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WCR VOL 2A

TUNA-4

W868

ESSO EXPLORATION AND PRODUCTION
AUSTRALIA INC.

190 pages
12 encl

WELL COMPLETION REPORT
TUNA-4
VOLUME II (A)
INTERPRETATIVE DATA

GIPPSLAND BASIN
VICTORIA

ESSO AUSTRALIA LIMITED

Compiled by: G.H.RODER APRIL.1985

WELL COMPLETION REPORT

VOLUME 2(A)

(Interpretative Data)

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VOLUME 2(B)

(2294f)

GEOLOGICAL AND GEOPHYSICAL ANALYSIS

SUMMARY WELL PROGNOSIS

FORMATION/HORIZON	DEPTH (mKB) PRE-DRILL	POST-DRILL
Gippsland Limestone	121	81
Lakes Entrance Formation	1081	1100
Gurnard Fm (M-1.1)	1376	1370
M-1.2 Reservoir (Top of Coarse Clastics)	1388	1375.5
Base Tuna and Flounder Channel	1556	1558.5
Mid Palaeocene Marker	2021	2016.5
Top C units	2911	3062
TD	3021	3321

INTRODUCTION

Tuna-4 was spudded on May 18, 1984, and plugged and abandoned as a deep pool discovery well on August 31, 1984. The well was designed to confirm a commercial accumulation of oil in the Top of Latrobe M-1 reservoir on the western extremity of the Tuna Field. In addition, Tuna-4 was to test the hydrocarbon potential of the deeper, intra-Latrobe L and T reservoirs, which contain hydrocarbons in the main Tuna structure. The well was programmed to drill beyond the 'T' to a total depth of some 3000m subsea so as to test the deep 'C' units which had given hydrocarbon shows during the Tuna Field drilling. In the event the well was deepened through a zone of continued shows to a final T.D. of 3300m SS. The success of the well lay in the confirmation of a commercial accumulation of oil in the M-1 reservoir, and the new discovery of oil accumulations in the intra-Latrobe 'R' and 'S' reservoirs. Table 1 is a list of Tuna-4 unit tops.

DRILLING HISTORY

The Tuna Field was discovered in 1968 with the drilling of the Tuna-1 wildcat well (T.D. -3630.5m). Tuna-2 (T.D. -2759.5m) and Tuna-3 (T.D. -2813.5m) to the west and east of Tuna-1 respectively were drilled in 1968 and 1969 to confirm and delineate the field. All three wells intersected hydrocarbon zones in the M-1.2 and T-1 reservoirs. Tuna-3 also intersected oil in the M-2, which as a hydrocarbon reservoir, is confined to the east of the field. Development drilling from the 18 conductor Tuna 'A' platform, commenced in October 1978, and completed in January 1982, proved further hydrocarbon reservoirs in the L, T-0.5 and T-2 units central to the main part of the field.

Batfish-1 was drilled off the southern flank of the Tuna Field in 1970, near the crest of an intra-Latrobe closure on the low side of a down to the south growth fault (the "Batfish Fault"). The well encountered uneconomic accumulations of gas in the Paleocene section ('L' units).

Kahawai-1 was drilled in 1982 on the north western edge of the Tuna M-1.2 reservoir to assess the hydrocarbon potential of inter-channel erosional high on westerly dipping M and L intra-Latrobe units. The closure lies between the Tuna-Flounder and Marlin channels, and was interpreted to be sealed by the channel fill shales and units of the Flounder Formation. The well intersected the Tuna M-1.2 hydrocarbon accummulation as expected, but no hydrocarbon shows were encountered in the primary target beneath the Eocene channel. The channel was filled with a clean sandstone rather than the predicted shale, and therefore did not provide a seal to the underlying sediments.

Tuna-4 was drilled May to August, 1984, to the west of the NW-SE trending West Tuna Fault. The well was sited as a pilot for the potential West Tuna development, with the aim of delineating for development the M-1.2 oil in the good quality M-1.2.1 sands on the western flank of the field, away from the poor quality M-1.2.2/ 1.2.3 sands in which the oil leg occurs crestally. The secondary objective of the well was to assess the potential of the intra-Latrobe section between the West Tuna and Batfish Faults. The well proved the existence of an 11.5m M-1.2 oil leg in good sands, and discovered new oil reservoirs in the intra-Latrobe R and S units.

STRUCTURE

At the top of "Coarse Clastics" level (Enclosure 1) the main Tuna Field is a northeast to southwest trending anticline with four way dip closure, formed in response to regional deformation during the late Eocene to early Oligocene time. This structure is broadly mirrored in the intra-Latrobe, beneath the Tuna-Flounder channel base unconformity, by the Mid Palaeocene Marker and L and T horizons.

Above the base of the Tuna-Flounder channel, the Tuna Field structure extends across West Tuna as the relatively gently dipping western flank, undisturbed by any major faults at this level. Below the channel, the West Tuna intra-Latrobe sediments of Late Cretaceous and Palaeocene age dip south-westerly in a plunging anticlinal nose abutting the downthrown southern side of the West Tuna Fault. This anticlinal nose is the flank of the main Tuna Field anticline west of the fault. Closure in the intra-Latrobe relies on seal against this major fault. The flank of the structure extends south and east towards Batfish-1 where it is disrupted by the down to the south "Batfish Fault" which sub-parallels the West Tuna Fault.

Between the West Tuna and Batfish Faults and parallel to their trends, an antithetic down to the north fault cuts the northwestern flank of the anticlinal structure. Tuna-4 intersected this minor fault at approximately -2300m SS, close to the base of the T-1 section.

Based on seismic interpretation this basic "faulted anticlinal flank" structure continues at depth to at least the base of the T.lilliei level ('R' reservoir), which is about -2500m SS in Tuna-4. Below that however, into the N.senectus and C.triplex (probably approximate T.apoxyexinus equivalent) zones, the current seismic does not allow reliable structural interpretation. The 'S' units and below are assumed to be more or less conformably overlain by the 'R', 'L' and 'T' units.

STRATIGRAPHY

For the comparison of West Tuna with the main Tuna Field area, stratigraphic, environmental and reservoir descriptions are given for each of the stratigraphic intervals intersected in Tuna-4.

M-1 RESERVOIR

In the Tuna Field the M-1.2 reservoir consists of four conformable units interpreted to have been deposited during P. asperopolus zonule time. These are, from the uppermost down, the M-1.2.1, M-1.2.2 and M-1.2.3, overlying the M-1.2.4. They form the Top of Latrobe "Coarse Clastics" common to most other Gippsland Basin fields, unconformably overlain by the marine M-1.1 Gurnard Formation.

The four M-1.2 units constitute the uppermost (Unit 3) of three sets of channel fill sequences in the Tuna-Flounder Channel. The lower two sets (Units 1 and 2), each of which is separated by an unconformity, occur to the southwest of Tuna-1, and are recognised in Tuna-1, Tuna-2 and Batfish-1, but are not seen in the central and northeastern Tuna field area, nor at Kahawai-1 nor Tuna-4. Units 1 and 2 are non-reservoir shales, silts and grits, interpreted to be deposited during Upper L. balmei to M. diversus zonule time.

In the central development area of the Tuna Field, the M-1.2.4 unit is interpreted to have been deposited as an offshore shale facies, with interspersed minor submarine fan sediments (sandier sequences). In the M-1.2.3 this grades through a more regularly interbedded upward coarsening interval of sands/silts and shales, interpreted to represent an offshore to lower shoreface transition. In the lower M-1.2.2 this typically becomes a broadly upward coarsening marine sand interpreted as shoreface facies, grading upward to a blocky foreshore marine to proximal delta marine sand in the M-1.2.1. The M-1.2.1 sand sequence is characteristically broken at or just below its mid section by a shale, which may coincide with a minor but abrupt seaward change in coastal onlap, depositing an offshore or lower shoreface facies sediment.

In Tuna-4 the good quality of the M-1.2 reservoir sands was as expected, although the units were intersected at a structurally higher position than anticipated (top of the M-1.2 12.5m high). This gives a gross gas column of 24.5m, and laterally extends the oil column further to the south-west than interpreted pre-Tuna-4. Average porosity of the M-1 units is 23%, average water saturation of the oil zone is 17%.

In the west Tuna area, as seen in Tuna-4, the M-1.2.1 (including the minor shale interval) is as seen in the main part of the field. The M-1.2.2, 1.2.3 and 1.2.4 however are represented by a sand pile of some 150m thickness to the base of the Tuna-Flounder Channel. For the large part only very minor shales (less than 2m thick) interrupt this sequence, with the exception of a 20m shale in the lower half of the M-1.2.4. This constancy of sandy sedimentation is interpreted to represent more landward deposition than that in the central Tuna Field area, and has resulted from the stacking of beach and barrier sands with deltaic channel sand input. The minor shales in the upper part of the sequence may then be taken as delta fringe deposits. The 20m shale toward the base of the M-1.2.4 overlies 10m of silty sand, over what is interpreted to be a poorly sorted fine gritty sandstone. These sediments are interpreted to represent channel base, possibly delta margin, deposition which is more extensive (and of lower shoreface to offshore facies) in other parts of the Tuna field area.

Overlying the M-1.2 in Tuna-4 is the glauconitic marine shale of the Gurnard Formation. The sharp boundary between the two, representing an unconformity, was caused by a relative sea level rise at the top of the M-1.2.1 interval.

L RESERVOIRS

In the central Tuna Field the L units comprise five significant reservoirs deposited during the L. balmei zonule time. They are the L-95/100, L-110, L-150/160, L-1.3 and L-350/400. These sediments lie beneath the base of the Tuna-Flounder Channel, above and below the Mid Palaeocene seismic marker horizon in the intra-Latrobe (Enclosure 2).

The upper L units (L-95/100, L-110 and L-150/160) in the main Tuna Field are interpreted to be stacked point bar and crevasse splay sandstones/silts interbedded with delta plain shales and interdistributary coals. The central unit (L-1.3) which occurs immediately below the 'Mid Palaeocene Marker' (MPM) is the largest of the L reservoirs and is interpreted to be a beach-barrier bar complex deposited during a cycle of local marine transgression/regression.

The lower part of this sequence grades into silty and shaly marine sediments with only thin sandstone lenses. The lower L units (L-350/400) are more massive sands, interpreted to have been deposited in a braided stream environment.

The L depositional units are interpreted to be present across West Tuna (Table 1). The upper L units, above the MPM (the L-95/100, L-110 and L-150/160 equivalents) were intersected in Tuna-4 between 1931m KB (base of the upper L. balmei zone) and 2016m KB (Top of MPM). The sandstone units are of the order of 5m-10m thick, interspersed with similar thickness shales, and the sequence is interpreted to have been deposited in a similar deltaic environment to that of the main Tuna area described above for this sequence.

The L-1.3 unit equivalent was intersected in Tuna-4 between 2037m KB and 2078m KB, and was deposited in the West Tuna area as a clean beach or barrier bar sand overlying an upward coarsening silt/shale of shoreface or offshore affinities. Minor sands are interbedded with the shale near the base of the unit (shoreface).

Below the L-1.3 in Tuna-4, correlation of the L-350/400 equivalents is not well defined. A broadly upward coarsening shale to silt to sand between 2078m KB and about 2100m KB (very similar in character in fact to the L-1.3) may represent the L-350, and a section below this (2100m KB to approximately 2136m KB) may represent the L-400 deposition. A facies change is clearly evidenced from the central Tuna field L-350/400 units to west Tuna, where the L-350/400 equivalents are shaly with minor silty sands, interpreted to have been deposited in a lower shoreface to offshore environment similar to the L-1.3. At Tuna-2 the same pattern of shaly L-350/400 deposition is seen as at Tuna-4. The predominantly shaly lithology continues with depth in Tuna-4 below the lower L units to 2180m KB, which marks the uppermost 5m thick sand of (or above) the 'T' section. This interpretation places the L-350/400 in Tuna-4 in the uppermost T. longus zone (based on the highest T. longus recorded in a Tuna-4 SWC at 2089.4m KB). This is also the case at Tuna-2 (uppermost T. longus recorded at 1888.5m KB, in the middle of the interpreted L-400 unit). No hydrocarbons were encountered in the 'L' unit equivalents in Tuna-4.

T RESERVOIR

The intra-Latrobe T units, deposited during T. longus zonule time, can be subdivided in the central Tuna Field on the basis of character and interpreted environment of deposition. The interpretation separates within the 'T-1' an upper point bar and crevasse splay sand/flood plain shale-coal system, from an underlying, sandier, point bar to braided stream/flood plain system. Further subdivision, into the T-0.5 (0.5.1/0.5.2), T-1 (T-1.1 to 1.4 and T-1.5 to 1.7) and T-2 reservoirs has been made, although a fieldwide correlation within the subdivisions is difficult due to the discontinuous nature of the sands. The T-1 contains the major intra-Latrobe oil accumulation in the central Tuna Field.

The T-1 subdivision based on sand unit thickness and character is not clear in Tuna-4. Broadly, character which typifies deltaic stream sedimentation is recognised in the Tuna-4 T section, but subdivisions are tenuous. As a preliminary correlation (Table 1), sands seen above the T-0.5 in Tuna-2 (and elsewhere, eg. Tuna-1) can be correlated with sands in Tuna-4 between 2180m KB and 2222m KB (blocky character, gentle upward fining pattern in the upper sands: between 2180m-2186m KB, and 2196m-2222m KB) interpreted to be the cleaner sands of channel to point bar deposition. This places the top of the T-0.5 in Tuna-4 at 2222m KB, at the top of a predominantly shaly section of interpreted deltaic to delta fringe or delta front deposition, down to the base of the T sequence at 2349m KB (a similar thickness T section to that in Tuna-1 and Tuna-2). Sands within this interval are mostly less than 5m thick, and are interpreted to represent point bars or crevasse splay deposition. No hydrocarbons were encountered in the 'T' unit equivalents in Tuna-4.

R RESERVOIRS

Hydrocarbon shows were encountered within the newly named 'R' units below 2388m KB. This interval, although now believed to have been penetrated in Batfish-1 and five earlier Tuna wells, had not previously been found to contain hydrocarbons, and pre-Tuna-4 did not carry a reservoir designation. The R units, deposited during the T. lilliei zonule time, are interpreted to have been deposited in a fluvial to deltaic environment, in which sands were deposited as channel and point bar sediments interbedded with overbank, interdistributary and delta fringe shales and silts. Minor upward coarsening sequences in the sands may indicate prograding sand bank deposition.

Pressure data from Tuna-4 indicate two separate oil systems within the R, separated by a 15m shale seal (Table 1). Coring, logging and pressure data established two main stacked gross oil columns of approximately 57.5m (top Upper R to top Lower R) and 45.5m (top Lower R to top of base seal). Based on log analysis (Appendix 3), the average net to gross ratios of the two systems is 28%, the average porosity of the reservoir sands is 18%, and the Sw is 45% for the Upper R, and 58% for the Lower R. The two reservoirs are not however separable according to their depositional environment nor net to gross sand contents. The pattern of fluvio-deltaic sedimentation continues with depth down to the top of the underlying dolerite intrusion between 2694m KB and 2734m KB in Tuna-4.

T.lilliei units ('R' equivalents) beneath the basal T-1 beds and above the C. triplex zone had, prior to Tuna-4, been penetrated by Tuna-1, 2, 3, A-2 and A-18, and Batfish-1. As a preliminary correlation the 40m section of shale/silt below the postulated T-1 section in Tuna-4 (i.e. below 2349m KB; probably the T-1.7 to T-2 equivalent) may be correlated with very similar shaly sections in Tuna-1, 2, 3, A-2 and A-18. Below this shaly section, direct correlation of individual lensing and channel truncated units may not be possible, but the character of the overall sedimentation package of the relatively sandy 'R' section is certainly similar in these wells.

Correlation of the Tuna-4 'R' units with Batfish-1 is more difficult, as the units penetrated in Batfish at the 'R' level consist of thicker shales and less sand than elsewhere, and contain some marked upward coarsening sands. These Batfish units must be regarded as representing a shift of depositional environment from the fluvio-deltaic environment of the 'R' interpreted for the Tuna wells, to swampy lagoonal facies deposition (to estuarine) with tidal channel deposits.

S RESERVOIRS

The S reservoirs, deposited during N. senectus zonule time, were intersected in Tuna-4 between 2652m KB and 3062 m KB.

Logging, coring and pressure data suggest a number of separate hydrocarbon systems within this interval. Based on preliminary log analysis, porosities of these reservoir sands vary between 12% and 18% (commonly 13%) and Sw varies from 35% to 65%.

The upper part of the S units is interpreted to consist of channel and point bar sands and minor interdistributary or overbank shales and silts. In the lower section (below approximately 2830m KB) thicker shale units are more common. The shales are 5-15m thick, and up to 45m thick near the base of the S (2950m KB-2995m KB). The nature of these sediments suggests a delta fringe to flood plain environment of deposition, a pattern of sedimentation which was begun in the T. apoxyexinus zone below the S units.

Equivalents of the 'S' units are interpreted to have been previously penetrated in Tuna-1, 2, 3, A-2 and A-18, and Batfish-1. Although unit for unit correlation of the 'S' across the Tuna Field is tenuous, and, indeed, probably not possible, the N. senectus section in each of these wells is 100-400m thick, has the same overall character of a sandier section with thin shales in its upper part, over a shalier section with thin sands, and has the same internal geometry of units. As with the 'R' correlation, the 'S' is difficult to correlate in Batfish-1. The Batfish section consists of thicker shales throughout, more characteristic of the lower 'S' in other wells (especially Tuna-1, 2 and 4), and similar comments to those made above for the 'R' relating to depositional environment shift might be made for the 'S'.

C UNIT EQUIVALENTS

Beneath the S reservoirs, from 3062 mKB to TD (3321 mKB) the sediments are interpreted to have been deposited during T.apoxyexinus zonule time, which is believed to probably be equivalent to the C.triplex zone (i.e. 'C' units) penetrated in Tuna-1 below 2652m, but not intersected by Tuna-2 nor Batfish-1.

Tuna-4 encountered scattered hydrocarbon shows in tight and non-net sections throughout this interval.

Below the S, part of core 12 of Tuna-4 (3274m-3283m KB: in the 'C' units) is interpreted to be of a marginal marine shale, based on the presence in the core of dinoflagellates and achritarchs, and the bioturbation of the sediment. This conforms well with the sequence of lower floodplain to delta fringe deposition as interpreted from the log character of the deeper sediments, with a marginal marine influence on estuarine/tidal channel sedimentation, gradually becoming more fluvio-deltaic landward deposition up the sequence.

HYDROCARBONS

Tuna-4 intersected a gross gas column in the M-1.2 'Coarse Clastics' reservoir of 24.5m over a thin oil column of 11.5m, in good quality M-1.2.1, M-1.2.2/1.2.3 reservoir sands. Based on log and core data the M-1.2 gas-oil contact in Tuna-4 is at 1400 mKB (-1379 mSS), and the oil-water contact is at 1411.5 mKB (-1390.5 mSS). No further hydrocarbons were encountered beneath the M-1.2 OWC to the base of the Tuna-Flounder channel.

No hydrocarbons were encountered beneath the Tuna-Flounder channel in the equivalent of the L and T units above and below the Mid Palaeocene Marker.

Tuna-4 intersected a gross oil column in the upper R reservoir of 43m from the top of the reservoir sand at 2465.5 mkB to the top of the base seal at 2508.5 mkB. The lower R reservoir in Tuna-4 has a gross oil column of 45.5 m from the top of the reservoir sand immediately below the intra-R seal to the base seal at 2568.5 mkB. Oil-water contacts were not intersected above nor below the intra-R seal.

The S reservoir interval spans a gross hydrocarbon bearing column of some 400m, consisting of a number of hydrocarbon reservoir sands separated by shale seals. No clearly defined gas-oil nor oil-water contacts were intersected over the interval.

The Tuna-4 RFT pressure data from the R reservoir (Fig. 2) provides oil water contact depth interpretations for both the Upper and Lower R. A water gradient interpretation of 1.44 psi/m, derived from data from the overlying and underlying formations, is shown in Figure 2. This water gradient interpretation provides an oil water contact for the Upper 'R' of 2537.5 mkB (-2516.5mSS), and for the Lower 'R' of 2570mkB (-2549mSS).

The Tuna-4 RFT pressure data from the S-reservoirs (Fig. 3) illustrates the complexity of this reservoir system. The data points on the plot progressively step out into further overpressured regimes with depth, and correlation of any grouping of data on Figure 3 is tenuous. No oil-water contacts can be clearly established.

GEOPHYSICAL ANALYSIS

The mapping of the Tuna structure was carried out using 1976 and 1980 seismic data with a line spacing of 0.5 km or less. The data has been reprocessed except for lines G76A-2015, 16, 17 and 18, and all lines migrated. All of the Tuna exploration and development wells as well as Kahawai-1, Batfish-1 and Morwong-1 were used for control.

The horizons mapped pre-drill include:

Top Latrobe Group (Gurnard formation)
Top "Coarse Clastics"
Base of Tuna-Flounder Channel
Mid Palaeocene Marker
T. lilliei

Depth conversion to the Top Latrobe was carried out using hand smoothed VNMO data taken from the 1976 data. The Top of Latrobe Group Gurnard Formation came in 6m high to prediction. This 0.5% error was corrected by adjusting the VNMO conversion factor map.

The Top of Coarse Clastics came in 13.5m high to prediction. The Gurnard isopach map was adjusted accordingly, and a revised Coarse Clastics map generated.

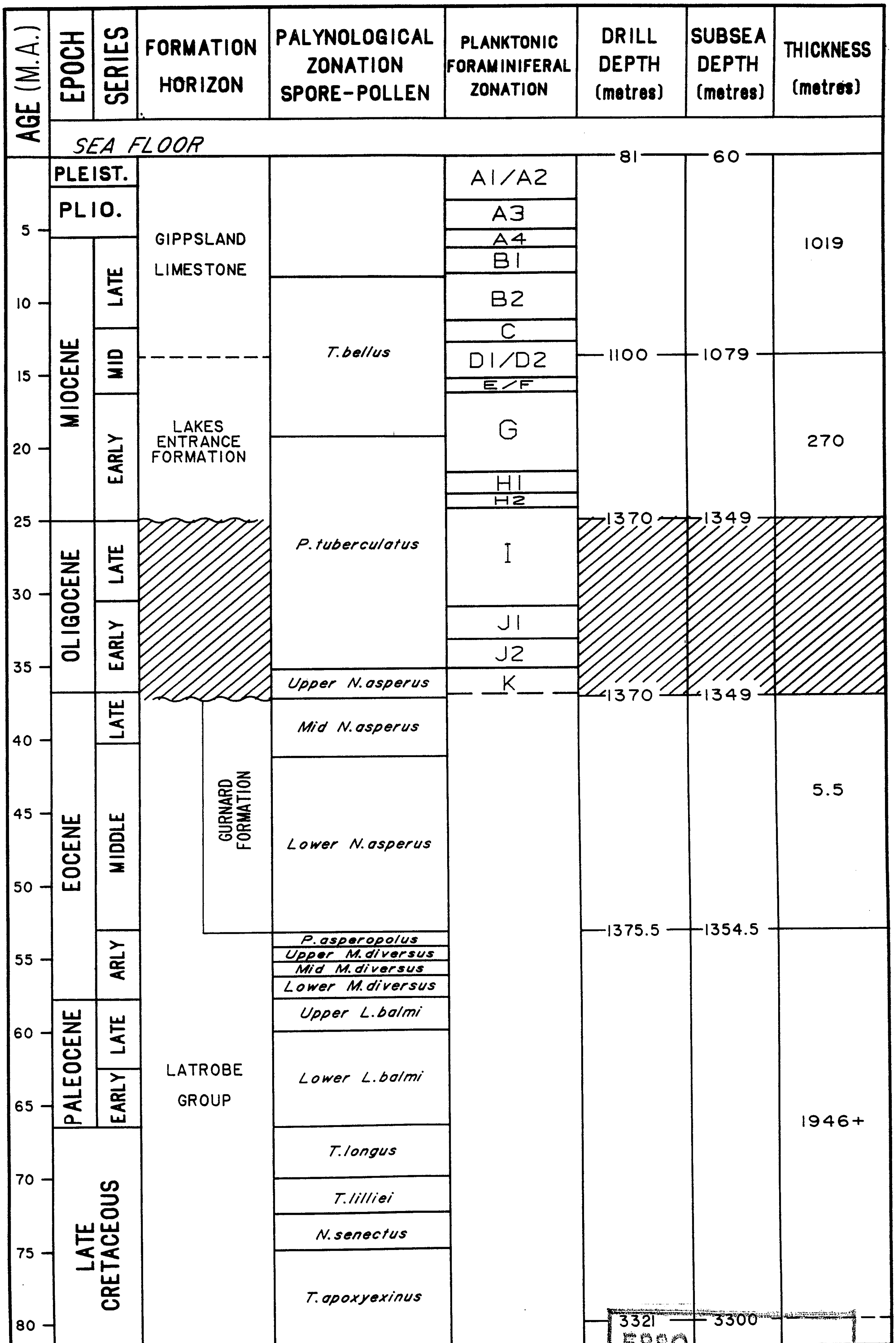
Pre-drill it was interpreted that there would be 12m of net sand within the expected 12m oil column of the M-1 reservoir.

Depth conversion to the base of Tuna-Flounder channel and Mid Palaeocene Marker was achieved by isopaching down from Top Latrobe. Interval velocities between the horizons were smoothed and tied to the wells. The Base of the Tuna-Flounder Channel came in 2.5m low to prediction, and the Mid Palaeocene Marker 4.5m high to prediction. In both cases, errors were due to slight inaccuracies of the interval velocities used.

The post-drill Top of R-Reservoir map was generated by taking a constant isopach of 79m and adding it to the pre-drill *T. lilliei* depth map.

FIGURES

TUNA-4
STRATIGRAPHIC TABLE



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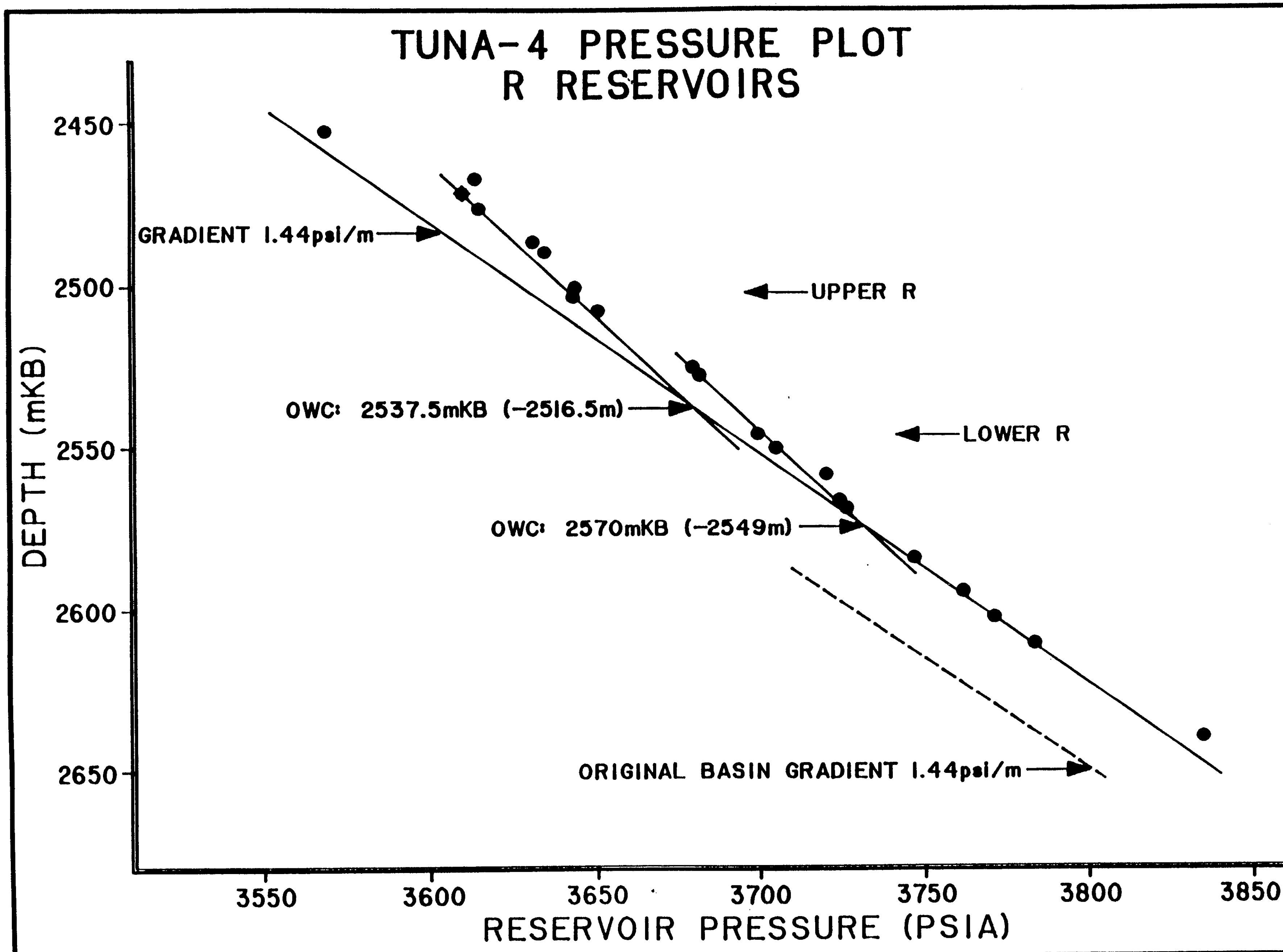
DWG. 2245/OP/10

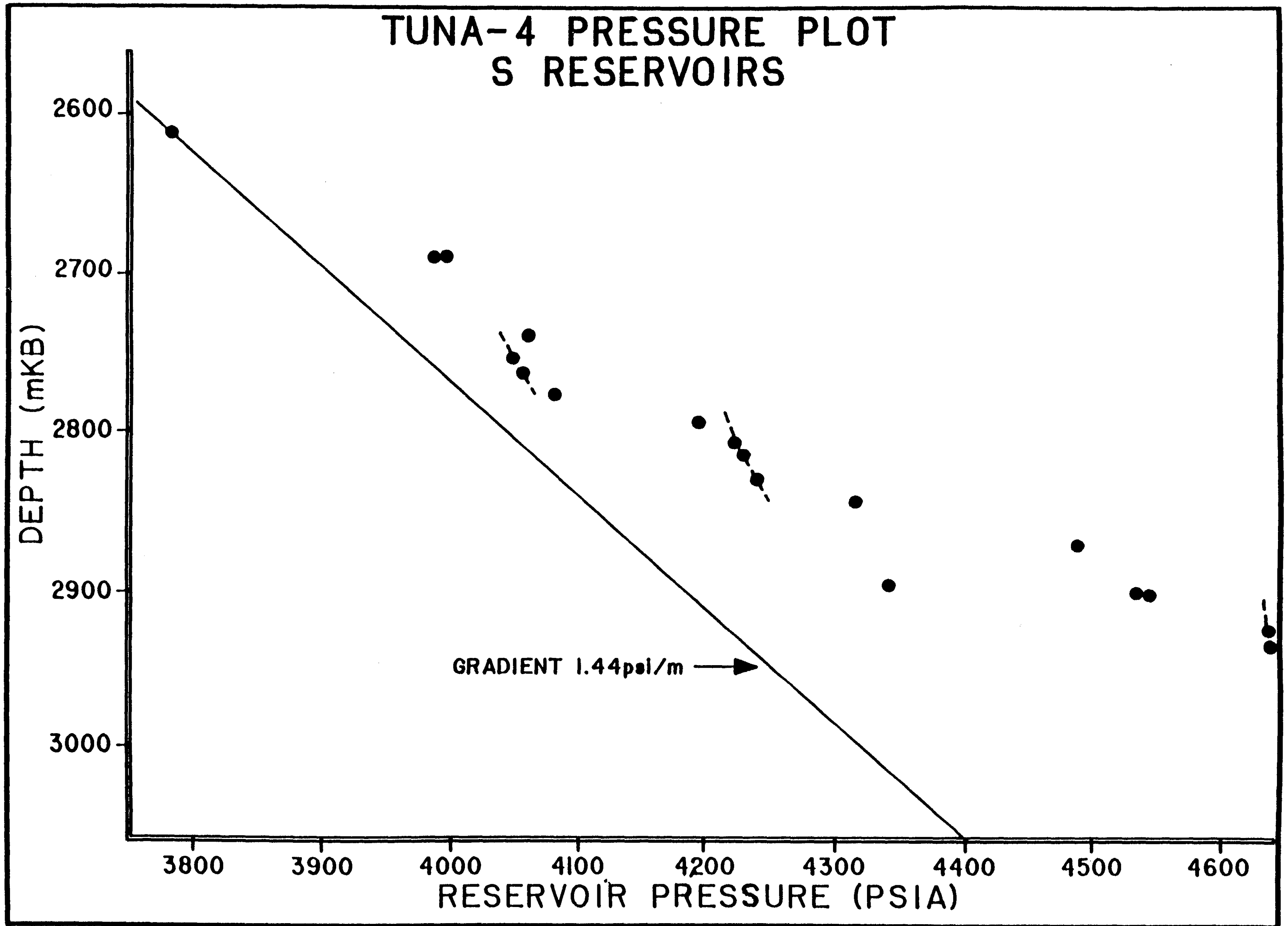
FIG. 1



TUNA-4.R.RES 4-85

FIG. 2

1320/V/1475-11/84



TUNA-4.S.RES 4-85

FIG. 3

1320/ /1474-11/84

ENCLOSURES

PE902470

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BASIN =	GIPPSLAND
PERMIT =	VIC/L4
TYPE =	WELL
SUBTYPE =	CROSS_SECTION
DESCRIPTION =	Geological Cross Section A-A' (enclosure from WCR vol.2) for Tuna-4
REMARKS =	
DATE_CREATED =	30/04/85
DATE_RECEIVED =	14/06/85
W_NO =	W868
WELL_NAME =	Tuna-4
CONTRACTOR =	ESSO
CLIENT_OP_CO =	ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

PE902471

This is an enclosure indicator page.
The enclosure PE902471 is enclosed within the container PE902468 at this location in this document.

The enclosure PE902471 has the following characteristics:

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BASIN =	GIPPSLAND
PERMIT =	VIC/L4
TYPE =	SEISMIC
SUBTYPE =	HRZN_CNTR_MAP
DESCRIPTION =	Structure Map Top of Coarse Clastics, Most Likely Case (enclosure from WCR) for Tuna-4
REMARKS =	
DATE_CREATED =	31/08/84
DATE_RECEIVED =	14/06/85
W_NO =	W868
WELL_NAME =	Tuna-4
CONTRACTOR =	ESSO
CLIENT_OP_CO =	ESSO

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PERMIT =	VIC/L4
TYPE =	SEISMIC
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DESCRIPTION =	Structure Map Mid Palaeocene Marker (enclosure from WCR) for Tuna-4
REMARKS =	
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DATE_RECEIVED =	14/06/85
W_NO =	W868
WELL_NAME =	Tuna-4
CONTRACTOR =	ESSO
CLIENT_OP_CO =	ESSO

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SUBTYPE = HRZN_CNTR_MAP
DESCRIPTION = Structure Map Top of R reservoir T lilliei (enclosure from WCR) for Tuna-4
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CONTRACTOR = ESSO
CLIENT_OP_CO = ESSO

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BASIN = GIPPSLAND
PERMIT = VIC/L4
TYPE = WELL
SUBTYPE = MUD_LOG
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DATE_RECEIVED = 14/06/85
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WELL_NAME = Tuna-4
CONTRACTOR = CORE LABORATORIES
CLIENT_OP_CO = ESSO

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DATE_RECEIVED = 14/06/85
W_NO = W868
WELL_NAME = TUNA-4
CONTRACTOR =
CLIENT_OP_CO = ESSO AUSTRALIA LIMITED

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APPENDIX 1

APPENDIX

MICROPALAEONTOLOGICAL REPORT, TUNA-4, GIPPSLAND BASIN

by

J.P. Rexilius

Esso Australia Ltd.

Palaeontological Report, 1984/29

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1232L

INTERPRETATIVE DATA

INTRODUCTION

Seventeen sidewall core samples and eleven samples of core (four from core 1 and seven from core 12) were examined for their foraminiferal content in Tuna-4 from 1360.1m to 3280.42m. All core and sidewall core samples from the Latrobe Group were barren of foraminifera with the exception of SWC 60 at 1375.5m which contained a sparse agglutinated foraminiferal assemblage and SWC 45 at 1522.1m which contained rare Bathysiphon sp.A.

Depth Discrepancy : log vs sample depths

Core analysis of core 1 (1380 - 1389m) indicate that there is a substantial mismatch (3.9m) with well log response at the corresponding depth interval. On the basis of log character core 1 equates with the interval 1383.9 - 1392.9m.

A discrepancy of approximately .9m was also detected between sidewall core sample lithologies and corresponding log character across the condensed glauconitic section at the top of the Latrobe Group (see Table overleaf). Sidewall core depths appear to be approximately .9m too deep when correlated with the bulk density, neutron porosity and PEF log. For example the pyritic-rich sidewall core sample at 1374.9m (SWC 61) equates with the density spike and PEF spike at 1374.0m. Likewise SWC 59 at 1376.0m was age-dated as lower N. asperus (A. diktyoplokus dinoflagellate Zone) by Macphail (1984) yet on the basis of log character this sample occurs within the Flounder Formation which is known to be P. asperopolus or older in age. The top of the Flounder Formation in Tuna-4 is selected at 1375.5m on the basis of base of caving as indicated by the caliper log. The sharp density break at 1374.5m (base of pyritic horizon) does not represent the base of the Mid Eocene intra-Latrobe marine glauconitic/pyritic sandstone unit. SWC 59 at 1376.0m has a corrected depth of 1375.1m when correlated with well log response.

SAMPLE TYPE	SAMPLE DEPTH (mKB)	ADJUSTED DEPTH *	LITHOLOGY #	UNIT
SWC 65	1370.0	1369.1	recrystallized Ls	Lakes Entrance Fm.
Log break at 1370.0m				
SWC 64	1371.3	1370.4	oxidized greensand	Top of Latrobe
SWC 63	1372.8	1371.9	glauconitic sandstone	Greensand
Log break at 1372.7m				
SWC 62	1374.0	1373.1	micaceous siltstone	intra-Latrobe
SWC 61	1374.9	1374.0	pyritic, glauconitic siltstone	glauconitic/
SWC 60	1375.5	1374.6	slightly glauconitic f.g. sandstone	pyritic sandstone
SWC 59	1376.0	1375.1	slightly glauconitic sandstone	& siltstone
Log break at 1375.5m				
Core 1	1381.90	1385.80		
Core 1	1382.80	1386.70		Flounder
Core 1	1383.50	1387.40		Formation
Core 1	1384.68	1388.58		

lithology based on washed residue.

* adjusted to match logs

Tables 1 and 2 provide a summary (Basic and Interpretative) of the palaeontological analysis in Tuna-4. A summary of the biostratigraphic breakdown of the stratigraphic units in the well is given below.

AGE	UNIT	ZONE	DEPTH (mKB)
Early Miocene	Lakes Entrance	F	1360.1 - 1365.1
Early Miocene	Formation	G or F	1367.1 - 1369.5
-		Indeterm.	1370.0
Log break at 1370.0m (Mid Miocene Marker)			
-	Top of Latrobe	Indeterm.	1371.3
* Late Eocene	greensand	Middle N. asperus	1372.8
Log break at 1375.5m (40 Ma)			
* Middle Eocene	intra-Latrobe glauconitic and pyritic sandstone, siltstone	Lower N. asperus	1374.0 - 1376.0
Log break at 1375.5m (49.5 Ma)			
* Early Eocene	Flounder Formation	P. asperopolus	1381.90 - 1560.5
Log break at 1559.0m			

* Age based on palynology (Macphail, 1984)

GEOLOGICAL COMMENTS

The *P. asperopolus* Flounder Formation channel fill in Tuna-4 (1375.5 - 1559.0m) consists predominantly of upper shoreface sands. Sidewall core samples from this sandy interval have yielded mainly spore/pollen assemblages and only rare dinoflagellates (Macphail, 1984). A marine shale unit near the base of the Flounder Formation (1516 - 1532m) has yielded common dinoflagellates (Macphail, 1984). Lithological and palaeontological evidence indicate a deeper and more marine environment of deposition of the *P. asperopolus* Flounder Formation channel fill in the Flounder wells than for Tuna-4.

The Flounder Formation is disconformably overlain by an intra-Latrobe glauconitic and pyritic sandstone-siltstone unit. The unit has been age-dated as lower *N. asperus*, with sidewall core samples at 1374.9, 1375.5 and 1376.0m being assigned to the *A. diktyoplokus* dinoflagellate Zone (Macphail, 1984). The sidewall core sample at 1375.5m contains a sparse agglutinated benthonic foraminiferal assemblage which unfortunately is of no stratigraphic or environmental value.

The intra-Latrobe glauconitic and pyritic sandstone-siltstone unit is disconformably overlain by the top of Latrobe greensand. Palynological evidence supports a time break between sidewall core samples at 1374.9m (*A. diktyoplokus* dinoflagellate Zone - lower part of *N. asperus* spore/pollen Zone) and 1372.8m (Middle *N. asperus* Zone). A subtle density and sonic log break at 1372.7m has been selected as the disconformity surface between the two units. Evidence from other wells in the Gippsland Basin indicates that the 40 Ma type-1 unconformity of Vail *et al.* (1977) equates with the base of the Middle *N. asperus* Zone.

The top of Latrobe greensand is disconformably overlain by the Lakes Entrance Formation. The hiatus between the two units spans the Oligocene and the lower part of the Early Miocene (i.e. approximately 20 my). The disconformity at

1370m probably equates with the Mid Miocene Marker. Most samples from the base of the Lakes Entrance Formation in Tuna-4 consist of planktonic foraminiferal ooze and are interpreted to have been deposited in a bathyal palaeoenvironment.

BIOSTRATIGRAPHY

The Tertiary biostratigraphy in Tuna-4 is based on the Gippsland Basin planktonic foraminiferal zonal scheme of Taylor (in prep.).

Indeterminate Interval: 3275.45 - 3280.42m (core 12)

The interval is barren of calcareous microfossils and agglutinated benthonic foraminifera. Macphail (1984) assigned the interval to the *T. apoxyexinus* spore/pollen Zone and noted an associated dinoflagellate assemblage indicative of a marine environment.

Indeterminate Interval: 1522.1 - 1531.0m

Two sidewall core samples (1522.1 & 1531.0m) from a shale near the base of the Flounder Formation (1516 - 1532m) were checked for their foraminiferal content and found to be barren of calcareous microfossils. The samples contained common dinoflagellates and are assignable to the *P. asperopolus* spore/pollen Zone (Macphail, 1984). The sidewall core sample at 1522.1m contains rare specimens of the large, fine grained agglutinated foraminiferal species, *Bathysiphon* sp. A.

Indeterminate Interval: 1381.90 - 1384.68m (core 1)

Four samples of core 1 (1381.90, 1382.80, 1383.50 and 1384.68m), representing the upper part of the Flounder Formation in Tuna-4, were checked for their foraminiferal content and found to be barren. The interval is *P. asperopolus* in age (Macphail, 1984).

Indeterminate Interval: 1374.0 - 1376.0m

Only one sample of the intra-Latrobe glauconitic and pyritic sandstone/siltstone unit (SWC at 1375.5m) yielded a foraminiferal assemblage. The assemblage consists of the following agglutinated foraminiferal species : *Bathysiphon* spp., *Bolivinopsis cubensis*, *Cyclammina rotundata* and *Cyclammina* sp. The assemblage is not age diagnostic. Macphail (1984) assigned the interval to the lower *N. asperus* spore/pollen Zone.

Indeterminate Interval: 1371.3 - 1372.8m

All samples of the top of Latrobe greensand in Tuna-4 are barren of foraminifera. Palynological evidence indicates that the SWC at 1372.8m is Middle N. asperus in age (Macphail, 1984).

Indeterminate Interval: 1370.0m

The lowermost sample of Lakes Entrance Formation in Tuna-4 (SWC at 1370.0m) contains a severely recrystallized planktonic foraminiferal assemblage which is not age diagnostic. Macphail (1984) assigned the sample to the P. tuberculatus spore/pollen Zone.

Zones G or F : 1367.1 - 1369.5m

The uphole entry of Globigerinoides trilobus at 1369.5m defines the base of Zone G in Tuna-4. The common occurrence of Globorotalia miozea miozea within the interval indicates a position high in Zone G. Although the Zone F indicator species Globigerinoides sicanus is absent in the interval it is quite possible that the assemblage is Zone F in age. Evidence from other wells in the Gippsland Basin has shown that the species makes a patchy first appearance (Rexilius, 1983). The use of Globigerinoides sicanus as a defining event in the Gippsland Basin has limitations. When the species is present without its descendant Praeorbulina glomerosa a definitive Zone F assignment is indicated. It is now clear however that a Zone G assemblage in the Gippsland Basin (presence Globigerinoides trilobus without G. sicanus) may in many cases be Zone F in age. The problem can be resolved by recognition of the Mid Miocene Marker on the sonic log. The Mid Miocene Marker has been shown to occur within Zone F in the Gippsland Basin (Rexilius, 1983). In Tuna-4 it is likely that the top of the Latrobe Group equates with the Mid Miocene Marker.

Zone F : 1360.1 - 1365.1

The rare occurrence of Globigerinoides sicanus at 1365.1m defines the base of definite Zone F in the well. The species however was not found in samples above this level.

REFERENCES

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VAIL, P.R., MITCHUM, R.M. & THOMPSON, S., 1977. Global cycles of relative changes of sea level. In: PAYTON, C.E., (Editor), Seismic Stratigraphy - Applications to Hydrocarbon Exploration. Am. Assoc. Pet. Geol., Mem., 26: 83-97.

MICROPALEONTOLOGICAL DATA SHEET

BASIN: GIPPSLAND　　　ELEVATION: KB: +21.0m GL: -60.0m

WELL NAME: TUNA-4　　　TOTAL DEPTH: 3321.0m KB

AGE		FORAM. ZONULES	HIGHEST DATA Preferred Depth	Rtg	Alternate Depth	Rtg	Two Way Time	LOWEST DATA Preferred Depth	Rtg	Alternate Depth	Rtg	Two Way Time
PLEISTOCENE		A_1										
		A_2										
PLIOCENE		A_3										
		A_4										
		B_1										
MIOCENE	LATE	B_2										
		C										
	MIDDLE	D_1										
		D_2										
		E_1										
		E_2										
	EARLY	F	1360.1	2				1365.1	1			
		G										
		H_1										
OLIGOCENE	LATE	H_2										
		I_1										
		I_2										
	EARLY	J_1										
		J_2										
EOCENE		K										
		Pre-K										

COMMENTS: Sidewall cores 1367.1 - 1369.5m inclusive are assignable to Zones F or G.

CONFIDENCE RATING:

- 0: SWC or Core - Complete assemblage (very high confidence).
- 1: SWC or Core - Almost complete assemblage (high confidence).
- 2: SWC or Core - Close to zonule change but able to interpret (low confidence).
- 3: Cuttings - Complete assemblage (low confidence).
- 4: Cuttings - Incomplete assemblage, next to uninterpretable or SWC with depth suspicion (very low confidence).

NOTE: If an entry is given a 3 or 4 confidence rating, an alternative depth with a better confidence rating should be entered, if possible. If a sample cannot be assigned to one particular zone, then no entry should be made, unless a range of zones is given where the highest possible limit will appear in one zone and the lowest possible limit in another.

DATA RECORDED BY: J.P. Rexilius　　DATE: 26/06/84

DATA REVISED BY: J.P. Rexilius　　DATE: 1/12/84

TABLE 1

SUMMARY OF PALAEONTOLOGICAL ANALYSIS, TUNA-4, GIPPSLAND BASIN
INTERPRETATIVE DATA

NATURE OF SAMPLE	DEPTH (mKB)	PLANKTONIC FORAMINIFERAL YIELD	PRESERVATION	PLANKTONIC FORAMINIFERAL DIVERSITY	ZONE	AGE	COMMENTS
SWC 72	1360.1	High	Moderate	Moderate	F	Early Miocene	
SWC 71	1362.6	High	Moderate	Moderate	F	Early Miocene	
SWC 70	1365.1	High	Good	Moderate	F	Early Miocene	
SWC 69	1367.1	High	Moderate	Moderate/Low	For G	Early Miocene	
SWC 68	1368.0	High	Moderate	Moderate	For G	Early Miocene	
SWC 67	1369.0	High	Moderate	Moderate/Low	For G	Early Miocene	
SWC 66	1369.5	High	Very poor	Low	For G	Early Miocene	
SWC 65	1370.0	High	Very poor	Very low	Indeterm.	-	
SWC 64	1371.3	Barren	-	-	-	-	
SWC 63	1372.8	Barren	-	-	-	-	
SWC 62	1374.0	Barren	-	-	-	-	
SWC 61	1374.9	Barren	-	-	-	-	
SWC 60	1375.5	Barren	-	-	-	-	Agglutinated forams only
SWC 59	1376.0	Barren	-	-	-	-	
Core 1	1381.90	Barren	-	-	-	-	
Core 1	1382.80	Barren	-	-	-	-	
Core 1	1383.50	Barren	-	-	-	-	
Core 1	1384.68	Barren	-	-	-	-	
SWC 45	1522.1	Barren	-	-	-	-	Rare Bathysiphon sp. A
SWC 44	1531.0	Barren	-	-	-	-	
Core 12	3275.45	Barren	-	-	-	-	
Core 12	3277.88	Barren	-	-	-	-	
Core 12	3278.20	Barren	-	-	-	-	
Core 12	3278.42	Barren	-	-	-	-	
Core 12	3279.30	Barren	-	-	-	-	
Core 12	3277.80	Barren	-	-	-	-	
Core 12	3280.42	Barren	-	-	-	-	
SWC 5	3281.0	Barren	-	-	-	-	

BASIC DATA

TABLE 2: Foraminiferal Data, Tuna-4

RANGE CHART: Tertiary Foraminifera

TABLE 2

SUMMARY OF PALAEONTOLOGICAL ANALYSIS, TUNA-4, GIPPSLAND BASIN

BASIC DATA

NATURE OF SAMPLE	DEPTH (mKB)	PLANKTONIC FORAMINIFERAL YIELD	PRESERVATION	PLANKTONIC FORAMINIFERAL DIVERSITY
SWC 72	1360.1	High	Moderate	Moderate
SWC 71	1362.6	High	Moderate	Moderate
SWC 70	1365.1	High	Good	Moderate
SWC 69	1367.1	High	Moderate	Moderate/Low
SWC 68	1368.0	High	Moderate	Moderate
SWC 67	1369.0	High	Moderate	Moderate/Low
SWC 66	1369.5	High	Very poor	Low
SWC 65	1370.0	High	Very poor	Very low
SWC 64	1371.3	Barren	-	-
SWC 63	1372.8	Barren	-	-
SWC 62	1374.0	Barren	-	-
SWC 61	1374.9	Barren	-	-
SWC 60	1375.5	Barren	-	-
SWC 59	1376.0	Barren	-	-
Core 1	1381.90	Barren	-	-
Core 1	1382.80	Barren	-	-
Core 1	1383.50	Barren	-	-
Core 1	1384.68	Barren	-	-
SWC 45	1522.1	Barren	-	-
SWC 44	1531.0	Barren	-	-
Core 12	3275.45	Barren	-	-
Core 12	3277.88	Barren	-	-
Core 12	3278.20	Barren	-	-
Core 12	3278.42	Barren	-	-
Core 12	3279.30	Barren	-	-
Core 12	3277.80	Barren	-	-
Core 12	3280.42	Barren	-	-
SWC 5	3281.0	Barren	-	-

FOSSIL TYPE: FORAMINIFERA

Well Name TUNA-4 Basin GIPPSLAND Sheet No. 1 of 1

FOSSIL NAMES / DEPTHS	1360.1	1362.6	1365.1	1367.1	1368.0	1369.0	1369.5	1370.0	1371.3	1372.8	1374.0	1374.9	1375.5	1376.0	1381.90	1382.80	1383.50	1384.68	3275.45	3277.88	3278.20	3278.42	3279.30	3279.80	3280.42	1522.10	1531.0
SAMPLE TYPE OR NO. *	S	S	S	S	S	S	S	S	S	S	S	S	S	S	C	C	C	C	C	C	C	C	C	C	C	S	S
PLANKTONIC FORAMINIFERA																											
Globigerina woodi woodi	Common	Common	Abundant	Few	Common	Common	Few																				
Globigerina praebulloides	Rare	Few	Few	Rare	Few	Few																					
Globorotalia miozea miozea	Common	Few	Few	Few	Common	Common																					
Globorotalia praescitula	Common	Common	Common	Common	Common	Common	Rare																				
Globoquadrina advena	Rare		Rare																								
Globigerinoides trilobus	Few	Rare	Few		Few	Few	Rare																				
juvenile planktonics	Abundant			Abundant		Abundant																					
Globoquadrina dehiscens s.s.		Few			Rare																						
Globigerinoides sicanus			Rare																								
Globigerina woodi connecta				Rare	Rare																						
indeterminate planktonics							Abundant	Abundant																			
indeterminate globigerinids							Common																				
BENTHONIC FORAMINIFERA (Latrobe Group)																											
Bathysiphon spp.													Rare														
Bolivinopsis cubensis													Rare														
Cyclammina rotundata													Rare														
Cyclammina sp. 1													Rare														
Bathysiphon sp. 1																										Rare	

* C=CORE S=SIDEWALL CORE T=CUTTINGS J=JUNK BASKET

--- Rare — Few ▬ Common ■ Abundant

PALAEO.CHART-2
DWG.1107/OP/287

APPENDIX 2

APPENDIX 2

PALYNOLOGICAL ANALYSIS OF TUNA-4, GIPPSLAND BASIN,

by

M.K. Macphail

ESSO
INTERPRETIVE
DATA

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INTERPRETATIVE DATA

INTRODUCTION

SUMMARY TABLE

GEOLOGICAL COMMENTS

DISCUSSION OF AGE ZONES

TABLE-1: INTERPRETATIVE DATA

TABLE-2: ANOMALOUS AND UNUSUAL OCCURRENCES OF SPORE POLLEN

PALYNOLOGY DATA SHEET

INTRODUCTION

One hundred and seven sidewall cores and twenty conventional cores were processed and examined for spore-pollen and dinoflagellates. Recovery was fair and preservation and diversity in the Late Cretaceous section unusually good. The well contains the only closely sampled interval of Santonian *T. apoxyexinus* Zone recorded to date in the Gippsland Basin.

Lithological and log analyses reveal discrepancies in depth of approximately 0.9m for SWC's 59-64 and 3.9m for Core 1. Drillers depths are used throughout this report including the summary below of lithological units and palynological zones from the base of the Lakes Entrance Formation to the total depth of the well. Occurrences of spore-pollen and dinoflagellate species are tabulated in the accompanying range chart. Anomalous and unusual occurrences of taxa are listed in Table 2.

SUMMARY

AGE	UNIT	ZONE	DEPTH (mKB)
Early Miocene	Lakes Entrance Fm.	*P. tuberculatus*	1362.6 - 1370.0
	Log break at 1370.0m		
Late Eocene	Top of Latrobe greensand	Middle *N. asperus*	1372.8
	Log break at 1375.5m		
Middle Eocene	Intra-Latrobe glauconitic pyritic sandstones and shales sandstone, siltstone	Lower *N. asperus*	1374.0 - 1376.0
	Log break at 1375.5m		
Early Eocene	Flounder Formation	*P. asperopolus*	1381.90 - 1560.5
	Log break at 1559.0m		
Early Eocene		Lower *M. diversus*	1574.3 - 1581.8
Paleocene		Upper *L. balmei*	1626.1 - 1816.0
Paleocene		Lower *L. balmei*	1917.9 - 2025.8
Maastrichtian		Upper *T. longus*	2067.2 - 2299.5
Campanian		Lower *T. longus*	2336.1
Campanian		*T. lilliei*	2412.0 - 2659.5
Campanian		*N. senectus*	2815.0 - 3043.0
Santonian		*T. apoxyexinus*	3070.0 - 3309.5

TD 3326 m

GEOLOGICAL COMMENTS

1. The Tuna-4 well contains a continuous sequence of zones from the Santonian T. apoxyexinus Zone up to the Early Eocene Lower M. diversus Zone. These are unconformably overlain by the P. asperopolus Zone Flounder Formation channel fill. These in turn are disconformably overlain by a condensed sequence of Middle and Late Eocene greensands, the uppermost of which forms the Top of Latrobe.

2. The occurrence of Lower M. diversus sediments at Tuna-4 reflects its marginal position with respect to the Flounder Channel. Since the channel is cut into Upper M. diversus Zone sediments at Kahawai-1, into Lower M. diversus Zone sediments at Tuna-3 and Morwong-1, and into Paleocene L. balmei Zone sediments at Tuna-2, deep incision during the channel-cutting event(s) was confined to a relatively narrow approximately north north-west to south south-east trending belt. Although channel cutting in this area was occurring during or at the end of the Early Eocene Upper M. diversus Zone, earlier episodes of channel cutting remain a possibility.

3. The Flounder Formation primarily consists of upper shore face sands with a 2.5m thick unit of shales between 1382.5 and 1385m representing coastal plain sediments (V. Rahmanian pers. comm.). Samples of these shales contain extremely rich, well-preserved palynofloras including large diameter pollen types which are unlikely to have been transported far from the plant source(s). Dinoflagellates are rare to absent in this section but become common in a marine shale unit between 1516 to 1532m near the base of the channel. The low diversity of dinoflagellates is consisted with relatively shallow water depths. The sidewall core at 1559.5m (a coal) contains a good L. balmei Zone palynoflora. Mislabelling of this sample is more likely than reworking.

4. The glauconitic sandstone-siltstone unit overlying the Flounder Formation is a condensed sequence of Middle N. asperus Zone and Lower N. asperus Zone [A. diktyoplokus Zone] sediments. The palynological data support the existence of a disconformity at 1372.7m [log depth].

5. A mixed P. asperopolus/Lower N. asperus Zone palynoflora occurs in the lowermost sample [SWC 59, 1376.0m] containing glauconite. Rexilius (1984) has commented on the mismatch between sidewall core sample lithologies and corresponding log character in this interval, and has assigned SWC 59 an adjusted (log) depth of 1375.1m, i.e. above the log break defining the top the Flounder Formation. Whilst the abundance of the Lower N. asperus Zone dinoflagellate, Areosphaeridium diktyopolokus supports this thesis, it is possible that both the Lower N. asperus Zone palynomorphs and glauconite have been translocated down into the top of the Flounder Formation by bioturbation.

6. Marginal marine environments are represented by samples at 1626.1, 1772.2 and (?) 1816.0m [Upper L. balmei Zone]; 2089.4m [I. druggii, Upper T. longus Zone]; (?) 2852.5, 3026.0 and 3043.0m [N. senectus Zone]; 3100, 3218.5 and 3275.78 to 3281.0m [T. apoxyexinus Zone]. Freshwater (?) lacustrine environments are represented at 3302.5 and 3309.5m [T. apoxyexinus Zone].

7. The "mid Palaeocene" seismic marker (predicted depth 2000m) occurs within the Lower L. balmei Zone but close to the Paleocene/Late Cretaceous boundary (2067.2m). This indicates either relatively low rates of sedimentation or a hiatus in deposition during the Danian.

BIOSTRATIGRAPHY

The zone boundaries have been established using the criteria of Stover and Evans (1973), Stover & Partridge (1973), subsequent proprietry revisions including Macphail (1983), and palynological data from the Morum-1 well, Otway Basin.

Zonation of the Late Cretaceous section has necessitated the erection of several new 'ms' species and the transfer of other existing 'ms' species to formally described taxa. These are:

Tricolpites labrum	- previously cited as Tricolpites sabulous var. B.
Proteacidites ademonosus	- previously cited as Proteacidites adenanthoides (late K var.)
Nothofagidites waipawaensis	- previously cited as N. cf senectus, N. cf endurus
N. kaitangata	- previously cited as N. endurus

Tricolporites apoxyexinus Zone 3070 to 3309.5m

The occurence of the ms species Tricolpites sabulosus var. A indicates the sample at 3309.5m is T. apoxyexinus Zone in age. This species is morphologically related to T. gillii Cookson and T. sabulosus Dettman & Playford, both of which first appear in the T. apoxyexinus Zone in Morum-1. Although T. sabulosus var. A differs from T. labrum in that thickened exinous ridges do not occur along the colpi, the range of variation in the latter species suggests T. sabulosus var. A may prove to be an end member of T. labrum. The sample includes the freshwater alga Pediastrum, a freshwater Deflandrea sp. and an acritarch. This acritarch and a spore which first appears in the T. apoxyexinus Zone, Latrobosporites amplus, occur at 3302.5m.

The first appearances of Tricolpites gillii and T. labrum are at 3278.42m. This sample occurs within a section (3275.78 - 3281.0m) characterized by extensively pyritized spore-pollen and containing infrequent occurences of dinoflagellates belonging to at least 3 taxa: (i) Deflandrea sp. nov. distinguished by numerous small elliptical-circular foveae in the periphragm; (ii) a species resembling Areosphaeridium diktyoplokus in that it possesses perforate platform-like tips on discrete processes but of unknown archeopyle organization; and (iii) a species with numerous ? interconnected processes provisionally referred to the genus Adnatosphaeridium. Pyritized palynofloras lacking dinoflagellates occur at 3100.0m and 3218.5m.

The upper boundary of the zone is placed at 3070.0m, the highest sample containing T. gillii but lacking Nothofagidites.

Nothofagidites senectus Zone: 2815.0 to 3043.0m

The base of the zone is defined by the first appearance of Nothofagidites senectus at 3043.0m. Nothofagidites waipawaensis appears at 3043.3m and both species together with N. kaitangata become increasingly common above 2992.0m. Otherwise the palynofloras are similar to those of the T. apoxyexinus Zone in that the dominant taxa are gymnosperm pollen (particularly Podocarpidites, Phyllocladidites and Podosporites microsaccatus) and Tricolpites spp. (particularly T. labrum). Proteacidites ademonosus appears within the zone, at 2992.0m. Spore-pollen at 2825.0, 3026.0 and 3043.0m are weakly pyritized. The upper boundary is placed at 2815.0m, the highest Nothofagidites - dominated palynoflora lacking T. lilliei Zone indicators.

Tricolporites lilliei Zone: 2412.0 to 2659.5m

The base of the zone is defined by simultaneous first occurrences of Gambierina rudata (sensu stricto), Triporopollenites sectilis and Nothofagidites flemingii at 2659.5m. This sample contains a pollen morphologically identical to Tricolporites lilliei except that its ornamentation is verrucate, not apiculate-baculate. A very poorly preserved specimen possibly referrable to T. lilliei occurs at 2768.5m but the first certain occurrence of this species is at 2608.5m. Other species first appearing within the zone are Gambierina edwardsii (2659.5m), Proteacidites palisadus (2634.0m) Tetracolporites verrucosus (2522.0m), Stereisporties regium (2485.16m), Tetradopollis securus, Proteacidites retiformis and Ornamentifera sentosa (2462.0m), and Periporopollenites polyoratus (2464.5m).

The upper boundary is provisionally placed at 2412.0m, a coal containing Triporopollenites sectilis and frequent to common Nothofagidites.

Lower T. longus Zone: 2336.1m

One sample is provisionally assigned to this zone, based on the first appearance of numerous specimens of Gambierina (approx. equal to numbers of Nothofagidites pollen) and a possible specimen of Tricolpites longus. Otherwise the palynoflora resembles those of the T. lilliei Zone.

Upper T. longus Zone: 2067.2 to 2299.5m

The lower boundary is defined by the first occurrence of Stereisporties punctatus at 2299.5m. Gambierina is common and Nothofagidites rare in this sample, which also contained the highest specimen of Tricolpites longus is at 2264.3m. The upper boundary is picked at 2067.2m, the highest sample containing S. punctatus with frequent to common Gambierina. However two species not previously recorded above the T. longus Zone occur at 2025.8m (Tricolporites lilliei) and 2019.7m (Tricolpites renmarkensis). The sample at 2067.2m contains low numbers of dinoflagellates, mostly derived by caving (?) e.g. Glaphyracysta sp., Apectodinium homomorpha and Palaeocystodinium golzowense but including one possible specimen of Isabelidinium druggii.

Lower Lygistepollenites balmei Zone: 1917.9 to 2025.8m

The lower boundary is provisionally placed at 2025.8m, the lowest sample containing general L. balmei Zone indicators except for one grain of Tricolpites lilliei. The presence of Proteacidites clinei in this and the samples at 2011.1 and 2014.7m show the interval is close to the L. balmei/T. longus Zone boundary. Dinoflagellates are absent except for rare, caved Apectodinium homomorpha.

The upper boundary is provisionally placed at 1917.9m, a sample containing the typically Lower L. balmei Zone indicators, Tetracolporites verrucosus and Proteacidites gemmatus and the typical Upper L. balmei Zone indicator Verrucosisporites kopukuensis. An alternative pick is 1985.1m, a sample containing Tetracolporites verrucosus and frequent Lygistepollenites balmei.

Upper Lygistepollenites balmei Zone: 1626.1 to 1816.0m

This interval is characterized by common to abundant Lygistepollenites balmei, Phyllocladidites mawsonii, Podocarpidites spp., Proteacidites spp. and (usually) Gleicheniidites spp. together with species restricted to or ranging no higher than the L. balmei Zone, e.g. Gambierina rudata, G. edwardsii, Australopollis obscurus, and Polycolpites langstonii.

The lower boundary is provisionally placed at 1816.0m, the first sample containing common-abundant L. balmei and Gleicheniidites spp. Species which first appear within this zone include Cyathidites gigantis, (associated with Verrucosisporites kopukuensis) at 1789.0m and Proteacidites incurvatus at 1777.2m. The latter sample contains Tetracolporites verrucosus, the lowest record of Haloragacidites harrisii and Lower-Upper L. balmei Zone dinoflagellate Deflandrea medcalfii.

Cyathidites gigantis, Verrucosisporites kopukuensis, Gambienna spp. and frequent to abundant Lygistepollenites balmei occur at 1737.0m, 1703.0m and 1626.1m, the upper zone boundary.

Lower Malvacipollis diversus Zone: 1574.3 to 1581.8m

Two samples are provisionally assigned to this zone. The lower, at 1581.8m, contains frequent Malvacipollis diversus and Tricolporites spp. but lacks Lygistepollenites balmei. The higher contains Schizocolpus marlinensis, a species which is usually a reliable indicator of the M. diversus Zone and Liliacidites lanceolatus, Tricolporites adelaidensis and T. moultonii, species which are typical of Middle M. diversus or younger palynofloras but which are known to range into the Lower M. diversus Zone.

The samples at 1561.8m and 1562.7m are no older than Lower M. diversus Zone in age but cannot be assigned to any specific zone. A characteristic of these samples and these within the P. asperopolus Zone section is the sporadic occurrence of Late Cretaceous-Paleocene taxa, including in the coal at 1559.5m. This sample contains frequent to common Lygistepollenites balmei, Gambierina rudata and Australopollis obscurus and may be mislabelled.

Proteacidites asperopolus Zone: Approx. 1385.6 to 1560.5m

The base of the zone is provisionally placed at 1560.5m, based on the occurrence of Tricolpites incisus. Proteacidites pachypolus shows this sample is no older than Upper M. diversus Zone in age. The first appearance of Proteacidites asperopolus is at 1531.0m.

Palynofloras within the P. asperopolus Zone are unusually rich with most including species that range no higher than this zone, e.g. Myrtaceidites tenuis, Proteacidites spp., Nothofagidites spp. are frequent to common but always less abundant than Proteacidites spp. and (usually) Haloragacidites harrisii. The very rare P. asperopolus Zone indicator species, Clavastephanocolpites meleous occurs at approx. 1386.5m.

Dinoflagellates occur sporadically throughout the zone, notably Apectodinium parvus [= Wetzeliella longispinosa Wilson] at 1516.6 and 1522.1m. The upper boundary is defined by the last occurrence of Myrtaceidites tenuis with Proteacidites asperapolus in a Proteacidites-dominated palynoflora at approx. 1385.6m.

Lower Nothofagidites asperus Zone: 1374.9 to 1376.0m

Three samples are assigned to this zone on the basis of Nothofagidites falcatus and rare to frequent Areosphaeridium diktyoplokus. The lower most sample includes Gambierina rudata and, less obviously reworked, Myrtaceidites tenuis and Intratriporopollenites notabilis. Occurrences of Proteacidites asperopolus and common Nothofagidites spp. confirm a Lower N. asperus Zone age for this sample. Tricolpites simatus and Rugulatisporites trophus occur at 1375.5m.

The upper boundary is defined by the highest occurrence of Areosphaeridium diktyoplokus. The (undated) sample at 1374.0m is similar but lacks this dinoflagellate.

Middle Nothofagidites asperus Zone: 1372.8m

One sample is assigned to this zone, based on occurrences of species restricted to his zone [Triorites magnificus, Corrudinium corrugatum] and species which range no higher than this zone [Proteacidites pachypolus, P. recavus, Stereisporites punctatus].

Proteacidites tuberculatus Zone: 1362.6 to 1370.0m

Occurrences of Cyatheacidites annulatus and Foveotriletes lacunosus confirm a P. tuberculatus Zone age for the samples at 1369.0 and 1370.0m. F. lacunosus occurs at 1362.6m. The interval is equally characterized by occurrences of the dinoflagellates Protoellipsodinium simplex, Pyxidinopsis pontus and "Dinosphaera" mammilatus.

REFERENCES

REXILIUS, J.P., 1984. Micropalaeontological analysis of Tuna-4, Gippsland Basin, Victoria. Esso Australia Ltd., Palaeontological Report 1984/29.

STOVER, L.E. & EVANS, P.R., 1973. Upper Cretaceous spore-pollen zonation, offshore Gippsland Basin, Australia. Spec. Publ. Geol. Soc. Aust., 4, 55-72.

STOVER, L.E. & PARTRIDGE, A.D., 1973. Tertiary and Late Cretaceous spores and pollen from the Gippsland Basin, Southeastern Australia. Proc. Roy. Soc. Vict., 85, 237-86.

PALYNOLOGY DATA SHEET

BASIN: GIPPSLAND ELEVATION: KB: +21.0m GL: -60.0m

WELL NAME: TUNA-4 TOTAL DEPTH: 3317m

AGE	PALYNOLOGICAL ZONES	HIGHEST DATA Preferred Depth	Rtg	Alternate Depth	Rtg	Two Way Time	LOWEST DATA Preferred Depth	Rtg	Alternate Depth	Rtg	Two Way Time
NEOGENE	*T. pleistocenicus*										
	M. lipsis										
	C. bifurcatus										
	T. bellus										
	P. tuberculatus	1362.6	1				1370.0	0			
PALEOGENE	Upper *N. asperus*										
	Mid *N. asperus*	1372.8	0				1372.8	0			
	Lower *N. asperus*	1374.9	1				1376.0	1			
	P. asperopolus	1381.9	0				1560.5	1	1531.0	0	
	Upper *M. diversus*										
	Mid *M. diversus*										
	Lower *M. diversus*	1574.3	2				1581.8	2			
	Upper *L. balmei*	1626.1	0				1816.0	2	1789.0	0	
	Lower *L. balmei*	1917.9	2	1958.1	1		2025.8	2	2014.7	1	
LATE CRETACEOUS	Upper *T. longus*	2067.2	2	2089.4	0		2299.5	0			
	Lower *T. longus*	2336.1	2				2336.1	2			
	T. lilliei	2412.0	2	2426.0	1		2659.5	1			
	N. senectus	2815.0	1				3043.0	1			
	T. apoxyexinus	3070.0	2	3125.0	1		3309.5	2	3278.7	0	
	C. triplex										
	A. distocarinatus										
EARLY CRET.	*C. paradoxus*										
	C. striatus										
	F. asymmetricus										
	F. wonthaggiensis										
	C. australiensis										
PRE-CRETACEOUS											

COMMENTS: *I. druggii* Zone 2067.2?

T. apoxyexinus Zone marginal marine unit 3275.78 - 3281.0m

T. apoxyexinus Zone freshwater ? lacustrine unit 3302.5 - 3309.

CONFIDENCE RATING:

- 0: SWC or Core, Excellent Confidence, assemblage with zone species of spores, pollen and microplankton.
- 1: SWC or Core, Good Confidence, assemblage with zone species of spores and pollen or microplankton.
- 2: SWC or Core, Poor Confidence, assemblage with non-diagnostic spores, pollen and or microplankton.
- 3: Cuttings, Fair Confidence, assemblage with zone species of either spores and pollen or microplankton, or both.
- 4: Cuttings, No Confidence, assemblage with non-diagnostic spores, pollen and or microplankton.

NOTE: If an entry is given a 3 or 4 confidence rating, an alternative depth with a better confidence rating should be entered, if possible. If a sample cannot be assigned to one particular zone, then no entry should be made, unless a range of zones is given where the highest possible limit will appear in one zone and the lowest possible limit in another.

DATA RECORDED BY: M.K. MACPHAIL DATE: 20/11/84

DATA REVISED BY: DATE:

TABLE 1: SUMMARY OF PALYNOLOGICAL ANALYSIS - TUNA-4

INTERPRETATIVE DATA

SAMPLE NO.	DEPTH (M)	YIELD	DIVERSITY SPORE POLLEN	LITHOLOGY	ZONE	AGE	CONFIDENCE RATING	COMMENTS
SWC 71	1362.6	Good	V. low	Slst., calc	P. tuberculatus	Oligocene-Miocene	1	Proto ellipsodinium simplex
SWC 69	1369.0	Good	V. low	Slst., calc	P. tuberculatus	Oligocene-Miocene	0	P. simplex, P. pontus, C. annulatus, F. lacunosus
SWC 65	1370.0	Fair	Low	Slst., calc	P. tuberculatus	Oligocene-Miocene	0	As above
SWC 64	1371.3	Barren	-	Slst., calc, glau.	-	-	-	-
SWC 63	1372.8	Fair	Fair	Slst., glau.	Middle N. asperus	Late Eocene	0	T. magnificus, P. pachypolus, S. punctatus, C. corrugatum
SWC 62	1374.0	Fair	Low	Slst., glau.	No older than Lower N. asperus	-	-	N. falcatus
SWC 61	1374.9	Low	Low	Slst., glau.	Lower N. asperus	Middle Eocene	1	A.diktyoplokus
SWC 60	1375.5	Good	Fair	Slst., glau.	Lower N. asperus	Middle Eocene	0	A.diktyoplokus, N. falcatus, T. simatus, R. trophus, V. attinatus
SWC 59	1376.0	Good	Good	Ss., glau.	Lower N. asperus	Middle Eocene	1	P. asperopolus, A. diktoplokus (common)
Core	1381.9	Low	Fair	Ss., glau.?	P. asperopolus	Early Eocene	0	P. asperopolus, M. tenuis, S. rotundus
Core	1382.8	V. good	Good	Sh. carb.	P. asperopolus	Early Eocene	0	C. meleosus, I. notabilis, P. ornatus, M. tenuis, P. asperopolus, freq. P. pachypolus
Core	1383.5	V. good	fair	Sh., carb.	P. asperopolus	Early Eocene	0	M. tenuis (common), P. ornatus, P. asperopolus
Core	1384.68	Fair	Low	Sh.	P. asperopolus	Early Eocene	1	P. asperopolus
SWC 58	1387.0	Good	V. good	Slst., carb.	P. asperopolus	Early Eocene	0	M. tenuis, P. asperopolus, I. notabilis, P. recavus, P.rugulatus, T. moultonii
SWC 53	1408.9	Barren	-	Ss.				
SWC 48	1412.6	Barren	-	Ss.				

TABLE 1: SUMMARY OF PALYNOLOGICAL ANALYSIS - TUNA-4
INTERPRETATIVE DATA

SAMPLE NO.	DEPTH (M)	YIELD	DIVERSITY SPORE POLLEN	LITHOLOGY	ZONE	AGE	CONFIDENCE RATING	COMMENTS
SWC 46	1516.6	V. good	Good	Ss., carb.	P. asperopolus	Early Eocene	2	M. tenuis, P. pachypolus
SWC 45	1522.1	V. good	Good	Slst., carb.	P. asperopolus	Early Eocene	0	M. tenuis, P. asperopolus P. ornatus P. tuberculiformis
SWC 44	1531.0	V. good	Good	Slst., Carb.	P. asperopolus	Early Eocene	0	M. tenuis, P. asperopolus I. notabilis
SWC 41	1559.5	Fair	Fair	Coal	Mislabelled sample?	-	-	Lygistepollenites balmei common, G. rudata
SWC 40	1560.5	V. good	Good	Slst.	P. asperopolus	Early Eocene	1	T. incisus, P. pachypolus
SWC 39	1561.8	Good	Good	Slst.	No older than Lower M. diversus		-	S. marlinensis, L. balmei
SWC 38	1562.7	V. good	Low	Coal	No older than Lower M. diversus		-	P. obscurus, P. lapis
SWC 37	1563.5	V. low	V. low	Slst., carb.	Indeterminate			
SWC 36	1574.3	Good	V. good	Slst., carb.	Lower M. diversus	Early Eocene	2	T. moultonii, L. lanceolatus, S. marlinensis, P. grandis common, T. adelaidensis
SWC 35	1581.8	V. low	V. low	Coal	Lower M. diversus	Early Eocene	2	M. diversus freq.
SWC 33	1626.1	V. good	V. good	Slst., carb.	Upper L. balmei	Paleocene	0	C. gigantis, L. balmei (common), G. rudata, V. kopukuensis, D. medcalfii
SWC 32	1646.1	Barren	-	Sslt.				
SWC 30	1703.0	Good	Low	Sslt.	Upper L. balmei	Paleocene	0	C. gigantis, L. balmei (abund.), V. kopukuensis
SWC 29	1709.7	Fair	Good	Slst., carb.	Upper L. balmei	Paleocene	2	L. balmei freq., P. langstonii, G. edwardsii
SWC 28	1737.0	V. good	V. good	Slst.	Upper L. balmei	Paleocene	2	L. balmei common, C. gigantis, V. kopukuensis, P. annularis
SWC 27	1777.2	V. good	V. good	Slst., carb.	Upper L. balmei	Paleocene	1	L. balmei & Gleicheniidites abund., V. kopukuensis

TABLE 1: SUMMARY OF PALYNOLOGICAL ANALYSIS - TUNA-4

INTERPRETATIVE DATA

SAMPLE NO.	DEPTH (M)	YIELD	DIVERSITY SPORE POLLEN	LITHOLOGY	ZONE	AGE	CONFIDENCE RATING	COMMENTS
SWC 26	1789.0	V. good	Fair	Slst., carb.	Upper L. balmei	Paleocene	0	L. balmei abund., C. gigantis, V. kopukuensis
SWC 25	1816.0	Good	Fair	Slst.	Upper L. balmei	Paleocene	2	L. balmei common, Gleichenlidites abund.
SWC 24	1847.0	Good	Low	Coal	L. balmei	Paleocene	-	A. obscurus abundant
SWC 23	1880.1	Fair	V. low	Coal	L. balmei	Paleocene	-	As above
SWC 22	1887.5	Negligible	-	Ss.				
SWC 21	1917.9	Good	Fair	Slst.	Lower L. balmei	Paleocene	2	V. kopukuensis, P. gemmatus, T. verrucosus
SWC 19	1985.1	Fair	Low	Slst.	Lower L. balmei	Paleocene	1	T. verrucosus
SWC 18	2011.1	Good	Fair	Ss.	Lower L. balmei	Paleocene	2	L. balmei, P. clinei, T. gillii
SWC 17	2014.7	Fair	Fair	Ss.	Lower L. balmei	Paleocene	1	L. balmei & P. verrucosus freq., P. clinei
SWC 16	2019.7	Good	Low	Slst.	Lower L. balmei	Paleocene	2	
SWC 15	2025.8	Good	Good	Slst.	Lower L. balmei	Paleocene	2	L. balmei assemblage but includes T. lilliei
SWC 14	2067.2	Good	Fair	Slst.	Upper T. longus	Maastrichtian	2	G. rudata common, T. sectilis, S. punctatus but includes (?caved) Paleocene dinos.
SWC 13	2089.4	Fair	Good	Slst.	Upper T. longus	Maastrichtian	0	G. rudata common, S. punctatus, T. longus, P. reticuloconcavus, P. otwayensis, I. druggii
SWC 12	2125.8	V. Low	V. low	Slst.	Upper T. longus	Maastrichtian	2	Caved Paleocene dinos; G. rudata common
SWC 11	2162.2	Fair	Low	Slst.	Upper T. longus	Maastrichtian	1	G. rudata common, S. punctatus
SWC 10	2193.0	Fair	Good	Slst.	Upper T. longus	Maastrichtian	0	T. longus, S. punctatus, P. amolosexinus

TABLE I: SUMMARY OF PALYNOLOGICAL ANALYSIS - TUNA-4

INTERPRETATIVE DATA

SAMPLE NO.	DEPTH (M)	YIELD	DIVERSITY SPORE POLLEN	LITHOLOGY	ZONE	AGE	CONFIDENCE RATING	COMMENTS
SWC 9	2229.5	Low	Low	Slst.	Indeterminate	Late Cretaceous	-	T. lilliei, P. otwayensis
SWC 8	2264.3	Low	Low	Slst., carb.	Upper T. longus	Maastrichtian	2	G. rudata common, T. longus, T. sectilis
SWC 7	2299.5	Fair	Good	Slst., carb.	Upper T. longus	Maastrichtian	0	S. punctatus, G. rudata common
SWC 6	2336.1	Good	Good	Slst.	Lower T. longus T. lilliei	Late Cretaceous	2	T. lilliei, T. sectilis
SWC 2	2412.0	Low	Low	Coal	T. lilliei	Late Cretaceous	2	Nothofagidites common
SWC 1	2426.0	Low	Low	Ss.	T. lilliei	Late Cretaceous	1	T. lilliei, T. sectilis
SWC 101	2456.0	Low	Fair	[listed as no recovery]	T. lilliei	Late Cretaceous	1	T. lilliei
SWC 100	2464.5	Low	Fair	Slst.	T. lilliei	Late Cretaceous	2	Nothofagidites freq.
SWC 98	2462.0	Good	Good	Coal	T. lilliei	Late Cretaceous	2	G. rudata, C. dumus freq.
SWC 122	2468.0	Good	Good	Slst., carb.	T. lilliei	Late Cretaceous	1	T. lilliei, v. abund. P. microsaccatus
Core	2485.16	Low	Good	-	T. lilliei	Late Cretaceous	1	T. lilliei, S. regium
Core 7	2522	Good	Fair	-	T. lilliei	Late Cretaceous	1	T. lilliei, Nothofagidites
Core 9	2558.42	Fair	Good	-	T. lilliei	Late Cretaceous	0	T. lilliei, G. rudata
SWC 94	2608.5	Good	Fair	Slst.	T. lilliei	Late Cretaceous	0	As above
SWC 92	2634.0	Low	Fair	Slst.	T. lilliei	Late Cretaceous	1	N. flemingii, T. sectilis
SWC 91	2642.0	Low	V. low	Sh.	No older than N. senectus	Late Cretaceous		N. senectus
SWC 89	2659.5	Fair	Fair	Sh., carb.	T. lilliei	Late Cretaceous	1	G. rudata, N. flemingii, T. sectilis

TABLE 1: SUMMARY OF PALYNOLOGICAL ANALYSIS - TUNA-4

INTERPRETATIVE DATA

SAMPLE NO.	DEPTH (M)	YIELD	DIVERSITY SPORE POLLEN	LITHOLOGY	ZONE	AGE	CONFIDENCE RATING	COMMENTS
SWC 85	2681.5	Barren	-	Slst.				
SWC 83	2730.0	Barren	-	Slst.				
SWC 77	2768.5	V. low	Low	Slst., carb.	No older than N. senectus		-	Possible specimen of T. lilliei present
SWC 74	2780.0	Fair	Low	Slst.	Indeterminate			
SWC 73	2790.4	Barren	-	Ss.				
SWC 72	2799.0	Barren	-	Ss.				
SWC 70	2815.0	V. low	Low	Slst.	N. senectus	Late Cretaceous	I	Nothofagidites dominant
Core 10	2822.6	Low	Fair	-	N. senectus	Late Cretaceous	I	N. endurus
SWC 66	2852.5	Low	V. low	Slst.	No older than T. apoxyexinus	Late Cretaceous	I	L. balmei
SWC 63	2875.0	Fair	Fair	Slst.	N. senectus	Late Cretaceous	I	Nothofagidites dominant
SWC 62	2885.0	Low	Low	Sh.	N. senectus	Late Cretaceous	I	N. senectus
SWC 59	2909.5	Fair	Fair	Slst., carb.	N. senectus	Late Cretaceous	I	Nothofagidites abundant
SWC 57	2926.0	Fair	Low	Slst., carb.	N. senectus	Late Cretaceous	I	As above
SWC 55	2940.0	Low	V. low	Ss.	N. senectus	Late Cretaceous	I	N. senectus
SWC 53	2946.0	Low	V. low	Slst., carb.	N. senectus	Late Cretaceous	I	N. senectus, N. endurus
SWC 48	2976.0	Good	Fair	Slst., carb.	N. senectus	Late Cretaceous	I	N. senectus freq.
SWC 118	2992.0	Low	Low	Slst.	N. senectus	Late Cretaceous	I	N. endurus common
SWC 45	3002.0	Barren	-	[listed as no recovery]	-	-	-	-
SWC 117	3010.5	V. low	V. low	Ss., carb.	No older than T. apoxyexinus	Late Cretaceous	-	T. labrum
SWC 116	3019.0	Barren	-	Ss.	-	-	-	-

TABLE 1: SUMMARY OF PALYNOLOGICAL ANALYSIS - TUNA-4

INTERPRETATIVE DATA

SAMPLE NO.	DEPTH (M)	YIELD	DIVERSITY SPORE POLLEN	LITHOLOGY	ZONE	AGE	CONFIDENCE RATING	COMMENTS
SWC 42	3024.0	Low	V. l	Slst., carb.	No older than T. apoxyexinus	Late Cretaceous	-	T. labrum
SWC 115	3026.0	V. low	Low	Slst., carb.	No older than T. apoxyexinus	Late Cretaceous	-	T. labrum
SWC 40	3031.5	Low	Low	Ss.	N. senectus	Late Cretaceous	1	N. senectus, N. waipawaensis, T. labrum frequent
SWC 39	3034.3	Low	Low	Slst., carb.	N. senectus	Late Cretaceous	1	N. waipawaensis
SWC 38	3043.0	Low	Low	Slst., carb.	N. senectus	Late Cretaceous	1	N. senectus
SWC 35	3070.0	Good	Low	Slst., carb.	T. apoxyexinus	Late Cretaceous	2	T. gillii, no older than this zone
SWC 111	3100.0	V. low	V. low	Slst., carb.	Indeterminate	-	-	Pyritized
SWC 29	3125.0	Low	Low	Slst., carb.	T. apoxyexinus	Late Cretaceous	1	L. amplus, T. labrum
SWC 108	3150.0	V. low	V. low	Slst., carb.	T. apoxyexinus	Late Cretaceous	2	T. sabulosus var. A
SWC 23	3169.0	Fair	Low	Slst., carb.	No older than C. triplex		-	P. mawsonii
SWC 21	3179.5	Fair	Fair	Slst., carb.	T. apoxyexinus	Late Cretaceous	1	T. sabulosus Dettman
SWC 105	3207.0	Low	Low	Ss.	T. apoxyexinus	Late Cretaceous	1	T. gillii, T. labrum, L. ohaiensis,
SWC 15	3212.5	V. low	V. low	Ss./Sh.	No older than C. triplex		-	P. mawsonii
SWC 14	3218.5	Fair	Good	Slst., carb.	T. apoxyexinus	Late Cretaceous	1	L. amplus, T. sabulosus var. A, pyritized
SWC 104	3225.0	Fair	Low	Slst., carb.	T. apoxyexinus	Late Cretaceous	2	P. microsaccatus common
SWC 105	3248.0	Barren	-	Slst., carb.	-	-	-	
SWC 9	3256.0	Barren	-	Slst.	-	-	-	
SWC 8	3261.-	Negligible	-	Ss.	-	-	-	
SWC 102	3266.0	Negligible	-	Slst., carb.	-	-	-	

TABLE I: SUMMARY OF PALYNOLOGICAL ANALYSIS - TUNA-4

INTERPRETATIVE DATA

SAMPLE NO.	DEPTH (M)	YIELD	DIVERSITY SPORE POLLEN	LITHOLOGY	ZONE	AGE	CONFIDENCE RATING	COMMENTS
Core 12	3274.87	Negligible	V. low	Sh.	No older than C. triplex	-	-	P. mawsonii
Core 12	3275.45	Low	Low	Sh.	No older than C. triplex	Late Cretaceous	-	P. mawsonii
Core 12	3275.5	Low	Fair	Sh.	T. apoxyexinus	Late Cretaceous	1	T. labrum, T. confessus
Core 12	3275.78	Good	Low	Sh.	T. apoxyexinus	Late Cretaceous	1	Gambierina sp.; T. labrum; cf Adnatosphaeridium; Deflandrea sp nov.; Areosphaeridium sp., pyritized
SWC 6	3277.0	Barren	-	Ss.	-	-	-	
Core 12	3277.5	V. low	V. low	Sh.	Indeterminate	-	-	Pyritized
Core 12	3277.53	V. low	V. low	Sh.	T. apoxyexinus	Late Cretaceous	-	Pyritized, T. sabulosus var. A
Core 12	3277.82	V. low	V. low	Sh.	T. apoxyexinus	Late Cretaceous	1	T. labrum, pyritized
Core 12	3277.88	Low	Fair	Sh.	T. apoxyexinus	Late Cretaceous	1	T. gillii, Deflandrea sp. nov., pyritized
Core 12	3278.10	Fair	Low	Sh.	T. apoxyexinus	Late Cretaceous	1	T. gillii, pyritized
Core 12	3278.42	Fair	Low	Sh.	T. apoxyexinus	Late Cretaceous	2	T. sabulosus var. A; Deflandrea sp. nov., Areosphaeridium sp.; pyritized
Core 12	3278.7	Low	Good	Sh.	T. apoxyexinus	Late Cretaceous	0	T. gillii, T. labrum, T. vergilius; T. confessus; areosphaeridium sp., Deflandrea sp. nov.; pyritized
Core 12	3278.95	V. low	V. low	Sh.	No older than C. triplex		-	P. mawsonii
Core 12	3279.30	V. low	V. low	Sh.	No older than C. triplex		-	P. mawsonii; cf Adnatosphaeridium, pyritized
Core 12	3279.80	V. low	V. low	Sh.	T. apoxyexinus	Late Cretaceous	2	Deflandrea sp. nov., cf Adnatosphaeridium sp., pyritized
Core 12	3280.42	Low	V. low	Sh.	No older than C. triplex		-	P. mawsonii

TABLE 1: SUMMARY OF PALYNOLOGICAL ANALYSIS - TUNA-4

INTERPRETATIVE DATA

SAMPLE NO.	DEPTH (M)	YIELD	DIVERSITY SPORE POLLEN	LITHOLOGY	ZONE	AGE	CONFIDENCE RATING	COMMENTS
SWC 5	3281.0	V. low	V. low	Slst., carb.	T. apoxyexinus	Late Cretaceous	2	Deflandrea sp. nov., cf Adnatosphaeridium sp. pyritized
SWC 4	3286.5	Neglible	-	Ss.	Indeterminate	Late Cretaceous	-	Proteacidites spp.
SWC 3	3294.0	Barren	-	Ss.	-	-	-	
SWC 2	3302.5	Fair	Low	Slst., carb.	T. apoxyexinus	Late Cretaceous	2	L. amplus, acritarchs
SWC 1	3309.5	Low	Low	Ss.	T. apoxyexinus	Late Cretaceous	2	T. sabulosus var. A, P. mawsonii, A. obscurus, Pediastrum, acritarchs

TABLE 2

ANOMALOUS AND UNUSUAL OCCURRENCES OF SPORE-POLLEN TAXA IN TUNA-4

SAMPLE NO.	DEPTH (m)	ZONE	TAXON	COMMENTS
SWC 71	1362.6	P. tuberculatus (1)	Camarozonosporites heskermensis	Rare sp.
SWC 71	1362.6	P. tuberculatus (1)	Foveotriletes lacunosus	Rare sp.
SWC 71	1362.6	P. tuberculatus (1)	Kuylisporites waterbolkii	Uncommon sp.
SWC 67	1369.0	P. tuberculatus (0)	Foveotriletes lacunosus	Rare sp.
SWC 65	1370.0	P. tuberculatus (0)	Foveotriletes lacunosus	Rare sp.
SWC 65	1370.0	P. tuberculatus (0)	Tricolporites paenestriatus	Uncommon in zone
SWC 63	1372.8	Middle N. asperus (0)	Stereisporites punctatus	Near top of range
SWC 63	1372.8	Middle N. asperus (0)	Camarozonosporites cf dumus	? Lycopodium laterale
SWC 62	1374.0	Lower N. asperus (2)	Foveotriletes palaequetrus	Uncommon sp.
SWC 62	1374.0	Lower N. asperus (0)	Polycolpites esobalteus	Near top of range
SWC 61	1374.9	Lower N. asperus (1)	Camarozonosporites cf dumus	As for SWC 63
SWC 60	1375.5	Lower N. asperus (0)	Rugulatisporites trophus	Rare sp.
SWC 60	1375.5	Lower N. asperus (0)	Verrucatosporites attinatus	V. rare sp.
SWC 59	1376.0	Lower N. asperus (1)	Anacolosidites luteoides	V. rare sp.
SWC 59	1376.0	Lower N. asperus (1)	Myrtaceidites tenuis	Reworked ?
SWC 59	1376.0	Lower N. asperus (1)	Intratriporopollenites notabilis	As above
SWC 59	1376.0	Lower N. asperus (1)	Gambierina rudata	Reworked
SWC 59	1376.0	Lower N. asperus (1)	Podosporites erugatus	V. rare sp.
SWC 59	1376.0	Lower N. asperus (1)	Horologinella tricornus	Ms. v. rare dino., with A. diktypolokus

TABLE 2

ANOMALOUS AND UNUSUAL OCCURRENCES OF SPORE-POLLEN TAXA IN TUNA-4

SAMPLE NO.	DEPTH (m)	ZONE	TAXON	COMMENTS
Core 1	1381.9	P. asperopolus (0)	Umbelliferae	Modern taxon
Core 1	1382.8	P. asperopolus (0)	Proteacidites plemmelus	V. rare sp.
Core 1	1382.8	P. asperopolus (0)	Clavastephanocolporites meleosus	V. rare sp.
Core 1	1382.8	P. asperopolus (0)	Cunoniaceae 3-p	Modern taxon
Core 1	1382.8	P. asperopolus (0)	Podocarpidites ostentatus	Ms. sp. ADP
Core 1	1382.8	P. asperopolus (0)	Tricolpites palisadus	Ms. sp. MKM
Core 1	1382.8	P. asperopolus (0)	Cupanieidites reticulatus	Rare sp.
Core 1	1382.8	P. asperopolus (0)	Tricolpites durus	Rare var. of T. phillipsii
SWC 58	1387.0	P. asperopolus (0)	Tricolpites durus	Rare var. of T. phillipsii
SWC 58	1387.0	P. asperopolus (0)	Cupanieidites reticulatus	As for Core 1
SWC 58	1387.0	P. asperopolus (0)	Schizocolpus rarus	Rare sp.
SWC 58	1387.0	P. asperopolus (0)	Periporopollenites vesicus	Rare below N. asperus Zone
SWC 58	1387.0	P. asperopolus (0)	Lygistepollenites balmei	Reworked
SWC 58	1387.0	P. asperopolus (0)	Propylipollis sp. D	Dudgeon 1983
SWC 46	1516.6	(P. asperopolus)	Halagoracidites verrucatoharrisii	Ms. MKM
SWC 46	1516.6	(P. asperopolus)	Proteacidites xestoformis	Rare ms. sp.
SWC 46	1516.6	(P. asperopolus)	"Wetzeliella" longispinosa	Wilson [= A. parvum]
SWC 45	1522.1	P. asperopolus (0)	Gleicheniidites sp.	Apiculate
SWC 45	1522.1	P. asperopolus (0)	"Wetzeliella" longispinosa	As above, abundant

TABLE 2

ANOMALOUS AND UNUSUAL OCCURRENCES OF SPORE-POLLEN TAXA IN TUNA-4

SAMPLE NO.	DEPTH (m)	ZONE	TAXON	COMMENTS
SWC 44	1531.0	P. asperopolus (0)	Erdtmanipollis	V. rare sp.
SWC 44	1531.0	P. asperopolus (0)	Schizocolpus rarus	As above
SWC 44	1531.0	P. asperopolus (0)	Anacolosidites luteoides	As above
SWC 41	1559.5	(P. asperopolus)	Lygistepollenites balmei	Common in coal; with G. rudata, N. endurus A. obscurus and P. verrucosus
SWC 41	1559.5	(P. asperopolus)	Bysmapollis emaciatus	
SWC 40	1560.5	P. asperopolus (0)	Periporopollenites vesicus	
SWC 40	1560.5	P. asperopolus (0)	Basopollis mutabilis	Top of range ?
SWC 40	1560.5	P. asperopolus (0)	Liliacidites sernatus	Ms. sp. Stover
SWC 39	1561.8	(M. diversus)	Liliacidites sernatus	Ms. sp. Stover
SWC 39	1561.8	(M. diversus)	Retistephano colpites nixonii	Rare sp.
SWC 39	1561.8	(M. diversus)	Tetacolporites multistrixus, T. textus	Rare spp.
SWC 39	1561.8	(M. diversus)	Lygistepollenites balmei	Seems in situ
SWC 38	1562.7	(M. diversus)	Periporopollenites vesicus	In coal palynoflora dominated by Podosporites microsaccatus & Laevigatosporites ovatus
SWC 36	1574.3	Lower M. diversus (2)	Proteacidites rugulatus	Very rare below P. asperopolus Zone
SWC 36	1574.3	Lower M. diversus (2)	Retistephanocolpites nixonii	As above
SWC 36	1574.3	Lower M. diversus (2)	Liliacidites lanceolatus	Rare below Middle M. diversus Zone

TABLE 2

ANOMALOUS AND UNUSUAL OCCURRENCES OF SPORE-POLLEN TAXA IN TUNA-4

SAMPLE NO.	DEPTH (m)	ZONE	TAXON	COMMENTS
SWC 33	1626.1	Upper L. balmei (0)	Amosopollis cruciformis	Rare above Lower L. balmei Zone
SWC 33	1626.1	Upper L. balmei (0)	Polycolpites esobalteus	Rare below M. diversus Zone
SWC 33	1626.1	Upper L. balmei (0)	"Wetzeliella" longispinosa	
SWC 29	1709.7	Upper L. balmei (2)	Cunoniaceae 3-p	Earliest record to date
SWC 28	1737.0	Upper L. balmei (0)	Tricolpites gigantis	Ms. sp. MKM
SWC 28	1737.0	Upper L. balmei (0)	Tetracolporites verrucosus	In assemblage with C. gigantis
SWC 28	1737.0	Upper L. balmei (0)	Proteacidites vulgaris	Typically Late Cretaceous sp.
SWC 28	1737.0	Upper L. balmei (0)	Proteacidites spp.	Cf. P. clinei & P. lapis
SWC 27	1777.2	Upper L. balmei (1)	Tetracolporites verrucosus	In assemblage with V. kopukuensis
SWC 27	1777.2	Upper L. balmei (1)	Amosopollis cruciformis	As above
SWC 27	1777.2	Upper L. balmei (1)	Nothofagidites asperus	V. rare in Zone
SWC 27	1777.2	Upper L. balmei (1)	Matonisporites ornamentalis	Uncommon
SWC 27	1847.0	(? Upper L. balmei)	Australopollis obscurus	Dominant of coal palynoflora
SWC 23	1880.1	(? Upper L. balmei)	Australopollis obscurus	Dominant of coal palynoflora
SWC 21	1917.9	Upper L. balmei (2)	Proteacidites gemmatus	In assemblage with V. kopukuensis
SWC 21	1917.9	Upper L. balmei (2)	Tetracolporites verrucosus	As above
SWC 21	1917.9	Upper L. balmei (2)	Crassiretitriletes vanraadshoovenii	Not prev. recorded below M.diversus Zone
SWC 21	1917.9	Lower L. balmei (2)	Peromonolites baculatus	V. rare ms. sp.
SWC 21	1917.9	Lower L. balmei (2)	Phyllocladidites verrucosus	Common. Assembl. includes P. reticulosaccatus
SWC 21	1917.9	Lower L. balmei (2)	Herkosporites elliotii	Frequent in assemblage

TABLE 2

ANOMALOUS AND UNUSUAL OCCURRENCES OF SPORE-POLLEN TAXA IN TUNA-4

SAMPLE NO.	DEPTH (m)	ZONE	TAXON	COMMENTS
SWC 18	2011.1	Lower L. balmei (1)	Proteacidites clinei	Near top of range
SWC 18	2011.1	Lower L. balmei (1)	Proteacidites cf. delicatus	? not prev. recorded in zone
SWC 17	2014.7	Lower L. balmei (2)	Proteacidites clinei	As above
SWC 17	2014.7	Lower L. balmei (2)	Periporopollenites vesicus	Earliest record to date
SWC 16	2019.7	Lower L. balmei (2)	Tricolpites renmarkensis	Late Cretaceous sp.
SWC 15	2025.8	Lower L. balmei (2)	Proteacidites clinei	As above
SWC 15	2025.8	Lower L. balmei (2)	Tricolpites lilliei	Not prev. recorded above T. longus Zone
SWC 15	2025.8	Lower L. balmei (2)	Tricolpites balmei	Ms. sp. MKM
SWC 14	2067.2	Upper T. longus (0)	Tricolpites gigantis	Ms. sp. MKM
SWC 12	2125.8	(Upper T. longus)	Tricolpites renmarkensis	Rare sp.
SWC 10	2193.0	Upper T. longus (0)	Proteacidites aff confragosus	
SWC 7	2299.5	Upper T. longus (0)	Tricolpites labrum	Highest record (with S. punctatus)
SWC 100	2464.5	T. lilliei (2)	Tetracolporites verrucosus	Rare below Upper T. longus Zone
SWC 100	2464.5	T. lilliei (2)	Rugulatisporites mallatus	Rare below Upper T. longus Zone
SWC 100	2464.5	T. lilliei (2)	Periporopollenites polyoratus	Rare below Upper T. longus Zone
SWC 98	2462.0	T. lilliei (2)	Proteacidites retiformis	Rare sp.
SWC 98	2462.0	T. lilliei (2)	Ornamentifera sentosa	Rare sp.
SWC 98	2462.0	T. lilliei (2)	Camarozonosporites dumus	Abundant in assemblage
SWC 122	2468.0	T. lilliei (1)	Tetracolporites verrucosus	As above
SWC 122	2468.0	T. lilliei (1)	Tricolpites vergillus	V. rare ms. sp. ADP

TABLE 2

ANOMALOUS AND UNUSUAL OCCURRENCES OF SPORE-POLLEN TAXA IN TUNA-4

SAMPLE NO.	DEPTH (m)	ZONE	TAXON	COMMENTS
Core 7	2522	T. lilliei (1)	Tetracolporites verrucosus	As above
Core 9	2558.42	T. lilliei (1)	Dilwynites granulatus	Rare below T. longus Zone
Core 9	2558.42	T. lilliei (1)	Gambierina sp. nov.	Punctate
Core 9	2558.42	T. lilliei (1)	Polycolpites aff langstonii	
Core 9	2558.42	T. lilliei (1)	T. apoxyexinus	Ms. sp. ADP
SWC 94	2659.5	T. lilliei (1)	Tricolporites sp.	Verruate but otherwise approx. to T. lilliei
SWC 89	2659.5	T. lilliei (1)	Triporopollenites sp.	Apiculate
Core 10	2822.86	N. senectus (1)	Tricolpites waiparensis	
Core 11	2828.45	N. senectus (1)	Tricolpites labrum	Common in palynoflora
SWC 63	2875.0	N. senectus (1)	Basopollis otwayensis	
SWC 57	2926.0	N. senectus (1)	Gambierina verrucosus	Ms. sp. MKM
SWC 57	2926.0	N. senectus (1)	Nothofagidites cf flemingii	Not prev. recorded below T. lilliei Zone
SWC 118	2992.0	N. senectus (1)	Proteacidites ademonosus	Ms. sp. MKM [= "Late K. var. of P. adenanthoides"]
SWC 115	3026.0	(N. senectus)	Dilwynites granulatus	As above
SWC 40	3031.5	N. senectus (1)	Rugulatisporites mallatus	Rare below T. longus Zone
SWC 38	3043.0	N. senectus (1)	Cyathidites splendens	Not prev. recorded below T. longus Zone
SWC 38	3043.0	N. senectus (1)	Tricolpites sp. nov.	Gemmate-verrucate (?) var. of T. labrum
SWC 29	3125.0	T. apoxyexinus (2)	Basopollis mutabilis	
SWC 14	3218.5	T. apoxyexinus (1)	Rugulatisporites mallatus	As above

TABLE 2

ANOMALOUS AND UNUSUAL OCCURRENCES OF SPORE-POLLEN TAXA IN TUNA-4

SAMPLE NO.	DEPTH (m)	ZONE	TAXON	COMMENTS
Core 12	3275.5	T. apoxyexinus (1)	Proteacidites clinei	Not prev. recorded below T. longus Zone
Core 12	3275.5	T. apoxyexinus (1)	Cyathidites splendens	As above
Core 12	3275.78	T. apoxyexinus (1)	Gambierina sp.	Earliest record to date in Basin
Core 12	3275.78	T. apoxyexinus (1)	Cyatheacidites tectifera	Rare sp.
Core 12	3275.78	T. apoxyexinus (1)	Deflandrea sp. nov.	Highest record of undescribed sp.
Core 12	3277.5	(T. apoxyexinus)	Amosopollis cruciformis	Uncommon sp.
Core 12	3277.88	T. apoxyexinus (1)	Amosopollis cruciformis	Uncommon sp.
Core 12	3278.7	T. apoxyexinus (1)	Basopollis mutabilis	Earliest record
Core 12	3278.7	T. apoxyexinus (1)	Tricolpites vergillus	V. rare ms. sp. ADP
Core 12	3280.42	(T. apoxyexinus)	Basopollis otwayensis	Earliest record
SWC 5	3281.0	T. apoxyexinus (2)	Deflandrea sp. nov.	First appearance
SWC 2	3302.5	T. apoxyexinus (2)	Latrobosporites amplus	First appearance
SWC 2	3309.5	T. apoxyexinus (2)	Pediastrum	Freshwater alga: v. rare in Late Cretaceous

PE902473

This is an enclosure indicator page.
The enclosure PE902473 is enclosed within the container PE902468 at this location in this document.

The enclosure PE902473 has the following characteristics:

ITEM_BARCODE =	PE902473
CONTAINER_BARCODE =	PE902468
NAME =	Palynological Analysis
BASIN =	GIPPSLAND
PERMIT =	VIC/L4
TYPE =	WELL
SUBTYPE =	DIAGRAM
DESCRIPTION =	Palynological Analysis (enclosure from WCR) for Tuna-4
REMARKS =	
DATE_CREATED =	18/05/84
DATE_RECEIVED =	5/12/85
W_NO =	W868
WELL_NAME =	Tuna-4
CONTRACTOR =	ESSO
CLIENT_OP_CO =	ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

PE902474

This is an enclosure indicator page.
The enclosure PE902474 is enclosed within the container PE902468 at this location in this document.

The enclosure PE902474 has the following characteristics:

ITEM_BARCODE =	PE902474
CONTAINER_BARCODE =	PE902468
NAME =	Palynological Analysis
BASIN =	GIPPSLAND
PERMIT =	VIC/L4
TYPE =	WELL
SUBTYPE =	DIAGRAM
DESCRIPTION =	Palynological Analysis with Age (enclosure from WCR) for Tuna-4
REMARKS =	
DATE_CREATED =	18/05/84
DATE_RECEIVED =	5/12/85
W_NO =	W868
WELL_NAME =	Tuna-4
CONTRACTOR =	ESSO
CLIENT_OP_CO =	ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

APPENDIX 3

TUNA-4

QUANTITATIVE LOG ANALYSIS

Interval: 1375 - 3315m KB

Analyst : D.J. Henderson

Date : September, 1984

ESSO

INTERPRETIVE

DATA

QUANTITATIVE LOG ANALYSIS TUNA-4

INTERVAL EVALUATED

1375m - 3315m. All depths are measured from Kelly Bushing. KB = 21.0m AMSL.

LOGS AVAILABLE

BHC-GR	807.5m - 60.0m
DLTE-MSFL-GR	2439.0m - 793.5m
LDTC-CNTH-GR	2427.0m - 793.5m
FDC-CNTA-GR	2440.0m - 793.5m
BHC-GR	2440.0m - 793.5m
DLTB-MSFL-GR	2649.0m - 2434.5m
LDTC-CNTH-GR	2649.0m - 2434.5m
DLTE-MSFL-GR	3007.5m - 2434.5m
LDTC-CNTH-GR	3011.0m - 2600.0m
BHC-GR	3010.0m - 2434.5m
DLTE-MSFL-GR	3319.0m - 2925.0m
LDTC-CNTH-GR	3322.0m - 2925.0m
BHC-GR	3321.0m - 2925.0m

ANALYSIS METHOD

1. Prior to calculation of reservoir parameters the GR, LLD, MSFL and CNL logs were corrected for borehole environmental effects using the EALOG program ENV1.1. The CNL log was converted to sandstone units by adding 0.04 to environmentally corrected readings.

2. Interval 1375-1559m (Top of Latrobe Group to base of Tuna-Flounder Channel).

   (a) The density and neutron porosity logs were corrected for hydrocarbon effects using estimates of expected and apparent calculated grain density.

$$\rho maa = \frac{\rho b - \phi Nss}{1 - \phi Nss} \quad \text{apparent grain density}$$

$$E\ ma = \rho ma + VSHGR\ (\rho maash - \rho ma)$$

where $$VSHGR = \frac{GR - GRclean}{GRshale - GRclean}$$

where $\rho maa < E\ ma$, density and neutron values were corrected for hydrocarbon effects using published density and neutron tool response equations:

$$\rho bc = \rho blog + \Delta\rho b$$

where $$\Delta\rho b = 1.07\ \phi\ (1\text{-}Sxo)\ [(1.11\text{-}0.15P)\rho mf - 1.15\rho h]$$

$$\phi NC = \phi Nss + \Delta\phi N$$

where $$\Delta\phi N = 1.3\ \phi(1\text{-}Sxo)\frac{\rho mf\ (1\text{-}P) - 1.5\rho h + 0.2}{\rho mf\ (1\text{-}P)}$$

$P = 0.035$
$\rho Pmf = 1.015$
$\rho h = 0.125$ for gas, 0.654 for oil

The ratio $\Delta\rho b/\Delta\phi N$ is independent of porosity and residual hydrocarbon saturations.

Bulk density and neutron porosity values were corrected for hydrocarbon effect by finding bhc and ONsshc where

$$\rho maa = E \; ma$$

using the algebraic solution of two lines with slopes of $\Delta\rho b/\Delta\phi N$ and $\rho f - \rho ma$.

(b) Total porosity is defined as:

$$\phi t = \frac{\phi D \times \phi DCN - \phi Nsshc \times \phi DCD}{\phi DCN - \phi DCD}$$

where $$\phi D = \frac{\rho ma - \rho bhc}{\rho ma - \rho f}$$

ϕDCN = neutron porosity value of dry clay

$$\phi DCN = \frac{\rho ma - \rho dc}{\rho ma - \rho f}$$

(c) Effective porosity is defined as:

$$\phi e = \phi t - VSH (\phi tshale)$$

(d) Water saturation was determined using a Dual Water Model as described by Coates et al (1982). The model considers a formation to contain two types of water, bound water which is ionically bound to clay mineral surfaces and free or far water. The model reconstructs expected deep resistivity assuming 100% water saturation (Ro).

$$Ro = \frac{a \; RwF \times RwB}{\phi t^m \, [RwB + VSHGR(RwB - RwF)]}$$

where RwF is free or far water resistivity and RwB is bound water resistivity.

$RwA = (\phi t^m \, Rt)/a$
RwF = RwA in clean water sand
RwB = RwA in shale

(e) Total water saturation:

$$SwT = (Ro/Rt)^{1/n}$$

(f) The Dual Water Model assumes that hydrocarbons exist only the free pore space. Thus, total hydrocarbon pore volume:

$$\phi t \, (1 - SwT) = \phi e \, (1 - Swe)$$

and $$Swe = 1 - \phi t/\phi e \, (1-SwT)$$

The expression $\phi t/\phi e$ above is not considered to be related to shale corrected porosity but is related to the apparent porosity present in the model due to the assumed presence of bound and far water. Thus:

$$\phi t \text{ bound} = \left(\frac{a \; RwB}{Rshale}\right)^{1/m}$$

and $$\phi t \text{ far} = \left(\frac{a \; RwF}{Rshale}\right)^{1/m}$$

The expression for Swe becomes:

$$Swe = 1 - \beta(1 - SwT)$$

$$\text{where } \beta = 1 + VCLND\ (\phi t\ bound/\phi t\ far - 1)$$

(g) Zones with calculated SwT 1.0 were assumed to be 100% water saturated. Porosity was recalculated using the relationship:

$$\phi t_R = (a\ Rw/Rt\ LLD)^{1/m}$$

where $Rw = RwF + VCLND\ (RwB - RwF)$

(h) Coal and highly carbonaceous zones are identified in the analysis model by the function Z.

$$Z = CNLss^2/\rho b^2$$

where $Z > .03$;
$\phi t = \phi e = 0$
$SwT = Swe = 1.0$

(i) In moderately carbonaceous shale zones where calculated total porosity is anomalously high and resulting SwT and Swe are too low, minimum acceptable Swe has been defined as a function of shale content.

$$Swe\ min = C + (1-C)\ 1/\alpha\ VSH^{(4VSH + 2)}$$

where C = minimum acceptable Swe calculated in clean sand
α = maximum acceptable shale content considered to have effective hydrocarbon saturation

$$Swe = \max\ [Swe, Swe\ min]$$

(j) Filtrate invaded zone water saturation was calculated using MSFL log readings corrected for borehole environmental effects.

Apparent mud filtrate resistivity:

$$Rmfa = (Rxo \times \phi t^m)/a$$

$$SxoT = ((Rmfab - Rmfaf)\ VCLND + Rmfaf)/Rmfa)^{1/n}$$

where; Rmfab = Rmfa in shale zones
Rmfaf = Rmfa in clean water sand.

SxoT was corrected for the effect of clay excess conductivity, and carbonaceous material using methods described in 2(f), 2(g), 2(h).

(k) Invaded zone water saturations were limited by:

$$Sxoe \geq Swe$$

(l) Cores through the intervals:

1380.0m - 1389.0m Core 1 and,
1389.0m - 1399.0m Core 2

allowed estimation of the relationship between porosity and permeability:

where $\phi e \geq .24$; $\log (10)\ k = 45.409\ \phi e - 9.067$
where $.19 < \phi e < .24$; $\log (10)\ k = 18.840\ \phi e - 2.677$
where $\phi e \leq .19$; $\log (10)\ k = 11.288\ \phi e - 1.242$

3. Interval 1559m - 2425m (Below Tuna-Flounder Channel).

This interval has been interpreted as dominantly water bearing. The abundance of coals and variably carbonaceous shales made conventional estimate of porosity and water saturation very difficult.

(a) Shale fraction was estimated from the gamma ray log:

$$VSHGR = \frac{GR - GRclean}{GRshale - GRclean}$$

(b) Porosity was determined using a Hodges-Lehmann estimation which is the median value of the average of all binary pairs.

(c) Five porosity estimates were used to derive the Hodges-Lehmann porosity estimation.

(i) Total porosity using the LDT-CNTH combination

$$\phi t\ ND = \frac{\phi D \times \phi DCN - \phi Nss \times \phi DCD}{\phi DCN - \phi DCD}$$

where $\phi D = \frac{\rho ma - \rho b}{\rho ma - \rho f}$

$$\phi DCD = \frac{\rho ma - \rho dry\ clay}{\rho ma - \rho f}$$

ϕDCN = neutron porosity for dry clay.

(ii) Total porosity using the LDTC

$$\phi t\ LDT = \frac{\rho ma - \rho b}{\rho ma - \rho f}$$

where $\rho ma = \rho ma\ sand + VSHGR(\rho ma\ shale - \rho ma\ sand)$

(iii) Total porosity using the resistivity log.

$$\phi t\ R_1 = \left[\frac{.62\ Rw}{Rt}\right]^{1/2.15}$$

where Rw = .075 (35000 ppm NaCl equivalent)

(iv) Total porosity using the resistivity log.

$$\phi t\ R_2 = \left(\frac{Rw}{Rt}\right)^{1/2}$$

(v) Total porosity using the resistivity log.

$$\phi t\ R_3 = \left(.03 + \frac{Rt}{1.03\ Rw}\right)^{-.515}$$

(d) Maximum acceptable porosity was determined as a function of shale fraction.

$$\phi t\ max = .28 - .16\ VSHGR$$

(e) Coal and highly carbonaceous zones were identified using the function Z.

$$Z = CNLss^2 / \rho b^2$$

where $Z > .03$, total porosity was assigned a value of 0.

(f) The Hodges-Lehmann estimate of total porosity was used in the water saturation model.

(i) $RwA = Rt\, \phi t^{m}/a$
RwF = Rwa in clean water sand
RwB = Rwa in shale

(ii) Total water saturation SwT was calculated as in 2(d), 2(e).

(iii) Zones with calculated SwT > 1.0 were assigned values of SwT = 1.0. Porosity was recalculated using:

$$\phi t\, R = (a\, Rw/Rt)^{1/m}$$

where $Rw = RwF + VSHGR\,(RwB - RwF)$

(iv) In zones identified as possibly hydrocarbon bearing, SwT was recalculated using total porosity calculated using the density-neutron combination 3.(c)(i).

(v) Swe was calculated as in 2.(f).

(vi) Minimum acceptable calculated Swe was defined as a function of shale content as in 2.(i). Zones with shale content greater than 0.60 were assigned values of Swe = 1.0.

(g) Effective porosity is defined as:

$$\phi e = \phi t - (VSHGR \times \phi t\ shale)$$

where shale total porosity was determined to be a function of depth.

(h) Filtrate invaded zone water saturations were calculated as in 2. (i), and 2. (k).

(i) Core analysis results over the interval 2481-2566m were used to establish the porosity-permeability relationship:

$$\log(10)\, k = 31.58\, \phi e - 3.63$$

4. Interval 2430m - 3000m.

(a) Shale fraction was determined from the LDTC-CNTH combination using the relationship:

$$VSHND = \frac{\dfrac{(\rho b + \Delta b) - \rho ma}{(\phi Nss + \Delta \phi N)} - (\rho f - \rho ma)}{\dfrac{\rho wc - \rho ma}{\phi Nss} - (\rho f - \rho ma)}$$

where $\Delta \rho b$ and $\Delta \phi N$ are corrections applied to the density and neutron porosity logs due to residual hydrocarbon saturation. Initially $\Delta \rho b$ and $\Delta \phi N$ are set equal to 0. After initial calculation of virgin zone water saturation;

$$\Delta \rho b = 1.07\, \phi t\, (1 - SwT^{.3})\, [(1.11 - 0.15\, P)\rho mf - 1.15\rho h]$$

$$\Delta \phi N = 1.3\, \phi t\, (1 - SwT^{.3})\, \frac{[\rho mf(1-P) - 1.5\rho h + 0.2]}{[\rho mf(1-P)]}$$

(b) Clay fraction was determined from the LDTC-CNTH combination using the relationship:

$$VCLND = \frac{[(\rho b + \Delta \rho b) - (\phi Nss + \Delta \phi N)/(1 - (\phi Nss + \Delta \phi N)] - \rho ma}{[(\rho wc - \phi Nwc)/(1 - \phi Nwc)] - \rho f}$$

(c) Total porosity is defined as:

$$\phi t = \frac{(((\rho b+\Delta\rho b) - \rho ma)/(\rho f-\rho ma)) - \phi DCN-\phi DCD\ (\phi Nss+\ \phi N)}{(\phi DCN\ -\ \phi DCD)}$$

(d) Apparent water resistivity is defined as:

$$Rwa = \frac{Rt \times \phi t^m}{a}$$

RwF = Rwa in clean water sand
Rwa = Rwa in shale zones

(e) Expected deep resistivity assuming 100% water saturation:

$$RO = \frac{a\ RwF \times RwB}{\phi t^m\ [RwB + VCLND\ (RwB-RwF)]}$$

(f) Total water saturation:

$$SwT = (RO/R_t)^{1/n}$$

(g) Effective water saturation Swe was calculated as in 2(f).

(h) Where calculated SwT>1.0, water saturation was assumed to be 100% and total porosity was recalculated as in 2(g).

(i) Zones where carbonaceous material and coal resulted in anomalous calculated total porosity and water saturation were identifed and modelled as in 2(h), 2(i).

(j) Effective porosity was defined as:

$$\phi e = \phi_t - (VSHND \times \phi_t\ shale)$$

(k) Filtrate invaded zone water saturation was calculated as in 2(j), 2(k).

(l) Permeability was determined as in 3(i).

5. Interval 3000 m - 3315 m.

Significant sections of this interval have log readings which are badly affected by washed-out hole.

(a) Shale fraction was determined from the gamma ray log:

$$VSHGR = \frac{GR - GR\ clean}{GR\ shale - GR\ clean}$$

(b) Hodges - Lehmann estimator was used to determine total porosity.

i) Porosity calculated from the LLD and LLS logs were used as the minimum acceptable porosity estimate.

$$\phi_t R\ (LLD) = (R_t/a\ Rw)^{-1/m}$$

$$\phi_t R\ (LLS) = (R_t/a\ Rmf)^{-1/m}$$

$$\phi_t R = \max \text{ of } \phi_t R\ (LLD),\ \phi_t R\ (LLS)$$

ii) Porosity calculated from the sonic log was used as the maximum acceptable porosity estimate.

$$\phi_t S = \frac{\Delta t - \Delta t\ ma}{\Delta tf - \Delta t\ ma}$$

iii) Total porosity was calculated from the LDTC:

$$\phi_t(LDT) = \frac{\rho ma - \rho b}{\rho ma - \rho f}$$

where $\rho ma = \rho ma\ sand + VSHGR\ (\rho ma\ shale - \rho ma\ sand)$

iv) Total porosity was calculated from the CNTH:

$\phi t(CNTH) = \phi NSS - VSHGR\ (\phi_t\ shale)$

v) Total porosity was calculated from the neutron density logs:

$$\phi t(ND) = \frac{\phi D \times \phi DCN - \phi NSS \times \phi DCD}{\phi DCN - \phi DCD}$$

where $\phi D = \frac{\rho\ ma - \rho b}{\rho\ ma - \rho\ f}$

ϕDCN = neutron porosity of dry clay

ϕDCD = density porosity of dry clay.

vi) Maximum acceptable total porosity was limited as a function of shale content.

$$\phi_t\ max = .18 - .13\ VSHGR$$

vii) The Hodges-Lehmann estimate of total porosity is the median value of all possible linear combinations of porosity estimates.

c) Apparent water resistivity is defined as:

$Rwa = (R_t\ \phi_t^m)/a$

Rwb = Rwa in shale zones

Rwf was estimated to be .095 Ωm (21,000 ppm NaCl equivalent).

(d) Total and effective water saturation was determined as in 4(e), 4(f), 2(f).

(e) Minimun acceptable water saturation was calculated as in 2(i).

(f) Flushed zone water saturation was not calculated for this interval because the MSFL log is badly affected by washed out hole.

VARIABLE ANALYSIS PARAMETERS

PARAMETER	DEPTH INTERVAL (M)			
	1375 - 1559	1559 - 2425	2430 - 3000	3000 - 3315
Rm	.096 @ 84°C	.096 @ 84°C	.119 @ 94.4°C	.088 @ 111°C
Rmf	.074 @ 84°C	.074 @ 84°C	.086 @ 94.4°C	.060 @ 111°C
Rmc	.104 @ 84°C	.104 @ 84°C	.134 @ 94.4°C	.103 @ 111°C
Pgas	.125 g/cm^3	.125 g/cm^3	.125 g/cm^3	.125 g/cm^3
Poil	.654 g/cm^3	.654 g/cm^3	.654 g/cm^3	.654 g/cm^3
Pwater	1.02 g/cm^3	1.015 g/cm^3	1.015 g/cm^3	1.015 g/cm^3
Pma	2.66 g/cm^3	2.66 g/cm^3	2.67 g/cm^3	2.67 g/cm^3
ØDCN	.356	.34	.295	.24
ØDCD	.0365	-.024	-.03	-.042
Pwc	2.42 g/cm^3	2.57 g/cm^3	2.62 g/cm^3	2.695 g/cm^3
ØNWC	.43	.40	.34	.27
RwB	.08 @ 84°C	.08 @ 84°C	.08 @ 94.4°C	0.2 @ 111°C
RwF	.064 @ 84°C	.075 @ 84°C	.09 @ 94.4°C	.095 @ 111°C
RmfB	.073 @ 84°C	.09 @ 84°C	.10 @ 94.4°C	-
RmfF	.067 @ 84°C	.06 @ 84°C	.075 @ 94.4°C	-
Øtshale	.12	Variable	.085	.05
Δtma		180.4 u sec/m	180.4u sec/m	180.4 u sec/m
ΔtF		620 u sec/m	620 u sec/m	620 u sec/m

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TUNA-4
LOG ANALYSIS
SUMMARY DATA

DEPTH INTERVAL (m)	GROSS THICKNESS	NET THICKNESS	POROSITY AV	ST DEV	WATER SATURATION	REMARKS
1375.50 - 1385.50	10.00	10.00	0.265	0.028	0.165	Gas, clean
1387.00 - 1388.50	01.50	01.00	0.180	0.013	0.50	Gas, shaly
1388.50 - 1400.00	11.50	11.50	0.270	0.022	0.10	Gas, clean
1400.00 - 1403.75	03.75	03.75	0.245	0.025	0.10	Oil, clean
1403.75 - 1411.5	07.75	07.75	0.260	0.031	0.36	Oil, some shaly
1411.50 - 1424.75	13.25		0.250	0.025	0.84	water, clean
1424.75 - 1431.50	06.75		0.270	0.020	0.86	water, clean
1431.50 - 1452.50	21.00		0.240	0.009	0.96	water, most clean
1452.50 - 1454.25	01.75		0.195	0.024	0.98	water, shaly
1454.25 - 1500.00	45.75		0.250	0.010	0.99	water, clean
1500.00 - 1515.75	15.75		0.240	0.014	1.00	water, clean
1529.25 - 1530.50	01.25		0.210	0.019	0.95	water, clean
1531.75 - 1558.50	26.75		0.215	0.022	0.97	water, clean
1564.00 - 15745.00	10.50		0.230	0.037	0.98	water
1583.25 - 1587.25	04.00		0.210	0.036	0.98	water
1588.50 - 1590.00	01.50		0.20	0.050	1.00	water
1598.50 - 1599.50	01.00		0.140	0.002	1.00	water, shaly
1605.50 - 1606.00	00.50		0.20	0.027	1.00	water, carb, shaly.
1608.75 - 1611.0	02.25		0.130	0.009	0.99	water, very shaly
1612.00 - 1613.00	01.00		0.185	0.034	0.98	water, shaly
1619.50 - 1621.50	02.00		0.150	0.009	0.97	water, very shaly
1641.00 - 1643.00	02.00		0.170	0.026	0.99	water, very shaly
1644.75 - 1645.50	00.75		.190	0.026	0.98	water, shaly

DEPTH INTERVAL (m)	GROSS THICKNESS	NET THICKNESS	POROSITY AV	ST DEV	WATER SATURATION	REMARKS
1646.75 - 1655.25	08.50		.205	0.024	1.00	water very shaly at base
1659.00 - 1666.00	07.00		0.220	0.047	0.98	water, most shaly
1668.50 - 1670.00	01.50		0.210	0.026	0.99	water
1675.50 - 1678.50	03.00		0.200	0.033	0.97	water, carb in part
1683.50 - 1694.50	11.00		0.230	0.025	0.97	water, some shaly
1698.00 - 1701.00	03.00		0.190	0.036	0.99	water, shaly at base
1705.50 - 1706.50	01.00		0.170	0.023	1.00	water, shaly
1717.50 - 1721.50	04.00		0.205	0.042	0.99	water, shaly at top
1724.50 - 1726.00	01.50		0.195	0.041	0.98	water, carbonaceous
1731.75 - 1734.50	02.75		0.185	0.037	0.99	water, shaly, pyritic
1735.25 - 1736.50	01.25		0.245	0.022	0.98	water, clean
1737.50 - 1740.25	02.75		0.190	0.030	0.98	water, shaly, carb.
1741.00 - 1745.00	04.00		0.215	0.027	0.99	water, shaly, carb.
1747.00 - 1749.50	02.50		0.210	0.039	0.96	water, shaly at top
1750.00 - 1751.25	01.25		0.170	0.019	0.98	water, very shaly
1753.50 - 1759.25	07.25		0.200	0.037	0.98	water, very shaly at base
1763.00 - 1765.75	02.75		0.195	0.041	0.98	water, mostly shaly
1766.25 - 1767.00	00.75		0.195	0.35	0.99	water, very shaly
1768.00 - 1769.00	01.00		0.205	0.036	0.99	water

DEPTH INTERVAL (m)	GROSS THICKNESS	NET THICKNESS	POROSITY AV	ST DEV	WATER SATURATION	REMARKS
1770.50 - 1773.50	03.00		0.225	0.025	0.98	water, most clean
1774.50 - 1776.25	01.75		0.240	0.029	0.99	water
1778.00 - 1781.75	03.75		0.245	0.049	1.00	water, clean
1790.50 - 1791.25	00.75		0.200	0.042	0.99	water
1792.50 - 1795.75	03.25		0.185	0.040	1.00	water, very shaly at top
1797.75 - 1801.75	04.00		0.210	0.051	0.99	water, very shaly at top
1802.75 - 1804.75	02.00		0.210	0.022	1.00	water, shaly
1806.00 - 1809.00	03.00		0.165	0.031	0.99	water, very shaly
1810.75 - 1813.75	03.00		0.200	0.045	1.00	water, partly shaly
1820.00 - 1826.00	06.00		0.250	0.050	.98	water, most clean
1826.75 - 1830.00	03.25		0.205	0.030	1.00	water, shaly carb.
1838.00 - 1839.50	01.50		0.200	0.032	0.99	water
1842.00 - 1844.00	02.00		0.160	0.029	0.99	water, dolomitic in part
1850.00 - 1854.00	04.00		0.230	0.035	0.99	water
1859.50 - 1866.25	06.75		0.225	0.030	0.96	water
1872.00 - 1872.75	00.75		0.175	0.029	0.98	water, shaly
1887.00 - 1888.00	01.00		0.140	0.010	0.91	water
1932.50 - 1936.75	04.25		0.190	0.043	0.97	water, most shaly
1942.00 - 1946.25	04.25		0.210	0.020	0.96	water
1958.50 - 1966.00	07.50		0.215	0.037	0.98	water, most shaly, carb.
1979.00 - 1981.50	02.50		0.225	0.025	0.98	water, very carbonaceous.

DEPTH INTERVAL (m)	GROSS THICKNESS	NET THICKNESS	POROSITY AV	ST DEV	WATER SATURATION	REMARKS
1988.50 - 1991.00	02.50		0.225	0.025	1.00	water, clean
2012.50 - 2013.25	00.75		0.160	0.008	0.96	water, shaly
2014.00 - 2016.50	02.50		0.160	0.016	0.97	water, shaly carb.
2031.00 - 2032.00	01.00		0.185	0.032	0.98	water, shaly carb.
2036.50 - 2063.00	26.50		0.230	0.039	1.00	water, shaly at base
2072.00 - 2074.75	02.75		0.205	0.027	1.00	water
2078.00 - 2083.50	05.50		0.165	0.019	1.00	water, shaly at top
2100.00 - 2101.50	01.50		0.140	0.012	0.97	water, very shaly
2109.00 - 2110.00	01.00		0.145	0.011	0.95	water, shaly
2130.25 - 2132.25	02.00		0.200	0.032	1.00	water, clean
2134.00 - 2135.50	01.50		0.200	0.035	0.98	water, clean
2152.00 - 2154.50	02.50		0.220	0.024	1.00	water, clean
2166.50 - 2167.50	01.00		0.140	0.002	0.97	water, shaly
2180.00 - 2181.50	01.50		0.155	0.015	0.98	water, very shaly
2182.50 - 2185.50	03.00		0.195	0.024	1.00	water, clean
2196.00 - 2202.50	06.50		0.180	0.018	0.98	water, clean
2205.00 - 2220.00	15.00		0.185	0.018	0.99	water, most clean
2239.00 - 2241.75	02.75		0.135	0.008	0.98	water, shaly
2244.25 - 2245.50	01.25		0.200	0.011	0.99	water, clean
2259.00 - 2261.50	02.50		0.155	0.015	0.99	water
2277.00 - 2283.00	05.80		0.155	0.017	0.96	water, shaly at top
2322.50 - 2324.00	01.50	0	0.140	0.004	0.92	water
2239.50 - 2342.50	02.75	0	0.155	0.027	.76-1.0 (.84)	possible hydro- carbons, shaly

DEPTH INTERVAL (m)	GROSS THICKNESS	NET THICKNESS	POROSITY AV	ST DEV	WATER SATURATION	REMARKS
2344.00 - 2345.50	01.50	0	0.140	0.009	.69-.80 (.76)	possible hydro-carbons, shaly
2346.50 - 2347.00	00.50	0.25	0.145	0.010	.61-.64 (.63)	possible hydro-carbons, shaly
2348.50 - 2349.25	00.75	0	0.150	0.008	.78-.81 (.79)	possible hydro-carbons, shaly
2368.50 - 2370.25	01.75	00.50	0.180	0.022	.60-1.0 (.70)	hydrocarbons, most clean
2380.00 - 2380.50	00.50	0	0.125	-	0.92	water, very shaly
2389.00 - 2390.25	01.25		0.175	0.021	0.97	water, clean
2391.00 - 2394.75	03.75		0.150	0.016	0.97	water, some tight, shaly
2398.00 - 2402.75	04.75		0.165	0.028	0.96	water, shaly at base
2406.00 - 2408.50	02.50		0.150	0.020	0.93	water, shaly at top
2450.50 - 2451.75	01.25	01.00	0.165	0.017	.48-.64 (.56)	oil productive, clean.
2465.50 - 2467.00	01.50	00.50	0.130	0.006	.43-.64 (.55)	oil, shaly, tight
2469.50 - 2476.50	07.00	07.00	0.185	0.024	.33-.55 (.40)	oil, most clean
2481.50 - 2486.00	04.50	02.50	0.145	0.019	.39-.64 (.55)	oil, very shaly to top
2487.50 - 2489.50	02.00	01.25	0.165	0.031	.43-.62 (.52)	oil, very shaly to top
2490.25 - 2490.75	00.50	0	0.125	-	.43	oil, clean, tight
2491.50 - 2492.00	00.50	0	0.120	-	.58	oil, tight
2494.50 - 2495.50	01.00	0	0.130	-	.59-.64 (.61)	oil, very shaly
2499.00 - 2500.50	01.50	01.50	0.175	0.026	.44-.62 (.52)	oil, clean
2502.00 - 2503.25	01.25	01.00	0.170	0.027	.43-.58 (.49)	oil, shaly
2504.75 - 2508.00	3.25	01.75	0.155	0.027	.40-.63 (.51)	oil, shaly to top

DEPTH INTERVAL (m)	GROSS THICKNESS	NET THICKNESS	POROSITY AV	ST DEV	WATER SATURATION	REMARKS
2523.75 - 2524.75	1.0	0.75	0.180	0.031	.40-.50 (.44)	oil, clean
2525.50 - 2528.75	3.25	2.75	0.180	0.029	.32-.48 (.38)	oil, most clean
2532.25 - 2532.75	0.50	0	0.135	-	.61	oil, thin, shaly
2537.00 - 2537.75	0.75	0	0.105	0.008	.71	oil, very shaly
2543.50 - 2552.00	8.50	8.25	0.185	0.021	.33-.65 (.48)	oil, most clean
2557.00 - 2559.25	2.25	-	0.155	0.016	.81	oil, possibly water productive
2563.25 - 2568.25	5.00	0.50	0.170	0.026	.42-1.0 (.88)	oil, probably water productive
2580.50 - 2583.00	2.50		0.130	0.007	.97	water, very shaly
2590.50 - 2603.25	12.75		0.150	0.027	.97	water, most clean
2609.25 - 2612.00	2.75		0.170	0.035	.93	water, some shaly
2615.00 - 2616.75	1.75		0.160	0.013	.96	water, shaly at base
2617.50 - 2618.75	1.25		0.145	0.009	.99	water, shaly
2621.50 - 2623.50	2.00		0.125	0.004	1.00	water, shaly, tight
2629.50 - 2631.00	1.50		0.125	0.003	.94	water, shaly, tight
2638.00 - 2640.50	2.50		0.160	0.014	.88	water, most clean
2595.50 - 2603.75	8.25		0.160	0.022	.95	water, some shaly
2609.25 - 2612.25	3.00		0.175	0.029	.97	water, some shaly
2615.00 - 2617.00	2.00		0.165	0.019	.93	water, clean
2617.50 - 2619.00	1.50		0.160	0.016	1.0	water

DEPTH INTERVAL (m)	GROSS THICKNESS	NET THICKNESS	POROSITY AV	ST DEV	WATER SATURATION	REMARKS
2621.75 - 2623.75	2.0		0.135	0.004	.98	water
2629.75 - 2631.25	1.5		0.145	0.007	.93	water, shaly
2635.75 - 2640.75	5.0	0	0.155	0.024	.54-.91 (.81)	hydrocarbons, clean
2655.50 - 2656.75	1.25	0.50	0.140	0.004	.57-.60 (.59)	hydrocarbons, clean
2657.75 - 2659.00	1.25	0.50	0.140	0.011	.62	hydrocarbons, clean
2659.75 - 2661.25	1.50	1.50	0.155	0.003	.57-.62 (.59)	hydrocarbons, clean
2674.25 - 2675.00	0.75	0	0.120	-	.51	hydrocarbons, shaly
2676.00 - 2676.75	0.75	0	0.120	-	.63	hydrocarbons, shaly
2681.00 - 2682.00	1.00	0.50	0.160	0.024	.51-.65 (.56)	hydrocarbons, clean
2683.75 - 2684.50	0.75	0	0.120	-	.61	gas
2685.50 - 2688.75	3.25	1.25	0.150	0.022	.48-.63 (.56)	gas, most clean
2690.50 - 2692.75	2.25	0	0.120	0.010	.64-.76 (.70)	hydrocarbons, shaly
2737.50 - 2739.25	1.75	0.50	0.145	0.020	.64-.90 (.72)	hydrocarbons, some clean
2741.50 - 2744.50	3.00	1.00	0.145	0.014	.54-.74 (.65)	hydrocarbons, most clean
2746.25 - 2749.75	3.50	0.25	0.120	0.010	.63-.82 (.71)	hydrocarbons, very shaly
2749.75 - 2753.00	3.25	3.00	0.170	0.014	.51-.57 (.54)	hydrocarbons, clean
2753.25 - 2762.50	9.25	3.50	0.145	0.020	.59-1.0 (.71)	hydrocarbons, most clean
2766.75 - 2770.50	3.75	2.00	0.150	0.020	.54-1.0 (.70)	oil, clean
2771.50 - 2772.00	0.50	0	0.135	-	.55	oil, shaly
2773.50 - 2775.25	1.75	0	0.145	0.020	.67-.88 (.77)	oil, some shaly

DEPTH INTERVAL (m)	GROSS THICKNESS	NET THICKNESS	POROSITY AV	ST DEV	WATER SATURATION	REMARKS
2778.00 - 2779.00	1.00	0	0.110	0.008	.79-.86 (.84)	oil, shaly
2783.75 - 2785.25	1.50	0	0.120	0.013	.66-.93 (.76)	oil, shaly
2788.25 - 2791.00	2.75	0.75	0.130	0.019	.42-.61 (.52)	hydrocarbons, most shaly
2800.50 - 2805.50	5.00	2.00	0.140	0.011	.27-.63 (.45)	gas, clean
2806.00 - 2810.50	4.50	1.50	0.145	0.021	.25-.64 (.43)	gas, clean
2811.50 - 2813.00	1.50	1.00	0.155	0.019	.32-.50 (.38)	oil, clean
2816.25 - 2817.00	0.75	0.25	0.135	0.012	.48-.62 (.54)	oil, shaly
2819.75 - 2820.75	1.00	0.25	0.135	0.006	.50-.59 (.54)	oil, clean
2821.25 - 2823.50	2.25	0.75	0.135	0.010	.45-.57 (.51)	oil, most clean
2826.00 - 2829.50	3.50	1.75	0.145	0.015	.39-.60 (.46)	oil, clean
2839.00 - 2841.25	2.25	0	.130	0.006	.51-.61	hydrocarbons, shaly
2850.00 - 2850.50	0.50	0	0.120	-	.53	hydrocarbons, shaly
2853.00 - 2854.00	1.00	0	0.115	0.007	.51-.62 (.55)	hydrocarbons, shaly
2865.00 - 2867.50	2.50	0	0.130	0.004	.37-.44 (.39)	Gas, most clean
2870.25 - 2871.50	1.25	0	0.105	0.012	.46-.52 (.49)	hydrocarbons, most shaly
2890.25 - 2890.75	0.50	0	0.130	-	0.54	hydrocarbons, clean
2891.50 - 2893.25	1.75	0	0.115	0.007	.45-.61 (.53)	hydrocarbons, clean
2895.50 - 2896.50	1.00	0	0.120	0.016	.36-.56 (.49)	possible oil, clean

DEPTH INTERVAL (m)	GROSS THICKNESS	NET THICKNESS	POROSITY AV	ST DEV	WATER SATURATION	REMARKS
2913.00 - 2914.25	1.25	0	0.130	0.009	.38-.49 (.43)	gas, most clean
2916.50 - 2917.25	0.75	0	0.125	0.013	.44	gas, clean
2918.50 - 2919.50	1.00	0	0.125	0.013	.33-.41 (.36)	gas, clean
2923.25 - 2924.25	1.00	0	0.130	0.013	.39-.53 (.46)	gas, clean
2928.75 - 2930.75	2.00	0.75	0.135	0.011	.38-.50 (.42)	gas, some shaly
2935.25 - 2936.00	0.75	0	0.125	0.016	0.41	possible oil, tight
2936.75 - 2937.25	0.50	0	0.115	-	0.47	oil, tight
2938.25 - 2940.25	2.00	0	0.125	0.012	.44-.57 (.50)	oil, tight
2941.25 - 2941.75	0.50	0	0.120	-	.48	oil, shaly, tight
2943.25 - 2944.25	1.00	0.25	0.140	0.010	.33-.55 (.44)	oil, clean
2947.25 - 2950.00	2.75	0.75	0.140	0.010	.42-.64 (.52)	oil, most clean
2952.00 - 2952.75	0.75	0	0.105	0.015	.34	oil(?) shaly, tight
2958.50 - 2959.00	0.50	0	0.105	-	.51	hydrocarbons, clean
2928.00 - 2930.50	2.50	1.0	0.135	0.030	.38-.58 (.45)	hydrocarbons, most clean
2931.25 - 3132.25	1.00	0.25	0.120	0.031	.38-.50 (.43)	hydrocarbons, shaly, tight
2934.50 - 2935.75	1.25	0.25	0.130	0.023	.49	hydrocarbons, clean
2936.25 - 2936.75	0.50	0	0.135	-	.48	hydrocarbons, shaly
2937.00 - 2939.75	2.75	0	0.130	0.013	.44-.60 (.52)	hydrocarbons, shaly
2940.50 - 2941.50	1.00	0	0.125	0.016	.50-.55 (.52)	hydrocarbons, very shaly

DEPTH INTERVAL (m)	GROSS THICKNESS	NET THICKNESS	POROSITY AV	ST DEV	WATER SATURATION	REMARKS
2942.75 - 2943.75	1.00	0.25	0.145	0.010	.47-.60 (.53)	hydrocarbons, clean
2946.50 - 2950.00	3.50	2.00	0.145	0.015	.43-.63 (.54)	hydrocarbons, shaly at base
2957.50 - 2958.75	1.25	0	0.115	0.011	.53-.61 (.56)	hydrocarbons, shaly
2969.50 - 2970.00	0.50	0	0.115	-	.70	water productive, very shaly
2994.00 - 2995.50	1.50	0	0.125	0.010	.51-.59 (.57)	hydrocarbons, clean, tight
2998.75 - 2999.50	0.75	0	0.120	-	.47	hydrocarbons, shaly, tight
3005.5 - 3007.00	1.50	0	0.105	0.005	.44-.56 (.52)	hydrocarbons, shaly to top
3008.25 - 3010.25	2.00	0.75	0.130	0.020	.36-.64 (.50)	hydrocarbons, most clean
3012.00 - 3013.50	1.50	0	0.125	0.004	.48-.59 (.52)	hydrocarbons, most shaly, tight
3014.00 - 3014.50	0.50	0.25	0.140	-	.41	hydrocarbons
3018.00 - 3019.25	1.25	0	0.125	0.009	.46-.60 (.53)	gas(?) clean
3027.75 - 3031.25	3.50	1.00	0.135	0.016	.41-.64 (.53)	oil, shaly to top
3034.00 - 3034.75	0.75	0	0.120	-	.44	hydrocarbons, shaly, tight
3053.25 - 3054.75	1.50	0	0.125	0.012	.47-.60 (.53)	gas
3055.00 - 3056.50	1.50	0	0.120	0.012	.40-.60 (.51)	gas
3057.50 - 3059.50	2.00	0.25	0.130	0.013	.36-.55 (.48)	gas(?), clean
3060.25 - 3061.25	1.00	0.25	0.130	0.015	.43-.57 (.49)	gas(?), clean
3086.25 - 3089.50	3.25	0	0.110	0.004	.37-.61 (.46)	hydrocarbons,

DEPTH INTERVAL (m)	GROSS THICKNESS	NET THICKNESS	POROSITY AV	ST DEV	WATER SATURATION	REMARKS
3093.75 - 3095.25	1.50	0	0.095	0.005	.45-.55 (.51)	hydrocarbons, shaly
3102.50 - 3105.25	2.75	0	0.115	0.010	.34-.63 (.43)	probable gas, clean
3116.75 - 3119.25	2.50	0	0.095	0.018	.44-.54 (.50)	probable gas, most clean
3121.25 - 3121.50	0.25	0	0.105	-	.55	probable gas
3126.75 - 3128.00	1.25	0	0.100	0.009	.46-.59 (.52)	gas, very shaly
3129.75 - 3131.00	1.25	0	0.115	0.009	.41-.51 (.47)	gas, clean
3135.50 - 3142.50	7.00	0	0.090	0.015	.51-.64 (.57)	gas, clean
3144.50 - 3146.25	1.75	0	0.120	0.006	.46-.63 (.55)	gas, shaly at top
3154.25 - 3160.00	5.75	0	0.105	0.011	.34-.54 (.41)	gas(?)
3174.75 - 3177.00	2.25	0	0.075	0.024	.53-.65 (.60)	hydrocarbons, shaly
3180.00 - 3183.50	3.50	0	0.080	0.013	.51-.64 (.57)	hydrocarbons, shaly at top
3186.75 - 3189.75	3.0	0	0.085	0.011	.38-.65 (.57)	probable gas, shaly at top
3193.75 - 3195.00	1.25	0	0.105	0.003	.38-.50 (.45)	hydrocarbons clean
3200.00 - 3202.75	2.75	0	0.070	0.009	.40-.63 (.52)	probable gas, clean
3204.25 - 3204.75	0.50	0	0.080	-	.47	hydrocarbons, shaly
3210.75 - 3212.75	2.00	0	0.105	0.005	.34-.59 (.42)	hydrocarbons, shaly
3213.75 - 3214.25	0.50	0	0.095	-	.45	hydrocarbons, shaly
3233.25 - 3234.25	1.00	0	0.100	0.023	.46-.59 (.51)	hydrocarbons, clean
3234.75 - 3236.25	1.50	0	0.125	0.012	.40-.60 (.46)	hydrocarbons, clean
3237.75 - 3239.00	1.25	0	0.100	0.012	.49-.76 (.64)	probable gas, clean

DEPTH INTERVAL (m)	GROSS THICKNESS	NET THICKNESS	POROSITY AV	ST DEV	WATER SATURATION	REMARKS
3257.00 - 3258.25	1.25	0	0.080	0.029	.53-.63 (.60)	hydrocarbons, clean
3259.50 - 3261.25	1.75	0	0.110	0.013	.58-.78 (.66)	hydrocarbons, shaly
3262.75 - 3263.25	0.50	0	0.090	-	.52	hydrocarbons, shaly
3269.00 - 3269.50	0.50	0	0.080	-	.60	hydrocarbons, clean
3271.50 - 3272.50	1.00	0	0.075	0.019	.48-.64 (.59)	hydrocarbons, very shaly
3273.25 - 3276.50	3.25	0	0.10	0.009	.36-.58 (.43)	hydrocarbons, clean
3277.75 - 3279.50	1.75	0	0.090	0.011	.45-.56 (.50)	hydrocarbons, clean
3280.75 - 3281.50	0.75	0	0.080	-	.77	hydrocarbons, shaly
3283.25 - 3284.75	1.50	0	0.075		.56-.88 (.66)	hydrocarbons, clean
3289.00 - 3290.00	1.00	0	0.120	0.010	1.00	water, clean
3293.00 - 3295.75	2.75	0	0.095	0.007	.40-.64 (.50)	hydrocarbons most clean

PE601203

This is an enclosure indicator page.
The enclosure PE601203 is enclosed within the container PE902468 at this location in this document.

The enclosure PE601203 has the following characteristics:

ITEM_BARCODE =	PE601203
CONTAINER_BARCODE =	PE902468
NAME =	Quantitative Log Analysis
BASIN =	GIPPSLAND
PERMIT =	VIC/L4
TYPE =	WELL
SUBTYPE =	WELL_LOG
DESCRIPTION =	Quantitative Log Analysis, 2595m to 3010m (enclosure from WCR vol.2) for Tuna-4
REMARKS =	
DATE_CREATED =	19/07/84
DATE_RECEIVED =	14/06/85
W_NO =	W868
WELL_NAME =	Tuna-4
CONTRACTOR =	ESSO
CLIENT_OP_CO =	ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

PE601204

This is an enclosure indicator page.
The enclosure PE601204 is enclosed within the container PE902468 at this location in this document.

The enclosure PE601204 has the following characteristics:

ITEM_BARCODE = PE601204
CONTAINER_BARCODE = PE902468
NAME = Quantitative Log Analysis
BASIN = GIPPSLAND
PERMIT = VIC/L4
TYPE = WELL
SUBTYPE = WELL_LOG
DESCRIPTION = Quantitative Log Analysis, 1375m to 1560m (enclosure from WCR vol.2) for Tuna-4
REMARKS =
DATE_CREATED = 27/07/84
DATE_RECEIVED = 14/06/85
W_NO = W868
WELL_NAME = Tuna-4
CONTRACTOR = ESSO
CLIENT_OP_CO = ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

PE601205

This is an enclosure indicator page.
The enclosure PE601205 is enclosed within the container PE902468 at this location in this document.

The enclosure PE601205 has the following characteristics:

ITEM_BARCODE =	PE601205
CONTAINER_BARCODE =	PE902468
NAME =	Quantitative Log Analysis
BASIN =	GIPPSLAND
PERMIT =	VIC/L4
TYPE =	WELL
SUBTYPE =	WELL_LOG
DESCRIPTION =	Quantitative Log Analysis, 1975m to 2425m (enclosure from WCR vol.2) for Tuna-4
REMARKS =	
DATE_CREATED =	27/07/84
DATE_RECEIVED =	14/06/85
W_NO =	W868
WELL_NAME =	Tuna-4
CONTRACTOR =	ESSO
CLIENT_OP_CO =	ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

PE601207

This is an enclosure indicator page.
The enclosure PE601207 is enclosed within the container PE902468 at this location in this document.

The enclosure PE601207 has the following characteristics:

ITEM_BARCODE	=	PE601207
CONTAINER_BARCODE	=	PE902468
NAME	=	Quantitative Log Analysis
BASIN	=	GIPPSLAND
PERMIT	=	VIC/L4
TYPE	=	WELL
SUBTYPE	=	WELL_LOG
DESCRIPTION	=	Quantitative Log Analysis, 2925m to 3310m (enclosure from WCR vol.2) for Tuna-4
REMARKS	=	
DATE_CREATED	=	27/07/84
DATE_RECEIVED	=	14/06/85
W_NO	=	W868
WELL_NAME	=	Tuna-4
CONTRACTOR	=	ESSO
CLIENT_OP_CO	=	ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

APPENDIX 4

GEOCHEMICAL REPORT

TUNA-4 WELL, GIPPSLAND BASIN

VICTORIA

by

J.K. EMMETT

Sample handling and Analyses by:

- H. Schiller)
- J. McCardle)
- D.M. Hill) ESSO AUSTRALIA LTD.
- D.M. Ford)
- D.E. Bishop)
- Exxon Production Research Company
- Geochem Laboratories
- AMDEL

Esso Australia Ltd.
Geochemical Report

ESSO
INTERPRETIVE
DATA

April 1985

1497L

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22) Tuna-4 Oil Saturate Chromatogram, RFT 13/57, 2507.2m KB

23) Tuna-4 Oil Saturate Chromatogram, RFT 18/88, 2948.5m KB

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APPENDICES

1. Detailed C4-7 Data Sheets
2. Detailed Vitrinite Reflectance and Exinite Fluorescence Data - Report by A.C. Cook

INTRODUCTION

A variety of geochemical analyses were performed on samples of wet canned cuttings, sidewall cores and conventional cores, collected during drilling of the Tuna-4 well, Gippsland Basin. Canned cuttings composited over 15 metre intervals were collected between 230m KB and 3185m KB. Alternate 15 metre intervals were analysed for headspace C_{1-4} hydrocarbon gases between 1220m KB and 3185m KB. Succeeding alternate 15 metre intervals were analysed for C_{4-7} gasoline-range hydrocarbons between 1205m KB and 3140m KB. Samples were hand-picked for more detailed analyses such as Total Organic Carbon (TOC), Rock-Eval pyrolysis, kerogen isolation and elemental analysis and C_{15+} liquid and gas chromatagraphy. Vitrinite reflectance determinations were performed by Professor A.C. Cook of Wollongong.

Eight oil samples (one from a top of Latrobe Group reservoir and seven from intra-Latrobe Group reservoirs) were analysed for API gravity and by "whole oil" gas chromatography. Of these eight oils, four were analysed for C_{12+} liquid and gas chromatography and stable carbon isotopes ($\delta^{13}C$) were determined on the saturate and aromatic fractions.

DISCUSSION OF RESULTS

The detailed C_{1-4} headspace cuttings gas results are listed in Table 1 and depth profiles of this data are shown in Figures 1(a) and 1(b). Total cuttings gas values in the Miocene Lakes Entrance Formation and the Gurnard and Flounder Formation sediments of the Latrobe Group (Figure 1(a)) vary from lean to moderately rich, indicating poor-fair hydrocarbon source potential. The undifferentiated Latrobe Group sediments (between 1558.5m KB and T.D.) on the other hand have generally rich cuttings gas levels with wet (C_{2+})gas concentrations commonly between 20% and 40% (Figure 1(b). These sediments are rated as having very good oil and gas source potential. Detailed interpretation of cuttings gas data for source rock potential is made difficult due to the presence of coals beds (the locations of which may be identified by referring to rock descriptions listed in Table 2) and numerous oil zones. In general, the richer cuttings gas levels recorded usually coincide with coaly intervals, although oil staining may also contribute to higher wet gas occurrences.

The well profile of the gasoline-range (C_{4-7}) hydrocarbons (Fig. 2) is similar to that for cuttings gas, with rich amounts of gasolines only in the undifferentiated Latrobe Group sediments. Again, the presence of coal beds or oil stained cuttings will contribute a high amount of gasolines masking true hydrocarbon source potential. The detailed C_{4-7} hydrocarbon data sheets are presented in Appendix-1. (Note: There were no samples suitable for C_{4-7} analysis between 1370m KB and 1580m KB).

Total Organic Carbon values (Table 2) in the Gippsland Limestone, Lakes Entrance Formation and the ? Gurnard Formation are poor (average T.O.C. values of 0.45%, 0.36% and 0.32% respectively), consistent with previous poor hydrocarbon source potential indications from these sediments. Shales and siltstones in the Flounder Formation and the undifferentiated Latrobe Group are organically rich, with average T.O.C. values of 3.63% and 2.94% respectively. Rock-Eval pyrolysis results (Table 3 and Figure 3) show that modal Type III kerogen (containing mainly woody, herbaceous and coaly organic matter types) predominates, although a certain amount of more hydrogen-rich (more oil-prone) Type II-III kerogen is also present.

Elemental analyses of kerogen samples isolated from the Flounder Formation and the underlying Latrobe Group sediments (Table 4) commonly yield hydrogen contents of 5-6%, which is supportive of a very good appraisal of oil and gas source potential for these sediments. Approximate hydrogen:carbon (H/C) oxygen:carbon (O/C) and nitrogen:carbon (N/C) atomic ratios are listed in Table 5. These atomic ratios are considered to be approximate because the % oxygen was determined by difference and the organic sulphur % was not determined. Since kerogen ash values are usually low - less than 10%, and the % sulphur is thought to be low also, then the calculated atomic ratios are considered to be good approximations. When atomic H/C ratio is plotted against atomic O/C ratio as in a modified Van Krevelen plot (Figure 4), the presence of a significant amount of oil-prone intermediate Type II-III kerogen is obvious.

Rock-Eval Tmax values (Table 3) indicates that the threshold of organic maturation for significant hydrocarbon generation occurs in the interval between 2412m KB and 3275.5m KB. Vitrinite reflectance data are shown in Table 6, and $\bar{R}_v$ max has been plotted with depth in Figure 5. Using the line of best fit plotted in Figure 5, the top of maturity for significant hydrocarbon generation (taken to be $\bar{R}_v$ max = 0.65%) occurs at about 2600m KB. Detailed vitrinite reflectance and exinite fluorescence data are given in Appendix-2.

The C_{15+} extract and liquid chromatography data obtained from selected canned cuttings are listed in Table 7. The Lakes Entrance Formation sample (1265-1280m KB) yielded a poor total extract (211 ppm) which indicates poor oil-source potential. There was insufficient extract to allow detailed liquid chromatography to be done, although a C_{15+} saturate chromatogram was obtained (Figure 6). The bimodal hydrocarbon distribution seen in Figure 6 represents an immature mixture of marine and land-derived organic matter. Total extract values for the six Latrobe Group samples vary from rich to very rich, confirming previous indications of very good oil and gas source potential. The corresponding C_{15+} saturate chromatograms (Figures 7-12) represent immature, predominantly terrestrial source organic matter in Figures 7-9, the prime indicator being significant odd/even predominance in the Waxy

(n-C_{25+}) n-alkane envelope. Figure 10 (2615-2630m KB) and Figure 11 (2795-2810m KB) are interpreted to be early mature hydrocarbon distributions, again derived from predominantly terrestial organic matter types. The increase in maturity is shown by the progressive shift of the n-alkane maxima from n-C_{29} in Figures 7 and 8 down to n-C_{25} in Figures 10 and 11, the gradual reduction of odd/even predominance and the disappearance of the baseline hump of unresolved complex triterpane material, obvious in the C_{26}-C_{32} region in Figures 7 and 8, but generally absent in the other chromatograms.

The fact that source rock hydrocarbon distributions are classed as early mature by about 2630m KB supports the top of organic maturity for oil generation at about 2600m as indicated by vitrinate reflectance. By 3170m KB, a mature saturate hydrocarbon distribution is evidence (Figure 12), not unlike those belonging to intra-Latrobe Group oil shows, a discussion of which will follow.

"Whole oil" chromatograms of eight Tuna-4 oil samples are shown in Figures 13-20. Oil from the top of Latrobe Group reservoir at 1400.5m KB (near the gas-oil contact) is severely biodegraded (Figure 13) as indicated by the almost total removal of n-alkanes. Liquid chromatography data for this oil (Table 8) also shows the depletion of normal and iso-paraffins and the corresponding C_{15+} saturate chromatogram shows primarily residual branched/cyclic hydrocarbons. The other seven oil samples analysed are from intra-Latrobe Group reservoirs, and can generally be described as waxy paraffinic (Tables 9-11) oils (most set solid at room temperature) of medium to high API gravity (Table 12), and commonly show remnant odd/even carbon preference above n-C_{25}. These oils are obviously derived from a predominantly terrestrial organic matter source. The hydrocarbon distributions of the intra-Latrobe Group oils do not show increasing maturity with increasing reservoir depth (and implicitly reservoir temperature), but rather an apparent increased presence of Waxy (i.e. C_{25+}) n-alkanes. (Compare the oil at 2475m KB (Figure 14) or 2566m KB (Figure 17) with that 2948.5m KB (Figure 20).) As deeper reservoirs are at higher temperature and therefore more likely to accommodate more waxy components in the entrapped oil, the apparent maturity difference in the oils may be due to differences in migration pathways. It may also indicate that the deeper oils have been generated later than oils occurring in the top of Latrobe Group reservoirs which show a relatively more mature hydrocarbon distribution.

CONCLUSIONS

1. The top of organic maturity for significant hydrocarbon generation occurs at about 2600m KB.

2. The Latrobe Group sediments have very good oil and gas source potential.

3. Oil encountered in the top of Latrobe Group reservoir is bio-degraded. Other oils present in deeper intra-Latrobe Group reservoirs have mature, waxy paraffinic hydrocarbon distributions and medium to high API gravities.

C1-C4 HYDROCARBON ANALYSES

REPORT A - HEADSPACE GAS

BASIN - GIPPSLAND
WELL - TUNA 4

SAMPLE NO.	DEPTH	METHANE C1	ETHANE C2	PROPANE C3	IBUTANE IC4	NBUTANE C4	WET C2-C4	TOTAL C1-C4	WET/TOTAL PERCENT	TOTAL GAS M	TOTAL GAS E	TOTAL GAS P	TOTAL GAS IB	TOTAL GAS NB	WET GAS E	WET GAS P	WET GAS IB	WET GAS NB
		GAS CONCENTRATION (VOLUME GAS PER MILLION VOLUMES CUTTINGS)								GAS COMPOSITION (PERCENT)								
73059 B	1235.00	182	19	26	15	8	68	250	27.20	73.	8.	10.	6.	3.	28.	38.	22.	12.
73059 D	1265.00	575	52	65	57	17	191	766	24.93	75.	7.	8.	7.	2.	27.	34.	30.	9.
73059 F	1295.00	1920	121	107	53	25	306	2226	13.75	86.	5.	5.	2.	1.	40.	35.	17.	8.
73059 H	1325.00	1165	109	147	42	56	354	1519	23.30	77.	7.	10.	3.	4.	31.	42.	12.	16.
73059 J	1355.00	1418	185	313	103	146	747	2165	34.50	65.	9.	14.	5.	7.	25.	42.	14.	20.
73059 L	1385.00	4380	403	633	257	492	1785	6165	28.95	71.	7.	10.	4.	8.	23.	35.	14.	28.
73059 N	1445.00	293	143	277	95	179	694	987	70.31	30.	14.	28.	10.	18.	21.	40.	14.	26.
73059 P	1475.00	120	25	52	20	41	138	258	53.49	47.	10.	20.	8.	16.	18.	38.	14.	30.
73059 R	1505.00	86	18	17	3	8	46	132	34.85	65.	14.	13.	2.	6.	39.	37.	7.	17.
73059 T	1535.00	8586	1663	832	147	128	2770	11356	24.39	76.	15.	7.	1.	1.	60.	30.	5.	5.
73059 V	1565.00	76275	15595	5109	790	840	22334	98609	22.65	77.	16.	5.	1.	1.	70.	23.	4.	4.
73059 X	1595.00	22549	2605	1179	243	214	4241	26790	15.83	84.	10.	4.	1.	1.	61.	28.	6.	5.
73059 Z	1625.00	33743	3768	1212	244	164	5388	39131	13.77	86.	10.	3.	1.	0.	70.	22.	5.	3.
73060 B	1655.00	27338	3519	1138	138	89	4884	32222	15.16	85.	11.	4.	0.	0.	72.	23.	3.	2.
73060 D	1685.00	43840	4746	1273	155	79	6253	50093	12.48	88.	9.	3.	0.	0.	76.	20.	2.	1.
73060 F	1715.00	33175	3135	614	69	24	3842	37017	10.38	90.	8.	2.	0.	0.	82.	16.	2.	1.
73060 H	1745.00	22225	2295	543	77	26	2941	25166	11.69	88.	9.	2.	0.	0.	78.	18.	3.	1.
73060 J	1775.00	44671	3184	618	80	26	3908	48579	8.04	92.	7.	1.	0.	0.	81.	16.	2.	1.
73060 L	1805.00	7099	1333	403	62	25	1823	8922	20.43	80.	15.	5.	1.	0.	73.	22.	3.	1.
73060 N	1835.00	44829	4546	872	96	30	5544	50373	11.01	89.	9.	2.	0.	0.	82.	16.	2.	1.
73060 P	1865.00	19701	3146	808	88	40	4082	23783	17.16	83.	13.	3.	0.	0.	77.	20.	2.	1.
73060 R	1895.00	52419	7105	2306	256	352	10019	62438	16.05	84.	11.	4.	0.	1.	71.	23.	3.	4.
73060 T	1925.00	46847	8524	2545	268	210	11547	58394	19.77	80.	15.	4.	0.	0.	74.	22.	2.	2.
73060 V	1955.00	21687	6275	2397	245	187	9104	30791	29.57	70.	20.	8.	1.	1.	69.	26.	3.	2.
73060 X	1985.00	76326	13883	2994	260	167	17304	93630	18.48	82.	15.	3.	0.	0.	80.	17.	2.	1.
73060 Z	2015.00	36050	13810	3028	184	141	17163	53213	32.25	68.	26.	6.	0.	0.	80.	18.	1.	1.
73061 B	2045.00	35315	6597	1584	151	134	8466	43781	19.34	81.	15.	4.	0.	0.	78.	19.	2.	2.
73061 D	2075.00	14288	3069	1249	150	150	4618	18906	24.43	76.	16.	7.	1.	1.	66.	27.	3.	3.
73061 F	2105.00	23618	3240	867	94	73	4274	27892	15.32	85.	12.	3.	0.	0.	76.	20.	2.	2.
73061 H	2135.00	23501	5658	1879	165	164	7866	31367	25.08	75.	18.	6.	1.	1.	72.	24.	2.	2.
73061 J	2165.00	3300	1658	729	75	79	2541	5841	43.50	56.	28.	12.	1.	1.	65.	29.	3.	3.
73061 L	2195.00	14703	4346	1875	193	198	6612	21315	31.02	69.	20.	9.	1.	1.	66.	28.	3.	3.
73061 N	2225.00	19848	2997	1048	107	113	4265	24113	17.69	82.	12.	4.	0.	0.	70.	25.	3.	3.
73061 P	2255.00	11099	3119	1060	93	85	4357	15456	28.19	72.	20.	7.	1.	1.	72.	24.	2.	2.
73061 R	2285.00	78702	18909	5230	485	450	25074	103776	24.16	76.	18.	5.	0.	0.	75.	21.	2.	2.
73061 X	2375.00	1808	330	110	12	17	469	2277	20.60	79.	14.	5.	1.	1.	70.	23.	3.	4.
73061 Z	2405.00	7828	1287	505	94	85	1971	9799	20.11	80.	13.	5.	1.	1.	65.	26.	5.	4.
73062 B	2435.00	30149	5566	1827	235	246	7874	38023	20.71	79.	15.	5.	1.	1.	71.	23.	3.	3.
73062 D	2465.00	2901	1336	543	81	80	2040	4941	41.29	59.	27.	11.	2.	2.	65.	27.	4.	4.
73062 F	2585.00	4633	99	367	53	61	580	5213	11.13	89.	2.	7.	1.	1.	17.	63.	9.	11.
73062 H	2615.00	11446	2385	886	166	170	3607	15053	23.96	76.	16.	6.	1.	1.	66.	25.	5.	5.
73062 J	2645.00	29679	5345	2001	428	385	8159	37838	21.56	78.	14.	5.	1.	1.	66.	25.	5.	5.
73062 L	2675.00	28366	4431	2107	390	437	7365	35731	20.61	79.	12.	6.	1.	1.	60.	29.	5.	6.
73062 N	2705.00	5047	875	404	79	106	1464	6511	22.49	78.	13.	6.	1.	2.	60.	28.	5.	7.
73062 P	2735.00	2776	331	134	20	38	523	3299	15.85	84.	10.	4.	1.	1.	63.	26.	4.	7.
73062 R	2765.00	3777	1042	506	73	122	1743	5520	31.58	68.	19.	9.	1.	2.	60.	29.	4.	7.
73062 T	2795.00	2421	935	498	64	98	1595	4016	39.72	60.	23.	12.	2.	2.	59.	31.	4.	6.

C1-C4 HYDROCARBON ANALYSES

REPORT A - HEADSPACE GAS

BASIN - GIPPSLAND
WELL - TUNA 4

SAMPLE NO.	DEPTH	METHANE C1	ETHANE C2	PROPANE C3	IBUTANE IC4	NBUTANE C4	WET C2-C4	TOTAL C1-C4	WET/TOTAL PERCENT	TOTAL GAS M	TOTAL GAS E	TOTAL GAS P	TOTAL GAS IB	TOTAL GAS NB	WET GAS E	WET GAS P	WET GAS IB	WET GAS NB
		GAS CONCENTRATION (VOLUME GAS PER MILLION VOLUMES CUTTINGS)								GAS COMPOSITION (PERCENT)								
73062 V	2825.00	1975	811	415	64	100	1390	3365	41.31	59.	24.	12.	2.	3.	58.	30.	5.	7.
73062 X	2855.00	7963	1705	592	77	99	2473	10436	23.70	76.	16.	6.	1.	1.	69.	24.	3.	4.
73062 Z	2885.00	11912	2997	1105	182	184	4468	16380	27.28	73.	18.	7.	1.	1.	67.	25.	4.	4.
73063 B	2915.00	9725	1800	601	84	106	2591	12316	21.04	79.	15.	5.	1.	1.	69.	23.	3.	4.
73063 D	2945.00	5577	1270	550	97	108	2025	7602	26.64	73.	17.	7.	1.	1.	63.	27.	5.	5.
73063 F	2975.00	36520	5276	1507	478	240	7501	44021	17.04	83.	12.	3.	1.	1.	70.	20.	6.	3.
73063 H	3005.00	56874	6232	1835	184	203	8454	65328	12.94	87.	10.	3.	0.	0.	74.	22.	2.	2.
73063 J	3035.00	10614	2291	1104	188	191	3774	14388	26.23	74.	16.	8.	1.	1.	61.	29.	5.	5.
73063 L	3065.00	3988	759	317	56	41	1173	5161	22.73	77.	15.	6.	1.	1.	65.	27.	5.	3.
73063 N	3095.00	4883	699	222	73	32	1026	5909	17.36	83.	12.	4.	1.	1.	68.	22.	7.	3.
73063 P	3125.00	5497	923	242	28	28	1221	6718	18.18	82.	14.	4.	0.	0.	76.	20.	2.	2.
73063 R	3155.00	4352	694	179	40	25	938	5290	17.73	82.	13.	3.	1.	0.	74.	19.	4.	3.
73063 T	3185.00	2531	422	154	31	17	624	3155	19.78	80.	13.	5.	1.	1.	68.	25.	5.	3.

TOTAL ORGANIC CARBON REPORT

BASIN - GIPPSLAND
WELL - TUNA 4

SAMPLE NO.	DEPTH	AGE	FORMATION	AN	TOC%	DESCRIPTION
73059 A	1220.00	UNDATED	GIPPSLAND LMST	2	.44	GRN/GY CLYST
73059 C	1250.00	UNDATED	GIPPSLAND LMST	2	.45	GRN/GY CLYST

===> DEPTH : .00 TO 1270.00 METRES. <=== I ===> AVERAGE TOC : .45 % EXCLUDING VALUES GREATER THAN 10.00 % <===

SAMPLE NO.	DEPTH	AGE	FORMATION	AN	TOC%	DESCRIPTION
73059 E	1280.00	EARLY MIOCENE	LAKES ENTRANCE	2	.21	GRN/GY CLYST
73059 G	1310.00	EARLY MIOCENE	LAKES ENTRANCE	2	.33	GRN/GY CLYST
73059 I	1340.00	EARLY MIOCENE	LAKES ENTRANCE	2	.39	GRN/GY CLYST
73023 P	1362.60	EARLY MIOCENE	LAKES ENTRANCE	1	.38	MED GY SHALE, CALC.
73023 L	1369.00	EARLY MIOCENE	LAKES ENTRANCE	1	.47	MED GY SHALE, CALC.

===> DEPTH : 1270.00 TO 1369.50 METRES. <=== I ===> AVERAGE TOC : .36 % EXCLUDING VALUES GREATER THAN 10.00 % <===

SAMPLE NO.	DEPTH	AGE	FORMATION	AN	TOC%	DESCRIPTION
73059 K	1370.00	EOCENE	?GURNARD	2	.34	GY/GRN CLYST
73023 H	1372.80	EOCENE	?GURNARD	1	.30	LT BRN SLTST, GLAUC
73023 F	1374.90	EOCENE	?GURNARD	1	.31	LT BRN SLTST, GLAUC, CALC

===> DEPTH : 1370.00 TO 1375.50 METRES. <=== I ===> AVERAGE TOC : .32 % EXCLUDING VALUES GREATER THAN 10.00 % <===

SAMPLE NO.	DEPTH	AGE	FORMATION	AN	TOC%	DESCRIPTION
73023 C	1387.00	EOCENE	FLOUNDER	1	2.99	LT-MED GREY SHALE
72974 P	1522.10	EOCENE	FLOUNDER	1	4.77	DK GY SLTST, LT LAM'TIONS
72974 O	1531.00	EOCENE	FLOUNDER	1	3.13	FINE DIRTY SNDST

===> DEPTH : 1375.50 TO 1558.50 METRES. <=== I ===> AVERAGE TOC : 3.63 % EXCLUDING VALUES GREATER THAN 10.00 % <===

SAMPLE NO.	DEPTH	AGE	FORMATION	AN	TOC%	DESCRIPTION
72974 G	1574.30	EOCENE	LATROBE GROUP	1	6.21	ALT. MD GY SH AND QUARTZ
73059 W	1580.00	EOCENE	LATROBE GROUP	2	31.03	OL BLK SH, COAL LAMINAE
73059 Y	1610.00	PALEOCENE	LATROBE GROUP	2	.36	OL GY CLYST
72974 D	1626.10	PALEOCENE	LATROBE GROUP	1	5.03	MD DK GY SHALE, FINE QTZ
73060 A	1640.00	PALEOCENE	LATROBE GROUP	2	54.31	COAL
72974 C	1646.10	PALEOCENE	LATROBE GROUP	1	5.60	MD DK MUDST, PYRITE
73060 C	1670.00	PALEOCENE	LATROBE GROUP	2	53.31	COAL
73060 E	1700.00	PALEOCENE	LATROBE GROUP	2	4.94	OL GY SLTST
72974 A	1709.70	PALEOCENE	LATROBE GROUP	1	2.51	LT GY SLTST, QTZ RICH
73060 G	1730.00	PALEOCENE	LATROBE GROUP	2	2.76	DK GRN/GY SLTST
72973 Z	1737.00	PALEOCENE	LATROBE GROUP	1	5.67	MD GY SLTST, FINE QTZ
73060 I	1760.00	PALEOCENE	LATROBE GROUP	2	52.56	COAL
72973 Y	1777.20	PALEOCENE	LATROBE GROUP	1	6.53	DK GY SLTST
72973 X	1789.00	PALEOCENE	LATROBE GROUP	1	3.60	MD DK GY SHALE

TOTAL ORGANIC CARBON REPORT

BASIN - GIPPSLAND
WELL - TUNA 4

SAMPLE NO.	DEPTH	AGE	FORMATION	AN	TOC%	AN	TOC%	AN	TOC%	DESCRIPTION
**********	*******	***	*********	*********		*********		*********		***********
73060 K	1790.00	PALEOCENE	LATROBE GROUP	2	3.50					DK GRN/GY CLYST
72973 W	1816.00	PALEOCENE	LATROBE GROUP	1	5.69					DK GY SLTST
73060 M	1820.00	PALEOCENE	LATROBE GROUP	2	3.70					OL GY SLTST
73060 O	1850.00	PALEOCENE	LATROBE GROUP	2	52.36					COAL
73060 Q	1880.00	PALEOCENE	LATROBE GROUP	2	3.66					DK GRN/GY SLTST
73060 S	1910.00	PALEOCENE	LATROBE GROUP	2	7.38					M-DK GY CLYST
73060 U	1940.00	PALEOCENE	LATROBE GROUP	2	.45					GRN/GY CLYST
73060 W	1970.00	PALEOCENE	LATROBE GROUP	2	3.88					DK GRN/GY CLYST
73060 Y	2000.00	PALEOCENE	LATROBE GROUP	2	52.33					COAL
72973 O	2019.70	PALEOCENE	LATROBE GROUP	1	1.24					QUARTZ RICH SLTST
72973 N	2025.80	LATE CRETACEOUS	LATROBE GROUP	1	5.21					DK GY MDST
73061 A	2030.00	LATE CRETACEOUS	LATROBE GROUP	2	.54					LT GRN/GY SST
73061 C	2060.00	LATE CRETACEOUS	LATROBE GROUP	2	3.12					DK GRN/GY SH
72973 M	2067.20	LATE CRETACEOUS	LATROBE GROUP	1	4.89					MICA RICH MD GY MDST
72973 L	2089.40	LATE CRETACEOUS	LATROBE GROUP	1	2.84					MD DK MDST
73061 E	2090.00	LATE CRETACEOUS	LATROBE GROUP	2	3.66					DK GRN/GY SH
73061 G	2120.00	LATE CRETACEOUS	LATROBE GROUP	2	3.26					DK GRN/GY SH, 50% SLTST
73061 I	2150.00	LATE CRETACEOUS	LATROBE GROUP	2	3.29					BRN/GY CLYST, 50% SLTST
73061 K	2180.00	LATE CRETACEOUS	LATROBE GROUP	2	.94					LT GRN/GY SST
73061 M	2210.00	LATE CRETACEOUS	LATROBE GROUP	2	1.51					LT GRN/GY SST
72973 H	2229.00	LATE CRETACEOUS	LATROBE GROUP	1	1.43					MD GY MUDSTONE
73061 O	2240.00	LATE CRETACEOUS	LATROBE GROUP	2	.61					GY/GRN CLYST
72973 G	2264.30	LATE CRETACEOUS	LATROBE GROUP	1	2.63					MD GY SLTST, QUARTZ MICA
73061 Q	2270.00	LATE CRETACEOUS	LATROBE GROUP	2	.73					GY/GRN CLYST
72973 F	2299.50	LATE CRETACEOUS	LATROBE GROUP	1	4.76					BRN GY SLTST
73061 S	2300.00	LATE CRETACEOUS	LATROBE GROUP	2	3.38					DUSKY GRN CLYST, 30% SST
73061 U	2330.00	LATE CRETACEOUS	LATROBE GROUP	2	1.02					GY/GRN SLTST
72973 E	2336.10	LATE CRETACEOUS	LATROBE GROUP	1	2.59					BRN GY SLTST
73061 W	2360.00	LATE CRETACEOUS	LATROBE GROUP	2	3.26					GY/GRN SLTST
73061 Y	2390.00	LATE CRETACEOUS	LATROBE GROUP	2	3.68					DUSKY GRN CLYST
72973 B	2412.00	LATE CRETACEOUS	LATROBE GROUP	1	8.36					DK GY BLK SHALE
73062 A	2420.00	LATE CRETACEOUS	LATROBE GROUP	2	.64					DK GRN/GY CLYST, CEMENT
73062 C	2450.00	LATE CRETACEOUS	LATROBE GROUP	2	.55					CEMENT
73062 E	2480.00	LATE CRETACEOUS	LATROBE GROUP	2	3.00					DUSKY GRN CLYST, CEMENT
73062 G	2600.00	LATE CRETACEOUS	LATROBE GROUP	2	1.36					PALE GRN SST, TR CLYST
73062 I	2630.00	LATE CRETACEOUS	LATROBE GROUP	2	3.82					DK GRN/GY CLYST, TR COAL
73062 M	2690.00	LATE CRETACEOUS	LATROBE GROUP	2	.79					YEL/GY SST
73062 O	2720.00	LATE CRETACEOUS	LATROBE GROUP	2	.40					CRYSTALLINE(IGNEOUS), BLK
73062 Q	2750.00	LATE CRETACEOUS	LATROBE GROUP	2	.04					CRYSTALLINE, BLK
73062 S	2780.00	LATE CRETACEOUS	LATROBE GROUP	2	.23					CRYSTALLINE, GRN/BLK
73062 U	2810.00	LATE CRETACEOUS	LATROBE GROUP	2	.04					CRYSTALLINE, BLK
73062 W	2840.00	LATE CRETACEOUS	LATROBE GROUP	2	1.20					DUSKY GRN CLYST, BLK CRYS
73062 Y	2870.00	LATE CRETACEOUS	LATROBE GROUP	2	2.78					DK GRN/GY CLYST, 40% SST
73063 A	2900.00	LATE CRETACEOUS	LATROBE GROUP	2	1.31					OL GY SLTST, LT BRN/GY SS
73063 E	2960.00	LATE CRETACEOUS	LATROBE GROUP	2	29.32					COAL
73063 G	2990.00	LATE CRETACEOUS	LATROBE GROUP	2	2.62					DK GRN/GY SLTST, TR COAL
73063 I	3020.00	LATE CRETACEOUS	LATROBE GROUP	2	4.90					DUSKY GRN CLYST

TOTAL ORGANIC CARBON REPORT

BASIN - GIPPSLAND
WELL - TUNA 4

SAMPLE NO.	DEPTH	AGE	FORMATION	AN	TOC%	AN	TOC%	AN	TOC%	DESCRIPTION
73063 K	3050.00	LATE CRETACEOUS	LATROBE GROUP	2	4.30					DK GRN/GY CLYST, SLTST
73063 M	3080.00	LATE CRETACEOUS	LATROBE GROUP	2	2.70					BRN/GY SLTST
73063 O	3110.00	LATE CRETACEOUS	LATROBE GROUP	2	2.36					BRN/GY SLTST
73063 Q	3140.00	LATE CRETACEOUS	LATROBE GROUP	2	1.20					GY/GRN SLTST, MNR SST
73037 V	3275.50	LATE CRETACEOUS	LATROBE GROUP	1	4.71					DARK GREY SHALE
73037 W	3277.53	LATE CRETACEOUS	LATROBE GROUP	1	4.15					DARK GREY SHALE
73037 X	3277.88	LATE CRETACEOUS	LATROBE GROUP	1	4.04					DARK GREY SHALE
73023 X	3278.70	LATE CRETACEOUS	LATROBE GROUP	1	2.42					DARK GREY SHALE
73023 Y	3279.45	LATE CRETACEOUS	LATROBE GROUP	1	3.24					DARK GREY SHALE
73023 Z	3280.15	LATE CRETACEOUS	LATROBE GROUP	1	1.18					DK GREY SLTST, CARB.

===> DEPTH : 1558.50 TO 3280.15 METRES. <=== I ===> AVERAGE TOC : 2.94 % EXCLUDING VALUES GREATER THAN 10.00 % <===

ROCK EVAL ANALYSES

BASIN - GIPPSLAND
WELL - TUNA 4

REPORT A - SULPHUR & PYROLYZABLE CARBON

SAMPLE NO.	DEPTH	SAMPLE TYPE	AGE	TMAX	S1	S2	S3	PI	S2/S3	PC	COMMENTS
73023 C	1387.0	SWC	EOCENE	415.	.97	5.85	.57	.14	10.26	.56	
72974 P	1522.1	SWC	EOCENE	418.	.44	6.65	.90	.06	7.38	.59	
72974 O	1531.0	SWC	EOCENE	418.	.31	3.10	.75	.09	4.13	.28	
72974 G	1574.3	SWC	EOCENE	413.	.60	9.22	.81	.06	11.38	.81	
72974 D	1626.1	SWC	PALEOCENE	425.	.23	3.28	1.41	.07	2.32	.29	
72974 C	1646.1	SWC	PALEOCENE	422.	.20	1.90	1.00	.10	1.90	.17	
72974 A	1709.7	SWC	PALEOCENE	428.	.16	2.40	.61	.06	3.93	.21	
72973 Z	1737.0	SWC	PALEOCENE	425.	.32	4.65	1.11	.06	4.18	.41	
72973 Y	1777.2	SWC	PALEOCENE	421.	.48	9.96	1.12	.05	8.89	.87	
72973 X	1789.0	SWC	PALEOCENE	429.	.16	1.75	.86	.08	2.03	.15	
72973 W	1816.0	SWC	PALEOCENE	423.	.32	7.73	.92	.04	8.40	.67	
72973 O	2019.7	SWC	PALEOCENE	417.	.13	.78	.49	.14	1.59	.07	
72973 N	2025.8	SWC	LATE CRETACEOUS	421.	.57	10.02	.84	.05	11.92	.88	
72973 M	2067.2	SWC	LATE CRETACEOUS	423.	.10	.97	.48	.09	2.02	.08	
72973 L	2089.4	SWC	LATE CRETACEOUS	426.	.15	1.84	.50	.08	3.68	.16	
72973 H	2229.0	SWC	LATE CRETACEOUS	433.	.21	2.72	.15	.07	18.13	.24	
72973 G	2264.3	SWC	LATE CRETACEOUS	431.	.13	.80	.24	.14	3.33	.07	
72973 F	2299.5	SWC	LATE CRETACEOUS	429.	.62	7.25	.47	.08	15.42	.65	
72973 E	2336.1	SWC	LATE CRETACEOUS	431.	.77	5.86	.28	.12	20.92	.55	
72973 B	2412.0	SWC	LATE CRETACEOUS	433.	1.86	41.50	.58	.04	71.55	3.61	
73037 V	3275.5	CORE	LATE CRETACEOUS	442.	.78	4.45	.21	.15	21.19	.43	
73037 W	3277.5	CORE	LATE CRETACEOUS	441.	.69	3.67	.16	.16	22.31	.35	
73037 X	3277.9	CORE	LATE CRETACEOUS	445.	.52	3.16	.18	.14	17.55	.30	
73023 X	3278.7	CORE	LATE CRETACEOUS	442.	.43	1.52	.19	.22	8.00	.16	
73023 Y	3279.5	CORE	LATE CRETACEOUS	439.	.70	2.04	.08	.26	25.50	.22	
73023 Z	3280.2	CORE	LATE CRETACEOUS	443.	.17	.30	.02	.37	15.00	.03	

PI=PRODUCTIVITY INDEX PC=PYROLYZABLE CARBON TC=TOTAL CARBON HI=HYDROGEN INDEX OI=OXYGEN INDEX

ROCK EVAL ANALYSES

BASIN - GIPPSLAND
WELL - TUNA 4

REPORT B - TOTAL CARBON, H/O INDICES

SAMPLE NO.	DEPTH	SAMPLE TYPE	FORMATION	TC	HI	OI	HI/OI	COMMENTS
73023 C	1387.0	SWC	FLOUNDER	2.99	195.	19.	10.26	
72974 P	1522.1	SWC	FLOUNDER	4.77	139.	18.	7.72	
72974 O	1531.0	SWC	FLOUNDER	3.13	99.	23.	4.30	
72974 G	1574.3	SWC	LATROBE GROUP	6.21	148.	13.	11.38	
72974 D	1626.1	SWC	LATROBE GROUP	5.03	65.	28.	2.32	
72974 C	1646.1	SWC	LATROBE GROUP	5.60	33.	17.	1.94	
72974 A	1709.7	SWC	LATROBE GROUP	2.51	95.	24.	3.96	
72973 Z	1737.0	SWC	LATROBE GROUP	5.67	82.	19.	4.32	
72973 Y	1777.2	SWC	LATROBE GROUP	6.53	152.	17.	8.94	
72973 X	1789.0	SWC	LATROBE GROUP	3.60	48.	23.	2.09	
72973 W	1816.0	SWC	LATROBE GROUP	5.69	136.	16.	8.50	
72973 O	2019.7	SWC	LATROBE GROUP	1.24	62.	39.	1.59	
72973 N	2025.8	SWC	LATROBE GROUP	5.21	192.	16.	12.00	
72973 M	2067.2	SWC	LATROBE GROUP	4.89	19.	9.	2.11	
72973 L	2089.4	SWC	LATROBE GROUP	2.84	65.	17.	3.82	
72973 H	2229.0	SWC	LATROBE GROUP	1.43	190.	10.	19.00	
72973 G	2264.3	SWC	LATROBE GROUP	2.63	30.	9.	3.33	
72973 F	2299.5	SWC	LATROBE GROUP	4.76	152.	9.	16.89	
72973 E	2336.1	SWC	LATROBE GROUP	2.59	226.	10.	22.60	
72973 B	2412.0	SWC	LATROBE GROUP	8.36	496.	6.	82.67	
73037 V	3275.5	CORE	LATROBE GROUP	4.71	94.	4.	23.50	
73037 W	3277.5	CORE	LATROBE GROUP	4.15	86.	3.	28.67	
73037 X	3277.9	CORE	LATROBE GROUP	4.04	78.	4.	19.50	
73023 X	3278.7	CORE	LATROBE GROUP	2.42	62.	7.	8.86	
73023 Y	3279.5	CORE	LATROBE GROUP	3.24	62.	2.	31.00	
73023 Z	3280.2	CORE	LATROBE GROUP	1.18	25.	1.	25.00	

PI=PRODUCTIVITY INDEX PC=PYROLYZABLE CARBON TC=TOTAL CARBON HI=HYDROGEN INDEX OI=OXYGEN INDEX

KEROGEN ELEMENTAL ANALYSIS REPORT

BASIN - GIPPSLAND
WELL - TUNA 4

SAMPLE NO.	DEPTH	SAMPLE TYPE	--- ELEMENTAL % (ASH FREE) --- N%	C%	H%	S%	O%	ASH%	COMMENTS
73023 E	1375.50	SWC	1.05	58.68	4.68	.00	35.59	.00	
73023 D	1376.00	SWC	1.33	68.77	5.33	.00	24.57	7.21	
73037 T	1382.80	CORE	.77	68.43	5.36	.00	25.44	3.90	
73023 W	1383.50	SWC	.82	69.67	5.42	.00	24.10	4.56	
73037 U	1384.68	CORE	.95	64.00	5.13	.00	29.92	10.83	HIGH ASH
73023 C	1387.00	SWC	.98	69.09	5.41	.00	24.52	8.27	
72974 Q	1516.60	SWC	1.08	68.81	5.43	.00	24.69	5.46	
72974 P	1522.10	SWC	1.32	66.19	5.14	.00	27.35	8.19	
72974 O	1531.00	SWC	1.03	67.80	5.40	.00	25.77	9.95	
72974 L	1559.50	SWC	.90	76.28	4.48	.00	18.35	.80	
72974 K	1560.00	SWC	1.13	71.52	5.47	.00	21.88	5.59	
72974 J	1561.80	SWC	1.11	70.62	5.36	.00	22.90	8.48	
72974 G	1574.30	SWC	1.14	68.39	4.99	.00	25.48	10.29	HIGH ASH
72974 F	1581.80	SWC	.98	74.72	6.29	.00	18.01	2.51	
72974 D	1626.10	SWC	1.18	60.82	4.21	.00	33.79	3.71	
72974 C	1646.10	SWC	1.31	70.44	5.07	.00	23.18	5.92	
72974 B	1703.00	SWC	1.50	71.87	5.10	.00	21.53	2.58	
72974 A	1709.70	SWC	1.45	68.67	5.28	.00	24.59	6.85	
72973 Z	1737.00	SWC	1.46	71.16	4.90	.00	22.48	8.51	
72973 Y	1777.20	SWC	1.50	68.57	4.97	.00	24.95	10.75	HIGH ASH
72973 X	1789.00	SWC	1.47	71.74	4.87	.00	21.91	7.03	
72973 W	1816.00	SWC	1.36	70.82	4.94	.00	22.88	9.31	
72973 U	1880.10	SWC	1.47	76.38	6.43	.00	15.73	1.05	
72973 T	1887.50	SWC	1.48	74.91	5.23	.00	18.38	13.54	HIGH ASH
72973 R	1917.90	SWC	1.24	74.26	4.41	.00	20.10	2.88	
72973 Q	2011.10	SWC	.96	76.79	4.90	.00	17.34	3.54	
72973 O	2019.70	SWC	1.09	74.32	5.34	.00	19.25	4.37	
72973 N	2025.80	SWC	1.12	68.59	4.98	.00	25.31	2.67	
72973 M	2067.20	SWC	1.27	73.54	5.06	.00	20.12	8.15	
72973 L	2089.40	SWC	1.35	74.08	4.44	.00	20.13	1.40	
72973 J	2162.20	SWC	1.24	78.31	4.25	.00	16.20	2.49	
72973 I	2193.00	SWC	1.69	79.02	3.89	.00	15.40	1.45	
72973 H	2229.00	SWC	1.29	69.09	5.16	.00	24.46	5.11	
72973 G	2264.30	SWC	1.43	74.07	4.34	.00	20.16	1.53	
72973 F	2299.50	SWC	1.44	77.94	5.35	.00	15.28	6.27	
72973 E	2336.10	SWC	1.38	79.53	6.11	.00	12.98	9.85	
72973 B	2412.00	SWC	1.15	80.07	6.91	.00	11.87	4.51	
72973 A	2426.00	SWC	1.48	80.54	5.22	.00	12.76	7.34	
73037 Z	2456.00	SWC	1.27	78.29	6.17	.00	14.27	2.53	
73036 X	2462.00	SWC	1.05	81.13	5.79	.00	12.03	2.29	
73036 Y	2464.50	SWC	1.42	82.26	6.17	.00	10.15	7.68	
73037 Q	2468.00	SWC	1.13	81.56	5.92	.00	11.39	2.81	
73023 R	2485.16	CORE	1.38	79.85	5.33	.00	13.45	6.97	
73023 S	2522.00	CORE	1.81	78.71	6.06	.00	13.42	7.90	
73023 T	2558.42	CORE	1.65	80.78	4.81	.00	12.76	1.87	

KEROGEN ELEMENTAL ANALYSIS REPORT

BASIN - GIPPSLAND
WELL - TUNA 4

SAMPLE NO.	DEPTH	SAMPLE TYPE	--- ELEMENTAL % (ASH FREE) ---						COMMENTS
			N%	C%	H%	S%	O%	ASH%	
73036 T	2608.50	SWC	1.12	71.97	5.52	.00	21.39	5.23	
73036 R	2634.00	SWC	.94	48.40	3.12	.00	47.54	6.42	
73036 Q	2642.00	SWC	1.26	70.92	5.85	.00	21.77	6.18	
77571 A	2652.00	SWC	1.51	82.58	6.87	.00	9.04	5.35	
73036 P	2659.50	SWC	1.54	84.24	7.00	.00	7.22	6.39	
73036 F	2768.50	SWC	1.59	82.76	5.46	.00	10.19	6.20	
73035 Y	2815.00	SWC	1.32	80.69	6.57	.00	11.42	5.03	
73023 U	2822.86	CORE	1.65	82.65	5.12	.00	10.58	8.13	
73023 V	2828.45	CORE	1.52	83.83	5.01	.00	9.64	3.81	
73035 O	2909.50	SWC	1.47	77.91	6.18	.00	14.44	7.55	
73035 M	2926.00	SWC	1.48	76.96	6.42	.00	15.14	8.76	
73035 K	2940.00	SWC	1.56	83.90	5.43	.00	9.11	11.05	
73035 I	2946.00	SWC	1.69	82.39	5.13	.00	10.79	7.32	
73037 N	2992.00	SWC	1.63	85.25	4.34	.00	8.78	1.38	
73037 M	3010.50	SWC	1.43	85.24	4.56	.00	8.77	6.16	
73035 D	3024.00	SWC	1.34	67.00	5.25	.00	26.41	9.73	HIGH ASH
73037 K	3026.00	SWC	1.56	83.16	4.73	.00	10.55	7.33	
73035 C	3031.50	SWC	1.62	83.89	5.02	.00	9.47	3.34	
73035 B	3034.30	SWC	1.32	72.72	5.43	.00	20.53	.82	
73035 A	3043.00	SWC	1.64	72.30	4.80	.00	21.26	1.39	
73034 Y	3070.00	SWC	1.34	71.62	5.51	.00	21.52	3.87	
73037 I	3100.00	SWC	1.54	80.43	5.33	.00	12.70	7.16	
73034 W	3125.00	SWC	1.80	78.10	4.64	.00	15.46	4.70	
73037 F	3150.00	SWC	1.55	86.34	4.04	.00	8.08	5.66	
73034 R	3169.00	SWC	1.50	66.99	4.03	.00	27.47	2.96	
73034 Q	3179.50	SWC	2.32	79.81	5.03	.00	12.83	2.36	
73037 C	3207.00	SWC	1.53	84.81	4.68	.00	8.99	3.77	
73034 L	3212.50	SWC	1.19	75.18	3.93	.00	19.70	1.10	
73034 K	3218.50	SWC	1.71	83.05	4.48	.00	10.76	7.16	
73037 B	3225.00	SWC	1.81	79.87	6.10	.00	12.22	8.23	
73037 A	3248.00	SWC	1.67	79.27	4.18	.00	14.88	3.58	
73036 Z	3266.00	SWC	1.45	86.60	3.95	.00	8.00	1.59	
73053 A	3275.45	CORE	1.61	81.48	4.60	.00	12.30	5.86	
73037 V	3275.50	CORE	1.58	82.76	4.28	.00	11.38	2.75	
73037 Y	3275.78	SWC	1.77	74.80	4.22	.00	19.22	8.23	
73053 B	3277.50	CORE	1.57	79.71	4.52	.00	14.20	10.02	HIGH ASH
73037 W	3277.53	CORE	1.49	78.50	4.34	.00	15.67	3.46	
73053 C	3277.82	CORE	1.72	80.13	4.70	.00	13.46	7.92	
73037 X	3277.88	SWC	1.84	81.61	4.71	.00	11.85	6.55	
73053 D	3278.10	CORE	1.80	83.86	4.75	.00	9.59	3.54	
73053 E	3278.42	CORE	1.85	80.49	4.75	.00	12.91	10.60	HIGH ASH
73023 X	3278.70	CORE	1.90	82.09	4.82	.00	11.19	6.31	
73053 F	3279.30	CORE	1.50	75.75	4.42	.00	18.33	3.18	
73053 G	3279.80	CORE	1.85	80.35	4.74	.00	13.07	8.62	
73053 H	3280.42	CORE	1.72	84.60	4.26	.00	9.43	5.08	

KEROGEN ELEMENTAL ANALYSIS REPORT

BASIN - GIPPSLAND
WELL - TUNA 4

SAMPLE NO.	DEPTH	SAMPLE TYPE	--- ELEMENTAL % (ASH FREE) ---						COMMENTS
			N%	C%	H%	S%	O%	ASH%	
73034 E	3281.00	SWC	1.97	81.98	4.67	.00	11.39	7.95	
73034 B	3302.50	SWC	1.97	83.25	4.57	.00	10.21	8.12	

KEROGEN ELEMENTAL ANALYSIS REPORT

BASIN - GIPPSLAND
WELL - TUNA 4

SAMPLE NO.	DEPTH	SAMPLE TYPE	AGE	FORMATION	ATOMIC RATIOS H/C	ATOMIC RATIOS O/C	ATOMIC RATIOS N/C	COMMENTS
73023 E	1375.50	SWC	EOCENE	FLOUNDER	.96	.45	.02	
73023 D	1376.00	SWC	EOCENE	FLOUNDER	.93	.27	.02	
73037 T	1382.80	CORE	EOCENE	FLOUNDER	.94	.28	.01	
73023 W	1383.50	SWC	EOCENE	FLOUNDER	.93	.26	.01	
73037 U	1384.68	CORE	EOCENE	FLOUNDER	.96	.35	.01	HIGH ASH
73023 C	1387.00	SWC	EOCENE	FLOUNDER	.94	.27	.01	
72974 Q	1516.60	SWC	EOCENE	FLOUNDER	.95	.27	.01	
72974 P	1522.10	SWC	EOCENE	FLOUNDER	.93	.31	.02	
72974 O	1531.00	SWC	EOCENE	FLOUNDER	.96	.29	.01	
72974 L	1559.50	SWC	EOCENE	LATROBE GROUP	.70	.18	.01	
72974 K	1560.00	SWC	EOCENE	LATROBE GROUP	.92	.23	.01	
72974 J	1561.80	SWC	EOCENE	LATROBE GROUP	.91	.24	.01	
72974 G	1574.30	SWC	EOCENE	LATROBE GROUP	.88	.28	.01	HIGH ASH
72974 F	1581.80	SWC	PALEOCENE	LATROBE GROUP	1.01	.18	.01	
72974 D	1626.10	SWC	PALEOCENE	LATROBE GROUP	.83	.42	.02	
72974 C	1646.10	SWC	PALEOCENE	LATROBE GROUP	.86	.25	.02	
72974 B	1703.00	SWC	PALEOCENE	LATROBE GROUP	.85	.22	.02	
72974 A	1709.70	SWC	PALEOCENE	LATROBE GROUP	.92	.27	.02	
72973 Z	1737.00	SWC	PALEOCENE	LATROBE GROUP	.83	.24	.02	
72973 Y	1777.20	SWC	PALEOCENE	LATROBE GROUP	.87	.27	.02	HIGH ASH
72973 X	1789.00	SWC	PALEOCENE	LATROBE GROUP	.81	.23	.02	
72973 W	1816.00	SWC	PALEOCENE	LATROBE GROUP	.84	.24	.02	
72973 U	1880.10	SWC	PALEOCENE	LATROBE GROUP	1.01	.15	.02	
72973 T	1887.50	SWC	PALEOCENE	LATROBE GROUP	.84	.18	.02	HIGH ASH
72973 R	1917.90	SWC	PALEOCENE	LATROBE GROUP	.71	.20	.01	
72973 Q	2011.10	SWC	PALEOCENE	LATROBE GROUP	.77	.17	.01	
72973 O	2019.70	SWC	PALEOCENE	LATROBE GROUP	.86	.19	.01	
72973 N	2025.80	SWC	LATE CRETACEOUS	LATROBE GROUP	.87	.28	.01	
72973 M	2067.20	SWC	LATE CRETACEOUS	LATROBE GROUP	.83	.21	.01	
72973 L	2089.40	SWC	LATE CRETACEOUS	LATROBE GROUP	.72	.20	.02	
72973 J	2162.20	SWC	LATE CRETACEOUS	LATROBE GROUP	.65	.16	.01	
72973 I	2193.00	SWC	LATE CRETACEOUS	LATROBE GROUP	.59	.15	.02	
72973 H	2229.00	SWC	LATE CRETACEOUS	LATROBE GROUP	.90	.27	.02	
72973 G	2264.30	SWC	LATE CRETACEOUS	LATROBE GROUP	.70	.20	.02	
72973 F	2299.50	SWC	LATE CRETACEOUS	LATROBE GROUP	.82	.15	.02	
72973 E	2336.10	SWC	LATE CRETACEOUS	LATROBE GROUP	.92	.12	.01	
72973 B	2412.00	SWC	LATE CRETACEOUS	LATROBE GROUP	1.04	.11	.01	
72973 A	2426.00	SWC	LATE CRETACEOUS	LATROBE GROUP	.78	.12	.02	
73037 Z	2456.00	SWC	LATE CRETACEOUS	LATROBE GROUP	.95	.14	.01	
73036 X	2462.00	SWC	LATE CRETACEOUS	LATROBE GROUP	.86	.11	.01	
73036 Y	2464.50	SWC	LATE CRETACEOUS	LATROBE GROUP	.90	.09	.01	
73037 Q	2468.00	SWC	LATE CRETACEOUS	LATROBE GROUP	.87	.10	.01	
73023 R	2485.16	CORE	LATE CRETACEOUS	LATROBE GROUP	.80	.13	.01	
73023 S	2522.00	CORE	LATE CRETACEOUS	LATROBE GROUP	.92	.13	.02	
73023 T	2558.42	CORE	LATE CRETACEOUS	LATROBE GROUP	.71	.12	.02	

KEROGEN ELEMENTAL ANALYSIS REPORT

BASIN - GIPPSLAND
WELL - TUNA 4

SAMPLE NO.	DEPTH	SAMPLE TYPE	AGE	FORMATION	ATOMIC RATIOS H/C	O/C	N/C	COMMENTS
73036 T	2608.50	SWC	LATE CRETACEOUS	LATROBE GROUP	.92	.22	.01	
73036 R	2634.00	SWC	LATE CRETACEOUS	LATROBE GROUP	.77	.74	.02	
73036 Q	2642.00	SWC	LATE CRETACEOUS	LATROBE GROUP	.99	.23	.02	
77571 A	2652.00	SWC	LATE CRETACEOUS	LATROBE GROUP	1.00	.08	.02	
73036 P	2659.50	SWC	LATE CRETACEOUS	LATROBE GROUP	1.00	.06	.02	
73036 F	2768.50	SWC	LATE CRETACEOUS	LATROBE GROUP	.79	.09	.02	
73035 Y	2815.00	SWC	LATE CRETACEOUS	LATROBE GROUP	.98	.11	.01	
73023 U	2822.86	CORE	LATE CRETACEOUS	LATROBE GROUP	.74	.10	.02	
73023 V	2828.45	CORE	LATE CRETACEOUS	LATROBE GROUP	.72	.09	.02	
73035 O	2909.50	SWC	LATE CRETACEOUS	LATROBE GROUP	.95	.14	.02	
73035 M	2926.00	SWC	LATE CRETACEOUS	LATROBE GROUP	1.00	.15	.02	
73035 K	2940.00	SWC	LATE CRETACEOUS	LATROBE GROUP	.78	.08	.02	
73035 I	2946.00	SWC	LATE CRETACEOUS	LATROBE GROUP	.75	.10	.02	
73037 N	2992.00	SWC	LATE CRETACEOUS	LATROBE GROUP	.61	.08	.02	
73037 M	3010.50	SWC	LATE CRETACEOUS	LATROBE GROUP	.64	.08	.01	
73035 D	3024.00	SWC	LATE CRETACEOUS	LATROBE GROUP	.94	.30	.02	HIGH ASH
73037 K	3026.00	SWC	LATE CRETACEOUS	LATROBE GROUP	.68	.10	.02	
73035 C	3031.50	SWC	LATE CRETACEOUS	LATROBE GROUP	.72	.08	.02	
73035 B	3034.30	SWC	LATE CRETACEOUS	LATROBE GROUP	.90	.21	.02	
73035 A	3043.00	SWC	LATE CRETACEOUS	LATROBE GROUP	.80	.22	.02	
73034 Y	3070.00	SWC	LATE CRETACEOUS	LATROBE GROUP	.92	.23	.02	
73037 I	3100.00	SWC	LATE CRETACEOUS	LATROBE GROUP	.80	.12	.02	
73034 W	3125.00	SWC	LATE CRETACEOUS	LATROBE GROUP	.71	.15	.02	
73037 F	3150.00	SWC	LATE CRETACEOUS	LATROBE GROUP	.56	.07	.02	
73034 R	3169.00	SWC	LATE CRETACEOUS	LATROBE GROUP	.72	.31	.02	
73034 Q	3179.50	SWC	LATE CRETACEOUS	LATROBE GROUP	.76	.12	.02	
73037 C	3207.00	SWC	LATE CRETACEOUS	LATROBE GROUP	.66	.08	.02	
73034 L	3212.50	SWC	LATE CRETACEOUS	LATROBE GROUP	.63	.20	.01	
73034 K	3218.50	SWC	LATE CRETACEOUS	LATROBE GROUP	.65	.10	.02	
73037 B	3225.00	SWC	LATE CRETACEOUS	LATROBE GROUP	.92	.11	.02	
73037 A	3248.00	SWC	LATE CRETACEOUS	LATROBE GROUP	.63	.14	.02	
73036 Z	3266.00	SWC	LATE CRETACEOUS	LATROBE GROUP	.55	.07	.01	
73053 A	3275.45	CORE	LATE CRETACEOUS	LATROBE GROUP	.68	.11	.02	
73037 V	3275.50	CORE	LATE CRETACEOUS	LATROBE GROUP	.62	.10	.02	
73037 Y	3275.78	SWC	LATE CRETACEOUS	LATROBE GROUP	.68	.19	.02	
73053 B	3277.50	CORE	LATE CRETACEOUS	LATROBE GROUP	.68	.13	.02	HIGH ASH
73037 W	3277.53	CORE	LATE CRETACEOUS	LATROBE GROUP	.66	.15	.02	
73053 C	3277.82	CORE	LATE CRETACEOUS	LATROBE GROUP	.70	.13	.02	
73037 X	3277.88	SWC	LATE CRETACEOUS	LATROBE GROUP	.69	.11	.02	
73053 D	3278.10	CORE	LATE CRETACEOUS	LATROBE GROUP	.68	.09	.02	
73053 E	3278.42	CORE	LATE CRETACEOUS	LATROBE GROUP	.71	.12	.02	HIGH ASH
73023 X	3278.70	CORE	LATE CRETACEOUS	LATROBE GROUP	.71	.10	.02	
73053 F	3279.30	CORE	LATE CRETACEOUS	LATROBE GROUP	.70	.18	.02	
73053 G	3279.80	CORE	LATE CRETACEOUS	LATROBE GROUP	.71	.12	.02	
73053 H	3280.42	CORE	LATE CRETACEOUS	LATROBE GROUP	.60	.08	.02	

KEROGEN ELEMENTAL ANALYSIS REPORT

BASIN - GIPPSLAND
WELL - TUNA 4

SAMPLE NO.	DEPTH	SAMPLE TYPE	AGE	FORMATION	ATOMIC RATIOS			COMMENTS
					H/C	O/C	N/C	
73034 E	3281.00	SWC	LATE CRETACEOUS	LATROBE GROUP	.68	.10	.02	
73034 B	3302.50	SWC	LATE CRETACEOUS	LATROBE GROUP	.66	.09	.02	

VITRINITE REFLECTANCE REPORT

BASIN - GIPPSLAND
WELL - TUNA 4

SAMPLE NO.	DEPTH	AGE	FORMATION	AN	MAX. RO	FLUOR. COLOUR	NO. CNTS.	MACERAL TYPE
73023 P	1362.60	EARLY MIOCENE	LAKES ENTRANCE	5	.65	GRN-OR	5	E>I, DOM SPARSE
73023 W	1383.50	EOCENE	FLOUNDER	5	.36	GRN-OR	27	V>E, SHLY COAL ABUNDANT
72974 G	1574.30	EOCENE	LATROBE GROUP	5	.49	YEL-DULL OR	25	V>OR=I>E SHLY COAL DOMIN
72974 F	1581.80	PALEOCENE	LATROBE GROUP	5	.45	YEL-OR	25	E>I>V DOM ABUNDANT
72973 W	1816.00	PALEOCENE	LATROBE GROUP	5	.50	YEL-OR	27	I>E>V DOM ABUNDANT
72973 V	1847.00	PALEOCENE	LATROBE GROUP	5	.50	YEL-OR	27	V>>E, COAL DOMINANT
72973 R	1917.90	PALEOCENE	LATROBE GROUP	5	.50	YEL-OR	21	I>E>V DOM ABUNDANT
72973 L	2089.40	LATE CRETACEOUS	LATROBE GROUP	5	.53	YEL-OR	16	I>E>V DOM ABUNDANT
72973 G	2264.30	LATE CRETACEOUS	LATROBE GROUP	5	.50	YEL-OR	25	I>V>E DOM ABUNDANT
72973 B	2412.00	LATE CRETACEOUS	LATROBE GROUP	5	.50	YEL-BRN	25	E>V>I DOM MAJOR
73036 Q	2642.00	LATE CRETACEOUS	LATROBE GROUP	5	.52	YEL-OR	28	V>E>I, DOM ABUNDANT
73036 F	2768.50	LATE CRETACEOUS	LATROBE GROUP	5	.57	YEL-OR	17	I>E>V, DOM ABUNDANT
73035 R	2875.00	LATE CRETACEOUS	LATROBE GROUP	5	.75	YEL-OR	22	I=V=E, DOM COMMON
73035 Q	2885.00	LATE CRETACEOUS	LATROBE GROUP	5	.72	YEL-DULL OR	30	I>V>E, DOM MAJOR
73035 M	2926.00	LATE CRETACEOUS	LATROBE GROUP	5	.69	YEL-OR	27	E>V>I, DOM ABUNDANT
73035 I	2946.00	LATE CRETACEOUS	LATROBE GROUP	5	.69	YEL-OR	29	I>V>E, DOM ABUNDANT
73035 D	3024.00	LATE CRETACEOUS	LATROBE GROUP	5	.70	YEL-OR	26	E>V>I, DOM ABUNDANT
73037 K	3026.00	LATE CRETACEOUS	LATROBE GROUP	5	.75	YEL-OR	17	I>E>V, DOM ABUNDANT
73037 R	3095.00	LATE CRETACEOUS	LATROBE GROUP	5	.75	OR-DULL OR	25	I>V>E, DOM SPARSE
73037 S	3135.00	LATE CRETACEOUS	LATROBE GROUP	5	.75	OR-DULL OR	25	I>V>E, DOM ABUNDANT
73034 Q	3179.50	LATE CRETACEOUS	LATROBE GROUP	5	.79	YEL-OR	28	I>E>V, DOM ABUNDANT
73023 X	3278.70	LATE CRETACEOUS	LATROBE GROUP	5	.84	YEL-OR	30	DOM ABUNDANT-MAJOR
73023 Y	3279.45	LATE CRETACEOUS	LATROBE GROUP	5	.87	YEL-OR	27	I>V>E, DOM MAJOR
73023 Z	3280.15	LATE CRETACEOUS	LATROBE GROUP	5	.90	OR	10	I>V>E, DOM ABUNDANT
73034 E	3281.00	LATE CRETACEOUS	LATROBE GROUP	5	.93	OR-DULL OR	4	I>E>V, DOM COMMON
73034 B	3302.50	LATE CRETACEOUS	LATROBE GROUP	5	.86	YEL-OR	12	I>E>V, DOM ABUNDANT

C15+ EXTRACT ANALYSES

BASIN - GIPPSLAND
WELL - TUNA 4

REPORT A - EXTRACT DATA (PPM)

SAMPLE NO.	DEPTH	TYPE	AN	AGE	TOTAL EXTRACT	HYDROCARBONS SATS.	HYDROCARBONS AROMS.	HYDROCARBONS TOTAL H/CARBS	NON-HYDROCARBONS ASPH.	NON-HYDROCARBONS ELUTED NSO	NON-HYDROCARBONS NON-ELT NSO	NON-HYDROCARBONS TOTAL NSO	SULPHUR	TOTAL NON/HCS
73059 E	1280.00	CTS	2	EARLY MIOCENE	211.	0.	0.	0.	158.	0.	0.	0.	0.	158.
73059 Y	1610.00	CTS	2	PALEOCENE	642.	40.	102.	142.	386.	98.	12.	110.	4.	500.
73060 U	1940.00	CTS	2	PALEOCENE	841.	55.	93.	148.	601.	75.	13.	88.	4.	693.
73061 S	2300.00	CTS	2	LATE CRETACEOUS	1330.	131.	216.	347.	792.	135.	43.	178.	13.	983.
73062 I	2630.00	CTS	2	LATE CRETACEOUS	1790.	501.	365.	866.	722.	163.	23.	186.	16.	924.
73062 U	2810.00	CTS	2	LATE CRETACEOUS	462.	73.	79.	152.	196.	26.	19.	45.	69.	310.
73063 S	3170.00	CTS	2	LATE CRETACEOUS	719.	142.	161.	303.	328.	56.	23.	79.	9.	416.

C15+ EXTRACT ANALYSES

BASIN - GIPPSLAND
WELL - TUNA 4

REPORT B - EXTRACTS % OF TOTAL

SAMPLE NO.	DEPTH	FORMATION	HYDROCARBONS SAT. %	HYDROCARBONS AROM. %	NON-HYDROCARBONS NSO. %	NON-HYDROCARBONS ASPH. %	NON-HYDROCARBONS SULPH%	SAT/AR	HC/NHC	COMMENTS
73059 E	1280.00	LAKES ENTRANCE	.0	.0	.0	74.9	.0	.0	.0	IMMATURE, MARINE+TERREST.
73059 Y	1610.00	LATROBE GROUP	6.2	15.9	17.1	60.1	.6	.4	.3	IMMATURE, TERRESTRIAL
73060 U	1940.00	LATROBE GROUP	6.5	11.1	10.5	71.5	.5	.6	.2	IMMATURE, TERRESTRIAL
73061 S	2300.00	LATROBE GROUP	9.8	16.2	13.4	59.5	1.0	.6	.4	IMMATURE, TERRESTRIAL
73062 I	2630.00	LATROBE GROUP	28.0	20.4	10.4	40.3	.9	1.4	.9	EARLY MATURE, TERREST.
73062 U	2810.00	LATROBE GROUP	15.8	17.1	9.7	42.4	14.9	.9	.5	EARLY MATURE, TERREST.
73063 S	3170.00	LATROBE GROUP	19.7	22.4	11.0	45.6	1.3	.9	.7	MATURE, TERRESTRIAL

TABLE 8

AMDEL

OIL ANALYSIS

WELL: TUNA-4

SAMPLE: 73038-R 1400.5M

OIL COMPOSITION (C-12 PLUS FRACTION)

n+iso PARAFFINS	8.7
NAPHTHENES	48.1
AROMATICS	25.5
RESINS	17.2
ASPHALTENES	.6

ISOPRENOID RATIOS

TMTD/pristane ratio	.72
norpristane/pristane ratio	.45
pristane/phytane ratio	1.86

TABLE 9

AMDEL
OIL ANALYSIS

WELL: TUNA-4

SAMPLE: 73038-S 2507.2M

OIL COMPOSITION (C-12 PLUS FRACTION)

n+iso PARAFFINS	60.2
NAPHTHENES	17.8
AROMATICS	8.4
RESINS	12.4
ASPHALTENES	1.2

N-ALKANE DISTRIBUTION IN SATURATES

C-NO.	%	C-NO.	%	C-NO.	%	C-NO.	%	C-NO.	%
12	.0	17	6.2	22	9.2	27	4.6	32	.3
13	.3	18	7.6	23	9.0	28	2.7	33	.2
14	1.2	19	8.3	24	8.0	29	1.9	34	.0
15	2.9	20	9.2	25	7.2	30	1.0	35	.0
16	4.6	21	9.4	26	5.4	31	.7	36	.0

ODD EVEN PREDOMINANCE

O.E.P. C-17 = 1
O.E.P. C-19 = .98
O.E.P. C-25 = 1.06
O.E.P. C-27 = 1.12

ISOPRENOID RATIOS

TMTD/pristane ratio	.19
norpristane/pristane ratio	.16
pristane/phytane ratio	6.54
pristane/C-17 ratio	.62
phytane/C-18 ratio	.08

TABLE 10

AMDEL

OIL ANALYSIS

WELL: TUNA-4

SAMPLE: 73038-T 2820-2829M

OIL COMPOSITION (C-12 PLUS FRACTION)

n+iso PARAFFINS	57.3
NAPHTHENES	17.2
AROMATICS	11.3
RESINS	13.5
ASPHALTENES	.8

N-ALKANE DISTRIBUTION IN SATURATES

C-NO.	%	C-NO.	%	C-NO.	%	C-NO.	%	C-NO.	%
12	.0	17	4.1	22	8.3	27	7.2	32	.9
13	.2	18	5.0	23	8.7	28	5.1	33	.6
14	.9	19	6.2	24	8.7	29	4.2	34	.2
15	2.0	20	6.8	25	8.7	30	2.4	35	.2
16	3.0	21	7.6	26	7.3	31	1.9	36	.0

ODD EVEN PREDOMINANCE

O.E.P. C-17 = 1.03
O.E.P. C-19 = 1.04
O.E.P. C-25 = 1.07
O.E.P. C-27 = 1.14

ISOPRENOID RATIOS

TMTD/pristane ratio	.23
norpristane/pristane ratio	.21
pristane/phytane ratio	6.92
pristane/C-17 ratio	.58
phytane/C-18 ratio	.07

TABLE 11

AMDEL

OIL ANALYSIS

WELL: TUNA-4

SAMPLE: 73038-U 2948.5M

OIL COMPOSITION (C-12 PLUS FRACTION)

n+iso PARAFFINS	58.1
NAPHTHENES	17.6
AROMATICS	7.9
RESINS	15.7
ASPHALTENES	.8

N-ALKANE DISTRIBUTION IN SATURATES

C-NO.	%	C-NO.	%	C-NO.	%	C-NO.	%	C-NO.	%
12	.0	17	5.3	22	9.8	27	4.8	32	.3
13	.9	18	6.7	23	9.5	28	2.9	33	.2
14	2.0	19	6.0	24	8.4	29	2.0	34	.0
15	3.1	20	8.9	25	7.6	30	1.1	35	.0
16	4.3	21	9.8	26	5.7	31	.7	36	.0

ODD EVEN PREDOMINANCE

O.E.P. C-17 = .94
O.E.P. C-19 = .82
O.E.P. C-25 = 1.06
O.E.P. C-27 = 1.12

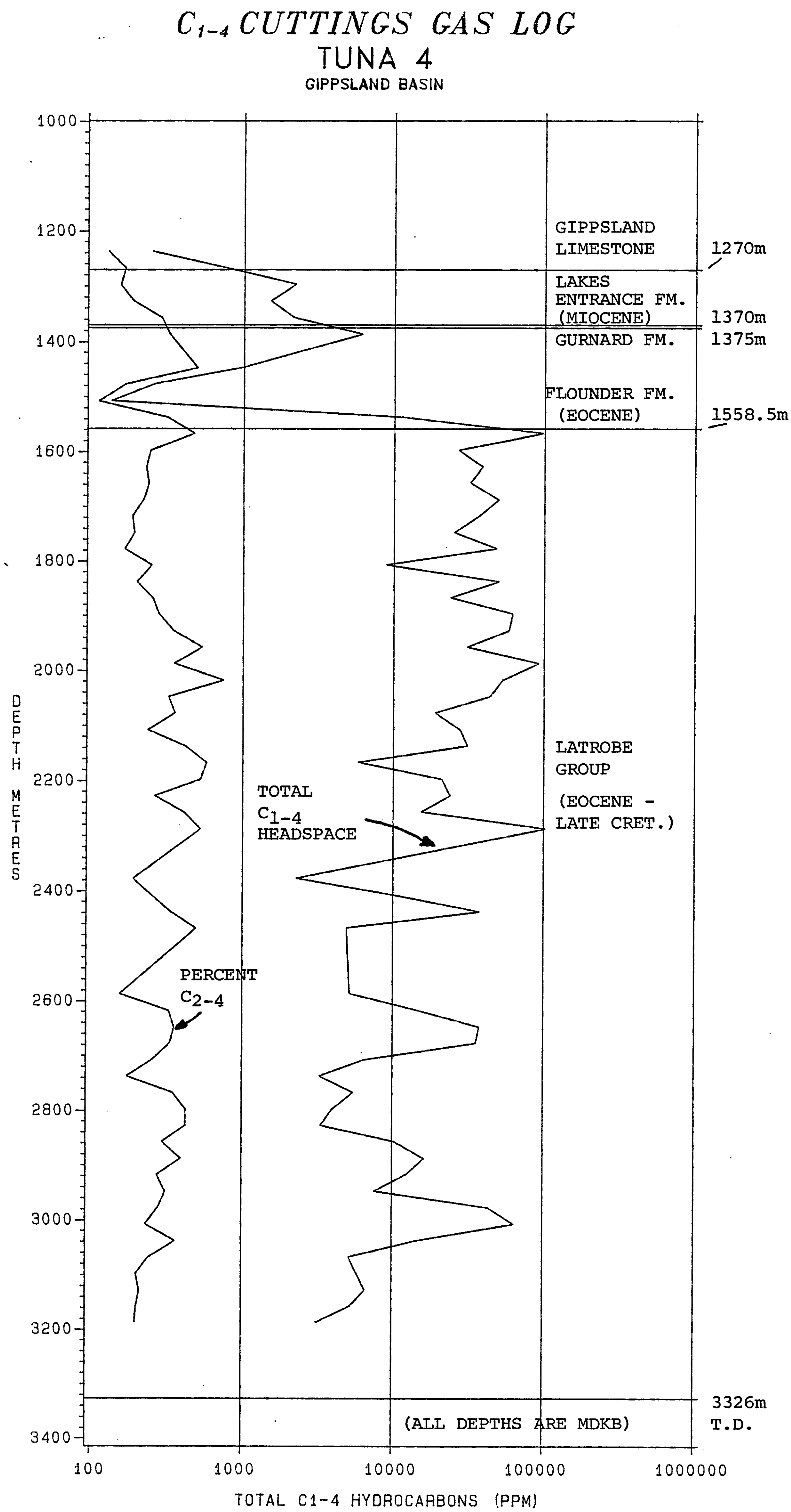
ISOPRENOID RATIOS

TMTD/pristane ratio	.26
norpristane/pristane ratio	.24
pristane/phytane ratio	6.06
pristane/C-17 ratio	.66
phytane/C-18 ratio	.09

TABLE 12

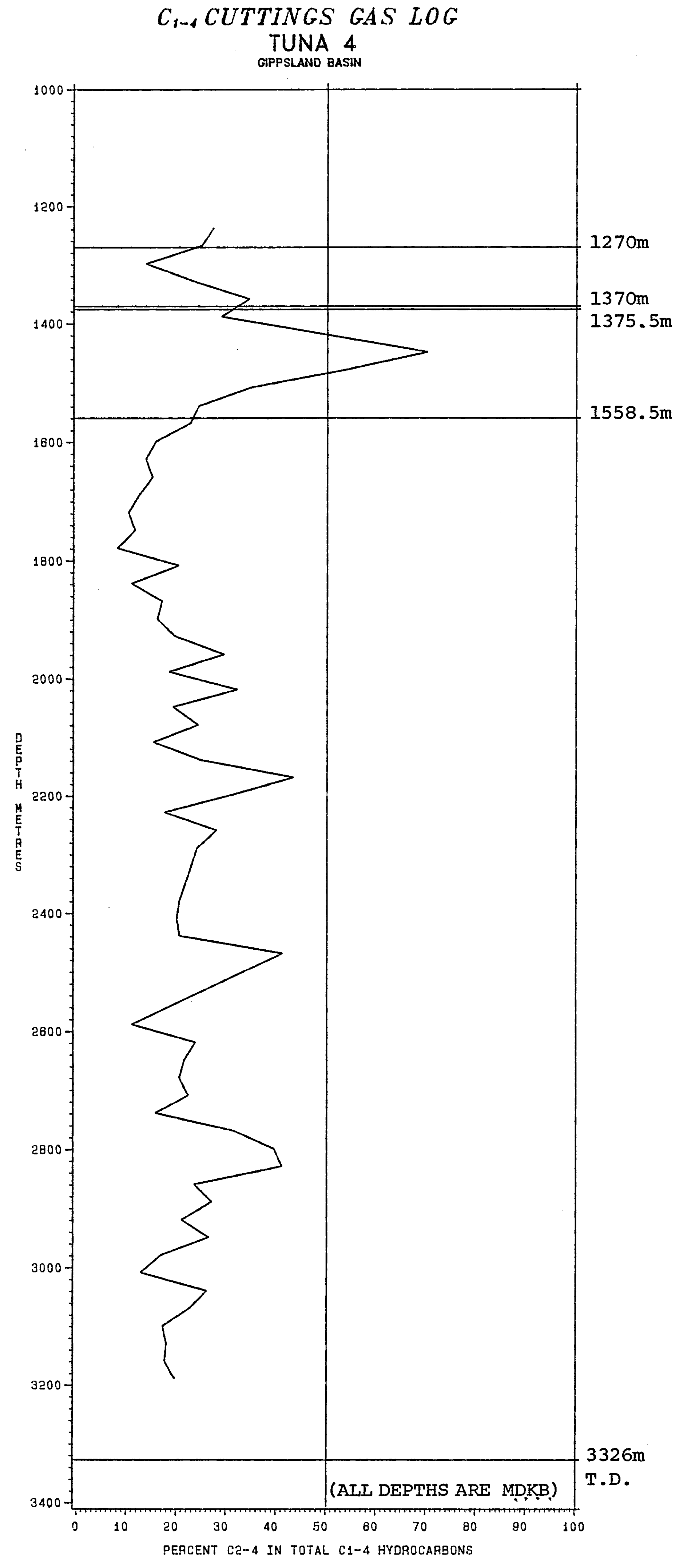
API GRAVITIES FOR TUNA-4 OILS

Sample No.	Sample	Depth (mKB)	°API (at 60°F)
77038-R	RFT 2/18	1400.5	48.27
77688-P	RFT 8/50	2475	-
73038-S	RFT 13/57	2507.2	38.8
77688-L	RFT 9/51	2550	39.8
77688-Q	RFT 10/52	2566	41.1
73038-T	Production Test -2	2820-2829	37.58
77688-S	Cased Hole RFT 2/4	2940	37.56
73038-U	RFT 18/88	2948.5	38.94



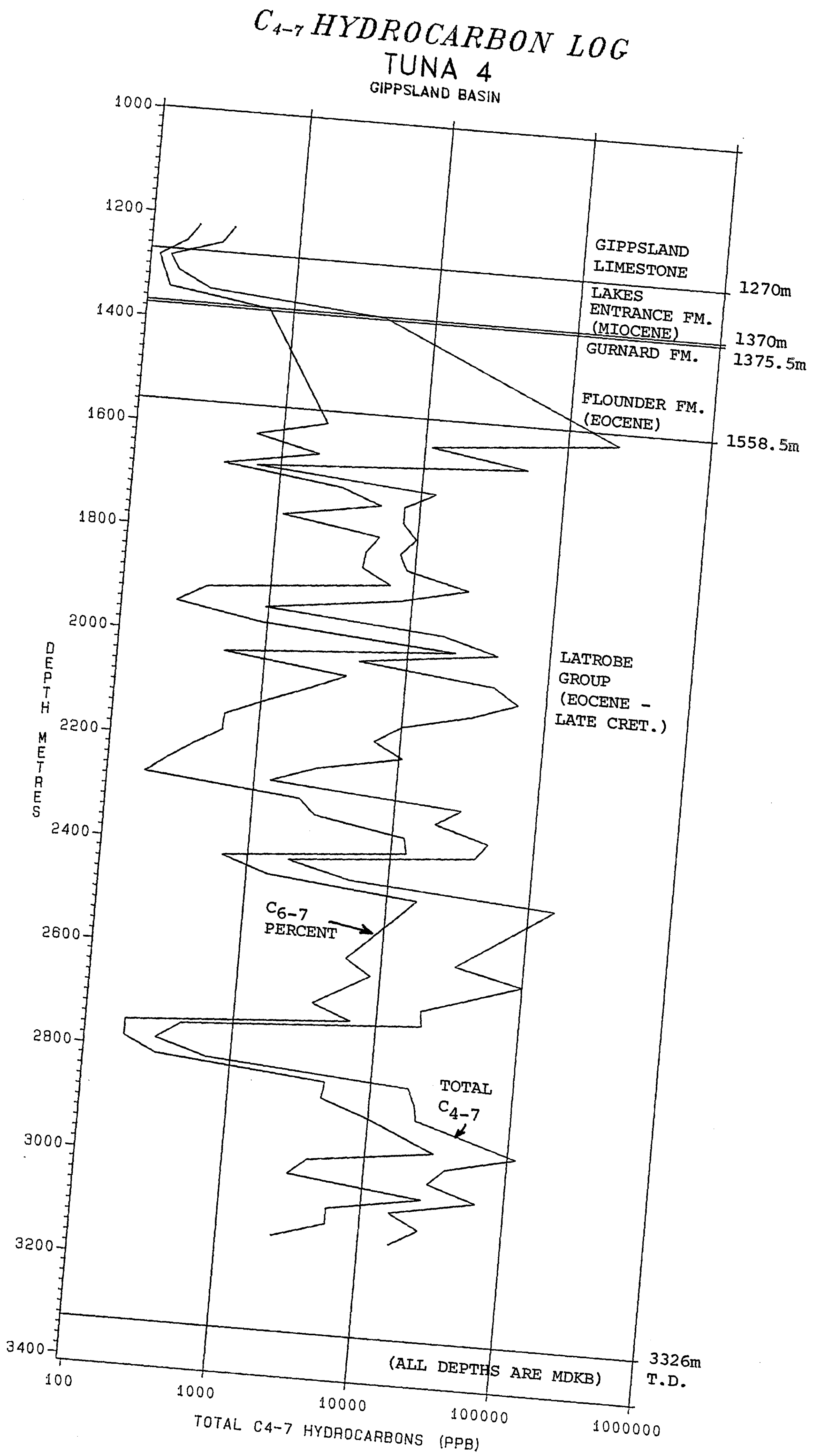
C1-4 CUTTINGS GAS LOG
TUNA 4
GIPPSLAND BASIN
1000
1200
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200
3400
DEPTH METRES
GIPPSLAND LIMESTONE
1270m
LAKES ENTRANCE FM. (MIOCENE)
1370m
GURNARD FM.
1375m
FLOUNDER FM. (EOCENE)
1558.5m
LATROBE GROUP
(EOCENE - LATE CRET.)
TOTAL C1-4 HEADSPACE
PERCENT C2-4
3326m T.D.
(ALL DEPTHS ARE MDKB)
100
1000
10000
100000
1000000
TOTAL C1-4 HYDROCARBONS (PPM)

FIGURE 1(b)

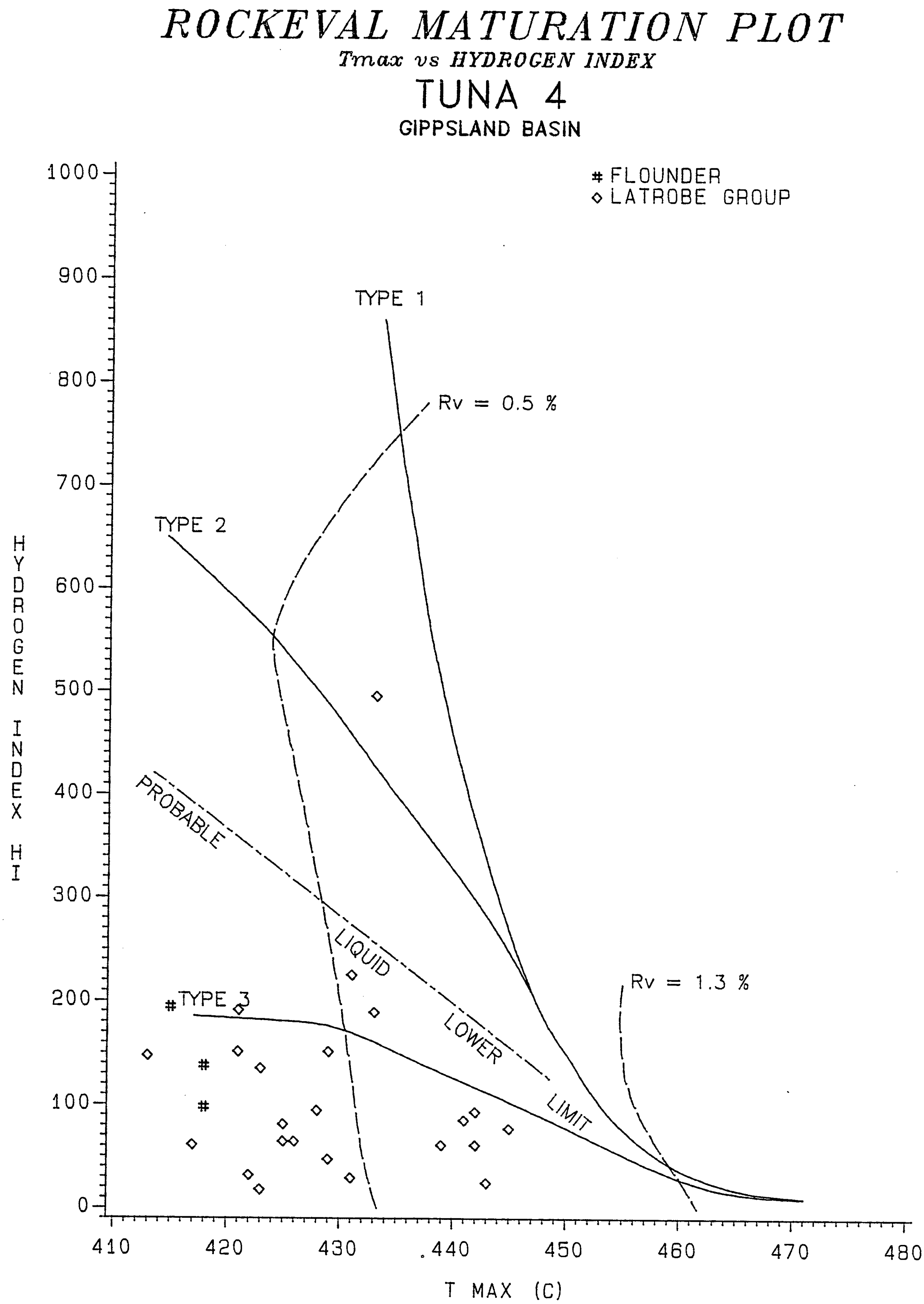


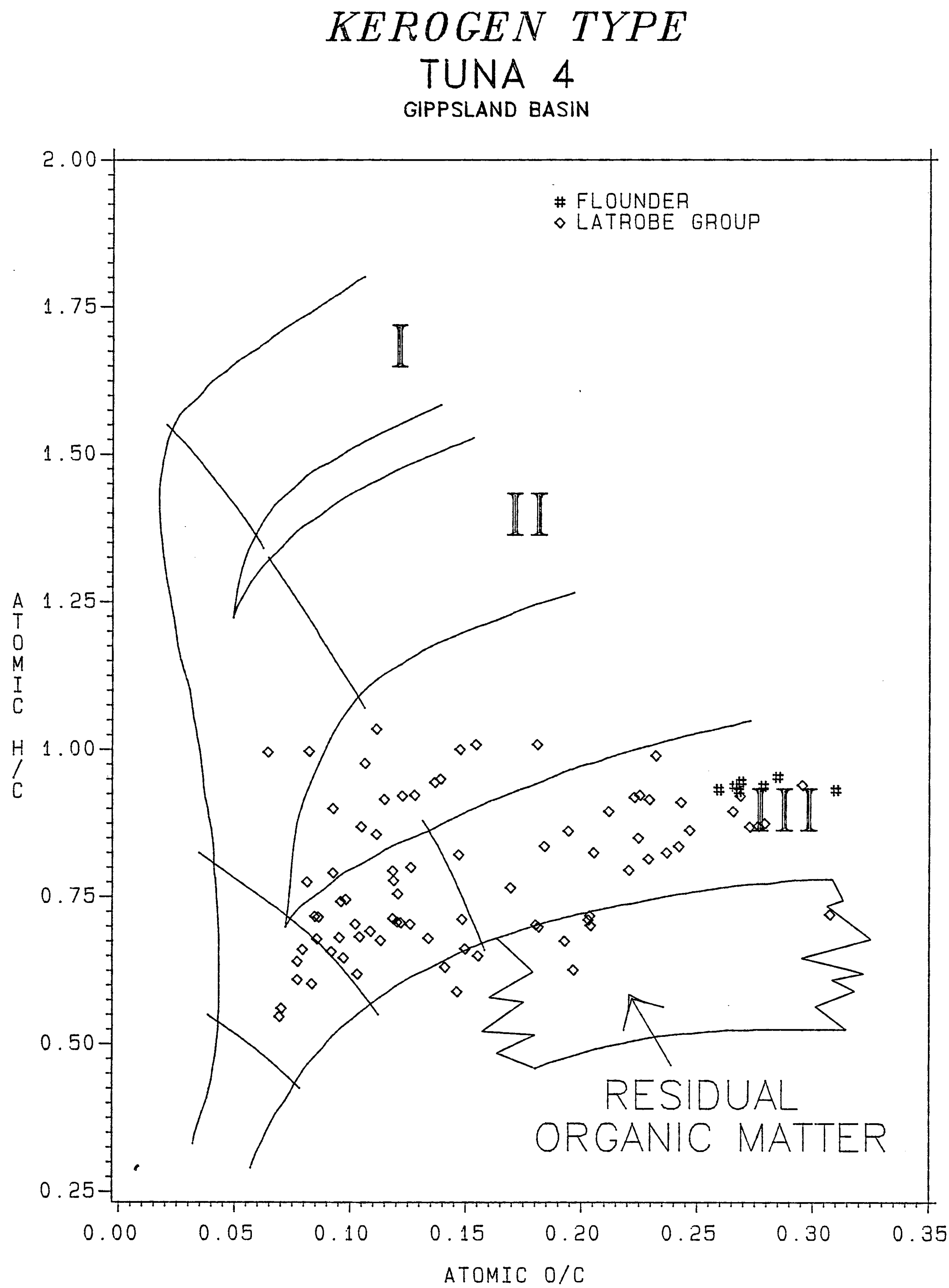
C1-4 CUTTINGS GAS LOG
TUNA 4
GIPPSLAND BASIN
DEPTH METRES
1000
1200
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200
3400
1270m
1370m
1375.5m
1558.5m
3326m
T.D.
(ALL DEPTHS ARE MDKB)
0 10 20 30 40 50 60 70 80 90 100
PERCENT C2-4 IN TOTAL C1-4 HYDROCARBONS

FIGURE 2

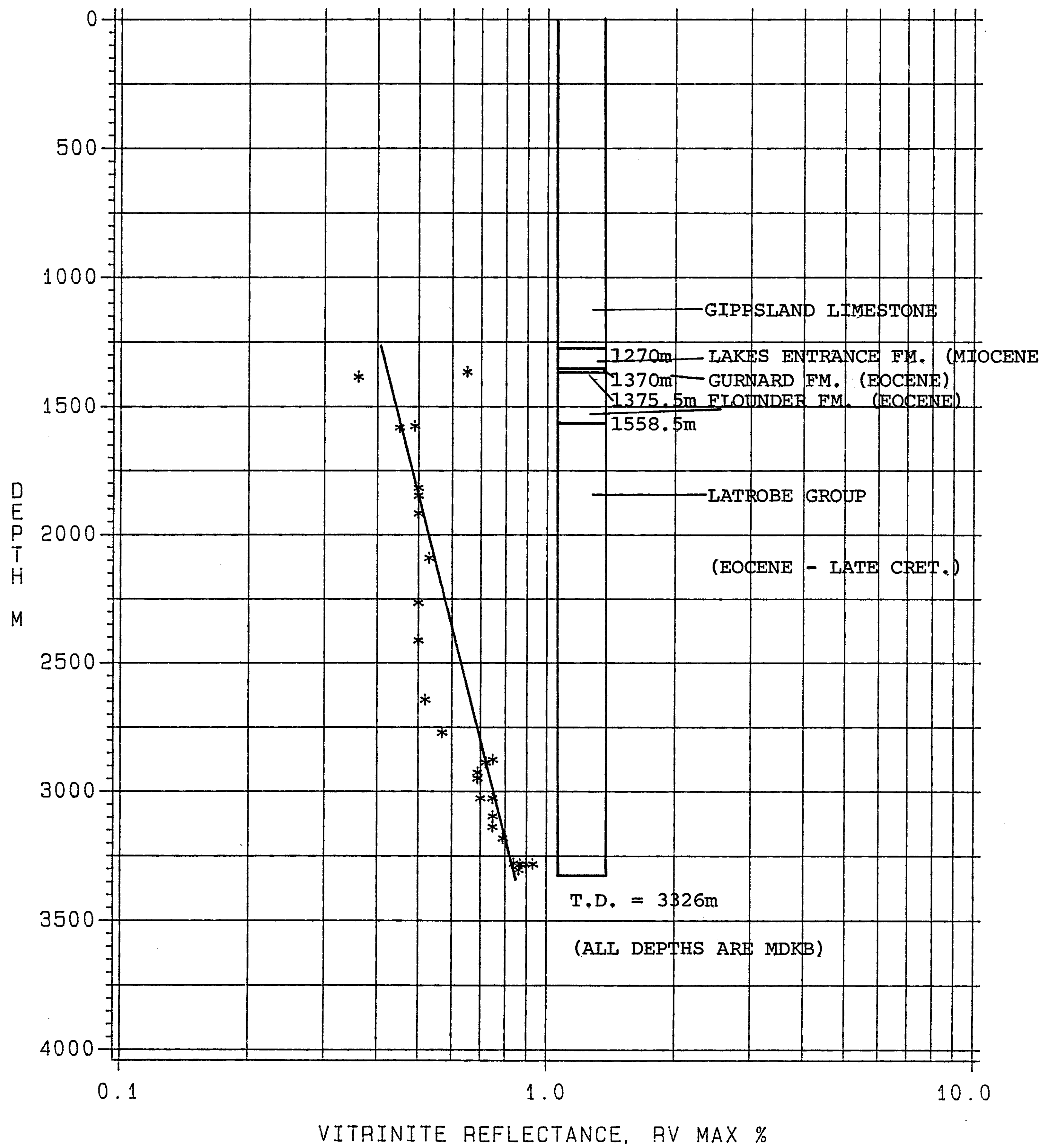


C4-7 HYDROCARBON LOG
TUNA 4
GIPPSLAND BASIN
1000
1200
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200
3400
DEPTH METRES
GIPPSLAND LIMESTONE
1270m
LAKES ENTRANCE FM. (MIOCENE)
1370m
GURNARD FM.
1375.5m
FLOUNDER FM. (EOCENE)
1558.5m
LATROBE GROUP (EOCENE - LATE CRET.)
C6-7 PERCENT
TOTAL C4-7
(ALL DEPTHS ARE MDKB)
3326m T.D.
100
1000
10000
100000
1000000
TOTAL C4-7 HYDROCARBONS (PPB)


ROCKEVAL MATURATION PLOT
Tmax vs HYDROGEN INDEX
TUNA 4
GIPPSLAND BASIN
FLOUNDER
◇ LATROBE GROUP
TYPE 1
Rv = 0.5 %
TYPE 2
PROBABLE
LIQUID
LOWER
LIMIT
TYPE 3
Rv = 1.3 %
HYDROGEN INDEX HI
T MAX (C)
0
100
200
300
400
500
600
700
800
900
1000
410
420
430
440
450
460
470
480


KEROGEN TYPE
TUNA 4
GIPPSLAND BASIN
FLOUNDER
◇ LATROBE GROUP
I
II
III
RESIDUAL ORGANIC MATTER
ATOMIC H/C
ATOMIC O/C
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35

VITRINITE REFLECTANCE vs. DEPTH
TUNA 4
GIPPSLAND BASIN



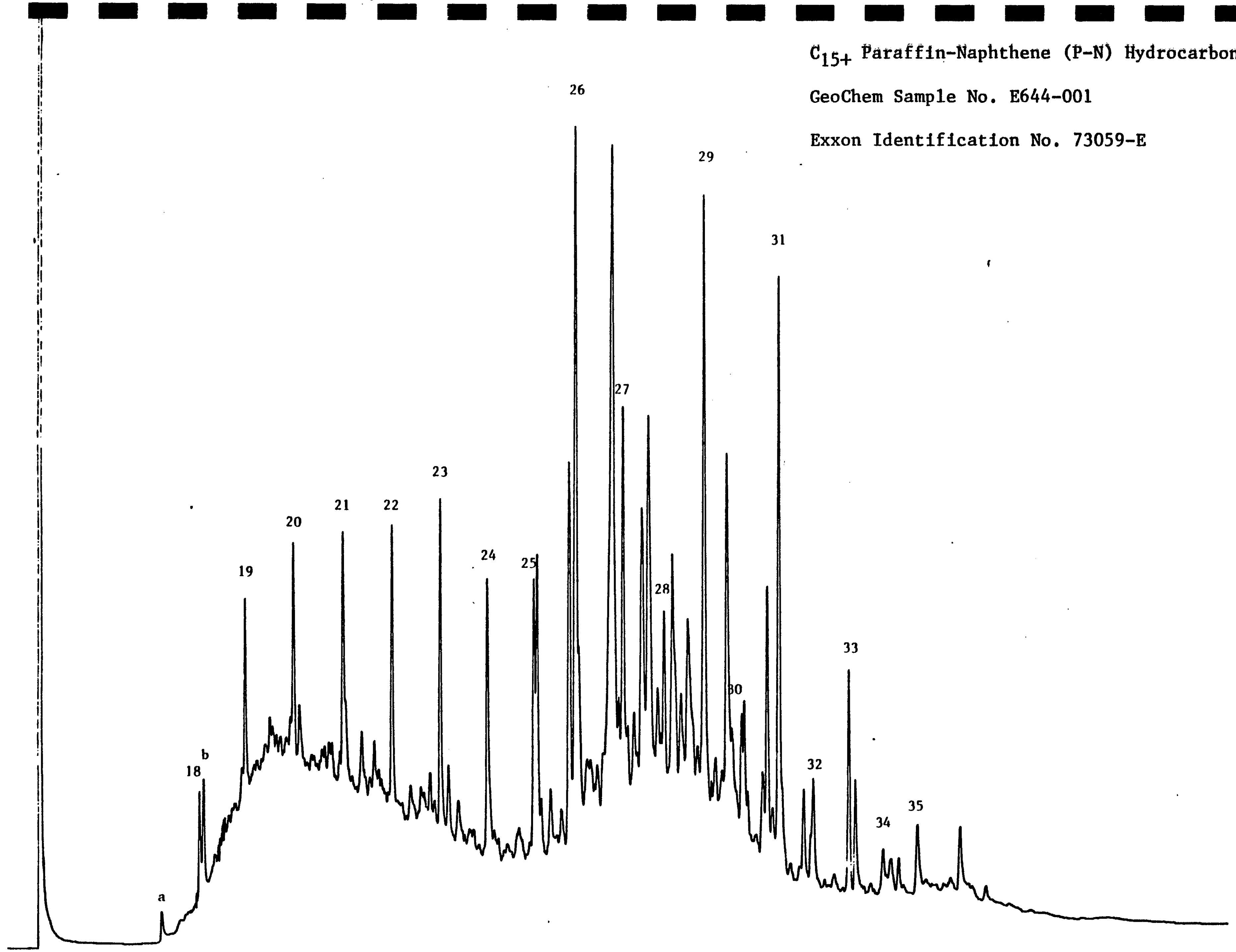


Figure 6: Tuna-4, Cuttings Extract, 1280 meters, Lakes Entrance Fm.

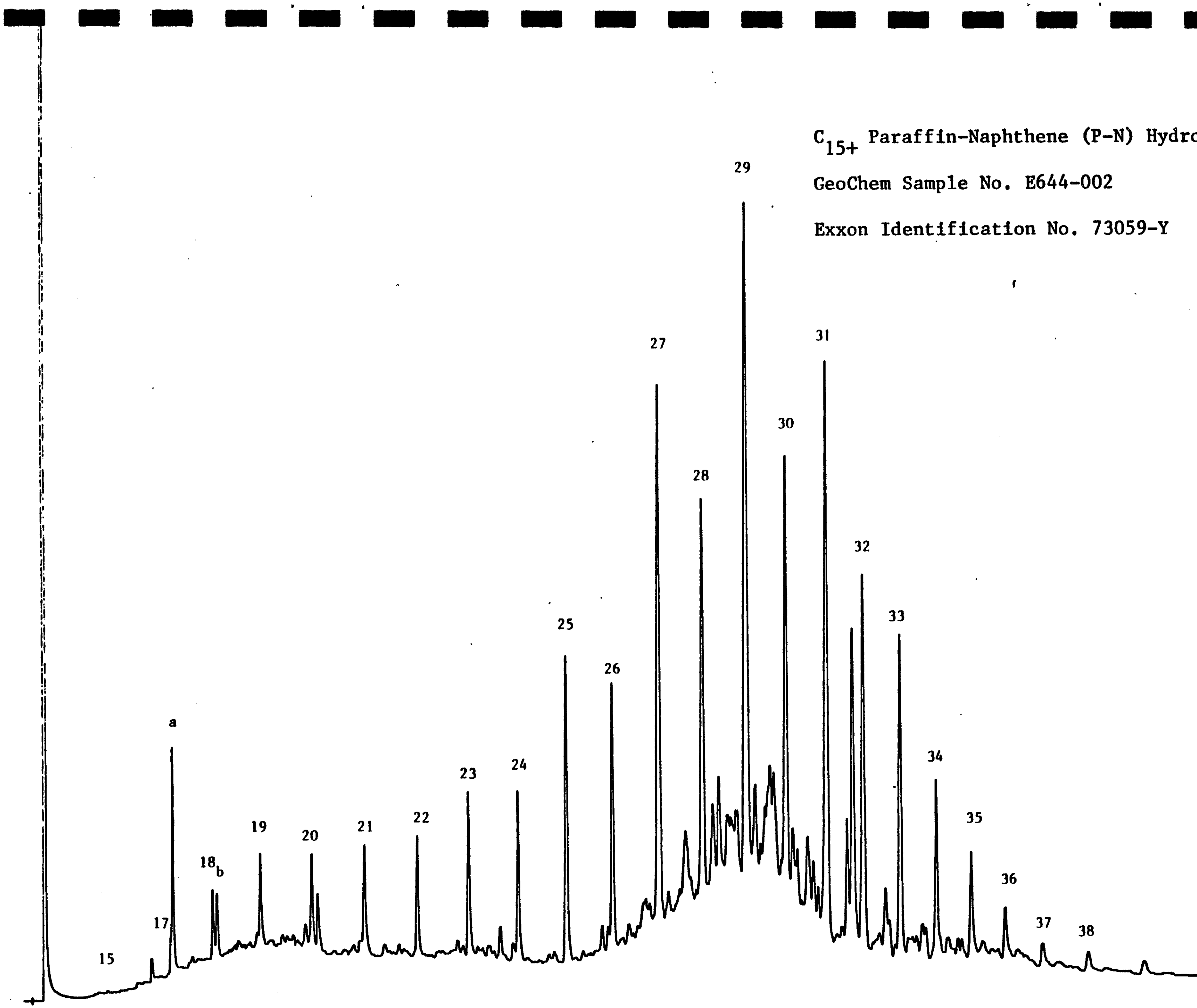


Figure 7: Tuna-4, Cuttings Extract, 1610 meters, Latrobe Group

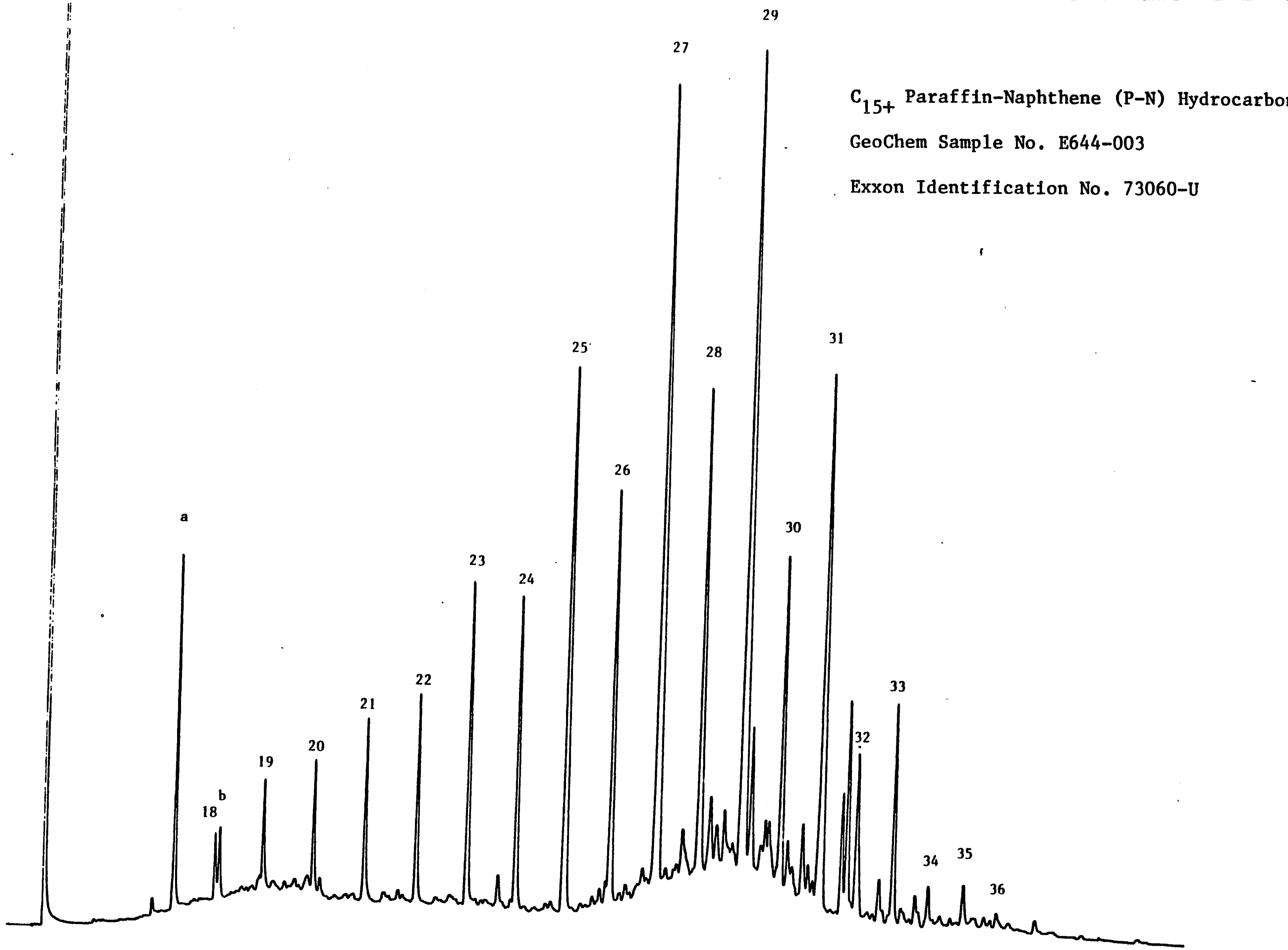


Figure 8: Tuna-4, Cuttings Extract, 1940 meters, Latrobe Group

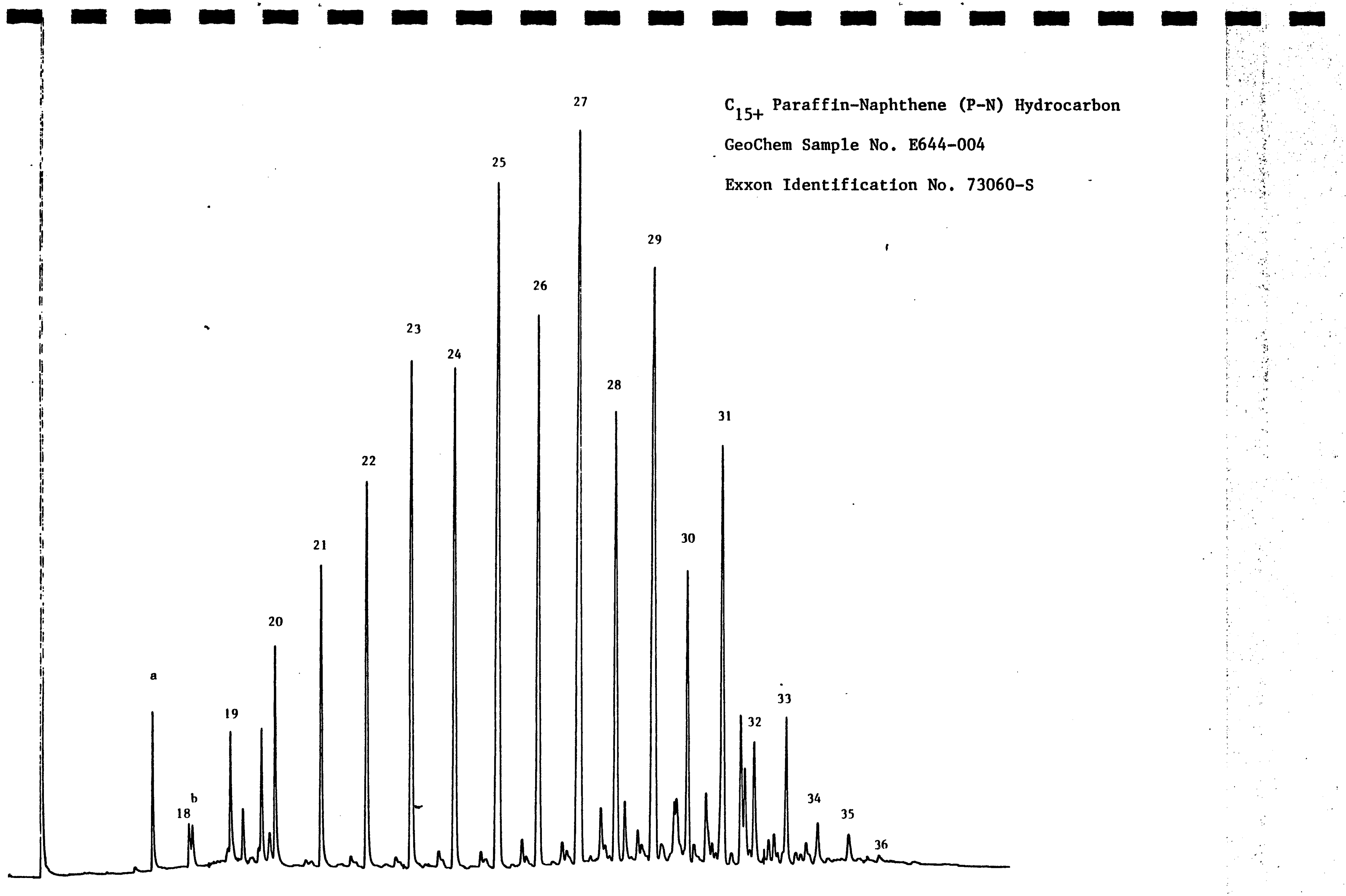


Figure 9: Tuna-4, Cuttings Extract, 2300 meters, Latrobe Group

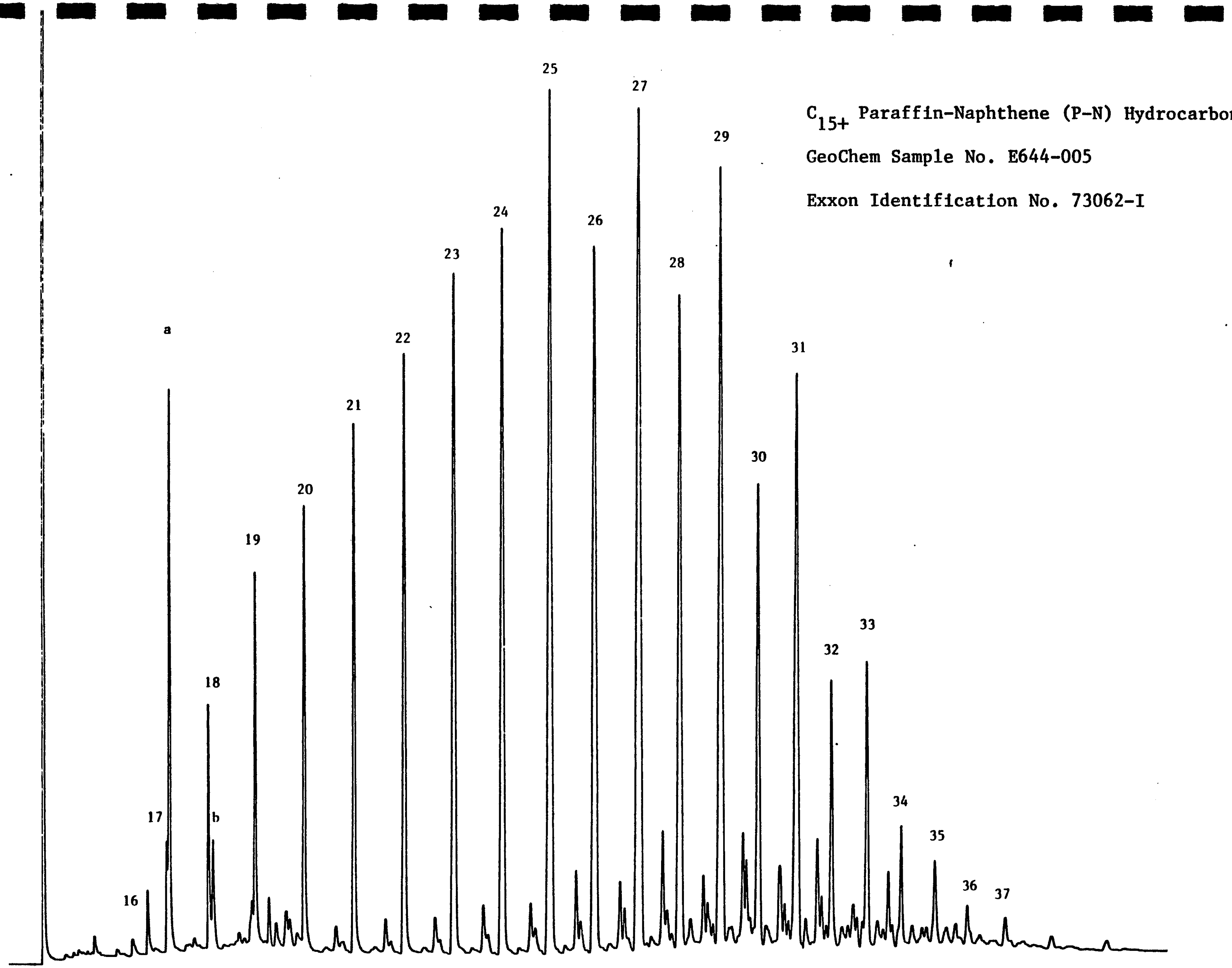


Figure 10: Tuna-4, Cuttings Extract, 2630 meters, Latrobe Group

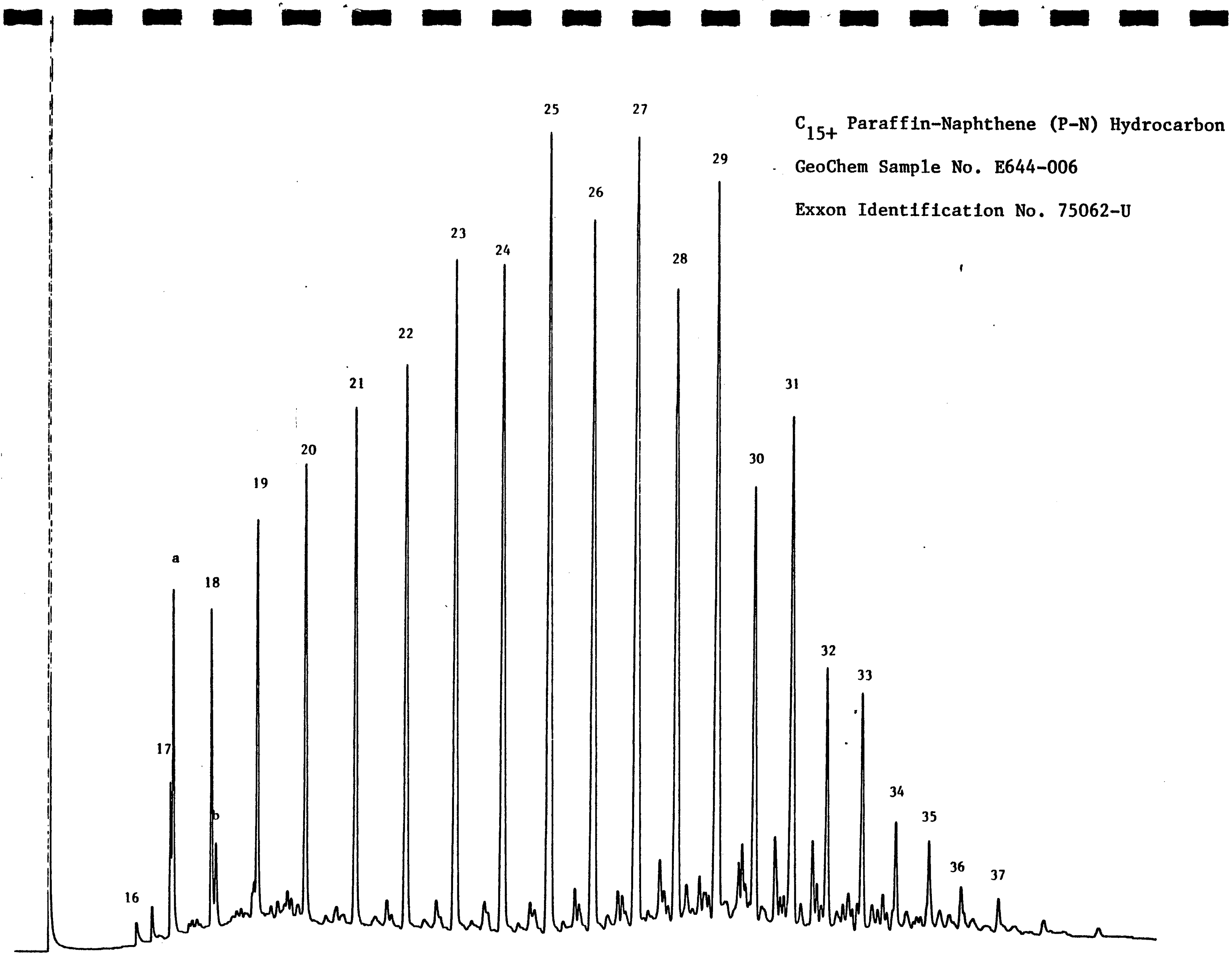


Figure 11: Tuna-4 , Cuttings Extract, 2810 meters , Latrobe Group

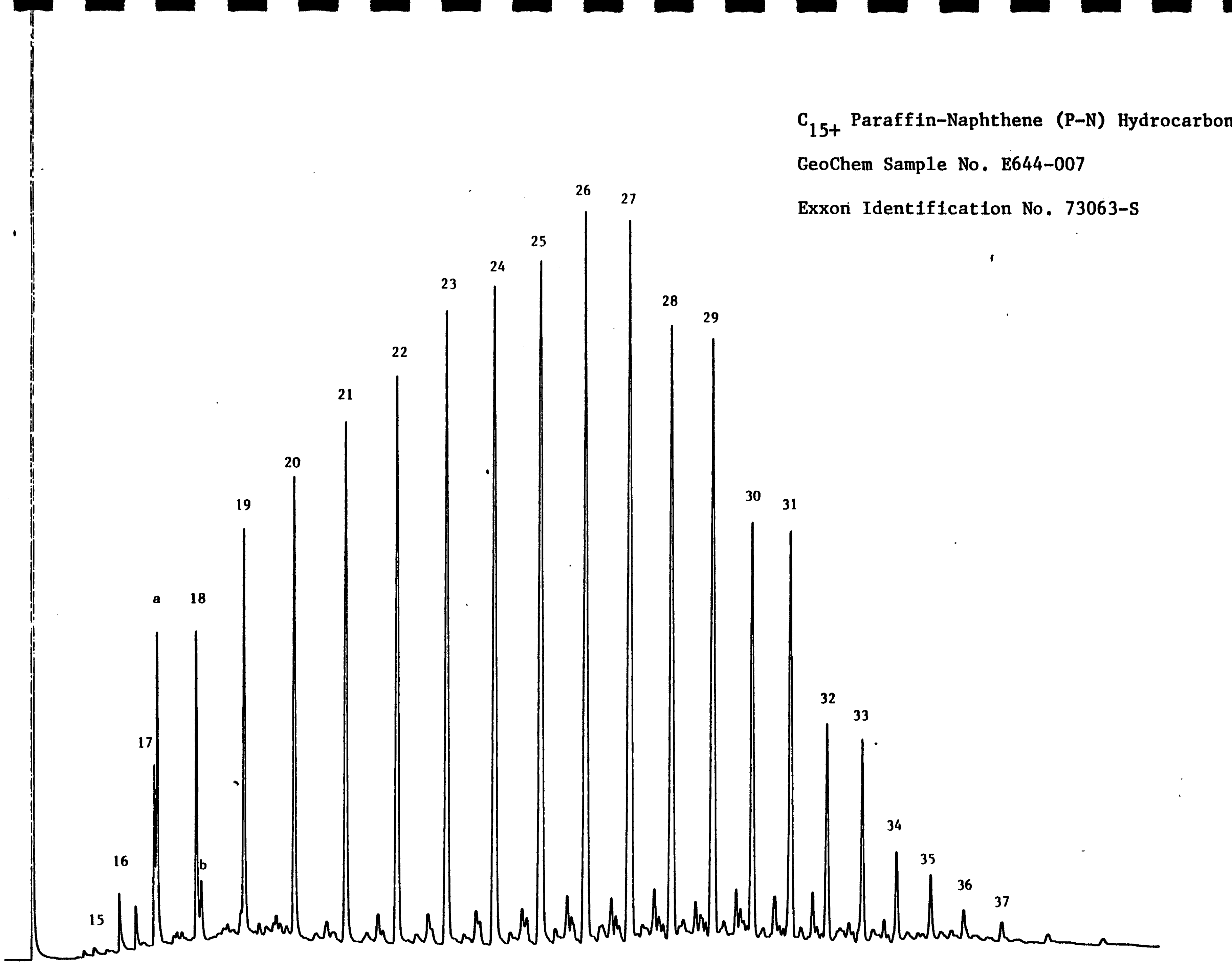
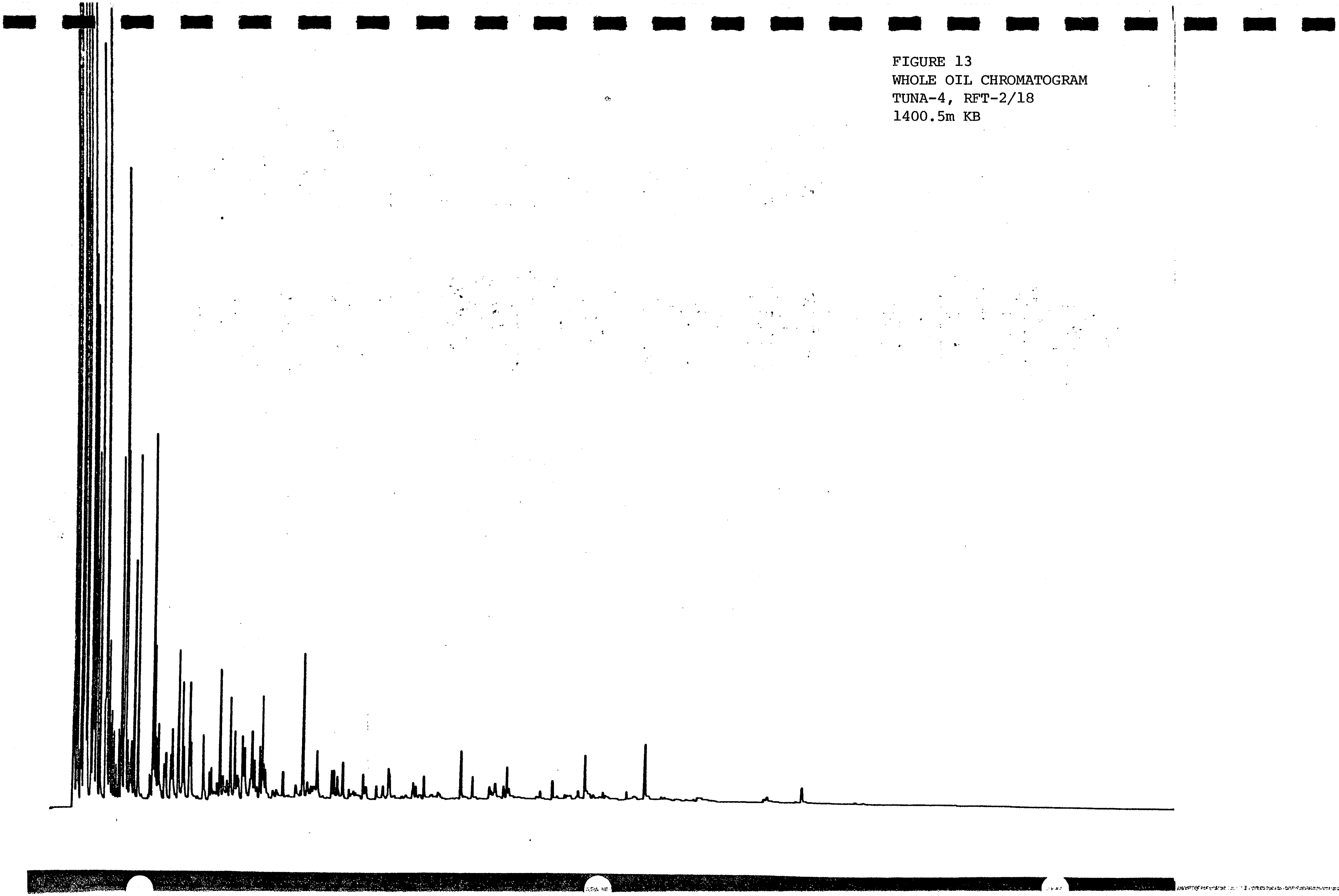


Figure 12: Tuna-4, Cuttings Extract, 3170 meters, Latrobe Group

FIGURE 13
WHOLE OIL CHROMATOGRAM
TUNA-4, RFT-2/18
1400.5m KB



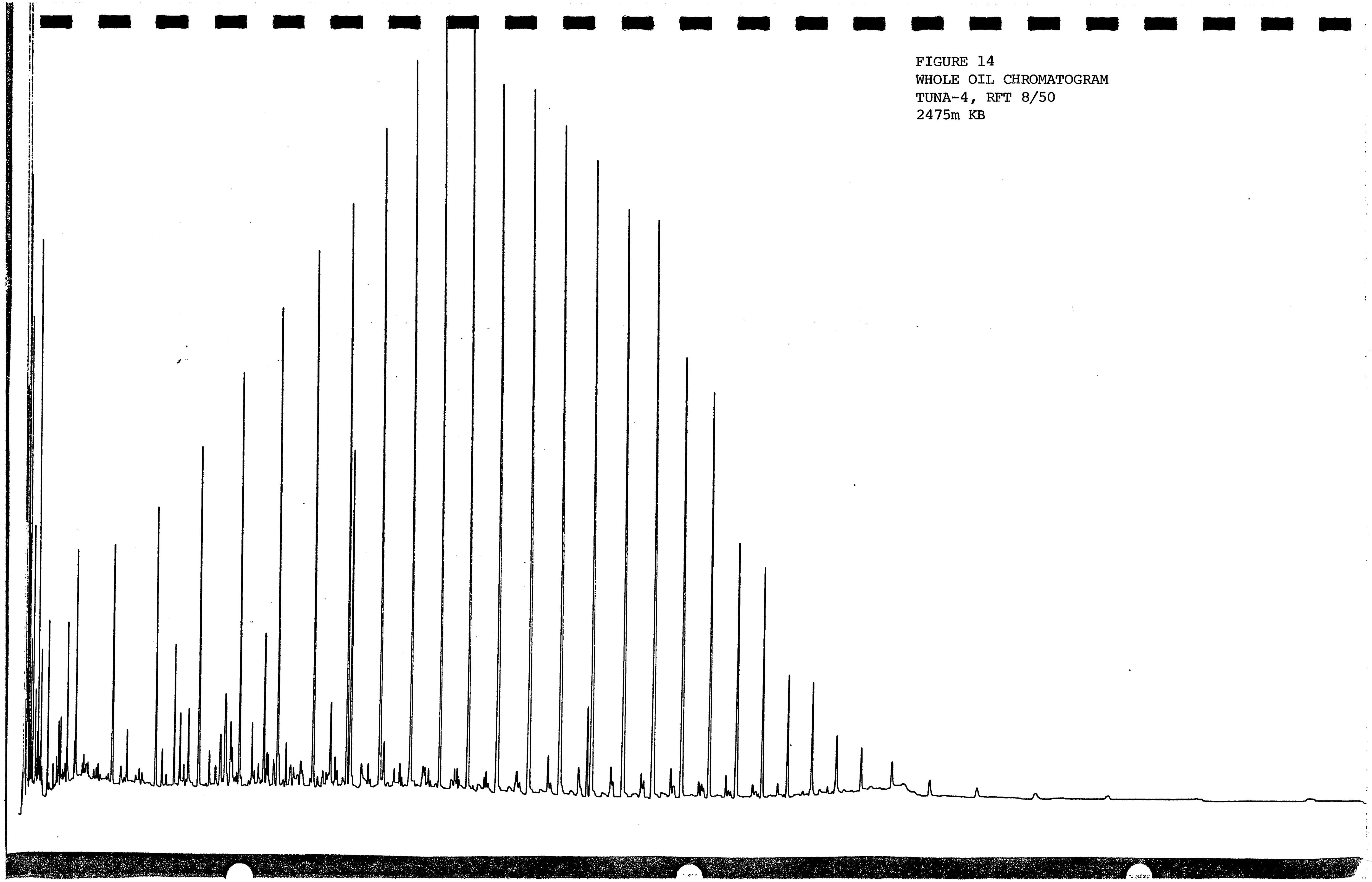


FIGURE 14
WHOLE OIL CHROMATOGRAM
TUNA-4, RFT 8/50
2475m KB

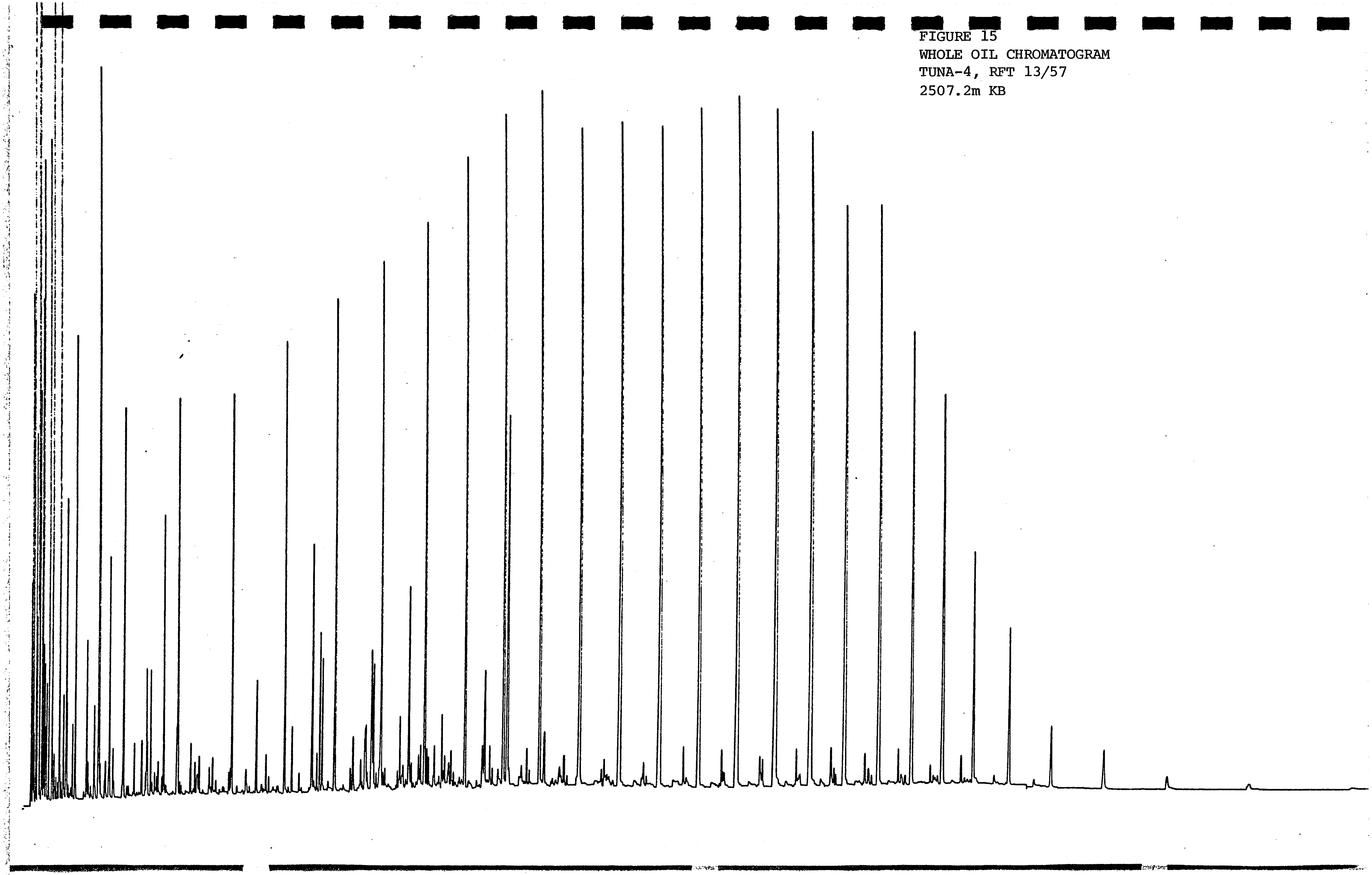
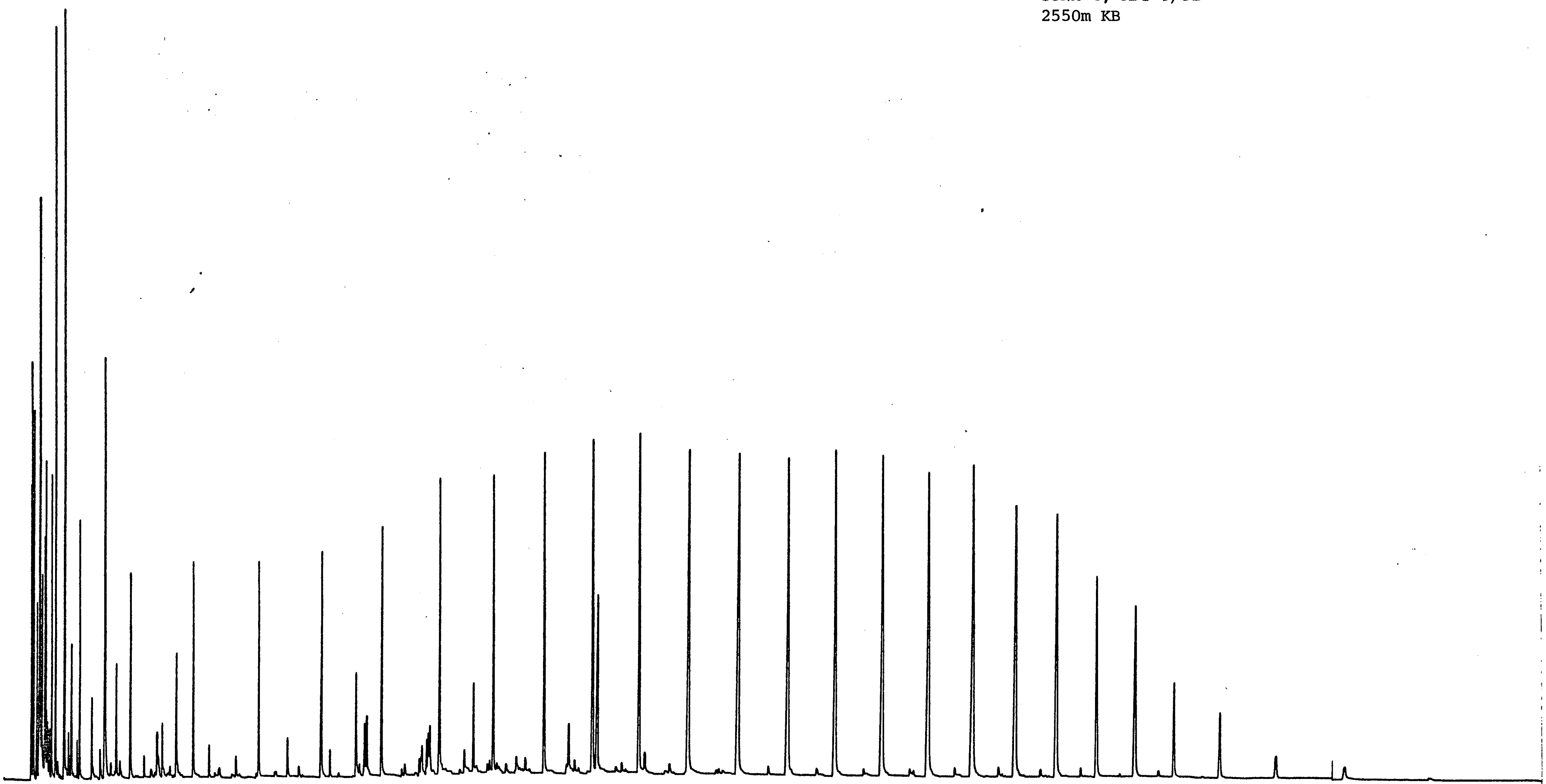


FIGURE 15
WHOLE OIL CHROMATOGRAM
TUNA-4, RFT 13/57
2507.2m KB

FIGURE 16
WHOLE OIL CHROMATOGRAM
TUNA-4, RFT 9/51
2550m KB



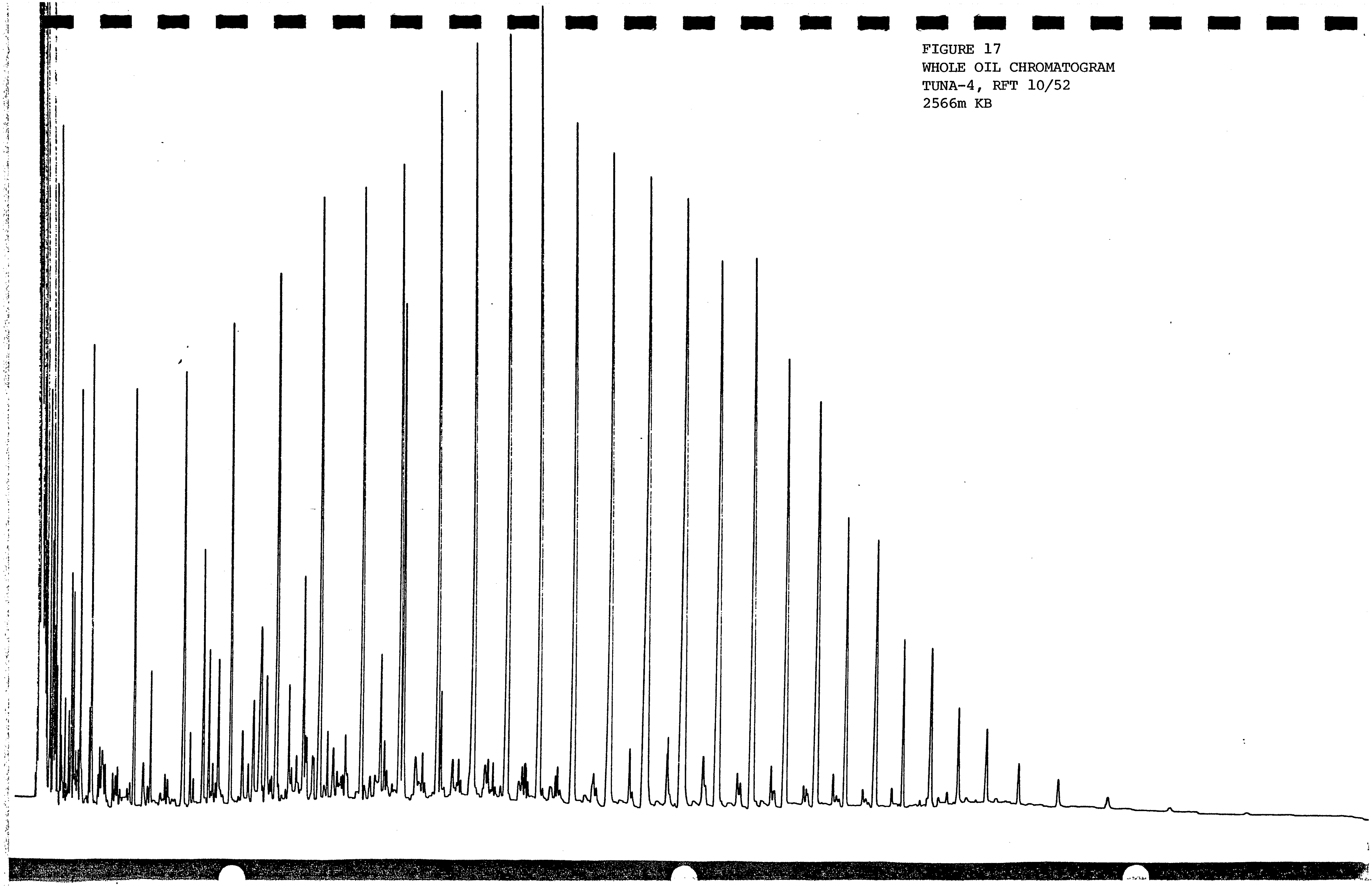
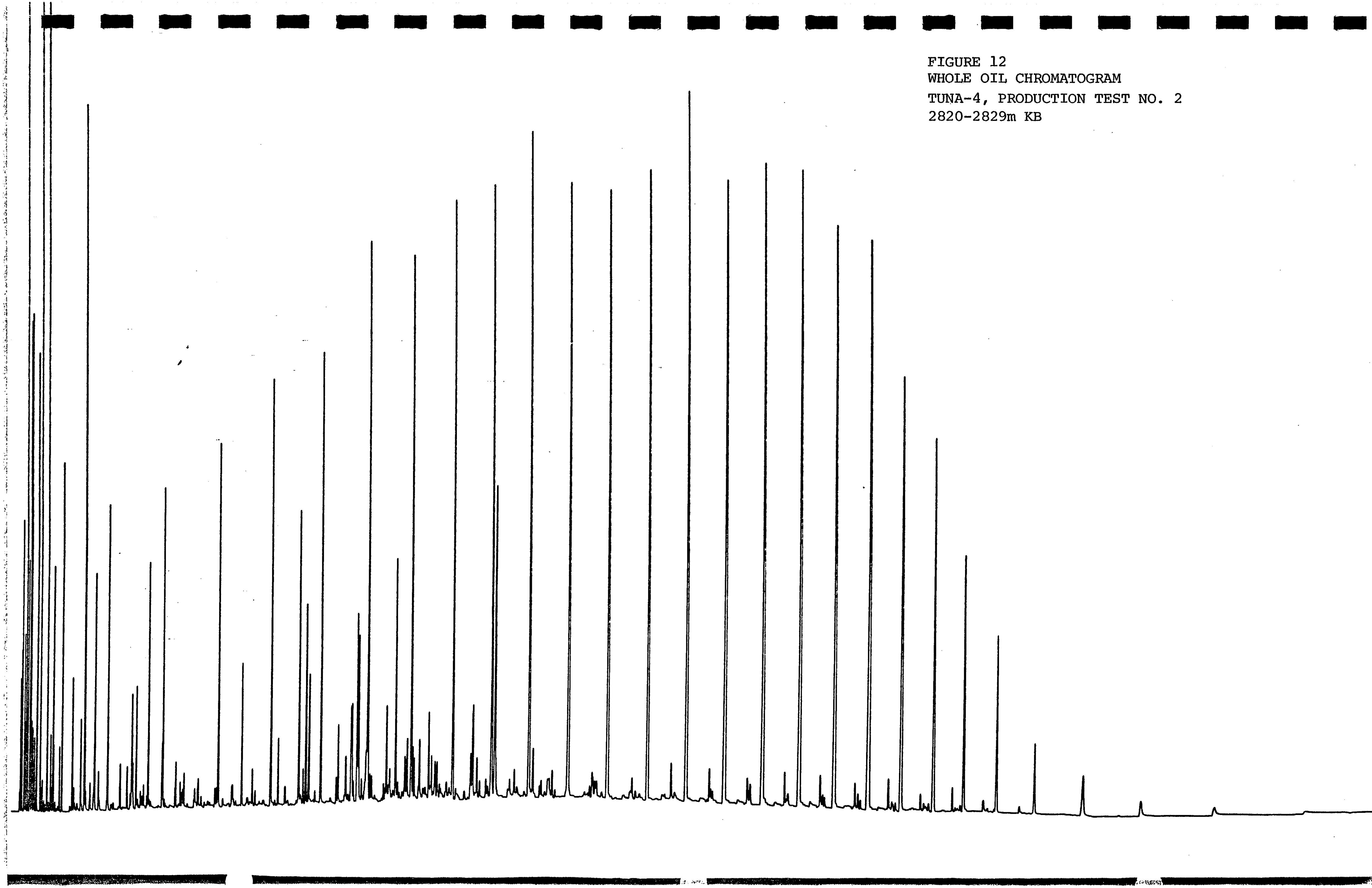


FIGURE 17
WHOLE OIL CHROMATOGRAM
TUNA-4, RFT 10/52
2566m KB

FIGURE 12
WHOLE OIL CHROMATOGRAM
TUNA-4, PRODUCTION TEST NO. 2
2820-2829m KB



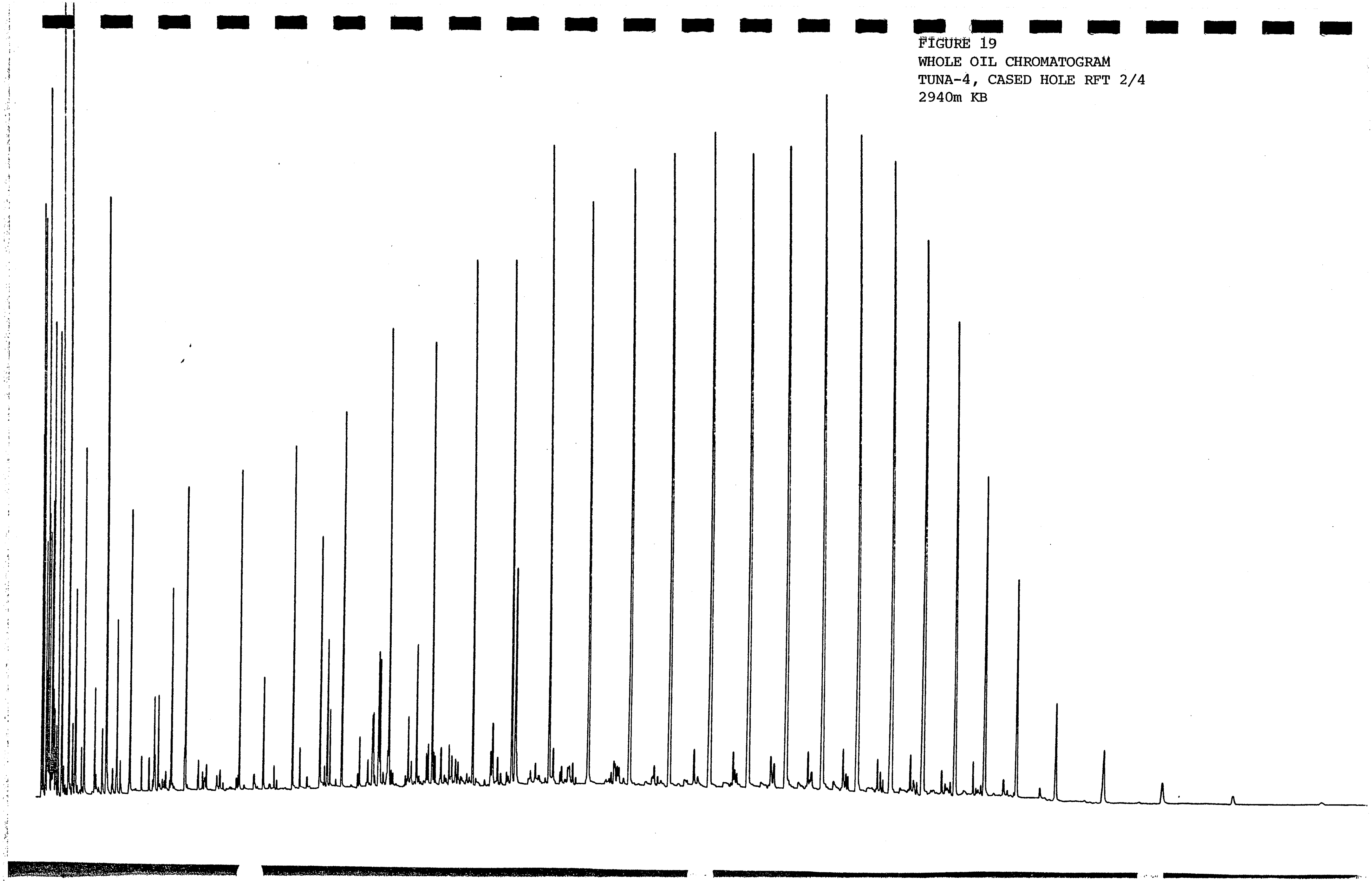


FIGURE 19
WHOLE OIL CHROMATOGRAM
TUNA-4, CASED HOLE RFT 2/4
2940m KB

FIGURE 20
WHOLE OIL CHROMATOGRAM
TUNA-4, RFT 18/88
2948.5m KB

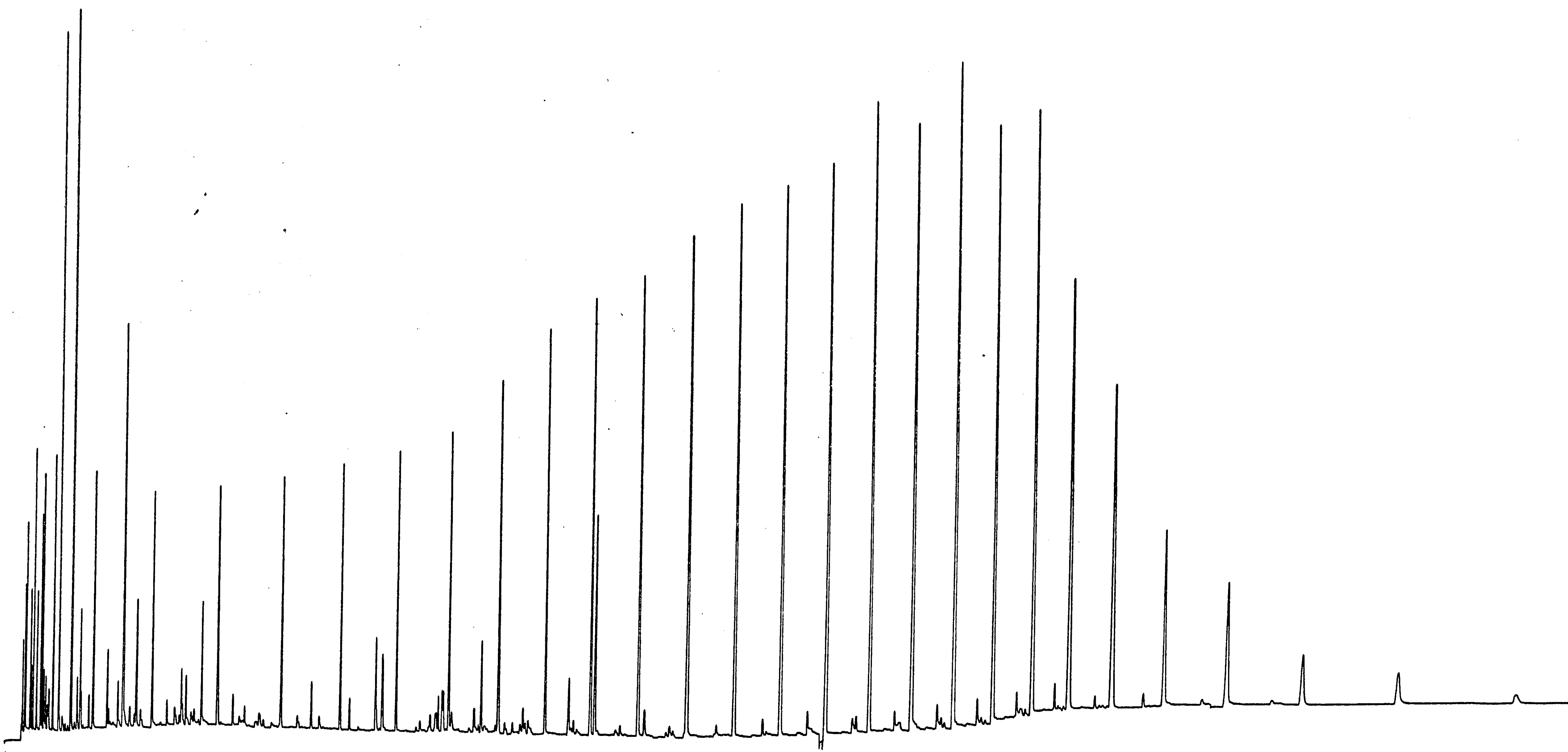


FIGURE 21
OIL SATURATE CHROMATOGRAM
TUNA-4
73038-R
1400.5 m
RFT 2/18

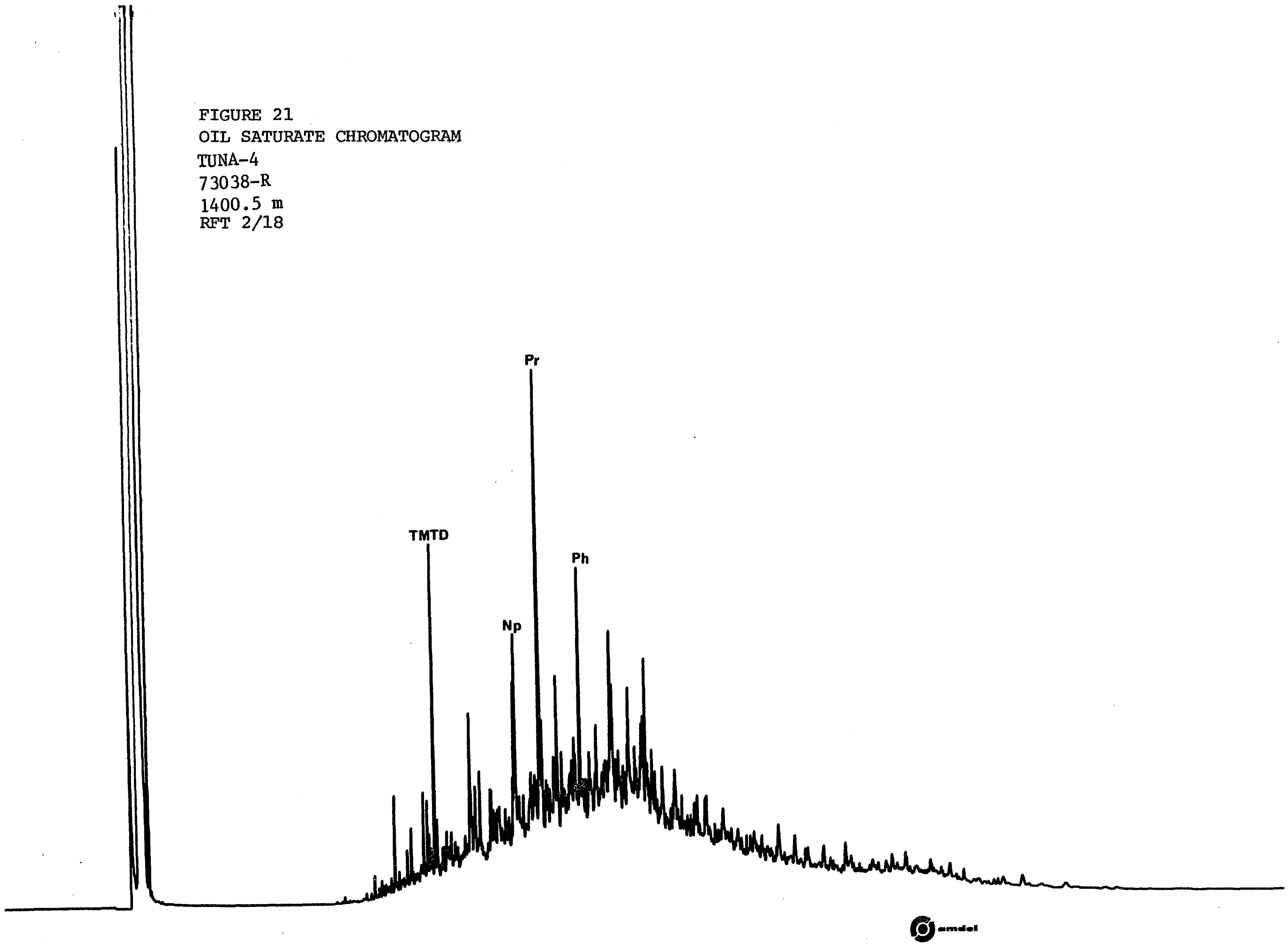


FIGURE 22
OIL SATURATE CHROMATOGRAM
TUNA-4
73038-S
2507.2 m
RFT 13/57

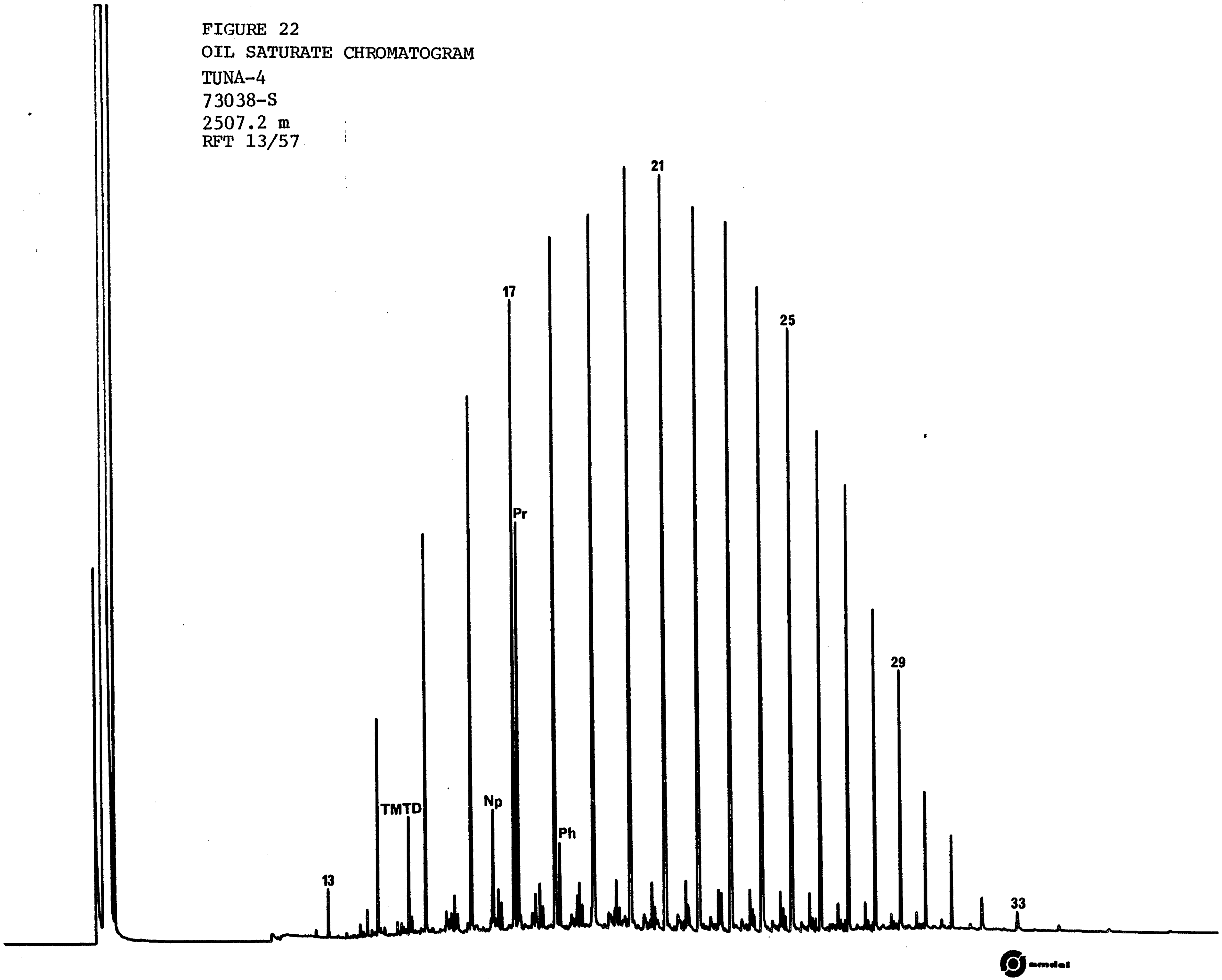


FIGURE 23
OIL SATURATE CHROMATOGRAM
TUNA-4
73038-U
2948.5 m
RFT 18/88

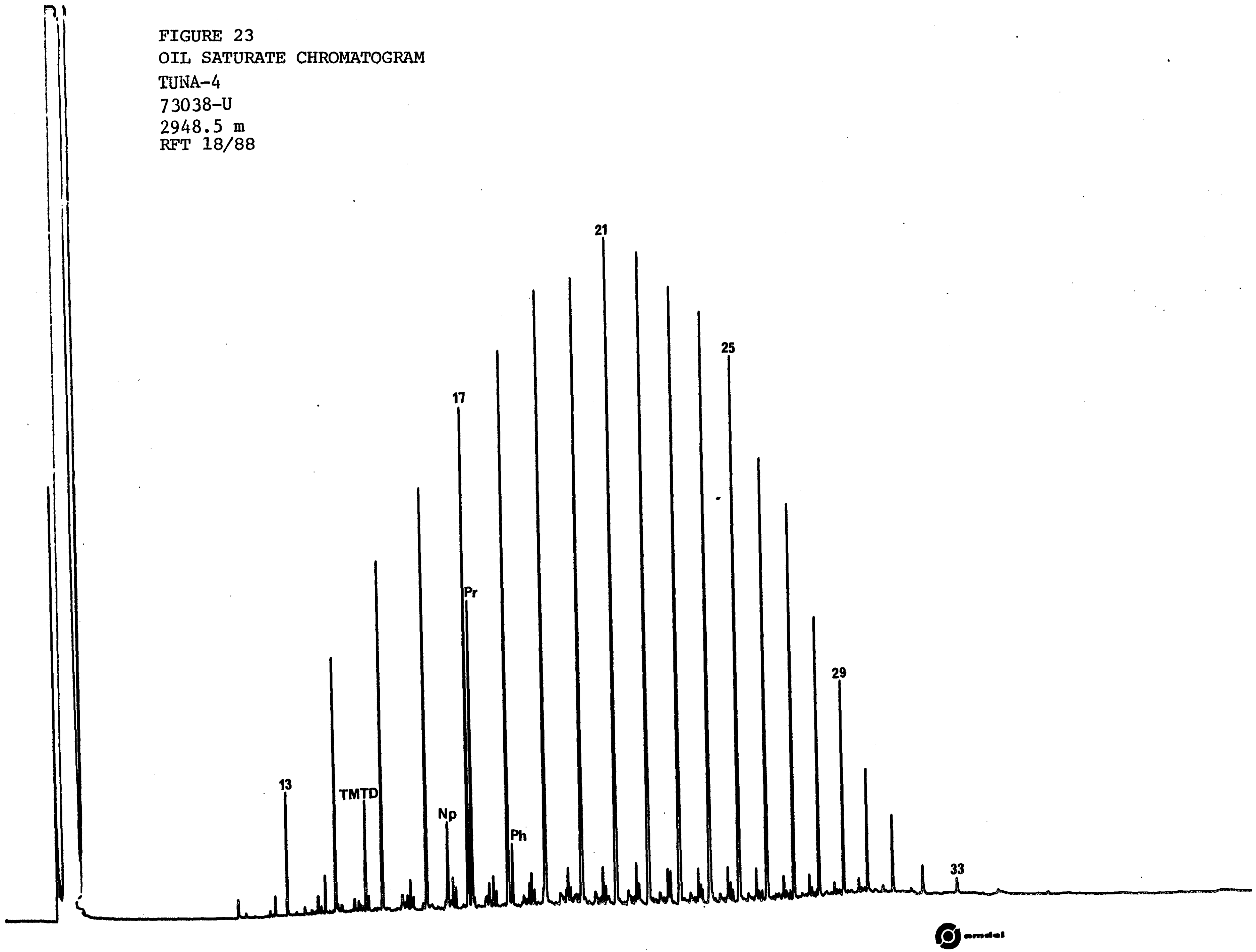
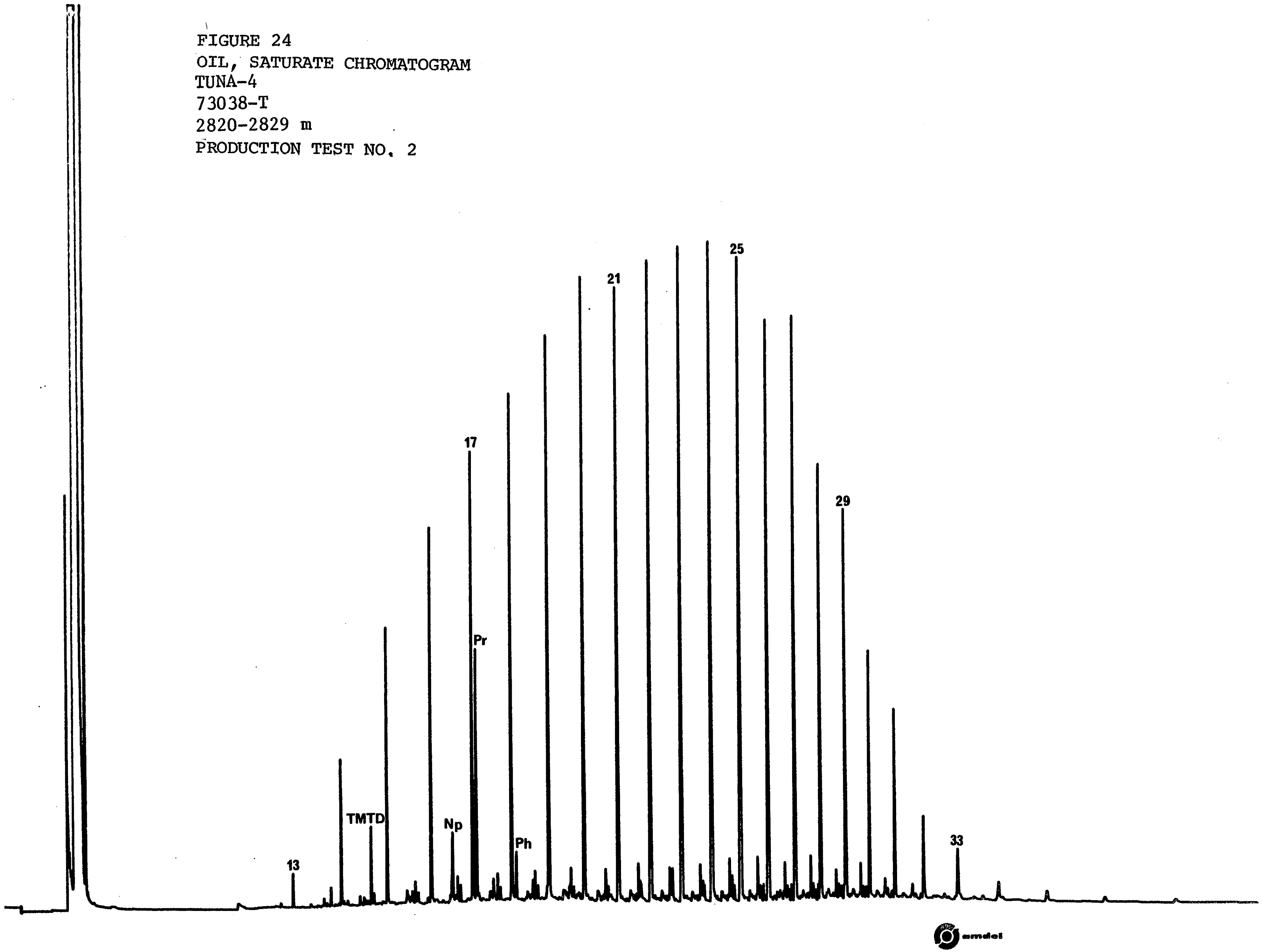


FIGURE 24
OIL, SATURATE CHROMATOGRAM
TUNA-4
73038-T
2820-2829 m
PRODUCTION TEST NO. 2



APPENDIX-1

Detailed C_{4-7} Data Sheets

73059A AUSTRALIA, TUNA-4,1220M.

	TOTAL PPB	NORM PERCENT
METHANE	0.0	
ETHANE	0.0	
PROPANE	49.6	
IBUTANE	7.4	2.14
NBUTANE	14.2	4.09
IPENTANE	54.0	15.56
NPENTANE	21.5	6.19
22-DMB	0.0	0.0
CPENTANE	0.0	0.0
23-DMB	3.3	0.94
2-MP	40.4	11.62
3-MP	14.5	4.18
NHEXANE	32.8	9.46
MCP	25.5	7.33
22-DMP	0.0	0.0
24-DMP	2.5	0.72
223-TMB	0.0	0.0
CHEXANE	3.7	1.07
33-DMP ,	0.0	0.0
11-DMCP	0.0	0.0
2-MHEX ,	40.4	11.62
23-DMP ,	8.7	2.52
3-MHEX ,	23.8	6.85
1C3-DMCP	7.7	2.21

	TOTAL PPB	NORM PERCENT
1T3-DMCP	7.6	2.19
1T2-DMCP	8.2	2.36
3-EPENT	0.0	0.0
224-TMP	0.0	0.0
NHEPTANE	0.0	0.0
1C2-DMCP	0.0	0.0
MCH	31.0	8.93

	TOTALS PPB	NORM PERCENT	SIG COMP RATIOS	
ALL COMP	397.		C1/C2	1.53
GASOLINE	347.		A /D2	1.38
NAPHTHENES	84.	24.10	C1/D2	3.16
C6-7	192.	55.26	CH/MCP	0.15
			PENT/IPENT,	0.40

	PPB	NORM PERCENT
MCP	25.5	42.3
CH	3.7	6.2
MCH	31.0	51.5
TOTAL	60.2	100.0

PARAFFIN INDEX 1 2.731

PARAFFIN INDEX 2 0.0

73059C AUSTRALIA, TUNA-4,1250M.

	TOTAL PPB	NORM PERCENT
METHANE	0.0	
ETHANE	0.0	
PROPANE	57.5	
IBUTANE	8.7	3.03
NBUTANE	13.2	4.62
IPENTANE	60.8	21.26
NPENTANE	23.7	8.29
22-DMB	0.0	0.0
CPENTANE	1.0	0.35
23-DMB	2.4	0.85
2-MP	30.3	10.60
3-MP	11.4	3.99
NHEXANE	24.0	8.40
MCP	23.9	8.34
22-DMP	0.0	0.0
24-DMP	0.0	0.0
223-TMB	0.0	0.0
CHEXANE	3.3	1.17
33-DMP ,	0.0	0.0
11-DMCP	0.0	0.0
2-MHEX ,	5.5	1.91
23-DMP ,	4.5	1.57
3-MHEX ,	7.2	2.52
1C3-DMCP	5.4	1.89

	TOTAL PPB	NORM PERCENT
1T3-DMCP	7.9	2.76
1T2-DMCP	6.1	2.13
3-EPENT	0.0	0.0
224-TMP	0.0	0.0
NHEPTANE	24.8	8.66
1C2-DMCP	0.0	0.0
MCH	21.9	7.65

	TOTALS PPB	NORM PERCENT	SIG COMP RATIOS	
ALL COMP	343.		C1/C2	0.71
GASOLINE	286.		A /D2	6.76
NAPHTHENES	69.	24.29	C1/D2	4.25
C6-7	134.	47.01	CH/MCP	0.14
			PENT/IPENT,	0.39

	PPB	NORM PERCENT
MCP	23.9	48.6
CH	3.3	6.8
MCH	21.9	44.6
TOTAL	49.1	100.0

PARAFFIN INDEX 1 0.655

PARAFFIN INDEX 2 28.632

73059E AUSTRALIA, TUNA-4,1280M.

	TOTAL PPB	NORM PERCENT
METHANE	0.0	
ETHANE	0.0	
PROPANE	59.7	
IBUTANE	5.5	4.27
NBUTANE	11.5	8.96
IPENTANE	32.3	25.22
NPENTANE	10.9	8.49
22-DMB	0.2	0.18
CPENTANE	0.0	0.0
23-DMB	1.6	1.25
2-MP	19.1	14.90
3-MP	7.5	5.88
NHEXANE	10.6	8.31
MCP	14.6	11.39
22-DMP	0.0	0.0
24-DMP	0.0	0.0
223-TMB	0.0	0.0
CHEXANE	0.0	0.0
33-DMP ,	0.0	0.0
11-DMCP	0.0	0.0
2-MHEX ,	0.0	0.0
23-DMP ,	0.0	0.0
3-MHEX ,	0.0	0.0
1C3-DMCP	0.0	0.0

	TOTAL PPB	NORM PERCENT
1T3-DMCP	0.0	0.0
1T2-DMCP	0.0	0.0
3-EPENT	0.0	0.0
224-TMP	0.0	0.0
NHEPTANE	1.8	1.42
1C2-DMCP	0.0	0.0
MCH	12.5	9.73

	TOTALS PPB	NORM PERCENT	SIG COMP RATIOS	
ALL COMP	188.		C1/C2	0.85
GASOLINE	128.		A /D2	999.99
NAPHTHENES	27.	21.13	C1/D2	999.99
C6-7	40.	30.86	CH/MCP	0.0
			PENT/IPENT,	0.34

	PPB	NORM PERCENT
MCP	14.6	53.9
CH	0.0	0.0
MCH	12.5	46.1
TOTAL	27.1	100.0

PARAFFIN INDEX 1 0.0

PARAFFIN INDEX 2 12.734

73059G AUSTRALIA, TUNA-4,1310M.

	TOTAL PPB	NORM PERCENT
METHANE	0.0	
ETHANE	0.0	
PROPANE	56.3	
IBUTANE	4.4	2.91
NBUTANE	11.2	7.38
IPENTANE	31.9	21.08
NPENTANE	17.0	11.24
22-DMB	0.0	0.0
CPENTANE	0.0	0.0
23-DMB	1.3	0.85
2-MP	15.8	10.44
3-MP	6.2	4.07
NHEXANE	15.1	9.99
MCP	8.9	5.87
22-DMP	0.0	0.0
24-DMP	0.0	0.0
223-TMB	0.0	0.0
CHEXANE	0.0	0.0
33-DMP ,	0.0	0.0
11-DMCP	0.0	0.0
2-MHEX ,	7.1	4.67
23-DMP ,	5.0	3.31
3-MHEX ,	2.8	1.86
1C3-DMCP	0.0	0.0

	TOTAL PPB	NORM PERCENT
1T3-DMCP	0.0	0.0
1T2-DMCP	0.0	0.0
3-EPENT	0.0	0.0
224-TMP	0.0	0.0
NHEPTANE	17.3	11.40
1C2-DMCP	0.0	0.0
MCH	7.4	4.92

	TOTALS PPB	NORM PERCENT	SIG COMP RATIOS	
ALL COMP	208.		C1/C2	1.63
GASOLINE	151.		A /D2	11.51
NAPHTHENES	16.	10.79	C1/D2	5.16
C6-7	64.	42.02	CH/MCP	0.0
			PENT/IPENT,	0.53

	PPB	NORM PERCENT
MCP	8.9	54.4
CH	0.0	0.0
MCH	7.4	45.6
TOTAL	16.3	100.0

PARAFFIN INDEX 1 0.0

PARAFFIN INDEX 2 43.623

73059I AUSTRALIA, TUNA-4,1340M.

	TOTAL PPB	NORM PERCENT		TOTAL PPB	NORM PERCENT
METHANE	0.0		1T3-DMCP	0.0	0.0
ETHANE	0.0		1T2-DMCP	0.0	0.0
PROPANE	61.4		3-EPENT	0.0	0.0
IBUTANE	12.8	5.00	224-TMP	0.0	0.0
NBUTANE	27.7	10.77	NHEPTANE	21.3	8.28
IPENTANE	63.0	24.52	1C2-DMCP	0.0	0.0
NPENTANE	47.7	18.57	MCH	7.1	2.75
22-DMB	0.0	0.0			
CPENTANE	2.6	1.01			
23-DMB	0.3	0.12			
2-MP	17.9	6.95			
3-MP	6.7	2.60			
NHEXANE	21.4	8.31			
MCP	14.7	5.71			
22-DMP	0.0	0.0			
24-DMP	0.0	0.0			
223-TMB	0.0	0.0			
CHEXANE	10.1	3.93			
33-DMP ,	0.0	0.0			
11-DMCP	0.0	0.0			
2-MHEX ,	0.0	0.0			
23-DMP ,	1.6	0.62			
3-MHEX ,	2.2	0.86			
1C3-DMCP	0.0	0.0			

	TOTALS PPB	NORM PERCENT	SIG COMP RATIOS	
ALL COMP	318.		C1/C2	1.17
GASOLINE	257.		A /D2	19.34
NAPHTHENES	34.	13.40	C1/D2	7.79
C6-7	78.	30.46	CH/MCP	0.69
			PENT/IPENT,	0.76

	PPB	NORM PERCENT
MCP	14.7	46.1
CH	10.1	31.7
MCH	7.1	22.2
TOTAL	31.9	100.0

PARAFFIN INDEX 1 0.0

PARAFFIN INDEX 2 50.331

73059K AUSTRALIA, TUNA-4,1370M.

	TOTAL PPB	NORM PERCENT
METHANE	0.0	
ETHANE	0.0	
PROPANE	55.5	
IBUTANE	28.9	0.64
NBUTANE	125.9	2.81
IPENTANE	531.4	11.85
NPENTANE	774.6	17.28
22-DMB	19.8	0.44
CPENTANE	31.7	0.71
23-DMB	62.5	1.39
2-MP	408.0	9.10
3-MP	221.5	4.94
NHEXANE	550.7	12.28
MCP	361.5	8.06
22-DMP	0.0	0.0
24-DMP	5.9	0.13
223-TMB	0.0	0.0
CHEXANE	397.3	8.86
33-DMP ,	0.0	0.0
11-DMCP	0.0	0.0
2-MHEX ,	61.9	1.38
23-DMP ,	50.9	1.14
3-MHEX ,	44.8	1.00
1C3-DMCP	47.9	1.07

	TOTAL PPB	NORM PERCENT
1T3-DMCP	62.3	1.39
1T2-DMCP	59.2	1.32
3-EPENT	0.0	0.0
224-TMP	0.0	0.0
NHEPTANE	104.1	2.32
1C2-DMCP	0.0	0.0
MCH	532.1	11.87

	TOTALS PPB	NORM PERCENT
ALL COMP	4538.	
GASOLINE	4483.	
NAPHTHENES	1492.	33.28
C6-7	2279.	50.83

SIG COMP RATIOS	
C1/C2	1.87
A /D2	14.63
C1/D2	22.15
CH/MCP	1.10
PENT/IPENT,	1.46

	PPB	NORM PERCENT
MCP	361.5	28.0
CH	397.3	30.8
MCH	532.1	41.2
TOTAL	1290.9	100.0

PARAFFIN INDEX 1 0.630

PARAFFIN INDEX 2 7.653

73059W AUSTRALIA, TUNA-4,1580M.

	TOTAL PPB	NORM PERCENT
METHANE	0.0	
ETHANE	0.0	
PROPANE	12128.5	
IBUTANE	18340.5	8.00
NBUTANE	37655.1	16.43
IPENTANE	30248.2	13.20
NPENTANE	27294.1	11.91
22-DMB	908.4	0.40
CPENTANE	3074.0	1.34
23-DMB	3068.0	1.34
2-MP	12608.4	5.50
3-MP	6650.8	2.90
NHEXANE	13309.3	5.81
MCP	17197.0	7.50
22-DMP	0.0	0.0
24-DMP	2144.8	0.94
223-TMB	97.3	0.04
CHEXANE	16361.0	7.14
33-DMP ,	0.0	0.0
11-DMCP	0.0	0.0
2-MHEX ,	1763.0	0.77
23-DMP ,	2612.6	1.14
3-MHEX ,	1964.7	0.86
1C3-DMCP	3820.6	1.67
1T3-DMCP	3029.0	1.32
1T2-DMCP	4819.2	2.10
3-EPENT	0.0	0.0
224-TMP	0.0	0.0
NHEPTANE	3599.8	1.57
1C2-DMCP	1041.6	0.45
MCH	17612.0	7.68

	TOTALS PPB	NORM PERCENT	SIG COMP RATIOS	
ALL COMP	241347.		C1/C2	1.19
GASOLINE	229219.		A /D2	8.61
NAPHTHENES	66954.	29.21	C1/D2	18.19
C6-7	89372.	38.99	CH/MCP	0.95
			PENT/IPENT,	0.90

	PPB	NORM PERCENT
MCP	17197.0	33.6
CH	16361.0	32.0
MCH	17612.0	34.4
TOTAL	51170.0	100.0

PARAFFIN INDEX 1 0.319

PARAFFIN INDEX 2 6.477

73059Y AUSTRALIA, TUNA-4,1610M.

	TOTAL PPB	NORM PERCENT
METHANE	0.0	
ETHANE	0.0	
PROPANE	608.0	
IBUTANE	784.4	7.05
NBUTANE	1684.8	15.15
IPENTANE	1508.8	13.56
NPENTANE	1432.3	12.88
22-DMB	37.6	0.34
CPENTANE	127.9	1.15
23-DMB	144.6	1.30
2-MP	616.2	5.54
3-MP	350.2	3.15
NHEXANE	758.3	6.82
MCP	919.8	8.27
22-DMP	0.0	0.0
24-DMP	20.5	0.18
223-TMB	3.8	0.03
CHEXANE	689.9	6.20
33-DMP ,	0.0	0.0
11-DMCP	0.0	0.0
2-MHEX ,	119.5	1.07
23-DMP ,	115.6	1.04
3-MHEX ,	115.4	1.04
1C3-DMCP	166.4	1.50
1T3-DMCP	158.0	1.42
1T2-DMCP	240.5	2.16
3-EPENT	0.0	0.0
224-TMP	0.0	0.0
NHEPTANE	194.4	1.75
1C2-DMCP	22.4	0.20
MCH	912.4	8.20

	TOTALS PPB	NORM PERCENT	SIG COMP RATIOS	
ALL COMP	11732.		C1/C2	1.14
GASOLINE	11124.		A /D2	8.25
NAPHTHENES	3237.	29.10	C1/D2	14.92
C6-7	4437.	39.89	CH/MCP	0.75
			PENT/IPENT,	0.95

	PPB	NORM PERCENT
MCP	919.8	36.5
CH	689.9	27.4
MCH	912.4	36.2
TOTAL	2522.1	100.0

PARAFFIN INDEX 1 0.416

PARAFFIN INDEX 2 7.168

73060A AUSTRALIA, TUNA-4,1640M.

	TOTAL PPB	NORM PERCENT
METHANE	0.0	
ETHANE	0.0	
PROPANE	934.5	
IBUTANE	4250.3	7.77
NBUTANE	10865.6	19.86
IPENTANE	6859.5	12.54
NPENTANE	2451.5	4.48
22-DMB	33.2	0.06
CPENTANE	971.3	1.77
23-DMB	544.5	1.00
2-MP	2275.7	4.16
3-MP	1049.3	1.92
NHEXANE	923.9	1.69
MCP	8740.7	15.97
22-DMP	0.0	0.0
24-DMP	31.2	0.06
223-TMB	4.3	0.01
CHEXANE	908.1	1.66
33-DMP ,	0.0	0.0
11-DMCP	0.0	0.0
2-MHEX ,	217.5	0.40
23-DMP ,	506.8	0.93
3-MHEX ,	390.6	0.71
1C3-DMCP	2223.2	4.06

	TOTAL PPB	NORM PERCENT
1T3-DMCP	1497.7	2.74
1T2-DMCP	4722.1	8.63
3-EPENT	0.0	0.0
224-TMP	0.0	0.0
NHEPTANE	924.5	1.69
1C2-DMCP	946.8	1.73
MCH	3384.7	6.19

	TOTALS PPB	NORM PERCENT	SIG COMP RATIOS	
ALL COMP	55657.		C1/C2	0.25
GASOLINE	54723.		A /D2	4.73
NAPHTHENES	23394.	42.75	C1/D2	11.55
C6-7	25422.	46.46	CH/MCP	0.10
			PENT/IPENT.	0.36

	PPB	NORM PERCENT
MCP	8740.7	67.1
CH	908.1	7.0
MCH	3384.7	26.0
TOTAL	13033.5	100.0

PARAFFIN INDEX 1 0.072

PARAFFIN INDEX 2 6.257

73060C AUSTRALIA, TUNA-4,1670M.

	TOTAL PPB	NORM PERCENT
METHANE	0.0	
ETHANE	0.0	
PROPANE	117.8	
IBUTANE	33.7	4.97
NBUTANE	65.4	9.64
IPENTANE	30.6	4.52
NPENTANE	17.6	2.60
22-DMB	0.0	0.0
CPENTANE	3.1	0.46
23-DMB	1.4	0.21
2-MP	17.8	2.62
3-MP	16.2	2.39
NHEXANE	25.1	3.70
MCP	69.0	10.18
22-DMP	0.0	0.0
24-DMP	0.0	0.0
223-TMB	0.0	0.0
CHEXANE	22.4	3.31
33-DMP ,	0.0	0.0
11-DMCP	0.0	0.0
2-MHEX ,	9.7	1.42
23-DMP ,	16.4	2.42
3-MHEX ,	22.2	3.27
1C3-DMCP	22.4	3.31

	TOTAL PPB	NORM PERCENT
1T3-DMCP	25.0	3.69
1T2-DMCP	71.5	10.55
3-EPENT	0.0	0.0
224-TMP	0.0	0.0
NHEPTANE	73.9	10.91
1C2-DMCP	8.6	1.27
MCH	125.6	18.54

	TOTALS PPB	NORM PERCENT
ALL COMP	795.	
GASOLINE	678.	
NAPHTHENES	348.	51.31
C6-7	492.	72.58

SIG COMP RATIOS	
C1/C2	0.80
A /D2	4.46
C1/D2	7.11
CH/MCP	0.32
PENT/IPENT,	0.58

	PPB	NORM PERCENT
MCP	69.0	31.8
CH	22.4	10.3
MCH	125.6	57.9
TOTAL	217.0	100.0

PARAFFIN INDEX 1 0.268

PARAFFIN INDEX 2 19.003

73060E AUSTRALIA, TUNA-4,1700M.

	TOTAL PPB	NORM PERCENT
METHANE	0.0	
ETHANE	0.0	
PROPANE	102.0	
IBUTANE	62.7	0.49
NBUTANE	409.1	3.19
IPENTANE	1671.8	13.02
NPENTANE	555.6	4.33
22-DMB	10.7	0.08
CPENTANE	167.0	1.30
23-DMB	137.7	1.07
2-MP	654.4	5.10
3-MP	371.1	2.89
NHEXANE	329.2	2.56
MCP	2781.6	21.66
22-DMP	0.0	0.0
24-DMP	0.0	0.0
223-TMB	0.0	0.0
CHEXANE	229.0	1.78
33-DMP ,	0.0	0.0
11-DMCP	0.0	0.0
2-MHEX ,	152.2	1.19
23-DMP ,	142.3	1.11
3-MHEX ,	147.6	1.15
1C3-DMCP	707.0	5.51

	TOTAL PPB	NORM PERCENT
1T3-DMCP	551.7	4.30
1T2-DMCP	1430.3	11.14
3-EPENT	0.0	0.0
224-TMP	0.0	0.0
NHEPTANE	347.3	2.70
1C2-DMCP	486.9	3.79
MCH	1495.5	11.65

	TOTALS PPB	NORM PERCENT	SIG COMP RATIOS	
ALL COMP	12943.		C1/C2	0.32
GASOLINE	12841.		A /D2	4.58
NAPHTHENES	7849.	61.13	C1/D2	12.72
C6-7	8801.	68.54	CH/MCP	0.08
			PENT/IPENT,	0.33

	PPB	NORM PERCENT
MCP	2781.6	61.7
CH	229.0	5.1
MCH	1495.5	33.2
TOTAL	4506.1	100.0

PARAFFIN INDEX 1 0.111

PARAFFIN INDEX 2 6.675

73060G AUSTRALIA, TUNA-4,1730M.

	TOTAL PPB	NORM PERCENT
METHANE	0.0	
ETHANE	0.0	
PROPANE	11.1	
IBUTANE	2.1	0.03
NBUTANE	26.9	0.34
IPENTANE	30.3	0.39
NPENTANE	93.0	1.19
22-DMB	0.0	0.0
CPENTANE	12.1	0.15
23-DMB	17.7	0.23
2-MP	278.9	3.57
3-MP	189.9	2.43
NHEXANE	220.6	2.82
MCP	1801.0	23.03
22-DMP	0.0	0.0
24-DMP	7.6	0.10
223-TMB	0.0	0.0
CHEXANE	79.1	1.01
33-DMP ,	0.0	0.0
11-DMCP	0.0	0.0
2-MHEX ,	158.3	2.02
23-DMP ,	119.8	1.53
3-MHEX ,	142.6	1.82
1C3-DMCP	767.8	9.82
1T3-DMCP	631.4	8.07
1T2-DMCP	1325.9	16.95
3-EPENT	0.0	0.0
224-TMP	0.0	0.0
NHEPTANE	189.5	2.42
1C2-DMCP	342.6	4.38
MCH	1383.2	17.69

	TOTALS PPB	NORM PERCENT	SIG COMP RATIOS	
ALL COMP	7832.		C1/C2	0.33
GASOLINE	7821.		A /D2	2.88
NAPHTHENES	6343.	81.11	C1/D2	11.37
C6-7	7169.	91.68	CH/MCP	0.04
			PENT/IPENT,	3.07

	PPB	NORM PERCENT
MCP	1801.0	55.2
CH	79.1	2.4
MCH	1383.2	42.4
TOTAL	3263.3	100.0

PARAFFIN INDEX 1 0.110

PARAFFIN INDEX 2 3.951

73060I AUSTRALIA, TUNA-4,1760M.

	TOTAL PPB	NORM PERCENT
METHANE	0.0	
ETHANE	0.0	
PROPANE	172.0	
IBUTANE	617.6	7.89
NBUTANE	668.0	8.53
IPENTANE	1109.6	14.17
NPENTANE	245.7	3.14
22-DMB	0.3	0.00
CPENTANE	103.2	1.32
23-DMB	85.4	1.09
2-MP	426.9	5.45
3-MP	246.5	3.15
NHEXANE	146.0	1.86
MCP	1938.5	24.75
22-DMP	0.0	0.0
24-DMP	0.0	0.0
223-TMB	0.0	0.0
CHEXANE	62.2	0.79
33-DMP ,	0.0	0.0
11-DMCP	0.0	0.0
2-MHEX ,	67.6	0.86
23-DMP ,	76.5	0.98
3-MHEX ,	126.1	1.61
1C3-DMCP	460.4	5.88

	TOTAL PPB	NORM PERCENT
1T3-DMCP	427.1	5.45
1T2-DMCP	88.4	1.13
3-EPENT	0.0	0.0
224-TMP	0.0	0.0
NHEPTANE	120.6	1.54
1C2-DMCP	0.0	0.0
MCH	814.1	10.40

	TOTALS PPB	NORM PERCENT	SIG COMP RATIOS	
ALL COMP	8003.		C1/C2	0.32
GASOLINE	7831.		A /D2	2.11
NAPHTHENES	3894.	49.73	C1/D2	7.49
C6-7	4328.	55.26	CH/MCP	0.03
			PENT/IPENT,	0.22

	PPB	NORM PERCENT
MCP	1938.5	68.9
CH	62.2	2.2
MCH	814.1	28.9
TOTAL	2814.8	100.0

PARAFFIN INDEX 1 0.198

PARAFFIN INDEX 2 5.377

73060K AUSTRALIA, TUNA-4,1790M.

	TOTAL PPB	NORM PERCENT		TOTAL PPB	NORM PERCENT
METHANE	0.0		1T3-DMCP	712.7	7.17
ETHANE	0.0		1T2-DMCP	1371.8	13.80
PROPANE	16.9		3-EPENT	0.0	0.0
IBUTANE	5.2	0.05	224-TMP	0.0	0.0
NBUTANE	47.2	0.47	NHEPTANE	226.2	2.27
IPENTANE	103.8	1.04	1C2-DMCP	281.7	2.83
NPENTANE	214.3	2.16	MCH	1617.7	16.27
22-DMB	3.9	0.04			
CPENTANE	37.1	0.37			
23-DMB	125.4	1.26			
2-MP	702.9	7.07			
3-MP	45.1	0.45			
NHEXANE	25.5	0.26			
MCP	2973.0	29.90			
22-DMP	0.0	0.0			
24-DMP	7.5	0.08			
223-TMB	0.0	0.0			
CHEXANE	140.8	1.42			
33-DMP ,	0.0	0.0			
11-DMCP	0.0	0.0			
2-MHEX ,	143.8	1.45			
23-DMP ,	143.5	1.44			
3-MHEX ,	246.9	2.48			
1C3-DMCP	766.9	7.71			

	TOTALS PPB	NORM PERCENT	SIG COMP RATIOS	
ALL COMP	9960.		C1/C2	0.31
GASOLINE	9943.		A /D2	1.02
NAPHTHENES	7902.	79.47	C1/D2	7.70
C6-7	8658.	87.08	CH/MCP	0.05
			PENT/IPENT,	2.06

	PPB	NORM PERCENT
MCP	2973.0	62.8
CH	140.8	3.0
MCH	1617.7	34.2
TOTAL	4731.5	100.0

PARAFFIN INDEX 1 0.137

PARAFFIN INDEX 2 4.212

73060M AUSTRALIA, TUNA-4,1820M.

	TOTAL PPB	NORM PERCENT
METHANE	0.0	
ETHANE	0.0	
PROPANE	11.8	
IBUTANE	3.6	0.05
NBUTANE	35.4	0.46
IPENTANE	37.8	0.49
NPENTANE	114.4	1.48
22-DMB	0.0	0.0
CPENTANE	12.8	0.17
23-DMB	32.7	0.42
2-MP	446.1	5.76
3-MP	295.8	3.82
NHEXANE	222.3	2.87
MCP	1976.5	25.52
22-DMP	0.0	0.0
24-DMP	9.3	0.12
223-TMB	0.0	0.0
CHEXANE	99.9	1.29
33-DMP ,	0.0	0.0
11-DMCP	0.0	0.0
2-MHEX ,	119.7	1.55
23-DMP ,	116.1	1.50
3-MHEX ,	202.8	2.62
1C3-DMCP	634.2	8.19
1T3-DMCP	592.9	7.65
1T2-DMCP	1107.7	14.30
3-EPENT	0.0	0.0
224-TMP	0.0	0.0
NHEPTANE	189.1	2.44
1C2-DMCP	161.9	2.09
MCH	1334.4	17.23

	TOTALS PPB	NORM PERCENT	SIG COMP RATIOS	
ALL COMP	7757.		C1/C2	0.35
GASOLINE	7745.		A /D2	2.03
NAPHTHENES	5920.	76.44	C1/D2	7.66
C6-7	6767.	87.37	CH/MCP	0.05
			PENT/IPENT,	3.03

	PPB	NORM PERCENT
MCP	1976.5	57.9
CH	99.9	2.9
MCH	1334.4	39.1
TOTAL	3410.8	100.0

PARAFFIN INDEX 1 0.138

PARAFFIN INDEX 2 4.301

730600 AUSTRALIA, TUNA-4,1850M.

	TOTAL PPB	NORM PERCENT
METHANE	0.0	
ETHANE	0.0	
PROPANE	3.8	
IBUTANE	63.7	0.72
NBUTANE	7.1	0.08
IPENTANE	38.6	0.43
NPENTANE	159.9	1.80
22-DMB	0.0	0.0
CPENTANE	7.0	0.08
23-DMB	301.7	3.39
2-MP	583.4	6.56
3-MP	266.9	3.00
NHEXANE	491.7	5.53
MCP	1673.8	18.81
22-DMP	0.0	0.0
24-DMP	22.5	0.25
223-TMB	0.0	0.0
CHEXANE	122.2	1.37
33-DMP	0.0	0.0
11-DMCP	0.0	0.0
2-MHEX	200.0	2.25
23-DMP	214.9	2.42
3-MHEX	243.7	2.74
1C3-DMCP	663.2	7.45

	TOTAL PPB	NORM PERCENT
1T3-DMCP	621.4	6.98
1T2-DMCP	1029.8	11.57
3-EPENT	0.0	0.0
224-TMP	0.0	0.0
NHEPTANE	441.3	4.96
1C2-DMCP	104.6	1.18
MCH	1640.2	18.43

	TOTALS PPB	NORM PERCENT	SIG COMP RATIOS	
ALL COMP	8901.		C1/C2	0.48
GASOLINE	8898.		A /D2	3.83
NAPHTHENES	5862.	65.88	C1/D2	8.05
C6-7	7469.	83.95	CH/MCP	0.07
			PENT/IPENT	4.14

	PPB	NORM PERCENT
MCP	1673.8	48.7
CH	122.2	3.6
MCH	1640.2	47.7
TOTAL	3436.2	100.0

PARAFFIN INDEX 1 0.192

PARAFFIN INDEX 2 8.524

73060Q AUSTRALIA, TUNA-4,1880M.

	TOTAL PPB	NORM PERCENT
METHANE	0.0	
ETHANE	0.0	
PROPANE	82.8	
IBUTANE	14.0	0.06
NBUTANE	125.7	0.51
IPENTANE	921.7	3.71
NPENTANE	1090.3	4.39
22-DMB	49.2	0.20
CPENTANE	118.8	0.48
23-DMB	255.8	1.03
2-MP	2208.0	8.88
3-MP	901.7	3.63
NHEXANE	2825.3	11.37
MCP	1619.9	6.52
22-DMP	0.0	0.0
24-DMP	226.7	0.91
223-TMB	20.5	0.08
CHEXANE	204.0	0.82
33-DMP ,	34.8	0.14
11-DMCP	0.0	0.0
2-MHEX ,	2134.4	8.59
23-DMP ,	468.8	1.89
3-MHEX ,	1455.7	5.86
1C3-DMCP	619.2	2.49

	TOTAL PPB	NORM PERCENT
1T3-DMCP	776.0	3.12
1T2-DMCP	592.7	2.39
3-EPENT	0.0	0.0
224-TMP	0.0	0.0
NHEPTANE	5503.7	22.15
1C2-DMCP	85.3	0.34
MCH	2598.9	10.46

	TOTALS PPB	NORM PERCENT	SIG COMP RATIOS	
ALL COMP	24934.		C1/C2	1.35
GASOLINE	24851.		A /D2	5.72
NAPHTHENES	6615.	26.62	C1/D2	3.42
C6-7	19166.	77.12	CH/MCP	0.13
			PENT/IPENT,	1.18

	PPB	NORM PERCENT
MCP	1619.9	36.6
CH	204.0	4.6
MCH	2598.9	58.8
TOTAL	4422.8	100.0

PARAFFIN INDEX 1 1.806

PARAFFIN INDEX 2 38.251

73060S AUSTRALIA, TUNA-4,1910M.

	TOTAL PPB	NORM PERCENT
METHANE	0.0	
ETHANE	0.0	
PROPANE	114.5	
IBUTANE	21.1	0.26
NBUTANE	1459.5	17.86
IPENTANE	1661.7	20.33
NPENTANE	1498.6	18.33
22-DMB	15.5	0.19
CPENTANE	175.0	2.14
23-DMB	114.1	1.40
2-MP	567.2	6.94
3-MP	265.8	3.25
NHEXANE	522.3	6.39
MCP	894.7	10.95
22-DMP	0.0	0.0
24-DMP	7.7	0.09
223-TMB	0.0	0.0
CHEXANE	286.6	3.51
33-DMP ,	0.0	0.0
11-DMCP	0.0	0.0
2-MHEX ,	54.6	0.67
23-DMP ,	51.3	0.63
3-MHEX ,	51.3	0.63
1C3-DMCP	109.7	1.34

	TOTAL PPB	NORM PERCENT
1T3-DMCP	92.9	1.14
1T2-DMCP	146.9	1.80
3-EPENT	0.0	0.0
224-TMP	0.0	0.0
NHEPTANE	77.9	0.95
1C2-DMCP	5.9	0.07
MCH	93.3	1.14

	TOTALS PPB	NORM PERCENT	SIG COMP RATIOS	
ALL COMP	8288.		C1/C2	0.35
GASOLINE	8174.		A /D2	11.70
NAPHTHENES	1805.	22.08	C1/D2	8.47
C6-7	2395.	29.30	CH/MCP	0.32
			PENT/IPENT,	0.90

	PPB	NORM PERCENT
MCP	894.7	70.2
CH	286.6	22.5
MCH	93.3	7.3
TOTAL	1274.6	100.0

PARAFFIN INDEX 1 0.303

PARAFFIN INDEX 2 8.076

73060U AUSTRALIA, TUNA-4,1940M.

	TOTAL PPB	NORM PERCENT
METHANE	0.0	
ETHANE	0.0	
PROPANE	108.3	
IBUTANE	70.3	7.43
NBUTANE	168.1	17.78
IPENTANE	136.0	14.38
NPENTANE	130.9	13.85
22-DMB	0.0	0.0
CPENTANE	0.0	0.0
23-DMB	11.2	1.19
2-MP	60.3	6.38
3-MP	26.9	2.84
NHEXANE	57.0	6.03
MCP	85.8	9.07
22-DMP	0.0	0.0
24-DMP	0.2	0.02
223-TMB	0.0	0.0
CHEXANE	37.4	3.95
33-DMP ,	0.0	0.0
11-DMCP	0.0	0.0
2-MHEX ,	6.0	0.63
23-DMP ,	7.0	0.74
3-MHEX ,	11.3	1.20
1C3-DMCP	15.5	1.64

	TOTAL PPB	NORM PERCENT
1T3-DMCP	13.6	1.44
1T2-DMCP	18.4	1.94
3-EPENT	0.0	0.0
224-TMP	0.0	0.0
NHEPTANE	35.2	3.72
1C2-DMCP	0.0	0.0
MCH	54.6	5.77

	TOTALS PPB	NORM PERCENT	SIG COMP RATIOS	
ALL COMP	1054.		C1/C2	0.73
GASOLINE	946.		A /D2	8.14
NAPHTHENES	225.	23.82	C1/D2	8.65
C6-7	342.	36.15	CH/MCP	0.44
			PENT/IPENT,	0.96

	PPB	NORM PERCENT
MCP	85.8	48.3
CH	37.4	21.0
MCH	54.6	30.7
TOTAL	177.8	100.0

PARAFFIN INDEX 1 0.365

PARAFFIN INDEX 2 17.682

73060W AUSTRALIA, TUNA-4,1970M.

	TOTAL PPB	NORM PERCENT
METHANE	0.0	
ETHANE	0.0	
PROPANE	104.0	
IBUTANE	315.8	1.79
NBUTANE	2035.2	11.53
IPENTANE	3195.0	18.10
NPENTANE	2082.3	11.80
22-DMB	48.0	0.27
CPENTANE	348.8	1.98
23-DMB	244.1	1.38
2-MP	1222.9	6.93
3-MP	571.1	3.24
NHEXANE	737.6	4.18
MCP	2016.0	11.42
22-DMP	0.0	0.0
24-DMP	17.4	0.10
223-TMB	4.3	0.02
CHEXANE	1047.0	5.93
33-DMP ,	0.0	0.0
11-DMCP	0.0	0.0
2-MHEX ,	135.9	0.77
23-DMP ,	180.0	1.02
3-MHEX ,	222.5	1.26
1C3-DMCP	380.1	2.15
1T3-DMCP	360.1	2.04
1T2-DMCP	568.5	3.22
3-EPENT	0.0	0.0
224-TMP	0.0	0.0
NHEPTANE	422.9	2.40
1C2-DMCP	73.3	0.42
MCH	1419.0	8.04

	TOTALS PPB	NORM PERCENT	SIG COMP RATIOS	
ALL COMP	17752.		C1/C2	0.77
GASOLINE	17648.		A /D2	5.22
NAPHTHENES	6213.	35.20	C1/D2	11.70
C6-7	7584.	42.98	CH/MCP	0.52
			PENT/IPENT,	0.65

	PPB	NORM PERCENT
MCP	2016.0	45.0
CH	1047.0	23.4
MCH	1419.0	31.7
TOTAL	4482.0	100.0

PARAFFIN INDEX 1 0.274

PARAFFIN INDEX 2 8.929

73060Y AUSTRALIA, TUNA-4,2000M.

	TOTAL PPB	NORM PERCENT
METHANE	0.0	
ETHANE	0.0	
PROPANE	77.4	
IBUTANE	59.6	0.14
NBUTANE	307.2	0.70
IPENTANE	543.6	1.24
NPENTANE	869.3	1.99
22-DMB	17.1	0.04
CPENTANE	1282.1	2.94
23-DMB	59.5	0.14
2-MP	1086.4	2.49
3-MP	723.2	1.66
NHEXANE	1929.6	4.42
MCP	7590.3	17.38
22-DMP	0.0	0.0
24-DMP	96.4	0.22
223-TMB	14.7	0.03
CHEXANE	6689.5	15.32
33-DMP	0.0	0.0
11-DMCP	0.0	0.0
2-MHEX	718.0	1.64
23-DMP	1218.5	2.79
3-MHEX	1014.4	2.32
1C3-DMCP	2617.0	5.99
1T3-DMCP	2011.4	4.61
1T2-DMCP	3077.0	7.05
3-EPENT	0.0	0.0
224-TMP	0.0	0.0
NHEPTANE	2965.4	6.79
1C2-DMCP	588.8	1.35
MCH	8182.9	18.74

	TOTALS PPB	NORM PERCENT	SIG COMP RATIOS	
ALL COMP	43739.		C1/C2	0.98
GASOLINE	43662.		A /D2	4.83
NAPHTHENES	32039.	73.38	C1/D2	15.37
C6-7	38714.	88.67	CH/MCP	0.88
			PENT/IPENT.	1.60

	PPB	NORM PERCENT
MCP	7590.3	33.8
CH	6689.5	29.8
MCH	8182.9	36.4
TOTAL	22462.7	100.0

PARAFFIN INDEX 1 0.225

PARAFFIN INDEX 2 10.407

73061A AUSTRALIA, TUNA-4,2030M.

	TOTAL PPB	NORM PERCENT
METHANE	0.0	
ETHANE	0.0	
PROPANE	60.9	
IBUTANE	22.2	0.48
NBUTANE	169.2	3.65
IPENTANE	964.9	20.84
NPENTANE	792.0	17.11
22-DMB	6.8	0.15
CPENTANE	118.3	2.55
23-DMB	70.8	1.53
2-MP	358.2	7.74
3-MP	138.2	2.98
NHEXANE	247.1	5.34
MCP	586.6	12.67
22-DMP	0.0	0.0
24-DMP	4.3	0.09
223-TMB	0.0	0.0
CHEXANE	232.6	5.03
33-DMP ,	0.0	0.0
11-DMCP	0.0	0.0
2-MHEX ,	50.3	1.09
23-DMP ,	57.0	1.23
3-MHEX ,	48.7	1.05
1C3-DMCP	101.8	2.20
1T3-DMCP	84.6	1.83
1T2-DMCP	120.1	2.59
3-EPENT	0.0	0.0
224-TMP	0.0	0.0
NHEPTANE	137.6	2.97
1C2-DMCP	10.3	0.22
MCH	307.6	6.65

	TOTALS PPB	NORM PERCENT	SIG COMP RATIOS	
ALL COMP	4690.		C1/C2	0.65
GASOLINE	4629.		A /D2	7.90
NAPHTHENES	1562.	33.74	C1/D2	12.12
C6-7	1988.	42.96	CH/MCP	0.40
			PENT/IPENT,	0.82

	PPB	NORM PERCENT
MCP	586.6	52.1
CH	232.6	20.6
MCH	307.6	27.3
TOTAL	1126.8	100.0

PARAFFIN INDEX 1 0.323

PARAFFIN INDEX 2 12.064

73061C AUSTRALIA, TUNA-4,2060M.

	TOTAL PPB	NORM PERCENT
METHANE	0.0	
ETHANE	0.0	
PROPANE	88.7	
IBUTANE	94.5	0.22
NBUTANE	426.6	1.00
IPENTANE	5015.5	11.76
NPENTANE	4772.6	11.19
22-DMB	110.0	0.26
CPENTANE	1323.3	3.10
23-DMB	638.8	1.50
2-MP	3026.9	7.10
3-MP	1390.8	3.26
NHEXANE	1877.7	4.40
MCP	6737.7	15.80
22-DMP	0.0	0.0
24-DMP	36.1	0.08
223-TMB	12.3	0.03
CHEXANE	4661.8	10.93
33-DMP ,	0.0	0.0
11-DMCP	0.0	0.0
2-MHEX ,	332.5	0.78
23-DMP ,	626.5	1.47
3-MHEX ,	519.8	1.22
1C3-DMCP	1360.2	3.19

	TOTAL PPB	NORM PERCENT
1T3-DMCP	1059.2	2.48
1T2-DMCP	1799.4	4.22
3-EPENT	0.0	0.0
224-TMP	0.0	0.0
NHEPTANE	1232.6	2.89
1C2-DMCP	358.9	0.84
MCH	5241.6	12.29

	TOTALS PPB	NORM PERCENT	SIG COMP RATIOS	
ALL COMP	42744.		C1/C2	0.90
GASOLINE	42655.		A /D2	5.98
NAPHTHENES	22542.	52.85	C1/D2	19.69
C6-7	25856.	60.62	CH/MCP	0.69
			PENT/IPENT,	0.95

	PPB	NORM PERCENT
MCP	6737.7	40.5
CH	4661.8	28.0
MCH	5241.6	31.5
TOTAL	16641.1	100.0

PARAFFIN INDEX 1 0.202

PARAFFIN INDEX 2 7.322

73061E AUSTRALIA, TUNA-4,2090M.

	TOTAL PPB	NORM PERCENT		TOTAL PPB	NORM PERCENT
METHANE	0.0		1T3-DMCP	912.5	1.43
ETHANE	0.0		1T2-DMCP	1602.3	2.51
PROPANE	141.2		3-EPENT	0.0	0.0
IBUTANE	457.7	0.72	224-TMP	0.0	0.0
NBUTANE	2980.9	4.67	NHEPTANE	955.2	1.50
IPENTANE	10897.8	17.07	1C2-DMCP	318.4	0.50
NPENTANE	10421.2	16.33	MCH	6143.8	9.63
22-DMB	198.7	0.31			
CPENTANE	1350.2	2.12			
23-DMB	847.0	1.33			
2-MP	4413.4	6.91			
3-MP	2372.3	3.72			
NHEXANE	4020.9	6.30			
MCP	7155.7	11.21			
22-DMP	0.0	0.0			
24-DMP	35.0	0.05			
223-TMB	13.5	0.02			
CHEXANE	6164.7	9.66			
33-DMP ,	0.0	0.0			
11-DMCP	0.0	0.0			
2-MHEX ,	343.5	0.54			
23-DMP ,	576.5	0.90			
3-MHEX ,	500.1	0.78			
1C3-DMCP	1143.0	1.79			

	TOTALS PPB	NORM PERCENT	SIG COMP RATIOS	
ALL COMP	63966.		C1/C2	1.14
GASOLINE	63824.		A /D2	9.95
NAPHTHENES	24791.	38.84	C1/D2	25.30
C6-7	29885.	46.82	CH/MCP	0.86
			PENT/IPENT,	0.96

	PPB	NORM PERCENT
MCP	7155.7	36.8
CH	6164.7	31.7
MCH	6143.8	31.6
TOTAL	19464.2	100.0

PARAFFIN INDEX 1 0.231

PARAFFIN INDEX 2 5.208

73061G AUSTRALIA, TUNA-4,2120M.

	TOTAL PPB	NORM PERCENT
METHANE	0.0	
ETHANE	0.0	
PROPANE	191.1	
IBUTANE	615.2	1.99
NBUTANE	3351.5	10.84
IPENTANE	4985.8	16.13
NPENTANE	4705.0	15.22
22-DMB	86.2	0.28
CPENTANE	598.0	1.93
23-DMB	408.3	1.32
2-MP	2256.4	7.30
3-MP	1160.4	3.75
NHEXANE	2106.3	6.81
MCP	3071.9	9.94
22-DMP	0.0	0.0
24-DMP	30.4	0.10
223-TMB	8.5	0.03
CHEXANE	2322.1	7.51
33-DMP ,	0.0	0.0
11-DMCP	0.0	0.0
2-MHEX ,	230.4	0.75
23-DMP ,	318.4	1.03
3-MHEX ,	286.1	0.93
1C3-DMCP	459.7	1.49

	TOTAL PPB	NORM PERCENT
1T3-DMCP	380.6	1.23
1T2-DMCP	683.2	2.21
3-EPENT	0.0	0.0
224-TMP	0.0	0.0
NHEPTANE	631.6	2.04
1C2-DMCP	56.3	0.18
MCH	2163.8	7.00

	TOTALS PPB	NORM PERCENT	SIG COMP RATIOS	
ALL COMP	31107.		C1/C2	1.01
GASOLINE	30916.		A /D2	9.57
NAPHTHENES	9736.	31.49	C1/D2	16.49
C6-7	12749.	41.24	CH/MCP	0.76
			PENT/IPENT,	0.94

	PPB	NORM PERCENT
MCP	3071.9	40.6
CH	2322.1	30.7
MCH	2163.8	28.6
TOTAL	7557.8	100.0

PARAFFIN INDEX 1 0.339

PARAFFIN INDEX 2 8.448

73061I AUSTRALIA, TUNA-4,2150M.

	TOTAL PPB	NORM PERCENT
METHANE	0.0	
ETHANE	0.0	
PROPANE	87.6	
IBUTANE	149.5	1.47
NBUTANE	1169.6	11.54
IPENTANE	1915.2	18.89
NPENTANE	1561.1	15.40
22-DMB	21.1	0.21
CPENTANE	240.1	2.37
23-DMB	142.0	1.40
2-MP	794.5	7.84
3-MP	314.5	3.10
NHEXANE	770.0	7.59
MCP	900.8	8.88
22-DMP	0.0	0.0
24-DMP	12.0	0.12
223-TMB	1.4	0.01
CHEXANE	553.2	5.46
33-DMP ,	0.0	0.0
11-DMCP	0.0	0.0
2-MHEX ,	96.4	0.95
23-DMP ,	125.1	1.23
3-MHEX ,	106.1	1.05
1C3-DMCP	134.7	1.33

	TOTAL PPB	NORM PERCENT
1T3-DMCP	126.2	1.24
1T2-DMCP	180.6	1.78
3-EPENT	0.0	0.0
224-TMP	0.0	0.0
NHEPTANE	436.2	4.30
1C2-DMCP	10.9	0.11
MCH	378.0	3.73

	TOTALS PPB	NORM PERCENT	SIG COMP RATIOS	
ALL COMP	10227.		C1/C2	0.76
GASOLINE	10139.		A /D2	11.37
NAPHTHENES	2524.	24.90	C1/D2	9.69
C6-7	3831.	37.79	CH/MCP	0.61
			PENT/IPENT,	0.82

	PPB	NORM PERCENT
MCP	900.8	49.2
CH	553.2	30.2
MCH	378.0	20.6
TOTAL	1832.0	100.0

PARAFFIN INDEX 1 0.459

PARAFFIN INDEX 2 20.416

73061K AUSTRALIA, TUNA-4,2180M.

	TOTAL PPB	NORM PERCENT		TOTAL PPB	NORM PERCENT
METHANE	0.0		1T3-DMCP	85.7	1.30
ETHANE	0.0		1T2-DMCP	80.6	1.22
PROPANE	93.9		3-EPENT	0.0	0.0
IBUTANE	66.0	1.00	224-TMP	0.0	0.0
NBUTANE	785.5	11.92	NHEPTANE	242.5	3.68
IPENTANE	1075.1	16.31	1C2-DMCP	9.0	0.14
NPENTANE	1086.7	16.49	MCH	560.2	8.50
22-DMB	14.1	0.21			
CPENTANE	146.6	2.22			
23-DMB	77.7	1.18			
2-MP	423.1	6.42			
3-MP	197.0	2.99			
NHEXANE	523.9	7.95			
MCP	483.7	7.34			
22-DMP	0.0	0.0			
24-DMP	8.5	0.13			
223-TMB	0.0	0.0			
CHEXANE	447.0	6.78			
33-DMP ,	0.0	0.0			
11-DMCP	0.0	0.0			
2-MHEX ,	79.7	1.21			
23-DMP ,	65.1	0.99			
3-MHEX ,	66.5	1.01			
1C3-DMCP	65.6	1.00			

	TOTALS PPB	NORM PERCENT	SIG COMP RATIOS	
ALL COMP	6684.		C1/C2	1.50
GASOLINE	6590.		A /D2	11.53
NAPHTHENES	1878.	28.50	C1/D2	16.34
C6-7	2718.	41.25	CH/MCP	0.92
			PENT/IPENT,	1.01

	PPB	NORM PERCENT
MCP	483.7	32.4
CH	447.0	30.0
MCH	560.2	37.6
TOTAL	1490.9	100.0

PARAFFIN INDEX 1 0.630

PARAFFIN INDEX 2 14.325

73063K AUSTRALIA, TUNA-4,3050M.

	TOTAL PPB	NORM PERCENT
METHANE	0.0	
ETHANE	0.0	
PROPANE	23.6	
IBUTANE	208.4	0.33
NBUTANE	21.3	0.03
IPENTANE	316.5	0.49
NPENTANE	622.4	0.97
22-DMB	23.7	0.04
CPENTANE	353.1	0.55
23-DMB	393.7	0.61
2-MP	4533.0	7.08
3-MP	2198.7	3.43
NHEXANE	5938.1	9.28
MCP	5318.4	8.31
22-DMP	0.0	0.0
24-DMP	118.6	0.19
223-TMB	35.5	0.06
CHEXANE	9107.9	14.23
33-DMP ,	0.0	0.0
11-DMCP	0.0	0.0
2-MHEX ,	1444.8	2.26
23-DMP ,	1085.9	1.70
3-MHEX ,	1434.6	2.24
1C3-DMCP	1026.4	1.60

	TOTAL PPB	NORM PERCENT
1T3-DMCP	952.9	1.49
1T2-DMCP	1759.8	2.75
3-EPENT	0.0	0.0
224-TMP	0.0	0.0
NHEPTANE	5200.1	8.12
1C2-DMCP	611.3	0.95
MCH	21316.2	33.30

	TOTALS PPB	NORM PERCENT	SIG COMP RATIOS	
ALL COMP	64045.		C1/C2	3.30
GASOLINE	64021.		A /D2	7.76
NAPHTHENES	40446.	63.18	C1/D2	22.21
C6-7	55350.	86.46	CH/MCP	1.71
			PENT/IPENT,	1.97

	PPB	NORM PERCENT
MCP	5318.4	14.9
CH	9107.9	25.5
MCH	21316.2	59.6
TOTAL	35742.5	100.0

PARAFFIN INDEX 1 0.770

PARAFFIN INDEX 2 12.001

73063M AUSTRALIA, TUNA-4,3080M.

	TOTAL PPB	NORM PERCENT
METHANE	0.0	
ETHANE	0.0	
PROPANE	8.4	
IBUTANE	105.0	0.66
NBUTANE	3.9	0.02
IPENTANE	138.3	0.87
NPENTANE	833.5	5.27
22-DMB	28.0	0.18
CPENTANE	124.3	0.79
23-DMB	149.8	0.95
2-MP	1209.4	7.65
3-MP	542.0	3.43
NHEXANE	1663.5	10.52
MCP	1158.3	7.32
22-DMP	0.0	0.0
24-DMP	37.6	0.24
223-TMB	5.5	0.03
CHEXANE	2055.0	12.99
33-DMP ,	0.0	0.0
11-DMCP	0.0	0.0
2-MHEX ,	401.5	2.54
23-DMP ,	282.3	1.79
3-MHEX ,	379.7	2.40
1C3-DMCP	206.3	1.30

	TOTAL PPB	NORM PERCENT
1T3-DMCP	207.7	1.31
1T2-DMCP	356.6	2.25
3-EPENT	0.0	0.0
224-TMP	0.0	0.0
NHEPTANE	1540.1	9.74
1C2-DMCP	49.5	0.31
MCH	4338.8	27.43

	TOTALS PPB	NORM PERCENT	SIG COMP RATIOS	
ALL COMP	15825.		C1/C2	3.43
GASOLINE	15817.		A /D2	8.44
NAPHTHENES	8497.	53.72	C1/D2	17.90
C6-7	12682.	80.18	CH/MCP	1.77
			PENT/IPENT,	6.03

	PPB	NORM PERCENT
MCP	1158.3	15.3
CH	2055.0	27.2
MCH	4338.8	57.5
TOTAL	7552.1	100.0

PARAFFIN INDEX 1 1.014

PARAFFIN INDEX 2 15.766

730630 AUSTRALIA, TUNA-4,3110M.

	TOTAL PPB	NORM PERCENT
METHANE	0.0	
ETHANE	0.0	
PROPANE	16.0	
IBUTANE	162.0	0.62
NBUTANE	0.8	0.00
IPENTANE	687.5	2.63
NPENTANE	2999.4	11.47
22-DMB	59.4	0.23
CPENTANE	360.8	1.38
23-DMB	255.9	0.98
2-MP	1698.8	6.50
3-MP	814.1	3.11
NHEXANE	2593.3	9.92
MCP	1793.8	6.86
22-DMP	0.0	0.0
24-DMP	62.5	0.24
223-TMB	10.2	0.04
CHEXANE	3560.6	13.62
33-DMP ,	0.0	0.0
11-DMCP	0.0	0.0
2-MHEX ,	565.2	2.16
23-DMP ,	399.5	1.53
3-MHEX ,	535.4	2.05
1C3-DMCP	281.8	1.08

	TOTAL PPB	NORM PERCENT
1T3-DMCP	289.4	1.11
1T2-DMCP	516.6	1.98
3-EPENT	0.0	0.0
224-TMP	0.0	0.0
NHEPTANE	2174.2	8.32
1C2-DMCP	64.4	0.25
MCH	6255.7	23.93

	TOTALS PPB	NORM PERCENT	SIG COMP RATIOS	
ALL COMP	26157.		C1/C2	3.52
GASOLINE	26141.		A /D2	8.90
NAPHTHENES	13123.	50.20	C1/D2	19.39
C6-7	19103.	73.07	CH/MCP	1.99
			PENT/IPENT,	4.36

	PPB	NORM PERCENT
MCP	1793.8	15.4
CH	3560.6	30.7
MCH	6255.7	53.9
TOTAL	11610.1	100.0

PARAFFIN INDEX 1 1.012

PARAFFIN INDEX 2 14.914

73063Q AUSTRALIA, TUNA-4,3140M.

	TOTAL PPB	NORM PERCENT		TOTAL PPB	NORM PERCENT
METHANE	0.0		1T3-DMCP	179.1	1.08
ETHANE	0.0		1T2-DMCP	310.4	1.87
PROPANE	62.2		3-EPENT	0.0	0.0
IBUTANE	784.1	4.73	224-TMP	0.0	0.0
NBUTANE	0.2	0.00	NHEPTANE	1106.9	6.68
IPENTANE	1579.7	9.54	1C2-DMCP	35.2	0.21
NPENTANE	1842.8	11.13	MCH	3199.8	19.32
22-DMB	35.8	0.22			
CPENTANE	186.1	1.12			
23-DMB	155.7	0.94			
2-MP	1035.0	6.25			
3-MP	528.6	3.19			
NHEXANE	1433.7	8.66			
MCP	1030.6	6.22			
22-DMP	0.0	0.0			
24-DMP	45.6	0.28			
223-TMB	6.8	0.04			
CHEXANE	1908.4	11.52			
33-DMP ,	0.0	0.0			
11-DMCP	0.0	0.0			
2-MHEX ,	369.3	2.23			
23-DMP ,	261.3	1.58			
3-MHEX ,	351.0	2.12			
1C3-DMCP	173.9	1.05			

	TOTALS PPB	NORM PERCENT	SIG COMP RATIOS	
ALL COMP	16622.		C1/C2	3.17
GASOLINE	16560.		A /D2	7.24
NAPHTHENES	7024.	42.41	C1/D2	15.61
C6-7	10412.	62.87	CH/MCP	1.85
			PENT/IPENT,	1.17

	PPB	NORM PERCENT
MCP	1030.6	16.8
CH	1908.4	31.1
MCH	3199.8	52.1
TOTAL	6138.8	100.0

PARAFFIN INDEX 1 1.086

PARAFFIN INDEX 2 14.083

APPENDIX 2

Detailed Vitrinite Reflectance and Exinite Fluorescence Data - Report by A.C. Cook

TUNA NO. 4

KK No.	Esso No.	Depth m	$\bar{R}_v$ max %	Range R_v max %	N	Exinite fluorescence (Remarks)
						EOCENE - LATE CRETACEOUS
						Latrobe Group
X486	73023-P	1362.6 SWC	-	-	-	Sparse phytoplankton, greenish yellow to yellow, rare sporinite, yellow orange. (Calcareous clay siltstone. D.o.m. sparse, E>I. Exinite sparse, inertinite rare, vitrinite absent. Forams present. Mineral matter fluorescence moderate to strong.)
		$\bar{R}_I$	0.65	0.43-0.82	5	
X487	73023-W	1383.5 SWC	0.36	0.31-0.42	27	Major sporinite and liptodetrinite yellow, common cutinite greenish yellow to yellow orange, sparse fluorinite green, rare resinite yellow. (Shaly coal>coal. Coal sparse, V>E>I. Clarite>vitrite>duroclarite. Exinite major. Abundant shaly coal, vitrite and exinite rich. D.o.m. abundant, V>E. Vitrinite and exinite abudnant, inertinite absent as d.o.m. Weak red-brown vitrinite fluorescence. Weak mineral matter fluorescence. Pyrite abundant.)
X381	72974-G	1574.3 SWC	0.49	0.36-0.59	25	Abundant sporinite, yellow to orange, abundant resinite, bright yellow to orange and dull yellow to dull orange, sparse cutinite, bright yellow to orange. (Shaly coal>coal>>claystone. Shaly coal dominant, V>or=I>E. Coal abundant, V>I>E. Lower Eastern View facies B. Duroclarite>fusite>clarodurite. Vitrite has brown fluorescence. D.o.m. rare, I>E>V. All macerals rare. Sparse pyrite.)
X382	72974-F	1581.8 SWC	0.45	0.36-0.61	25	Common to abundant sporinite, yellow to orange, common resinite, yellow to orange and dull yellow to dull orange, sparse cutinite, yellow to dull orange. (Siltstone>claystone. D.o.m. abundant, E>I>V. Exinite and inertinite abundant, vitrinite common. Abundant pyrite.)
X383	72973-W	1816 SWC	0.50	0.37-0.66	27	Common sporinite, yellow to yellow orange, sparse resinite, dull yellow, rare cutinite, orange. (Claystone and silty claystone. D.o.m. abundant, I>E>V. Inertinite abundant, exinite and vitrinite common. Abundant pyrite.)
X384	72973-V	1847 SWC	0.50	0.40-0.61	27	Major sporinite, yellow to orange, rare cutinite and resinite, yellow to orange. Coal> claystone. Coal dominant, V>>E, vitrite. Telocollinite>>desmocollinite. Sclerotinite present. D.o.m. major, E>V>>I. Exinite major, vitrinite abundant, inertinite rare. Abundant pyrite.)

TUNA NO. 4

KK No.	Esso No.	Depth m	$\bar{R}_v max$ %	Range $R_v max$ %	N	Exinite fluorescence (Remarks)
X385	72973-R	19851.1 SWC	0.50	0.41-0.61	21	Common sporinite, yellow orange, sparse cutinite, orange, rare resinite, bright orange. (Siltstone>>coal. Coal rare, vitrite. D.o.m. abundant, I>E>V. Inertinite abundant, exinite and vitrinite common. Rare pyrite.)
X386	72973-L	2089.4 SWC	0.53	0.48-0.63	16	Common cutinite, bright yellow to dull orange, sparse to common sporinite, yellow to yellow orange, rare resinite, bright orange. (Siltstone and silty claystone. D.o.m. abundant, I>E>V. Inertinite abundant, exinite common to abundant, vitrinite sparse. Abundant pyrite.)
X387	72973-G	2264.3 SWC	0.50	0.36-0.64	25	Sparse cutinite, yellow to orange, sparse sporinite, yellow to yellow orange. (Siltstone> sandstone. D.o.m. abundant, I>V>E. Inertinite abundant, vitrinite common, exinite sparse. Vitrinite has brown fluorescence. Abundant carbonate and pyrite.)
X388	72973-B	2412 SWC	0.50	0.39-0.61	25	Abundant sporinite and cutinite, yellow to orange, sparse resinite, yellow and dull yellow, sparse suberinite, brown, rare ?telalginite, yellow. (Claystone and silty claystone>>coal. Coal, rare vitrite. D.o.m. major, E>V>I. Exinite major, vitrinite abundant, inertinite common. Abundant pyrite.)
X488	73036-Q	2642 SWC	0.52	0.46-0.59	28	Common sporinite, yellow to orange, sparse cutinite and liptodetrinite, yellow to orange, rare resinite yellow. (Siltstone>coal. Rare coal V>E. Vitrite>clarite. D.o.m. abundant, V>E>I. Vitrinite abundant, exinite common, inertinite rare. Weak mineral matter fluorescence. Rare pyrite.)
X489	73036-F	2768.5 SWC	0.57	0.44-0.68	17	Sparse sporinite, yellow to yellow orange, rare liptodetrinite and cutinite, yellow to orange. (Calcareous sandy siltstone. D.o.m. abundant, I>E>V. Inertinite abundant, exinite sparse, vitrinite sparse. Weak to moderate mineral matter fluorescence. Iron oxides present. Sparse pyrite.)
x1000	73035-R	2875 SWC	0.75	0.56-0.84	22	Sparse to common sporinite, yellow to orange. (Calcareous siltstone>>coal. Coal rare, vitrite. Dom common, I=V=E. Inertinite and vitrinite common, exinite sparse to common. Rare ?bitumen present. Moderate mineral fluorescence.)
x1001	73035-Q	2885 SWC	0.72	0.56-0.83	30	Sparse sporinite, yellow to orange, sparse cutinite, orange to dull orange. (Siltstone. Dom major, I>V>E. Inertinite and vitrinite abundant, exinite sparse. Moderate mineral fluorescence.)

TUNA NO. 4

KK No.	Esso No.	Depth m	$\bar{R}_v$ max %	Range R_v max %	N	Exinite fluorescence (Remarks)
x1002	73035-M	2926 SWC	0.69	0.52-0.84	27	Abundant sporinite and common cutinite, yellow to orange, rare resinite, yellow and rare fluorinite, bright yellow. (Silty claystone. Dom abundant, E>V>I. Exinite abundant, vitrinite common, inertinite sparse. Weak mineral fluorescence.)
X1003	73035-I	2946 SWC	0.69	0.54-0.82	29	Sparse sporinite, yellow to orange, rare cutinite, orange. (Siltstone. Dom abundant, I>V>E. Inertinite abundant, vitrinite sparse to common, exinite sparse. Common carbonate. Weak to moderate mineral fluorescence. Iron oxides present.)
X1004	73035-D	3024 SWC	0.70	0.64-0.84	26	Abundant sporinite, yellow to dull orange, rare cutinite, orange. (Silty claystone. Dom abundant, E>V>I. Exinite abundant, vitrinite common to abundant, inertinite common. Moderate mineral fluorescence.)
X490	73037-K	3026 SWC	0.75	0.65-0.86	17	Sparse sporinite, yellow orange to dull orange, rare cutinite, yellow to orange, rare liptodetrinite, yellow to yellow orange. (Sandy siltstone. D.o.m. abundant, I>E>V. Inertinite abundant, exinite sparse, vitrinite rare to sparse. Textural features indicate vitrinite may be slightly reworked or was subjected to early partial replacement by silicate minerals. Moderate mineral matter fluorescence. Pyrite sparse.)
X491	73037-R	3090.95 Ctgs	0.75	0.61-0.88	25	Rare sporinite, orange to dull orange, rare phytoplankton, orange, rare cutinite, orange to dull orange. (Sandstone>>siltstone>>carbonate. D.o.m. sparse, I>V>E. Inertinite sparse, vitrinite rare to sparse, exinite rare. Some vitrinite has weak brown fluorescence. Strong mineral matter fluorescence. Iron oxides present. Siderite sparse, pyrite common.)
X492	73037-S	3130-35 Ctgs	0.75	0.64-0.86	25	Sparse liptodetrinite, sporinite and cutinite, orange to dull orange. (Sandstone>siltstone. D.o.m. abundant, I>V>E. Inertinite abundant, vitrinite common to abundant, exinite sparse. Mineral matter fluorescence strong. Pyrite common.)
X493	73034-Q	3179.5 SWC	0.79	0.67-0.95	28	Sparse cutinite and sporinite, yellow orange to orange, rare liptodetrinite, yellow to orange. (Siltstone. D.o.m. abundant, I>E>V. Inertinite and vitrinite abundant, exinite sparse. Iron oxides abundant, carbonate common. Pyrite common.)

TUNA NO. 4

KK No.	Esso No.	Depth m	$\bar{R}_v$ max %	Range R_v max %	N	Exinite fluorescence (Remarks)
X494	73023-X	3278.7 Core	0.84	0.70-0.99	30	Common sporinite, orange, sparse phytoplankton, yellow to orange, rare cutinite, orange. (Siltstone. D.o.m. abundant to major. All three maceral groups abundant. Pyrite abundant.)
X495	73023-Y	3279.45 Core	0.87	0.77-1.01	27	Sparse sporinite, yellow orange to orange. (Siltstone tending to shaly coal. D.o.m, major, I>V>E. Inertinite major, vitrinite abundant, exinite sparse. Iron oxides abundant. Mineral fluorescence strong. Pyrite abundant, with some pyrite petrifactions of wood.)
X496	73023-Z	3280.15 Core	0.90	0.74-1.02	10	Sparse cutinite and sporinite, orange. (Siltstone. D.o.m. abundant, I>V>E. Inertinite abundant, vitrinite sparse, exinite sparse. Mineral fluorescence strong. Pyrite abundant.)
X497	73034-E	3281 SWC	0.93	0.82-0.97	4	Common sporinite and liptodetrinite orange, sparse cutinite, orange to dull orange. (Siltstone. D.o.m. common, I>E>V. Inertinite and exinite common, vitrinite rare. Pyrite common.)
X498	73034-B	3302.5 SWC	0.86	0.66-0.98	12	Common sporinite, orange, sparse cutinite, bright yellow to dull orange, rare resinite, yellow. (Calcareous siltstone>carbonate. D.o.m. abundant, I>E>V. Inertinite abundant, exinite common, vitrinite rare. Diffuse humic matter sparse. Detrital iron oxides common. Siderite major. Pyrite common.)

73061M AUSTRALIA, TUNA-4,2210M.

	TOTAL PPB	NORM PERCENT		TOTAL PPB	NORM PERCENT
METHANE	0.0		1T3-DMCP	101.7	0.95
ETHANE	0.0		1T2-DMCP	88.0	0.82
PROPANE	134.9		3-EPENT	0.0	0.0
IBUTANE	380.7	3.55	224-TMP	0.0	0.0
NBUTANE	2839.6	26.48	NHEPTANE	320.9	2.99
IPENTANE	1809.9	16.88	1C2-DMCP	7.2	0.07
NPENTANE	1523.3	14.20	MCH	350.8	3.27
22-DMB	12.9	0.12			
CPENTANE	532.0	4.96			
23-DMB	22.0	0.21			
2-MP	416.9	3.89			
3-MP	226.0	2.11			
NHEXANE	567.5	5.29			
MCP	689.0	6.43			
22-DMP	0.0	0.0			
24-DMP	7.4	0.07			
223-TMB	0.0	0.0			
CHEXANE	521.1	4.86			
33-DMP ,	0.0	0.0			
11-DMCP	0.0	0.0			
2-MHEX ,	79.3	0.74			
23-DMP ,	76.2	0.71			
3-MHEX ,	66.4	0.62			
1C3-DMCP	84.9	0.79			

	TOTALS PPB	NORM PERCENT	SIG COMP RATIOS	
ALL COMP	10858.		C1/C2	0.98
GASOLINE	10724.		A /D2	13.37
NAPHTHENES	2375.	22.14	C1/D2	14.32
C6-7	2960.	27.61	CH/MCP	0.76
			PENT/IPENT,	0.84

	PPB	NORM PERCENT
MCP	689.0	44.1
CH	521.1	33.4
MCH	350.8	22.5
TOTAL	1560.9	100.0

PARAFFIN INDEX 1 0.531

PARAFFIN INDEX 2 18.995

730610 AUSTRALIA, TUNA-4,2240M.

	TOTAL PPB	NORM PERCENT		TOTAL PPB	NORM PERCENT
METHANE	0.0		1T3-DMCP	13.2	0.48
ETHANE	0.0		1T2-DMCP	21.1	0.76
PROPANE	229.0		3-EPENT	0.0	0.0
IBUTANE	259.8	9.43	224-TMP	0.0	0.0
NBUTANE	733.2	26.61	NHEPTANE	66.2	2.40
IPENTANE	368.2	13.37	1C2-DMCP	0.0	0.0
NPENTANE	392.9	14.26	MCH	121.1	4.39
22-DMB	3.3	0.12			
CPENTANE	52.1	1.89			
23-DMB	21.6	0.78			
2-MP	119.4	4.33			
3-MP	58.8	2.14			
NHEXANE	151.1	5.48			
MCP	144.9	5.26			
22-DMP	0.0	0.0			
24-DMP	0.9	0.03			
223-TMB	0.0	0.0			
CHEXANE	151.6	5.50			
33-DMP ,	0.0	0.0			
11-DMCP	0.0	0.0			
2-MHEX ,	27.6	1.00			
23-DMP ,	14.9	0.54			
3-MHEX ,	16.3	0.59			
1C3-DMCP	16.6	0.60			

	TOTALS PPB	NORM PERCENT	SIG COMP RATIOS	
ALL COMP	2984.		C1/C2	1.53
GASOLINE	2755.		A /D2	13.30
NAPHTHENES	521.	18.90	C1/D2	18.38
C6-7	746.	27.06	CH/MCP	1.05
			PENT/IPENT,	1.07

	PPB	NORM PERCENT
MCP	144.9	34.7
CH	151.6	36.3
MCH	121.1	29.0
TOTAL	417.6	100.0

PARAFFIN INDEX 1 0.863

PARAFFIN INDEX 2 14.755

73061Q AUSTRALIA, TUNA-4,2270M.

	TOTAL PPB	NORM PERCENT
METHANE	0.0	
ETHANE	0.0	
PROPANE	181.9	
IBUTANE	132.7	10.20
NBUTANE	374.0	28.74
IPENTANE	185.9	14.28
NPENTANE	210.8	16.20
22-DMB	0.4	0.03
CPENTANE	44.3	3.40
23-DMB	3.5	0.27
2-MP	48.3	3.71
3-MP	25.8	1.99
NHEXANE	67.9	5.22
MCP	71.9	5.52
22-DMP	0.0	0.0
24-DMP	0.0	0.0
223-TMB	0.0	0.0
CHEXANE	54.2	4.16
33-DMP ,	0.0	0.0
11-DMCP	0.0	0.0
2-MHEX ,	0.0	0.0
23-DMP ,	4.9	0.38
3-MHEX ,	5.9	0.45
1C3-DMCP	7.2	0.55

	TOTAL PPB	NORM PERCENT
1T3-DMCP	5.5	0.42
1T2-DMCP	9.1	0.70
3-EPENT	0.0	0.0
224-TMP	0.0	0.0
NHEPTANE	9.6	0.74
1C2-DMCP	0.0	0.0
MCH	39.4	3.03

	TOTALS PPB	NORM PERCENT	SIG COMP RATIOS	
ALL COMP	1483.		C1/C2	1.00
GASOLINE	1301.		A /D2	13.23
NAPHTHENES	232.	17.80	C1/D2	16.00
C6-7	276.	21.18	CH/MCP	0.75
			PENT/IPENT,	1.13

	PPB	NORM PERCENT
MCP	71.9	43.4
CH	54.2	32.7
MCH	39.4	23.8
TOTAL	165.5	100.0

PARAFFIN INDEX 1 0.268

PARAFFIN INDEX 2 7.053

73061S AUSTRALIA, TUNA-4,2300M.

	TOTAL PPB	NORM PERCENT		TOTAL PPB	NORM PERCENT
METHANE	0.0		1T3-DMCP	320.1	1.08
ETHANE	0.0		1T2-DMCP	540.2	1.82
PROPANE	119.2		3-EPENT	0.0	0.0
IBUTANE	212.6	0.71	224-TMP	0.0	0.0
NBUTANE	2220.2	7.46	NHEPTANE	1238.3	4.16
IPENTANE	3338.0	11.22	1C2-DMCP	41.9	0.14
NPENTANE	3988.9	13.40	MCH	3557.9	11.96
22-DMB	63.5	0.21			
CPENTANE	514.7	1.73			
23-DMB	317.5	1.07			
2-MP	2031.3	6.83			
3-MP	1008.3	3.39			
NHEXANE	2864.1	9.62			
MCP	2560.4	8.60			
22-DMP	0.0	0.0			
24-DMP	40.7	0.14			
223-TMB	10.0	0.03			
CHEXANE	3386.9	11.38			
33-DMP ,	0.0	0.0			
11-DMCP	0.0	0.0			
2-MHEX ,	402.6	1.35			
23-DMP ,	347.1	1.17			
3-MHEX ,	405.2	1.36			
1C3-DMCP	346.7	1.17			

	TOTALS PPB	NORM PERCENT	SIG COMP RATIOS	
ALL COMP	29876.		C1/C2	1.93
GASOLINE	29757.		A /D2	10.12
NAPHTHENES	11269.	37.87	C1/D2	18.13
C6-7	16062.	53.98	CH/MCP	1.32
			PENT/IPENT,	1.19

	PPB	NORM PERCENT
MCP	2560.4	26.9
CH	3386.9	35.6
MCH	3557.9	37.4
TOTAL	9505.2	100.0

PARAFFIN INDEX 1 0.669

PARAFFIN INDEX 2 11.743

73061U AUSTRALIA, TUNA-4,2330M.

	TOTAL PPB	NORM PERCENT
METHANE	0.0	
ETHANE	0.0	
PROPANE	75.7	
IBUTANE	31.6	0.16
NBUTANE	405.5	2.05
IPENTANE	1846.2	9.35
NPENTANE	2635.9	13.36
22-DMB	33.8	0.17
CPENTANE	339.9	1.72
23-DMB	170.6	0.86
2-MP	1160.1	5.88
3-MP	595.1	3.02
NHEXANE	2034.1	10.31
MCP	1635.1	8.29
22-DMP	0.0	0.0
24-DMP	29.3	0.15
223-TMB	4.1	0.02
CHEXANE	2380.4	12.06
33-DMP ,	0.0	0.0
11-DMCP	0.0	0.0
2-MHEX ,	338.4	1.71
23-DMP ,	244.8	1.24
3-MHEX ,	335.9	1.70
1C3-DMCP	243.4	1.23
1T3-DMCP	230.8	1.17
1T2-DMCP	396.8	2.01
3-EPENT	0.0	0.0
224-TMP	0.0	0.0
NHEPTANE	1250.1	6.33
1C2-DMCP	31.2	0.16
MCH	3362.8	17.04

	TOTALS PPB	NORM PERCENT	SIG COMP RATIOS	
ALL COMP	19812.		C1/C2	2.40
GASOLINE	19736.		A /D2	9.78
NAPHTHENES	8620.	43.68	C1/D2	18.10
C6-7	12517.	63.42	CH/MCP	1.46
			PENT/IPENT,	1.43

	PPB	NORM PERCENT
MCP	1635.1	22.2
CH	2380.4	32.3
MCH	3362.8	45.6
TOTAL	7378.3	100.0

PARAFFIN INDEX 1 0.774

PARAFFIN INDEX 2 14.233

73061W AUSTRALIA, TUNA-4,2360M.

	TOTAL PPB	NORM PERCENT
METHANE	0.0	
ETHANE	0.0	
PROPANE	80.2	
IBUTANE	22.0	0.05
NBUTANE	203.5	0.43
IPENTANE	815.2	1.71
NPENTANE	3644.7	7.64
22-DMB	108.1	0.23
CPENTANE	695.5	1.46
23-DMB	442.4	0.93
2-MP	2937.9	6.16
3-MP	1565.4	3.28
NHEXANE	4901.1	10.27
MCP	4177.6	8.75
22-DMP	0.0	0.0
24-DMP	92.2	0.19
223-TMB	20.7	0.04
CHEXANE	6404.3	13.42
33-DMP ,	0.0	0.0
11-DMCP	0.0	0.0
2-MHEX ,	974.7	2.04
23-DMP ,	708.5	1.48
3-MHEX ,	999.4	2.09
1C3-DMCP	762.1	1.60
1T3-DMCP	697.3	1.46
1T2-DMCP	1244.5	2.61
3-EPENT	0.0	0.0
224-TMP	0.0	0.0
NHEPTANE	3809.5	7.98
1C2-DMCP	330.9	0.69
MCH	12166.3	25.49

	TOTALS PPB	NORM PERCENT	SIG COMP RATIOS	
ALL COMP	47804.		C1/C2	2.71
GASOLINE	47724.		A /D2	8.72
NAPHTHENES	26478.	55.48	C1/D2	19.56
C6-7	37289.	78.14	CH/MCP	1.53
			PENT/IPENT,	4.47

	PPB	NORM PERCENT
MCP	4177.6	18.4
CH	6404.3	28.2
MCH	12166.3	53.5
TOTAL	22748.2	100.0

PARAFFIN INDEX 1 0.730

PARAFFIN INDEX 2 13.720

73061Y AUSTRALIA, TUNA-4,2390M.

	TOTAL PPB	NORM PERCENT
METHANE	0.0	
ETHANE	0.0	
PROPANE	74.3	
IBUTANE	8.1	0.02
NBUTANE	113.1	0.29
IPENTANE	588.0	1.50
NPENTANE	2546.9	6.51
22-DMB	78.7	0.20
CPENTANE	356.4	0.91
23-DMB	302.2	0.77
2-MP	2075.6	5.31
3-MP	1124.0	2.87
NHEXANE	3420.9	8.75
MCP	2924.4	7.48
22-DMP	0.0	0.0
24-DMP	90.8	0.23
223-TMB	26.8	0.07
CHEXANE	4945.4	12.64
33-DMP ,	0.0	0.0
11-DMCP	0.0	0.0
2-MHEX ,	880.8	2.25
23-DMP ,	680.7	1.74
3-MHEX ,	939.4	2.40
1C3-DMCP	637.0	1.63

	TOTAL PPB	NORM PERCENT
1T3-DMCP	613.3	1.57
1T2-DMCP	1175.9	3.01
3-EPENT	0.0	0.0
224-TMP	0.0	0.0
NHEPTANE	3323.6	8.50
1C2-DMCP	342.8	0.88
MCH	11918.2	30.47

	TOTALS PPB	NORM PERCENT	SIG COMP RATIOS	
ALL COMP	39187.		C1/C2	3.12
GASOLINE	39113.		A /D2	7.18
NAPHTHENES	22913.	58.58	C1/D2	18.89
C6-7	31920.	81.61	CH/MCP	1.69
			PENT/IPENT,	4.33

	PPB	NORM PERCENT
MCP	2924.4	14.8
CH	4945.4	25.0
MCH	11918.2	60.2
TOTAL	19788.0	100.0

PARAFFIN INDEX 1 0.750

PARAFFIN INDEX 2 13.234

73062A AUSTRALIA, TUNA-4,2420M.

	TOTAL PPB	NORM PERCENT
METHANE	0.0	
ETHANE	0.0	
PROPANE	155.6	
IBUTANE	46.5	2.40
NBUTANE	158.3	8.18
IPENTANE	147.4	7.61
NPENTANE	152.2	7.86
22-DMB	3.1	0.16
CPENTANE	18.4	0.95
23-DMB	14.7	0.76
2-MP	93.5	4.83
3-MP	56.2	2.91
NHEXANE	157.6	8.14
MCP	115.9	5.99
22-DMP	0.0	0.0
24-DMP	4.4	0.23
223-TMB	0.0	0.0
CHEXANE	171.4	8.85
33-DMP ,	0.0	0.0
11-DMCP	0.0	0.0
2-MHEX ,	75.5	3.90
23-DMP ,	21.8	1.13
3-MHEX ,	42.9	2.21
1C3-DMCP	19.8	1.02
1T3-DMCP	22.7	1.17
1T2-DMCP	29.6	1.53
3-EPENT	0.0	0.0
224-TMP	0.0	0.0
NHEPTANE	142.4	7.36
1C2-DMCP	2.7	0.14
MCH	438.7	22.67

	TOTALS PPB	NORM PERCENT	SIG COMP RATIOS	
ALL COMP	2091.		C1/C2	3.60
GASOLINE	1936.		A /D2	7.00
NAPHTHENES	819.	42.32	C1/D2	16.00
C6-7	1245.	64.34	CH/MCP	1.48
			PENT/IPENT,	1.03

	PPB	NORM PERCENT
MCP	115.9	16.0
CH	171.4	23.6
MCH	438.7	60.4
TOTAL	726.0	100.0

PARAFFIN INDEX 1 1.642

PARAFFIN INDEX 2 14.761

73062C AUSTRALIA, TUNA-4,2450M.

	TOTAL PPB	NORM PERCENT
METHANE	0.0	
ETHANE	0.0	
PROPANE	115.4	
IBUTANE	123.5	2.25
NBUTANE	163.7	2.99
IPENTANE	401.2	7.32
NPENTANE	345.1	6.29
22-DMB	20.4	0.37
CPENTANE	23.2	0.42
23-DMB	73.1	1.33
2-MP	451.4	8.23
3-MP	233.4	4.26
NHEXANE	670.5	12.23
MCP	266.0	4.85
22-DMP	0.0	0.0
24-DMP	31.8	0.58
223-TMB	4.3	0.08
CHEXANE	408.3	7.45
33-DMP ,	0.0	0.0
11-DMCP	0.0	0.0
2-MHEX ,	213.1	3.89
23-DMP ,	112.6	2.05
3-MHEX ,	182.9	3.34
1C3-DMCP	56.5	1.03
1T3-DMCP	94.8	1.73
1T2-DMCP	70.1	1.28
3-EPENT	0.0	0.0
224-TMP	0.0	0.0
NHEPTANE	552.7	10.08
1C2-DMCP	4.9	0.09
MCH	979.2	17.86

	TOTALS PPB	NORM PERCENT	SIG COMP RATIOS	
ALL COMP	5598.		C1/C2	3.25
GASOLINE	5483.		A /D2	6.69
NAPHTHENES	1903.	34.71	C1/D2	8.75
C6-7	3648.	66.53	CH/MCP	1.54
			PENT/IPENT,	0.86

	PPB	NORM PERCENT
MCP	266.0	16.1
CH	408.3	24.7
MCH	979.2	59.2
TOTAL	1653.5	100.0

PARAFFIN INDEX 1 1.789

PARAFFIN INDEX 2 20.700

73062E AUSTRALIA, TUNA-4,2480M.

	TOTAL PPB	NORM PERCENT
METHANE	0.0	
ETHANE	0.0	
PROPANE	211.3	
IBUTANE	304.8	0.20
NBUTANE	1732.0	1.12
IPENTANE	13466.8	8.71
NPENTANE	14584.5	9.43
22-DMB	344.2	0.22
CPENTANE	2028.2	1.31
23-DMB	1442.3	0.93
2-MP	8755.4	5.66
3-MP	4376.3	2.83
NHEXANE	13431.2	8.68
MCP	10764.6	6.96
22-DMP	0.0	0.0
24-DMP	1341.4	0.87
223-TMB	59.1	0.04
CHEXANE	18561.5	12.00
33-DMP ,	0.0	0.0
11-DMCP	0.0	0.0
2-MHEX ,	2784.1	1.80
23-DMP ,	2176.0	1.41
3-MHEX ,	2858.6	1.85
1C3-DMCP	2195.9	1.42
1T3-DMCP	2049.3	1.33
1T2-DMCP	3970.8	2.57
3-EPENT	0.0	0.0
224-TMP	0.0	0.0
NHEPTANE	12234.2	7.91
1C2-DMCP	0.0	0.0
MCH	35194.3	22.76

	TOTALS PPB	NORM PERCENT	SIG COMP RATIOS	
ALL COMP	154867.		C1/C2	2.98
GASOLINE	154655.		A /D2	8.98
NAPHTHENES	74765.	48.34	C1/D2	19.78
C6-7	107621.	69.59	CH/MCP	1.72
			PENT/IPENT,	1.08

	PPB	NORM PERCENT
MCP	10764.6	16.7
CH	18561.5	28.8
MCH	35194.3	54.5
TOTAL	64520.4	100.0

PARAFFIN INDEX 1 0.687

PARAFFIN INDEX 2 14.915

73062G AUSTRALIA, TUNA-4,2600M.

	TOTAL PPB	NORM PERCENT
METHANE	0.0	
ETHANE	0.0	
PROPANE	861.9	
IBUTANE	611.3	1.84
NBUTANE	1864.2	5.62
IPENTANE	1917.9	5.78
NPENTANE	2478.7	7.47
22-DMB	55.9	0.17
CPENTANE	281.7	0.85
23-DMB	245.9	0.74
2-MP	1756.4	5.29
3-MP	868.1	2.62
NHEXANE	2655.2	8.00
MCP	1899.9	5.72
22-DMP	0.0	0.0
24-DMP	104.9	0.32
223-TMB	15.6	0.05
CHEXANE	3193.7	9.62
33-DMP ,	0.0	0.0
11-DMCP	0.0	0.0
2-MHEX ,	867.8	2.61
23-DMP ,	554.8	1.67
3-MHEX ,	866.2	2.61
1C3-DMCP	368.4	1.11

	TOTAL PPB	NORM PERCENT
1T3-DMCP	403.3	1.21
1T2-DMCP	644.8	1.94
3-EPENT	0.0	0.0
224-TMP	0.0	0.0
NHEPTANE	3025.3	9.11
1C2-DMCP	80.4	0.24
MCH	8432.0	25.40

	TOTALS PPB	NORM PERCENT	SIG COMP RATIOS	
ALL COMP	34054.		C1/C2	3.68
GASOLINE	33192.		A /D2	6.56
NAPHTHENES	15304.	46.11	C1/D2	14.42
C6-7	23112.	69.63	CH/MCP	1.68
			PENT/IPENT,	1.29

	PPB	NORM PERCENT
MCP	1899.9	14.0
CH	3193.7	23.6
MCH	8432.0	62.3
TOTAL	13525.6	100.0

PARAFFIN INDEX 1 1.224

PARAFFIN INDEX 2 16.481

73062I AUSTRALIA, TUNA-4,2630M.

	TOTAL PPB	NORM PERCENT
METHANE	0.0	
ETHANE	0.0	
PROPANE	274.0	
IBUTANE	1379.7	1.37
NBUTANE	5807.8	5.78
IPENTANE	8480.3	8.43
NPENTANE	7565.2	7.52
22-DMB	264.9	0.26
CPENTANE	824.1	0.82
23-DMB	1094.7	1.09
2-MP	6741.6	6.71
3-MP	3490.1	3.47
NHEXANE	7358.2	7.32
MCP	5834.3	5.80
22-DMP	0.0	0.0
24-DMP	372.9	0.37
223-TMB	69.1	0.07
CHEXANE	10332.4	10.28
33-DMP ,	0.0	0.0
11-DMCP	0.0	0.0
2-MHEX ,	2445.0	2.43
23-DMP ,	1919.6	1.91
3-MHEX ,	2582.1	2.57
1C3-DMCP	1112.6	1.11
1T3-DMCP	1241.4	1.23
1T2-DMCP	1953.7	1.94
3-EPENT	0.0	0.0
224-TMP	0.0	0.0
NHEPTANE	5996.5	5.96
1C2-DMCP	479.0	0.48
MCH	23199.7	23.07

	TOTALS PPB	NORM PERCENT	SIG COMP RATIOS	
ALL COMP	100819.		C1/C2	3.39
GASOLINE	100545.		A /D2	5.17
NAPHTHENES	44977.	44.73	C1/D2	13.93
C6-7	64896.	64.54	CH/MCP	1.77
			PENT/IPENT,	0.89

	PPB	NORM PERCENT
MCP	5834.3	14.8
CH	10332.4	26.2
MCH	23199.7	58.9
TOTAL	39366.4	100.0

PARAFFIN INDEX 1 1.167

PARAFFIN INDEX 2 11.808

73062M AUSTRALIA, TUNA-4,2690M.

	TOTAL PPB	NORM PERCENT
METHANE	0.0	
ETHANE	0.0	
PROPANE	77.5	
IBUTANE	55.2	0.27
NBUTANE	846.0	4.17
IPENTANE	1445.4	7.12
NPENTANE	2187.4	10.78
22-DMB	38.2	0.19
CPENTANE	201.9	0.99
23-DMB	161.3	0.79
2-MP	1153.8	5.69
3-MP	603.1	2.97
NHEXANE	2184.8	10.77
MCP	1281.7	6.32
22-DMP	0.0	0.0
24-DMP	57.7	0.28
223-TMB	8.4	0.04
CHEXANE	1999.0	9.85
33-DMP ,	0.0	0.0
11-DMCP	0.0	0.0
2-MHEX ,	548.1	2.70
23-DMP ,	315.8	1.56
3-MHEX ,	511.6	2.52
1C3-DMCP	217.4	1.07

	TOTAL PPB	NORM PERCENT
1T3-DMCP	227.9	1.12
1T2-DMCP	389.7	1.92
3-EPENT	0.0	0.0
224-TMP	0.0	0.0
NHEPTANE	2129.1	10.49
1C2-DMCP	37.1	0.18
MCH	3690.2	18.19

	TOTALS PPB	NORM PERCENT	SIG COMP RATIOS	
ALL COMP	20368.		C1/C2	2.90
GASOLINE	20291.		A /D2	8.43
NAPHTHENES	8045.	39.65	C1/D2	12.19
C6-7	13598.	67.02	CH/MCP	1.56
			PENT/IPENT,	1.51

	PPB	NORM PERCENT
MCP	1281.7	18.4
CH	1999.0	28.7
MCH	3690.2	52.9
TOTAL	6970.9	100.0

PARAFFIN INDEX 1 1.269

PARAFFIN INDEX 2 21.229

730620 AUSTRALIA, TUNA-4,2720M.

	TOTAL PPB	NORM PERCENT
METHANE	0.0	
ETHANE	0.0	
PROPANE	64.9	
IBUTANE	7.7	0.04
NBUTANE	111.6	0.53
IPENTANE	304.8	1.45
NPENTANE	1807.3	8.60
22-DMB	36.7	0.17
CPENTANE	631.1	3.00
23-DMB	65.7	0.31
2-MP	900.8	4.29
3-MP	603.7	2.87
NHEXANE	2152.2	10.24
MCP	1728.6	8.23
22-DMP	0.0	0.0
24-DMP	35.8	0.17
223-TMB	5.3	0.03
CHEXANE	3167.9	15.08
33-DMP ,	0.0	0.0
11-DMCP	0.0	0.0
2-MHEX ,	416.4	1.98
23-DMP ,	290.9	1.38
3-MHEX ,	414.4	1.97
1C3-DMCP	271.9	1.29
1T3-DMCP	269.9	1.28
1T2-DMCP	473.0	2.25
3-EPENT	0.0	0.0
224-TMP	0.0	0.0
NHEPTANE	1783.1	8.49
1C2-DMCP	46.1	0.22
MCH	5483.8	26.10

	TOTALS PPB	NORM PERCENT	SIG COMP RATIOS	
ALL COMP	21074.		C1/C2	3.25
GASOLINE	21009.		A /D2	9.50
NAPHTHENES	12072.	57.46	C1/D2	21.88
C6-7	16539.	78.73	CH/MCP	1.83
			PENT/IPENT,	5.93

	PPB	NORM PERCENT
MCP	1728.6	16.7
CH	3167.9	30.5
MCH	5483.8	52.8
TOTAL	10380.3	100.0

PARAFFIN INDEX 1 0.819

PARAFFIN INDEX 2 14.184

73062Q AUSTRALIA, TUNA-4,2750M.

	TOTAL PPB	NORM PERCENT
METHANE	0.0	
ETHANE	0.0	
PROPANE	70.0	
IBUTANE	14.0	3.23
NBUTANE	47.2	10.92
IPENTANE	21.1	4.89
NPENTANE	159.1	36.80
22-DMB	0.0	0.0
CPENTANE	0.0	0.0
23-DMB	2.8	0.65
2-MP	11.2	2.60
3-MP	8.8	2.04
NHEXANE	35.7	8.26
MCP	20.2	4.68
22-DMP	0.0	0.0
24-DMP	0.0	0.0
223-TMB	0.0	0.0
CHEXANE	35.7	8.26
33-DMP ,	0.0	0.0
11-DMCP	0.0	0.0
2-MHEX ,	10.1	2.34
23-DMP ,	0.0	0.0
3-MHEX ,	0.0	0.0
1C3-DMCP	0.0	0.0

	TOTAL PPB	NORM PERCENT
1T3-DMCP	0.0	0.0
1T2-DMCP	0.0	0.0
3-EPENT	0.0	0.0
224-TMP	0.0	0.0
NHEPTANE	0.0	0.0
1C2-DMCP	0.0	0.0
MCH	66.3	15.33

	TOTALS PPB	NORM PERCENT	SIG COMP RATIOS	
ALL COMP	502.		C1/C2	5.55
GASOLINE	432.		A /D2	999.99
NAPHTHENES	122.	28.27	C1/D2	999.99
C6-7	168.	38.87	CH/MCP	1.77
			PENT/IPENT,	7.53

	PPB	NORM PERCENT
MCP	20.2	16.5
CH	35.7	29.2
MCH	66.3	54.2
TOTAL	122.2	100.0

PARAFFIN INDEX 1 0.0

PARAFFIN INDEX 2 0.0

73062S AUSTRALIA, TUNA-4,2780M.

	TOTAL PPB	NORM PERCENT
METHANE	0.0	
ETHANE	0.0	
PROPANE	64.1	
IBUTANE	7.4	2.55
NBUTANE	24.0	8.23
IPENTANE	14.5	4.98
NPENTANE	72.4	24.80
22-DMB	0.0	0.0
CPENTANE	0.0	0.0
23-DMB	0.6	0.21
2-MP	9.2	3.15
3-MP	6.5	2.24
NHEXANE	29.9	10.24
MCP	14.7	5.03
22-DMP	0.0	0.0
24-DMP	0.0	0.0
223-TMB	0.0	0.0
CHEXANE	21.8	7.48
33-DMP ,	0.0	0.0
11-DMCP	0.0	0.0
2-MHEX ,	10.3	3.54
23-DMP ,	0.0	0.0
3-MHEX ,	0.0	0.0
1C3-DMCP	0.0	0.0

	TOTAL PPB	NORM PERCENT
1T3-DMCP	0.0	0.0
1T2-DMCP	3.0	1.04
3-EPENT	0.0	0.0
224-TMP	0.0	0.0
NHEPTANE	31.7	10.87
1C2-DMCP	0.0	0.0
MCH	45.6	15.63

	TOTALS PPB	NORM PERCENT	SIG COMP RATIOS	
ALL COMP	356.		C1/C2	4.39
GASOLINE	292.		A /D2	999.99
NAPHTHENES	85.	29.18	C1/D2	999.99
C6-7	157.	53.83	CH/MCP	1.49
			PENT/IPENT,	4.98

	PPB	NORM PERCENT
MCP	14.7	17.9
CH	21.8	26.6
MCH	45.6	55.6
TOTAL	82.1	100.0

PARAFFIN INDEX 1 3.400

PARAFFIN INDEX 2 28.179

73062U AUSTRALIA, TUNA-4,2810M.

	TOTAL PPB	NORM PERCENT
METHANE	0.0	
ETHANE	0.0	
PROPANE	67.6	
IBUTANE	19.1	2.78
NBUTANE	65.8	9.59
IPENTANE	34.1	4.97
NPENTANE	126.9	18.49
22-DMB	0.0	0.0
CPENTANE	6.4	0.93
23-DMB	1.0	0.14
2-MP	23.7	3.45
3-MP	15.4	2.24
NHEXANE	70.7	10.30
MCP	36.1	5.26
22-DMP	0.0	0.0
24-DMP	0.0	0.0
223-TMB	0.0	0.0
CHEXANE	59.7	8.69
33-DMP ,	0.0	0.0
11-DMCP	0.0	0.0
2-MHEX ,	22.1	3.22
23-DMP ,	3.5	0.51
3-MHEX ,	9.4	1.37
1C3-DMCP	3.7	0.54

	TOTAL PPB	NORM PERCENT
1T3-DMCP	3.4	0.50
1T2-DMCP	8.5	1.24
3-EPENT	0.0	0.0
224-TMP	0.0	0.0
NHEPTANE	59.3	8.64
1C2-DMCP	0.0	0.0
MCH	117.6	17.13

	TOTALS PPB	NORM PERCENT	SIG COMP RATIOS	
ALL COMP	754.		C1/C2	3.85
GASOLINE	686.		A /D2	13.79
NAPHTHENES	235.	34.29	C1/D2	21.15
C6-7	394.	57.40	CH/MCP	1.65
			PENT/IPENT,	3.72

	PPB	NORM PERCENT
MCP	36.1	16.9
CH	59.7	28.0
MCH	117.6	55.1
TOTAL	213.4	100.0

PARAFFIN INDEX 1 2.015

PARAFFIN INDEX 2 20.635

73062W AUSTRALIA, TUNA-4,2840M.

	TOTAL PPB	NORM PERCENT
METHANE	0.0	
ETHANE	0.0	
PROPANE	70.6	
IBUTANE	10.1	0.05
NBUTANE	150.9	0.81
IPENTANE	844.7	4.55
NPENTANE	1428.0	7.69
22-DMB	42.2	0.23
CPENTANE	160.4	0.86
23-DMB	183.1	0.99
2-MP	1297.9	6.99
3-MP	655.7	3.53
NHEXANE	1712.5	9.23
MCP	1147.4	6.18
22-DMP	0.0	0.0
24-DMP	80.8	0.44
223-TMB	13.5	0.07
CHEXANE	1952.9	10.52
33-DMP ,	0.0	0.0
11-DMCP	0.0	0.0
2-MHEX ,	609.7	3.28
23-DMP ,	414.7	2.23
3-MHEX ,	566.1	3.05
1C3-DMCP	218.1	1.18

	TOTAL PPB	NORM PERCENT
1T3-DMCP	249.4	1.34
1T2-DMCP	389.0	2.10
3-EPENT	0.0	0.0
224-TMP	0.0	0.0
NHEPTANE	1854.8	9.99
1C2-DMCP	44.2	0.24
MCH	4537.2	24.44

	TOTALS PPB	NORM PERCENT	SIG COMP RATIOS	
ALL COMP	18634.		C1/C2	3.47
GASOLINE	18563.		A /D2	6.30
NAPHTHENES	8699.	46.86	C1/D2	12.54
C6-7	13790.	74.29	CH/MCP	1.70
			PENT/IPENT,	1.69

	PPB	NORM PERCENT
MCP	1147.4	15.0
CH	1952.9	25.6
MCH	4537.2	59.4
TOTAL	7637.5	100.0

PARAFFIN INDEX 1 1.373

PARAFFIN INDEX 2 17.187

73062Y AUSTRALIA, TUNA-4,2870M.

	TOTAL PPB	NORM PERCENT
METHANE	0.0	
ETHANE	0.0	
PROPANE	76.9	
IBUTANE	30.2	0.14
NBUTANE	341.2	1.63
IPENTANE	1335.7	6.38
NPENTANE	2049.3	9.78
22-DMB	35.3	0.17
CPENTANE	234.8	1.12
23-DMB	163.4	0.78
2-MP	1189.5	5.68
3-MP	568.8	2.72
NHEXANE	1967.8	9.39
MCP	1365.5	6.52
22-DMP	0.0	0.0
24-DMP	58.3	0.28
223-TMB	8.6	0.04
CHEXANE	2350.8	11.22
33-DMP ,	0.0	0.0
11-DMCP	0.0	0.0
2-MHEX ,	536.6	2.56
23-DMP ,	357.8	1.71
3-MHEX ,	506.8	2.42
1C3-DMCP	240.0	1.15

	TOTAL PPB	NORM PERCENT
1T3-DMCP	254.8	1.22
1T2-DMCP	456.6	2.18
3-EPENT	0.0	0.0
224-TMP	0.0	0.0
NHEPTANE	1848.1	8.82
1C2-DMCP	54.3	0.26
MCH	4995.0	23.84

	TOTALS PPB	NORM PERCENT	SIG COMP RATIOS	
ALL COMP	21026.		C1/C2	3.32
GASOLINE	20949.		A /D2	7.53
NAPHTHENES	9952.	47.50	C1/D2	15.55
C6-7	15001.	71.61	CH/MCP	1.72
			PENT/IPENT,	1.53

	PPB	NORM PERCENT
MCP	1365.5	15.7
CH	2350.8	27.0
MCH	4995.0	57.3
TOTAL	8711.3	100.0

PARAFFIN INDEX 1 1.097

PARAFFIN INDEX 2 16.005

73063A AUSTRALIA, TUNA-4,2900M.

	TOTAL PPB	NORM PERCENT
METHANE	0.0	
ETHANE	0.0	
PROPANE	22.2	
IBUTANE	4.3	0.02
NBUTANE	62.3	0.29
IPENTANE	110.9	0.51
NPENTANE	623.2	2.87
22-DMB	43.9	0.20
CPENTANE	76.9	0.35
23-DMB	194.5	0.90
2-MP	1497.6	6.89
3-MP	728.0	3.35
NHEXANE	2067.1	9.52
MCP	1175.0	5.41
22-DMP	0.0	0.0
24-DMP	65.1	0.30
223-TMB	9.3	0.04
CHEXANE	2222.2	10.23
33-DMP ,	0.0	0.0
11-DMCP	0.0	0.0
2-MHEX ,	565.1	2.60
23-DMP ,	362.4	1.67
3-MHEX ,	530.9	2.44
1C3-DMCP	229.8	1.06

	TOTAL PPB	NORM PERCENT
1T3-DMCP	254.0	1.17
1T2-DMCP	4100.2	18.88
3-EPENT	0.0	0.0
224-TMP	0.0	0.0
NHEPTANE	1730.7	7.97
1C2-DMCP	50.6	0.23
MCH	5016.5	23.10

	TOTALS PPB	NORM PERCENT	SIG COMP RATIOS	
ALL COMP	21743.		C1/C2	1.34
GASOLINE	21721.		A /D2	7.15
NAPHTHENES	13125.	60.43	C1/D2	14.70
C6-7	18379.	84.62	CH/MCP	1.89
			PENT/IPENT,	5.62

	PPB	NORM PERCENT
MCP	1175.0	14.0
CH	2222.2	26.4
MCH	5016.5	59.6
TOTAL	8413.7	100.0

PARAFFIN INDEX 1 0.239

PARAFFIN INDEX 2 11.529

73063E AUSTRALIA, TUNA-4,2960M.

	TOTAL PPB	NORM PERCENT
METHANE	0.0	
ETHANE	0.0	
PROPANE	106.9	
IBUTANE	74.4	0.06
NBUTANE	536.5	0.46
IPENTANE	1218.9	1.05
NPENTANE	3671.0	3.17
22-DMB	192.8	0.17
CPENTANE	4252.0	3.67
23-DMB	544.7	0.47
2-MP	7073.4	6.11
3-MP	4219.4	3.64
NHEXANE	14100.4	12.17
MCP	9197.9	7.94
22-DMP	0.0	0.0
24-DMP	977.7	0.84
223-TMB	131.1	0.11
CHEXANE	17907.4	15.46
33-DMP ,	0.0	0.0
11-DMCP	0.0	0.0
2-MHEX ,	2550.7	2.20
23-DMP ,	1790.9	1.55
3-MHEX ,	2468.8	2.13
1C3-DMCP	1482.2	1.28
1T3-DMCP	1509.0	1.30
1T2-DMCP	2497.1	2.16
3-EPENT	0.0	0.0
224-TMP	0.0	0.0
NHEPTANE	10098.7	8.72
1C2-DMCP	800.0	0.69
MCH	28544.8	24.64

	TOTALS PPB	NORM PERCENT	SIG COMP RATIOS	
ALL COMP	115946.		C1/C2	3.16
GASOLINE	115840.		A /D2	9.80
NAPHTHENES	66190.	57.14	C1/D2	19.85
C6-7	94057.	81.20	CH/MCP	1.95
			PENT/IPENT,	3.01

	PPB	NORM PERCENT
MCP	9197.9	16.5
CH	17907.4	32.2
MCH	28544.8	51.3
TOTAL	55650.1	100.0

PARAFFIN INDEX 1 0.915

PARAFFIN INDEX 2 14.668

73063G   AUSTRALIA, TUNA-4,2990M.

	TOTAL PPB	NORM PERCENT
METHANE	0.0	
ETHANE	0.0	
PROPANE	96.4	
IBUTANE	91.4	0.25
NBUTANE	1056.3	2.83
IPENTANE	3722.9	9.98
NPENTANE	4310.3	11.56
22-DMB	75.6	0.20
CPENTANE	345.0	0.93
23-DMB	371.0	1.00
2-MP	2830.5	7.59
3-MP	1275.8	3.42
NHEXANE	3647.7	9.78
MCP	2044.4	5.48
22-DMP	0.0	0.0
24-DMP	93.5	0.25
223-TMB	16.7	0.04
CHEXANE	3831.6	10.28
33-DMP ,	0.0	0.0
11-DMCP	0.0	0.0
2-MHEX ,	902.8	2.42
23-DMP ,	577.0	1.55
3-MHEX ,	807.0	2.16
1C3-DMCP	342.1	0.92
1T3-DMCP	380.0	1.02
1T2-DMCP	607.3	1.63
3-EPENT	0.0	0.0
224-TMP	0.0	0.0
NHEPTANE	2933.5	7.87
1C2-DMCP	69.7	0.19
MCH	6953.8	18.65

	TOTALS PPB	NORM PERCENT	SIG COMP RATIOS	
ALL COMP	37382.		C1/C2	3.39
GASOLINE	37286.		A /D2	8.16
NAPHTHENES	14574.	39.09	C1/D2	14.48
C6-7	23207.	62.24	CH/MCP	1.87
			PENT/IPENT,	1.16

	PPB	NORM PERCENT
MCP	2044.4	15.9
CH	3831.6	29.9
MCH	6953.8	54.2
TOTAL	12829.8	100.0

PARAFFIN INDEX 1   1.286

PARAFFIN INDEX 2   16.922

730631 AUSTRALIA, TUNA-4,3020M.

	TOTAL PPB	NORM PERCENT
METHANE	0.0	
ETHANE	0.0	
PROPANE	1237.3	
IBUTANE	732.9	2.57
NBUTANE	2561.2	8.97
IPENTANE	2245.8	7.86
NPENTANE	2769.7	9.70
22-DMB	48.8	0.17
CPENTANE	266.5	0.93
23-DMB	245.2	0.86
2-MP	1779.7	6.23
3-MP	832.1	2.91
NHEXANE	2342.9	8.21
MCP	1618.3	5.67
22-DMP	0.0	0.0
24-DMP	59.4	0.21
223-TMB	11.4	0.04
CHEXANE	2941.2	10.30
33-DMP ,	0.0	0.0
11-DMCP	0.0	0.0
2-MHEX ,	573.2	2.01
23-DMP ,	401.8	1.41
3-MHEX ,	532.2	1.86
1C3-DMCP	282.4	0.99
1T3-DMCP	299.9	1.05
1T2-DMCP	491.5	1.72
3-EPENT	0.0	0.0
224-TMP	0.0	0.0
NHEPTANE	1850.2	6.48
1C2-DMCP	59.7	0.21
MCH	5608.6	19.64

	TOTALS PPB	NORM PERCENT	SIG COMP RATIOS	
ALL COMP	29792.		C1/C2	3.32
GASOLINE	28554.		A /D2	7.88
NAPHTHENES	11568.	40.51	C1/D2	17.14
C6-7	17073.	59.79	CH/MCP	1.82
			PENT/IPENT,	1.23

	PPB	NORM PERCENT
MCP	1618.3	15.9
CH	2941.2	28.9
MCH	5608.6	55.2
TOTAL	10168.1	100.0

PARAFFIN INDEX 1 1.029

PARAFFIN INDEX 2 14.253

APPENDIX 5

APPENDIX 5

APPENDIX 5

SYNTHETIC SEISMIC TRACE

SYNTHETIC SEISMIC TRACE

PARAMETERS

WELL:	Tuna-4
TD:	3321 mKB
KB:	21 m
WATER DEPTH:	60 m
POLARITY:	Trough on trace represents an acoustic impedence increase.
PULSE TYPE:	Zero phase, second derivative, Gaussian function.
PEAK FREQUENCY:	25 Hz
SAMPLE INTERVAL:	3m
CHECKSHOT CORRECTION:	Yes
COMMENTS:	No filtering or editing of Sonic log run 800-3321 mKB Density log run 800-3321 mKB

1276L

PE902475

This is an enclosure indicator page.
The enclosure PE902475 is enclosed within the container PE902468 at this location in this document.

The enclosure PE902475 has the following characteristics:

ITEM_BARCODE =	PE902475
CONTAINER_BARCODE =	PE902468
NAME =	Synthetic Seismogram
BASIN =	GIPPSLAND
PERMIT =	VIC/L4
TYPE =	WELL
SUBTYPE =	SYNTH_SEISMOGRAM
DESCRIPTION =	Synthetic Seismogram (enclosure from WCR) for Tuna-4
REMARKS =	
DATE_CREATED =	27/07/84
DATE_RECEIVED =	14/06/85
W_NO =	W868
WELL_NAME =	Tuna-4
CONTRACTOR =	ESSO
CLIENT_OP_CO =	ESSO

(Inserted by DNRE - Vic Govt Mines Dept)