



DEPT. NAT. RES & ENV



PE800048

GEOCHEMICAL EVALUATION OF SWC SAMPLES FROM

WARRACBARUNAH-2, STONEYFORD-1

AND TIRRENGOWA-1, OTWAY BASIN

VICTORIA

REPORT LQ2471 FOR

GAS AND FUEL EXPLORATION N.L.

BY

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Attention: Val Akbari

REPORT LQ2471

CLIENT REFERENCE:

Order No. 2298

WELL NAME:

Warracbarunah-2, Stoneyford-1
and Tirrengowa-1, Otway Basin

MATERIAL:

Side-wall core samples

WORK REQUIRED:

Source Rock Analysis

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

Brian L. Watson
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1. INTRODUCTION

Fifty-one (51) samples were received for TOC analysis and Rock-Eval pyrolysis. This report is a formal presentation of results which were forwarded by facsimile on 28 August 1993.

2. ANALYTICAL PROCEDURES

2.1 Sample Preparation

Samples (as received) were ground in a Siebtechnik mill for 20-30 seconds.

2.2 Total Organic Carbon (TOC)

Total organic carbon was determined by digestion of a known weight (approximately 0.2 g) of powdered rock in HCl to remove carbonates, followed by combustion in oxygen in the induction furnace of a Leco WR-12 Carbon Determinator and measurement of the resultant CO₂ by infra-red detection.

2.3 Rock-Eval Pyrolysis

A 100 mg portion of powdered rock was analysed by the Rock-Eval pyrolysis technique (Girdel IFP-Fina Mark 2 instrument; operating mode, Cycle 1).

3. RESULTS

TOC and Rock-Eval data are listed in Table 1. Figures 1-3 are plots of T_{max} versus Hydrogen Index illustrating kerogen Type and maturity for each well.

4. INTERPRETATION

WARRACBARUNAH-2

4.1 Maturity

Rock-Eval T_{max} values show only marginal variation over the interval studied (429-439°C). These values, in conjunction with the Hydrogen Indices (Table 1; Figure 1), suggest that the sediments analysed from Warracbarunah-2 range from immature to marginally mature for the generation of liquid hydrocarbons (VR_{equiv} ≈ 0.4 - 0.6 %).

High Production Indices (>0.2) in samples from the following depths suggest that migrated hydrocarbons may be present in these intervals: 960-963, 1050-1053, 1059-1062 and 1443-1446 metres depth. Other production indices show a broad trend of increasing with depth and maturity.

4.2 Source Richness

Organic richness ranges from poor to excellent in the samples studied (TOC = 0.09 - 40.94%; Table 1), with the majority of the richer samples occurring between 730-800 metres depth. The sample from 1110-1113 metres depth also has excellent organic richness.

Source richness for the generation of hydrocarbons is ranges from poor to excellent in the samples studied ($S_1 + S_2 = 0.63 - 69.99$ kg of hydrocarbons/tonne; Table 1). However, source richness is uniformly poor in the samples examined between 960-1062 and 1188-1446 metres depth. Intervals with best source richness occur between 739-798, 1110-1167 and 1479-1482 metres depth.

4.3 Kerogen Type and Source Quality

Hydrogen Index and T_{max} values (Table 1; Figure 1) indicate that the sediments examined contain organic matter which have bulk compositions ranging from that of Type II-III to Type IV kerogen. However, most of the samples analysed have Hydrogen Index and T_{max} values which are typical of Type III kerogen bulk compositions. Samples from 1110-1167, 1479-1482 and 745-759 metres depth appear to have the best source quality of the samples studied. Pyrolysis-GC analyses of selected samples would provide more accurate source quality data.

STONEYFORD-1

4.1 Maturity

Rock-Eval T_{max} values again vary only marginally over the interval studied (428-442°C). These values in conjunction with the Hydrogen Indices (Table 1; Figure 2) suggest that the sediments analysed from Stoneyford-1 range from immature to marginally mature for the generation of liquid hydrocarbons ($VR_{equiv} \approx 0.4-0.6\%$).

Production Indices of >0.2 in the samples from 875-880 suggest that migrated hydrocarbons may be present in this interval. Other production indices show a broad trend of increasing with depth and maturity.

4.2 Source Richness

Organic richness ranges from fair to excellent in the samples studied (TOC = 1.77 - 27.37%; Table 1), with the majority of the richer samples occurring below 800 metres depth. TOC values are generally greater than 5% in the samples studied.

Source richness for the generation of hydrocarbons is generally excellent in the samples studied ($S_1 + S_2 = 2.74 - 59.94$ kg of hydrocarbons/tonne and generally >7 kg of hydrocarbons/tonne; Table 1).

4.3 Kerogen Type and Source Quality

Hydrogen Index and T_{\max} values (Table 1; Figure 2) indicate that the sediments examined contain organic matter which have bulk compositions ranging from that of Type II-III to Type IV kerogen. However, most of the samples analysed have Hydrogen Index and T_{\max} values which are typical of Type III kerogen bulk compositions. Samples from 800-805, 860-865 and 920-925 metres depth appear to have the best source quality of the samples studied. Pyrolysis-GC analyses of selected samples would provide more accurate source quality data.

TIRRENGOWA-1

4.1 Maturity

Rock-Eval T_{\max} values again vary only marginally over the interval studied (428-440°C). These values in conjunction with the Hydrogen Indices (Table 1; Figure 3) suggest that the sediments analysed from Stoneyford-1 range from immature to marginally mature for the generation of liquid hydrocarbons ($VR_{\text{equiv}} \approx 0.4-0.6\%$).

Production Indices of >0.2 in the samples from 1900 feet suggest that migrated hydrocarbons may be present in this interval. Other production indices show a broad trend of increasing with depth and maturity.

4.2 Source Richness

Organic richness ranges from poor to excellent in the samples studied (TOC = 0.46 - 25.68%; Table 1). TOC values are generally greater than 5% in the samples studied.

Source richness for the generation of hydrocarbons ranges from fair to excellent and is generally excellent in the samples studied ($S_1 + S_2 = 0.74 - 31.96$ kg of hydrocarbons/tonne and generally >4 kg of hydrocarbons/tonne; Table 1).

4.3 Kerogen Type and Source Quality

Hydrogen Index and T_{\max} values (Table 1; Figure 3) indicate that the sediments examined contain organic matter which have bulk compositions ranging from that of Type III to Type IV kerogen. However, most of the samples analysed have Hydrogen Index and T_{\max} values which are typical of Type III kerogen bulk compositions. Samples from 1990, 2440 and 3870 feet depth appear to have the best source quality of the samples studied. Pyrolysis-GC analyses of selected samples would provide more accurate source quality data.

TABLE 1
AMDEL PETROLEUM SERVICES

Rock-Eval Pyrolysis

23/09/93

Client: GAS AND FUEL EXPLORATION N.L.

Basin: OTWAY

Depth (m)	T Max	S1	S2	S3	S1+S2	PI	S2/S3	PC	TOC	HI	OI
WARRACBARUNAH-2											
711-714									0.09		
716-720									0.29		
720-723									0.25		
726-729	431	0.09	0.78	0.35	0.93	0.10	2.21	0.07	0.42	185	84
739-740	430	1.90	52.27	15.86	54.17	0.04	3.30	4.51	29.37	177	54
745-748	430	0.62	11.62	3.06	12.24	0.05	3.80	1.02	5.27	220	58
756-759	432	1.02	47.80	12.71	48.82	0.02	3.76	4.06	21.55	221	59
759-762	432	0.47	15.09	19.27	15.56	0.03	0.78	1.29	33.81	44	57
762-765	429	1.82	68.17	23.75	69.99	0.03	2.87	5.83	40.94	166	58
768-771	431	0.46	22.04	8.04	22.50	0.02	2.74	1.87	10.86	202	74
780-783	432	0.93	15.54	7.61	16.47	0.06	2.04	1.37	7.93	195	96
795-798	429	0.81	29.86	11.58	30.67	0.03	2.58	2.55	18.68	159	62
960-963	430	0.37	0.76	0.83	1.13	0.33	0.92	0.09	0.76	100	109
969-972	442	0.12	0.57	0.38	0.69	0.18	1.49	0.05	0.46	123	83
1032-1035	429	0.03	0.60	0.75	0.63	0.05	0.80	0.05	0.93	64	81
1050-1053	432	0.33	0.63	0.67	0.96	0.34	0.94	0.08	0.63	100	106
1059-1062	432	0.15	0.51	0.63	0.66	0.23	0.81	0.05	0.55	92	114
1110-1113	432	0.78	28.93	6.28	29.71	0.03	4.61	2.47	10.29	281	61
1164-1164	439	0.30	1.68	0.47	1.98	0.15	3.58	0.16	0.68	247	69
1188-1192	429	0.16	1.03	0.46	1.19	0.14	2.23	0.09	0.81	127	57
1209-1212	435	0.10	1.28	0.42	1.38	0.07	3.02	0.11	0.92	139	46
1323-1326	436	0.13	1.28	0.67	1.41	0.09	1.90	0.11	0.82	156	82
1443-1446	438	0.34	0.59	0.46	0.93	0.37	1.29	0.07	0.74	79	62
1479-1482	435	0.26	1.88	0.29	2.14	0.12	6.39	0.17	0.70	268	42
STONEYFORD-1											
460-465	428	0.47	10.29	4.02	10.76	0.04	2.56	0.89	6.38	161	63
675-680	435	0.73	16.93	6.23	17.66	0.04	2.72	1.47	10.93	154	57
705-710	437	0.46	6.93	3.80	7.39	0.06	1.82	0.61	5.59	124	68
745-750	434	0.23	3.89	3.74	7.39	0.06	1.04	0.61	5.27	74	71
765-770	429	0.18	2.56	1.15	2.74	0.07	2.23	0.23	1.77	145	65
780-785	438	0.40	9.51	3.30	9.91	0.04	2.88	0.82	5.90	161	56
800-805	442	1.32	58.62	13.13	59.94	0.02	4.47	4.98	27.35	214	48
820-825	434	0.97	4.98	4.42	5.96	0.01	1.13	0.49	7.62	65	58
860-865	436	1.60	30.67	9.14	32.27	0.03	3.36	2.68	11.28	272	81
875-880	440	1.60	6.30	10.51	7.90	0.20	0.60	0.66	14.20	44	74
895-900	437	2.18	32.59	12.02	34.76	0.06	2.71	2.89	19.71	165	61
905-910	440	4.41	31.67	8.94	36.08	0.12	3.54	2.99	16.55	191	54
920-925	438	2.06	24.17	6.21	26.23	0.08	3.89	2.18	10.71	226	58
TIRRENGOWA-1											
(feet)											
1550	430	0.40	6.76	5.91	7.16	0.06	1.14	0.59	8.96	75	66
1610	432	0.06	4.41	3.50	4.47	0.01	1.26	0.37	5.93	74	59
1660	431	1.03	30.93	18.49	31.96	0.03	1.67	2.65	25.68	120	72
1700	428	0.46	9.22	6.90	9.68	0.05	1.34	0.80	10.15	91	68
1900	439	0.92	3.32	8.58	4.24	0.22	0.39	0.35	15.89	21	54
1990	429	0.63	26.69	8.68	27.32	0.02	3.07	2.27	14.23	188	61
2080	430	0.24	3.21	1.81	3.45	0.07	1.77	0.29	4.02	80	45
2360	436	0.09	0.86	1.71	0.95	0.09	0.50	0.08	1.11	77	154
2440	432	0.34	9.91	7.41	10.25	0.03	1.34	0.85	5.79	171	128
3170	438	0.17	8.48	5.51	8.65	0.02	1.54	0.72	10.59	80	52
3390	436	0.46	8.93	8.04	9.39	0.05	1.11	0.78	13.87	64	58
3450	440	0.86	10.54	5.23	11.40	0.08	2.02	0.95	10.67	99	49
3510	438	0.97	11.51	6.48	12.48	0.08	1.78	1.04	11.36	101	57
3870	443	0.06	0.68	0.26	0.74	0.08	2.64	0.06	0.46	148	56

FIGURE 1

HYDROGEN INDEX vs T max

Client : GAS AND FUEL CORPORATION
Location : WARRACBARUNAH-2

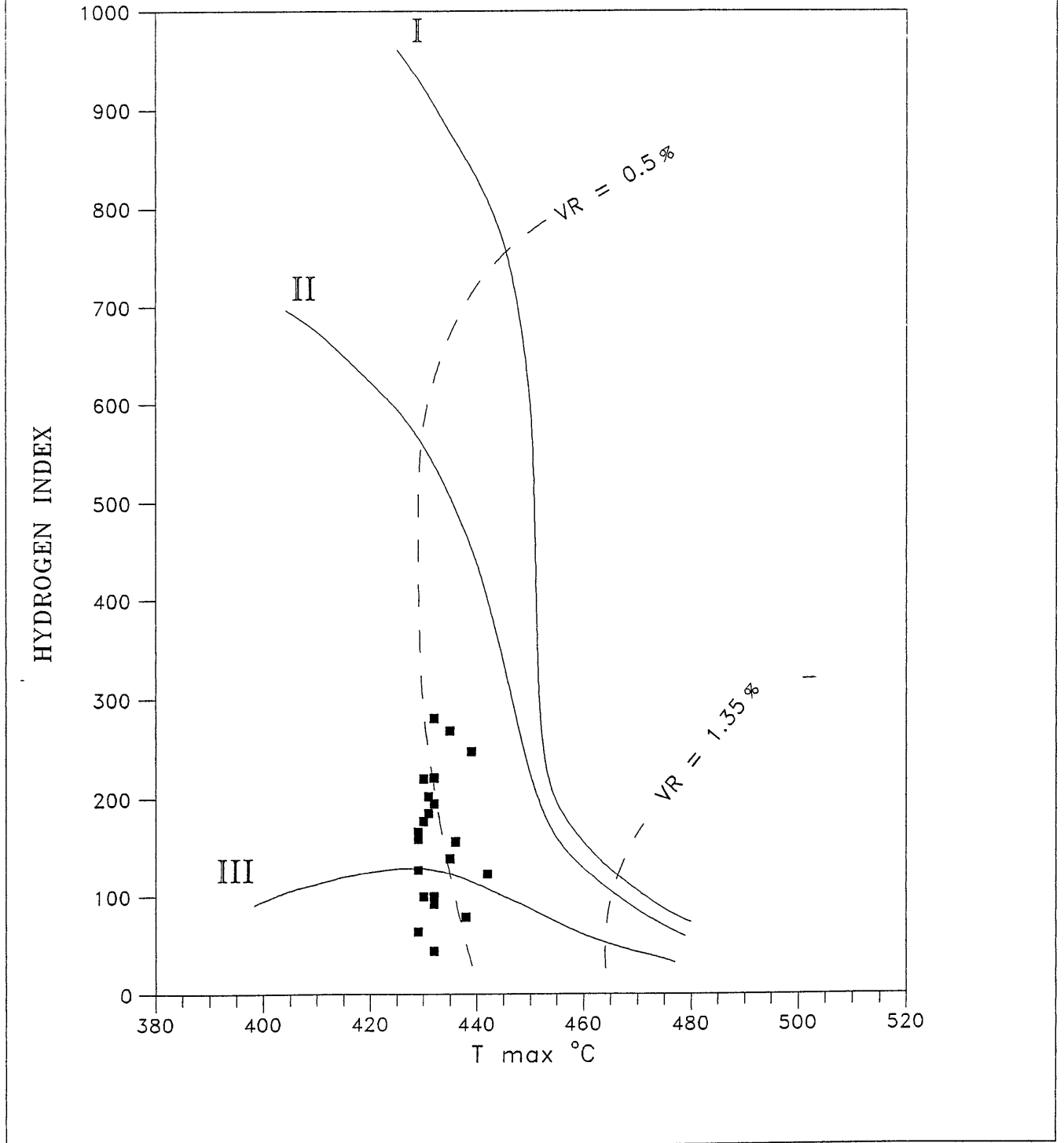


FIGURE 2

HYDROGEN INDEX vs T max

Client : GAS AND FUEL CORPORATION
Location : STONYFORD-1

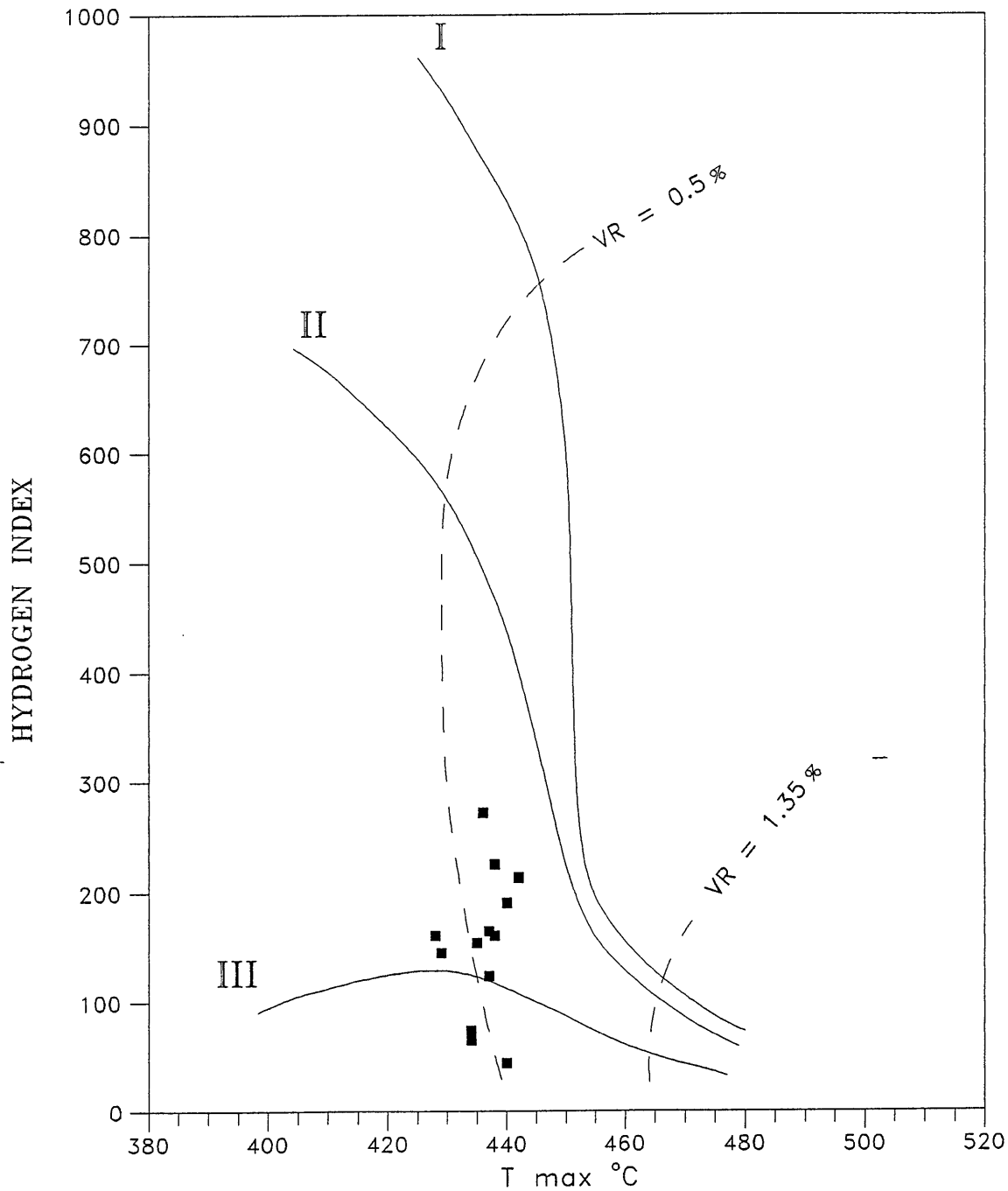


FIGURE 3

HYDROGEN INDEX vs T max

Client : GAS AND FUEL CORPORATION
Location : TIRRENGOWA-1

