Visual kerogen analysis and maceral vitrinite reflectance data from cuttings (2,910' - 13,500') and from core (12,399') of the Union Oil Company of California Trail Ridge Unit No. 1 well.

ALASKA GEOLOGIC MATERIALS CENTER

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Alaska Geologic Materials Center Data Report No. 244

VISUAL KEROGEN ANALYSIS SUMMARY

Fourteen whole rock samples were analyzed with kerogen microscopy. The samples contain a mixture of sandstone and coaly material, except for samples 95R1015 and 1016, which contain no organic material at all. The mean reflectance ranges between 0.30 to 0.46%, indicating a very low thermal maturity. However, the indicated maturity is probably too low due to vitrinite suppression because all of the coals are dominated by lipid-rich vitrinite such as desmocollinite and they contain a significant amount of resinite and sporinite. Most of the measured reflectance values are on telocollinite but a few of the lower values are believed to be on desmocollinite. Good examples of suberinite were noted in several samples and cell structure in corpohuminite is very well displayed in two samples. The Visual Kerogen Analysis tables provide the details.

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. In certain situations, the whole rock is used for analysis. This approach is used for coals, where acid treatment is unnecessary ,in studies of solid bitumen and graptolites where preservation of rock structure is important, and in samples too small for acid treatment. 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 solid bitumen has a different reflectance than vitrinite, Landis and Castaño's calibration chart can be used to obtain an estimated vitrinite reflectance equivalent. Graptolites have a slightly higher reflectance than vitrinite and can often be used to obtain maturity data in 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 ultraviolet 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 is sometimes called structureless organic matter (SOM) or 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 group 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.

   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 is called migrabitumen and solid hydrocarbon. In 1992, the International Committee for Coal and Organic Petrology (ICCP) 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 is 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 is organic material derived from the woody tissue of land plants. The most important of this group are vitrinite and inertinite:

   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.

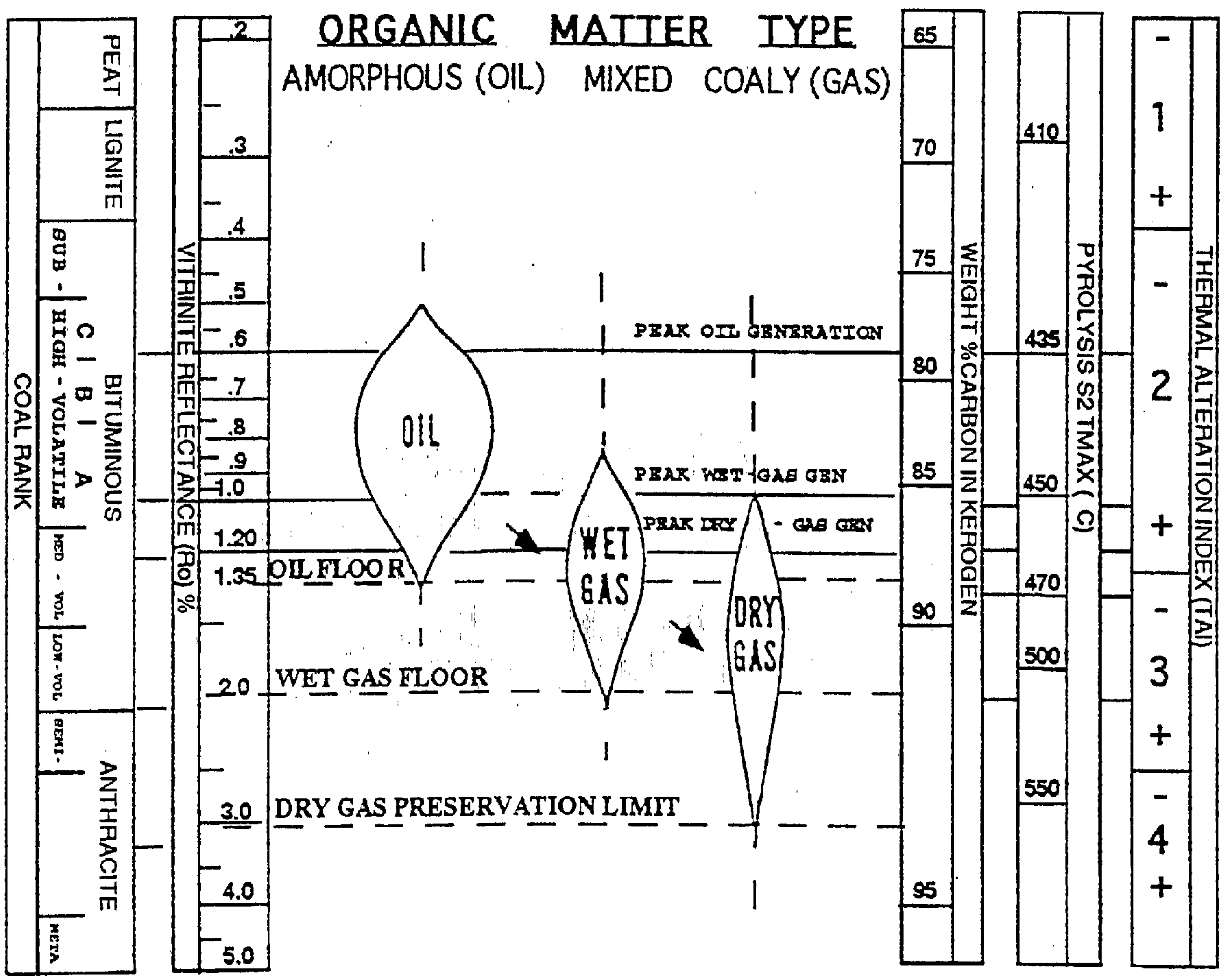
b. Inertinite is made up of woody tissue that has been matured by a different pathway. Early intense oxidation, usually involving charring, fungal attack or biochemical gelification, creates the much more highly reflecting fusinite and semi-fusinite. Sometimes the division between vitrinite and fusinite 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. Lipid-rich, caved and recycled vitrinite. These are put in this section so we can 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 slightly higher than 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.

ZONES OF PETROLEUM GENERATION AND DESTRUCTION



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

GMC Data Report No. 244

95R1013 - 1026

DGSI PROJECT: 95/3227

DGSI

DATE: 3/14/95

DGSI NUMBER	ID OR DEPTH	SAMPLE TYPE	ORGANIC MATTER – LIPIDS – UNSTRUCTURED: UNDIFFERENTIATED (%)	AMORPHOUS (%)	MASSIVE (%)	MICRONIZED (%)	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 I INTENSITY	TRANSMITTED – LIPIDS – UNSTR.: TAI VALUE	FLUOR. COLOR	FLUOR. INTENSITY	STRU.: TAI VALUE	FLUOR. COLOR	FLUOR. INTENSITY	Ro: VITRINITE REFLECTANCE Maturity or Equivalent
1	95R1013	WR					S 5	R 10	C 5			F	10	VL 70		MA	-	+	++	-						O Y	1- 3	1 2							0.34
Comments:	Particles of coal and sandstone intermixed. Inerts mainly sclerotinite. Lipid-rich vitrinite dominates. Some green fluor cutinite noted.																																			
2	95R1014	WR					S 4	R 8	C 3			F	10	VL 75		MA	T	+	++	-						O Y	1- 3	1 2							0.34
Comments:	Similar to previous sample.																																			
3	95R1015	WR														MA																			---
Comments:	Barren of organic matter.																																			
4	95R1016	WR														MA																			---
Comments:	As above.																																			
5	95R1017	WR					R 6	S 3	C 1			F	10	VL 80		MA F	-	-	++	-								1 2							0.33
Comments:																																				

ANALYST

X Castano
O'Connor

MICROSCOPE

X Jena
Zeiss

SAMPLE TYPE/PREP
- CTG Cuttings
- CC Conv. Core
- SWC SideWallCore
- OC Outcrop
- M Mine
- Q Quarry
- NI No Inform.
- K Kerogen
- WR Whole Rock
- C Coal
- 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

95R1013 - 1026

DGSI

DGSI PROJECT: 95/3227

DATE: 3/14/95

DGSI NUMBER	ID OR DEPTH	SAMPLE TYPE	Lipids Unstructured: Undifferentiated (%)	Amorphous (%)	Massive (%)	Micrinized (%)	Lipids Structured: Type / (%)	Type / (%)	Type / (%)	Type / (%)	Solid Bitumen (%)	Humic: Inertinite (%)	Vitrinite (%)	Other: Type / (%)	Type / (%)	Pyrite Type	Pyrite	Total Organic Matter	Vitrinite: Normal	Rough	Lipid-Rich	Oxidized	Coked	Reflected Lipids Unstr.: Color	Intensity	Reflected Lipids Stru.: Color	Intensity	Background Intensity	Transmitted Lipids Unstr.: TAI Value	Fluor. Color	Intensity	Transmitted Lipids Stru.: TAI Value	Fluor. Color	Intensity	Ro: Vitrinite Reflectance Maturity or Equivalent
6	95R1018	WR					R 10	S 5	U 8	C 2		T	5	VL 70		MA	T	M	+	-	+					O Y	1- 4	1 2							0.38
Comments:	*Inerts- Ro 0.64%+. U= Low Ro (0.18-0.22) bands of yellow brown-fluor. Fluor stronger than VL.*																																		
7	95R1019	WR					R 5	S 3	U 2			T	5	VL 85		MA	T	M	+	-	+					O Y	1- 4	1 2							0.30
Comments:	*Inerts- Ro 0.51%+. U= As above.*																																		
8	95R1020	WR					SB T	S 2	R 3			T	65	VL 30	E T	MA	T	++	+	-	M					GY Y	1- 3	1- 2							0.36
Comments:	*VL- desmocolllinite Suberinite fluor GY.*																																		
9	95R1021	WR					SB 1	S 6	R 10	LD 3		T	40	VL 40		MA	T	+	+	-	+					GY Y	1- 4	1- 2							0.41
Comments:	*As above. Higher Ro than previous samples.*																																		
10	95R1022	WR					SB 1	S 6	R 10	LD 3		T	50	U 30		MA	T	+	+	-	+					GY Y	1- 4	1- 2							0.43
Comments:	*Inerts .56 Similar to 95R1021.*																																		

ANALYST

X Castano
O'Connor

MICROSCOPE

X Jena
Zeiss

SAMPLE TYPE/PREP	STRUCTURED LIPIDS	OTHER ORGANIC MATTER	PYRITE	ABUND.	FLUOR. INTENS.	VIT. REFLECT. EQUIVALENCE	FLUOR. COLOR	TAI COLOR VALUES
CTG Cuttings	AL Alginite	E Exudatinite	E Euhedral	N None	0 None	B Bitumen	W White	1- Straw Yellow
CC Conv. Core	SB Suberinite	G Graptolites	F Framboid	T Trace	1 Weak	G Graptolites	G Green	1 Pale Yellow
SWC SideWallCore	C Cutinite	VL Lipid-Rich Vitrinite	MA Massive	- Small Amt.	2 Moderate	VL Lipid-Rich Vitrinite	Y Yellow	1+ Yellow
OC Outcrop	LD Liptodetrinite	VC VitriniteContamination	RI Replace-infill	M Mod. Amt.	3 Strong	VC Vitrinite Contam.	O Orange	2- Yellow-Orange
M Mine	U Undiffer.	VR Recycled Vitrinite		+ Large Amt.	4 Intense	VR Recycled Vitrinite	R Red	2 Golden
Q Quarry	S Sporinite			++ Abundant			B Brown	2+ Amber
NI No Inform.	R Resinite						BL Black	3- Reddish Brown
K Kerogen	O Other							3 Medium Brown
WR Whole Rock							L Light	3+ Dark Brown
C Coal							D Dark	4- Brown-Black
n.d. Not Determ.								4 Black
								4+ Black-Opaque

VISUAL KEROGEN ANALYSIS
Total Quality Geochemistry

GMC Data Report No. 244

95R1013 - 1026

DGSI PROJECT: 95/3227

DGSI

DATE: 3/14/95

DGSI NUMBER	ID OR DEPTH	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 I INTENSITY	TRANSMITTED – LIPIDS – UNSTR.: TAI VALUE	FLUOR. COLOR	FLUOR. INTENSITY	STRU.: TAI VALUE	FLUOR. COLOR	FLUOR. INTENSITY	Ro: VITRINITE REFLECTANCE Maturity or Equivalent
11	95R1023	WR					R 10	S 4	C 1	LD T		T	50	VL 35	E T	MA	T	+	+	-	+					O Y	1- 3	1 2							0.42
Comments:																																			
12	95R1024	WR					R 10	S 3	SB T	LD 2		T	65	VL 20	E T	MA	T	+	+	-	+					O Y	1- 3	1 2							0.44
Comments:	*Cell structure in vitrinite exceptionally well preserved.*																																		
13	95R1025	WR					R 12	S 6	LD 2			T	55	VL 25	E T	MA	T	+	+	-	+					O Y	1 4	1 2							0.46
Comments:	*Similar to previous sample.*																																		
14	95R1026	WR					R 8	S 10	LD 2			T	40	VL 40		MA	T	+	+	-	+					O Y	1 3	1 2							0.43
Comments:	*VL Ro <0.39.*																																		
Comments:																																			

ANALYST

X Castano
O'Connor

MICROSCOPE

X Jena
Zeiss

SAMPLE TYPE/PREP
- CTG Cuttings
- CC Conv. Core
- SWC SideWallCore
- OC Outcrop
- M Mine
- Q Quarry
- NI No Inform.
- K Kerogen
- WR Whole Rock
- C Coal
- 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 Mod. Amt.
- \+ Large Amt.
- ++ Abundant

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

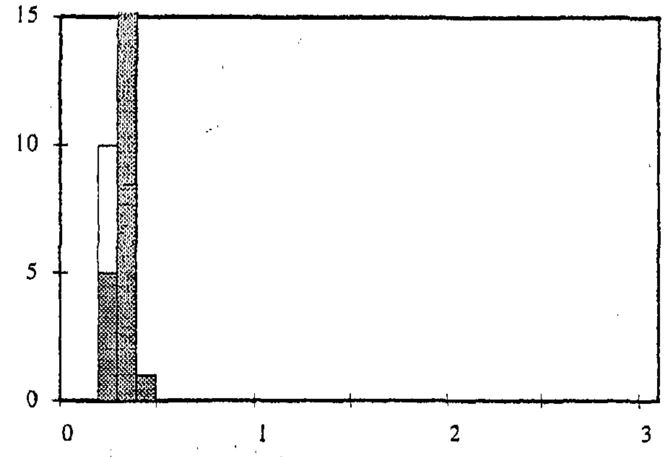
VIT. REFLECT. EQUIVALENCE
- B Bitumen
- G Graptolites
- VL Lipid-Rich Vitrinite
- VC Vitrinite Contam.
- VR Recycled Vitrinite

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

DGSI # 95/3227 Sample No. 1
OTHER ID: 95R1013



VITRINITE

MEAN	0.34
ST DEV	0.04
VARIANCE	0.00
MINIMUM	0.28
MAXIMUM	0.43
NUMBER	22

BITUMEN

MEAN
ST DEV
VARIANCE
MINIMUM
MAXIMUM
NUMBER

0.23	V 0.28	V 0.31	V 0.33	V 0.36	V 0.38
0.23	V 0.29	V 0.31	V 0.34	V 0.36	V 0.43
0.24	V 0.29	V 0.33	V 0.35	V 0.36	
0.25	V 0.29	V 0.33	V 0.35	V 0.37	
0.26	V 0.29	V 0.33	V 0.36	V 0.37	

TYPE		
	WR	
	TOC	
	TMAX	
	HI	
	V Ro	0.34
	B Ro	-
	VRE	-

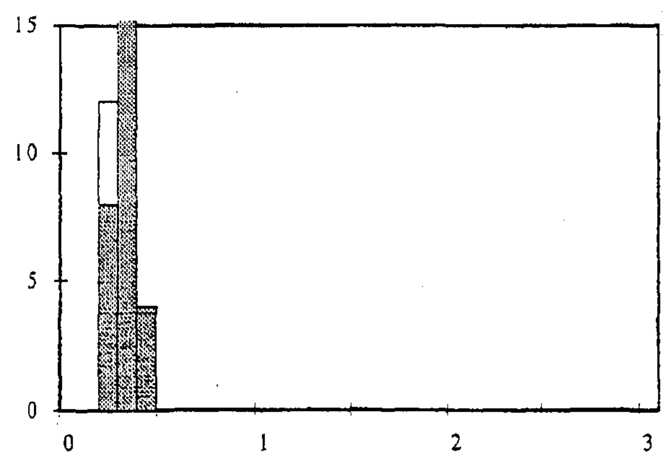
Visual Kerogen Summary

Unstructured Lipids	
Structured Lipids	20
Solid Bitumen	
Inertinite	
Vitrinite	10
Other	70
TOTAL	100

Background Fluorescence	Weak-Mod
TAI Unstructured	
TAI Structured	

COMMENTS:

DGSI # 95/3227 Sample No. 2
OTHER ID: 95R1014



VITRINITE

MEAN	0.34
ST DEV	0.05
VARIANCE	0.00
MINIMUM	0.27
MAXIMUM	0.44
NUMBER	29

BITUMEN

MEAN
ST DEV
VARIANCE
MINIMUM
MAXIMUM
NUMBER

0.24	V 0.27	V 0.29	V 0.31	V 0.37	V 0.38	V 0.41
0.24	V 0.28	V 0.29	V 0.32	V 0.37	V 0.38	V 0.42
0.25	V 0.28	V 0.30	V 0.35	V 0.37	V 0.39	V 0.44
0.25	V 0.28	V 0.30	V 0.35	V 0.37	V 0.39	
V 0.27	V 0.29	V 0.30	V 0.36	V 0.37	V 0.40	

TYPE		
	WR	
	TOC	
	TMAX	
	HI	
	V Ro	0.34
	B Ro	-
	VRE	-

Visual Kerogen Summary

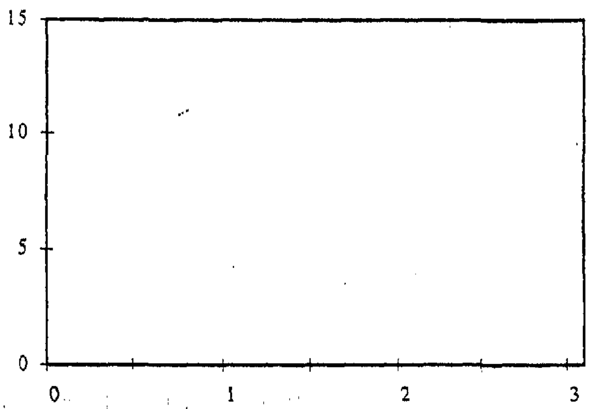
Unstructured Lipids	
Structured Lipids	15
Solid Bitumen	
Inertinite	
Vitrinite	10
Other	75
TOTAL	100

Background Fluorescence	Weak-Mod
TAI Unstructured	
TAI Structured	

COMMENTS:

VITRINITE REFLECTANCE **SAMPLES: 95R1013 - 1226**

DGSI # 95/3227 Sample No. 3
OTHER ID: 95R1015



VITRINITE	
MEAN	0.00
ST DEV	N.A.
VARIANCE	N.A.
MINIMUM	0.00
MAXIMUM	0.00
NUMBER	1

BITUMEN	
MEAN	
ST DEV	
VARIANCE	
MINIMUM	
MAXIMUM	
NUMBER	

TYPE		
	WR	
	TOC	
	TMAX	
	HI	
	V Ro	0.00
	B Ro	-
	VRE	-

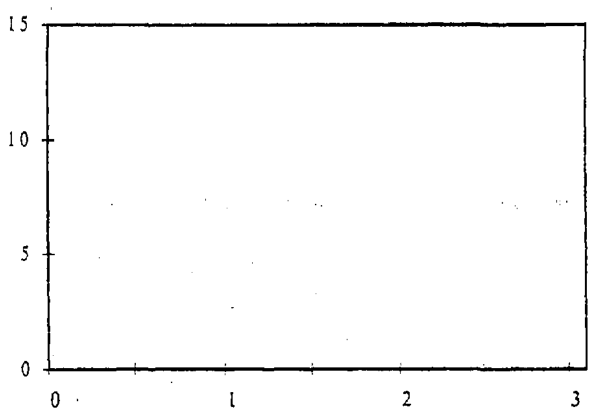
Visual Kerogen Summary

Unstructured Lipids	
Structured Lipids	
Solid Bitumen	
Inertinite	
Vitrinite	
Other	
TOTAL	0

Background Fluorescence
TAI Unstructured
TAI Structured

COMMENTS:

DGSI # 95/3227 Sample No. 4
OTHER ID: 95R1016



VITRINITE	
MEAN	0.00
ST DEV	N.A.
VARIANCE	N.A.
MINIMUM	0.00
MAXIMUM	0.00
NUMBER	1

BITUMEN	
MEAN	
ST DEV	
VARIANCE	
MINIMUM	
MAXIMUM	
NUMBER	

TYPE		
	WR	
	TOC	
	TMAX	
	HI	
	V Ro	0.00
	B Ro	-
	VRE	-

Visual Kerogen Summary

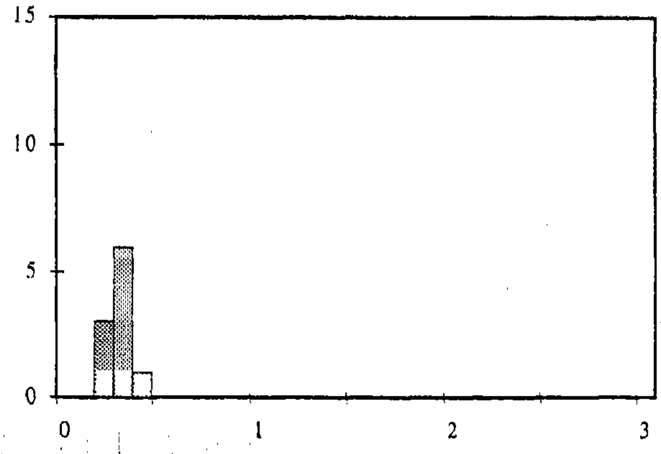
Unstructured Lipids	
Structured Lipids	
Solid Bitumen	
Inertinite	
Vitrinite	
Other	
TOTAL	0

Background Fluorescence
TAI Unstructured
TAI Structured

COMMENTS:

DGSI # 95/3227 Sample No. 5

OTHER ID: 95R1017



VITRINITE	
MEAN	0.33
ST DEV	0.05
VARIANCE	0.00
MINIMUM	0.25
MAXIMUM	0.41
NUMBER	10

BITUMEN	
MEAN	
ST DEV	
VARIANCE	
MINIMUM	
MAXIMUM	
NUMBER	

V 0.25	V 0.35
V 0.28	V 0.36
V 0.28	V 0.37
V 0.32	V 0.38
V 0.33	V 0.41

TYPE	WR	
	TOC	
	TMAX	
	HI	
	V Ro	0.33
	B Ro	-
	VRE	-

Visual Kerogen Summary

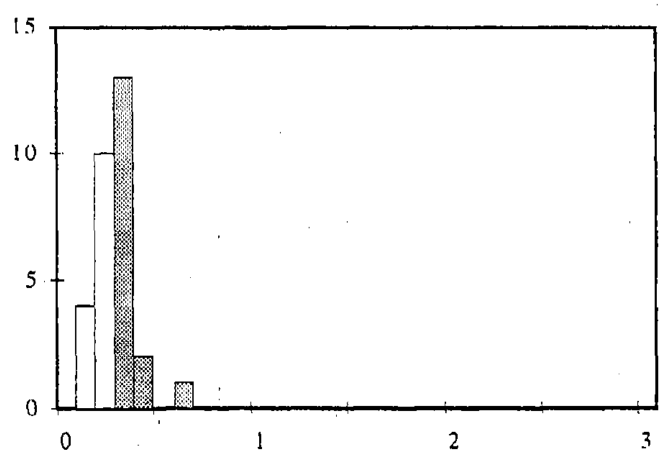
Unstructured Lipids	
Structured Lipids	10
Solid Bitumen	
Inertinite	
Vitrinite	10
Other	80
TOTAL	100

Background Fluorescence	Weak-Mod
TAI Unstructured	
TAI Structured	

COMMENTS:

DGSI # 95/3227 Sample No. 6

OTHER ID: 95R1018



VITRINITE	
MEAN	0.38
ST DEV	0.08
VARIANCE	0.01
MINIMUM	0.30
MAXIMUM	0.64
NUMBER	16

BITUMEN	
MEAN	
ST DEV	
VARIANCE	
MINIMUM	
MAXIMUM	
NUMBER	

0.17	0.20	0.26	V 0.30	V 0.36	V 0.39
0.18	0.22	0.27	V 0.31	V 0.37	V 0.39
0.19	0.23	0.29	V 0.31	V 0.38	V 0.40
0.19	0.23	0.29	V 0.33	V 0.38	V 0.41
0.20	0.24	V 0.30	V 0.34	V 0.39	V 0.64

TYPE	WR	
	TOC	
	TMAX	
	HI	
	V Ro	0.38
	B Ro	-
	VRE	-

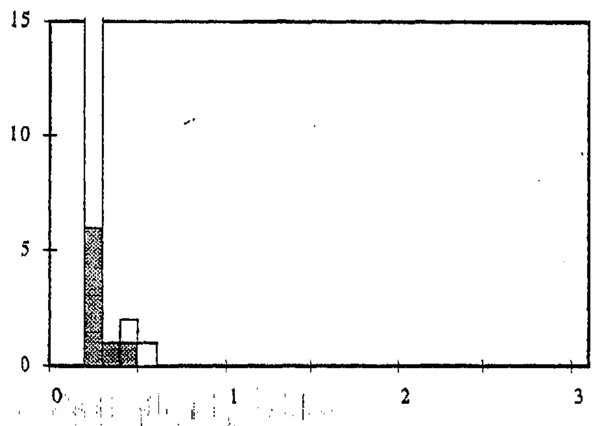
Visual Kerogen Summary

Unstructured Lipids	
Structured Lipids	25
Solid Bitumen	
Inertinite	
Vitrinite	5
Other	70
TOTAL	100

Background Fluorescence	Weak-Mod
TAI Unstructured	
TAI Structured	

COMMENTS:
Low Ro is VL

DGSI # 95/3227 Sample No. 7
OTHER ID: 95R1019



VITRINITE

MEAN	0.30
ST DEV	0.06
VARIANCE	0.00
MINIMUM	0.26
MAXIMUM	0.42
NUMBER	8

BITUMEN

MEAN	
ST DEV	
VARIANCE	
MINIMUM	
MAXIMUM	
NUMBER	

0.20	0.21	0.22	0.22	0.23	V 0.26	V 0.28
0.20	0.21	0.22	0.22	0.23	V 0.26	V 0.33
0.20	0.21	0.22	0.22	0.24	V 0.27	V 0.42
0.21	0.21	0.22	0.23	0.24	V 0.27	0.49
0.21	0.21	0.22	0.23	0.24	V 0.28	0.51

TYPE	WR	
	TOC	
	TMAX	
	HI	
	V Ro	0.30
	B Ro	-
	VRE	-

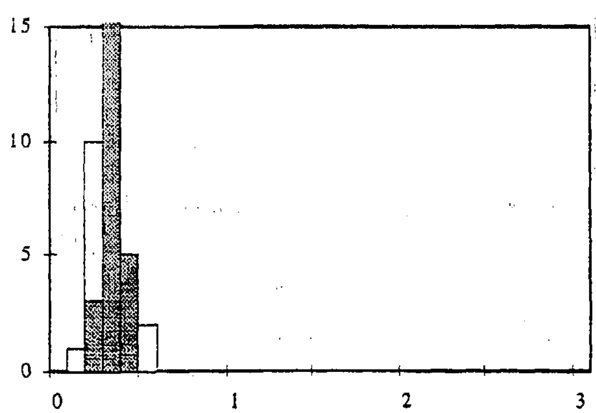
Visual Kerogen Summary

Unstructured Lipids	
Structured Lipids	10
Solid Bitumen	
Inertinite	
Vitrinite	5
Other	85
TOTAL	100

Background Fluorescence	Weak-Mod
TAI Unstructured	
TAI Structured	

COMMENTS:
Low Ro is VL

DGSI # 95/3227 Sample No. 8
OTHER ID: 95R1020



VITRINITE

MEAN	0.36
ST DEV	0.04
VARIANCE	0.00
MINIMUM	0.28
MAXIMUM	0.46
NUMBER	26

BITUMEN

MEAN	
ST DEV	
VARIANCE	
MINIMUM	
MAXIMUM	
NUMBER	

0.19	0.25	V 0.29	V 0.34	V 0.36	V 0.37	V 0.41	0.53
0.20	0.25	V 0.31	V 0.34	V 0.36	V 0.37	V 0.41	
0.21	0.26	V 0.32	V 0.35	V 0.36	V 0.37	V 0.43	
0.23	V 0.28	V 0.33	V 0.36	V 0.37	V 0.38	V 0.46	
0.25	V 0.29	V 0.33	V 0.36	V 0.37	V 0.41	0.50	

TYPE	WR	
	TOC	
	TMAX	
	HI	
	V Ro	0.36
	B Ro	-
	VRE	-

Visual Kerogen Summary

Unstructured Lipids	
Structured Lipids	5
Solid Bitumen	
Inertinite	
Vitrinite	65
Other	30
TOTAL	100

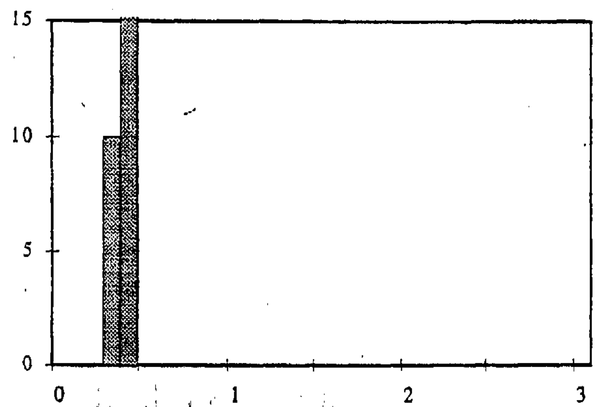
Background Fluorescence	Weak-Mod
TAI Unstructured	
TAI Structured	

COMMENTS:

VITRINITE REFLECTANCE

SAMPLES: 95R1013 - 1226

DGSI # 95/3227 Sample No. 9
OTHER ID: 95R1021



VITRINITE

MEAN	0.41
ST DEV	0.03
VARIANCE	0.00
MINIMUM	0.32
MAXIMUM	0.47
NUMBER	30

BITUMEN

MEAN	
ST DEV	
VARIANCE	
MINIMUM	
MAXIMUM	
NUMBER	

V 0.32	V 0.37	V 0.40	V 0.42	V 0.43	V 0.44
V 0.36	V 0.37	V 0.41	V 0.42	V 0.43	V 0.44
V 0.36	V 0.38	V 0.41	V 0.42	V 0.43	V 0.44
V 0.37	V 0.39	V 0.42	V 0.42	V 0.43	V 0.44
V 0.37	V 0.39	V 0.42	V 0.42	V 0.43	V 0.47

TYPE		
	WR	
	TOC	
	TMAX	
	HI	
	V Ro	0.41
	B Ro	-
	VRE	-

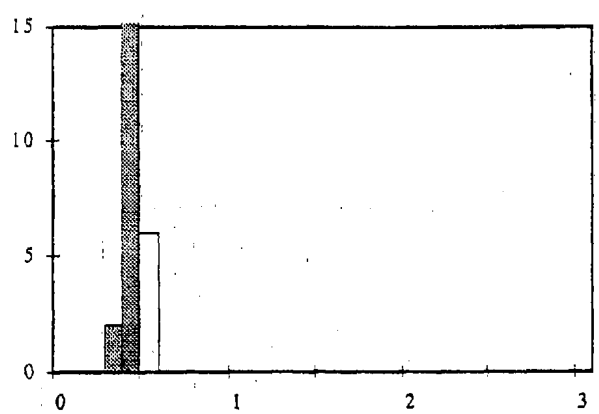
Visual Kerogen Summary

Unstructured Lipids	
Structured Lipids	20
Solid Bitumen	
Inertinite	
Vitrinite	40
Other	40
TOTAL	100

Background Fluorescence	Weak-Mod
TAI Unstructured	
TAI Structured	

COMMENTS:

DGSI # 95/3227 Sample No. 10
OTHER ID: 95R1022



VITRINITE

MEAN	0.43
ST DEV	0.03
VARIANCE	0.00
MINIMUM	0.37
MAXIMUM	0.48
NUMBER	32

BITUMEN

MEAN	
ST DEV	
VARIANCE	
MINIMUM	
MAXIMUM	
NUMBER	

0.31	V 0.40	V 0.41	V 0.43	V 0.44	V 0.46	V 0.48	0.50
V 0.37	V 0.41	V 0.42	V 0.43	V 0.44	V 0.46	V 0.48	0.51
V 0.37	V 0.41	V 0.42	V 0.43	V 0.44	V 0.47	V 0.48	0.51
V 0.40	V 0.41	V 0.43	V 0.43	V 0.45	V 0.47	0.50	0.56
V 0.40	V 0.41	V 0.43	V 0.44	V 0.46	V 0.47	0.50	

TYPE		
	WR	
	TOC	
	TMAX	
	HI	
	V Ro	0.43
	B Ro	-
	VRE	-

Visual Kerogen Summary

Unstructured Lipids	
Structured Lipids	20
Solid Bitumen	
Inertinite	
Vitrinite	50
Other	30
TOTAL	100

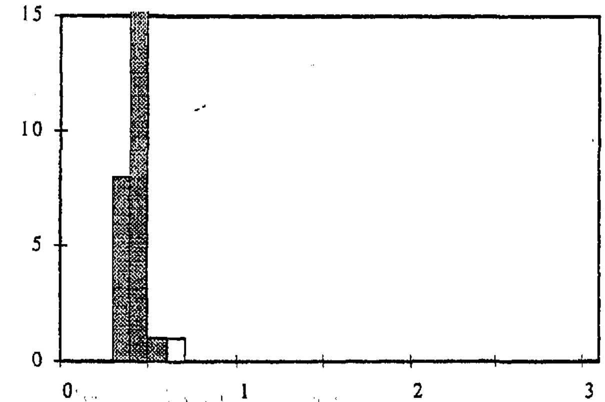
Background Fluorescence	Weak-Mod
TAI Unstructured	
TAI Structured	

COMMENTS:

VITRINITE REFLECTANCE

SAMPLES: 95R1013 - 1226

DGSI # 95/3227 Sample No. 11
OTHER ID: 95R1023



V 0.36	V 0.38	V 0.40	V 0.42	V 0.44	V 0.47	0.69
V 0.36	V 0.39	V 0.40	V 0.43	V 0.44	V 0.48	
V 0.36	V 0.39	V 0.40	V 0.43	V 0.45	V 0.49	
V 0.36	V 0.40	V 0.42	V 0.44	V 0.45	V 0.49	
V 0.37	V 0.40	V 0.42	V 0.44	V 0.45	V 0.50	

VITRINITE

MEAN	0.42
ST DEV	0.04
VARIANCE	0.00
MINIMUM	0.36
MAXIMUM	0.50
NUMBER	30

BITUMEN

MEAN	
ST DEV	
VARIANCE	
MINIMUM	
MAXIMUM	
NUMBER	

TYPE	
WR	
TOC	
TMAX	
HI	
V Ro	0.42
B Ro	-
VRE	-

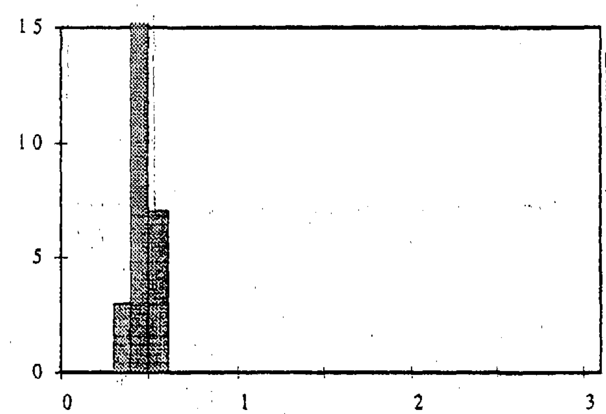
Visual Kerogen Summary

Unstructured Lipids	
Structured Lipids	15
Solid Bitumen	
Inertinite	
Vitrinite	50
Other	35
TOTAL	100

Background Fluorescence	Weak-Mod
TAI Unstructured	
TAI Structured	

COMMENTS:

DGSI # 95/3227 Sample No. 12
OTHER ID: 95R1024



V 0.36	V 0.40	V 0.41	V 0.43	V 0.44	V 0.46	V 0.52
V 0.37	V 0.40	V 0.41	V 0.43	V 0.45	V 0.48	V 0.53
V 0.38	V 0.40	V 0.41	V 0.43	V 0.45	V 0.48	V 0.53
V 0.40	V 0.40	V 0.41	V 0.43	V 0.45	V 0.50	V 0.53
V 0.40	V 0.41	V 0.41	V 0.44	V 0.45	V 0.50	V 0.53

VITRINITE

MEAN	0.44
ST DEV	0.05
VARIANCE	0.00
MINIMUM	0.36
MAXIMUM	0.53
NUMBER	35

BITUMEN

MEAN	
ST DEV	
VARIANCE	
MINIMUM	
MAXIMUM	
NUMBER	

TYPE	
WR	
TOC	
TMAX	
HI	
V Ro	0.44
B Ro	-
VRE	-

Visual Kerogen Summary

Unstructured Lipids	
Structured Lipids	15
Solid Bitumen	
Inertinite	
Vitrinite	65
Other	20
TOTAL	100

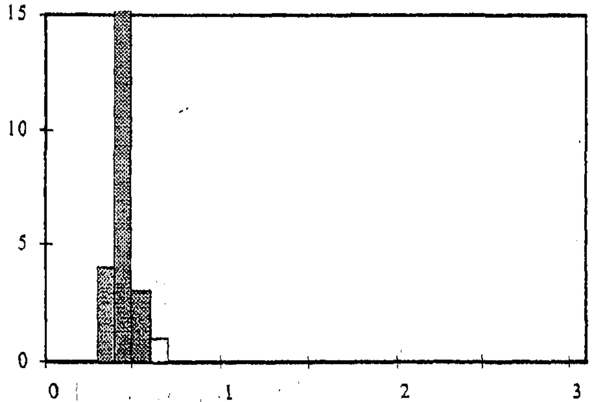
Background Fluorescence	Weak-Mod
TAI Unstructured	
TAI Structured	

COMMENTS:

VITRINITE REFLECTANCE

SAMPLES: 95R1013 - 1226

DGSI # 95/3227 Sample No. 13
OTHER ID: 95R1025



VITRINITE	
MEAN	0.46
ST DEV	0.04
VARIANCE	0.00
MINIMUM	0.36
MAXIMUM	0.53
NUMBER	32

BITUMEN	
MEAN	
ST DEV	
VARIANCE	
MINIMUM	
MAXIMUM	
NUMBER	

V 0.36	V 0.43	V 0.45	V 0.46	V 0.47	V 0.48	V 0.52
V 0.38	V 0.44	V 0.45	V 0.46	V 0.47	V 0.48	V 0.53
V 0.39	V 0.44	V 0.45	V 0.46	V 0.47	V 0.50	0.61
V 0.39	V 0.44	V 0.45	V 0.46	V 0.47	V 0.50	
V 0.41	V 0.45	V 0.46	V 0.46	V 0.48	V 0.51	

TYPE		
	WR	
	TOC	
	TMAX	
	HI	
	V Ro	0.46
	B Ro	-
	VRE	-

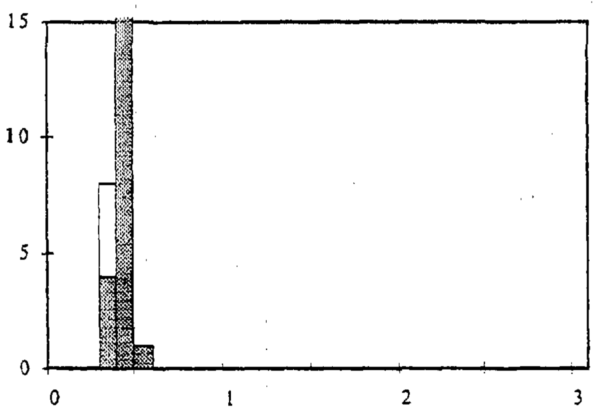
Visual Kerogen Summary

Unstructured Lipids	
Structured Lipids	20
Solid Bitumen	
Inertinite	
Vitrinite	55
Other	25
TOTAL	100

Background Fluorescence	Weak-Mod
TAI Unstructured	
TAI Structured	

COMMENTS:

DGSI # 95/3227 Sample No. 14
OTHER ID: 95R1026



VITRINITE	
MEAN	0.43
ST DEV	0.03
VARIANCE	0.00
MINIMUM	0.39
MAXIMUM	0.50
NUMBER	35

BITUMEN	
MEAN	
ST DEV	
VARIANCE	
MINIMUM	
MAXIMUM	
NUMBER	

0.31	V 0.39	V 0.40	V 0.41	V 0.43	V 0.44	V 0.45	V 0.46
0.32	V 0.39	V 0.40	V 0.42	V 0.44	V 0.45	V 0.45	V 0.46
0.37	V 0.39	V 0.40	V 0.42	V 0.44	V 0.45	V 0.45	V 0.49
0.38	V 0.40	V 0.41	V 0.42	V 0.44	V 0.45	V 0.45	V 0.50
V 0.39	V 0.40	V 0.41	V 0.43	V 0.44	V 0.45	V 0.46	

TYPE		
	WR	
	TOC	
	TMAX	
	HI	
	V Ro	0.43
	B Ro	-
	VRE	-

Visual Kerogen Summary

Unstructured Lipids	
Structured Lipids	20
Solid Bitumen	
Inertinite	
Vitrinite	40
Other	40
TOTAL	100

Background Fluorescence	Weak-Mod
TAI Unstructured	
TAI Structured	

COMMENTS:

Sample Log In Sheet

SYSTEM SOURCE ID NUMBER	(1) GEOCHEMIST	(2) OPERATOR
95029	CRL	
(3) WELL NAME OR FIELD PARTY: Trail Ridge 1		(4) LEASE OR SEASON
(5) FIELD	(6) BASIN	(7) GEOGRAPHIC AREA
(8) LATITUDE IN DEGREES	(9) LONGITUDE IN DEGREES	(13) COUNTY
(10) SECTION / (11) TOWNSHIP	(12) RANGE	(14) STATE
		(15) COUNTRY

SAMPLE NUMBER	(20) DEPTH OR (19) OUTCROP NUMBER	(1) FORMATION	(2) GEOLOGIC AGE	(6) SAMPLE TYPE	(7) DEPOSITIONAL ENVIRONMENT	(11) LITHOLOGY	(18) COMMENTS
95R1013	2910 - 2940'			CT			
1014	4440 - 4470'						
1015	5160 - 5190'						
1016	8550 - 8580						
1017	8940 - 8970						
1018	9570 - 9600						
1019	9960 - 9990						
1020	11430 - 11460						
1021	11970 - 12000						
1022	12390 - 12420						
1023	12960 - 12990						
1024	13320 - 13350						
1025	13470 - 13500						
1026	12399'			CO			Core chips

17/17