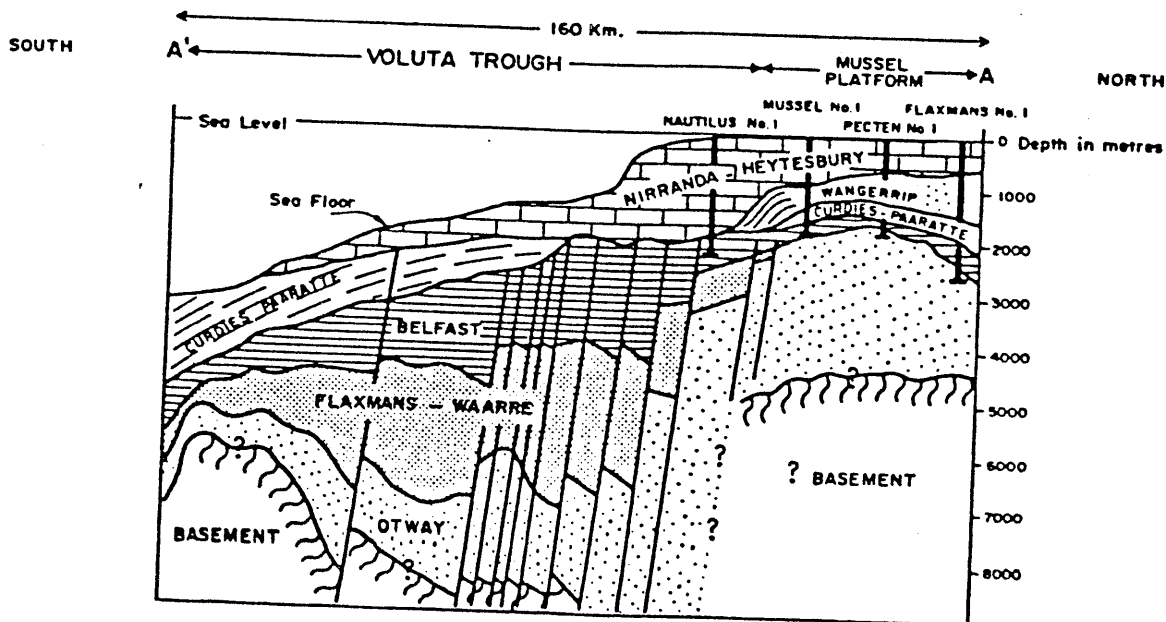
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OTWAY BASIN



CROSS SECTION A'-A

To accompany  
Basin Data Sheet : Otway Basin, Code K 300

[fig 1]

BP PETROLEUM DEV. AUST.	
Area: OTWAY BASIN	
South Australia - Victoria	
Ref: 4	
MARCH 1963	M. HOSIARA

## 1. INTRODUCTION

Previous geochemical studies have correlated the waxy oils of the southern Australian margin (e.g. Gippsland Basin) with coals and associated carbonaceous mudstones of Cretaceous and Eocene age. In the Otway Basin the maximum development of coal occurs in the thick Lower Cretaceous Otway Group, the sediments being preserved in a series of minor depocentres. Pyrolysis data from Chama-1a, Tullich-1 and Pretty Hill-1 (Mason, 1983) suggest an southeastwards increase in the oil potential of the coals.

In this study coals from Lindon-1, located in the onshore Tyrendara embayment (c.t. Pretty Hill-1), have been analysed for source potential and maturity. The eight pre-selected (by BPPDA) ground cuttings samples contain varying amounts of coal, as reflected in the range of pyrolysis yields recorded, but GOGI values and hydrogen indices will primarily indicate the oil potential of these coals. These data are to be incorporated into the forthcoming Australasian Coals Project report (Gibbons et al., 1985).

## 2. RESULTS AND DISCUSSION

### 2.1 Maturity

Vitrinite reflectance data, supplied by BDPDA, range from 0.61%R<sub>o</sub> at 2000m to 0.86%R<sub>o</sub> at 2995m, and indicate the sediments to be mature. Current wisdom suggests that for oil-prone coals, effective expulsion of a liquid phase occurs between 120°C and 140°C (ca. 0.60 - 0.75%R<sub>o</sub>). At higher temperatures/maturities, the generation of gas and its preferential expulsion results in any remaining oil potential being realised as gas condensate, and ultimately gas only. Thus the examined section in Lindon-1 spans the effective oil generation window, although palaeotemperatures were higher than those measured today (max 130°C at 2950m) and the generation process has ceased.

### 2.2 Source Potential

The eight bulked, ground samples have excellent pyrolysis yields of 31 to 182kg/t. With the exception of the sample at 1950m, PGC distributions, GOGI values and hydrogen indices show the coals to have a significant waxy-oil component. The observed decrease of this potential with depth may be explained by generation. Indeed the pyrolysis and TOC data of the shallowest samples are comparable to those of oil-prone coals at similar maturities in the Gippsland Basin.

Although the coal at 1950m has an oil-prone GOGI value (0.25), its hydrogen index is anomalously low (161) and the PGC distribution is not dominated by the long chain doublets of the waxy oil-prone coals. The largely unresolved aromatic/naphthenic potential will be realised only as gas or gas condensate, and in this respect the coal is similar to others in the neighbouring Tullich-1 well (Mason, 1983). The absence of the exinitic (oil-prone) component that characterizes many of the southern margin coals, may be due to selective preservation of humic kerogens by either physical or chemical processes.

3. CONCLUSIONS

- The examined coals spanned the effective oil generation window (0.60 - 0.75% $R_o$ ) prior to uplift. The immature coals show significant waxy-oil potential. The decrease in this potential with increasing maturity provides indirect evidence of generation of liquid hydrocarbons.

REFERENCES

- Mason, P.C. 1983 Geochemical Study of 3 Wells from the Otway Basin Australia. GCB/129/83.
- Gibbons, M.J., Barwise, A.J.G. and Mackenzie, A.S. 1985 The Distribution and Geochemical Characteristics of Australasian Oil-Prone Coals and Associated Carbonaceous shales and their Generation Products. In prep.



L I T H O L O G Y   A N D   S T R A T I G R A P H Y

WELL: LINDON-1

LOCATION: AUSTRALIA

DEPTH (m)	DEPTH RANGE	FORMATION	AGE	LITHOLOGY
1950.00		OTWAY GROUP	EARLY CRETACEOUS	COAL: MUDSTONE
2000.00		OTWAY GROUP	EARLY CRETACEOUS	
2285.00		OTWAY GROUP	EARLY CRETACEOUS	COAL
2330.00		OTWAY GROUP	EARLY CRETACEOUS	COAL: SHALE
2350.00		OTWAY GROUP	EARLY CRETACEOUS	
2460.00		OTWAY GROUP	EARLY CRETACEOUS	SHALE : COAL
2650.00		OTWAY GROUP	EARLY CRETACEOUS	
2685.00		OTWAY GROUP	EARLY CRETACEOUS	COAL: MUDSTONE
2730.00		OTWAY GROUP	EARLY CRETACEOUS	COAL: SHALE
2740.00		OTWAY GROUP	EARLY CRETACEOUS	
2790.00		OTWAY GROUP	EARLY CRETACEOUS	COAL: SHALE
2830.00		OTWAY GROUP	EARLY CRETACEOUS	COAL: SHALE - CARB
2880.00		OTWAY GROUP	EARLY CRETACEOUS	
2945.00		OTWAY GROUP	EARLY CRETACEOUS	
2970.00		OTWAY GROUP	EARLY CRETACEOUS	
2995.00		OTWAY GROUP	EARLY CRETACEOUS	

OPTICAL SOURCE ROCK MATURITY INDICATORS

WELL: LINDON-1

LOCATION: AUSTRALIA

DEPTH (m)	FORMATION	SPORE COLOUR	VITRINITE REFLECTANCE (%Ro)	COMMENTS
2000.00	OTWAY GROUP		0.61	CONSULTANTS DATA FROM BPPDA
2285.00	OTWAY GROUP		0.69	
2460.00	OTWAY GROUP		0.68	
2685.00	OTWAY GROUP		0.76	
2790.00	OTWAY GROUP		0.82	
2945.00	OTWAY GROUP		0.81	
2970.00	OTWAY GROUP		0.87	
2995.00	OTWAY GROUP		0.86	

S O U R C E   R O C K   Q U A L I T Y   I N D I C A T O R S

WELL: LINDON-1

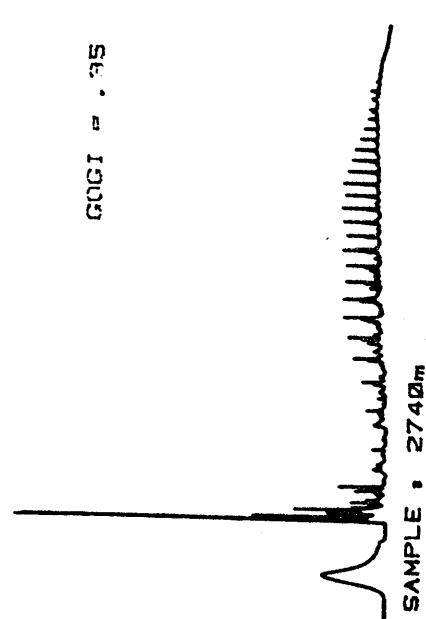
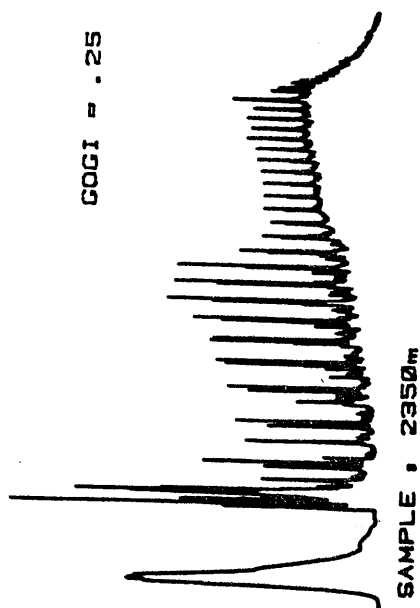
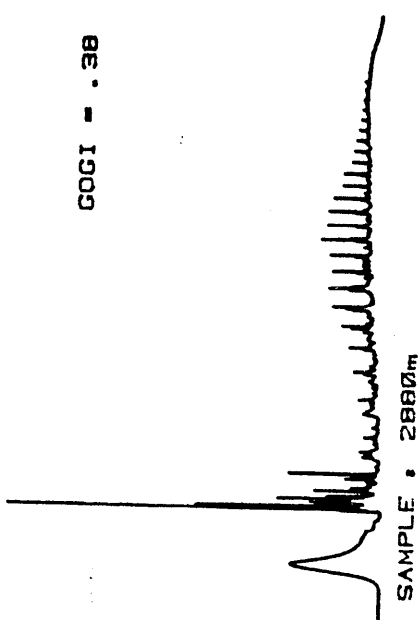
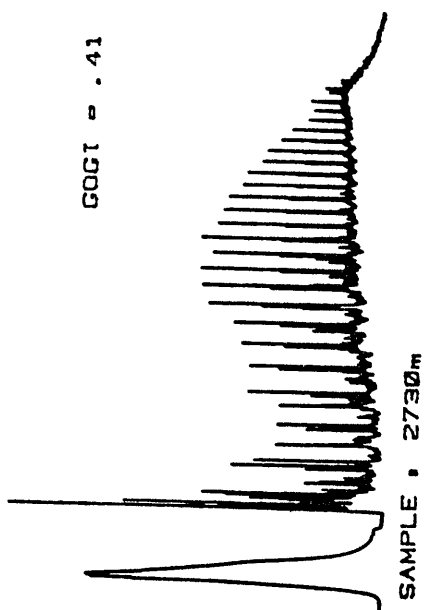
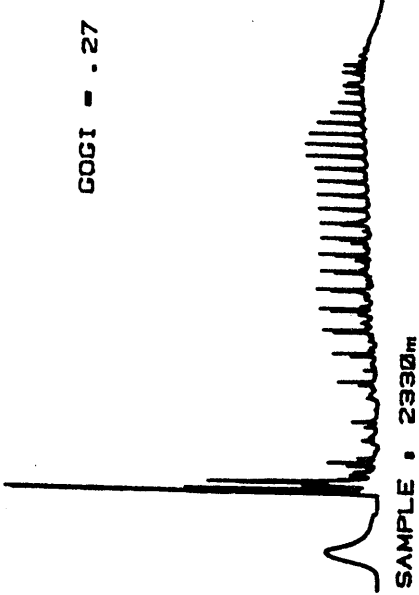
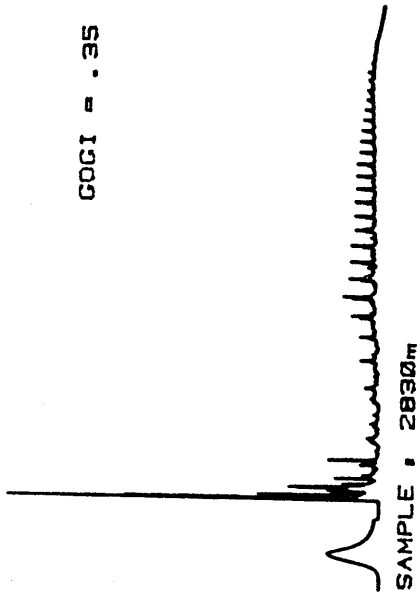
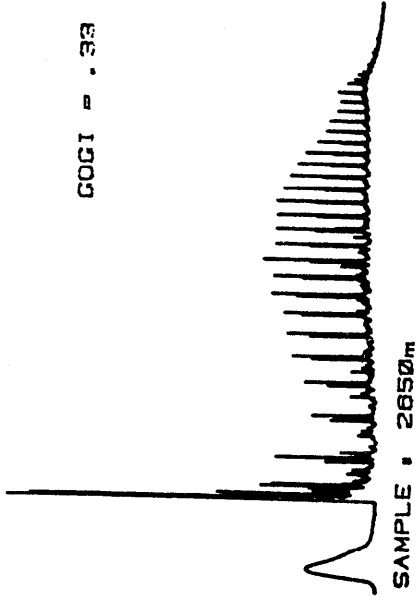
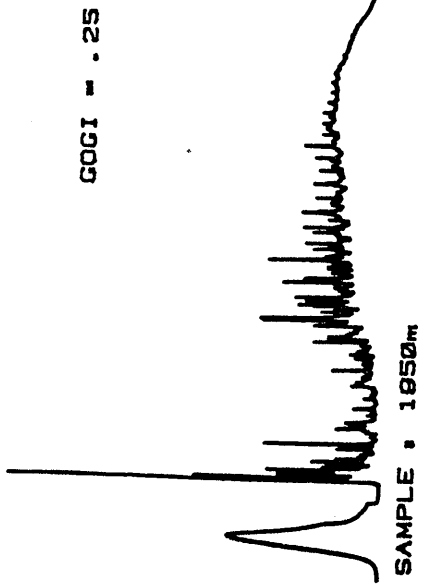
LOCATION: AUSTRALIA

DEPTH (m)	DEPTH RANGE (m)	FORMATION	PICKED LITH	P1 (kg/t)	P2 (kg/t)	GOGI	HI	TOC (%)
1950.00		OTWAY GROUP	BULKED	1.5	31.0	0.25	161	19.3
2000.00		OTWAY GROUP	BULKED					
2285.00		OTWAY GROUP	BULKED					
2330.00		OTWAY GROUP	BULKED	3.1	182.0	0.27	357	51.0
2350.00		OTWAY GROUP	BULKED	3.1	157.0	0.25	335	46.8
2460.00		OTWAY GROUP	BULKED					
2650.00		OTWAY GROUP	BULKED	1.5	32.0	0.33	337	9.5
2685.00		OTWAY GROUP	BULKED					
2730.00		OTWAY GROUP	BULKED	2.5	86.0	0.41	315	27.3
2740.00		OTWAY GROUP	BULKED	2.7	122.0	0.35	286	42.7
2790.00		OTWAY GROUP	BULKED					
2830.00		OTWAY GROUP	BULKED	3.0	77.0	0.35	281	27.4
2880.00		OTWAY GROUP	BULKED	2.5	41.0	0.38	295	13.9
2945.00		OTWAY GROUP	BULKED					
2970.00		OTWAY GROUP	BULKED					
2995.00		OTWAY GROUP	BULKED					

P Y R O L Y S I S - P G C    D A T A  
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WELL: LINDON-1  
 LOCATION: AUSTRALIA

| DEPTH<br>(m) | FORMATION   | C1-C5    C6-C9    C10-C13    C14-C22    C23-C36 |     |     |     |     | GOGI | HI  | TOC<br>(%) |
|--------------|-------------|-------------------------------------------------|-----|-----|-----|-----|------|-----|------------|
|              |             | (%)                                             | (%) | (%) | (%) | (%) |      |     |            |
| 1950.00      | OTWAY GROUP | 20                                              | 8   | 15  | 29  | 28  | 0.25 | 161 | 19.3       |
| 2330.00      | OTWAY GROUP | 21                                              | 10  | 11  | 26  | 30  | 0.27 | 357 | 51.0       |
| 2350.00      | OTWAY GROUP | 20                                              | 13  | 11  | 26  | 30  | 0.25 | 335 | 46.8       |
| 2650.00      | OTWAY GROUP | 25                                              | 13  | 12  | 27  | 23  | 0.33 | 337 | 9.5        |
| 2730.00      | OTWAY GROUP | 29                                              | 12  | 11  | 25  | 23  | 0.41 | 315 | 27.3       |
| 2740.00      | OTWAY GROUP | 26                                              | 9   | 11  | 26  | 28  | 0.35 | 286 | 42.7       |
| 2830.00      | OTWAY GROUP | 26                                              | 12  | 11  | 24  | 27  | 0.35 | 281 | 27.4       |
| 2880.00      | OTWAY GROUP | 28                                              | 11  | 11  | 25  | 25  | 0.38 | 295 | 13.9       |



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