Visual kerogen and vitrinite reflectance data derived from washed cuttings (90' - 6,100') and from core chips (4,739' - 4,894') of the BP Exploration (Alaska) Inc. Kuparuk Uplands Ekvik No. 1 well, and derived from unwashed cuttings (300' - 6,500') of the BP Alaska Inc. Kuparuk Unit No. 1 well.

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KEROGEN MICROSCOPY OF SAMPLES FROM TWO WELLS, ALASKA

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DGSI Project: 94/2879
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GMC Data Report No. 224

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Total Quality Geochemistry

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DISCUSSION

Bit cuttings samples from two wells were analyzed with kerogen microscopy only. No geochemical or geological information were provided to help with data interpretation. Some of the maturity calculations, especially on the Kuparuk well samples, are open to question and must be confirmed by other information.

Ekvik No. 1 Well

All nine of the samples analyzed from this well contain both terrigenous and lipid organic matter with the terrigenous component generally predominating. Structured lipids consist of land plant derived sporinite, cutinite, resinite and suberinite as well as liptodetrinite of unknown affinity. These kerogens should generate primarily gas although there could be some waxy oil generating potential in three cutinite rich samples from between 90 and 2,880 feet. Low background and lipid fluorescence intensity and limited solid bitumen (except in the 5,970-6,100 foot sample) indicates that oil has not been generated.

Because of the high percentage of terrigenous organic matter, vitrinite is abundant and calculated maturities are based on reliable reflectance populations. Samples from 3,500 feet and deeper contain some high reflecting, probably recycled vitrinite that was excluded from the maturity calculations. The calculated vitrinite reflectance maturities are supported by other indices such as TAI, structured lipids fluorescence color and intensity, and unstructured lipids texture.

There is a persistent maturity increase with depth and the top of the oil window (0.6 R_o) is just being approached in the deepest sample. The entire section penetrated is therefore immature and has not generated oil or gas. A maturity offset between 2,880 and 3,570 feet may be caused by a reverse fault between these two depths. This conclusion must be considered tentative until it is supported by geological information. Considering the excellent quality of the reflectance maturity calculations, however, the presence of such a fault is a distinct probability.

Kuparuk No. 1 Well

Eight samples from this well also contain mixed terrigenous and aquatic organic matter with the terrigenous component predominating. Structured lipids are primarily liptodetrinite but there is some higher plant sporinite and cutinite in the two shallowest samples. The organic matter in these samples should yield only gas, possibly including minor wet gas.

Vitrinite is abundant in all of the samples analyzed but most contain multiple vitrinite populations and it is sometimes difficult to determine which population represents the true maturity of the samples. Other maturity indices are also affected because they parallel the reflectance maturities. The situation is complicated by the fact that cavings below reverse faults can be more mature than indigenous material. There is some high reflective vitrinite in all of the samples which appears to be recycled and this material was excluded from the maturity calculations.

Our vitrinite reflectance maturity calculations are mostly based on the lowest good vitrinite population in the samples. There appears to be a general increase with depth with strong offsets between 1,300 and 2,100 feet and between 4,850 and 5,750 feet. Maturity reversals at these two depth positions could indicate reverse faults. The maturity offset at the shallow fault position indicates a greater throw than the lessor offset at the deeper position. Because of the multiple vitrinite populations, our maturity calculations are suspect and must be supported by geological data. If our interpretation is correct, the shallowest thrust plate is within the oil window, the second plate is just approaching the oil window, and the third plate is immature. Hydrocarbon generation is suspended throughout the section by cooling associated with overburden removal and is not active at the present time.

VISUAL KEROGEN ANALYSIS TECHNIQUES

Visual kerogen analysis employs a Zeiss Universal microscope system equipped with halogen, xenon, and tungsten light sources or a Jena Lumar microscope equipped with halogen and mercury light sources. Vitrinite reflectance and kerogen typing are performed on a polished epoxy plug of unfloated kerogen concentrate using reflected light from the halogen source. The digital indicator is calibrated using a glass standard with a reflectance of 1.02% in oil. This calibration is linearly accurate for reflectance values ranging from peat (R_o 0.20%) through anthracite (R_o 4.0%).

Reflectance values are recorded only on good quality vitrinite, including obvious contamination and recycled material. The relative abundance of normal, altered, lipid-rich, oxidized, and coked vitrinite is recorded. When good quality, normal vitrinite is absent, notations are made indicating how the maturity is affected by weathering, oxidation, bitumen saturation, or coking. When normal vitrinite is absent or sparse, other macerals may be substituted. Solid bitumen, for example is present in many samples. Although it often has a different reflectance than vitrinite, Jacob's calibration chart can be used to obtain an estimated vitrinite reflectance equivalent. Graptolites have about the same reflectance as vitrinite and can often be used to obtain maturity data in early Paleozoic rocks that have no vitrinite.

Unstructured lipid kerogen changes in texture and color during the maturation process. Typically, unstructured kerogen at low maturity is reddish brown and amorphous. Somewhere between R_o 0.50 to 0.65%, the kerogen takes on a massive texture and is gray in color. At higher maturity, generally above R_o 1.30%, unstructured kerogen is light gray and micrinized.

Kerogen typing and maturity assessments from the polished plug are enhanced by utilizing fluorescence from blue light excitation. The xenon or mercury lamp is used with an excitation filter at 495 nm coupled with a barrier filter of 520 nm. With the Jena microscope we also have the option of observing fluorescence under ultra violet excitation. The intensity of fluorescence in the epoxy mounting medium (background fluorescence) correlates well with the onset of oil generation and destruction. The identification of structured and unstructured liptinite is also enhanced with the use of fluorescence in those samples having a maturity less than R_o 1.3%. The relative abundance and type of pyrite is also recorded.

TAI is performed using tungsten or halogen light source that is transmitted through a glass slide made from the unfloated kerogen concentrate. Ideally, TAI color is based on sporinite of terrestrial origin. When sporinite is absent, TAI is estimated from the unstructured lipid material. Weathering, bitumen admixed with the unstructured material and micrinization can darken the kerogen and raise the TAI value. The character of the organic matter in transmitted light is correlated with observations made in reflected light for kerogen typing.

Kerogen typing and maturity assessments from the slide preparation are also reinforced by using different light sources. The slide is first observed in transmitted light to obtain TAI color and organic matter structure or type. The light is then switched to reflected halogen light to observe structure and amount of pyrite, and finally to reflected blue light excitation from the xenon or mercury source for fluorescence. The fluorescence of structured and unstructured liptinite is not masked by the epoxy fluorescence as it is in the reflected light mode because the mounting medium is non-fluorescent. Remnant lipid structures (e.g. sporinite and alginite) within the unstructured kerogen can often be identified in blue light.

Maturity calculations are made from the vitrinite reflectance histograms. Decisions as to which reflectance measurements indicate the maturity of the sample are based not only on the histogram but on all of the kerogen descriptive elements as well. Because it is not done at the time of measurement, alternate maturity calculations can be made if kerogen data and geological information dictate.

In summary, vitrinite reflectance measurements are performed on a polished plug in reflected light, TAI is performed on a slide in transmitted light, and kerogen typing is estimated from both preparations using a combination of reflected, transmitted, and fluorescent light techniques. Fluorescence in blue light is used to enhance the identification of structured and unstructured lipid material, solid bitumens, and drilling mud contaminants. Fluorescence also correlates with the maturity and state of preservation of the sample. Maturity calculations from measured reflectance data are made from the histograms and are influenced by all of the kerogen data.

VISUAL KEROGEN ANALYSIS GLOSSARY

Several key definitions are included in this glossary in order to make our reports more self-explanatory. In our reports, we refer to organic substances as macerals. Macerals are akin to minerals in rock, in that they are organic constituents that have microscopically recognizable characteristics. However, macerals vary widely in their chemical and physical properties, and they are not crystalline.

1. UNSTRUCTURED KEROGEN, or sometimes called structureless organic matter (SOM) and bituminite; it is widely held that unstructured kerogen represents the bacterial breakdown of lipid material. It also includes fecal pellets, minute particles of algae, organic gels, and may contain a humic component. As described on the first page of this section, unstructured lipid kerogen changes character during maturation. The three principal stages are amorphous, massive, and micrinized. Amorphous kerogen is simply without any structure. Massive kerogen has taken on a cohesive structure, as the result of polymerization during the process of oil generation. At high maturity, unstructured kerogen becomes micrinized. Micrinite is characterized optically by an aggregation of very small (less than one micron) round bodies that make up the kerogen.

2. STRUCTURED LIPID KEROGEN consists of a group of macerals which have a recognized structure, and can be related to the original living tissue from which they were derived. There are many different types, and the types can be grouped follows:
    a. Alginite, derived from algae. It is sometimes very useful to distinguish the different algal types, for botryococcus and pediastrum are associated with lacustrine and non-marine source rocks, while algae such as tasmanites, gloecapsomorpha, and nostocopsis are typically marine. Acritarchs and dinoflaggelates are marine organisms which are also included in the algal category.

b. Cutinite, derived from plant cuticles, the remains of leaves.
c. Resinite, (including fluorinite) derived from plant resins, balsams, latexes, and waxes.
d. Sporinite, derived from spores and pollen from a wide variety of land plants.
e. Suberinite is derived from the corky tissue of land plants.
f. Liptodetrinite is that structured lipid material that is too small to be specifically identified. Usually, it is derived from alginite or sporinite.
g. Undifferentiated. At times, one can readily distinguish structured lipid material from the unstructured without being able to make a specific determination of the structured material.

The algae are an important part of many oil source rocks, both marine and lacustrine. Alginite has a very high hydrogen index in Rock-Eval pyrolysis. Resins, cuticles, and suberinite contribute to the waxy, non-marine oils that are found in Africa and the Far East. At vitrinite reflectance levels above R_o 1.2 - 1.4%, structured lipid kerogen changes structure and it becomes very difficult to distinguish them from vitrinite.

3. SOLID BITUMEN, also called migrabitumen and solid hydrocarbon. In 1992, the International Committee for Coal and Organic Petrology (ICCP) has decided to include solid bitumen in the Exsudatinite group. Solid bitumens are expelled hydrocarbon products which have particular morphology, reflectance and fluorescence properties which make it possible to identify them. They represent two classes of substances: one which is present at or near the place where it was generated, and second as a substance which is present in a reservoir rock and may have migrated a great distance from its point of origin. The solid bitumens have been given names, such as gilsonite, impsonite, grahamite, etc., but they represent generated heavy hydrocarbons which remain in place in the source rock or have migrated into a reservoir and mature along with the rock. Consequently, it is possible to use the reflectance of solid bitumens for maturation determinations when vitrinite is not present.

4. HUMIC TISSUE, that is organic material derived from the woody tissue of land plants. The most important of this group is:

   a. Vitrinite is derived from woody tissue, which has been subjected to a minimum amount of oxidation. Normally, it is by far the most abundant maceral in humic coals, and because the rate of change of vitrinite reflectance is at a more even pace than it is for other macerals, it offers the best means of obtaining thermal maturity data in coals and other types of sedimentary rocks.

Because the measurement of vitrinite is so important, care is taken to distinguish normal (fresh, unaltered) vitrinite from other kinds of vitrinite. Rough vitrinite does not take a good polish and therefore may not yield good data. Oxidized vitrinite may have a reflectance higher or lower than fresh vitrinite; this is a problem often encountered in outcrop samples. Lipid-rich vitrinite, or saprovitrinite, has a lower reflectance than normal vitrinite, and will produce an abnormally low thermal maturity value. Coked vitrinite is vitrinite that has structures found in vitrinite heated in a coke oven. Naturally coked vitrinite is the product of very rapid heating, such as that found adjacent to intrusions. Where it is possible to do so, vitrinite derived from an uphole portion of a well will be identified as caved vitrinite. Recycled vitrinite is the vitrinite of higher maturity which clearly can be separated from the indigenous first-cycle vitrinite population. Often, the recycled vitrinite merges in with the inert group.

b. Inertinite is made up of woody tissue that has been matured by a different pathway. Early intense oxidation, usually involving charring, fungal attack, biochemical gelification, creates the much more highly reflecting fusinite and semi-fusinite. Sometimes the division between vitrinite and fusinite is transitional. Sclerotinite, fungal remains having a distinct morphology are considered to be inert. An important consideration is that the inerts, as the name implies, are largely non- reactive, "dead carbon", and they have an extremely low hydrogen index in Rock-Eval pyrolysis.

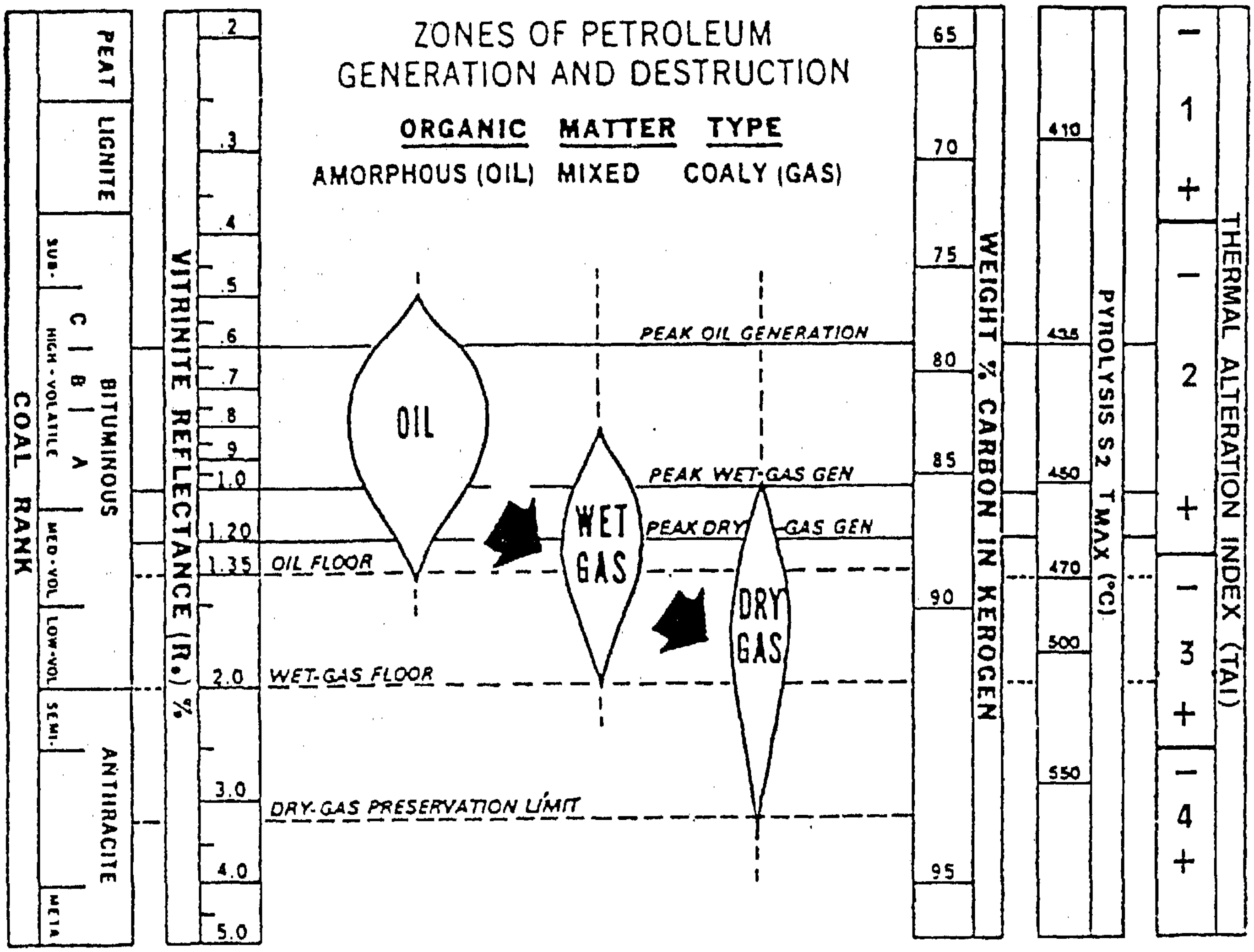
5. OTHER ORGANIC MATERIAL

a. In the table, we have put lipid-rich, caved and recycled vitrinite in this section so that we could show the percentages of these macerals; they are described above.

b. Exsudatinite. Oil and oily exudates fall in this group. Exsudatinite differs from the solid bitumens on the basis of mobility and solubility. We prefer to maintain this distinction although the ICCP has now included the solid bitumens in with the Exsudatinite group.

c. Graptolites are marine organisms that range from the Cambrian to the lower Mississippian; it has been found that they have a reflectance similar to that of vitrinite. Because vitrinite is lacking in early Paleozoic rocks, the proper identification and measurement of graptolites is important in these sediments.

6. PYRITE. Various forms of pyrite can be readily identified under the microscope. Euhedral is pyrite with a definite crystalline habit. Framboidal is pyrite in the form of grape-like clusters which are made up of euhedral to subhedral crystals. Framboidal pyrite is normally found in sediments with a marine influence; for example, coals with a marine shale roof rock usually contain framboidal pyrite. Massive pyrite is pyrite with no particular external form; often this is pyrite that forms rather late in the pore spaces of the sediment. Replacement/infilling is self-explanatory.



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

#1 EKVIK

DGSI

Project: DGSI/94/2879

DATE: 2/9/94

DGSI NUMBER	DEPTH IN FEET	SAMPLE TYPE	Lipids, Unstructured: UNDIFFERENTIATED (%)	Lipids, Unstructured: AMORPHOUS (%)	Lipids, Unstructured: MASSIVE (%)	Lipids, Unstructured: MICRINIZED (%)	Lipids, Structured: TYPE / (%)	Lipids, Structured: TYPE / (%)	Lipids, Structured: TYPE / (%)	Lipids, Structured: TYPE / (%)	Lipids, Structured: SOLID BITUMEN (%)	Humic: INERTINITE (%)	Humic: VITRINITE (%)	Other: TYPE / (%)	Other: TYPE / (%)	PYRITE TYPE	PYRITE	TOTAL ORGANIC MATTER	Vitrinite: NORMAL	Vitrinite: ROUGH	Vitrinite: LIPID-RICH	Vitrinite: OXIDIZED	Vitrinite: COKED	Reflected, Unstr.: COLOR	Reflected, Unstr.: INTENSITY	Reflected, Stru.: COLOR	Reflected, Stru.: INTENSITY	BACKGROUND INTENSITY	Transmitted, Unstr.: TAI VALUE	Transmitted, Unstr.: FLUOR. COLOR	Transmitted, Unstr.: FLUOR. INTENSITY	Transmitted, Stru.: TAI VALUE	Transmitted, Stru.: FLUOR. COLOR	Transmitted, Stru.: FLUOR. INTENSITY	Ro: VITRINITE REFLECTANCE Maturity or Equivalent
1	90 - 210	CTG K			10	LD T	SB T	C 10	S T			20	55	VL 5		MA	T	+	+		-			B	1	O Y	1 4	0	n.d.				O Y	1 4	0.31
Comments:	Unstructured kerogen difficult to identify in slide.																																		
2	1020 - 1140	CTG K		10			LD 5	S T				5	75	VL 5	VR T	MA	M	+	+	-	-	-		DB O	1	O	2	1	n.d.			2	O BL	2 0	0.33
Comments:	Some light oxidation.																																		
3	1950 - 2070	CTG K		10			LD 10	C 10	S T			10	55	VL 5	VR T	MA	M	+	M	M	-			O B	1	O Y	2 4	0 1	n.d.			1	O Y	2 3	0.37
Comments:																																			
4	2760 - 2880	CTG K			15		LD 5	C 10	R T	S T	? 5	20	45			MA	M	+	+	-				DB	1	O Y	1 4	1	n.d.			O	1	2	0.43
Comments:	Bituminite?																																		
5	3570 - 3690	CTG K			30		LD 5					10	50		VR 5	MA	M	+	M	M		M		B	1	O Y	1 4	1	2	O	1		O	2	0.39
Comments:	Some light oxidation rims.																																		

ANALYST

____ Castano
__X__ O'Connor

MICROSCOPE

____ Jena
__X__ Zeiss

SAMPLE TYPE/PREP
- CTG Cuttings
- CC Conv. Core
- SWC SideWallCore
- OC Outcrop
- NI No Inform.
- C Coal
- K Kerogen
- WR Whole Rock
- n.d. Not Determ.

STRUCTURED LIPIDS
- AL Alginite
- SB Suberinite
- C Cutinite
- LD Liptodetrinite
- U Undiffer.
- S Sporinite
- R Resinite
- O Other

OTHER ORGANIC MATTER
- E Exsudatinite
- G Graptolites
- VL Lipid-Rich Vitrinite
- VC VitriniteContamination
- VR Recycled Vitrinite

PYRITE
- E Euhedral
- F Framboid
- MA Massive
- RI Replace-infill

ABUND.
- N None
- T Trace
- \- Small Amt.
- M Med. Amt.
- \+ Large Amt.
- ++ Abundant

FLUOR. INTENS.
- 0 None
- 1 Weak
- 2 Moderate
- 3 Strong
- 4 Intense

VIT. REFLECT. EQUIVALENCE
- B Bitumen
- G Graptolites
- VL Lipid-Rich Vitrinite
- VC Vitrinite Contam.
- VR Recycled Vitrinite

FLUOR. COLOR
- W White
- G Green
- Y Yellow
- O Orange
- R Red
- B Brown
- BL Black
- L Light
- D Dark

TAI COLOR VALUES
- 1- Straw Yellow
- 1 Pale Yellow
- 1+ Yellow
- 2- Yellow-Orange
- 2 Golden
- 2+ Amber
- 3- Reddish Brown
- 3 Medium Brown
- 3+ Dark Brown
- 4- Brown-Black
- 4 Black
- 4+ Black-Opaque

VISUAL KEROGEN ANALYSIS
Total Quality Geochemistry

#1 EKVIK

DGSI

Project: DGSI/94/2879

DATE: 2/9/94

DGSI NUMBER	DEPTH IN FEET	SAMPLE TYPE	ORGANIC MATTER – LIPIDS – UNSTRUCTURED: UNDIFFERENTIATED (%)	AMORPHOUS (%)	MASSIVE (%)	MICRINZED (%)	LIPIDS – STRUCTURED: TYPE / (%)	TYPE / (%)	TYPE / (%)	TYPE / (%)	SOLID BITUMEN (%)	HUMIC: INERTINITE (%)	VITRINITE (%)	OTHER: TYPE / (%)	TYPE / (%)	RELATIVE ABUNDANCE: PYRITE TYPE	PYRITE	TOTAL ORGANIC MATTER	VITRINITE: NORMAL	ROUGH	LIPID-RICH	OXIDIZED	COKED	FLUORESCENCE / TAI – REFLECTED – LIPIDS – UNSTR.: COLOR	INTENSITY	STRU.: COLOR	INTENSITY	BACKGROUND INTENSITY	TRANSMITTED – LIPIDS – UNSTR.: TAI VALUE	FLUOR. COLOR	INTENSITY	STRU.: TAI VALUE	FLUOR. COLOR	INTENSITY	Ro: VITRINITE REFLECTANCE Maturity or Equivalent
6	4530 - 4650	CTG K			45		LD 5					10	30	VL 5	VR 5	MA F	M	+	M	M	-	M		B DB	1	O Y	1 2	2	2	OB	1		O Y	2	0.42
Comments:	Rough, dark oxidation. Nutshell contamination.																																		
7	4739 - 4894	CC K			20		LD 5	S T			T	15	45		VR 15	F MA	M	+	+	-		-		DB	1	O Y	1 2	2	2	O BL	1 0	2- 2	Y YO	2 3	0.46
Comments:																																			
8	5190 - 5310	CTG K			40		LD 5					10	30	VL 5	VR 10	F MA	M	+	M	M	-	-		DB D	1	O Y	1 2	2	2	OB	1		O Y	2 3	0.46
Comments:	Dark oxidation.																																		
9	5970 - 6100	CTG K			20		LD 5				5	10	45	VL 5	VR 10	F	M	+	M	M	-	M		DB	1	O	2	3	2	OB	1		O Y	2	0.55
Comments:	Same. Large fragments solid bitumen - Ro 0.03 - 0.28.																																		
	-																																		
Comments:																																			

ANALYST

____ Castano
_X_ O'Connor

MICROSCOPE

____ Jena
_X_ Zeiss

SAMPLE TYPE/PREP
- CTG Cuttings
- CC Conv. Core
- SWC SideWallCore
- OC Outcrop
- NI No Inform.
- C Coal
- K Kerogen
- WR Whole Rock
- n.d. Not Determ.

STRUCTURED LIPIDS
- AL Alginite
- SB Suberinite
- C Cutinite
- LD Liptodetrinite
- U Undiffer.
- S Sporinite
- R Resinite
- O Other

OTHER ORGANIC MATTER
- E Exsudatinite
- G Graptolites
- VL Lipid-Rich Vitrinite
- VC VitriniteContamination
- VR Recycled Vitrinite

PYRITE
- E Euhedral
- F Framboid
- MA Massive
- RI Replace-infill

ABUND.
- N None
- T Trace
- \- Small Amt.
- M Med. Amt.
- \+ Large Amt.
- ++ Abundant

FLUOR. INTENS.
- 0 None
- 1 Weak
- 2 Moderate
- 3 Strong
- 4 Intense

VIT. REFLECT. EQUIVALENCE
- B Bitumen
- G Graptolites
- VL Lipid-Rich Vitrinite
- VC Vitrinite Contam.
- VR Recycled Vitrinite

FLUOR. COLOR
- W White
- G Green
- Y Yellow
- O Orange
- R Red
- B Brown
- BL Black
- L Light
- D Dark

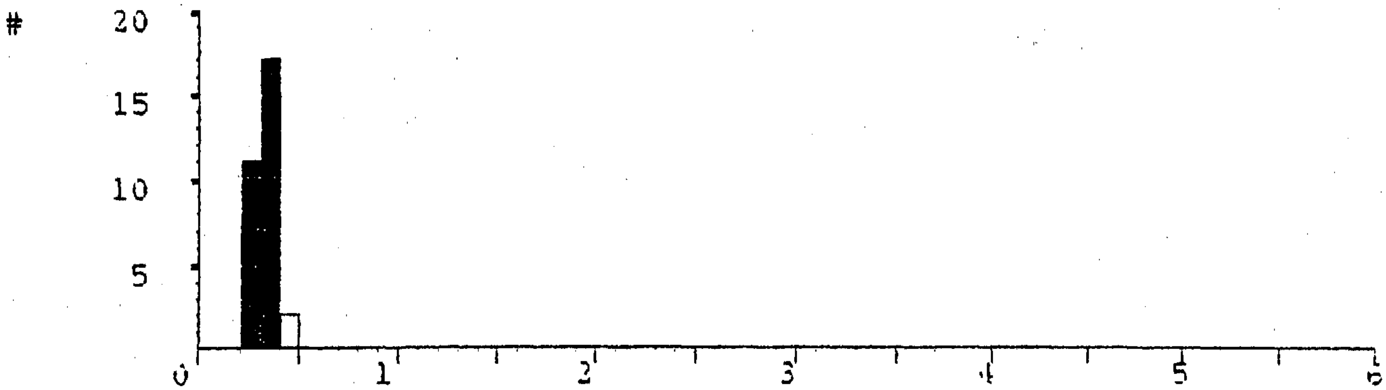
TAI COLOR VALUES
- 1- Straw Yellow
- 1 Pale Yellow
- 1+ Yellow
- 2- Yellow-Orange
- 2 Golden
- 2+ Amber
- 3- Reddish Brown
- 3 Medium Brown
- 3+ Dark Brown
- 4- Brown-Black
- 4 Black
- 4+ Black-Opaque

VISUAL KEROGEN ANALYSIS
Total Quality Geochemistry

#1 EKVIK

90 - 210 ft. CTG KEROGEN

INTERPRETED MATURITY : 0.31 Ro Std. Dev. : 0.05 No. Readings : 28



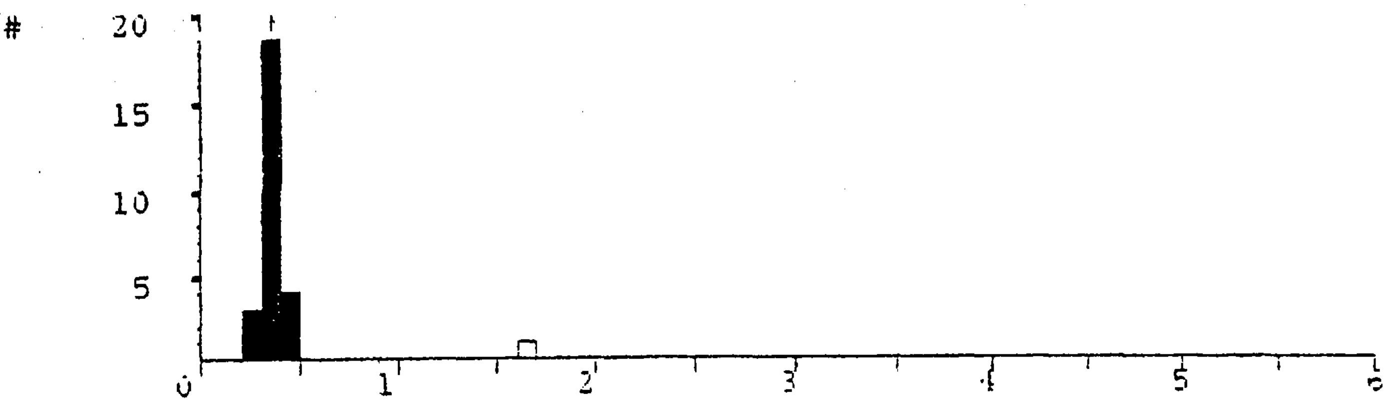
* = Maturity Values REFLECTANCE VALUES

*0.23	*0.29	*0.35
*0.24	*0.30	*0.35
*0.25	*0.30	*0.35
*0.25	*0.30	*0.36
*0.25	*0.30	*0.38
*0.26	*0.31	*0.38
*0.26	*0.31	*0.39
*0.26	*0.32	*0.39
*0.29	*0.33	0.40
*0.29	*0.35	0.40

#1 EKVIK

1020 - 1140 ft. CTG KEROGEN

INTERPRETED MATURITY : 0.33 Ro Std. Dev. : 0.05 No. Readings : 30



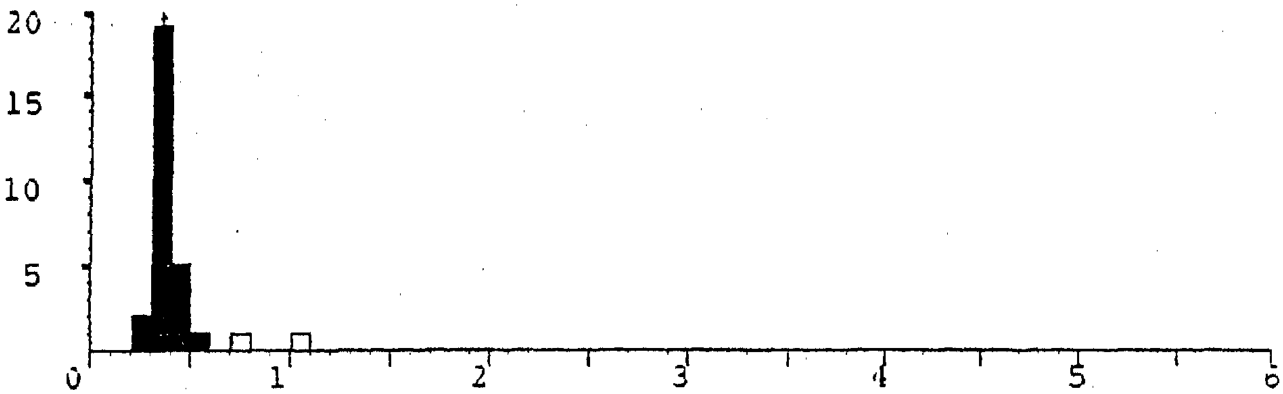
* = Maturity Values REFLECTANCE VALUES

*0.23	*0.31	*0.34	1.61
*0.29	*0.31	*0.34	
*0.29	*0.31	*0.35	
*0.30	*0.31	*0.36	
*0.30	*0.31	*0.38	
*0.30	*0.32	*0.38	
*0.30	*0.32	*0.41	
*0.30	*0.33	*0.43	
*0.30	*0.33	*0.43	
*0.30	*0.33	*0.49	

#1 EKVIK

1950 - 2070 ft.   CTG   KEROGEN

INTERPRETED MATURITY : 0.37 Ro   Std. Dev. : 0.06   No. Readings : 33



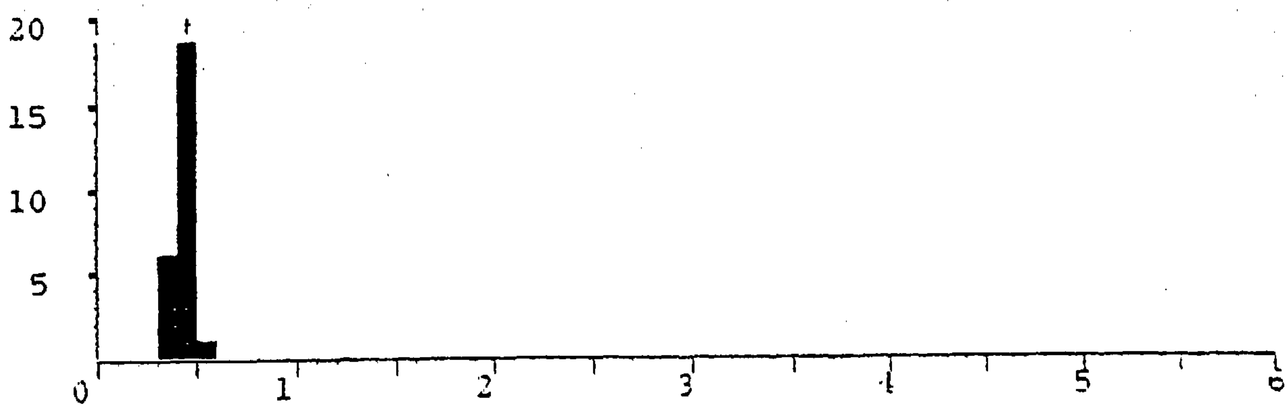
* = Maturity Values   REFLECTANCE VALUES

*0.26	*0.34	*0.37	*0.44
*0.28	*0.34	*0.37	*0.46
*0.31	*0.34	*0.37	*0.59
*0.32	*0.35	*0.38	0.79
*0.32	*0.35	*0.39	1.04
*0.33	*0.36	*0.39	
*0.33	*0.36	*0.39	
*0.33	*0.36	*0.40	
*0.34	*0.36	*0.41	
*0.34	*0.37	*0.44	

#1 EKVIK

2760 - 2880 ft.   CTG   KEROGEN

INTERPRETED MATURITY : 0.43 Ro   Std. Dev. : 0.05   No. Readings : 35



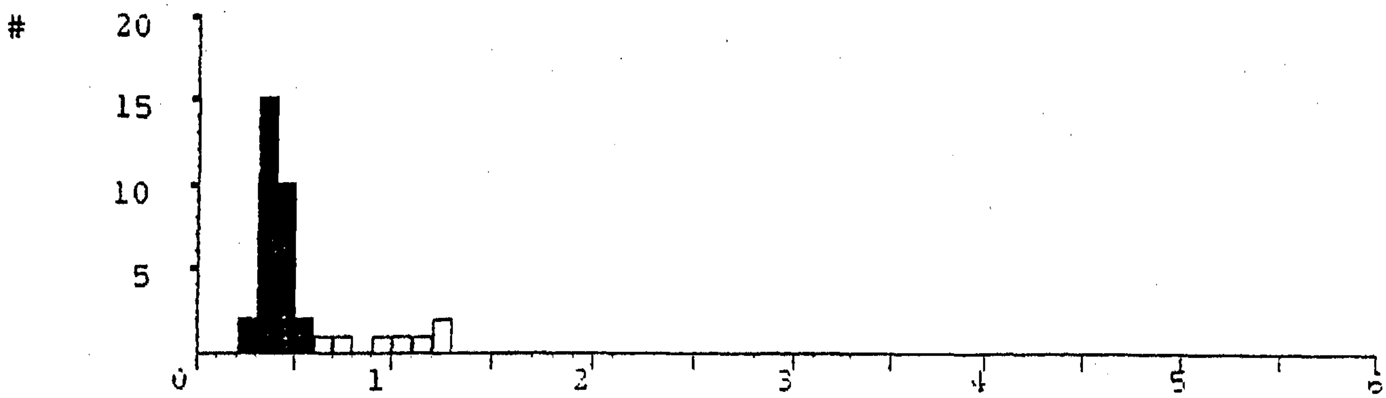
* = Maturity Values   REFLECTANCE VALUES

*0.33	*0.41	*0.45	*0.46
*0.34	*0.41	*0.45	*0.48
*0.37	*0.42	*0.45	*0.48
*0.39	*0.42	*0.45	*0.49
*0.39	*0.43	*0.46	*0.58
*0.39	*0.43	*0.46	
*0.40	*0.43	*0.46	
*0.40	*0.44	*0.46	
*0.40	*0.44	*0.46	
*0.40	*0.45	*0.46	

#1 EKVIK

3570 - 3690 ft.   CTG   KEROGEN

INTERPRETED MATURITY : 0.39 Ro   Std. Dev. : 0.07   No. Readings : 29



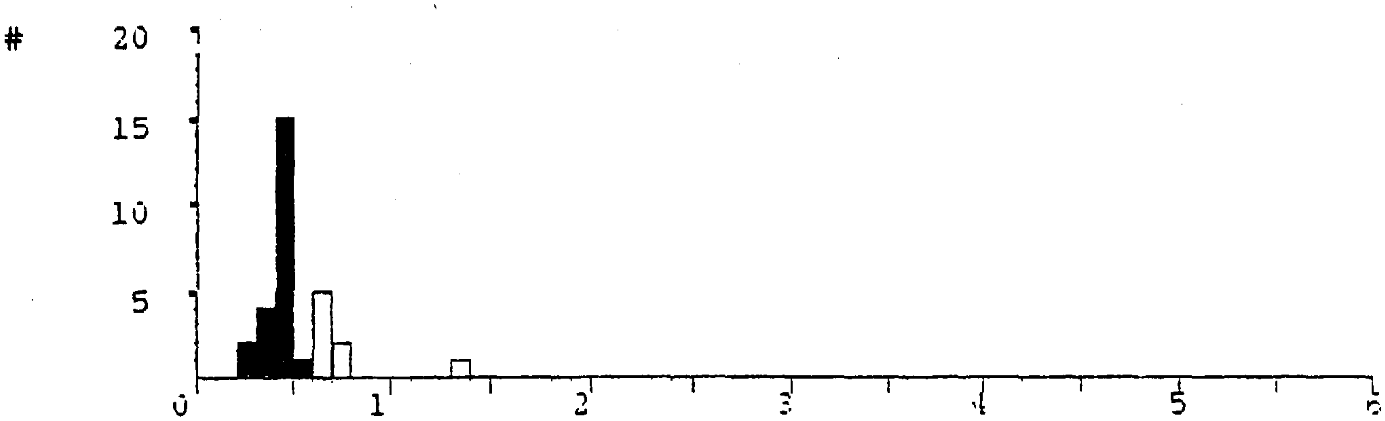
* = Maturity Values   REFLECTANCE VALUES

*0.26	*0.36	*0.42	0.74
*0.27	*0.36	*0.43	0.90
*0.30	*0.38	*0.44	1.02
*0.31	*0.38	*0.44	1.17
*0.33	*0.39	*0.45	1.22
*0.33	*0.39	*0.45	1.26
*0.34	*0.39	*0.48	
*0.35	*0.41	*0.50	
*0.35	*0.42	*0.54	
*0.35	*0.42	0.66	

#1 EKVIK

4530 - 4650 ft.   CTG   KEROGEN

INTERPRETED MATURITY : 0.42 Ro   Std. Dev. : 0.07   No. Readings : 22



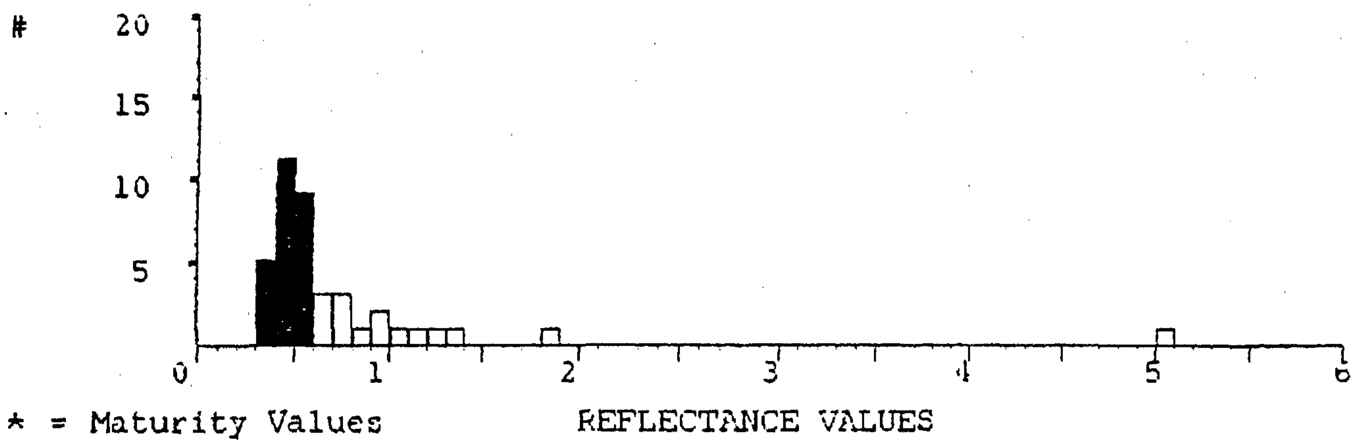
* = Maturity Values   REFLECTANCE VALUES

*0.29	*0.42	*0.49
*0.29	*0.43	*0.57
*0.35	*0.43	0.61
*0.36	*0.44	0.62
*0.37	*0.44	0.64
*0.37	*0.44	0.66
*0.41	*0.46	0.67
*0.41	*0.47	0.70
*0.42	*0.49	0.78
*0.42	*0.49	1.35

#1 EKVIK

4739 - 4894 ft.   CORE   KEROGEN

INTERPRETED MATURITY : 0.46 Ro   Std. Dev. : 0.06   No. Readings : 25



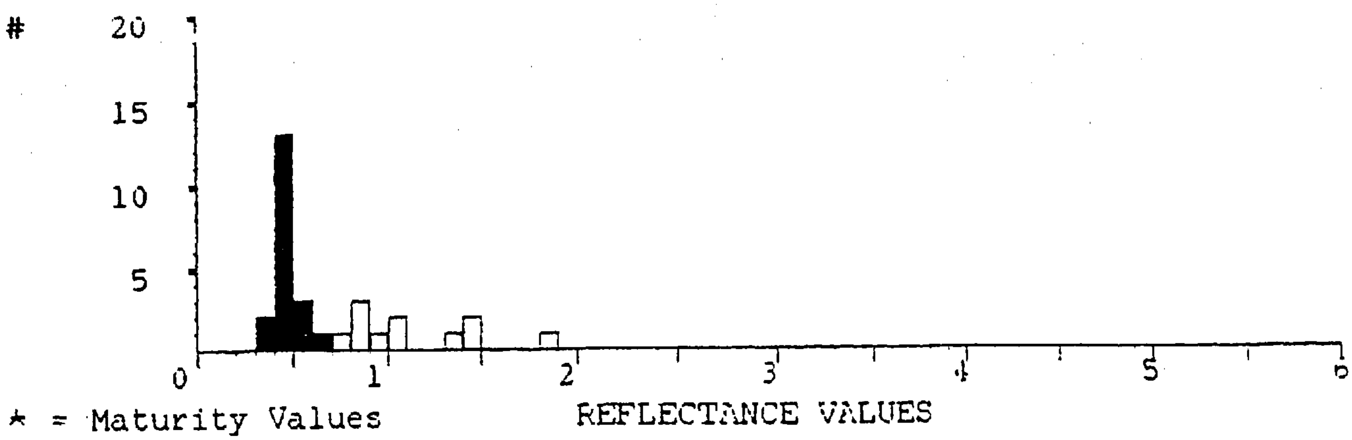
* = Maturity Values

*0.37	*0.43	*0.53	0.79
*0.38	*0.43	*0.54	0.82
*0.39	*0.43	*0.54	0.92
*0.39	*0.45	*0.55	0.93
*0.39	*0.45	*0.56	1.04
*0.41	*0.48	0.64	1.11
*0.41	*0.50	0.66	1.25
*0.41	*0.50	0.67	1.35
*0.42	*0.51	0.70	1.86
*0.42	*0.51	0.77	5.09

#1 EKVIK

5190 - 5310 ft.   CTG   KEROGEN

INTERPRETED MATURITY : 0.46 Ro   Std. Dev. : 0.05   No. Readings : 19



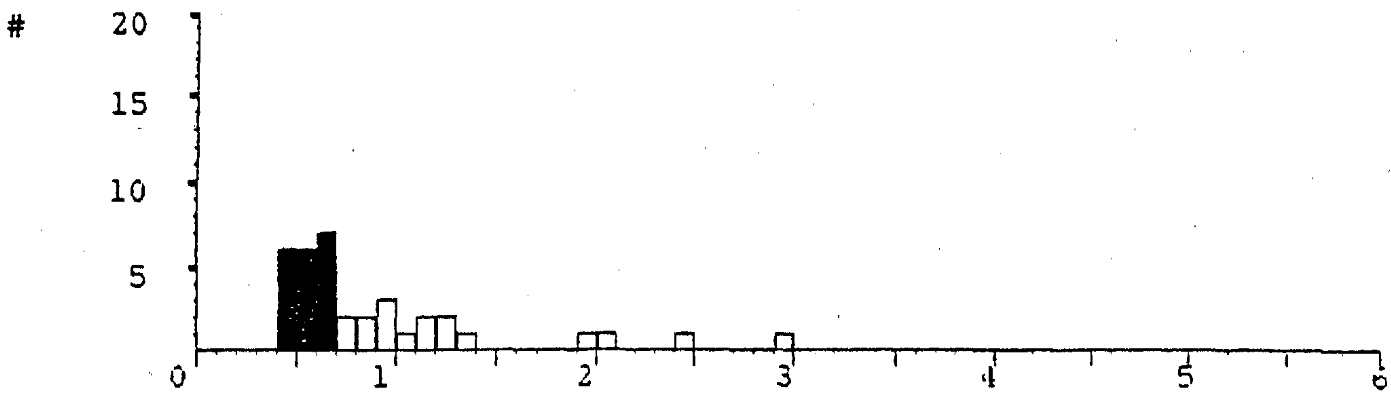
* = Maturity Values

*0.38	*0.46	0.83
*0.39	*0.46	0.83
*0.41	*0.46	0.84
*0.41	*0.47	0.92
*0.41	*0.49	1.01
*0.42	*0.52	1.07
*0.42	*0.52	1.37
*0.44	*0.52	1.43
*0.45	*0.60	1.43
*0.46	0.73	1.85

#1 EKVIK

5970 - 6100 ft. CTG KEROGEN

INTERPRETED MATURITY : 0.55 Ro Std. Dev. : 0.08 No. Readings : 19



* = Maturity Values REFLECTANCE VALUES

*0.41	*0.59	0.76	1.27
*0.44	*0.59	0.84	1.36
*0.45	*0.60	0.85	1.93
*0.46	*0.60	0.91	2.02
*0.47	*0.61	0.92	2.41
*0.49	*0.64	0.97	2.97
*0.50	*0.66	1.09	
*0.53	*0.68	1.15	
*0.54	*0.68	1.18	
*0.55	0.74	1.24	

DGSI

#1 KUPARUK

Project: DGSI/94/2879

DATE: 2/15/94

DGSI NUMBER	DEPTH IN FEET	SAMPLE TYPE	ORGANIC MATTER – LIPIDS – UNSTRUCTURED: UNDIFFERENTIATED (%)	AMORPHOUS (%)	MASSIVE (%)	MICRINIZED (%)	LIPIDS – STRUCTURED: TYPE / (%)	TYPE / (%)	TYPE / (%)	TYPE / (%)	SOLID BITUMEN (%)	HUMIC: INERTINITE (%)	VITRINITE (%)	OTHER: TYPE / (%)	TYPE / (%)	RELATIVE ABUNDANCE: PYRITE TYPE	PYRITE	TOTAL ORGANIC MATTER	VITRINITE: NORMAL	ROUGH	LIPID-RICH	OXIDIZED	COKED	FLUORESCENCE / TAI – REFLECTED – LIPIDS – UNSTR.: COLOR	INTENSITY	STRU.: COLOR	INTENSITY	BACKGROUND INTENSITY	TRANSMITTED – LIPIDS – UNSTR.: TAI VALUE	FLUOR. COLOR	FLUOR. INTENSITY	STRU.: TAI VALUE	FLUOR. COLOR	FLUOR. INTENSITY	Ro: VITRINITE REFLECTANCE Maturity or Equivalent
10	300 - 400	CTG K			10		LD 5	S 5				20	60			MA F	M	+	M	M		-		B	1	O	1 2	1	n.d.			2- 2	O Y	2	0.41
Comments:																																			
11	1200 - 1300	CTG K			35		LD 5	S T	C 5			20	35			F MA	M	+	M	M		M		DB	1	O	1	2 3	2	BL O	0 1	2	O Y	1 2	0.72
Comments: *Trace nutshell contamination.*																																			
12	2100 - 2200	CTG K			35		LD 5				T	20	40			F MA	M	+	M	M		M		DB BL	1 0	O	1	2 3	2+	BL	0		O	1 2	0.51
Comments:																																			
13	2900 - 3000	CTG K			35		LD 5				T	20	40			F MA	M	+	M	M		M		DB BL	1 0	O	1	3	2 2+	BL	0		O	1 2	0.54
Comments: *Trace nutshell contamination.*																																			
14	3700 - 3800	CTG K	15				LD 5				T	20	60			MA	M	M	M	M		M		DB	1	O	2	2	n.d.				O	1 2	0.52
Comments:																																			

ANALYST

___ Castano
_X_ O'Connor

MICROSCOPE

___ Jena
_X_ Zeiss

SAMPLE TYPE/PREP
- CTG Cuttings
- CC Conv. Core
- SWC SideWallCore
- OC Outcrop
- NI No Inform.
- C Coal
- K Kerogen
- WR Whole Rock
- n.d. Not Determ.

STRUCTURED LIPIDS
- AL Alginite
- SB Suberinite
- C Cutinite
- LD Liptodetrinite
- U Undiffer.
- S Sporinite
- R Resinite
- O Other

OTHER ORGANIC MATTER
- E Exsudatinite
- G Graptolites
- VL Lipid-Rich Vitrinite
- VC VitriniteContamination
- VR Recycled Vitrinite

PYRITE
- E Euhedral
- F Framboid
- MA Massive
- RI Replace-infill

ABUND.
- N None
- T Trace
- \- Small Amt.
- M Med. Amt.
- \+ Large Amt.
- ++ Abundant

FLUOR. INTENS.
- 0 None
- 1 Weak
- 2 Moderate
- 3 Strong
- 4 Intense

VIT. REFLECT. EQUIVALENCE
- B Bitumen
- G Graptolites
- VL Lipid-Rich Vitrinite
- VC Vitrinite Contam.
- VR Recycled Vitrinite

FLUOR. COLOR
- W White
- G Green
- Y Yellow
- O Orange
- R Red
- B Brown
- BL Black
- L Light
- D Dark

TAI COLOR VALUES
- 1- Straw Yellow
- 1 Pale Yellow
- 1+ Yellow
- 2- Yellow-Orange
- 2 Golden
- 2+ Amber
- 3- Reddish Brown
- 3 Medium Brown
- 3+ Dark Brown
- 4- Brown-Black
- 4 Black
- 4+ Black-Opaque

VISUAL KEROGEN ANALYSIS
Total Quality Geochemistry

GMC Data Report No. 224

#1 KUPARUK

DGSI

Project: DGSI/94/2879

DATE: 2/15/94

DGSI NUMBER	DEPTH IN FEET	SAMPLE TYPE	ORGANIC MATTER: LIPIDS, UNSTRUCTURED: UNDIFFERENTIATED (%)	AMORPHOUS (%)	MASSIVE (%)	MICRINIZED (%)	LIPIDS, STRUCTURED: TYPE / (%)	TYPE / (%)	TYPE / (%)	TYPE / (%)	SOLID BITUMEN (%)	HUMIC: INERTINITE (%)	VITRINITE (%)	OTHER: TYPE / (%)	TYPE / (%)	RELATIVE ABUNDANCE: PYRITE TYPE	PYRITE	TOTAL ORGANIC MATTER	VITRINITE: NORMAL	ROUGH	LIPID-RICH	OXIDIZED	COKED	FLUORESCENCE / TAI, REFLECTED LIPIDS, UNSTR.: COLOR	INTENSITY	STRU.: COLOR	INTENSITY	BACKGROUND INTENSITY	TRANSMITTED LIPIDS, UNSTR.: TAI VALUE	FLUOR. COLOR	FLUOR. INTENSITY	STRU.: TAI VALUE	FLUOR. COLOR	FLUOR. INTENSITY	Ro: VITRINITE REFLECTANCE Maturity or Equivalent
15	4750 - 4850	CTG K			30		LD 5					20	45			F MA	M	M	M	M		-	T	DB	1	O	1	2	2 2+	O	1		O	2	70.66
Comments:	Trace of graphite-like fragments.																																		
16	5750 - 5850	CTG K		15			LD 10					10	65			F MA	M	M	M	M		-	T	OB	1	O Y	2	2	n.d.				O	1 2	0.49
Comments:	Same.																																		
17	6400 - 6500	CTG K			20		LD 10					20	50			F MA	M	+	M	M		-		DB	1	O	1 2	2 3	2+	OB BL	1 0		O	1 2	0.52
Comments:																																			
Comments:																																			
Comments:																																			

ANALYST

Castano
X O'Connor

MICROSCOPE

Jena
X Zeiss

SAMPLE TYPE/PREP

- CTG Cuttings
- CC Conv. Core
- SWC SideWallCore
- OC Outcrop
- NI No Inform.
- C Coal
- K Kerogen
- WR Whole Rock
- n.d. Not Determ.

STRUCTURED LIPIDS

- AL Alginite
- SB Suberinite
- C Cutinite
- LD Liptodetrinite
- U Undiffer.
- S Sporinite
- R Resinite
- O Other

OTHER ORGANIC MATTER

- E Exsudatinite
- G Graptolites
- VL Lipid-Rich Vitrinite
- VC VitriniteContamination
- VR Recycled Vitrinite

PYRITE

- E Euhedral
- F Framboid
- MA Massive
- RI Replace-infill

ABUND.

- N None
- T Trace
- \- Small Amt.
- M Med. Amt.
- \+ Large Amt.
- ++ Abundant

FLUOR. INTENS.

- 0 None
- 1 Weak
- 2 Moderate
- 3 Strong
- 4 Intense

VIT. REFLECT. EQUIVALENCE

- B Bitumen
- G Graptolites
- VL Lipid-Rich Vitrinite
- VC Vitrinite Contam.
- VR Recycled Vitrinite

FLUOR. COLOR

- W White
- G Green
- Y Yellow
- O Orange
- R Red
- B Brown
- BL Black
- L Light
- D Dark

TAI COLOR VALUES

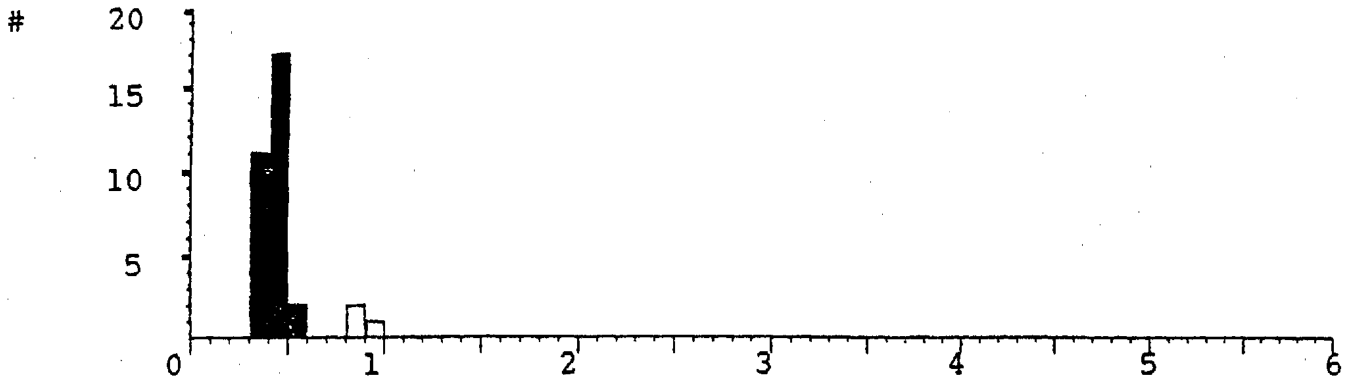
- 1- Straw Yellow
- 1 Pale Yellow
- 1+ Yellow
- 2- Yellow-Orange
- 2 Golden
- 2+ Amber
- 3- Reddish Brown
- 3 Medium Brown
- 3+ Dark Brown
- 4- Brown-Black
- 4 Black
- 4+ Black-Opaque

VISUAL KEROGEN ANALYSIS
Total Quality Geochemistry

#1 KUPARUK

300 - 400 ft. CTG KEROGEN

INTERPRETED MATURITY : 0.41 Ro Std. Dev. : 0.05 No. Readings : 30



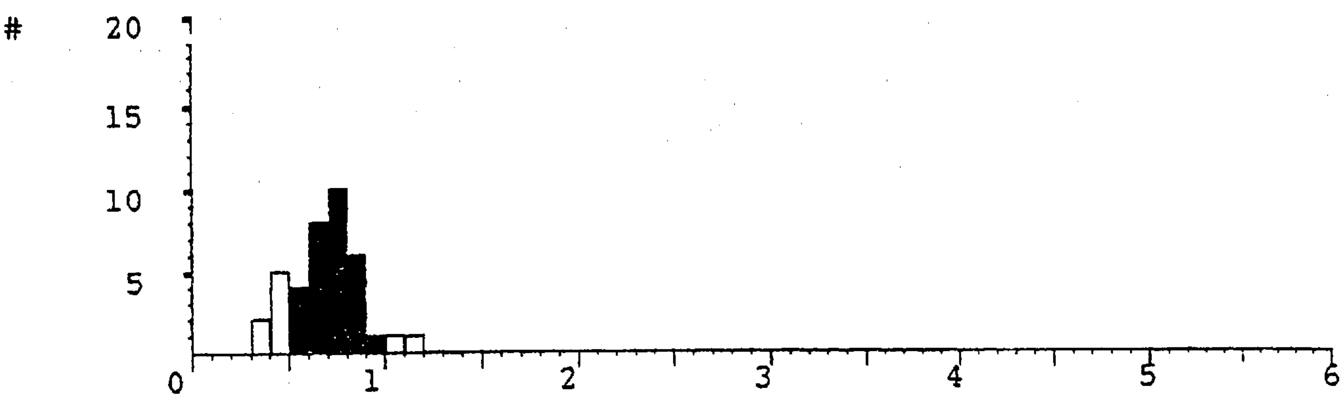
* = Maturity Values REFLECTANCE VALUES

*0.34	*0.39	*0.43	0.80
*0.34	*0.40	*0.44	0.82
*0.35	*0.40	*0.44	0.98
*0.36	*0.41	*0.44	
*0.37	*0.41	*0.44	
*0.37	*0.41	*0.45	
*0.37	*0.41	*0.46	
*0.38	*0.43	*0.48	
*0.39	*0.43	*0.50	
*0.39	*0.43	*0.59	

#1 KUPARUK

1200 - 1300 ft. CTG KEROGEN

INTERPRETED MATURITY : 0.72 Ro Std. Dev. : 0.11 No. Readings : 29



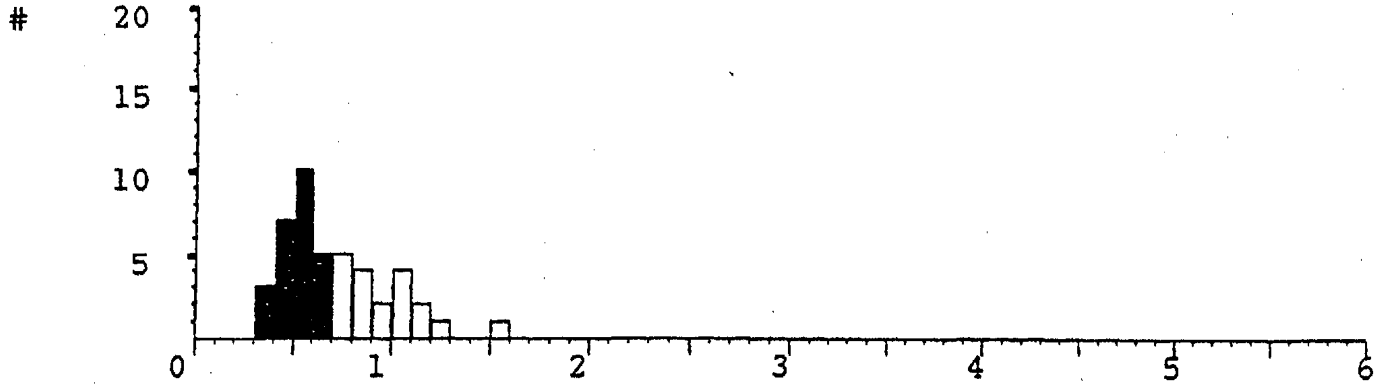
* = Maturity Values REFLECTANCE VALUES

0.35	*0.57	*0.71	*0.82
0.37	*0.60	*0.71	*0.86
0.41	*0.63	*0.71	*0.88
0.41	*0.64	*0.73	*0.89
0.43	*0.64	*0.73	*0.89
0.46	*0.66	*0.73	*0.90
0.46	*0.68	*0.76	1.03
*0.52	*0.69	*0.77	1.12
*0.54	*0.69	*0.79	
*0.56	*0.70	*0.82	

#1 KUPARUK

2100 - 2200 ft. CTG KEROGEN

INTERPRETED MATURITY : 0.51 Ro Std. Dev. : 0.10 No. Readings : 25



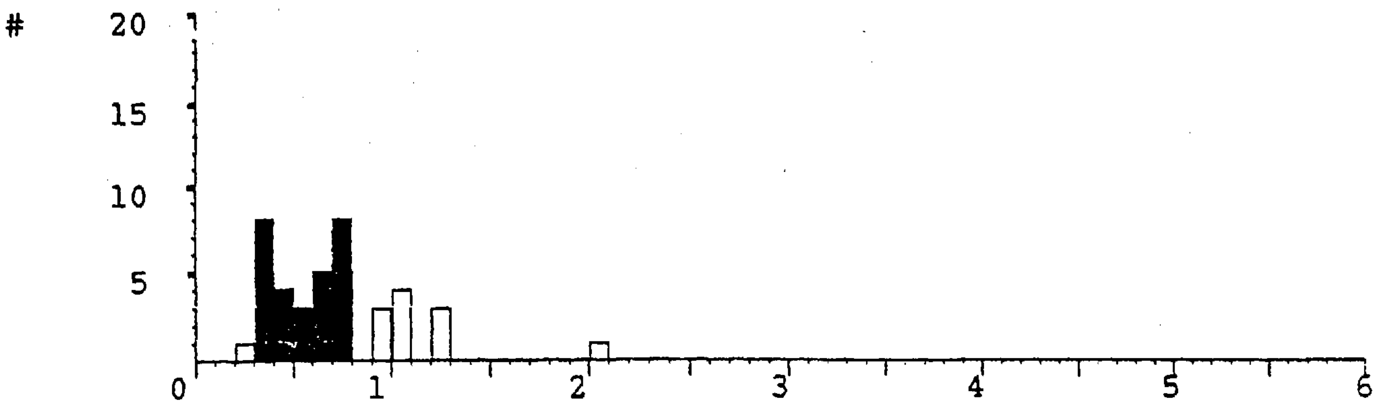
* = Maturity Values REFLECTANCE VALUES

*0.33	*0.52	*0.61	0.81	1.12
*0.34	*0.52	*0.61	0.85	1.15
*0.37	*0.53	*0.62	0.86	1.22
*0.40	*0.53	*0.64	0.88	1.50
*0.40	*0.54	*0.65	0.98	
*0.40	*0.55	0.75	0.99	
*0.43	*0.56	0.76	1.00	
*0.48	*0.59	0.77	1.04	
*0.48	*0.59	0.78	1.09	
*0.48	*0.59	0.79	1.09	

#1 KUPARUK

2900 - 3000 ft. CTG KEROGEN

INTERPRETED MATURITY : 0.54 Ro Std. Dev. : 0.17 No. Readings : 28



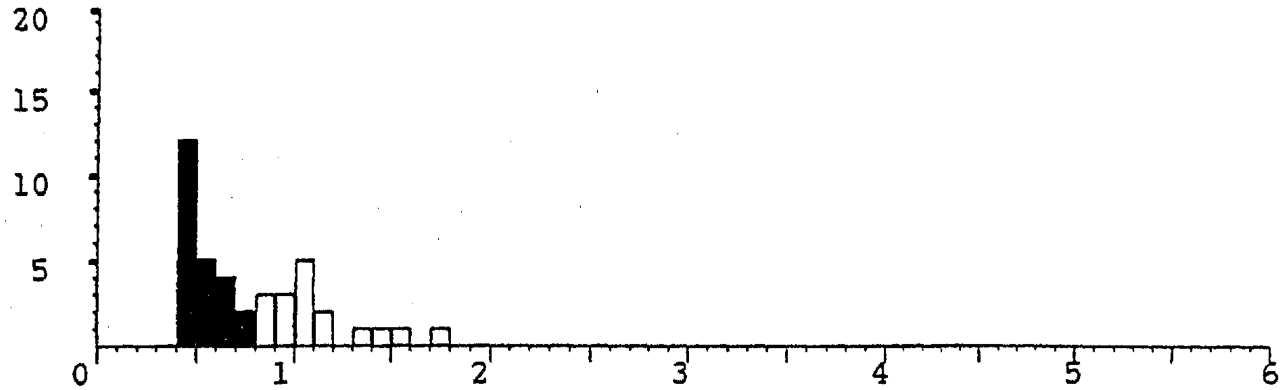
* = Maturity Values REFLECTANCE VALUES

0.24	*0.44	*0.62	0.93
*0.31	*0.47	*0.70	0.97
*0.32	*0.49	*0.71	1.02
*0.32	*0.51	*0.72	1.04
*0.33	*0.58	*0.76	1.06
*0.33	*0.59	*0.76	1.09
*0.34	*0.60	*0.76	1.20
*0.34	*0.62	*0.78	1.21
*0.35	*0.62	*0.78	1.27
*0.40	*0.62	0.92	2.05

#1 KUPARUK

3700 - 3800 ft. CTG KEROGEN

INTERPRETED MATURITY : 0.52 Ro Std. Dev. : 0.10 No. Readings : 23



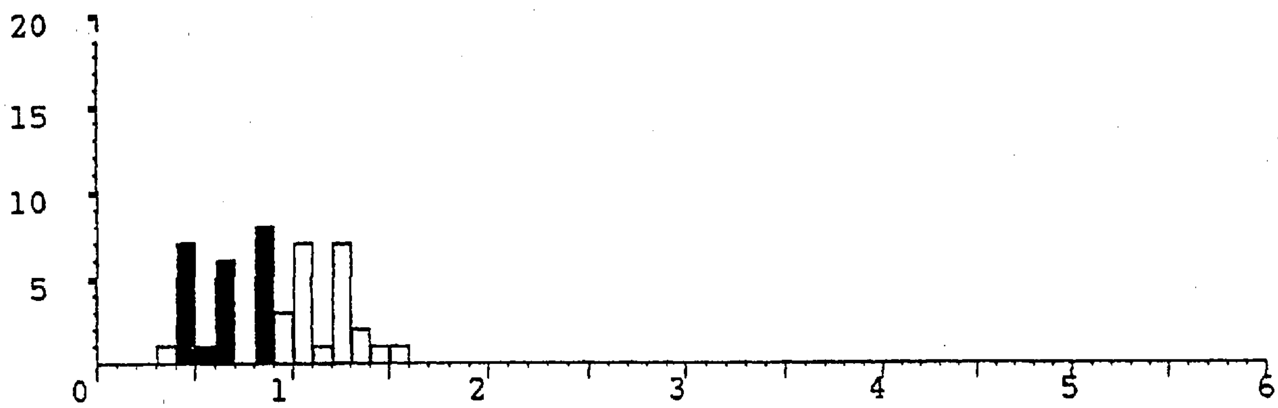
* = Maturity Values REFLECTANCE VALUES

*0.40	*0.46	*0.65	1.02
*0.43	*0.48	*0.71	1.07
*0.44	*0.50	*0.72	1.07
*0.44	*0.51	0.86	1.07
*0.44	*0.54	0.86	1.14
*0.45	*0.54	0.87	1.18
*0.45	*0.59	0.90	1.32
*0.46	*0.61	0.90	1.40
*0.46	*0.63	0.99	1.56
*0.46	*0.64	1.01	1.76

#1 KUPARUK

4750 - 4850 ft. CTG KEROGEN

INTERPRETED MATURITY : 0.66 Ro Std. Dev. : 0.18 No. Readings : 22



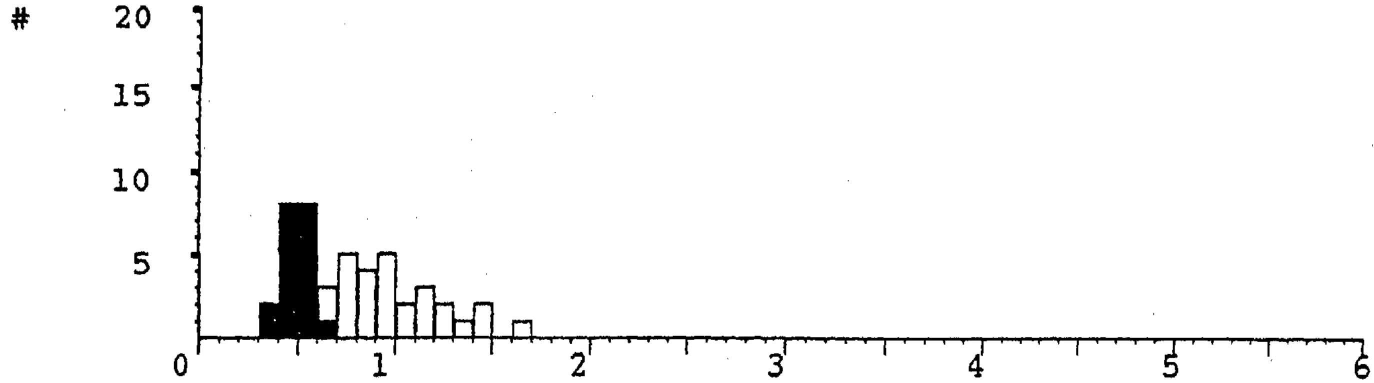
* = Maturity Values REFLECTANCE VALUES

0.36	*0.62	*0.88	1.04	1.29
*0.40	*0.64	*0.89	1.06	1.32
*0.43	*0.65	*0.89	1.08	1.36
*0.45	*0.66	0.95	1.19	1.42
*0.47	*0.69	0.98	1.20	1.53
*0.48	*0.81	0.98	1.21	
*0.48	*0.84	1.01	1.22	
*0.48	*0.84	1.01	1.23	
*0.55	*0.86	1.04	1.25	
*0.62	*0.88	1.04	1.28	

#1 KUPARUK

5750 - 5850 ft. CTG KEROGEN

INTERPRETED MATURITY : 0.49 Ro Std. Dev. : 0.08 No. Readings : 19



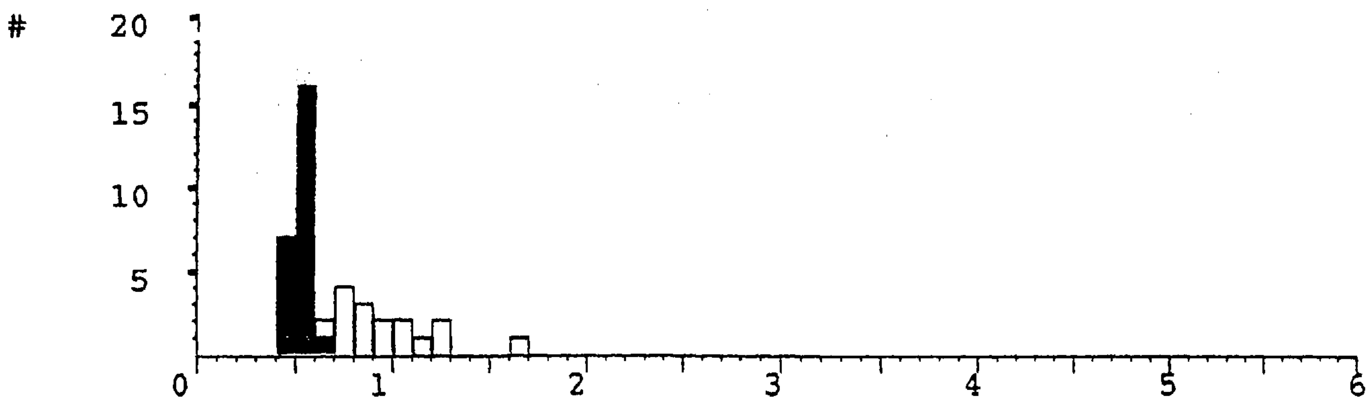
* = Maturity Values REFLECTANCE VALUES

*0.35	*0.50	0.68	0.92	1.24
*0.38	*0.54	0.71	0.92	1.25
*0.40	*0.55	0.74	0.94	1.32
*0.41	*0.56	0.75	0.97	1.45
*0.42	*0.57	0.77	0.98	1.49
*0.43	*0.58	0.79	1.01	1.61
*0.45	*0.59	0.81	1.07	
*0.46	*0.59	0.82	1.10	
*0.48	*0.60	0.86	1.10	
*0.49	0.67	0.88	1.16	

#1 KUPARUK

6400 - 6500 ft. CTG KEROGEN

INTERPRETED MATURITY : 0.52 Ro Std. Dev. : 0.05 No. Readings : 24



* = Maturity Values REFLECTANCE VALUES

*0.43	*0.52	*0.56	0.84
*0.44	*0.53	*0.58	0.88
*0.45	*0.53	*0.58	0.91
*0.45	*0.53	*0.60	0.92
*0.46	*0.54	0.68	1.04
*0.48	*0.54	0.71	1.06
*0.49	*0.54	0.72	1.19
*0.50	*0.54	0.76	1.22
*0.51	*0.55	0.78	1.25
*0.52	*0.56	0.82	1.63