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GEOCHEMICAL ANALYSIS OF THE CHAMPLIN PETROLEUM NO. 1 MESA ALTA FEDERAL (43-C-9) WELL, MCKINLEY COUNTY, NEW MEXICO

by
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Houston, Texas

April 18, 1983

Mesa Alta Prospect
Champlin #1 Federal - Mesa Alta
SE 9-18N-8W

ROBERTSON RESEARCH (U.S.) INC.

REPORT NO. 823/260

Geology

GEOCHEMICAL ANALYSIS OF THE FEDERAL 34D-9 WELL, MCKINLEY CO., NEW MEXICO

by
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PROJECT NO. RRUS/823/T/260/2

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I

SUMMARY

Geochemical analyses of cuttings in the Federal 34D-9 well indicate that only the Cretaceous section is capable of hydrocarbon generation. All of the samples analyzed from deeper parts of the section penetrated are organic lean and are considered to be nonsources for migratable amounts of oil or gas.

Wet and dry gas should be the primary hydrocarbons generated from Cretaceous source beds; however, maturity determinations indicate that the Cretaceous section is not sufficiently mature for peak wet gas generation. No oil source beds were identified by this study. Some migrated gas appears to be present in the lowermost part of the Cretaceous section.

II

INTRODUCTION

Geochemical analysis of canned cuttings from the Champlin, #1 Federal 34D-9 well have been performed in order to determine the source bed capability of the penetrated section. The age of the sedimentary section ranges from Cretaceous at the surface to Carboniferous at T.D. Two large sample gaps exist at approximately 3,200 to 4,300 feet and 4,400 to 7,510 feet. The Exlog sample log provided by the client indicates that much of the missing sections consist of red shale, sandstone, and siltstone. Some intervals, however, appear to contain brown and gray shales which could possibly have some source capability. Because these samples were not made available, the source capability in these parts of the section could not be determined.

Analytical data are tabulated in Appendices I-VI. Age designations shown on the figures were provided by the client and lithologies were taken from the Exlog sample log.

III
DISCUSSION

ORGANIC MATTER CONCENTRATION

The organic matter content of rocks is measured by the weight percent organic carbon they contain. The distribution of organic carbon in samples from the Federal 34D-9 well is shown on Figure 1. Highest organic carbon content occurs in the Cretaceous part of the section which ranges from marginal (0.5 percent) to very good (>2.0 percent) in source quality (Figure 1). Only one sample analyzed from the Cretaceous section (2,200 feet) is rated as nonsource rock (<0.5 percent). Samples from the following depths are rated as good or very good in source quality: 225 feet; 600 feet; 1,020 feet; 1,600 feet; 2,600 feet; and 3,000 feet.

The Lower Jurassic and Carboniferous samples analyzed are all rated as nonsource rocks because of very low organic carbon content.

ORGANIC MATTER TYPE

The type of organic matter present, and hence its capability to generate oil or gas, was determined by a number of techniques including visual examination with reflected light microscopy and Rock-Eval pyrolysis. Supporting evidence of organic matter type is provided by C_1-C_5 headspace gas analysis and organic extract data.

Optical methods of kerogen type analysis have the ability to discriminate the various components of organic matter mixtures and are valid regardless of rank. Chemical or physical methods, on the other hand, can reveal the actual capacity of organic matter to generate hydrocar-

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bons but reflect only the average of the kerogen mixture present. The best results are achieved when subjective optical studies are used in conjunction with objective chemical data.

The visual percent of oil-generating kerogen (amorphous + exinite) as determined by reflected light microscopy is plotted on Figure 1. Because amorphous kerogen is considrably less dense than other kerogen types, relatively high visual percentages must be present before oil can be expelled. Our experience indicates that samples with less than about 35 visual percent amorphous kerogen will yield primarily dry gas and that oil source beds contain 65 percent or more of oil-generating components. Intermediate kerogen mixtures will expel primarily wet gas and condensate although a complete transition probably exists. Visual kerogen analysis reveals that dry gas-generating organic matter predominates throughout most of the section penetrated by the well, especially in the most organic-rich, coaly intervals in the Cretaceous section. Sufficient amorphous kerogen for wet gas generation is present in most Cretaceous and Jurassic samples analysed but no samples are classified as primarily oil-generating.

Data obtained from Rock-Eval pyrolysis can also be used as a general indication of kerogen type as well as the actual remaining potential to generate hydrocarbons. Pyrolysis S_2/S_3 ratios can generally be used as a kerogen type indicator and values in excess of 5.0 are usually taken to signify oil-generating capability. On the basis of this parameter, most of the Cretaceous organic-rich zones above about 3,200 feet appear to have primarily an oil-generating capability. We have found, however, that pyrolysis S_2/S_3 ratios are usually misleading in some organic-rich samples, especially if solid bitumen is present. A good oil-generating potential, therefore, may not be present in these organic-rich, coaly intervals.

Rock-Eval pyrolysis confirms the visual kerogen conclusions that dry gas-generating organic matter predominates in the subject well. Some wet gas-generating capability may occur in thin Cretaceous zones above 3,200 feet. Many of the organic-rich, coaly samples contain solvent insoluble solid bitumen which distorts the analytical results. The relatively low hydrogen content and minor quantities of this solid bitumen suggest that it probably should not be considered to be a significant potential source for crude oil.

Supporting evidence for kerogen type is provided by the hydrocarbon gas and solvent extractable material present although it is realized that these components could be migrated as well as indigenous. Indigenous free hydrocarbons also reflect thermal maturity as well as kerogen type. Headspace gas data (Figure 6) in Cretaceous samples from above about 2,000 feet contain moderate percentages of wet gas which is consistent with the kerogen type present. Between 2,500 and 3,200 feet, wet gas percentages increase, total gas/organic carbon ratios increase, and n-butane/isobutane ratios increase. These parameters all suggest much of the gas in this interval is not related to the kerogen present but has migrated from more mature, possibly oil-generating source beds.

Relatively low productivity indices (S_1/S_1+S_2) from Rock-Eval pyrolysis indicates only minor quantities of free hydrocarbons are present in the samples analysed (Figure 2). This is verified by very low organic extract/organic carbon ratios in both of the samples analysed (Appendix VI). Low percent saturates, high percent NSO compounds, high pristane/phytane ratios, and high carbon preference indices all indicate an abundance of gas-generating, terrestrial organic matter in both of the samples analysed.

ORGANIC MATTER MATURITY

The thermal maturity of organic matter and, therefore, whether oil or gas generation capability has been realized, was determined with basically the same techniques used to define organic matter type. Vitrinite reflectance and pyrolysis T-max values are both kerogen maturity indicators. Additional maturity evidence is supplied by headspace gas and organic extract data. The same arguments pertaining to the strengths and weaknesses of optical versus chemical and physical methods of kerogen type analysis, can be applied here as well.

Because of the abundance of terrestrial kerogen in most of the samples analysed, vitrinite reflectance data are generally very good and provide the most reliable maturity indicator for the subject well. Strong, unimodal, reflectance histograms were obtained on some samples, resulting in a reasonably good maturation profile for the well (Figure 4). The only significant problems are high rank, recycled organic matter in some samples, semifusinite, and minor caving.

The vitrinite reflectance profile indicates the section above about 1,782 feet is thermally immature (less than 0.6 R_o) and has not reached peak oil or gas generation (Figure 4). The interval between 1,782 feet and 7,024 feet is within the oil-generating maturity zone. Peak generation of wet gas (0.8-2.0 R_o) should occur only below about 3,560 feet (0.8 R_o).

Projection of the maturation profile to 0.2 R_o indicates that approximately 5,000 feet of overburden has been lost to erosion since maximum burial took place. Cooling associated with the loss of this section has caused hydrocarbon generation to become suspended and source beds are probably not actively generating oil or gas at the present time.

The conclusions drawn by vitrinite reflectance maturity interpretations are supported by kerogen fluorescence intensity (Figure 1). Fluorescence intensity increases as the top of the oil-generating maturity zone is approached and is absent in most samples below the oil floor.

Pyrolysis T-max values can be used as a general indication of thermal maturity but, because they are obtained on whole rock samples, they can be affected by recycled or oxidized organic matter, caving, or solid bitumen. Solid bitumen typically results in substantially reduced T-max values (Clementz, 1979).

Pyrolysis T-max data (Figure 2) point to virtually the same conclusions as vitrinite reflectance. The top of the oil-generating maturity zone (435°C) is difficult to pick but most samples have T-max values close to 435°C. Organic-rich samples with solid bitumen contents have reduced T-max values and many shallow samples have relatively high T-max values due to recycled organic matter. Pyrolysis T-max maturity data, therefore, provides some confirmation for the kerogen type and maturity conclusions described previously.

Additional evidence of kerogen maturity is supplied by headspace gas and organic extract data. As mentioned previously, these components could be migrated as well as indigenous and may reflect kerogen type as well as maturity.

Wet gas percent and total gas to organic carbon ratios gradually increase in response to maturity, especially above the top of the wet gas-generation zone at about 3,560 feet. An increase in n-butane/iso-butane ratios also marks increasing maturity. High odd carbon predominances in the organic extracts from the two samples analysed indicate maturities of less than about 0.8 R_o as well as the presence of terrestrial kerogen.

V
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FEDERAL 34D-9 WELL

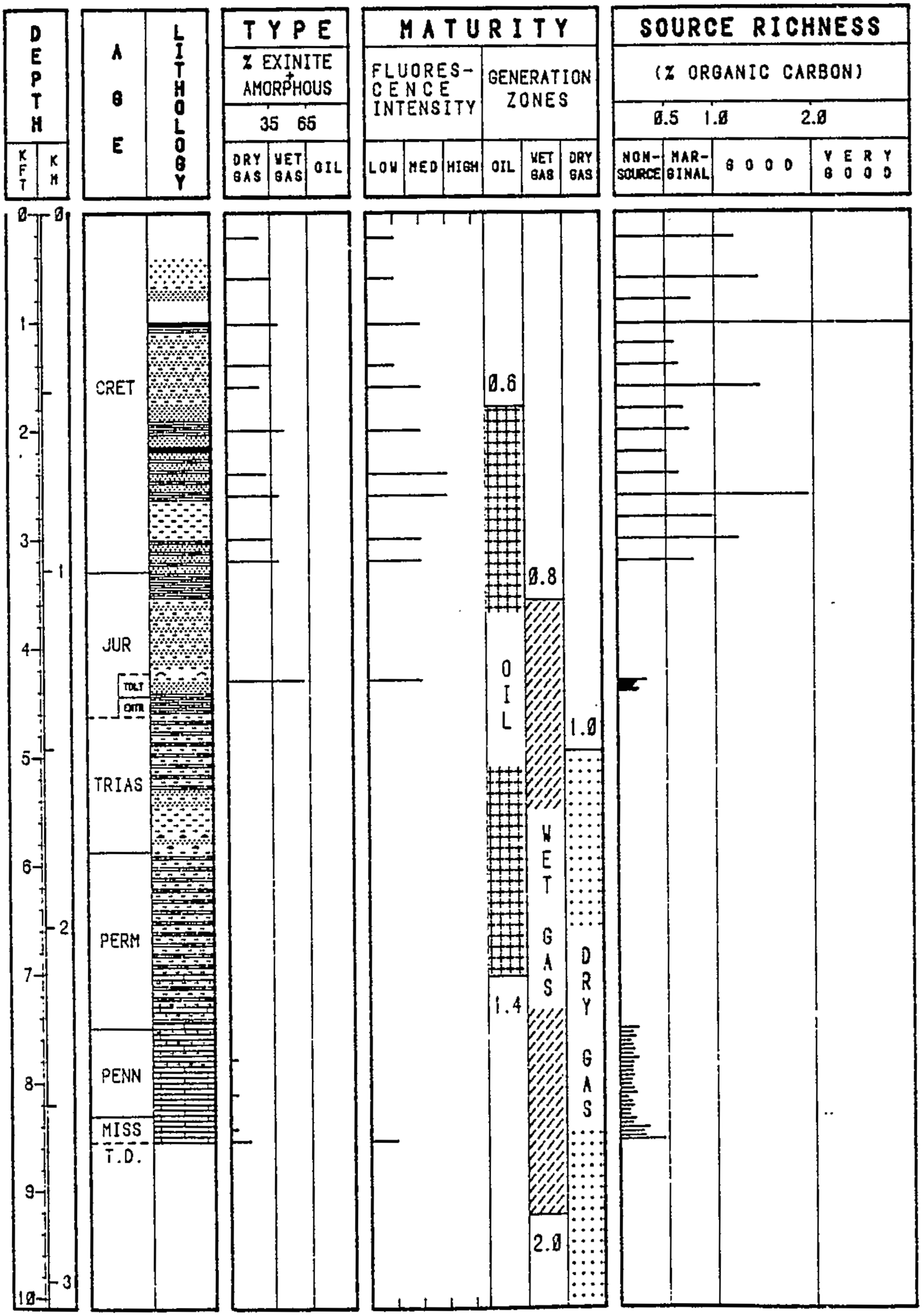


FIGURE 1: SUMMARY PLOTS SHOWING KEROGEN TYPES, MATURITY, AND SOURCE RICHNESS (SEE APPENDICES II AND IV)

FEDERAL 34D-9 WELL

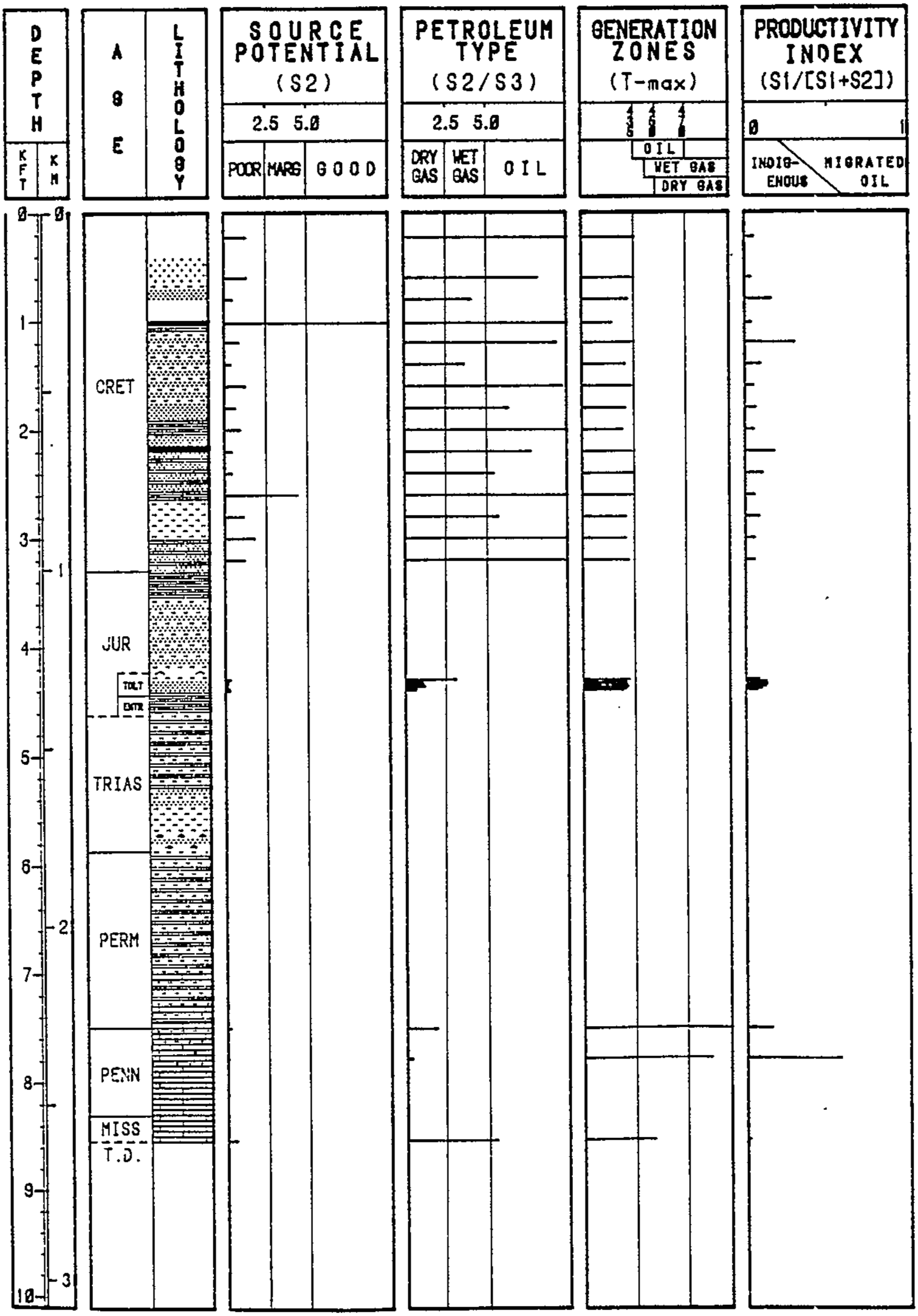


FIGURE 2: SUMMARY PLOTS OF ROCK-EVAL PYROLYSIS DATA (APPENDIX III)

FEDERAL 34D-9 WELL

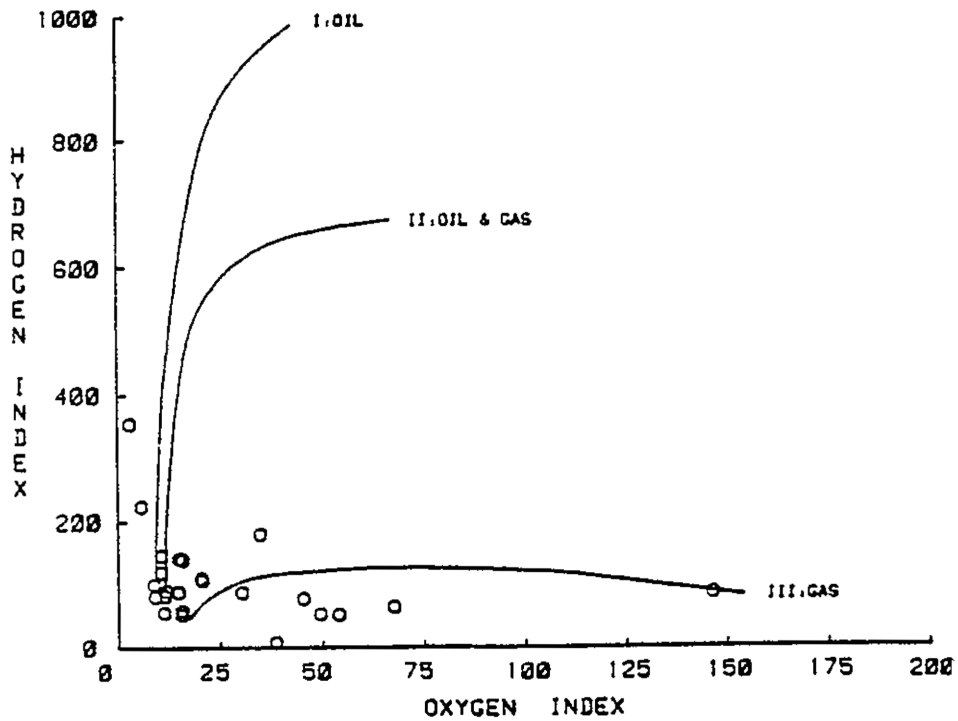


FIGURE 3: KEROGEN TYPE DETERMINATION FROM ROCK-EVAL PYROLYSIS DATA (APPENDIX III).

FEDERAL 34D-9 WELL

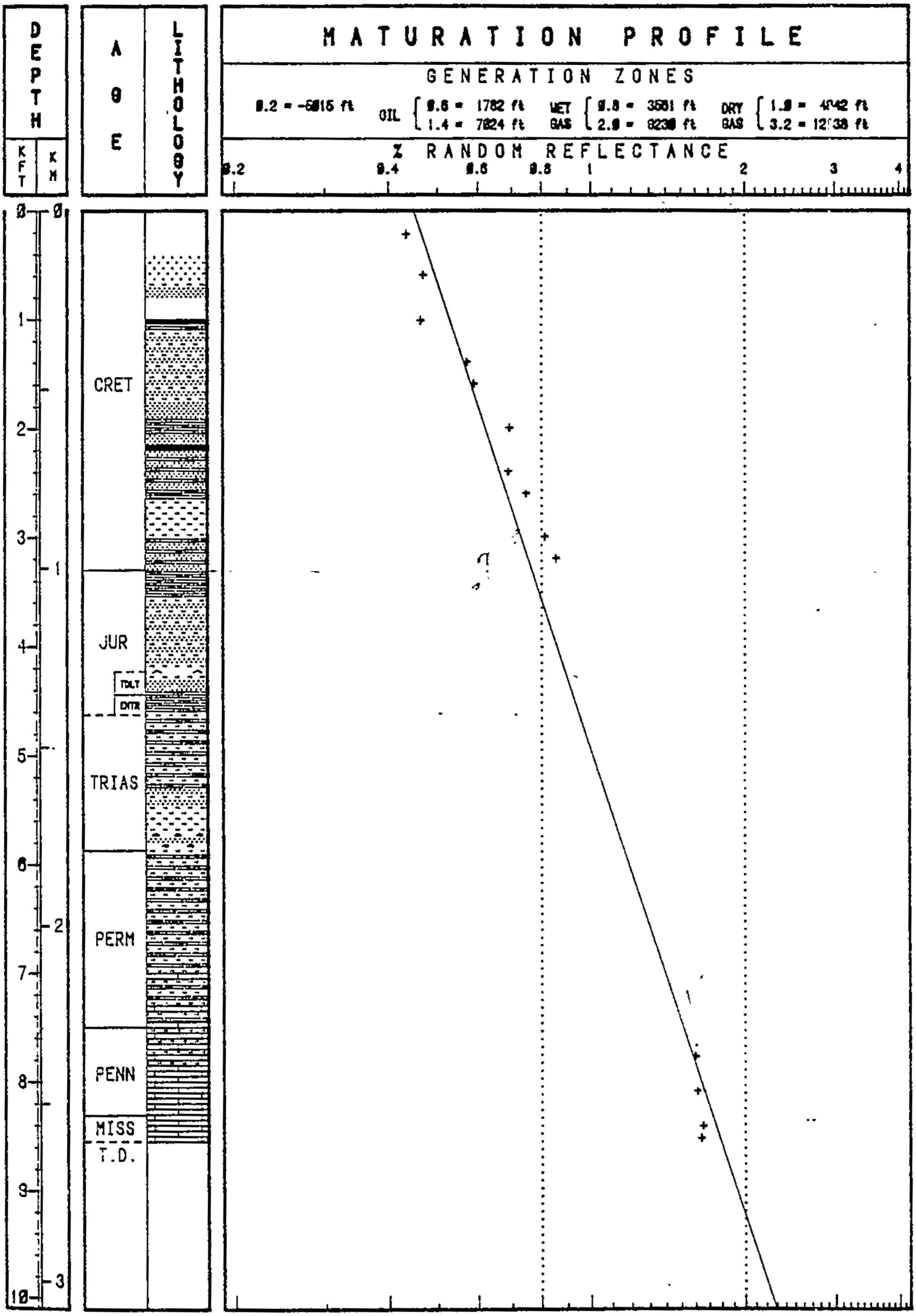


FIGURE 4: MATURATION PROFILE, BASED ON VITRINITE REFLECTANCE DATA (APPENDIX IV)

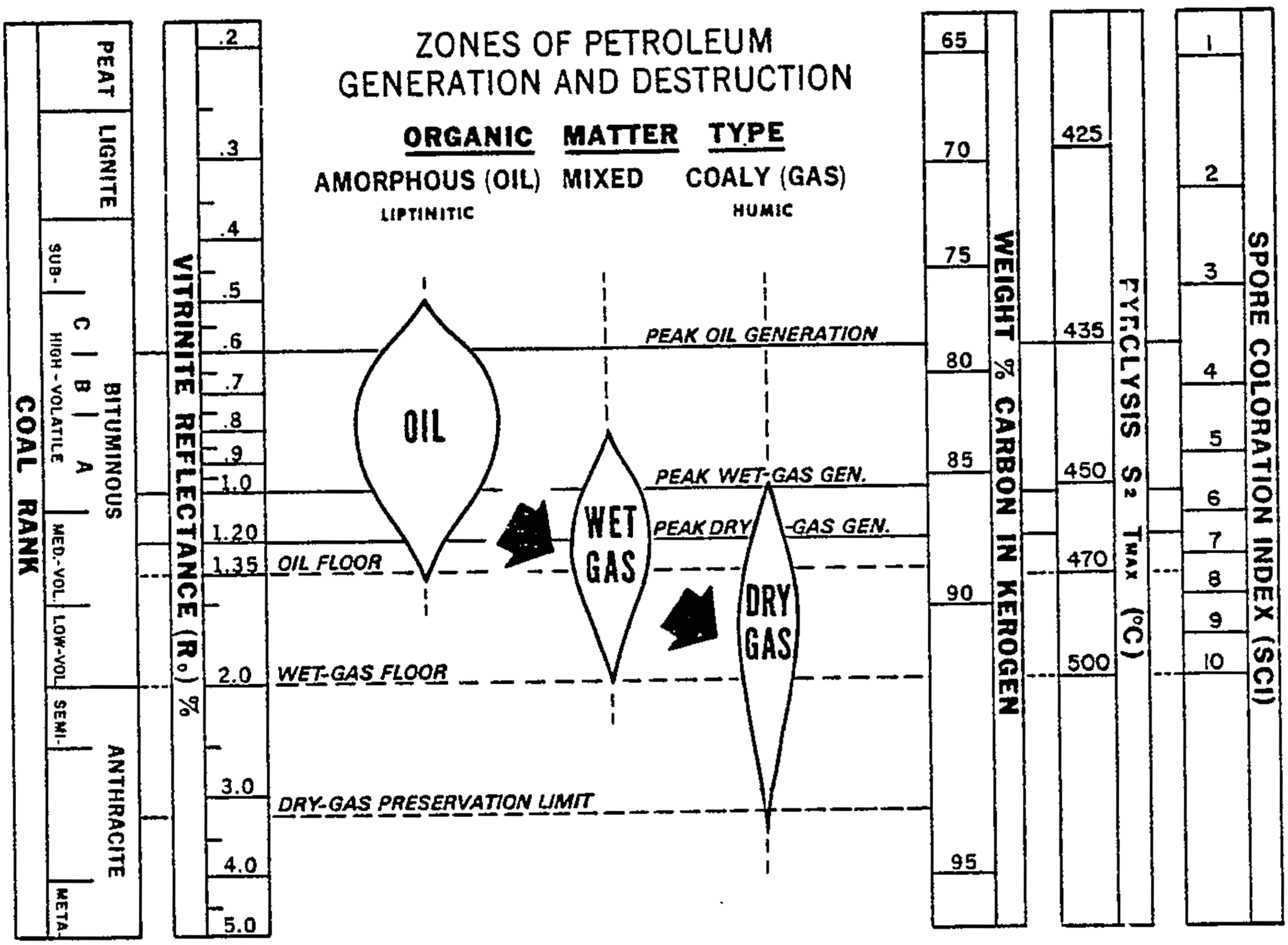


FIGURE 5 : CORRELATION OF VARIOUS MATURATION INDICES AND ZONES OF PETROLEUM GENERATION AND DESTRUCTION.

FEDERAL 34D-9 WELL

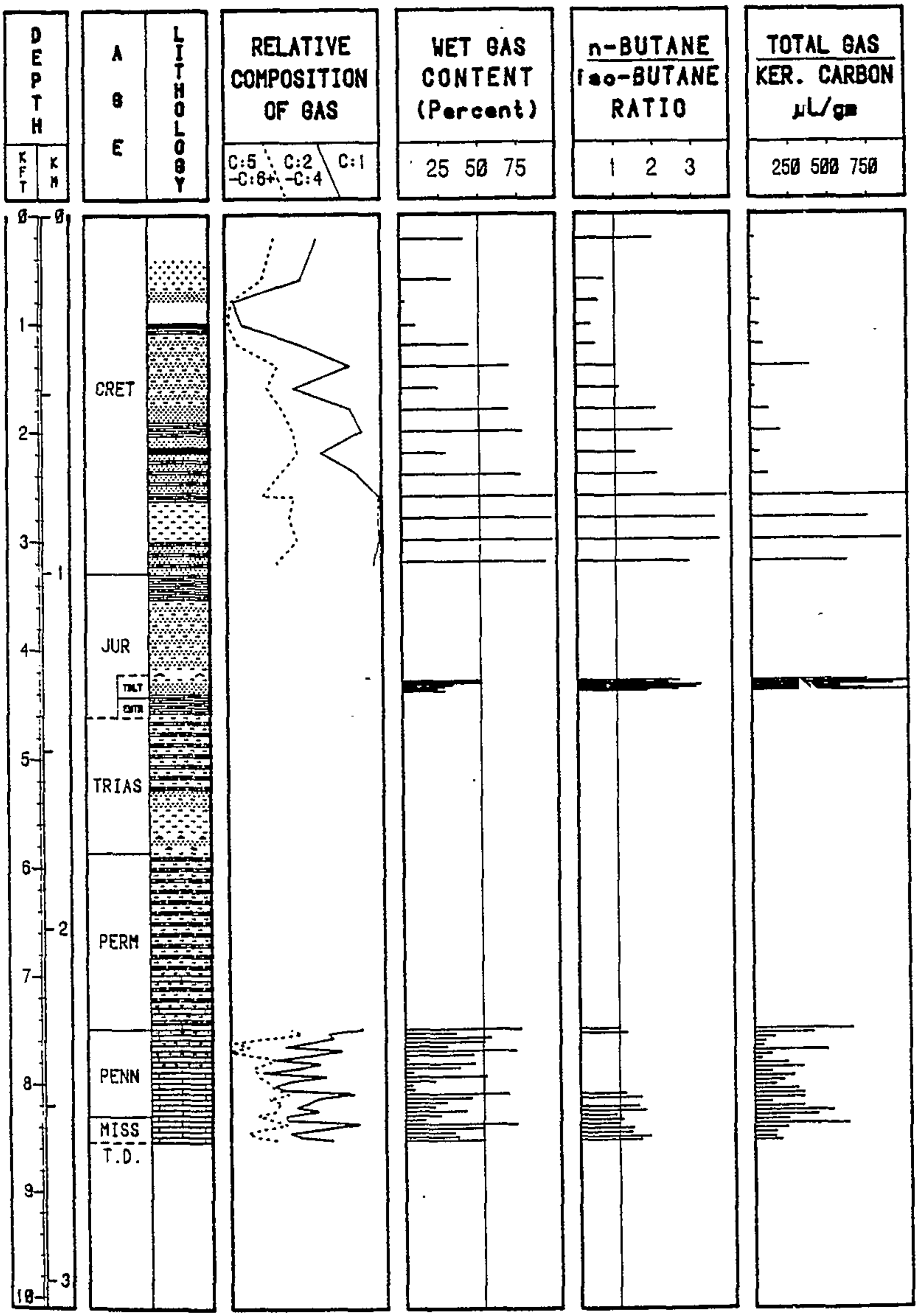


FIGURE 6: SUMMARY PLOTS OF HEADSPACE GAS DATA (APPENDIX V)

APPENDIX I

DETAILS OF ANALYSES

DETAILS OF ANALYSIS

FEDERAL 34D-9 WELL

Project No. : RRUS/823/T/260/02

SAMPLE IDENTIFICATION		ANALYSES CARRIED OUT								
RRUS	DEPTH (Feet)	TOC	REV	REF	SCI	ELM	HSP	EXT	SEP	GCR
1	225	X	X	X	-	-	X	-	-	-
2	600	X	X	X	-	-	X	-	-	-
3	800	X	X	-	-	-	X	-	-	-
4	1020	X	X	X	-	-	X	X	X	X
5	1200	X	X	-	-	-	X	X	X	X
6	1400	X	X	X	-	-	X	-	-	-
7	1600	X	X	X	-	-	X	-	-	-
8	1800	X	X	-	-	-	X	-	-	-
9	2000	X	X	X	-	-	X	-	-	-
10	2200	X	X	-	-	-	X	-	-	-
11	2400	X	X	X	-	-	X	-	-	-
12	2600 A	X	X	X	-	-	X	-	-	-
13	2600 B	X	X	-	-	-	X	-	-	-
14	2800	X	X	-	-	-	X	-	-	-
15	3000	X	X	X	-	-	X	-	-	-
16	3200	X	X	X	-	-	X	-	-	-
17	4298	X	X	X	-	-	X	-	-	-
18	4320	X	X	-	-	-	X	-	-	-
19	4340	X	X	-	-	-	X	-	-	-
20	4360	X	X	-	-	-	X	-	-	-
21	4380	X	X	-	-	-	X	-	-	-
22	4395	X	X	-	-	-	X	-	-	-
23	7510	X	X	-	-	-	X	-	-	-
24	7550	X	-	-	-	-	X	-	-	-
25	7590	X	-	-	-	-	X	-	-	-
26	7630	X	-	-	-	-	X	-	-	-
27	7670	X	-	-	-	-	X	-	-	-
28	7710	X	-	-	-	-	X	-	-	-
29	7750	X	-	-	-	-	X	-	-	-
30	7790	X	X	X	-	-	X	-	-	-
31	7830	X	-	-	-	-	X	-	-	-
32	7870	X	-	-	-	-	X	-	-	-
33	7910	X	-	-	-	-	X	-	-	-
34	7950	X	-	-	-	-	X	-	-	-
35	7990	X	-	-	-	-	X	-	-	-
36	8030	X	-	-	-	-	X	-	-	-
37	8070	X	-	-	-	-	X	-	-	-
38	8110	X	-	X	-	-	X	-	-	-
39	8150	X	-	-	-	-	X	-	-	-
40	8190	X	-	-	-	-	X	-	-	-
41	8230	X	-	-	-	-	X	-	-	-
42	8270	X	-	-	-	-	X	-	-	-
43	8310	X	-	-	-	-	X	-	-	-
44	8350	X	-	-	-	-	X	-	-	-
45	8390	X	-	-	-	-	X	-	-	-
46	8430	X	-	X	-	-	X	-	-	-
47	8470	X	-	-	-	-	X	-	-	-
48	8510	X	-	-	-	-	X	-	-	-
49	8540	X	X	X	-	-	X	-	-	-

LIST OF LITHOLOGY SYMBOLS USED IN FIGURES

10 : GAP
20 : CLY/CLYST
31 : MDST
41 : SH
50 : SLTST
61 : SST,fn
62 : SST,med
63 : SST,crs
70 : CGL+
80 : CGL-
90 : MARL
100 : LST
110 : DOL
320 : CHK
820 : SHELL DEBRIS
120 : ANH

130 : SALT
140 : COAL
146 : COAL(I),Thin
150 : IGN/IGN BSMNT
151 : BSMNT(UD)
153 : BSMNT(MET)
154 : TUFF BANDS
160 : CHERT
161 : BRECCIA
170 : SLTY CLY(ST)
180 : SNDY CLY(ST)
171 : SLTY SH
181 : SNDY SH
191 : SLTY MDST
201 : SNDY MDST
210 : SLTY MARL

220 : SNDY MARL
230 : ARG LST
240 : ARG DOL
250 : SNDY LST
260 : SNDY DOL
270 : SLTY LST
280 : SLTY DOL
291 : DOL LST
292 : CALC DOL
300 : ANH LST
310 : ANH DOL
340 : I/B SST/SH
350 : I/B SST/MDST
360 : I/B SST/CLYST

APPENDIX II

TOTAL ORGANIC CARBON DATA

Total organic carbon is determined by pulverizing the sample, treating a carefully weighed portion with warm hydrochloric acid to remove carbonate minerals, and analysing the residue for carbon content with a Leco carbon analyser. It is generally accepted that samples with less than about 0.5 percent TOC cannot yield sufficient petroleum to form commercial deposits and are therefore considered nonsources; samples with between 0.5 and 1.0 TOC are rated as marginal in source quality; and samples with more than 1.0 TOC are considered to be good in source quality.

TOTAL ORGANIC CARBON DATA

FEDERAL 34D-9 WELL

DEPTH (Feet)	TOC (%)	DEPTH (Feet)	TOC (%)
225	1.19	7630	0.10
600	1.44	7670	0.12
800	0.75	7710	0.14
1020	22.29	7750	0.12
1200	0.58	7790	0.18
1400	0.62	7830	0.13
1600	1.45	7870	0.12
1800	0.67	7910	0.12
2000	0.73	7950	0.13
2200	0.46	7990	0.11
2400	0.62	8030	0.10
2600 A	1.94	8070	0.13
2600 B	1.44	8110	0.16
2800	0.96	8150	0.07
3000	1.23	8190	0.11
3200	0.77	8230	0.13
4298	0.28	8270	0.09
4320	0.18	8310	0.09
4340	0.16	8350	0.15
4360	0.14	8390	0.12
4380	0.20	8430	0.29
4395	0.18	8470	0.23
7510	0.18	8510	0.25
7550	0.12	8540	0.45
7590	0.15		

APPENDIX III

ROCK-EVAL PYROLYSIS DATA

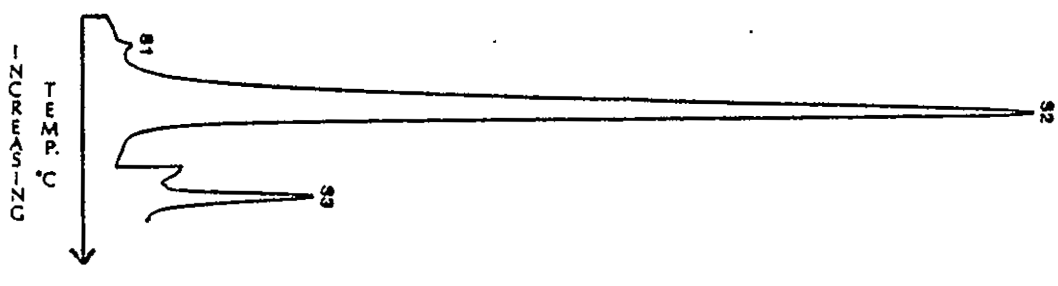
Rock-Eval data are expressed as mg/g of rock and include four basic parameters: 1) S_1 represents the quantity of free hydrocarbons present in the rock and is roughly analogous to the solvent extractable portion of the organic matter; 2) S_2 represents the quantity of hydrocarbons released by the kerogen in the sample during pyrolysis; 3) S_3 is related to the amount of oxygen present in the kerogen; and 4) T-max is the temperature at which the maximum rate of generation (of the S_2 peak) occurs and can be used as an estimate of thermal maturity.

In addition, the ratio S_2/S_3 provides a general indication of kerogen quality (type) and reveals whether oil or gas is likely to be generated. The ratio $S_1/(S_1+S_2)$, or the productivity index, is an indication of the relative amount of free hydrocarbons (in place or migrated) present in the sample. Hydrogen and oxygen index values are expressed as mg of hydrocarbons (S_2 peak) or carbon dioxide (S_3 peak) per gram of organic carbon. When plotted against each other on a van Krevelen-type diagram, information on kerogen type and maturity can be obtained.

Key for data interpretation:

Source Potential - values of S2	<2.5	: poor
	2.5-5.0	: marginal
	>5.0	: good
Petroleum Type - values of S2/S3	<2.5	: dry gas
	2.5-5.0	: wet gas
	>5.0	: oil
Generation Zones - values of T-max (°C)	<435	: immature
	435-470	: oil
	450 +	: gas

Productivity Index - high values of S1/(S1+S2) indicate migrated hydrocarbons.



ROCK-EVAL PYROLYSIS RAW DATA

FEDERAL 34D-9 WELL

DEPTH (FEET)	S1	S2	S3	S2/S3	S1/(S1+S2)	T-MAX
225	0.061	1.226	0.099	12.332	0.047	435
600	0.047	1.340	0.164	8.169	0.034	433
800	0.085	0.460	0.114	4.047	0.157	431
1020	2.905	79.383	0.576	137.791	0.035	420
1200	0.353	0.825	0.088	9.333	0.300	433
1400	0.034	0.342	0.094	3.638	0.090	429
1600	0.062	1.210	0.125	9.699	0.049	433
1800	0.040	0.609	0.096	6.345	0.062	429
2000	0.046	0.891	0.074	12.061	0.049	427
2200	0.083	0.390	0.051	7.703	0.175	433
2400	0.041	0.362	0.067	5.398	0.101	434
2600 A (Carlile Sh. Mbr.)	0.166	4.382	0.105	41.816	0.037	428
2600 B (Carlile Sh. Mbr.)	0.131	2.621	0.495	5.291	0.048	433
2800 (Carlile Sh. Mbr.)	0.092	1.081	0.190	5.677	0.078	429
3000 Kd "A"	0.097	1.767	0.178	9.917	0.052	429
3200 Kd "C"	0.061	1.141	0.078	14.700	0.051	431
4298 Jt	0.022	0.253	0.083	3.032	0.079	431
4320 (Je)	0.016	0.120	0.121	0.990	0.118	429
4340 (Je)	0.012	0.087	0.086	1.019	0.124	429
4360 (Je)	0.010	0.078	0.069	1.132	0.115	430
4380 (Je)	0.018	0.178	0.292	0.610	0.091	429
4395 (Je)	0.016	0.220	0.388	0.566	0.068	427
7510	0.025	0.144	0.081	1.789	0.147	501
7790	0.023	0.017	0.069	0.249	0.570	486
8540	0.005	0.493	0.091	5.440	0.010	447

HYDROGEN AND OXYGEN INDICES FROM ROCK-EVAL PYROLYSIS DATA, WITH TOC DATA

FEDERAL 34D-9 WELL

DEPTH (FEET)	HYDROGEN INDEX (mg HC/g TOC)	OXYGEN INDEX (mg CO2/g TOC)	TOC (%)
225	103	8	1.19
600	93	11	1.44
800	61	15	0.75
1020	356	3	22.29
1200	142	15	0.58
1400	55	15	0.62
1600	83	9	1.45
1800	91	14	0.67
2000	122	10	0.73
2200	85	11	0.46
2400	58	11	0.62
2600 A	226	5	1.94
2600 B	182	34	1.44
2800	113	20	0.96
3000	144	14	1.23
3200	148	10	0.77
4298	90	30	0.28
4320	66	67	0.18
4340	55	54	0.16
4360	56	49	0.14
4380	89	146	0.20
4395	122	216	0.18
7510	80	45	0.18
7790	9	38	0.18
8540	110	20	0.45

APPENDIX IV

REFLECTED LIGHT MICROSCOPY DATA

A sample of ground rock is treated successively with hydrochloric and hydrofluoric acids to concentrate the kerogen, freeze-dried, mounted in an epoxy plug, and polished. Kerogen type is identified with the aid of blue light fluorescence.

The visual kerogen analysis data table contains visual percentage estimates of each principle kerogen type and kerogen background fluorescence data. This data is also displayed on the histograms with relative amounts of solid bitumen and coked material.

The histograms show measured reflectance values of all vitrinite present and on all material with the visual appearance of vitrinite. Shaded values (marked with *) are those used to calculate the interpreted vitrinite reflectance maturities. Unshaded values are interpreted to be oxidized vitrinite, recycled vitrinite, or possibly misidentified material such as solid bitumen, pseudo-vitrinite, or semifusinite. When samples analysed contain no vitrinite, nonindigenous vitrinite or have an insufficient number of readings to allow a reliable maturity determination to be made, then the mean value for that sample is shown as N. D. (Not Determined). Alternate maturity calculations are possible on a few samples. The histograms are identified by a Robertson Research sequence number (RRUS No.) and depth or other notation.

ABBREVIATIONS USED IN VISUAL KEROGEN ANALYSIS DATA SHEET AND HISTOGRAMS

Am	:	Amorphous Kerogen
Ex	:	Exinite
Vit	:	Vitrinite
Inert	:	Inertinite
R_o	:	Vitrinite Reflectance Mean in Immersion Oil
Bkg Fl	:	Background Fluorescence

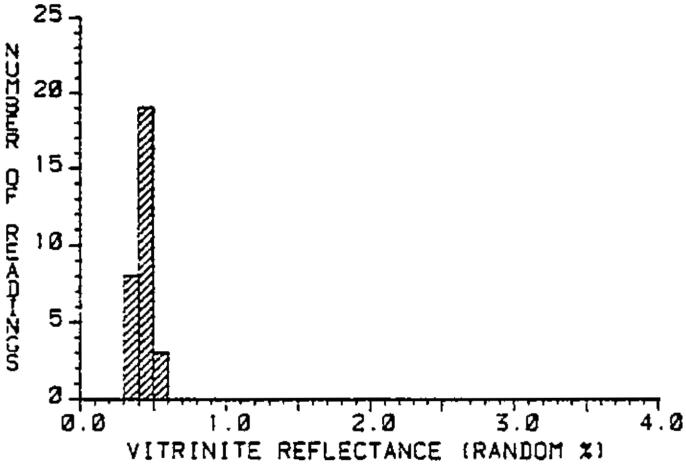
VISUAL KEROGEN ANALYSIS - REFLECTED LIGHT

FEDERAL 34D-9 WELL

Project No. : RRUS/823/T/260/02

SAMPLE IDENTIFICATION		REFLECT.	KEROGEN CHARACTERISTICS					TOC
RRUS	DEPTH (Feet)	Ro %	Am%	Ex%	Vit%	Inert%	Fluor	%
1	225	0.43	10	15	50	25	Low	1.19
2	600	0.47	20	15	40	25	Low	1.44
4	1020	0.46	20	20	40	20	Med	22.29
6	1400	0.57	25	10	40	25	Low	0.62
7	1600	0.59	15	10	40	35	Med	1.45
9	2000	0.69	30	15	30	25	Med	0.73
11	2400	0.69	20	10	45	25	High	0.62
12	2600 A	0.74	30	10	40	20	High	1.94
15	3000	0.81?	30	5	45	20	Med	1.23
16	3200	0.85	30	10	35	25	Med	0.77
17	4298	----	55	5	30	10	Med	0.28
30	7790	1.59	5	0	85	10	None	0.18
38	8110	1.61	5	0	50	45	None	0.16
46	8430	1.65	5	0	50	45	None	0.29
49	8540	1.63	10	5	60	25	Low	0.45

FEDERAL 34D-9



RRUS No. : 1

DEPTH : 225.0 Ft
: 68.6 M

* = Ro MATURITY

VALUES : 30

MEAN : 0.43
STD DEV : 0.05
MEDIAN : 0.44
MODE : 0.45

HISTOGRAM:
Range: 0- 4%
Increment: 0.10%

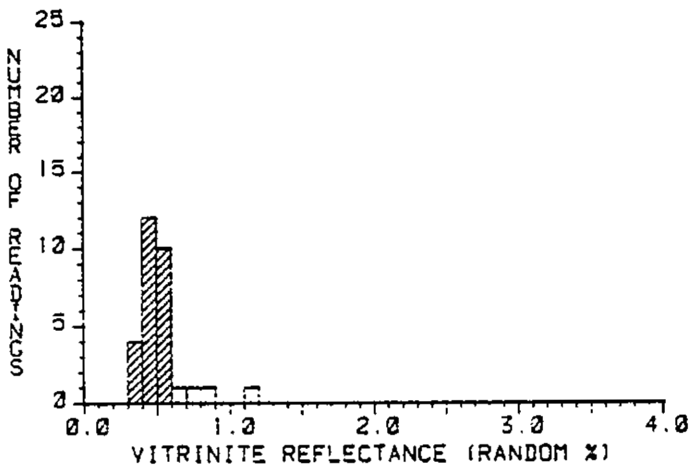
ORDERED REFLECTANCE VALUES:

*0.32	*0.41	*0.46
*0.36	*0.42	*0.46
*0.38	*0.43	*0.46
*0.38	*0.43	*0.47
*0.38	*0.44	*0.47
*0.38	*0.44	*0.48
*0.38	*0.44	*0.48
*0.39	*0.44	*0.50
*0.40	*0.45	*0.52
*0.40	*0.45	*0.54

KEROGEN DESCRIPTION

Amorphous	:	10 %
Exinite	:	15 %
Vitrinite	:	50 %
Inertinite	:	25 %
Back Fluor	:	Low
Bitumen	:	None
Coke	:	None

FEDERAL 34D-9



RRUS No. : 2

DEPTH : 600.0 Ft
: 192.9 M

* = Ro MATURITY

VALUES : 26

MEAN : 0.47
STD DEV : 0.06
MEDIAN : 0.48
MODE : 0.45

HISTOGRAM:
Range: 0- 4%
Increment: 0.10%

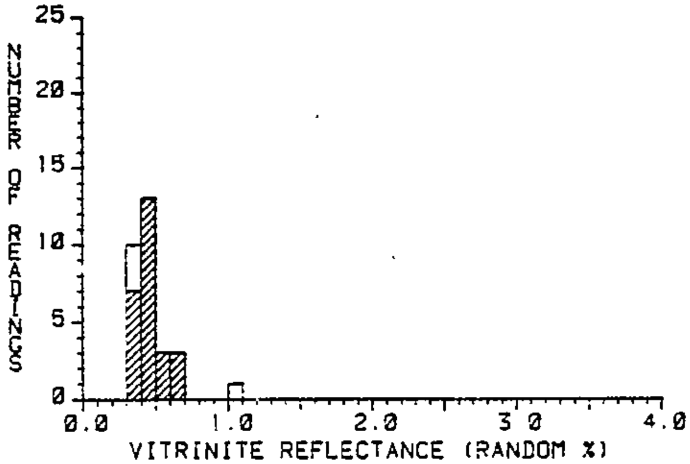
ORDERED REFLECTANCE VALUES:

*0.35	*0.47	*0.52
*0.35	*0.47	*0.52
*0.37	*0.48	*0.52
*0.37	*0.48	*0.53
*0.40	*0.48	*0.53
*0.40	*0.49	*0.57
*0.43	*0.50	0.63
*0.45	*0.50	0.74
*0.46	*0.51	0.89
*0.47	*0.52	1.18

KEROGEN DESCRIPTION

Amorphous	:	20 %
Exinite	:	15 %
Vitrinite	:	40 %
Inertinite	:	25 %
Back Fluor	:	Low
Bitumen	:	?Small
Coke	:	None

FEDERAL 34D-9



RRUS No. : 4

DEPTH : 1020.0 Ft
: 310.9 M

* = Ro MATURITY

VALUES : 26

MEAN : 0.46
STD DEV : 0.08
MEDIAN : 0.44
MODE : 0.45

HISTOGRAM:
Range: 0- 4%
Increment: 0.10%

ORDERED REFLECTANCE VALUES:

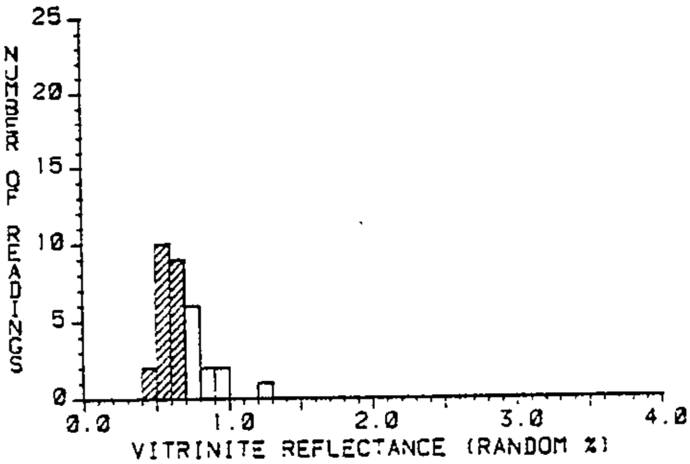
0.35	*0.40	*0.48
0.35	*0.42	*0.49
0.36	*0.43	*0.49
*0.38	*0.43	*0.53
*0.38	*0.44	*0.53
*0.38	*0.44	*0.54
*0.38	*0.44	*0.60
*0.39	*0.44	*0.64
*0.39	*0.45	*0.65
*0.39	*0.46	1.02

KEROGEN DESCRIPTION

Amorphous : 20 %
Exinite : 20 %
Vitrinite : 40 %
Inertinite : 20 %

Back Fluor : Med
Bitumen : ?High
Coke : None

FEDERAL 34D-9



RRUS No. : 6

DEPTH : 1400.0 Ft
: 426.7 M

* = Ro MATURITY

VALUES : 21

MEAN : 0.57
STD DEV : 0.07
MEDIAN : 0.56
MODE : 0.55

HISTOGRAM:
Range: 0- 4%
Increment: 0.10%

ORDERED REFLECTANCE VALUES:

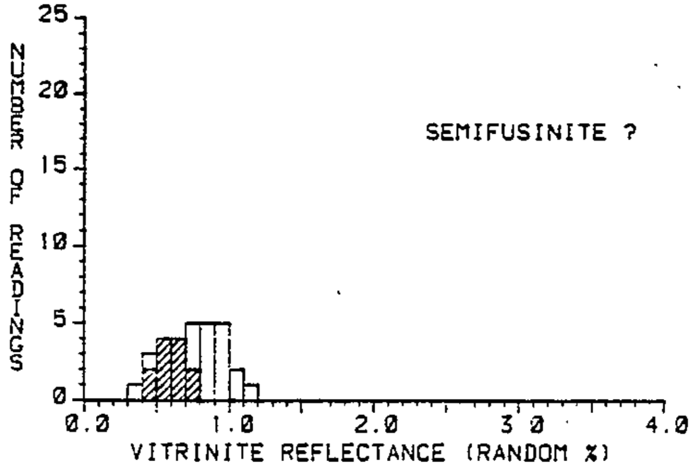
*0.44	*0.56	*0.69	0.92
*0.46	*0.56	0.72	1.27
*0.50	*0.60	0.74	
*0.51	*0.61	0.74	
*0.51	*0.61	0.77	
*0.51	*0.62	0.77	
*0.53	*0.63	0.78	
*0.54	*0.65	0.83	
*0.55	*0.65	0.84	
*0.56	*0.66	0.92	

KEROGEN DESCRIPTION

Amorphous : 25 %
Exinite : 10 %
Vitrinite : 40 %
Inertinite : 25 %

Back Fluor : Low
Bitumen : Small
Coke : None

FEDERAL 34D-9



RRUS No. : 7

DEPTH : 1600.0 Ft
: 487.7 M

* = Ro MATURITY

VALUES : 12

MEAN	:	0.59
STD DEV	:	0.09
MEDIAN	:	0.60
MODE	:	0.65

HISTOGRAM:
Range: 0- 4%
Increment: 0.10%

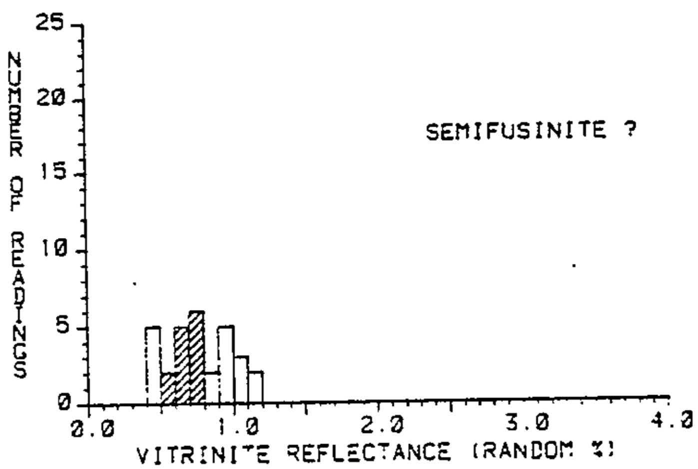
ORDERED REFLECTANCE VALUES:

0.39	*0.66	0.88
0.40	*0.66	0.89
*0.46	*0.72	0.90
*0.49	*0.74	0.93
*0.52	0.77	0.93
*0.53	0.79	0.98
*0.53	0.79	0.99
*0.53	0.81	1.00
*0.60	0.87	1.01
*0.61	0.88	1.14

KEROGEN DESCRIPTION

Amorphous	:	15 %
Exinite	:	10 %
Vitrinite	:	40 %
Inertinite	:	35 %
Back Fluor	:	Med
Bitumen	:	Small
Coke	:	tr

FEDERAL 34D-9



RRUS No. : 9

DEPTH : 2000.0 Ft
: 609.6 M

* = Ro MATURITY

VALUES : 13

MEAN	:	0.69
STD DEV	:	0.06
MEDIAN	:	0.69
MODE	:	0.75

HISTOGRAM:
Range: 0- 4%
Increment: 0.10%

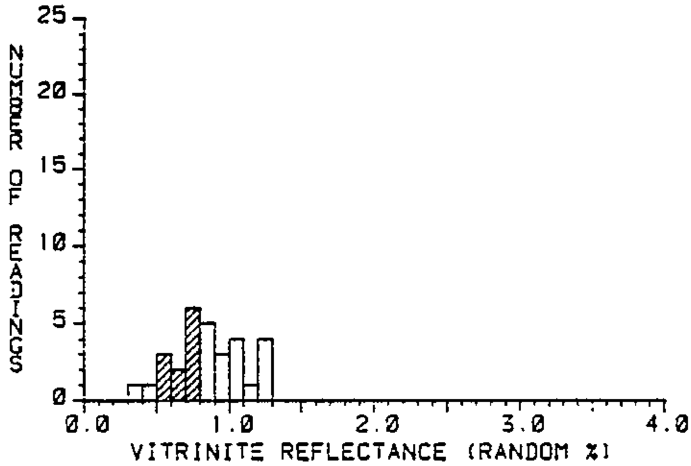
ORDERED REFLECTANCE VALUES:

0.41	*0.68	0.90
0.43	*0.69	0.93
0.46	*0.72	0.97
0.46	*0.73	0.97
0.47	*0.75	0.97
*0.54	*0.75	1.00
*0.58	*0.75	1.04
*0.67	*0.76	1.06
*0.67	0.81	1.15
*0.68	0.87	1.18

KEROGEN DESCRIPTION

Amorphous	:	30 %
Exinite	:	15 %
Vitrinite	:	30 %
Inertinite	:	25 %
Back Fluor	:	Med
Bitumen	:	Small
Coke	:	tr

FEDERAL 34D-9



RRUS No. : 11

DEPTH : 2400.0 Ft
: 731.5 M

* = Ro MATURITY

VALUES : 11

MEAN : 0.69
STD DEV : 0.07
MEDIAN : 0.70
MODE : 0.75

HISTOGRAM:
Range: 0- 4%
Increment: 0.10%

ORDERED REFLECTANCE VALUES:

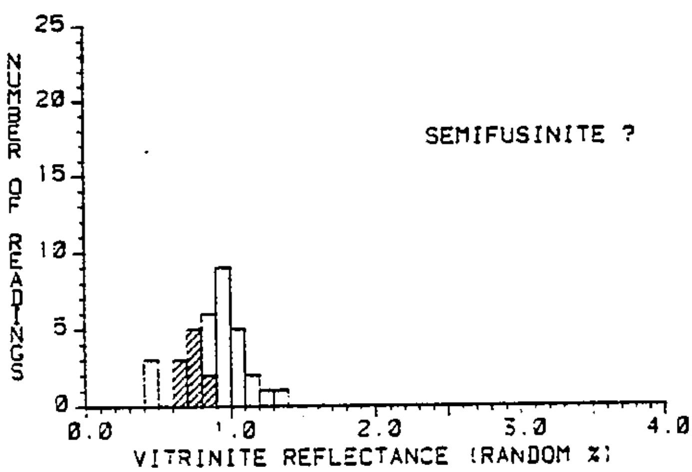
0.39	*0.75	0.99
0.49	*0.78	1.03
*0.58	*0.78	1.03
*0.59	0.80	1.05
*0.59	0.82	1.09
*0.63	0.86	1.10
*0.69	0.87	1.20
*0.70	0.89	1.21
*0.73	0.93	1.22
*0.73	0.98	1.26

KEROGEN DESCRIPTION

Amorphous	:	20 %
Exinite	:	10 %
Vitrinite	:	45 %
Inertinite	:	25 %

Back Fluor	:	High
Bitumen	:	None
Coke	:	tr

FEDERAL 34D-9



RRUS No. : 12

DEPTH : 2600.0 Ft
: 792.5 M

* = Ro MATURITY

VALUES : 10

MEAN : 0.74
STD DEV : 0.06
MEDIAN : 0.77
MODE : 0.75

HISTOGRAM:
Range: 0- 4%
Increment: 0.10%

ORDERED REFLECTANCE VALUES:

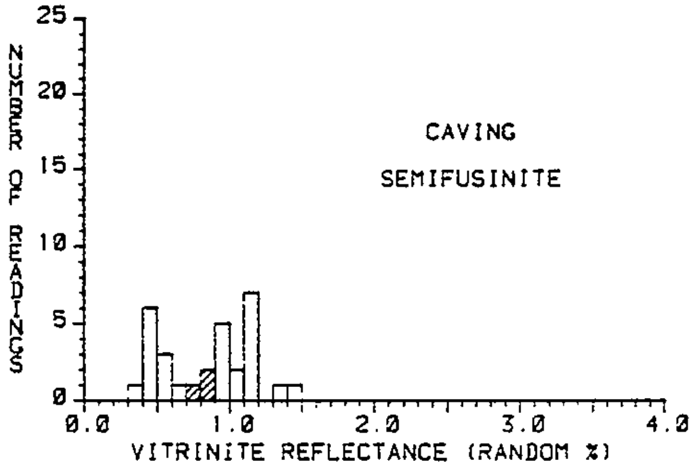
0.41	*0.79	0.93	1.05
0.43	*0.80	0.94	1.10
0.45	*0.82	0.94	1.13
*0.55	0.85	0.95	1.20
*0.65	0.85	0.96	1.34
*0.68	0.86	0.99	
*0.74	0.86	1.01	
*0.76	0.90	1.01	
*0.77	0.92	1.03	
*0.78	0.93	1.04	

KEROGEN DESCRIPTION

Amorphous	:	30 %
Exinite	:	10 %
Vitrinite	:	40 %
Inertinite	:	20 %

Back Fluor	:	High
Bitumen	:	Small
Coke	:	None

FEDERAL 34D-9



RRUS No. : 15

DEPTH : 3000.0 Ft
: 914.4 M

* = Ro MATURITY

VALUES : 3

MEAN : 0.81
STD DEV : 0.02
MEDIAN : 0.81
MODE : 0.85

HISTOGRAM:
Range: 0- 4%
Increment: 0.10%

ORDERED REFLECTANCE VALUES:

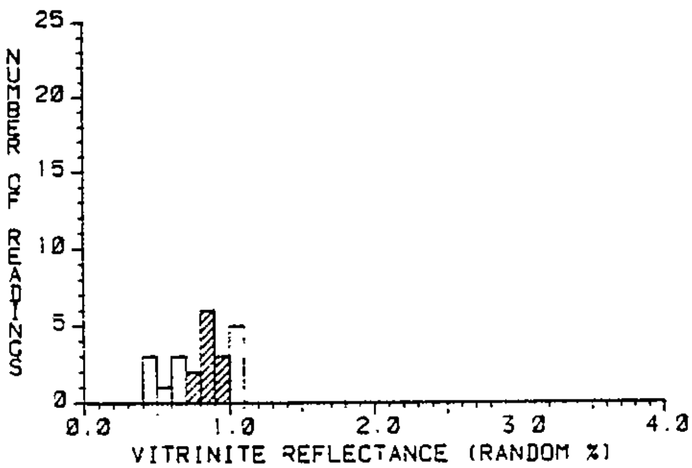
0.36	0.66	1.05
0.40	*0.79	1.10
0.42	*0.81	1.10
0.47	*0.83	1.11
0.47	0.93	1.12
0.48	0.95	1.12
0.49	0.96	1.18
0.50	0.98	1.19
0.51	0.98	1.31
0.57	1.02	1.40

KEROGEN DESCRIPTION

Amorphous	:	30 %
Exinite	:	5 %
Vitrinite	:	45 %
Inertinite	:	20 %

Back Fluor	:	Med
Bitumen	:	Med
Coke	:	tr

FEDERAL 34D-9



RRUS No. : 16

DEPTH : 3200.0 Ft
: 975.4 M

* = Ro MATURITY

VALUES : 11

MEAN : 0.85
STD DEV : 0.07
MEDIAN : 0.83
MODE : 0.85

HISTOGRAM:
Range: 0- 4%
Increment: 0.10%

ORDERED REFLECTANCE VALUES:

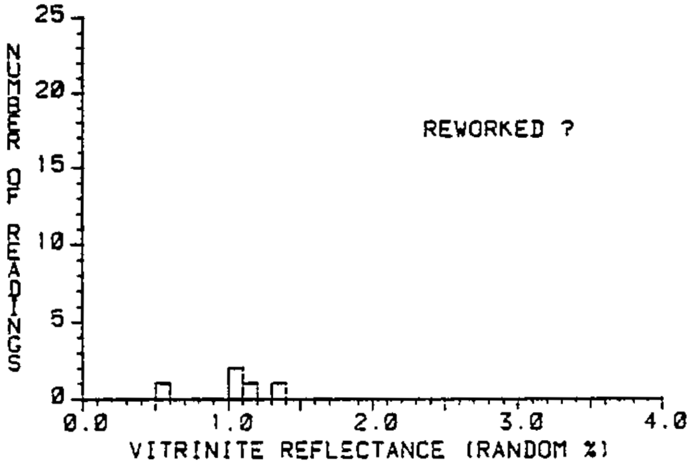
0.40	*0.82	1.04
0.43	*0.82	1.05
0.45	*0.83	1.07
0.58	*0.87	
0.60	*0.87	
0.62	*0.92	
0.63	*0.94	
*0.74	*0.97	
*0.79	1.00	
*0.80	1.01	

KEROGEN DESCRIPTION

Amorphous	:	30 %
Exinite	:	10 %
Vitrinite	:	35 %
Inertinite	:	25 %

Back Fluor	:	Med
Bitumen	:	Small
Coke	:	tr

FEDERAL 34D-9



RRUS No. : 17

DEPTH : 4298.0 Ft
: 1310.0 M

MEAN : N.D.

HISTOGRAM:
Range: 0- 4%
Increment: 0.10%

ORDERED REFLECTANCE VALUES:

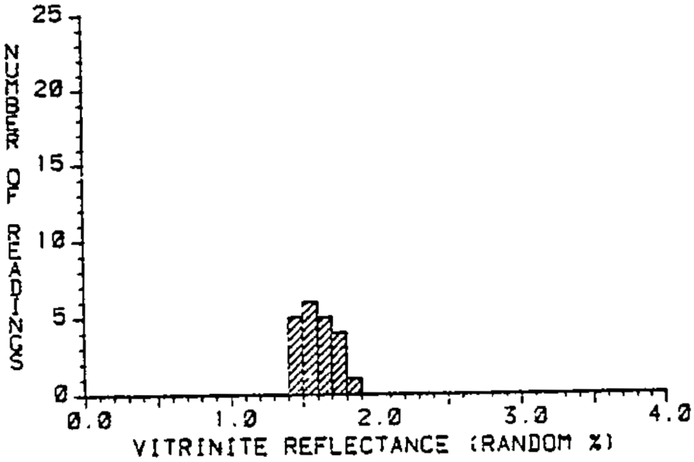
0.59
1.03
1.08
1.19
1.32

KEROGEN DESCRIPTION

Amorphous	:	55 %
Exinite	:	5 %
Vitrinite	:	30 %
Inertinite	:	10 %

Back Fluor	:	Med
Bitumen	:	Small
Coke	:	None

FEDERAL 34D-9



RRUS No. : 30

DEPTH : 7790.0 Ft
: 2374.4 M

* = Ro MATURITY

* VALUES : 21

MEAN	:	1.59
STD DEV	:	0.12
MEDIAN	:	1.58
MODE	:	1.55

HISTOGRAM:
Range: 0- 4%
Increment: 0.10%

ORDERED REFLECTANCE VALUES:

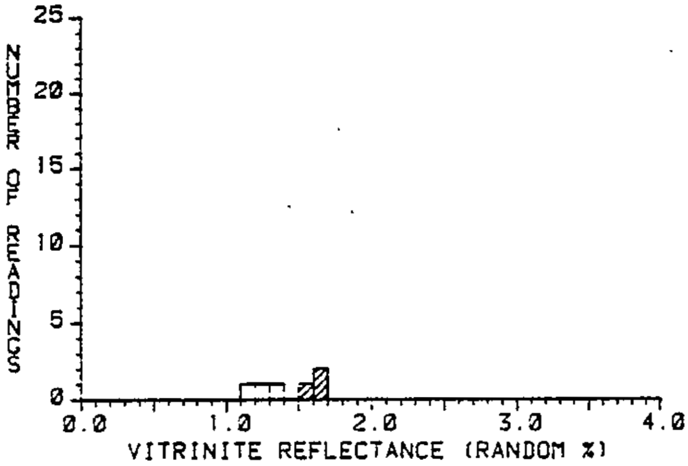
*1.43	*1.58	*1.86
*1.43	*1.60	
*1.44	*1.61	
*1.48	*1.65	
*1.49	*1.65	
*1.51	*1.66	
*1.52	*1.72	
*1.53	*1.73	
*1.54	*1.73	
*1.56	*1.77	

KEROGEN DESCRIPTION

Amorphous	:	5 %
Exinite	:	0 %
Vitrinite	:	85 %
Inertinite	:	10 %

Back Fluor	:	None
Bitumen	:	None
Coke	:	tr

FEDERAL 34D-9



RRUS No. : 38

DEPTH : 8110.0 Ft
: 2471.9 M

* = Ro MATURITY

VALUES : 3

MEAN : 1.61
STD DEV : 0.07
MEDIAN : 1.62
MODE : 1.65

HISTOGRAM:
Range: 0- 4%
Increment: 0.10%

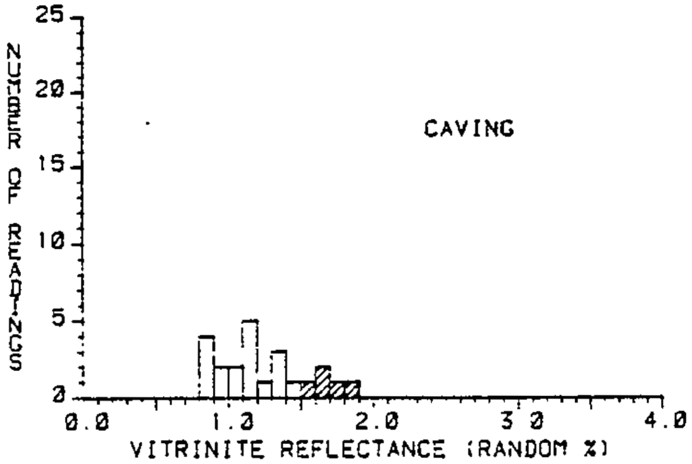
ORDERED REFLECTANCE VALUES:

1.19
1.21
1.39
*1.52
*1.62
*1.68

KEROGEN DESCRIPTION

Amorphous	:	5 %
Exinite	:	0 %
Vitrinite	:	50 %
Inertinite	:	45 %
Back Fluor	:	None
Bitumen	:	None
Coke	:	None

FEDERAL 34D-9



RRUS No. : 46

DEPTH : 8430.0 Ft
: 2569.5 M

* = Ro MATURITY

VALUES : 5

MEAN : 1.65
STD DEV : 0.10
MEDIAN : 1.63
MODE : 1.65

HISTOGRAM:
Range: 0- 4%
Increment: 0.10%

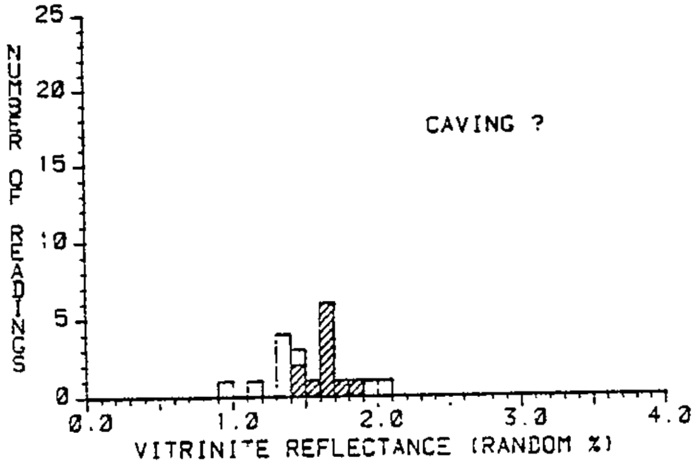
ORDERED REFLECTANCE VALUES:

0.81	1.12	*1.63
0.83	1.12	*1.71
0.84	1.14	*1.80
0.86	1.25	
0.91	1.34	
0.96	1.35	
1.02	1.38	
1.07	1.47	
1.10	*1.50	
1.12	*1.60	

KEROGEN DESCRIPTION

Amorphous	:	5 %
Exinite	:	0 %
Vitrinite	:	50 %
Inertinite	:	45 %
Back Fluor	:	None
Bitumen	:	Small
Coke	:	tr

FEDERAL 34D-9



RRUS No. : 49

DEPTH : 8540.0 Ft
: 2603.0 M

* = Ro MATURITY

VALUES : 11

MEAN : 1.63
STD DEV : 0.10
MEDIAN : 1.65
MODE : 1.65

HISTOGRAM:
Range: 0- 4%
Increment: 0.10%

ORDERED REFLECTANCE VALUES:

0.94	*1.62
1.10	*1.63
1.31	*1.65
1.34	*1.66
1.36	*1.67
1.39	*1.69
1.40	*1.76
*1.48	*1.81
*1.49	1.95
*1.51	2.01

KEROGEN DESCRIPTION

Amorphous	10 %
Exinite	5 %
Vitrinite	60 %
Inertinite	25 %

Back Fluor	Low
Bitumen	Small
Coke	None

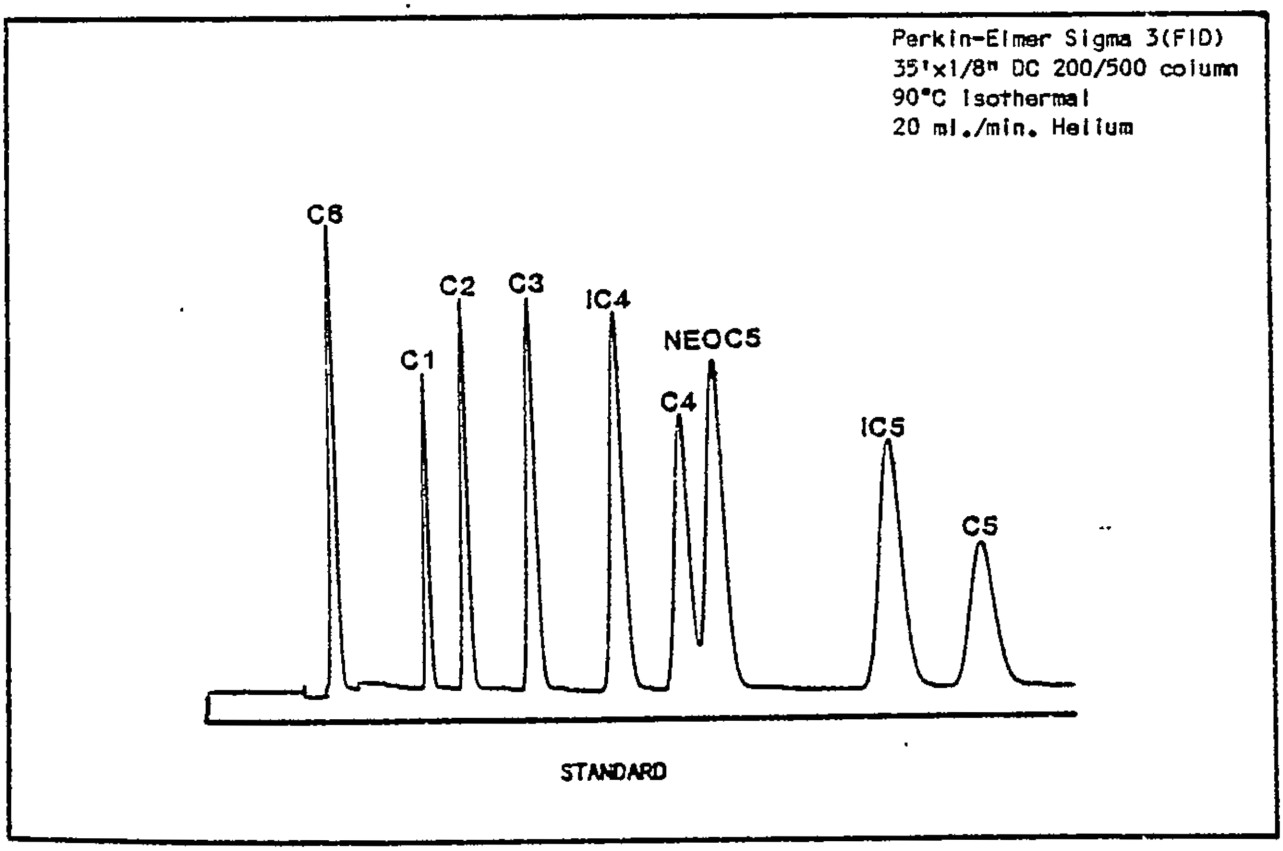
APPENDIX V

LIGHT ENDS (C_1-C_6^+) GAS ANALYSIS

Samples collected in sealed cans are analyzed for light end (C_1-C_6^+) components by headspace gas or cuttings gas chromatography. To provide an improved integration of the C_6^+ components a back-flush technique is employed resulting in the C_6^+ peak eluting first. The amounts of the individual gas components are computed in parts per million by multiplying the integrated peak areas for each by response factors determined from a standard gas. These values are then divided by the headspace volume to obtain the amounts of each gas component in microliters as reported in the data tables.

Key for data presented in "calculated ratios and parameters" table:

KCARB	-	weight of kerogen carbon (gms) in can.
GAS	-	amount of gas generated from kerogen carbon (μ liters)
WET GAS %	-	$\frac{(C_2-C_4) \times 100}{C_1 - C_4}$
----	-	ratios not obtained due to insufficient data



SUMMARY OF INDIVIDUAL COMPONENT CONCENTRATIONS IN HEADSPACE GAS
(ppm by volume in n-C:1 to n-C:6+ range)

FEDERAL 34D-9 WELL

STATION (Feet)	n-C:1 ppm	n-C:2 ppm	n-C:3 ppm	i-C:4 ppm	n-C:4 ppm	neC:5 ppm	i-C:5 ppm	n-C:5 ppm	C:6+ ppm	GAS uL	KCARB gms
225	19	3	9	Tr	Tr	Tr	1	Tr	11	33	1.2
600	13	Tr	4	Tr	Tr	Tr	Tr	0	4	18	1.4
800	15	Tr	0	Tr	Tr	0	Tr	0	0	13	0.2
1020	874	21	42	16	5	Tr	4	1	11	615	12.4
1200	66	10	30	6	2	0	2	0	7	86	1.1
1400	38	10	39	16	16	7	12	9	29	148	0.4
1600	19	Tr	2	1	1	Tr	1	Tr	6	27	1.4
1800	28	5	25	9	19	0	10	3	36	100	0.8
2000	30	7	36	17	42	0	22	10	67	169	0.9
2200	18	Tr	4	Tr	1	0	3	Tr	17	34	0.7
2400	19	5	32	7	15	0	8	5	27	94	0.9
2600 A	42	94	586	128	434	0	111	65	205	1369	1.3
2600 B	14	15	123	36	141	0	49	50	152	513	0.7
2800	14	12	120	38	135	0	49	44	118	442	0.6
3000	17	18	158	51	185	0	69	54	225	656	0.6
3200	41	99	171	50	145	0	56	13	168	561	0.9
4298	9	2	3	Tr	2	0	2	3	91	102	0.1
4320	11	1	3	1	3	0	3	4	102	114	0.1
4340	8	Tr	1	Tr	1	0	1	1	73	80	0.0
4360	9	Tr	1	Tr	1	0	1	1	78	83	0.1
4380	8	Tr	1	Tr	Tr	0	Tr	1	73	78	0.1
4395	12	Tr	3	Tr	Tr	0	Tr	1	72	81	0.0
7510	24	14	28	13	12	12	11	10	24	136	0.2
7550	10	1	1	Tr	1	1	1	1	8	22	0.0
7590	10	Tr	12	Tr	0	Tr	Tr	0	6	24	0.2
7630	18	Tr	17	Tr	0	0	0	0	1	21	0.3
7670	31	Tr	10	Tr	0	0	0	0	5	22	0.4
7710	16	2	37	0	0	0	0	0	0	37	0.0
7750	27	2	18	0	0	0	0	0	6	32	0.3
7790	16	Tr	0	0	0	0	0	0	6	16	0.3
7830	18	Tr	13	0	0	0	0	0	9	33	0.1
7870	22	Tr	11	0	0	0	0	0	5	33	0.1
7910	39	1	0	0	0	0	0	0	8	33	0.3
7950	26	1	26	0	0	0	0	0	12	49	0.2
7990	32	7	0	0	0	Tr	0	0	11	38	0.2
8030	26	1	0	0	0	0	0	0	9	28	0.2
8070	42	2	0	0	0	0	0	0	19	51	0.1
8110	57	15	53	18	21	Tr	26	10	60	163	0.5
8150	27	Tr	16	1	1	0	1	1	12	46	0.1
8190	20	1	4	Tr	0	0	1	1	11	25	0.2
8230	23	3	1	Tr	Tr	0	Tr	0	10	33	0.1
8270	16	1	7	Tr	Tr	0	Tr	Tr	8	29	0.0
8310	48	5	6	Tr	Tr	0	1	1	10	55	0.1
8350	17	Tr	1	Tr	Tr	0	Tr	0	7	23	0.1
8390	20	8	26	7	7	6	7	6	19	83	0.1
8430	39	7	25	1	2	Tr	1	1	17	80	0.3
8470	109	32	10	2	3	Tr	2	1	14	97	0.7
8510	31	8	4	1	1	0	1	Tr	8	44	0.3
8540	44	12	23	1	3	0	1	1	37	101	0.6

SUMMARY OF IMPORTANT RATIOS AND PARAMETERS
OBTAINED FROM HEADSPACE GAS ANALYSIS

FEDERAL 34D-9 WELL

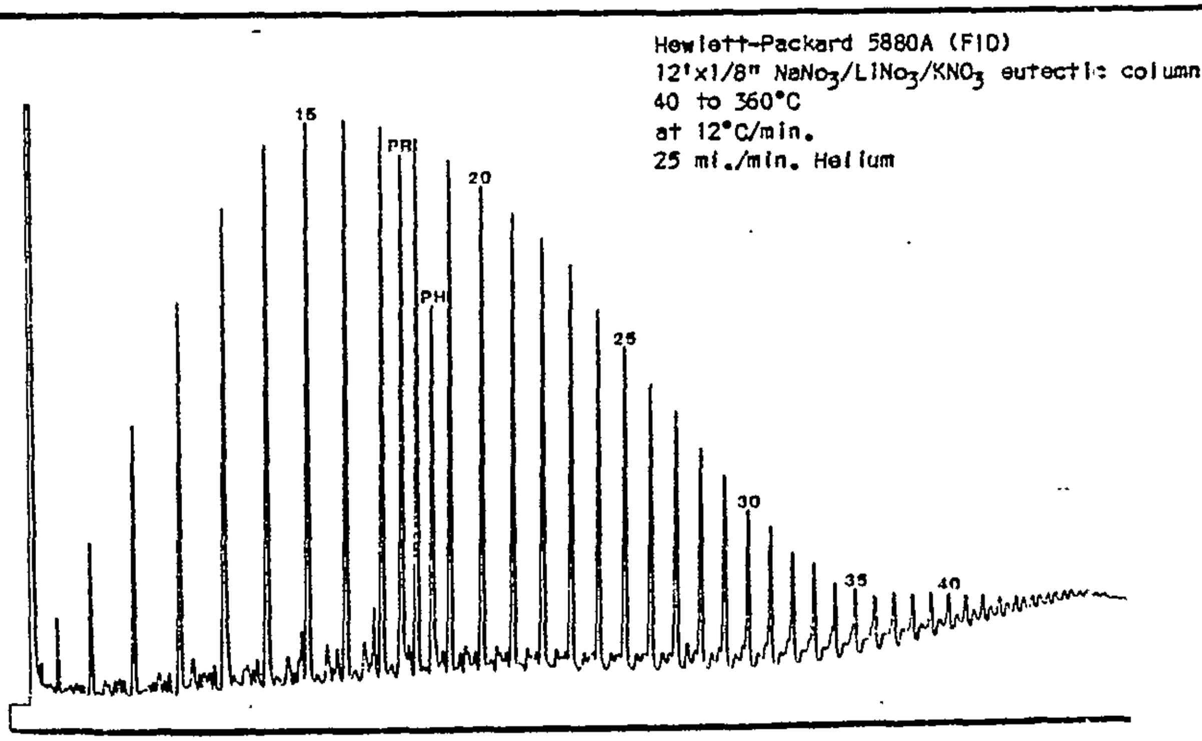
STATION (Feet)	GAS/KCARB uL/gm	WET GAS %	n/iso-C:4 ratio	n/iso-C:5 ratio	HEADSPACE GAS COMPOSITION %C:5-6+	%C:2-4	%C:1
225	26.4	39.7	1.9	0.4	30.9	27.4	41.6
600	12.8	31.9	0.7	---	23.0	24.5	52.3
800	52.6	2.0	0.5	---	2.8	1.9	95.2
1020	49.4	8.9	0.3	0.4	1.7	8.7	89.4
1200	76.5	42.9	0.4	---	7.7	39.5	52.6
1400	370.1	68.6	1.0	0.7	32.7	46.1	21.1
1600	18.6	22.7	1.0	0.8	25.9	16.8	57.2
1800	112.5	68.0	2.0	0.3	36.2	43.4	20.3
2000	182.0	77.0	2.4	0.4	42.6	44.2	13.1
2200	47.5	27.5	1.4	0.1	45.3	15.0	39.6
2400	100.1	76.3	2.0	0.5	33.7	50.5	15.7
2600 A	1037.1	96.6	3.3	0.5	22.9	74.5	2.5
2600 B	650.5	95.6	3.8	1.0	43.2	54.3	2.4
2800	738.2	95.4	3.5	0.9	39.9	57.3	2.7
3000	952.0	95.9	3.6	0.7	44.8	52.9	2.2
3200	603.2	91.8	2.8	0.2	31.9	62.4	5.5
4298	730.0	49.4	2.6	1.3	84.1	7.8	8.0
4320	1143.9	48.8	2.3	1.4	83.5	8.0	8.4
4340	893.6	31.5	3.1	1.5	85.3	4.6	10.0
4360	559.5	26.2	3.0	1.4	86.1	3.6	10.2
4380	710.2	21.3	2.5	1.0	87.0	2.7	10.2
4395	1021.7	26.2	1.7	1.4	80.9	5.0	14.0
7510	621.6	73.8	0.9	0.9	38.7	45.2	16.0
7550	370.8	31.8	1.1	0.9	45.4	17.3	37.2
7590	122.1	54.4	---	---	23.6	41.5	34.8
7630	62.9	50.1	---	---	2.9	48.6	48.4
7670	50.9	26.5	---	---	11.7	23.4	64.7
7710	463.1	71.0	---	---	0.0	71.0	29.0
7750	105.6	43.2	---	---	12.4	37.8	49.7
7790	43.0	1.8	---	---	28.8	1.3	69.9
7830	209.1	44.1	---	---	22.2	34.3	43.4
7870	306.2	34.5	---	---	14.0	29.7	56.2
7910	107.4	4.6	---	---	16.8	3.8	79.3
7950	249.2	51.6	---	---	18.2	42.2	39.5
7990	181.6	18.4	---	---	22.8	14.2	62.9
8030	129.5	3.9	---	---	25.5	2.9	71.5
8070	273.4	5.0	---	---	30.2	3.5	66.1
8110	309.1	65.6	1.1	0.4	36.6	41.5	21.7
8150	309.6	41.8	1.5	0.7	23.8	31.8	44.3
8190	101.4	25.6	---	1.0	32.3	17.3	50.2
8230	307.8	18.0	1.4	---	29.3	12.7	57.9
8270	498.0	38.0	1.6	0.7	27.6	27.5	44.8
8310	396.9	21.6	0.9	0.8	17.0	17.9	65.0
8350	210.7	12.0	1.0	---	28.1	8.6	63.2
8390	594.6	71.2	1.0	0.8	36.1	45.4	18.3
8430	205.6	48.9	1.3	0.9	21.5	38.3	40.1
8470	133.4	31.0	1.3	0.5	10.7	27.6	61.6
8510	126.9	33.4	1.7	0.6	17.5	27.6	54.8
8540	168.5	48.2	1.5	0.7	32.5	32.5	34.9

APPENDIX VI

ORGANIC EXTRACT DATA AND C_{15+} SATURATE ANALYSIS

A weighed amount of each sample is pulverized and soxhlet extracted for 18 hours with dichloromethane to obtain the total amount of extractable material. The extract is first treated with hexane in order to remove the insoluble asphaltenes. The precipitate is considered to be asphaltenes and the weight is recorded. The hexane soluble fraction is then separated into saturates, aromatics, and NSO compounds by successive elutions with hexane, benzene, and benzene-methanol on a silica-alumina chromatographic column. The functional groups, including asphaltenes, are weighed and expressed as the total extract in parts per million of the original sample weight. Each functional group is also expressed as a normalized weight per cent of the total extract.

The saturate fraction is analyzed using gas chromatographic techniques to separate and identify components in the C_{15} to C_{40} range. These straight chain paraffins (n-alkanes) are normalized to 100% and the per cent of each component is plotted on a bargraph. Specific pristane (Pr) and phytane(Ph) ratios are also calculated and plotted. Carbon preference index (CPI) values are calculated by the Bray and Evans formula.



STANDARD

COMPOSITION OF SOURCE ROCK EXTRACT

FEDERAL 34D-9 WELL

DEPTH(FEET)	EXTRACT PPM	% SAT	% AROM	% NSO	% ASPH
1020	7379	11.30	45.40	32.60	10.70
1200	309	9.10	19.50	47.80	23.60

SUMMARY TABLE SHOWING GROUP COMPOSITION AND SELECTED PARAMETERS OF ROCK EXTRACT

FEDERAL 34D-9 WELL

NOTATION	EXT/TOC	RELATIVE COMPOSITION			PR/PH	CPI
DEPTH(FEET)		%SAT	%ARO	%NSO+ ASPH		
1020	0.033	11.3	45.4	43.3	6.36	----
1200	0.053	9.1	19.5	71.4	4.03	1.83

HEAVY HYDROCARBONS NORMALIZED TO 100%

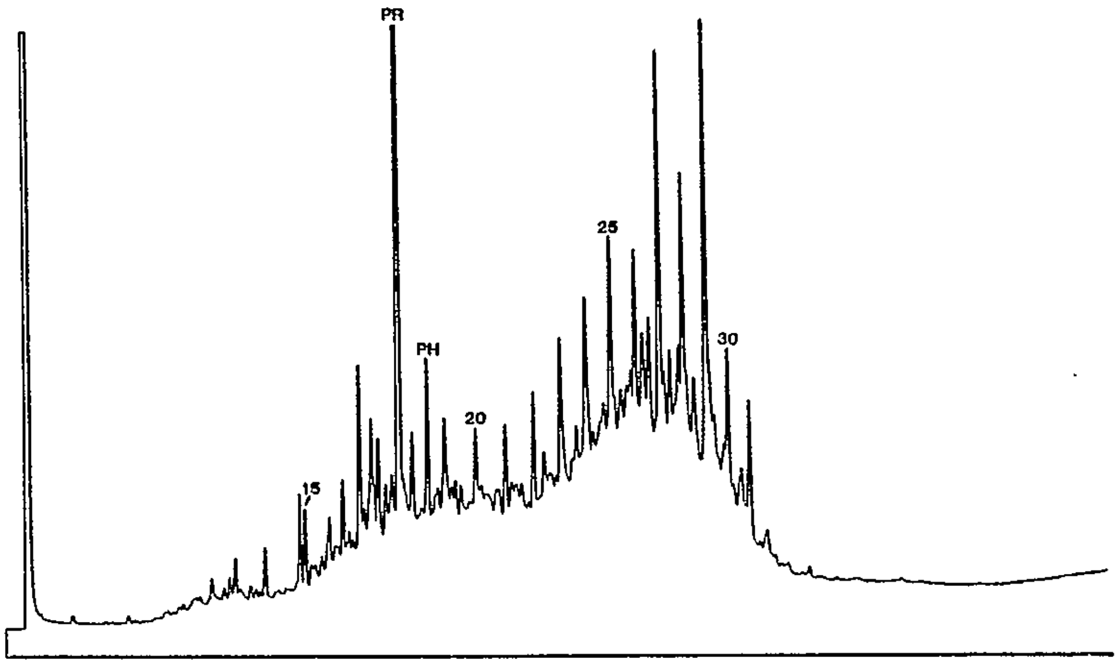
FEDERAL 34D-9 WELL

ID	C-10	C-11	C-12	C-13	C-14	C-15	C-16	C-17	C-18	C-19	C-20
1020.0	0.00	0.00	0.00	0.00	0.00	2.71	2.71	3.41	3.11	3.41	2.61
1200.0	0.00	0.00	0.00	0.00	0.00	0.60	1.40	2.70	3.60	3.50	3.70

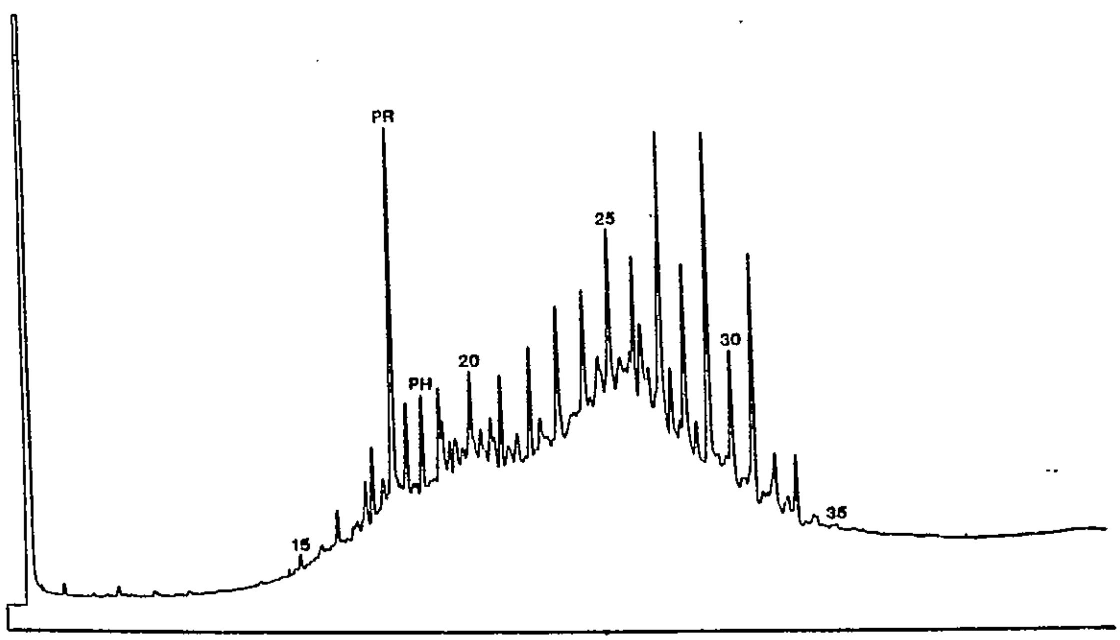
ID	C-21	C-22	C-23	C-24	C-25	C-26	C-27	C-28	C-29	C-30
1020.0	3.11	4.01	5.32	5.82	6.92	5.72	13.64	9.33	17.65	5.02
1200.0	3.40	4.30	5.60	6.00	8.10	6.90	11.30	6.90	12.50	5.00

ID	C-31	C-32	C-33	C-34	C-35	C-36	C-37	C-38	C-39	C-40
1020.0	4.71	0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1200.0	9.20	2.20	2.50	0.40	0.20	0.00	0.00	0.00	0.00	0.00

ID	PR/T X100	PH/T X100	PR/17	PH/18	PR/PH	CPI	C-MAX
1020.0	35.71	5.62	10.47	1.81	6.36	----	C-29
1200.0	14.10	3.50	5.22	0.97	4.03	1.83	C-29

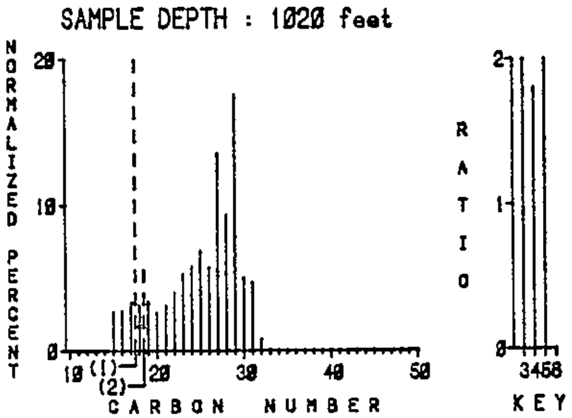


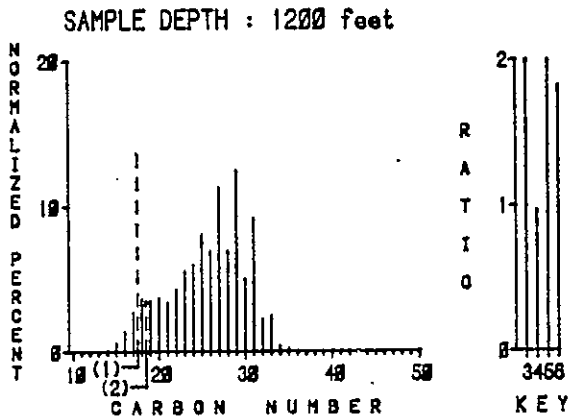
SAMPLE: 1,020 feet



SAMPLE: 1,200 feet

GAS CHROMATOGRAMS OF C15+ SATURATE HYDROCARBONS





FEDERAL 34D-9 WELL

1=100xPristane/Total 3=Pristane/n-C-17 5=Pristane/Phytane
2=100xPhytane/Total 4=Phytane/n-C-18 6=Carbon Pref.Index

NORMALIZED DISTRIBUTION OF n-ALKANES

ROBERTSON RESEARCH (U.S.) INC.
16730 Hedgecroft, Suite 306,
Houston, Texas 77060-3697
Tel: (713) ~~445-4587~~ 354-8018
Telex: 762684

Champlin #1 Federal-Mesa Alta
SE 9-18N-8W
McKinley County, New Mexico

April 30, 1984

Champlin Petroleum Company
5800 S. Quebec
Englewood, CO 80111

Attention: Jim Lister

Reference: Calibration Error in Rock-Eval Pyrolysis Equipment

Dear Mr. Lister:

Please be advised that the following project has been affected by a calibration error (see enclosed erratum sheet):

1. Project Number: RRUS/823/T/260/2
2. Report Number: 823/260
3. Name of Well: Federal 34D-9 Well
4. Date of Execution: April, 1983

We apologize for any inconvenience this error may cause. However, we would point out that the revised data will not influence our interpretation in any significant manner.

If you require a reprint of the corrected pyrolysis data, please let us know.

Sincerely,

ROBERTSON RESEARCH (U.S.) INC.

S H Coleman

Stephen H. Coleman
Director, Geochemical Studies

John R. Allen

John R. Allen
Director, Laboratory Services

JRA:jh

Erratum (March 19, 1984)

There was a calibration error in the Rock-Eval pyrolysis equipment during this project which has produced distorted S_3 data.

The impact of this error is on the reported S_3 abundance (mg carbon dioxide/gm of rock) and on the Oxygen Index value which is derived from the S_3 and total organic carbon data ($OI = (S_3 \times 100)/TOC$).

The correct S_3 values should read exactly twice the tabulated value.

Corrections should be made as follows:

1. Rock-Eval Pyrolysis Raw Data Table
   a. New S_3 = old S_3 X 2
   b. New S_2/S_3 ratio = old ratio X 0.5

2. Hydrogen and Oxygen Index Table
   a. New oxygen index = old oxygen index X 2

3. Hydrogen and Oxygen Index Crossplots
   a. All points move horizontally away from the origin, to their new oxygen index values.

4. No change to depth plots.

Union Pacific Resources
A Subsidiary of Union Pacific Corporation

FEB 16 1988
OIL CONSERVATION DIVISION
SANTA FE

February 11, 1988

SF - OK
1 year confid. 3-8-88

Mr. Roy Johnson
Energy Minerals and Natural Resources Dept.
Oil Conservation Division
P. O. Box 2088
Land Office Building
Santa FE, New Mexico 87501

Dear Roy:

Enclosed herewith is a copy of the geochemical analyses conducted on the Champlin Petroleum Federal 34D-9 well in McKinley County, New Mexico.

While our partner Santa Fe Energy and UPRC, have not been able to locate the particular confidentiality agreement regarding this well, Tim Parker, District Geologist for Santa Fe, and I discussed the matter and agreed to send you the information provided that you keep such data confidential.

Since Santa Fe is monetarily supporting your efforts to study the regional source rock potential of New Mexico, they, as we do, hope this will assist you.

Thank you very much for your help in obtaining data for the Shell SWEPI State well.

Sincerely,

Santa Fe OK
Norsan OK
UPR OK
Imediate Release
3-15-88
RE

James C. Lister

JCL/cjs
Enclosure
cc: W/O Attach Tim Parker
District Geologist
Santa Fe Energy
500 W. Illinois, Suite 500
Midland, Texas 79701

Union Pacific Resources Company
P.O. Box 1257
Englewood, Colorado 80150-1257
303/721-2000

STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION DIVISION

GARREY CARRUTHERS
GOVERNOR

POST OFFICE BOX 2088
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SANTA FE, NEW MEXICO 87504
(505) 827-5800

RECEIVED
APR 19 1988
ROCKY MOUNTAIN
EXPLORATION

APR 28 1988

APR 22 1988

April 15, 1988

Mr. James C. Lister
Union Pacific Resources Company
P. O. Box 1257
Englewood, Colorado 80150-1257

Dear Jim:

Thank you very much for your contribution of the geochemical analyses of the Champlin Petroleum Federal 34D-9 well in McKinley County to the New Mexico Hydrocarbon Source Rock Data Base. This report will be a very useful addition to the data base.

If you would sign below and return this letter to me as a waiver of confidentiality, we can release this information and incorporate it in the New Mexico Bureau of Mines open file system. I apologize for the delay in sending this letter after our conversation last month regarding its release.

Very truly yours,

Roy E. Johnson
Senior Petroleum Geologist

REJ:JB:sl

James C Lister
Senior Staff Geologist
4/22/88