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GEOCHEMICAL ANALYSES OF WELLS FROM THE GIPPSLAND BASIN, AUSTRALIA

BARRACOUTA-1, HALIBUT-1, HAPUKU-1, KINGFISH-1, MORAY-1, PERCH-A1, PIKE-1, PISCES-1, SNAPPER-1, TUNA-1

Project No. 9/83/10S

By

S. Sengupta, S. Hindmarsh and P.J. Bigg

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Prepared by:

Gearhart Pty. Ltd. - Geodata
Unit 2
138 Musgrave Avenue
Welland, S.A. 5007
Australia

Prepared for:

Union Texas Australia Inc.
23rd Level
459 Collins Street
Melbourne, VIC 3000
Australia

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I. INTRODUCTION

This report discusses the results of geochemical analyses carried out on 240 ditch cuttings and sidewall core samples from ten wells (Barracouta-1, Halibut-1, Hapuku-1, Kingfish-1, Moray-1, Perch-A1, Pike-1, Pisces-1, Snapper-1 and Tuna-1) drilled in the Gippsland Basin, Bass Strait, Australia.

Pyro-analysis, total organic carbon content and residual organic carbon measurements were undertaken at Gearhart's geochemical laboratory, Sale, Victoria using the new pyrolysis instrument manufactured by Girdel of France, the "Oil Shows Analyzer" (OSA).

The OSA comprises the latest generation of "Rock-Eval" type instruments and is similar in construction to the "Rock-Eval II". The latter instrument is in use worldwide for the pyro-analysis of geochemical samples.

Microscope analyses (spore colouration, vitrinite reflectivity and kerogen type analyses) were carried out at Gearhart Stratigraphic Services Laboratory in Singapore.

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I.A. PARAMETERS MEASURED BY THE OIL SHOWS ANALYZER

S_0 - light, free hydrocarbons evolved up to 80°C

S_1' - free hydrocarbons evolved from 80°C to 320°C

S_2 - hydrocarbons evolved during programmed pyrolysis of sample kerogen from 320°C to 600°C

S_4 - carbon dioxide evolved by combustion of residual organic carbon at 590°C

I.B. PARAMETERS CALCULATED BY THE OIL SHOWS ANALYZER

GPI - gas production index $= \dfrac{S_0}{S_0 + S_1' + S_2}$

OPI - oil production index $= \dfrac{S_1'}{S_0 + S_1' + S_2}$

TPI - total production index $= \dfrac{S_0 + S_1'}{S_0 + S_1' + S_2}$

Tmax - temperature, during pyrolysis, at which the rate of hydrocarbon evolution reaches a maximum

TOC - total organic carbon

$$= 0.83\,(S_0 + S_1' + S_2) + \frac{12}{44}\,(S_4)$$

expressed as a percentage weight of the original sample

HI - hydrogen index = milligrams S_2 evolved per gram of TOC

I.C. COMPARISON WITH ROCK-EVAL II

The Rock-Eval II instrument measures and calculates the following parameters:

S_1 - free hydrocarbons evolved up to 320°C

S_2 - hydrocarbons obtainable by programmed pyrolysis between 320°C and 600°C

S_3 - carbon dioxide obtained by pyrolysis of sample kerogen

Tmax - as defined in Section I.B.

P.I. - production index $= \frac{S_1}{S_1 + S_2}$

S_2/S_3

PC - pyrolysable carbon $= 0.83\ (S_1 + S_2)$

expressed as a percentage weight of the original sample

IO - oxygen index

HI - hydrogen index; defined as in Section I.B. but requiring TOC figures to be entered following TOC analysis using an external carbon analyser (eg. Leco).

As can be seen, the Oil Shows Analyzer differs from the Rock-Eval II by separating and measuring the light-free hydrocarbons (S_0) and by measuring residual organic carbon (S_4).

The thermal conductivity detector, which in the Rock-Eval II is used for S_3 measurement (carbon dioxide from the decarboxylation of kerogen), is linked, in the case of the Oil Shows Analyzer, to a combustion oven for the determination of residual organic carbon (as carbon dioxide, S_4).

The total organic carbon content of a sample is then calculated by the addition of the carbon contents of S_0, S_1', S_2 and S_4.

A number of authorities (including IFP) have encountered problems with the measurement of S_3 when using the Rock-Eval II machine. In all but the most thermally immature samples, S_3 is quite small and can be significantly affected by background levels of carbon dioxide. Samples containing labile carbonates can give large values of S_3 which in turn lead to large errors in the oxygen index.

This is the reason why IFP/Girdel decided upon a new design, using the S_3 facilities to measure residual organic carbon.

I.D. SAMPLE PREPARATION (OSA ANALYSIS)

The samples were supplied already sieved and dried and no further preparation was necessary after checking for constant weight dryness.

How the samples were initially dried is not known. The application of excessive heat to aid water evaporation may degrade the source ability of the rock and artificially increase the level of maturity.

Weighing was carried out with the use of a "CAHN 25" electrobalance to 0.1mg accuracy prior to crucible loading, each crucible containing approximately 100mg.

Each sample was checked to be free of obvious contamination by paint, L.C.M., metal fragments, etc.

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I.E. ORGANISATION AND COMPILATION OF GEOCHEMICAL SCREENING LOGS

A flexible computer programme has been developed for plotting geochemical logs. Any seven of the parameters measured or calculated by the "Oil Shows Analyzer" can be presented in any order. The depth scale can be varied within wide limits, a 3000' section per sheet giving the best presentation over such widely spread intervals.

Facilities exist for storing a further 10 data tracks (eg. mud log gas or digitised wire line data), which may be accessed and plotted alongside the geochemical data.

The plots for these ten wells include the seven most important parameters measured or calculated by the "Oil Shows Analyzer" and these are, in order:

Gas (S_0) in Kg /Tonne (mg/g) red

0 - .5 Kg /T	Halibut, Hapuku, Tuna, Perch, Barracouta, Snapper
0 - .25 Kg /T	Pisces, Kingfish
0 - .1 Kg /T	Pike,Moray

Oil (S_1') in Kg/Tonne (mg/g) blue

0 - 10 Kg/T	Halibut, Hapuku, Tuna, Perch, Barracouta, Snapper
0 - 5 Kg/T	Pisces, Kingfish
0 - 1 Kg/T	Pike, Moray

S_2 in Kg/Tonne (mg/g) green

0 - 50 Kg/T	Halibut, Hapuku, Tuna, Perch, Barracouta, Snapper
0 - 25 Kg/T	Pisces, Kingfish
0 - 5 Kg/T	Pike, Moray

T.O.C. in percentage weight for weight, black

0 - 10 %	Halibut, Hapuku, Tuna, Perch, Barracouta, Snapper

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0 - 5 %	Pisces, Kingfish
0 - 2 %	Pike, Moray

T.P.I.	0 - 1 scale, blue, all wells.
Tmax	in degree centigrade on a 420 - 470° scale, blue, all wells.
H.I.	0 - 500, blue, all wells.

The plots are compiled from data directly output from the analyzer at the end of each run. After storing on magnetic tape the crude data is edited to ensure all intervals or points are in the correct sequence and that all standard, blanks and spurious runs are omitted. This data is then restored in a different format to be used for all graphics and data outputs submitted to the client.

I.F. PARAMETERS MEASURED BY MICROSCOPE (USING TRANSMITTED, INCIDENT AND INCIDENT UV-LIGHT)

Spore colouration (a) and vitrinite reflectance (b) are measured to determine the thermal maturity of organic matter in a sample. Kerogen types (c) are optically analysed to assess the quality of organic matter and source rock potential, i.e. whether the organic matter is oil prone, gas prone or of negligible potential.

a) Spore Colouration

The maturity of the oil prone organic matter present in the demineralized (HCl and HF) kerogen concentrate is assessed by visual examination of the in situ palynomorph assemblage of a sample.

Sporopollenin is the major component of the outer wall complex of spores and pollen grains. With increasing temperature, sporopollenin changes colour from cream - yellow - orange - rusty brown - dark brown - black (Sengupta, 1975). This component is sensitive to heat and oxidation, and, having sporopollenin as a major component in the spore - pollen walls, palynomorphs are used as indicators of thermal maturity with reference to their degree of carbonization (Gutjahr, 1966; Staplin, 1969; Sengupta 1975; Fisher, 1980).

In this project, spore colour measurements are made by using Gearhart's Spore Colour Standard (1982), modified from the Phillips Petroleum Company Standard (1981) and correlated with Staplin's Thermal Alteration Index (1969), Fisher's 10 Point Scale (1980) and Sengupta's Spore Chart (1975 and 1978).

Gearhart's Spore Colour Standard is also a 10 point scale. The intermediate values of the scale can be interpreted as follows:

1 - 4 : immature

4 - 8 : significant oil generation window

8 - 10 : gas generation

Numbers 4 and 8 on the scale are considered to be transitionally early mature stages for the generation of oil and gas respectively.

b) Vitrinite Reflectance

Vitrinite is a humic degradation product mostly derived from structured woody fragments (lignin, cellulose and nitrogen compounds) and is one of the major components of coal. Its reflectance is considered to be one of the best parameters to define coalification rank, but reflectance measurements have been extended to particles of disseminated organic matter (kerogen) occurring in shales and other rocks. They usually show several groups of reflectance values, corresponding to the various macerals of the kerogen concentrate. In the same sample the reflectance increases from liptinite particles to vitrinite and finally to inertinite. Both liptinite and vitrinite reflectance increases with thermal evolution.

The correlation of reflectance with other maturation indicators and with oil and gas accumulations has distinguished the following stages (Tissot & Welte, 1978; Hunt, 1979):

VITRINITE REFLECTIVITY VALUE (%)	INDICATION
0.10 - 0.40	Source rock is considered to be immature.
0.45 - 0.60	This value is generally recognised as onset of commercial oil accummulation, depending on the type of sedimentary basin.
0.80 - 1.00	Peak oil generation.
1.30	End of oil generation. Peak value for wet gas generation.
2.00	End value for wet gas.
2.00 - 3.00	Dry gas zone.

c) Kerogen Type Visual Analysis

Visual identification of the kerogen components and their fluorescence and colouration give an indication of the type of hydrocarbon likely to be sourced.

We have adopted a broad classification and terminology for kerogen type analyses which is in general use by coal petrologists, palynologists and geochemists. A three to four fold division of kerogen type is now standard in the latest publications (Dow, 1977; Tissot & Welte, 1978; Bernard et al., 1981; Brooks, 1981; Palmer et al., 1981).

The main kerogen components and types, with their hydrocarbon potential capability, are as follows:

	KEROGEN TYPE	KEROGEN FORM	SOURCE POTENTIAL
Sapropelic	Type I	1. Liptinite-Exinite (a) Alginite (algal bodies, cysts, marine algae, etc.)	Liptinite has high potential for oil
	Type II	(b) Dinocyst (c) Cuticle (d) Resin (e) Spore and pollen	Good oil and gas prone
Sapropelic	Type I and Type II	2. Amorphous (degraded structureless debris of algal origin [highly liptinitic] or planktonic, primarily of marine origin)	Good oil and gas prone
Humic	Type III	3. Vitrinite (fibrous and woody plant fragments, and structureless colloids of humic matter)	Gas prone (oxidised and recycled vitrinite may have little or no hydrocarbon generating capacity)
	Type IV	4. Inertinite (coaly, dark woody debris oxidised and recycled)	Nil potential or can produce minor dry gas

Kerogen Type I and dinocysts are aquatic, while the rest of the kerogen types are terrestrial in origin.

Amorphous organic matter is frequently considered as being derived from plankton and having a good oil potential. Although this is generally correct, there are other origins for amorphous organic matter which do not have good oil potential.

Plant fragments which are rich in lipids (eg. algal bodies, resin, plant cuticle, spores and pollen) may be grouped under liptinite (Tissot & Welte, 1978). However, in general, algal bodies (like Botryococcus, Tasmanites, marine algae, etc.) possess higher lipid fractions (algae have high hydrogen and low oxygen contents due to the presence of aliphatic carbon chains; Brooks, 1981) than dinocysts, resin, plant cuticle, spores and pollen (= exinite).

The relative proportions of each kerogen component are represented on the Kerogen Type Log using the following scale:

————	Abundant
———	Common
——	Moderately Common
–	Rare

d) Evaluation of Organic Maturity and Kerogen Type by UV-light Fluorescence

i) To assess the thermal maturity of organic matter (Spore-pollen are used as indicators), the fluorescence colour scheme utilised is as follows:

FLUORESCENCE COLOUR OF SPORE-POLLEN	MATURATION LEVEL
blue-green/whitish yellow	immature
yellow - brown	mature
dull brown - dark brown	late/post mature

ii) To assess the type of kerogen, the following scheme is used:

TYPE OF KEROGEN	SOURCE POTENTIAL
Liptinite and Exinite: fluorescent in UV-light	oil prone
Amorphous Organic Matter (A O M): fluorescent in UV-light - sapropelic organic matter	oil prone
Amorphous Organic Matter: non fluorescent in UV-light	gas prone or overmature or oxidised
Vitrinite: usually non fluorescent	gas prone or oxidised
Inertinite: non fluorescent in UV-light	nil potential or produces minor dry gas.

II. DISCUSSION

Vitrinite reflectivity, spore colour and Tmax values are used to assess the thermal maturity of organic matter in a sample.

Visual kerogen type analyses determine the source rock potential by estimating the abundance and quality of kerogen type.

In the OSA programs, the magnitude of S_2 and the TOC indicate the organic richness of a source rock. S_0 and S_1 are indicative of the quantity of migrated free hydrocarbons. The magnitude of S_2 quantifies the ability of the kerogen to produce hydrocarbons under thermal cracking.

Tmax gives a measure of the thermal maturity of the sample kerogen (435°C, thermally immature; 435°-460° C, oil generation window; 460°C, gas generation only; 475°C, spent source material).

The Hydrogen Index indicates whether a source rock is oil or gas prone. Oil prone sources give values greater than 250-300. Gas prone sources are usually less than 250. Hydrogen Indices of 100 indicate a poor source material that is hydrogen deficient, or alternatively a spent source.

In places, Tmax values are suppressed by coal inclusions and vitrinite reflectivity values are raised by oxidation. For this reason, spore colouration has been used where possible as the principal evaluation of thermal maturity.

The well sections are discussed below, in order of hydrocarbon generating potential.

II.A. PISCES-1 WELL

SYNOPSIS

Sidewall core and cuttings samples from 1836m-2580m of the Pisces-1 well section have been analysed. The samples supplied are very small. In many cases spore colours are estimated from one or two spores or from dinocysts and algal cysts.

The well section has been divided into two subsections on the basis of TOC content. The subsections are subdivided into intervals based on thermal maturity.

Subsection 1836m-2277m: TOC level is less than 1%.

Interval 1836m-2052m: Poor-moderate amounts of oil generation can be expected only at 1940m. The rest of the interval, in spite of having oil prone kerogen, can only produce nil-poor amounts of oil/gas due to the presence of poor TOC levels and moderate amounts of inertinite.

The presence of rare-moderately common dinocysts suggests a marine, inner shelf depositional environment.

Interval 2100m-2277m: This interval can generate poor-moderate amounts of oil from 2178m-2277m. The rest of the interval is immature and no hydrocarbon generation is expected.

The presence of rare-moderately common dinocysts, in association with predominantly amorphous kerogen, suggests a marine, inner shelf depositional environment.

Subsection 2283m-2580m: TOC level is 0.13 - 4+%.

Interval 2283m-2457m: The interval is thermally mature and is dominated by amorphous (Type I and II) kerogen but it can produce poor-moderate amounts of oil only where TOC levels are average (1%) or above.

The occurrence of rare to moderately common dinocysts, in association with amorphous kerogen, suggests marine, inner shelf deposition.

Interval 2466m-2580m: The interval is thermally mature, except at 2466m, 2493m and 2512.5m(SWC) where it is immature. From 2505m(SWC)-2509m(SWC) and 2535m(SWC)-2559.5m(SWC) a moderate-good amount of gas generation can be expected, while moderate amounts of oil generation can be expected at 2524.5m(SWC).

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A poor amount of oil can be expected from 2568m-2580m, and from the rest of the interval where the samples have attained thermal maturity.

The presence of rare-moderately common dinocysts down to 2502m suggests marine, inner shelf deposition. Below this depth the occurrence of dinocysts decreases abruptly (absent-rare), and the increase in vitrinitic kerogen suggests marine, shallow water nearshore deposition with terrigenous input.

SUBSECTION 1836m-2277m

INTERVAL 1836m-2052m

Description: Spore colour (5-6), vitrinite reflectivity and Tmax values suggest the interval is thermally mature, except at 1836m and 1932m(SWC), where the organic matter is immature. Due to the absence of spores at 1932m the maturity level is based on the Tmax value only (the vitrinite reflectivity value for this sample is high due to oxidation).

Free high boiling components have elevated the Tmax values at 1851m, 1866m, 1881m, 1901.5m(SWC) and 1940m.

TOC levels are less than 1%. S_2 values are poor down to 1929m, but below this depth they vary between 2-5 Kg/T. T.P.I. values are high (in excess of 0.3) between 1851m and 1881m, suggesting a possible free oil region.

The kerogen type at 1836m is predominantly inertinitic, with a moderate amount of cuticle (Type II) and amorphous (Type I and II) kerogen. From 1851m-2052m the kerogen is a mixture of amorphous and inertinite, except at 1940m(SWC), where amorphous kerogen predominates. The entire interval contains a considerable amount of oil prone kerogen (which is also substantiated by the H.I. values, especially at the bottom part of the interval).

However, in spite of having oil prone kerogen, this interval (except at 1940m(SWC)) can only produce nil-poor amounts of oil/gas, due to the low TOC levels and the presence of inertinite. At 1940m(SWC), where the TOC level (0.99%) is nearly average, a poor-moderate amount of oil generation can be expected.

INTERVAL 2100m-2277m

Description: The interval down to 2163m is thermally immature. Below 2178m, the rest of the interval is transitionally early mature to mature, based on the spore colour, vitrinite reflectivity and Tmax values. Tmax values are high at 2178m, 2199m and 2277m due to contamination.

TOC levels are low (less than 1%). S_2 values are low, varying between 1-3 Kg/T, indicating poor to fair source potential.

The interval contains predominantly non fluorescent amorphous (Type I and II) kerogen, with a moderate amount of inertinite. A moderate amount of cuticle is also present from 2199m-2277m. The amorphous kerogen is partially oxidised from 2100m-2163m, while in the lower part of the interval the high Tmax values indicate that the kerogen is affected by thermal degradation.

HI values are high throughout the interval, indicating the presence of a considerable amount of oil prone kerogen.

However, down to 2163m no hydrocarbon generation is expected due to thermal immaturity, while below 2178m, the rest of the interval can produce only a poor to moderate amount of oil as the source potential is poor (TOC less than 1%).

The abrupt change in maturity level and increase in amorphous kerogen at the top of this interval may be of tectonic significance.

SUBSECTION 2283m-2580m

INTERVAL 2283m-2457m

Description: Spore colour, vitrinite reflectivity and Tmax values suggest that the organic matter is thermally mature. The spore colour reading at 2283m, 2346m and 2421m is low (immature) due to the presence of immature caved spores. Tmax values are high at 2283m, 2367m and 2391m due to contamination (free high boiling components may have increased the temperature).

TOC values are poor to average. S_2 values are moderate to good (3-12 Kg/T). TPI values are moderate.

The interval is dominated by amorphous kerogen (Type I and II) in association with moderate amounts of inertinite, except from 2421m-2457m, where it is predominantly inertinitic. Very high HI values suggest the interval has high amounts of oil prone kerogen.

The interval can produce poor to moderate amounts of oil (where the TOC is nearly average or above).

INTERVAL 2466m-2580m

Description: The spore colour and Tmax values suggest that the interval is thermally mature, except at 2466m, 2493m and 2512.5m(SWC), where the interval is immature. The vitrinite reflectivity values are mature throughout the interval. In some cases the values are high due to oxidation.

Tmax values are high at 2473m(SWC), 2502m and at 2580m due to contamination.

TOC levels are in some cases above average (2-4%). S_2 values fluctuate (1-10 Kg/T). TPI values are fairly good at 2466m-2493m. However, the TOC levels are in general low, indicating poor to moderate source potential.

The kerogen type is predominantly amorphous at 2466m, 2502m, 2511m, 2535m(SWC) and from 2568m-2580m. Vitrinite dominates the interval at 2505m(SWC) and 2512.5m(SWC)-2524.5m(SWC), in association with moderate amounts of algae (Type I) and cuticle (Type II). The interval is predominantly inertinitic from 2473m(SWC)-2493m and at 2509m(SWC). HI values are high, particularly at 2473m(SWC)-2502m, 2511m and at the bottom of the interval.

TOC levels are above average to high from 2505m(SWC)-2509m(SWC) and from 2535m(SWC)-2559-5m(SWC), where the dominant kerogen is a mixture of vitrinite and inertinite, and a moderate to good amount of gas generation can be expected. At 2524.5m(SWC), a moderate amount of oil can be expected, due to the presence of moderately common algal (Type I) and cuticlar (Type II) fragments. A poor amount of oil can be expected from 2568m-2580m, and from the rest of the interval, where the samples have attained thermal maturity.

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II.B. BARRACOUTA-1 WELL

SYNOPSIS

The cuttings samples from 3580'-8620' of the Barracouta-1 well section have been analysed. They are grouped into two intervals based on thermal maturity.

Interval 3580'-6610': The interval down to 6250' is thermally immature. Below this depth it may be transitionally early mature. Predominantly vitrinitic. TOC levels are high due to coal inclusions. A poor amount of gas generation is expected from 6420'-6610'. The rest of the interval, in spite of having gas prone kerogen, is unable to generate hydrocarbons due to thermal immaturity. The interval is partially affected by oxidation.

The occurrence of rare-moderately common dinocysts down to 5400', in association with vitrinitic kerogen, suggests a marginal marine environment with terrigenous input. However, the dinocysts could be caved, and below 5400' the absence of dinocysts, the increased amounts of vitrinite and the presence of coal inclusions suggests a deltaic/estuarine depositional environment.

Interval 6710'-8620': Most of the interval is transitionally early mature to mature. Predominantly vitrinitic. TOC levels are high. A moderate amount of cuticle (Type II kerogen) is present at 8380', where a poor amount of oil generation can be expected. The rest of the interval can produce a moderate to good amount of gas. In places the interval is badly oxidised.

The absence of dinocysts, and the presence of coal inclusions and predominantly vitrinitic kerogen, suggests a deltaic/estuarine depositional environment.

INTERVAL 3580'-6610'

Description: Vitrinite reflectivity, spore colour and Tmax values suggest that the interval is thermally immature down to 6250' and transitionally early mature below this depth. The thermal maturity evaluation for this interval is based principally on spore colour readings, as the vitrinite reflectivity values might have been raise slightly by partial oxidation, while the Tmax values for these samples (which are all below the maturity level) have been slightly suppressed by coal inclusions.

High TOC levels throughout the interval are mostly attributable to a high coal content. Thus yields of free and pyrolysable hydrocarbons are large, eg. at 4670' S_2 = 125 Kg/T. TPI values remain low, generally less than 0.1, indicating no oil shows.

The interval is predominantly vitrinitic with a moderate amount of inertinite and amorphous kerogen, except at 3870' and 4670', where the dominant type is amorphous kerogen (oil prone). A moderate amount of cuticle (Type II) is present from 5240'-6610'. HI values are particularly high at 4670' and 5870', indicating the presence of immature oil prone kerogen.

No hydrocarbon generation is expected from this interval at the present state of maturity, except from 6420'-6610', where the transitionally early mature organic matter can generate a poor amount of gas.

INTERVAL 6710'-8620'

Description: Vitrinite reflectivity and spore colour values suggest that the interval is transitionally early mature to mature, except from 7650'-7800' and at 8510', where the spore colour values suggest immaturity for the organic matter. Tmax values, however, remain slightly below the maturity level. In some samples, the Tmax values are suppressed by coal inclusions (although the interval as a whole is relatively free of coal). Vitrinite reflectivity values are high in places due to oxidation.

TOC levels are high (1-23%). Pyrolysate yields indicate a moderate to good sourcing ability. TPI values increase to in excess of 0.3 at 6940', 7650' and 8510', where oil shows may be expected.

The interval is predominantly vitrinitic (gas prone), in association with moderate amounts of inertinite and amorphous kerogen, except at 7910' where the sample is dominated by cuticle (Type II kerogen). A moderate amount of cuticle is also present from 6710'-7910' and 8380'-8510'. A high HI value at 8380' suggests the presence of oil prone kerogen.

The interval can generate a moderate to good amount of gas at its present state of maturity. A poor amount of oil can be expected only at 8380'.

The samples at 7200' and 8240' contain minor amounts of asphaltene. The entire section is badly oxidised in places, which can effect hydrocarbon generation.

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II.C. SNAPPER-1 WELL

SYNOPSIS

The cuttings samples from 4990'-12,300' of the Snapper-1 well have been grouped into two intervals based on thermal maturity.

Interval 4990'-9100': The interval is thermally immature to transitionally early mature. Predominantly vitrinitic(gas prone), with a moderate amount of cuticle (Type II). TOC levels are high, mostly due to coal inclusions. At the present state of maturity, no hydrocarbon generation is expected down to 7760'. Below this depth the interval can generate poor amounts of gas.

The absence of dinocysts and the presence of predominantly vitrinitic kerogen with significant coal inclusion suggests a deltaic/estuarine depositional environment.

Interval 9550'-12,300': The interval is thermally mature to late mature. Predominantly vitrinitic down to 11,133'. The rest of the interval is mostly inertinitic. TOC levels in general are average to high. Moderate to good amounts of gas generation are expected down to 11,350'. The remainder of the interval can only produce poor amounts of gas (due to the presence of inertinite and to late maturity).

The depositional environment is the same as in the previous interval.

INTERVAL 4990'-9100'

Description: Spore colour and Tmax values suggest that the interval is immature down to 7760'. Spore colour values show transitional early maturity from 7900'-8110' and 8560'-8810'. Tmax values for these samples are slightly below the maturity level, although Tmax values in the entire interval are slightly suppressed due to coal inclusions.

Vitrinite reflectivity values are high (and not reliable) in this interval, as in most cases they are derived from the included coal.

TOC and S_2 values are high due to the presence of significant amounts of coal, in places exceeding 25% and 63+ Kg/T respectively. Most of the carbon is present in a pyrolysable form, as is indicated by the very good pyrolysate yields, suggesting that source potential exists. However, no free hydrocarbon accumulations are noted.

The interval is predominantly vitrinitic, except at 5880' where the dominant type is amorphous kerogen (Type I and II) in association with moderate amount of cuticle (Type II). A moderate amount of cuticle is also present at 5660', 6960' and from 7180'-9100', indicating the presence of oil prone kerogen. Very high HI values at 5880', 7560' and 8310' also indicate the presence of oil rich kerogen.

No hydrocarbon generation is expected down to 7760' at the present state of maturity, in spite of having gas prone kerogen. Below 7760', transitionally early mature organic matter can generate poor amounts of gas only.

INTERVAL 9550'-12,300'

Description: Vitrinite reflectivity, spore colour and Tmax values suggest that most of the interval is thermally mature, but that late maturity is pronounced from 11,630'-11,640' and 11,900'-12,300'.

TOC levels are low from 11,350'-11,360'. The rest of the interval has above average to high TOC levels. The interval is not affected so much by coal contamination and has significant hydrocarbon generating capacity down to 11,360'. S_2 values from 2-8 Kg/T indicate moderate to good hydrocarbon generation down to 11,350'. Below this level, late maturity might have affected the hydrocarbon generation, except at 11,760', where there is a good pyrolysate yield of 9.68 Kg/T (the TPI value (0.3) is also good at 11,350', indicating an oil show for this sample).

The interval contains predominantly vitrinitic kerogen in association with moderate amounts of amorphous kerogen, from 9900'-11,133'. At 11,350' the dominant kerogen type is amorphous (oil prone?) kerogen, while the rest of the interval (9550' and 11,360'-12,300') is dominated by inertinite. The HI value is high (oil prone) at 11,350', below which the HI values are low, perhaps due to the presence of predominantly inertinitic kerogen.

The interval down to 11,360' can produce moderate to good amounts of gas. Below 11,360', in general the late maturity and inertinitic kerogen suggest that the interval can only generate poor amounts of gas, in spite of having high TOC levels.

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II.D. TUNA-1 WELL

SYNOPSIS

The cuttings samples of the Tuna-1 well section from 4690'-10,790' have been analysed, and have been divided into two intervals on the basis of thermal maturity.

Interval 4690'-6230': Thermally immature to transitionally early mature. Due to low TOC levels down to 4950', only nil-poor amounts of gas generation are expected, in spite of having amorphous kerogen (Type I and II, but oxidised). However, the samples from 4690'-4950' could be contaminated by caving (these samples are from immediately below the cored sequence). The rest of the interval has high TOC levels (due to coal inclusions), is predominantly vitrinitic, and can produce minor-moderate amounts of gas where the interval has attained maturity.

The presence of rare-moderately common dinocysts, in association with predominantly vitrinitic kerogen, suggests marginal marine deposition.

Interval 6480'-10,790': Most of the samples below 6950' are transitionally early mature to mature. The predominantly vitrinitic kerogen, in association with moderate amounts of inertinite, can produce poor-moderate amounts of gas (below 6950').

Rare dinocysts are present down to 6950', which, in association with the predominantly vitrinitic kerogen, suggests a marginal marine environment. Below 6950', dinocysts are absent and the interval has increased terrigenous input, indicating deltaic/estuarine conditions.

INTERVAL 4690'-6230'

Description: Vitrinite reflectivity values in this interval are in the immature range, while Tmax values (except from 4700'-4950') are also below thermal maturity level. However, from 4700'-5930' spore colour values are mature to transitionally early mature, although below 5930' the spore colouration also suggests that the organic matter is thermally immature.

The high Tmax and spore colour values from 4700'-4950' may be due to local tectonism or to contamination by caving (the samples from 4690'-4950' are immediately below the cored sequence). Tmax values are elsewhere slightly suppressed due to coal inclusions. Similarly, spore colour values are slightly higher (from 5300'-5930') due to partial oxidation. In general, the maturity level of the organic matter in this interval therefore remains in the immature to transitionally early mature range.

The interval is dominated by amorphous kerogen from 4690'-4950' and at 6230'. The amorphous kerogen down to 4950' could be caved. The rest of the interval is predominantly vitrinitic, in association with moderate amounts of inertinite and amorphous kerogen. HI values fall within the gas prone range, except at 5300', where the value is high due to the presence of moderate amounts of cuticle (Type II).

TOC levels are very low down to 4950', so that only nil-poor amounts of gas generation can be expected. Below 4950', the rest of the interval has high TOC levels due to coal inclusions. A minor-moderate amount of gas generation is expected from 5300'-5930'. Below 5930', no hydrocarbon generation is expected due to thermal immaturity.

INTERVAL 6480'-10,780'

Description: Vitrinite reflectivity values suggest that the organic matter is thermally mature. However, down to 6950' the values are high due to partial oxidation. Spore colour and Tmax values down to this level suggest that the interval is thermally immature, except at 6820', where the spore colour value is transitionally early mature. Below 6950', spore colour values remain in the transitionally early mature to mature range. Tmax values are in general suppressed due to coal inclusions. High spore colour and Tmax values at 7350' and 10,320' suggest local tectonism. Both spore colour and Tmax values are below maturity level at 9020'.

The interval is predominantly vitrinitic, except at 6950', where the dominant type is amorphous kerogen, and at 9020' where the sample is dominated by cuticle (Type II). A moderate to common amount of inertinite is present throughout the interval. HI values remain in the gas prone range, except at 7350' and 9020', where the HI values are high (oil prone).

Asphaltene is present in the sample at 10,320'.

TOC values are low at 7350' and 10,320'. The high Tmax values for these samples suggest that they are a spent source. The rest of the section has high TOC levels, which are mostly due to coal contamination. S_2 values are highest where coal is predominant.

Almost nil hydrocarbon generation is expected down to 6950' and at 9020', mostly due to thermal immaturity. The rest of the section can produce poor to moderate amounts of gas.

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II.E. PERCH-A1 WELL

SYNOPSIS

Cuttings samples of the Perch-A1 well section have been analysed from 3790'-9370' and have been divided into three intervals, based on thermal maturity and change of dominant kerogen type, with respect to oil and gas generation.

Interval 3790'-4330': The interval is thermally immature. Dominated by amorphous kerogen (may be of Type III origin). Despite the presence of gas prone kerogen, no hydrocarbon generation is expected at the present level of maturity.

The occurrence of rare-common dinocysts, in association with amorphous kerogen, would suggest a marine environment, but inclusions of coal indicate probable nearshore/marginal marine deposition.

Interval 4820'-8450': The interval is partially mature. Predominantly vitrinitic. Poor-moderate gas generation is expected.

The presence of rare-moderately common dinocysts, in association with vitrinite, suggests a marginal marine environment down to 8250', below which the decline in numbers of dinocysts suggests deltaic/estuarine deposition.

Interval 8600'-9370': The interval is thermally mature. Predominantly inertinitic. Poor-moderate gas generation is expected.

Dinocysts are rare, absent below 9060', which, together with the presence of vitrinite/inertinite, suggests a deltaic/estuarine environment.

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INTERVAL 3790'-4330'

Description: The spore colour (3), vitrinite reflectivity (0.42%) and Tmax (less than 435°C) values suggest that the interval is thermally immature with respect to oil generation.

TOC levels are high due to coal contamination, the sample at 3940' being virtually all coal, which has given a very high S_2 value (86.46 Kg/T) and swamped the detector response.

The kerogen type is predominantly amrophous, except at 3940', where the dominant kerogen is vitrinite. The amorphous kerogen is non fluorescent and the interval is thermally immature, suggesting that the amorphous kerogen may be a degraded form of vitrinite (gas prone). However, dinocysts are common at 3790', indicating the presence of oil prone kerogen at this level. A moderate amount of vitrinite is present throughout the interval. The interval is predominantly gas prone, which is substantiated by the HI values. However, no hydrocarbon generation is expected from this interval at its present state of maturity.

INTERVAL 4820'-8450'

Description: The spore colour values (3) suggest that the organic matter is mostly immature, in this interval, except from 5060'-5720', where the spore colour values (4) indicate transitional early maturity, and at 7160', 7660'-7860', and 8090', where the spore colour values (5-6) suggest that the organic matter is thermally mature.

Vitrinite particles are partially oxidised in most of the samples and have given higher readings throughout the interval, while the easily degassified coal has lowered the Tmax values. For these reasons, only spore colour readings have been used for the maturity evaluation of organic matter in this interval.

TOC (3-34%) and S_2 (10-40+ Kg/T) values are very high down to 7900'. Coal is present over most of this interval and is abundant down to 7900', becoming a minor component below 8000'.

Free hydrocarbon readings are relatively high, although not when compared with the quantity of organic material, so that a free hydrocarbon accumulation is not believed to be present.

The interval is predominantly vitrinitic (gas prone), except from 4820'-5060', where the interval is dominated by inertinite, at 7860' where the dominant type is amorphous kerogen (may be a degraded form of vitrinite), and from 8090'-8150', where the dominant kerogen is cuticle (oil/gas prone Type II). Moderate amounts of amorphous kerogen and inertinite are present throughout the interval.

HI values (less than 260) are mostly at the gas prone level, except from 8090'-8150', where the values are high, suggesting the presence of considerable amounts of oil prone kerogen.

However, in spite of having oil prone kerogen (at 8090'-8150'), the interval can produce poor-moderate amounts of gas only, where the interval is transitionally early mature-mature.

INTERVAL 8600'-9370'

Description: The spore colour, Tmax and vitrinite reflectivity values suggest that the organic matter in this interval is thermally mature, except from 8700'-8770', where the spore colour/Tmax values are immature, and at 8820', where the spore colour value (8) suggests late maturity. High Tmax values at 8600' and 8820' suggest a spent source. Vitrinite particles are partly oxidised and have given higher values throughout the interval.

TOC values are very low to above average, suggesting that the section is organically leaner than the previous intervals, although the values are still affected by the presence of thin coals.

Pyrolysate yields have dropped relative to the intervals above, to moderate-poor. The range of TPI values, perhaps more reliable than in the above intervals, do not indicate any free hydrocarbon accumulation.

The interval is predominantly inertinitic, except at 8600', where the kerogen type is a mixture of amorphous, vitrinite and inertinite, and at 9150' where the dominant type is non fluorescent amorphous kerogen (with a moderate amount of (oil/gas prone) cuticle). A moderate amount of vitrinite is present throughout the interval. HI values are low, except at 9150', where the HI value is very high.

A poor to moderate amount of gas generation can be expected from this interval.

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II.F. PIKE-1 WELL

SYNOPSIS

The cuttings samples analysed from the Pike-1 well section (6460'-6950') have been grouped as one interval on the basis of thermal maturity.

Interval 6460'-6950': The organic matter is mature to late mature, and is a poor source (very low to average TOC levels). In spite of having oil prone kerogen (amorphous, Type I and II/cuticle, Type II), at the present state of maturity the interval can produce minor-moderate amounts of gas only.

The presence of rare-moderately common dinocysts, with predominantly amorphous kerogen down to 6850', suggests marine, shallow water nearshore deposition, below which depth the incoming of vitrinite suggests a marginal marine environment.

INTERVAL 6460'-6950'

Description: Vitrinite reflectivity and spore colour (6-8) values suggest that the interval is mature to late mature. Tmax values are below maturity level from 6600' to 6660'. A considerable amount of immature caved kerogen has been observed at 6600' and 6660', which may have lowered the Tmax values. However, the high Tmax values (post mature) at 6460' and from 6770'-6930' suggest that the organic matter is a spent source. Vitrinite reflectivity values are mature, but they are not as high as spore colour/Tmax values (and are in fact immature at 6950').

TOC levels are low, except at 6660' and 6950', where the TOC levels are average. The interval is organically poor and yields of pyrolysable hydrocarbon are low, so that a poor source ability is interpreted. The presence of free hydrocarbons is noted in the upper part of the interval (6460'-6600'), where the TPI value reaches a maximum of 0.87.

The interval down to 6850' is dominated by non fluorescent amorphous (Type I and II) kerogen, while below 6850' the interval is predominantly vitrinitic. A moderate amount of vitrinite (gas prone) is also present in the higher part of the interval, and a moderate amount of cuticle (Type II) is encountered from 6850'-6950'. HI values in most samples are high, suggesting the presence of good oil prone kerogen.

However, this interval cannot generate oil, in spite of having good quality oil prone (cuticle/amorphous) kerogen, because of late to over maturity. The high thermal maturity and the TOC levels indicate that the interval can produce a moderate amount of gas at 6660' and 6950', and a minor amount of gas at 6770'.

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II.G. KINGFISH-1 WELL

SYNOPSIS

The cuttings samples analysed (7540'-8450') from the Kingfish-1 well section have been grouped as one interval on the basis of thermal maturity.

Interval 7540'-8450': The interval is transitionally early mature to mature. Predominantly vitrinitic down to 7840' and at 8120', the rest of the section being inertinitic. TOC levels, except at 8120', are low. The present state of maturity and partial oxidation suggest a poor quantity of gas generation from the entire interval.

The occurrence of rare-moderately common dinocysts, in association with vitrinitic and inertinitic kerogen, suggests a marginal marine depositional environment.

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INTERVAL 7540'-8450'

Description: Vitrinite reflectivity and spore colour values suggest that the interval is transitionally early mature to mature. Tmax values are high from 7840'-7950' and at 8400'. However, the spore colour values for these samples suggest that the organic matter is mature, rather than post mature. The Tmax values in the rest of the interval are slightly below maturity level.

TOC levels are low (less than 1%), except at 8120', where the TOC and S_2 values are high due to coal contamination. TPI values are low and no evidence of oil shows is noted.

The kerogen type is predominantly vitrinitic from 7540'-7840' and at 8120'. The rest of the interval is predominantly inertinitic, although the kerogen type below 8120' could be influenced by caving. The interval is partially oxidised. HI values remain in the gas prone range. Minor quantities of asphaltene are noted at 7950'.

A poor quantity of gas can be expected from the entire section at its present TOC levels and state of maturity.

II.H. MORAY-1 WELL

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SYNOPSIS

The analysed cuttings samples (5480'-8750') of the Moray-1 well section have been divided into two intervals based on thermal maturity.

Interval 5480'-6420': The interval, except at 5480', is thermally immature. In spite of having amorphous kerogen, at the present state of maturity no hydrocarbon generation is expected (although the sample at 5480', which is predominantly vitrinitic, can produce poor amounts of gas). The high thermal maturity at 5480' suggests local tectonism.

The occurrence of rare-moderately common dinocysts, in association with predominantly amorphous kerogen and moderate amounts of vitrinite, suggests a marine, shallow water nearshore environment.

Interval 6850'-8750': The interval is thermally mature (-over mature). Despite having predominantly amorphous kerogen,due to low TOC levels and high maturity the interval can only generate negligible to poor amounts of gas.

The absence of dinocysts (down to 8230' - they occur rarely and probably caved below this depth), and the presence of predominantly amorphous kerogen, suggests a marginal marine depositional environment.

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INTERVAL 5840'-6420'

Description: The spore colour (3) and Tmax values suggest that the interval is thermally immature, except at 5480', where the spore colour (5-6) and vitrinite reflectivity (0.50%) values indicate the organic matter is thermally mature. The high Tmax value (505°C) at 5480' suggests local tectonism. Vitrinite reflectivity values from 5690'-6420' fluctuate from immature-early mature, due to heating during sample drying, and are therefore not reliable.

TOC levels are very low, the low pyrolysate yield indicating almost negligible source potential in this section. High TPI values indicate a free hydrocarbon accumulation throughout the interval.

The dominant kerogen at 5480' is vitrinite, with a moderate amount of cuticle and amorphous kerogen. The rest of the interval is dominated by amorphous kerogen in association with moderate amounts of vitrinite. HI values are low.

At the present state of maturity, no hydrocarbon generation is expected from this interval, except at 5480', where the organic matter can produce poor amounts of gas.

INTERVAL 6850'-8750'

Description: The spore colour in this interval values are estimated on one or two dinocysts and by using the TAI scale, due to the absence of spores. Vitrinite reflectivity, TAI and Tmax values suggest that the interval is thermally mature. However, vitrinite reflectivity values are not as high as the TAI (3-4) and Tmax values. The slight traces of asphaltene contamination from 7820'-8750' have raised the Tmax values.

The sample at 6850' is so organically barren that the minimum detection limits of the OSA have been exceeded. Values for S_1 and S_2 are masked by amplifier background 'noise', which has lead to erroneous production indices. At such low values of S_2, maturity levels deduced from Tmax are unreliable.

TOC levels are low throughout the interval. High TPI values, as in the interval above, indicate a free hydrocarbon accumulation throughout this interval.

The interval is dominated by amorphous kerogen, with small to moderate amounts of inertinite and small amounts of vitrinite. HI values are high in most samples, indicating the presence of oil prone kerogen.

The very low TOC levels and high maturity of this interval indicate that, despite having amorphous kerogen (perhaps of Type I and II Origin), the interval can produce negligible to poor amounts of gas only.

II.I. HAPUKU-I WELL

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SYNOPSIS

The cuttings samples from 9240'-11,750' of the Hapuku-I well section have been analysed, and have been grouped into two intervals on the basis of TOC levels.

Interval 9240'-10,450': The interval has low TOC levels (less than 1 - 1%). Down to 9940', it is thermally mature/over mature, mostly dominated by amorphous (non fluorescent) kerogen and can produce a poor quantity of gas. The rest of the interval is thermally immature and no hydrocarbon generation is expected.

The presence of moderately common dinocysts down to 9940', in association with predominantly amorphous kerogen, suggests marine, inner shelf conditions. Below 9940', the absence of dinocysts and increase of vitrinitic kerogen suggests a marine, shallow water nearshore depositional environment.

Interval 10,540'-11,750': The interval down to 11,450' has high TOC levels (1+ to 16+ %) and is predominantly vitrinitic. However, due to thermal immaturity, no hydrocarbon generation is expected. Negligible amounts of gas can be produced only at 11,750', where the interval has attained thermal maturity.

The virtual absence of dinocysts, and the presence of coal inclusions and vitrinitic kerogen, suggest a marginal marine environment.

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INTERVAL 9240'-10,450'

Description: The interval down to 9940' is thermally mature, based on the spore colour, vitrinite reflectivity and Tmax values (Tmax values are anomalously high, perhaps due to tectonism). Below 9940', vitrinite reflectivity values (and spore colour values at 10,170') are slightly higher due to partial oxidation. Tmax values here are below the maturity level, while spore colour values from 10,320'-10,450' are also immature. The Tmax value at 9240' is high due to the high boilding point of free hydrocarbons.

The TOC levels are low (less than 1%), except at 10,170' where the TOC is average (1%). TPI values are above 0.3 from 9240'-9540'.

The dominant kerogen type from 9240'-9640' and at 9940' is amorphous. The rest of the interval is predominantly vitrinitic. High HI values suggest the presence of oil prone kerogen.

At the present state of maturity, only a poor quantity of gas generation is expected down to 9940', and no hydrocarbon generation is expected below this depth, due to thermal immaturity.

INTERVAL 10,540'-11,750'

Description: Spore colour, vitrinite reflectivity and Tmax values suggest that this interval is immature down to 11,450'. However, vitrinite values are slightly higher from 10,880'-11,010' due to oxidation. Both spore colour and Tmax values at 11,750' suggest that the organic matter is thermally mature. The presence of coal down to 11,450' has slightly depressed the Tmax values.

TOC and S_2 levels are high due to coal inclusions, the TOC reaching values of over 16%. This gives increased values of free and evolved hydrocarbons.

The interval is dominated by vitrinitic (gas prone) kerogen, with moderate amounts of cuticle (Type II) and amorphous (Type I and II) kerogen. Moderate amounts of inertinite are present from 11,310'-11,750'. HI values are high (oil prone) at 10,770' and at 11,450'.

No hydrocarbon generation is expected from this interval at its present state of maturity, except at 11,750', where the interval can produce a negligible amount of gas.

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II.J. HALIBUT-1 WELL

SYNOPSIS

The cuttings samples analysed from the Halibut-1 well (7450'-9990') have been divided into three intervals based on TOC levels.

Interval 7450'-8120': TOC values are less than 1%, excepting probable coal-influenced results. The interval is transitionally early mature to immature, and dominated by amorphous kerogen (perhaps of Type I and II origin). Only a poor amount of gas generation is expected. The samples from 8090'-8120' could be contaminated by caving, as the samples are from immediately below the cored sequence.

The presence of moderately common dinocysts and of amorphous kerogen suggests marine deposition, shallow water nearshore in view of the terrigenous (coal) influences.

Interval 8240'-9000': TOC values vary from 1-20%. The interval is thermally immature, and dominated by amorphous and vitrinitic kerogen. At the present state of maturity no hydrocarbon generation is expected.

The presence of rare dinocysts (and their absence below 8670') suggests a marginal marine environment.

Interval 9200'-9990': TOC values are between 2 and 22+%. The interval is thermally immature, and predominantly vitrinitic. At the present level of maturity no hydrocarbon generation is expected.

The absence of dinocysts and increased proportion of vitrinite, in association with amorphous kerogen, suggests marginal marine deposition.

INTERVAL 7450'-8120' 41/119

Description: Vitrinite reflectivity values are in the early mature range, except at 7720', where the value suggests that the organic matter is immature. The vitrinite reflectivity values are slightly high due to the effect of heating during sample drying and because, to a certain extent, the vitrinite particles are derived from coal. Spore colour values are mature from 7450'-7620', where the Tmax values are high, suggesting local tectonism. Spore colour values are immature from 7660'-7810'. Below 7810', spore colouration suggests that the organic matter is transitionally early mature. Tmax values are immature below 7620'. The higher spore colour values in the samples from 8090'-8120' may be a reflection of caving, as they are immediately below the cored sequence.

If spore colour, vitrinite reflectivity and Tmax values are all taken into account, the interval may be said to be thermally immature to transitionally early mature

TOC levels are low, except from 7720'-7810', where TOC levels are high due to coal inclusions.

The interval is dominated by amorphous kerogen, with a moderate amount of inertinite. HI values are low to moderate. Pyrolysable hydrocarbon yields are less than 2 Kg/T, indicating poor source qualities. No free accumulation of hydrocarbons is noted in this section. Only a poor amount of gas generation is expected from this interval.

INTERVAL 8240'-9000'

Description: The vitrinite reflectivity values suggest that the interval is thermally mature, but the values are anomalously high due to heating during sample drying. Spore colour and Tmax values suggest that the interval is thermally immature. Palynomorphs are rare below 8520'.

TOC values are high due to significant coal contamination. Pyrolysate yields are also high, some being greater than 20 Kg/T. Samples near the base of the interval (8810' and 8920') contain significant shows of free oil in this predominantly sandstone member.

The kerogen type is predominantly vitrinitic down to 8500' and at 9000', the rest of the interval being dominated by amorphous kerogen. A moderate amount of inertinite is present throughout the interval. However, at the present state of maturity no hydrocarbon generation is expected.

INTERVAL 9200'-9990'

Description: Vitrinite reflectivity values remain in the immature to early mature range. These values in places are higher due to heating during the sample drying.

Palynomorphs are rare or lacking, and in most cases spore colour values are measured on 2-4 spores. Both spore colour and Tmax values suggest that the interval is thermally immature.

High TOC and S_2 values are due to coal contamination. No free hydrocarbons are noted in this interval.

The kerogen type is predominantly vitrinitic in association with moderate amounts of amorphous kerogen. A moderate amount of cuticle (Type II) is present from 9380'-9560'. The HI value is high at 9380', suggesting the presence of a considerable amount of oil prone kerogen. However, at the present state of maturity no hydrocarbon generation is expected from this interval.

III. GENERAL CONCLUSIONS

On the basis of hydrocarbon generating potential, the following conclusions have been drawn on the ten analysed well sections.

Pisces-1 is probably the most promising well with respect to oil generation. The section can generate poor-moderate amounts of oil and poor-moderate amounts of gas at its present state of maturity.

The section is partially mature and contains good quality amorphous (oil prone) kerogen, but the source is poor. The TOC levels in most places are below average (less than 1%). Regardless of having good oil prone kerogen, the low TOC levels and the presence of moderate to common amounts of inertinite (nil potential) have in general limited the oil generating potential of this section.

Barracouta-1 and Snapper-1 are both predominantly gas prone (vitrinitic). However, Barracouta-1 has a considerable amount of immature oil prone kerogen, except at 8380', where it is mature. The organic matter from this sample can generate moderate amounts of oil. The rest of the Barracouta-1 and the entire Snapper-1 section can generate moderate-good amounts of gas. Both sections are organically rich, but the organic richness is to a certain extent due to inclusions of coal. Barracouta-1 is partially oxidised, which also has affected the hydrocarbon generating potential.

Tuna-1, Perch-A1 and Pike-1 can all generate poor-moderate amounts of gas at their present state of maturity.

Tuna-1 is predominantly vitrinitic and has high TOC levels, but these are affected by coal inclusions. The presence of amorphous kerogen at the top of the section may be due to contamination by caving, as the samples from 4690'-4950' are from immediately below the cored sequence. Inertinite (nil potential) in moderate amounts is present throughout the section, and has affected the gas generation.

In the upper part of the Perch-A1 section, the predominantly amorphous kerogen is immature, so that it has no hydrocarbon generating potential. The middle part of the section is partially mature and has gas prone (vitrinite) kerogen, while the bottom part contains inertinitic (nil potential) kerogen. Thus, despite having high TOC levels, the entire section can produce only poor-moderate amounts of gas.

Pike-1 is organically lean. The section contains predominantly amorphous (oil prone) kerogen, but due to late maturity the organic matter can only produce poor-moderate amounts of gas.

Kingfish-1 is a mature, gas prone but organically lean section, so that it can only generate poor amounts of gas. The high TOC level at 8120' is due to coal inclusions. The section is partially affected by oxidation.

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Moray-1 and Hapuku-1 can both generate poor gas only.

Moray-1 is organically lean and is dominated by immature amorphous kerogen down to 6420', so that no hydrocarbon generation is expected. Below 6420', the amorphous kerogen, as in the Pike-1 well, is late-over mature and thus can generate poor amounts of gas only.

In the Hapuku-1 well, the sequence found in Moray-1 is reversed. The section down to 9940' is mature-over mature (possibly due to tectonism), organically lean, and can produce only poor gas. Below 9940', the section, although organically rich, contains gas prone kerogen which is immature, and thus no hydrocarbon generation is expected. The lower part of the section is affected by coal inclusions.

The Halibut-1 well section is mostly immature. Only poor amounts of gas can be expected from 7450'-7620', where the organic matter is mature (possibly over mature, considering the Tmax values) but sparse. Most of the immature section is organically rich due to coal inclusions.

The depositional environment has also affected the ten well sections, with respect to hydrocarbon generation.

A poor-moderate oil prone source (Pisces-1) has been found in marine, inner shelf deposits.

Moderate-good gas prone sources (Barracouta-1, Snapper-1 and Tuna-1) are present in deltaic/estuarine sediments.

No hydrocarbon - poor-moderate gas prone sources (the rest of the well sections) are confined to marginal marine-marine, shallow water nearshore deposits.

IV. SUMMARY TABLE

Well	Interval	Thermal Maturity	Dominant Kerogen Type	Organic Richness (TOC-level)	Type of Hydrocarbon Generated	Environment
PISCES-1	1836m-2277m					
	1836m-2052m	immature-mature	mixture of amorphous/inertinite	low	mod oil at 1940m, nil-poor oil/gas	marine inner shelf
	2100m-2277m	partially mature	amorphous	low	poor-mod oil	marine inner shelf
	2283m-2580m					
	2283m-2457m	mature	amorphous	low-average	poor-mod oil	marine inner shelf
	2466m-2580m	partially mature	amorphous/vitrinite/inertinite	low-high	mod-good gas/poor-mod oil	marine shallow water nearshore.
BARRACOUTA-1						
	3580'-6610'	immature-transitionally early mature	vitrinite	high	no hydrocarbon-poor gas	marginal marine-deltaic/estuarine
	6710'-8620'	transitionally early mature-mature	vitrinite	high	mod-good gas/mod oil at 8380'	deltaic/estuarine

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Well	Interval	Thermal Maturity	Dominant Kerogen Type	Organic Richness (TOC-level)	Type of Hydrocarbon Generated	Environment
SNAPPER-1						
	4990'-9100'	immature-transitionally early mature	vitrinite	high	poor gas	deltaic/ estuarine
	9550'-12300'	mature-late mature	vitrinite/ inertinite	average-high	poor-mod-good gas	deltaic/ estuarine
TUNA-1						
	4690'-6230'	immature-transitionally early mature	vitrinite	low-high	poor-mod gas	marginal marine
	6480'-10790'	transitionally early mature-mature	vitrinite	average-high	poor-mod gas	marginal deltaic/ estuarine
PERCH-A1						
	3790'-4330'	immature	amorphous	high	no hydrocarbon	marginal marine
	4820'-8450'	partially mature	vitrinite	high	poor-mod gas	marginal marine-deltaic/ estuarine
	8600'-9370'	mature	inertinite	average-high	poor-mod gas	deltaic/ estuarine

Well	Interval	Thermal Maturity	Dominant Kerogen Type	Organic Richness (TOC-level)	Type of Hydrocarbon Generated	Environment
PIKE-1	6460'-6950'	mature-late mature	amorphous-vitrinite	low-average	poor-mod gas	marine shallow water nearshore-marginal marine
KINGFISH-1	7540'-8450'	transitionally early mature-mature	vitrinite	low	poor gas	marginal marine
MORAY-1	5480'-6420'	immature	amorphous	low	no hydrocarbon-poor gas	marine shallow water nearshore
	6850'-8750'	mature	amorphous	low	poor gas	marginal marine
HAPUKU-1	9240'-10450'	mature/over mature-immature	amorphous	low	poor gas	marine, inner shelf-marine, shallow water nearshore

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Well	Interval	Thermal Maturity	Dominant Kerogen Type	Organic Richness (TOC-level)	Type of Hydrocarbon Generated	Environment
	10540'-11750'	immature	vitrinite	average-high	no hydrocarbon	marginal marine
HALIBUT-1						
	7450'-8120'	transitionally early mature-immature	amorphous	low	poor gas	marine shallow water nearshore
	8240'-9000'	immature	amorphous/ vitrinite	average-high	no hydrocarbon	marginal marine
	9200'-9990'	immature	vitrinite	high	no hydrocarbon	marginal marine

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<u>BARRACOUTA - 1</u>

MATURATION LOG

DEPTH IN FEET \ MATURATION LEVEL	VITRINITE REFLECTIVITY (%)			SPORE COLOUR SCALE			SPORE-POLLEN FLUORESCENCE COLOUR	
	0.1-0.44	0.45-1	1-3	1-4	4-8	8-10	BLUE/GREEN/ WHITISH YELLOW	YELLOW/ BROWN
	IMMATURE	OIL WINDOW	GAS WINDOW	IMMATURE	OIL WINDOW	GAS WINDOW	IMMATURE	OIL WINDOW
3580	0.42(20)			2-3(5)			w. yellow	
3870	0.40(20)			2(4)			w. yellow	
4220		0.49(20)		2(3)			w. yellow	
4520		0.50(21)		3(8)			yellow	
4670	0.42(21)			2-3(9)			w. yellow	
4960		0.56(20)		3(19)			w. yellow	
5240	0.44(22)			3(11)			w. yellow	
5400	0.44(22)			3(20)			w. yellow	
5530	0.41(20)			2-3(13)			w. yellow	
5700		0.47(20)		2-3(14)			w. yellow	
5870	0.43(20)			2-3(5)			w. yellow	
5960	0.44(21)			2-3(10)			w. yellow	
6060		0.49(21)		2-3(7)			w. yellow	
6250		0.49(20)		2-3(6)			w. yellow	
6420		0.49(7)			4(13)			yellow
6610		0.49(20)		2(6)	4(8)		w. yellow	yellow
6710		0.55(20)			4(16)			yellow
6940		0.54(20)			7(8)			d. orange
7200		0.53(21)			4(10)			yellow
7400		0.66(21)			4(16)			yellow
7590		0.53(20)		3	4(6)			yellow
7650		0.48(23)		2-3(3)			w. yellow	
7800	0.39(20)			2-3(7)			w. yellow	
7910		0.56(21)			5(12)			yellow
8060		0.52(21)			6(15)			d. yellow
8140		0.67(23)			5(10)			yellow
8240		0.62(21)			5(12)			d. yellow
8380		0.55(20)			5(8)			yellow
8510		0.54(21)		3(6)			w.yellow	
8620		0.53(20)			4-5(5)			non-fluores-cent-yellow

w. = whitish
d. = dull

5/119

HALIBUT - 1

MATURATION LOG

DEPTH IN FEET \ MATURATION LEVEL	VITRINITE REFLECTIVITY (%)			SPORE COLOUR SCALE			SPORE-POLLEN FLUORESCENCE COLOUR	
	0.1-0.44	0.45-1	1-3	1-4	4-8	8-10	BLUE/GREEN/ WHITISH YELLOW	YELLOW/ BROWN
	IMMATURE	OIL WINDOW	GAS WINDOW	IMMATURE	OIL WINDOW	GAS WINDOW	IMMATURE	OIL WINDOW
7450		0.53(3)			5(4)			yellow
7620		0.47(20)			5-6(3)			yellow
7660		0.49(20)		3(6)			w. yellow	
7720	0.44(20)			3(2)			w. yellow	
7810		0.50(20)		3(5)			w. yellow	
8090		0.45(21)			4(6)			yellow-orange -yellow
8120		0.48(20)			4(12)		w. yellow	
8240		0.46(20)		3(5)			w. yellow	
8340		0.48(21)		2-3(5)			w. yellow	
8500		0.51(21)		3(4)			w. yellow	
8520		0.48(20)		3(5)			w. yellow	
8670		0.50(20)		3(1)			w. yellow	
8810	0.43(8)			2(1)			w. yellow	
8920		0.48(14)		2(1)			w. yellow	
9000		0.52(20)		NIL			NIL	
9200		0.46(21)		NIL			NIL	
9230	0.41(20)			NIL			NIL	
9380		0.47(21)		3(2)			w. yellow	
9500	0.44(20)			3(3)			w. yellow	
9560		0.47(20)		NIL			NIL	
9630		0.48(20)		NIL			NIL	
9720	0.42(20)			2(2)			w. yellow	
9900		0.50(20)		NIL			NIL	
9990	0.46(20)			3(4)			w. yellow	

w. = whitish

52/119

HAPUKU - 1

MATURATION LOG

MATURATION LEVEL / DEPTH IN FEET	VITRINITE REFLECTIVITY (%)			SPORE COLOUR SCALE			SPORE-POLLEN FLUORESCENCE COLOUR	
	0.1-0.44	0.45-1	1-3	1-4	4-8	8-10	BLUE/GREEN/ WHITISH YELLOW	YELLOW/ BROWN
	IMMATURE	OIL WINDOW	GAS WINDOW	IMMATURE	OIL WINDOW	GAS WINDOW	IMMATURE	OIL WINDOW
9240		0.55(1)				8(2)		non fluores-cent
9540		NIL			6(2)			yellow-orange
9610		0.45(5)			6(2)			d. orange
9640		0.48(2)			6-7(4)			d. brown
9710		NIL			5(3)			yellow
9820	0.32(5)				NIL	TAI 3		NIL
9940		0.51(6)				8(1)		non fluores-cent
10170		0.52(20)		3(1)	5(3)		w. yellow	d. yellow
10320		0.47(21)		3(4)			w. yellow	
10450	0.40(8)			3(6)			w. yellow	
10540	0.44(22)			2(1)			w. yellow	
10680	0.42(14)			3(2)			w. yellow	
10770	0.43(23)			2-3(5)			w. yellow	
10880		0.46(23)		3(4)			w. yellow	
11010		0.45(20)		3(4)			w. yellow	
11190	0.43(20)			2-3(5)			w. yellow	
11310	0.44(20)			3(6)			w. yellow	
11450	0.42(20)			3(2)			w. yellow	
11750	0.43(20)				6(5)			orange

d. = dull
w. = whitish

53/119

MORAY - 1

MATURATION LOG

DEPTH IN FEET \ MATURATION LEVEL	VITRINITE REFLECTIVITY (%)			SPORE COLOUR SCALE			SPORE-POLLEN FLUORESCENCE COLOUR	
	0.1-0.44	0.45-1	1-3	1-4	4-8	8-10	BLUE/GREEN/ WHITISH YELLOW	YELLOW/ BROWN
	IMMATURE	OIL WINDOW	GAS WINDOW	IMMATURE	OIL WINDOW	GAS WINDOW	IMMATURE	OIL WINDOW
5480		0.50(2)			5-6(8)			yellow
5690	0.40(2)			3(4)			w. yellow	
5930		0.47(6)		3(3)			w. yellow	
6060		0.54(3)		3(5)			w. yellow	
6230	0.43(1)			2-3(2)			w. yellow	
6420		0.48(11)		3(2)			w. yellow	
6850	0.38(4)				TAI 3			non fluores-cent
7080	NIL				TAI 3			non fluores-cent
7820		0.48(16)			TAI 3			non fluores-cent
8230	NIL					TAI 4		non fluores-cent
8330		0.46(17)			TAI 3			non fluores-cent
8560		0.55(9)			TAI 3			non fluores-cent
8690		0.53(8)				TAI 4		non fluores-cent
8750		0.67(7)				TAI 4		non fluores-cent

w. = whitish

PERCH - A1

MATURATION LOG

DEPTH IN FEET \ MATURATION LEVEL	VITRINITE REFLECTIVITY (%)			SPORE COLOUR SCALE			SPORE-POLLEN FLUORESCENCE COLOUR	
	0.1-0.44	0.45-1	1-3	1-4	4-8	8-10	BLUE/GREEN/ WHITISH YELLOW	YELLOW/ BROWN
	IMMATURE	OIL WINDOW	GAS WINDOW	IMMATURE	OIL WINDOW	GAS WINDOW	IMMATURE	OIL WINDOW
3790	0.42(20)			3(5)			w. yellow	
3940	0.42(20)			3(3)			w. yellow	
4230	0.41(20)			3(2)			w. yellow	
4330	0.41(20)			2(2)			w. yellow	
4820		0.50(20)		3(4)			yellow (oxidised)	
4960		0.58(20)		3(2)			w. yellow	
5060		0.53(20)			4(15)			d. yellow (oxidised)
5510	0.41(20)				4(20)			yellow
5720		0.54(20)			4(30)			d. yellow (oxidised)
5940		0.49(20)		2-3(15)			w. yellow	
6050		0.52(20)		3(11)			w. yellow	
6330		0.54(20)		3(12)			w. yellow	
6550		0.53(17)		3(11)			w. yellow	
6860		0.59(21)		3(21)			w. yellow	
7040		0.52(24)		3(20)			w. yellow	
7160		0.60(20)		-	5(3)			yellow-orange (oxidised)
7250	0.42(20)			3(20)			w. yellow	
7440		0.49(21)		3(9)			w. yellow	
7660		0.62(23)			5(12)			yellow-orange
7860		0.56(22)			5(9)			yellow

w. = whitish
d. = dull

PERCH - A1

MATURATION LOG

DEPTH IN FEET \ MATURATION LEVEL	VITRINITE REFLECTIVITY (%)			SPORE COLOUR SCALE			SPORE-POLLEN FLUORESCENCE COLOUR	
	0.1-0.44	0.45-1	1-3	1-4	4-8	8-10	BLUE/GREEN/ WHITISH YELLOW	YELLOW/ BROWN
	IMMATURE	OIL WINDOW	GAS WINDOW	IMMATURE	OIL WINDOW	GAS WINDOW	IMMATURE	OIL WINDOW
7900		0.54(21)		3(15)			w. yellow	
8090		0.65(22)			6(13)			orange
8150		0.63(22)		2-3(15)			w. yellow	
8250		0.57(20)		3(15)			w. yellow	
8450		0.49(20)		3(3)			w. yellow	
8600		0.60(7)			6(1)			brown
8700		0.54(10)		2-3(5)			w. yellow	
8770		0.54(13)		3(8)			w. yellow	
8820		0.89(20)				8(3)		dark brown
9060		0.85(20)			4(9)			yellow brown (oxidised)
9150		0.72(9)			6(5)			
9290		0.67(20)			6(14)			d. orange brown (oxidised)
9370		0.68(22)			6(10)			

w. = whitish
d. = dull

PIKE - 1

MATURATION LOG

MATURATION LEVEL / DEPTH IN FEET	VITRINITE REFLECTIVITY (%)			SPORE COLOUR SCALE			SPORE-POLLEN FLUORESCENCE COLOUR	
	0.1-0.44	0.45-1	1-3	1-4	4-8	8-10	BLUE/GREEN/ WHITISH YELLOW	YELLOW/ BROWN
	IMMATURE	OIL WINDOW	GAS WINDOW	IMMATURE	OIL WINDOW	GAS WINDOW	IMMATURE	OIL WINDOW
6460		0.48(15)			7(4)			orange
6600		0.62(4)			6(8)			yellow-orange
6660		0.48(20)			6(2)			yellow-brown
6770		0.52(20)			7	8(9)		dark brown
6850		0.49(8)			7(10)			d. brown
6930		0.49(7)			7	8(5)		dark brown
6950	0.43(20)					8(10)		d. brown

d. = dull

PISCES - 1

MATURATION LOG

MATURATION LEVEL / DEPTH IN METRES	VITRINITE REFLECTIVITY (%)			SPORE COLOUR SCALE			SPORE-POLLEN FLUORESCENCE COLOUR	
	0.1-0.44	0.45-1	1-3	1-4	4-8	8-10	BLUE/GREEN/ WHITISH YELLOW	YELLOW/ BROWN
	IMMATURE	OIL WINDOW	GAS WINDOW	IMMATURE	OIL WINDOW	GAS WINDOW	IMMATURE	OIL WINDOW
1836	0.40(5)			3(15)			w. yellow	
1851	0.41(5)				5(5)			yellow
1863		0.61(1)			5(2)			yellow
1866	0.33(1)				6(7)			d. yellow
1881	NIL				6(3)			d. yellow
1901.5(SWC)		0.52(10)			5(1)			orange
1929		0.48(2)			4(3)			d. yellow
1932(SWC)		0.58(10)		NIL			NIL	
1940(SWC)		0.55(10)			5(5)			yellow
2052		NIL			5(2)			d. yellow
2100	0.43(20)			3(6)			w. yellow	
2107(SWC)	0.43(21)			3(4)			w. yellow	yellow
2163		0.47(20)		2(18)			green/w.	
							yellow	
2178		NIL			4(1)			yellow
2199		0.45(26)			6(24)			d. yellow
								orange
2277		0.52(20)			5(4)			yellow
2283	0.40(1)			3(6)			w. yellow	
2304		0.49(20)			5(2)			d. yellow
2346	NIL			2(38)			green/w. yellow	
2367		0.51(20)			6(3)			d. yellow
2391		0.60(7)			5(1)			d. yellow
2409		0.59(6)			6(2)			d. yellow
2421		0.57(8)		3(10)			w. yellow	
2457		0.53(4)			6(3)			d. yellow

w. = whitish
d. = dull

58/119

<u>SNAPPER - 1</u>

MATURATION LOG

MATURATION LEVEL / DEPTH IN FEET	VITRINITE REFLECTIVITY (%)			SPORE COLOUR SCALE			SPORE-POLLEN FLUORESCENCE COLOUR	
	0.1-0.44	0.45-1	1-3	1-4	4-8	8-10	BLUE/GREEN/ WHITISH YELLOW	YELLOW/ BROWN
	IMMATURE	OIL WINDOW	GAS WINDOW	IMMATURE	OIL WINDOW	GAS WINDOW	IMMATURE	OIL WINDOW
4990		0.48(20)		3(6)			w. yellow	
5210		0.50(20)		3(10)			w. yellow	
5660		0.55(20)		3(10)			w. yellow	
5670		0.50(20)		3(10)			w. yellow	
5870		0.63(20)		3(12)			w. yellow	
5880		0.55(20)		3(9)			w. yellow	
6160		0.59(20)		3(17)			w. yellow	
6410		0.52(20)		3(11)			w. yellow	
6710		0.56(20)		3(13)			w. yellow	
6960		0.53(20)		2-3(9)			w. yellow	
7180		0.52(20)		2-3(23)			w. yellow	
7360		0.56(20)		3(17)			w. yellow	
7560		0.57(20)		3(10)			w. yellow	
7760		0.59(20)		3(12)			w. yellow	
7900		0.63(20)		3	4(16)		w. yellow	yellow
8110		0.66(20)		3	4(10)		w. yellow	yellow
8310		0.59(20)		3(10)			w. yellow	
8560		0.63(20)		3	4(16)		w. yellow	yellow
8810		0.66(20)		3	4(17)		w. yellow	yellow
9100		0.65(20)		3(6)			w. yellow	
9550		0.69(20)			4(11)			yellow
9900		0.86(20)			5(10)			yellow
10200		0.83(20)			6(6)			d. orange
10330		0.84(25)			7(4)			d. orange
11133		0.99(20)			6(13)			d. yellow
11350			1.19(20)		6(3)			d. yellow
11360			1.27(20)		6(3)			d. yellow
11630			1.51(20)			8(6)		non fluores-cent

w. = whitish
d. = dull

59/119

SNAPPER - 1

MATURATION LOG

MATURATION LEVEL / DEPTH IN FEET	VITRINITE REFLECTIVITY (%)			SPORE COLOUR SCALE			SPORE-POLLEN FLUORESCENCE COLOUR	
	0.1-0.44	0.45-1	1-3	1-4	4-8	8-10	BLUE/GREEN/ WHITISH YELLOW	YELLOW/ BROWN
	IMMATURE	OIL WINDOW	GAS WINDOW	IMMATURE	OIL WINDOW	GAS WINDOW	IMMATURE	OIL WINDOW
11640			1.44(20)			8(5)		non fluorescent
11750			1.36(20)		7(5)			d. orange
11760			1.02(9)		6(6)			d. yellow
11890			1.12(20)		7(3)			d. orange-brown
11900			1.28(20)			8(2)		non fluorescent
12070			1.07(20)		7(2)			d. orange-brown
12080		0.98(20)			7(4)			d. orange-brown
12290			1.13(20)			8(1)		non fluorescent
12300			1.11(20)			8(4)		non fluorescent

d. = dull

TUNA - 1

MATURATION LOG

DEPTH IN FEET \ MATURATION LEVEL	VITRINITE REFLECTIVITY (%)			SPORE COLOUR SCALE			SPORE-POLLEN FLUORESCENCE COLOUR	
	0.1-0.44	0.45-1	1-3	1-4	4-8	8-10	BLUE/GREEN/ WHITISH YELLOW	YELLOW/ BROWN
	IMMATURE	OIL WINDOW	GAS WINDOW	IMMATURE	OIL WINDOW	GAS WINDOW	IMMATURE	OIL WINDOW
4690	0.32(6)			2(3)			w. yellow	
4700	0.37(5)				6(14)			yellow- d. yellow
4950	0.40(3)				6	8(4)		orange
5230	0.31(20)			3	4(3)		w. yellow	yellow
5300	0.37(20)				5-6(22)			yellow- orange
5460	0.33(20)				4(11)			yellow
5620	0.42(20)				4(15)			yellow
5680	0.38(20)			3	4(20)			yellow
5720	0.35(20)			3	4(12)			yellow
5930	0.34(20)				4-5(6)			d. yellow
6130	0.34(25)			3(14)			w. yellow	
6170	0.33(20)			3(8)			w. yellow	
6230		0.46(21)		3(3)			w. yellow	
6480		0.49(20)		3(16)			w. yellow	
6820		0.52(18)			4(2)		w. yellow	orange (oxidised)
6950		0.54(21)		3(8)			w. yellow	
7350		NIL				TAI 3		non fluor- escent
7840	0.43(8)			3	4(5)			yellow
7960		0.57(20)		3	4(12)			yellow
8170		0.67(4)			4-5(5)			d. yellow
8320		0.60(20)			4(16)			yellow
8500		0.65(20)			6(22)			d. yellow
8600		0.61(20)		3	4(7)		w. yellow	
8760		0.60(20)			4-5(13)			yellow
9020		0.64(20)		2-3(17)			w. yellow	

w. = whitish
d. = dull

TUNA - 1

MATURATION LOG

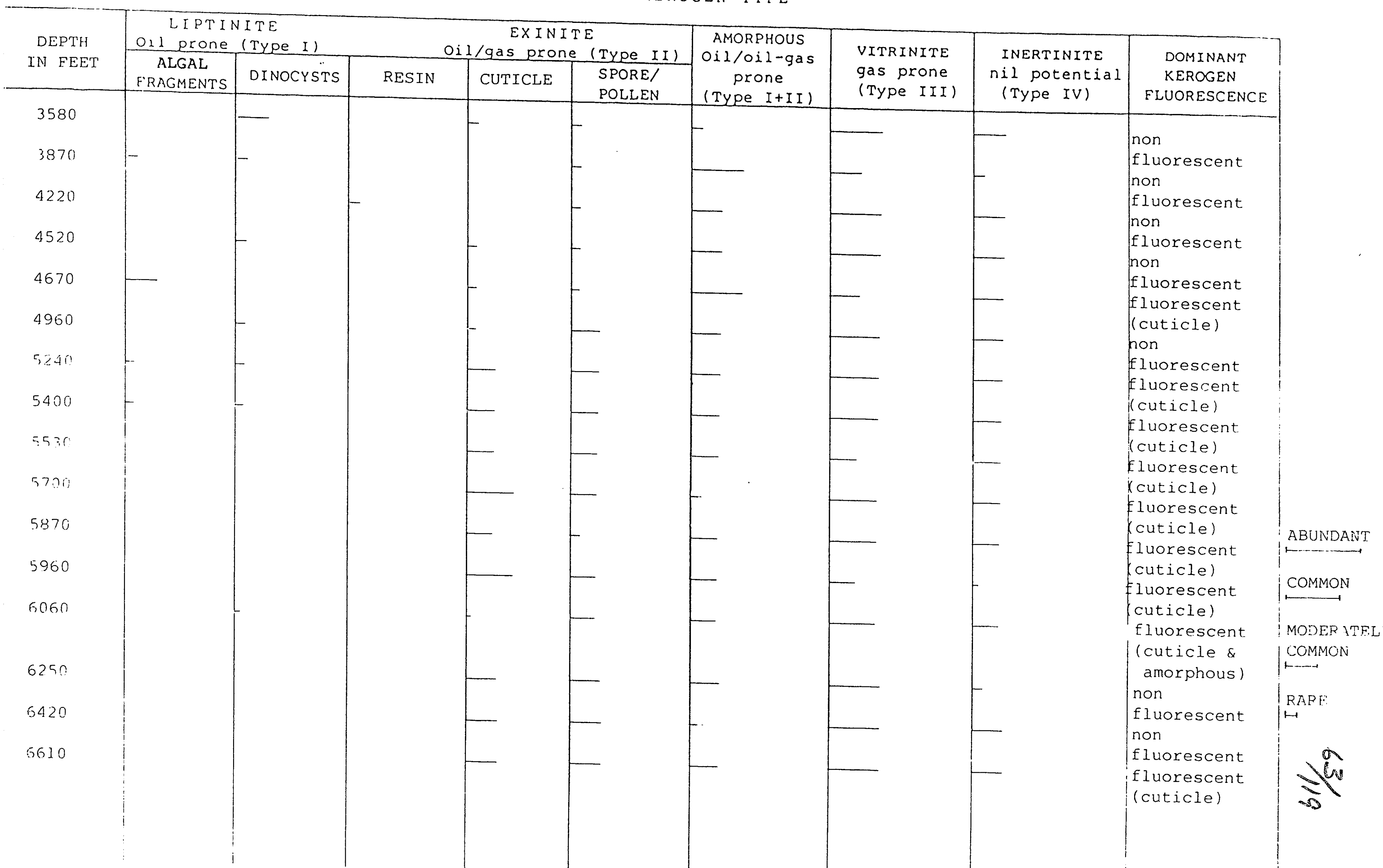
DEPTH IN FEET \ MATURATION LEVEL	VITRINITE REFLECTIVITY (%)			SPORE COLOUR SCALE			SPORE-POLLEN FLUORESCENCE COLOUR	
	0.1-0.44	0.45-1	1-3	1-4	4-8	8-10	BLUE/GREEN/ WHITISH YELLOW	YELLOW/ BROWN
	IMMATURE	OIL WINDOW	GAS WINDOW	IMMATURE	OIL WINDOW	GAS WINDOW	IMMATURE	OIL WINDOW
9270		0.64(20)			5(30)			yellow
9540		0.68(20)			6(17)			d. yellow-orange
10000		0.86(23)			6(21)			orange
10320		0.88(16)				8(13)		dark brown
10790		0.81(20)			4(10)		w. yellow	

w. = whitish
d. = dull

62/119

BARRACOUTA - 1

KEROGEN TYPE



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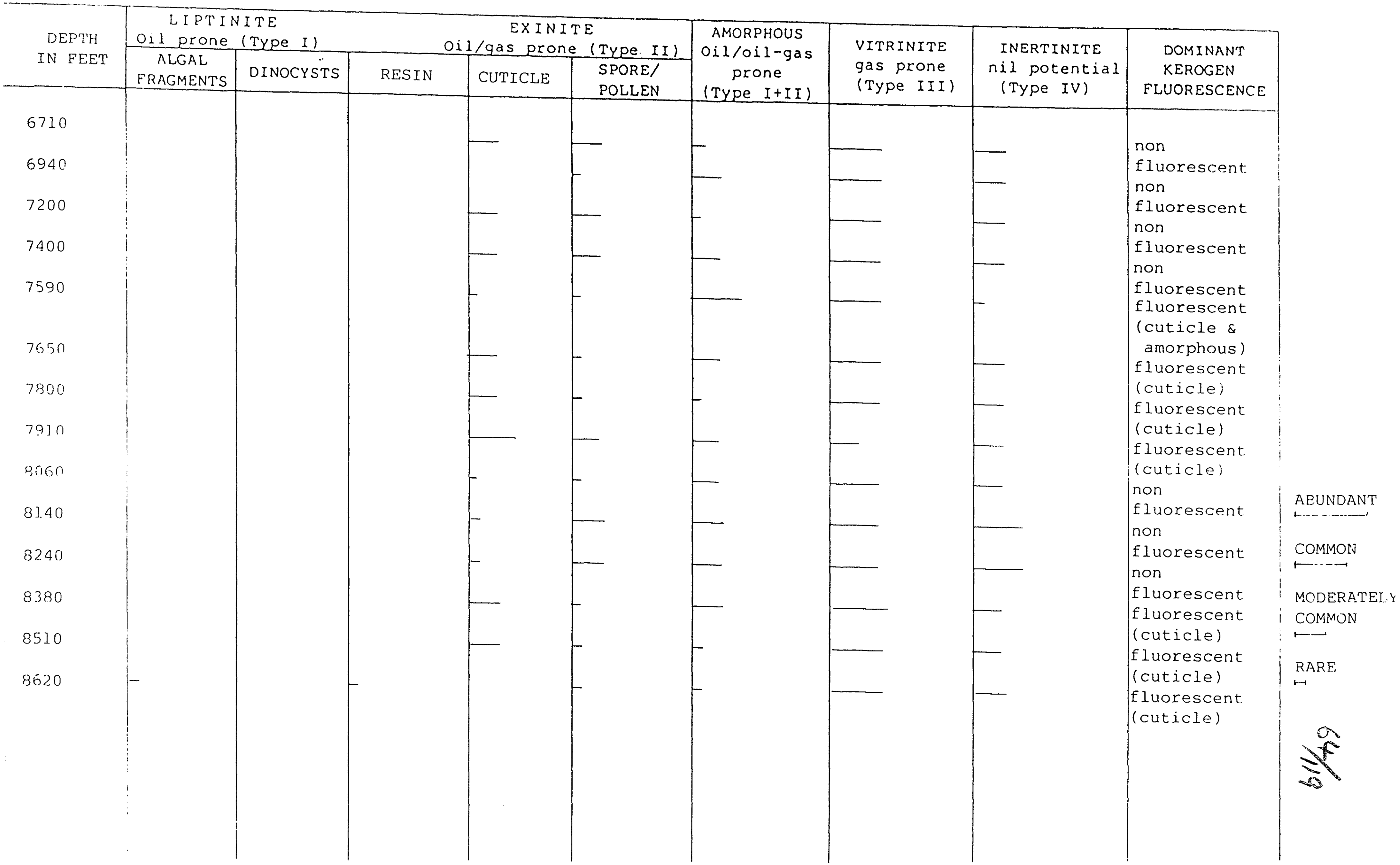
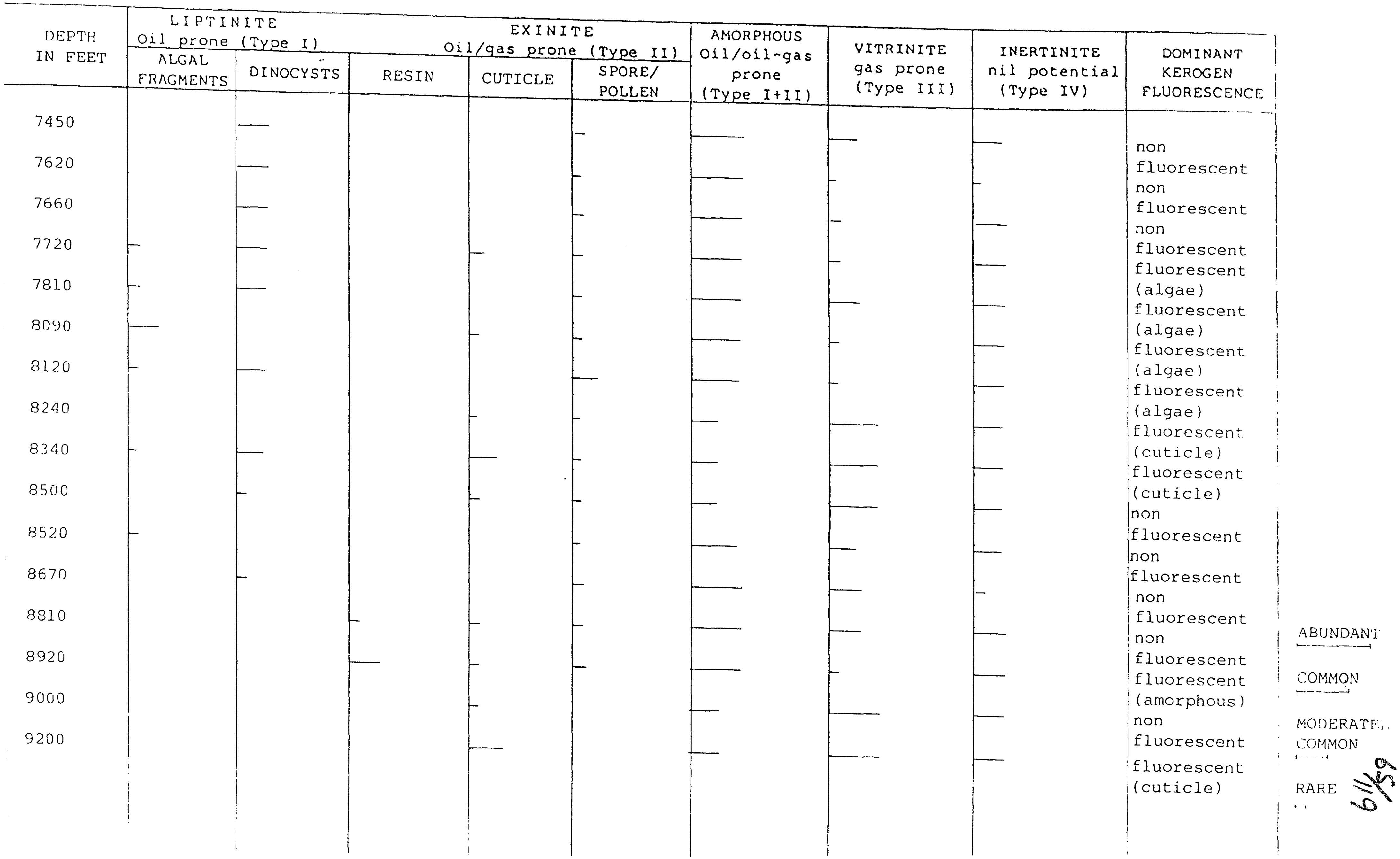
BARRACOUTA - 1

KEROGEN TYPE



HALIBUT - 1

KEROGEN TYPE



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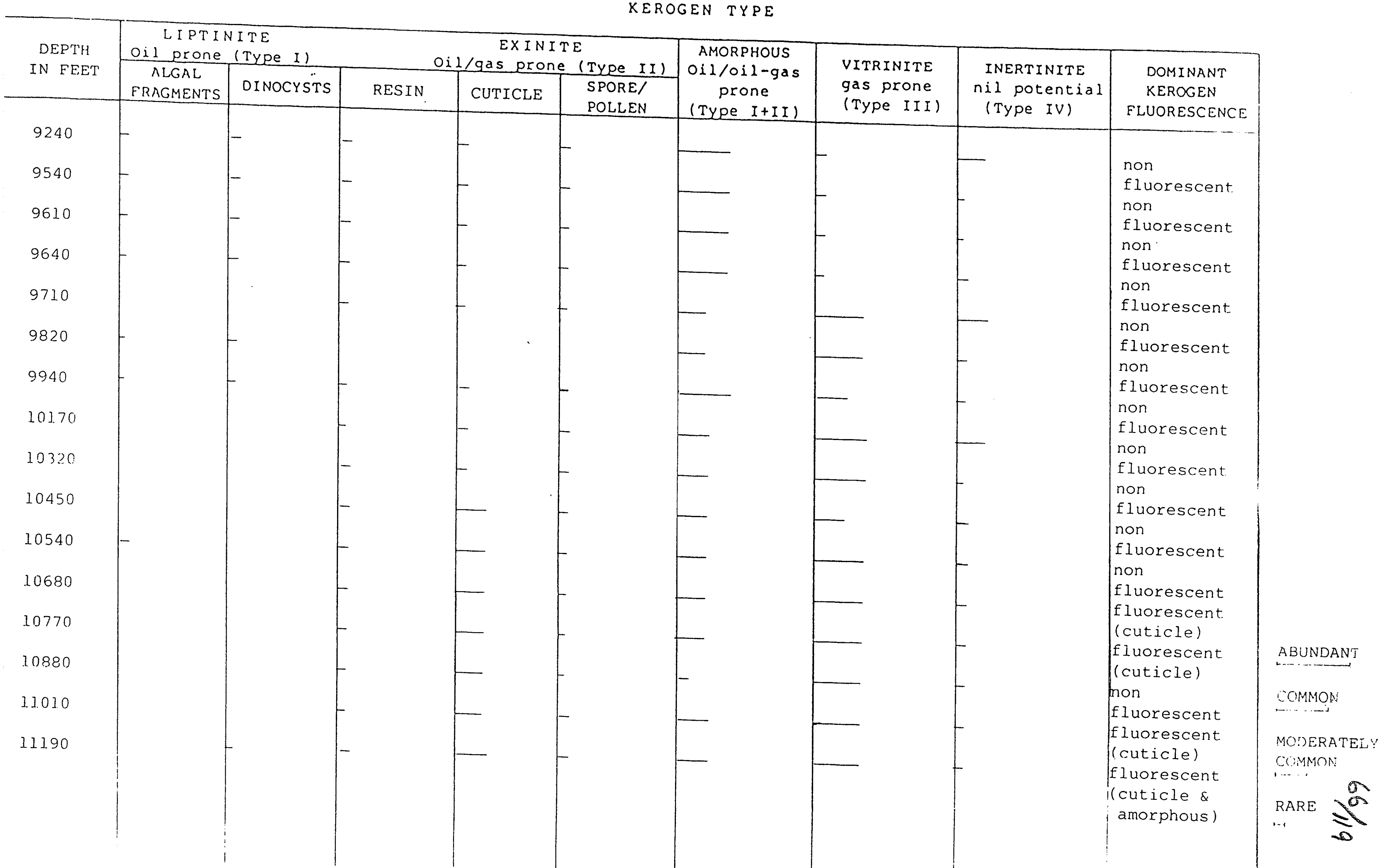
HAPUKU - 1

KEROGEN TYPE



DEPTH IN FEET	DOMINANT KEROGEN FLUORESCENCE
9240	non fluorescent
9540	non fluorescent
9610	non fluorescent
9640	non fluorescent
9710	non fluorescent
9820	non fluorescent
9940	non fluorescent
10170	non fluorescent
10320	non fluorescent
10450	non fluorescent
10540	non fluorescent
10680	fluorescent (cuticle)
10770	fluorescent (cuticle)
10880	non fluorescent
11010	fluorescent (cuticle)
11190	fluorescent (cuticle & amorphous)

66/119

HAPUKU - 1

KEROGEN TYPE

DEPTH IN FEET	LIPTINITE Oil prone (Type I)		EXINITE Oil/gas prone (Type II)			AMORPHOUS Oil/oil-gas prone (Type I+II)	VITRINITE gas prone (Type III)	INERTINITE nil potential (Type IV)	DOMINANT KEROGEN FLUORESCENCE
	ALGAL FRAGMENTS	DINOCYSTS	RESIN	CUTICLE	SPORE/ POLLEN				
11310			Rare	Moderately common	Rare	Rare	Common	Moderately common	fluorescent (cuticle)
11450			Rare	Moderately common	Rare	Rare	Common	Moderately common	fluorescent (cuticle)
11750		Rare	Rare	Rare	Rare	Moderately common	Common	Moderately common	non fluorescent

ABUNDANT

COMMON

MODERATELY COMMON

RARE

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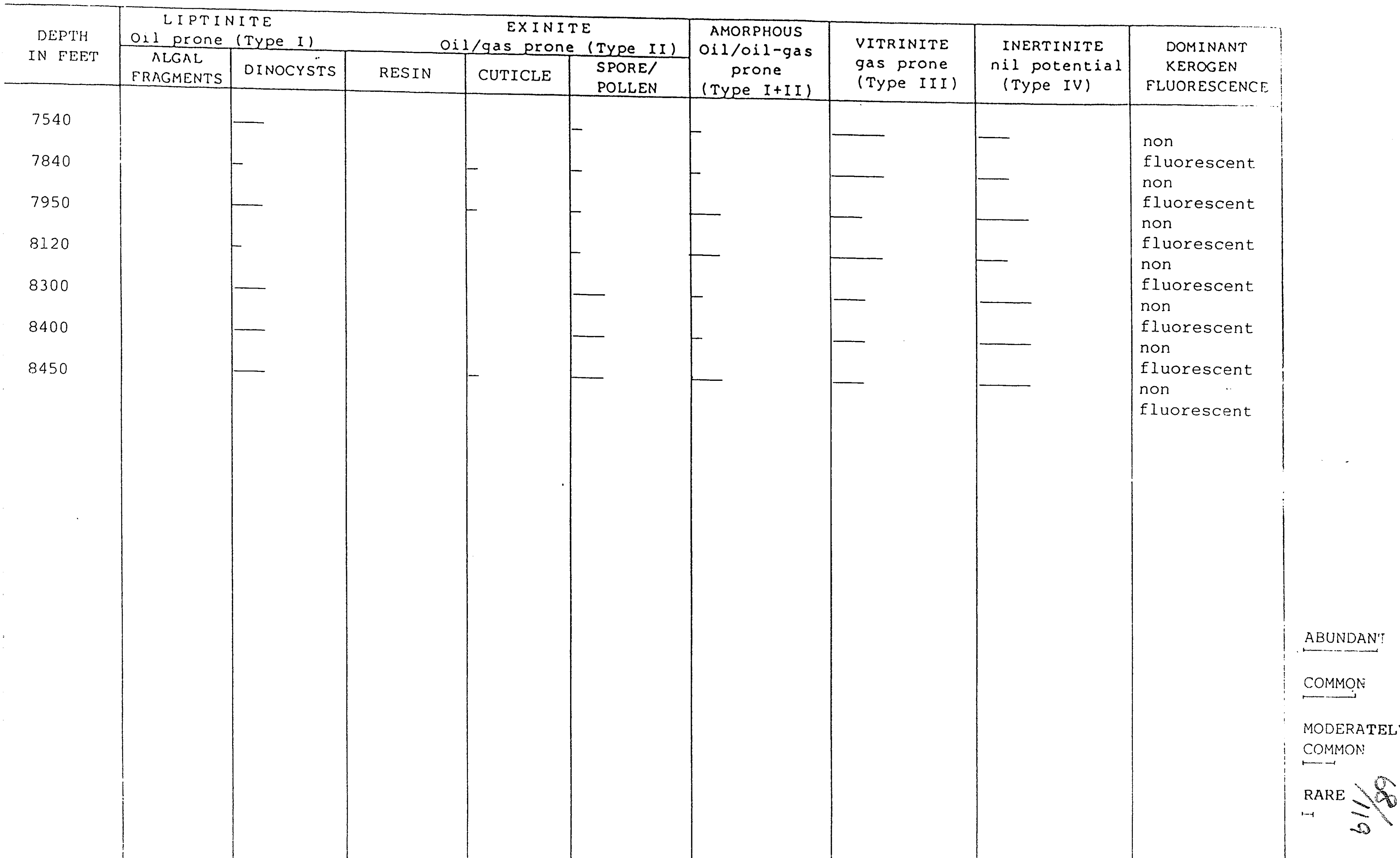
KINGFISH - 1

KEROGEN TYPE



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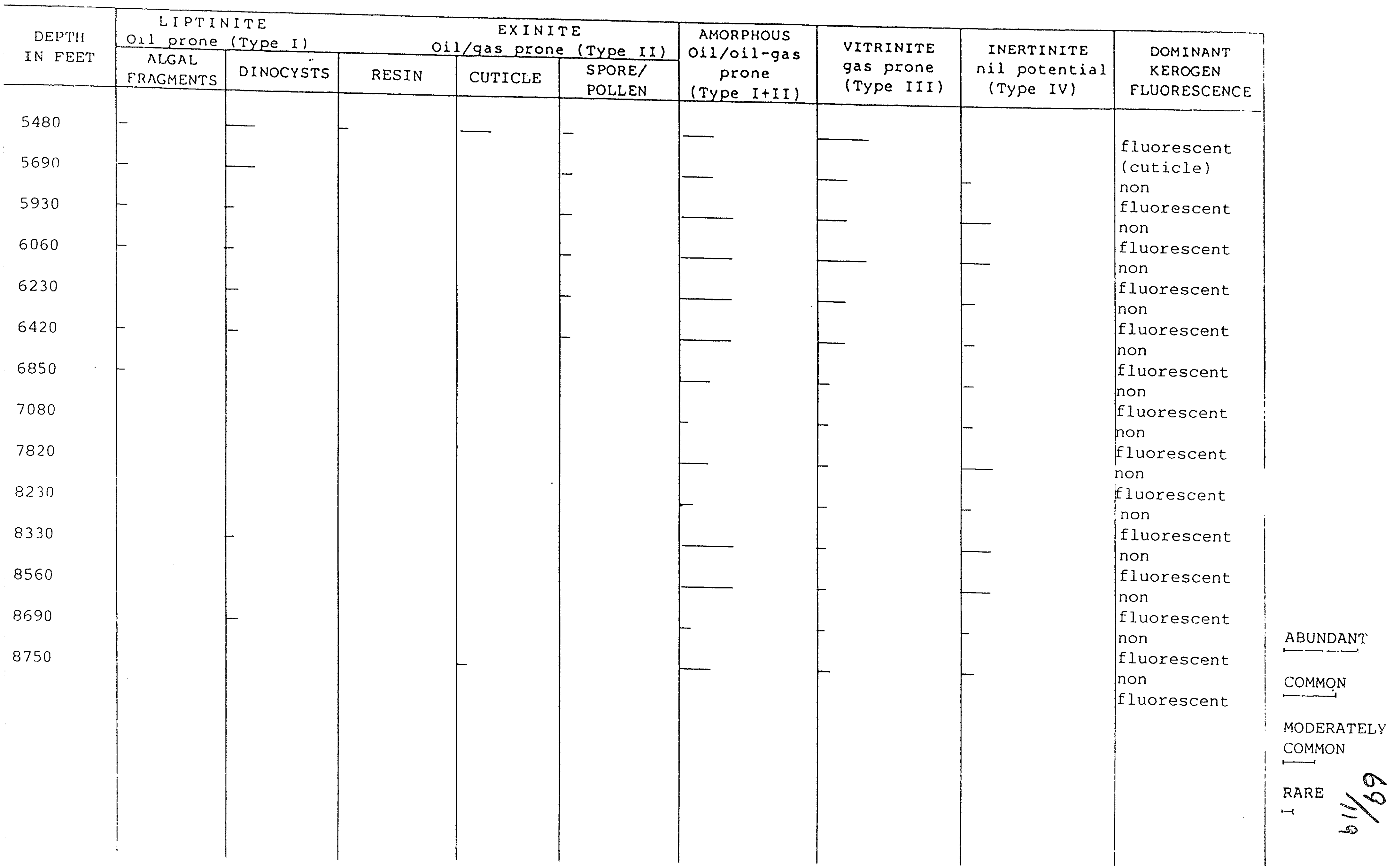
MORAY - 1

KEROGEN TYPE



…TE …e …II)	INERTINITE nil potential (Type IV)	DOMINANT KEROGEN FLUORESCENCE
		non fluorescent
		non fluorescent
		non fluorescent
		non fluorescent
		non fluorescent
		non fluorescent
		non fluorescent
		non fluorescent
		non fluorescent
		non fluorescent
		non fluorescent
		non fluorescent
		non fluorescent
		non fluorescent
		non fluorescent
		non fluorescent

ABUNDANT

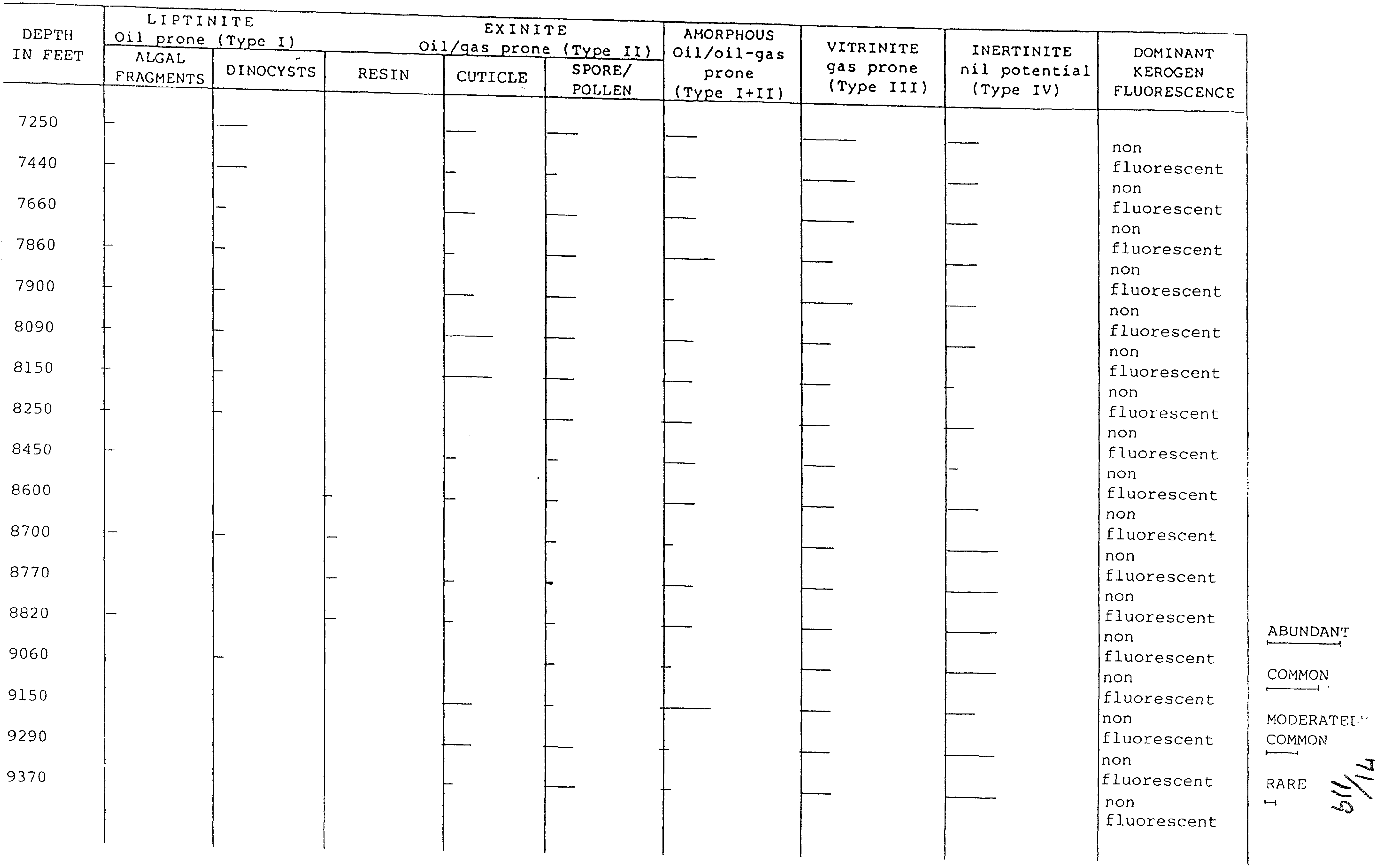
COMMON

MODERATELY COMMON

RARE

PERCH - A1

KEROGEN TYPE



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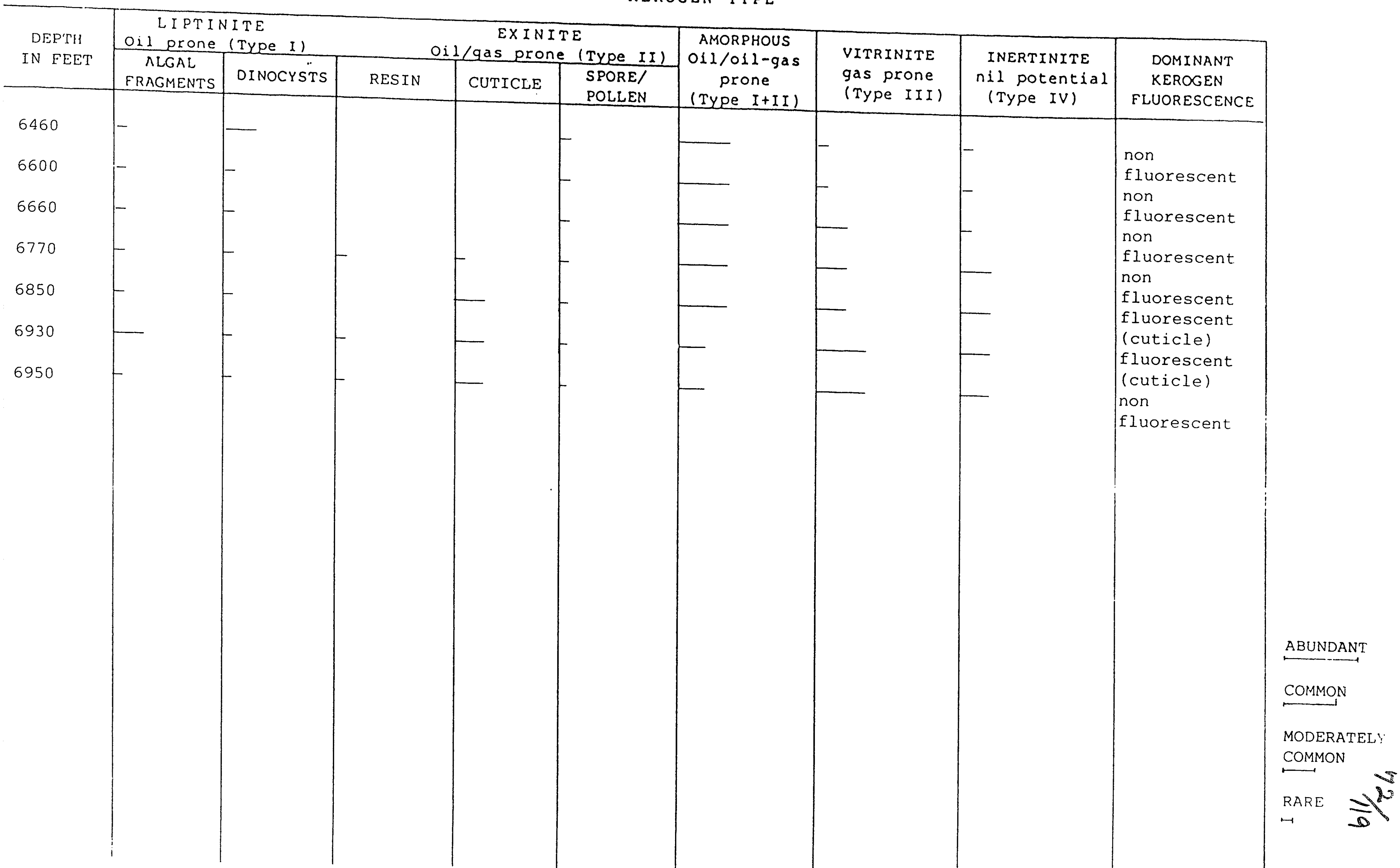
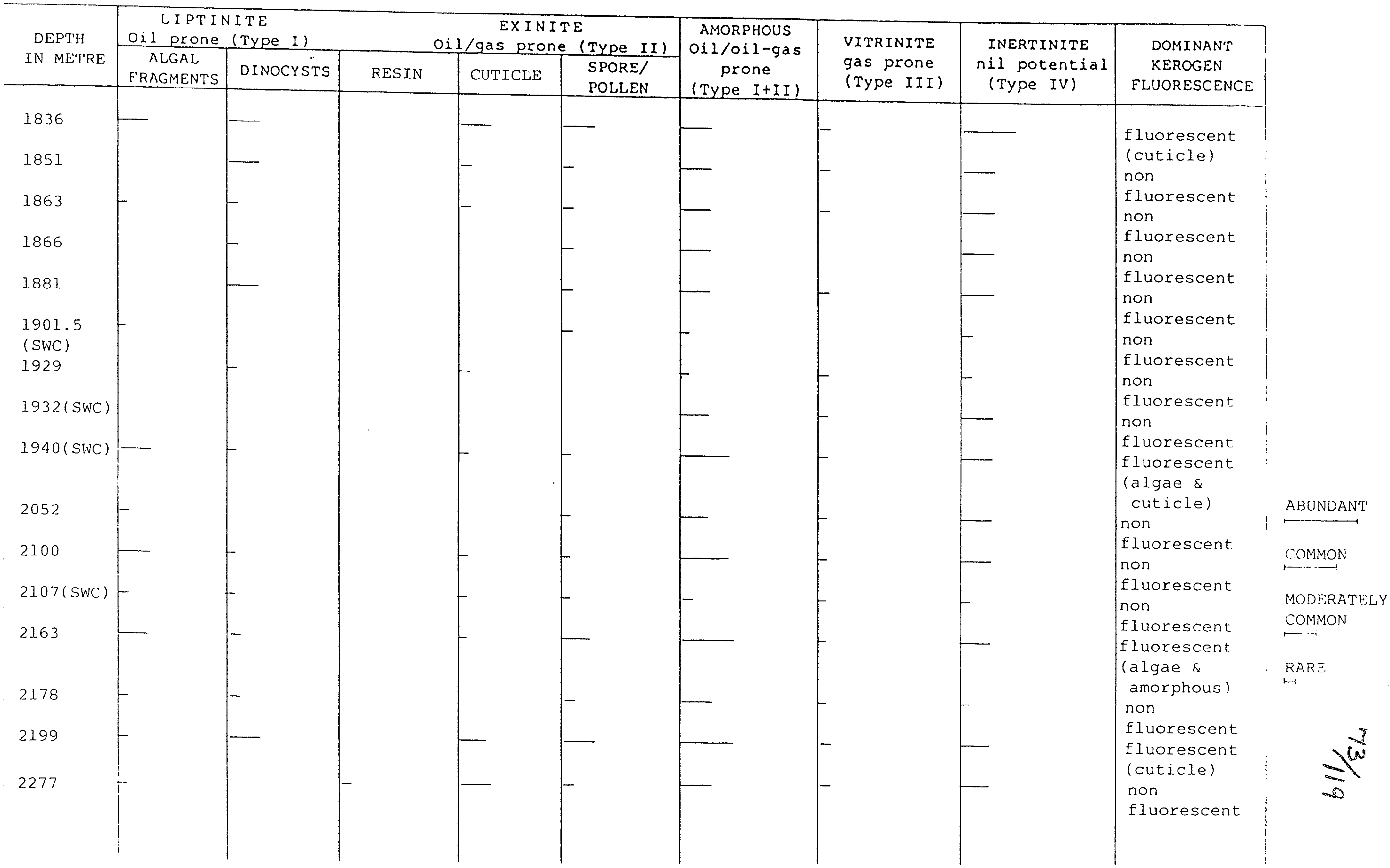
PIKE - 1

KEROGEN TYPE



PISCES - 1

KEROGEN TYPE



PISCES - 1

KEROGEN TYPE

DEPTH IN METRE	LIPTINITE Oil prone (Type I): ALGAL FRAGMENTS	LIPTINITE Oil prone (Type I): DINOCYSTS	EXINITE Oil/gas prone (Type II): RESIN	EXINITE Oil/gas prone (Type II): CUTICLE	EXINITE Oil/gas prone (Type II): SPORE/ POLLEN	AMORPHOUS Oil/oil-gas prone (Type I+II)	VITRINITE gas prone (Type III)	INERTINITE nil potential (Type IV)	DOMINANT KEROGEN FLUORESCENCE
2283	Rare	Rare		Rare	Rare	Common	Rare	Moderately common	non fluorescent
2304		Rare			Rare	Common	Rare	Moderately common	non fluorescent
2346	Rare				Moderately common	Common	Rare	Common	non fluorescent
2367	Moderately common	Rare		Rare	Rare	Common	Rare	Moderately common	non fluorescent
2391	Rare				Rare	Common	Moderately common	Rare	non fluorescent
2409	Rare	Rare			Rare	Common	Rare	Moderately common	non fluorescent
2421	Rare	Rare			Moderately common	Moderately common	Rare	Common	non fluorescent
2457	Rare	Rare			Rare	Moderately common	Rare	Common	non fluorescent
2466		Moderately common			Moderately common	Common	Rare	Moderately common	non fluorescent
2473(SWC)	Rare	Rare				Moderately common	Rare	Common	non fluorescent
2493	Rare	Rare		Moderately common	Rare	Moderately common	Rare	Common	non fluorescent
2502		Rare	Rare		Rare	Common	Rare	Moderately common	non fluorescent
2505(SWC)	Moderately common			Rare	Rare	Rare	Common	Moderately common	non fluorescent
2509(SWC)				Rare	Rare	Rare	Moderately common	Common	non fluorescent
2511	Rare	Rare	Rare		Rare	Common	Rare	Moderately common	non fluorescent
2512.5 (SWC)	Moderately common			Moderately common	Rare	Rare	Common	Moderately common	non fluorescent
2524.5 (SWC)	Moderately common			Moderately common	Rare		Common	Common	non fluorescent

ABUNDANT

COMMON

MODERATELY COMMON

RARE

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PISCES - 1

KEROGEN TYPE

DEPTH IN METRE	LIPTINITE Oil prone (Type I): ALGAL FRAGMENTS	LIPTINITE Oil prone (Type I): DINOCYSTS	EXINITE Oil/gas prone (Type II): RESIN	EXINITE Oil/gas prone (Type II): CUTICLE	EXINITE Oil/gas prone (Type II): SPORE/POLLEN	AMORPHOUS Oil/oil-gas prone (Type I+II)	VITRINITE gas prone (Type III)	INERTINITE nil potential (Type IV)	DOMINANT KEROGEN FLUORESCENCE
2535(SWC)			Rare	Rare	Rare	Common	Moderately common	Common	non fluorescent
2545.5 (SWC)				Moderately common	Rare	Rare	Common	Common	non fluorescent
2559.5 (SWC)				Rare	Rare	Rare	Moderately common	Moderately common	non fluorescent
2568	Rare	Rare			Rare	Common	Rare	Moderately common	non fluorescent
2571	Rare			Moderately common		Common	Rare	Common	non fluorescent
2580	Rare			Rare	Rare	Common	Rare	Moderately common	non fluorescent

ABUNDANT

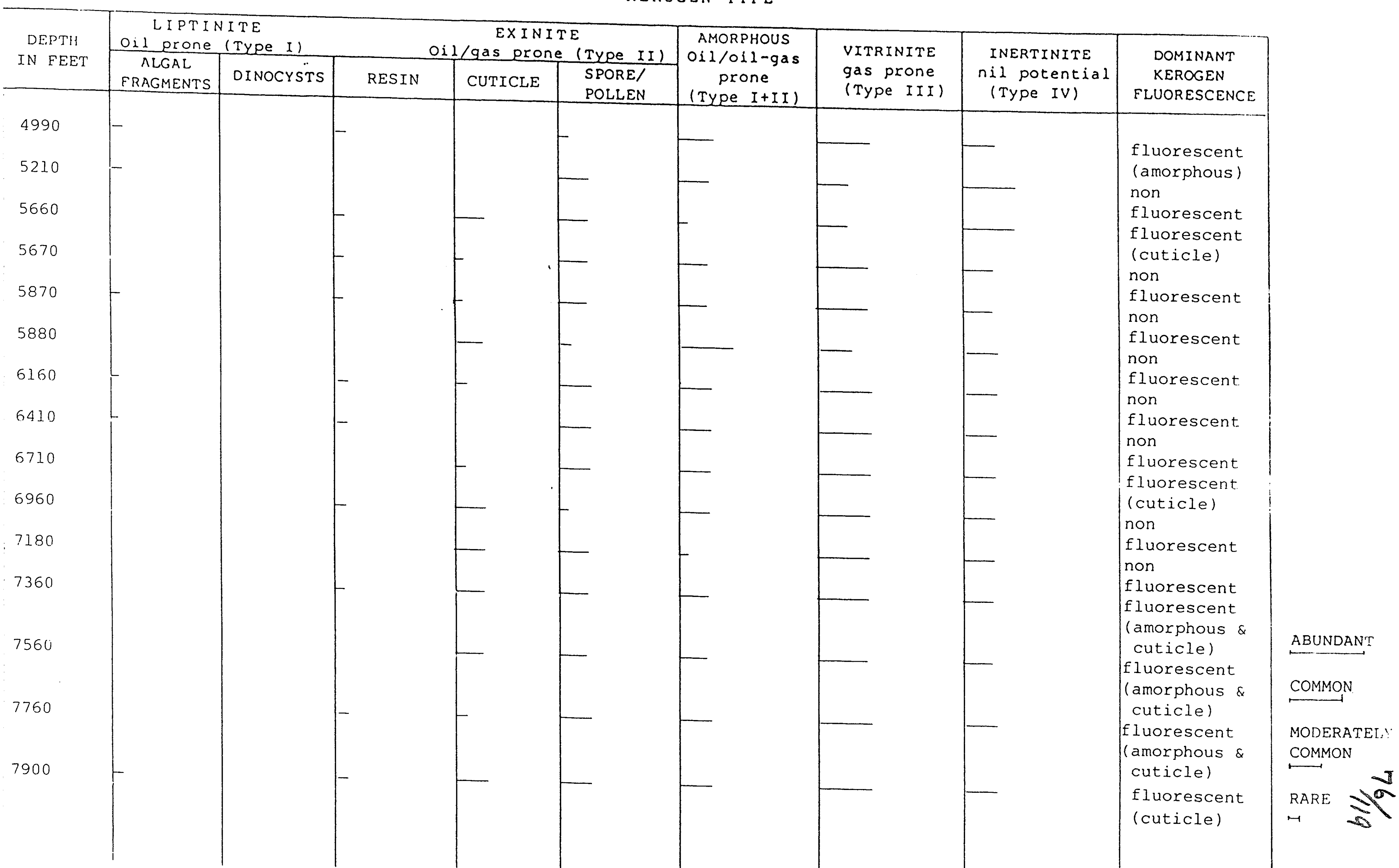
COMMON

MODERATELY COMMON

RARE

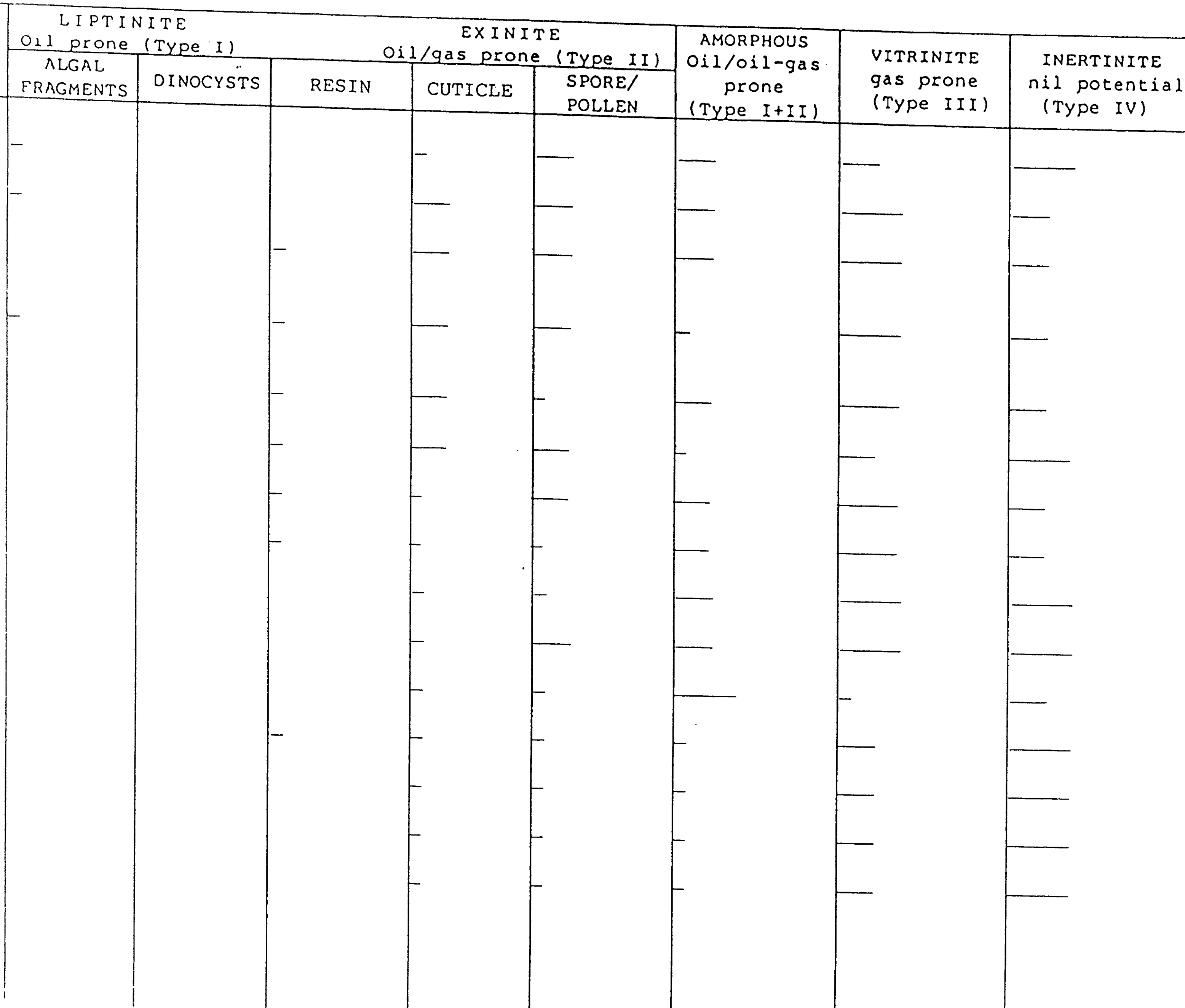
SNAPPER - 1

KEROGEN TYPE



SNAPPER - 1

KEROGEN TYPE



DEPTH IN FEET	DOMINANT KEROGEN FLUORESCENCE
8110	fluorescent (cuticle)
8310	fluorescent (cuticle)
8560	fluorescent (amorphous & cuticle)
8810	fluorescent (amorphous & cuticle)
9100	fluorescent (cuticle)
9550	non fluorescent
9900	non fluorescent
10200	non fluorescent
10330	non fluorescent
11133	non fluorescent
11350	non fluorescent
11360	non fluorescent
11630	non fluorescent
11640	non fluorescent
11750	non fluorescent

ABUNDANT

COMMON

MODERATELY COMMON

RARE

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SNAPPER - 1

KEROGEN TYPE

DEPTH IN FEET	LIPTINITE Oil prone (Type I): ALGAL FRAGMENTS	LIPTINITE Oil prone (Type I): DINOCYSTS	EXINITE Oil/gas prone (Type II): RESIN	EXINITE Oil/gas prone (Type II): CUTICLE	EXINITE Oil/gas prone (Type II): SPORE/POLLEN	AMORPHOUS Oil/oil-gas prone (Type I+II)	VITRINITE gas prone (Type III)	INERTINITE nil potential (Type IV)	DOMINANT KEROGEN FLUORESCENCE
11760				Rare	Rare	Moderately common	Moderately common	Common	non fluorescent
11890			Rare	Rare	Rare	Moderately common	Moderately common	Common	non fluorescent
11900	Rare				Rare	Rare	Moderately common	Common	non fluorescent
12070					Rare	Moderately common	Moderately common	Common	non fluorescent
12080				Rare	Rare	Moderately common	Moderately common	Common	non fluorescent
12290					Rare	Rare	Moderately common	Common	non fluorescent
12300			Rare	Rare	Rare	Rare	Moderately common	Common	non fluorescent

ABUNDANT
COMMON
MODERATELY COMMON
RARE

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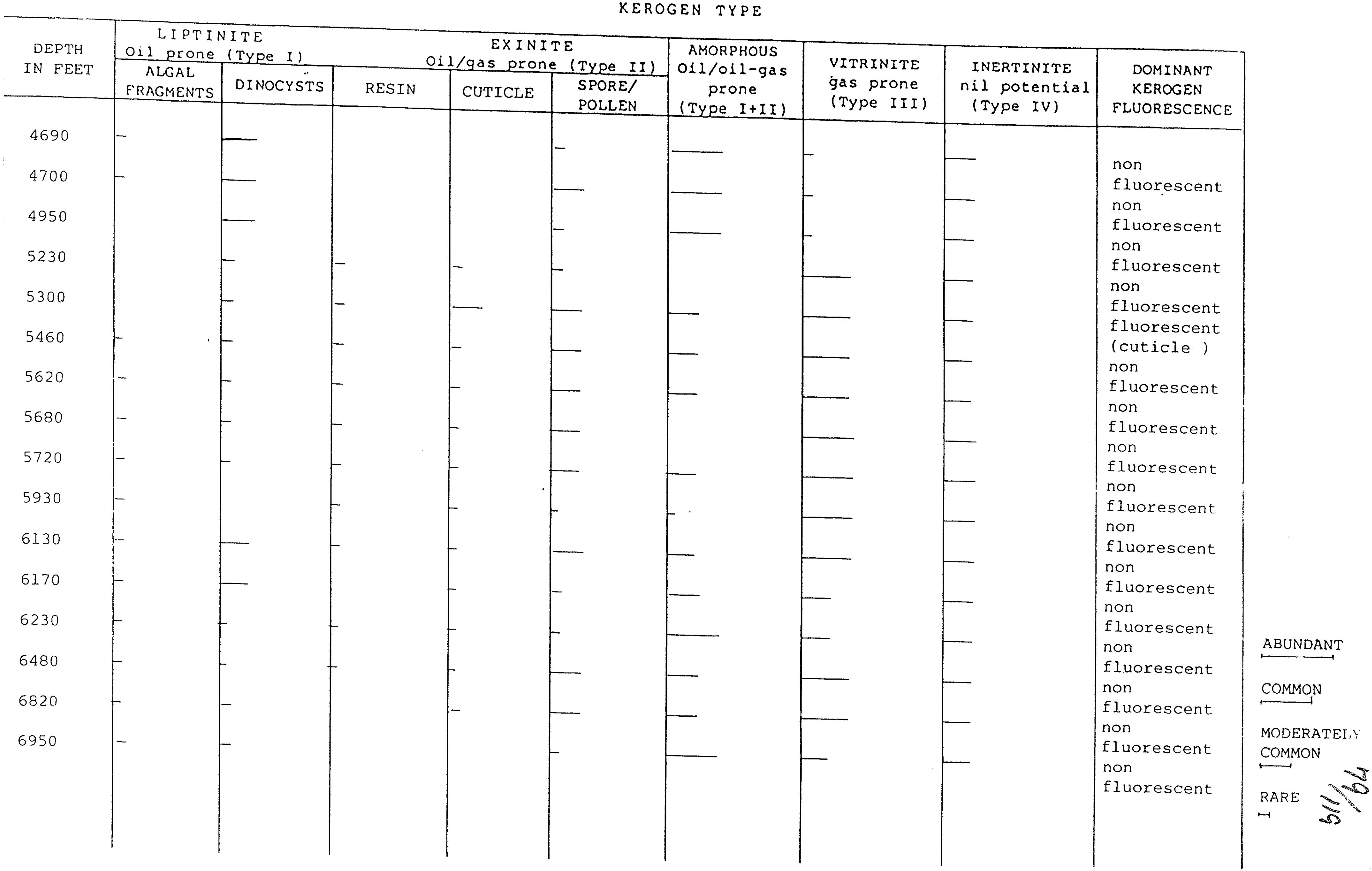
TUNA - 1

KEROGEN TYPE



TUNA - 1

KEROGEN TYPE

DEPTH IN FEET	LIPTINITE Oil prone (Type I): ALGAL FRAGMENTS	LIPTINITE Oil prone (Type I): DINOCYSTS	EXINITE Oil/gas prone (Type II): RESIN	EXINITE Oil/gas prone (Type II): CUTICLE	EXINITE Oil/gas prone (Type II): SPORE/POLLEN	AMORPHOUS Oil/oil-gas prone (Type I+II)	VITRINITE gas prone (Type III)	INERTINITE nil potential (Type IV)	DOMINANT KEROGEN FLUORESCENCE
7350	Rare				Rare	Moderately common	Rare	Rare	non fluorescent
7840	Rare		Rare	Rare	Moderately common	Moderately common	Common	Moderately common	non fluorescent
7960	Rare		Rare	Rare	Moderately common	Rare	Common	Moderately common	non fluorescent
8170				Moderately common	Rare	Rare	Common	Moderately common	fluorescent (cuticle)
8320	Rare		Rare	Moderately common	Moderately common	Rare	Common	Moderately common	fluorescent (algae & cuticle)
8500			Rare	Moderately common	Moderately common	Rare	Common	Common	fluorescent (cuticle)
8600	Rare		Rare	Moderately common	Rare	Rare	Common	Rare	fluorescent (cuticle)
8760	Rare		Rare	Moderately common	Moderately common	Rare	Common	Moderately common	non fluorescent
9020			Moderately common	Common	Moderately common	Rare	Common	Moderately common	fluorescent (cuticle)
9270	Rare			Rare	Moderately common	Rare	Common	Moderately common	non fluorescent
9540				Rare	Moderately common	Rare	Common	Common	non fluorescent
10000	Rare			Moderately common	Moderately common	Rare	Moderately common	Moderately common	non fluorescent
10320			Rare	Rare	Moderately common	Rare	Moderately common	Common	non fluorescent
10790			Rare	Rare	Moderately common	Rare	Common	Common	non fluorescent

ABUNDANT

COMMON

MODERATELY COMMON

RARE

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RESIDUAL ORGANIC CARBON DETERMINATIONS

Residual Organic Carbon (ROC) has been back calculated for each sample according to the following formulae:

$$ROC\,\% = TOC\,\% - \%\text{ carbon contained in } (S_0 + S_1' + S_2)$$

$$= TOC\,\% - 1/10 \times .83\,(S_0 + S_1' + S_2)$$

The results together with the ratio ROC : TOC for each well are appended in the following tables.

BARRACOUTA-1

Depth in feet	TOC %	ROC %	ROC : TOC
3580	.43	.36	.84
3870	14.24	10.47	.74
4220	24.96	18.61	.75
4520	7.02	6.02	.86
4670	35.9	24.2	.67
4960	11.49	10.62	.92
5240	11.94	9.44	.79
5400	8.23	6.61	.8
5530	8.35	6.26	.75
5700	7.55	6.59	.87
5870	32.99	23.91	.73
5960	10.31	7.96	.77
6060	12.99	11.05	.85
6250	11.39	8.66	.76
6420	1.24	1.13	.91
6610	2.12	1.78	.84
6710	2.65	2.22	.84
6940	.65	.58	.89
7200	1.13	.91	.81
7400	3.97	3.56	.9
7590	8.66	6.46	.75
7650	23.74	18.07	.76

Depth in feet	TOC %	ROC %	ROC : TOC
7800	3.47	2.6	.75
7910	1.52	1.26	.83
8060	.75	.61	.81
8140	9.24	8.41	.91
8240	2.07	1.87	.9
8380	1.92	1.45	.76
8510	22.27	17.07	.77
8620	2.59	2.34	.9

HALIBUT-1

Depth in feet	TOC %	ROC %	ROC : TOC
7450	.35	.33	.94
7620	.35	.32	.91
7660	.85	.71	.84
7720	8.05	6.03	.75
7810	2.89	2.42	.84
8090	.59	.53	.9
8120	.53	.5	.94
8240	10.76	8.09	.75
8340	20.94	16.21	.77
8500	1.52	1.18	.78
8520	15.31	12.22	.8
8670	1.61	1.4	.87
8810	2.93	2.13	.73
8920	3.41	2.	.59
9000	5.85	4.69	.8
9200	10.92	8.52	.78
9230	2.02	1.53	.76
9380	8.83	6.24	.71
9500	7.45	6.04	.81
9560	6.13	5.6	.91
9630	2.34	2.07	.89
9720	22.14	18.39	.83
9900	12.35	10.49	.85
9990	5.24	4.52	.86

HAPUKU-1

Depth in feet	TOC %	ROC %	ROC : TOC
9240	.12	.07	.58
9540	.03	.01	.33
9610	.07	.04	.57
9640	.2	.14	.7
9710	.09	.06	.67
9820	.11	.07	.64
9940	.18	.15	.83
10170	1.	.88	.88
10320	.83	.71	.86
10450	.13	.06	.46
10540	16.22	12.71	.78
10680	1.57	1.2	.76
10770	3.29	2.33	.71
10880	3.1	2.37	.77
11010	6.8	5.22	.77
11190	5.85	4.35	.74
11310	9.34	7.3	.78
11450	6.77	4.95	.73
11750	.35	.29	.83

KINGFISH-1

Depth in feet	TOC %	ROC %	ROC : TOC
7540	.25	.22	.88
7840	.37	.3	.81
7950	.57	.47	.83
8120	13.46	11.82	.88
8300	1.66	1.47	.86
8400	.43	.37	.86
8450	.6	.5	.83

PERCH-A1

Depth in feet	TOC %	ROC %	ROC : TOC
3790	3.91	3.47	.89
3940	38.3	30.22	.79
4230	4.08	3.48	.85
4330	7.85	6.42	.82
4820	18.85	17.29	.92
4960	20.59	18.42	.9
5060	4.54	4.27	.94
5510	4.34	3.37	.78
5720	3.64	3.43	.94
5940	9.7	8.23	.85
6050	12.23	11.35	.93
6330	9.43	8.78	.93
6550	8.59	7.56	.88
6860	3.8	3.53	.93
7040	8.67	7.54	.87
7160	2.43	2.23	.92
7250	18.22	14.69	.81
7440	9.36	7.95	.85
7660	3.48	3.08	.89
7860	34.99	31.43	.9
7900	13.83	12.37	.89
8090	.24	.1	.42
8150	2.31	1.45	.63
8250	2.4	2.22	.93
8450	1.9	1.6	.84
8600	.63	.6	.95
8700	1.76	1.52	.86
8770	2.04	1.93	.95
8820	.31	.28	.9
9060	2.94	2.6	.88
9150	.1	.01	.1
9290	1.54	1.26	.82
9370	.17	.16	.94

PIKE-1

PISCES-1

Depth in metres	TOC %	ROC %	ROC : TOC
1836	.49	.31	.64
1851	.19	.05	.28
1863	.51	.4	.78
1866	.08	.0	.0
1881	.17	.0	.0
1902	.42	.27	.64
1929	.1	.0	.0
1932	.71	.12	.17
1940	.99	.56	.57
2052	.29	.04	.14
2100	.84	.48	.57
2107	.9	.52	.58
2163	.7	.19	.27
2178	.23	.0	.0
2199	.28	.06	.21
2277	.55	.13	.24
2283	.89	.28	.32
2304	1.18	.27	.23
2346	.4	.05	.13
2367	1.99	1.27	.64
2391	.47	.22	.47
2409	1.32	.36	.27
2421	1.87	.6	.32
2457	.44	.03	.07
2466	.44	.27	.61
2473	.59	.29	.49
2493	.27	.09	.33
2502	.57	.26	.46
2505	2.85	2.49	.87
2509	2.18	1.82	.83
2511	.44	.14	.32

Depth in metres	TOC %	ROC %	ROC : TOC
2525	1.4	.96	.69
2535	4.37	3.42	.78
2546	2.22	1.61	.73
2560	1.93	1.55	.8
2568	.46	.07	.15
2571	.13	.0	.0
2580	.39	.08	.21

SNAPPER-1

Depth in feet	TOC %	ROC %	ROC : TOC
4990	16.84	14.87	.88
5210	28.91	23.19	.8
5660	7.83	7.24	.93
5670	4.06	3.71	.91
5870	20.73	17.11	.83
5880	18.74	11.81	.63
6160	14.49	11.45	.79
6410	4.91	4.03	.82
6710	4.17	3.67	.88
6960	3.2	2.98	.93
7180	1.58	1.33	.84
7360	9.17	6.83	.75
7560	1.82	.77	.42
7760	5.14	4.08	.79
7900	4.45	4.	.9
8110	3.39	3.17	.94
8310	5.02	2.99	.6
8560	3.06	2.51	.82
8810	3.97	2.85	.72
9100	7.31	6.26	.86
9550	4.18	3.95	.95
9900	1.86	1.53	.82
10200	3.63	2.82	.78
10330	5.27	4.83	.92
11133	1.97	1.78	.9
11350	.17	.11	.65
11360	.67	.58	.87
11630	1.55	1.42	.92
11640	3.	2.77	.92
11750	4.6	4.	.87
11760	7.24	6.36	.88

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Depth in feet	TOC %	ROC %	ROC : TOC
11890	3.76	3.29	.86
11900	11.62	11.18	.96
12070	3.66	3.55	.97
12080	1.78	1.6	.9
12290	1.91	1.75	.92
12300	5.27	4.76	.9

TUNA-1

Depth in feet	TOC %	ROC %	ROC : TOC
4690	.32	.29	.91
4700	.25	.22	.88
4950	.13	.1	.77
5230	35.64	32.56	.91
5300	8.49	6.5	.77
5460	6.57	6.11	.93
5620	9.1	8.65	.95
5680	20.42	19.14	.94
5720	8.74	7.68	.88
5930	8.98	8.66	.96
6130	3.86	3.31	.86
6170	5.84	4.77	.82
6230	33.8	28.83	.85
6480	4.14	3.63	.88
6820	10.77	9.45	.88
6950	2.05	1.74	.85
7350	.06	.04	.67
7840	1.18	1.	.85
7960	3.28	2.99	.91
8170	19.98	18.37	.92
8320	2.12	1.81	.85
8500	1.15	1.03	.9
8600	5.61	4.65	.83
8760	5.04	4.55	.9
9020	3.	1.91	.64
9270	3.55	3.26	.92
9540	1.81	1.68	.93
10000	2.19	2.05	.94
10320	.97	.88	.9
10790	3.	2.72	.91

92/119

GEARHART GEODATA SERVICES

GEOCHEMICAL DATA LOG

Date:- 28 OCT 1983 Unit number:- 2

Company:- UNION TEXAS Well number:- BARRACOUTA 1 Sheet No. 1

IV.	DEPTH	WEIGHT	GAS	OIL	S2	Tmax	GPI	OPI	TPI	TOC	HI
1	3580	106.50	0.00	0.25	0.60	424.00	0.00	0.30	0.30	0.43	139.00
2	3870	107.40	0.11	5.94	39.40	411.00	0.00	0.13	0.13	14.24	276.00
3	4220	96.20	0.10	5.51	70.89	418.00	0.00	0.07	0.07	24.96	284.00
4	4520	102.40	0.15	1.23	10.64	421.00	0.01	0.10	0.11	7.02	151.00
5	4670	92.70	0.16	15.07	125.65	419.00	0.00	0.11	0.11	35.90	350.00
6	4960	101.80	0.13	0.60	9.73	421.00	0.01	0.06	0.07	11.49	84.00
7	5240	90.10	0.12	1.64	28.41	420.00	0.00	0.05	0.05	11.94	237.00
8	5400	93.70	0.11	1.62	17.73	418.00	0.01	0.08	0.09	8.23	215.00
9	5530	97.30	0.09	0.95	24.15	419.00	0.00	0.04	0.04	8.35	289.00
10	5700	103.90	0.10	0.86	10.60	423.00	0.01	0.07	0.08	7.55	140.00
11	5870	94.70	0.08	4.86	104.49	420.00	0.00	0.04	0.04	32.99	316.00
12	5960	97.60	0.08	1.57	26.70	419.00	0.00	0.06	0.06	10.31	258.00
13	6060	96.60	0.08	0.67	22.56	423.00	0.00	0.03	0.03	12.99	173.00
14	6250	104.30	0.09	8.50	24.27	413.00	0.00	0.26	0.26	11.39	213.00
15	6420	95.90	0.09	0.19	1.04	415.00	0.07	0.14	0.21	1.24	83.00
16	6610	93.00	0.10	0.77	3.31	428.00	0.02	0.18	0.20	2.12	156.00
17	6710	90.30	0.07	0.39	4.76	430.00	0.01	0.07	0.08	2.65	179.00
18	6940	103.60	0.00	0.31	0.58	577.00	0.00	0.35	0.35	0.65	89.00
19	7200	102.10	0.03	0.40	2.17	431.00	0.01	0.15	0.16	1.13	192.00
20	7400	103.80	0.03	0.26	4.64	431.00	0.01	0.05	0.06	3.97	116.00
21	7590	99.80	0.03	5.94	20.52	431.00	0.00	0.22	0.22	8.66	236.00
22	7650	109.00	0.02	35.48	32.80	393.00	0.00	0.52	0.53	23.74	138.00
23	7800	102.70	0.01	1.04	9.41	426.00	0.00	0.10	0.10	3.47	271.00
24	7910	103.40	0.02	0.18	2.91	435.00	0.01	0.06	0.07	1.52	191.00
25	8060	104.50	0.01	0.14	1.48	443.00	0.01	0.09	0.10	0.75	197.00
26	8140	96.00	0.01	0.15	9.85	428.00	0.00	0.01	0.01	9.24	106.00
27	8240	103.30	0.01	0.18	2.21	440.00	0.00	0.07	0.07	2.07	106.00
28	8380	93.60	0.04	0.34	5.29	434.00	0.01	0.06	0.07	1.92	275.00
29	8510	93.70	0.04	31.73	30.92	383.00	0.00	0.51	0.51	22.27	138.00
30	8620	97.60	0.01	0.17	2.82	434.00	0.00	0.06	0.06	2.59	108.00

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GEARHART GEODATA SERVICES — GEOCHEMICAL DATA LOG

Date:- 7 OCT 1983 Unit number:- 2

Company:- UNION TEXAS Well number:- HALIBUT 1 Sheet No. 1

EV.	DEPTH	WEIGHT	GAS	OIL	S2	Tmax	GPI	OPI	TPI	TOC	HI
1	7450	109.10	0.00	0.04	0.20	506.00	0.00	0.17	0.17	0.35	57.00
2	7620	95.30	0.01	0.08	0.28	452.00	0.03	0.22	0.25	0.35	80.00
3	7660	104.00	0.00	0.22	1.42	427.00	0.00	0.13	0.13	0.85	167.00
4	7720	99.10	0.02	2.66	21.65	416.00	0.00	0.11	0.11	8.05	268.00
5	7810	108.90	0.00	0.44	5.24	422.00	0.00	0.08	0.08	2.89	181.00
6	8090	101.70	0.00	0.09	0.65	434.00	0.00	0.12	0.12	0.59	110.00
7	8120	100.70	0.00	0.06	0.35	433.00	0.00	0.15	0.15	0.53	66.00
8	8240	99.60	0.01	1.49	30.72	417.00	0.00	0.05	0.05	10.76	285.00
9	8340	104.10	0.00	4.07	52.94	420.00	0.00	0.07	0.07	20.94	252.00
10	8500	96.40	0.00	1.45	2.64	426.00	0.00	0.36	0.36	1.52	173.00
11	8520	96.40	0.00	2.72	34.48	415.00	0.00	0.07	0.07	15.31	225.00
12	8670	92.50	0.01	0.43	2.08	426.00	0.00	0.17	0.17	1.61	129.00
13	8810	95.10	0.02	3.89	5.68	420.00	0.00	0.41	0.41	2.93	193.00
14	8920	98.10	0.11	10.69	6.13	422.00	0.01	0.63	0.64	3.41	179.00
15	9000	90.30	0.15	1.77	12.03	419.00	0.01	0.13	0.14	5.85	205.00
16	9200	90.60	0.04	2.49	26.40	416.00	0.00	0.09	0.09	10.92	241.00
17	9230	98.70	0.03	0.34	5.56	418.00	0.01	0.06	0.07	2.02	275.00
18	9380	96.40	0.01	1.82	29.37	425.00	0.00	0.06	0.06	8.83	332.00
19	9500	107.50	0.01	3.75	13.24	418.00	0.00	0.22	0.22	7.45	177.00
20	9560	93.70	0.00	0.44	5.99	423.00	0.00	0.07	0.07	6.13	97.00
21	9630	94.30	0.01	0.29	2.91	428.00	0.00	0.09	0.09	2.34	124.00
22	9720	95.40	0.03	3.06	42.09	423.00	0.00	0.07	0.07	22.14	190.00
23	9900	90.30	0.01	1.70	20.64	429.00	0.00	0.08	0.08	12.35	167.00
24	9990	92.50	0.02	0.56	8.07	421.00	0.00	0.06	0.06	5.24	154.00

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GEARHART GEODATA SERVICES

GEOCHEMICAL DATA LOG

Date:- 7 OCT 1983

Unit number:- 2

Company:- UNION TEXAS Well number:- HAPUKU 1 Sheet No. 1

N.	DEPTH	WEIGHT	GAS	OIL	S2	Tmax	GPI	OPI	TPI	TOC	HI
1	9240	101.10	0.09	0.12	0.36	572.00	0.16	0.21	0.37	0.12	300.00
2	9540	98.70	0.04	0.07	0.12	461.00	0.18	0.32	0.50	0.03	400.00
3	9610	107.00	0.01	0.04	0.28	567.00	0.03	0.12	0.15	0.07	400.00
4	9640	97.20	0.00	0.10	0.65	526.00	0.00	0.14	0.14	0.20	325.00
5	9710	92.20	0.02	0.08	0.20	435.00	0.07	0.27	0.34	0.09	222.00
6	9820	103.00	0.00	0.02	0.41	560.00	0.00	0.05	0.05	0.11	372.00
7	9940	90.10	0.00	0.05	0.36	504.00	0.00	0.12	0.12	0.18	200.00
8	10170	109.10	0.03	0.16	1.27	425.00	0.02	0.11	0.13	1.00	127.00
9	10320	109.60	0.02	0.11	1.36	430.00	0.01	0.07	0.08	0.83	163.00
10	10450	105.30	0.04	0.19	0.65	420.00	0.05	0.22	0.27	0.13	500.00
11	10540	108.80	0.07	2.26	39.92	408.00	0.00	0.05	0.05	16.22	246.00
12	10680	100.90	0.04	0.18	4.23	419.00	0.01	0.04	0.05	1.57	269.00
13	10770	109.70	0.09	0.46	11.00	412.00	0.01	0.04	0.05	3.29	334.00
14	10880	95.30	0.04	0.38	8.33	417.00	0.00	0.04	0.04	3.10	268.00
15	11010	104.60	0.03	0.74	18.26	418.00	0.00	0.04	0.04	6.80	268.00
16	11190	92.90	0.06	1.00	17.05	413.00	0.00	0.06	0.06	5.85	291.00
17	11310	105.10	0.08	0.78	23.67	414.00	0.00	0.03	0.03	9.34	253.00
18	11450	106.60	0.04	1.11	20.80	416.00	0.00	0.05	0.05	6.77	307.00
19	11750	109.10	0.04	0.07	0.59	487.00	0.06	0.10	0.16	0.35	168.00

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GEARHART GEODATA SERVICES

GEOCHEMICAL DATA LOG

Date:- 28 OCT 1983 Unit number:- 2

Company:- UNION TEXAS Well number:- KINGFISH 1 Sheet No. 1

V.	DEPTH	WEIGHT	GAS	OIL	S2	Tmax	GPI	OPI	TPI	TOC	HI
1	7540	105.80	0.02	0.05	0.29	434.00	0.06	0.14	0.20	0.25	116.00
2	7840	91.10	0.04	0.09	0.69	502.00	0.05	0.11	0.16	0.37	186.00
3	7950	93.60	0.05	0.13	0.96	494.00	0.04	0.11	0.15	0.57	168.00
4	8120	101.10	0.07	0.84	18.87	421.00	0.00	0.04	0.04	13.46	140.00
5	8300	91.60	0.09	0.22	1.99	422.00	0.04	0.10	0.14	1.66	119.00
6	8400	109.60	0.07	0.13	0.49	476.00	0.10	0.19	0.29	0.43	113.00
7	8450	90.50	0.07	0.22	0.95	431.00	0.06	0.18	0.24	0.60	158.00

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GEARHART GEODATA SERVICES

GEOCHEMICAL DATA LOG

Date:- 7 OCT 1983 Unit number:- 2

Company:- UNION TEXAS Well number:- MORAY 1 Sheet No. 1

V.	DEPTH	WEIGHT	GAS	OIL	S2	Tmax	GPI	OPI	TPI	TOC	HI
1	5480	100.50	0.07	0.21	0.29	505.00	0.12	0.37	0.49	0.24	120.00
2	5690	104.90	0.05	0.32	0.12	375.00	0.10	0.67	0.77	0.08	150.00
3	5930	108.90	0.00	0.08	0.06	301.00	0.00	0.57	0.57	0.07	85.00
4	6060	109.90	0.00	0.08	0.06	351.00	0.00	0.57	0.57	0.04	150.00
5	6230	100.60	0.00	0.09	0.08	414.00	0.00	0.56	0.56	0.07	114.00
6	6420	97.10	0.01	0.08	0.05	368.00	0.07	0.57	0.64	0.02	250.00
7	6850	103.40	0.00	0.03	0.04	467.00	0.00	0.50	0.50	0.00	0.00
8	7080	95.30	0.03	0.07	0.15	454.00	0.12	0.29	0.41	0.10	150.00
9	7820	90.20	0.04	0.02	0.08	566.00	0.29	0.14	0.43	0.01	800.00
10	8230	106.10	0.03	0.06	0.19	595.00	0.11	0.21	0.32	0.02	950.00
11	8330	107.30	0.12	0.07	0.31	503.00	0.24	0.14	0.38	0.14	221.00
12	8560	105.60	0.16	0.10	0.32	466.00	0.28	0.17	0.45	0.06	533.00
13	8690	108.10	0.14	0.08	0.23	539.00	0.32	0.18	0.50	0.03	766.00
14	8750	101.50	0.19	0.08	0.30	511.00	0.34	0.14	0.48	0.04	750.00

GEARHART GEODATA SERVICES — GEOCHEMICAL DATA LOG

Date:- 8 OCT 1983 Unit number:- 2

Company:- UNION TEXAS Well number:- PERCHA1 Sheet No. 1

EV.	DEPTH	WEIGHT	GAS	OIL	S2	Tmax	GPI	OPI	TPI	TOC	HI
1	3790	108.00	0.05	0.43	4.81	411.00	0.01	0.08	0.09	3.91	123.00
2	3940	95.10	0.08	10.75	86.47	413.00	0.00	0.11	0.11	38.30	225.00
3	4230	106.50	0.10	0.33	6.79	417.00	0.01	0.05	0.06	4.08	166.00
4	4330	107.30	0.11	1.57	15.52	413.00	0.01	0.09	0.10	7.85	197.00
5	4820	97.40	0.12	2.48	16.20	415.00	0.01	0.13	0.14	18.85	85.00
6	4960	94.30	0.09	1.36	24.64	407.00	0.00	0.05	0.05	20.59	119.00
7	5060	94.70	0.00	0.11	3.16	417.00	0.00	0.03	0.03	4.54	69.00
8	5510	102.90	0.00	0.41	11.28	417.00	0.00	0.04	0.04	4.34	259.00
9	5720	105.40	0.03	0.14	2.32	427.00	0.01	0.06	0.07	3.64	63.00
10	5940	99.20	0.03	0.78	16.95	406.00	0.00	0.04	0.04	9.70	174.00
11	6050	102.10	0.03	0.49	10.09	415.00	0.00	0.05	0.05	12.23	82.00
12	6330	96.00	0.02	0.33	7.52	421.00	0.00	0.04	0.04	9.43	79.00
13	6550	103.90	0.10	0.37	11.94	419.00	0.01	0.03	0.04	8.59	138.00
14	6860	90.70	0.04	0.11	3.12	430.00	0.01	0.03	0.04	3.80	82.00
15	7040	106.10	0.01	0.36	13.21	417.00	0.00	0.03	0.03	8.67	152.00
16	7160	106.30	0.01	0.09	2.32	427.00	0.00	0.04	0.04	2.43	95.00
17	7250	106.90	0.01	1.60	40.89	420.00	0.00	0.04	0.04	18.22	224.00
18	7440	95.90	0.05	0.62	16.37	415.00	0.00	0.04	0.04	9.36	174.00
19	7660	96.70	0.05	0.17	4.63	427.00	0.01	0.04	0.05	3.48	133.00
20	7860	93.60	0.02	2.35	40.55	415.00	0.00	0.05	0.05	34.99	115.00
21	7900	93.70	0.29	0.87	16.42	420.00	0.02	0.05	0.07	13.83	118.00
22	8090	102.20	0.02	0.07	1.63	427.00	0.01	0.04	0.05	0.24	679.00
23	8150	102.40	0.02	0.27	10.09	422.00	0.00	0.03	0.03	2.31	436.00
24	8250	97.00	0.03	0.08	2.01	429.00	0.01	0.04	0.05	2.40	83.00
25	8450	97.80	0.04	0.30	3.24	421.00	0.01	0.08	0.09	1.90	170.00
26	8600	96.70	0.03	0.04	0.27	522.00	0.09	0.12	0.21	0.63	42.00
27	8700	99.10	0.04	0.12	2.74	432.00	0.01	0.04	0.05	1.76	155.00
28	8770	109.80	0.03	0.12	1.11	428.00	0.02	0.10	0.12	2.04	54.00
29	8820	110.00	0.04	0.02	0.25	550.00	0.13	0.07	0.20	0.31	80.00
30	9060	105.50	0.04	0.08	3.95	436.00	0.01	0.02	0.03	2.94	134.00
31	9150	105.80	0.05	0.09	0.93	438.00	0.05	0.08	0.13	0.10	930.00
32	9290	91.50	0.25	0.21	2.90	443.00	0.07	0.06	0.13	1.54	188.00
33	9370	108.10	0.01	0.01	0.07	458.00	0.12	0.12	0.24	0.17	41.00

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GEARHART GEODATA SERVICES

GEOCHEMICAL DATA LOG

Date:- 7 OCT 1983   Unit number:- 2

Company:- UNION TEXAS   Well number:- PIKE 1   Sheet No. 1

EV.	DEPTH	WEIGHT	GAS	OIL	S2	Tmax	GPI	OPI	TPI	TOC	HI
1	6460	107.50	0.02	0.17	0.13	558.00	0.06	0.53	0.59	0.03	433.00
2	6600	104.40	0.03	0.39	0.06	344.00	0.06	0.81	0.87	0.03	200.00
3	6660	93.80	0.03	0.21	3.30	425.00	0.01	0.06	0.07	1.15	286.00
4	6770	91.90	0.16	0.41	1.14	486.00	0.09	0.24	0.33	0.47	242.00
5	6850	109.00	0.01	0.14	0.34	556.00	0.02	0.29	0.31	0.07	485.00
6	6930	97.80	0.03	0.09	0.38	558.00	0.06	0.18	0.24	0.05	760.00
7	6950	101.30	0.04	0.41	1.73	462.00	0.02	0.19	0.21	1.42	121.00

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GEARHART GEODATA SERVICES

GEOCHEMICAL DATA LOG

Date:- 8 OCT 1983 Unit number:- 2

Company:- UNION TEXAS Well number:- PISCES 1 Sheet No. 1

N.	DEPTH	WEIGHT	GAS	OIL	S2	Tmax	GPI	OPI	TPI	TOC	HI
1	1836	99.30	0.03	0.30	1.82	427.00	0.01	0.14	0.15	0.49	371.00
2	1851	102.40	0.08	0.86	0.72	558.00	0.05	0.52	0.57	0.19	378.00
3	1863	92.00	0.19	0.19	1.00	440.00	0.14	0.14	0.28	0.51	196.00
4	1866	101.40	0.12	0.19	0.70	553.00	0.12	0.19	0.31	0.08	875.00
5	1881	99.80	0.16	1.30	0.71	544.00	0.07	0.60	0.67	0.17	417.00
6	1902	97.60	0.08	0.26	1.06	570.00	0.06	0.19	0.25	0.42	252.00
7	1929	104.30	0.16	0.19	0.89	484.00	0.13	0.15	0.28	0.10	890.00
8	1932	108.60	0.05	1.51	5.59	400.00	0.01	0.21	0.22	0.71	787.00
9	1940	90.00	0.06	1.02	4.12	502.00	0.01	0.20	0.21	0.99	416.00
10	2052	104.10	0.30	0.20	2.47	438.00	0.10	0.07	0.17	0.29	851.00
11	2100	106.00	0.07	1.07	3.16	420.00	0.02	0.25	0.27	0.84	376.00
12	2107	94.20	0.09	1.08	3.39	420.00	0.02	0.24	0.26	0.90	376.00
13	2163	98.30	0.03	1.41	4.65	428.00	0.00	0.23	0.23	0.70	664.00
14	2178	103.60	0.04	0.67	2.09	488.00	0.01	0.24	0.25	0.23	908.00
15	2199	107.00	0.03	0.88	1.77	460.00	0.01	0.33	0.34	0.28	632.00
16	2277	104.10	0.07	1.66	3.38	595.00	0.01	0.33	0.34	0.55	614.00
17	2283	107.10	0.03	1.71	5.61	595.00	0.00	0.23	0.23	0.89	630.00
18	2304	94.60	0.04	3.25	7.64	527.00	0.00	0.30	0.30	1.18	647.00
19	2346	97.20	0.06	1.15	3.06	492.00	0.01	0.27	0.28	0.40	765.00
20	2367	106.40	0.03	1.47	7.16	589.00	0.00	0.17	0.17	1.99	359.00
21	2391	101.30	0.06	0.96	1.97	506.00	0.02	0.32	0.34	0.47	419.00
22	2409	107.70	0.02	2.09	9.51	509.00	0.00	0.18	0.18	1.32	720.00
23	2421	96.30	0.15	2.61	12.48	468.00	0.01	0.17	0.18	1.87	667.00
24	2457	94.10	0.03	1.19	3.67	450.00	0.01	0.24	0.25	0.44	834.00
25	2466	98.90	0.05	0.80	1.19	411.00	0.02	0.39	0.41	0.44	270.00
26	2473	94.00	0.04	1.21	2.35	596.00	0.01	0.34	0.35	0.59	398.00
27	2493	94.20	0.05	0.77	1.38	300.00	0.02	0.35	0.37	0.27	511.00
28	2502	101.00	0.03	1.05	2.67	596.00	0.01	0.28	0.29	0.57	468.00
29	2505	101.00	0.03	0.82	3.44	436.00	0.01	0.19	0.20	2.85	120.00
30	2509	106.00	0.05	0.88	3.42	435.00	0.01	0.20	0.21	2.18	156.00
31	2511	102.00	0.03	0.66	2.96	508.00	0.01	0.18	0.19	0.44	672.00
32	2513	102.30	0.05	1.16	7.15	426.00	0.01	0.14	0.15	3.16	226.00
33	2525	96.80	0.09	0.96	4.30	466.00	0.02	0.18	0.20	1.40	307.00
34	2535	92.10	0.05	1.15	10.29	428.00	0.00	0.10	0.10	4.37	235.00
35	2546	94.80	0.11	1.02	6.25	462.00	0.01	0.14	0.15	2.22	281.00
36	2560	109.70	0.02	0.66	3.94	588.00	0.00	0.14	0.14	1.93	204.00
37	2568	102.50	0.03	0.55	4.11	478.00	0.01	0.12	0.13	0.46	893.00
38	2571	102.40	0.02	0.35	1.30	589.00	0.01	0.21	0.22	0.13	$$$$$$$10
39	2580	96.60	0.04	0.49	3.14	476.00	0.01	0.13	0.14	0.39	805.00

GEARHART GEODATA SERVICES

GEOCHEMICAL DATA LOG

Date:- 28 OCT 1983 Unit number:- 2

Company:- UNION TEXAS Well number:- SNAPPER 1 Sheet No. 1

.V.	DEPTH	WEIGHT	GAS	OIL	S2	Tmax	GPI	OPI	TPI	TOC	HI
1	4990	96.70	0.28	2.08	21.40	414.00	0.01	0.09	0.10	16.84	127.00
2	5210	105.70	0.18	5.11	63.65	411.00	0.00	0.07	0.07	28.91	220.00
3	5660	104.40	0.19	0.62	6.28	422.00	0.03	0.09	0.12	7.83	80.00
4	5670	106.10	0.16	0.45	3.60	424.00	0.04	0.11	0.15	4.06	88.00
5	5870	102.70	0.16	2.23	41.16	424.00	0.00	0.05	0.05	20.73	198.00
6	5880	106.20	0.14	5.27	78.04	424.00	0.00	0.06	0.06	18.74	416.00
7	6160	91.30	0.14	2.21	34.30	424.00	0.00	0.06	0.06	14.49	236.00
8	6410	109.50	0.11	0.55	9.95	422.00	0.01	0.05	0.06	4.91	202.00
9	6710	92.30	0.20	0.68	5.16	427.00	0.03	0.11	0.14	4.17	123.00
10	6960	97.30	0.14	0.26	2.30	428.00	0.05	0.10	0.15	3.20	71.00
11	7180	99.30	0.11	0.27	2.64	432.00	0.04	0.09	0.13	1.58	167.00
12	7360	106.20	0.02	1.61	26.55	424.00	0.00	0.06	0.06	9.17	289.00
13	7560	105.20	0.09	0.71	11.80	425.00	0.01	0.06	0.07	1.82	648.00
14	7760	92.20	0.09	1.01	11.62	430.00	0.01	0.08	0.09	5.14	226.00
15	7900	108.90	0.08	0.41	4.87	431.00	0.01	0.08	0.09	4.45	109.00
16	8110	98.70	0.10	0.29	2.26	430.00	0.04	0.11	0.15	3.39	66.00
17	8310	91.40	0.08	1.57	22.82	423.00	0.00	0.06	0.06	5.02	454.00
18	8560	93.80	0.01	0.72	5.92	433.00	0.00	0.11	0.11	3.06	193.00
19	8810	108.60	0.14	0.80	12.54	432.00	0.01	0.06	0.07	3.97	315.00
20	9100	95.90	0.16	1.19	11.31	431.00	0.01	0.09	0.10	7.31	154.00
21	9550	97.40	0.14	0.44	2.24	436.00	0.05	0.16	0.21	4.18	53.00
22	9900	101.10	0.11	0.48	3.36	440.00	0.03	0.12	0.15	1.86	180.00
23	10200	97.70	0.13	1.09	8.48	444.00	0.01	0.11	0.12	3.63	233.00
24	10330	95.70	0.15	0.61	4.54	446.00	0.03	0.12	0.15	5.27	86.00
25	11133	96.20	0.15	0.19	1.99	450.00	0.06	0.08	0.14	1.97	101.00
26	11350	105.00	0.05	0.17	0.50	442.00	0.07	0.24	0.31	0.17	294.00
27	11360	109.70	0.11	0.31	0.63	439.00	0.11	0.30	0.41	0.67	94.00
28	11630	106.00	0.11	0.28	1.14	506.00	0.07	0.18	0.25	1.55	73.00
29	11640	103.50	0.14	0.32	2.34	457.00	0.05	0.11	0.16	3.00	78.00
30	11750	109.70	0.04	2.22	4.95	449.00	0.01	0.31	0.32	4.60	107.00
31	11760	91.50	0.08	0.88	9.68	444.00	0.01	0.08	0.09	7.24	133.00
32	11890	33.30	0.30	1.86	3.54	444.00	0.05	0.33	0.38	3.76	94.00
33	11900	64.10	0.10	0.53	4.68	462.00	0.02	0.10	0.12	11.62	40.00
34	12070	91.00	0.05	0.27	1.01	458.00	0.04	0.20	0.24	3.66	27.00
35	12080	90.80	0.06	0.80	1.35	457.00	0.03	0.36	0.39	1.78	75.00
36	12290	93.80	0.04	0.67	1.17	482.00	0.02	0.36	0.38	1.91	61.00
37	12300	96.00	0.04	2.07	4.00	452.00	0.01	0.34	0.35	5.27	75.00

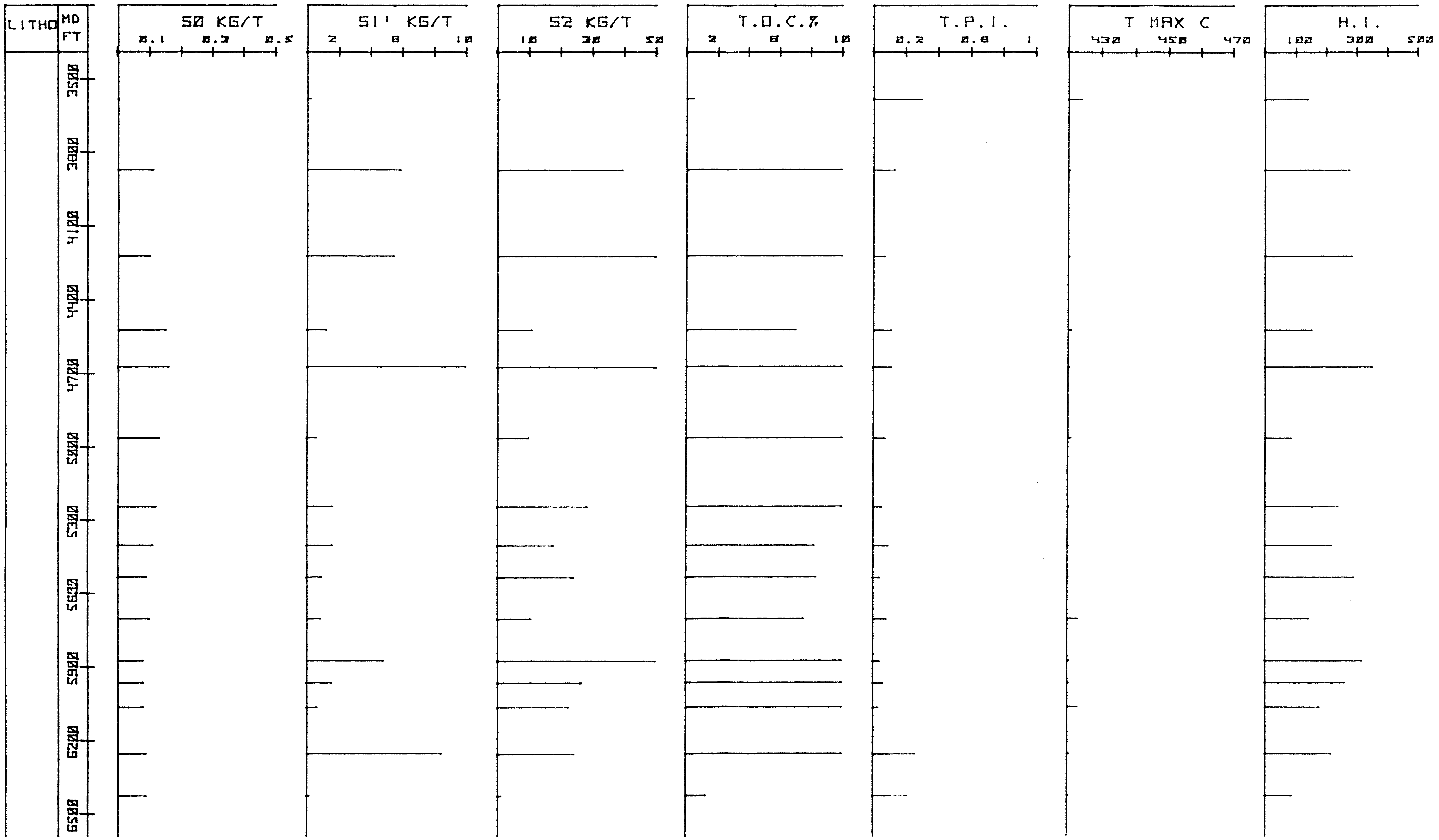
GEARHART GEODATA SERVICES — GEOCHEMICAL DATA LOG

Date:- 7 OCT 1983 Unit number:- 2

Company:- UNION TEXAS Well number:- TUNA 1 Sheet No. 1

NV.	DEPTH	WEIGHT	GAS	OIL	S2	Tmax	GPI	OPI	TPI	TOC	HI
1	4690	90.70	0.01	0.14	0.26	427.00	0.02	0.35	0.37	0.32	81.00
2	4700	98.30	0.01	0.05	0.27	563.00	0.03	0.16	0.19	0.25	108.00
3	4950	92.30	0.03	0.07	0.20	549.00	0.10	0.23	0.33	0.13	153.00
4	5230	101.80	0.00	2.18	34.97	419.00	0.00	0.06	0.06	35.64	98.00
5	5300	107.40	0.17	0.95	22.88	417.00	0.01	0.04	0.05	8.49	269.00
6	5460	98.10	0.02	0.19	5.34	429.00	0.00	0.03	0.03	6.57	81.00
7	5620	100.80	0.09	0.32	4.98	426.00	0.02	0.06	0.08	9.10	54.00
8	5680	90.30	0.08	0.88	14.47	423.00	0.01	0.06	0.07	20.42	70.00
9	5720	100.20	0.16	0.88	11.79	420.00	0.01	0.07	0.08	8.74	134.00
10	5930	101.50	0.00	0.19	3.63	424.00	0.00	0.05	0.05	8.98	40.00
11	6130	104.80	0.02	0.62	5.98	427.00	0.00	0.09	0.09	3.86	154.00
12	6170	92.50	0.06	0.55	12.24	425.00	0.00	0.04	0.04	5.84	209.00
13	6230	92.40	0.04	3.18	56.62	426.00	0.00	0.05	0.05	33.80	167.00
14	6480	106.80	0.05	0.33	5.72	430.00	0.01	0.05	0.06	4.14	138.00
15	6820	104.10	0.02	0.75	15.13	426.00	0.00	0.05	0.05	10.77	140.00
16	6950	105.40	0.03	0.20	3.51	433.00	0.01	0.05	0.06	2.05	171.00
17	7350	104.30	0.01	0.05	0.22	552.00	0.04	0.18	0.22	0.06	366.00
18	7840	108.30	0.01	0.23	1.96	430.00	0.00	0.10	0.10	1.18	166.00
19	7960	103.50	0.02	0.44	2.99	432.00	0.01	0.13	0.14	3.28	91.00
20	8170	98.70	0.05	0.67	18.72	429.00	0.00	0.03	0.03	19.98	93.00
21	8320	109.50	0.12	0.28	3.29	433.00	0.03	0.08	0.11	2.12	155.00
22	8500	98.50	0.07	0.10	1.25	443.00	0.05	0.07	0.12	1.15	108.00
23	8600	92.90	0.05	0.48	11.03	433.00	0.00	0.04	0.04	5.61	196.00
24	8760	97.40	0.04	0.99	4.81	438.00	0.01	0.17	0.18	5.04	95.00
25	9020	98.00	0.14	0.97	12.03	425.00	0.01	0.07	0.08	3.00	401.00
26	9270	108.10	0.03	0.26	3.21	435.00	0.01	0.07	0.08	3.55	90.00
27	9540	108.90	0.11	0.11	1.30	443.00	0.07	0.07	0.14	1.81	71.00
28	10000	95.70	0.08	0.08	1.58	448.00	0.05	0.05	0.10	2.19	72.00
29	10320	109.60	0.10	0.07	0.95	554.00	0.09	0.06	0.15	0.97	97.00
30	10790	96.30	0.12	0.15	3.08	432.00	0.04	0.04	0.08	3.00	102.00

GEARHART GEODATA SERVICES. GEOCHEMICAL SCREENING LOG. WELL NUMBER: BARRACOUTA 1 SHEET 1



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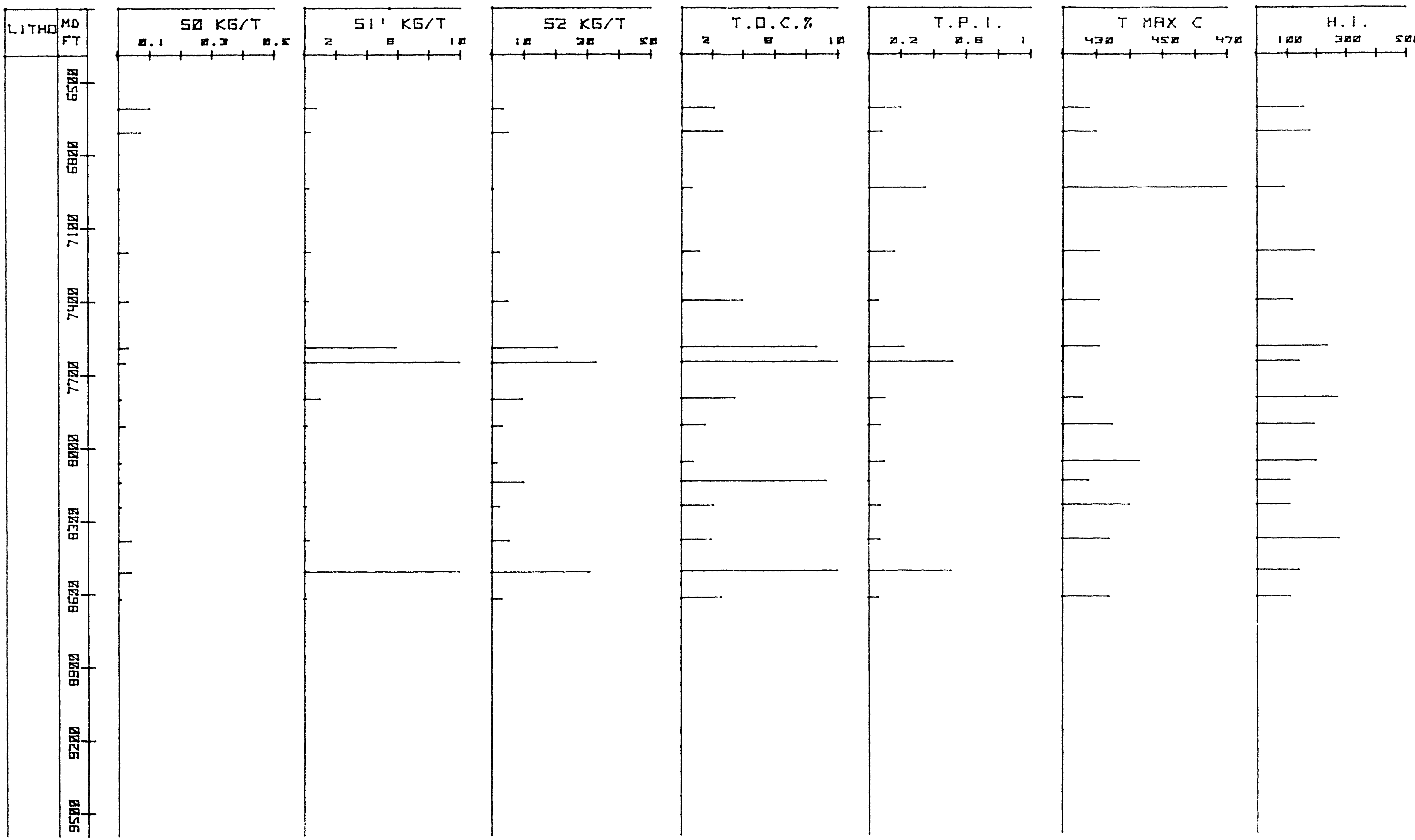

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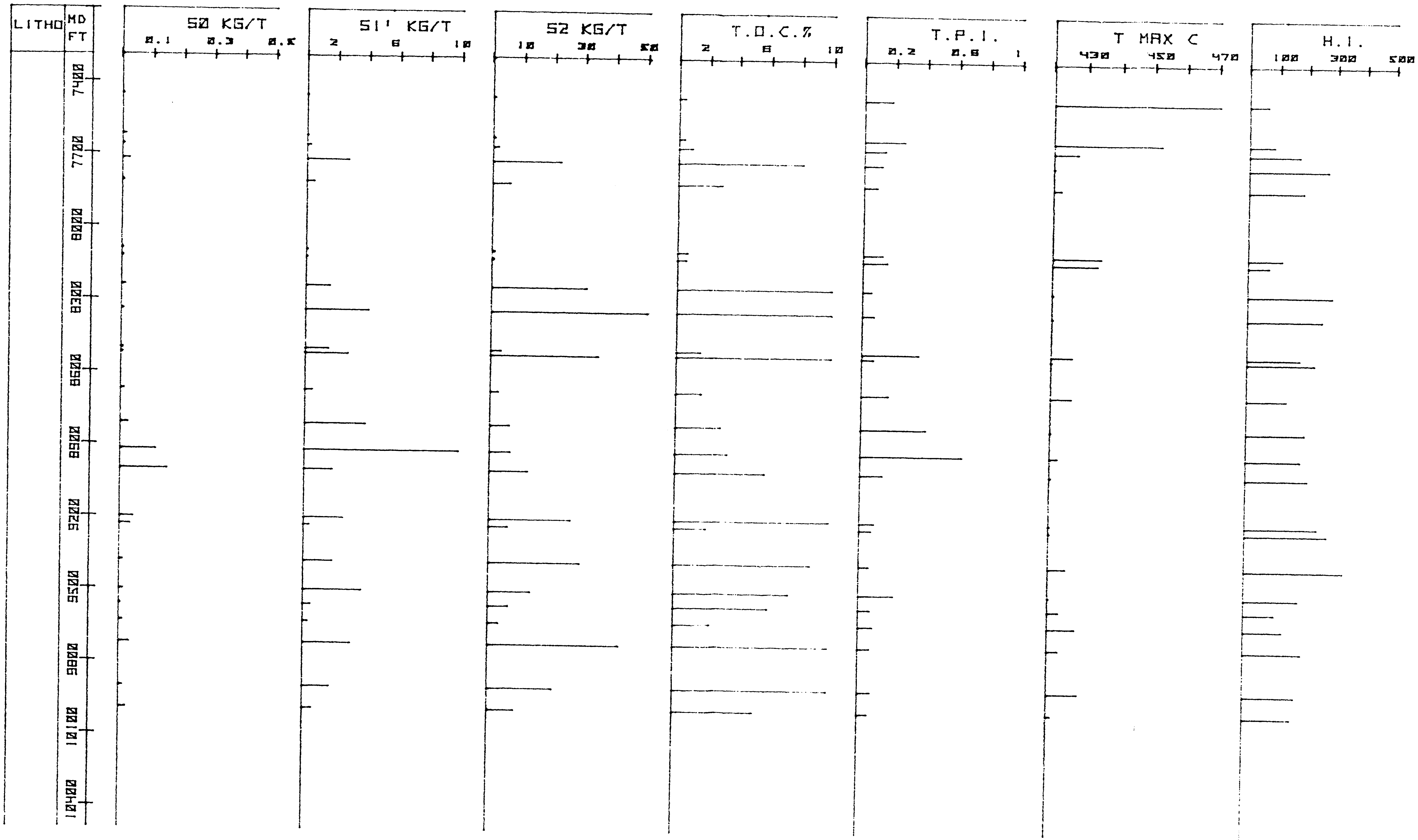

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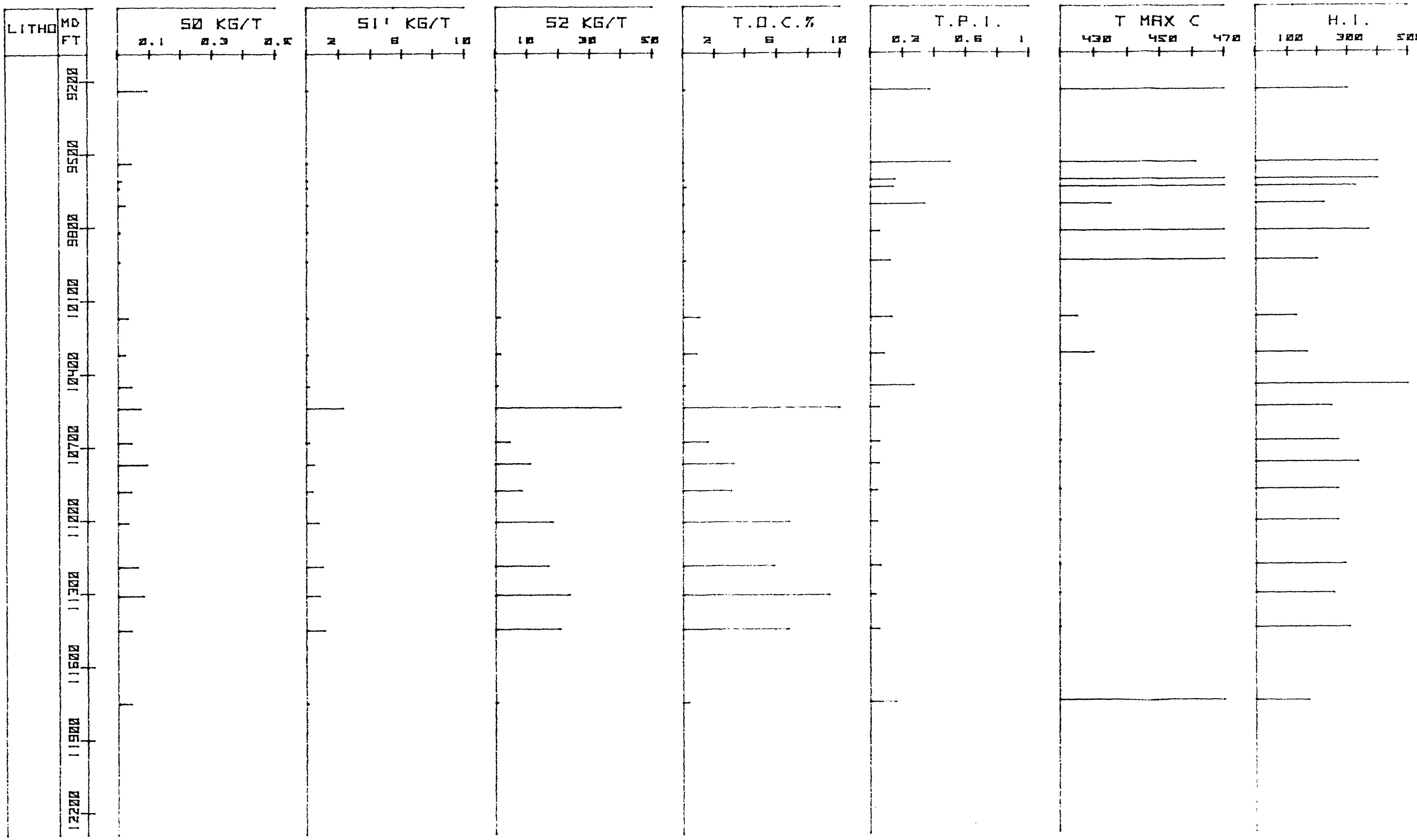

106/119

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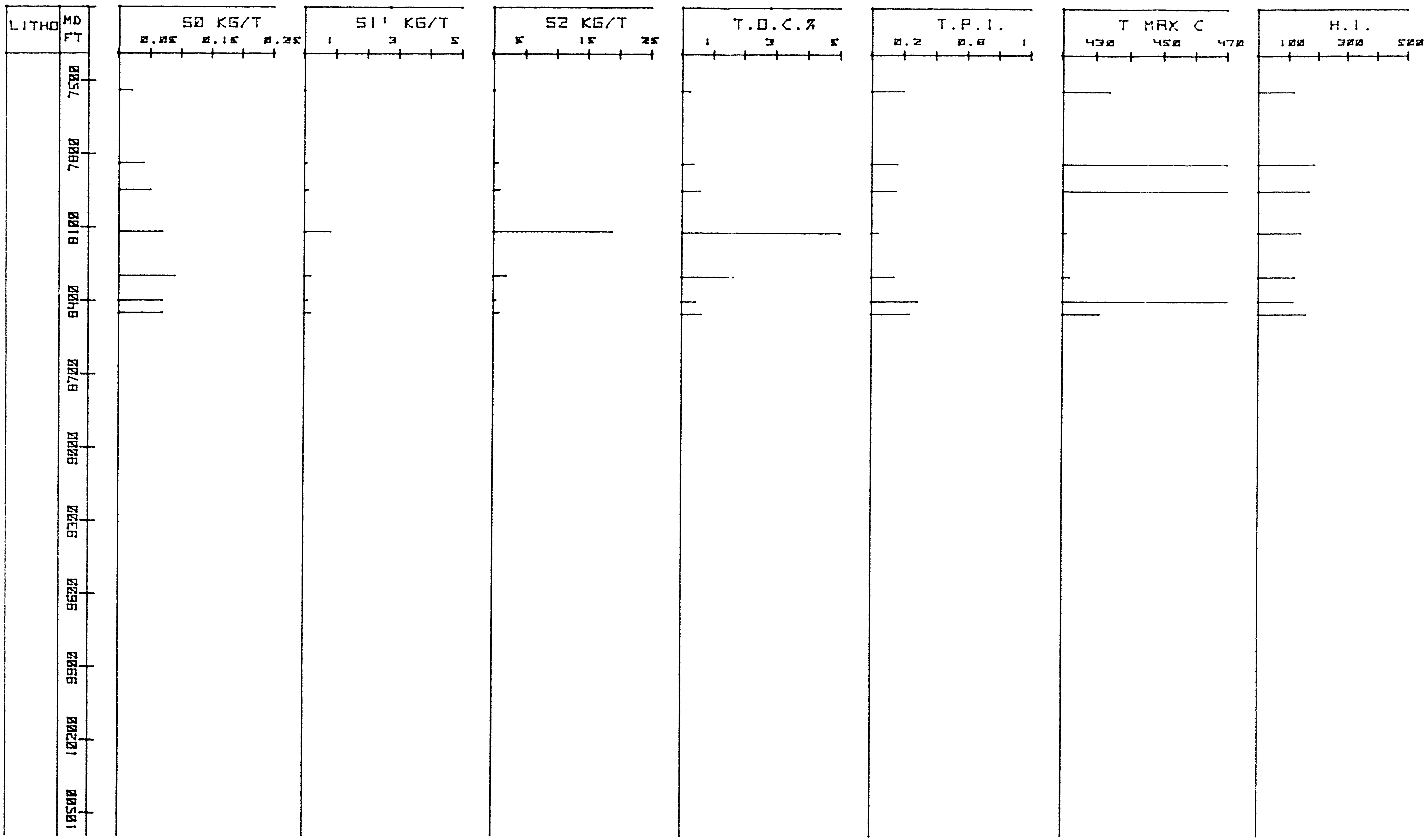

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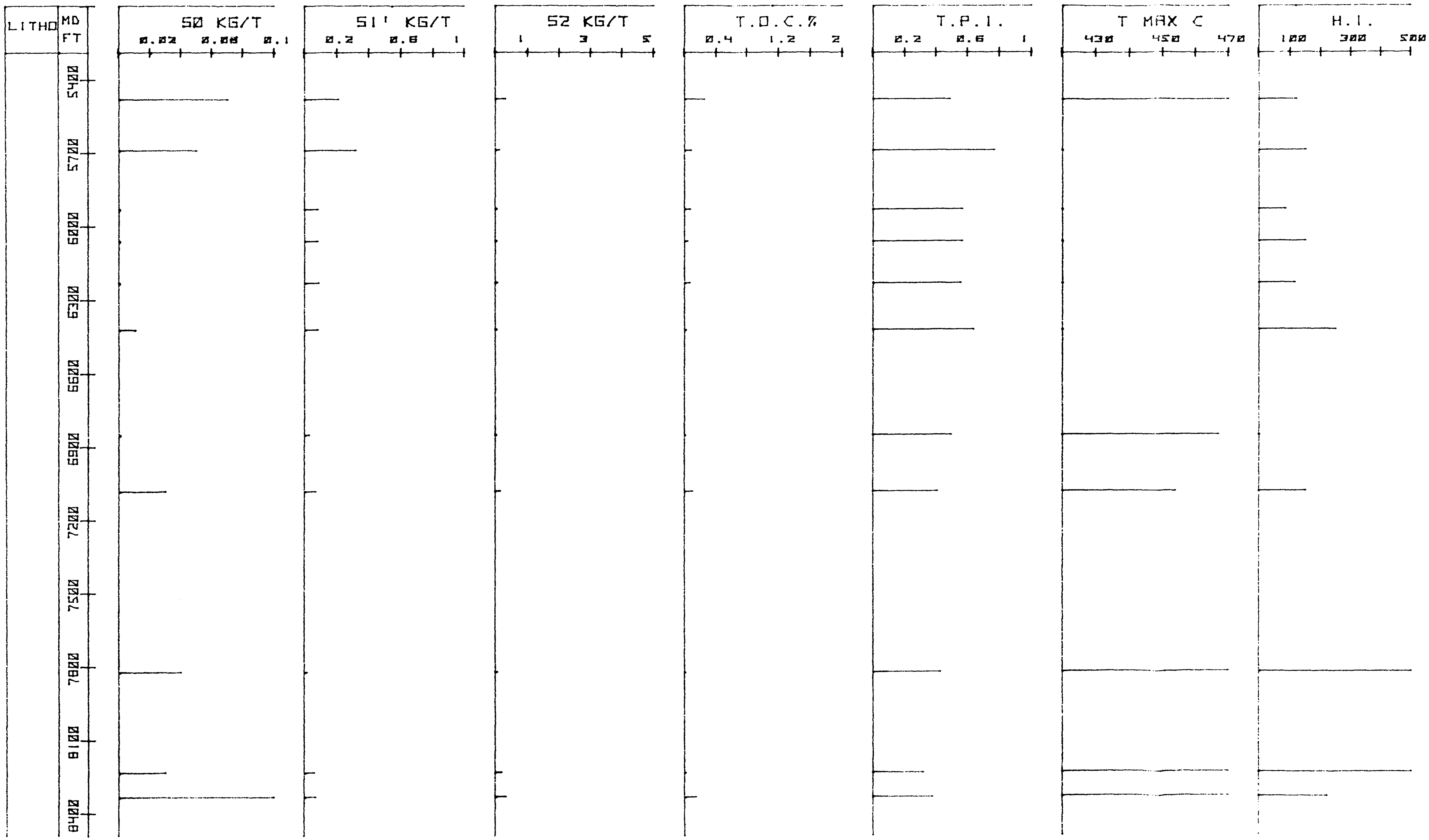

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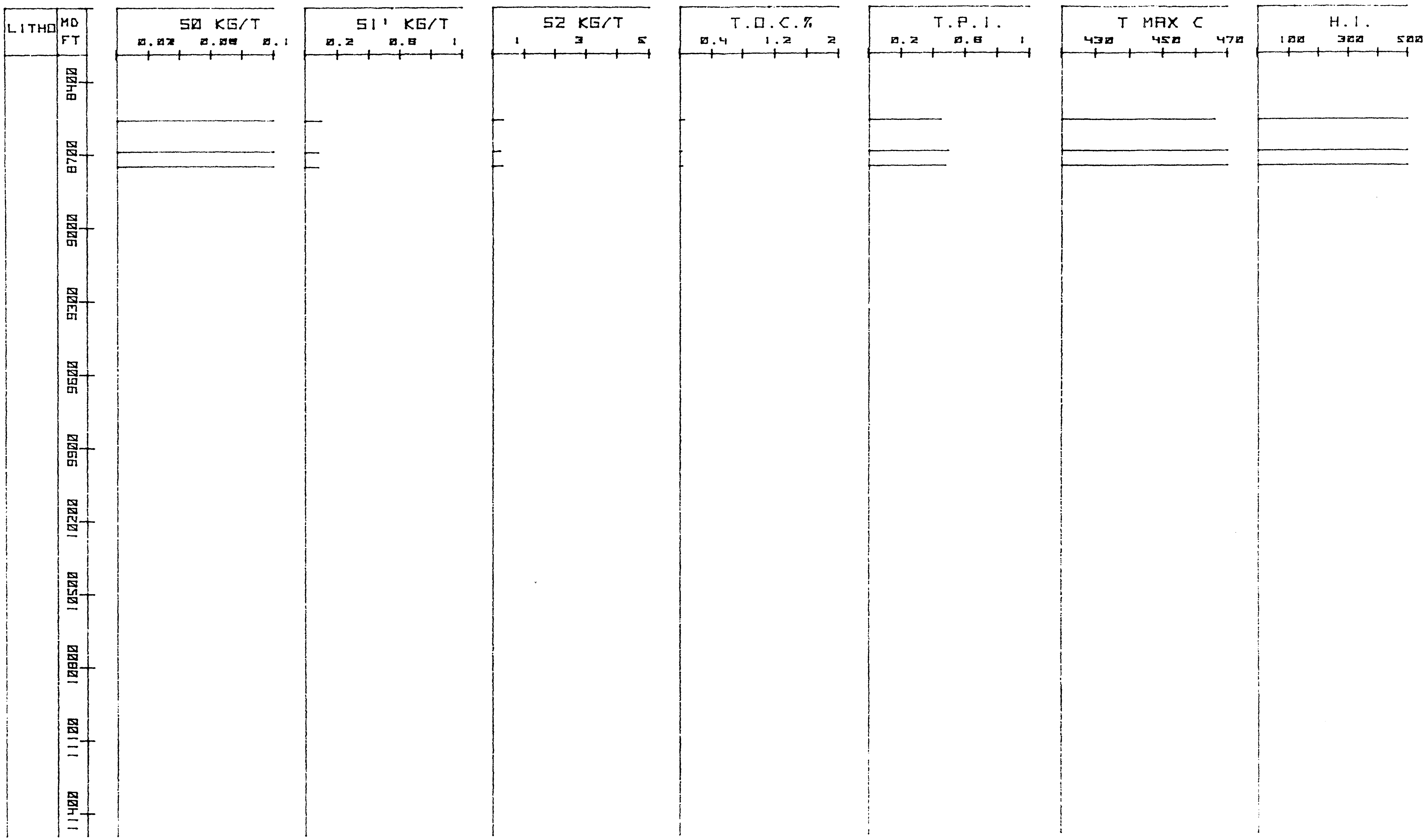

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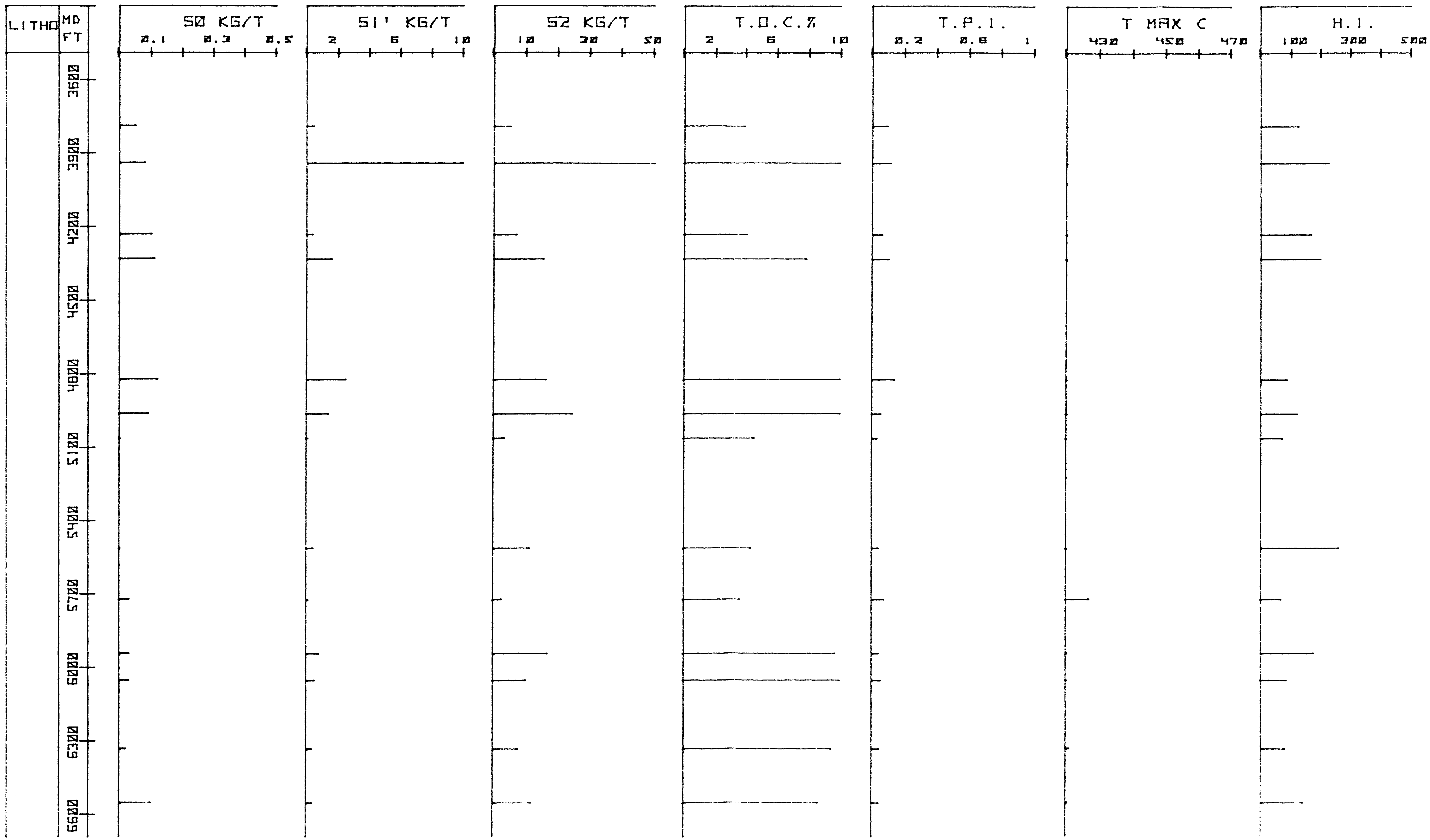

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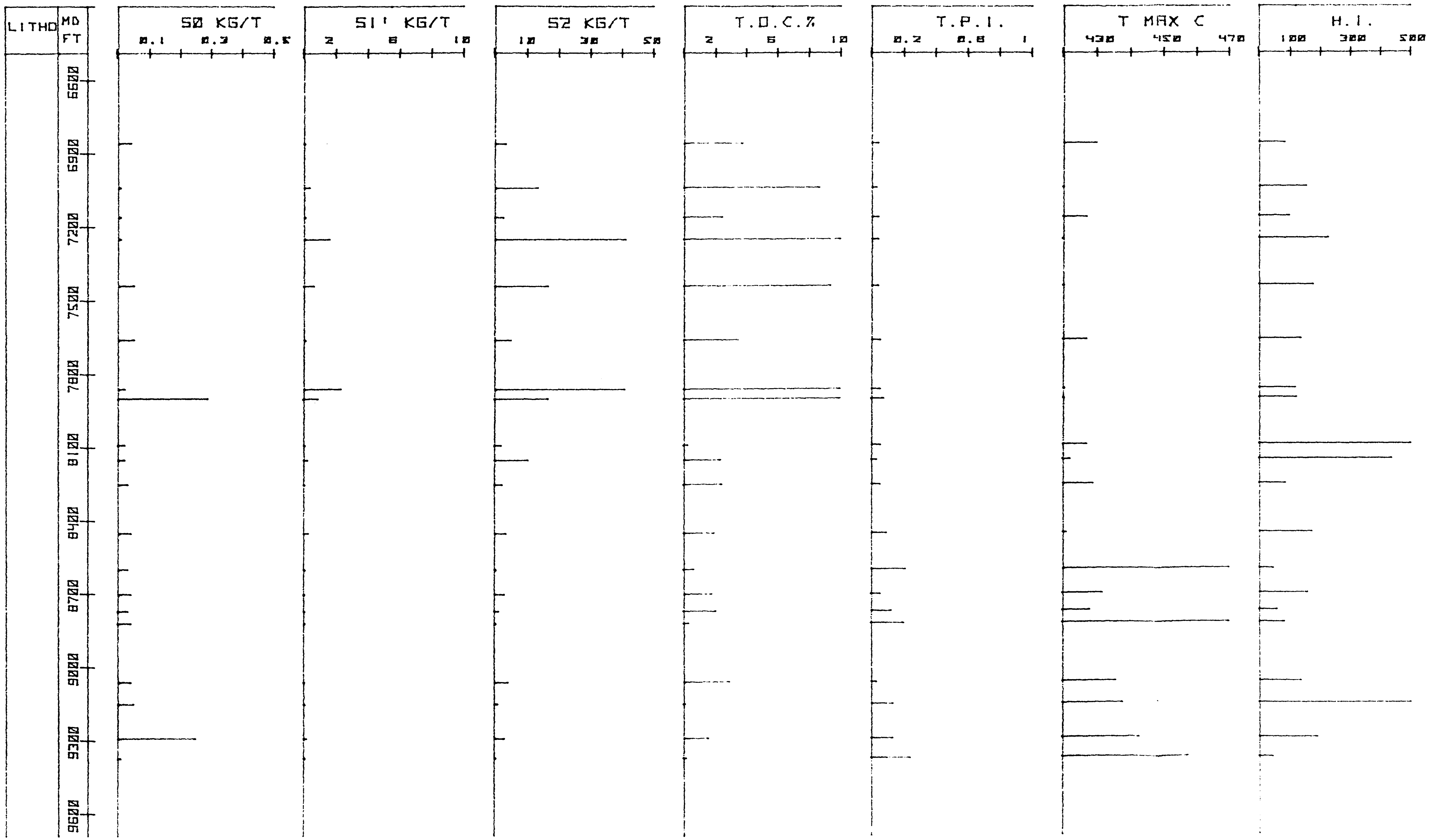

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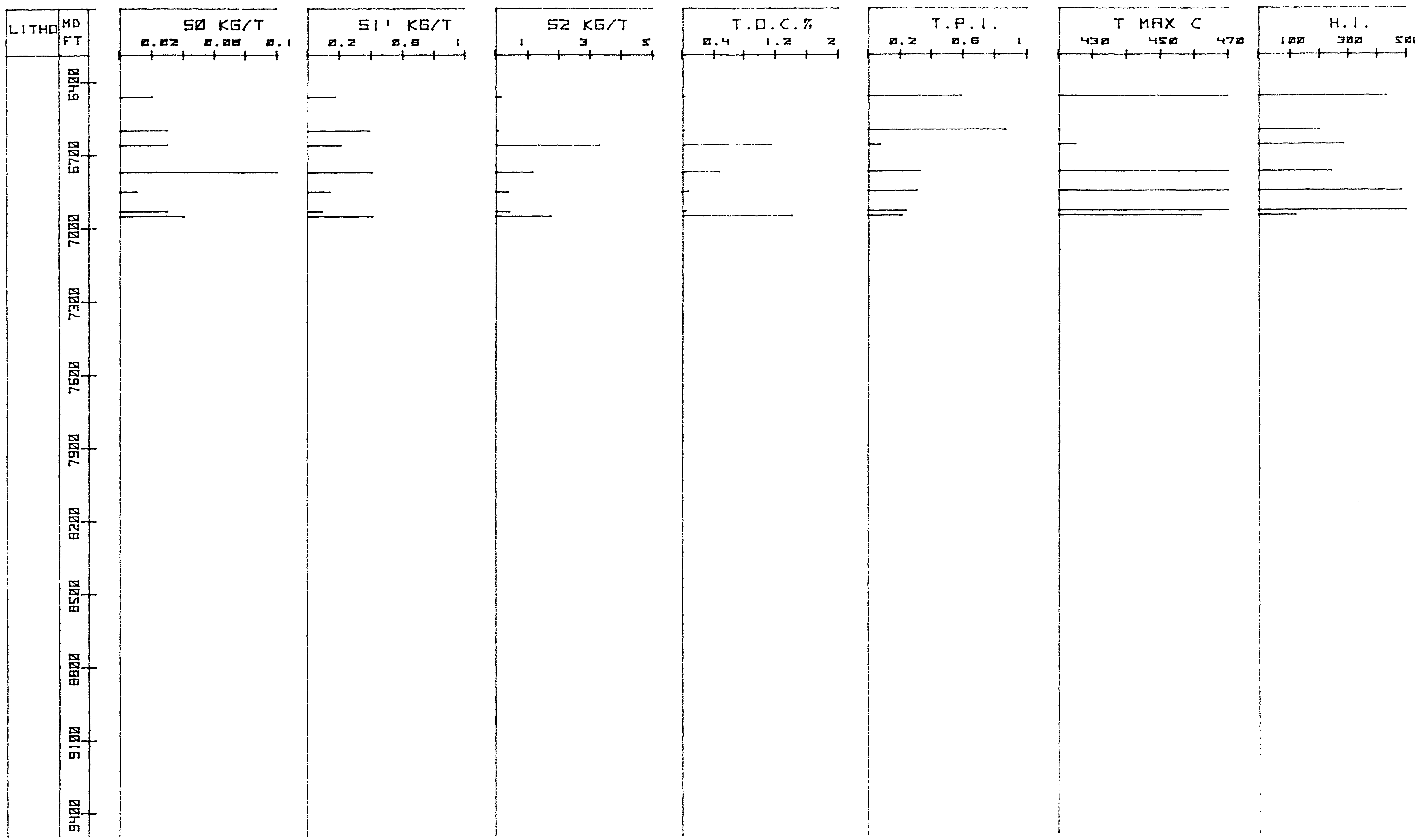

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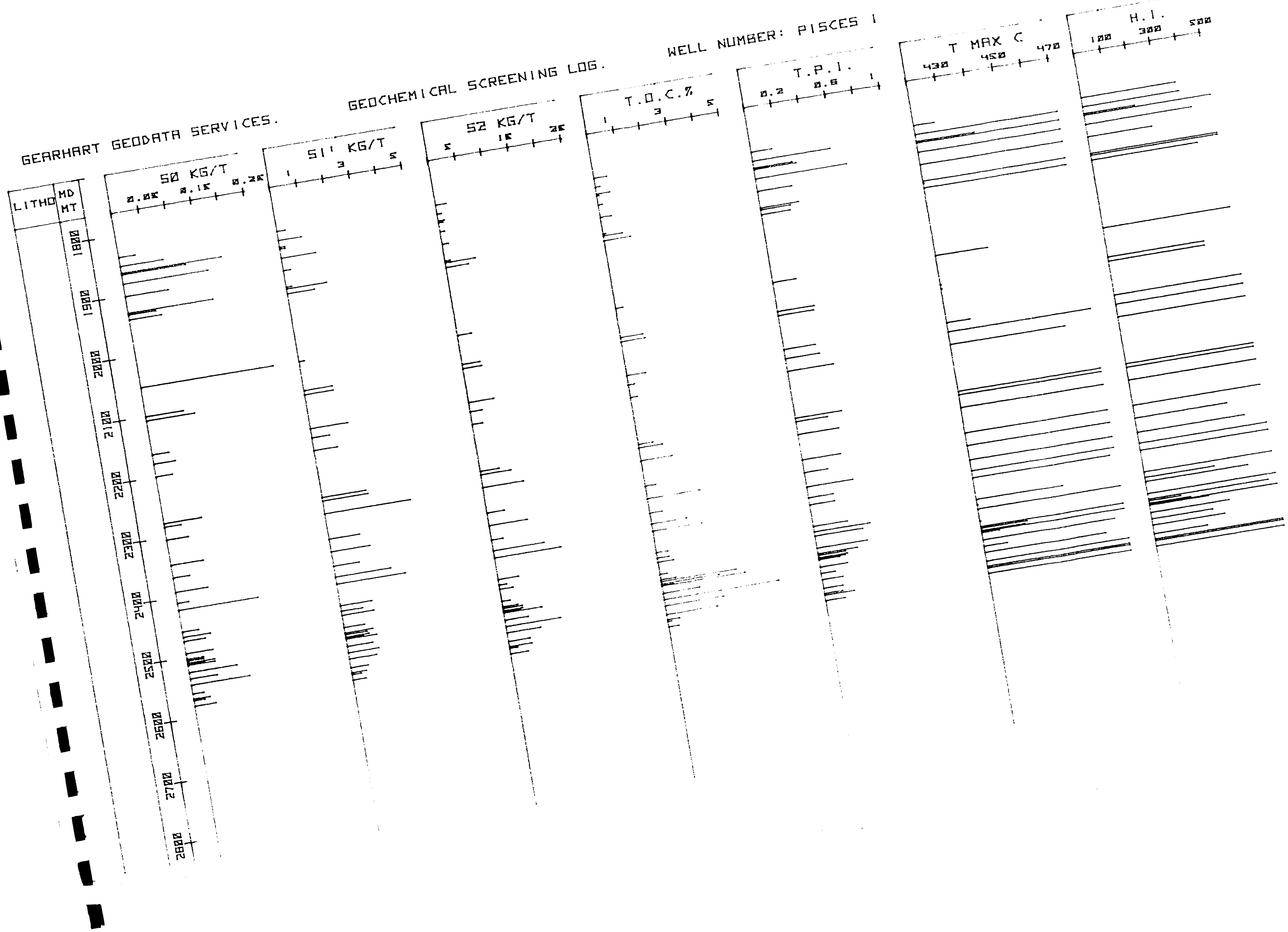
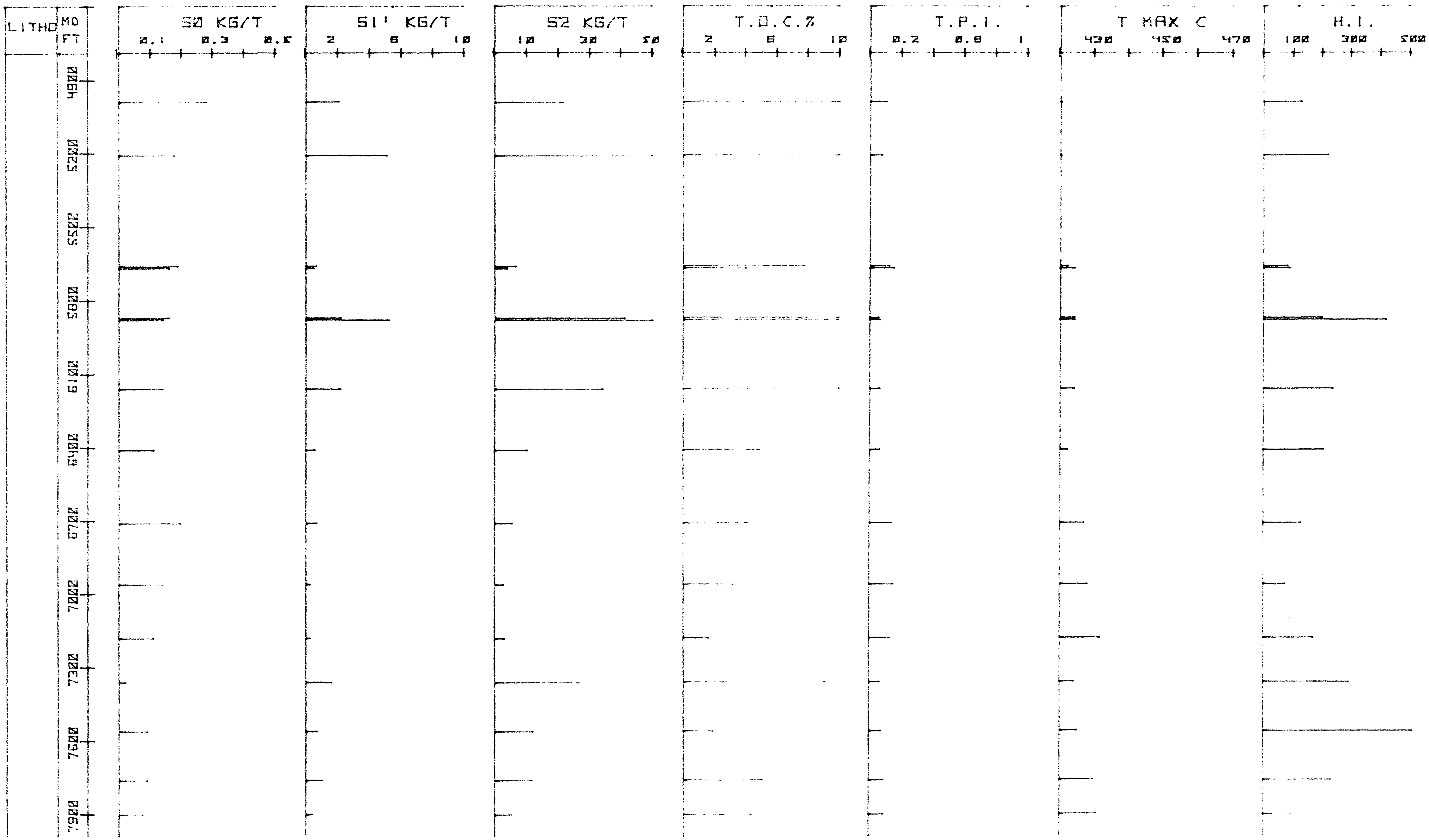


GEARHART GEODATA SERVICES.
GEOCHEMICAL SCREENING LOG.
WELL NUMBER: PISCES 1
SHEET 1
LITHO
MD MT
1800
1900
2000
2100
2200
2300
2400
2500
2600
2700
2800
S0 KG/T
0.05
0.15
0.25
S1' KG/T
1
3
5
S2 KG/T
5
15
25
T.O.C.%
1
3
5
T.P.I.
0.2
0.6
1
T MAX C
430
450
470
H.I.
100
300
500

113/119

GEARHART GEODATA SERVICES. GEOCHEMICAL SCREENING LOG. WELL NUMBER: SNAPPER 1 SHEET 1



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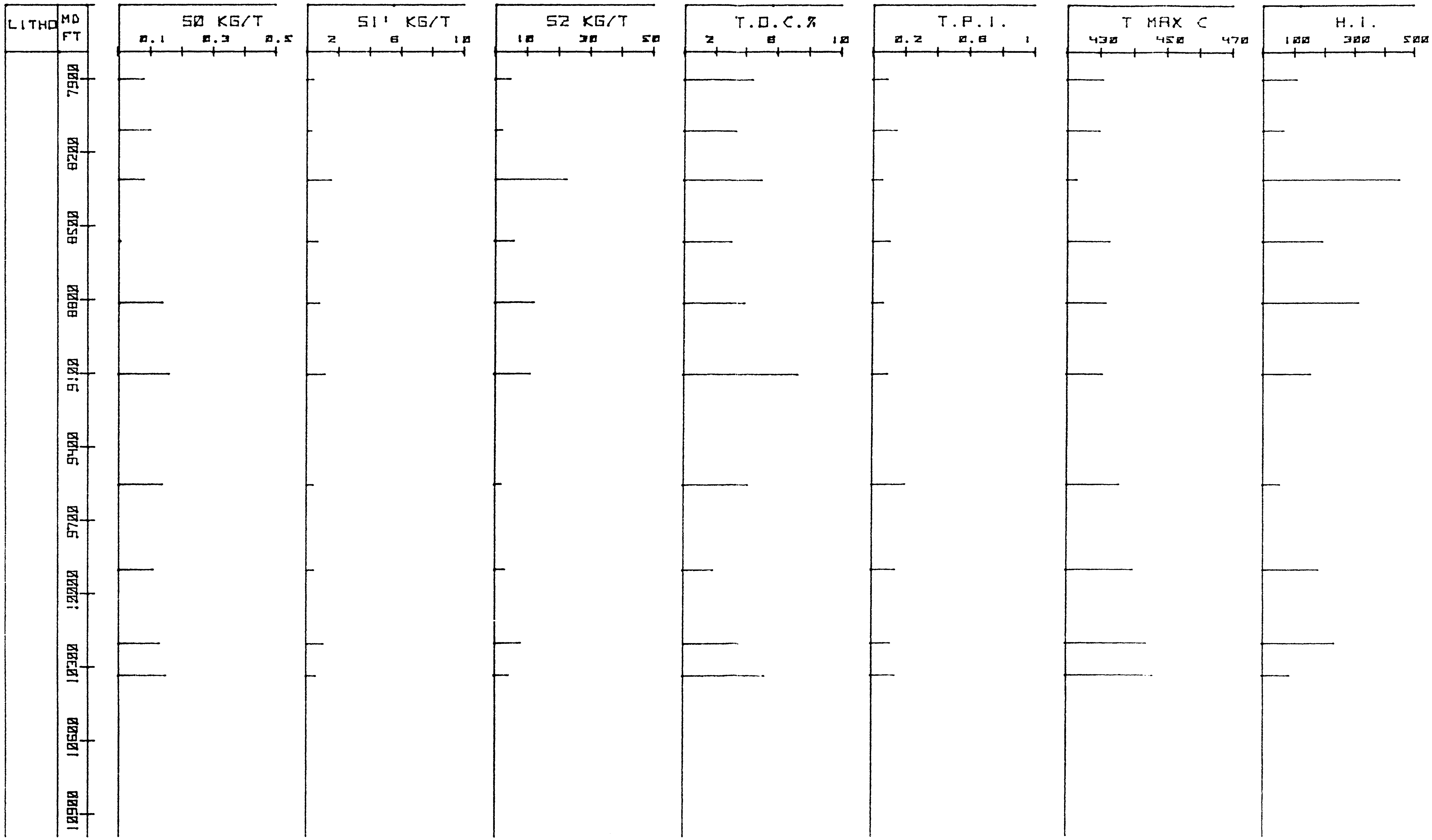

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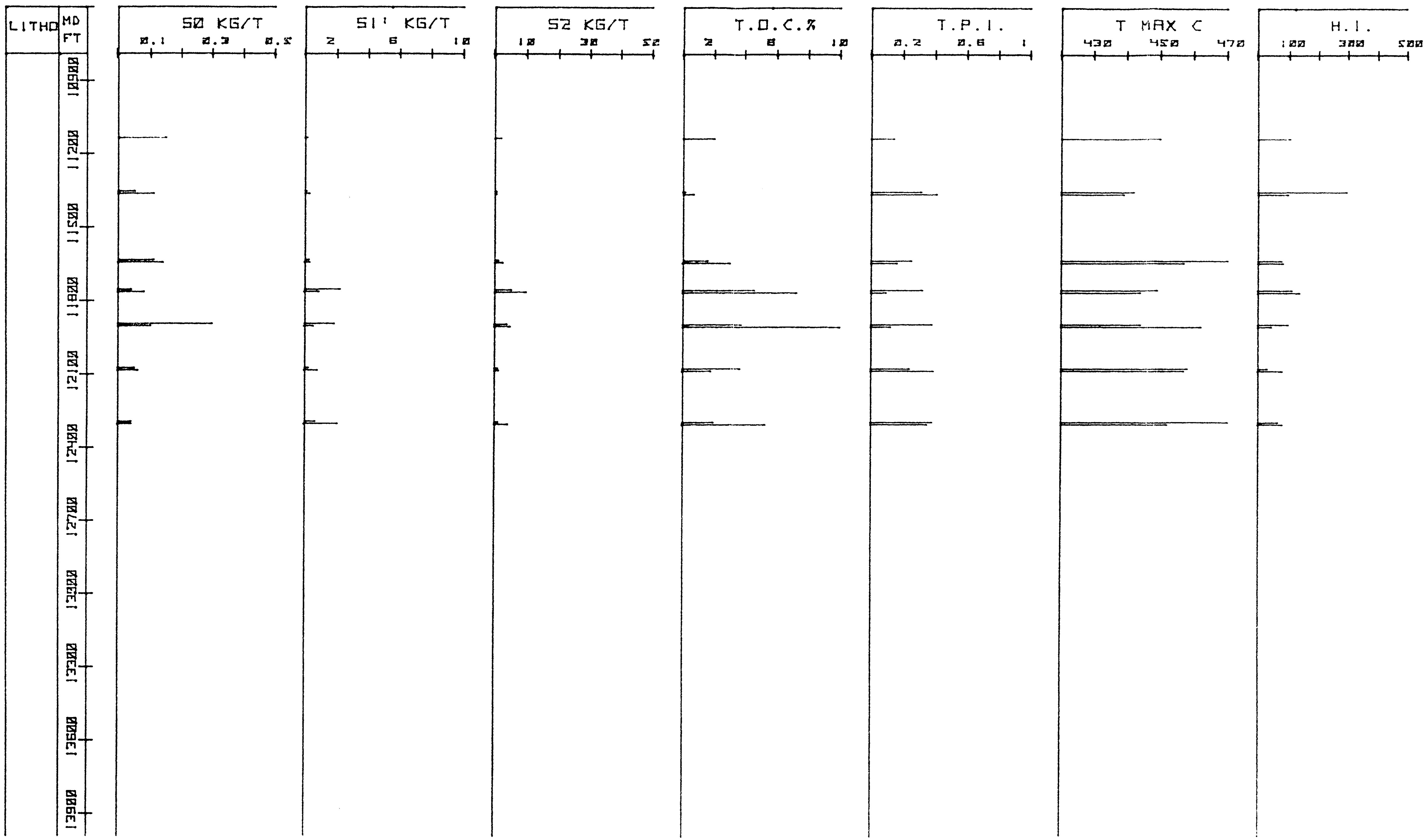

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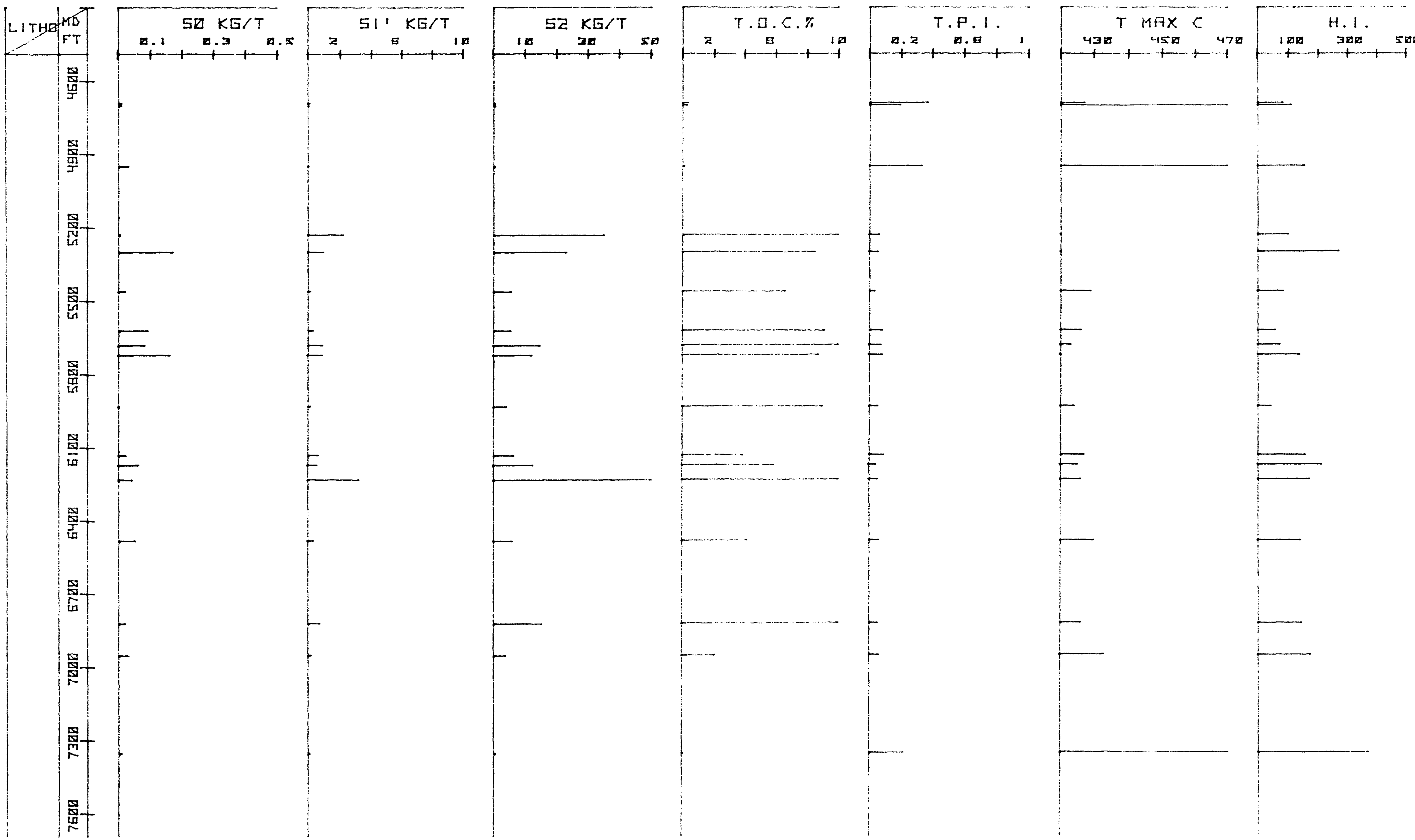

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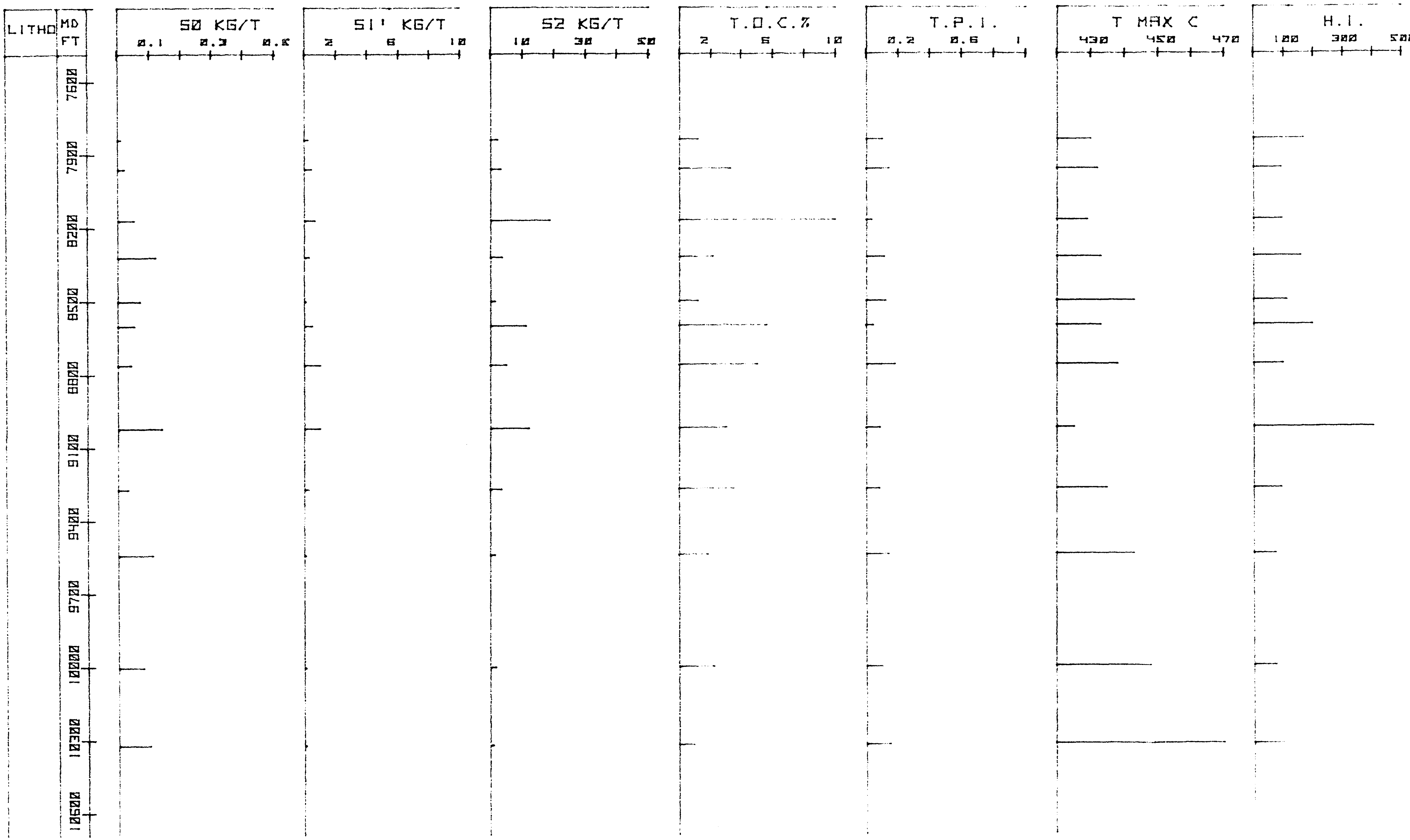

GEARHART GEODATA SERVICES.　　GEOCHEMICAL SCREENING LOG.　　WELL NUMBER: TUNA 1　　SHEET 1

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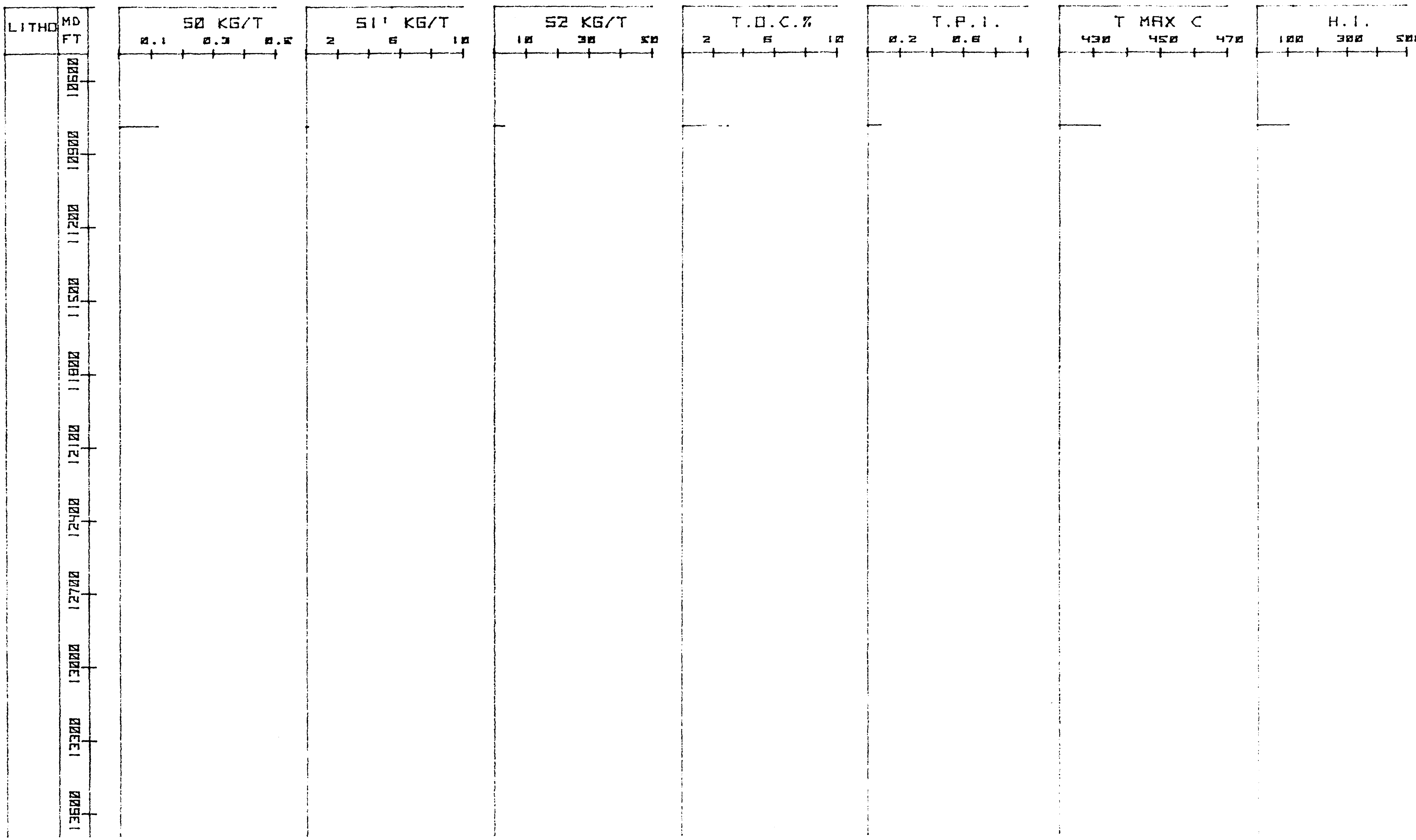
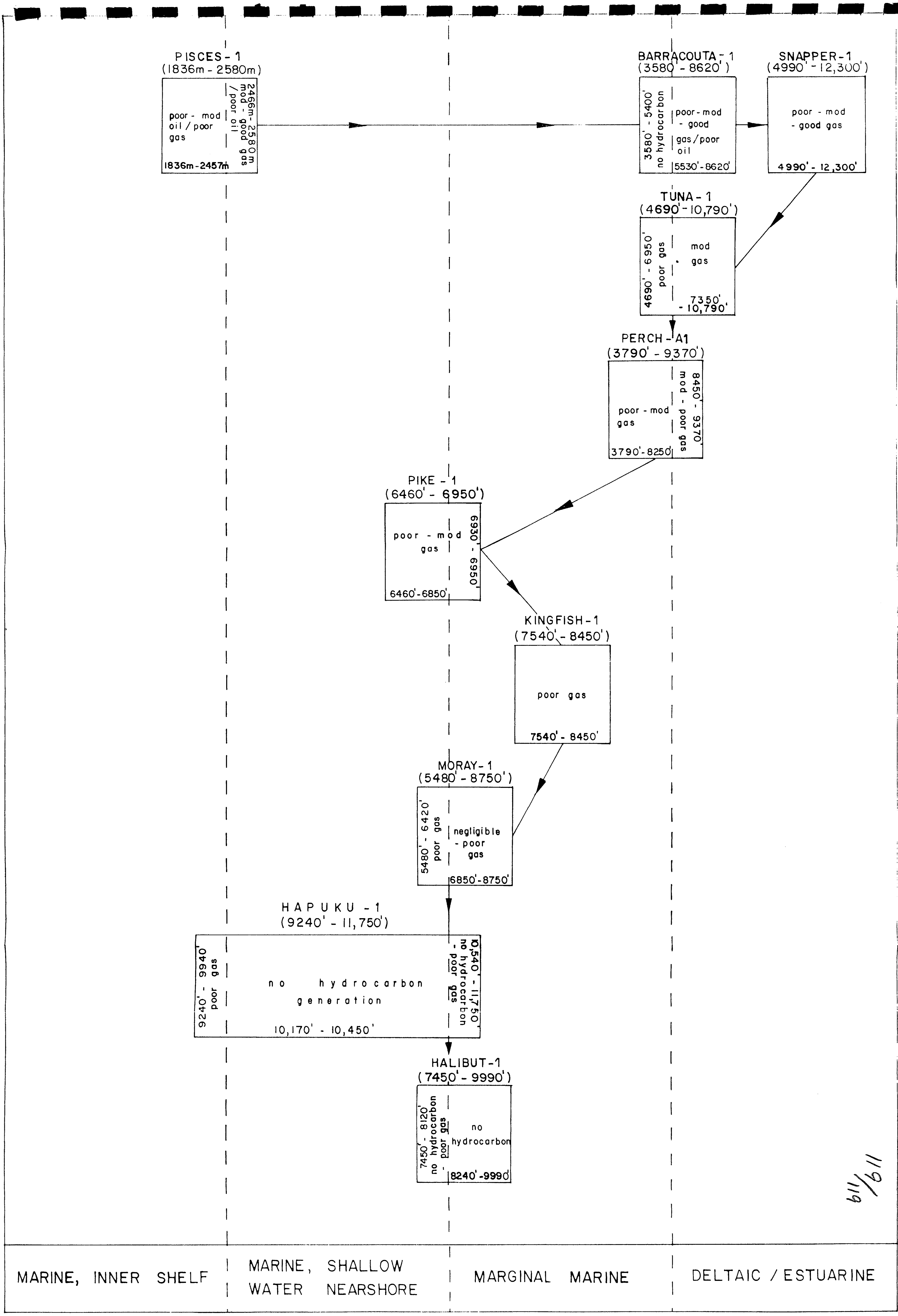


POSTULATED TREND OF WELL SECTIONS, BASED ON HYDROCARBON GENERATING POTENTIAL



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