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KEROGEN MICROSCOPY OF COAL AND SHALES FROM THE NORTHSLOPE OF ALASKA

by

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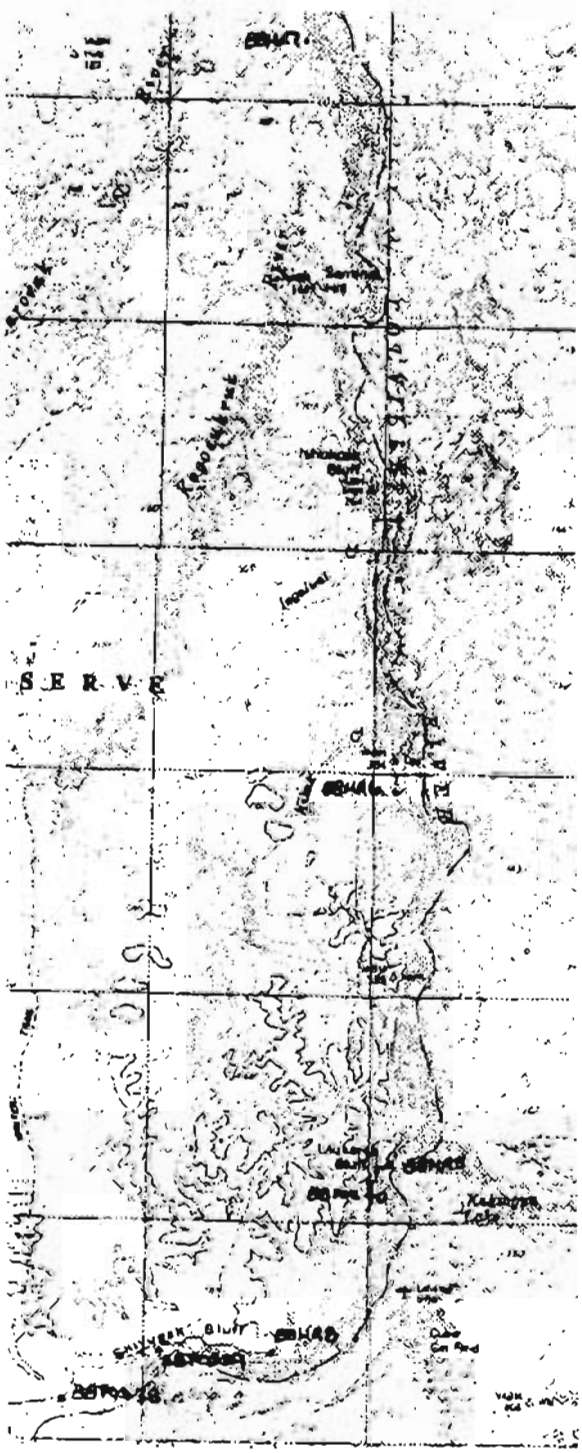
This report contains kerogen microscopy data for coals and carbonaceous shales collected during the 1988 field season in northern Alaska as part of the ADGGS Northslope Petroleum Appraisal Program.

Areas that were collected included a suite of samples along the Colville River; one sample from just south of Sagwon Bluffs; and two samples from the northern exposures along Sabbath Creek in ANWR.

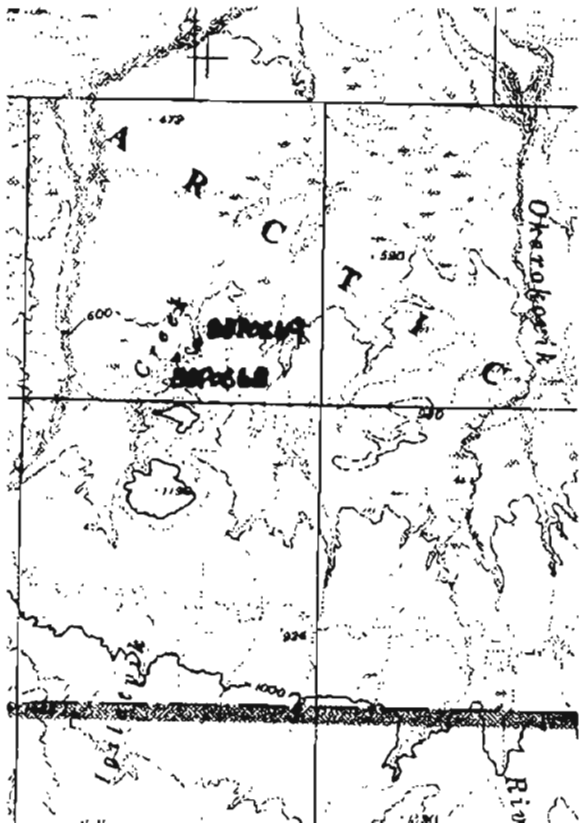
Samples were collected from the following units:

88MR5A	Colville Group (Prince Creek Fm.)
88MR6B	Colville Group (Prince Creek Fm.)
88MR7B	Colville Group (Prince Creek Fm.)
88MR8A	Colville Group (Prince Creek Fm.)
88POS38A	Colville Group (Prince Creek Fm.)
88POS39B	Colville Group (Prince Creek Fm.)
88POS40L	Colville Group (Prince Creek Fm.)
88POS68B	Jago River Formation (Sabbath Creek)
88POS69B	Jago River Formation (Sabbath Creek)
NS403	Upper Cretaceous(?)

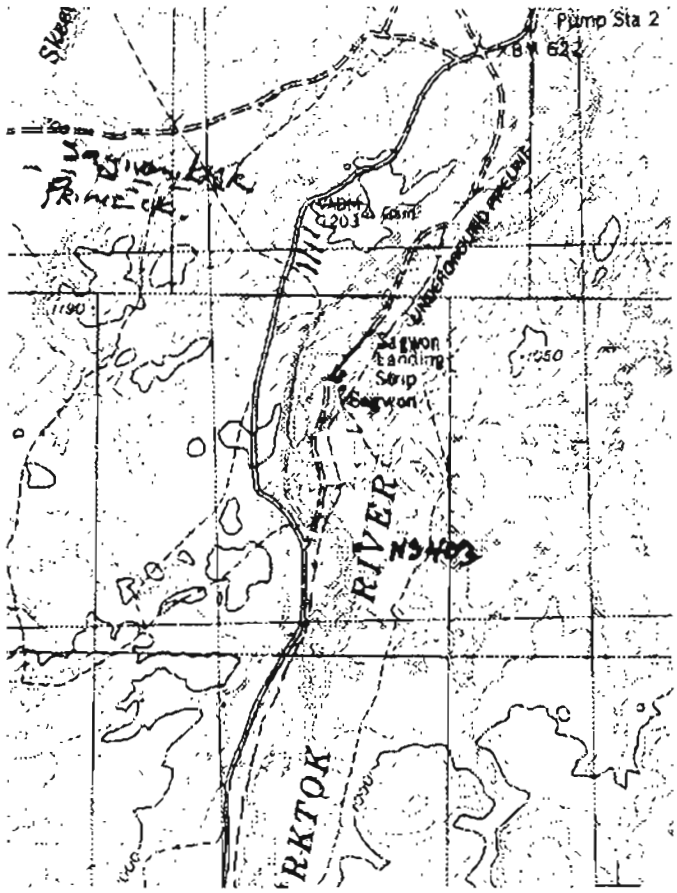
Sample locality map of Samples collected along the Colville River. Map modified from the U.S. Geological Survey Umiat 1:250,000 scale quadrangle map.



Sample locality map for samples collected along Sabbath Creek. Map modified from U.S. Geological Survey Demarcation Point quadrangle map.



Sample locality map for the sample collected south of Sagwon Bluffs. Map modified from U.s. Geological Survey Sagavanirktok quadrangle map.



KEROGEN MICROSCOPY OF COAL AND SHALES FROM THE NORTHSLOPE OF ALASKA

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INTRODUCTION

Ten samples of coal and organic-rich shale from the North slope of Alaska were analyzed for random vitrinite reflectance, kerogen type, and TAI. Most samples did not have amorphous kerogen or isolated sporinite for TAI analysis. Maturity interpretations are based on visual data only as no geochemical information was made available.

SAMPLE DESCRIPTION

88MR5A

Sample consists of large coaly fragments. In reflected light, inclusions of exinite and inertinite can be identified. Reflectance values may be slightly lowered because of the large amount of exinite within many vitrinite fragments. TAI is based only on several isolated spores. Exinite fluorescence is yellow and orange. The kerogen is slightly weathered, there is no solid bitumen, and only traces of pyrite.

88MR6B

Similar to sample 88MR5A, but with different maceral percentages and a slightly lower maturity. There were no isolated spores for TAI.

88MR7B

Nearly identical to sample 88MR6B, but very slightly higher in maturity. Exinite fluorescence is yellow and orange with most of the vitrinite fluorescing low brown. This could lower the reflectivity slightly.

88MR8A

Sample consists of large coaly fragments of vitrinite with inclusions as in previous samples, plus large, isolated inertinite and solid bitumen fragments. Reflectance values may be lowered by exinite inclusions and solid bitumen saturation. There are no isolated spores for TAI. Exinite fragments fluoresce yellow and orange. Some humic fragments have low yellow fluorescing halos around them. There is a small amount of pyrite.

88P0S38A

Sample consists almost entirely of solid bitumen with a high orange fluorescence and a trace amount of exinite. This sample represents a devolatilized crude oil or a solid bitumen band in a coal. Ro is measured as solid bitumen and is not the maturity of the sample.

88POS39B

Sample is 40% solid bitumen as in sample 88POS38A and 55% vitrinite with remnant cell structure and inertinite inclusions. Reflectance for vitrinite and solid bitumen are similar.

88POS40L

In reflected light, the organic matter consists of a brown sapropelic groundmass of amorphous material and stringy solid bitumen. There are vitrinite, solid bitumen, and fusinite fragments. In transmitted light, the sapropelic matter is golden with granular texture but does not fluoresce. Exinite fragments fluoresce yellow and orange. There is a small amount of pyrite, moderate kerogen weathering and no background fluroescence.

88POS68B

Amorphous material is brown and fine grained with inclusions of high rank exinite, vitrinite-like fragments, inertinite, and several ranks of solid bitumen. Some reflectance values may be on solid bitumen. In transmitted light, the amorphous material is fine grained, dark brown and does not fluoresce. TAI, Ro, and lack of fluorescence all indicate high rank, but Ro maturity is questionable due to limited measurements.

88P0S69B

Sample consists of moderately weathered vitrinite and solid bitumen fragments. The small amount of amorphous material may be degraded solid bitumen. Organic matter does not fluoresce, but there are yellow halos around organic masses. There is a small amount of pyrite and moderate evidence of kerogen oxidation.

NS403

Sample consists of large coaly fragments. In reflected light, inclusions of exinite and inertinite can be identified. Reflectance may be slightly lowered because of exinite content within vitrinite fragments. Exinite fragments fluoresce yellow and orange and there is moderate background fluorescence. Pyrite is present in small amounts.

REFLECTED LIGHT MICROSCOPY DATA

A sample of ground rock is treated successively with hydrochloric, hydrofluoric and hot hydrochloric acids to concentrate the kerogen, dried, mounted in an epoxy plug, and polished. The sample is examined at 500X magnification with a Zeiss Universal microscope. A halogen light source is used for reflectance measurement and a zenon light source for blue light fluorescence.

The microscopy data table contains interpreted maturity values, the normalized visual percentage of each principle kerogen type and background fluorescence intensity. The percentage of solid bitumen is also indicated. The histograms show measured reflectance values of all material visually identified as vitrinite. Reflectance (R_o) values marked with * (shaded on the histograms) are those used to calculate the interpreted vitrinite reflectance maturities. Other R_o values are interpreted to be caving, oxidized, or recycled vitrinite.

ABBREVIATIONS USED IN MICROSCOPY DATA TABLE AND HISTOGRAMS

Amor	:	Amorphous Kerogen
Exin	:	Exinite
Vit	:	Vitrinite
Inert	:	Inertinite
Bit	:	Solid Bitumen

TRANSMITTED LIGHT MICROSCOPY DATA

Transmitted light slides are prepared from isolated kerogens using elvacite as a mounting medium. Analysis is done with a tungsten light source on a Zeiss Universal microscope. Blue light fluorescence using a xenon light source is used to help identify kerogen type.

TAI color values are normally recorded only on spores and pollen but when this material is absent, amorphous kerogen is substituted. In such cases the TAI value is preceded by an "*" on the data table. Kerogen color is usually slightly darker for amorphous material than spores and pollen in the sample and this must be considered when evaluating the TAI results.

A brief description of the color for each TAI unit is as follows:

TAI COLOR SCALE

1-	straw yellow	3-	reddish brown
1	pale yellow	3	medium brown
1+	yellow	3+	dark brown
2-	yellow-orange	4-	brown-black
2	golden	4	black with structure
2+	amber	5	black without structure

MICROSCOPY DATA

ALASKAN GEOLOGICAL & GEOPHYSICAL SURVEY

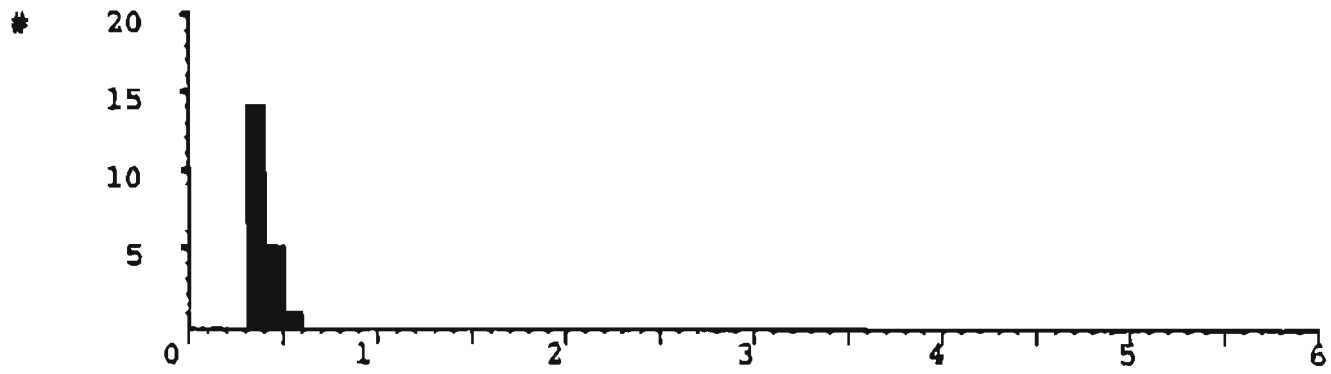
Project : DGSI/89/1060

SAMPLE IDENTIFICATION DEPTH (Feet)		INTERPRETED MATURITY RO	TAI	KEROGEN TYPE - VISUAL PERCENT AMOR	EXIN	VIT	INERT	BIT	BACKGROUND FLUORESCENCE
88MR5A	-	0.39	1-,-	0	20	75	5	0	Low
88MR6B	-	0.37	----	0	15	65	20	0	Low
88MR7B	-	0.40	----	0	15	65	20	0	Low
88MR8A	-	0.37	----	0	10	40	40	10	Low
88POS38A	-	70.31	----	0	Tr	0	0	99	Low
88POS39B	-	0.45	----	0	Tr	55	5	40	Medium
88POS40L	-	0.37	2	25	10	25	10	30	None
88POS68B	-	71.65	>3+	55	5	710	10	720	None
88POS69B	-	0.49	----	75	Tr	50	Tr	50	None
N5403	-	0.62	----	5	20	40	15	20	Medium

NORTHSLOPE OF ALASKA

88MR5A

INTERPRETED MATURITY : 0.39 Ro Std. Dev. : 0.05 No. Readings : 20



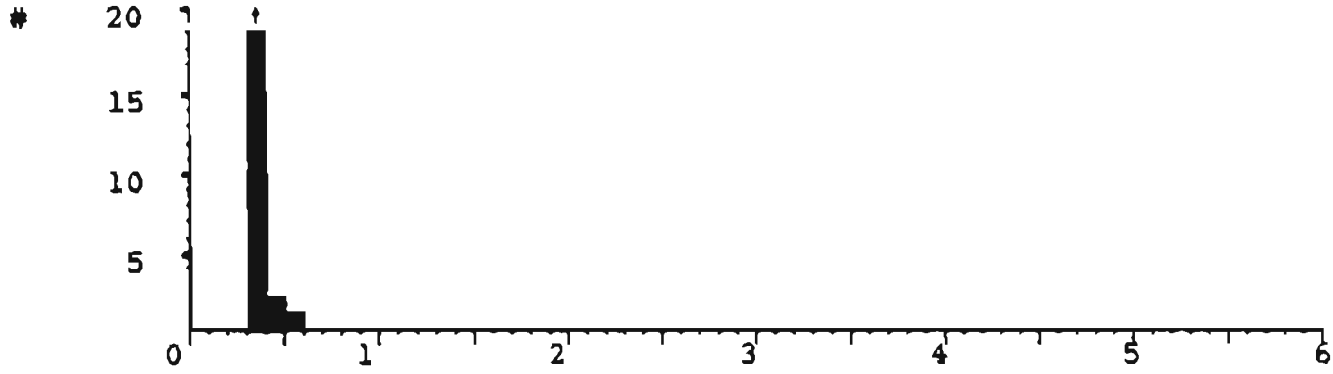
* = Maturity Values REFLECTANCE VALUES

*0.30	*0.38
*0.32	*0.39
*0.34	*0.39
*0.34	*0.39
*0.37	*0.41
*0.37	*0.41
*0.38	*0.42
*0.38	*0.46
*0.38	*0.49
*0.38	*0.50

NORTHSLOPE OF ALASKA

88MR6B

INTERPRETED MATURITY : 0.37 Ro Std. Dev. : 0.04 No. Readings : 25



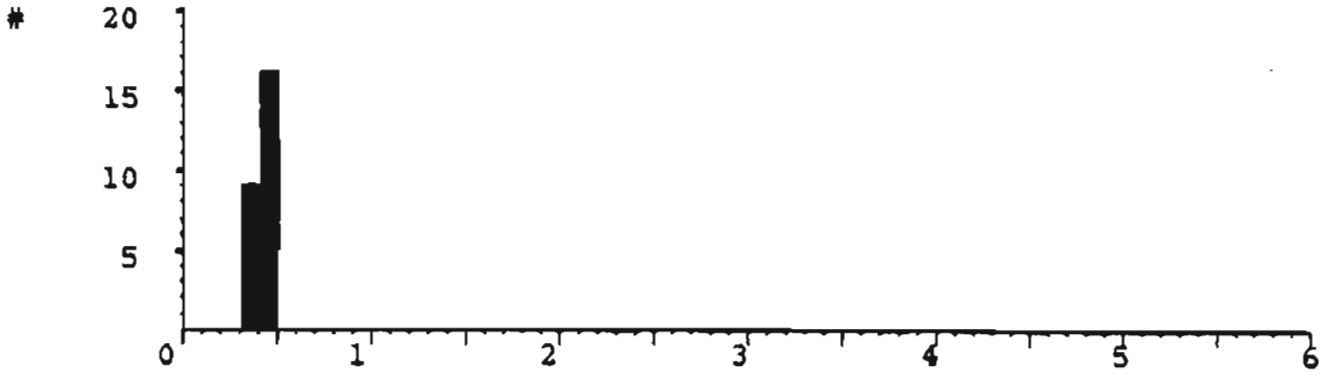
* = Maturity Values REFLECTANCE VALUES

*0.33	*0.35	*0.39
*0.33	*0.36	*0.39
*0.33	*0.36	*0.41
*0.34	*0.36	*0.43
*0.34	*0.36	*0.54
*0.34	*0.36	
*0.34	*0.37	
*0.34	*0.38	
*0.35	*0.38	
*0.35	*0.39	

NORTHSLOPE OF ALASKA

88MR7B

INTERPRETED MATURITY : 0.40 Ro Std. Dev. : 0.03 No. Readings : 25



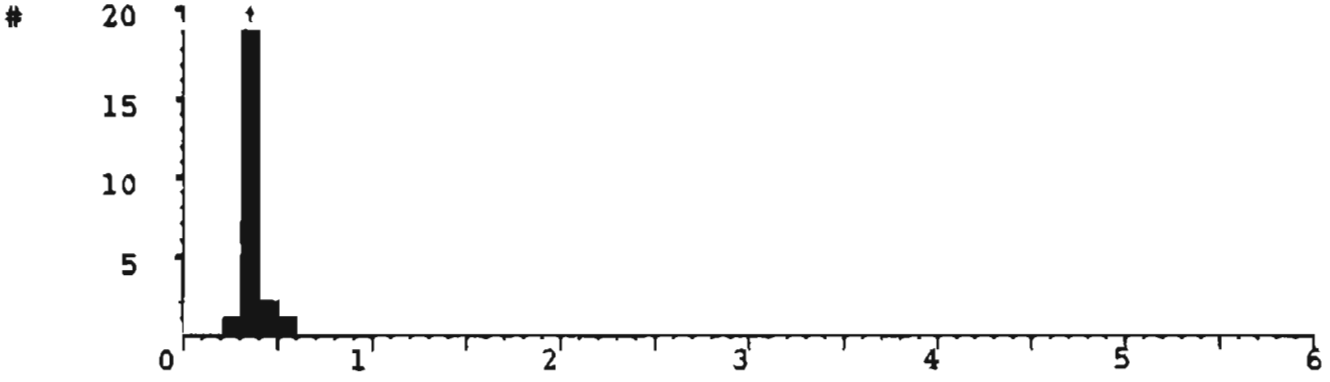
* = Maturity Values REFLECTANCE VALUES

*0.35	*0.40	*0.42
*0.36	*0.40	*0.42
*0.36	*0.40	*0.43
*0.36	*0.40	*0.43
*0.37	*0.41	*0.45
*0.38	*0.41	
*0.38	*0.41	
*0.39	*0.41	
*0.39	*0.42	
*0.40	*0.42	

NORTHSLOPE OF ALASKA

88MR8A

INTERPRETED MATURITY : 0.37 Ro Std. Dev. : 0.05 No. Readings : 24



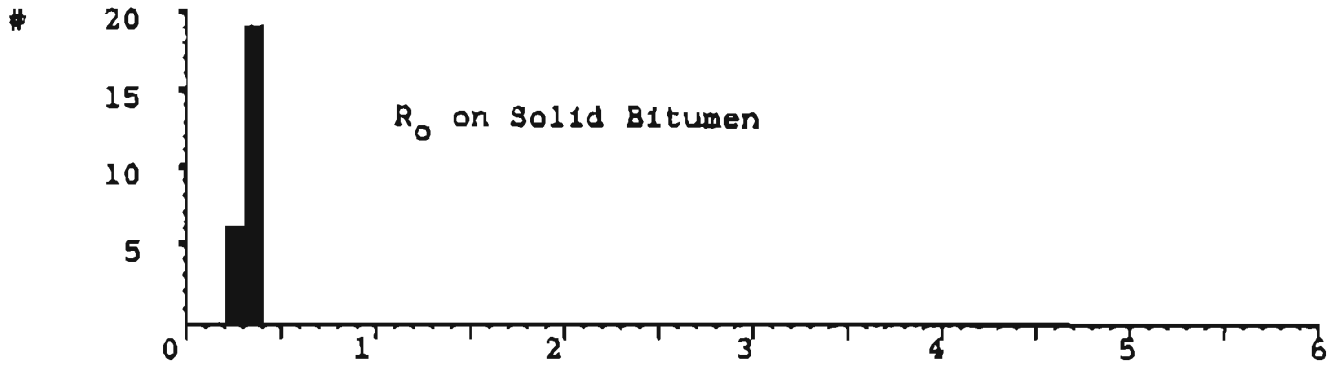
* = Maturity Values REFLECTANCE VALUES

*0.24	*0.35	*0.38
*0.30	*0.35	*0.38
*0.32	*0.36	*0.41
*0.32	*0.36	*0.46
*0.32	*0.36	*0.57
*0.33	*0.36	
*0.33	*0.36	
*0.33	*0.37	
*0.35	*0.38	
*0.35	*0.38	

NORTHSLOPE OF ALASKA

88POS38A

INTERPRETED MATURITY : 0.31 Ro? Std. Dev. : 0.02 No. Readings : 25



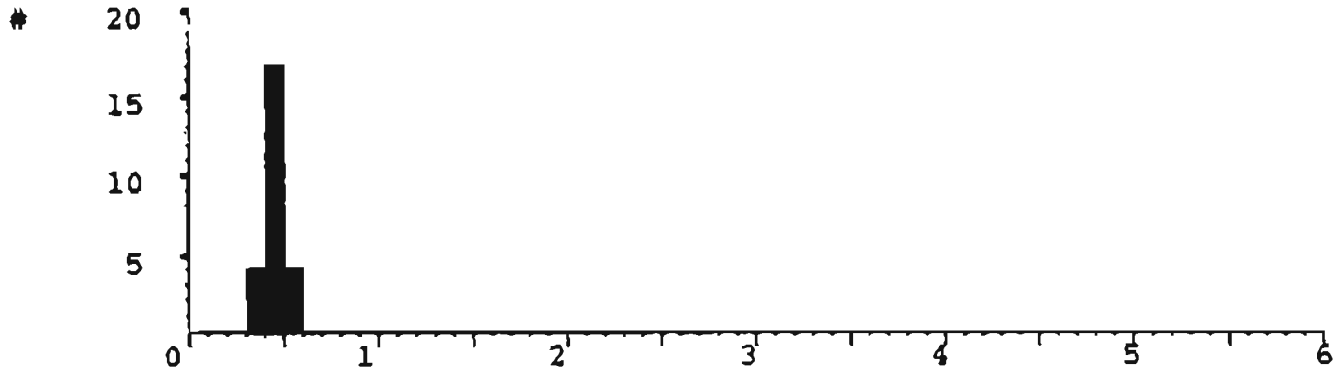
★ = Maturity Values

★0.27	★0.31	★0.33
★0.28	★0.31	★0.33
★0.29	★0.31	★0.33
★0.29	★0.31	★0.33
★0.29	★0.31	★0.34
★0.29	★0.32	
★0.30	★0.32	
★0.30	★0.32	
★0.31	★0.32	
★0.31	★0.33	

NORTHSLOPE OF ALASKA

88POS39B

INTERPRETED MATURITY : 0.45 Ro Std. Dev. : 0.05 No. Readings : 25



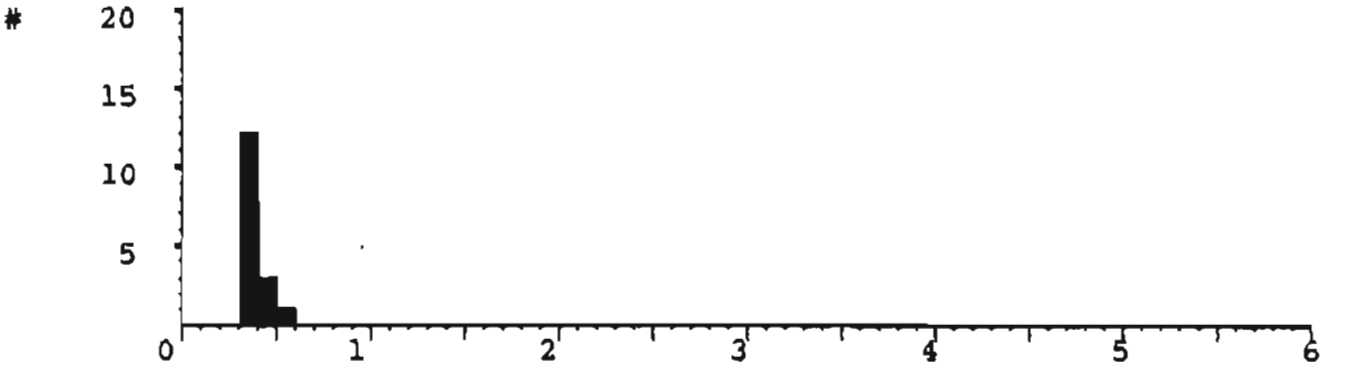
★ = Maturity Values

★0.38	★0.42	★0.49
★0.38	★0.44	★0.50
★0.38	★0.44	★0.51
★0.39	★0.46	★0.53
★0.40	★0.46	★0.53
★0.40	★0.47	
★0.41	★0.47	
★0.42	★0.47	
★0.42	★0.47	
★0.42	★0.48	

NORTHSLOPE OF ALASKA

88POS40L

INTERPRETED MATURITY : 0.37 Ro Std. Dev. : 0.05 No. Readings : 16



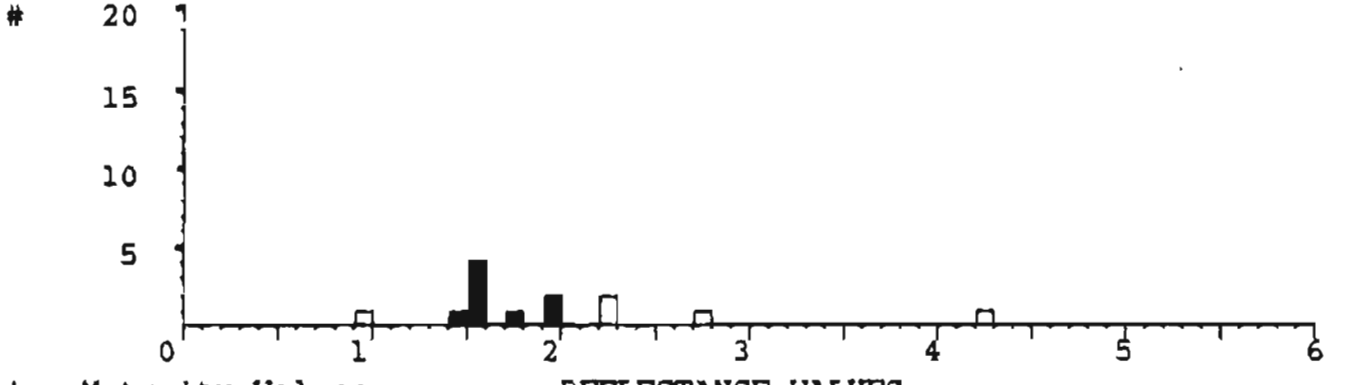
★ = Maturity Values REFLECTANCE VALUES

★0.31 ★0.39
★0.32 ★0.39
★0.33 ★0.40
★0.35 ★0.41
★0.35 ★0.41
★0.36 ★0.51
★0.36
★0.36
★0.37
★0.38

NORTHSLOPE OF ALASKA

88POS68B

INTERPRETED MATURITY : 1.65 Ro Std. Dev. : 0.20 No. Readings : 8



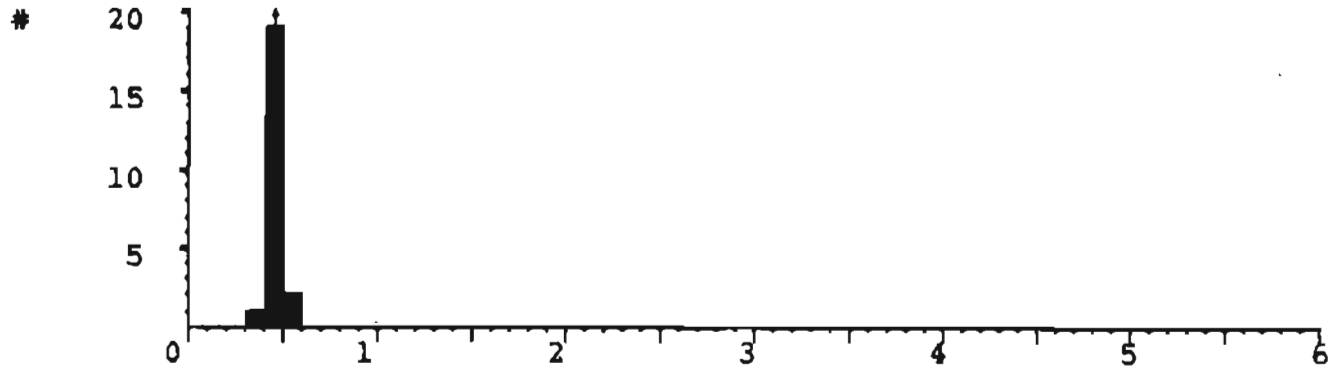
★ = Maturity Values REFLECTANCE VALUES

0.91 2.28
★1.41 2.72
★1.53 4.25
★1.53
★1.53
★1.53
★1.79
★1.91
★1.95
2.26

NORTHSLOPE OF ALASKA

88POS69B

INTERPRETED MATURITY : 0.45 Ro Std. Dev. : 0.04 No. Readings : 25



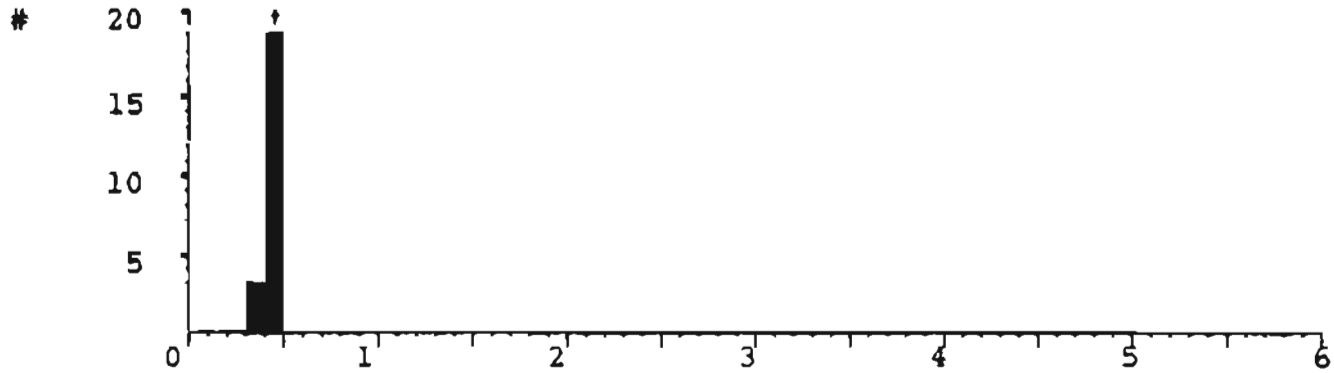
* = Maturity Values REFLECTANCE VALUES

*0.39	*0.45	*0.48
*0.40	*0.46	*0.48
*0.40	*0.46	*0.49
*0.41	*0.46	*0.51
*0.41	*0.47	*0.52
*0.41	*0.47	
*0.42	*0.47	
*0.43	*0.47	
*0.43	*0.47	
*0.45	*0.48	

NORTHSLOPE OF ALASKA

NS403

INTERPRETED MATURITY : 0.42 Ro Std. Dev. : 0.02 No. Readings : 25



* = Maturity Values REFLECTANCE VALUES

*0.39	*0.42	*0.44
*0.39	*0.42	*0.45
*0.39	*0.42	*0.45
*0.40	*0.43	*0.47
*0.40	*0.43	*0.47
*0.41	*0.43	
*0.41	*0.43	
*0.42	*0.43	
*0.42	*0.44	
*0.42	*0.44	

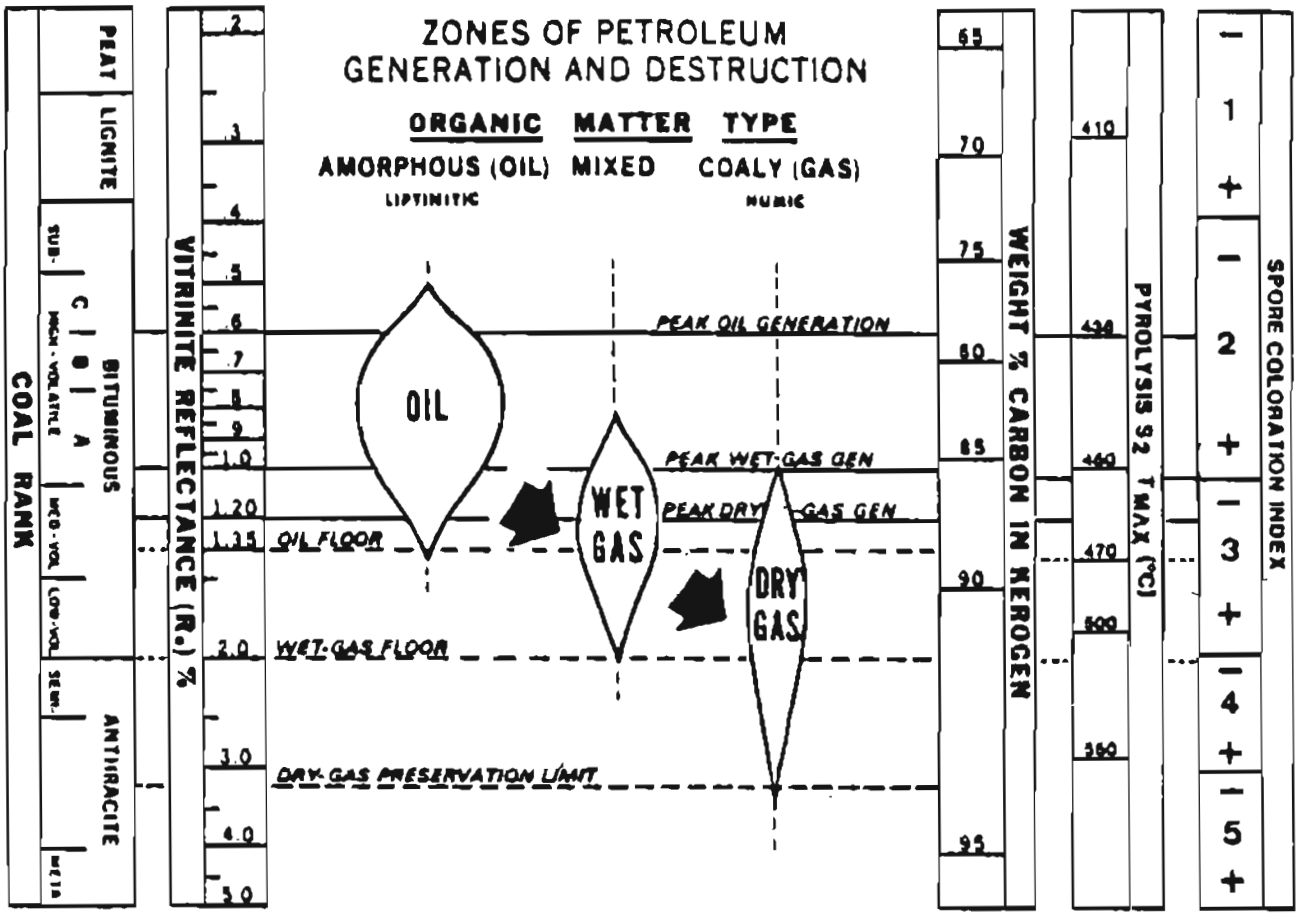


FIGURE 1 : CORRELATION OF VARIOUS MATURATION INDICES AND ZONES OF PETROLEUM GENERATION AND DESTRUCTION.