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A GEOCHEMICAL STUDY OF THE NOCS WELL 7/12-5

by

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SUMMARY

As requested (ref.1) the geochemical study consisted primarily of Vitrinite Reflectance and pyrolysis measurements undertaken on about forty samples covering the Tertiary to Permian sequence (2100-4430m) in the well 7/12-5, with emphasis being placed on the Jurassic sediments. In addition, selected Visual Kerogen results were obtained in a successful attempt to clarify the maturity of the examined sediments.

Vitrinite Reflectance maturity measurements appeared to have been partially affected by generally strong bitumen staining, reworked material in the Ula and older formations, and in the Triassic samples, by significant caving from the Jurassic. The results from the Tertiary and Upper Cretaceous samples suggested that the Oil Generation Threshold lay below the Upper/Lower Cretaceous unconformity at 3332m, while selected results from the Triassic placed it above the Upper/Lower Jurassic unconformity at 3916m. Upper Jurassic samples gave rise to low reflectances, which implied that they were immature, but it was considered that this effect was due to the presence of bitumen.

In contrast, spore colours indicated that the Upper Jurassic Kimmeridge Clay Formation was just within the oil generation window, and these results, supported by pyrolysis Production Indices, were considered to be the more reliable.

Moderate to good gas/condensate prone sediments were identified in the immature Hordaland Group sediments of Tertiary age. between 2100 and 2280m. Good light oil prone source rocks were identified throughout the Kimmeridge Clay formation of the Upper Jurassic. However, the source potential of these and older formations, has probably been lowered to varying degrees by prior generation. Minor mudstones from the older formations showed good to moderate light oil potential, but any indigenous potential within these sediments (Ula Formation and older), would have been effectively lowered by the isolated nature of the source rocks in a predominantly sandstone section

A coal observed in the Triassic at 4340m had a good gas/condensate potential, but because of its absence on the lithological log at this depth and its high reflectivity, it was felt to be possibly allochthonous.

1. INTRODUCTION

The Norwegian exploration well 7/12-5 was drilled in the most westerly of the three fault segments in the complex salt induced 7/12B structure. The trap is defined by a combination of dip and fault closure on the base Cretaceous unconformity. The primary objective was the reservoir development of an Upper Jurassic sandstone, similar to that of the Ula field, approx. 7km to the south. Secondary targets were defined as Lower Jurassic and Triassic sandstones.

The Geochemical Study requested was initially limited to maturity and source estimations on the sediments below 2100m (Lower Tertiary to Upper Permian) using Vitrinite Reflectance and Pyrolysis Techniques. However, the Vitrinite Reflectance analyses were inconclusive as maturity indicators, and consequently, a restricted Visual Kerogen study was made in an attempt to clarify the situation.

2. ANALYTICAL TECHNIQUES

The objectives of the geochemical analyses undertaken were to establish the maturity and hydrocarbon source potential of the sediment samples. The following techniques were used to determine the parameters.

2.1 Sample Preparation

Prior to any sediment analysis, cutting samples were washed, dried and picked to remove cavings, any obvious contaminants and, in samples of mixed lithology, to concentrate those of apparent organic richness. The S.W.C.'s and the core chip sample were also cleaned as far as possible by the removal of surface contamination. Apart from the samples for Vitrinite Reflectance and Visual Kerogen measurements, those for pyrolysis analysis were ground and then sieved to give a uniform powder.

2.2 Vitrinite Reflectance

Vitrinite Reflectance measurements were made on coarsely ground samples contained in polished resin blocks. Reflectances ($\%R_o$) were determined using oil immersion objectives on $\sim 5\mu$ particle widths at a light wavelength of 546nm. A reflectance value of $R_o = 0.55\%$ is considered to characterise the Oil Generation Threshold and a value of $R_o = 0.80\%$ the level of Maximum Oil Generation for an average oil-prone kerogen.

2.3 Visual Kerogen and Spore Colour Description

Visual Kerogen and sporomorph colour studies were carried out using transmitted light microscopy on samples previously demineralised by hydrochloric acid treatment. A colour rating of 3/4 on a scale of 1 - 7 is considered representative of the Generation Threshold for liquid hydrocarbons from an average oil-prone kerogen.

2.4 Pyrolysis Studies

Maximum hydrocarbon source potential yields (kg/tonne) of the samples were assessed by Rock-Eval equipment and from these figures the Production Indices ($P_1/P_1 + P_2$) could be calculated. An uncontaminated sample with an index in excess of 0.1 is likely to be below the Hydrocarbon Generation Threshold. If the samples contained significant potentials, a pyrolysis-gas chromatography technique developed at BP Sunbury was also employed to determine their Gas/Oil Generation Index (GOGI). Analysis of the GOGI value and maximum hydrocarbon potential yield makes possible a relative estimation of the amount of oil and gas likely to be sourced from a kerogen.

The Pyrolysis data were collected and analysed by a Hewlett-Packard HP 3354 Laboratory Automation System.

3. RESULTS AND DISCUSSION

3.1 Samples

This report describes the results of a geochemical evaluation made on 38 samples covering the interval 2100 to 4430m: Tertiary (Middle Hordaland Group) to Upper Permian (Zechstein Group). The samples were of four types. Down to, and including 3180m, the samples were canned wet cuttings, taken at the stated depths. Below 3180m the wet cutting samples were supplied in 30m composites with a mean depth being quoted in the report. Five sidewall cores (S.W.C's) at depths of 3732m, 3740m, 3780m, 3820m and 3838m, and a core chip from 3909m were used to supplement the wet cuttings in the Jurassic interval of the well. The Tertiary and Cretaceous sediments were comprised largely of shale units, interrupted by a 400m band of chalk in the Upper Cretaceous (ca 2850-3250m). It was noted that the Plenus Marl and Hidra Formations of the early Upper Cretaceous are condensed into 10m of sediments, and are separated from the Valhall Formation of the early Lower Cretaceous by an unconformity at 3332m (approx). The Upper Jurassic is represented by the shales of the Kimmeridge Clay Formation and the sandstones of the Ula Formation. The base of the latter, at 3900.5m, marks a second unconformity between it and the interbedded sandstones/mudstones/siltstones/evaporites of the Lower Jurassic, Triassic and Permian sediments. Coal fragments were observed in the sample at 4340m and, although they were not identified in the lithological log, they were treated as an individual sample alongside the shale cuttings picked at that depth.

The stratigraphic Jurassic nomenclature used in this report was detailed in the BP Petroleum Development Ltd Norway's memo of 9th June 1981 (ref.2) which identified the Kimmeridge Clay Formation as an individual unit. However, the more recent summarised well log supplied by BP Petroleum Development Norway stated that no existing nomenclature could be used for the Upper Jurassic in this well and the Upper Jurassic Mudstones are therefore grouped together in three parts, Upper, Middle and Lower.

3.2 Maturity Estimation

Estimation of maturity from Vitrinite Reflectance measurements was affected by generally strong overall bitumen staining, reworked material in Ula and older Formations and, in the Triassic, by significant caving from the Jurassic. Substituting the results from samples above the Upper/Lower Cretaceous unconformity at 3332m into a linear regression programme designed to calculate hydrocarbon generation thresholds within 95% confidence limits, a very poor correlation coefficient of 0.54 and least squares fit of 0.29 were obtained. This showed that the calculated thresholds were statistically unreliable. However, the trend produced by the results suggested that the O(11) G(eneration) T(hreshold) lay below the Cretaceous unconformity. Selected results from the Triassic samples when substituted into the same programme, placed the OGT above the Upper/Lower Jurassic unconformity and gave a correlation coefficient and least squares fit of 0.81 and 0.66 respectively.

Although statistically better than those previously obtained, they could not be used to accurately predict OGT other than to place it above the Jurassic unconformity.

Upper Jurassic samples (3730.5 to 3916m) gave low reflectances ($R_o = 0.45 - 0.52\%$), which implied immaturity, but it was considered that this effect was due to the presence of bitumen staining. In contrast, spore colours indicated that the Upper Jurassic Kimmeridge Clay Formation was within the Oil Generation Window (spore colour = 4), and these results, supported by pyrolysis Production Indices, were considered to be more reliable. This would give a stratigraphically shallower O.G.T. than those estimated for some other wells in the area (ref.3), however, this could be accounted for by the deeper burial of the Upper Jurassic in this location (ref.4). The Triassic coal observed at 4340m gave a very high result ($R_o 1.31\%$) and was considered possibly to be allochthonous.

3.3 Source Potential Estimation

The richest Tertiary sediments studied occurred at 2100 to 2280m in the Hordaland Group. These were gas/condensate prone sediments, having moderate gas (Max 1.6-3.7 kg/t) and moderate/good condensate potential (MAX 2.6 - 5.6 kg/t) - figs. 1-3. Remaining Tertiary and Cretaceous sediments examined had insignificant or poor hydrocarbon source potential.

The Kimmeridge Clay Formation contained generally good light oil (MAX 7.4 - 19.4 kg/t) and moderate/good gas (MAX 2.5 - 5.6 kg/t) potential - figs. 4-9. An isolated mudstone at 3875m in the mainly sandstone sediments of the Ula Formation had moderate light oil (MAX 2.9 kg/t) and poor gas (MAX 1.0 kg/t) potential (figs. 10 and 11).

Isolated mudstones in the predominantly sandstone/evaporitic Triassic sediments contained generally good light oil (MAX 6.3-8.7 kg/t) and moderate gas (MAX 2.9 - 3.8 kg/t) potential on pyrolysis - figs. 12-17. However, the Visual Kerogen data on samples from these isolated mudstones, suggested that some of the organic matter was caved material from higher in the well, which together with their minor occurrence would lower the overall hydrocarbon potential of this interval. The Triassic coal observed in the sample of 4340m had good gas (MAX 15.1 kg/t) and good light oil (MAX* 9.1 kg/t) potential (fig.18), but it is likely that any products obtained would be gas and condensate. An isolated Permian shale band from a composite sample at 4400 - 4430m had a good maximum hydrocarbon potential of 9.3 kg/t, although the latter was felt to be influenced by the presence of cavings.

Details of all geochemical results are contained in the appendix.

*MAX : Maximum theoretical hydrocarbon source potential in kilograms per tonne of sediment.

4. CONCLUSIONS

Vitrinite Reflectance data by themselves were generally inconclusive owing to the presence of bitumen staining in the majority of the samples, and cavings and reworked material in the samples of the Ula and older formations. However, when combined with the Visual Kerogen data, the results indicated that the Upper Cretaceous and younger sediments were immature, while those deeper were mature and approached maximum oil generation in the Lower Jurassic/Upper Triassic sediments.

Apart from the moderate to good immature gas/condensate prone sediments at the top of the sequence sampled, the Tertiary and Cretaceous systems had generally insignificant or at best poor hydrocarbon source potential. The Kimmeridge Clay Formation and minor shales in the Lower Jurassic and Triassic sediments had good to moderate light oil and moderate to poor gas potential. The possibly allochthonous coal observed in the Lower Triassic had a good potential for gas and light oil/condensate, while a minor mudstone in the Permian showed good overall hydrocarbon potential.

Since all these Jurassic and older source rocks lay below the Oil Generation Threshold, their potential was already likely to have been lowered to varying extents by past generation and migration. The effective potential of the Ula and older formations is lowered by the minor occurrence of mudstones in a predominantly sandstone interval and by the likely presence of abundant cavings.

REFERENCE

1. GSR No. 0750/Memo BP Petroleum Development Ltd Norway
(POM/1gn/700/019 665/1) dated 9.4.81.
2. Memo BP Petroleum Development Ltd Norway (BT/6S) dated 9.6.81.
3. J.A. Miles A Geochemical Study of NOCS well 7/12-3 EPR/TN 7039
" " " " " " 7/12-3A EPR/TN 7042
" " " " " " 7/12-4 EPR/TN 7041
R.R.I. A Maturation and Source Rock Study of the Section 1560-
3676m of the Conoco NOCS 7/12-2 well. Report NP 4032P
4. K. Mills Two Way Time Contour Map on Base Cretaceous - BP
Petroleum Development Norway, 1982 Work Prog.

TABLE 1
VITRINITE REFLECTANCE DATA

WELL: 7/12-5
LOCATION: NORWEGIAN SECTOR, NORTH SEA

	DEPTH (M)	REFLECTANCE VALUES (XRO)	COMMENTS
	2100	.31(21)	L/VW+PAR/STR OBS/Y
	2190	.34(21)	L/VW+PAR/STR OBS/TR I/Y/O
Hordaland Gp	2230	.33(20)	TR VW+W PAR/STR OBS/Y+Y/O
	2370	.37(6)	TR VW+W PAR/BW/Y+Y/O
	2460	.32(27)	TR V PAR/VAR BS+W/F I SP/Y+Y/O
	2550	.41(22)	L/V PAR/BW+VAR BS/TR I/Y+Y/O
	2640	.51(20)	VL/F V PAR/BW/TR I/Y+Y/O
Pogaland Gp	2670	.37(12)	TR V=I PAR/VAR STR BS+W/Y/O
	2730	.5(12)	F VW+PAR=RM/BW+OCC BS/Y/O
Montrose Gp	2820	.42(20)	TR V PAR/VAR STR BS+BLOBS/F I PAR/Y/O
	2910	.33(20)	TR V PAR+W/VAR STR BS+W/Y/O
Chalk Group	3000	.33(13)	L/SUB V-COR/B BLOBS+OCC BS/I+R PAR/Y/O
	3090	.41(11)	L/TR V PAR+W PAR/BW+OCC STR BS/I+R PAR/Y/L
	3150	0(0)	N.D.P.
	3255	.39(3)	VL/3 V PAR/OCC BS+W/TR I+RM/Y+Y/O
	3315	.5(10)	VL/VW+PAR=RM+I/BW/LT 0
	3375	.39(5).62(3)	VL/F SML V+I PAR/BS+W/Y+Y/O
	3435	.44(19)	F V PAR+W IN BS CTGS/VAR BS+W/TR I/LT 0
Cromer Knoll Group	3525	.44(7)	TR V PAR+W=I/VAR BS/Y-LT 0
	3615	.35(5)	TR V PAR+W=I/VAR BS/Y-Y/O
	3705	.39(6)	6 PAR V/S STR BS/TR R+I PAR/LT 0
	3732	.45(8)	TR V/STR OBS/TR I+R PAR/LT 0
	3755	.46(19)	VL/TR V W PAR/STR OBS/TR I+R PAR/LT 0
Kinn Clay Fm	3730	.52(2)	VL/2 V PAR/BS/TR I/LT 0
	3735	.45(2).73(3)	VL/TR V-LOW-M RM/STR OBS IN S CTGS/TR I/LT
	3315	.44(3)	L/F W PAR+PAR V/VAR BS/I PAR/LT 0
	3320	.49(6)	VL/6 PAR POS V/OBS/F PAR I+RM/LT 0
	3333	.76(3)1.17(1)	VL/F HIGH RO V+I PAR-POS WH RM/LT BS/LT 0
Ula Fm	3375	.75(16)1.04(5)	TR SML PAR V+I-LOW-POS TRUE/OBS/LT 0
Fjerritslev Fm	3909	.33(3)	BAR* V SP
Triassic	3965	.74(16)1.07(5)	L/V PAR-LOW-POS TRUE/STR OBS/I PAR/LT 0
	4055	.53(3).33(10)	L/I+V PAR-LOW-POS TRUE/STR BS+W/Y/O+LT 0
	4145	.46(5).8(14)	L-MOD/PAR I+V-LOW-POS TRUE/DD/STR BS+W/LTC
	4145.1	1.12(1)	
	4233	.55(9).33(7)	L-MOD/PAR I+V-LOW-S R/OBS+W/Y/O+LT 0
	4340	.66(9)1.02(4)	L/PAR I+V-LOW/DD/OBS/LT 0
Permian	4340.1	1.31(20)	COAL/WH V-CELL STC
	4415	.38(3).57(11)	L/LOW-POS TRUE/BS+W/TR SML I PAR/Y/O+LT 0

FIGURES IN PARENTHESES INDICATE NUMBER OF READINGS
SEE LIST OF ABBREVIATIONS OVERLEAF

TABLE 1A

VITRINITE TABLE ABBREVIATIONS

ANS - ANISOTROPIC	B - BITUMEN
ES - BITUMEN STAINING	BW - BITUMEN WISPS
BAR - VIRTUALLY BARREN	CAV - CAVED
CARB - CARBARGILITE	COR - CORRODED
CTGS - CUTTINGS	DD - DIFFERENTIATION DIFFICULT
DMA - DRILLING MUD ADDITIVE	DOM - DOMINANT
F - FEW	FL - FLUORESCENCE
FR - FRAGMENTS	G - GOOD
GN - GNARLED	GRAN - GRANULARITY
I - INERTINITE	INST - INTERSTITIAL
L - LOW ORGANIC CONTENT	LGN - LIGNITE
LOW - LOWEST REFLECTANCES MEASURED	M - MOSTLY
MOD - MODERATE ORGANIC CONTENT	NDP - NO DETERMINATION POSSIBLE
NTV - NO TRUE VITRINITE	OBS - OVERALL BITUMEN STAINING
OCC - OCCASIONAL	OX - INDICATIONS OF OXIDATION
P - POOR	PAR - PARTICLES
PL - PLENTIFUL-PLenty	POS - POSSIBLY
R - REWORKED	RM - REWORKED MATERIAL
RO - REFLECTANCE MEASUREMENT	RES - RESIN
RICH - RICH-HIGH ORGANIC CONTENT	S - SOME
SC - SCRUFFY	SH - SHALE
SLT - SILTSTONE	SML - SMALL
SP - SPECKS	SUB - SUBORDINATE
STC - STRUCTURE	STR - STRONGLY
TB - TURBO-DRILLED	TR - TRACE
TEL - TELINITIC	V - VITRINITE
VL - V.LOW ORGANIC CONTENT	VW - VITRINITE WISPS
VAR - VARIABLE	VST - VITRINITE STRINGERS
W - WISPS-WISPY	WH - WHOLLY
* - ALLOCTHONOUS	= - EQUAL PROPORTIONS

SPORE FLUORESCENCE COLOURS UNDER U.V. LIGHT

G - GREEN	Y - YELLOW
O - ORANGE	R - RED
LT - LIGHT	M - MID
D - DEEP	P - PALE

TABLE 1a. - Vitrinite Reflectance Analysis
for well: 7/12-5

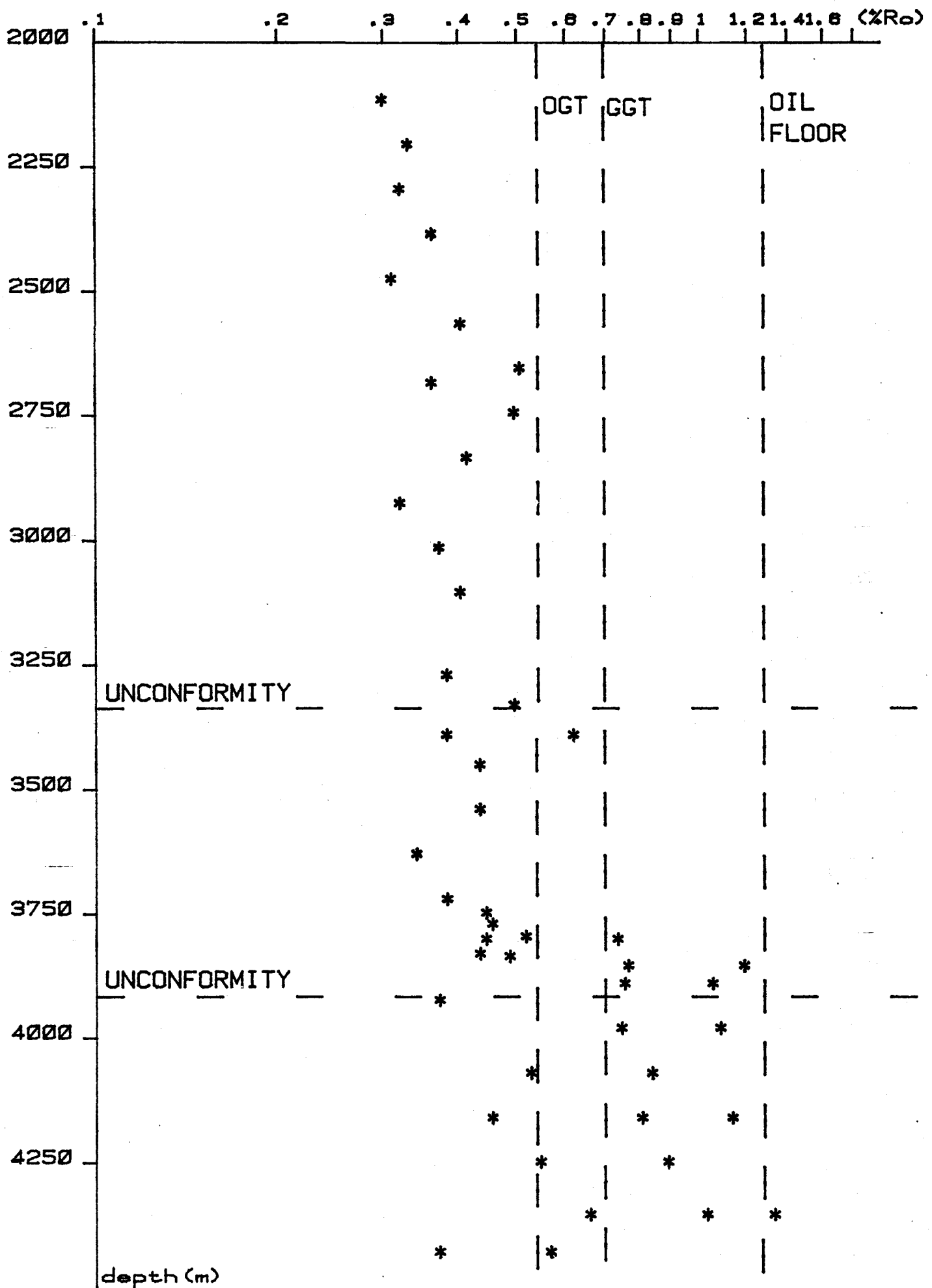


TABLE 2

 VISUAL KEROGEN DESCRIPTIONS

WELL: 7/12-5

LOCATION: NORWEGIAN SECTOR, NORTH SEA

	DEPTH(M)	SPORE COLOUR	SOURCE POTENTIAL	

Tertiary	Hordaland Gp	2100	2/3	GOOD OIL
	Rogaland Gp	2910	2/3	POOR-MOD OIL
Cretaceous		3090	3	NONE
	Chalk Group	3315	3-3/4	NONE
	Cromer Knoll	3525	3/4	NONE
Jurassic		3740	4	GOOD OIL
	Kinn Clay Fm	3820	4-4/5	GOOD OIL
	Fjerritslev Fm	3909	4/5	NONE-ORGANICALLY LEAN
	Triassic	3965	5	NONE
	Permian	4415	5-5/6	NONE

TABLE 3

ROCK-EVAL AND PYROLYSIS DATA

WELL: 7/12-5

LOCATION: NORWEGIAN SECTOR, NORTH SEA

	DEPTH (M)	P1 KG/TONNE	P2 KG/TONNE	GOGI	OIL YIELD KG/TONNE	GAS YIELD KG/TONNE	
Tertiary	2100	.1	9.5	.64	5.8	3.7	
	2190	.1	5.7	.65	3.5	2.2	
	Hordaland Gp	2280	.1	4.2	.6	2.6	1.6
	2370	.1	1.1				
	2460	.1	2.1				
	2550	.1	.8				
	2640	.1	.3				
	Rogaland Gp	2670	0	.5			
	2730	0	.4				
	2820	.1	.6				
Montrose Gp	2910	.1	1.9				
	3000	0	.5				
Cretaceous	3090	.1	.9				
	Chalk Group	3180	.1	0			
	3255	.1	.4				
	3315	.1	.5				
	3375	.1	.4				
	Cromer Knoll Group	3435	.1	.4			
	3525	.1	.7				
	3615	0	.3				
	3705	0	.1				
	3732	2.5	25	.29	19.4	5.6	
3755	2.3	17	.44	11.8	5.2		
Jurassic	Kinn Clay Fm	3780	.4	2			
	3785	1.2	11	.3	8.5	2.5	
	3815	1.1	3.7				
	3820	2.1	10.1	.36	7.4	2.7	
	3838	.4	.3				
	Ula Fm	3875	1.1	3.9	.35	2.9	1
	Fjerritslev Fm	3909	0	.1			
	3965	1.9	12.5	.44	8.7	3.8	
Triassic	4055	1.7	7.6				
	4145	1.7	9.2	.46	6.3	2.9	
	4233	1.5	8.2				
	4340	2.1	10.3	.47	7	3.3	
	4340	1	24.2	0.6	15.1	9.1	
Permian	4415	1.9	9.3				

TABLE 3A

KEROGEN PYROLYSATE DATA

WELL: 7/12-5

LOCATION: NORWEGIAN SECTOR, NORTH SEA

Sample Depth	%wt in P2					
	Methane C1	Gases C2-C5	Gasoline C6-C9	Kerosene C10-C13	Gas Oil C14-C22	Wax Distillate C23-C36
2100m	32	7	23	21	17	0
2190m	39	9	24	20	16	0
2280m	29	8	27	18	17	1
3732m	13	9	17	22	31	8
3755m	15	16	24	21	24	0
3785m	12	11	20	25	31	1
3820m	16	9	22	20	28	5
3875m	15	11	25	22	27	0
3965m	19	11	29	17	21	3
4145m	23	8	25	22	22	0
4340m	26	6	20	26	21	1

TABLE 4

LITHOLOGY OF WASHED, UNPICKED SAMPLES

Well: 7/12-5

Location: NORWEGIAN SECTOR, NORTH SEA

<u>Depth (m)</u>	<u>Description</u>
2100	95% MDST lt-dark gy occn silty 5% LST tan/white.
2190	MDST a/a occn calc occn silty.
2280	MDST a/a calc, occn, v.silty, LST tr buff, tan.
2370	MDST as above, occn gn/gy occn brn, LST tr a/a
2460	90% MDST gn-md gy occn dk gy - brn occn silty 10% LST cream.
2550	90% MDST lt gy-gn/tn 10% LST tan, cream, tr MDST dk gy, tr CALC.
2640	70% MDST lt gy-gn 30% MDST multicoloured tuffaceous.
2670	a/a a/a Abundant cavings.
2730	90% MDST multicoloured 10% LST white-tan.
2820	60% MDST lt gy-gn gy 30% MDST brn-med gy/brn 10% LST a/a.
2910	60% MDST a/a cavings 30% MDST lt red brn occn pink 10% LST a/a.
3000	50% LST white 40% MDST a/a cavings 10% MDST lt-med gy.
3090	60% LST white occn silty 40% MDST lt-med gy/brn occn calc.
3180	95% LST a/a 5% MDST a/a cavings.
3255	80% KMST a/a 20% MDST red brn, gy/gn, dk gy, calc.
3315	60% LST a/a occn pink 40% MDST med gy, calc, many cavings.

TABLE 4 (Contd.)

<u>Depth(m)</u>	<u>Description</u>
3375	20% assorted cavings 40% MDST lt gy-gn gy silty, calc 20% LST pink. 15% SLTST lt gy-gn calc 5% SST tan v.fine.
3435	70% LST white 30% MDST various colours/gy/gn/brn calc grading to SLTST.
3525	60% MDST lt-med gy 20% MDST red-brn calc 20% LST pink.
3615	80% MDST a/a 10% a/a 5% LST a/a 5% DOC tan
3705	90% MDST med gy-gn - gy/brn calc 5% MDST a/a 5% LST gy- arg.
3720	S.W.C. MDST med gy, calc.
3732	S.W.C. a/a.
3755	85% MDST dk brn/gy calc, Fe stained 15% LST white.
3785	100% MDST Fe stained, lt-dk gy, tr LST white.
3815	50% Fe filings 50% MDST FE stained med-dk gy calc, many cavings tr SH dh gy.
3820	S.W.C. SH dk gy.
3838	S.W.C. SLTST med gy poorly consolidated.
3875	80% MDST med-dk gy 20% SST off-white.
3909	CORECHIP MDST med gy sl calc.
3765	80% MDST dk gy occn silty 10% SLTST red/brn 10% SST off-white.
4055	40% MDST a/a 30% SLTST a/a 30% SST a/a.
4145	33% MDST a/a 33% SLTST a/a 33% SST white & red Abundant cavings.
4255	25% MDST a/a 33% SLTST a/a 33% SST a/a Abundant cavings.
4340	33% MDST a/a 33% SLTST a/a 33% SST a/a Mnr Coal Abundant Cavings.
4415	40% MDST a/a 40% SLTST a/a 20% SST a/a Abundant cavings.

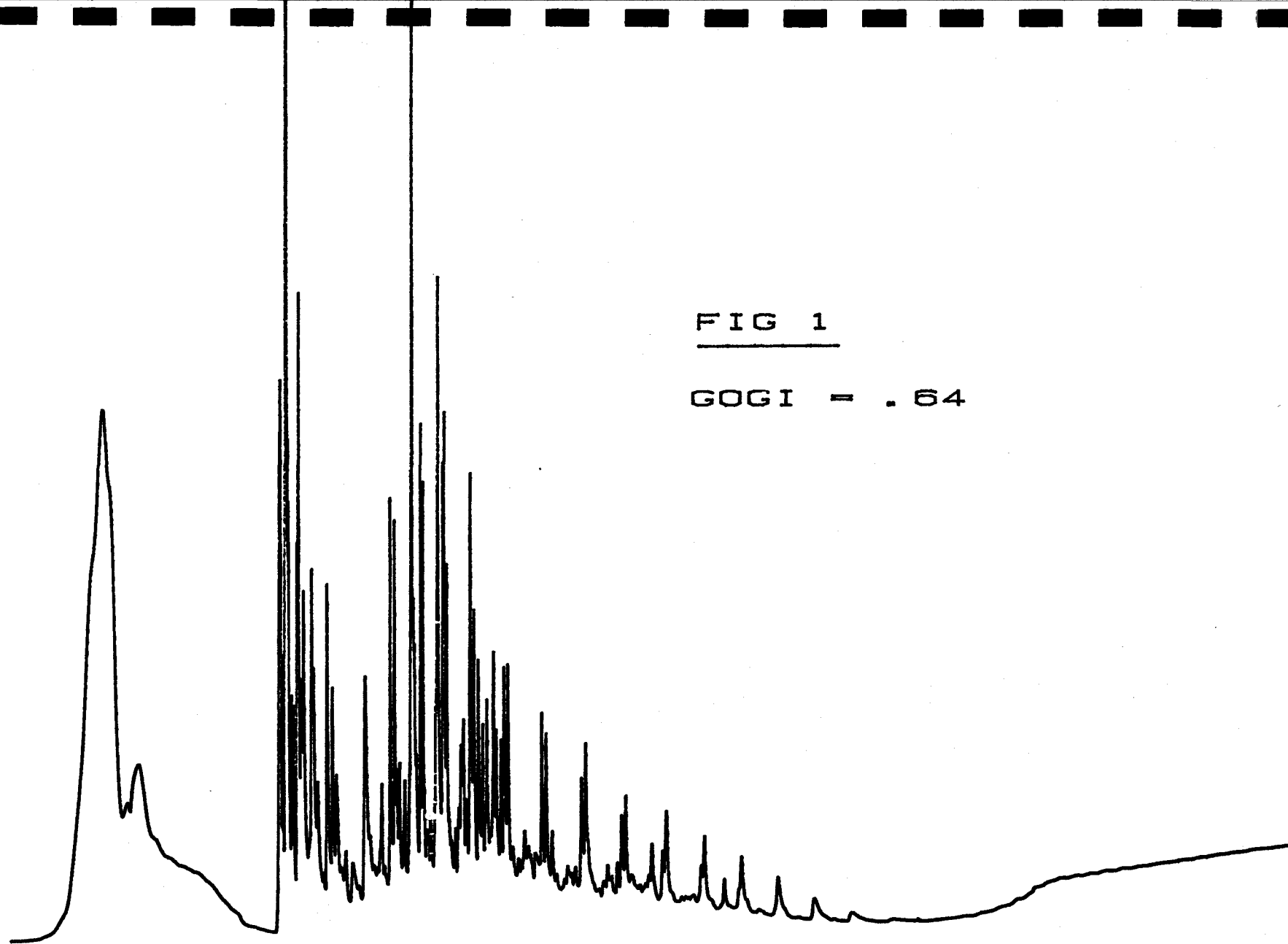


FIG 1

GOGI = .64

SAMPLE. 7/12-5 2100M. KEROGEN PYROLYSATE

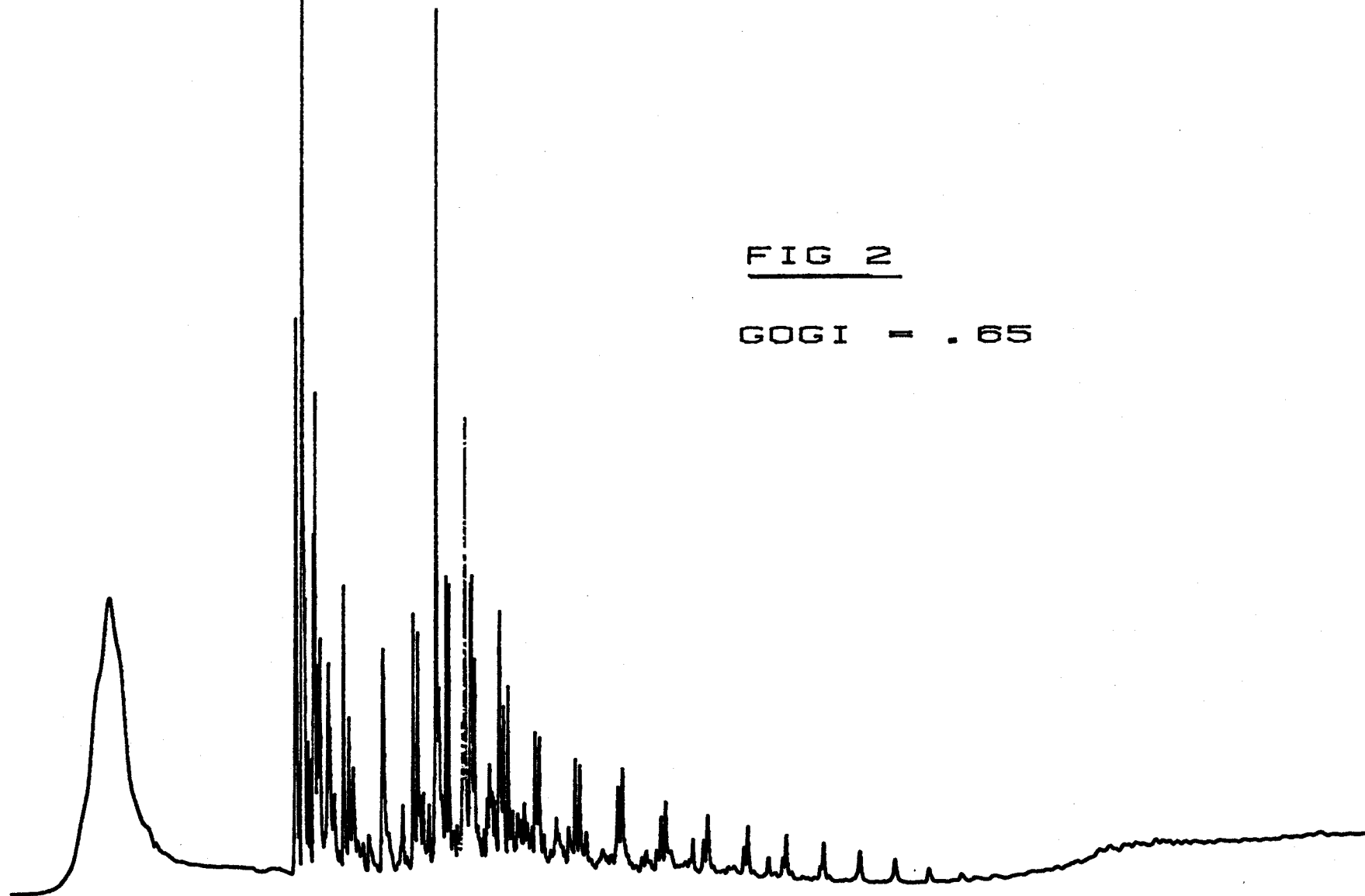


FIG 2

GOGI = .65

SAMPLE: 7/12-5 2190M. KEROGEN PYROLYSATE

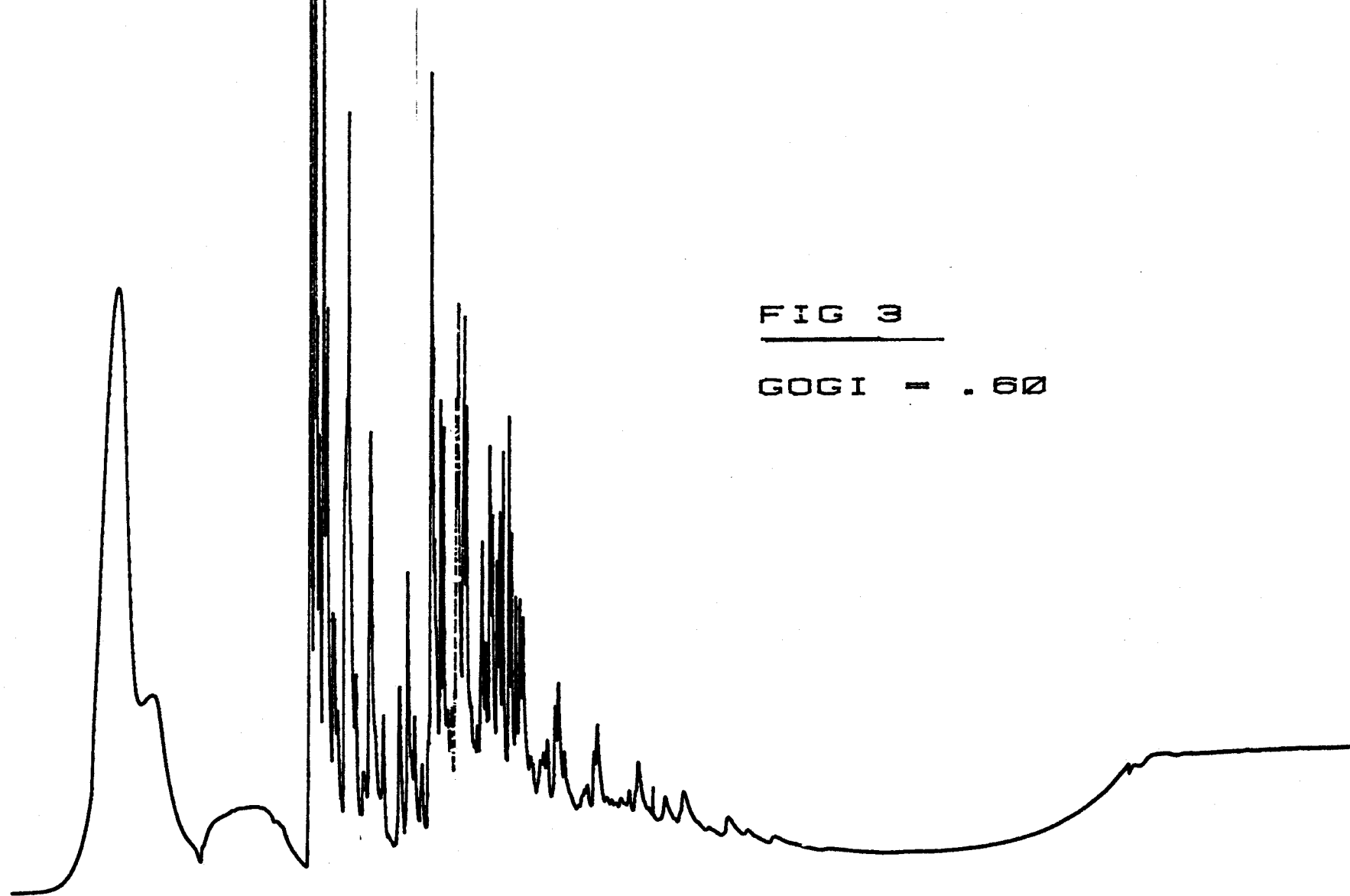


FIG 3

GOGI = .60

SAMPLE: 7/12-5 2280M. KEROGEN PYROLYSATE

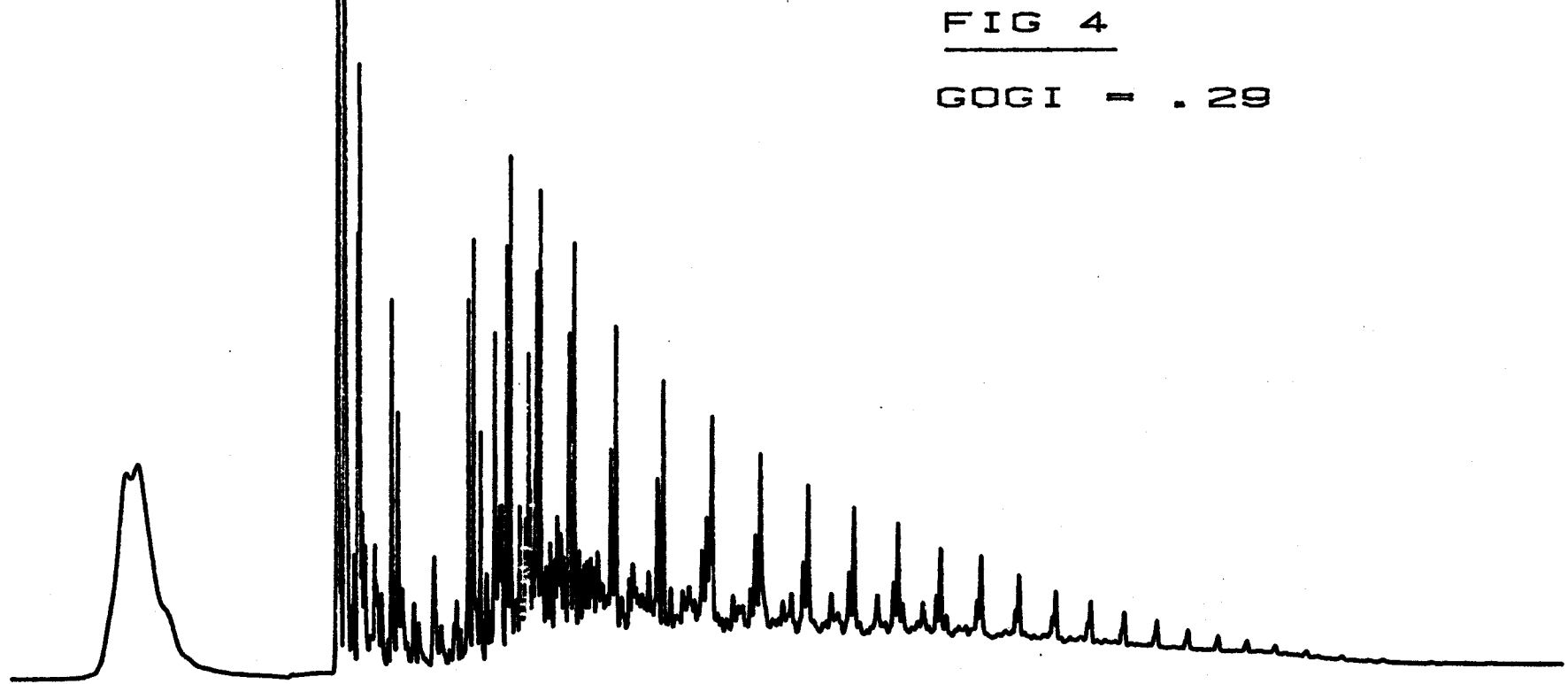


FIG 4
GOGI = .29

SAMPLE: 7/12-5 3732 M.KEROGEN PYROLYSATE

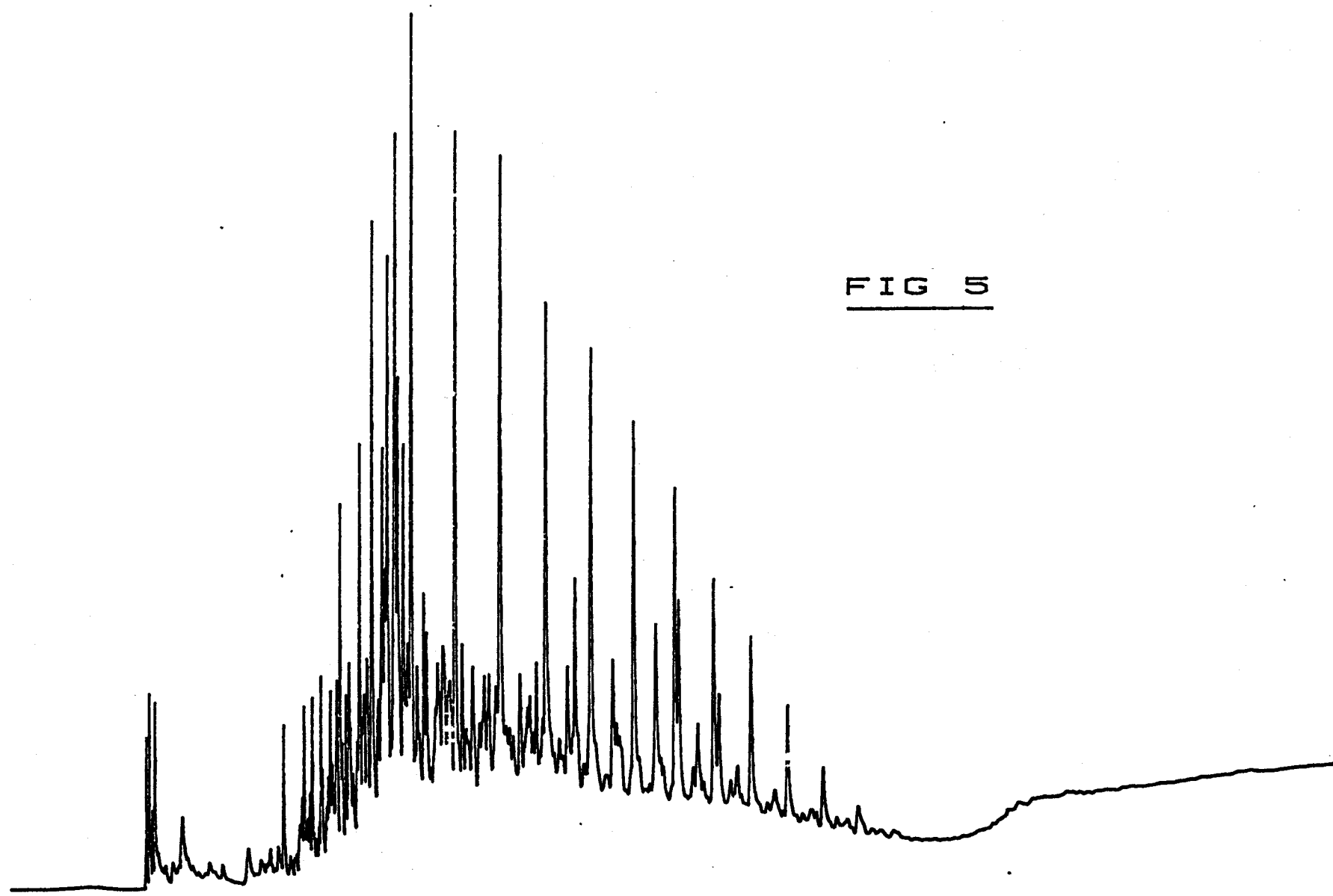


FIG 5

SAMPLE: 7/12-5 3755M. THERMAL VOLATILATE

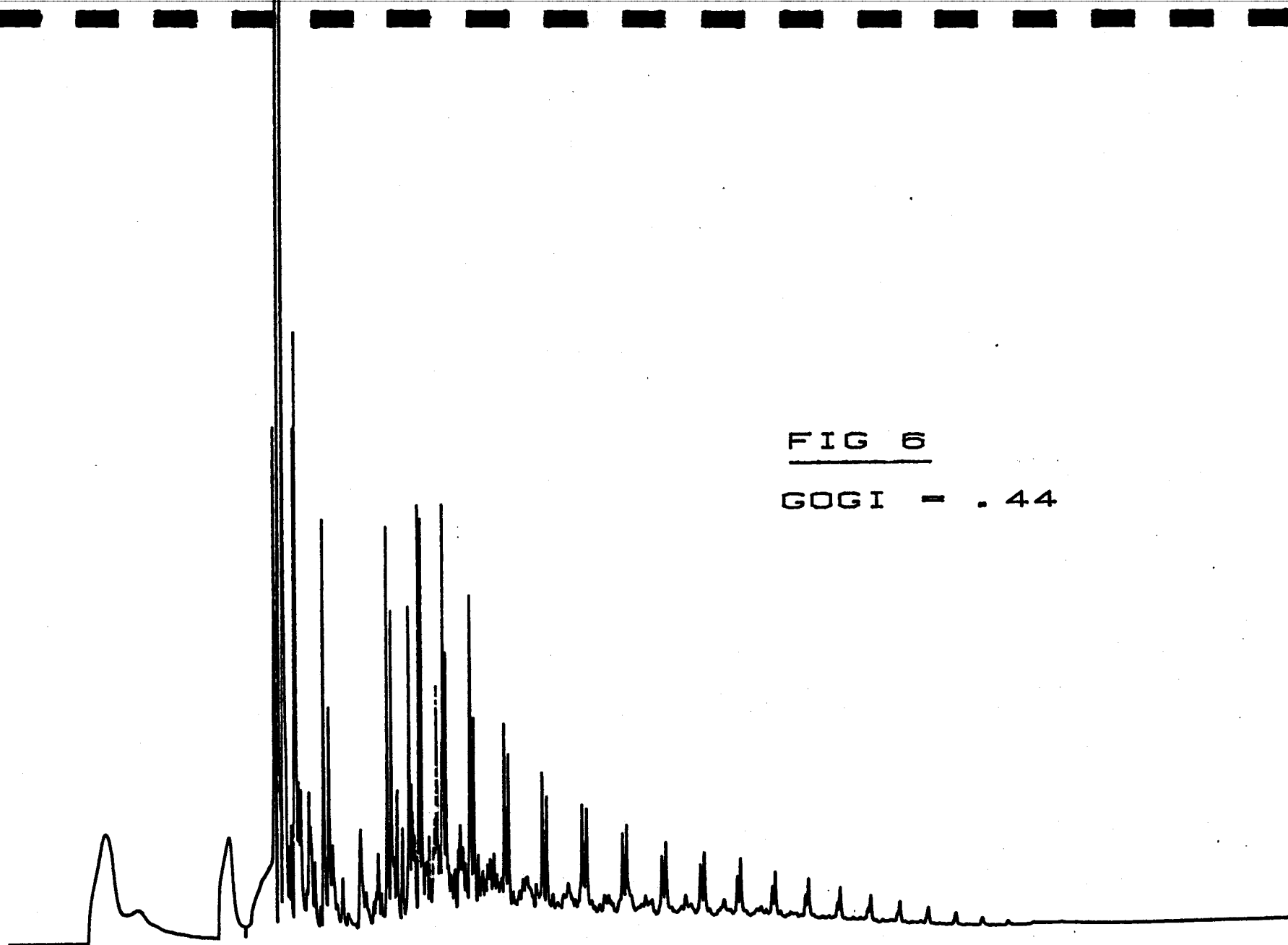


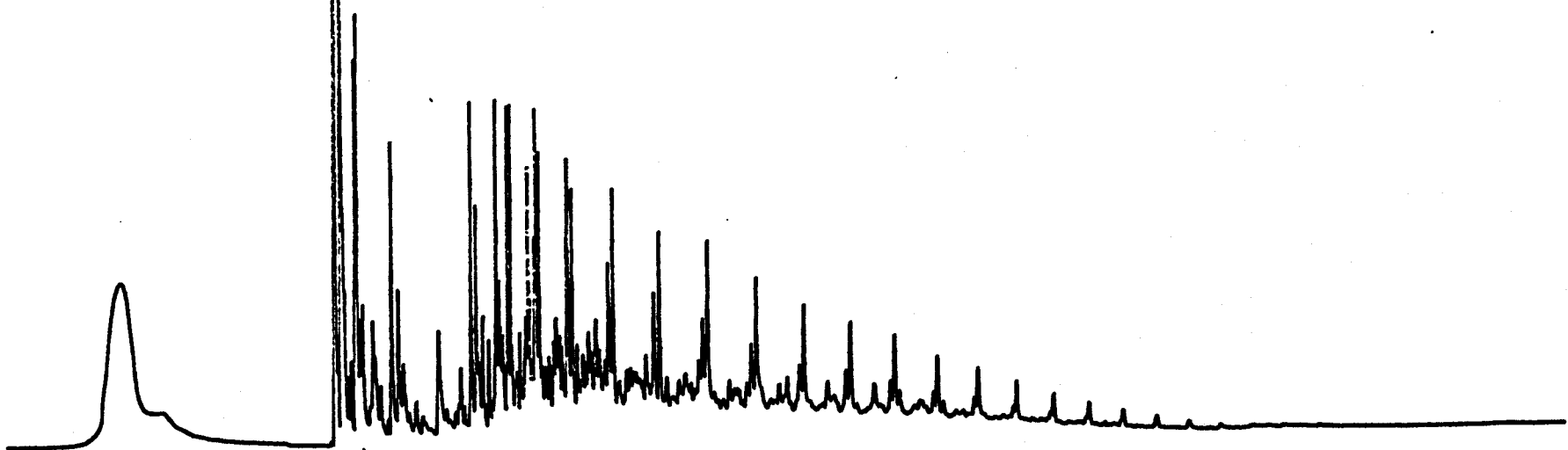
FIG 6

GOGI - .44

SAMPLE: 7/12-5 3755M.KEROGEN PYROLYSATE

FIG 7

GOGI = .30



SAMPLE: 7/12-5 3785 M. KEROGEN PYROLYSATE

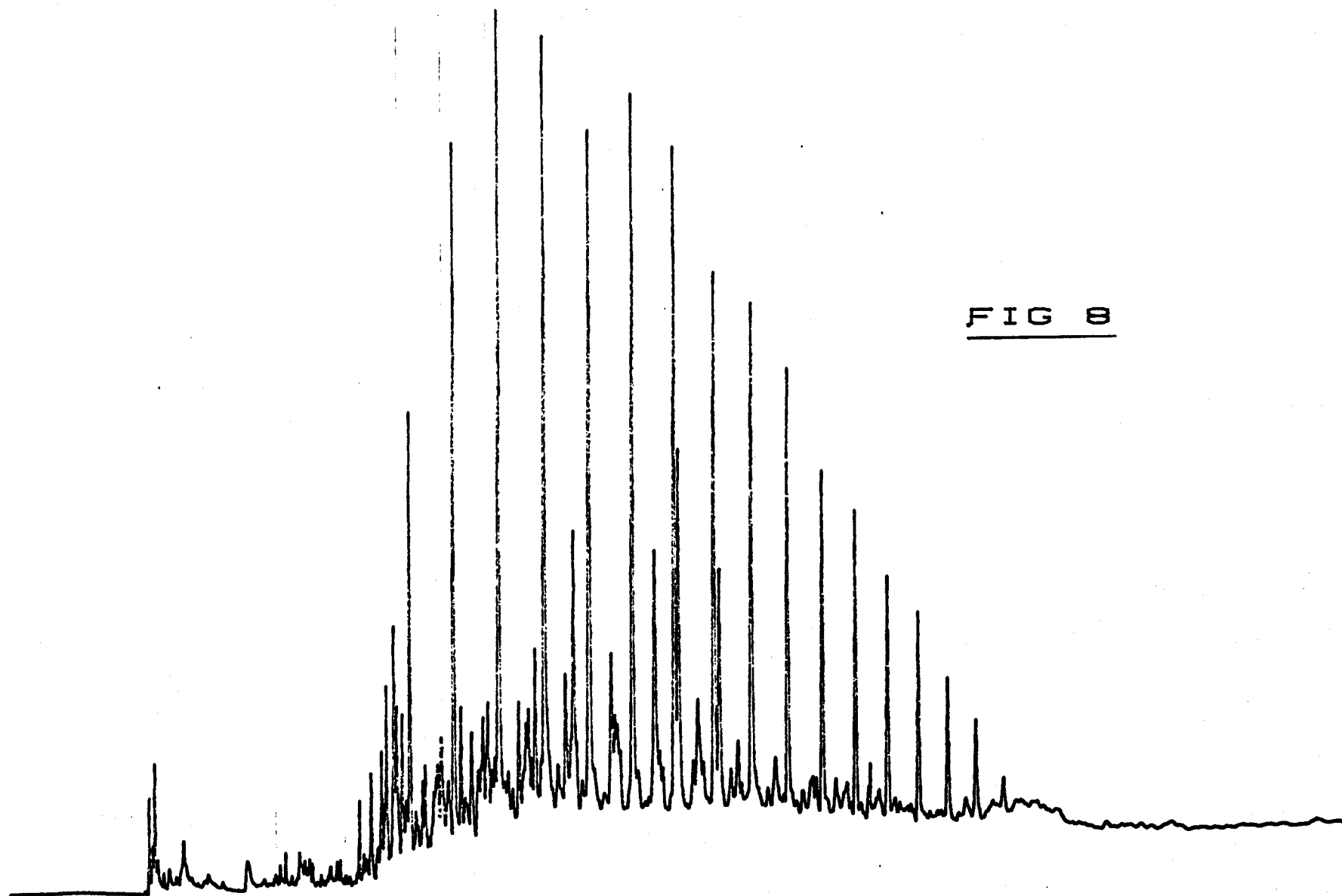


FIG 8

SAMPLE: 7/12-5 3820M. THERMAL VOLATILATE

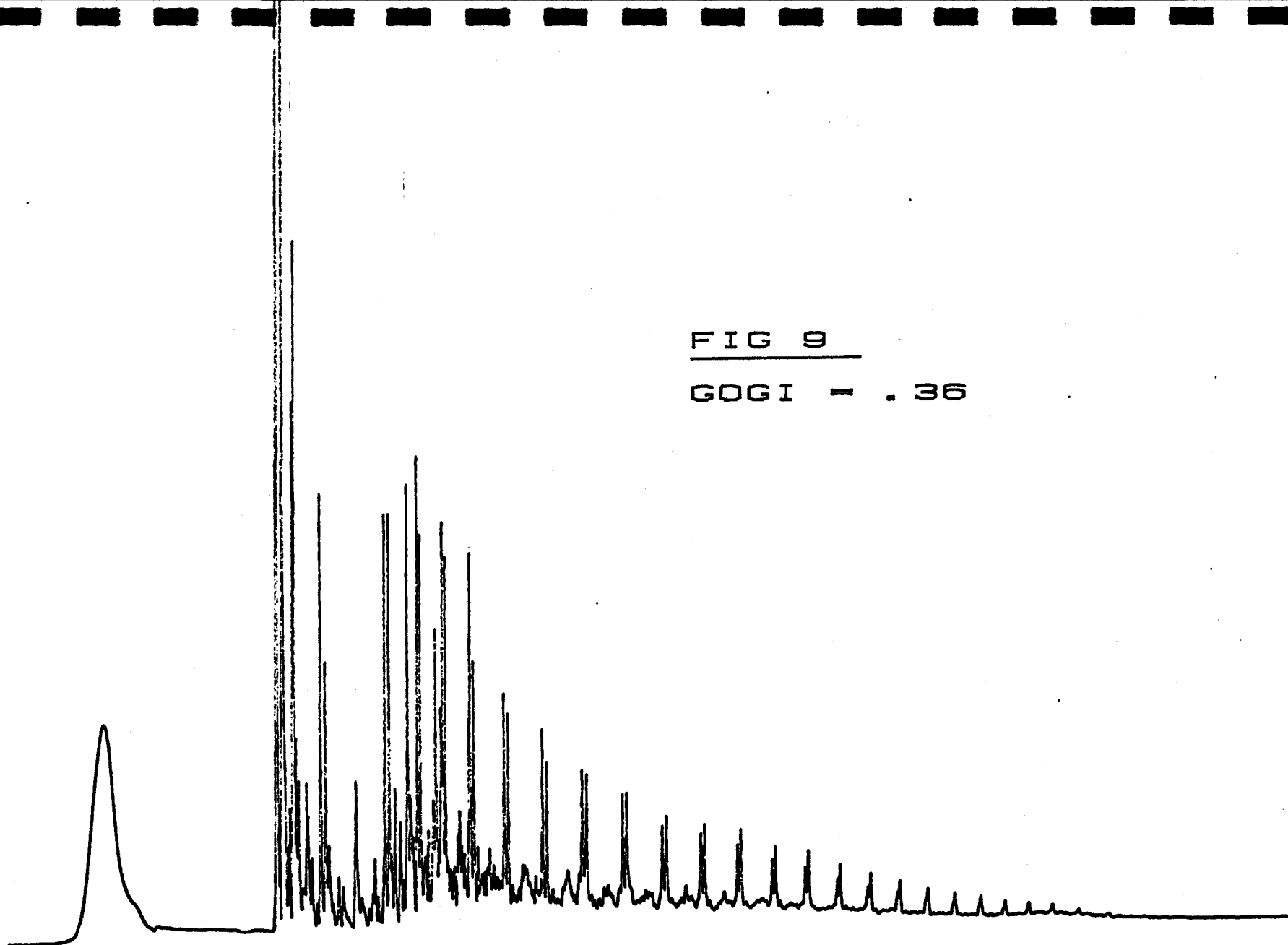


FIG 9

GOCI = .36

SAMPLE: 7/12-5 3820M. KEROGEN PYROLYSATE

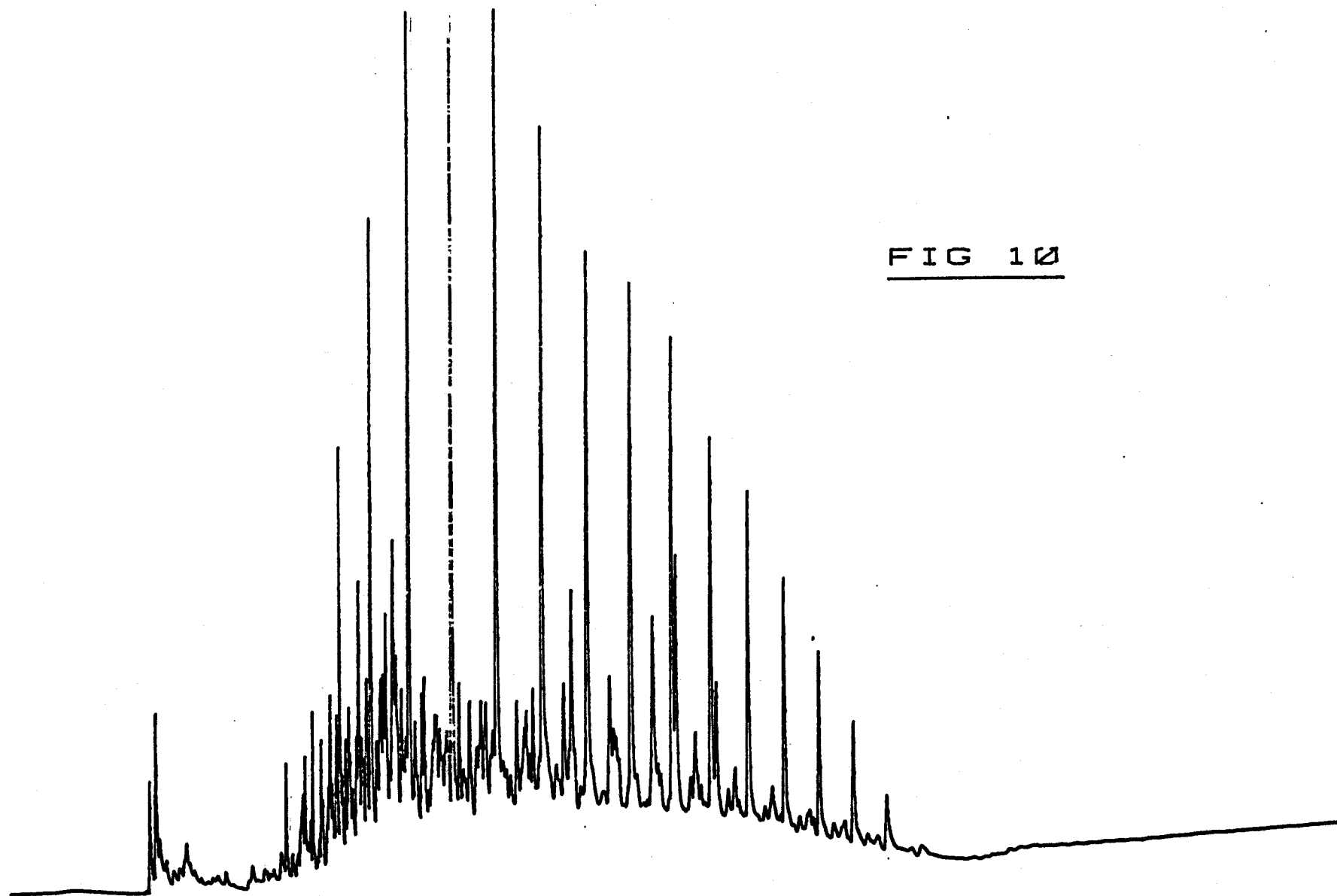


FIG 10

SAMPLE: 7/12-5 3875M. THERMAL VOLATILATE

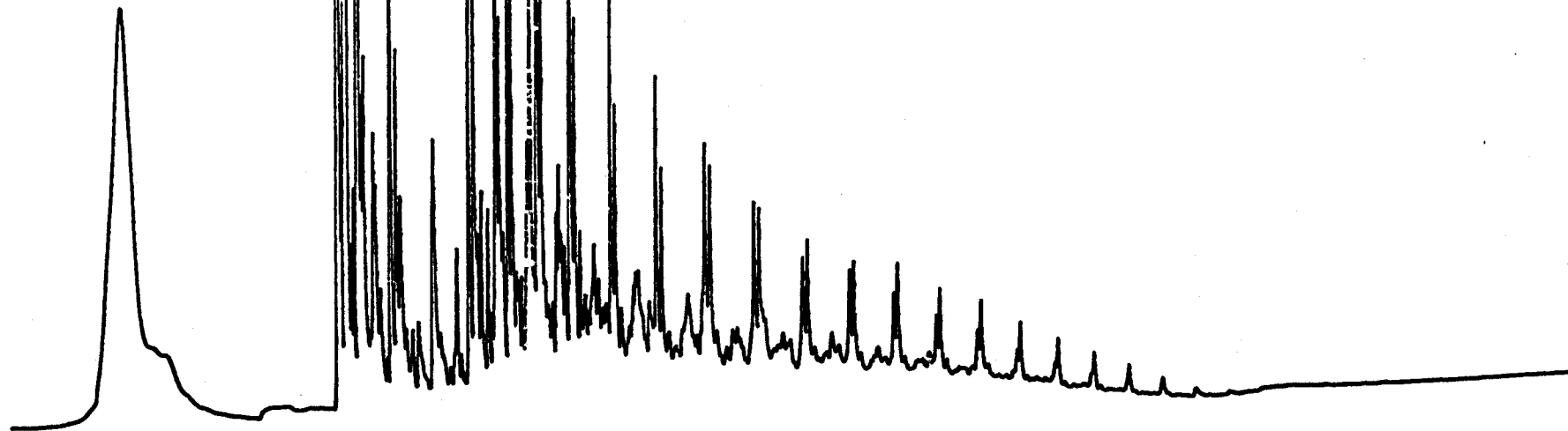


FIG 11

GOGI - .35

SAMPLE: 7/12-5 3875M. KEROGEN PYROLYSATE

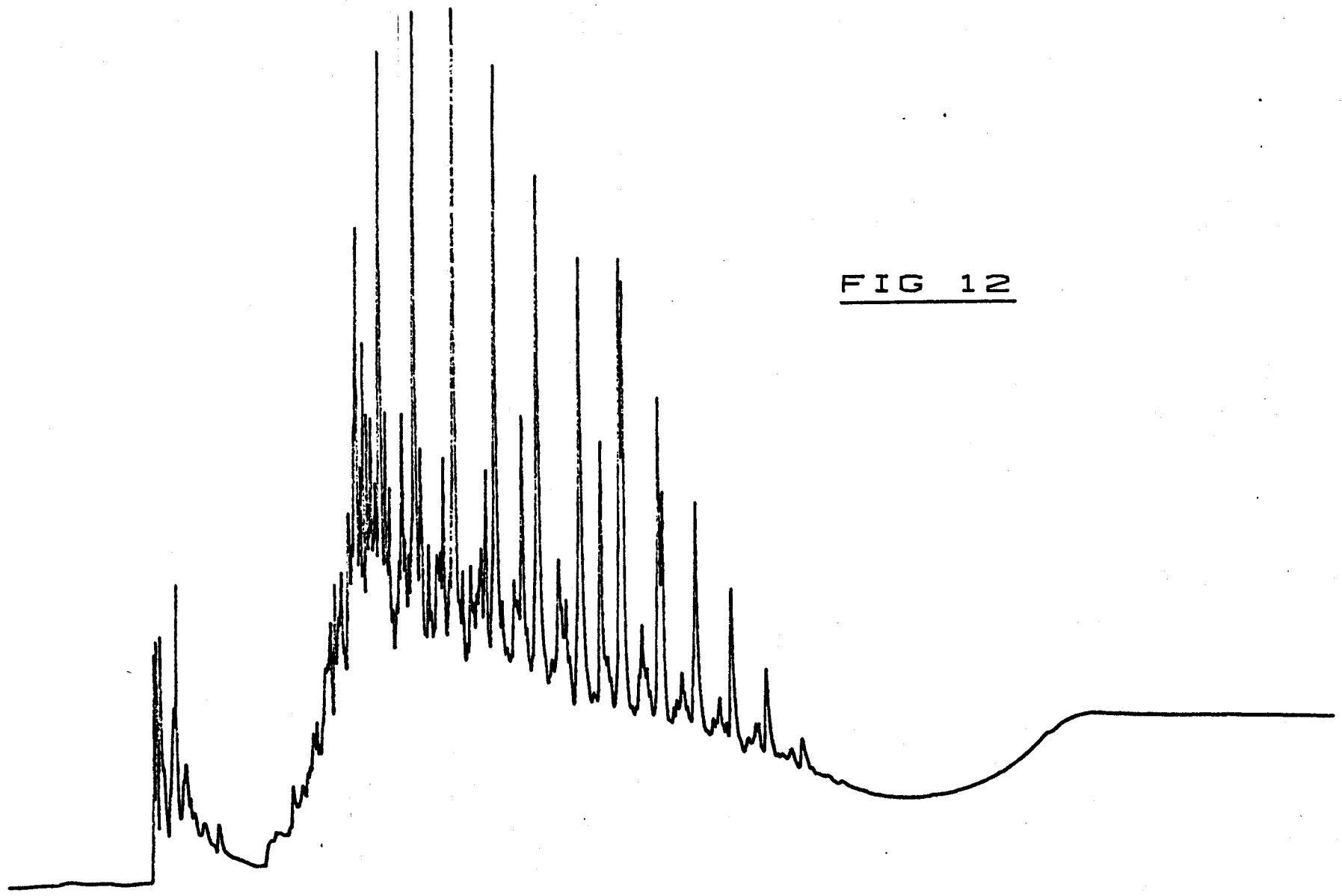
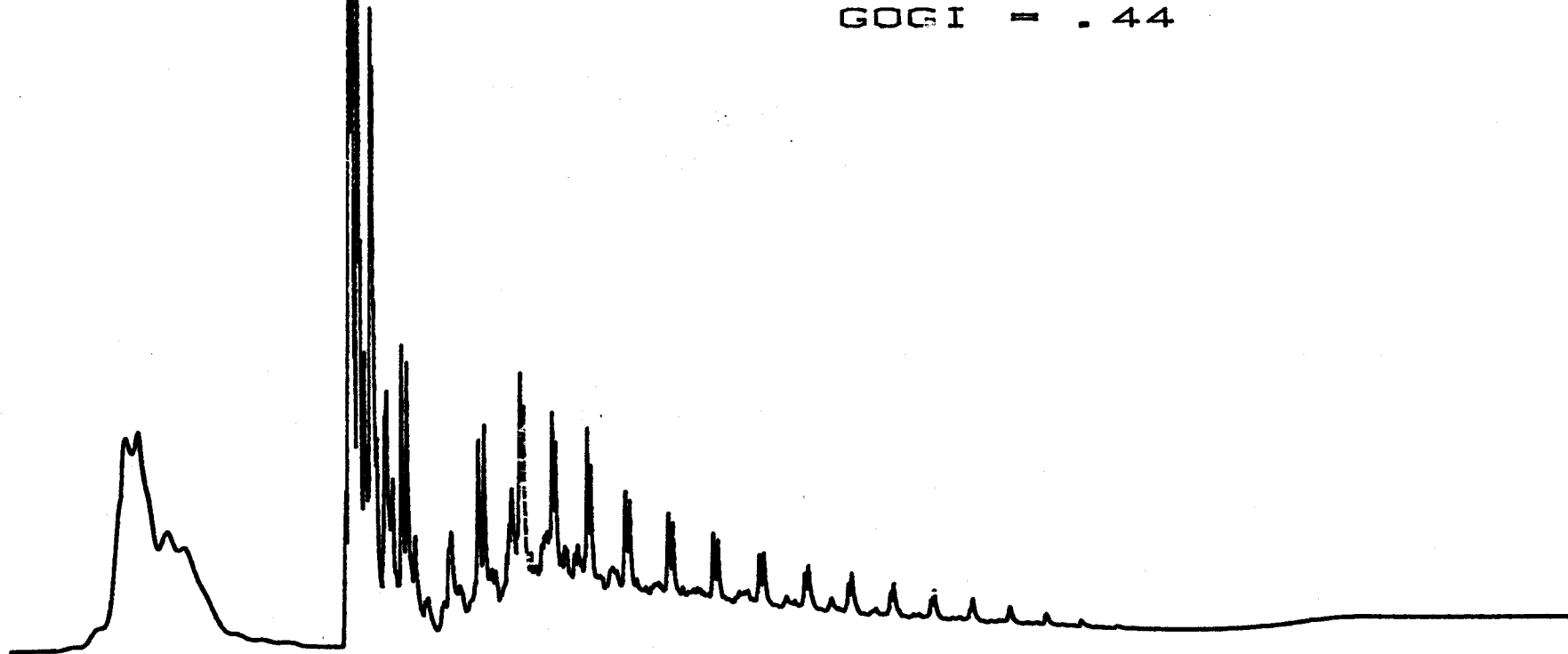


FIG 12

SAMPLE: 7/12-5 3965M.THERMAL VOLATILATE

FIG 13

GOGI = .44



SAMPLE. 7/12-5 3965M. KEROGEN PYROLYSATE

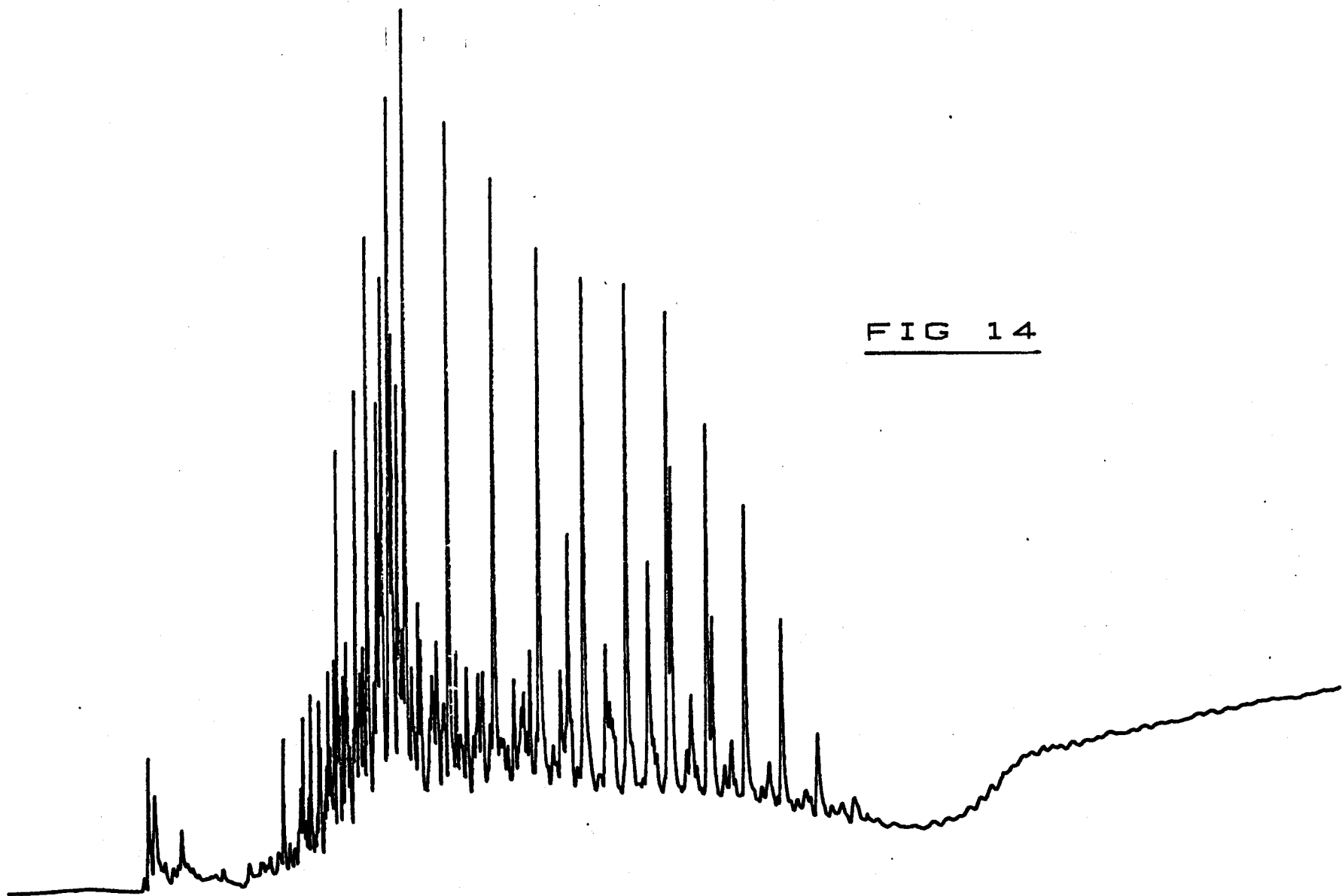
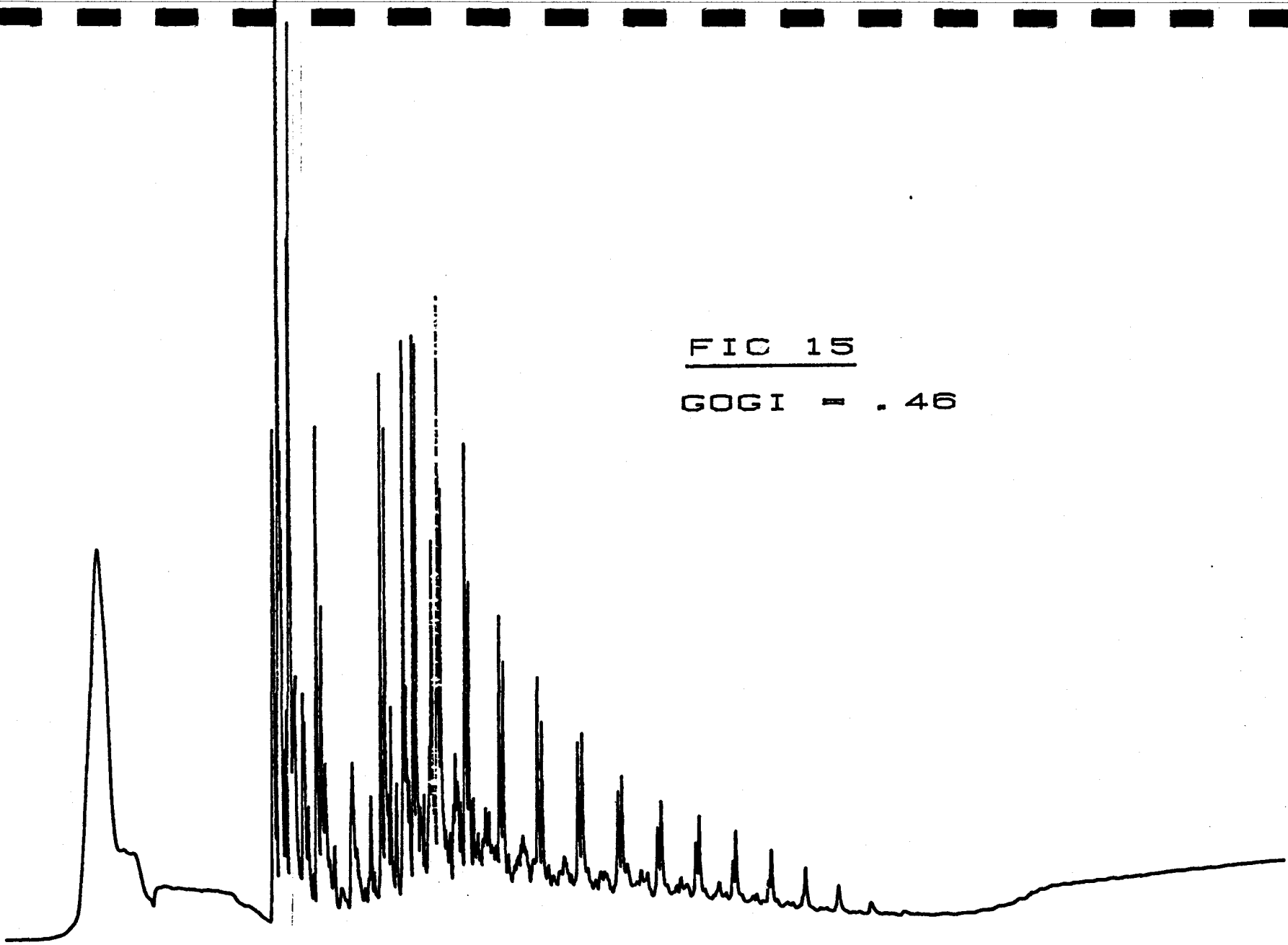


FIG 14

SAMPLE: 7/12-5 4145M. THERMAL VOLATILATE



FIC 15

GOGI = .46

SAMPLE: 7/12-5 4145M. KEROGEN PYROLYSATE

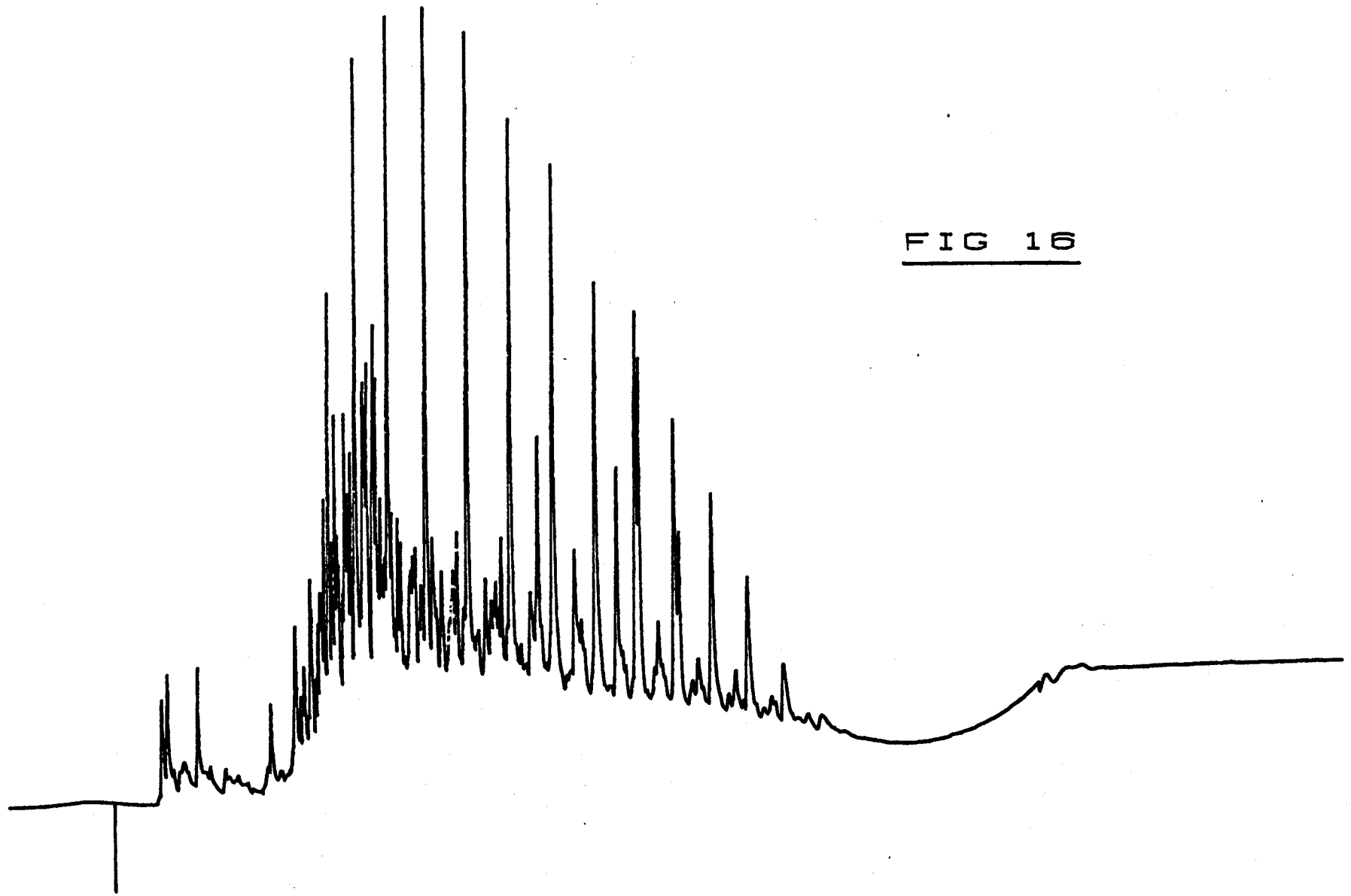


FIG 16

SAMPLE: 7/12-5 4340M. THERMAL VOLATILATE

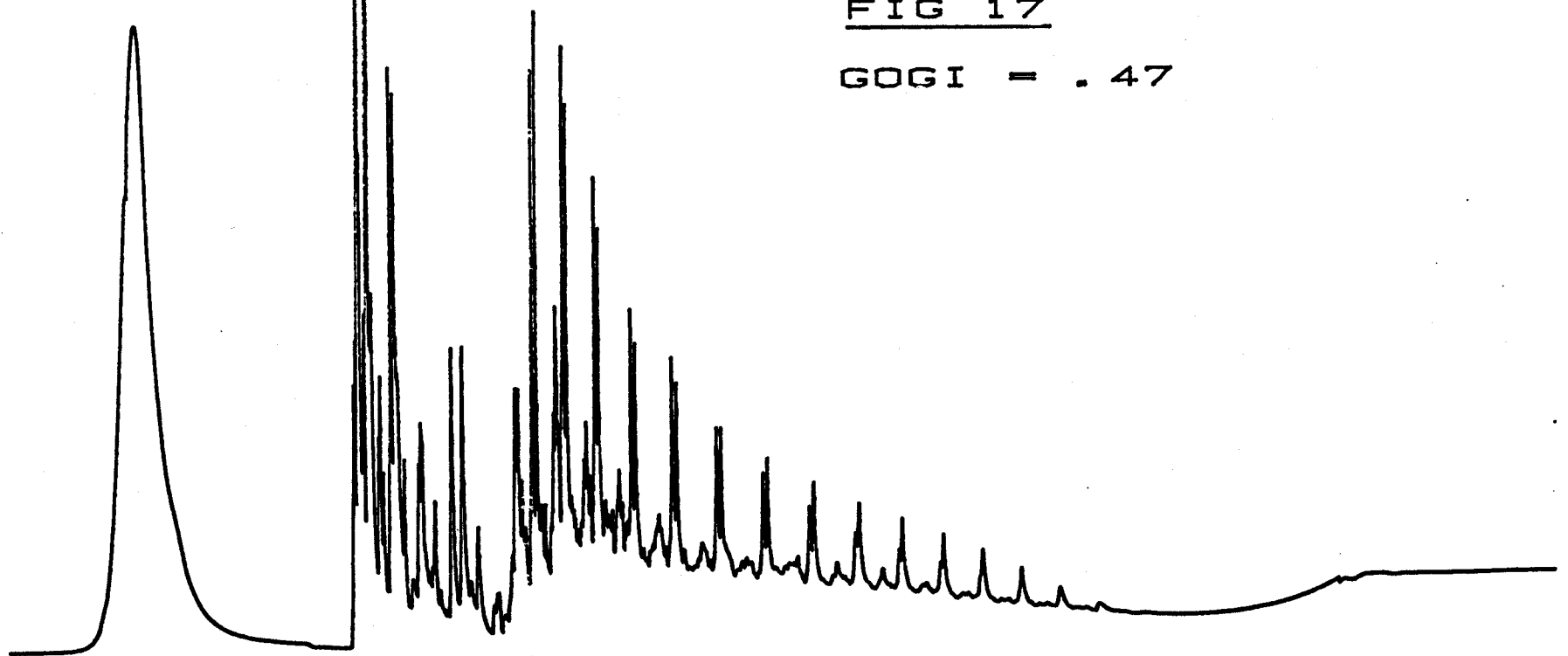


FIG 17

GOGI = .47

SAMPLE: 7/12-5 4340M. KEROGEN PYROLYSATE

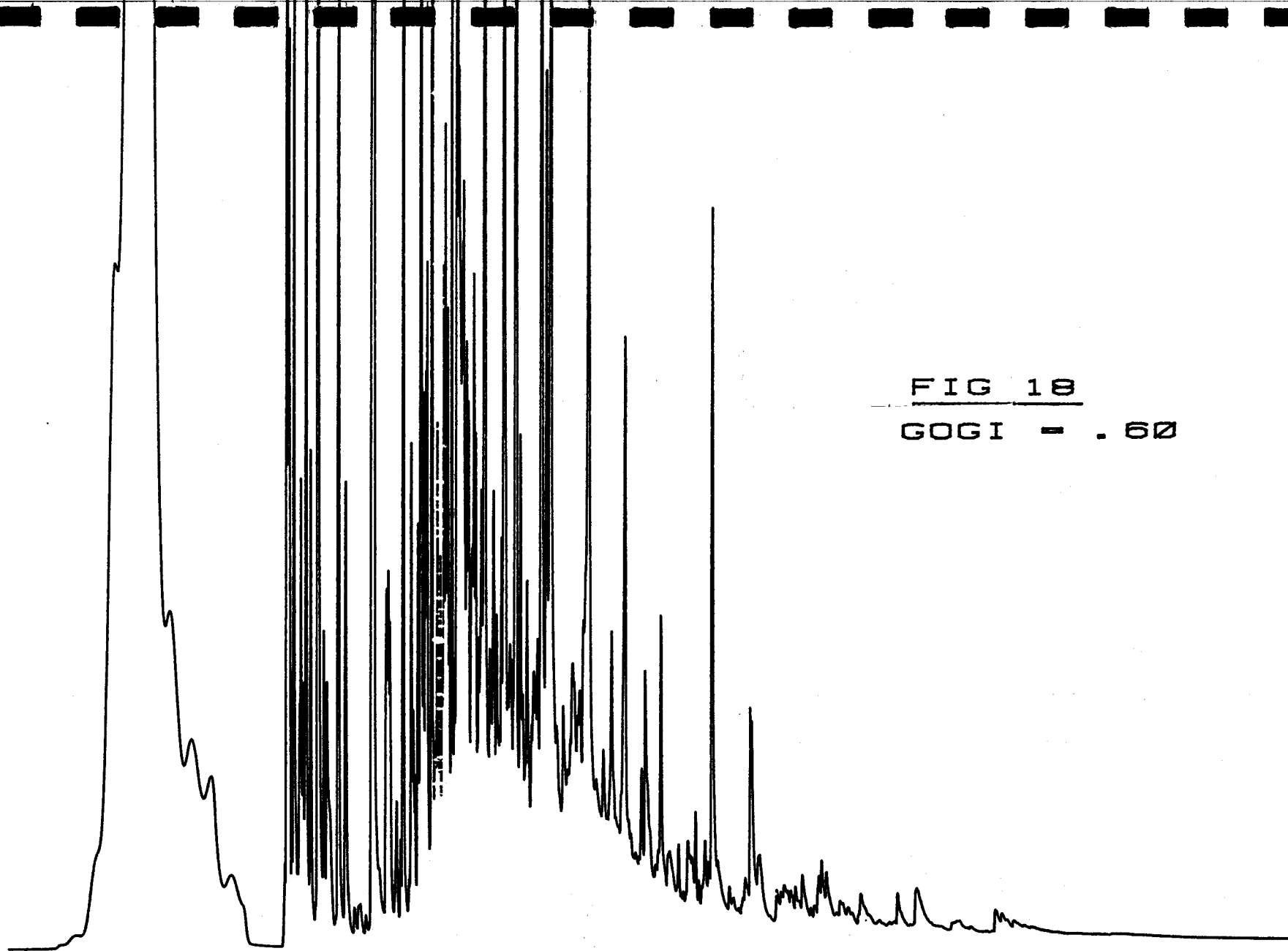


FIG 18
GOGI - .60

SAMPLE: 7/12-5 4340M KEROGEN PYROLYSATE
(COAL)

ORIGIN <i>B.P.</i>	SAMPLE Our Ref: <i>A.S./J.M.J.</i> Your Ref: <i>UU13</i> 2100m
LITHOLOGY <i>CALCAREOUS SHALE / SHALY LIMESTONE</i>	
MINERALOGY	GENERAL COMMENTS
ORGANIC MATERIAL <i>STRONG OVERALL BITUMEN STAINING</i> <i>OTHERWISE, LOW CONTENT OF</i> <i>VITRINITE WISPS + PARTICLES</i>	
APPEARANCE IN U.V. <i>YELLOW FLUORESCENCE</i> <i>FROM SPORES</i>	
EXINITE CONTENT IN U.V. <i>TRACE</i>	<div style="text-align: right;"> <p>Geo-optics Ltd. Ash House Bell Villas Ponteland Northumberland NE20 9BE Date <i>9.7.81</i></p> </div> <div style="text-align: center;"> <p><i>[Signature]</i> Signature</p> </div>

2100m

PREPARATION					WAVELENGTH		R.I. OF IMMERSION OIL	
<i>ISOPRENYL AZIDOC</i>					<i>546 nm.</i>		<i>1.516</i>	
<i>0.30</i>	<i>0.29</i>	<i>0.27</i>	<i>0.32</i>	<i>0.26</i>	TOTAL No. OF PARTICLES MEASURED <i>21</i>			
<i>0.31</i>	<i>0.32</i>	<i>0.32</i>	<i>0.31</i>		REFLECTIVITY (%)		No. OF PARTICLES	
<i>0.30</i>	<i>0.33</i>	<i>0.34</i>	<i>0.31</i>					
<i>0.23</i>	<i>0.31</i>	<i>0.54</i>	<i>0.31</i>		$\bar{R}_{max.}$			
<i>0.31</i>	<i>0.34</i>	<i>0.39</i>	<i>0.31</i>					
					$\bar{R}_{aver.}$		<i>0.31</i> <i>21</i>	
					CARBON (%)	VOLATILE MATTER YIELD (%)	CARBON RATIO	
					<i>63</i>			

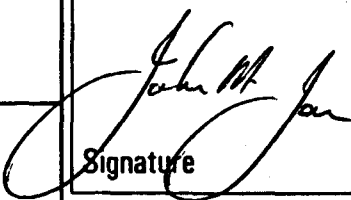
2100m

ORIGIN	<i>B.P.</i>	SAMPLE	Our Ref: <i>A.S./J.M.J.</i> Your Ref: <i>UV14</i>	2190m
LITHOLOGY	<i>SHALE</i>			
MINERALOGY	GENERAL COMMENTS			
ORGANIC MATERIAL				
APPEARANCE IN U.V.	<i>HEAVY OVERALL BITUMEN STAINING. LOW CONTENT OF VITRINITE PARTICLES + WISPS WITH TRACE ONLY OF INERTINITE.</i>	Geo-optics Ltd. Ash House Bell Villas Ponteland Northumberland NE20 9BE Date <i>9.7.81</i>		
EXINITE CONTENT IN U.V.	<i>TRACE</i>			

2190m

PREPARATION					WAVELENGTH		R.I. OF IMMERSION OIL				
Isopropyl Alcohol					546nm		1.516				
0.37	0.35	0.34	0.32	0.29	TOTAL No. OF PARTICLES MEASURED 21						
0.35	0.32	0.37	0.33		REFLECTIVITY (%)		No. OF PARTICLES				
0.39	0.29	0.39	0.26								
0.36	0.38	0.25	0.36		$\bar{R}_{max.}$						
0.33	0.39	0.27	0.36								
					$\bar{R}_{aver.}$		0.34 21				
					EQUIVALENT CHEMICAL PARAMETERS DRY ASH FREE						
					CARBON (%)		VOLATILE MATTER YIELD (%)		CARBON RATIO		
					64						

2190m

ORIGIN	<i>B.P.</i>	SAMPLE	Our Ref: <i>A.S./J.M.J.</i> Your Ref: <i>VU15</i>	2280m
LITHOLOGY	<i>SHALE</i>			
MINERALOGY	GENERAL COMMENTS			
ORGANIC MATERIAL				
APPEARANCE IN U.V.	<i>OVERALL STRONG BITUMEN STAINING</i> <i>TRACE ONLY OF VITRINITE WISPS</i> <i>+ WISPY PARTICLES</i>			
EXINITE CONTENT IN U.V.	<i>TRACE</i>	 Signature		Geo-optics Ltd. Ash House Bell Villas Ponteland Northumberland NE20 9BE Date <i>9.7.81</i>

2280m

PREPARATION				WAVELENGTH		R.I. OF IMMERSION OIL															
ISOPROPYL ALCOHOL				546nm		1.516															
0.28	0.32	0.35	0.38	TOTAL No. OF PARTICLES MEASURED 20																	
0.31	0.25	0.35	0.32	<table border="1"> <thead> <tr> <th>REFLECTIVITY (%)</th> <th>No. OF PARTICLES</th> </tr> </thead> <tbody> <tr> <td>$\bar{R}_{max.}$</td> <td></td> </tr> <tr> <td>$\bar{R}_{aver.}$</td> <td>0.33</td> </tr> <tr> <td colspan="2">EQUIVALENT CHEMICAL PARAMETERS DRY ASH FREE</td> </tr> <tr> <td>CARBON (%)</td> <td>VOLATILE MATTER YIELD (%)</td> <td>CARBON RATIO</td> </tr> <tr> <td>64</td> <td></td> <td></td> </tr> </tbody> </table>				REFLECTIVITY (%)	No. OF PARTICLES	$\bar{R}_{max.}$		$\bar{R}_{aver.}$	0.33	EQUIVALENT CHEMICAL PARAMETERS DRY ASH FREE		CARBON (%)	VOLATILE MATTER YIELD (%)	CARBON RATIO	64		
REFLECTIVITY (%)	No. OF PARTICLES																				
$\bar{R}_{max.}$																					
$\bar{R}_{aver.}$	0.33																				
EQUIVALENT CHEMICAL PARAMETERS DRY ASH FREE																					
CARBON (%)	VOLATILE MATTER YIELD (%)	CARBON RATIO																			
64																					
0.35	0.32	0.32	0.31																		
0.33	0.34	0.32	0.25																		
0.32	0.36	0.40	0.34																		

2280m

ORIGIN	<i>B.P.</i>	SAMPLE	Our Ref: <i>A.S./J.M.J.</i> Your Ref: <i>UU16</i>	<i>2370m</i>
LITHOLOGY	<i>SHALE</i>			
MINERALOGY	GENERAL COMMENTS			
ORGANIC MATERIAL				
APPEARANCE IN U.V.	<i>BITUMEN WISPS. TRACE OF VITRINITE WISPS + WISPY PARTICLES</i>	<p>Geo-optics Ltd. Ash House Bell Villas Ponteland Northumberland NE20 9BE</p> <p><i>John M. Jan</i> Signature</p> <p>Date <i>9.7.81</i></p>		
EXINITE CONTENT IN U.V.	<i>TRACE</i>			

2370m

PREPARATION <i>Isopropyl Alcohol</i>		WAVELENGTH <i>546m.</i>		R.I. OF IMMERSION OIL <i>1.516</i>		
<i>0.36</i>	<i>0.37</i>			TOTAL No. OF PARTICLES MEASURED <i>6</i>		
<i>0.31</i>				REFLECTIVITY (%)	No. OF PARTICLES	
<i>0.34</i>						
<i>0.51</i>				$\bar{R}_{max.}$		
<i>0.35</i>						
				$\bar{R}_{aver.}$	<i>0.37</i>	<i>6.</i>
				EQUIVALENT CHEMICAL PARAMETERS DRY ASH FREE		
				CARBON (%)	VOLATILE MATTER YIELD (%)	CARBON RATIO
				<i>67</i>		

2370m

ORIGIN	<i>B.P.</i>	SAMPLE	Our Ref: <i>A.S./UMJ</i> Your Ref: <i>UV17</i>	<i>2460m</i>
LITHOLOGY	<i>SHALE</i>			
MINERALOGY	GENERAL COMMENTS			
ORGANIC MATERIAL				
APPEARANCE IN U.V.				
EXINITE CONTENT IN U.V.	<i>TRACE</i>	<p>Geo-optics Ltd. Ash House Bell Villas Ponteland Northumberland NE20 9BE Date <i>9.7.81</i></p> <p><i>[Signature]</i> Signature</p>		

ORGANIC MATERIAL

*VARIABLE BITUMEN STAINING +
WISPS
TRACE OF VITRINITE PARTICLES +
A HANDFUL OF INERTINITE
SPRES*

APPEARANCE
IN U.V.

*YELLOW + YELLOW/ORANGE
FLUORESCENCE FROM SPRES*

EXINITE CONTENT
IN U.V.

TRACE

2460m

PREPARATION						WAVELENGTH						R.I. OF IMMERSION OIL					
ISOPROPYL ALCOHOL						546nm						1.516					
0.37	0.38	0.30	0.33	0.27	0.32	TOTAL No. OF PARTICLES MEASURED						27					
0.30	0.35	0.25	0.33	0.38	0.29	REFLECTIVITY (%)						No. OF PARTICLES					
0.37	0.24	0.33	0.31	0.36													
0.38	0.27	0.29	0.32	0.36		\bar{R}_{max}											
0.32	0.29	0.33	0.31	0.30													
						\bar{R}_{aver}						0.32		27			
												EQUIVALENT CHEMICAL PARAMETERS DRY ASH FREE					

2460m

ORIGIN	<i>B.P.</i>	SAMPLE	Our Ref: <i>A.S./J.M.J.</i> Your Ref: <i>UU18</i> <i>2550m</i>
LITHOLOGY	<i>SHALE</i>		
MINERALOGY	GENERAL COMMENTS		
ORGANIC MATERIAL			
APPEARANCE IN U.V.	<p><i>BITUMEN WISPS + VARIABLE STAINING</i> <i>LOW CONTENT OF VITRINITE PARTICLES</i> <i>+ WISPS WITH TRACE OF INERTINITE</i></p> <p><i>YELLOW + YELLOW/ORANGE</i> <i>FLUORESCENCE FROM SPICES</i></p>		
EXINITE CONTENT IN U.V.	<i>LOW</i>	Signature	<p>Geo-optics Ltd. Ash House Bell Villas Ponteland Northumberland NE20 9BE Date <i>9.7.81</i></p>

2550m

PREPARATION					WAVELENGTH	R.I. OF IMMERSION OIL	
ISOPROPYL ALCOHOL					546 m μ	1.516	
0.37	0.53	0.42	0.41	0.35	TOTAL No. OF PARTICLES MEASURED 22		
0.47	0.39	0.39	0.35	0.45	REFLECTIVITY (%)		No. OF PARTICLES
0.31	0.39	0.45	0.43				
0.43	0.38	0.39	0.54		$\bar{R}_{max.}$		
0.50	0.36	0.31	0.43				
					$\bar{R}_{aver.}$		
							0.41
							22
EQUIVALENT CHEMICAL PARAMETERS							
DRY ASH FREE							
CARBON (%)		VOLATILE MATTER YIELD (%)		CARBON RATIO			
71							

2550m

ORIGIN	<i>B.P.</i>	SAMPLE	Our Ref: <i>A.S./J.M.J.</i> Your Ref: <i>UU19</i>	<i>2640m</i>
LITHOLOGY	<i>SHALE</i>			
MINERALOGY	GENERAL COMMENTS			
ORGANIC MATERIAL				
APPEARANCE IN U.V.	<p><i>VERY LOW ORGANIC CONTENT.</i> <i>A FEW VITRINITE PARTICLES +</i> <i>TRACE OF INERTINITE</i> <i>BITUMEN WISPS.</i></p> <p><i>YELLOW + YELLOW/ORANGE</i> <i>FLUORESCENCE FROM SPALLS</i></p>			
EXINITE CONTENT IN U.V.	<i>TRACE</i>	<p><i>John M. Jan</i></p> <p>Signature</p>		<p>Geo-optics Ltd. Ash House Bell Villas Ponteland Northumberland NE20 9BE</p> <p>Date <i>9.7.81</i></p>

2640m

PREPARATION				WAVELENGTH		R.I. OF IMMERSION OIL	
ISOPROPYL ALCOHOL				546 nm.		1.516	
0.53	0.47	0.55	0.56			TOTAL No. OF PARTICLES MEASURED 20	
0.50	0.53	0.45	0.46			REFLECTIVITY (%)	
0.53	0.47	0.54	0.52			No. OF PARTICLES	
0.49	0.38	0.58	0.62			REFLECTIVITY (%)	
0.59	0.36	0.57	0.56			No. OF PARTICLES	
						$\bar{R}_{max.}$	
						$\bar{R}_{aver.}$	
						0.51	
						20	
EQUIVALENT CHEMICAL PARAMETERS						DRY ASH FREE	
CARBON (%)		VOLATILE MATTER YIELD (%)		CARBON RATIO			
74							

2640m

ORIGIN <i>B.P.</i>	SAMPLE Our Ref: <i>A.S./J.M.L.</i> Your Ref: <i>VU20 2670m</i>
LITHOLOGY <i>SHALE</i>	
MINERALOGY	GENERAL COMMENTS
ORGANIC MATERIAL <i>VARIABLE STRONG BITUMEN STAINING + WISPS. TRACE ONLY OF VITRINITE + INERTINITE PARTICLES IN ABOUT EQUIV PROPORTIONS.</i>	
APPEARANCE IN U.V. <i>YELLOW/ORANGE FLUORESCENCE FROM SPOTS</i>	
EXINITE CONTENT IN U.V. <i>TRACE</i>	<p>Geo-optics Ltd. Ash House Bell Villas Ponteland Northumberland NE20 9BE Date <i>9.7.81</i></p> <p><i>J. M. L.</i> Signature</p>

2670m

PREPARATION			WAVELENGTH			R.I. OF IMMERSION OIL		
ISOPHYL AROMAC			546m			1.576		
0.48	0.30	0.36				TOTAL No. OF PARTICLES MEASURED 12		
0.48	0.38	0.35				REFLECTIVITY (%)		
0.57	0.34					No. OF PARTICLES		
0.31	0.37					REFLECTIVITY (%)		
0.30	0.26					No. OF PARTICLES		
						REFLECTIVITY (%)		
						$\bar{R}_{max.}$		
						$\bar{R}_{aver.}$		
						0.37		
						12		
EQUIVALENT CHEMICAL PARAMETERS DRY ASH FREE								
CARBON (%)			VOLATILE MATTER YIELD (%)			CARBON RATIO		
67								


2670m

ORIGIN <i>B.P.</i>	SAMPLE Our Ref: <i>A.S./J.M.L</i> Your Ref: <i>VU21</i> 2730m
LITHOLOGY <i>SHALE</i>	
MINERALOGY	GENERAL COMMENTS
ORGANIC MATERIAL <i>BITUMEN WISPS + OCCASIONAL STAINING. LOW CONTENT OF VITRINITE WISPS + PARTICLES WITH ABOUT EQUAL PROPORTION OF RENORDED MATERIAL.</i>	
APPEARANCE IN U.V. <i>YELLOW/ORANGE FLUORESCENCE FROM SPORES</i>	
EXINITE CONTENT IN U.V. <i>LOW</i>	<p>Geo-optics Ltd. Ash House Bell Villas Ponteland Northumberland NE20 9BE Date 9.7.81</p> <p><i>John M. Ja</i> Signature</p>

2730m

PREPARATION				WAVELENGTH				R.I. OF IMMERSION OIL					
<i>ISOMORPH FERRIC</i>				<i>546nm.</i>				<i>1.516</i>					
<i>0.31</i>	<i>0.48</i>	<i>0.52</i>						TOTAL No. OF PARTICLES MEASURED <i>12</i>					
<i>0.57</i>	<i>0.49</i>	<i>0.45</i>						REFLECTIVITY (%)		No. OF PARTICLES			
<i>0.59</i>	<i>0.50</i>												
<i>0.51</i>	<i>0.49</i>							$\bar{R}_{\text{max.}}$					
<i>0.49</i>	<i>0.54</i>												
								$\bar{R}_{\text{aver.}}$		<i>0.50</i>		<i>12</i>	
								CARBON (%)		VOLATILE MATTER YIELD (%)		CARBON RATIO	
								<i>73</i>					

2730m

ORIGIN	B.P.	SAMPLE	Our Ref: <i>A.S./J.M.L</i> Your Ref: <i>UU 22</i> <i>2820m</i>
LITHOLOGY	<i>SHALE</i>		
MINERALOGY	<i>SOME HAEMATITE - STAINED CUTTINGS.</i>		
ORGANIC MATERIAL	<i>VARIABLE STRONG BITUMEN STAINING + BLENDS. TRACE ONLY OF VITRINITE PARTICLES WITH HANDFULL OF INERTINITE PARTICLES.</i>		
APPEARANCE IN U.V.	<i>YELLOW/ORANGE FLUORESCENCE FROM SPORES</i>		
EXINITE CONTENT IN U.V.	<i>LOW</i>		
	 Signature		Geo-optics Ltd. Ash House Bell Villas Ponteland Northumberland NE20 9BE Date <i>9.7.81</i>

2820m

PREPARATION				WAVELENGTH		R.I. OF IMMERSION OIL		
<i>КОПИРОВАЯ ПЕРЛОМ</i>				<i>546mμ</i>		<i>1.516</i>		
<i>0.46</i>	<i>0.35</i>	<i>0.49</i>	<i>0.43</i>			TOTAL No. OF PARTICLES MEASURED <i>20</i>		
<i>0.29</i>	<i>0.29</i>	<i>0.49</i>	<i>0.56</i>			REFLECTIVITY (%)	No. OF PARTICLES	
<i>0.44</i>	<i>0.29</i>	<i>0.43</i>	<i>0.54</i>					
<i>0.36</i>	<i>0.33</i>	<i>0.45</i>	<i>0.55</i>					
<i>0.35</i>	<i>0.34</i>	<i>0.42</i>	<i>0.53</i>					
						$\bar{R}_{max.}$		
						$\bar{R}_{aver.}$	<i>0.42</i>	<i>20</i>
						EQUIVALENT CHEMICAL PARAMETERS DRY ASH FREE		
						CARBON (%)	VOLATILE MATTER YIELD (%)	CARBON RATIO
						<i>71</i>		

2820m

ORIGIN <i>B.P.</i>	SAMPLE Our Ref: <i>A.S./U.M.J</i> Your Ref: <i>UU23 2910m</i>
LITHOLOGY <i>MIXED SHALE LITHOLOGIES</i>	
MINERALOGY <i>SOME IRON OXIDE STAINED COTTINGS</i>	GENERAL COMMENTS
ORGANIC MATERIAL <i>VARIABLE STRONG BITUMEN STRAINING + WISPS. TRACE ONLY OF VITRINITE PARTICLES + WISPS</i>	
APPEARANCE IN U.V. <i>YELLOW/ORANGE FLUORESCENCE FROM SPORES</i>	
EXINITE CONTENT IN U.V. <i>LOW</i>	<p data-bbox="1141 1388 1364 1422">Geo-optics Ltd.</p> <p data-bbox="1141 1444 1380 1601">Ash House Bell Villas Ponteland Northumberland NE20 9BE</p> <p data-bbox="1173 1612 1364 1646">Date <i>9.7.81</i></p> <p data-bbox="821 1612 933 1646">Signature <i>[Signature]</i></p>

2910m

PREPARATION				WAVELENGTH		R.I. OF IMMERSION OIL		
ISOMAXYL FROHOC				546nm		1.516		
0.29	0.27	0.34	0.33			TOTAL No. OF PARTICLES MEASURED 20		
0.28	0.30	0.36	0.36			REFLECTIVITY (%)	No. OF PARTICLES	
0.27	0.32	0.37	0.36					
0.28	0.35	0.37	0.31			$\bar{R}_{\text{max.}}$		
0.36	0.36	0.32	0.32					
						$\bar{R}_{\text{aver.}}$	0.33	20
						EQUIVALENT CHEMICAL PARAMETERS DRY ASH FREE		
						CARBON (%)	VOLATILE MATTER YIELD (%)	CARBON RATIO
						64		

2910m

ORIGIN	<i>B.P.</i>	SAMPLE	Our Ref: <i>A.S./J.M.J.</i> Your Ref: <i>UU 24</i>	<i>3000m</i>
LITHOLOGY	<i>SHALE</i>			
MINERALOGY	<i>IRON OXIDE STAINING</i>			
ORGANIC MATERIAL	<i>BITUMEN BLENDS + OCCASIONAL STAINING. LOW CONTENT OF INERTINITE + REWOODLED PARTICLES WITH SUBORDINATE VITRINITE PARTICLES - RATHER CORRODED.</i>			
APPEARANCE IN U.V.	<i>YELLOW/ORANGE FLUORESCENCE FROM SPINES</i>			
EXINITE CONTENT IN U.V.	<i>LOW</i>	<p><i>John M. J.</i></p> <p>Signature</p> <p>Geo-optics Ltd. Ash House Bell Villas Ponteland Northumberland NE20 9BE Date <i>9.7.81</i></p>		

3000m

PREPARATION			WAVELENGTH			R.I. OF IMMERSION OIL					
<i>ISOPROPYL ALCOHOL</i>			<i>546m</i>			<i>1.516</i>					
<i>0.47</i>	<i>0.34</i>	<i>0.34</i>				TOTAL No. OF PARTICLES MEASURED <i>13</i>					
<i>0.47</i>	<i>0.37</i>	<i>0.33</i>				REFLECTIVITY (%)					
<i>0.47</i>	<i>0.37</i>	<i>0.33</i>						No. OF PARTICLES			
<i>0.30</i>	<i>0.37</i>										
<i>0.39</i>	<i>0.33</i>										
						$\bar{R}_{max.}$					
						$\bar{R}_{aver.}$		<i>0.38</i>	<i>13</i>		
						EQUIVALENT CHEMICAL PARAMETERS			DRY ASH FREE		
						CARBON (%)	VOLATILE MATTER YIELD (%)	CARBON RATIO			
<i>68</i>											

3000m

ORIGIN	<i>B.P.</i>	SAMPLE	Our Ref: <i>A.S./J.M.J.</i> Your Ref: <i>VU25</i> <i>3090m</i>
LITHOLOGY	<i>SHALE</i>		
MINERALOGY	GENERAL COMMENTS		
ORGANIC MATERIAL			
APPEARANCE IN U.V.			
EXINITE CONTENT IN U.V.	<i>LOW</i>	<p>Geo-optics Ltd. Ash House Bell Villas Ponteland Northumberland NE20 9BE Date <i>9.7.81</i></p> <p><i>J.M.J.</i> Signature</p>	

BITUMEN WISPS + STRONG PATCHY STAINING. LOW CONTENT OF INERTINITE + RENORDED PARTICLES. TRACE ONLY OF VITRINITE PARTICLES + WISPY PARTICLES

YELLOW/ORANGE + LIGHT ORANGE FLUORESCENCE FROM SPOTS

3090m

PREPARATION <i>ISOPROPYL ALCOHOL</i>			WAVELENGTH <i>546m.</i>			R.I. OF IMMERSION OIL <i>1.516</i>			
<i>0.43</i>	<i>0.32</i>	<i>0.39</i>				TOTAL No. OF PARTICLES MEASURED <i>11</i>			
<i>0.46</i>	<i>0.41</i>					REFLECTIVITY (%)		No. OF PARTICLES	
<i>0.46</i>	<i>0.40</i>								
<i>0.44</i>	<i>0.41</i>								
<i>0.33</i>	<i>0.41</i>								
						$\bar{R}_{max.}$			
						$\bar{R}_{aver.}$		<i>0.41</i>	<i>11</i>
						EQUIVALENT CHEMICAL PARAMETERS DRY ASH FREE			
						CARBON (%)	VOLATILE MATTER YIELD (%)	CARBON RATIO	
						<i>71</i>			

3090m

ORIGIN	<i>B.P.</i>	SAMPLE	Our Ref: <i>A.S./J.M.J.</i> Your Ref: <i>UU26</i> <i>3180m</i>
LITHOLOGY	<i>LIMESTONE</i>		
MINERALOGY	GENERAL COMMENTS <i>No DETERMINATION POSSIBLE</i>		
ORGANIC MATERIAL			
APPEARANCE IN U.V.	<i>No ORGANIC MATERIAL LOCATED.</i>	Geo-optics Ltd. Ash House Bell Villas Ponteland Northumberland NE20 9BE Date <i>9.7.81</i>	
EXINITE CONTENT IN U.V.	<i>Nil</i>		

3180m

PREPARATION <i>ISOPROPYL ALCOHOL</i>				WAVELENGTH <i>546m</i>				R.I. OF IMMERSION OIL <i>1.516</i>							
						TOTAL No. OF <i>No DETERMINATION</i> PARTICLES MEASURED <i>POSSIBLE</i>									
						REFLECTIVITY (%)				No. OF PARTICLES					
						$\bar{R}_{max.}$									
						$\bar{R}_{aver.}$									
						EQUIVALENT CHEMICAL PARAMETERS DRY ASH FREE									
						CARBON (%)		VOLATILE MATTER YIELD (%)		CARBON RATIO					

3180m

ORIGIN <i>B.P.</i>	SAMPLE Our Ref: <i>A.S./J.M.J.</i> Your Ref: <i>UU27</i> <i>3255m</i>
LITHOLOGY <i>MIXED SHALE LITHOLOGIES</i>	
MINERALOGY <i>SOME HAEMATITIC POTTINGS</i>	GENERAL COMMENTS
ORGANIC MATERIAL <i>VARIABLE BITUMEN STAINING + WISPS. TRACE ONLY OF ORGANIC MATERIAL. THREE VITRINITE PARTICLES LOCATED WITH A LITTLE INERTINITE + REMOVED MATERIAL</i>	
APPEARANCE IN U.V. <i>YELLOW + YELLOW/ORANGE FLUORESCENCE FROM SPOT</i>	
EXINITE CONTENT IN U.V. <i>LOW - MODERATE</i>	<p>Geo-optics Ltd. Ash House Bell Villas Ponteland Northumberland NE20 9BE Date <i>9.7.81</i></p> <p><i>[Signature]</i> Signature</p>

3255m

PREPARATION				WAVELENGTH		R.I. OF IMMERSION OIL			
ISODIATYL ALCOHOL				546m μ		1.516			
0.36				TOTAL No. OF PARTICLES MEASURED 3					
0.37				REFLECTIVITY (%)		No. OF PARTICLES			
0.43									
				$\bar{R}_{max.}$					
				$\bar{R}_{aver.}$		0.39		3	
				EQUIVALENT CHEMICAL PARAMETERS DRY ASH FREE					
				CARBON (%)		VOLATILE MATTER YIELD (%)		CARBON RATIO	
69									

3255m

ORIGIN	<i>B.P.</i>	SAMPLE	Our Ref: <i>AS/J.M.J.</i> Your Ref: <i>UU28</i>	3315m
LITHOLOGY	<i>SHALE + SILTSTONE</i>			
MINERALOGY	<i>OPALONITE TRACES</i>	GENERAL COMMENTS		
ORGANIC MATERIAL	<i>BITUMEN WISPS. VERY LOW ORGANIC CONTENT. VITRINITE WISPS + PARTICLES WITH ABOUT AN EQUAL PROPORTION OF REWORKED MATERIAL + INERTINITE</i>			
APPEARANCE IN U.V.	<i>LIGHT ORANGE FLUORESCENCE FROM SPOTS</i>			
EXINITE CONTENT IN U.V.	<i>LOW - MODERATE</i>	<p>Geo-optics Ltd. Ash House Bell Villas Ponteland Northumberland NE20 9BE Date <i>9.7.81</i></p> <p><i>J.M.J.</i> Signature</p>		

3315m

PREPARATION		WAVELENGTH				R.I. OF IMMERSION OIL		
ISOPROPYL ALCOHOL		546 m μ				1.516		
0.35	0.55					TOTAL No. OF PARTICLES MEASURED 10		
0.39	0.48					REFLECTIVITY (%)	No. OF PARTICLES	
0.68	0.59							
0.50	0.50					$\bar{R}_{max.}$		
0.45	0.46							
						$\bar{R}_{aver.}$	0.50	10
						EQUIVALENT CHEMICAL PARAMETERS DRY ASH FREE		
						CARBON (%)	VOLATILE MATTER YIELD (%)	CARBON RATIO
						73		

3315m

ORIGIN	<i>B.P.</i>	SAMPLE	Our Ref: <i>A.S./J.M.L</i> Your Ref: <i>UU29</i>	<i>3375m</i>
LITHOLOGY	<i>SHALE</i>			
MINERALOGY	GENERAL COMMENTS			
ORGANIC MATERIAL				
APPEARANCE IN U.V.				
EXINITE CONTENT IN U.V.	<i>LOW</i>	<p>Geo-optics Ltd. Ash House Bell Villas Ponteland Northumberland NE20 9BE</p> <p><i>J.M.L.</i> Signature</p> <p>Date <i>9.7.81</i></p>		
		<p><i>TRACE OF ORGANIC MATERIAL.</i> <i>A FEW SMALL VITRINITE + INERTINITE</i> <i>PARTICLES.</i> <i>BITUMEN WISPS + STAINING.</i></p>		
		<p><i>YELLOW + YELLOW/ORANGE</i> <i>FLUORESCENCE FROM SPORES</i></p>		

3375m

PREPARATION					WAVELENGTH					R.I. OF IMMERSION OIL		
ISOPROPYL ALUMINUM					576 nm					1.516		
0.64	0.66				TOTAL No. OF PARTICLES MEASURED 8							
0.30	0.39				REFLECTIVITY (%)					No. OF PARTICLES		
0.40	0.46											
0.55					$\bar{R}_{max.}$							
0.38												
					$\bar{R}_{aver.}$					0.39	5	
												EQUIVALENT CHEMICAL PARAMETERS DRY ASH FREE
					69 77							

3375m

ORIGIN	<i>B.P.</i>	SAMPLE	Our Ref: <i>A.S./J.M.J.</i> Your Ref: <i>UU30</i>	<i>3435m</i>
LITHOLOGY	<i>SHALE</i>			
MINERALOGY	GENERAL COMMENTS			
ORGANIC MATERIAL				
APPEARANCE IN U.V.				
EXINITE CONTENT IN U.V.	<i>TRACE</i>	<p>Geo-optics Ltd. Ash House Bell Villas Ponteland Northumberland NE20 9BE Date <i>9.7.81</i></p> <p><i>J.M.J.</i> Signature</p>		

*VARIABLE BITUMEN STAINING + WISPS.
A FEW VITRINITE PARTICLES + WISPS
IN BITUMEN STAINED CUTTINGS
TRACE OF INERTINITE.*

*LIGHT ORANGE FLUORESCENCE
FROM SPORES*

3435m

PREPARATION				WAVELENGTH		R.I. OF IMMERSION OIL		
<i>ISOTROPIC FLUORIDE</i>				<i>546nm</i>		<i>1.516</i>		
<i>0.46</i>	<i>0.39</i>	<i>0.38</i>	<i>0.50</i>			TOTAL No. OF PARTICLES MEASURED <i>19</i>		
<i>0.46</i>	<i>0.42</i>	<i>0.46</i>	<i>0.49</i>			REFLECTIVITY (%)	No. OF PARTICLES	
<i>0.46</i>	<i>0.39</i>	<i>0.49</i>	<i>0.66</i>					
<i>0.33</i>	<i>0.37</i>	<i>0.50</i>	<i>0.40</i>			\bar{R}_{max}		
<i>0.35</i>	<i>0.38</i>	<i>0.50</i>						
						\bar{R}_{aver}	<i>0.44</i>	<i>19</i>
							EQUIVALENT CHEMICAL PARAMETERS DRY ASH FREE	
						CARBON (%)	VOLATILE MATTER YIELD (%)	CARBON RATIO
						<i>72</i>		

3435m

ORIGIN <i>B.P.</i>	SAMPLE Our Ref: <i>A.S./J.M.-1</i> Your Ref: <i>UU 31</i>	<i>3525m</i>
LITHOLOGY <i>SHALE</i>		
MINERALOGY	GENERAL COMMENTS	
ORGANIC MATERIAL <i>VARIABLE BROWN STAINING. TRACE OF PARTICLES + WISPS OF VITRINITE WITH ABOUT AN EQUAL PROPORTION OF INERTINITE.</i>		
APPEARANCE IN U.V. <i>YELLOW - LIGHT ORANGE FLUORESCENCE FROM SINES VARIABLE CUTTING TO CUTTING - (AVINGS)</i>	<p>Geo-optics Ltd. Ash House Bell Villas Ponteland Northumberland NE20 9BE</p> <p><i>J. M. J.</i> Signature</p> <p>Date <i>9.7.61</i></p>	
EXINITE CONTENT IN U.V. <i>LOW</i>		

3525m

PREPARATION		WAVELENGTH		R.I. OF IMMERSION OIL		
Isopropyl Alcohol		546m		1.516		
0.45	0.32			TOTAL No. OF PARTICLES MEASURED 7		
0.45	0.36					
0.45				REFLECTIVITY (%)	No. OF PARTICLES	
0.45						
0.58						
				$\bar{R}_{max.}$		
				$\bar{R}_{aver.}$	0.44	7
				EQUIVALENT CHEMICAL PARAMETERS DRY ASH FREE		
				CARBON (%)	VOLATILE MATTER YIELD (%)	CARBON RATIO
72						

3525m

ORIGIN	<i>B.P.</i>	SAMPLE	Our Ref: <i>A.S./J.M.J.</i> Your Ref: <i>UU 32</i>	<i>3615 m</i>
LITHOLOGY	<i>SHALE</i>			
MINERALOGY	GENERAL COMMENTS			
ORGANIC MATERIAL				
APPEARANCE IN U.V.				
EXINITE CONTENT IN U.V.	<i>TRACE</i>	<p>Geo-optics Ltd. Ash House Bell Villas Ponteland Northumberland NE20 9BE</p> <p><i>John M. J.</i> Signature</p> <p>Date <i>9.7.81</i></p>		

3615m

PREPARATION				WAVELENGTH				R.I. OF IMMERSION OIL					
ISOPROPYL ALCOHOL				546nm.				1.516					
0.30								TOTAL No. OF PARTICLES MEASURED 5					
0.39								REFLECTIVITY (%)		No. OF PARTICLES			
0.33													
0.37													
0.34													
								$\bar{R}_{max.}$					
								$\bar{R}_{aver.}$		0.35		5	
								EQUIVALENT CHEMICAL PARAMETERS DRY ASH FREE					
								CARBON (%)		VOLATILE MATTER YIELD (%)		CARBON RATIO	
65													

3615m

ORIGIN	<i>B.P.</i>	SAMPLE	Our Ref: <i>A.S./J.M.J.</i> Your Ref: <i>UU33</i>	<i>3705m</i>
LITHOLOGY	<i>SHALE</i>			
MINERALOGY	GENERAL COMMENTS			
ORGANIC MATERIAL				
APPEARANCE IN U.V.	<p><i>A FEW COTTINGS SHOW HEAVY BITUMEN STAINING. OTHERWISE, A TRACE OF RENOVATED + MELTIMITE PARTICLES WITH SIX PARTICLES OF VITRINITE.</i></p>			
EXINITE CONTENT IN U.V.	<i>TRACE</i>	<p><i>Light Orange fluorescence from Spores</i></p>		<p>Geo-optics Ltd. Ash House Bell Villas Ponteland Northumberland NE20 9BE Date <i>9.7.81</i></p>
		<p>Signature <i>J.M.J.</i></p>		

3705m

PREPARATION					WAVELENGTH		R.I. OF IMMERSION OIL				
ISOPROPYL ALCOHOL					546 nm		1.516				
0.48	0.37				TOTAL No. OF PARTICLES MEASURED 6						
0.46					REFLECTIVITY (%)		No. OF PARTICLES				
0.44											
0.29					$\bar{R}_{\max.}$						
0.28											
					$\bar{R}_{\text{aver.}}$		0.39	6			
					EQUIVALENT CHEMICAL PARAMETERS DRY ASH FREE						
					CARBON (%)		VOLATILE MATTER YIELD (%)		CARBON RATIO		
					69						

3705m

ORIGIN	<i>B.P.</i>	SAMPLE	Our Ref: <i>A.S./J.M.J</i> Your Ref: <i>UU34</i>	<i>3732m</i>
LITHOLOGY	<i>SHALE</i>			
MINERALOGY	<i>RATHER PYRITIC</i>			
ORGANIC MATERIAL	<i>HEAVY OVERALL BITUMEN STAINING OTHERWISE, TRACE OF INERTINITES REWORKED PARTICLES WITH EVEN LESS VITRINITE</i>			
APPEARANCE IN U.V.	<i>LIGHT ORANGE FLUORESCENCE FROM SPINES</i>			
EXINITE CONTENT IN U.V.	<i>LOW</i>			
		<p>Geo-optics Ltd. Ash House Bell Villas Ponteland Northumberland NE20 9BE Date <i>9.7.81</i></p> <p><i>John M. Jones</i> Signature</p>		

3732m

PREPARATION		WAVELENGTH				R.I. OF IMMERSION OIL							
<i>ISOPIIDYL Acetate</i>		<i>546mμ</i>				<i>1.516</i>							
<i>0.53</i>	<i>0.50</i>					TOTAL No. OF PARTICLES MEASURED <i>8</i>							
<i>0.41</i>	<i>0.30</i>					REFLECTIVITY (%)	No. OF PARTICLES						
<i>0.53</i>	<i>0.37</i>												
<i>0.46</i>						$\bar{R}_{\text{max.}}$							
<i>0.51</i>													
						<i>0.45</i>	<i>8</i>						
						EQUIVALENT CHEMICAL PARAMETERS						DRY ASH FREE	
						CARBON (%)		VOLATILE MATTER YIELD (%)		CARBON RATIO			
						<i>72</i>							

3732m

ORIGIN	<i>B.P.</i>	SAMPLE	Our Ref: <i>A.S./J.M.J</i> Your Ref: <i>UU35</i>	<i>3755m</i>
LITHOLOGY	<i>SHALE</i>			
MINERALOGY	<i>Pyritic</i>			
ORGANIC MATERIAL	<i>Overall Strong Bitumen Staining</i> <i>Very Low Content of Inertinite +</i> <i>Renovated Particles with Trace of</i> <i>Vitrinite Wispy Particles</i>			
APPEARANCE IN U.V.	<i>Light Orange Fluorescence</i> <i>from Spores + Pencilful</i> <i>Hydrocarbon Waxes</i>		Geo-optics Ltd. Ash House Bell Villas Ponteland Northumberland NE20 9BE Date <i>9.7.81</i>	
EXINITE CONTENT IN U.V.	<i>Low</i>			

3755m

ORIGIN	<i>B.P.</i>	SAMPLE	Our Ref: <i>A.S./J.M.J.</i> Your Ref: <i>UU36</i>	<i>3780m</i>
LITHOLOGY	<i>SILTY SHALE</i>			
MINERALOGY	<i>GLAUCONITE TRACES</i>	GENERAL COMMENTS		
ORGANIC MATERIAL	<i>MODERATE BITUMEN STAINING VERY LOW CONTENT OF PARTICLES ON INERTINITE WITH ONLY TWO PARTICLES OF VITRINITE.</i>			
APPEARANCE IN U.V.	<i>LIGHT ORANGE FLUORESCENCE FROM SPACES</i>	Geo-optics Ltd. Ash House Bell Villas Ponteland Northumberland NE20 9BE Date <i>9.7.81</i>		
EXINITE CONTENT IN U.V.	<i>LOW</i>			

3780m

PREPARATION				WAVELENGTH		R.I. OF IMMERSION OIL	
ISOPROPYL ALCOHOL				546 nm		1.576	
0.53	0.59	0.54	0.53			TOTAL No. OF PARTICLES MEASURED 19	
0.53	0.44	0.33	0.48			REFLECTIVITY (%)	
0.47	0.45	0.33	0.32			No. OF PARTICLES	
0.43	0.35	0.46	0.46				
0.52	0.35	0.46					
						$\bar{R}_{max.}$	
						$\bar{R}_{aver.}$	
						0.46	
						19	
EQUIVALENT CHEMICAL PARAMETERS DRY ASH FREE							
CARBON (%)		VOLATILE MATTER YIELD (%)		CARBON RATIO			
72							

3755m

PREPARATION					WAVELENGTH					R.I. OF IMMERSION OIL				
SOPRANON PERMAN					546m					1.516				
0.48					TOTAL No. OF PARTICLES MEASURED 2									
0.56					REFLECTIVITY (%)					No. OF PARTICLES				
					$\bar{R}_{max.}$									
					$\bar{R}_{aver.}$					0.52 2				
EQUIVALENT CHEMICAL PARAMETERS DRY ASH FREE														
CARBON (%)					VOLATILE MATTER YIELD (%)					CARBON RATIO				
74														

3780m

ORIGIN <i>B.P.</i>	SAMPLE Our Ref: <i>A.S./U.M.L</i> Your Ref: <i>UU37</i> <i>3785m</i>
LITHOLOGY <i>SHALE + SILTSTONE</i>	
MINERALOGY <i>RATHER PYRITIC</i>	GENERAL COMMENTS
ORGANIC MATERIAL <i>HEAVY OVERALL BITUMEN STAINING IN SOME CUTTINGS. VERY LOW CONTENT OF INERTINITE + VITRINITE PARTICLES. LOWEST R.O. PARTICLES MEASURED - SOME POSSIBLY TRUE - MOSTLY REMOVED</i>	
APPEARANCE IN U.V. <i>LIGHT ORANGE FLUORESCENCE FROM SPINES + HYDROCARBON WSPS</i>	
EXINITE CONTENT IN U.V. <i>MODERATE</i>	<p data-bbox="1157 1408 1374 1446">Geo-optics Ltd.</p> <p data-bbox="1157 1460 1394 1628">Ash House Bell Villas Ponteland Northumberland NE20 9BE</p> <p data-bbox="834 1505 1134 1687"><i>John M. Jan</i> Signature</p> <p data-bbox="1193 1635 1382 1673">Date <i>9.7.81</i></p>

3785m

PREPARATION <i>ISOPROPYL ACETATE</i>					WAVELENGTH <i>546 mμ</i>					R.I. OF IMMERSION OIL <i>1.516</i>									
<i>0.43</i>					TOTAL No. OF PARTICLES MEASURED <i>5</i>														
<i>0.61</i>					REFLECTIVITY (%)					No. OF PARTICLES									
<i>0.47</i>																			
<i>0.70</i>					$\bar{R}_{max.}$														
<i>0.80</i>																			
										$\bar{R}_{aver.}$					EQUIVALENT CHEMICAL PARAMETERS DRY ASH FREE				
										<i>0.73</i>					<i>3</i>				
										CARBON (%)					VOLATILE MATTER YIELD (%)				
<i>72</i> <i>79</i>																			

3785m

ORIGIN <i>B.P.</i>	SAMPLE Our Ref: <i>A.S./J.M.J.</i> Your Ref: <i>UU38</i> <i>3815m</i>
LITHOLOGY <i>SHALE + SILTY SHALE</i>	
MINERALOGY	GENERAL COMMENTS
ORGANIC MATERIAL <i>VARIABLE BITUMEN STAINING LOW ORGANIC CONTENT. PARTICLES OF INERTINITE + REWORKED MATERIAL. A FEW WISPY PARTICLES + PARTICLES OF TRUE VITRINITE.</i>	
APPEARANCE IN U.V. <i>LIGHT ORANGE FLUORESCENCE FROM SPORES + HYDROCARBON WISPS</i>	<p data-bbox="1161 1415 1382 1453">Geo-optics Ltd.</p> <p data-bbox="1161 1465 1398 1628">Ash House Bell Villas Ponteland Northumberland NE20 9BE</p> <p data-bbox="1198 1639 1382 1673">Date <i>9.7.81</i></p> <p data-bbox="841 1505 1105 1691"><i>J.H.M.</i> Signature</p>
EXINITE CONTENT IN U.V. <i>LOW-MODERATE</i>	

3815m

PREPARATION		WAVELENGTH		R.I. OF IMMERSION OIL			
Isopropyl Alcohol		546nm		1.516			
0.30	0.43			TOTAL No. OF PARTICLES MEASURED 8			
0.46	0.49						
0.58	0.44						
0.45							
0.38							
				REFLECTIVITY (%)		No. OF PARTICLES	
				\bar{R}_{max}			
				\bar{R}_{aver}		0.44	8
EQUIVALENT CHEMICAL PARAMETERS DRY ASH FREE							
CARBON (%)		VOLATILE MATTER YIELD (%)		CARBON RATIO			
72							

3815m

ORIGIN <i>B.P.</i>	SAMPLE Our Ref: <i>A.S./J.M.J</i> Your Ref: <i>UV39</i> <i>3820m</i>
LITHOLOGY <i>SHALE</i>	
MINERALOGY <i>RATHER PYRITIC</i>	GENERAL COMMENTS
ORGANIC MATERIAL <i>OVERALL BITUMEN STAINING TRACE ONLY OF ORGANIC MATERIAL A FEW PARTICLES OF INERTINITE + REWORKED MATERIAL. Six PARTICLES OF POSSIBLE VITRINITE</i>	
APPEARANCE IN U.V. <i>LIGHT ORANGE FLUORESCENCE FROM SCALES</i>	
EXINITE CONTENT IN U.V. <i>LOW</i>	<p>Geo-optics Ltd. Ash House Bell Villas Ponteland Northumberland NE20 9BE Date <i>9.7.81</i></p> <p><i>John M. J.</i> Signature</p>

3820m

PREPARATION <i>ISOPTHYL ALCOHOL</i>				WAVELENGTH <i>546 nm</i>				R.I. OF IMMERSION OIL <i>1.516</i>									
<i>0.51</i>	<i>0.42</i>					TOTAL No. OF PARTICLES MEASURED <i>6</i>											
<i>0.55</i>						REFLECTIVITY (%)				No. OF PARTICLES							
<i>0.49</i>																	
<i>0.42</i>						$\bar{R}_{max.}$				<i>6</i>							
<i>0.57</i>																	
						$\bar{R}_{aver.}$		<i>0.49</i>		<i>6</i>							
						EQUIVALENT CHEMICAL PARAMETERS DRY ASH FREE						CARBON (%)		VOLATILE MATTER YIELD (%)		CARBON RATIO	
												<i>73</i>					

3820m

ORIGIN <i>B.P.</i>	SAMPLE Our Ref: <i>AS./J.M.J.</i> Your Ref: <i>UU40</i> <i>3838m</i>
LITHOLOGY <i>SILTSTONE</i>	
MINERALOGY <i>CLAUCONITE</i>	GENERAL COMMENTS
ORGANIC MATERIAL <i>LIGHT BITUMEN STAINING. TRACE ONLY OF ORGANIC MATERIAL. A FEW HIGH RO. VITRINITE + INERTINITE PARTICLES - PROBABLY WHOLLY REMOVED MATERIAL</i>	
APPEARANCE IN U.V. <i>LIGHT ORANGE FLUORESCENCE FROM SPORES</i>	
EXINITE CONTENT IN U.V. <i>TRACE</i>	<p data-bbox="1141 1406 1364 1451">Geo-optics Ltd.</p> <p data-bbox="1141 1462 1380 1621">Ash House Bell Villas Ponteland Northumberland NE20 9BE</p> <p data-bbox="821 1496 1125 1689">Signature <i>John M. Jan</i></p> <p data-bbox="1173 1632 1396 1678">Date <i>9.7.81</i></p>

3838m

PREPARATION <i>ISOPROPYL ALCOHOL</i>				WAVELENGTH <i>546nm.</i>				R.I. OF IMMERSION OIL <i>1.576</i>			
<i>0.76</i>								TOTAL No. OF PARTICLES MEASURED <i>4</i>			
<i>0.71</i>											
<i>1.17</i>								REFLECTIVITY (%)		No. OF PARTICLES	
<i>0.80</i>											
				$\bar{R}_{max.}$							
				$\bar{R}_{aver.}$		<i>0.76</i>		<i>3</i>			
						<i>1.17</i>		<i>1</i>			
EQUIVALENT CHEMICAL PARAMETERS DRY ASH FREE						CARBON (%)		VOLATILE MATTER YIELD (%)		CARBON RATIO	
						<i>80</i> <i>86</i>					

3838m

ORIGIN	<i>B.P.</i>	SAMPLE	Our Ref: <i>A.S./J.M.J.</i> Your Ref: <i>UU41</i>	<i>3875m</i>
LITHOLOGY	<i>SHALE</i>			
MINERALOGY	GENERAL COMMENTS			
ORGANIC MATERIAL				
APPEARANCE IN U.V.				
EXINITE CONTENT IN U.V.	<i>LOW - MODERATE</i>	<p>Geo-optics Ltd. Ash House Bell Villas Ponteland Northumberland NE20 9BE Date <i>9.7.81</i></p>		

*OVERALL BITUMEN STAINING.
 LOW CONTENT OF SMALL PARTICLES
 OF INERTINITE + VIRGINITE.
 LOWEST R.O. PARTICLES MEASURED
 - POSSIBLY TRUE.*

*LIGHT ORANGE FLUORESCENCE
 FROM SPORES*

John M. Jan
 Signature

3875m

PREPARATION				WAVELENGTH		R.I. OF IMMERSION OIL										
ISOPROPYL ALCOHOL				546nm.		1.576										
0.60	0.94	0.67	0.65	0.82	TOTAL No. OF PARTICLES MEASURED 21											
0.62	0.77	0.80	1.00		REFLECTIVITY (%)											
0.88	1.19	0.96	0.81					No. OF PARTICLES								
0.87	0.77	1.03	0.72		<table border="1"> <tr> <td>$\bar{R}_{max.}$</td> <td></td> <td></td> </tr> <tr> <td>$\bar{R}_{aver.}$</td> <td>0.75</td> <td>16</td> </tr> <tr> <td></td> <td>1.04</td> <td>5</td> </tr> </table>						$\bar{R}_{max.}$			$\bar{R}_{aver.}$	0.75	16
$\bar{R}_{max.}$																
$\bar{R}_{aver.}$	0.75	16														
	1.04	5														
0.80	0.72	0.55	1.00		EQUIVALENT CHEMICAL PARAMETERS											
						DRY ASH FREE										
						CARBON (%)	VOLATILE MATTER YIELD (%)	CARBON RATIO								
						80 85										

3875m

ORIGIN <i>B.P.</i>	SAMPLE Our Ref: <i>A.S./J.M.J.</i> Your Ref: <i>UV60 3909m</i>
LITHOLOGY <i>SHALE</i>	
MINERALOGY	GENERAL COMMENTS <i>ALTHOUGH NO DEFINITE LIPTINITE, GENERAL FLUORESCENCE COLOUR SUGGESTS MUCH HIGHER LEVEL OF MATURITY. -cf. c. 0.8?</i>
ORGANIC MATERIAL <i>SEDIMENT BARREN. A FEW LOOSE VITRINITE SPECKS - NOT IN MATRIX. PROBABLY CONTAMINATION.</i>	
APPEARANCE IN U.V. <i>DEEP ORANGE HYDROCARBON SPECKS. NO DEFINITE LIPTINITE</i>	<div data-bbox="1145 1384 1396 1653"> <p>Geo-optics Ltd. Ash House Bell Villas Ponteland Northumberland NE20 9BE Date <i>9.7.81</i></p> </div> <div data-bbox="826 1473 1114 1668"> <p><i>John M. J.</i> Signature</p> </div>
EXINITE CONTENT IN U.V. <i>NIL</i>	

3909m

PREPARATION		WAVELENGTH		R.I. OF IMMERSION OIL		
ISOPROPYL ALCOHOL		546m μ .		1.516		
0.43	0.28			TOTAL No. OF PARTICLES MEASURED 8		
0.43	0.38			REFLECTIVITY (%)	No. OF PARTICLES	
0.42	0.38					
0.39						
0.31						
				$\bar{R}_{max.}$		
				$\bar{R}_{aver.}$	0.38	8
				EQUIVALENT CHEMICAL PARAMETERS DRY ASH FREE		
				CARBON (%)	VOLATILE MATTER YIELD (%)	CARBON RATIO
				68		

3909m

ORIGIN <i>B.P.</i>	SAMPLE Our Ref: <i>A.S./J.M.L</i> Your Ref: <i>UU42 3965m</i>
LITHOLOGY <i>SHALE</i>	
MINERALOGY	GENERAL COMMENTS
ORGANIC MATERIAL <i>OVERALL STRONG BITUMEN STAINING. LOW CONTENT OF PARTICLES OF INERTINITE + VITRINITE. LOWEST Ro. PARTICLES MEASURED - POSSIBLY TRUE. No WISPS</i>	
APPEARANCE IN U.V. <i>LIGHT ORANGE FLUORESCENCE FROM SPICES</i>	
EXINITE CONTENT IN U.V. <i>LOW</i>	<p data-bbox="1145 1408 1374 1446">Geo-optics Ltd.</p> <p data-bbox="1145 1460 1390 1628">Ash House Bell Villas Ponteland Northumberland NE20 9BE</p> <p data-bbox="826 1505 1118 1689"><i>J.M.L.</i> Signature</p> <p data-bbox="1182 1635 1390 1673">Date <i>9.7.81</i></p>

3965m

PREPARATION					WAVELENGTH	R.I. OF IMMERSION OIL		
ISOPHTHALIC ANHYDRIDE					546nm	1.576		
0.94	0.75	0.79	0.70	0.76	TOTAL No. OF PARTICLES MEASURED 21			
0.50	0.76	0.80	0.80					
0.71	0.64	0.83	0.81		REFLECTIVITY (%)	No. OF PARTICLES		
0.77	0.63	0.81	1.24					
0.84	1.04	1.00	1.14					
						$\bar{R}_{max.}$		
						$\bar{R}_{aver.}$	0.74	16
							1.07	5
						EQUIVALENT CHEMICAL PARAMETERS DRY ASH FREE		
CARBON (%)		VOLATILE MATTER YIELD (%)	CARBON RATIO					
79 85								

3965m

ORIGIN <i>B.P.</i>	SAMPLE Our Ref: <i>A.S./J.M.J</i> Your Ref: <i>UU43</i> <i>4055m</i>
LITHOLOGY <i>SHALE</i>	
MINERALOGY	GENERAL COMMENTS
ORGANIC MATERIAL <i>HEAVY BITUMEN STAINING + WISPS</i> <i>LOW ORGANIC CONTENT. PARTICLES</i> <i>OF INERTINITE + VITRINITE. LOWEST</i> <i>R.O. PARTICLES MEASURED</i> <i>- POSSIBLY TRUE</i>	
APPEARANCE IN U.V. <i>YELLOW + L.A.S</i> <i>YELLOW/ORANGE + LIGHT ORANGE</i> <i>FLUORESCENCE FROM SPICES</i>	
EXINITE CONTENT IN U.V. <i>LOW</i>	<p data-bbox="1157 1410 1374 1446">Geo-optics Ltd.</p> <p data-bbox="1157 1460 1394 1628">Ash House Bell Villas Ponteland Northumberland NE20 9BE</p> <p data-bbox="836 1505 1082 1691"><i>John M. Jan</i> Signature</p> <p data-bbox="1193 1637 1401 1673">Date <i>9.7.81</i></p>

4055m

PREPARATION			WAVELENGTH			R.I. OF IMMERSION OIL			
ISOPODYK AZOXYL			546 nm			1.516			
0.96	0.72	0.83				TOTAL No. OF PARTICLES MEASURED 13			
0.54	0.82	0.90				REFLECTIVITY (%)		No. OF PARTICLES	
0.57	0.78	0.56							
0.77	0.86								
0.94	0.76								
						$\bar{R}_{max.}$			
						$\bar{R}_{aver.}$		0.53	3.
								0.83	10
EQUIVALENT CHEMICAL PARAMETERS DRY ASH FREE									
CARBON (%)			VOLATILE MATTER YIELD (%)			CARBON RATIO			
74 81									

4055m

ORIGIN <i>B.P.</i>	SAMPLE Our Ref: <i>A.S./J.M.J.</i> Your Ref: <i>UU44</i> <i>4145m</i>
LITHOLOGY <i>SHALE + SILTSTONE</i>	
MINERALOGY <i>CLAUCONITE</i> <i>RATHER PYRITIC</i>	GENERAL COMMENTS
ORGANIC MATERIAL <i>HEAVY BITUMEN STAINING + WISPS</i> <i>LOW - MODERATE ORGANIC CONTENT</i> <i>PARTICLES OF INERTINITE + VITONITE -</i> <i>LOWEST R.O. PARTICLES MEASURED -</i> <i>POSSIBLY TRUE. A FEW WISPS OF LOWER R.O.</i> <i>WT. / BITUMEN - IDENTIFICATION DIFFICULT.</i>	
APPEARANCE IN U.V. <i>LIGHT ORANGE FLUORESCENCE</i> <i>FROM SPICES</i>	<div style="text-align: right;"> <p>Geo-optics Ltd. Ash House Bell Villas Ponteland Northumberland NE20 9BE Date <i>9.7.81</i></p> </div> <div style="text-align: center;"> <p><i>J.M.J.</i> Signature</p> </div>
EXINITE CONTENT IN U.V. <i>LOW - MODERATE</i>	

4145m

PREPARATION				WAVELENGTH		R.I. OF IMMERSION OIL			
ISOPROPYL ALCOHOL				546nm		1.576			
0.84	0.78	0.93	0.47	TOTAL No. OF PARTICLES MEASURED 20					
0.78	0.78	0.78	0.52						
0.83	0.83	0.90	0.49						
0.75	0.92	0.65	0.67						
0.38	0.84	0.60	1.12						
				REFLECTIVITY (%)		No. OF PARTICLES			
				$\bar{R}_{max.}$					
				$\bar{R}_{aver.}$		0.46	5		
						0.80	14		
						1.12	1		
EQUIVALENT CHEMICAL PARAMETERS						DRY ASH FREE			
CARBON (%)		VOLATILE MATTER YIELD (%)		CARBON RATIO					
72 81 86									

4145m

ORIGIN	<i>B.P.</i>	SAMPLE	Our Ref: <i>AS/UM-J</i> Your Ref: <i>UU 45</i>	<i>4233m</i>
LITHOLOGY	<i>SHALE + SLTSTONE</i>			
MINERALOGY	GENERAL COMMENTS			
ORGANIC MATERIAL				
APPEARANCE IN U.V.	<p><i>BITUMEN WISPS + OVERALL STAINING.</i> <i>LOW-MODERATE ORGANIC CONTENT.</i> <i>PARTICLES OF INERTINITE + VITRINITE.</i> <i>LOWEST R.O. PARTICLES MEASURED -</i> <i>VARIABLE R.O. - SOME REMARKED</i></p> <p><i>YELLOW/ORANGE + LIGHT ORANGE</i> <i>FLUORESCENCE FROM SPORES</i></p>			
EXINITE CONTENT IN U.V.	<i>MODERATE</i>	<p><i>John M. Jan</i></p> <p>Signature</p>		<p>Geo-optics Ltd. Ash House Bell Villas Ponteland Northumberland NE20 9BE Date <i>9.7.81</i></p>

4233m

PREPARATION				WAVELENGTH		R.I. OF IMMERSION OIL	
Isopropyl Alcohol				546nm		1.516	
0.71	0.58	0.63	0.38	TOTAL No. OF PARTICLES MEASURED 16			
0.58	0.83	0.52		REFLECTIVITY (%)			
0.76	0.57	1.06					
0.88	0.57	0.95		No. OF PARTICLES			
0.53	0.56	0.95					
				$\bar{R}_{max.}$			
				$\bar{R}_{aver.}$		0.55	9
						0.88	7
EQUIVALENT CHEMICAL PARAMETERS DRY ASH FREE							
CARBON (%)		VOLATILE MATTER YIELD (%)		CARBON RATIO			
75 82							

4233m

ORIGIN <i>B.P.</i>	SAMPLE Our Ref: <i>A.S./J.M.J</i> Your Ref: <i>UU46</i> <i>4340m</i>
LITHOLOGY <i>SHALE</i>	
MINERALOGY	GENERAL COMMENTS
ORGANIC MATERIAL <i>OVERALL MODERATE BITUMEN STAINING. LOW CONTENT OF PARTICLES OF INERTINITE + VITRINITE. LOWEST R.O. PARTICLES MEASURED - TRUE/REMOVED DIFFERENTIATION UNCERTAIN.</i>	
APPEARANCE IN U.V. <i>LIGHT ORANGE FLUORESCENCE FROM SPORES</i>	
EXINITE CONTENT IN U.V. <i>MODERATE</i>	<p>Geo-optics Ltd. Ash House Bell Villas Ponteland Northumberland NE20 9BE Date <i>9.7.81</i></p> <p><i>John M. J.</i> Signature</p>

4340m

ORIGIN	<i>B.P.</i>	SAMPLE	Our Ref: <i>A.S./J.M.J</i> Your Ref: <i>UU47</i> <i>4340m</i>
LITHOLOGY	<i>COAL</i>		
MINERALOGY	GENERAL COMMENTS		
ORGANIC MATERIAL			
APPEARANCE IN U.V.	<i>No FLUORESCENCE</i>	Geo-optics Ltd. Ash House Bell Villas Ponteland Northumberland NE20 9BE Date <i>9.7.81</i>	
EXINITE CONTENT IN U.V.	<i>Nic</i>		

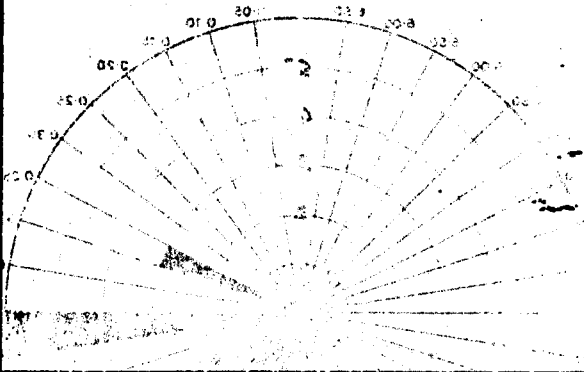
4340m

PREPARATION			WAVELENGTH			R.I. OF IMMERSION OIL		
Isopropyl Alcohol			546 nm.			1.516		
0.66	0.86	1.22				TOTAL No. OF PARTICLES MEASURED 13		
0.65	0.61	0.96				REFLECTIVITY (%)		
0.64	0.68	0.73				No. OF PARTICLES		
0.63	0.59							
0.72	1.05							
						EQUIVALENT CHEMICAL PARAMETERS		
						DRY ASH FREE		
						CARBON (%)	VOLATILE MATTER YIELD (%)	CARBON RATIO
						78 84		
$\bar{R}_{max.}$								
$\bar{R}_{aver.}$						0.66	9	
						1.02	4	

4340m

PREPARATION				WAVELENGTH		R.I. OF IMMERSION OIL			
ISOPROPYL ALCOHOL				546 nm		1.516			
1.34	1.16	1.36	1.40	TOTAL No. OF PARTICLES MEASURED 20					
1.19	1.37	1.16	1.20	REFLECTIVITY (%)					
1.26	1.37	1.04	1.37						
1.43	1.24	1.36	1.48	No. OF PARTICLES					
1.27	1.33	1.43	1.36						
				$\bar{R}_{max.}$					
				$\bar{R}_{aver.}$		1.31		20	
				EQUIVALENT CHEMICAL PARAMETERS DRY ASH FREE					
				CARBON (%)		VOLATILE MATTER YIELD (%)		CARBON RATIO	
87									

4340m

ORIGIN B.P.	SAMPLE Our Ref: A.S./J.M.J Your Ref: U.D. 48 4415m
LITHOLOGY SAMPLE	
MINERALOGY KAOLIN PEARLITE	GENERAL COMMENTS
ORGANIC MATERIAL BITUMEN WISPS + STAINING. LOW CONTENT OF SMALL PARTICLES OF INERTINITE. LOWEST R.O. PARTICLES MEASURED - PROBABLY TRUE.	
APPEARANCE	
IN U.V. YELLOW/ORANGE + LIGHT ORANGE FLUORESCENCE FROM SPICLES	<div data-bbox="799 1366 1458 1657" style="border: 1px solid black; padding: 5px;"> <p>Geo-optics Ltd. Ash House Bell Villas Ponteland Northumberland NE20 9BE</p> <p>Signature: <i>John M. J.</i> Date: 9.7.81</p> </div>
EXINITE CONTENT IN U.V. LOW	

4415m

PREPARATION <i>ISOPROPYL ALCOHOL</i>			WAVELENGTH <i>546nm</i>			R.T. OF IMMERSION OIL <i>1.516</i>		
<i>0.53</i>	<i>0.65</i>	<i>0.39</i>				TOTAL No. OF PARTICLES MEASURED <i>74</i>		
<i>0.52</i>	<i>0.53</i>	<i>0.37</i>				REFLECTIVITY (%)		
<i>0.55</i>	<i>0.67</i>	<i>0.56</i>				No. OF PARTICLES		
<i>0.50</i>	<i>0.39</i>	<i>0.53</i>				R _{max}		
<i>0.69</i>	<i>0.50</i>					R _{aver.}		
						EQUIVALENT CHEMICAL PARAMETERS		
						DRY ASH FREE		
						CARBON (%)	VOLATILE MATTER YIELD (%)	CARBON RATIO
						<i>68</i> <i>76</i>	<i>2.55</i>	<i>1.0</i>

4415m
m211A

