

New Mexico Bureau of Mines and Mineral Resources
Open-File Report No. OF-268

GEOCHEMICAL ANALYSIS OF THE BRINKERHOFF DRILLING CO.
NO. 1 CABEZON-GOVERNMENT (SANDOVAL COUNTY), GREAT
WESTERN DRILLING CO. NO. 1 HOSPAH-SANTA FE
(MCKINLEY COUNTY), MAGNOLIA PETROLEUM CORP. NO. 1
HUTCHINSON-FEDERAL (SANDOVAL COUNTY), UNION OIL CO.
OF CALIFORNIA NO. 1 M-13 USA (SANDOVAL COUNTY), SUN OIL CO.
NO. 1 NAVAJO LANDS (SAN JUAN COUNTY), APACHE CORP. NO. 1
FOSHAY (SAN JUAN COUNTY), SHELL OIL CO. NO. 113-17
CARSON UNIT (SAN JUAN COUNTY), SKELLY OIL CO. NO. 1 NAVAJO O
(SAN JUAN COUNTY), TEXACO, INC. NO. 1 NAVAJO AL
(SAN JUAN COUNTY), AMERADA PETROLEUM CORP. NO. 1
NAVAJO TRACT 20 (SAN JUAN COUNTY), AND DELHI OIL CORP. NO. 4
UTE (SAN JUAN COUNTY) WELLS, NEW MEXICO

By James E. Keal
Robertson Research, Inc.
Houston, Texas

August 5, 1982

ROBERTSON RESEARCH (U.S.) INC.

REPORT NO. 823/43

GEOCHEMICAL ANALYSIS OF
ELEVEN WELLS FROM
SAN JUAN BASIN,
NEW MEXICO

Brinkerhoff #1 Cabezon	7-17N-3W	Sandoval
Great Western #1 Hospah	1-17N-9W	McKinley
Magnolia #1 Hutchinson-Fed.	14-19N-3W	Sandoval
Union of Cal. #1 M-13 USA	13-21N-5W	Sandoval
Sun #1 Navajo Lands	25-22N-9W	San Juan
Apache #1 Foshay	9-23N-13W	San Juan
Shell #113-17 Carson Unit	17-25N-11W	San Juan
Skelly #1 Navajo O	34-26N-14W	San Juan
Texaco #1 Navajo	28-26N-18W	San Juan
Amerada #1 Navajo Tr. 20	31-29N-17W	San Juan
Delhi #4 Ute	10-32N-14W	San Juan

by
James E. Keal

PROJECT NO. RRUS/823/T/43/2

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I

SUMMARY

Geochemical evaluation of samples from eleven wells in San Juan Basin, New Mexico indicate that Lower Cretaceous samples range from marginal to very good in source rock quality. Organic carbon values for Pennsylvanian age samples are much lower ranging from non-source to marginal except in the Delhi, #4 Ute well where source rock quality is good in some samples. The kerogen in all samples analyzed is primarily terrestrial and dry gas-generating. Wet gas-generating kerogen occurs to some extent in northwesterly wells. Cretaceous age samples have reached the oil-generating maturation zone only in the lower most part of the section in two of the three wells analyzed containing Cretaceous samples. These samples are not mature enough for gas-generation. Most Pennsylvanian age samples have matured beyond the oil-generation zone, although in two wells the section is immature. Erosion has removed 1,300 to 7,600 feet since maximum burial took place in these wells and hydrocarbon generation may no longer be active in some areas. Economic evaluation of the area should include consideration of source bed distribution and timing of hydrocarbon generation in relation to structural events.

II

INTRODUCTION

Cretaceous and Pennsylvanian age samples from eleven wells in San Juan Basin, New Mexico were analyzed according to a program outlined by the client. Because of very low organic content, Rock-Eval pyrolysis could not be run on three of these wells.

Analytical data are tabulated in Appendices I-III and selected parameters are plotted on Figures 1 through 38. Age designations shown on the figures were taken from sample logs supplied by the client.

III DISCUSSION

Organic Richness

Organic richness refers to the weight percent organic carbon the samples contain. Cretaceous samples from three wells were selected for total organic carbon (TOC) analyses. The Shell, #113-17 Carson Unit and the Apache, #1 Foshay contain the highest carbon content of Cretaceous samples. Lower Cretaceous samples from these two wells range from marginal (0.5-1.0%) to very good (>2.0%) (Figures 7 and 15) in source quality. The Great Western, #1 Hospah-Santa Fe Cretaceous samples range from marginal to good (1.0-2.0%) with the exception of the sample at 405 feet which is very good (Figure 1).

Most Pennsylvanian samples range from non-source (<0.5%) to marginal (Figures 1, 5, 7, 11, 15, 19, 21, 25, 29, 31, and 35) in source quality. Highest organic carbon values in Pennsylvanian age samples are found in wells to the northwest, particularly the Delhi, #4 Ute (Figure 35). In this well source quality ranges from marginal to good. The Amerada, #1 Navajo Tract-20 contains one sample at 6,768 feet rated as very good by TOC content (Figure 11). Other samples near this depth are very lean. The high TOC value for this sample is probably due to large amounts of migrated bitumen present as verified by visual kerogen examination (Appendix III). The majority of samples analysed of Pennsylvanian age are organic lean and are not considered to be source rocks. The volume of any possible source quality Pennsylvanian section which which may be present and the amount of petroleum generated would

be limited from this part of the basin. More favorable source facies may be present in other areas of the basin.

Kerogen Type

The type of kerogen present, and its capability to generate oil or gas, was determined by Rock-Eval pyrolysis and by visual examination with reflected light microscopy. Both techniques indicate a predominance of gas-generating, terrestrial organic matter in all of the samples analysed. Poor source potential (data from pyrolysis S_2 peak, Figures 2, 8, 12, 16, 22, 26, 32, and 36), low hydrogen index values (Figures 3, 9, 13, 17, 23, 27, 33, and 37), and low visual percentages of oil-generating amorphous and exinite organic matter (Figures 1, 5, 7, 11, 15, 19, 21, 25, 29, 31, and 35), all are characteristic of low hydrogen gas-generating kerogen. Somewhat more favorable convertability to oil defined by pyrolysis S_2/S_3 ratios (Figures 2, 8, 12, 16 and 36) is believed to be due to solid bitumen in the samples (Appendix III) and to unusually low oxygen index values (Figures 3, 9, 13, 17, and 37). This ratio, therefore, is probably not a good kerogen type indicator for samples from these wells.

Pennsylvanian organic carbon values were too low for kerogen typing by pyrolysis in the Texaco, #1 Navajo AL, Great Western, #1 Hospah-Santa Fe, Magnolia, #1 Hutchinson-Federal and the Sun, #1 Navajo Lands, but appear to contain terrestrial kerogen from visual analysis.

Of the wells analysed, those in the northwesterly area appear to have the best potential for kerogen convertability to liquid hydrocarbons from visual kerogen examination (Figures 5, 7, 11, 25, and 35).

Kerogen Maturity

Kerogen maturity was determined by vitrinite reflectance (R_o) and Rock-Eval pyrolysis (T-max). Zones of petroleum generation and destruction are correlated with T-max and vitrinite reflectance values (Figure, Appendix III). Pyrolysis T-max values are often low due to cavings. Significant amounts of caved material affected T-max values in these wells. The apparent lack of maturity increase with depth in the Skelly, #1 Navajo-0, Brinkerhoff, #1 Cabezon Gov't, Apache, #1 Foshay, Shell, #113-17 Carson Unit, and Union, #1-M-13 U.S.A. is probably due to the presence of cavings from shallower organic rich sections (Figures 8, 16, 22, 26, and 32). The presence of anomalously low-rank vitrinite in deeper Pennsylvanian samples in these wells was confirmed by visual kerogen analysis of samples (Appendix III). Indigenous vitrinite is present in nearly all wells examined except the Skelly, #1 Navajo-0. The Pennsylvanian section analyzed in this well contains primarily caved vitrinite. Maturation profiles are more reliable when samples for vitrinite reflectance are chosen every few hundred feet throughout a well. Two wells, Skelly, #1 Navajo-0 and Texaco, #1 Navajo AL, contain only one depth with reasonable reflectance values. For these wells we have projected a maturation profile similar to that of nearby wells with more reliable data. The most likely indigenous vitrinite populations are used in constructing maturation profiles (Figures 4, 6, 10, 14, 18, 20, 24, 28, 30, 34, and 38). In spite of contamination problems and somewhat poor quality data in many samples, we believe the maturity profiles are reasonable.

Lower Cretaceous cuttings reach the oil-generation zone ($0.6-1.4 R_o$) in the Shell, #113-17 Carson Unit (Figure 18) and in the Apache, #1 Foshay (Figure 10). Cretaceous age cuttings in the Great Western, #1 Hospah-Santa Fe well do not attain oil-generating maturity (Figure 4).

Reflectance values in Pennsylvanian age sections indicate that the Apache, #1 Foshay, Skelly, #1 Navajo-0, Magnolia, #1 Hutchinson-

Federal, Sun, #1 Navajo Lands, Union, #1-M-13 U.S.A., and Shelf, #113-17 Carson Unit have matured beyond the oil-generation zone and have reached the wet gas (0.8-2.0 R_o) and dry gas-generation zone (1.0-3.2 R_o) (Figures 10, 18, 20, 24, 28, and 30). Pennsylvanian age sections in the Great Western, #1 Hospah-Santa Fe, Texaco, #1 Navajo AL, Amerada, #1 Navajo Tract-20, and Brinkerhoff, #1 Cabezon Gov't have not matured beyond the oil-generation zone (Figures 6, 4, 14, and 34).

Projection of the maturity profile to 0.2 R_o in these wells indicates that 1,300 to 7,600 feet of overburden has been lost to erosion since maximum burial took place. Cooling associated with this loss of section may have caused hydrocarbon generation to become suspended and source beds classified as being in a certain hydrocarbon-generating zone (i.e. oil, wet, or dry gas) by vitrinite reflectance may not be actively generating oil or gas at the present time. Hydrocarbon expulsion, migration and accumulation are likely to have occurred during maximum burial. Structures formed later may not contain hydrocarbons unless remigration has occurred.

Maturation trends from these wells suggest that the geothermal gradient increases basinward. Meissner (1981) found that Upper Cretaceous coals are low in rank on the south flank of the basin while they crop out on the north and northeast flank at a much higher rank. This suggests equivalent maturation levels in the basin are not horizontal due to differential erosion and variable geothermal gradients due to intrusives.

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GREAT WESTERN, #1 HOSPAN-SANTA-FE

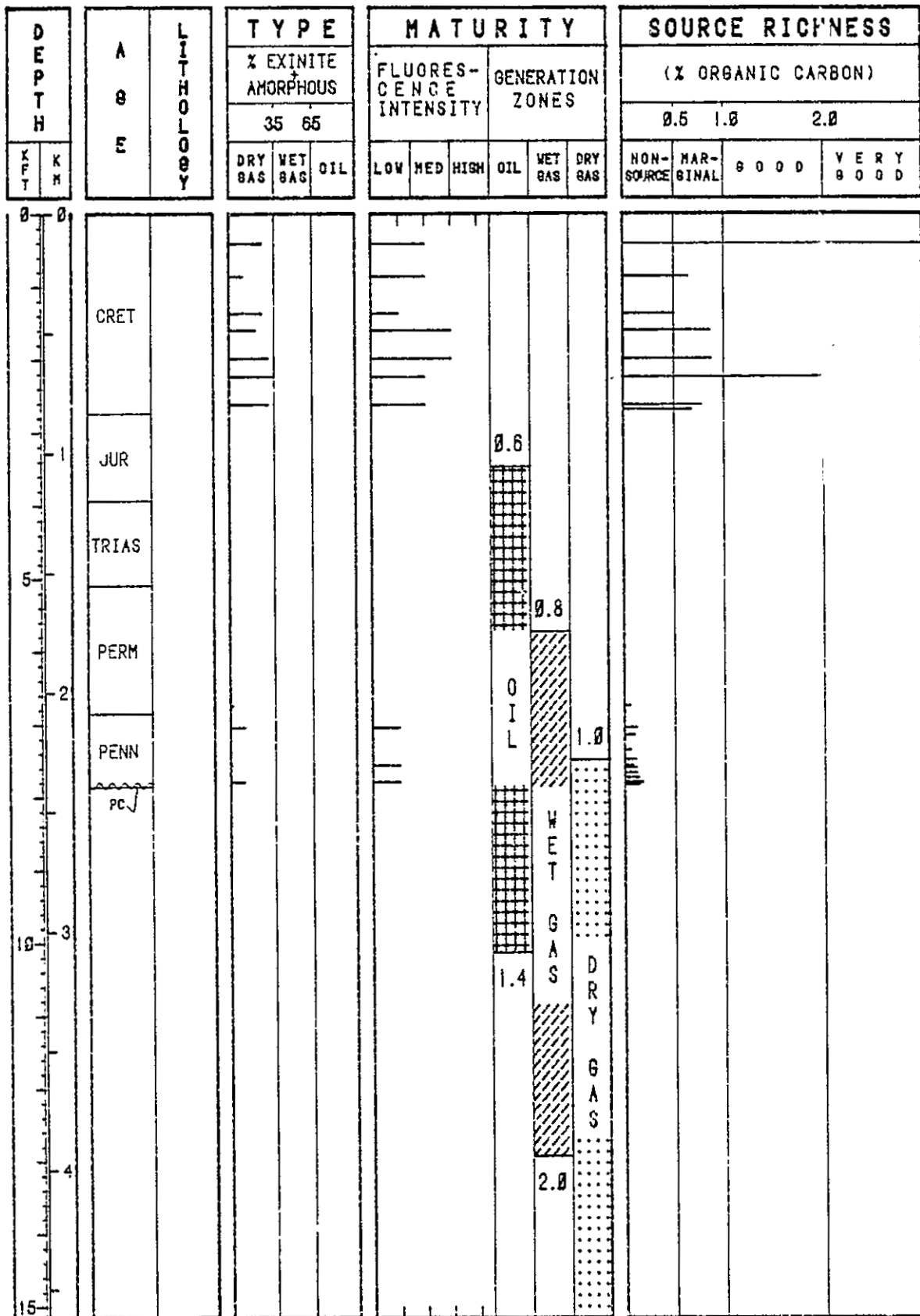


FIGURE 1: SUMMARY PLOTS SHOWING KEROGEN TYPES, MATURITY,
AND SOURCE RICHNESS (SEE APPENDICES I AND III)

GREAT WESTERN, #1 HOSPAH-SANTA-FE

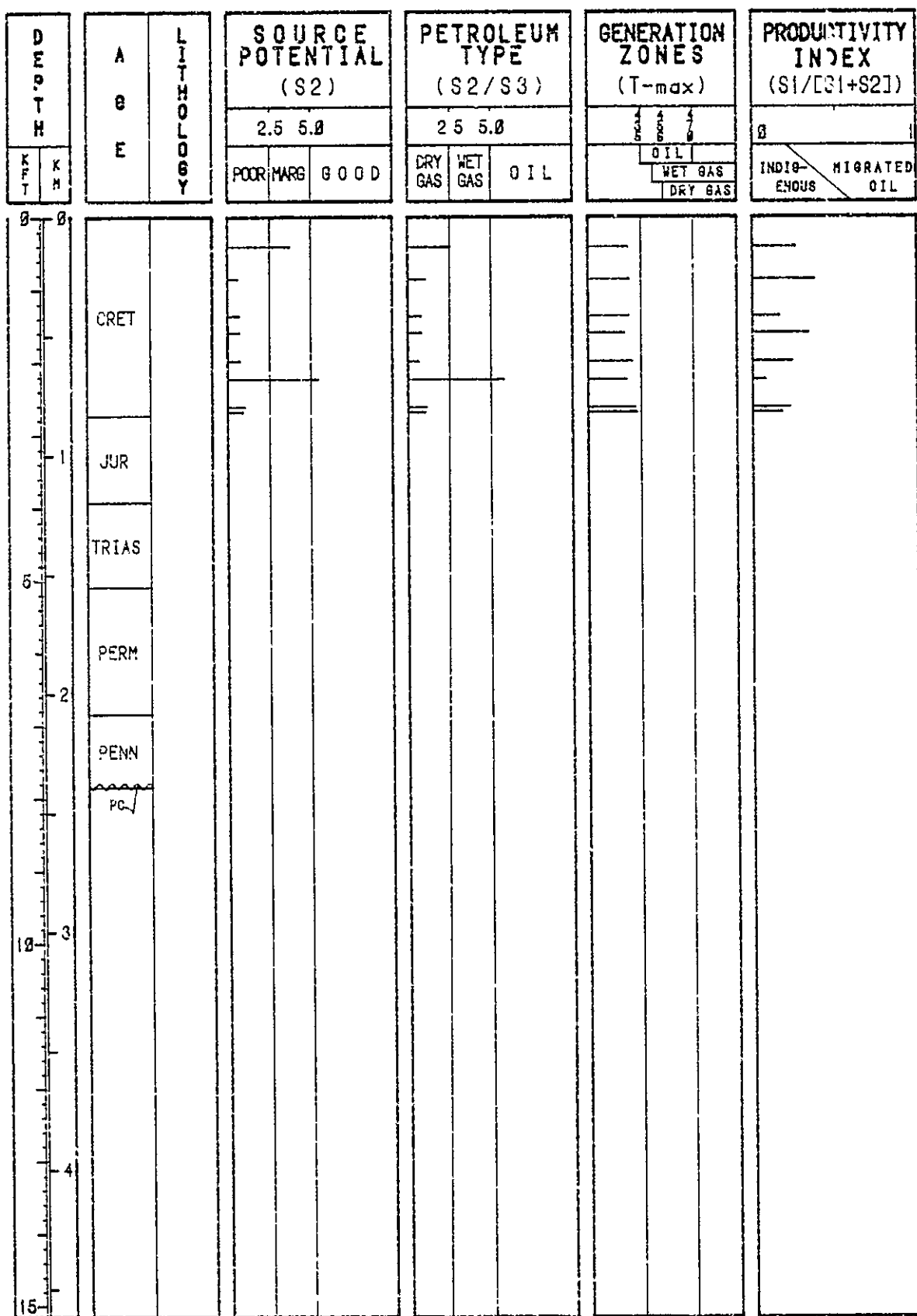


FIGURE 2: SUMMARY PLOTS OF ROCK-EVAL PYROLYSIS DATA (APPENDIX II)

GREAT WESTERN, #1 HOSPAH-SANTA-FE

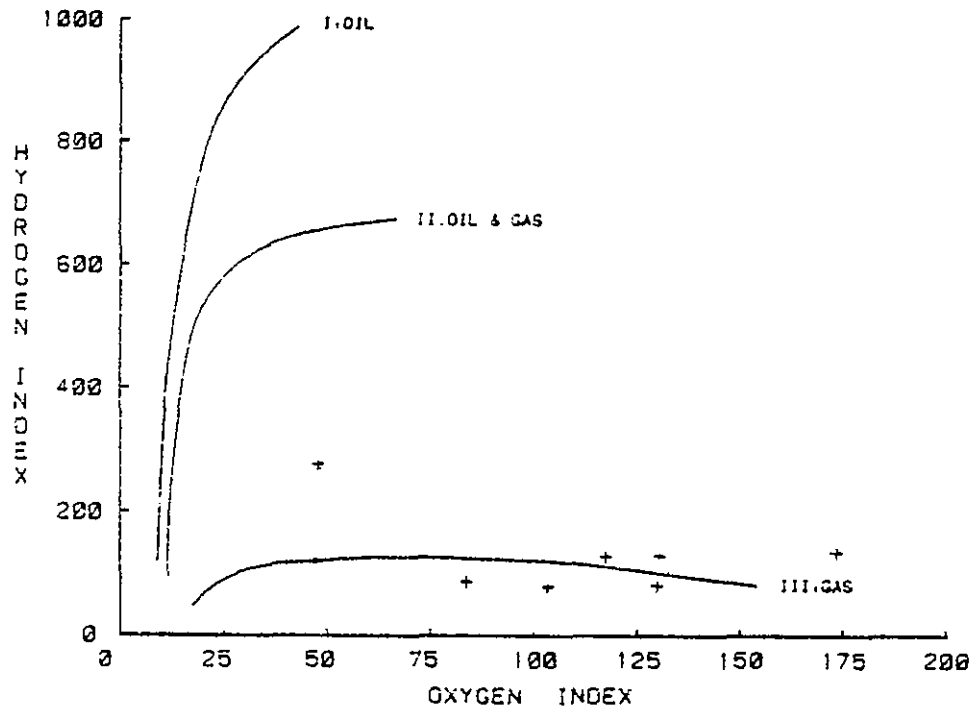


FIGURE 3: KEROGEN TYPE DETERMINATION FROM ROCK-EVAL. PYROLYSIS DATA (APPENDIX II).

GREAT WESTERN, #1 HOSPAH-SANTA-FE

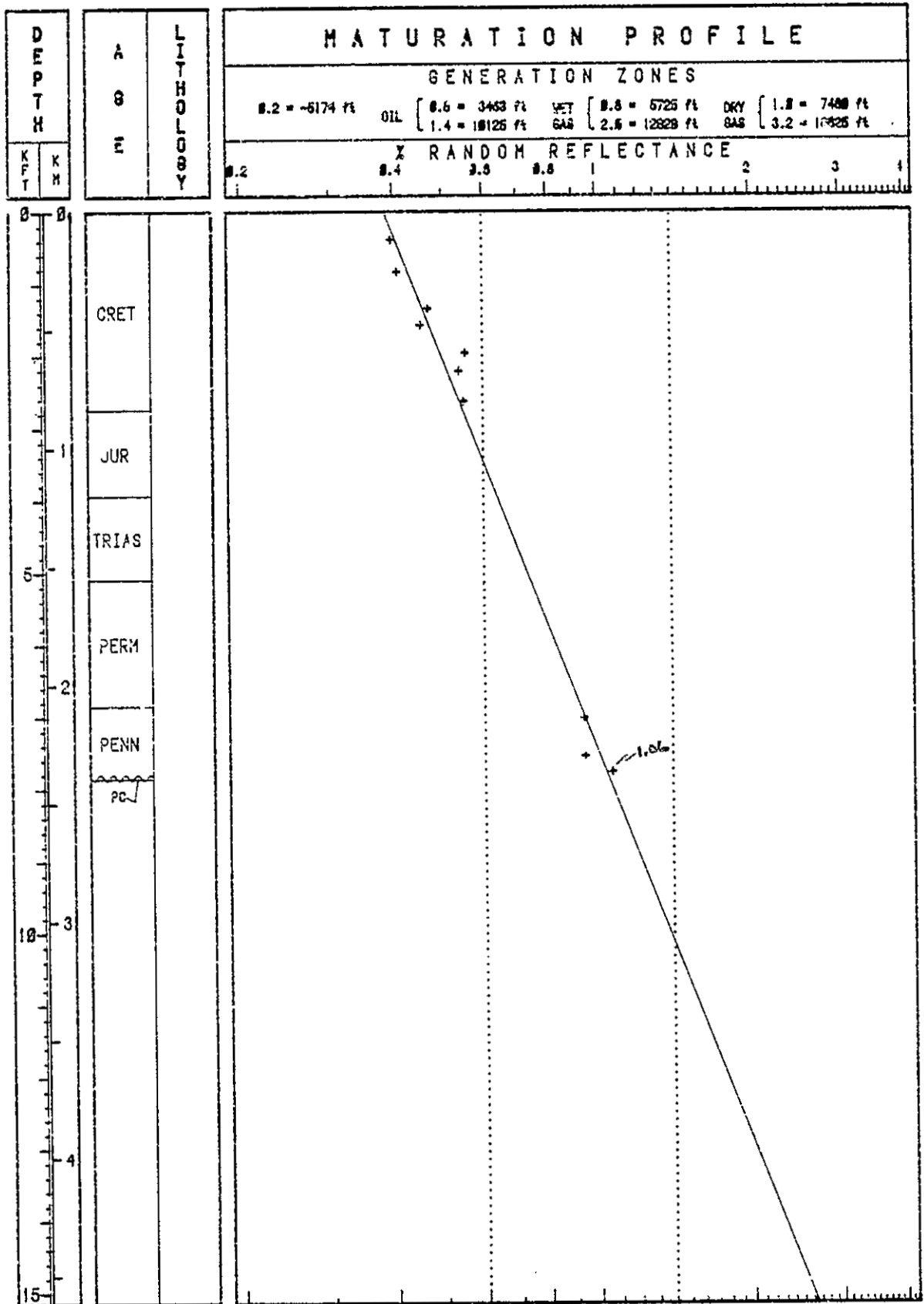


FIGURE 4: MATURATION PROFILE, BASED ON VITRINITE
REFLECTANCE DATA (APPENDIX III)

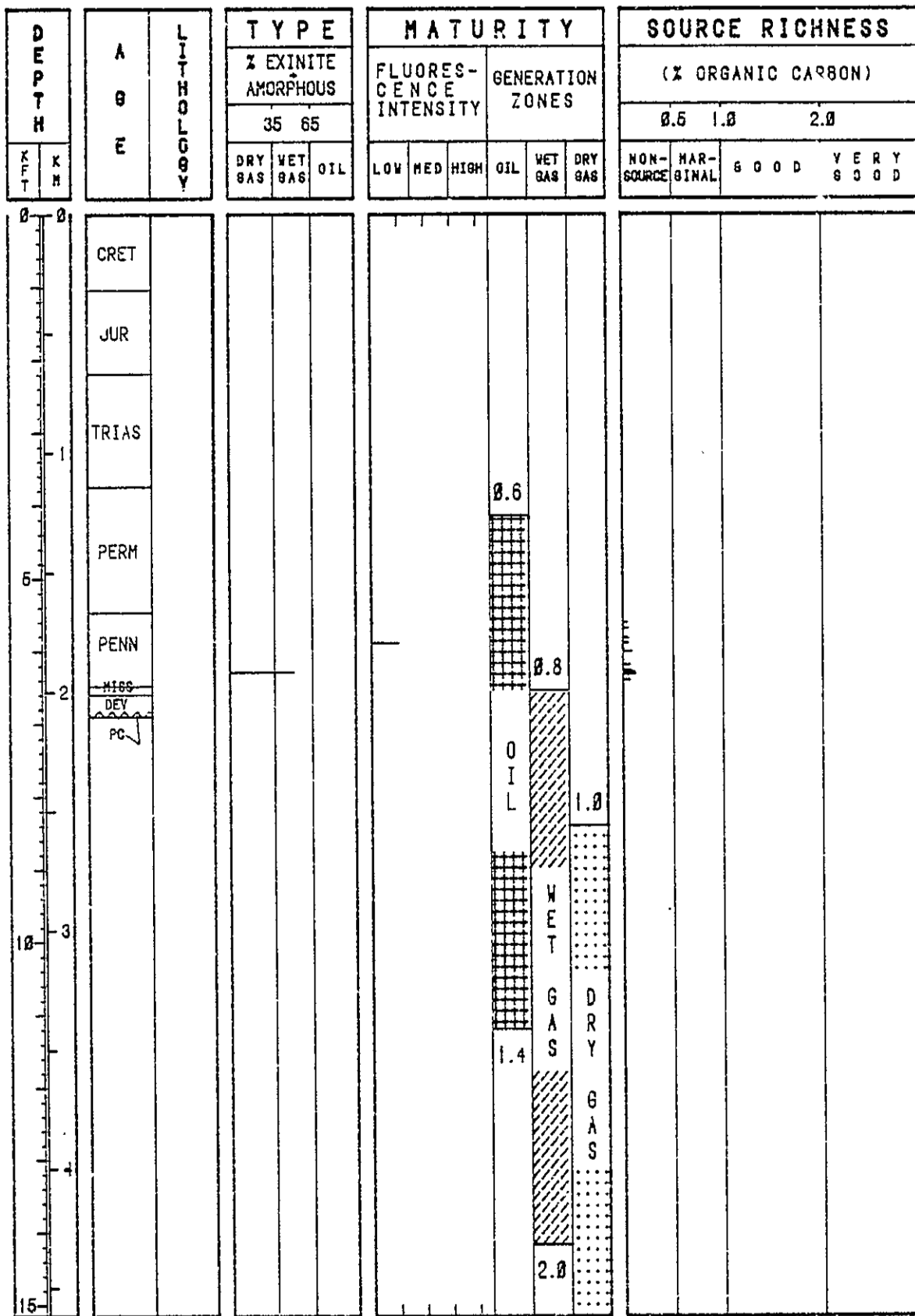


FIGURE 5: SUMMARY PLOTS SHOWING KEROGEN TYPES, MATURITY, AND SOURCE RICHNESS (SEE APPENDICES I AND III)

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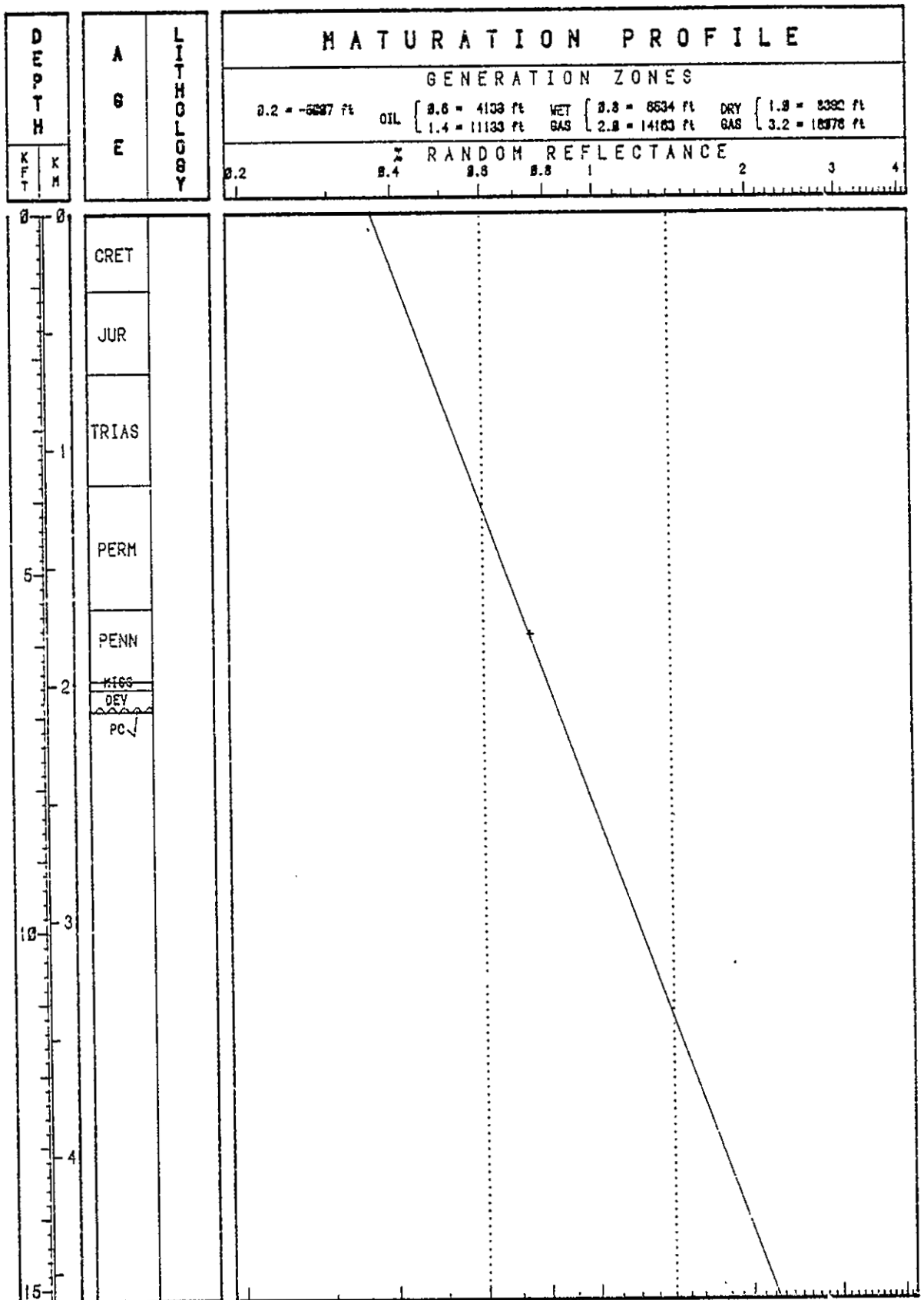


FIGURE 6: MATURATION PROFILE, BASED ON VITRINITE REFLECTANCE DATA (APPENDIX III)

APACHE, #1 FOSHAY

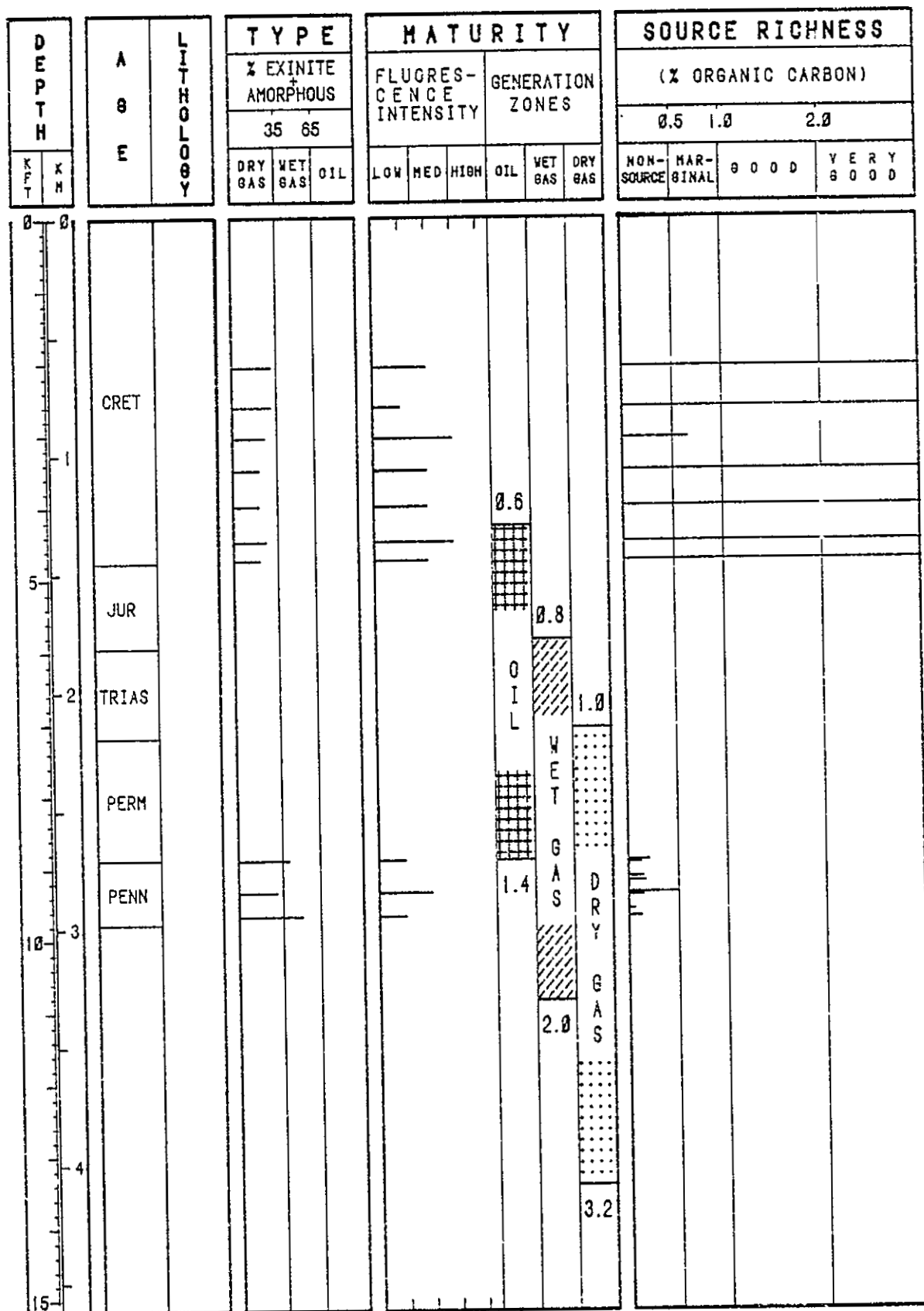


FIGURE 7: SUMMARY PLOTS SHOWING KEROGEN TYPES, MATURITY,
AND SOURCE RICHNESS (SEE APPENDICES I AND II)

ROBERTSON
RESEARCH (U.S.) INC.

APACHE, #1 FOSHAY

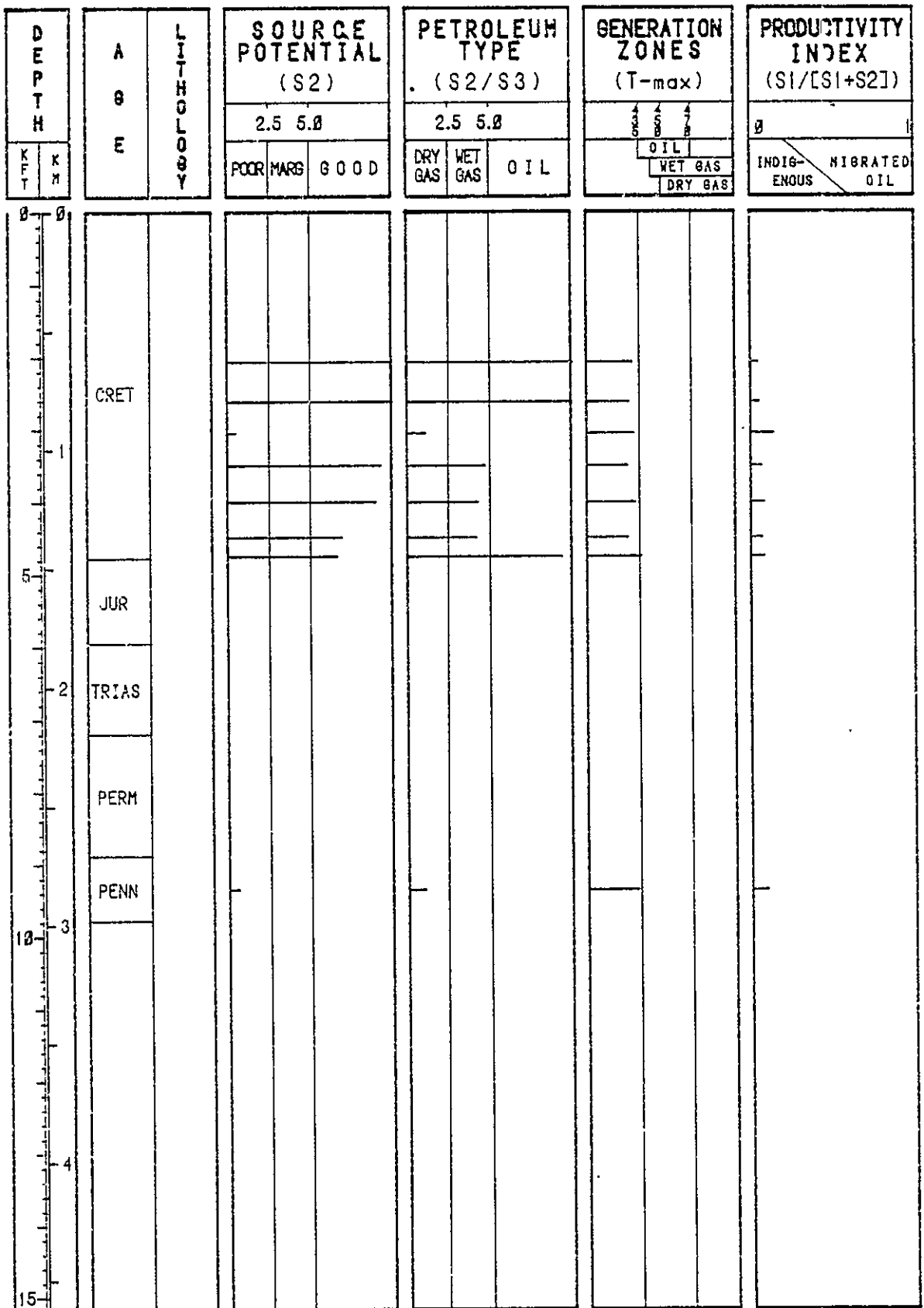


FIGURE 8: SUMMARY PLOTS OF ROCK-EVAL PYROLYSIS DATA (APPENDIX II)

APACHE, #1 FOSHAY

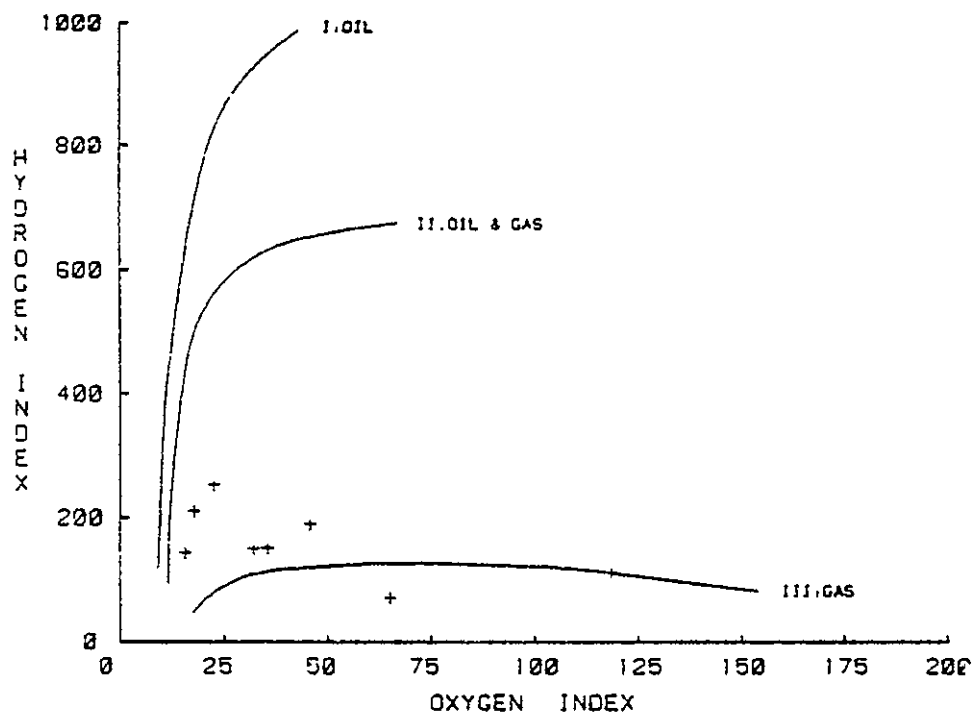


FIGURE 9: KEROGEN TYPE DETERMINATION FROM ROCK-EVAL. PYROLYSIS DATA (APPENDIX II).

APACHE, #1 FOSHAY

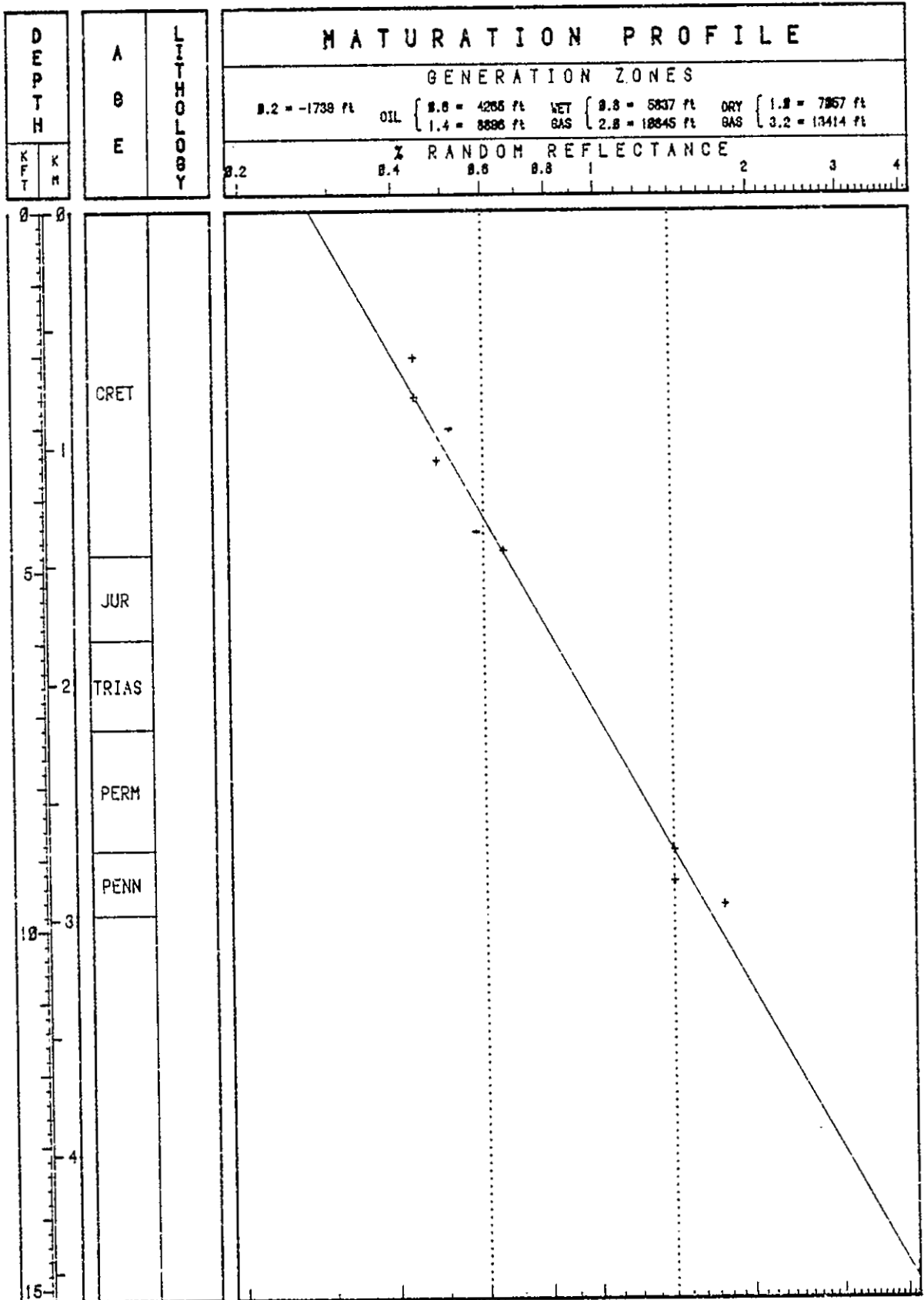


FIGURE 10: MATURATION PROFILE, BASED ON VITRINITE REFLECTANCE DATA (APPENDIX III)

AMERADA, #1 NAVAJO TRACT-20

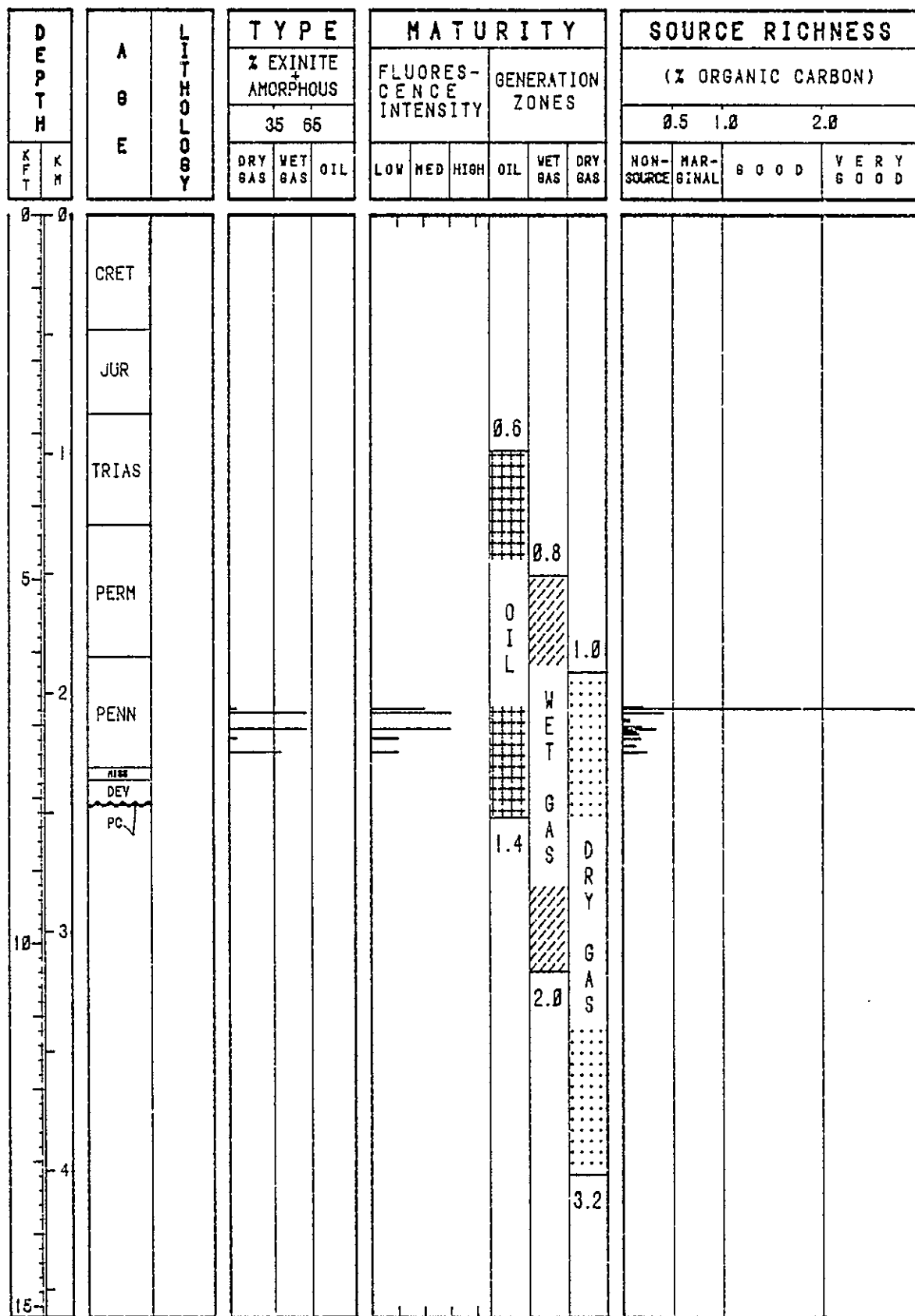


FIGURE 11: SUMMARY PLOTS SHOWING KEROGEN TYPES, MATURITY, AND SOURCE RICHNESS (SEE APPENDICES I AND II)

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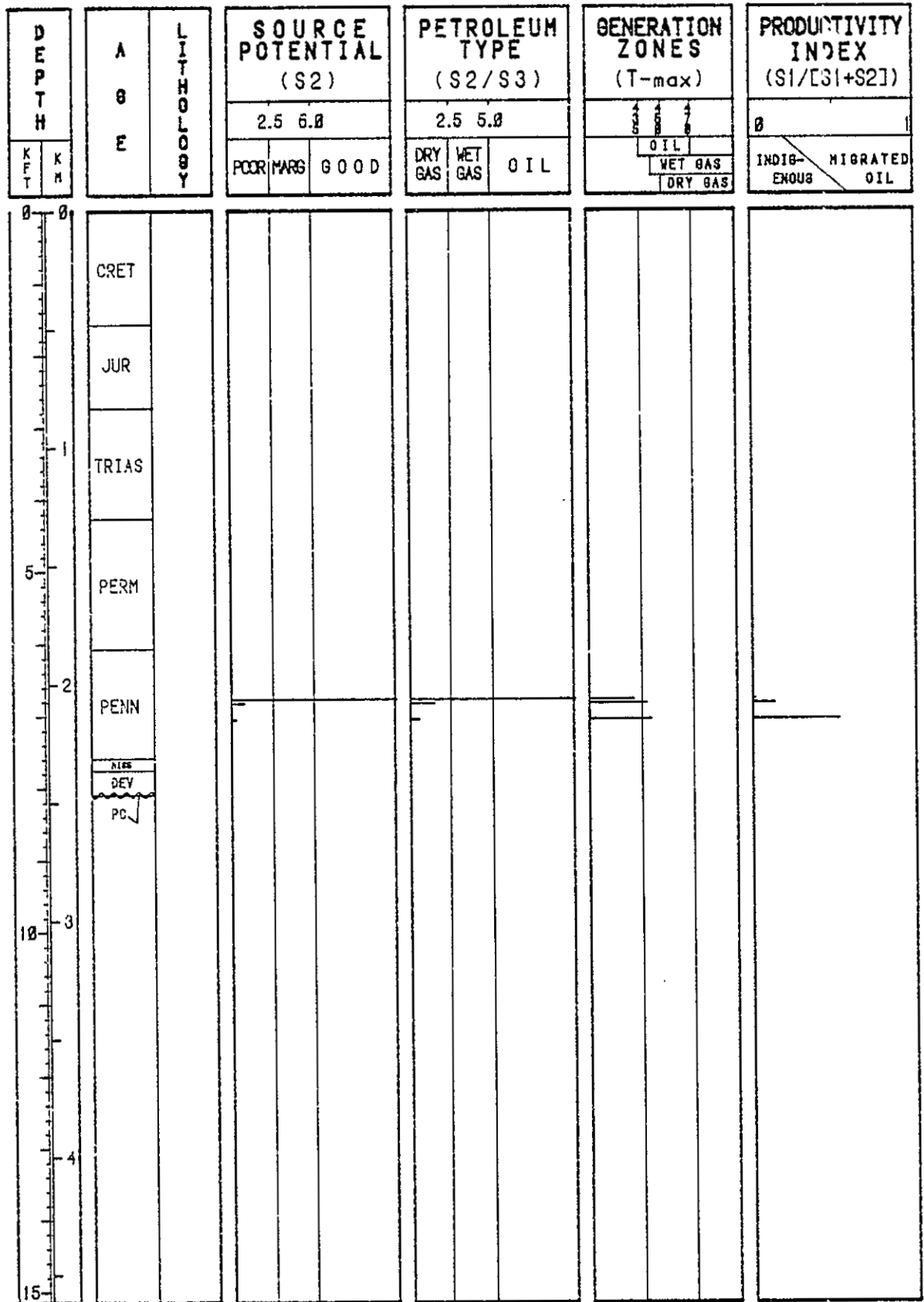


FIGURE 12: SUMMARY PLOTS OF ROCK-EVAL PYROLYSIS DATA (APPENDIX II)

AMERADA, #1 NAVAJO TRACT-20

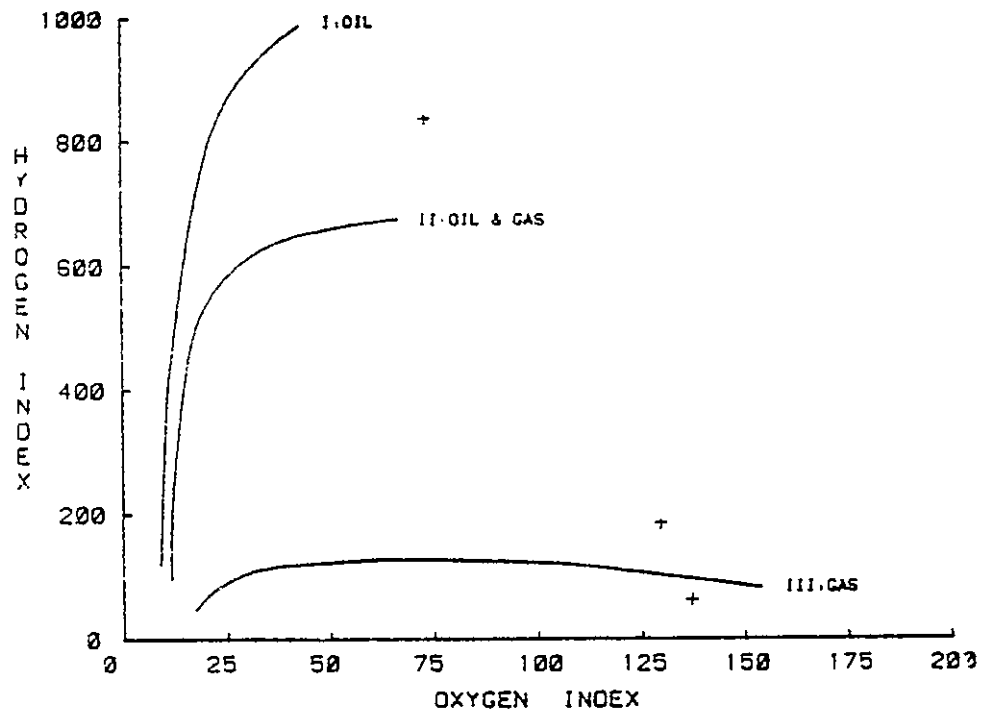


FIGURE 13: KEROGEN TYPE DETERMINATION FROM ROCK-EVAL.
PYROLYSIS DATA (APPENDIX II).

AMERADA, #1 NAVAJO TRACT-20

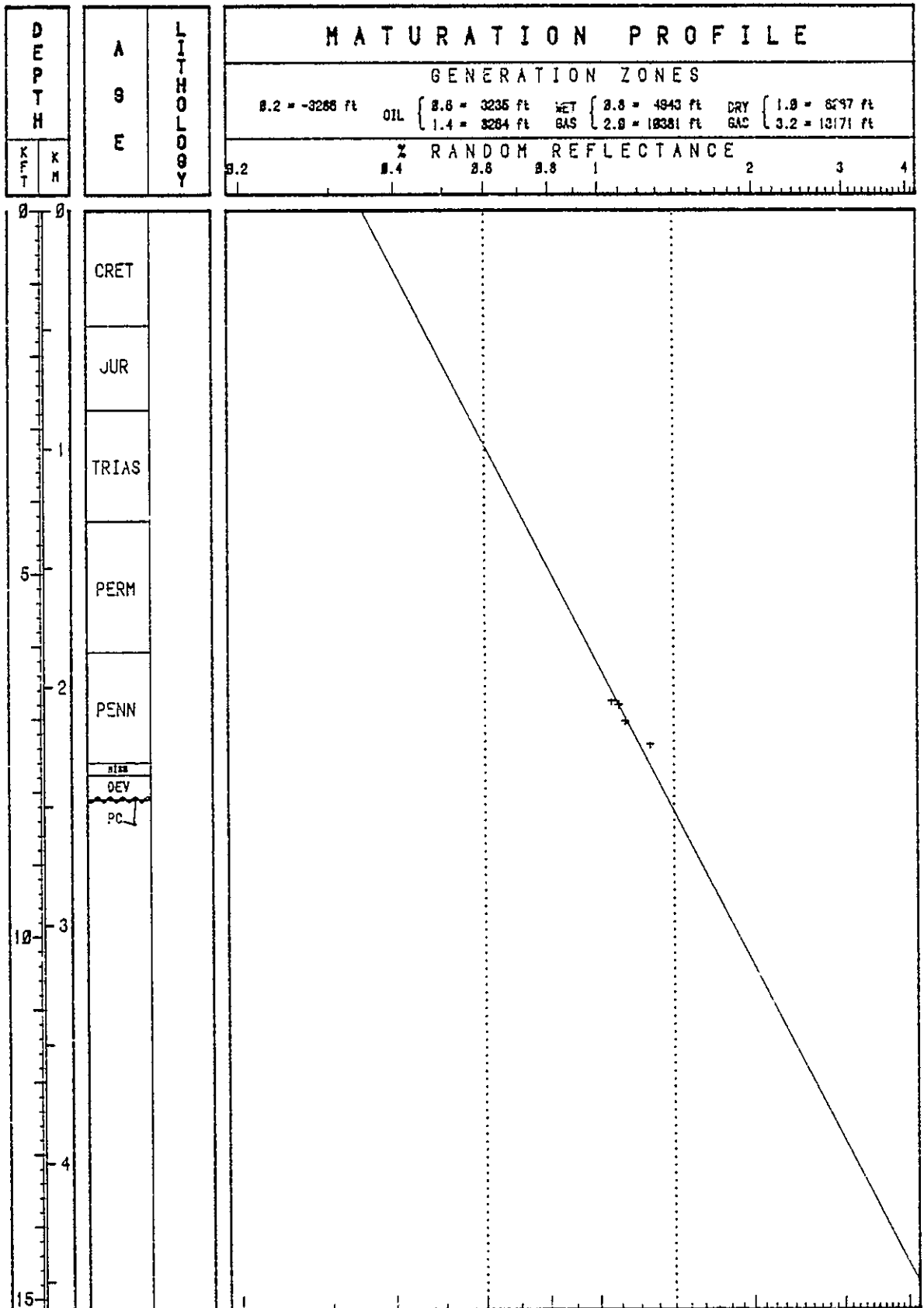


FIGURE 14: MATURATION PROFILE, BASED ON VITRINITE REFLECTANCE DATA (APPENDIX III)

SHELL, #113-17 CARSON UNIT

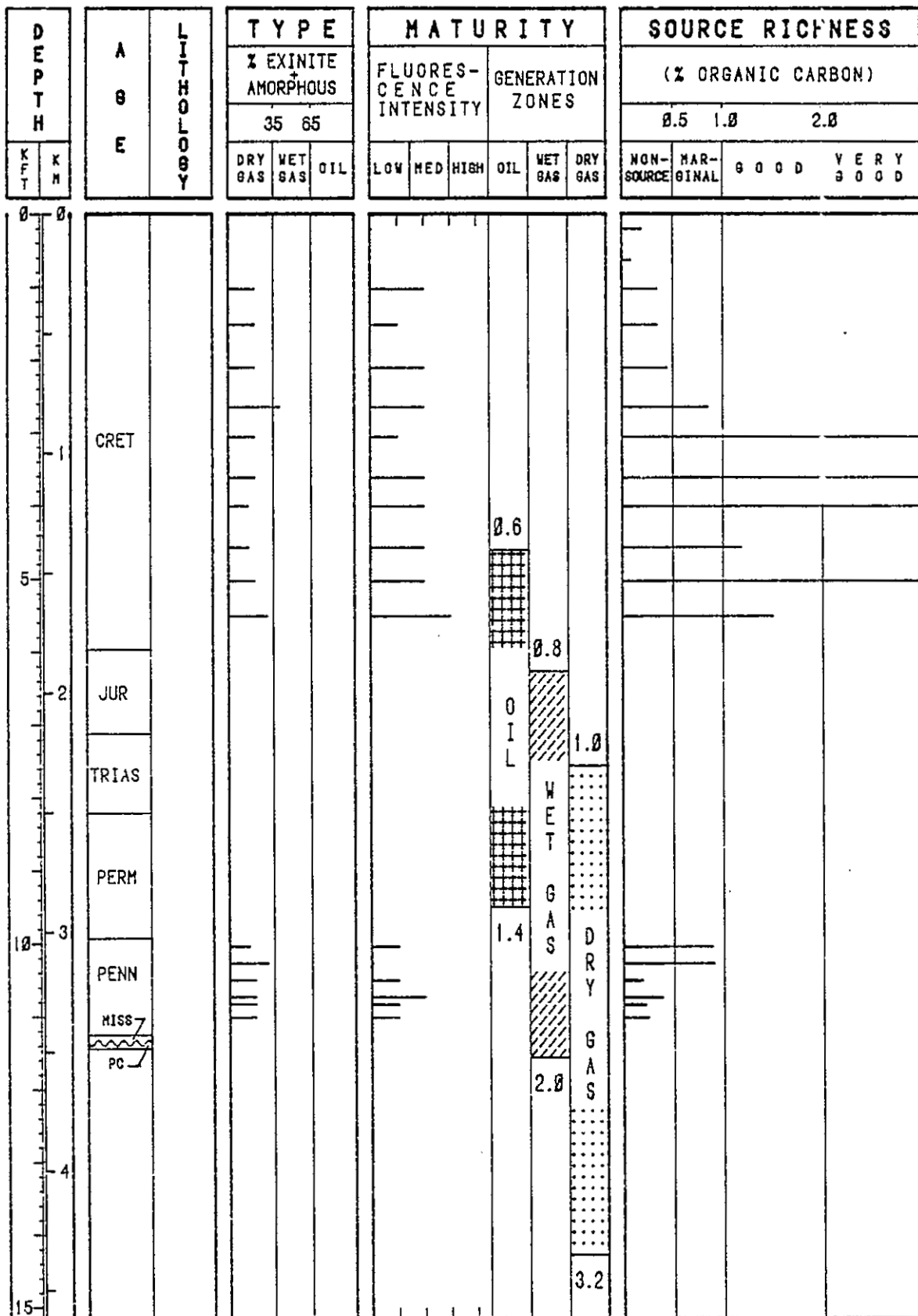


FIGURE 15: SUMMARY PLOTS SHOWING KEROGEN TYPES, MATURITY, AND SOURCE RICHNESS (SEE APPENDICES I AND II)

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SHELL, #113-17 CARSON UNIT

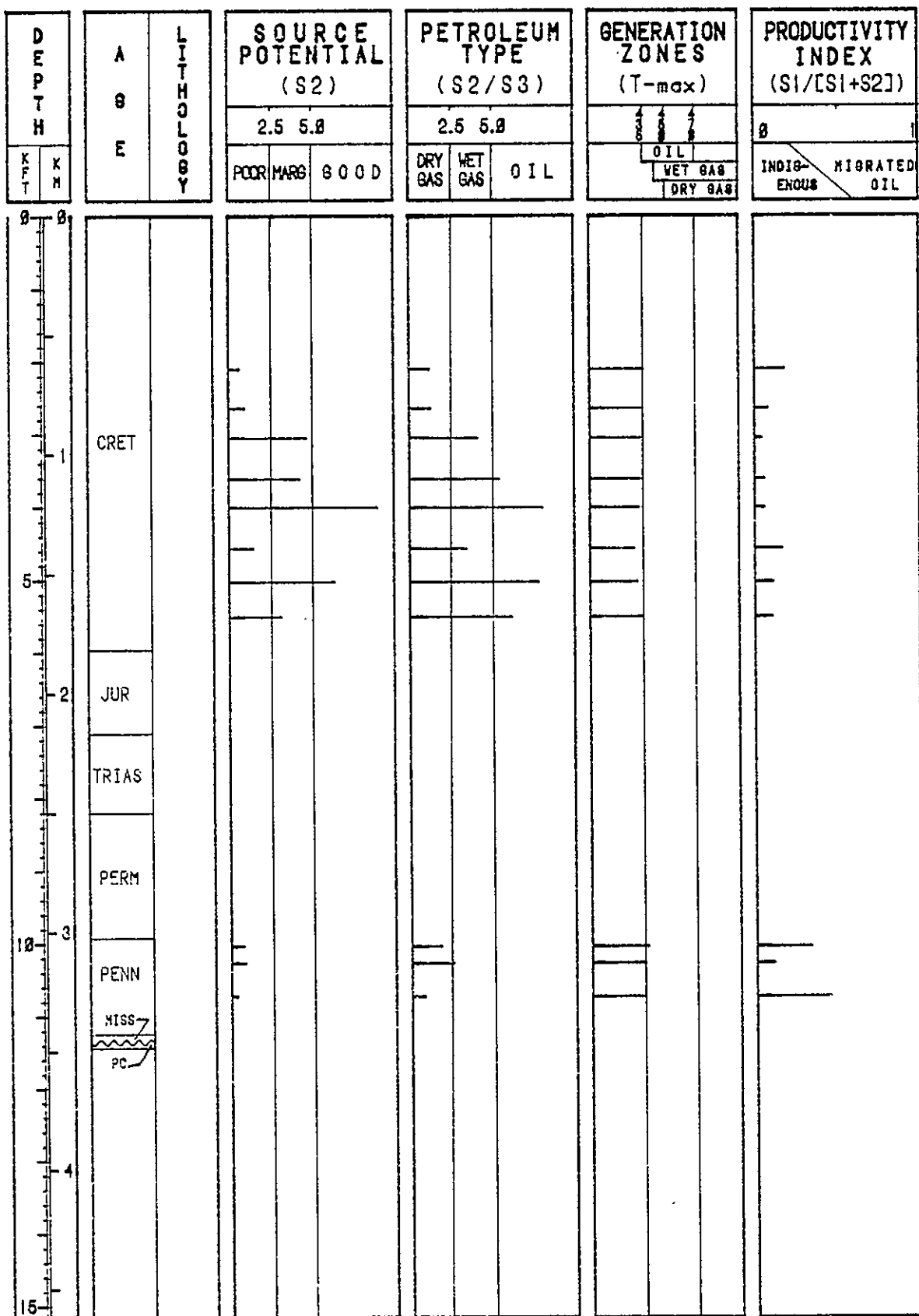


FIGURE 16: SUMMARY PLOTS OF ROCK-EVAL PYROLYSIS DATA (APPENDIX II)

SHELL, #113-17 CARSON UNIT

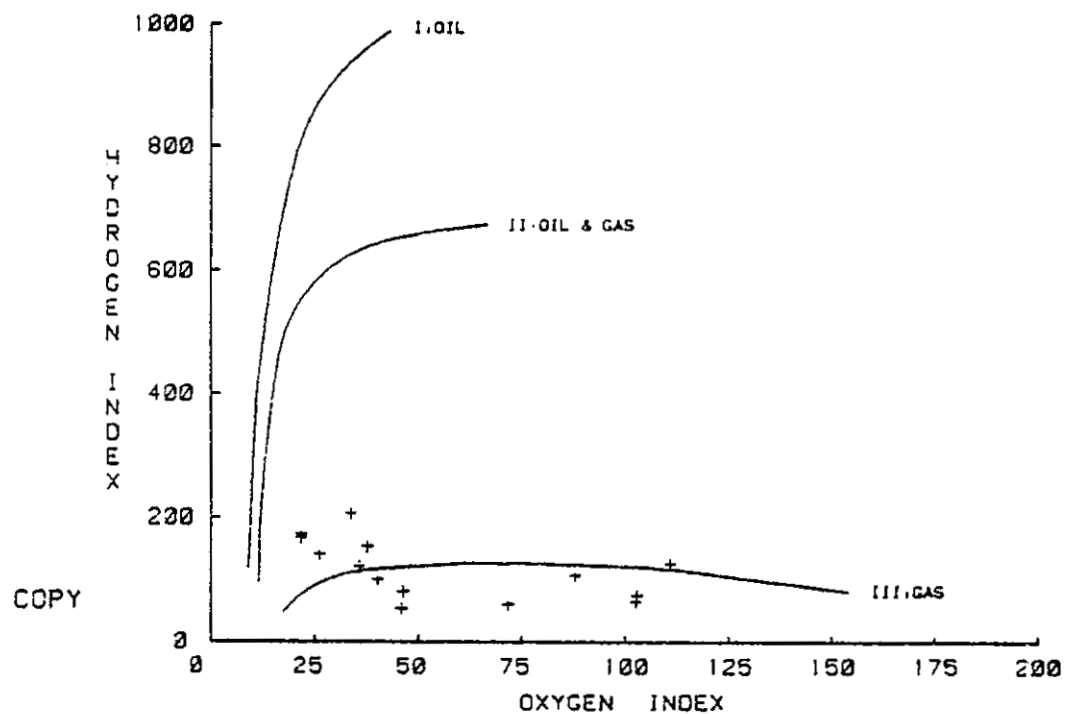


FIGURE 17: KEROGEN TYPE DETERMINATION FROM ROCK-EVAL. PYROLYSIS DATA (APPENDIX II).

SHELL, #113-17 CARSON UNIT

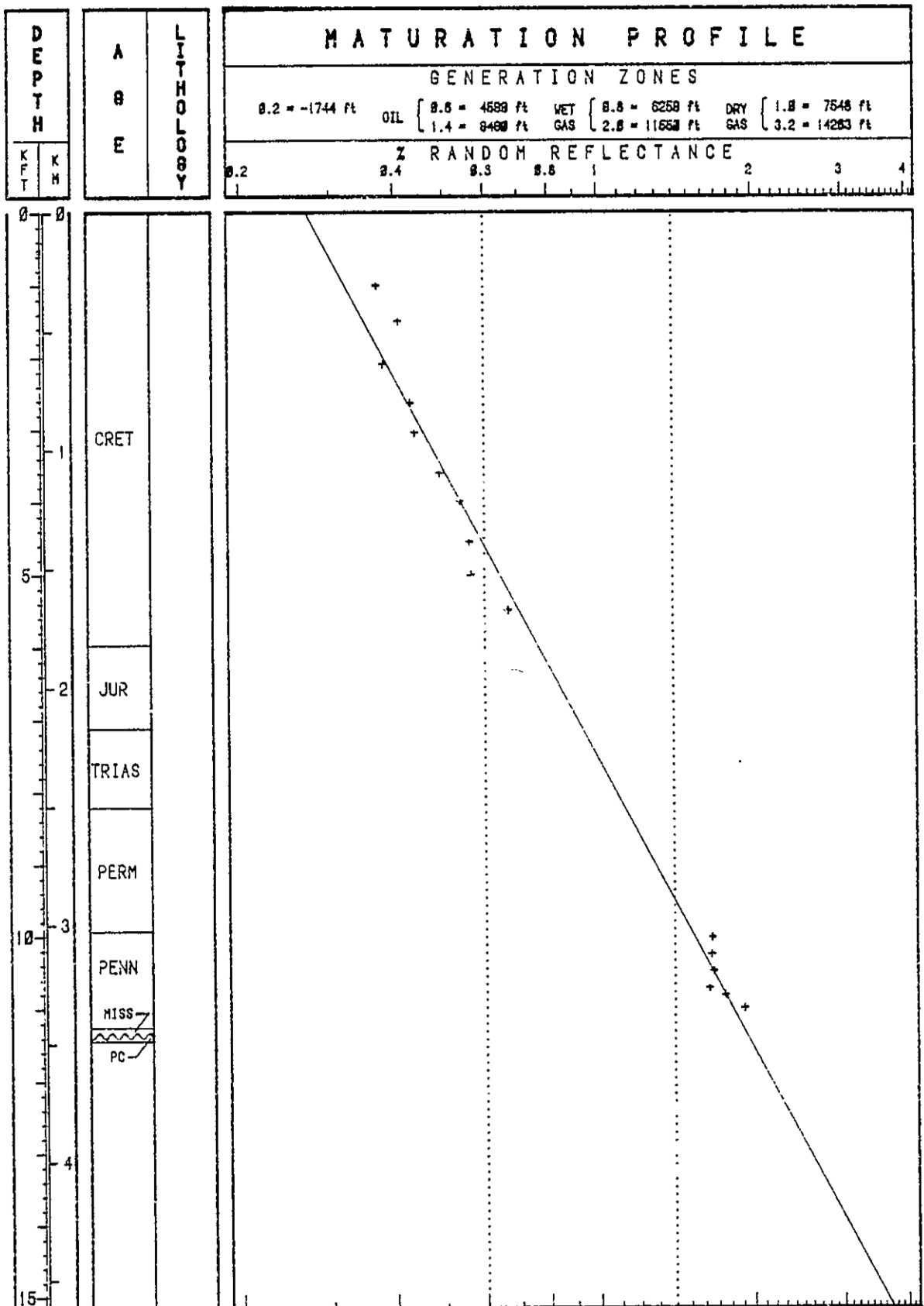


FIGURE 18: MATURATION PROFILE, BASED ON VITRINITE REFLECTANCE DATA (APPENDIX III)

SUN, #1 NAVAJO LANDS

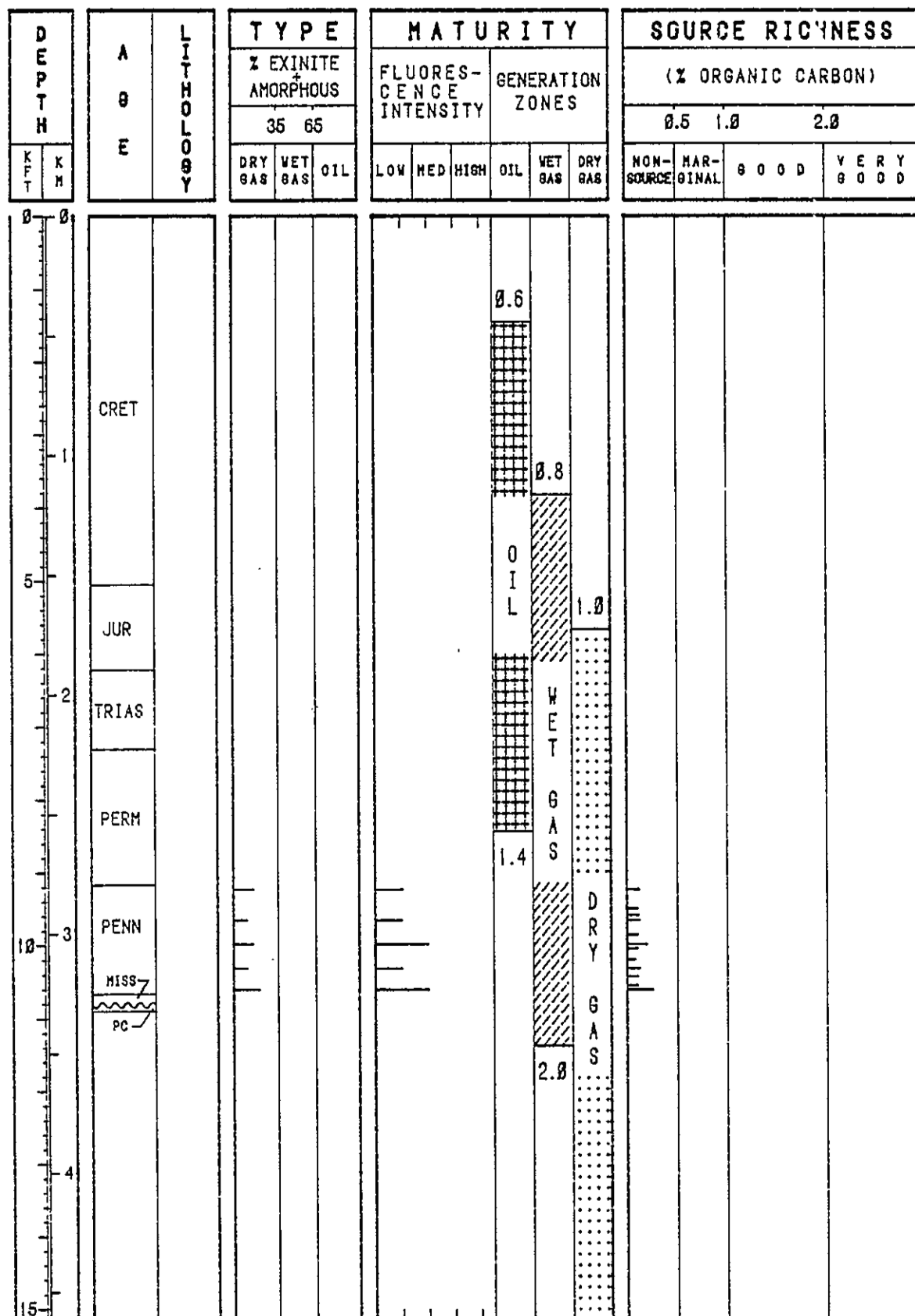


FIGURE 19: SUMMARY PLOTS SHOWING KEROGEN TYPES, MATURITY,
AND SOURCE RICHNESS (SEE APPENDICES I AND III)

SUN, #1 NAVAJO LANDS

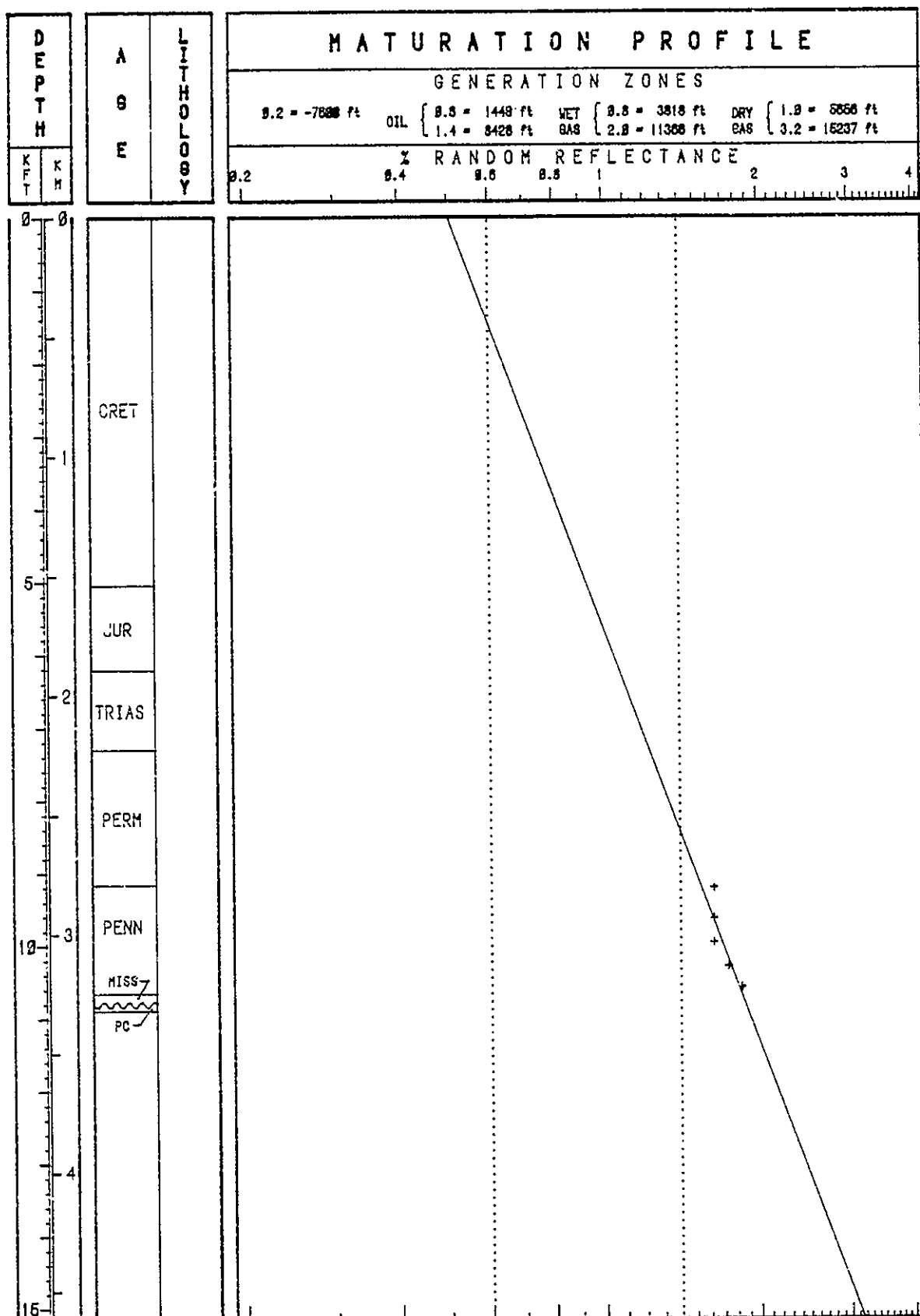


FIGURE 20: MATURATION PROFILE, BASED ON VITRINITE REFLECTANCE DATA (APPENDIX III)

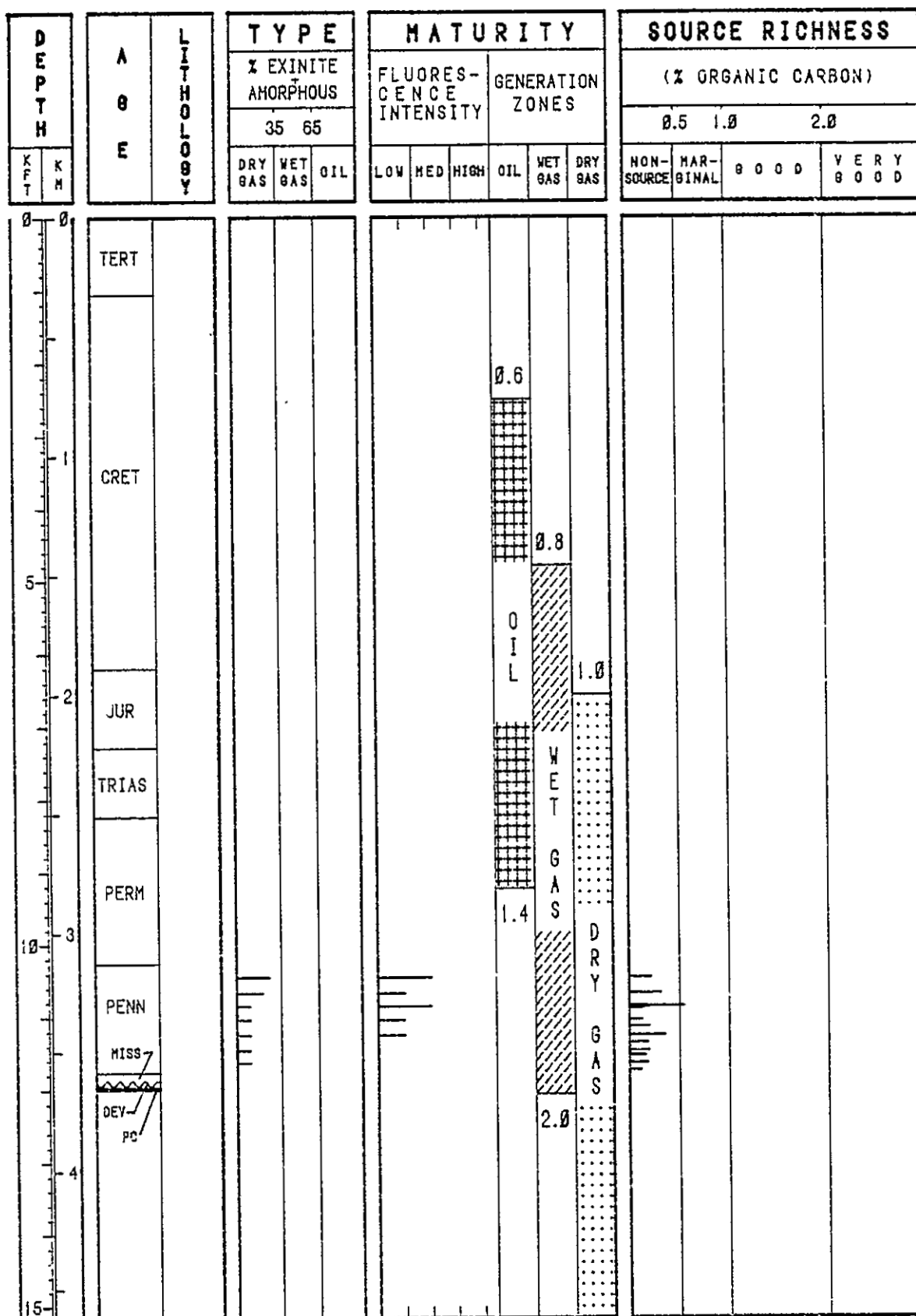


FIGURE 21: SUMMARY PLOTS SHOWING KEROGEN TYPES, MATURITY, AND SOURCE RICHNESS (SEE APPENDICES I AND II)

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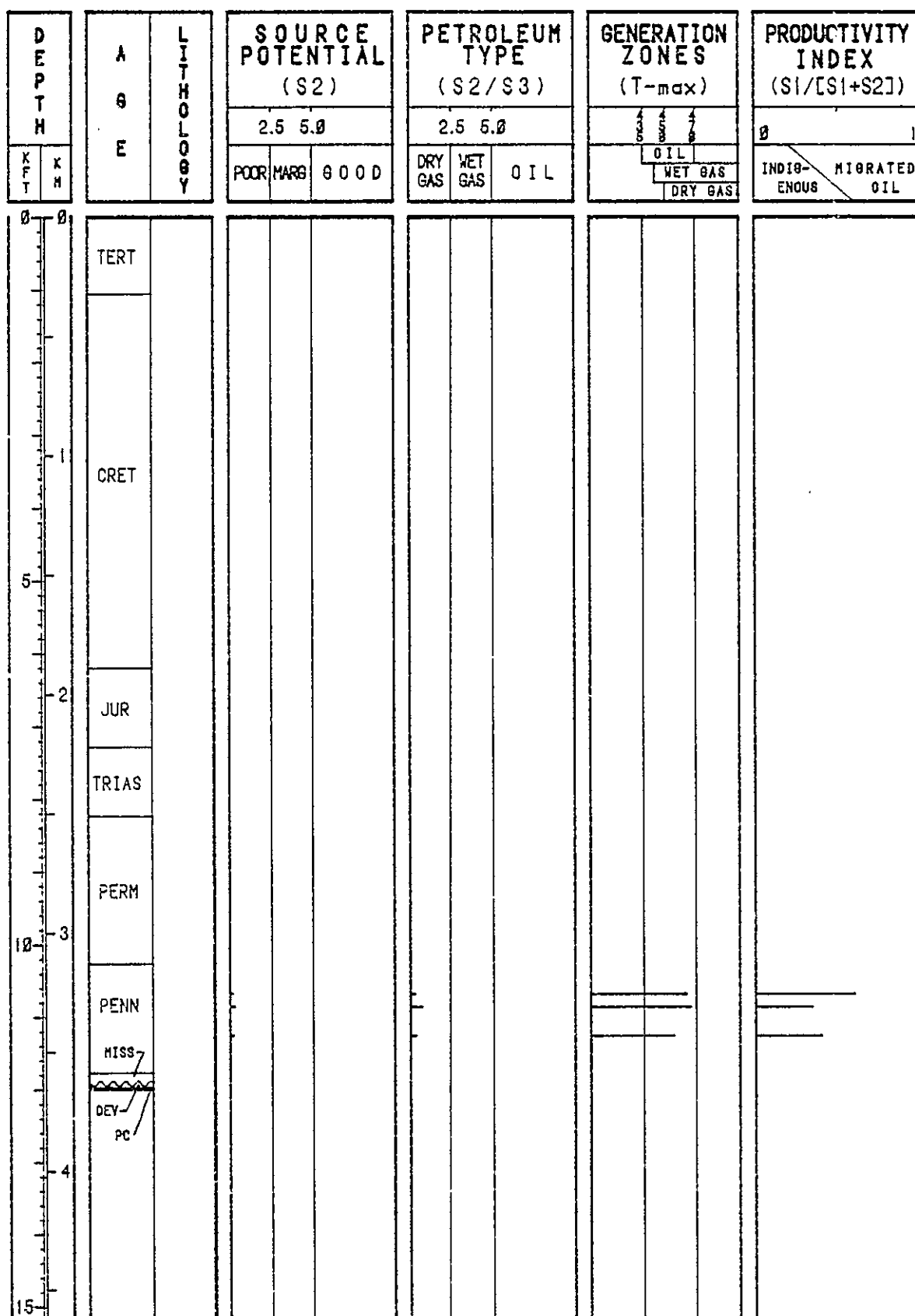


FIGURE 22: SUMMARY PLOTS OF ROCK-EVAL PYROLYSIS DATA (APPENDIX II)

UNION, #1-M-13 USA

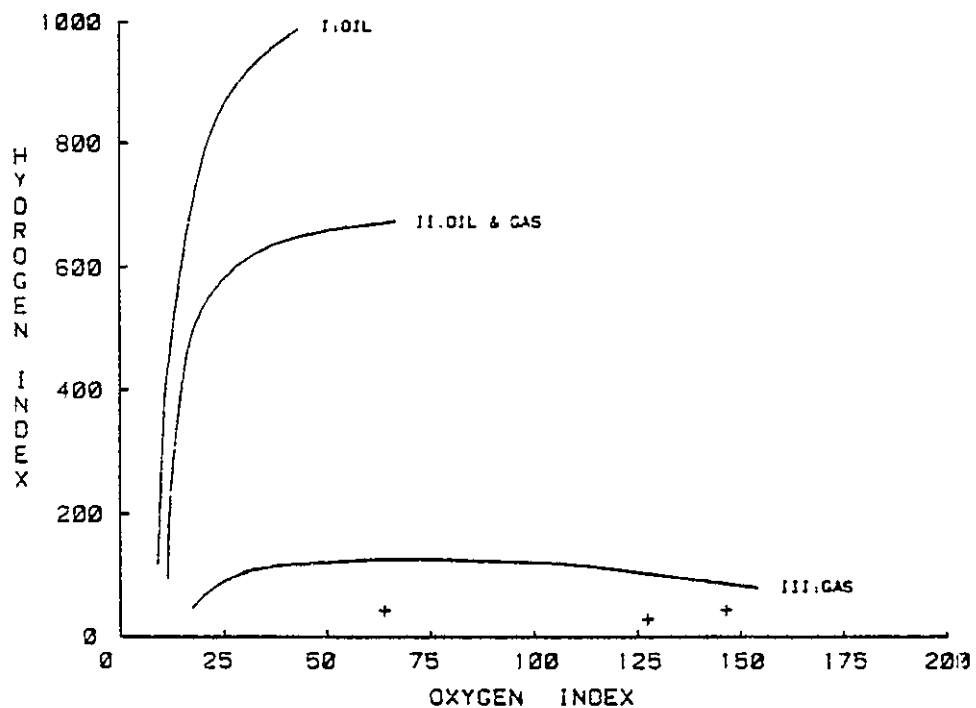


FIGURE 23: KEROGEN TYPE DETERMINATION FROM ROCK-EVAL.
PYROLYSIS DATA (APPENDIX II).

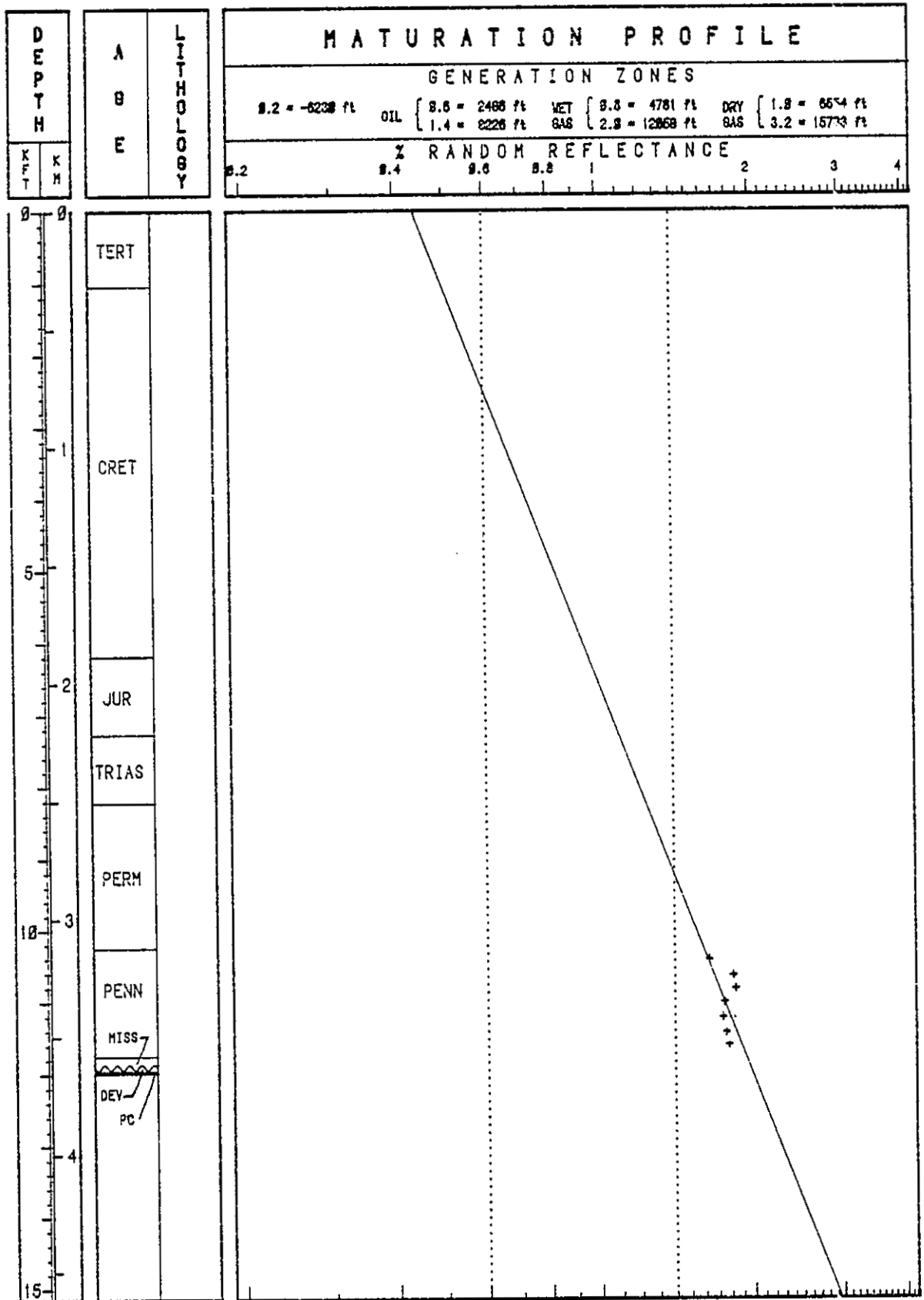


FIGURE 24: MATURATION PROFILE, BASED ON VITRINITE REFLECTANCE DATA (APPENDIX III)

SKELLY, #1 NAVAJO-0

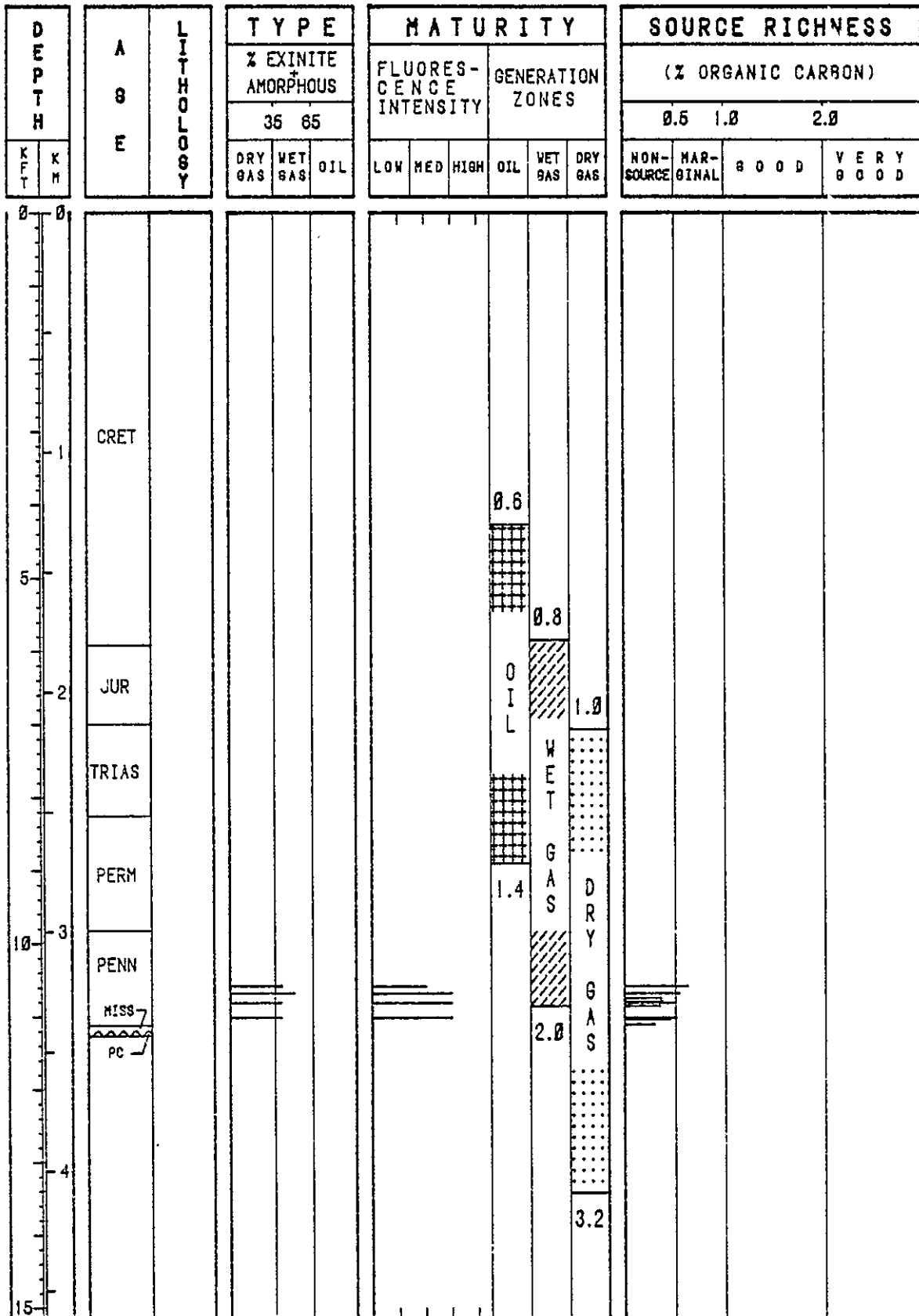


FIGURE 25: SUMMARY PLOTS SHOWING KEROGEN TYPES, MATURITY, AND SOURCE RICHNESS (SEE APPENDICES I AND III)

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SKELLY, #1 NAVAJO-0

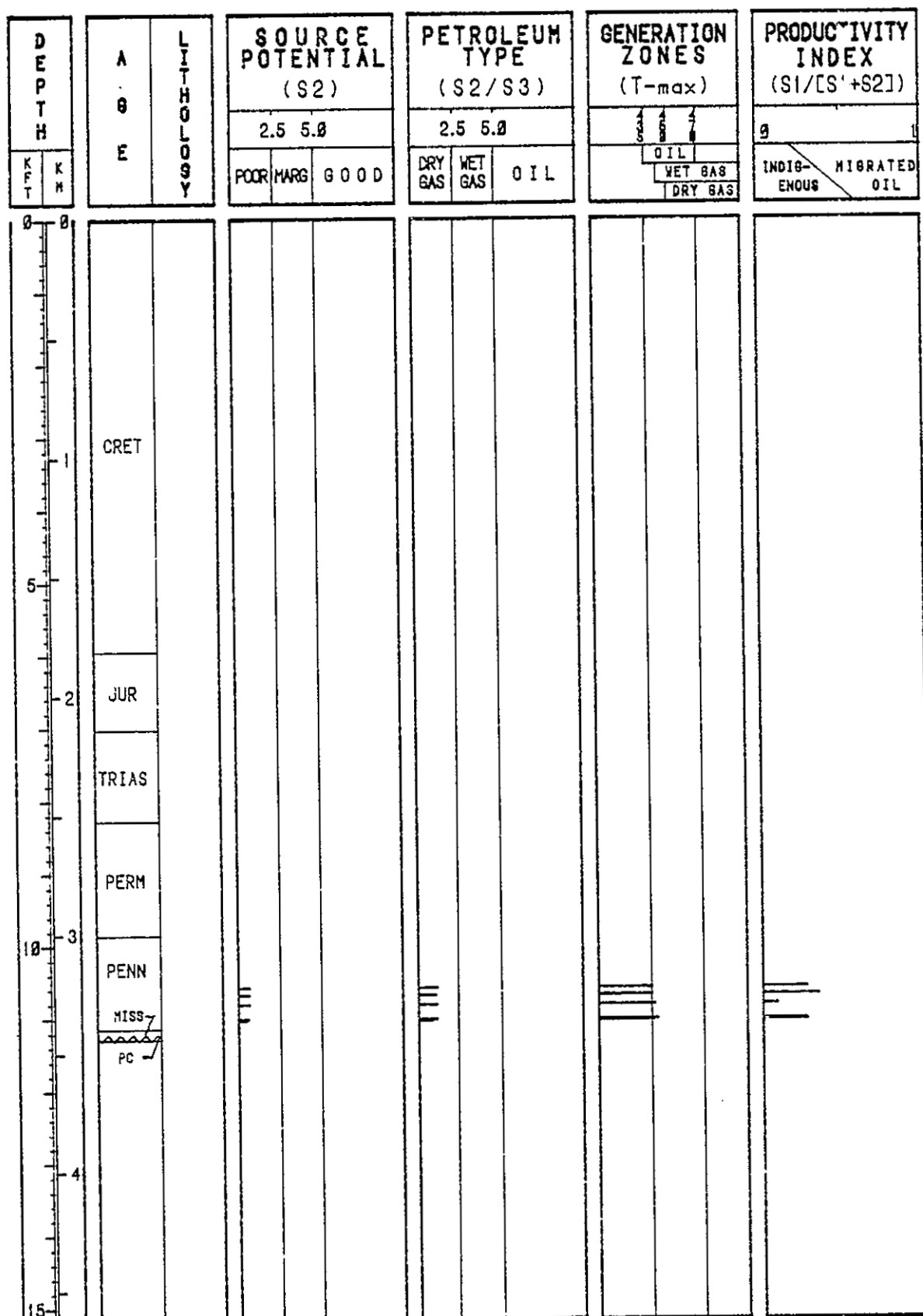


FIGURE 26: SUMMARY PLOTS OF ROCK-EVAL PYROLYSIS DATA (APPENDIX II)

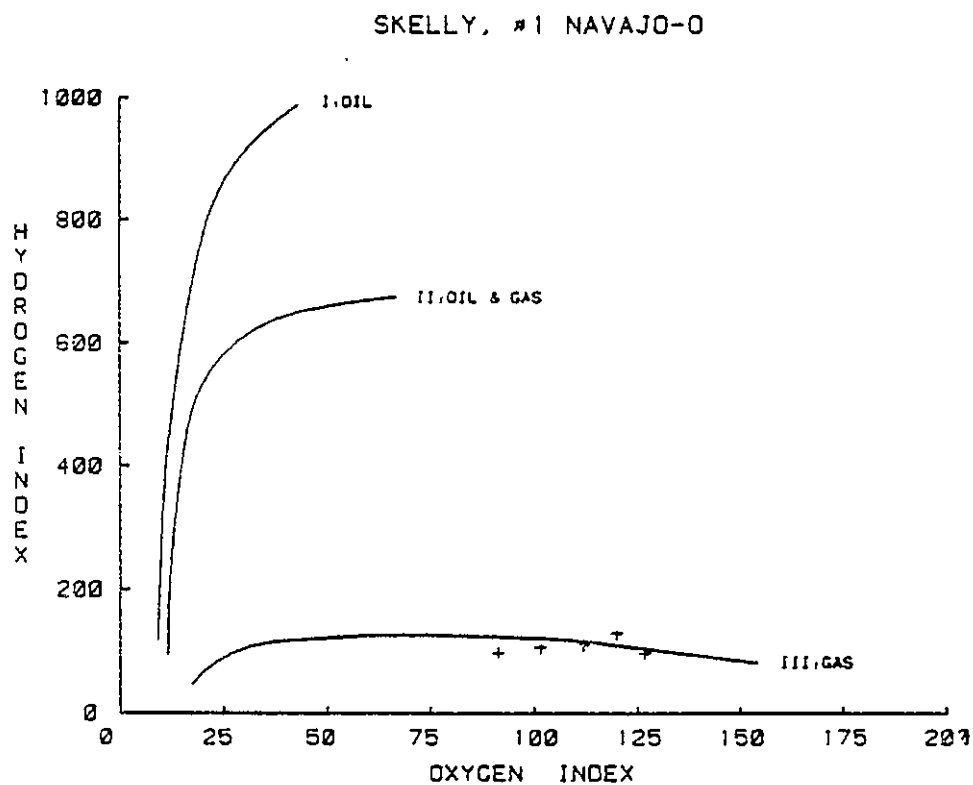


FIGURE 27: KEROGEN TYPE DETERMINATION FROM ROCK-EVAL.
PYROLYSIS DATA (APPENDIX II).

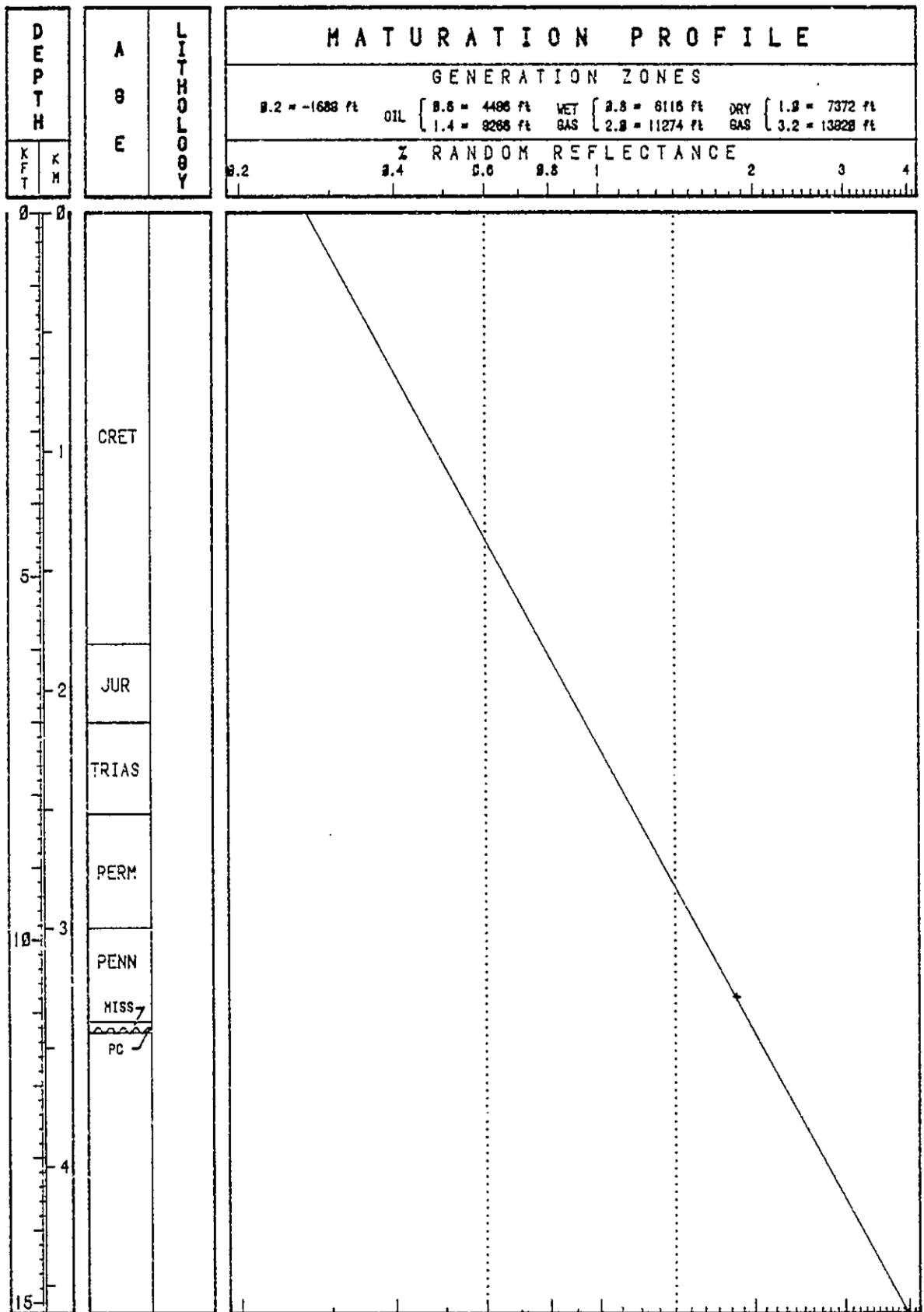


FIGURE 28: MATURATION PROFILE, BASED ON VITRINITE REFLECTANCE DATA (APPENDIX III)

MAGNOLIA, #1 HUTCHINSON-FEDERAL

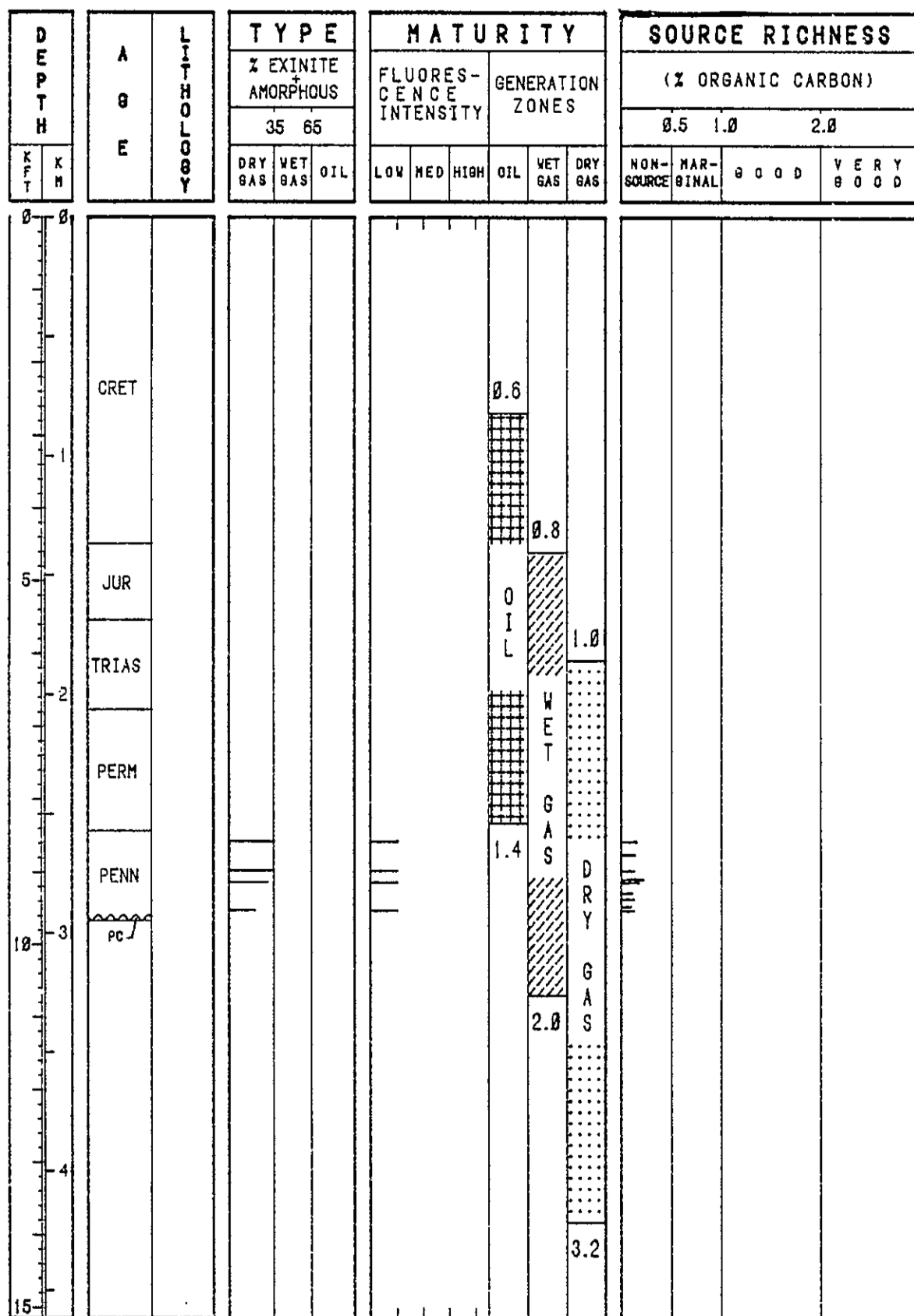


FIGURE 29: SUMMARY PLOTS SHOWING KEROGEN TYPES, MATURITY, AND SOURCE RICHNESS (SEE APPENDICES I AND II)

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MAGNOLIA, #1 HUTCHINSON-FEDERAL

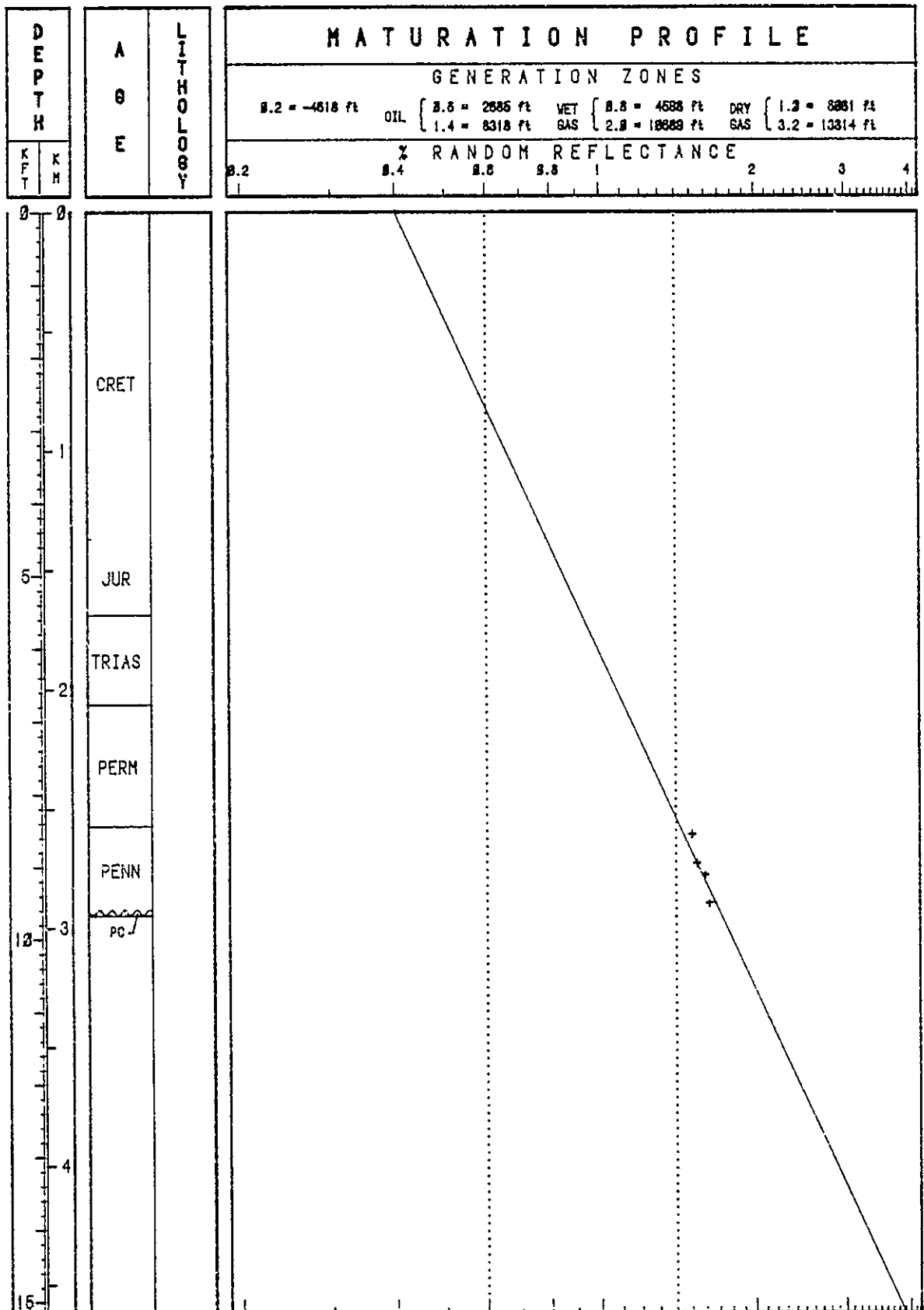


FIGURE 30: MATURATION PROFILE, BASED ON VITRINITE
REFLECTANCE DATA (APPENDIX III)

BRINKERHOFF, #1 CABEZON-GOV'T

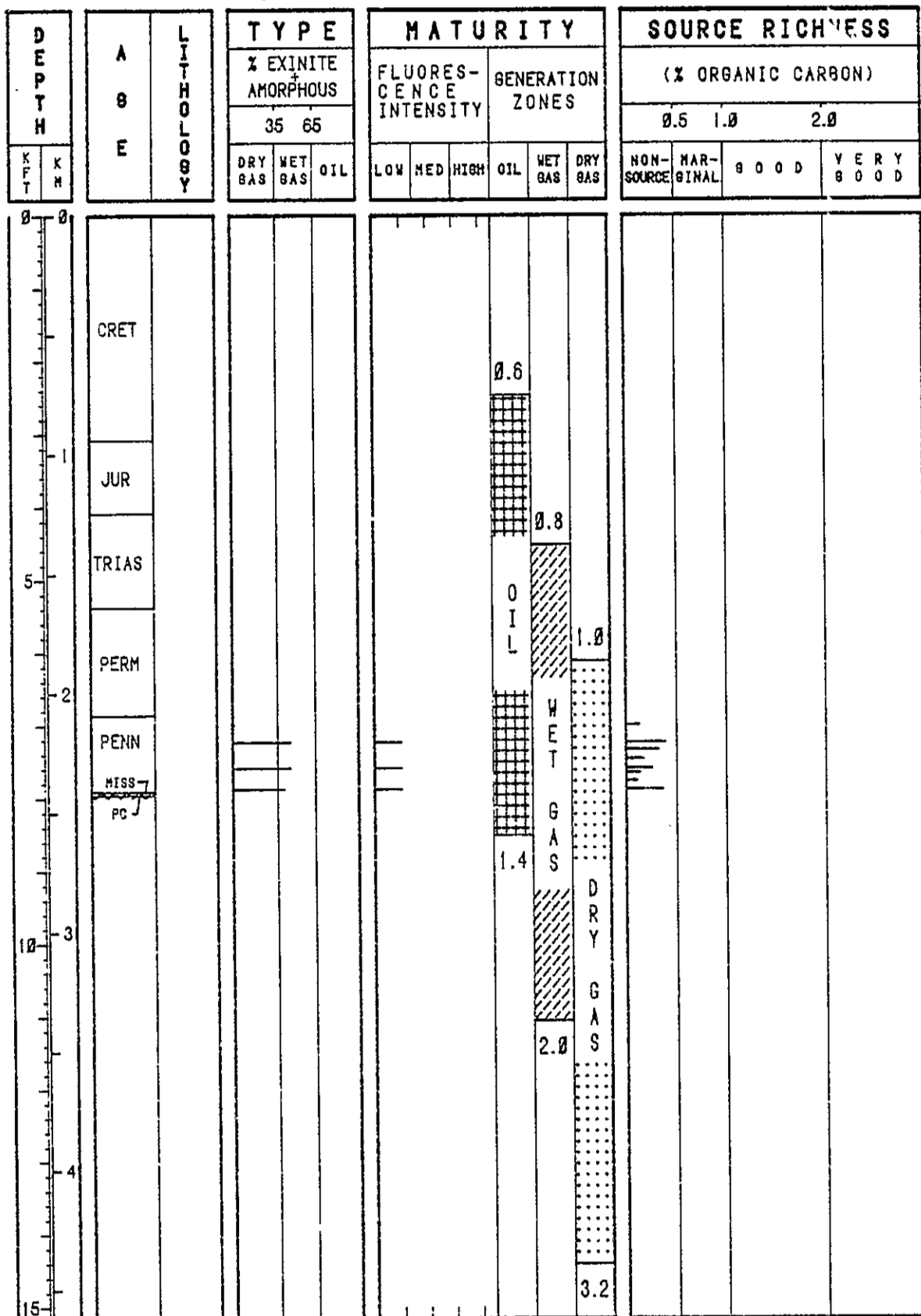


FIGURE 31: SUMMARY PLOTS SHOWING KEROGEN TYPES, MATURITY, AND SOURCE RICHNESS (SEE APPENDICES I AND III)

ROBERTSON
RESEARCH (U.S.) INC.

BRINKERHOFF, #1 CABEZON GOV'T

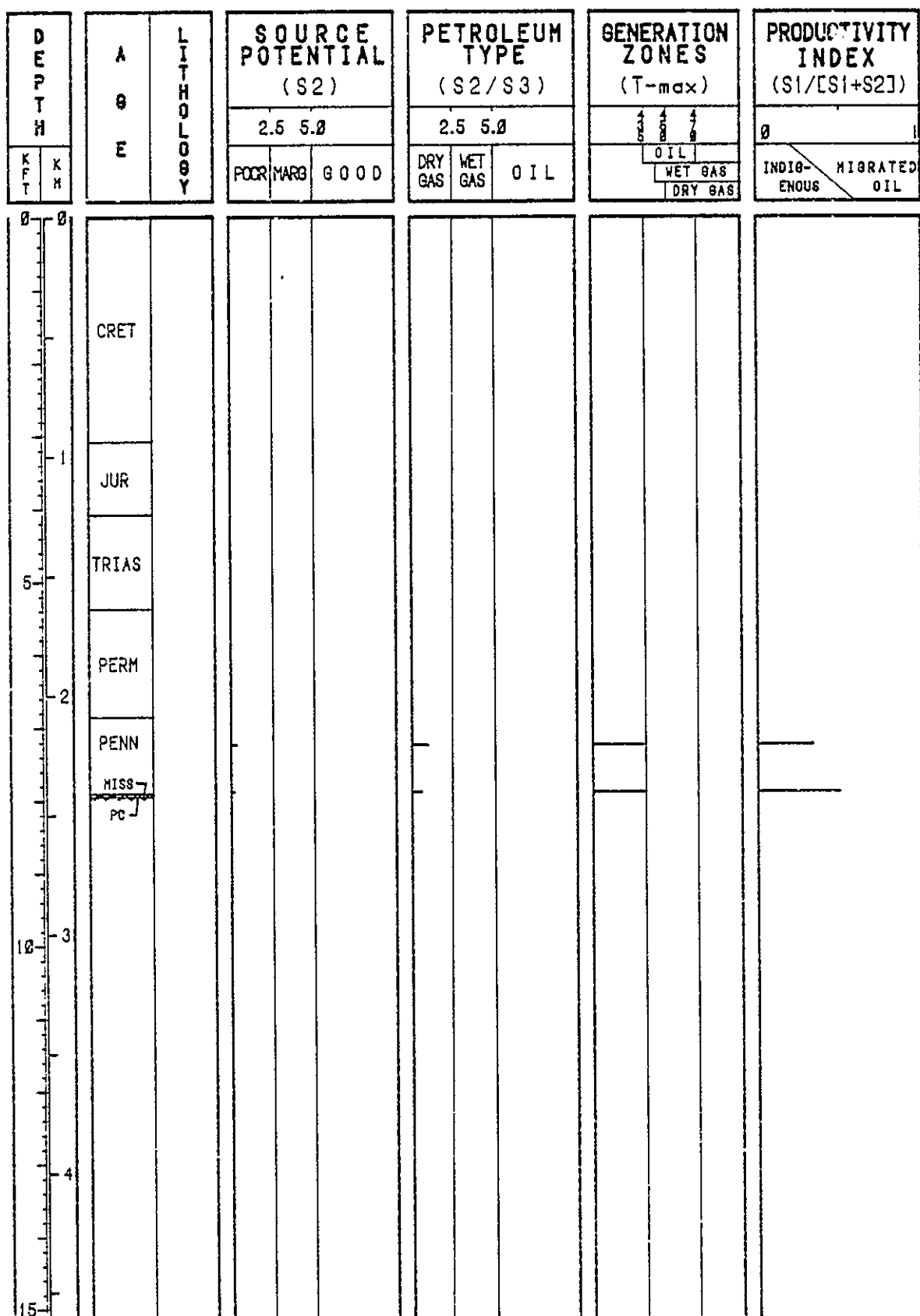


FIGURE 32: SUMMARY PLOTS OF ROCK-EVAL PYROLYSIS DATA (APPENDIX II)

BRINKERHOFF, #1 CABEZON GOV'T

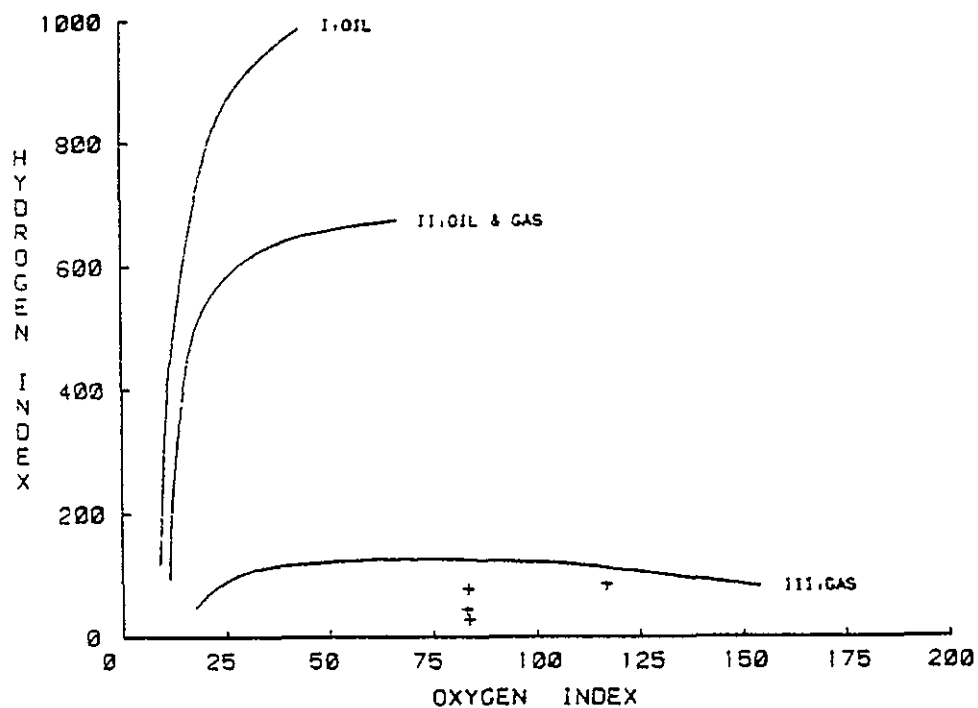


FIGURE 33: KEROGEN TYPE DETERMINATION FROM ROCK-EVAL. PYROLYSIS DATA (APPENDIX 11).

BRINKERHOFF, #1 CABEZON-GOV'T

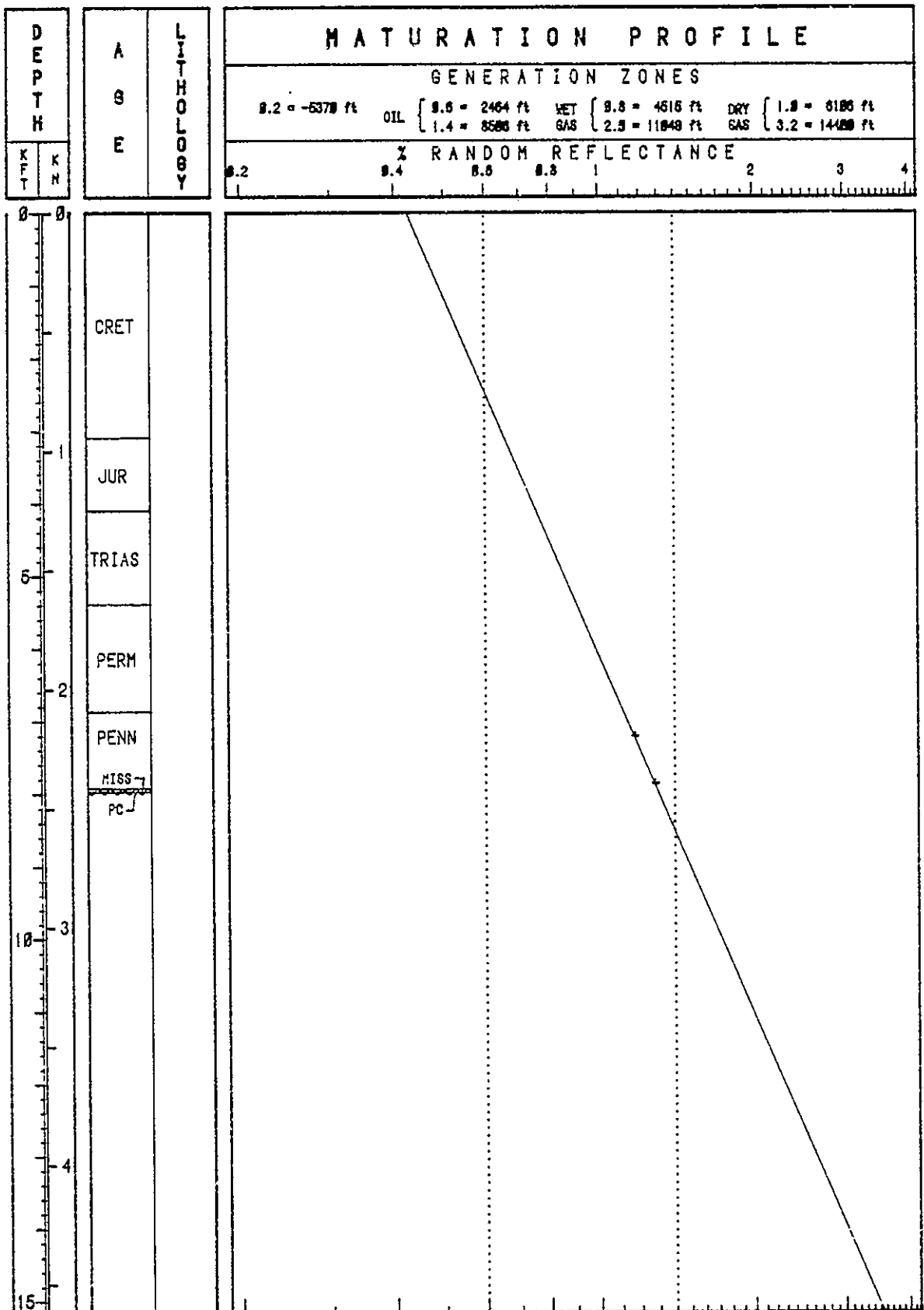


FIGURE 34: MATURATION PROFILE, BASED ON VITRINITE REFLECTANCE DATA (APPENDIX III)

DELHI, #4 UTE

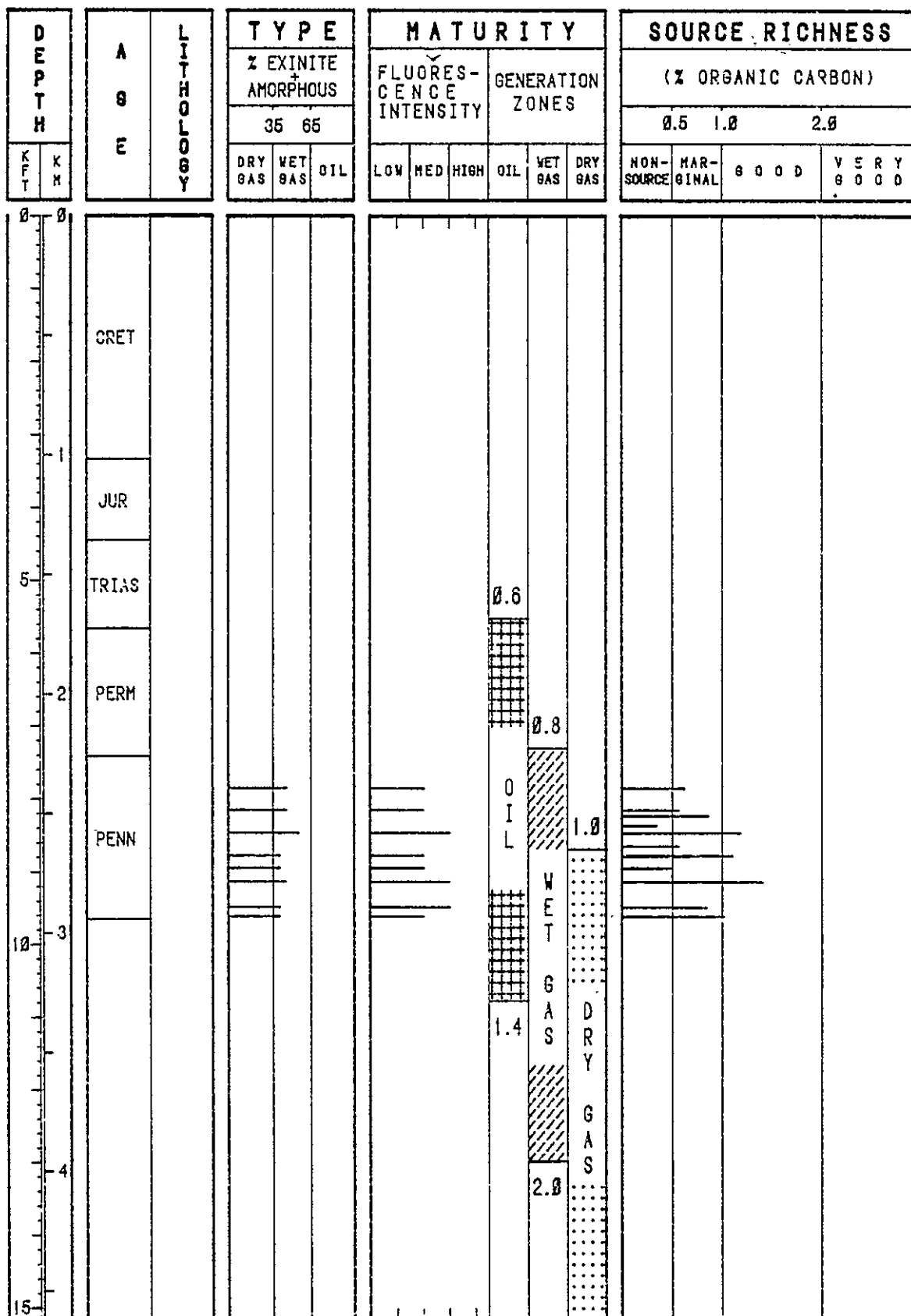


FIGURE 35: SUMMARY PLOTS SHOWING KEROGEN TYPES, MATURITY, AND SOURCE RICHNESS (SEE APPENDICES I AND III)

DELHI, #4 UTE

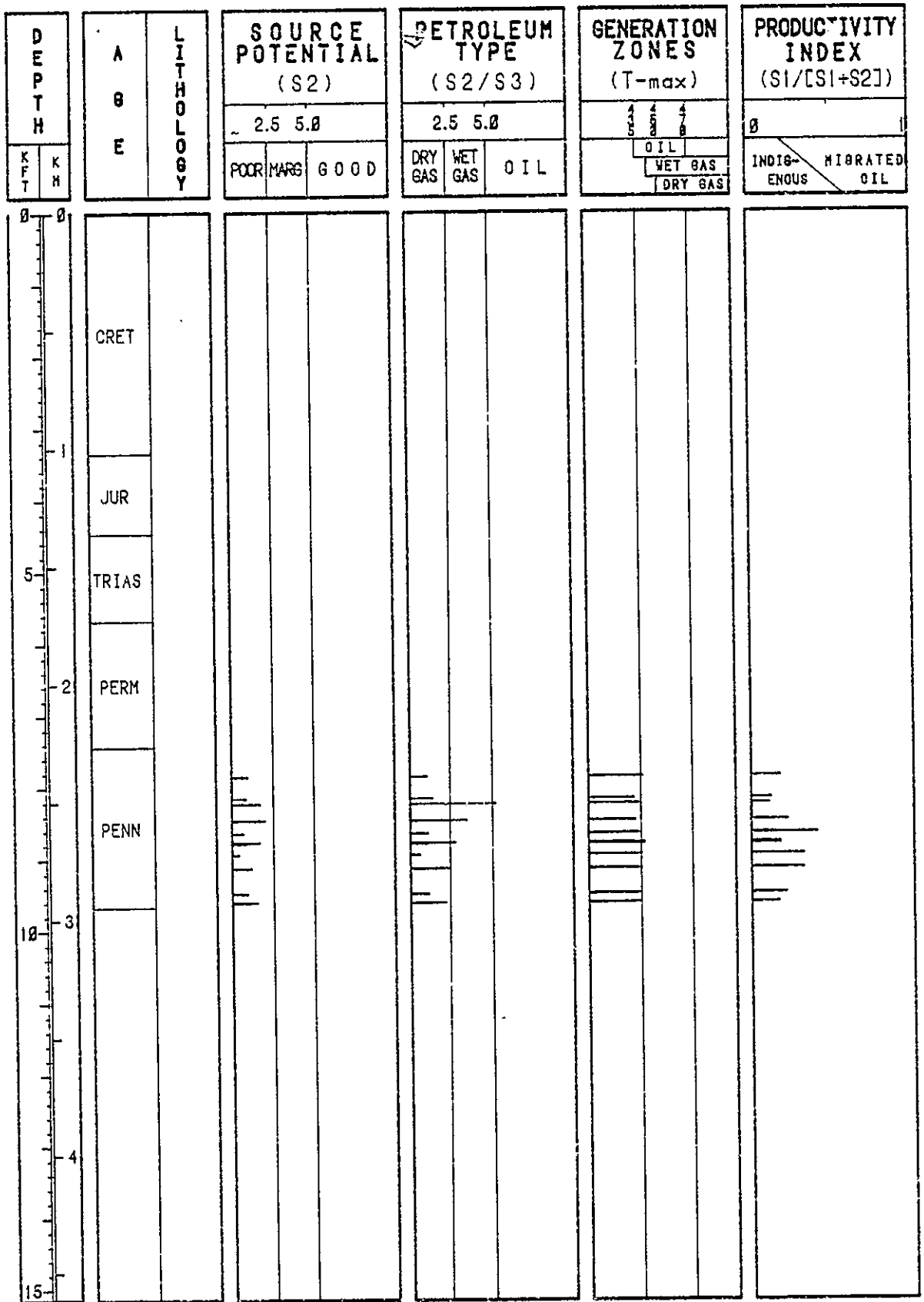


FIGURE 38: SUMMARY PLOTS OF ROCK-EVAL PYROLYSIS DATA (APPENDIX II)

DELHI, #4 UTE

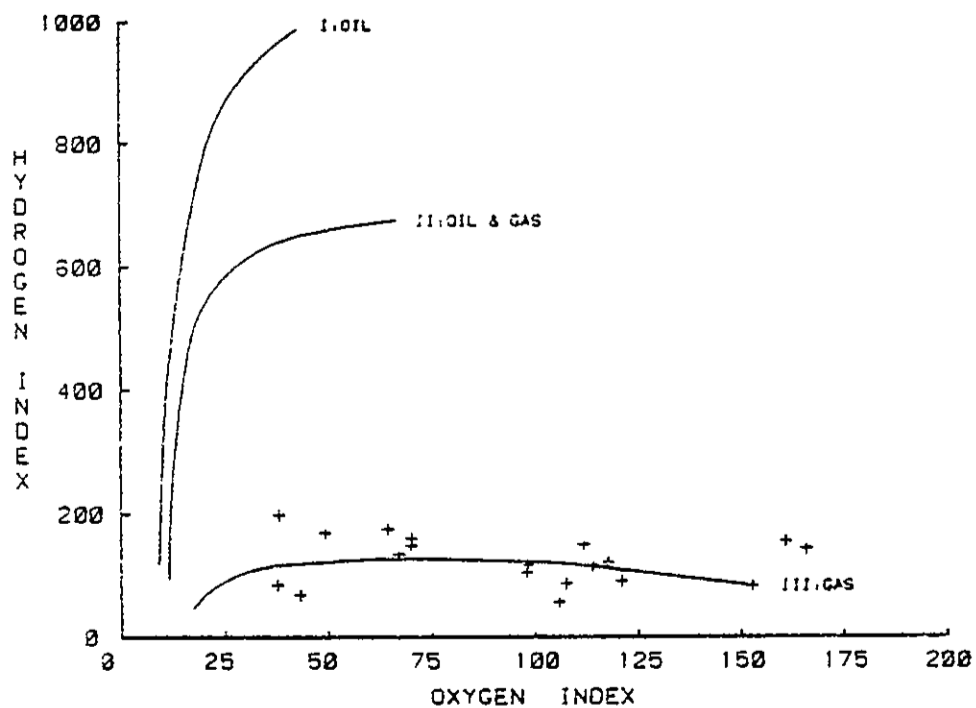


FIGURE 37: KEROGEN TYPE DETERMINATION FROM ROCK-EVAL. PYROLYSIS DATA (APPENDIX II).

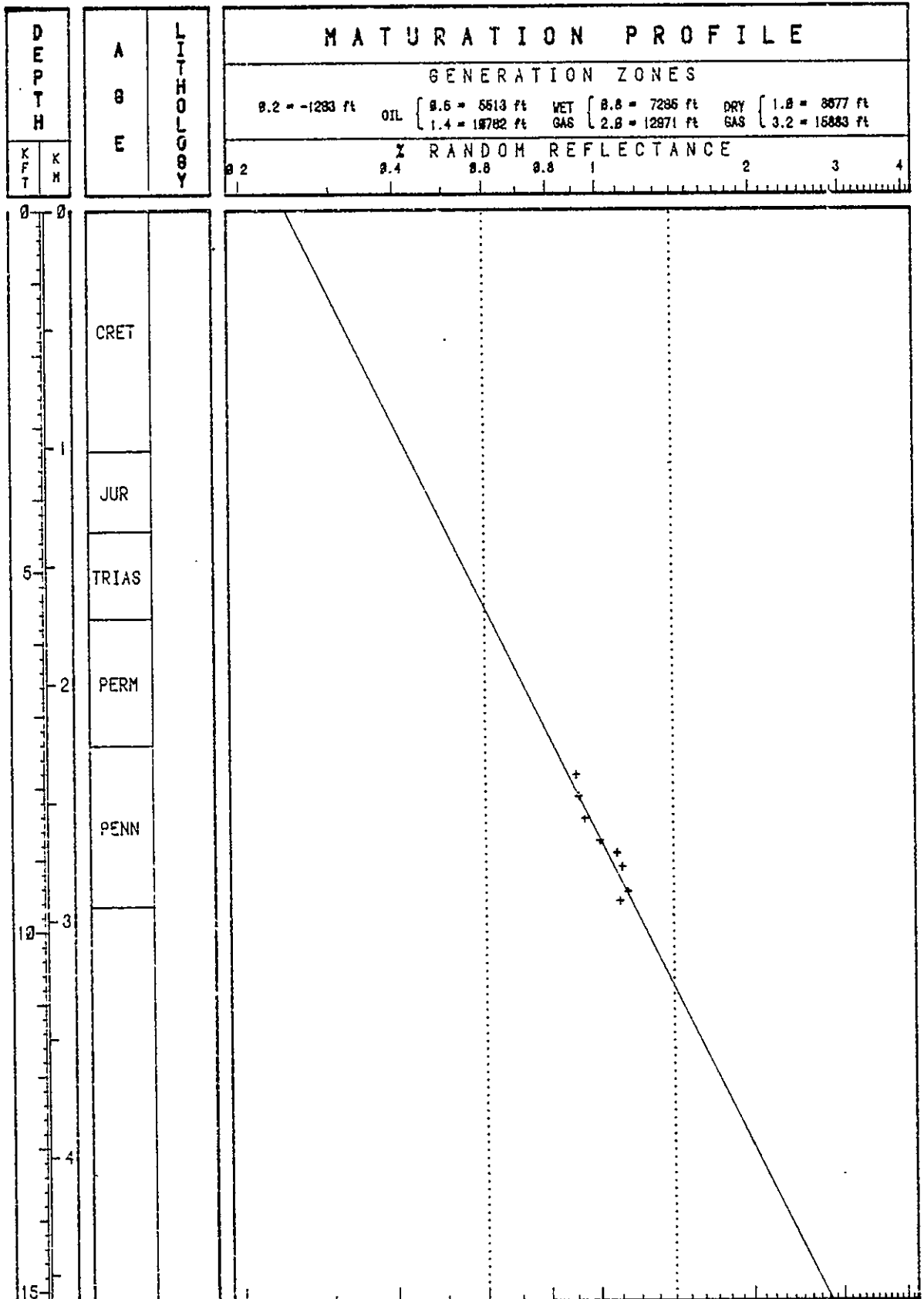


FIGURE 38: MATURATION PROFILE, BASED ON VITRINITE REFLECTANCE DATA (APPENDIX III)

APPENDIX I

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

GREAT WESTERN, #1 HOSPAH-SANTA-FE

DEPTH (Feet)	TOC (%)	DEPTH (Feet)	TOC (%)
405	3.15	7135	0.09
855	0.64	7345	0.05
1365	0.50	7475	0.10
1595	0.86	7555	0.07
1985	0.87	7585	0.11
2235	1.98	7655	0.11
2615	0.77	7725	0.13
2685	0.67	7785	0.17
6735	0.05	7815	0.14
7035	0.11	7825	0.12

TOTAL ORGANIC CARBON DATA

TEXACO, #1 NAVAJO AL

DEPTH (Feet)	TOC (%)	DEPTH (Feet)	TOC (%)
5605	0.03	6268	0.07
5685	0.04	6288	0.10
5815	0.05	6313	0.11
5885	0.04	6318	0.06
6005	0.08	6393	0.05
6185	0.06	6398	0.06
6263	0.06		

TOTAL ORGANIC CARBON DATA

APACHE, #1 FOSHAY

DEPTH (Feet)	TOC (%)	DEPTH (Feet)	TOC (%)
2065	5.38	8925	0.13
2613	6.08	9125	0.14
3048	0.65	9185	0.16
3495	6.25	9345	0.48
3995	6.00	9395	0.14
4485	3.67	9575	0.05
4745	4.66	9675	0.12
8895	0.20		

TOTAL ORGANIC CARBON DATA
AMERADA, #1 NAVAJO TRACT-20

DEPTH (Feet)	TOC (%)	DEPTH (Feet)	TOC (%)
6743	0.19	7043	0.28
6748	0.17	7048	0.32
6763	0.12	7083	0.13
6768	3.18	7098	0.09
6823	0.40	7113	0.13
6828	0.23	7118	0.15
6913	0.06	7173	0.14
6918	0.05	7178	0.17
6933	0.04	7273	0.10
6938	0.06	7278	0.12
7013	0.12	7363	0.23
7018	0.18	7368	0.14

TOTAL ORGANIC CARBON DATA

SHELL, #113-17 CARSON UNIT

DEPTH (Feet)	TOC (%)	DEPTH (Feet)	TOC (%)
205	0.18	10033	0.88
625	0.08	10038	0.37
1025	0.34	10263	0.90
1515	0.34	10268	0.77
2105	0.44	10493	0.18
2645	0.85	10498	0.15
3055	3.08	10723	0.35
3615	3.02	10728	0.38
4005	5.23	10823	0.17
4565	1.18	10828	0.21
5025	3.81	11003	0.24
5505	1.50	11008	0.23

TOTAL ORGANIC CARBON DATA

SUN, #1 NAVAJO LANDS

DEPTH (Feet)	TOC (%)	DEPTH (Feet)	TOC (%)
9225	0.11	10035	0.10
9485	0.10	10185	0.07
9575	0.11	10305	0.12
9645	0.12	10415	0.10
9845	0.10	10535	0.10
9975	0.19	10595	0.25

TOTAL ORGANIC CARBON DATA

UNION, #1-M-13 USA

DEPTH (Feet)	TOC (%)	DEPTH (Feet)	TOC (%)
10445	0.21	11245	0.35
10665	0.31	11345	0.18
10835	0.15	11455	0.19
10845	0.54	11515	0.14
10855	0.19	11525	0.15
10875	0.14	11625	0.18
11035	0.12	11725	0.11
11125	0.19		

TOTAL ORGANIC CARBON DATA

SKELLY, #1 NAVAJO-O

DEPTH (Feet)	TOC (%)	DEPTH (Feet)	TOC (%)
10575	0.62	10845	0.35
10675	0.54	11005	0.51
10738	0.36	11025	0.45
10785	0.37	11096	0.29
10805	0.48		

TOTAL ORGANIC CARBON DATA
MAGNOLIA, #1 HUTCHINSON-FEDERAL

DEPTH (Feet)	TOC (%)	DEPTH (Feet)	TOC (%)
8565	0.14	9125	0.17
8745	0.13	9275	0.10
8965	0.12	9355	0.12
9073	0.13	9455	0.09
9085	0.21	9515	0.12

TOTAL ORGANIC CARBON DATA
BRINKERHOFF, #1 CABEZON-GOV'T

DEPTH (Feet)	TOC (%)	DEPTH (Feet)	TOC (%)
6983	0.12	7583	0.14
6988	0.11	7588	0.25
7223	0.31	7643	0.12
7228	0.38	7648	0.13
7323	0.10	7753	0.10
7328	0.31	7758	0.10
7453	0.11	7873	0.31
7458	0.16	7878	0.36

TOTAL ORGANIC CARBON DATA

DELHI, #4 UTE

DEPTH (Feet)	TOC (%)	DEPTH (Feet)	TOC (%)
7843	0.61	8763	0.94
7848	0.44	8768	1.10
8143	0.43	8773	0.71
8148	0.56	8778	0.66
8223	0.86	8933	0.47
8228	0.42	8938	0.39
8353	0.34	9123	1.34
8358	0.32	9128	1.40
8453	1.18	9473	0.56
8458	0.89	9478	0.84
8633	0.55	9603	1.01
8638	0.56	9608	0.86

APPENDIX II

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, in °C, 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 are 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 in 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.

Data are interpreted in the following manner:

Source Potential - values of S_2	<2.5	: poor
	2.5-5.0	: marginal
	>5.0	: good
Petroleum Type - value of S_2/S_3	<2.5	: dry gas
	2.5-5.0	: wet gas
	>5.0	: oil
Generation Zones - values of T-max	<435	: immature
	435-470	: oil
	450 +	: gas

Productivity Index - high values of $S_1/(S_1+S_2)$ indicate migrated hydrocarbons.

ROCK-EVAL PYROLYSIS RAW DATA
GREAT WESTERN, #1 HOSPAH-SANTA-FE

DEPTH (FEET)	S1	S2	S3	S2/S3	S1/(S1+S2)	T-MAX
405	1.265	3.706	1.473	2.516	0.255	426
855	0.326	0.546	0.533	1.024	0.374	427
1365	0.128	0.669	0.866	0.772	0.160	427
1595	0.335	0.670	0.886	0.757	0.333	424
1985	0.214	0.698	1.126	0.620	0.234	429
2235	0.427	5.429	0.942	5.766	0.073	425
2615	0.280	0.972	0.903	1.077	0.224	431
2685	0.178	0.853	0.872	0.978	0.173	432

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

GREAT WESTERN, #1 HOSPAH-SANTA-FE

DEPTH (FEET)	HYDROGEN INDEX (mg HC/g TOC)	OXYGEN INDEX (mg CO2/g TOC)	TOC (%)
405	118	47	3.15
855	85	83	0.64
1365	134	173	0.50
1595	78	103	0.86
1985	80	129	0.87
2235	274	48	1.98
2615	126	117	0.77
2685	127	130	0.67

ROCK-EVAL PYROLYSIS RAW DATA

APACHE, #1 FOSHAY

DEPTH (FEET)	S1	S2	S3	S2/S3	S1/(S1+S2)	T-MAX
2065	0.504	13.491	1.202	11.222	0.036	430
2615	0.584	12.657	1.059	11.948	0.044	428
3048	0.069	0.451	0.421	1.073	0.133	431
3495	0.608	9.292	1.981	4.691	0.061	427
3995	0.748	8.970	2.111	4.248	0.077	432
4485	0.469	6.902	1.668	4.137	0.064	427
4745	0.536	6.607	0.706	9.357	0.075	436
9345	0.050	0.526	0.567	0.929	0.087	433

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

APACHE, #1 FOSHAY

DEPTH (FEET)	HYDROGEN INDEX (mg HC/g TOC)	OXYGEN INDEX (mg CO2/g TOC)	TOC (%)
2065	251	22	5.38
2615	208	17	6.08
3048	69	65	0.65
3495	149	32	6.25
3995	149	35	6.00
4485	188	45	3.67
4745	142	15	4.66
9345	110	118	0.48

ROCK-EVAL PYROLYSIS RAW DATA

AMERADA, #1 NAVAJO TRACT-20

DEPTH (FEET)	S1	S2	S3	S2/S3	S1/(S1+S2)	T-MAX
6768	0.267	26.516	2.316	11.448	0.010	429
6823	0.104	0.732	0.517	1.416	0.124	438
7048	0.212	0.194	0.437	0.444	0.522	441

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

AMERADA, #1 NAVAJO TRACT-20

DEPTH (FEET)	HYDROGEN INDEX (mg HC/g TOC)	OXYGEN INDEX (mg CO2/g TOC)	TOC (%)
6768	834	73	3.18
6823	183	129	0.40
7048	61	137	0.32

ROCK-EVAL PYROLYSIS RAW DATA

SHELL, #113-17 CARSON UNIT

DEPTH (FEET)	S1	S2	S3	S2/S3	S1/(S1+S2)	T-MAX
2105	0.113	0.547	0.487	1.123	0.171	434
2645	0.073	0.898	0.745	1.205	0.075	434
3055	0.170	4.663	1.152	4.049	0.035	433
3615	0.228	4.204	0.781	5.389	0.051	433
4005	0.489	8.923	1.118	7.981	0.052	432
4565	0.265	1.409	0.419	3.364	0.159	429
5025	0.717	6.304	0.814	7.748	0.102	431
5505	0.327	3.057	0.501	6.105	0.097	434
10033	0.043	0.701	0.404	1.734	0.058	436
10038	0.105	0.218	0.264	0.826	0.324	437
10263	0.051	0.457	0.411	1.112	0.100	434
10268	0.065	0.764	0.307	2.492	0.073	434
10723	0.174	0.222	0.358	0.619	0.439	430
10728	0.046	0.277	0.390	0.711	0.142	433

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

SHELL, #113-17 CARSON UNIT

DEPTH (FEET)	HYDROGEN INDEX (mg HC/g TOC)	OXYGEN INDEX (mg CO2/g TOC)	TOC (%)
2105	124	111	0.44
2645	106	88	0.85
3055	151	37	3.08
3615	139	26	3.02
4005	171	21	5.23
4565	119	35	1.18
5025	165	21	3.81
5505	204	33	1.50
10033	80	46	0.88
10038	59	71	0.37
10263	51	46	0.90
10268	99	40	0.77
10723	63	102	0.35
10728	73	103	0.38

ROCK-EVAL PYROLYSIS RAW DATA

SKELLY, #1 NAVAJO-O

DEPTH (FEET)	S1	S2	S3	S2/S3	S1/(S1+S2)	T-MAX
10575	0.207	0.597	0.564	1.059	0.258	434
10675	0.295	0.593	0.603	0.983	0.332	434
10805	0.055	0.611	0.574	1.065	0.082	437
11005	0.187	0.537	0.516	1.040	0.258	439
11025	0.154	0.430	0.569	0.755	0.263	436

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

SKELLY, #1 NAVAJO-O

DEPTH (FEET)	HYDROGEN INDEX (mg HC/g TOC)	OXYGEN INDEX (mg CO2/g TOC)	TOC (%)
10575	96	91	0.62
10675	110	112	0.54
10805	127	120	0.48
11005	105	101	0.51
11025	95	126	0.45

ROCK-EVAL PYROLYSIS RAW DATA

UNION, #1-M-13 USA

DEPTH (FEET)	S1	S2	S3	S2/S3	S1/(S1+S2)	T-MAX
10665	0.122	0.083	0.394	0.212	0.594	463
10845	0.113	0.220	0.343	0.640	0.340	466
11245	0.097	0.147	0.511	0.287	0.397	455

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

UNION, #1-M-13 USA

DEPTH (FEET)	HYDROGEN INDEX (mg HC/g TOC)	OXYGEN INDEX (mg CO2/g TOC)	TOC (%)
10665	27	127	0.31
10845	41	64	0.54
11245	42	146	0.35

ROCK-EVAL PYROLYSIS RAW DATA
BRINKERHOFF, #1 CABEZON GOV'T

DEPTH (FEET)	S1	S2	S3	S2/S3	S1/(S1+S2)	T-MAX
7223	0.127	0.261	0.361	0.723	0.327	433
7228	0.125	0.288	0.315	0.915	0.303	430
7873	0.091	0.133	0.256	0.517	0.408	431
7878	0.092	0.096	0.300	0.320	0.489	435

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

BRINKERHOFF, #1 CABEZON GOV'T

DEPTH (FEET)	HYDROGEN INDEX (mg HC/g TOC)	OXYGEN INDEX (mg CO2/g TOC)	TOC (%)
7223	84	116	0.31
7228	76	83	0.38
7873	43	83	0.31
7878	27	83	0.36

ROCK-EVAL PYROLYSIS RAW DATA

DELHI, #4 UTE

DEPTH (FEET)	S1	S2	S3	S2/S3	S1/(S1+S2)	T-MAX
7843	0.193	0.936	0.980	0.956	0.171	433
7848	0.127	0.622	0.728	0.854	0.170	436
8148	0.108	0.829	0.624	1.329	0.115	430
8223	0.200	1.689	0.324	5.208	0.106	433
8453	0.538	1.967	0.577	3.408	0.215	429
8458	0.349	1.407	0.621	2.265	0.199	431
8633	0.068	0.657	0.645	1.018	0.094	433
8638	0.202	0.305	0.590	0.516	0.398	430
8763	0.163	1.629	0.603	2.703	0.091	432
8768	0.297	1.457	0.734	1.984	0.169	436
8773	0.081	0.605	0.761	0.795	0.118	437
8778	0.154	0.751	0.750	1.001	0.170	433
8933	0.174	0.378	0.716	0.528	0.315	435
9123	0.429	1.115	0.501	2.225	0.278	432
9128	0.426	0.929	0.599	1.551	0.315	433
9473	0.129	0.498	0.676	0.737	0.206	433
9478	0.194	0.867	0.821	1.055	0.183	432
9603	0.284	1.476	0.704	2.098	0.161	434
9608	0.138	0.994	0.842	1.181	0.122	431

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

DELHI, #4 UTE

DEPTH (FEET)	HYDROGEN INDEX (mg HC/g TOC)	OXYGEN INDEX (mg CO2/g TOC)	TOC (%)
7843	154	161	0.61
7848	141	165	0.44
8148	148	111	0.56
8223	196	38	0.86
8453	167	49	1.18
8458	158	70	0.89
8633	119	117	0.55
8638	54	105	0.56
8763	173	64	0.94
8768	132	67	1.10
8773	85	107	0.71
8778	114	114	0.66
8933	80	152	0.47
9123	83	37	1.34
9128	66	43	1.40
9473	89	121	0.56
9478	103	98	0.84
9603	146	70	1.01
9608	116	98	0.86

APPENDIX III

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 sheet contains visual percentage estimates of each principle kerogen type, notes on vitrinite description, and kerogen fluorescence data.

The histograms show measured reflectance values of all vitrinite present and on all material with the visual appearance of vitrinite. Shaded values 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. Sometimes the samples analysed contain no vitrinite or have an insufficient number of readings to allow a reliable maturity determination to be made. Alternate maturity calculations are possible on a few samples. The histograms are identified by a sequence number and depth or notation.

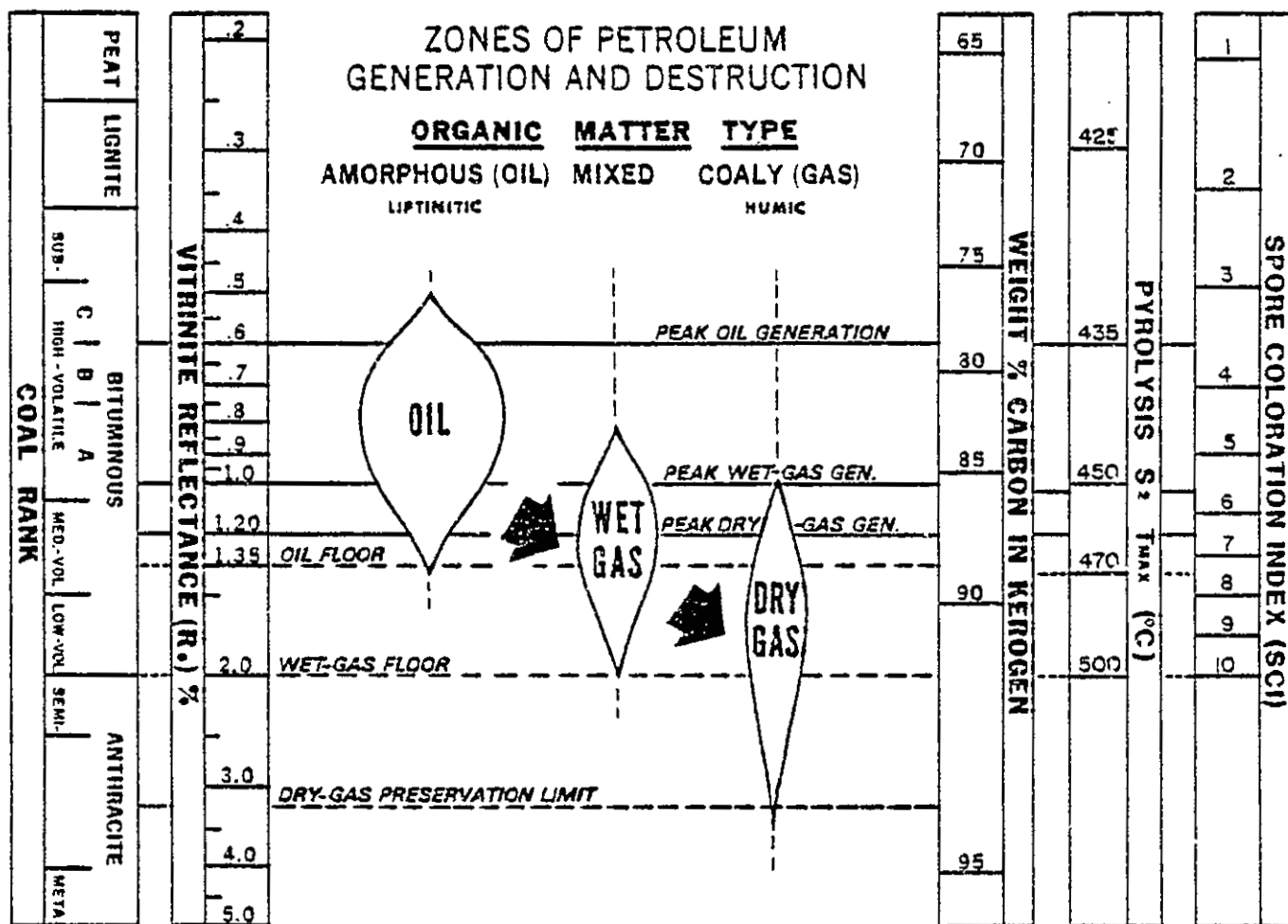


FIGURE CORRELATION OF VARIOUS MATURATION INDICES AND ZONES OF PETROLEUM GENERATION AND DESTRUCTION.

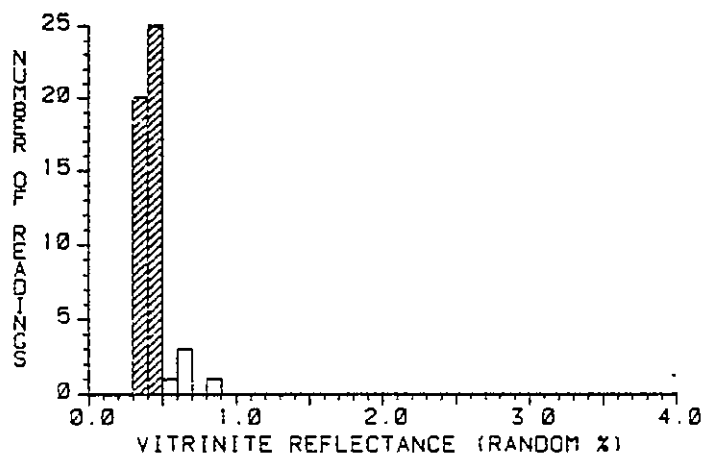
VISUAL KEROGEN ANALYSIS - REFLECTED LIGHT

GREAT WESTERN #1 HOSPAH-SANTA-FE

Project No. : RRUS/823/T/43/02

SAMPLE IDENTIFICATION		REFLECT.	KEROGEN CHARACTERISTICS					TOC
RRUS	DEPTH (Feet)	Ro %	Am%	Ex%	Vit%	Inert%	Fluor	%
601	405	0.40	10	15	45	30	Med	3.15
602	855	0.41	5	5	65	25	Med	0.64
603	1365	0.47	15	10	35	40	Low	0.50
604	1595	0.45	15	5	40	40	High	0.86
605	1985	0.55	25	5	35	35	High	0.87
606	2235	0.54	30	5	35	30	Med	1.98
607-608	2650	0.55	25	5	30	40	Med	----
610	7035	0.93	10	tr	40	50	Low	0.11
614-615	7570	0.94	tr	tr	tr	tr	Low	----
616	7785	1.06	10	tr	45	45	Low	0.17

GREAT WESTERN #1 HOSPAH-SANTA-FE



RRUS No. : 601

DEPTH : 405.0 F
: 123.4 M

* = Ro MATURITY

* VALUES : 45

MEAN : 0.40
STD DEV : 0.03
MEDIAN : 0.40
MODE : 0.45

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

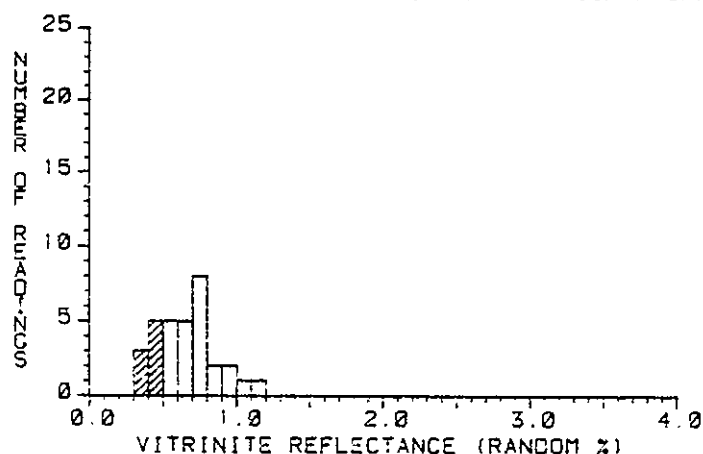
ORDERED REFLECTANCE VALUES:

*0.32	*0.38	*0.40	*0.40	*0.43
*0.33	*0.38	*0.40	*0.41	*0.44
*0.36	*0.38	*0.40	*0.41	*0.45
*0.36	*0.38	*0.40	*0.41	*0.47
*0.36	*0.38	*0.40	*0.41	*0.47
*0.36	*0.39	*0.40	*0.41	0.52
*0.36	*0.39	*0.40	*0.42	0.60
*0.37	*0.39	*0.40	*0.42	0.64
*0.37	*0.39	*0.40	*0.43	0.64
*0.38	*0.39	*0.40	*0.43	0.80

KEROGEN DESCRIPTION

Amorphous	: 10 %
Exinite	: 15 %
Vitrinite	: 45 %
Inertinite	: 30 %
Back Fluor	: Med
Bitumen	: High
Coke	: None

GREAT WESTERN #1 HOSPAH-SANTA-FE



RRUS No. : 602

DEPTH : 855.0 F
: 260.6 M

* = Ro MATURITY

* VALUES : 8

MEAN : 0.41
STD DEV : 0.05
MEDIAN : 0.43
MODE : 0.45

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

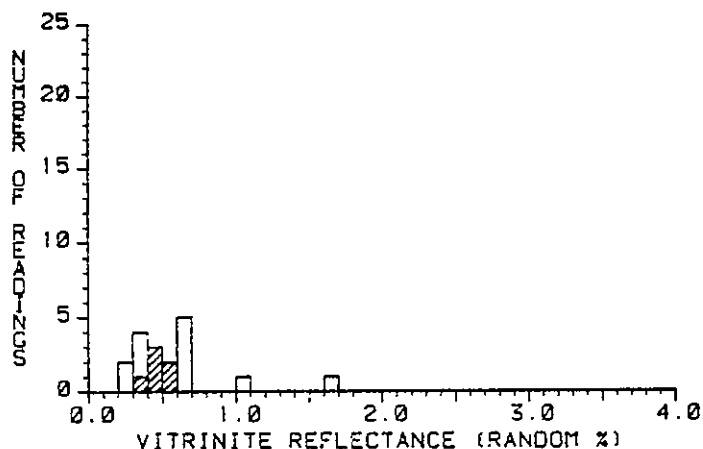
ORDERED REFLECTANCE VALUES:

*0.32	0.54	0.71	1.01
*0.36	0.55	0.71	1.10
*0.39	0.58	0.72	
*0.40	0.60	0.73	
*0.43	0.60	0.76	
*0.43	0.60	0.77	
*0.45	0.63	0.80	
*0.48	0.67	0.85	
0.52	0.70	0.94	
0.53	0.70	0.97	

KEROGEN DESCRIPTION

Amorphous	: 5 %
Exinite	: 5 %
Vitrinite	: 65 %
Inertinite	: 25 %
Back Fluor	: Med
Bitumen	: Med
Coke	: None

GREAT WESTERN #1 HOSPAH-SANTA-FE



RRUS No. : 603

DEPTH : 1365.0 Ft
: 416.1 M

* = Ro MATURITY

* VALUES : 6

MEAN : 0.47
STD DEV : 0.08
MEDIAN : 0.47
MODE : 0.45

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

ORDERED REFLECTANCE VALUES:

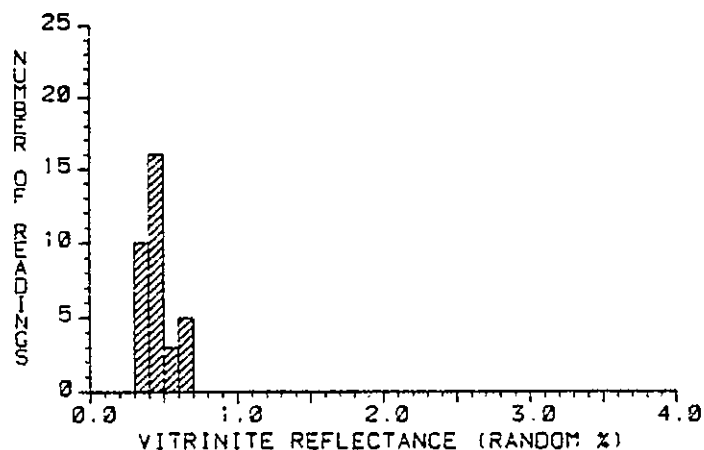
0.26 *0.59
0.28 0.61
0.30 0.62
0.30 0.63
0.30 0.66
*0.35 0.68
*0.42 1.03
*0.43 1.66
*0.47
*0.56

KEROGEN DESCRIPTION

Amorphous : 15 %
Exinite : 10 %
Vitrinite : 35 %
Inertinite : 40 %

Back Fluor : Low
Bitumen : None
Coke : None

GREAT WESTERN #1 HOSPAH-SANTA-FE



RRUS No. : 604

DEPTH : 1593.0 Ft
: 486.2 M

* = Ro MATURITY

* VALUES : 34

MEAN : 0.45
STD DEV : 0.10
MEDIAN : 0.41
MODE : 0.45

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

ORDERED REFLECTANCE VALUES:

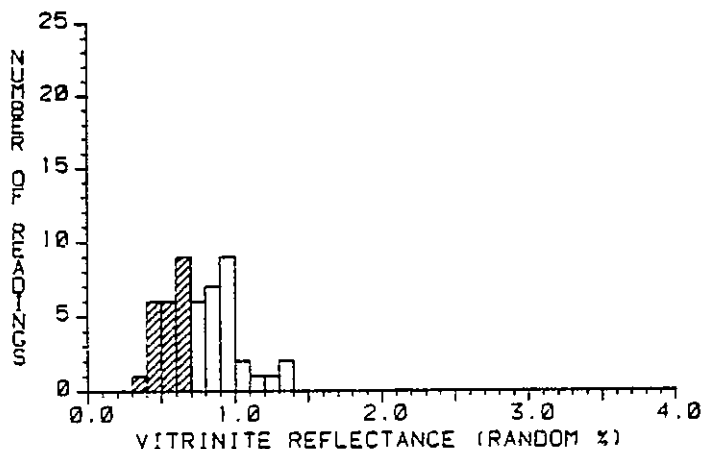
*0.32 *0.40 *0.43 *0.63
*0.35 *0.40 *0.43 *0.65
*0.36 *0.41 *0.44 *0.66
*0.36 *0.41 *0.44 *0.68
*0.37 *0.41 *0.44
*0.38 *0.41 *0.48
*0.38 *0.41 *0.53
*0.39 *0.41 *0.57
*0.39 *0.42 *0.59
*0.39 *0.42 *0.62

KEROGEN DESCRIPTION

Amorphous : 15 %
Exinite : 5 %
Vitrinite : 40 %
Inertinite : 40 %

Back Fluor : High
Bitumen : Med
Coke : None

GREAT WESTERN #1 HOSPAH-SANTA-FE



RRUS No. : 605

DEPTH : 1985.0 Ft
: 605.0 M

* = Ro MATURITY

VALUES : 22

MEAN : 0.55
STD DEV : 0.10
MEDIAN : 0.57
MODE : 0.65

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

ORDERED REFLECTANCE VALUES:

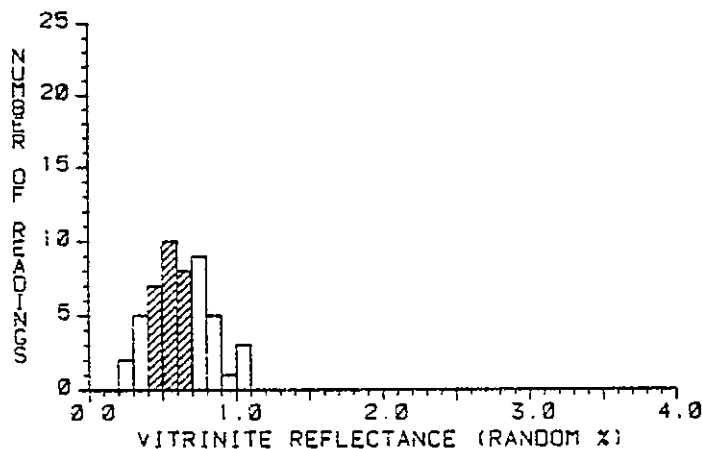
*0.34	*0.56	*0.69	0.82	0.92
*0.42	*0.57	*0.69	0.82	0.93
*0.43	*0.57	0.72	0.83	0.97
*0.45	*0.51	0.73	0.86	0.97
*0.46	*0.62	0.75	0.86	1.04
*0.48	*0.62	0.79	0.90	1.05
*0.48	*0.62	0.79	0.90	1.11
*0.50	*0.64	0.79	0.90	1.28
*0.54	*0.67	0.80	0.91	1.30
*0.55	*0.67	0.82	0.92	1.36

KEROGEN DESCRIPTION

Amorphous : 25 %
Exinite : 5 %
Vitrinite : 35 %
Inertinite : 35 %

Back Fluor : High
Bitumen : Med
Coke : None

GREAT WESTERN #1 HOSPAH-SANTA-FE



RRUS No. : 606

DEPTH : 2235.0 Ft
: 681.2 M

* = Ro MATURITY

VALUES : 25

MEAN : 0.54
STD DEV : 0.08
MEDIAN : 0.54
MODE : 0.55

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

ORDERED REFLECTANCE VALUES:

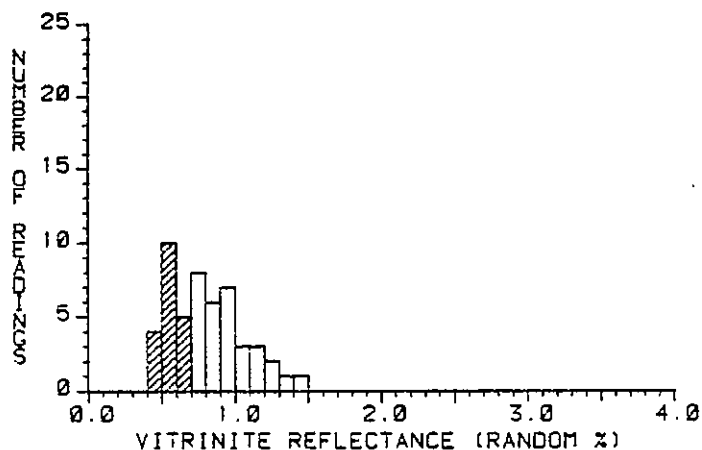
0.27	*0.42	*0.56	*0.66	0.79
0.28	*0.45	*0.57	*0.67	0.80
0.33	*0.46	*0.57	0.71	0.82
0.33	*0.47	*0.58	0.73	0.83
0.34	*0.50	*0.60	0.73	0.86
0.34	*0.50	*0.60	0.75	0.87
0.35	*0.51	*0.62	0.75	0.90
*0.40	*0.53	*0.63	0.75	1.00
*0.40	*0.53	*0.63	0.76	1.05
*0.40	*0.54	*0.64	0.77	1.05

KEROGEN DESCRIPTION

Amorphous : 30 %
Exinite : 5 %
Vitrinite : 35 %
Inertinite : 30 %

Back Fluor : Med
Bitumen : Med
Coke : Small

GREAT WESTERN #1 HOSPAH-SANTA-FE



RRUS No. : 607-608
 DEPTH : 2650.0 Ft
 : 807.7 M

* = Ro MATURITY

* VALUES : 19

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

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

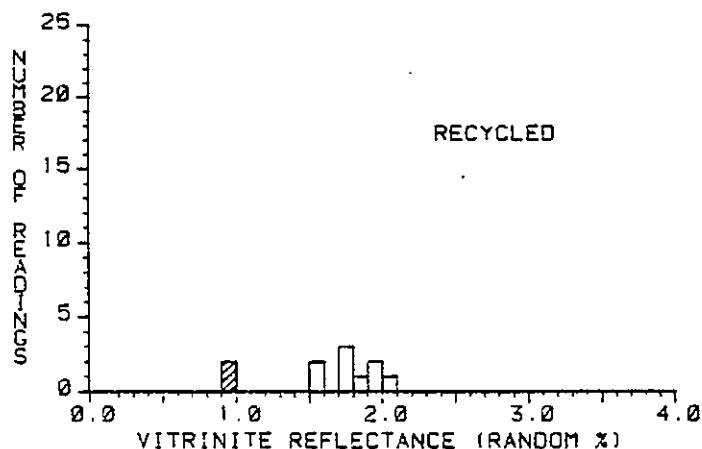
ORDERED REFLECTANCE VALUES:

*0.41	*0.55	0.72	0.86	1.01
*0.45	*0.56	0.75	0.89	1.03
*0.45	*0.59	0.76	0.89	1.04
*0.46	*0.59	0.76	0.90	1.12
*0.50	*0.61	0.77	0.92	1.13
*0.51	*0.63	0.77	0.92	1.18
*0.51	*0.64	0.77	0.92	1.21
*0.53	*0.66	0.84	0.94	1.22
*0.55	*0.68	0.84	0.94	1.33
*0.55	0.71	0.85	0.98	1.44

KEROGEN DESCRIPTION:

Amorphous : 25 %
 Exinite : 5 %
 Vitrinite : 30 %
 Inertinite : 40 %
 Back Fluor : Med
 Bitumen : Med
 Coke : None

GREAT WESTERN #1 HOSPAH-SANTA-FE



RRUS No. : 610

DEPTH : 7035.0 Ft
 : 2144.3 M

* = Ro MATURITY

* VALUES : 2

MEAN : 0.93
 STD DEV : 0.01
 MEDIAN : 0.94
 MODE : 0.93

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

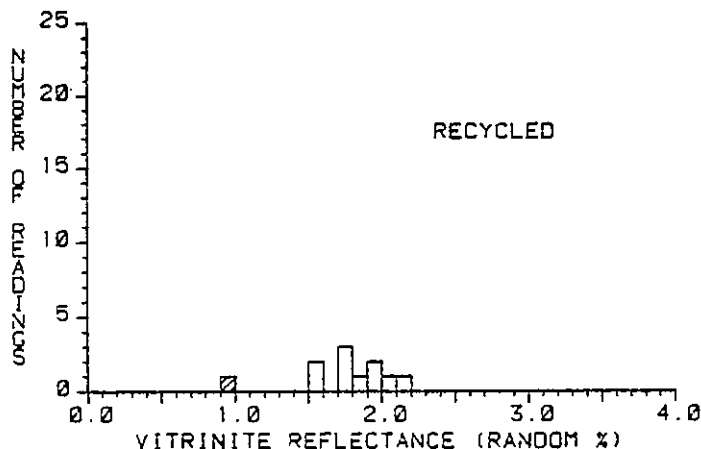
ORDERED REFLECTANCE VALUES:

*0.93	2.00
*0.94	
1.58	
1.59	
1.71	
1.76	
1.78	
1.86	
1.94	
1.98	

KEROGEN DESCRIPTION:

Amorphous : 10 %
 Exinite : 0 %
 Vitrinite : 40 %
 Inertinite : 50 %
 Back Fluor : Low
 Bitumen : Ir
 Coke : Small

GREAT WESTERN #1 HOSPAH-SANTA-FE



RRUS No. : 614-615

DEPTH : 7570.0 Ft
: 2307.3 M

* = Ro MATURITY

* VALUES : 1

MEAN : 0.94
STD DEV : 0.00
MEDIAN : 0.94
MODE : 0.95

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

ORDERED REFLECTANCE VALUES:

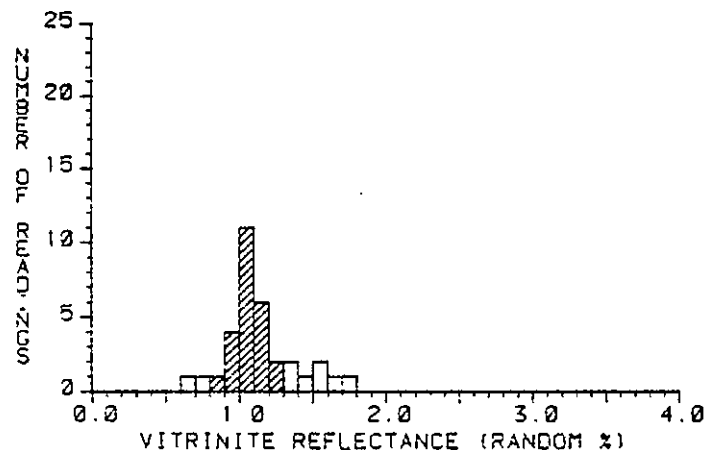
*0.94 2.10
1.58
1.59
1.71
1.76
1.78
1.86
1.94
1.98
2.00

KEROGEN DESCRIPTION

Amorphous : 1r %
Exinite : 1r %
Vitrinite : 1r %
Inertinite : 1r %

Back Fluor : Low
Bitumen : None
Coke : None

GREAT WESTERN #1 HOSPAH-SANTA-FE



RRUS No. : 618

DEPTH : 7785.0 Ft
: 2372.9 M

* = Ro MATURITY

* VALUES : 24

MEAN : 1.06
STD DEV : 0.09
MEDIAN : 1.05
MODE : 1.05

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

ORDERED REFLECTANCE VALUES:

0.66 *1.03 *1.15 1.56
0.78 *1.03 *1.15 1.61
*0.85 *1.04 *1.17 1.72
*0.92 *1.05 *1.18
*0.97 *1.05 *1.20
*0.97 *1.06 *1.27
*0.98 *1.06 1.36
*1.00 *1.08 1.39
*1.01 *1.12 1.45
*1.02 *1.15 1.54

KEROGEN DESCRIPTION

Amorphous : 10 %
Exinite : 1r %
Vitrinite : 45 %
Inertinite : 45 %

Back Fluor : Low
Bitumen : Small
Coke : None

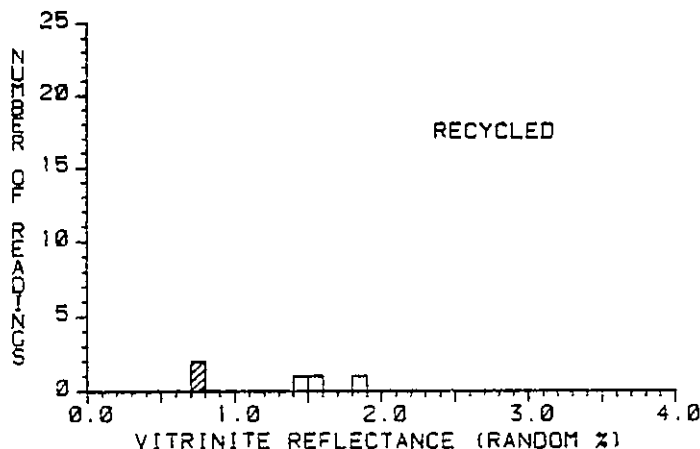
VISUAL KEROGEN ANALYSIS - REFLECTED LIGHT

TEXACO #1 NAVAJO AL

Project No. : RRUS/823/T/43/02

SAMPLE IDENTIFICATION		REFLECT.	KEROGEN CHARACTERISTICS					TOC
RRUS	DEPTH (Feet)	Ro %	Am%	Ex%	Vit%	Inert%	Fluor	%
804	5885	0.74	tr	tr	tr	tr	Low	0.04
809	6288	----	50?	tr	40	10	None	0.10

TEXACO #1 NAVAJO AL



RRUS No. : 804

DEPTH : 5885.0 Ft
: 1793.7 M

* = Ro MATURITY

* VALUES : 2

MEAN : 0.74

STD DEV : 0.03

MEDIAN : 0.77

MODE : 0.75

HISTOGRAM:

Range: 0- 4%

Increment: 0.10%

ORDERED REFLECTANCE VALUES:

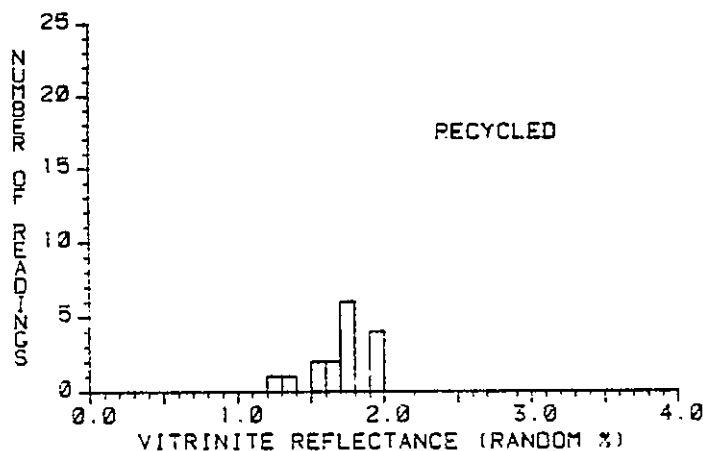
*0.71
*0.77
1.45
1.59
1.88

KEROGEN DESCRIPTION

Amorphous : 1r %
Exinite : 1r %
Vitrinite : 1r %
Inertinite : 1r %

Back Fluor : Low
Bitumen : Small
Coke : Small

TEXACO #1 NAVAJO AL



RRUS No. : 809

DEPTH : 6288.0 Ft
: 1916.6 M

* VALUES : 16

MEAN : 1.71

STD DEV : 0.19

MEDIAN : 1.75

MODE : 1.75

HISTOGRAM:

Range: 0- 4%

Increment: 0.10%

ORDERED REFLECTANCE VALUES:

1.29 1.76
1.31 1.78
1.56 1.90
1.57 1.94
1.67 1.95
1.69 1.96
1.71
1.72
1.75
1.76

KEROGEN DESCRIPTION

Amorphous : ? 50 %
Exinite : 1r %
Vitrinite : 40 %
Inertinite : 10 %

Back Fluor : None
Bitumen : High
Coke : None

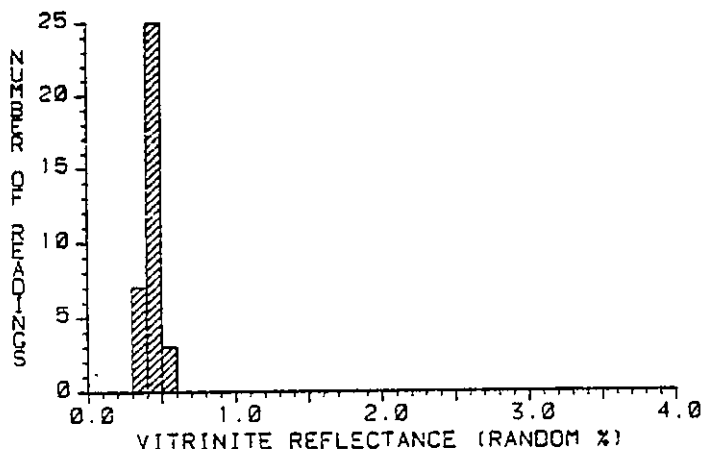
VISUAL KEROGEN ANALYSIS - REFLECTED LIGHT

APACHE #1 FOSHAY

Project No. : RRUS/823/T/43/02

SAMPLE IDENTIFICATION		REFLECT.	KEROGEN CHARACTERISTICS					TOC
RRUS	DEPTH (Feet)	Ro %	Am%	Ex%	Vit%	Inert%	Fluor	%
101	2065	0.44	25?	5	50	20	Med	5.38
102	2615	0.44	20?	10	45	25	Low	6.08
103	3048	0.51	20	5	45	30	High	0.65
104	3495	0.49	10	10	65	15	Med	6.25
105	3995	----	15	5	65	15	Med	6.00
106	4485	0.58	20	5	60	15	High	3.67
107	4745	0.66	10	10	35	45	Med	4.66
108-109	8910	1.40	35	5	25	35	Low	----
112	9345	1.40	20	10	50	20	Med	0.49
115	9675	1.75	10	40	35	15	Low	0.12

APACHE #1 FOSHAY



RRUS No. : 101

DEPTH : 2065.0 F1
: 629.4 M

* = Ro MATURITY

* VALUES : 35

MEAN : 0.44

STD DEV : 0.05

MEDIAN : 0.43

MODE : 0.45

HISTOGRAM:

Range: 0- 4%

Increment: 0.10%

ORDERED REFLECTANCE VALUES:

*0.35	*0.42	*0.43	*0.49
*0.38	*0.42	*0.43	*0.49
*0.38	*0.42	*0.44	*0.52
*0.38	*0.42	*0.44	*0.57
*0.39	*0.42	*0.46	*0.59
*0.39	*0.42	*0.46	
*0.39	*0.43	*0.47	
*0.40	*0.43	*0.48	
*0.40	*0.43	*0.48	
*0.41	*0.43	*0.48	

KEROGEN DESCRIPTION

Amorphous : 25 %

Exinite : 5 %

Vitrinite : 50 %

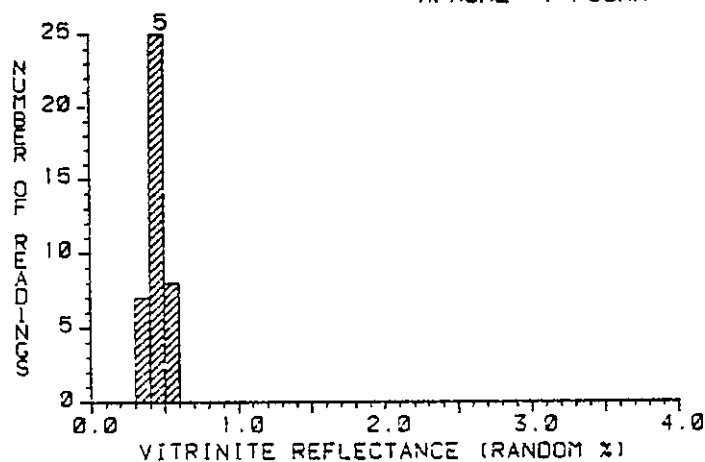
Inertinite : 20 %

Back Fluor : Med

Bitumen : Small

Coke : None

APACHE #1 FOSHAY



RRUS No. : 102

DEPTH : 2615.0 F1
: 797.1 M

* = Ro MATURITY

* VALUES : 45

MEAN : 0.44

STD DEV : 0.05

MEDIAN : 0.44

MODE : 0.45

HISTOGRAM:

Range: 0- 4%

Increment: 0.10%

ORDERED REFLECTANCE VALUES:

*0.33	*0.40	*0.44	*0.47	*0.50
*0.34	*0.40	*0.44	*0.47	*0.51
*0.34	*0.40	*0.44	*0.47	*0.51
*0.35	*0.41	*0.44	*0.47	*0.54
*0.37	*0.42	*0.44	*0.47	*0.56
*0.37	*0.42	*0.45	*0.48	
*0.38	*0.43	*0.45	*0.49	
*0.40	*0.43	*0.45	*0.50	
*0.40	*0.44	*0.46	*0.50	
*0.40	*0.44	*0.46	*0.50	

KEROGEN DESCRIPTION

Amorphous : 20 %

Exinite : 10 %

Vitrinite : 45 %

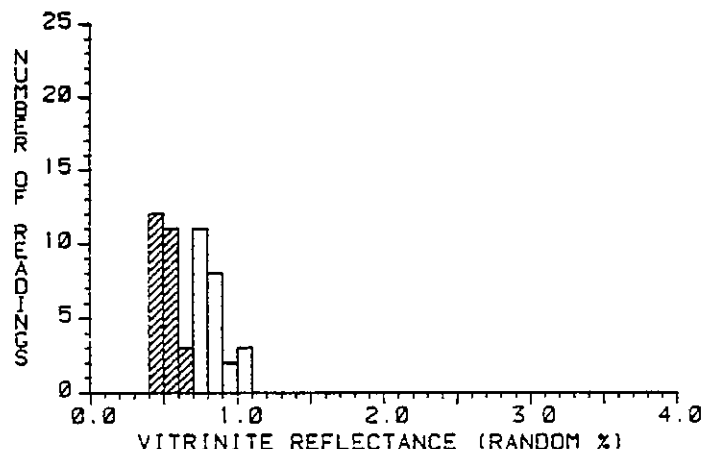
Inertinite : 25 %

Back Fluor : Low

Bitumen : Small

Coke : None

APACHE #1 FOSHAY



RRUS No. : 103

DEPTH : 3048.0 Ft
: 929.0 M

* = Ro MATURITY

VALUES : 26

MEAN : 0.51
STD DEV : 0.07
MEDIAN : 0.52
MODE : 0.45

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

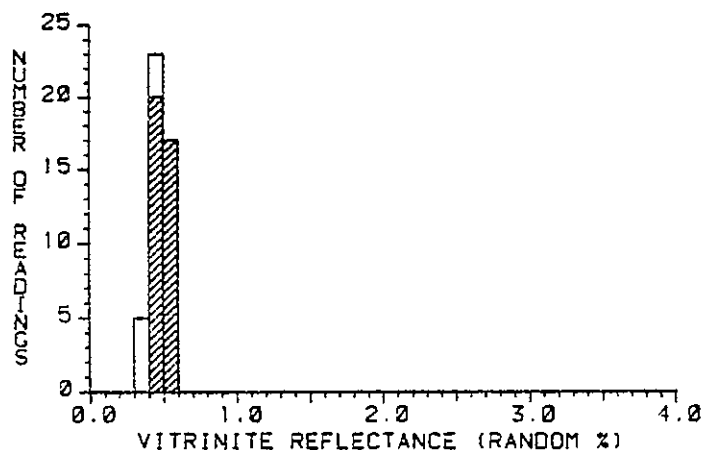
ORDERED REFLECTANCE VALUES:

*0.40	*0.49	*0.59	0.73	0.83
*0.40	*0.49	*0.59	0.74	0.83
*0.42	*0.50	*0.59	0.75	0.86
*0.43	*0.52	*0.60	0.75	0.88
*0.44	*0.53	*0.62	0.76	0.89
*0.45	*0.53	*0.65	0.77	0.96
*0.45	*0.55	0.70	0.79	0.99
*0.47	*0.55	0.71	0.81	1.00
*0.47	*0.57	0.71	0.81	1.06
*0.48	*0.58	0.72	0.81	1.07

KEROGEN DESCRIPTION

Amorphous : 20 %
Exinite : 5 %
Vitrinite : 45 %
Inertinite : 30 %
Back Fluor : High
Bitumen : Small
Coke : None

APACHE #1 FOSHAY



RRUS No. : 104

DEPTH : 3495.0 Ft
: 1065.3 M

* = Ro MATURITY

VALUES : 37

MEAN : 0.49
STD DEV : 0.03
MEDIAN : 0.49
MODE : 0.45

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

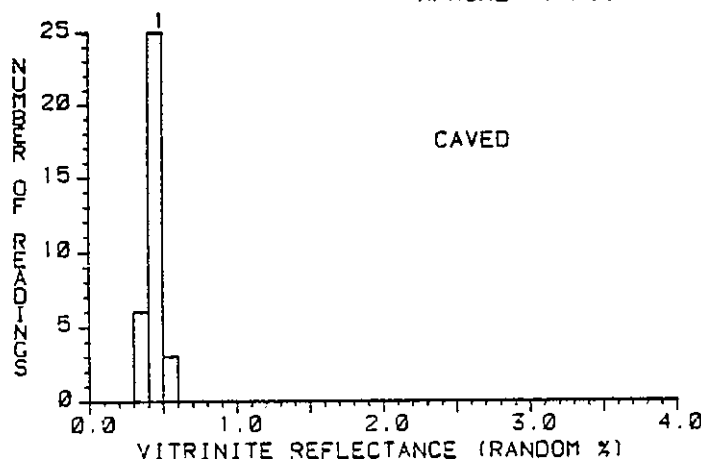
ORDERED REFLECTANCE VALUES:

0.32	*0.44	*0.47	*0.50	*0.52
0.37	*0.44	*0.47	*0.50	*0.52
0.37	*0.44	*0.48	*0.50	*0.52
0.38	*0.45	*0.49	*0.50	*0.52
0.39	*0.45	*0.49	*0.51	*0.53
0.40	*0.46	*0.49	*0.51	
0.41	*0.46	*0.49	*0.51	
0.41	*0.47	*0.49	*0.51	
*0.43	*0.47	*0.50	*0.51	
*0.43	*0.47	*0.50	*0.51	

KEROGEN DESCRIPTION

Amorphous : 10 %
Exinite : 10 %
Vitrinite : 65 %
Inertinite : 15 %
Back Fluor : Med
Bitumen : None
Coke : None

APACHE #1 FOSHAY



RRUS No. : 105

DEPTH : 3995.0 F1
: 1217.7 M

VALUES : 35

MEAN : 0.44
STD DEV : 0.04
MEDIAN : 0.44
MODE : 0.45HISTOGRAM:
Range: 0- 4%
Increment: 0.10%

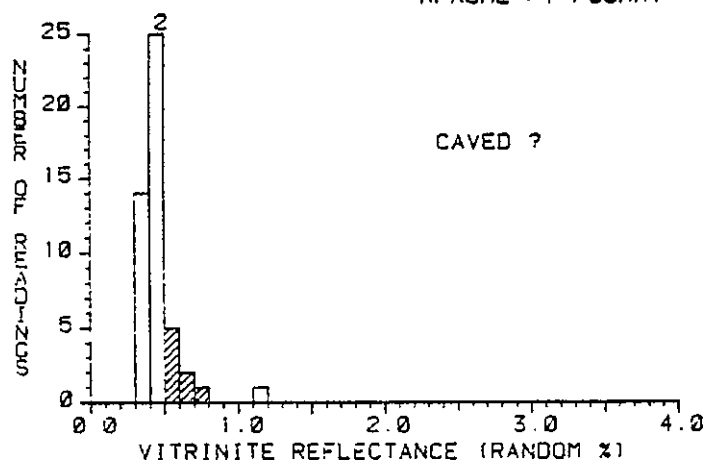
ORDERED REFLECTANCE VALUES:

0.34	0.42	0.45	0.49
0.36	0.43	0.45	0.49
0.36	0.43	0.46	0.50
0.38	0.43	0.46	0.51
0.39	0.43	0.46	0.52
0.39	0.43	0.46	
0.40	0.44	0.46	
0.42	0.44	0.47	
0.42	0.44	0.49	
0.42	0.45	0.49	

KEROGEN DESCRIPTION

Amorphous : 15 %
Exinite : 5 %
Vitrinite : 65 %
Inertinite : 15 %Back Fluor : Med
Bitumen : None
Coke : None

APACHE #1 FOSHAY



RRUS No. : 106

DEPTH : 4485.0 F1
: 1367.0 M

= Ro MATURITY

VALUES : 8

MEAN : 0.58
STD DEV : 0.08
MEDIAN : 0.54
MODE : 0.55HISTOGRAM:
Range: 0- 4%
Increment: 0.10%

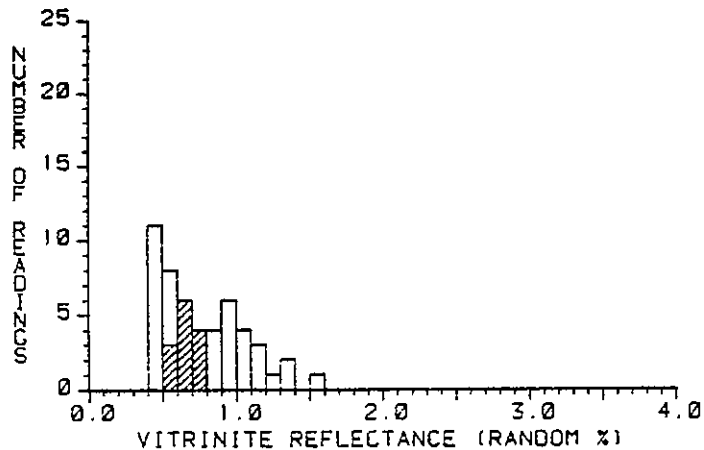
ORDERED REFLECTANCE VALUES:

0.30	0.39	0.41	0.43	0.48
0.35	0.39	0.41	0.44	*0.50
0.36	0.39	0.41	0.44	*0.50
0.37	0.39	0.41	0.44	*0.52
0.38	0.40	0.41	0.45	*0.53
0.38	0.40	0.41	0.45	*0.54
0.38	0.40	0.41	0.45	*0.64
0.38	0.40	0.42	0.46	*0.69
0.38	0.40	0.42	0.47	*0.72
0.39	0.41	0.42	0.47	1.13

KEROGEN DESCRIPTION

Amorphous : 20 %
Exinite : 5 %
Vitrinite : 60 %
Inertinite : 15 %Back Fluor : High
Bitumen : None
Coke : None

APACHE #1 FOSHAY



RRUS No. : 107

DEPTH : 4745.0 Ft
: 1446.3 M

* = Ro MATURITY

VALUES : 13

MEAN : 0.66
STD DEV : 0.07
MEDIAN : 0.64
MODE : 0.65

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

ORDERED REFLECTANCE VALUES:

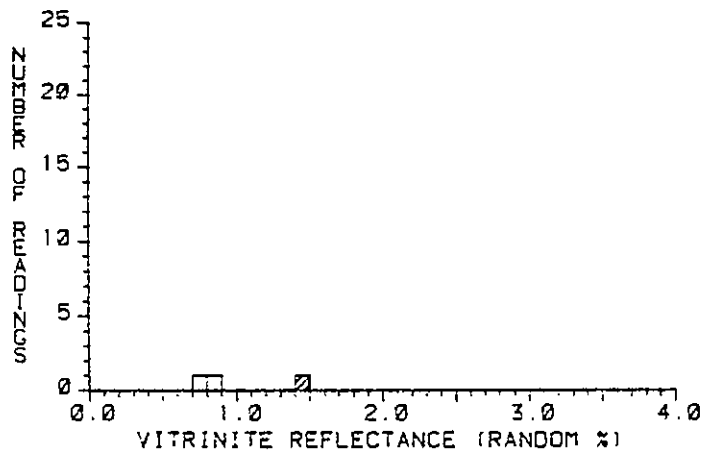
0.42	0.48	*0.63	0.84	1.05
0.42	0.51	*0.64	0.86	1.07
0.43	0.51	*0.64	0.87	1.09
0.44	0.52	*0.65	0.90	1.10
0.45	0.52	*0.66	0.93	1.11
0.47	0.53	*0.73	0.93	1.18
0.47	*0.55	*0.74	0.93	1.27
0.47	*0.57	*0.75	0.97	1.31
0.47	*0.58	*0.76	0.99	1.31
0.48	*0.62	0.83	1.00	1.51

KEROGEN DESCRIPTION:

Amorphous : 10 %
Exinite : 10 %
Vitrinite : 35 %
Inertinite : 45 %

Back Fluor : Med
Bitumen : Med
Coke : None

APACHE #1 FOSHAY



RRUS No. : 108-109

DEPTH : 8910.0 Ft
: 2715.8 M

* = Ro MATURITY

VALUES : 1

MEAN : 1.40
STD DEV : 0.00
MEDIAN : 1.40
MODE : 1.45

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

ORDERED REFLECTANCE VALUES:

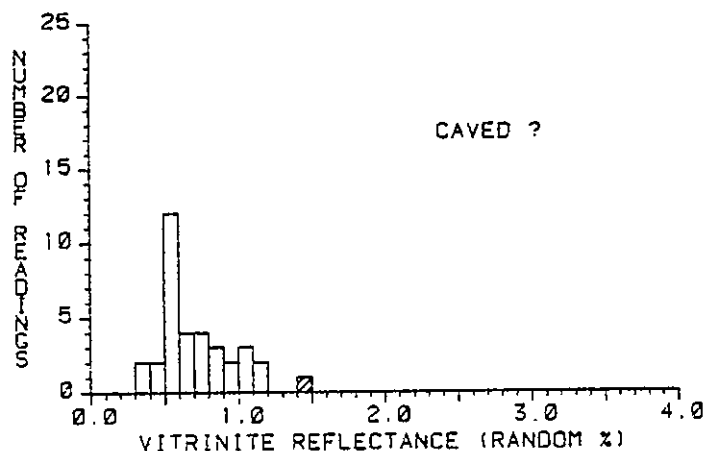
0.70
0.88
*1.40

KEROGEN DESCRIPTION:

Amorphous : 35 %
Exinite : 5 %
Vitrinite : 25 %
Inertinite : 35 %

Back Fluor : Low
Bitumen : None
Coke : None

APACHE #1 FOSHAY



RRUS No. : 112

DEPTH : 9345.0 F1
: 2848.4 M

* = Ro MATURITY

* VALUES : 1

MEAN : 1.40
STD DEV : 0.00
MEDIAN : 1.40
MODE : 1.45

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

ORDERED REFLECTANCE VALUES:

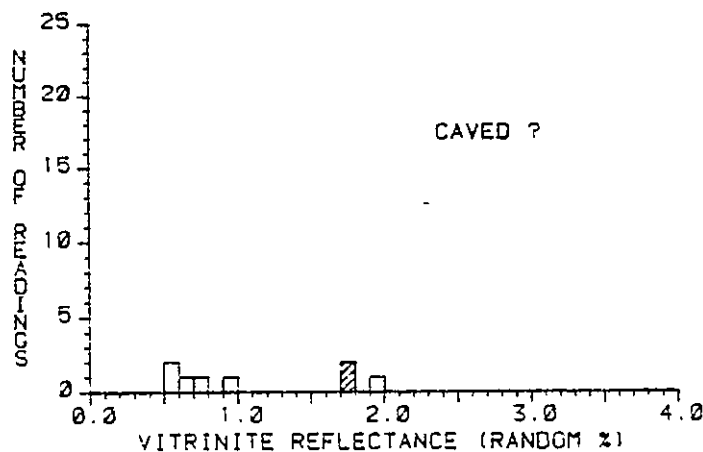
0.37	0.53	0.71	1.04
0.38	0.53	0.73	1.05
0.46	0.54	0.78	1.11
0.49	0.55	0.78	1.15
0.50	0.55	0.81	*1.40
0.50	0.58	0.82	
0.50	0.61	0.89	
0.51	0.66	0.92	
0.52	0.67	0.93	
0.53	0.68	1.02	

KEROGEN DESCRIPTION

Amorphous : 20 %
Exinite : 10 %
Vitrinite : 50 %
Inertinite : 20 %

Back Fluor : Med
Bitumen : Med
Coke : tr

APACHE #1 FOSHAY



RRUS No. : 115

DEPTH : 9675.0 F1
: 2948.9 M

* = Ro MATURITY

* VALUES : 2

MEAN : 1.75
STD DEV : 0.03
MEDIAN : 1.79
MODE : 1.75

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

ORDERED REFLECTANCE VALUES:

0.52
0.53
0.63
0.70
0.97
*1.72
*1.79
1.90

KEROGEN DESCRIPTION

Amorphous : 10 %
Exinite : 40 %
Vitrinite : 35 %
Inertinite : 15 %

Back Fluor : Low
Bitumen : None
Coke : tr

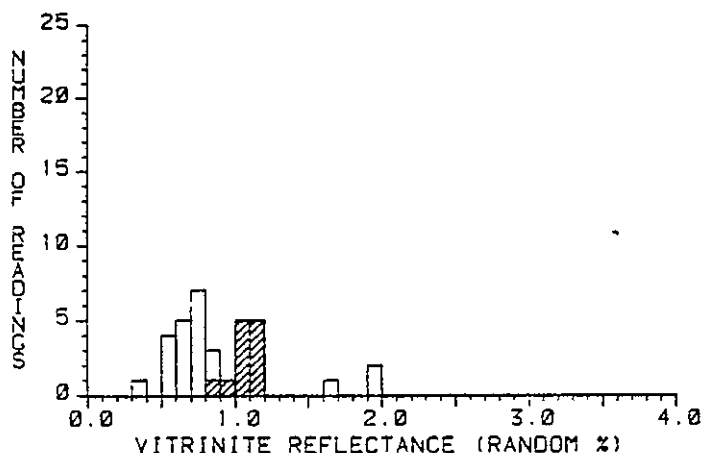
VISUAL KEROGEN ANALYSIS - REFLECTED LIGHT

AMERADA #1 NAVAJO TRACT-20

Project No. : RRUS/823/T/43/02

SAMPLE IDENTIFICATION		REFLECT.	KEROGEN CHARACTERISTICS					TOC
RRUS	DEPTH (Feet)	Ro %	Am%	Ex%	Vit%	Inert%	Fluor	%
4	6768	1.06	5	0	75	20	Med	3.18
5	6823	1.09	60	0	20	20	High	0.40
13-14	7045	1.12	60	0	20	20	High	----
19-20	7175	----	5	tr	70	25	Low	----
23-24	7365	1.24	40	tr	40	20	Low	----

AMERADA #1 NAVAJO TRACT-20



RRUS No. : 4
 DEPTH : 8768.0 F
 : 2062.9 M

* = Ro MATURITY

* VALUES : 12

MEAN : 1.06
 STD DEV : 0.08
 MEDIAN : 1.08
 MODE : 1.15

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

ORDERED REFLECTANCE VALUES:

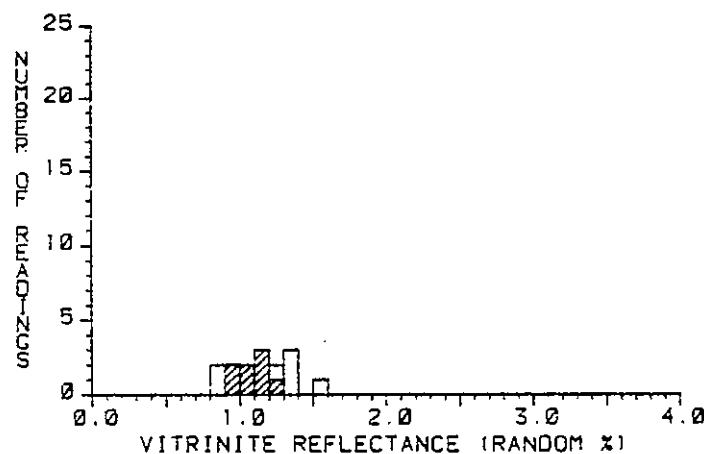
0.34	0.71	*0.91	*1.18
0.50	0.72	*1.01	1.65
0.54	0.76	*1.04	1.94
0.58	0.76	*1.05	1.94
0.58	0.76	*1.07	
0.63	0.79	*1.08	
0.63	0.79	*1.10	
0.65	0.80	*1.10	
0.67	0.81	*1.11	
0.69	*0.89	*1.13	

KEROGEN DESCRIPTION

Amorphous : 5 %
 Exinite : 0 %
 Vitrinite : 75 %
 Inertinite : 20 %

Back Fluor : Med
 Bitumen : High
 Coke : None

AMERADA #1 NAVAJO TRACT-20



RRUS No. : 5

DEPTH : 6823.0 F
 : 2079.7 M

* = Ro MATURITY

* VALUES : 8

MEAN : 1.09
 STD DEV : 0.09
 MEDIAN : 1.12
 MODE : 1.15

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

ORDERED REFLECTANCE VALUES:

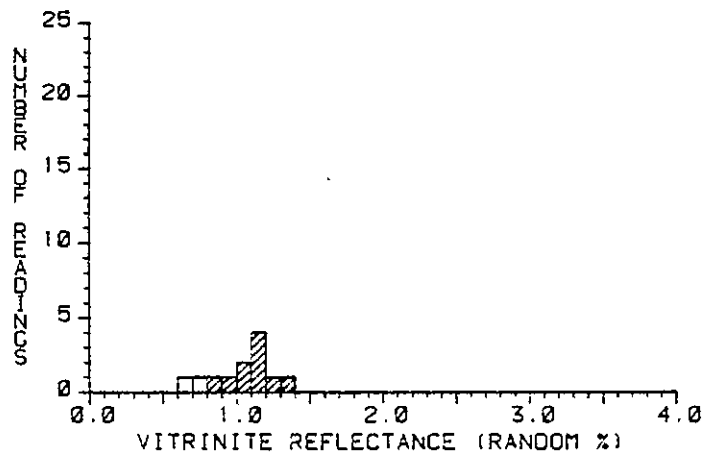
0.81	1.27
0.83	1.30
*0.95	1.33
*0.97	1.35
*1.08	1.50
*1.08	
*1.12	
*1.15	
*1.18	
*1.21	

KEROGEN DESCRIPTION

Amorphous : 60 %
 Exinite : 0 %
 Vitrinite : 20 %
 Inertinite : 20 %

Sack Fluor : High
 Bitumen : High
 Coke : None

AMERADA #1 NAVAJO TRACT-20



RRUS No. : 13-14

DEPTH : 7045.0 Ft
: 2147.3 M

* = Ro MATURITY

VALUES : 10

MEAN : 1.12
STD DEV : 0.14
MEDIAN : 1.18
MODE : 1.15HISTOGRAM:
Range: 0- 4%
Increment: 0.10%

ORDERED REFLECTANCE VALUES:

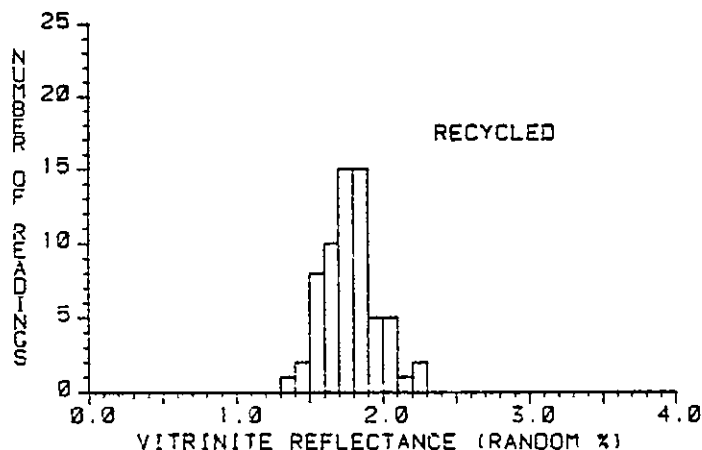
0.67 *1.27
0.77 *1.33
*0.85
*0.96
*1.05
*1.05
*1.17
*1.18
*1.19
*1.19

KEROGEN DESCRIPTION:

Amorphous : 60 %
Exinite : 0 %
Vitrinite : 20 %
Inertinite : 20 %

Back Fluor : High
Bitumen : High
Coke : None

AMERADA #1 NAVAJO TRACT-20



RRUS No. : 19-20

DEPTH : 7175.0 Ft
: 2186.9 M

VALUES : 64

MEAN : 1.73
STD DEV : 0.13
MEDIAN : 1.76
MODE : 1.85HISTOGRAM:
Range: 0- 4%
Increment: 0.10%

ORDERED REFLECTANCE VALUES:

1.30	1.58	1.68	1.72	1.82	1.87	2.07
1.40	1.60	1.70	1.74	1.82	1.90	2.16
1.46	1.61	1.70	1.76	1.84	1.90	2.20
1.51	1.62	1.70	1.76	1.85	1.90	2.20
1.51	1.62	1.70	1.77	1.85	1.91	
1.53	1.63	1.70	1.78	1.85	1.98	
1.53	1.64	1.71	1.80	1.85	2.00	
1.53	1.65	1.71	1.80	1.86	2.01	
1.54	1.66	1.71	1.81	1.87	2.04	
1.57	1.68	1.72	1.82	1.87	2.06	

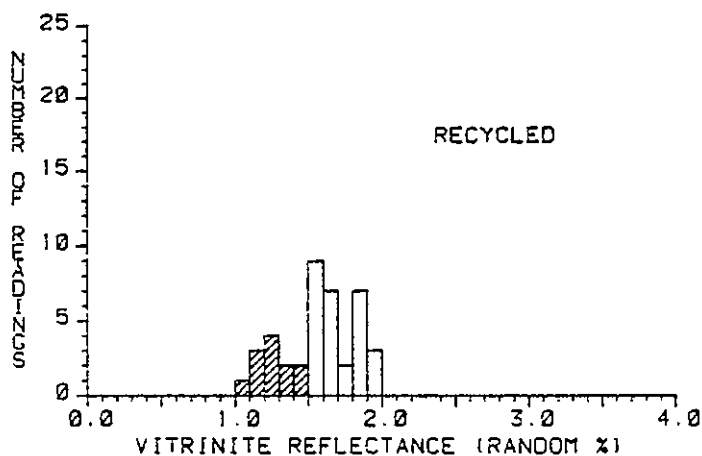
KEROGEN DESCRIPTION

Amorphous : 5 %
Exinite : 0 %
Vitrinite : 70 %
Inertinite : 25 %

Back Fluor : Low
Bitumen : Med
Coke : None

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AMERADA #1 NAVAJO TRACT-20



RRUS No. : 23-24

DEPTH : 7365.0 F1
: 2244.9 M

* = R_o MATURITY

* VALUES : 12

MEAN : 1.26

STD DEV : 0.13

MEDIAN : 1.23

MODE : 1.25

HISTOGRAM:

Range: 0- 4%

Increment: 0.10%

ORDERED REFLECTANCE VALUES:

*1.05	*1.47	1.59	1.80
*1.12	*1.47	1.60	1.82
*1.14	1.50	1.61	1.83
*1.17	1.50	1.62	1.83
*1.21	1.51	1.63	1.84
*1.23	1.52	1.63	1.85
*1.23	1.55	1.66	1.87
*1.28	1.57	1.66	1.90
*1.33	1.59	1.72	1.95
*1.38	1.59	1.73	1.98

KEROGEN DESCRIPTION

Amorphous	: 40 %
Exinite	: 0 %
Vitrinite	: 40 %
Inertinite	: 20 %

Back Fluor : Low

Bitumen : High

Coke : None

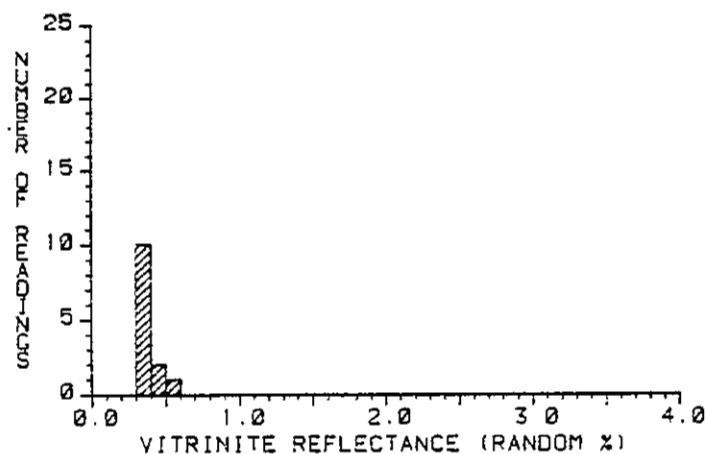
VISUAL KEROGEN ANALYSIS - REFLECTED LIGHT

SHELL #113-17 CARSON UNIT

Project No. : RRUS/323/T/43/02

SAMPLE IDENTIFICATION		REFLECT.	KEROGEN CHARACTERISTICS					TOC
RRUS	DEPTH (Feet)	Ro %	Am%	Ex%	Vit%	Inert%	Fluor	%
203	1025	0.37	10	10	65	15	Med	0.34
204	1515	0.41	5	15	35	45	Low	0.34
205	2105	0.38	10	10	60	20	Med	0.44
206	2645	0.43	30	10	40	20	Med	0.85
207	3055	0.44	5	15	60	20	Low	3.08
208	3615	0.49	5	15	55	25	Med	3.02
209	4005	0.54	5	10	60	20	Med	5.23
210	4565	0.56	5	10	55	30	Med	1.18
211	5025	0.56	10	10	50	30	Med	3.81
212	5505	0.67	20	10	50	20	High	1.50
213	10033	1.65	5	10	50	35	Low	0.88
215-216	10265	1.65	20	10	40	30	None	----
217-218	10495	1.66	10	10	60	20	Low	----
219-220	10725	1.63	15	5	35	45	Med	----
221-222	10825	1.75	15	5	45	35	Low	----
223-224	11005	1.91	15	5	40	40	Low	----

SHELL #113-17 CARSON UNIT



RRUS No. : 203

DEPTH : 1025.0 Ft
: 312.4 M

* = Ro MATURITY

VALUES : 13

MEAN : 0.37

STD DEV : 0.06

MEDIAN : 0.36

MODE : 0.35

HISTOGRAM:

Range: 0- 4%

Increment: 0.10%

ORDERED REFLECTANCE VALUES:

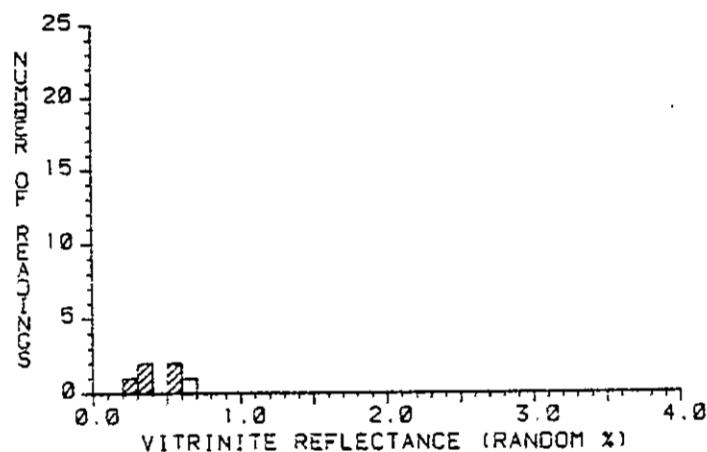
*0.31 *0.42
 *0.31 *0.42
 *0.33 *0.52
 *0.33
 *0.34
 *0.35
 *0.36
 *0.37
 *0.37
 *0.38

KEROGEN DESCRIPTION

Amorphous : 10 %
 Exinite : 10 %
 Vitrinite : 65 %
 Inertinite : 15 %

Back Fluor : Med
 Bitumen : None
 Coke : None

SHELL #113-17 CARSON UNIT



RRUS No. : 204

DEPTH : 1515.0 Ft
: 461.8 M

* = Ro MATURITY

VALUES : 5

MEAN : 0.41

STD DEV : 0.10

MEDIAN : 0.37

MODE : 0.55

HISTOGRAM:

Range: 2- 4%

Increment: 0.10%

ORDERED REFLECTANCE VALUES:

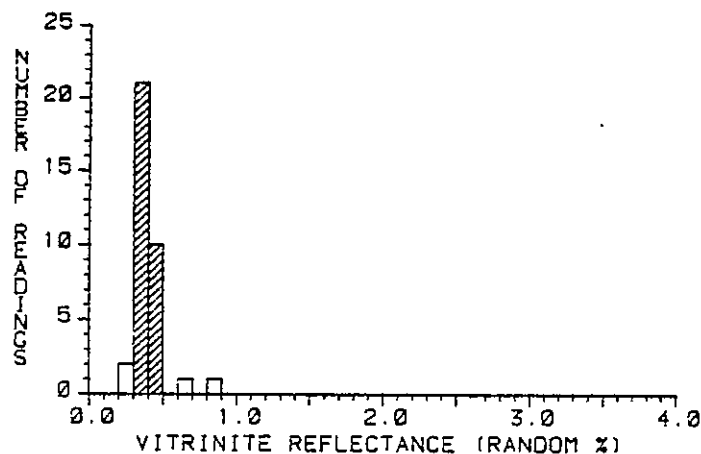
*0.29
 *0.34
 *0.37
 *0.51
 *0.53
 0.64

KEROGEN DESCRIPTION

Amorphous : 5 %
 Exinite : 15 %
 Vitrinite : 35 %
 Inertinite : 45 %

Back Fluor : Low
 Bitumen : None
 Coke : None

SHELL #113-17 CARSON UNIT



RRUS No. : 205

DEPTH : 2105.0 Ft
641.6 M

* = Ro MATURITY

VALUES : 31

MEAN : 0.38

STD DEV : 0.04

MEDIAN : 0.38

MODE : 0.35

HISTOGRAM:

Range: 0- 4%

Increment: 0.10%

ORDERED REFLECTANCE VALUES:

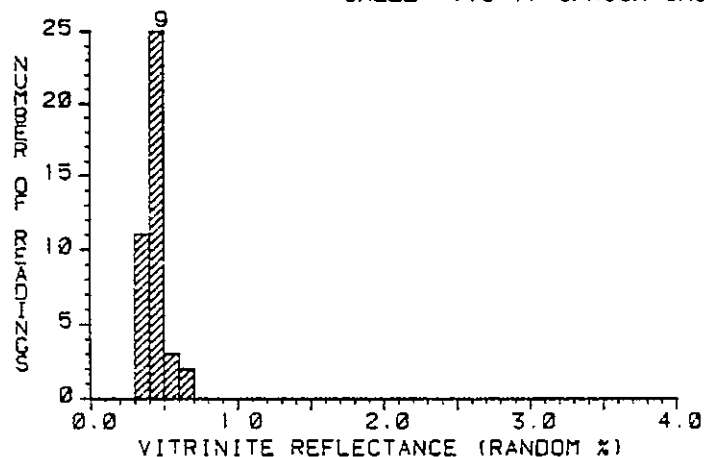
0.27	*0.35	*0.39	*0.44
0.29	*0.35	*0.39	*0.45
*0.32	*0.35	*0.39	*0.47
*0.32	*0.36	*0.41	0.63
*0.32	*0.37	*0.42	0.87
*0.32	*0.37	*0.42	
*0.33	*0.37	*0.43	
*0.33	*0.38	*0.43	
*0.33	*0.38	*0.44	
*0.34	*0.38	*0.44	

KEROGEN DESCRIPTION

Amorphous	: 10 %
Exinite	: 10 %
Vitrinite	: 60 %
Inertinite	: 20 %

Back Fluor	: Med
Bitumen	: None
Coke	: None

SHELL #113-17 CARSON UNIT



✓ RRUS No. : 206

DEPTH : 2645.0 Ft
806.2 M

* = Ro MATURITY

VALUES : 50

MEAN : 0.43

STD DEV : 0.06

MEDIAN : 0.41

MODE : 0.45

HISTOGRAM:

Range: 0- 4%

Increment: 0.10%

ORDERED REFLECTANCE VALUES:

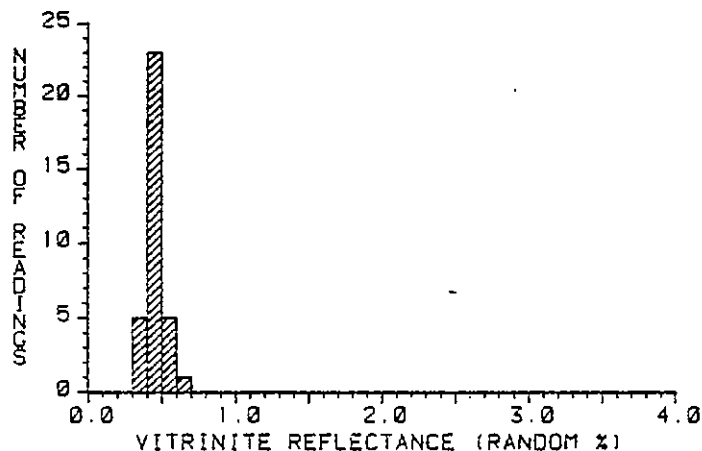
*0.35	*0.39	*0.41	*0.42	*0.45
*0.36	*0.40	*0.41	*0.42	*0.46
*0.36	*0.40	*0.41	*0.43	*0.48
*0.36	*0.40	*0.41	*0.43	*0.48
*0.38	*0.40	*0.41	*0.43	*0.49
*0.39	*0.40	*0.41	*0.43	*0.51
*0.39	*0.40	*0.41	*0.44	*0.55
*0.39	*0.40	*0.42	*0.45	*0.55
*0.39	*0.41	*0.42	*0.45	*0.62
*0.39	*0.41	*0.42	*0.45	*0.66

KEROGEN DESCRIPTION

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

Back Fluor	: Med
Bitumen	: Med
Coke	: None

SHELL #113-17 CARSON UNIT



RRUS No. : 207

DEPTH : 3055.0 Ft
: 931.2 M

* = Ro MATURITY

VALUES : 34

MEAN : 0.44

STD DEV : 0.06

MEDIAN : 0.43

MODE : 0.45

HISTOGRAM:

Range: 0- 4%

Increment: 0.10%

ORDERED REFLECTANCE VALUES:

*0.34	*0.41	*0.44	*0.52
*0.35	*0.41	*0.44	*0.54
*0.36	*0.41	*0.45	*0.55
*0.36	*0.42	*0.45	*0.64
*0.38	*0.42	*0.45	
*0.40	*0.42	*0.47	
*0.40	*0.42	*0.47	
*0.40	*0.43	*0.48	
*0.40	*0.43	*0.50	
*0.41	*0.44	*0.50	

KEROGEN DESCRIPTION

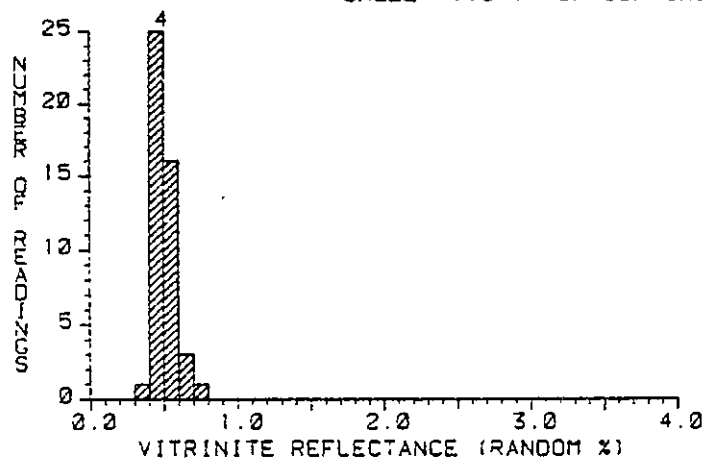
Amorphous	5 %
Exinite	15 %
Vitrinite	60 %
Inertinite	20 %

Back Fluor : Low

Bitumen : None

Coke : None

SHELL #113-17 CARSON UNIT



RRUS No. : 208

DEPTH : 3615.0 Ft
: 1101.9 M

* = Ro MATURITY

VALUES : 50

MEAN : 0.49

STD DEV : 0.07

MEDIAN : 0.48

MODE : 0.45

HISTOGRAM:

Range: 0- 4%

Increment: 0.10%

ORDERED REFLECTANCE VALUES:

*0.31	*0.45	*0.46	*0.50	*0.53
*0.40	*0.45	*0.47	*0.50	*0.53
*0.40	*0.45	*0.47	*0.50	*0.55
*0.41	*0.45	*0.47	*0.50	*0.55
*0.41	*0.45	*0.48	*0.50	*0.58
*0.42	*0.45	*0.48	*0.51	*0.58
*0.43	*0.46	*0.48	*0.51	*0.62
*0.43	*0.46	*0.49	*0.52	*0.67
*0.43	*0.46	*0.49	*0.52	*0.69
*0.44	*0.46	*0.49	*0.53	*0.70

KEROGEN DESCRIPTION

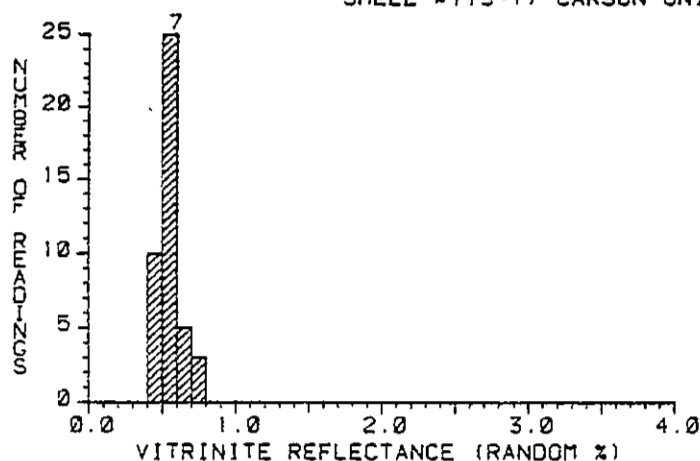
Amorphous	5 %
Exinite	15 %
Vitrinite	55 %
Inertinite	25 %

Back Fluor : Med

Bitumen : Med

Coke : None

SHELL #113-17 CARSON UNIT



RRUS No. : 209

DEPTH : 4005.0 Ft
: 1220.7 M

* = Ro MATURITY

VALUES : 50

MEAN : 0.54
STD DEV : 0.07
MEDIAN : 0.52
MODE : 0.55HISTOGRAM:
Range: 0- 4%
Increment: 0.10%

ORDERED REFLECTANCE VALUES:

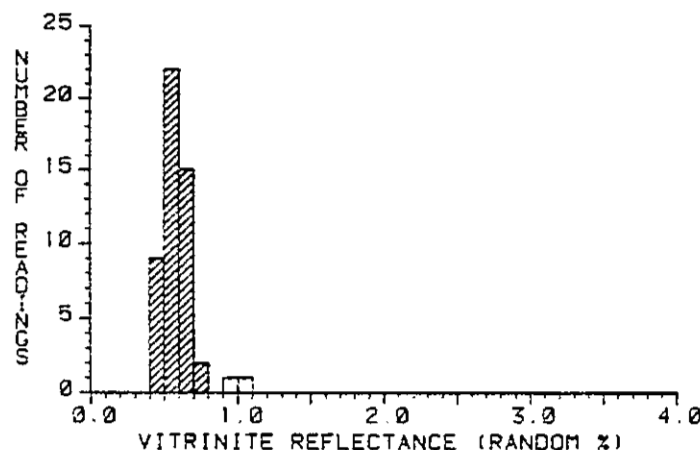
*0.40	*0.50	*0.52	*0.53	*0.58
*0.42	*0.50	*0.52	*0.54	*0.58
*0.43	*0.51	*0.52	*0.55	*0.60
*0.44	*0.51	*0.52	*0.56	*0.61
*0.46	*0.51	*0.52	*0.56	*0.63
*0.46	*0.51	*0.52	*0.56	*0.64
*0.47	*0.51	*0.52	*0.57	*0.68
*0.47	*0.51	*0.53	*0.57	*0.70
*0.48	*0.51	*0.53	*0.57	*0.70
*0.49	*0.51	*0.53	*0.57	*0.70

KEROGEN DESCRIPTION

Amorphous	: 5 %
Exinite	: 10 %
Vitrinite	: 60 %
Inertinite	: 20 %

Back Fluor	: Med
Bitumen	: None
Coke	: None

SHELL #113-17 CARSON UNIT



RRUS No. : 210

DEPTH : 4565.0 Ft
: 1391.4 M

* = Ro MATURITY

VALUES : 48

MEAN : 0.56
STD DEV : 0.07
MEDIAN : 0.56
MODE : 0.55HISTOGRAM:
Range: 0- 4%
Increment: 0.10%

ORDERED REFLECTANCE VALUES:

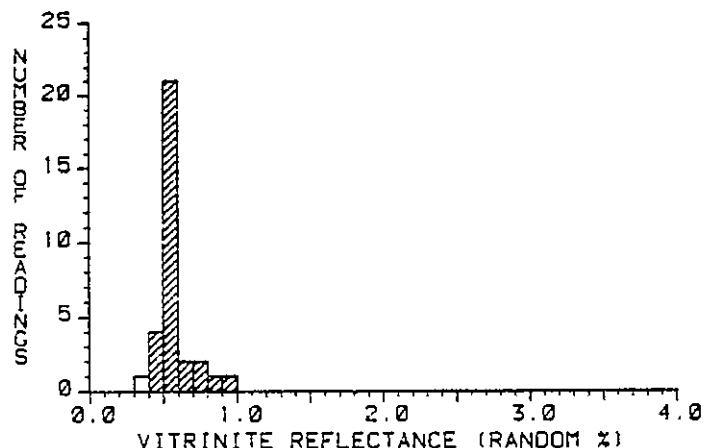
*0.45	*0.50	*0.54	*0.59	*0.64
*0.45	*0.50	*0.55	*0.60	*0.65
*0.45	*0.50	*0.55	*0.60	*0.66
*0.45	*0.50	*0.56	*0.61	*0.67
*0.46	*0.51	*0.56	*0.61	*0.67
*0.46	*0.52	*0.56	*0.62	*0.67
*0.46	*0.53	*0.57	*0.62	*0.70
*0.46	*0.53	*0.57	*0.62	*0.70
*0.47	*0.54	*0.58	*0.62	*0.94
*0.50	*0.54	*0.58	*0.63	1.08

KEROGEN DESCRIPTION

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

Back Fluor	: Med
Bitumen	: Med
Coke	: None

SHELL #113-17 CARSON UNIT



RRUS No. : 211

DEPTH : 5025.0 Ft
: 1531.6 M

* = Ro MATURITY

VALUES : 31

MEAN : 0.56

STD DEV : 0.11

MEDIAN : 0.52

MODE : 0.55

HISTOGRAM:

Range: 0- 4%

Increment: 0.10%

ORDERED REFLECTANCE VALUES:

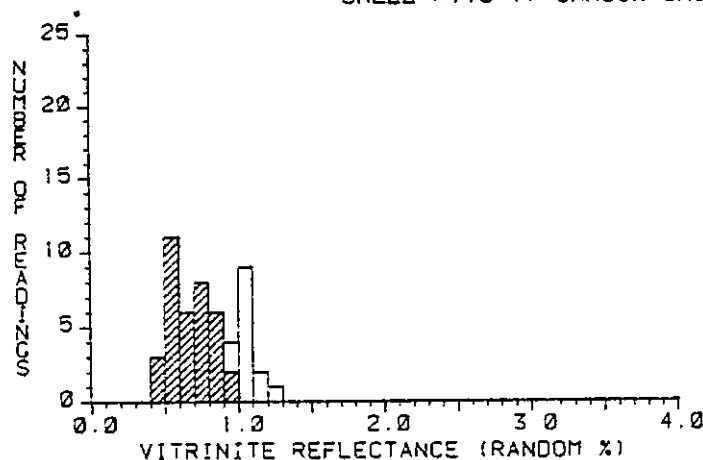
0.36	*0.51	*0.53	*0.85
*0.45	*0.51	*0.54	*0.90
*0.47	*0.52	*0.55	
*0.48	*0.52	*0.55	
*0.49	*0.52	*0.56	
*0.51	*0.52	*0.56	
*0.51	*0.52	*0.62	
*0.51	*0.53	*0.67	
*0.51	*0.53	*0.73	
*0.51	*0.53	*0.76	

KEROGEN DESCRIPTION

Amorphous	: 10 %
Exinite	: 10 %
Vitrinite	: 50 %
Inertinite	: 30 %

Back Fluor	: Med
Bitumen	: None
Coke	: None

SHELL #113-17 CARSON UNIT



RRUS No. : 212

DEPTH : 5505.0 Ft
: 1677.9 M

* = Ro MATURITY

VALUES : 36

MEAN : 0.67

STD DEV : 0.14

MEDIAN : 0.66

MODE : 0.55

HISTOGRAM:

Range: 0- 4%

Increment: 0.10%

ORDERED REFLECTANCE VALUES:

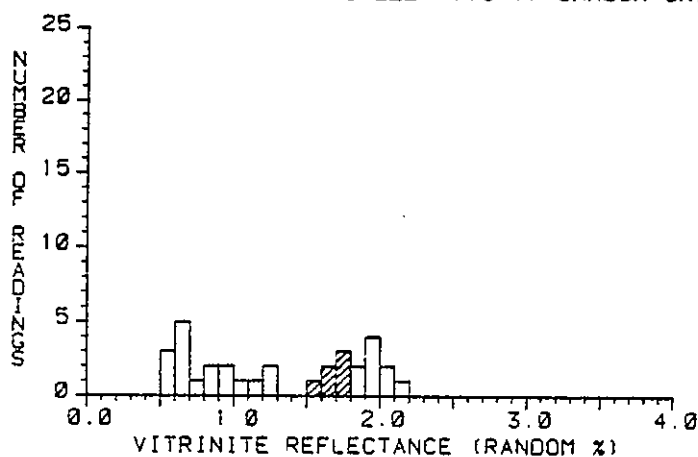
*0.43	*0.54	*0.71	*0.85	1.01
*0.47	*0.55	*0.72	*0.85	1.02
*0.48	*0.56	*0.73	*0.88	1.03
*0.50	*0.58	*0.74	*0.89	1.06
*0.51	*0.60	*0.75	*0.91	1.07
*0.51	*0.60	*0.77	*0.92	1.07
*0.52	*0.61	*0.78	0.96	1.09
*0.53	*0.62	*0.79	0.99	1.11
*0.53	*0.66	*0.81	1.00	1.11
*0.54	*0.69	*0.82	1.00	1.24

KEROGEN DESCRIPTION

Amorphous	: 20 %
Exinite	: 10 %
Vitrinite	: 50 %
Inertinite	: 20 %

Back Fluor	: High
Bitumen	: Small
Coke	: None

SHELL #113-17 CARSON UNIT



RRUS No. : 213

DEPTH : 10033.0 Ft
: 3058.1 M

* = Ro MATURITY

VALUES : 6

MEAN : 1.65
STD DEV : 0.06
MEDIAN : 1.71
MODE : 1.75HISTOGRAM:
Range: 0- 4%
Increment: 0.10%

ORDERED REFLECTANCE VALUES:

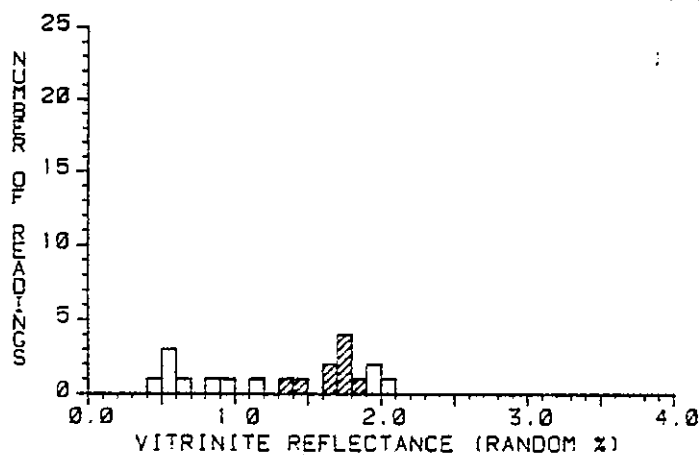
0.50	0.86	*1.71	2.07
0.53	0.91	*1.72	2.15
0.59	0.95	*1.74	
0.60	1.00	1.86	
0.62	1.11	1.86	
0.63	1.23	1.90	
0.67	1.25	1.93	
0.69	*1.51	1.97	
0.70	*1.61	1.97	
0.80	*1.62	2.02	

KEROGEN DESCRIPTION

Amorphous	: 5 %
Exinite	: 10 %
Vitrinite	: 50 %
Inertinite	: 35 %

Back Fluor	: Low
Bitumen	: None
Coke	: Small

SHELL #113-17 CARSON UNIT



RRUS No. : 215-216

DEPTH : 10265.0 Ft
: 3128.8 M

* = Ro MATURITY

VALUES : 9

MEAN : 1.65
STD DEV : 0.15
MEDIAN : 1.71
MODE : 1.75HISTOGRAM:
Range: 0- 4%
Increment: 0.10%

ORDERED REFLECTANCE VALUES:

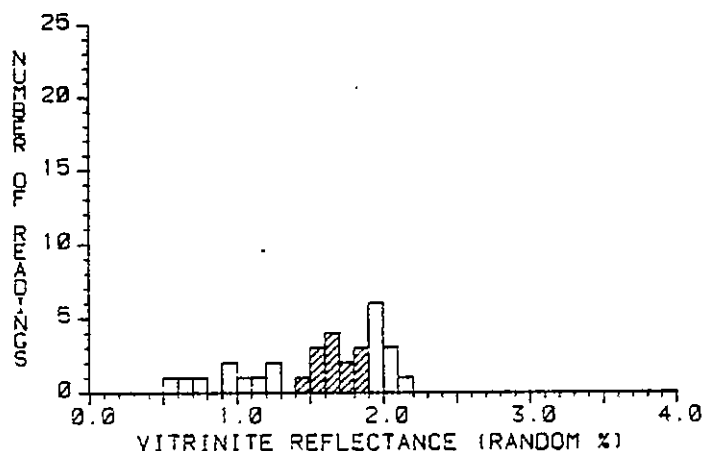
0.42	*1.61
0.51	*1.65
0.52	*1.71
0.54	*1.73
0.68	*1.75
0.83	*1.76
0.96	*1.85
1.12	1.90
*1.37	1.96
*1.40	2.04

KEROGEN DESCRIPTION

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

Back Fluor	: None
Bitumen	: None
Coke	: None

SHELL #113-17 CARSON UNIT



RRUS No. : 217-218

DEPTH : 10495.0 Ft
: 3198.9 M

* = Ro MATURITY

VALUES : 13

MEAN : 1.66

STD DEV : 0.13

MEDIAN : 1.67

MODE : 1.65

HISTOGRAM:

Range: 0- 4%

Increment: 0.10%

ORDERED REFLECTANCE VALUES:

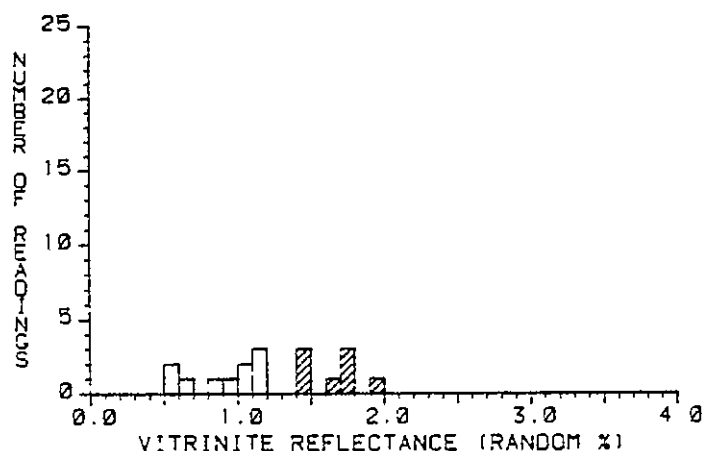
0.51	*1.51	*1.84	2.02
0.62	*1.54	*1.85	2.16
0.75	*1.58	1.90	
0.90	*1.61	1.92	
0.95	*1.63	1.92	
1.01	*1.67	1.95	
1.13	*1.68	1.95	
1.24	*1.73	1.96	
1.25	*1.75	2.01	
*1.40	*1.81	2.02	

KEROGEN DESCRIPTION

Amorphous	: 10 %
Exinite	: 10 %
Vitrinite	: 80 %
Inertinite	: 20 %

Back Fluor	: Low
Bitumen	: Small
Coke	: None

SHELL #113-17 CARSON UNIT



RRUS No. : 219-220

DEPTH : 10725.0 Ft
: 3269.0 M

* = Ro MATURITY

VALUES : 8

MEAN : 1.63

STD DEV : 0.18

MEDIAN : 1.71

MODE : 1.75

HISTOGRAM:

Range: 0- 4%

Increment: 0.10%

ORDERED REFLECTANCE VALUES:

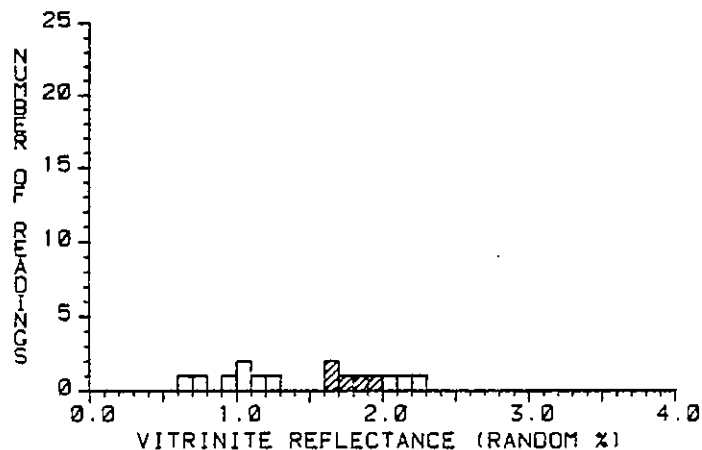
0.56	*1.41
0.58	*1.43
0.65	*1.46
0.85	*1.61
0.91	*1.71
1.01	*1.71
1.06	*1.74
1.10	*1.97
1.12	
1.12	

KEROGEN DESCRIPTION

Amorphous	: 15 %
Exinite	: 5 %
Vitrinite	: 35 %
Inertinite	: 45 %

Back Fluor	: Med
Bitumen	: Small
Coke	: None

SHELL #113-17 CARSON UNIT



RRUS No. : 221-222

DEPTH : 10825.0 Ft
: 3299.5 M

* = Ro MATURITY

* VALUES : 5

MEAN : 1.75
STD DEV : 0.13
MEDIAN : 1.75
MODE : 1.65

HISTOGRAM:

Range: 0- 4%
Increment: 0.10%

ORDERED REFLECTANCE VALUES:

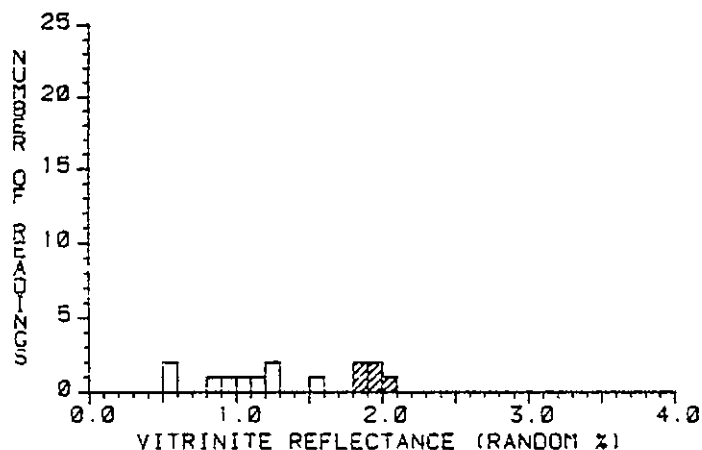
0.65 *1.85
0.76 *1.94
0.97 2.08
1.00 2.15
1.09 2.25
1.16
1.29
*1.60
*1.61
*1.75

KEROGEN DESCRIPTION:

Amorphous : 15 %
Exinite : 5 %
Vitrinite : 45 %
Inertinite : 35 %

Back Fluor : Low
Bitumen : None
Coke : None

SHELL #113-17 CARSON UNIT



RRUS No. : 223-224

DEPTH : 11005.0 Ft
: 3354.3 M

* = Ro MATURITY

* VALUES : 5

MEAN : 1.91
STD DEV : 0.09
MEDIAN : 1.93
MODE : 1.93

HISTOGRAM:

Range: 0- 4%
Increment: 0.10%

ORDERED REFLECTANCE VALUES:

0.53 *1.84
0.56 *1.90
0.88 *1.95
0.90 *2.06
1.01
1.14
1.21
1.23
1.51
*1.80

KEROGEN DESCRIPTION:

Amorphous : 15 %
Exinite : 5 %
Vitrinite : 40 %
Inertinite : 40 %

Back Fluor : Low
Bitumen : Small
Coke : None

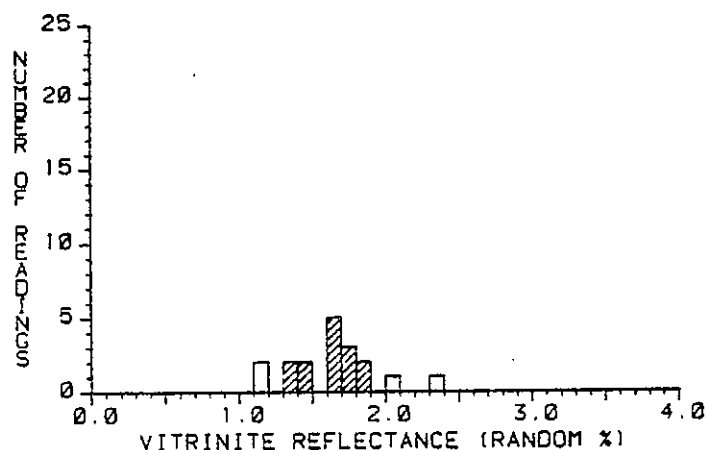
VISUAL KEROGEN ANALYSIS - REFLECTED LIGHT

SUN #1 NAVAJO LANDS

Project No. : RRUS/823/T/43/02

SAMPLE IDENTIFICATION		REFLECT.	KEROGEN CHARACTERISTICS						TOC
RRUS	DEPTH (Feet)	Ro %	Am%	Ex%	Vit%	Inert%	Fluor		%
301	9225	1.62	15	tr	65	20	Low		0.11
304	9645	1.62	10	tr	75	15	Low		0.12
306	9975	1.62	15	tr	60	25	Med		0.19
309	10305	1.73	10	tr	50	40	Low		0.12
312	10595	1.84	15	5	50	30	Med		0.25

SUN #1 NAVAJO LANDS



RRUS No. : 301

DEPTH : 9225.0 Ft
: 2811.8 M

* = Ro MATURITY

VALUES : 14

MEAN : 1.62
STD DEV : 0.16
MEDIAN : 1.67
MODE : 1.65

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

ORDERED REFLECTANCE VALUES:

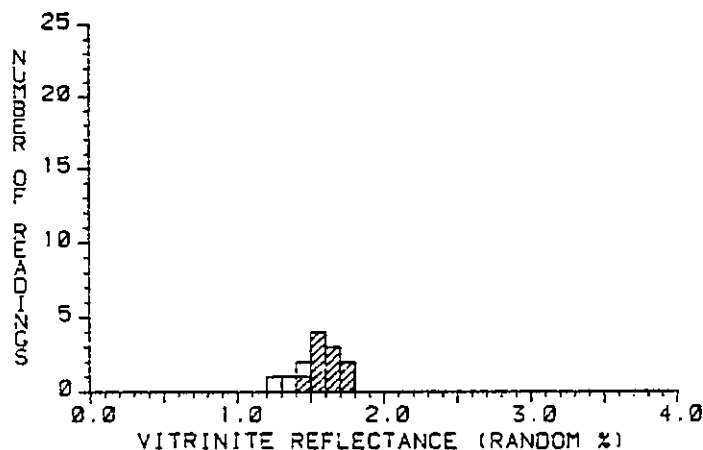
1.14 *1.68
1.19 *1.70
*1.35 *1.74
*1.36 *1.75
*1.42 *1.83
*1.45 *1.88
*1.60 2.03
*1.64 2.39
*1.65
*1.67

KEROGEN DESCRIPTION

Amorphous : 15 %
Exinite : 10 %
Vitrinite : 65 %
Inertinite : 20 %

Back Fluor : Low
Bitumen : High
Coke : Small

SUN #1 NAVAJO LANDS



RRUS No. : 304

DEPTH : 9645.0 Ft
: 2939.8 M

* = Ro MATURITY

VALUES : 10

MEAN : 1.62
STD DEV : 0.10
MEDIAN : 1.65
MODE : 1.55

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

ORDERED REFLECTANCE VALUES:

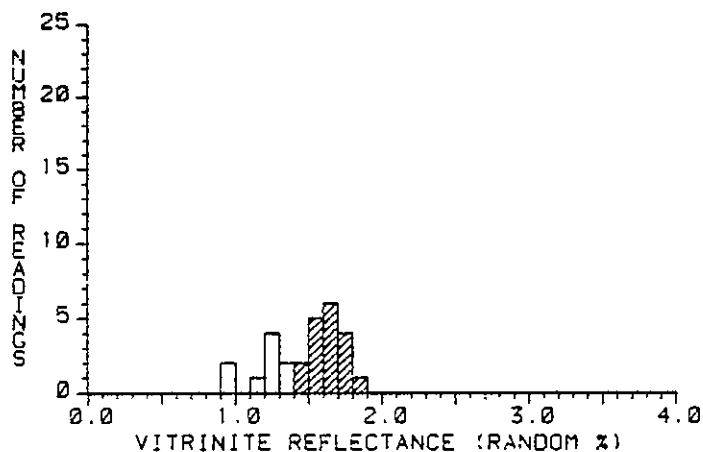
1.29 *1.68
1.39 *1.76
1.40 *1.77
*1.45
*1.52
*1.55
*1.58
*1.59
*1.65
*1.67

KEROGEN DESCRIPTION

Amorphous : 10 %
Exinite : 10 %
Vitrinite : 75 %
Inertinite : 15 %

Back Fluor : Low
Bitumen : None
Coke : Small

SUN #1 NAVAJO LANDS



RRUS No. : 306

DEPTH : 9975.0 Ft
: 3040.4 M

* = Ro MATURITY

VALUES : 18

MEAN : 1.62
STD DEV : 0.11
MEDIAN : 1.63
MODE : 1.65HISTOGRAM:
Range: 0- 4%
Increment: 0.10%

ORDERED REFLECTANCE VALUES:

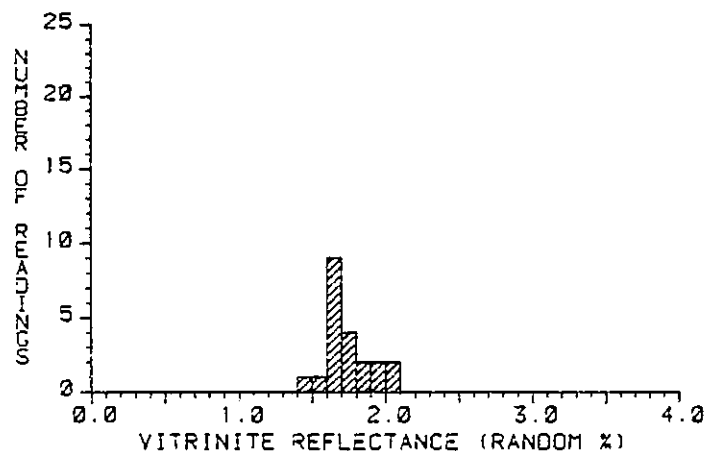
0.92	*1.44	*1.68
0.99	*1.51	*1.68
1.10	*1.53	*1.71
1.23	*1.54	*1.73
1.25	*1.55	*1.75
1.26	*1.59	*1.75
1.27	*1.61	*1.80
1.32	*1.61	
1.35	*1.63	
*1.41	*1.64	

KEROGEN DESCRIPTION

Amorphous	: 15 %
Exinite	: 10 %
Vitrinite	: 60 %
Inertinite	: 25 %

Back Fluor	: Med
Bitumen	: Med
Coke	: 10

SUN #1 NAVAJO LANDS



RRUS No. : 309

DEPTH : 10305.0 Ft
: 3141.0 M

* = Ro MATURITY

VALUES : 21

MEAN : 1.73
STD DEV : 0.16
MEDIAN : 1.68
MODE : 1.65HISTOGRAM:
Range: 0- 4%
Increment: 0.10%

ORDERED REFLECTANCE VALUES:

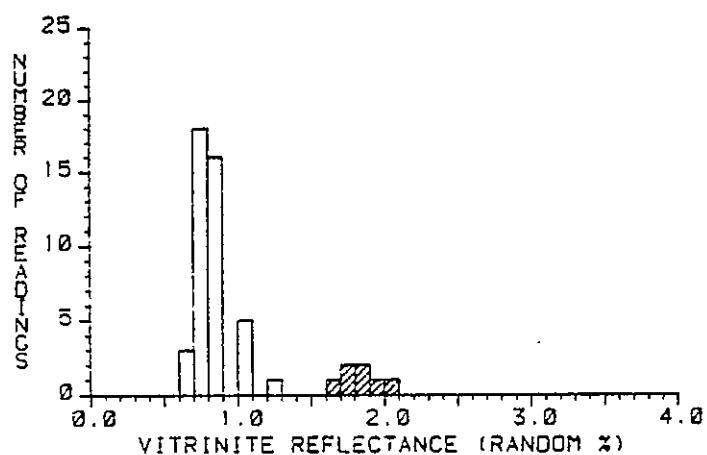
*1.45	*1.68	*2.07
*1.56	*1.71	
*1.60	*1.71	
*1.60	*1.74	
*1.60	*1.77	
*1.61	*1.81	
*1.62	*1.89	
*1.64	*1.90	
*1.66	*1.99	
*1.67	*2.05	

KEROGEN DESCRIPTION

Amorphous	: 10 %
Exinite	: 10 %
Vitrinite	: 50 %
Inertinite	: 40 %

Back Fluor	: Low
Bitumen	: None
Coke	: None

SUN #1 NAVAJO LANDS



RRUS No. : 312

DEPTH : 10595.0 Ft
: 3229.4 M

* = Ro MATURITY

* VALUES : 7

MEAN : 1.84

STD DEV : 0.10

MEDIAN : 1.82

MODE : 1.85

HISTOGRAM:

Range: 0- 4%

Increment: 0.10%

ORDERED REFLECTANCE VALUES:

0.66	0.76	0.79	0.83	1.07
0.68	0.76	0.80	0.84	1.08
0.69	0.76	0.80	0.86	1.20
0.70	0.76	0.80	0.87	*1.69
0.73	0.77	0.81	0.88	*1.78
0.73	0.77	0.81	0.88	*1.78
0.73	0.78	0.81	0.89	*1.82
0.74	0.78	0.81	1.00	*1.82
0.74	0.79	0.81	1.01	*1.94
0.75	0.79	0.83	1.02	*2.02

KEROGEN DESCRIPTION

Amorphous	: 15 %
Exinite	: 5 %
Vitrinite	: 50 %
Inertinite	: 30 %

Back Fluor	: Med
Bitumen	: None
Coke	: None

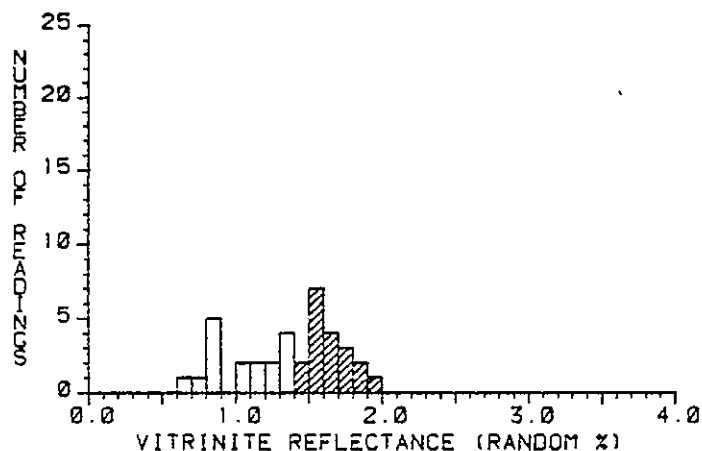
VISUAL KEROGEN ANALYSIS - REFLECTED LIGHT

UNION #1-M-13 USA

Project No. : RRUS/923/T/43/02

SAMPLE IDENTIFICATION		REFLECT.	KEROGEN CHARACTERISTICS					TOC
RRUS	DEPTH (Feet)	Ro %	Am%	Ex%	Vit%	Inert%	Fluor	%
501	10445	1.63	20	5	35	40	Med	0.21
502	10665	1.82	15	5	75	5	Low	0.31
504	10845	1.84	5	5	85	5	Med	0.54
507	11035	1.75	5	5	80	10	Low	0.12
509	11245	1.73	5	5	80	10	Low	0.35
511	11455	1.76	5	5	80	10	None	0.19
514	11625	1.78	5	5	45	45	None	0.18

UNION #1-M-13 USA



RRUS No. : 501
DEPTH : 10445.2 Ft
: 3183.6 M

* = Ro MATURITY

VALUES : 19

MEAN : 1.63
STD DEV : 0.13
MEDIAN : 1.61
MODE : 1.55

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

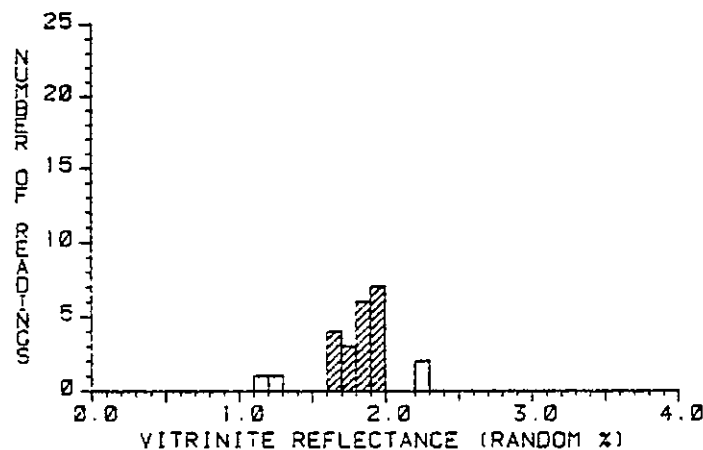
ORDERED REFLECTANCE VALUES:

0.62	1.15	*1.52	*1.73
0.78	1.20	*1.56	*1.76
0.80	1.20	*1.56	*1.78
0.80	1.31	*1.56	*1.80
0.83	1.32	*1.57	*1.85
0.84	1.33	*1.59	*1.90
0.88	1.33	*1.61	
1.04	*1.41	*1.61	
1.09	*1.47	*1.61	
1.15	*1.50	*1.66	

KEROGEN DESCRIPTION

Amorphous	: 20 %
Exinite	: 5 %
Vitrinite	: 35 %
Inertinite	: 40 %
Back Fluor	: Med
Bitumen	: Med
Coke	: Small

UNION #1-M-13 USA



RRUS No. : 502

DEPTH : 10665.0 Ft
: 3250.7 M

* = Ro MATURITY

VALUES : 20

MEAN : 1.82
STD DEV : 0.11
MEDIAN : 1.86
MODE : 1.95

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

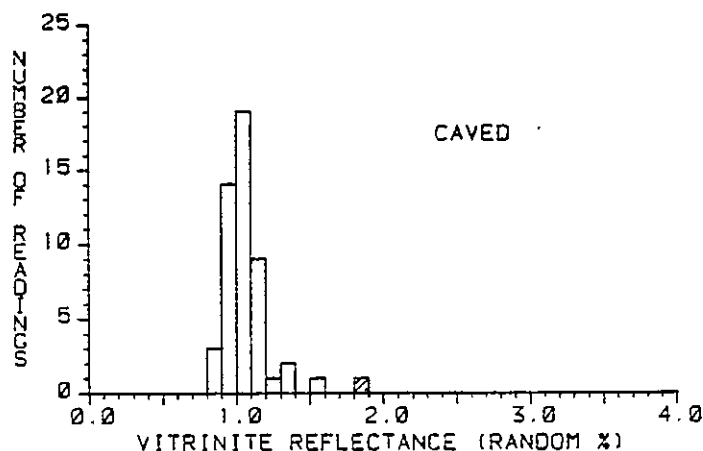
ORDERED REFLECTANCE VALUES:

1.17	*1.81	*1.96
1.26	*1.83	*1.99
*1.60	*1.86	2.21
*1.66	*1.87	2.28
*1.68	*1.88	
*1.68	*1.90	
*1.72	*1.90	
*1.74	*1.90	
*1.77	*1.92	
*1.80	*1.94	

KEROGEN DESCRIPTION

Amorphous	: 15 %
Exinite	: 5 %
Vitrinite	: 75 %
Inertinite	: 5 %
Back Fluor	: Low
Bitumen	: Med
Coke	: None

UNION #1-M-13 USA



RRUS No. : 504

DEPTH : 10845.0 Ft
: 3305.6 M

* = Ro MATURITY

* VALUES : 1

MEAN : 1.84
STD DEV : 0.00
MEDIAN : 1.84
MODE : 1.85

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

ORDERED REFLECTANCE VALUES:

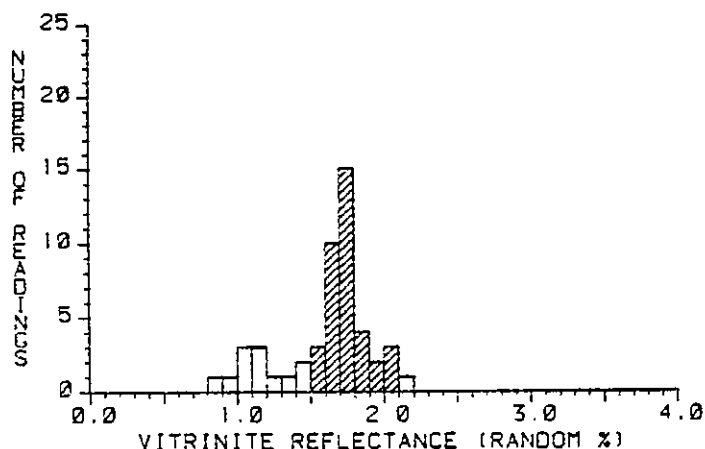
0.82	0.96	1.01	1.05	1.12
0.83	0.97	1.01	1.05	1.13
0.88	0.98	1.01	1.05	1.14
0.90	0.98	1.01	1.06	1.17
0.91	0.99	1.02	1.06	1.18
0.92	0.99	1.03	1.08	1.22
0.94	0.99	1.03	1.10	1.31
0.94	1.00	1.03	1.10	1.31
0.95	1.00	1.04	1.11	1.51
0.95	1.00	1.05	1.12	*1.84

KEROGEN DESCRIPTION

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

Back Fluor : Med
Bitumen : None
Coke : None

UNION #1-M-13 USA



RRUS No. : 507

DEPTH : 11035.0 Ft
: 3363.5 M

* = Ro MATURITY

* VALUES : 37

MEAN : 1.75
STD DEV : 0.12
MEDIAN : 1.74
MODE : 1.75

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

ORDERED REFLECTANCE VALUES:

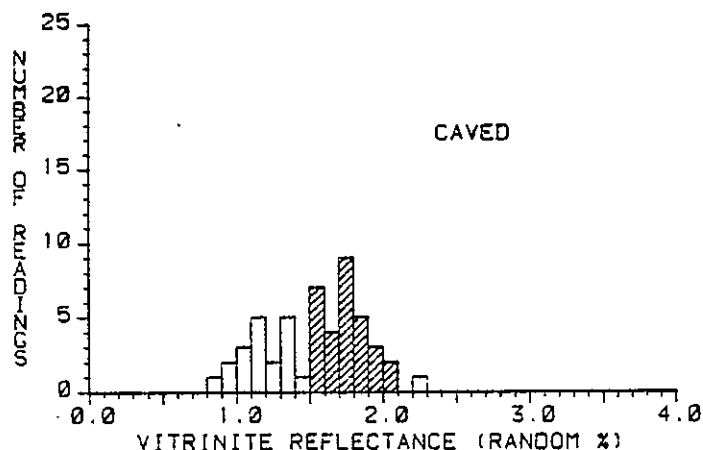
0.85	1.41	*1.67	*1.74	*1.80
0.98	1.47	*1.67	*1.74	*1.80
1.00	*1.55	*1.68	*1.75	*1.89
1.05	*1.57	*1.68	*1.76	*1.89
1.08	*1.58	*1.69	*1.77	*1.91
1.10	*1.60	*1.71	*1.77	*1.97
1.13	*1.61	*1.71	*1.78	*2.00
1.14	*1.62	*1.72	*1.78	*2.01
1.25	*1.63	*1.72	*1.79	*2.01
1.35	*1.64	*1.72	*1.79	2.17

KEROGEN DESCRIPTION

Amorphous : 5 %
Exinite : 5 %
Vitrinite : 80 %
Inertinite : 10 %

Back Fluor : Low
Bitumen : Small
Coke : None

UNION #1-M-13 USA



RRUS No. : 509

DEPTH : 11245.0 Ft
: 3427.5 M

* = Ro MATURITY

* VALUES : 30

MEAN : 1.73
STD DEV : 0.14
MEDIAN : 1.74
MODE : 1.75

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

ORDERED REFLECTANCE VALUES:

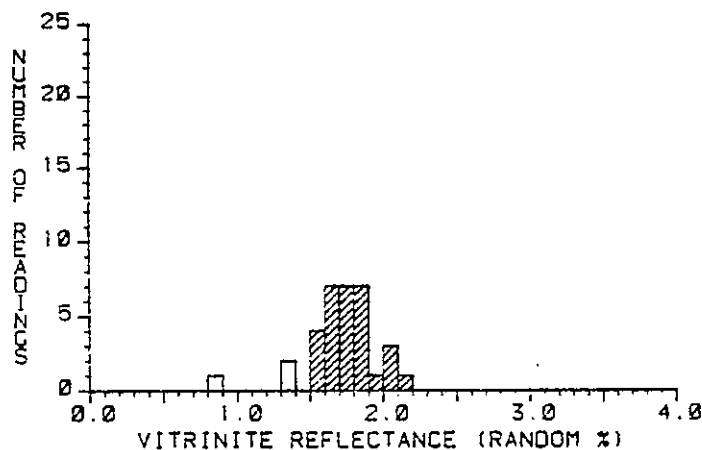
0.80	1.19	*1.54	*1.70	*1.83
0.95	1.23	*1.54	*1.70	*1.84
0.95	1.25	*1.55	*1.72	*1.85
1.02	1.33	*1.56	*1.72	*1.86
1.02	1.34	*1.58	*1.74	*1.92
1.06	1.36	*1.58	*1.74	*1.93
1.12	1.37	*1.62	*1.76	*1.94
1.12	1.39	*1.63	*1.76	*2.02
1.15	1.49	*1.64	*1.76	*2.02
1.17	*1.53	*1.66	*1.81	2.27

KEROGEN DESCRIPTION

Amorphous : 5 %
Exinite : 5 %
Vitrinite : 80 %
Inertinite : 10 %

Back Fluor : Low
Bitumen : None
Coke : Small

UNION #1-M-13 USA



RRUS No. : 511

DEPTH : 11455.0 Ft
: 3491.5 M

* = Ro MATURITY

* VALUES : 30

MEAN : 1.76
STD DEV : 0.16
MEDIAN : 1.77
MODE : 1.85

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

ORDERED REFLECTANCE VALUES:

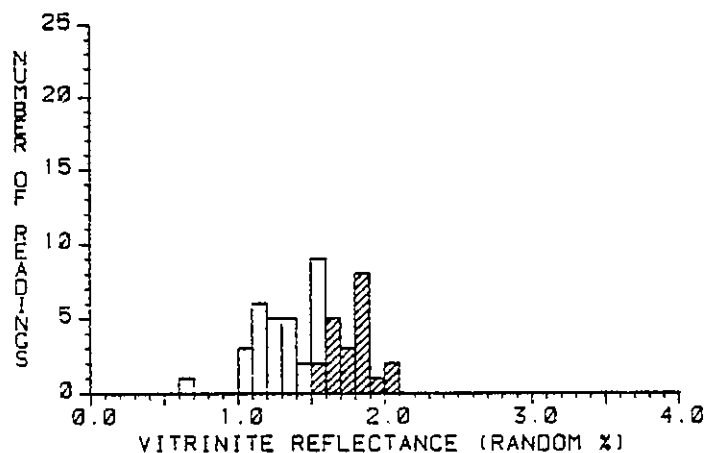
0.88	*1.62	*1.79	*2.06
1.32	*1.62	*1.80	*2.09
1.36	*1.67	*1.80	*2.13
*1.54	*1.68	*1.80	
*1.56	*1.70	*1.82	
*1.57	*1.71	*1.83	
*1.58	*1.72	*1.83	
*1.61	*1.72	*1.89	
*1.61	*1.77	*1.91	
*1.61	*1.77	*2.01	

KEROGEN DESCRIPTION

Amorphous : 5 %
Exinite : 5 %
Vitrinite : 80 %
Inertinite : 10 %

Back Fluor : None
Bitumen : None
Coke : None

UNION #1-M-13 USA



RRUS No. : 514

DEPTH : 11625.0 Ft
: 3543.3 M

* = Ro MATURITY

VALUES : 21

MEAN : 1.78

STD DEV : 0.14

MEDIAN : 1.80

MODE : 1.85

HISTOGRAM:

Range: 0- 4%

Increment: 0.10%

ORDERED REFLECTANCE VALUES:

0.63	1.20	1.46	*1.59	*1.81
1.00	1.21	1.49	*1.61	*1.81
1.03	1.23	1.51	*1.61	*1.85
1.04	1.24	1.51	*1.65	*1.85
1.10	1.26	1.53	*1.67	*1.86
1.13	1.30	1.53	*1.68	*1.87
1.15	1.30	1.55	*1.73	*1.89
1.15	1.33	1.57	*1.75	*1.94
1.17	1.36	1.57	*1.77	*2.05
1.18	1.37	*1.59	*1.80	*2.06

KEROGEN DESCRIPTION

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

Back Fluor	: None
Bitumen	: None
Coke	: None

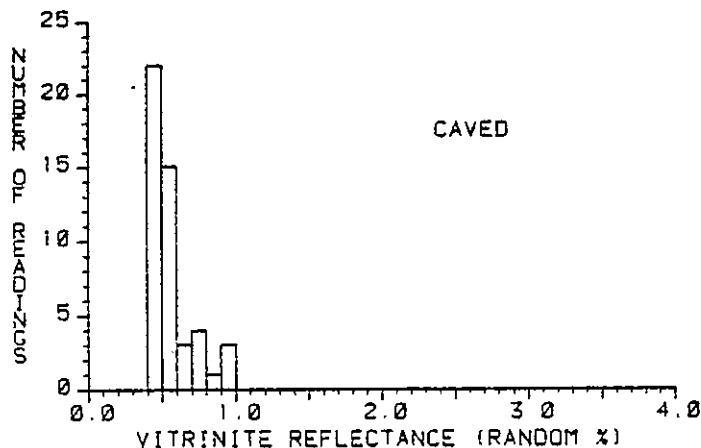
VISUAL KEROGEN ANALYSIS - REFLECTED LIGHT

SKELLY #1 NAVAJO-O

Project No. : RRUS/823/T/43/02

SAMPLE IDENTIFICATION		REFLECT.	KEROGEN CHARACTERISTICS					TOC
RRUS	DEPTH (Feet)	Ro %	Am%	Ex%	Vit%	Inert%	Fluor	%
701	10575	----	30	10	50	10	Med	0.62
702	10675	----	35	15	40	10	High	0.54
703	10803	1.84	30	10	45	15	High	0.48
707	11005	----	30	10	45	15	High	0.51

SKELLY #1 NAVAJO-0



RRUS No. : 701

DEPTH : 10575.0 Ft
: 3223.3 M

VALUES : 48

MEAN : 0.56
STD DEV : 0.14
MEDIAN : 0.51
MODE : 0.45

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

ORDERED REFLECTANCE VALUES:

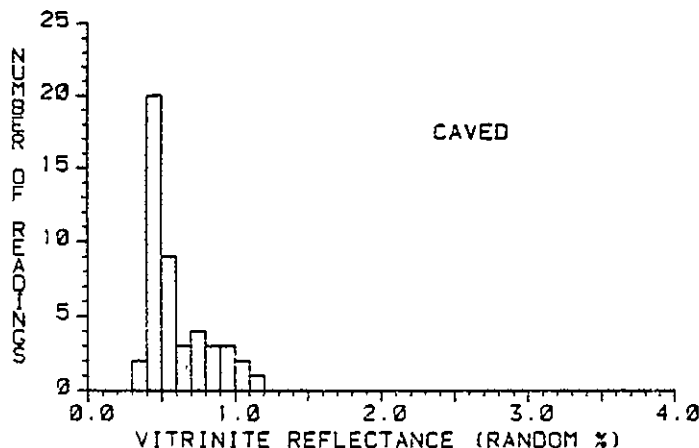
0.40	0.46	0.49	0.56	0.71
0.40	0.47	0.49	0.56	0.71
0.41	0.48	0.50	0.56	0.72
0.43	0.48	0.51	0.57	0.77
0.43	0.48	0.51	0.58	0.80
0.43	0.48	0.51	0.58	0.94
0.44	0.49	0.52	0.58	0.97
0.44	0.49	0.55	0.60	0.99
0.45	0.49	0.55	0.61	
0.45	0.49	0.55	0.63	

KEROGEN DESCRIPTION

Amorphous : 30 %
Exinite : 10 %
Vitrinite : 50 %
Inertinite : 10 %

Back Fluor : Med
Bitumen : Small
Coke : None

SKELLY #1 NAVAJO-0



RRUS No. : 702

DEPTH : 10675.0 Ft
: 3253.7 M

VALUES : 47

MEAN : 0.60
STD DEV : 0.21
MEDIAN : 0.51
MODE : 0.45

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

ORDERED REFLECTANCE VALUES:

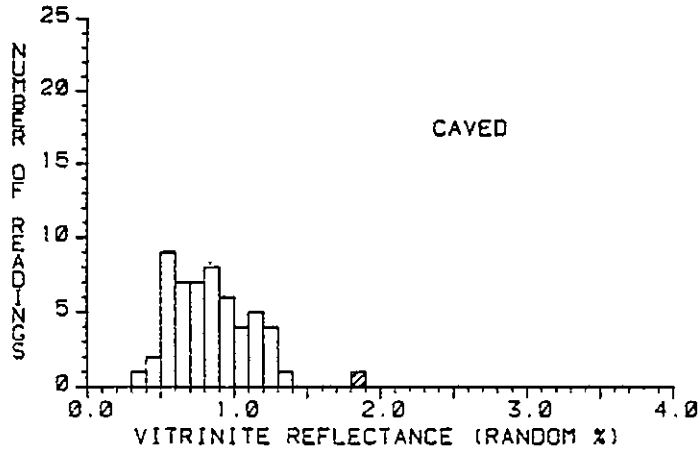
0.36	0.44	0.49	0.58	0.88
0.38	0.45	0.49	0.64	0.90
0.40	0.45	0.51	0.69	0.91
0.40	0.45	0.51	0.69	0.98
0.40	0.45	0.53	0.75	1.01
0.41	0.46	0.54	0.75	1.08
0.42	0.47	0.54	0.78	1.17
0.42	0.48	0.55	0.79	
0.42	0.48	0.56	0.80	
0.43	0.49	0.58	0.87	

KEROGEN DESCRIPTION

Amorphous : 35 %
Exinite : 15 %
Vitrinite : 40 %
Inertinite : 10 %

Back Fluor : High
Bitumen : Small
Coke : None

SKELLY #1 NAVAJO-0



RRUS No. : 705

DEPTH : 10805.0 Ft
: 3293.4 M

* = Ro MATURITY

VALUES : 1

MEAN : 1.84
STD DEV : 0.00
MEDIAN : 1.84
MODE : 1.85

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

ORDERED REFLECTANCE VALUES:

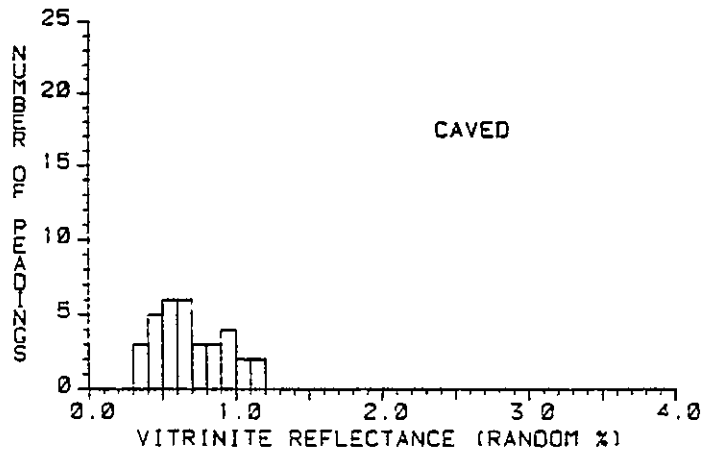
0.33	0.57	0.71	0.85	1.02	1.21
0.42	0.58	0.72	0.85	1.02	1.25
0.47	0.60	0.73	0.86	1.04	1.25
0.50	0.60	0.75	0.86	1.05	1.38
0.51	0.63	0.75	0.91	1.13	*1.84
0.52	0.65	0.78	0.92	1.15	
0.55	0.66	0.80	0.92	1.15	
0.55	0.65	0.80	0.93	1.16	
0.57	0.69	0.81	0.94	1.16	
0.57	0.70	0.83	0.96	1.21	

KEROGEN DESCRIPTION:

Amorphous : 30 %
Exinite : 10 %
Vitrinite : 45 %
Inertinite : 15 %

Back Fluor : High
Bitumen : High
Coke : None

SKELLY #1 NAVAJO-0



RRUS No. : 707

DEPTH : 11005.0 Ft
: 3354.3 M

VALUES : 34

MEAN : 0.69
STD DEV : 0.23
MEDIAN : 0.65
MODE : 0.65

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

ORDERED REFLECTANCE VALUES:

0.33	0.52	0.70	1.03
0.34	0.55	0.78	1.07
0.39	0.56	0.79	1.10
0.44	0.59	0.84	1.13
0.48	0.61	0.86	
0.48	0.61	0.88	
0.49	0.61	0.92	
0.49	0.65	0.94	
0.51	0.68	0.96	
0.52	0.69	0.98	

KEROGEN DESCRIPTION:

Amorphous : 30 %
Exinite : 10 %
Vitrinite : 45 %
Inertinite : 15 %

Back Fluor : High
Bitumen : Small
Coke : None

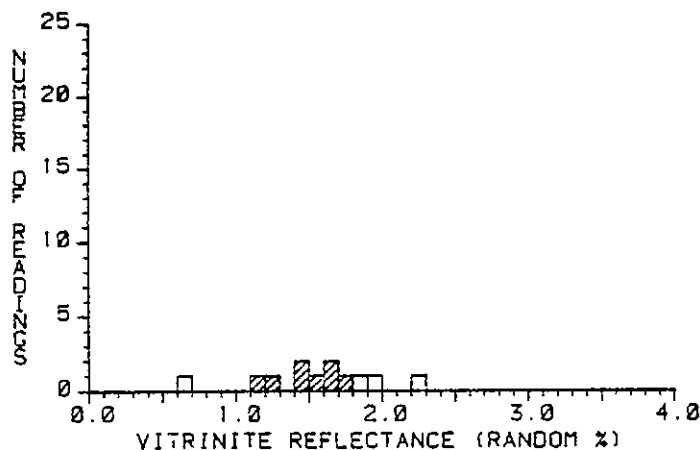
VISUAL KEROGEN ANALYSIS - REFLECTED LIGHT

MAGNOLIA #1 HUTCHINSON-FEDERAL

Project No. : RRUS/823/T/43/02

SAMPLE IDENTIFICATION		REFLECT.	KEROGEN CHARACTERISTICS						TOC
RRUS	DEPTH (Feet)	Ro %	Am%	Ex%	Vit%	Inert%	Fluor		%
901	8565	1.50	30	5	45	20	Low		0.14
903	8965	1.53	30	5	50	15	Low		0.12
906	9125	1.59	25	5	50	20	Low		0.17
910	9515	1.62	20	tr	65	15	Low		0.12

MAGNOLIA #1 HUTCHINSON-FEDERAL



RRUS No. : 901

DEPTH : 8565.0 Ft
: 2610.6 M

* = Ro MATURITY

VALUES : 8

MEAN : 1.50

STD DEV : 0.10

MEDIAN : 1.52

MODE : 1.65

HISTOGRAM:

Range: 0- 4%

Increment: 0.10%

ORDERED REFLECTANCE VALUES:

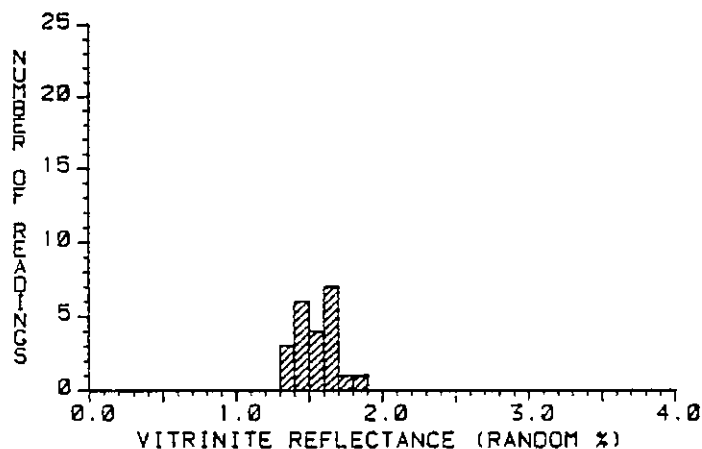
0.67 1.90
 *1.18 2.21
 *1.28
 *1.48
 *1.48
 *1.52
 *1.63
 *1.67
 *1.78
 1.85

KEROGEN DESCRIPTION

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

Back Fluor : Low
 Bitumen : Small
 Coke : tr

MAGNOLIA #1 HUTCHINSON-FEDERAL



RRUS No. : 903

DEPTH : 8965.0 Ft
: 2732.5 M

* = Ro MATURITY

VALUES : 22

MEAN : 1.53

STD DEV : 0.13

MEDIAN : 1.54

MODE : 1.65

HISTOGRAM:

Range: 0- 4%

Increment: 0.10%

ORDERED REFLECTANCE VALUES:

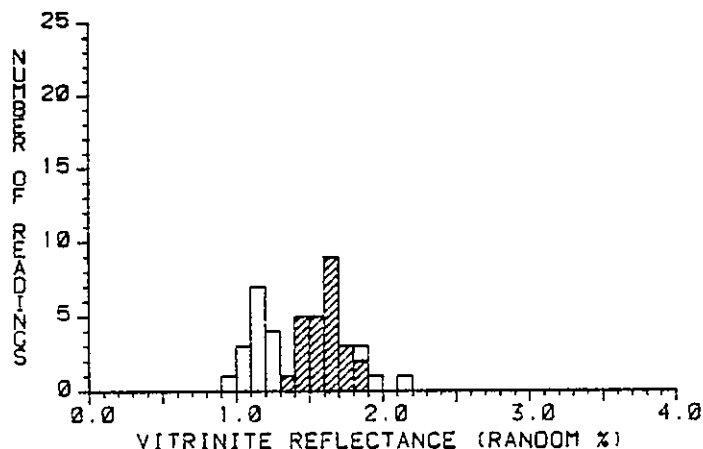
*1.32 *1.52 *1.73
 *1.32 *1.54 *1.80
 *1.33 *1.54
 *1.41 *1.60
 *1.42 *1.63
 *1.43 *1.63
 *1.46 *1.64
 *1.48 *1.64
 *1.48 *1.66
 *1.51 *1.66

KEROGEN DESCRIPTION

Amorphous : 30 %
 Exinite : 5 %
 Vitrinite : 50 %
 Inertinite : 15 %

Back Fluor : Low
 Bitumen : Small
 Coke : tr

MAGNOLIA #1 HUTCHINSON-FEDERAL



RRUS No. : 906

DEPTH : 9125.0 Ft
: 2781.3 M

* = Ro MATURITY

VALUES : 25

MEAN : 1.59
STD DEV : 0.13
MEDIAN : 1.62
MODE : 1.65HISTOGRAM:
Range: 0- 4%
Increment: 0.10%

ORDERED REFLECTANCE VALUES:

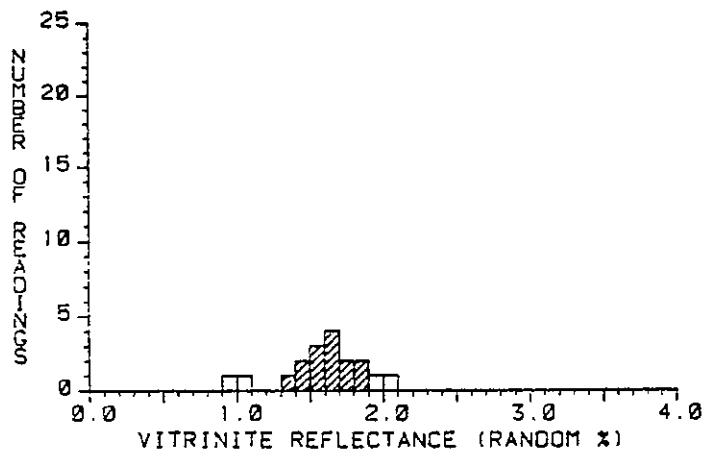
0.91	1.17	*1.45	*1.65	1.86
1.00	1.27	*1.50	*1.65	1.91
1.03	1.27	*1.52	*1.66	2.13
1.07	1.28	*1.55	*1.67	
1.10	1.29	*1.56	*1.69	
1.10	*1.31	*1.58	*1.72	
1.10	*1.40	*1.61	*1.76	
1.13	*1.40	*1.62	*1.77	
1.14	*1.43	*1.62	*1.80	
1.14	*1.43	*1.64	*1.83	

KEROGEN DESCRIPTION

Amorphous	: 25 %
Exinite	: 5 %
Vitrinite	: 50 %
Inertinite	: 20 %

Back Fluor	: Low
Bitumen	: Med
Coke	: tr

MAGNOLIA #1 HUTCHINSON-FEDERAL



RRUS No. : 910

DEPTH : 9515.0 Ft
: 2900.2 M

* = Ro MATURITY

VALUES : 14

MEAN : 1.62
STD DEV : 0.14
MEDIAN : 1.65
MODE : 1.65HISTOGRAM:
Range: 0- 4%
Increment: 0.10%

ORDERED REFLECTANCE VALUES:

0.90	*1.68
1.06	*1.69
*1.36	*1.72
*1.42	*1.78
*1.43	*1.81
*1.54	*1.85
*1.56	1.97
*1.59	2.04
*1.61	
*1.65	

KEROGEN DESCRIPTION

Amorphous	: 20 %
Exinite	: tr %
Vitrinite	: 65 %
Inertinite	: 15 %

Back Fluor	: Low
Bitumen	: Med
Coke	: tr

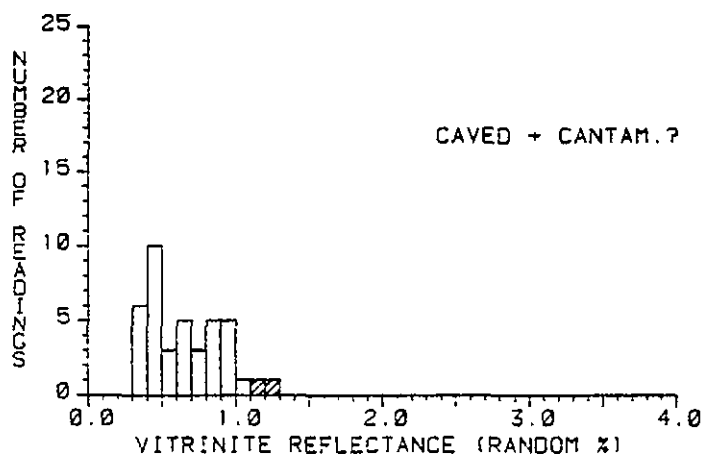
VISUAL KEROGEN ANALYSIS - REFLECTED LIGHT

BRINKERHOFF #1 CABEZON-GOV'T

Project No. : RRUS/823/T/43/02

SAMPLE IDENTIFICATION		REFLECT.	KEROGEN CHARACTERISTICS					TOC
RRUS	DEPTH (Feet)	Ro %	Am%	Ex%	Vit%	Inert%	Fluor	%
403-404	7226	1.17	35	10	40	15	Low	----
409-410	7583	----	35	10	45	10	Low	0.14
415-416	7876	1.28	30	10	50	10	Low	----

BRINKERHOFF #1 CABEZON-GOV'T



RRUS No. : 403-404

DEPTH : 7226.0 Ft
: 2202.5 M

* = Ro MATURITY

VALUES : 2

MEAN : 1.17

STD DEV : 0.07

MEDIAN : 1.24

MODE : 1.25

HISTOGRAM:

Range: 0- 4%

Increment: 0.10%

ORDERED REFLECTANCE VALUES:

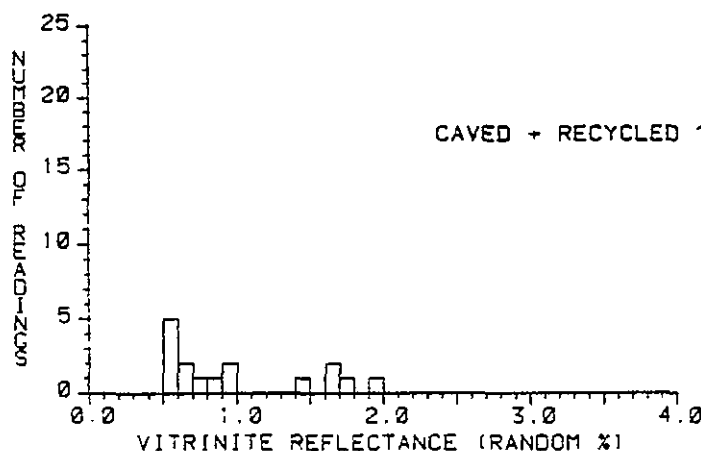
0.33	0.45	0.62	0.88
0.34	0.45	0.67	0.89
0.35	0.45	0.67	0.92
0.37	0.45	0.67	0.92
0.37	0.48	0.70	0.98
0.38	0.49	0.75	0.98
0.40	0.54	0.76	0.99
0.41	0.57	0.82	1.06
0.41	0.59	0.83	*1.10
0.43	0.62	0.88	*1.24

KEROGEN DESCRIPTION

Amorphous	: 35 %
Exinite	: 10 %
Vitrinite	: 40 %
Inertinite	: 15 %

Back Fluor	: Low
Bitumen	: Small
Coke	: None

BRINKERHOFF #1 CABEZON-GOV'T



RRUS No. : 409-410

DEPTH : 7583.0 Ft
: 2311.3 M

VALUES : 16

MEAN : 0.99

STD DEV : 0.49

MEDIAN : 0.82

MODE : 0.55

HISTOGRAM:

Range: 0- 4%

Increment: 0.10%

ORDERED REFLECTANCE VALUES:

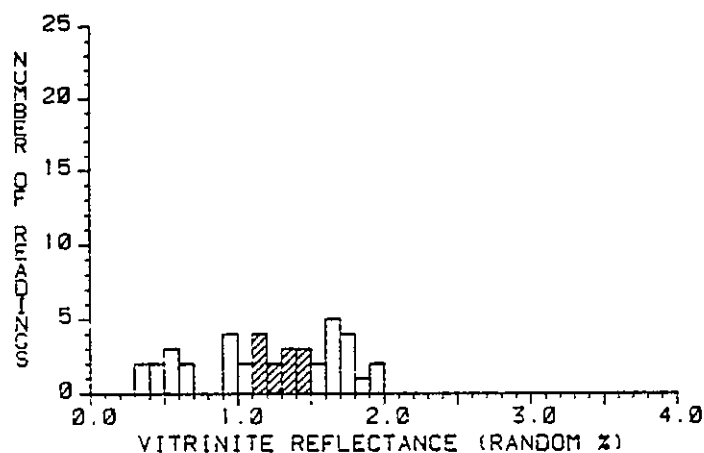
0.50	0.98
0.50	1.43
0.51	1.61
0.53	1.63
0.56	1.72
0.63	1.93
0.69	
0.75	
0.82	
0.98	

KEROGEN DESCRIPTION

Amorphous	: 35 %
Exinite	: 10 %
Vitrinite	: 45 %
Inertinite	: 10 %

Back Fluor	: Low
Bitumen	: None
Coke	: None

BRINKERHOFF #1 CABEZON-GOV'T



RRUS No. : 415-419

DEPTH : 7876.0 Ft
: 2400.6 M

* = Ro MATURITY

* VALUES : 12

MEAN : 1.28
STD DEV : 0.12
MEDIAN : 1.32
MODE : 1.15

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

ORDERED REFLECTANCE VALUES:

0.30	0.91	*1.20	1.66	1.93
0.38	0.97	*1.32	1.67	
0.41	0.97	*1.32	1.67	
0.48	1.00	*1.38	1.69	
0.57	1.07	*1.40	1.70	
0.58	*1.13	*1.44	1.70	
0.58	*1.16	*1.47	1.72	
0.60	*1.17	1.55	1.74	
0.67	*1.19	1.56	1.80	
0.90	*1.20	1.64	1.93	

KEROGEN DESCRIPTION

Amorphous	: 30 %
Exinite	: 10 %
Vitrinite	: 50 %
Inertinite	: 10 %

Back Fluor	: Low
Bitumen	: Small
Coke	: None

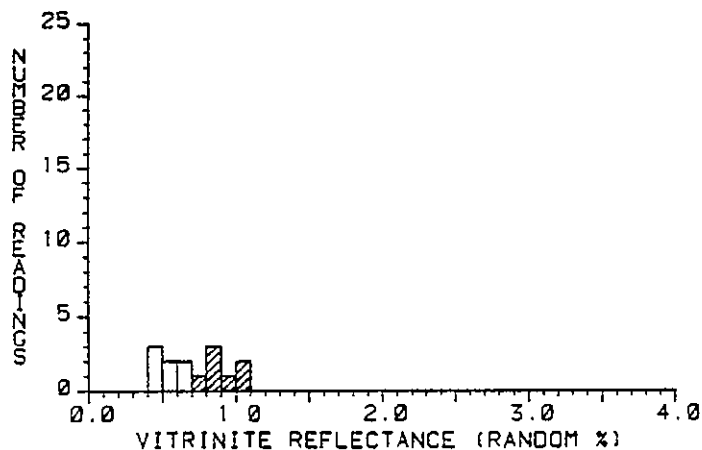
VISUAL KEROGEN ANALYSIS - REFLECTED LIGHT

DELHI #4 UTE

Project No. : RRUS/823/T/43/02

SAMPLE IDENTIFICATION		REFLECT.	KEROGEN CHARACTERISTICS					TOC
RRUS	DEPTH (Feet)	Ro %	Am%	Ex%	Vit%	Inert%	Fluor	%
1001-02	7845	0.90	40	5	25	30	Med	----
1003-04	8145	0.91	40	5	20	35	Med	----
1009	8453	0.94	50	5	20	25	High	1.18
1013-14	8765	1.00	35	5	35	25	Med	----
1017	8933	1.08	35	5	35	25	Med	0.47
1019-20	9125	1.11	40	5	25	30	High	----
1021-22	9475	1.14	30	10	30	30	High	----
1023-24	9605	1.10	35	5	35	25	Med	----

DELHI #4 UTE



RRUS No. : 1001-1002

DEPTH : 7845.0 Ft
: 2391.2 M

* = Ro MATURITY

* VALUES : 7

MEAN : 0.90
STD DEV : 0.10
MEDIAN : 0.88
MODE : 0.85

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

ORDERED REFLECTANCE VALUES:

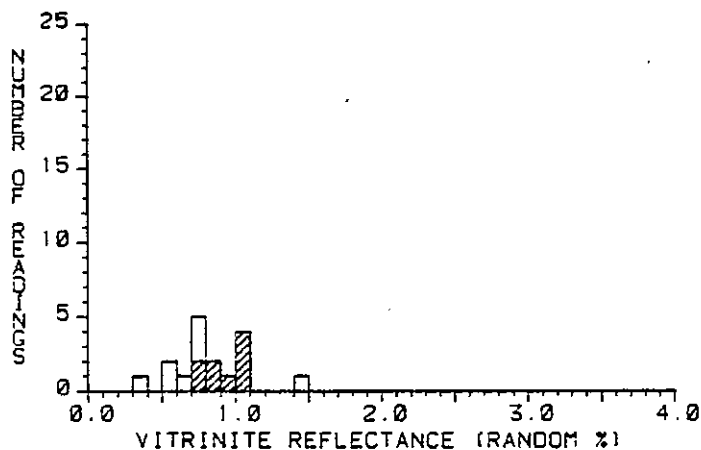
0.41 *0.88
0.41 *0.98
0.45 *1.02
0.55 *1.03
0.55
0.61
0.69
*0.74
*0.82
*0.85

KEROGEN DESCRIPTION

Amorphous : 40 %
Exinite : 5 %
Vitrinite : 25 %
Inertinite : 30 %

Back Fluor : Med
Bitumen : Small
Coke : None

DELHI #4 UTE



RRUS No. : 1003-1004

DEPTH : 8145.0 Ft
: 2482.6 M

* = Ro MATURITY

* VALUES : 9

MEAN : 0.91
STD DEV : 0.11
MEDIAN : 0.92
MODE : 1.05

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

ORDERED REFLECTANCE VALUES:

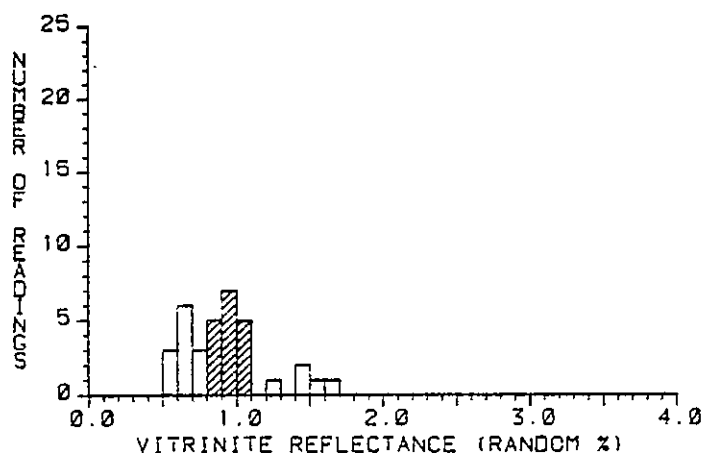
0.39 *0.85
0.50 *0.92
0.50 *1.00
0.62 *1.00
0.70 *1.02
0.71 *1.07
0.72 1.40
*0.76
*0.77
*0.83

KEROGEN DESCRIPTION

Amorphous : 40 %
Exinite : 5 %
Vitrinite : 20 %
Inertinite : 35 %

Back Fluor : Med
Bitumen : Small
Coke : None

DELHI #4 UTE



RRUS No. : 1000

DEPTH : 8453.0 Ft
: 2576.5 M

* = Ro MATURITY

VALUES : 17

MEAN : 0.94

STD DEV : 0.07

MEDIAN : 0.93

MODE : 0.95

HISTOGRAM:

Range: 0- 4%

Increment: 0.10%

ORDERED REFLECTANCE VALUES:

0.51	0.77	*0.93	1.41
0.53	0.77	*0.93	1.43
0.57	*0.83	*0.96	1.52
0.61	*0.84	*0.98	1.63
0.61	*0.84	*1.01	
0.63	*0.87	*1.01	
0.66	*0.87	*1.02	
0.67	*0.90	*1.04	
0.68	*0.92	*1.06	
0.75	*0.92	1.28	

KEROGEN DESCRIPTION

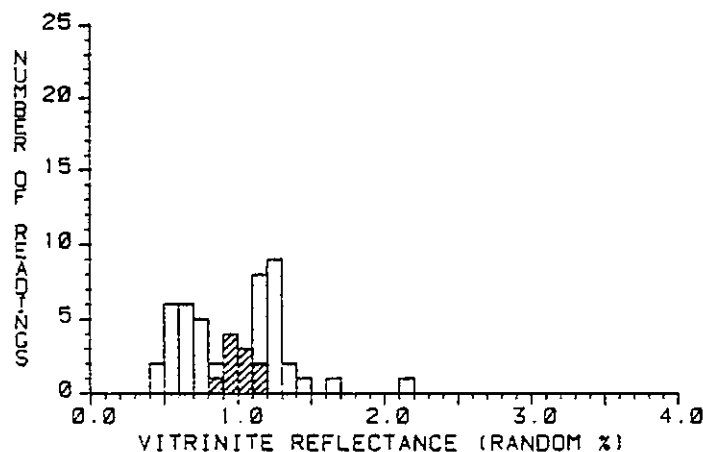
Amorphous	: 50 %
Exinite	: 5 %
Vitrinite	: 20 %
Inertinite	: 25 %

Back Fluor : High

Bitumen : Med

Coke : None

DELHI #4 UTE



RRUS No. : 1013-1014

DEPTH : 8765.0 Ft
: 2671.6 M

* = Ro MATURITY

VALUES : 10

MEAN : 1.00

STD DEV : 0.09

MEDIAN : 1.07

MODE : 0.95

HISTOGRAM:

Range: 0- 4%

Increment: 0.10%

ORDERED REFLECTANCE VALUES:

0.45	0.66	*0.88	1.12	1.21
0.47	0.67	*0.91	1.14	1.26
0.50	0.68	*0.91	1.14	1.26
0.50	0.68	*0.93	1.15	1.27
0.52	0.72	*0.95	1.15	1.27
0.55	0.72	*1.07	1.15	1.30
0.55	0.77	*1.09	1.20	1.33
0.59	0.77	*1.09	1.20	1.48
0.60	0.77	*1.10	1.21	1.60
0.64	0.83	*1.10	1.21	2.12

KEROGEN DESCRIPTION

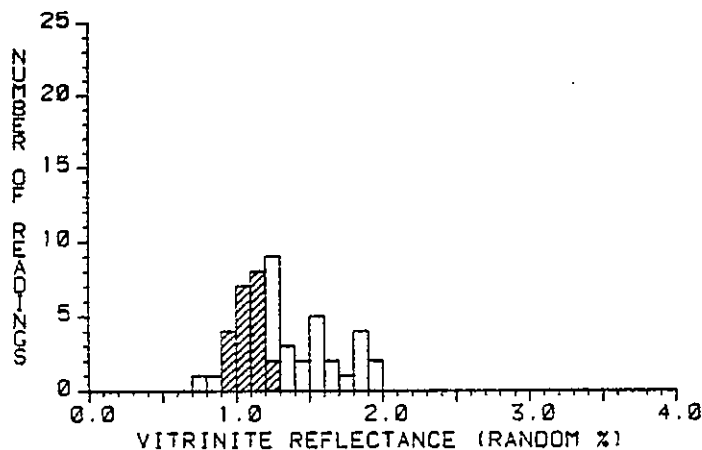
Amorphous	: 35 %
Exinite	: 5 %
Vitrinite	: 35 %
Inertinite	: 25 %

Back Fluor : Med

Bitumen : Med

Coke : None

DELHI #4 UTE



RRUS No. : 1017

DEPTH : 8933.0 Ft
: 2722.8 M

* = Ro MATURITY

VALUES : 21

MEAN : 1.08
STD DEV : 0.03
MEDIAN : 1.09
MODE : 1.15

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

ORDERED REFLECTANCE VALUES:

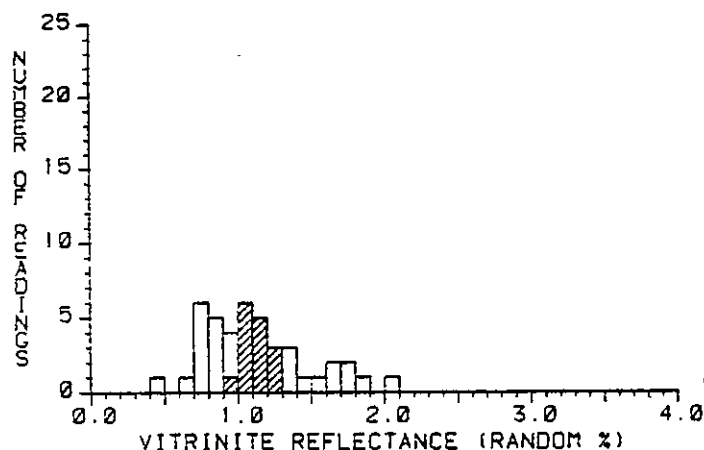
0.77	*1.06	*1.19	1.30	1.62
0.80	*1.07	*1.20	1.34	1.66
*0.94	*1.09	*1.20	1.35	1.71
*0.96	*1.10	1.22	1.47	1.83
*0.97	*1.12	1.22	1.48	1.83
*0.99	*1.13	1.23	1.50	1.83
*1.01	*1.15	1.24	1.52	1.85
*1.01	*1.16	1.25	1.52	1.92
*1.02	*1.17	1.27	1.58	1.95
*1.03	*1.18	1.27	1.59	

KEROGEN DESCRIPTION

Amorphous : 35 %
Exinite : 5 %
Vitrinite : 35 %
Inertinite : 25 %

Back Fluor : Med
Bitumen : Med
Coke : None

DELHI #4 UTE



RRUS No. : 1019-1020

DEPTH : 9125.0 Ft
: 2781.3 M

* = Ro MATURITY

VALUES : 15

MEAN : 1.11
STD DEV : 0.09
MEDIAN : 1.11
MODE : 1.05

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

ORDERED REFLECTANCE VALUES:

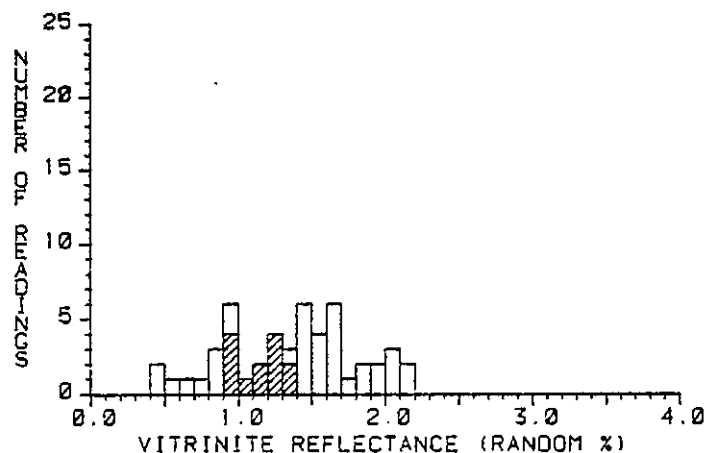
0.47	0.85	*1.08	*1.29	1.84
0.68	0.86	*1.09	1.32	2.03
0.73	0.88	*1.09	1.32	
0.73	0.92	*1.11	1.39	
0.74	0.93	*1.11	1.41	
0.75	0.93	*1.13	1.57	
0.77	*0.97	*1.17	1.60	
0.78	*1.00	*1.17	1.63	
0.81	*1.00	*1.20	1.70	
0.84	*1.01	*1.22	1.72	

KEROGEN DESCRIPTION

Amorphous : 40 %
Exinite : 5 %
Vitrinite : 25 %
Inertinite : 30 %

Back Fluor : High
Bitumen : Med
Coke : None

DELHI #4 UTE



RRUS No. : 1021-1022

DEPTH : 9475.0 F1
: 2888.0 M

* = Ro MATURITY

* VALUES : 13

MEAN : 1.14
STD DEV : 0.14
MEDIAN : 1.15
MODE : 1.25

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

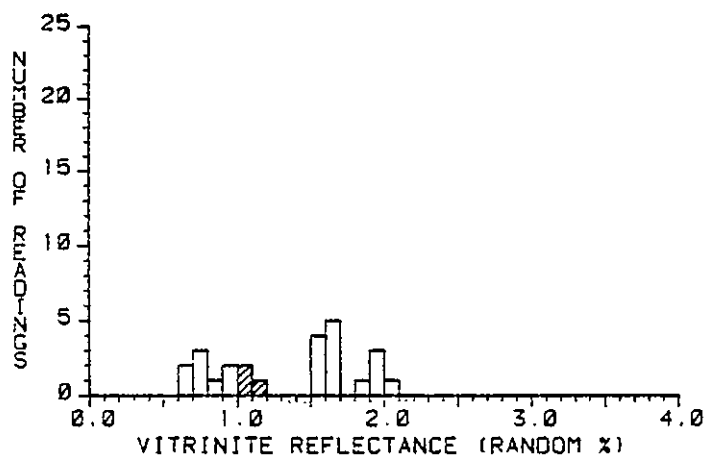
ORDERED REFLECTANCE VALUES:

0.45	*0.96	*1.27	1.50	1.77
0.45	*0.96	*1.32	1.54	1.88
0.53	*0.96	*1.33	1.56	1.89
0.67	*0.98	1.37	1.59	1.91
0.73	*1.06	1.40	1.61	1.94
0.80	*1.10	1.41	1.62	2.01
0.83	*1.15	1.43	1.63	2.01
0.86	*1.21	1.44	1.63	2.02
0.90	*1.23	1.45	1.66	2.16
0.93	*1.25	1.46	1.67	2.17

KEROGEN DESCRIPTION

Amorphous	: 30 %
Exinite	: 10 %
Vitrinite	: 30 %
Inertinite	: 30 %
Back Fluor	: High
Bitumen	: Med
Coke	: None

DELHI #4 UTE



RRUS No. : 1023-1024

DEPTH : 9605.0 F1
: 2927.6 M

* = Ro MATURITY

* VALUES : 3

MEAN : 1.10
STD DEV : 0.07
MEDIAN : 1.05
MODE : 1.05

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

ORDERED REFLECTANCE VALUES:

0.62	*1.19	1.82
0.66	1.50	1.92
0.76	1.52	1.96
0.77	1.52	1.99
0.79	1.54	2.07
0.86	1.61	
0.93	1.63	
0.94	1.63	
*1.05	1.66	
*1.05	1.68	

KEROGEN DESCRIPTION

Amorphous	: 35 %
Exinite	: 5 %
Vitrinite	: 35 %
Inertinite	: 25 %
Back Fluor	: Med
Bitumen	: High
Coke	: None