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Organic geochemical characterisation of shallow cores from Nordflaket 1994

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Organic geochemical characterisation of shallow cores from Nordflaket 1994

Please find enclosed three copies of the report concerning the abovementioned project.

Please sign and return the enclosed receipt.

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Exploration Department

Ellen M. Solberg

Ellen M. Solberg
Secretary

Enclosure

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Organic geochemical characterisation of shallow cores from Nordflaket 1994

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SUMMARY

This report presents the results of organic geochemical analyses of seven shallow cores drilled during the project "GUNF 1994".

Core 7418/01-U-01 has poor to fair organic richness and contains early mature, land-plant derived organic material with no significant liquid hydrocarbon generation potential. Oil staining occurs in sandstones at 70.7-75 m and was probably generated at relatively low maturity from a predominantly marine source rock. Biomarker and isotope data are rather ambiguous with regard to the age of the source rock, but share more features in common with Upper Jurassic than Triassic (Botneheia-type) sources. Sourcing from Cretaceous appears to be unlikely, but should not be excluded on the basis of the available data. Bitumen staining detected at two levels below the oil-stained zone bears signs of a contribution from terrestrially-dominated organic source material of late Cretaceous or Tertiary age.

Core 7517/12-U-01 is of variable organic richness and contains poorly preserved, early mature, land-plant dominated organic material with little or no liquid hydrocarbon generation potential. The bitumen from this core could be indigenous but may also contain a non-indigenous contribution.

Cores 7616/11-U-01 and -02 contain intervals with organic-rich claystones and siltstones and dark-grey, organic-rich sandstones. The organic matter is predominantly derived from poorly preserved land plant material of probably early oil-window maturity. High concentrations of non-indigenous, more mature and partly biodegraded bitumen occur locally.

Core 7617/11-U-02 is sandstone-dominated, but also contains fine-grained lithologies with fair to good organic richness. The organic matter is terrestrially-dominated and has no hydrocarbon generation potential. It has probably late oil-window or early gas window maturity. The traces of hydrocarbons in this core may stem from a less mature source.

Cores 7618/10-U-01 and 03 are of poor to good organic richness and have no residual hydrocarbon generation potential. The organic matter is mainly land-plant derived, very poorly preserved and probably at late oil-window or early gas window maturity. No migrated liquid hydrocarbons have been found in these cores.

KEYWORDS ENGLISH	KEYWORDS NORWEGIAN
Organic geochemistry	
Nordflaket	
Barents Sea	
Shallow Drilling	

Table of contents

Preface

The following persons have contributed to this report:

Rolf Angell-Petersen (graphic data processing)
Berit Fossum (graphic data processing)
Leif Husvik (analytical work)
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Kristin Lind (technical responsibility for analytical work and data reporting)
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Cecilie L. Sneeggen (analytical work)
Ellen M. Solberg (project secretary)
Sølvi Stene (analytical work)
Jorunn Os Vigran (visual kerogen description)
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Stable isotope analyses were carried out by Institutt for energiteknikk (IFE, Kjeller) and pyrolysis-GC analyses by Geolab Nor A/S (Trondheim). All other work was performed at IKU.

NPD supplied geochemical data from Cretaecous source rocks of the western Barents Shelf.

1. Introduction

This document presents the results from organic geochemical analyses of shallow cores drilled in 1994 during the project "Geologiske Undersøkelser, Nordflaket" which was carried out by IKU Petroleumsforskning a.s for the Norwegian Petroleum Directorate (NPD). A description of the field work and of the core material was given in a report by Fanavoll et al. (1994), filed under IKU project number 23.2518.00. Analyses of headspace/occluded gas and oil-stained sandstones were carried out in 1994 under IKU project 24.4422.00 and documented in a data report (Lind 1994). The major part of the organic geochemical analyses was performed in 1995 under IKU project 23.2548.00. All data reported by Lind (1994) are included in the present report. An overview on all samples and analyses is presented in Table A.1 of Appendix 1.

The purpose of the work carried out in this project is

- to evaluate the possible hydrocarbon generation potential and thermal maturity of the fine clastic sediments found in the cores
- to screen the cores for the occurrence of non-indigenous (i.e. migrated) hydrocarbons
- to characterise the oil staining found in sandstones of core 7418/01-U-01
- to correlate the oil staining with source rocks and other oils from the Barents Shelf and, if possible, other relevant regions of the Arctic.

The present report is organised as follows:

- **Chapter 1** gives background information for the project.
- **Chapter 2** presents a summary of the geochemical results.
- **Chapter 3** contains five sections with the data presentation for the cores 7418/01-U-01, 7517/12-U-01, 7616/11-U-01 and -02, 7617/11-U-02, and 7618/10-U-01 and -02 respectively. Summary figures are included at the end of each section.
- **Chapter 4** presents the results from the correlation of oil staining in core 7418/01-U-01 with potential source rocks.
- **Appendices 1 and 2** contain data tables, gas chromatograms and mass fragmentograms.
- **Appendix 3** presents a description of the analytical methods.
- **Appendix 4** is a removable summary figure in which organic richness, kerogen type and maturity data are presented together with sedimentological core logs and seismic sections through the drilling locations.

2. Summary and conclusions

Rock samples from seven shallow cores have been analysed using organic geochemical methods in order to evaluate their source potential and thermal maturity, to characterise the extracted hydrocarbons and to correlate the migrated hydrocarbons found in core 7418/01-U-01 with potential source rocks in the wider area.

Core 7418/01-U-01 has poor to fair organic richness and contains land-plant dominated organic matter with no significant liquid hydrocarbon generation potential.
The thermal maturity is probably around the onset of liquid hydrocarbon generation, although some vitrinite reflectance data and fluorescence colours may suggest a higher maturity.

The indigenous hydrocarbons found in this core are immature and are probably derived from terrestrially dominated organic matter.

Oil staining was found in sandstones between 70.7 and 75 m. The oil was probably generated from a predominantly marine source rock with relatively low thermal maturity. Biomarker and isotope data are rather ambiguous with regard to the age of the source rock, but share more common features with Upper Jurassic than Triassic (Botneheia-type) sources. Sourcing from Cretaceous appears not very likely, but should not be excluded on the basis of the available data. The carbon isotopic and biomarker composition of this oil staining cannot be clearly related to one particular source rock. However, the data are generally more consistent with an Upper Jurassic or younger source than with a Triassic source of the Botneheia type. The high concentrations of bitumen found at 85.00 m and possibly at 117.81 m are also non-indigenous and share some common features with the oil staining, but have a more terrestrial character. The occurrence of the biomarker oleanane at 85.00 m indicates a contribution from a terrestrially-dominated source of late Cretaceous or Tertiary age to these hydrocarbons. It might be speculated that the biomarker composition of the non-indigenous EOM in this core reflects different migration processes.

Moderate to high concentrations of light hydrocarbons with a rather dry composition were recorded in this core. The appreciable concentrations of C_{5+} hydrocarbons in the middle and upper part of the core are likely to be non-indigenous.

Core 7517/12-U-01 contains mainly clayey sandstones with variable organic richness, which typically ranges from about 0.5 to 2 wt% TOC. The organic matter consists mostly of poorly preserved, land-plant derived material. Its thermal maturity is similar to that of core 7418/01-U-01 and probably corresponds to the early stage of liquid hydrocarbon generation. The rocks from core 7517/12-U-01 have a low residual hydrocarbon generation potential (type-III and type-IV kerogen based on Rock-Eval pyrolysis data), although the pyrolysate composition suggests that there could be a limited potential for liquid hydrocarbon generation.

The hydrocarbons extracted from a silty claystone and two siltstones are derived from a land-plant derived source with a thermal maturity slightly above that of the indigenous hydrocarbons from core 7418/01-U-01. Their molecular composition is generally consistent with an indigenous origin, although their stable carbon isotope composition is similar to that of the migrated hydrocarbons in core 7418/01-U-01. A non-indigenous contribution to these hydrocarbons may therefore not be absolutely excluded.

Core 7616/11-U-01 contains organic-rich claystones and siltstones in the interval 47 - 27 m and dark grey, organic-rich sandstones between 17 and 10 m. The remaining intervals are mainly sandy and of poor to fair organic richness. The organic matter is predominantly derived from poorly preserved land plant material, possibly due to reworking and/or mineral diagenetic processes. Rock-Eval Tmax and vitrinite reflectance data suggest early oil-window maturity. High concentrations of bitumen containing weakly to strongly biodegraded hydrocarbons were found at 56.25 and 7.41 m. Biomarker and isotope data indicate that this bitumen is derived from a different and more mature source than the bitumen extracted from the remaining samples which is hydrocarbon-poor, derived from predominantly terrestrial organic matter and probably of local origin. Rock-Eval analyses of core 7616/11-U-02 were consistent with those from core -01.

Cores 7617/11-U-01 and -02 are sandstone-dominated, but also contain siltstones and claystones of fair to good organic richness (typically 1-2 wt% TOC). The organic material is predominantly land-plant derived and has probably late oil-window or early gas-window maturity. Its liquid hydrocarbon generation potential is zero at present and was probably not very high before maturation. The traces of hydrocarbon-poor bitumen found in this core contain aromatic-rich hydrocarbons with a mature n-alkane composition. Biomarker data of moderate to poor quality, however, suggest that the source of these hydrocarbons may be less mature than the kerogen in these rocks, in which case they would be non-indigenous.

Cores 7618/10-U-01 and **-03** are of poor to good organic richness but have no residual hydrocarbon generation potential. Thermal maturity could not be determined precisely, but probably corresponds to the late oil window or early gas window stage. The organic matter seems to contain mainly land-plant derived material and may therefore have had a rather limited initial hydrocarbon generation potential. It is now strongly degraded which might be related to the high maturity, but perhaps also to the substantial carbonate cementation of these rocks which is mentioned in the field report (Fanavoll et al. 1994). No migrated hydrocarbons were found in these cores. The locally abundant methane in the headspace and occluded gas may have been sourced from the mature organic matter in these rocks.

The composition of the hydrocarbons, particularly the biomarkers, in the analysed cores may point to complex migration processes in the area.

3. Analytical results and interpretation

3.1 Core 7418/01-U-01

3.1.1 Headspace and occluded gas analysis

A total of ten canned core chip samples was analysed for hydrocarbons in the headspace and occluded gas fractions, (Figure 3.1.1). Samples from the oil-stained part of the core (70.7 - 75 m) were not analysed in order not to destroy the possibility for whole oil analysis of these frozen core chip samples.

The concentrations of C_1-C_4 hydrocarbons decreased from about 80 000 µl/kg dry sediment in the lower part of the core, to 200 µl/kg at the top. Headspace and occluded hydrocarbons occurred in rather similar concentrations, except for the lower part of the core, where the headspace hydrocarbons clearly dominate. No reason was found for the very low occluded gas concentration at 39 m. The gases contained mainly methane and had a maximum (reliable) wetness ratio of about 7%. The occluded gas from the upper part of the core (above 88.52 m) was generally somewhat richer in C_{2+} hydrocarbons (7 - 20 % wetness) than that from the lower part of the core (1-9 % wetness). This may relate to the occurrence of non-indigenous hydrocarbons in the sandstone succession at around 70 m.

The samples with reasonably high gas concentrations showed i-C_4/n-C_4 ratios which varied between 0.65 and 0.89. These values are not very specific, but are generally consistent with late diagenetic or early mature, thermogenic gases. C_{5+} hydrocarbons occurred in the occluded fraction in concentrations ranging from traces (<100 µl/kg) to appreciable (2500 µl/kg). The highest abundances were recorded in the siltstone-claystone succession in the middle section of the core (45 - 65 m) and close to the top of the bedrock section at 16 m depth. These hydrocarbons are likely to be migrated as the rocks in this core have no significant liquid hydrocarbon generation potential (see below). As already mentioned, samples from the visibly oil-stained interval were not analysed.

3.1.2 TOC content and Rock-Eval pyrolysis

A total of 55 core chip samples was analysed for total organic carbon (TOC) content and Rock-Eval pyrolysis character (Figure 3.1.2). The TOC contents varied between 0.4 and 1.1 wt%. Average values for the two siltstone/claystone sections (126.2 - 89.2 and 70.7 - 7.5 m) were 0.45 wt% (lower section) and 0.58 wt% (upper section), which indicates poor to fair organic richness. Despite the poor S2 peaks (typically less than 0.5 mg/g rock), a relatively consistent set of Tmax data was obtained. The values increase from about 430°C at the top to about 440°C at the bottom of the core, which suggests late immaturity to early maturity. Hydrogen index values of 14 - 89 mg/g TOC indicate that the organic matter has no significant petroleum generation potential (type-III and type-IV kerogen). S1 values of less than 0.1 mg/g rock and production indices (PI) of less than 0.2 are in agreement with the relatively low thermal maturity suggested by the Tmax data. Higher S1 and PI values were observed in and around the oil-stained sandstone interval at 74.73 - 71.44 m (PI up to 0.86) and in two samples at 21.68 and 19.87 m (PI = 0.24 - 0.28) which may also contain traces of non-indigenous hydrocarbons.

3.1.3 Pyrolysis-GC

Four solvent-extracted siltstone and claystone samples (117.81, 85.00, 61.34, 39.36 m) were analysed using temperature-programmed pyrolysis-gas chromatography (PY-GC) in order to obtain a more detailed characterisation of the kerogen. The methane content of the pyrolysate is relatively low and increases from the shallowest to the deepest sample (8 - 19%). All pyrolysates contain a series of n-alkenes/n-alkanes with carbon numbers of up to C_{20}, accompanied by moderately abundant low-molecular weight aromatic compounds [(m+p)-xylene/n-octene = 0.5 - 1.0]. This rather aliphatic character and the chain length distribution of the n-alkenes/n-alkanes suggest that the kerogen may be slightly more hydrogen-rich than indicated by the hydrogen index values. This can possibly be explained by the presence of type-II/III kerogen together with completely hydrogen-devoid type-IV kerogen or (more likely?) by the presence of poorly soluble but readily pyrolysable "heavy bitumen" in these samples.

3.1.4 Vitrinite reflectance

Four polished rock chip samples were analysed for vitrinite reflectance in order to obtain an independent indication of the thermal maturity of this core. All were poor in organic matter and contained only few vitrinite particles that could be regarded as indigenous. This and the generally poor quality of the phytoclasts led to rather unreliable and highly variable mean vitrinite reflectance values. Mean values of about 0.5% Rm, obtained at 117.81 and 61.34 m, agree with the yellow-orange to middle orange fluorescence colours of the scarce sporinite particles and suggest early maturity. This result is reasonably consistent with the Rock-Eval Tmax values. Reflectance values exceeding 0.7% Ro were obtained from reworked or oxidised vitrinite.

3.1.5 Visual kerogen description

Seven kerogen isolates were examined in transmitted light and fluorescent light in order to determine the nature and maturity of the particulate organic matter. The material is poorly preserved, probably due to the depositional conditions. The residues consist mainly of non-fluorescent amorphous material (hebamorphinite, 35 - 70%), along with varying proportions of herbaceous (5 - 30%) and woody (10 - 45%) material (Figure 3.1.3). Some opaque coaly material (5 - 10%) was also present in all specimens. The particulate herbaceous matter shows scattered pollen or dinocysts with an orange-brown to brown fluorescence. The thermal alteration index (TAI)[1], evaluated from the colours of bisaccate pollen, was determined as 4-5, suggesting early to moderate thermal maturity. The wall material appears like thin films with adhering granular material, which could be interpreted as a sign of short-term heating, but may also be related to the

[1] For the use of TAI (Thermal Alteration Index) and SCI (Spore Colour Index) see chapter "Experimental" in the Appendix.

chemistry of the pore solution during mineral diagenesis (e.g. an alkaline environment during possible carbonate cementation). Petrological data would be required to elucidate this problem. The land-plant dominated nature of the organic matter is consistent with the Rock-Eval pyrolysis results and confirms the low liquid hydrocarbon generation potential of these rocks.

3.1.6 Whole oil analysis of oil-stained sandstones

Small amounts of oil exsudated from the canned and frozen core chips when these were brought to room temperature. The oil was collected with a syringe as quickly as possible and immediately injected in a gas chromatograph. The "whole oil" gas chromatograms obtained give some impression of the composition of the C_{15-} fraction, but are not suitable for the calculation of Thompson indices (Thompson 1977, 1988) or for direct comparison with whole oil gas chromatograms of reservoired oils (e.g. from DST samples). This is due to the high probability that the low molecular weight hydrocarbons may have suffered considerable evaporative fractionation during the collection procedure. The sample at 74.67 m gave the most complete gas chromatogram. The unimodal, low molecular-weight based n-alkane composition with a low to moderate content in naphthenes and aromatics is basically similar to that of many marine-sourced oils from the Norwegian continental shelf.

3.1.7 Extraction and group type separation

Ten samples were selected for extraction and group type separation of the extracted organic matter (EOM). These included three claystones from the upper claystone/siltstone interval (21.68, 39.36 and 61.34 m), five visibly oil-stained (71.44 and 74.62 - 74.73 m) and one unstained sample (85.00 m) from the middle sandstone interval and one siltstone sample (117.81 m) from the lower siltstone/claystone interval (Figure 3.1.4).

The claystone, siltstone and unstained sandstone samples contained 386 - 686 wt ppm (0.04 - 0.07 wt%) EOM. The EOM yields relative to the total organic carbon content ranged from 58.1 to 96.1 mg/g TOC, except for the claystone sample at 39.36 m which showed a relatively high EOM concentration of 148.2 mg/g TOC. This sample also contained the least asphaltene-rich EOM of this group (36.4% of EOM), while the EOM of the remaining samples contained 43 - 68.5% asphaltenes and 22.5 - 39.8 % hydrocarbons with SAT/ARO ratios between 0.25 and 0.75. The TOC-related hydrocarbon concentrations in the clearly unstained samples varied between 16 and 30 mg/g TOC. These data are consistent with thermally immature and probably indigenous hydrocarbons.

In contrast, the oil-stained sandstones (74.62 - 74.73 m) contained moderate concentrations (1752 - 2822 wt ppm) of an asphaltene-poor (4.6 - 13.7 wt%) and hydrocarbon-rich (85.5 - 94.8 %) EOM with SAT/ARO ratios of 2.9 - 3.5. The weakly stained sandstone at 71.44 m showed a lower extractability (496 wt ppm), a less hydrocarbon-rich EOM composition (60.2 % HC) and a lower SAT/ARO ratio (1.3) than the fully stained samples.

3.1.8 GC of the saturated hydrocarbon fraction

The saturated hydrocarbon gas chromatograms of the five unstained samples (117.81, 85.00, 61.34, 39.36 and 21.68 m) show the typical features of thermally immature and predominantly land-plant derived hydrocarbons, such as high molecular-weight biased n-alkane distributions with a maximum between C_{25} and C_{30} [n-C_{17}/(n-C_{17}+n-C_{27}) = 0.3 - 0.5] and a moderate to strong odd predominance (CPI = 1.1 - 1.6), a significant background of chromatographically unresolved compounds, moderately strong peaks in the biomarker region and prominent pristane peaks (Pr/n-C_{17} = 1.2 - 6.0, Figure 3.1.5). Only the shallowest sample shows relatively strong n-alkane peaks also in the C_{17}-C_{19} region which may suggest that marine organic matter also contributed to the formation of these hydrocarbons. The low-molecular fraction ($C_{<17}$) has been lost by evaporation during work-up in the laboratory. It cannot be excluded that the hydrocarbons in this sample are partly non-indigenous, particularly as the production index and the SAT/ARO ratio are slightly higher than in the other unstained samples. The composition of the saturated hydrocarbons from the sandstone at 85.00 m differs from that of the remaining samples by a very high pristane/ n-C_{17} ratio of 6.0 and by the somewhat higher abundance of biomarker compounds relative to n-alkanes.

The gas chromatograms of the five oil-stained sandstone samples (74.62 - 74.73 and 71.44 m) are characterised by unimodal and rather smooth n-alkane distributions (CPI = 1.1 - 1.2) with a bias towards the low molecular-weight compounds [n-C_{17}/(n-C_{17}+n-C_{27}) = 0.9]. The sample at 71.44 m shows a very small second mode at C_{29}. The isoprenoid/n-alkane ratios are relatively low (Pr/n-C_{17} = 0.6, Ph/n-C_{18} = 0.2) and the pristane/phytane ratios rather high (3.3 - 3.9). These features are in agreement with an early mature to mature oil from a predominantly marine source.

3.1.9 GC of the aromatic fraction

The aromatic fractions of all samples have a composition which is typical of thermally rather immature hydrocarbons. The gas chromatograms obtained from the unstained samples are characterised by missing alkylnaphthalene peaks, poorly developed phenanthrene and alkylphenanthrene peaks, a prominent 4-methyldibenzothiophene[2] peak, and a number of strong peaks in the higher molecular region which probably represent aromatic steroids. The isomer distribution of the methylphenanthrenes should be interpreted with caution as it may be influenced by the probable presence of 1-methyldibenzothiophene which coelutes with 3-methylphenanthrene and thus may suggest a maturity that is higher than the actual maturity.

The most characteristic feature of the gas chromatograms obtained from the oil-stained samples is the considerable background of chromatographically unresolved compounds

[2] tentatively identified on the basis of the FID chromatogram, but not verified by GC-FPD or GC-MS.

(UCM) and the relative abundance of peaks in the high molecular-weight region. Both features are often associated with thermally immature hydrocarbons, but might also be related to migration effects. Alkylnaphthalene and -phenanthrene peaks are present but poorly developed, and no peak ratios can be computed.

3.1.10 GC-MS of saturated biomarkers

The three samples from the upper claystone-siltstone interval of this core show similar saturated biomarker compositions. The terpane distribution patterns as represented by the m/z 191 mass fragmentograms are characterised by the near absence of tri- and tetracyclic diterpanes, a strong predominance of 27Tm[3] over 27Ts, the presence of 17β(H) trisnorhopane and incomplete isomerisation of C_{30} hopane (%αβ = 67 - 76) and C_{31+} homohopanes (%22S = 38 - 42). Homomoretanes with 17β(H),21α(H) configuration are relatively abundant. The occurrence of a small peak representing oleanane (30O) at 39.36 m and 61.34 m is in agreement with a geologically young (Tertiary or late Cretaceous), land-plant derived source (Peters & Moldowan 1993). The sterane composition (m/z 217, 218) is dominated by the regular C_{27}, C_{28} and C_{29} 14α(H), 17α(H) 20R steranes of which the C_{29} compound is most prominent. This feature is also generally associated with terrestrially-derived hydrocarbons. The presence of a significant peak representing the regular C_{30}ααR sterane in all three mass fragmentograms, however, indicates that also marine organic material has contributed to these hydrocarbons. Isomerisation of the regular C_{29} steranes at C_{20} (%20S = 7-10) and C_{14}/C_{17} (%ββ = 19 - 30) is far from the equilibrium values and is indicative of low thermal maturity. Diasteranes occur in low concentrations relative to the regular steranes. In summary, the saturated biomarker composition suggests a maturity prior to the onset of liquid hydrocarbon generation.

The saturated biomarkers from the oil-stained sandstones between 74.73 and 74.62 m have a slightly more mature composition, as suggested the more advanced isomerisation of C_{30} hopanes (%αβ = 87 - 88), homohopanes (%22S = 50 - 54) and regular C_{29} steranes (%20S = 16 - 20, %ββ = 38 - 45). Tricyclic diterpanes are, however, still poorly developed, and the approximately equal abundances of 27Ts and 27Tm (Tm/Ts = 0.87 - 1.03) can reflect a different source as well as a higher maturity. The diasterane/sterane ratio is markedly higher than in the unstained samples (%dia = 52 - 56), while the carbon number distribution of the C_{27}-C_{29} ααR steranes is less dominated by the C_{29} compound. The regular C_{30} aaR sterane, however, is less prominent than in the unstained samples. A characteristic feature is the presence of 28,30-bisnorhopane (28αβ). This compound is generally associated with oils sourced from Upper Jurassic shales in the North Sea and occurs occasionally in oil-stained Triassic and Jurassic rocks in the Barents Sea. However, it appears to be generally absent from both Upper Jurassic and Triassic source rocks in the circum-arctic region (Leith et al. 1993). Oleanane was not detected in any of the oil-stained samples from this core.

The sterane composition of the slightly stained sandstone at 71.44 m is similar to that of the overlying unstained siltstones and suggests a rather strong terrestrial source input,

[3] For a list of all compound names and abbreviations see Appendix 3.

while the terpane distribution shows a closer similarity to that of the oil-stained samples (e.g. by the presence of 28αβ). It cannot be ruled out that this reflects a migration effect.

The extract from the apparently unstained sandstone at 85.00 m shows a unique biomarker composition which is characterised by a predominance of the 28,30-bisnorhopane peak over all other terpane peaks in the m/z 191 mass fragmentogram and by the presence of a rather prominent oleanane peak. Oleanane is regarded as a highly specific marker for hydrocarbons generated from Tertiary or late Cretaceous sources containing higher land plant input, and high relative concentrations of 28,30-bisnorhopane are normally found in hydrocarbons of relatively low thermal maturity. The sample shows a similar hopane isomerisation ratio to the unstained samples (%22S = 43), while the sterane isomerisation ratio (%20S = 31) and diasterane ratio (%dia = 45) suggest a higher maturity of the hydrocarbons at 85.00 m. The carbon number distribution of the regular C_{29} ααR steranes is biased towards the C_{29} compound which could indicate a strong input from terrestrially-derived material (Figure 3.1.6). This is consistent with the presence of oleanane.

The biomarker composition in the siltstone from 117.81 m bears similarities to the apparently unstained siltstone samples from the upper part of the core, but also to the hydrocarbons at 85.00 m and to the oil stains. The Tm/Ts ratio (= 11) and hopane isomerisation ratio (%22S = 42) are similar to those found in the unstained siltstones, while the sterane isomerisation ratios (%20S = 16, %bb = 51), the relatively high proportion of diasteranes (%dia = 54) and the relative distribution of the regular C_{29} ααR steranes are more similar to the values described from the oil-stained sandstones. A relatively small 28,30-bisnorhopane peak is present in the m/z 191 mass fragmentogram, but no oleanane was detected.

3.1.11 Stable carbon isotope analysis of EOM fractions

The stable carbon isotope composition of the EOM fractions of nine samples was analysed. These include four siltstones and claystones (117.81, 95.20, 39.36, 21.60 m) and five oil-stained sandstones (71.44, 74.62 - 74.73 m). The $\delta^{13}C$ values of the saturated hydrocarbon fractions vary between -32.6 and -29.0‰ PDB and those of the aromatic fraction between -30 and -27.3‰ PDB. The siltstone extract at 39.36 m shows the isotopically lightest composition and the strongest isotope fractionation between the different EOM fractions, which separates this extract clearly from the remaining samples ($\delta^{13}C_{ASPH}$-$\delta^{13}C_{SAT}$ = 3.4‰ PDB; Figure 3.1.7). The oil-stained samples gave $\delta^{13}C_{SAT}$ values of -29.4 to -29.2‰ PDB and $\delta^{13}C_{SAT}$ values of -28.6 to -28.2‰ PDB, and they show a weaker isotope fractionation between the saturated hydrocarbons and the asphaltene fraction ($\delta^{13}C_{ASPH}$-$\delta^{13}C_{SAT}$ = 1.3 - 2.0‰ PDB). The siltstone extracts at 117.81 and 85.00 m show slightly higher values (i.e. a more heavy isotope composition) and that from 21.68 m a somewhat more light isotope composition than the oil stains. In the $\delta^{13}C_{ARO}$ vs. $\delta^{13}C_{SAT}$ crossplot according to Sofer (1984), the oil stains and the extract at 21.68 m fall into the field of predominantly marine oils, while the remaining extracts have a more terrestrial isotope signature.

3.1.12 Summary for core 7418/01-U-01

The rocks of this core have poor to fair organic richness, and contain land-plant dominated organic matter with no significant liquid hydrocarbon generation potential. The thermal maturity is probably around the onset of liquid hydrocarbon generation, although some vitrinite reflectance data and fluorescence colours may suggest a higher maturity.

The indigenous hydrocarbons found in this core are immature and are probably derived from terrestrially dominated organic matter.

Oil staining was found in sandstones between 70.7 and 75 m. The oil was probably generated from a predominantly marine source rock with relatively low thermal maturity. The high concentrations of bitumen found at 85.00 m and possibly at 117.81 m are also non-indigenous and share some common features with the oil stains, but have a more terrestrial character than these. The occurrence of the biomarker oleanane at 85.00 m indicates a contribution from a terrestrially-dominated source of late Cretaceous or Tertiary age to these hydrocarbons. It might be speculated that the biomarker composition of the non-indigenous EOM in this core reflects different migration processes.

Moderate to high concentrations of light hydrocarbons with a rather dry composition were recorded in this core. The appreciable concentrations of C_{5+} hydrocarbons in the middle and upper part of the core are likely to be non-indigenous.

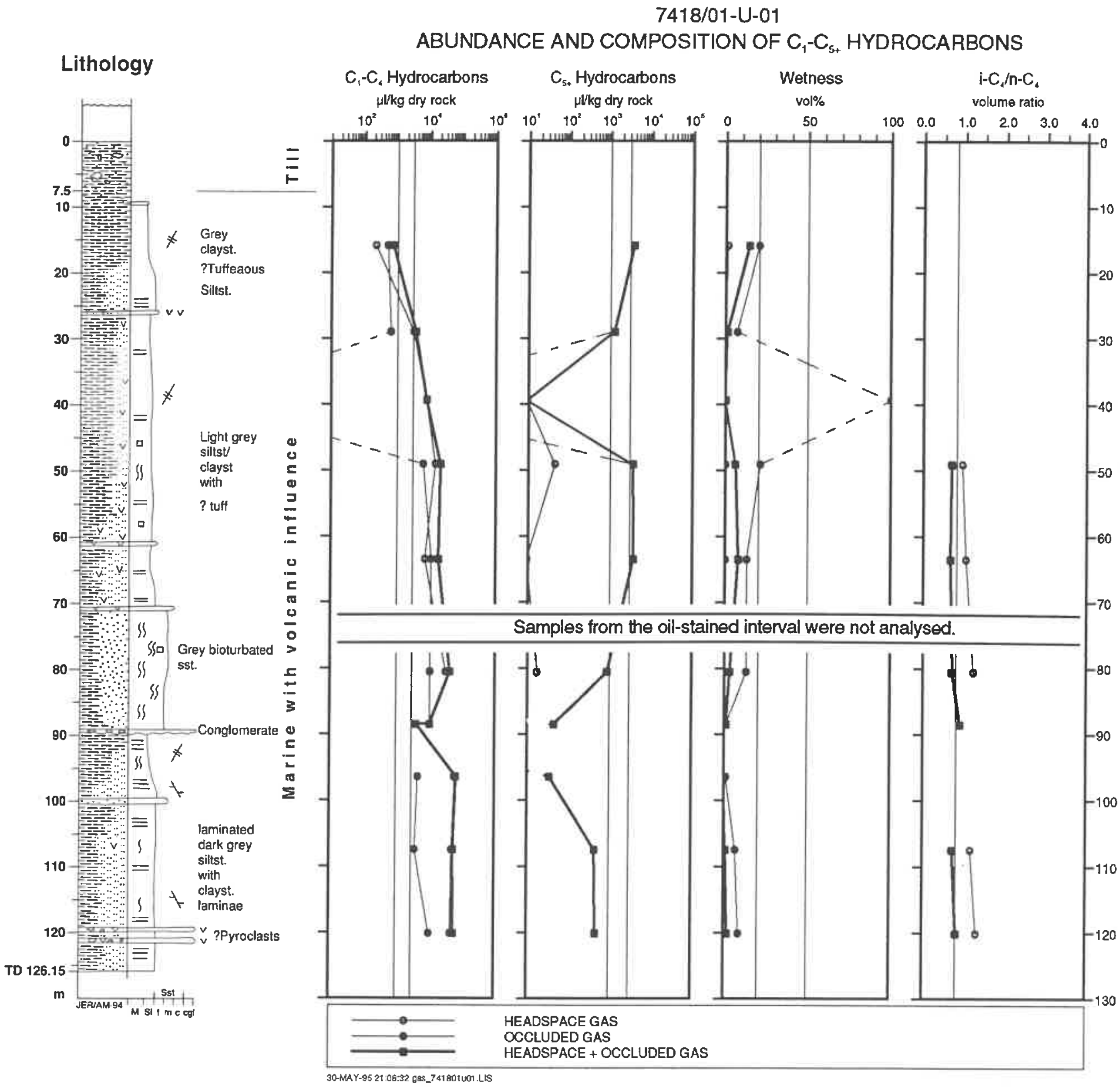

Figure 3.1.1 Yield and composition of headspace/occluded gas of core 7418/01-U-01.

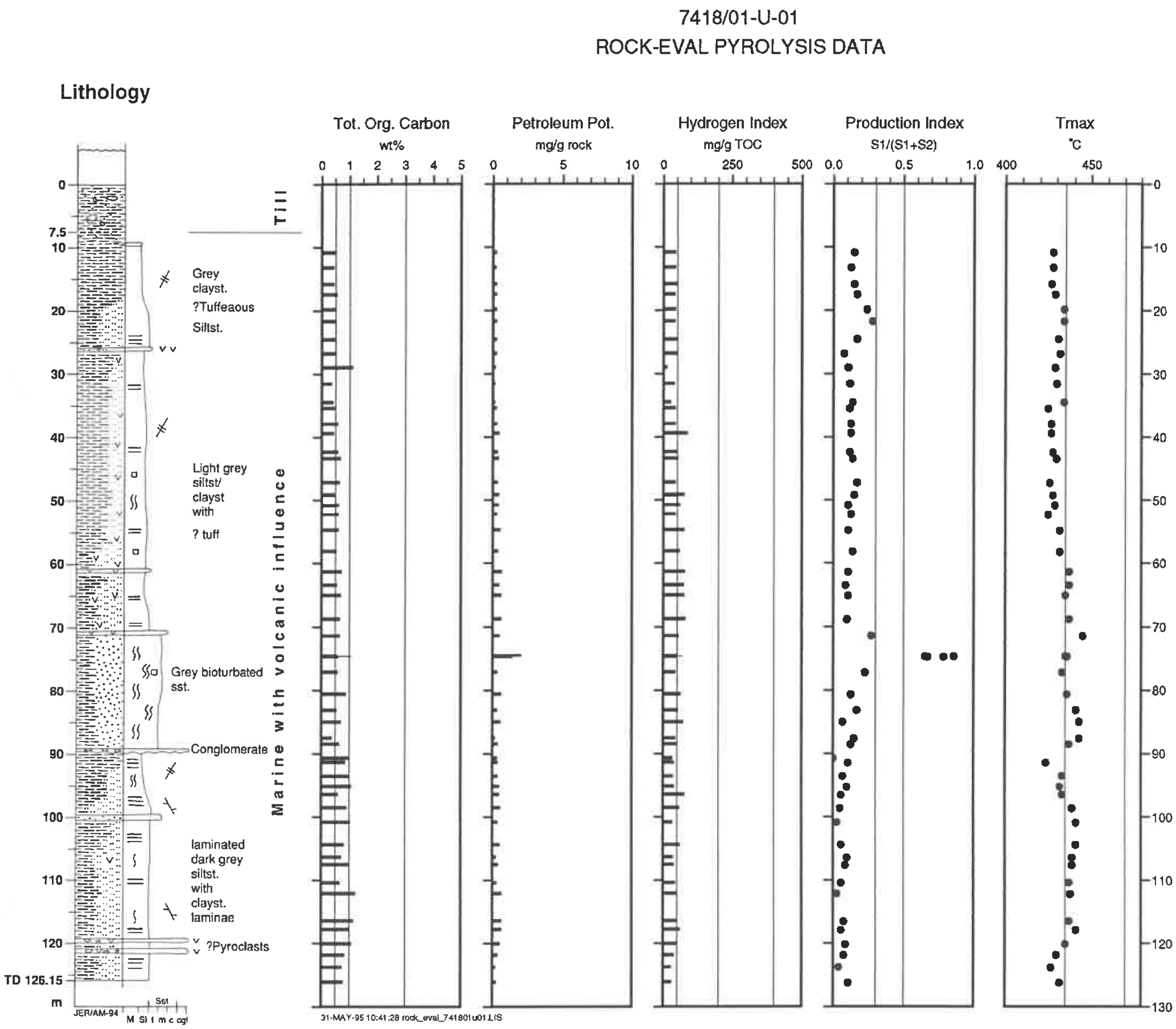

Figure 3.1.2 *Total organic carbon content and Rock-Eval data from core 7418/01-U-01.*

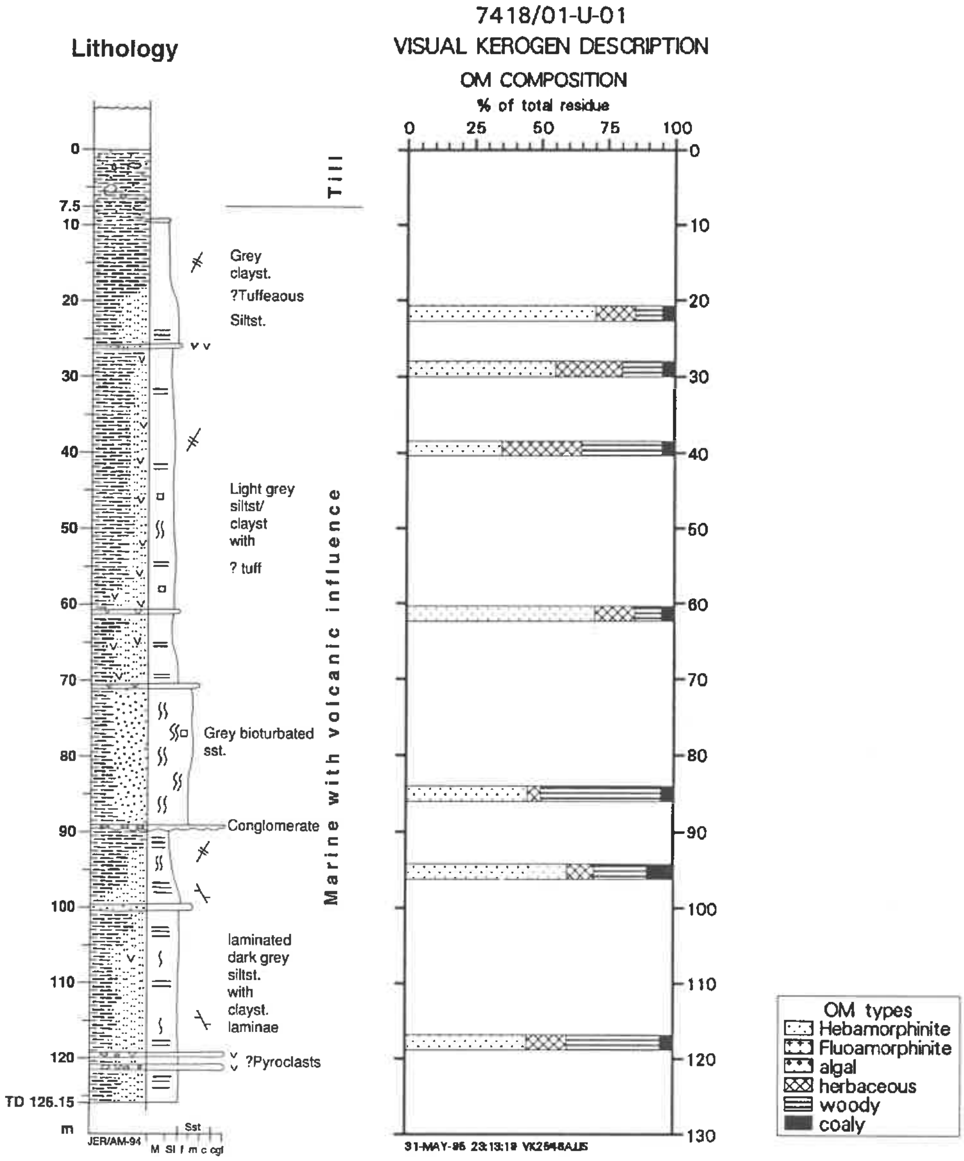

Figure 3.1.3 *Composition of organic matter in core 7418/01-U-01 determined by transmitted light microscopy.*

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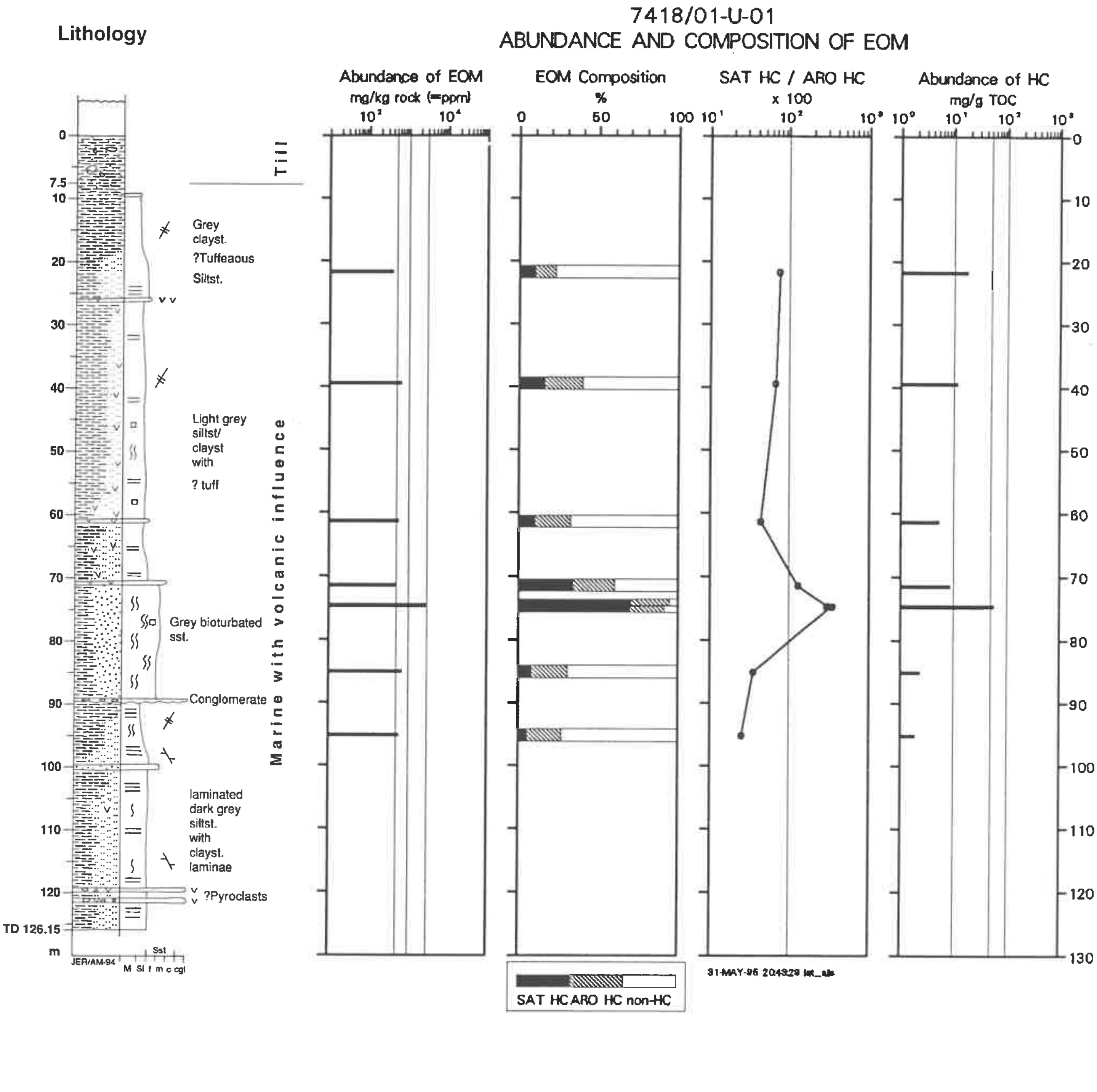

Figure 3.1.4 *Yield and bulk composition of extractable organic matter from core 7418/01-U-01 (TLC-FID data).*

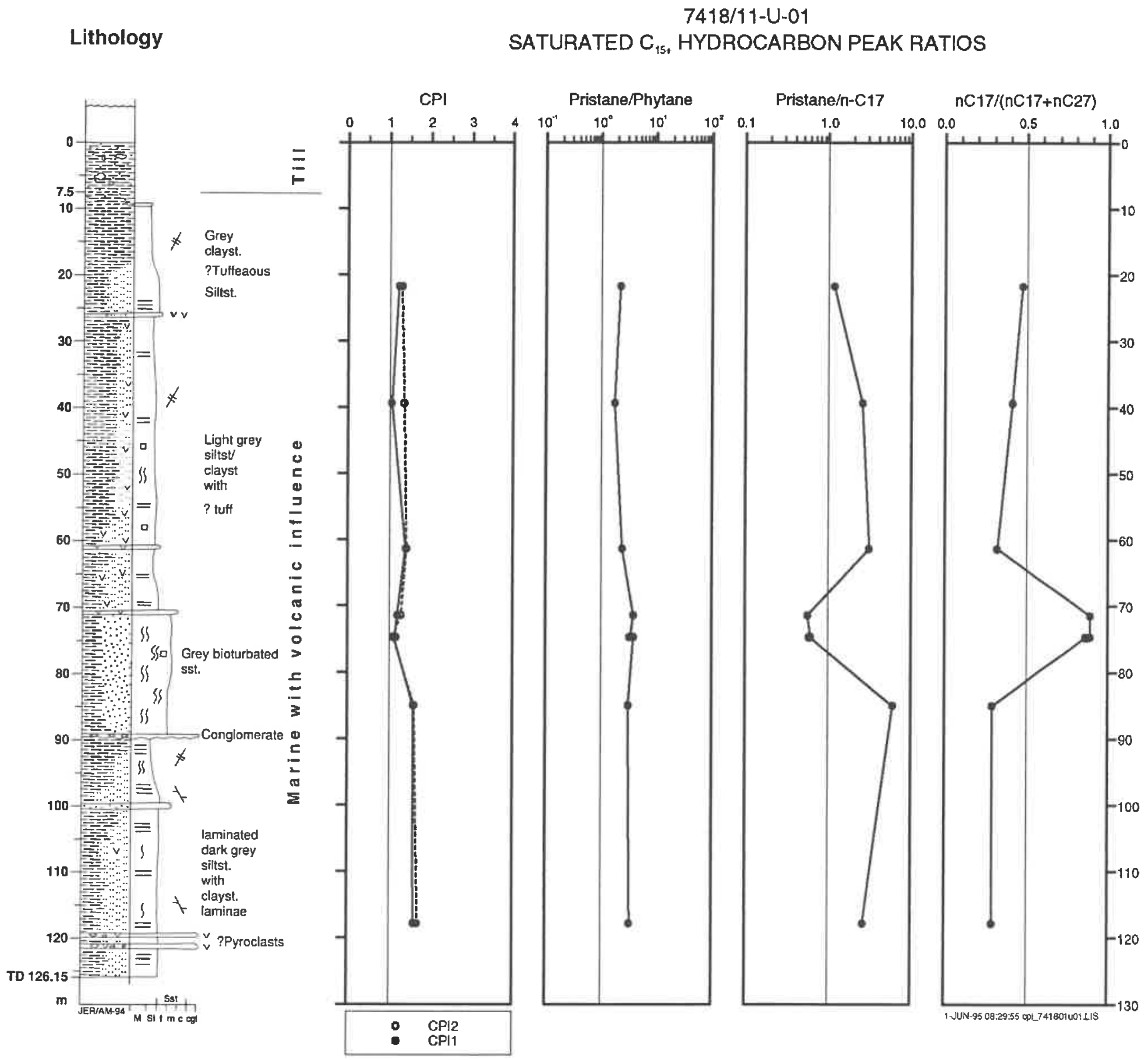

Figure 3.1.5 Selected saturated hydrocarbon peak ratios from core 7418/01-U-01.

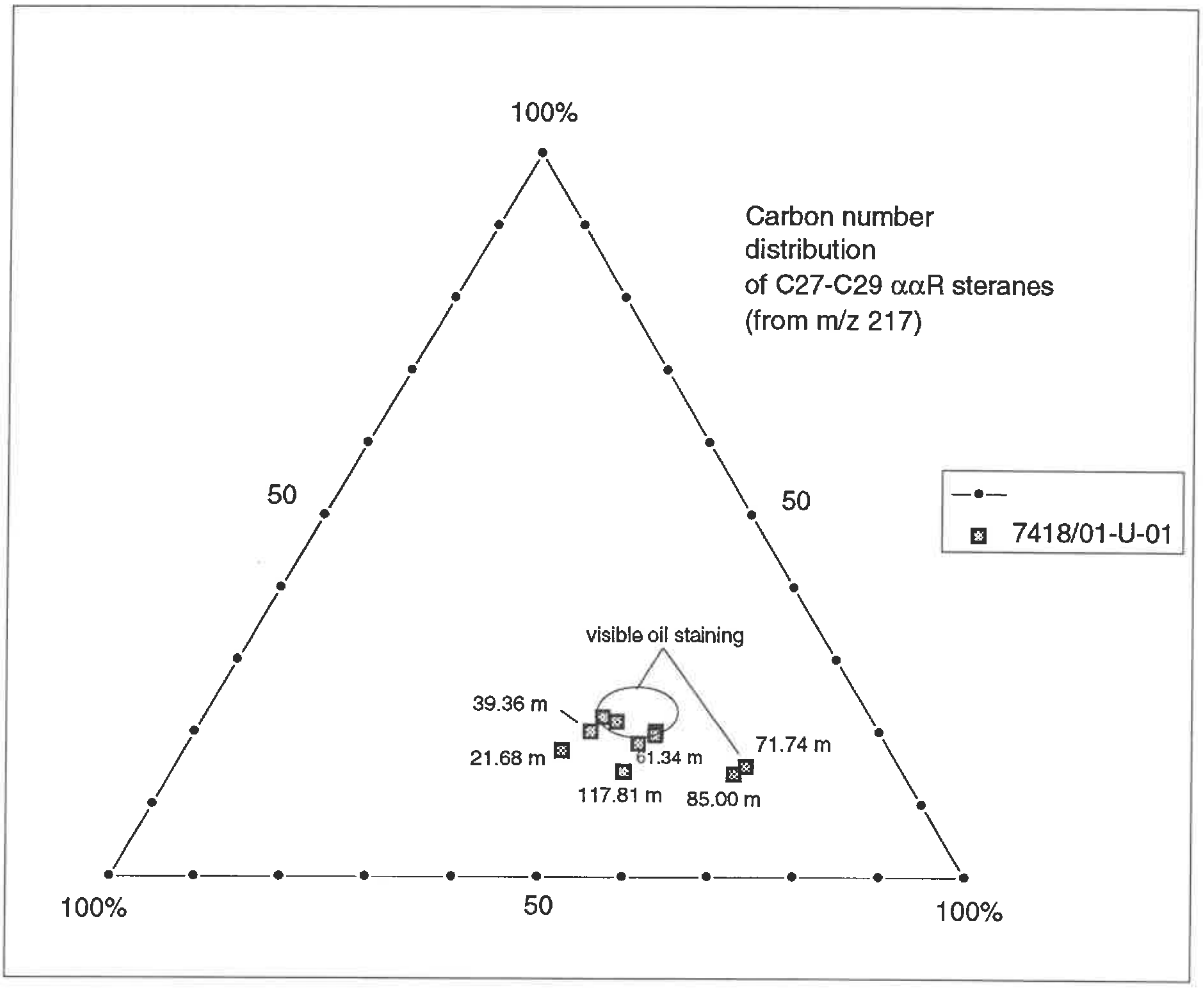

Figure 3.1.6 *Molecular distribution of regular C_{27}, C_{28} and C_{29} αααR steranes in samples from core 7418/01-U-01(from m/z 217).*

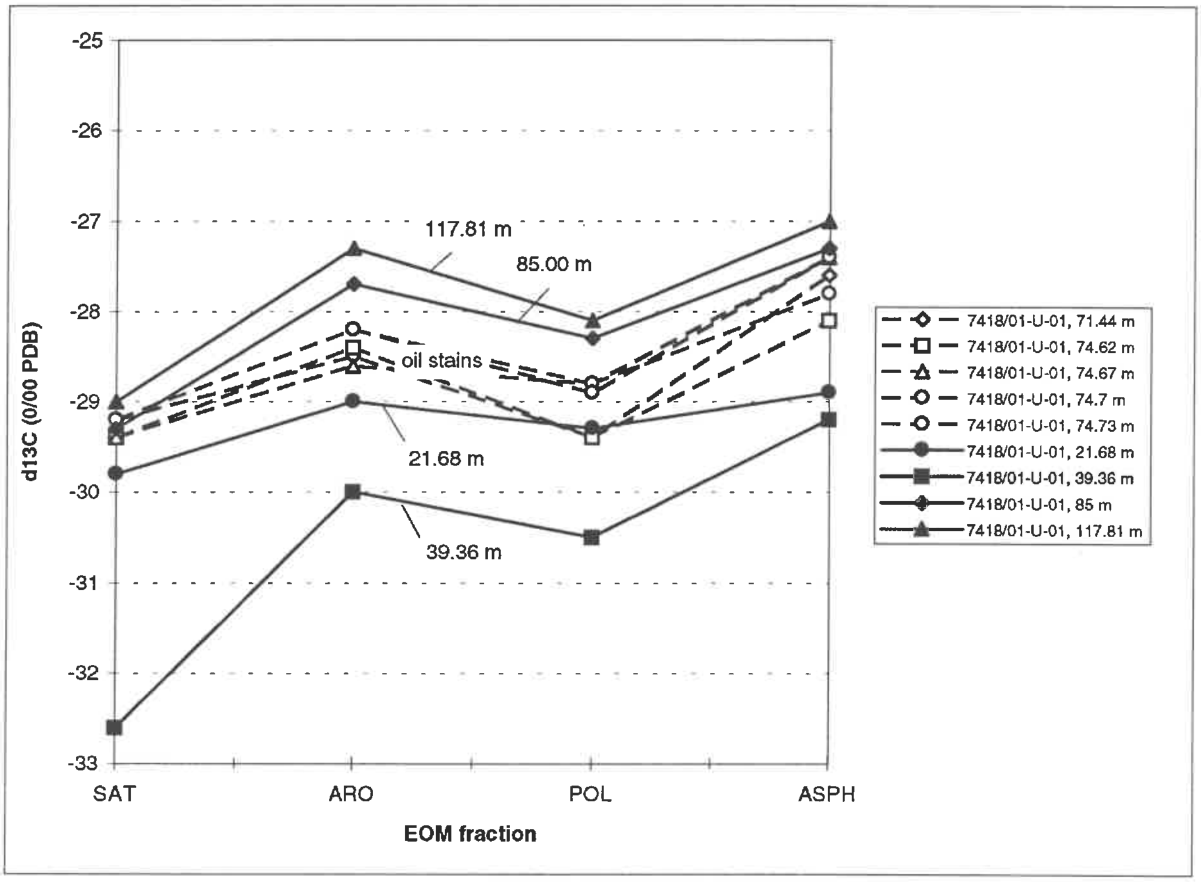

Figure 3.1.7 Isotope type curves (Galimov-type plot) for EOM fractions from core 7418/01-U-01.

3.2 Core 7517/12-U-01

3.2.1 Headspace and occluded gas analysis

The headspace and occluded gas hydrocarbons of nine canned core chip samples were analysed (Figure 3.2.1). All yielded high and rather invariable concentrations of C_1-C_4 hydrocarbons (14 000 to 61 000 µl/kg dry rock), which were contained mainly in the headspace fraction and were dominated by methane (max. wetness = 2 vol%). Only traces of C_{5+} hydrocarbons were detected, with a maximum concentration of 260 µl/kg in the deepest sample at 194.21 m. The gases could be indigenous, although the wetness appears somewhat low before the background of the pyrolysis-GC data (see below). A contribution from non-indigenous methane can therefore not be fully excluded, but has to remain unproved as no isotope data are available.

3.2.2 TOC content and Rock-Eval pyrolysis

Total organic carbon (TOC) analysis and Rock-Eval pyrolysis were carried out on 30 core chip samples from the pre-Quaternary interval below 110.75 m (Figure 3.2.2). The organic matter content varies throughout the core, with TOC contents typically ranging from 1 to 2 wt% and reaching a maximum of 4.34 wt% at 111.15 m. Tmax varies between 429 and 441°C (average 437 ± 3°C) which suggests that the thermal maturity is roughly equivalent to the onset of liquid hydrocarbon generation. It should, however, be noted that although the Tmax data are broadly consistent, they are not very reliable due to the small size of the S2 signals. Low values of the hydrogen index throughout the whole core (13 - 109 mg/g TOC) suggest a very poor initial hydrocarbon generation potential for these rocks. Low S1 values and production index values of less than 0.17 indicate that the analysed samples are free of non-indigenous hydrocarbons.

3.2.3 Pyrolysis-GC

Three extracted siltstone samples with relatively high petroleum potential (198.68, 143.97, 111.15 m) were analysed using pyrolysis-gas chromatography (PY-GC) in order to cross-check the Rock-Eval pyrolysis results. The PY-GC gas chromatograms are all similar and show a well developed series of n-alkene/n-alkane doublets extending up to C_{27}-C_{30}. Aromatics are moderately abundant [(m+p)-xylene/n-octene = 0.9 - 1.0]. The pyrolysates contained about 12 - 14% methane. Their composition is consistent with type-II/III rather than with type-III kerogen which typically yields more aromatic and less aliphatic pyrolysates. It is therefore possible that these rocks have a slightly higher liquid hydrocarbon generation potential than might be expected solely on the basis of the Rock-Eval results.

3.2.4 Vitrinite reflectance

Vitrinite reflectance was determined on five polished block samples from this core. Phytoclasts were more abundant in these samples than in those from core 7418/01-U-01, but their preservation was variable and partly poor. Three samples (198.68, 174.66, 124.66 m) gave mean reflectance values between 0.53 and 0.58% Rm, which is reasonably consistent with the Rock-Eval Tmax data and suggests early thermal maturity. The very rare presence of sporinite with yellow-orange fluorescence colours in the two deepest samples could suggest a slightly lower maturity, but these observations are rather uncertain. Fluorescence colours ranging from middle orange to orange-red and vitrinite reflectance values of more than 0.6% Ro are associated with reworked, oxidised or otherwise poorly preserved organic material.

3.2.5 Visual kerogen description

The organic residues of five claystone and siltstone samples were analysed in transmitted and fluorescence light in order to determine the nature of the organic matter and to obtain an independent estimate of its thermal maturity. All kerogen isolates are dominated by woody (30 - 55%) and non-fluorescent amorphous material (10 - 45%) which is probably derived from land-plant material (Figure 3.2.3). Angular, opaque "coaly" material (10 - 20%) and herbaceous material (10 - 25%) account for the remainder. There is a major component of poorly preserved cuticles, along with scattered pollen and dinocysts with an orange-brown to brown fluorescence. This composition is generally consistent with the poor generation potential suggested by the Rock-Eval results, but does not fully explain the potential which is apparent from the pyrolysis-GC data.

The dark yellow to orange "spore" (actually bisaccate) colour, expressed as TAI values of 4 - 5 on a 1 - 10 scale, in connection with the orange-brown fluorescence, are largely consistent with the vitrinite reflectance data and roughly agree with the Tmax values, if the uncertainties of both methods and the poor preservation of the palynomorphs are taken into account.

3.2.6 Extraction and group type separation

Three samples, including two siltstones (198.68 and 143.97 m) and one claystone-siltstone (111.15 m) were selected for extraction and group-type separation. Their content in extractable organic material (EOM) varies from 1346 to 1635 ppm of rock weight. The EOM is rich in asphaltenes (50.2 - 69.1 wt%) and contains 25 - 42% hydrocarbons with low SAT/ARO ratios of 0.07 - 0.12 (Figure 3.2.4). The TOC-normalised hydrocarbon concentrations vary between 15 and 20 mg/g TOC. These relatively low yields and the bulk composition suggest that the EOM is indigenous to these rocks, although a minor input from non-indigenous bitumen cannot be absolutely excluded before the background of the very low source potential of these rocks.

3.2.7 GC of the saturated hydrocarbon fraction

The saturated hydrocarbon gas chromatograms of all three samples are similar and show unimodal, medium- to high molecular weight biased n-alkane distributions [$n\text{-}C_{17}/(n\text{-}C_{17} + n\text{-}C_{27}) = 0.2 - 0.3$] with a maximum between C_{23} and C_{25} and a strong odd/even predominance (CPI = 1.7 - 1.9; Figure 3.2.5). The peaks in the biomarker region are relatively prominent. The gas chromatogram at 111.15 m contains additional peaks in the C_{13}-C_{15} region.

All these features point at a thermally immature source containing predominantly terrestrial organic matter.

3.2.8 GC of the aromatic fraction

The gas chromatograms of the aromatic fractions show a prominent UCM background and abundant peaks in the high molecular weight (i.e. steroid and terpenoid) region, while methylphenanthrene peaks are rather poorly developed and show a relatively immature isomer distribution. C_3-naphthalenes are present but poorly developed. In summary, the composition of the aromatics is consistent with the immaturity suggested by the composition of the saturated hydrocarbons.

3.2.9 GC-MS of saturated biomarkers

The composition of the saturated biomarkers is also typical of thermally rather immature hydrocarbons and shows little variation between the three samples. The terpane (m/z 191) mass fragmentograms are characterised by a lack of tri- and tetracyclic compounds, presence of 17β(H)-trisnorhopane and absence of 28,30-bisnorhopane (28αβ). The strong predominance of 27Tm over 27Ts and the moderate isomerisation ratios of hopane (%αβ = 56-59) and extended hopanes (%22S = 39-41) support the rather immature character of these hydrocarbons. Traces of oleanane may be present in the sample at 111.15 m, while this compound is missing in the deeper two samples. The sterane (m/z 217) mass fragmentograms contain only moderately developed diasterane peaks (%dia = 43 - 49). The maturity indicated by the C_{29} sterane isomerisation ratios (%20S = 14 - 23; %ββ = 50 - 54) is more similar to that of the oil staining in core 7418/01-U-01 than to that of the indigenous hydrocarbons in that core. The internal distribution of the ααR steranes is dominated by the C_{29} compound (Figure 3.2.6), and no prominent C_{30} ααR sterane peak can be recognised, which suggests that these hydrocarbons were generated from land-plant dominated organic matter.

3.2.10 Stable carbon isotope analysis of EOM fractions

The EOM fractions from the siltstone at 198.68 m were analysed for their stable carbon isotope composition. The values and their distribution tend to support the terrestrially-dominated nature of these hydrocarbons and are similar to those of the migrated hydrocarbons at 117.81 and 85.00 m in core 7418/01-U-01 (Figure 3.2.7).

3.2.11 Summary for core 7517/12-U-01

Core 7517/12-U-01 contains mainly clayey sandstones with variable organic richness, which typically ranges from about 0.5 to 2 wt% TOC. The organic matter consists mostly of poorly preserved, land-plant derived material. Its thermal maturity is similar to that of core 7418/01-U-01 and probably corresponds to the early stage of liquid hydrocarbon generation. The rocks from core 7517/12-U-01 have a low residual hydrocarbon generation potential (type-III and type-IV kerogen based on Rock-Eval pyrolysis data), although the pyrolysate composition suggests that there could be a limited potential for liquid hydrocarbon generation.

The hydrocarbons extracted from a silty claystone and two siltstones are derived from a land-plant derived source with a thermal maturity slightly above that of the indigenous hydrocarbons from core 7418/01-U-01. Their molecular composition is generally consistent with an indigenous origin, although their stable carbon isotope composition is similar to that of the migrated hydrocarbons in core 7418/01-U-01. A non-indigenous contribution to these hydrocarbons may therefore not be absolutely excluded.

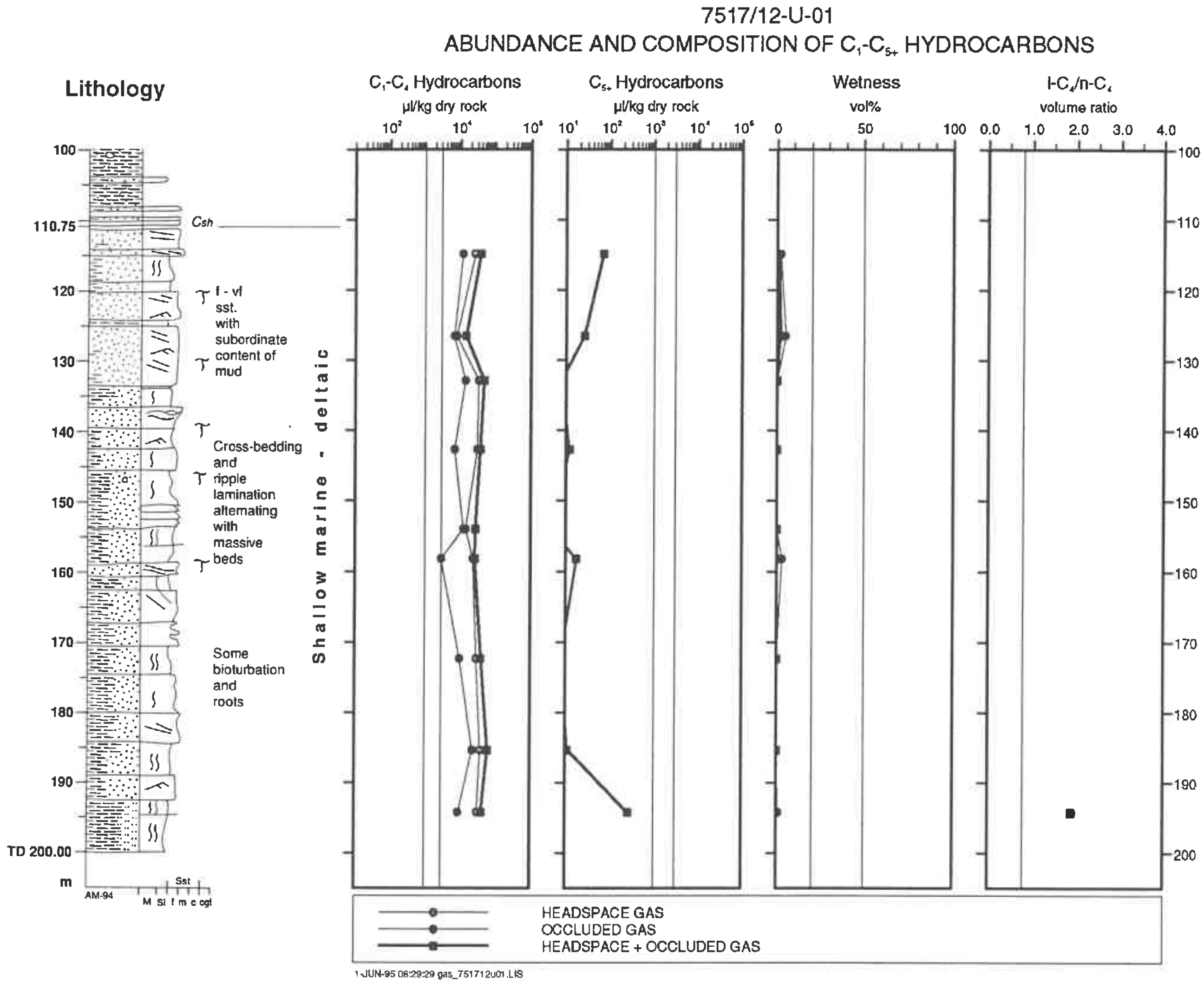

Figure 3.2.1 *Yield and composition of headspace/occluded gas of core 7517/12-U-01.*

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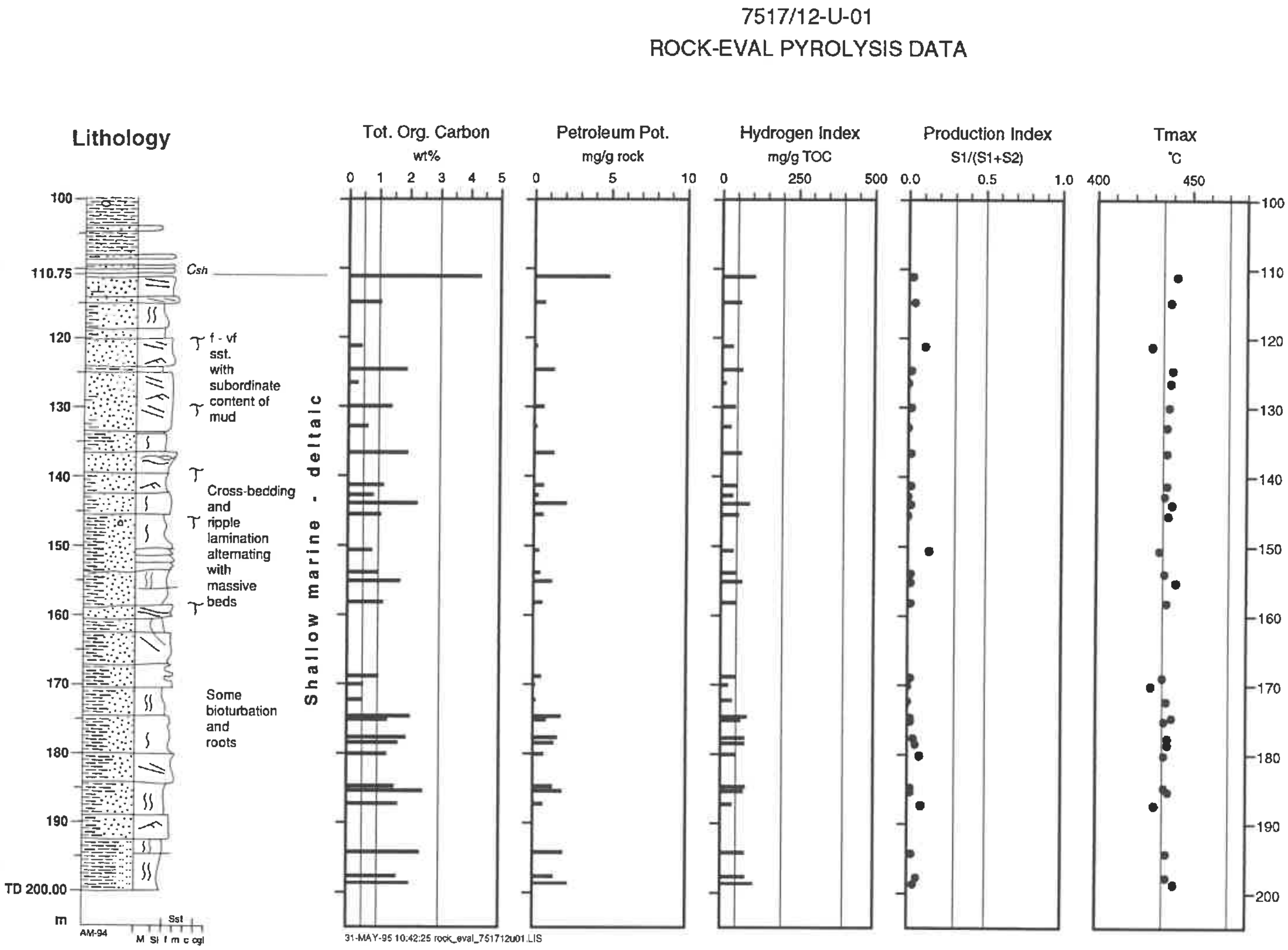

Figure 3.2.2 *Total organic carbon content and Rock-Eval data from core 7517/12-U-01.*

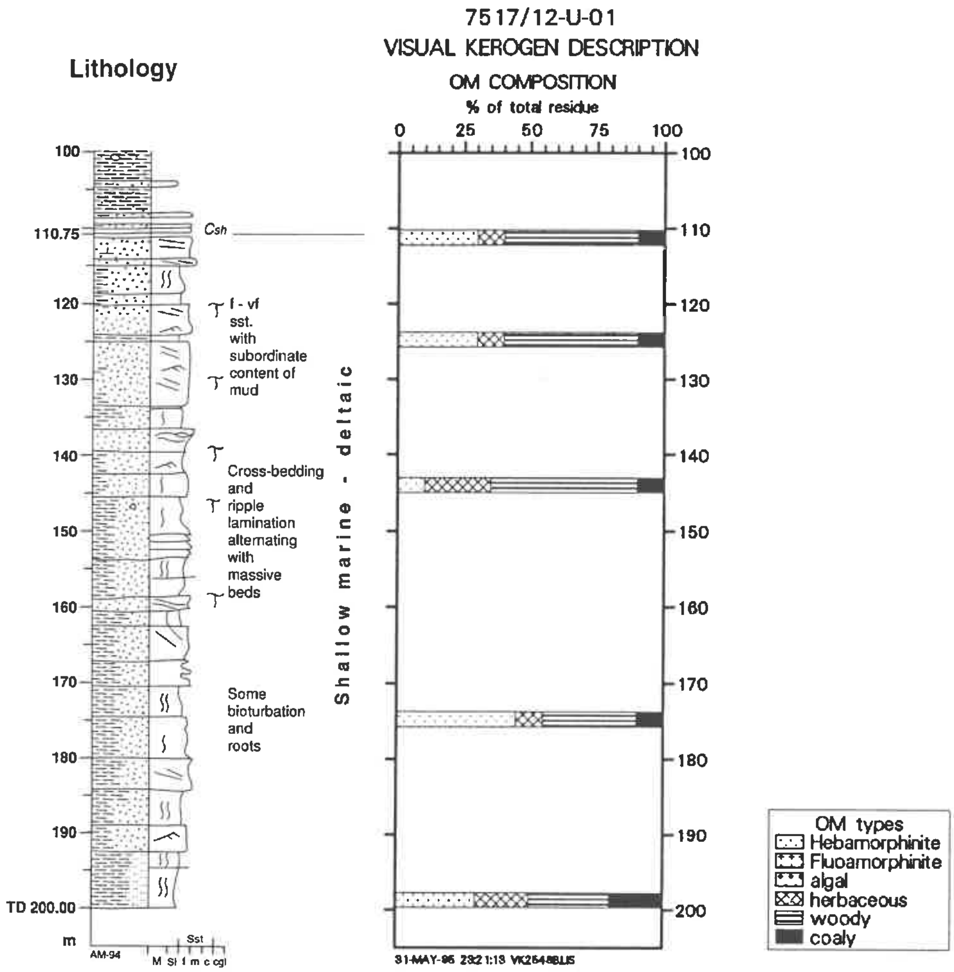

Figure 3.2.3 *Composition of organic matter in core 7517/12-U-01 determined by transmitted light microscopy.*

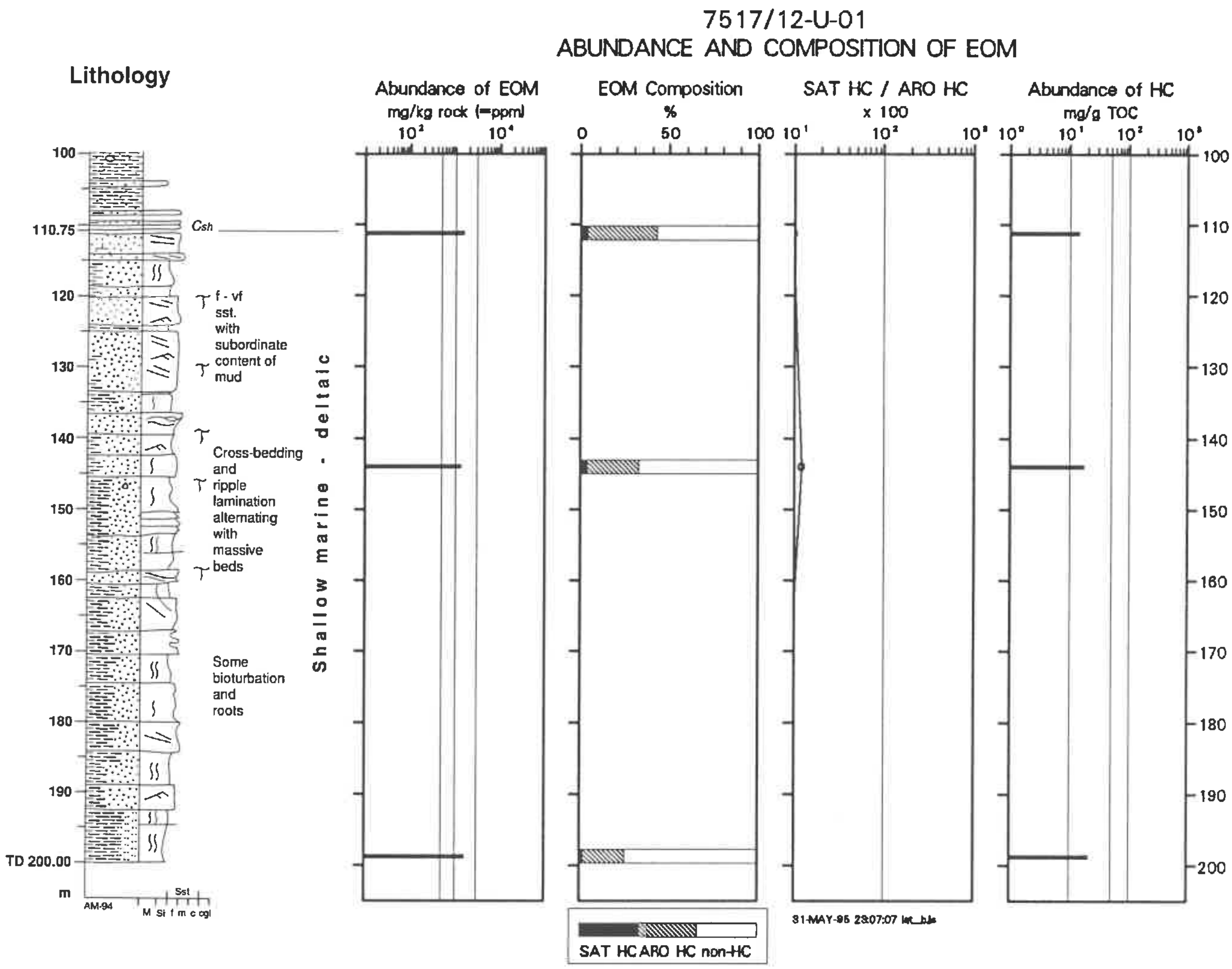

Figure 3.2.4 *Yield and bulk composition of extractable organic matter from core 7517/12-U-01 (TLC-FID data).*

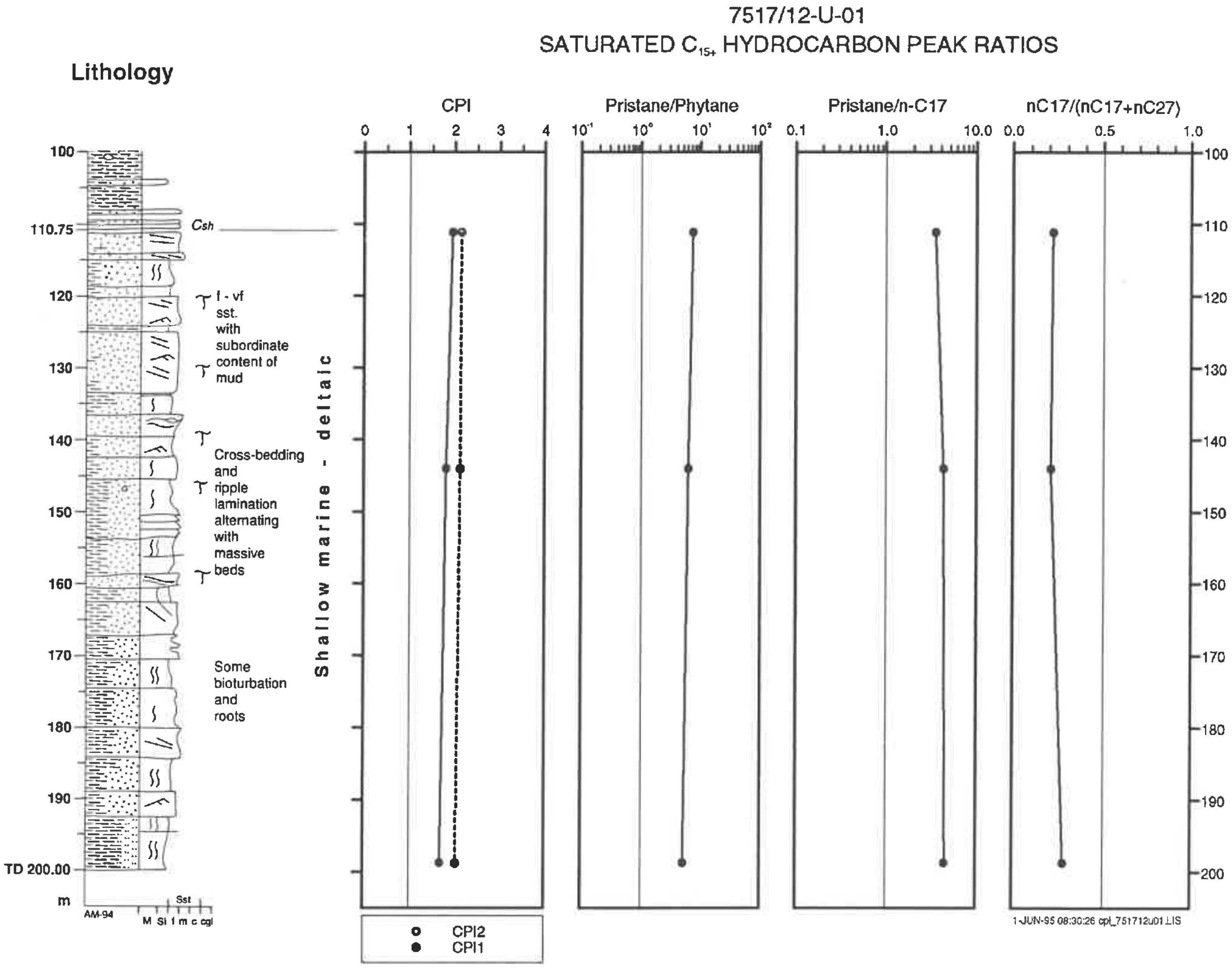

Figure 3.2.5 Selected saturated hydrocarbon peak ratios from core 7517/12-U-01.

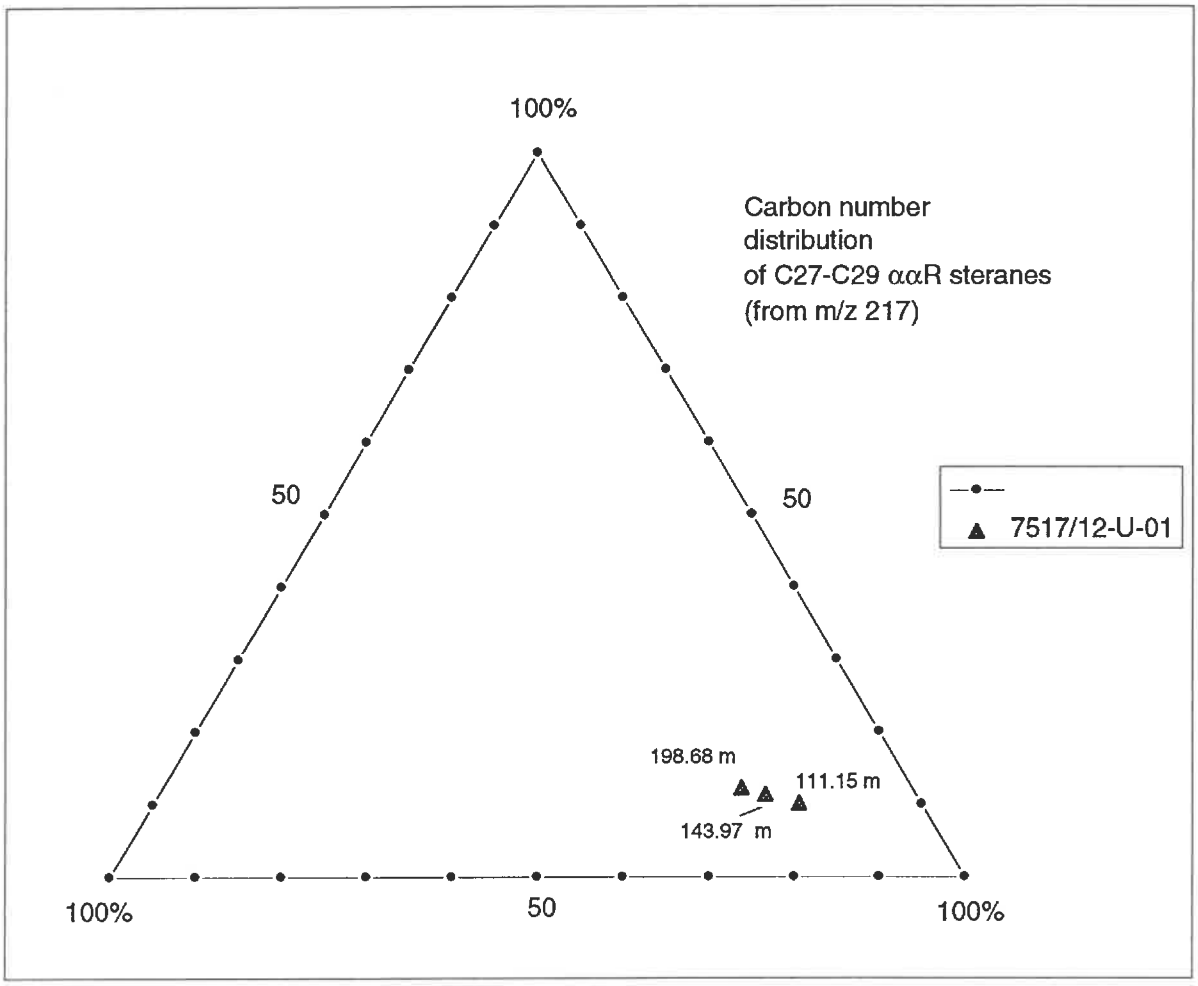

Figure 3.2.6 *Molecular distribution of regular C_{27}, C_{28} and C_{29} αααR steranes in samples from core 7517/12-U-01 (from m/z 217).*

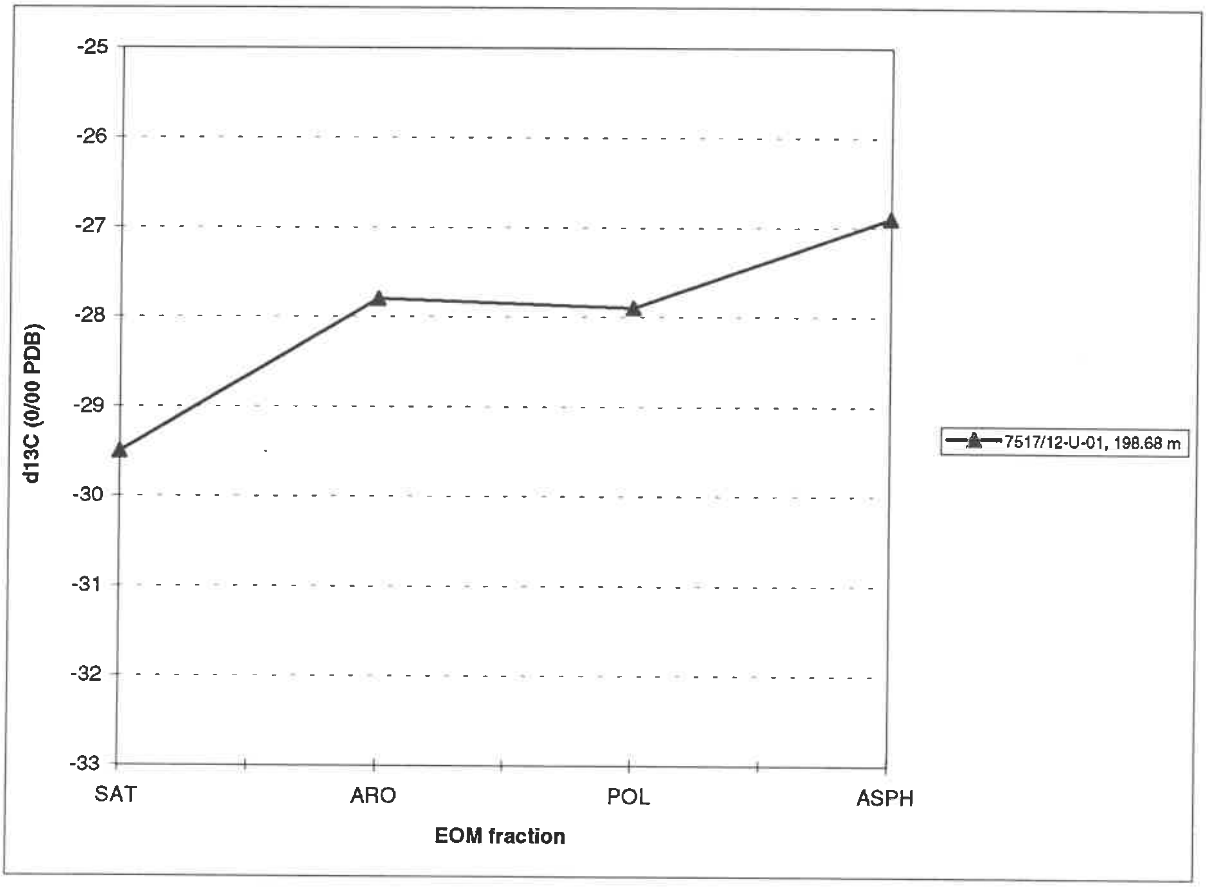

Figure 3.2.7 *Isotope type curves (Galimov-type plot) for EOM fractions from core 7517/12-U-01.*

3.3 Cores 7616/11-U-01 and -02

3.3.1 Headspace and occluded gas analysis

Six canned core chip samples were analysed for light hydrocarbons in the headspace and occluded gas fractions. C_1-C_4 hydrocarbons were present in concentrations between 3000 and 100 000 µl/kg (Figure 3.3.1). Most of the gas was contained in the occluded fraction, and the highest values were recorded in the claystone-siltstone succession in the middle of the core (ca. 30 - 45 m), which is more organic rich than the sandstone intervals at the bottom and top. The i-C_4/n-C_4 ratios were below 0.6 which is within the typical range of mature thermogenic gases. C_{5+} hydrocarbons occurred in moderate concentrations (300 - 800 µl/kg). Concentration and composition of the gases in this core are consistent with the thermally mature and mainly gas-prone character of the rocks in this core. This and the correspondence between organic richness and gas content suggests that the hydrocarbon gases in this core are indigenous.

3.3.2 TOC content and Rock-Eval pyrolysis

TOC analysis and Rock-Eval pyrolysis were carried out on 22 core chip samples. They revealed a wide range of TOC contents (0.5 - 4.1 wt%, Figure 3.3.2). The most organic rich rocks with TOC contents of 2.5 - 4.1 wt% are associated with the more clayey-silty sediments in the middle part of the core (ca. 27 - 45 m), and with the finer-grained and dark coloured sandstones between 10 and 17 m. The remaining samples have fair to poor TOC contents of around 1 wt% or less.

Reliable Tmax values, which decrease from about 440°C at the bottom to about 432°C at the top of the core, suggest a maturity just at the onset of liquid hydrocarbon generation. The hydrogen index varies between 22 and 133 mg/g TOC and is typically highest in the most organic rich samples. The values suggest that the organic matter varies from kerogen type IV, which has no hydrocarbon potential, to type III whose generation potential is usually limited to gas. Most samples show S1 values of less than 0.2 mg/g rock and production indices of less than 0.1 which suggests that the hydrocarbons found in these rocks are indigenous. Traces of migrated hydrocarbons are, however, indicated by slightly elevated S1 values and relatively high production indices at 7.41 m (PI = 0.62) and 56.25 m (PI = 0.25).

TOC and Rock-Eval pyrolysis data of eight core chip samples from core 7616/11-U-02 basically confirm the observation made on core 7616/11-U-01. The sampled interval corresponds to the claystone-siltstone interval in the middle of core 7616/11-U-01, and the TOC contents (1.5 - 2.3 wt%), Tmax values (437 - 445°C) and hydrogen indices (78 - 118 mg/g TOC) confirm that these sediments have good organic richness and contain type III kerogen of early oil-window maturity. No indications of migrated hydrocarbons were found, and no further analyses were carried out on this core.

3.3.3 Pyrolysis-GC

Three samples, comprising one siltstone (36.21 m) and two relatively organic-rich sandstones (65.08 and 13.15 m) were selected for pyrolysis-gas chromatography in order to characterise the pyrolysate composition. The methane content varied between 7 - 9% in the sandstone pyrolysates and 16% in the siltstone pyrolysate The pyrolysates had moderate to high aromaticities [(m+p)-xylene/n-octene = 0.7 - 2.2], which agrees with the terrestrially-dominated nature of the organic matter; however the presence of n-alkenes/n-alkanes extending to C_{27} - C_{30} suggests that the kerogen still should possess some generation potential for liquid hydrocarbons. Asphaltenes which were not completely removed during solvent extraction could also have contributed to the aliphatic content of the pyrolysates. A rather high background (UCM[4]) was recorded in the sandstone pyrolysates.

3.3.4 Vitrinite reflectance

Four samples were analysed for vitrinite reflectance and sporinite fluorescence. Abundance and quality of phytoclasts in these samples varied from poor to moderate, and intergrown pyrite occasionally made measurements difficult. Mean reflectance values between 0.39 and 0.49% Rm were obtained from small populations of apparently indigenous vitrinite, while the secondary populations showed mean reflectance values from 0.6 to 1.0% Rm. Sporinite occurred in very low to moderate concentrations and showed yellow-orange to middle orange fluorescence colours. This is roughly consistent with the reflectance values and suggests that the indigenous phytoclasts have early thermal maturity.

3.3.5 Visual kerogen description

Kerogen isolates of five samples with silty or sandy lithologies were examined in transmitted and fluorescent light (Figure 3.3.3). The organic matter in the specimens consists mainly of non-fluorescent amorphous matter (30 - 50%) and woody material (20 - 55%), with minor contributions from herbaceous (0 - 20%) and opaque "coaly" material (10 - 15%). The particulate herbaceous matter is made up of scattered pollen and dinocysts. This composition basically supports the low liquid hydrocarbon generation potential suggested by the pyrolysis results.

The brown or orange-brown fluorescence of these components and the relatively dark coloration of the bisaccate pollen (TAI = 5) suggest a thermal maturity well within the liquid hydrocarbon window. This is in poor agreement with the Tmax and vitrinite reflectance data and may reflect the poor preservation of the organic matter and the abundance of reworked material. The pollen walls appeared as thin films with adhering granular material. Similar effects have been observed with organic matter that has been artificially heated during a short period of time, but could also be related to the chemistry of the pore solution during mineral diagenesis, e.g. during the formation of carbonate cement.

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[4] Unresolved Complex Mixture (= the 'hump' in the gas chromatogram)

3.3.6 Extraction and group type separation

Five samples, comprising one siltstone (36.21 m) and four sandstone samples (65.08, 56.25, 13.15, 7.41 m), were extracted (Figure 3.3.4). The siltstone had a moderate EOM content of 1356 wt ppm, while the sandstones showed variable EOM yields which ranged from 1557 to 5013 wt ppm EOM. The highest contents were recorded in the organic-poor sandstone at 7.41 m and the organic-rich sandstone at 13.15 m. The bulk composition of the EOM was also quite variable. The sandstone samples at 56.25 and 7.41 m contained rather hydrocarbon-rich EOM (56 - 58 % HC) with moderate asphaltene content (27 - 41 wt%). The EOM from the remaining samples was asphaltene-rich (72 - 80 wt%) and contained only 17 - 25% hydrocarbons. The unusually high TOC-related hydrocarbon contents of these two samples (120 - 366 mg/g TOC vs. 10 - 24 mg/g TOC in the remaining samples) and their increased SAT/ARO ratios (0.2 - 1.1 vs. 0.05 - 0.07) clearly indicate that they contain migrated bitumen, while the bitumen extracted from the remaining samples is regarded as indigenous.

3.3.7 GC of the saturated hydrocarbon fraction

A considerable compositional variation is also evident from the gas chromatograms of the saturated hydrocarbon fractions. The samples at 36.21 (siltstone) and 13.15 m (sandstone) are characterised by unimodal, high molecular weight biased n-alkane distributions with a maximum at C_{27} and a strong odd/even predominance (CPI = 1.4 - 1.5; Figure 3.3.5). High pristane/n-C_{17} ratios (3.1 - 3.5) and pristane/phytane ratios (3.2 - 4.0), abundant peaks in the biomarker region and a moderate UCM background are further characteristics which suggest a land-plant dominated source material of low thermal maturity. This does not wholly match with the early maturity of the kerogen and may suggest a contribution from an immature source in the vicinity.

The gas chromatogram at 65.08 m (sandstone) shows a more low-molecular weight biased n-alkane distribution with a moderate odd/even predominance (CPI = 1.2). The pristane/phytane ratio (4.7) is similar to those of the other samples. Very prominent n-C_{17} and n-C_{19} peaks may suggest a contribution from algal source material to these hydrocarbons and lead to a rather low pristane/n-C_{17} ratio (1.5).

The saturated hydrocarbons in the stained sandstone samples are biodegraded and contain either low concentrations of n-alkanes (56.25 m) or no n-alkanes at all (7.41 m). The strong biodegradation of the shallowest sample may be easily explained by the near-surface position. The isolated occurrence of partly biodegraded hydrocarbons between layers containing undegraded hydrocarbons may be related to differences in relative permeability and therefore to accessibility to meteoric water.

3.3.8 GC of the aromatic fraction

The aromatic hydrocarbon gas chromatograms of the unstained samples contain moderately developed alkylnaphthalene, phenanthrene and alkylphenanthrene peaks on a low to moderate UCM background. The methylphenanthrene distribution suggests a thermal maturity before or around the onset of significant liquid hydrocarbon generation

(MPI = 0.4 - 0.5). The gas chromatograms from the stained samples show a high background of unresolved compounds, but no identifiable peaks. This indicates that biodegradation was intense enough to affect not only the n-alkanes but also the more resistent aromatic compounds.

3.3.9 GC-MS of saturated biomarkers

The terpanes extracted from the siltstone at 36.21 m and the sandstones at 65.08 and 13.15 m are characterised by the near absence of diterpanes and 27Ts, by a high relative abundance of 28,30-bisnorhopane (which is the dominant terpane compound at 13.15 m), by still incomplete hopane isomerisation (%αβ = 61 - 73), but almost complete isomerisation of the homohopanes (%22S = 54 - 56). All this points to a maturity before or around the onset of liquid hydrocarbon generation. A series of relatively strong peaks, eluting between the homohopane doublets and tentatively identified as 17β(H), 21β(H) hopanes, occurs at 36.21 m and, less prominently, at 65.08 m. If the identification is correct[5], the presence of these compounds would support the relatively immature character of these hydrocarbons.

The partly biodegraded hydrocarbons from 56.25 m (sandstone) gave a m/z 191 mass fragmentogram of good quality. The presence of diterpanes, the almost equal abundances of 27Ts and 27Tm and the hopane isomerisation ratios (%αβ = 83, %22S = 58) suggest a slightly higher maturity for these hydrocarbons than for those from the unstained samples in this core. Minor concentrations of 28,30-bisnorhopane (28αβ) and of (presumably) ββ terpanes are present in this sample. Whether these compounds belong to the migrated fraction of the hydrocarbons or whether they are indigenous to the rock is difficult to decide.

The terpane mass fragmentogram obtained from the strongly biodegraded sample at 7.41 m (sandstone) is of moderate quality. It is dominated by the C_{30} diahopane peak (30D) and contains a relatively strong diterpane peaks (24/3 : 30αβ = 1.56), while hopane and homohopane peaks are rather poorly developed. The calculated isomerisation ratios (%αβ = 69, %22S = 67) are therefore quite unreliable and should be considered with utmost care.

The sterane (m/z 217) mass fragmentograms of the three unstained samples show an inconsistent distribution of the regular C_{29} steranes, characterised by an unusually strong 29ααS peak. This is due to the high concentrations of 28,30-bisnorhopane (28αβ) in these samples. This compound coelutes with the 29ααS sterane and has a minor m/z 217 fragment ion which at high 28αβ concentrations interferes with the m/z 217 ion of the 29ααS sterane. This increases the %20S sterane isomerisation ratio and decreases the %ββ ratio relative to their real values. Judging from the ratio between 29ααR and the 29ββ steranes, the correct %ββ value may be in the order of 25 - 35. This and the moderate to high diasterane/sterane ratios (%dia = 53 - 70) suggest that the maturity of these hydrocarbons is slightly higher than that of the oil staining in core 7418/01-U-01,

[5] A full scan GC-MS analysis could not be run as all the material had been used up.

which is in reasonable agreement with the %22S ratios. The composition of the regular C_{27} - C_{29} $\alpha\alpha$R steranes is dominated by the C_{29} compound which suggests a strong terrestrial input to the source of these hydrocarbons and is consistent with a local source (Figure 3.3.6). A particular feature of the sample from 65.08 m is the occurrence of relatively prominent peaks representing 29dβS+27$\beta\beta$R and 29dβR.

The steranes from the slightly biodegraded hydrocarbon staining at 56.25 m have a clearly more mature composition which is characterised by well developed peaks representing C_{21} and C_{22} steranes, a dominating 27dβS diasterane peak (%dia = 75) and a rather mature C_{29} sterane composition (%20S = 50, %$\beta\beta$ = 70). This is consistent with the hopane data. The similar concentrations of the 27$\alpha\alpha$R and 29$\alpha\alpha$R steranes suggest that the source of these migrated hydrocarbons is less influenced by terrestrial material than that of the indigenous hydrocarbons (Figure 3.3.6). The strongly biodegraded hydrocarbon staining at 7.41 m gave a noisy m/z 217 mass fragmentogram with relatively prominent C_{21} and C_{22} sterane peaks. Poor resolution of the C_{27}-C_{30} sterane peaks renders all the calculated sterane ratios highly uncertain and uninterpretable.

3.3.10 Stable carbon isotope analysis of EOM fractions

Stable carbon isotope analyses were carried out on the EOM fractions of one siltstone (36.21 m) and three sandstone samples (65.08, 56.25, 7.41 m). The non-biodegraded and probably indigenous EOM from 36.21 and 65.08 m has a relatively heavy isotopic composition ($\delta^{13}C_{SAT}$ = -28.6 to -28.5‰ PDB, $\delta^{13}C_{ARO}$ = -26.4 to -26.2‰ PDB) with rather similar isotope type curves (Figure 3.3.7) and a "terrestrial" character on the $\delta^{13}C_{ARO}$ vs. $\delta^{13}C_{SAT}$ (Sofer) plot (Figure 4.2.1 in Chapter 4). The hydrocarbon and polar fractions of the biodegraded EOM at 56.25 and 7.41 m show lower (more negative) values ($\delta^{13}C_{SAT}$ = -30.0‰ PDB, $\delta^{13}C_{ARO}$ = -28.5 to -28.3‰ PDB) which makes them isotopically similar to the oil staining in core 7418/01-U-01. The $\delta^{13}C$ value of the asphaltene fraction at 56.25 m, however, is similar to that of the unstained samples in the present core, which may suggest that the high molecular weight fraction of the bitumen in this sample is largely indigenous.

3.3.11 Summary for cores 7616/11-U-01 and -02

This core contains organic-rich claystones and siltstones in the interval 47 - 27 m and dark grey, organic-rich sandstones between 17 and 10 m. The remaining intervals are mainly sandy and of poor to fair organic richness. The organic matter is predominantly derived from poorly preserved land plant material, possibly due to reworking and/or mineral diagenetic processes. Rock-Eval Tmax and vitrinite reflectance data suggest early oil-window maturity. High concentrations of bitumen containing weakly to strongly biodegraded hydrocarbons were found at 56.25 and 7.41 m. Biomarker and isotope data indicate that this bitumen is derived from a different and more mature source than the bitumen extracted from the remaining samples which is hydrocarbon-poor, derived from predominantly terrestrial organic matter and probably of local origin.

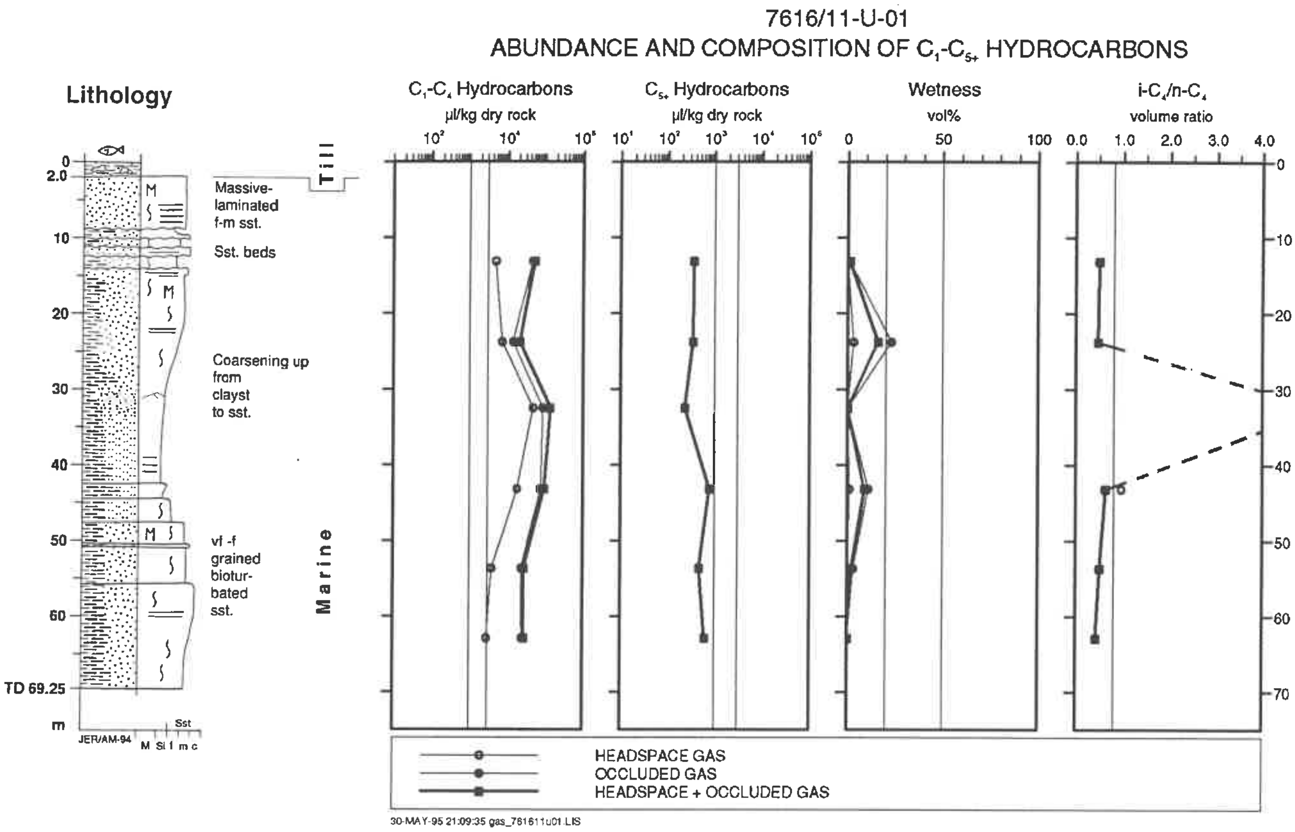

Figure 3.3.1 *Yield and composition of headspace/occluded gas of cores 7616/11-U-01.*

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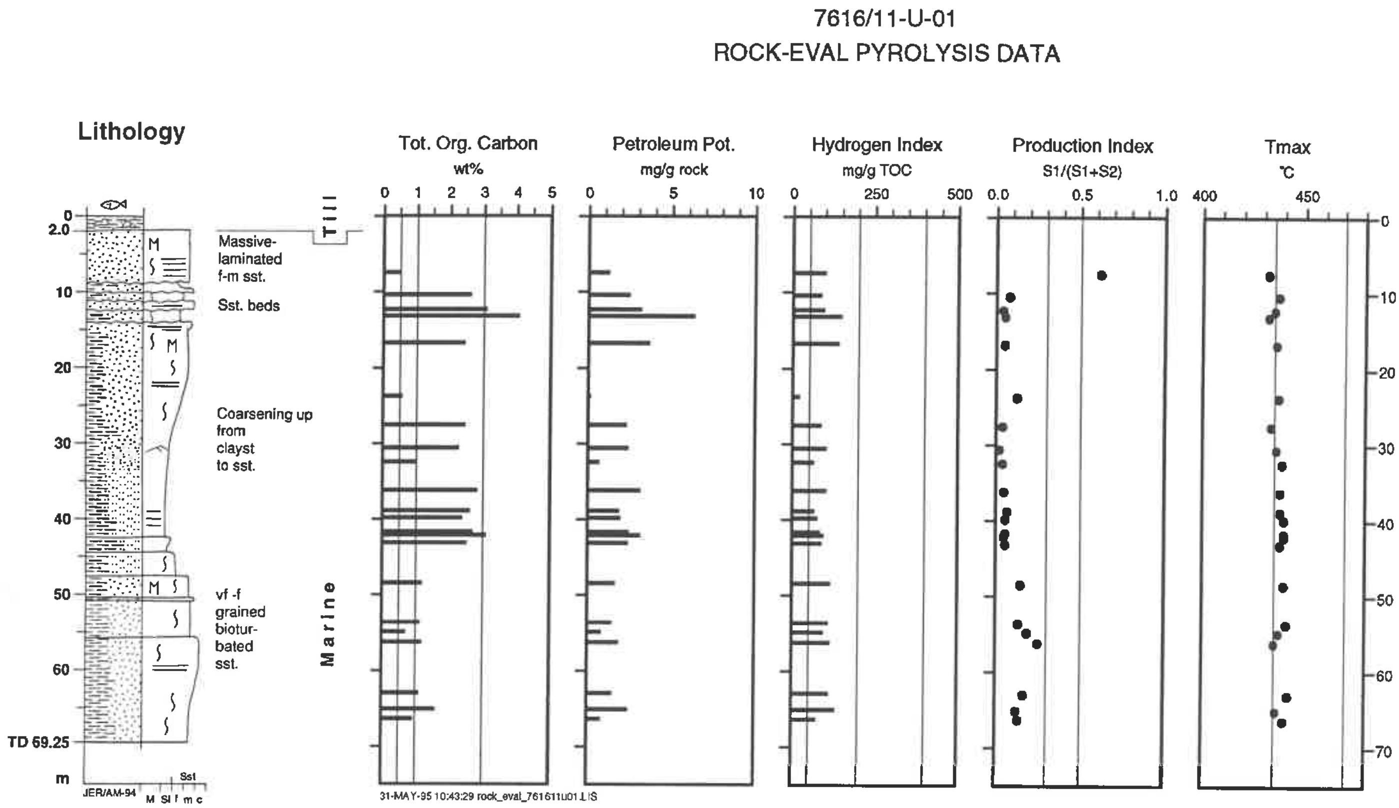

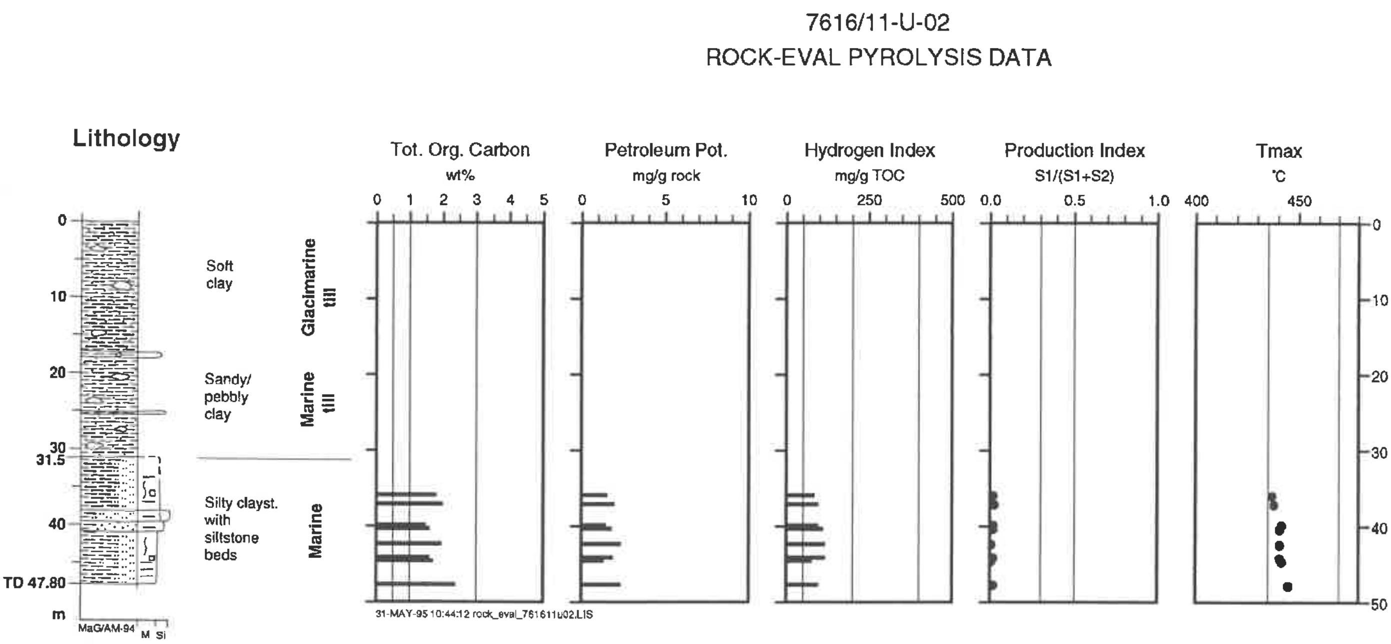

Figure 3.3.2 *Total organic carbon content and Rock-Eval data from cores 7616/11-U-01 and -02.*

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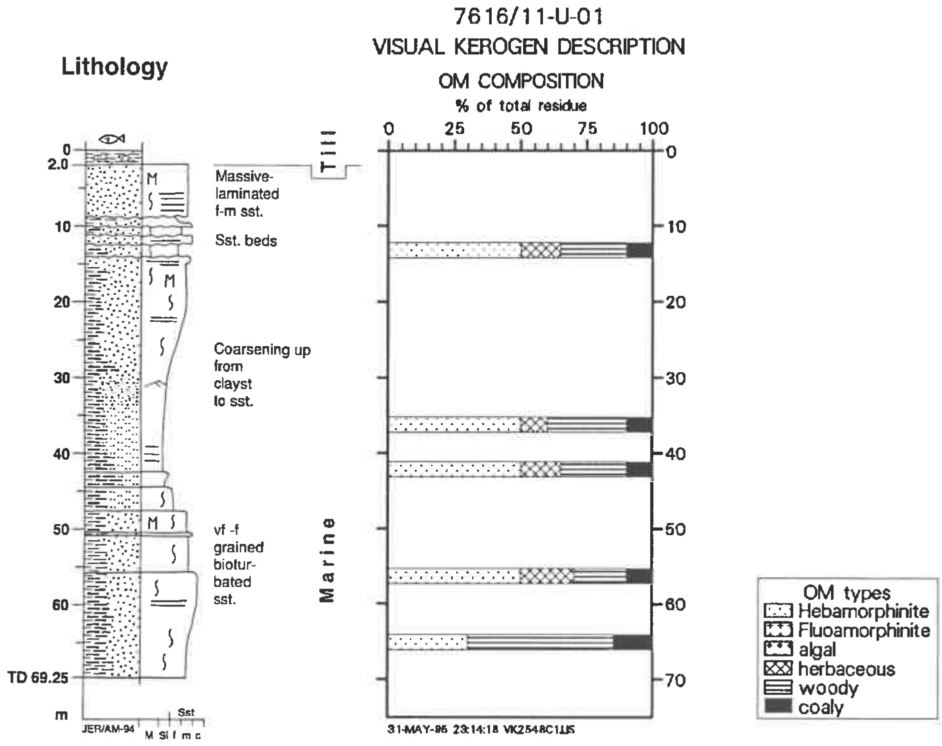

Figure 3.3.3 *Composition of organic matter in core 7616/11-U-01 determined by transmitted light microscopy.*

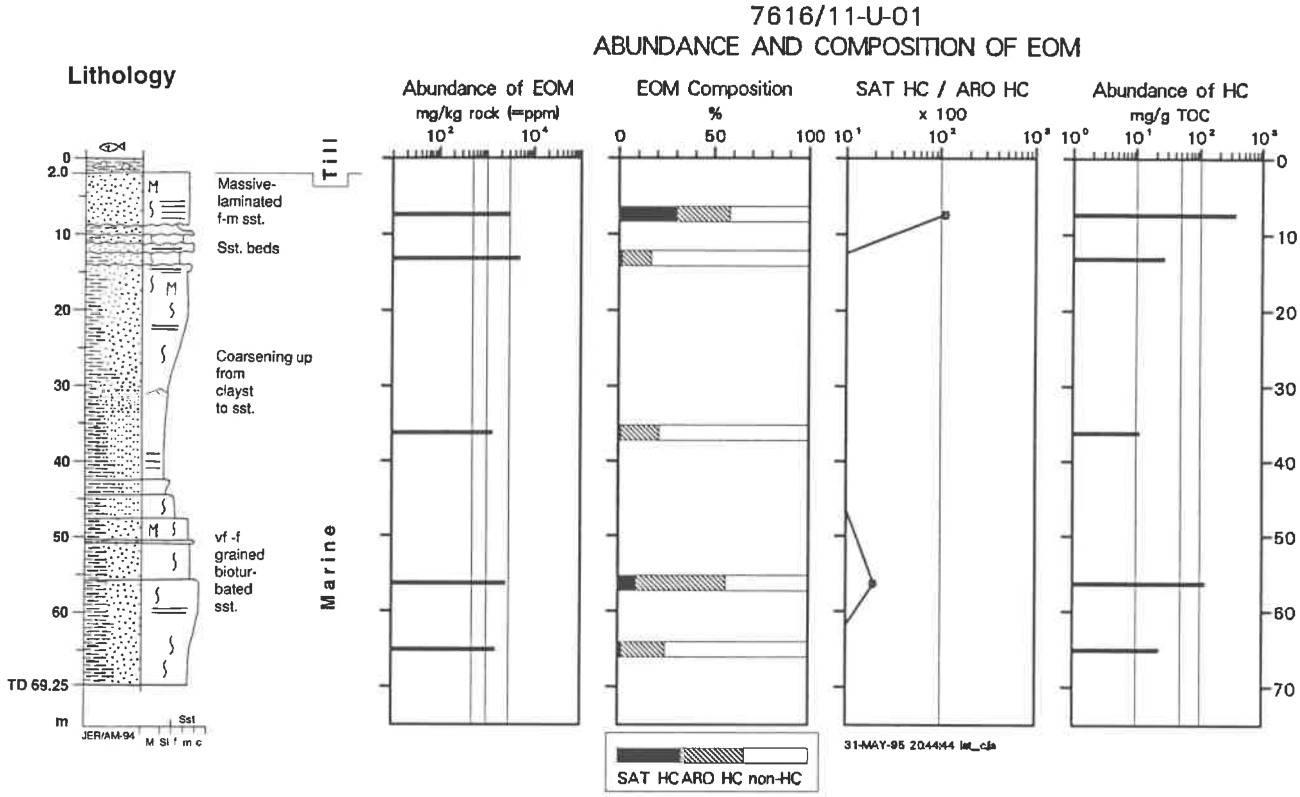

Figure 3.3.4 *Yield and bulk composition of extractable organic matter from core 7616/11-U-01 (TLC-FID data).*

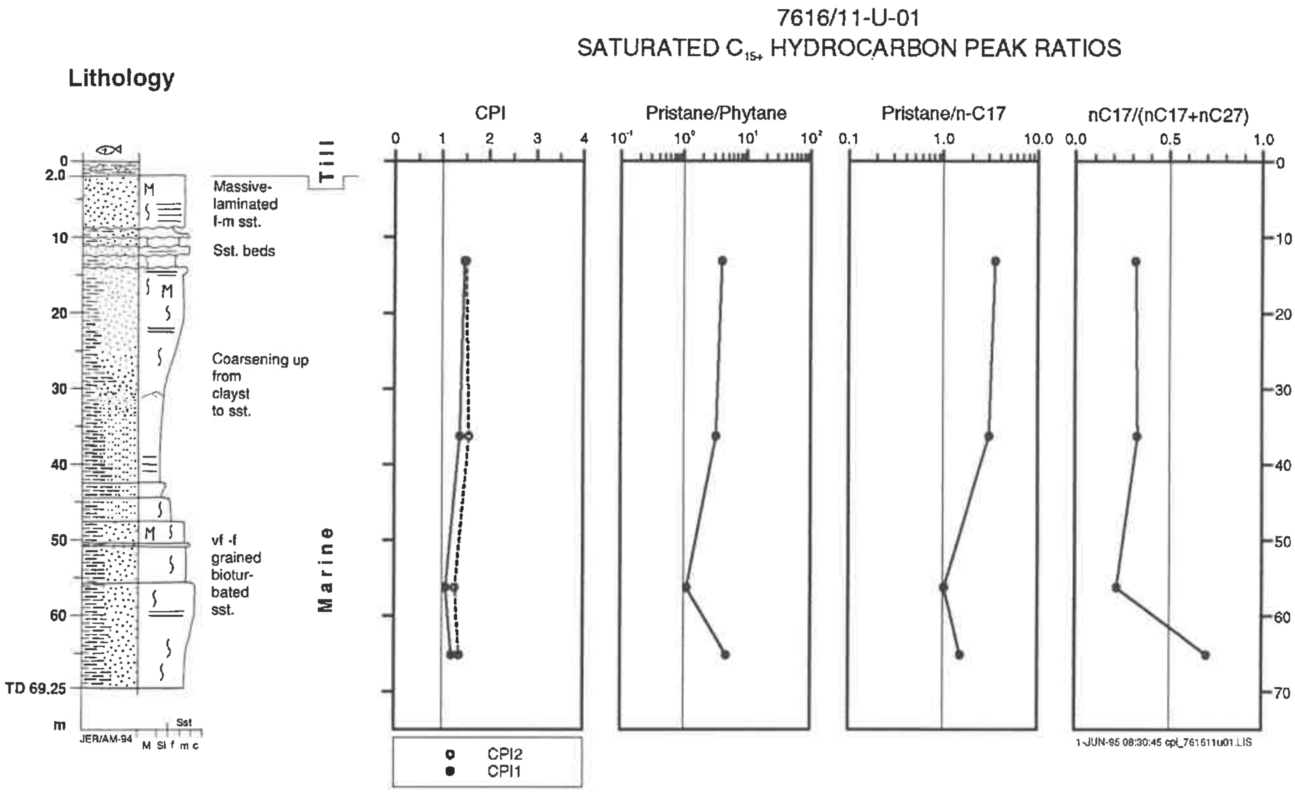

Figure 3.3.5 *Selected saturated hydrocarbon peak ratios from core 7616/11-U-01.*

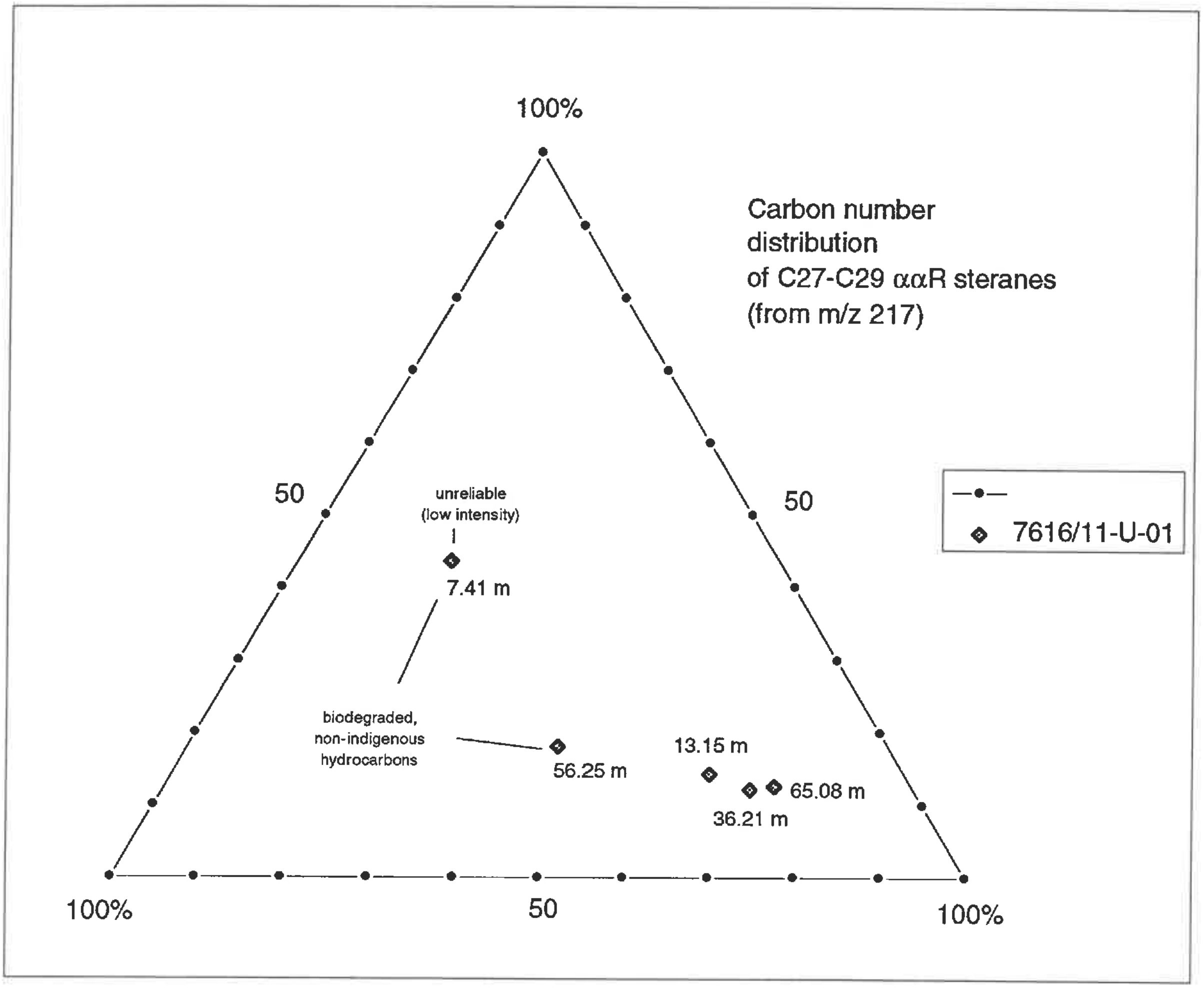

Figure 3.3.6 *Molecular distribution of regular C_{27}, C_{28} and C_{29} αααR steranes in samples from core 7616/11-U-01 (from m/z 217).*

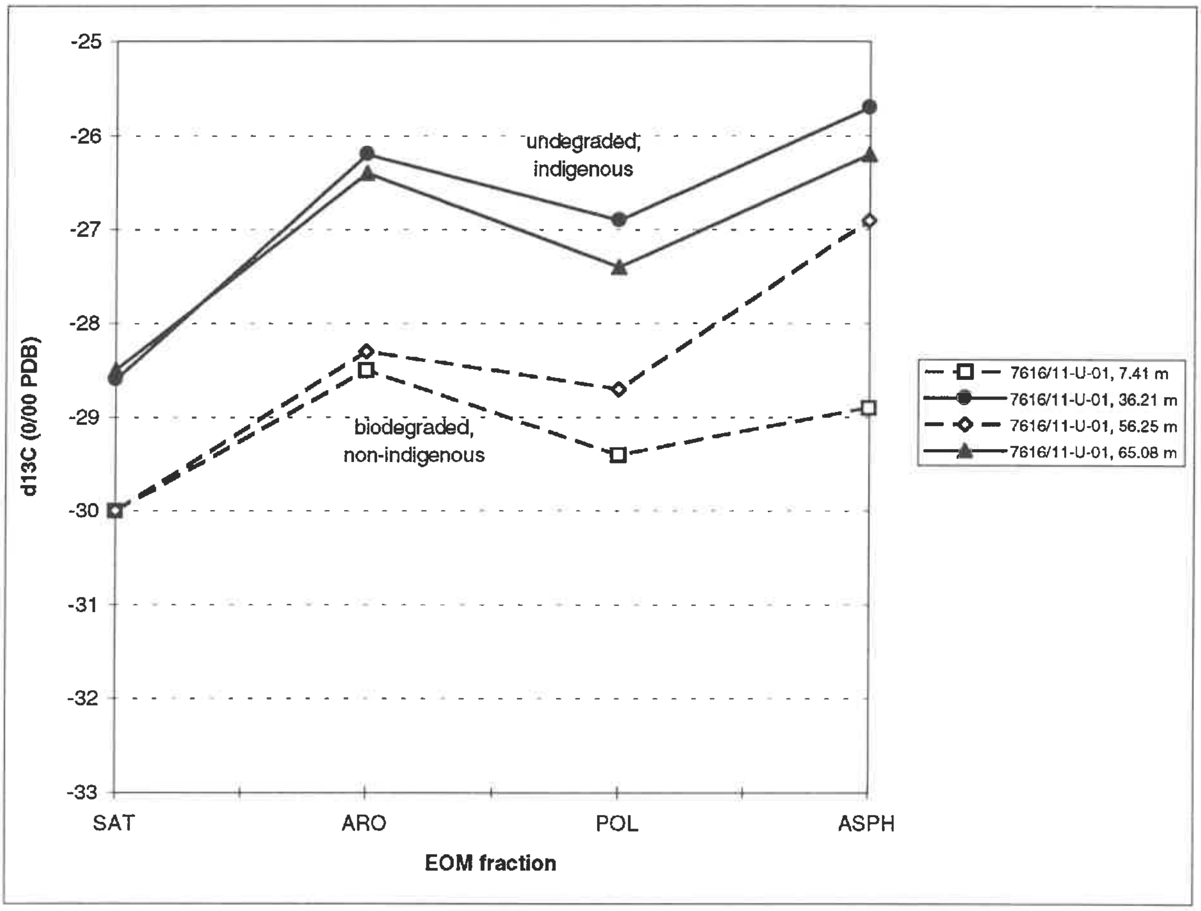

Figure 3.3.7 Isotope type curves (Galimov-type plot) for EOM fractions from core 7616/11-U-01.

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3.4 Cores 7617/11-U-01 and -02

Samples from core 7617/11-U-01 were not analysed.

3.4.1 Headspace and occluded gas analysis

The headspace and occluded gas fractions of twelve canned core chip samples from core 7617/11-U-02 were analysed for light hydrocarbons (Figure 3.4.1). They contained between 1000 and 100 000 µl C_1-C_4 hydrocarbons per kg of dry rock, of which the largest part was contained in the occluded fraction. The gas concentration decreased from the bottom to the top of the core, particularly in the uppermost 50 metres, but is not clearly related to the lithology. The gases had low wetness ratios (maximum 10 %) and contained only traces of C_{5+} hydrocarbons (max. 200 µl/kg). This composition is consistent with an immature or overmature source and suggests that no significant concentrations of migrated liquid hydrocarbons are present in these rocks.

3.4.2 TOC content and Rock-Eval pyrolysis

A total of 56 core chip samples were analysed for TOC content and Rock-Eval pyrolysis character. TOC contents varied between 0.4 and 2.25 wt% and were highest in the clay- and silt-rich sediments in the lower half of the core (154.05 - ~95 m) and in the shallowest silty bedrock section at 28 - 20 m (Figure 3.4.2). On Rock-Eval pyrolysis, all samples showed very low S1 (max. 0.17 mg/g rock) and S2 (max. 0.53 mg/g rock) values which indicates that they presently have no liquid hydrocarbon generation potential nor contain significant concentrations of migrated hydrocarbons. The partly rather high production index values are of no significance because of the small numbers for the S1 and S2 signals. Tmax values centering at about 500°C (476 - 519°C) suggest that the organic matter has a maturity beyond the main phase of liquid hydrocarbon generation. The large scatter is due to the small size of the S2 signals which is normal at this high maturity. Despite the low significance of the individual data, the general increase of Tmax with increasing depth and the concomittant decrease of the production index appear consistent and point at a significant maturity increase through the cored interval.

3.4.3 Pyrolysis-GC

One siltstone sample (23.45 m) was analysed using pyrolysis-gas chromatography. The pyrolysate consisted mainly of methane (42%) and C_2-C_7 hydrocarbons with low content in aliphatic compounds. This composition is typical of organic matter which has never had any hydrocarbon generation potential or has lost it during maturation. This result is consistent with the Rock-Eval data.

3.4.4 Vitrinite reflectance

Vitrinite reflectance and spore fluorescence colour were determined on five polished block samples. Phytoclasts were scarce to moderately abundant, often poorly preserved and sometimes heavily pyritised. The mean vitrinite reflectance values of the main population varied between 0.77 and 0.92% Rm, suggesting mid- to late oil-window maturity. This result is broadly consistent with the mid-orange to orange-red fluorescence colours of the very rare to moderately abundant sporinite in these samples, but it differs from the Rock-Eval Tmax data which tend to indicate post-oil window maturity. Secondary vitrinite populations with lower reflectance (0.4 - 0.45% Rm) were also present.

3.4.5 Visual kerogen description

Seven kerogen isolates from mainly silty lithologies were examined in transmitted and fluorescence light in order to determine the composition and thermal maturity of the organic matter (Figure 3.4.3). The kerogen consists predominantly of non-fluorescent amorphous (40 - 60%) and woody (25 - 45%) material with poorly preserved cuticles, along with minor proportions of herbaceous (0 - 15%) and opaque, coaly material (5%, max. 20%). The particulate herbaceous matter consisted only of pollen and cysts whose very weak brown fluorescence in UV light indicates a high maturity. This and the kerogen composition agree well with the poor hydrocarbon generation potential of these rocks.

The thermal alteration index was difficult to assess, but is thought to be in the order of 6 (or higher?). This broadly agrees with the Tmax data which also indicate a high (post oil-window) maturity for this core, and to some degree with the vitrinite reflectance values. The wall material of the bisaccate pollen which were used for TAI determination, appeared as a thin film with adhering granular material. The reason for this is unclear but may be found in diagenetic processes for which no data were available to this project.

3.4.6 Extraction and group type separation

Three samples were extracted, comprising a claystone (147.00 m) and a siltstone (117.80 m) sample from the lower third of the core and a siltstone sample (23.45 m) close to the top of the bedrock section (Figure 3.4.4). All gave low and very similar EOM yields of around 300 ppm. The EOM from the two lower samples was hydrocarbon-rich (64 - 72%) and contained 20 - 29% asphaltenes, while the shallowest sample contained a very asphaltene-rich EOM (75%). The TOC-related hydrocarbon concentrations varied between 5.5 and 10.6 mg/g TOC which is within the range expected from immature or overmature source rocks. The hydrocarbons from all three samples were completely dominated by aromatics which accounted for more than 85% of the hydrocarbon fraction.

3.4.7 GC of the saturated hydrocarbon fraction

The saturated hydrocarbons from the siltstone at 23.45 m have a mature, oil-like composition, characterised by a unimodal and rather smooth n-alkane distribution (CPI = 1.1) with a maximum at C_{18}, low isoprenoid/n-alkane ratios (Pr/n- C_{17} = 0.5, Ph/n- C_{18}

= 0.2), a moderate pristane/phytane ratio (2.9) and very low biomarker concentrations (Figure 3.4.5). The gas chromatograms from the two remaining samples are different and show considerable 'humps' of chromatographically unresolved compounds in the C_{17}-C_{30} region. The n-alkane distributions are smooth (CPI = 1.1 - 1.2), but have their main maximum at C_{22}-C_{24} and contain relatively prominent n-C_{17} and n-C_{18} peaks. The lack of the low molecular-weight hydrocarbons may partly be caused by evaporative fractionation during the work-up procedure, but the relative prominence of hepta- and octadecane may suggest that the source for these hydrocarbons was slightly different from that of the hydrocarbons in the shallowest sample.

3.4.8 GC of the aromatic fraction

The aromatic hydrocarbon gas chromatograms show moderately developed alkylnaphthalene peaks and well developed phenanthrene and alkylphenanthrene peaks whose isomer distribution is consistent with late oil-window to early gas window maturity (MPI = 1.5 - 1.7). This result agrees roughly with the vitrinite reflectance data, if the considerable uncertainties in both data sets is taken into account. A peak representing 4-methyldibenzothiophene is particularly prominent at 147.00 m. Minor differences in the aromatic hydrocarbon composition between the sample at 23.45 m and the remaining two samples are consistent with the observations made on the saturated hydrocarbon gas chromatograms.

3.4.9 GC-MS of saturated biomarkers

The mass fragmentograms obtained from the three samples were of moderate to poor quality due to the low biomarker concentration in the saturated fraction. All calculated peak ratios should therefore be used with caution, particularly those for the shallowest sample.

The terpane (m/z 191) mass fragmentograms are dominated by the norhopane (29$\alpha\beta$) and hopane (30$\alpha\beta$) peaks. Relatively abundant diterpane peaks (23/3 through 26/3) suggest that these hydrocarbons are thermally mature, while the hopane isomerisation ratios (%$\alpha\beta$ = 72 - 88, %22S = 50 - 57) only indicate early oil-window maturity. The mature character of the hydrocarbons is also apparent from the similar concentrations of 27Ts and 27Tm in the two deepest samples, although the distribution between these compounds is also source-type dependent. The shallowest sample has a less mature appearance.

The sterane composition of all three samples is characterised by a predominance of diasteranes over steranes (%dia = 55 - 82) which is typical of mature hydrocarbons from siliciclastic sources. The sterane isomerisation ratios are, however, lower than normally expected from hydrocarbons generated at mid- or late oil-window maturity (%20S = 33 - 42, %$\beta\beta$ = 62 - 69). The composition of the regular C_{27}-C_{29} $\alpha\alpha$R steranes is dominated by the C_{27} compound (Figure 3.4.6), a feature which is often associated with mature oils sourced by largely marine-dominated source rocks.

The obvious discrepancy between the mid- to post-oil window maturity of the kerogen and the apparently still incomplete sterane isomerisation may reflect the poor data quality due to the high maturity of the samples. However, if the observations are correct, the traces of hydrocarbons in these rocks would have to be regarded as non-indigenous. This seems reasonable also in the view of the lack of source potential in the rocks. The migration may have taken place during the uplift stage.

3.4.10 Stable carbon isotope analysis of EOM fractions

The EOM fractions from the sample at 23.45 m were analysed for stable carbon isotopes (Figure 3.4.7). The relatively heavy isotope composition ($\delta^{13}C_{SAT}$ = -28.1‰ PDB, $\delta^{13}C_{ARO}$ = -25.1 ‰ PDB) is consistent with a relatively high maturity and a predominantly terrestrial source. This agrees with the maturity and character of the kerogen, but contrasts with the regular C_{29} sterane distribution which points at a marine source for the hydrocarbons.

3.4.11 Summary for cores 7617/11-U-01 and -02

In summary, the siltstones and claystones in these sandstone-dominated cores have fair to good organic richness (typically 1-2 wt% TOC). The organic material is predominantly by land-plant derived and has probably late oil-window or early gas-window maturity. Its liquid hydrocarbon generation potential is zero at present and was probably not very high before maturation. The traces of hydrocarbon-poor bitumen found in this core contain aromatic-rich hydrocarbons with a mature n-alkane composition. Biomarker data of moderate to poor quality, however, suggest that the source of these hydrocarbons may be less mature than the kerogen in these rocks, in which case they would be non-indigenous.

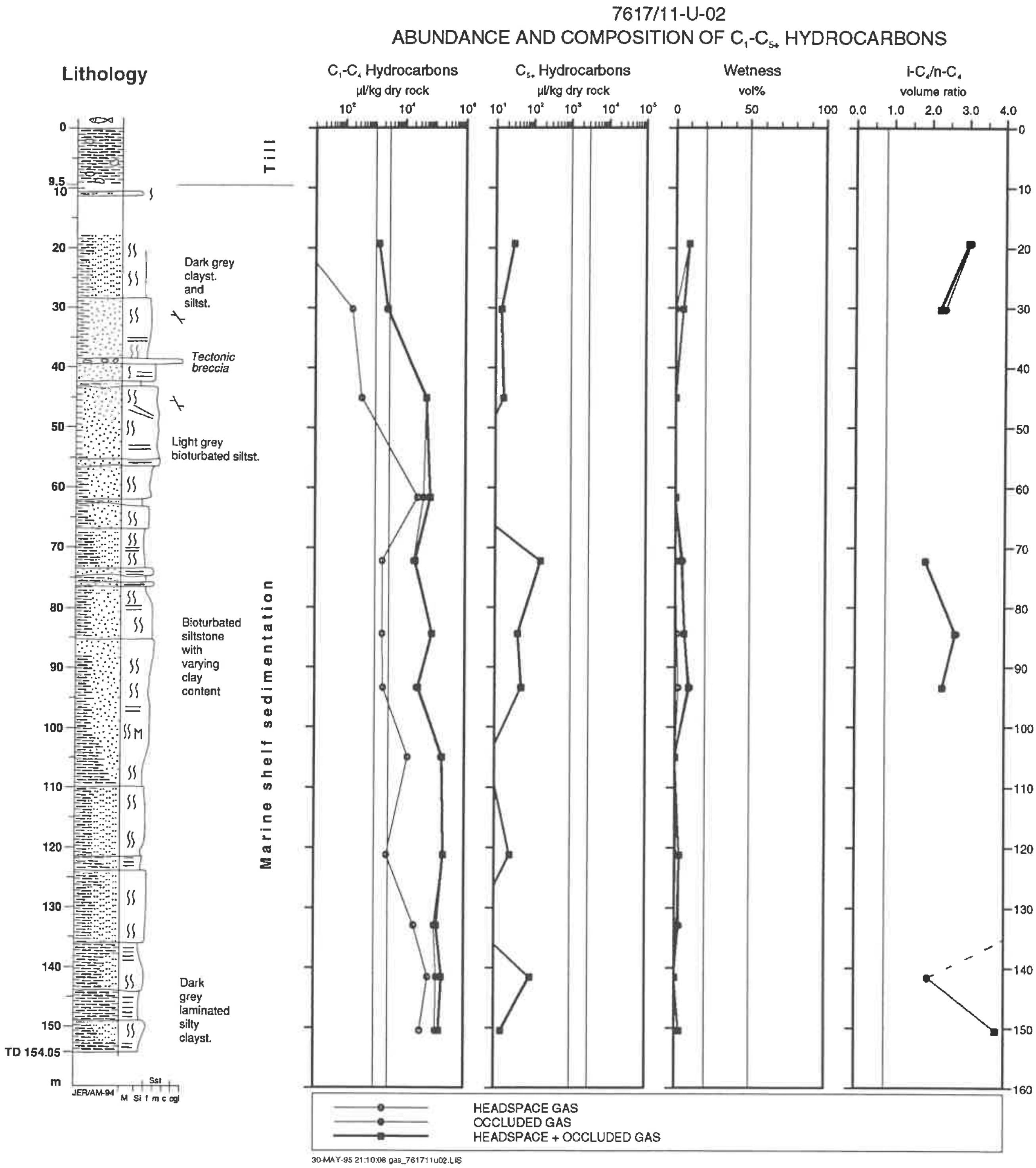

Figure 3.4.1 *Yield and composition of headspace/occluded gas of core 7617/11-U-02.*

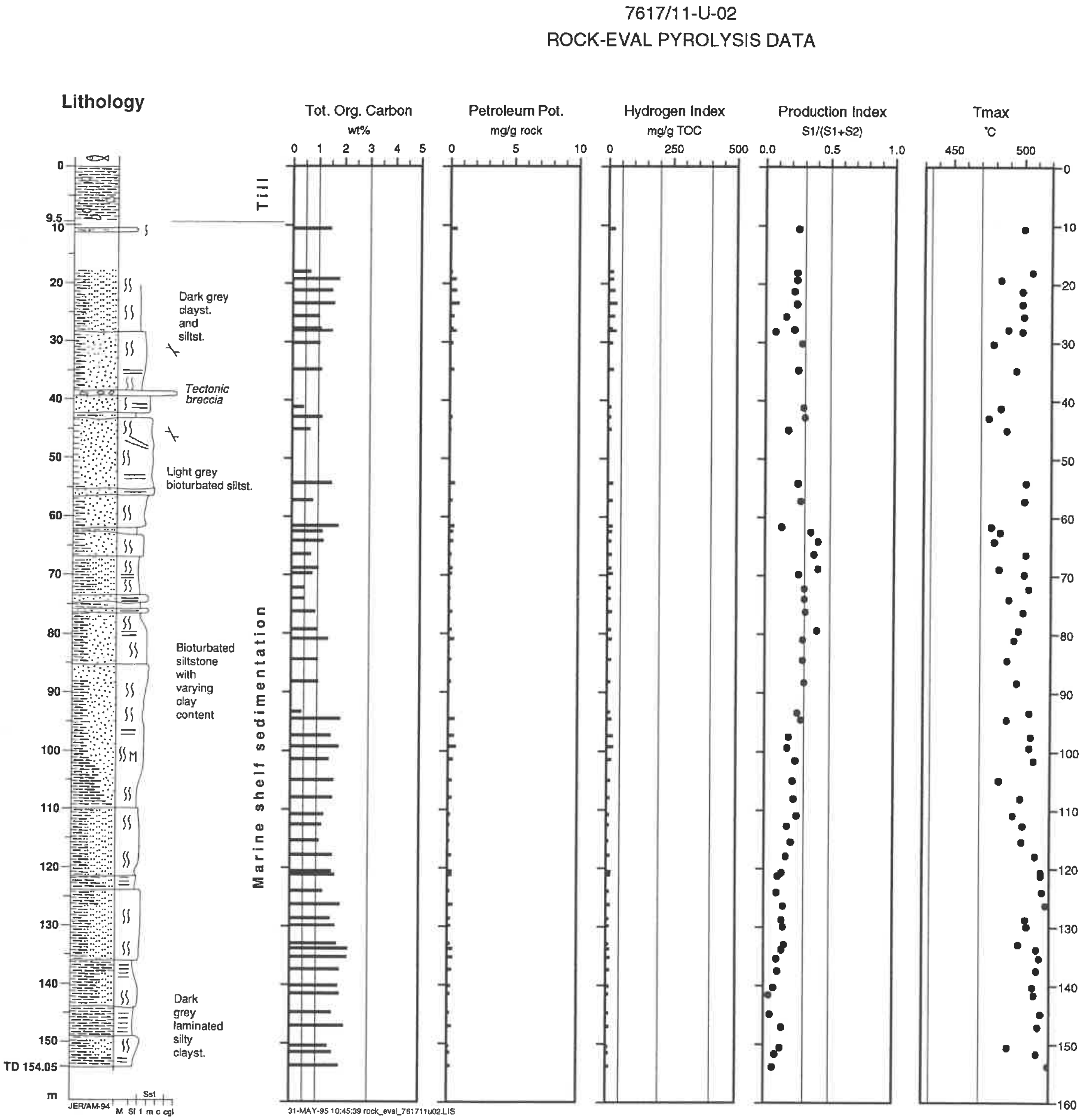

Figure 3.4.2 *Total organic carbon content and Rock-Eval data from core 7617/11-U-02.*

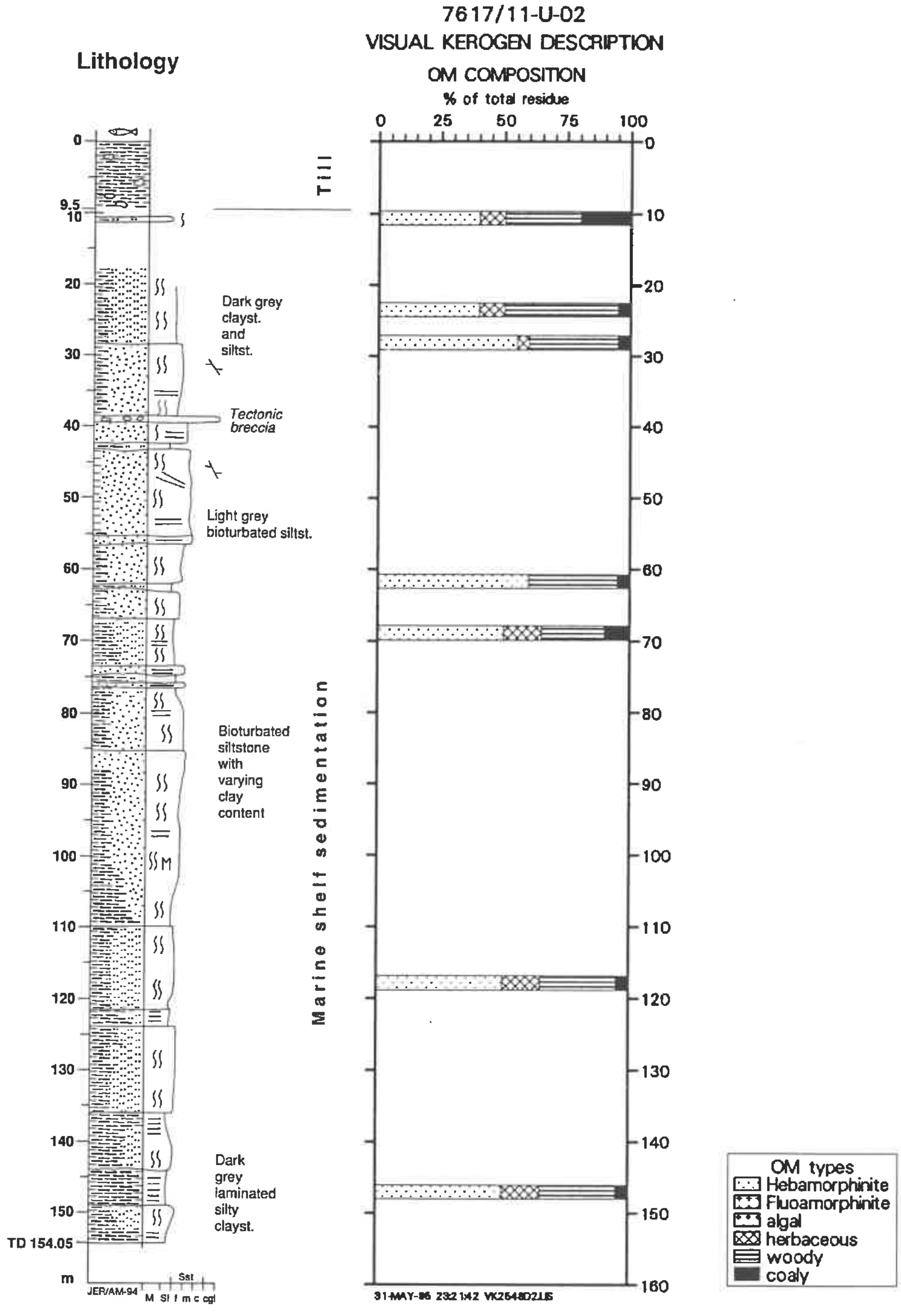

Figure 3.4.3 *Composition of organic matter in core 7617/11-U-02 determined by transmitted light microscopy.*

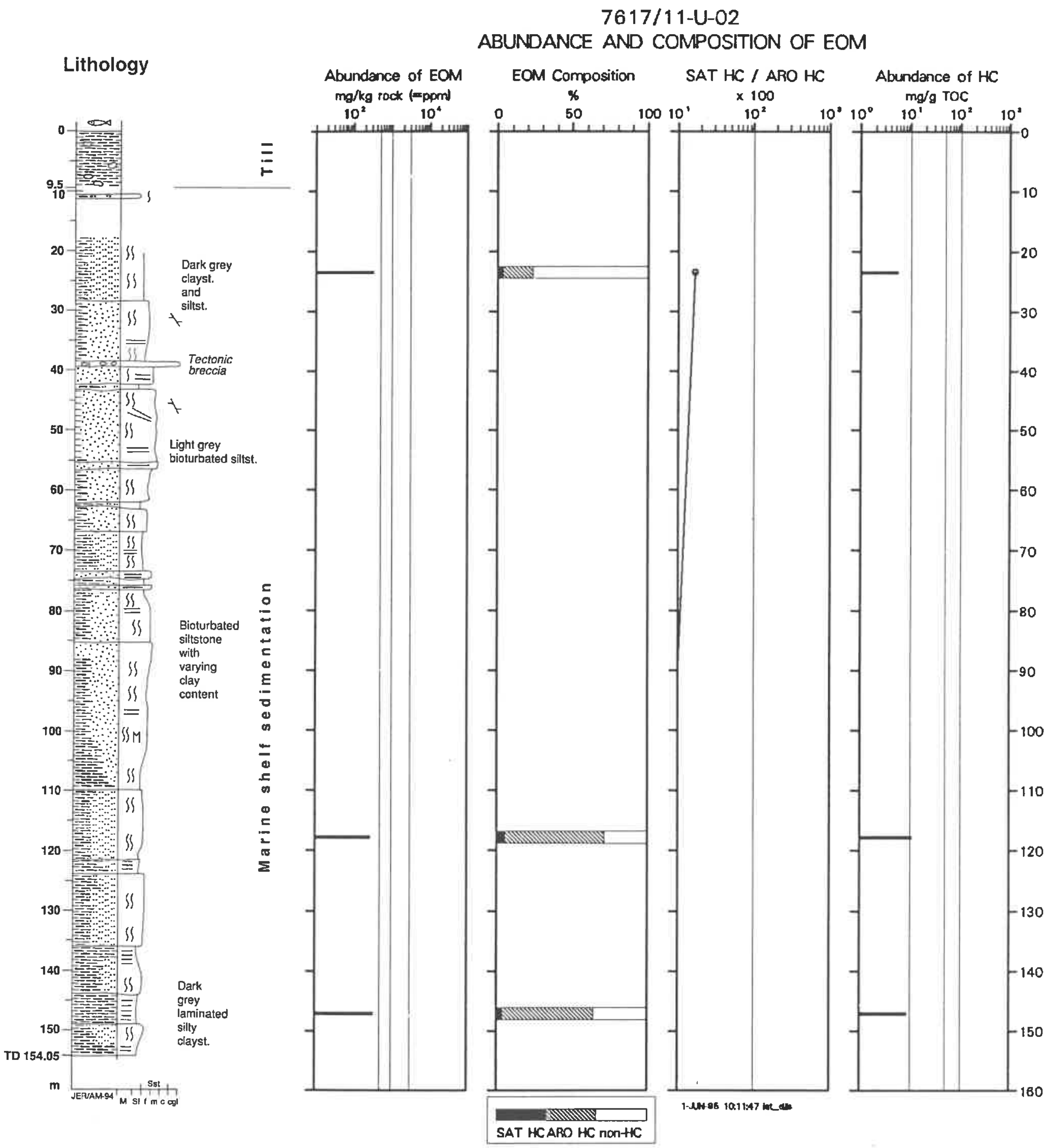

Figure 3.4.4 *Yield and bulk composition of extractable organic matter from core 7617/11-U-02 (TLC-FID data).*

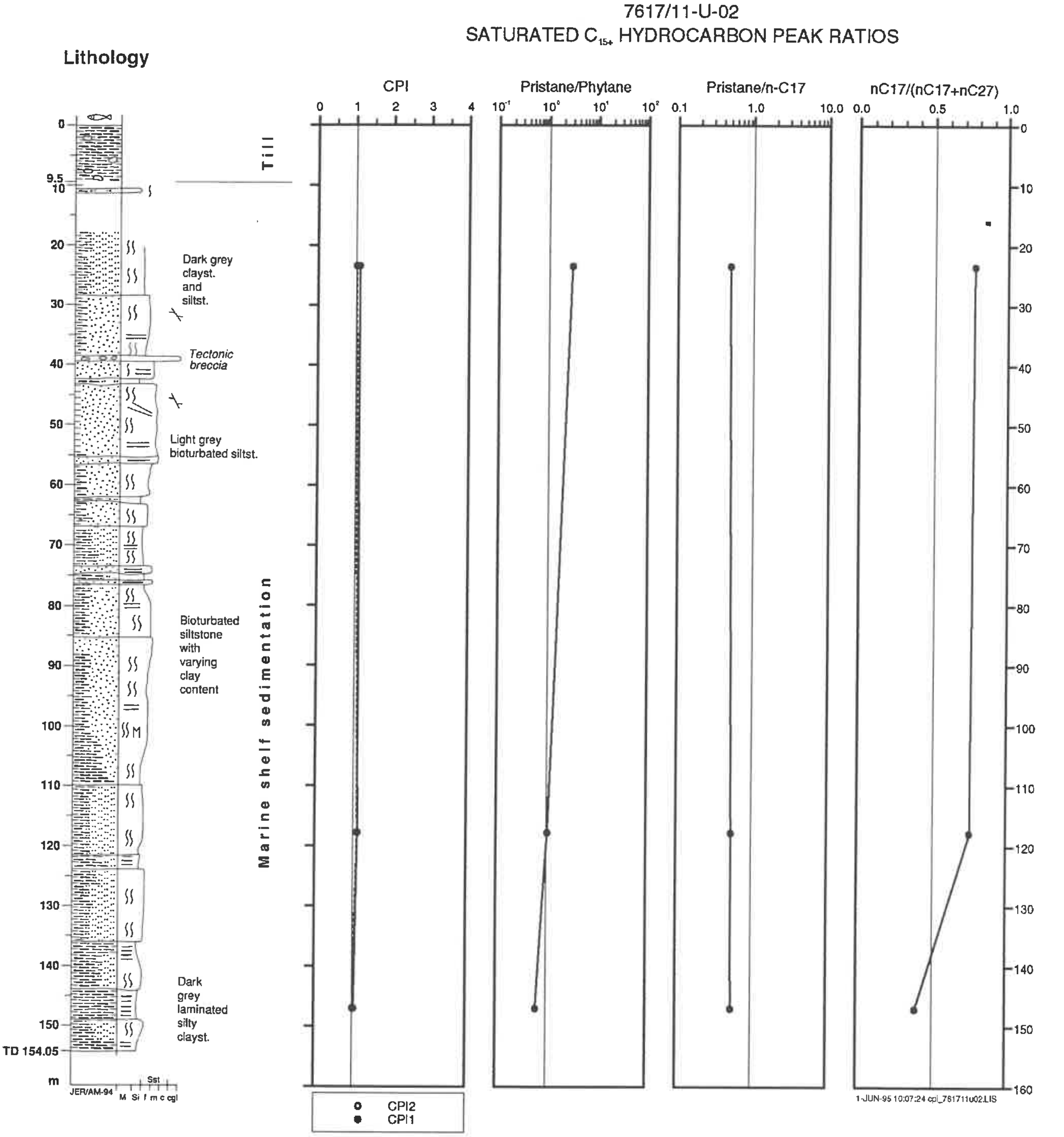

Figure 3.4.5 *Selected saturated hydrocarbon peak ratios from core 7617/11-U-02.*

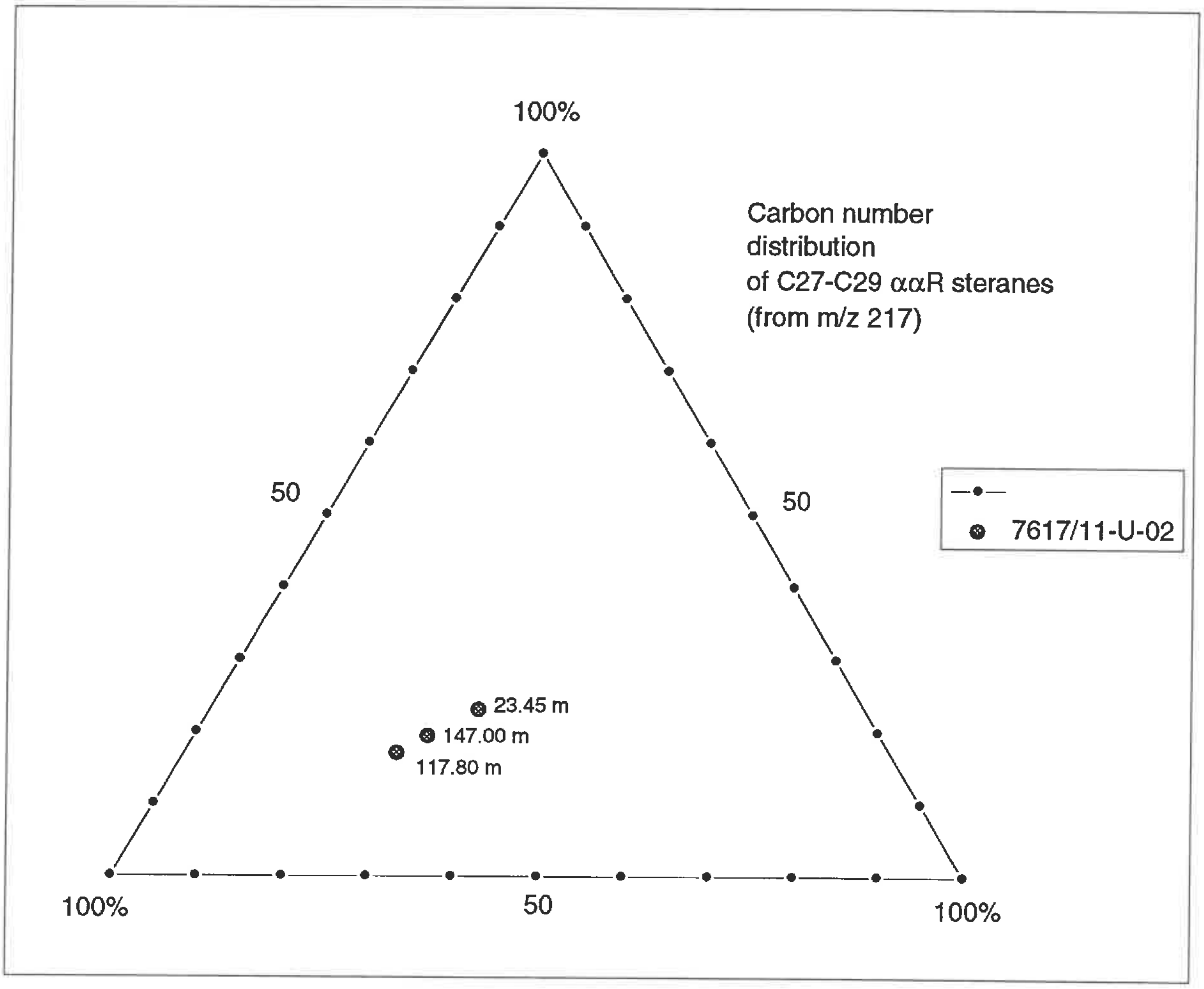

Figure 3.4.6 *Molecular distribution of regular C_{27}, C_{28} and C_{29} $\alpha\alpha\alpha R$ steranes in samples from core 7617/11-U-02 (from m/z 217).*

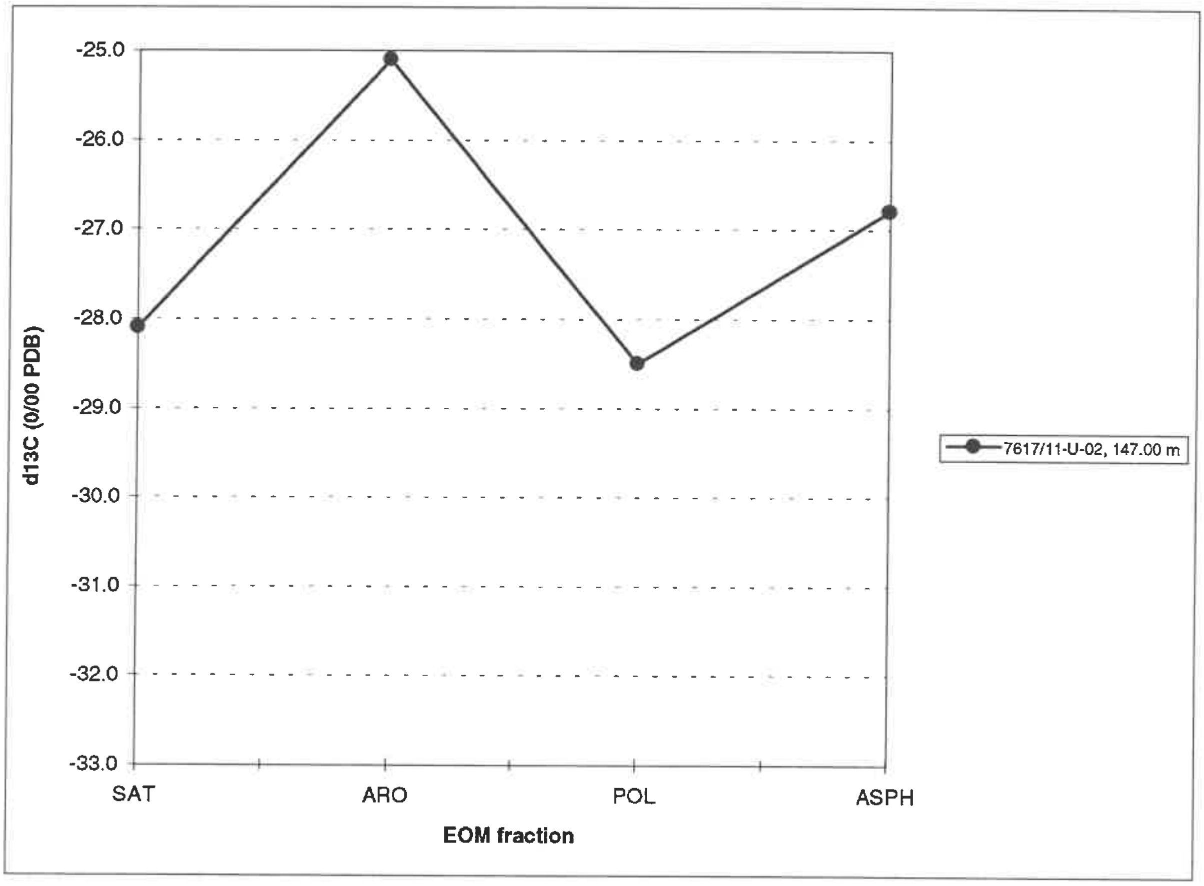

Figure 3.4.7 *Isotope type curves (Galimov plot) for EOM fractions from core 7617/11-U-02.*

3.5 Cores 7618/10-U-01 and -03

3.5.1 Headspace and occluded gas analysis

Three canned chip samples from core 7618/10-U-01 were analysed for light hydrocarbons in the headspace and occluded gas fractions (Figure 3.5.1). The uppermost sample (13.16 m) contained low concentrations of hydrocarbons (2000 µl/kg dry rock). The two remaining samples showed high hydrocarbon concentrations (232 000 - 346 000 µl/kg), most of the gas being contained in the occluded fraction. The hydrocarbons consisted of practically pure methane (<0.5% wetness). C_{5+} hydrocarbons were not detected in any of the samples.

3.5.2 TOC content and Rock-Eval pyrolysis

In total nine core chip samples were analysed from the two cores in order to determine the TOC content and Rock-Eval pyrolysis character. The organic carbon content varied between 0.2 and 3.1 wt%, the poorest samples being recorded at the top of the shallow marine sediment succession (Figure 3.5.2). The analysed rocks produced practically no pyrolysate and have no hydrocarbon potential. Accordingly, no reliable Tmax values could be obtained. S1 values of zero indicate that the sediments contain no migrated liquid hydrocarbons. No extract analyses were performed on the background of these results.

3.5.3 Vitrinite reflectance

Vitrinite reflectance measurements were carried out on one claystone sample from core 7618/10-U-01 (22.10 m) and one siltstone sample from core 7618/10-U-03 (19.25 m). The first sample showed a rock fabric with a typical "high rank" appearance and contained only a few phytoclasts which were poorly preserved and often heavily pyritised. The mean vitrinite reflectance value of 1.1% Rm suggests late oil-window maturity and is consistent with the very dull fluorescence of the rare sporinite particles. The phytoclasts in the second sample were very inertinitic in appearance, and the possible vitrinite particles were poorly preserved and often blocky. They gave a mean reflectance value of about 2% Rm. This high value is inconsistent with the weak sporinite fluorescence in the first sample and may reflect oxidation rather than maturity. Sporinite was absent from the second sample.

3.5.4 Visual kerogen description

Only one visual kerogen analysis was carried out (22.10 m in core 7618/10-U-01; Figure 3.5.3). The organic matter isolate consisted of non-fluorescent granular amorphous material (35%) and very poorly preserved particulate herbaceous matter which showed very weak brown fluorescence. There is no doubt that the organic matter in this core has a considerable thermal maturity (late oil window?), but no good TAI value could be obtained from this sample as the bisaccate pollen had very poorly preserved wall material. The estimated TAI value of 6 is therefore rather uncertain.

3.5.5 Summary for cores 7618/10-U-01 and -03

The sedimentary rocks from the cores 7618/10-U-01 and -03 are of poor to good organic richness but have no residual hydrocarbon generation potential. Thermal maturity could not be determined precisely, but probably corresponds to the late oil window or early gas window stage. The organic matter seems to contain mainly land-plant derived material and may therefore have had a rather limited initial hydrocarbon generation potential. It is now strongly degraded which might be related to the high maturity, but perhaps also to the substantial carbonate cementation of these rocks which is mentioned in the field report (Fanavoll et al. 1994). No migrated hydrocarbons were found in these cores. The locally abundant methane in the headspace and occluded gas may have been sourced from the mature organic matter in these rocks.

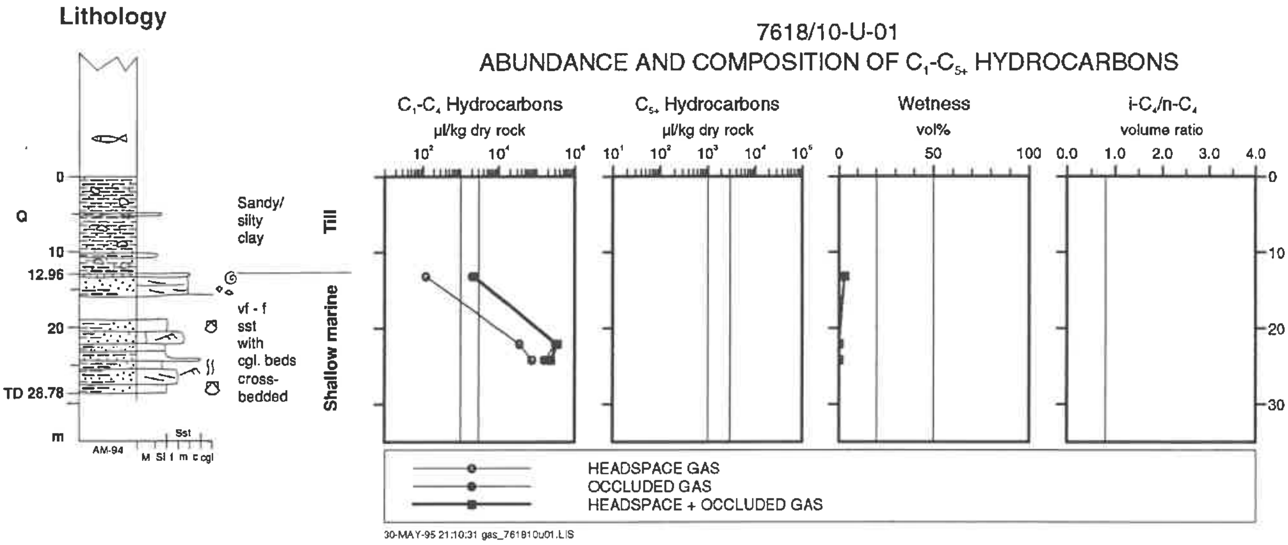

Figure 3.5.1 *Yield and composition of headspace/occluded gas of core 7618/10-U-01.*

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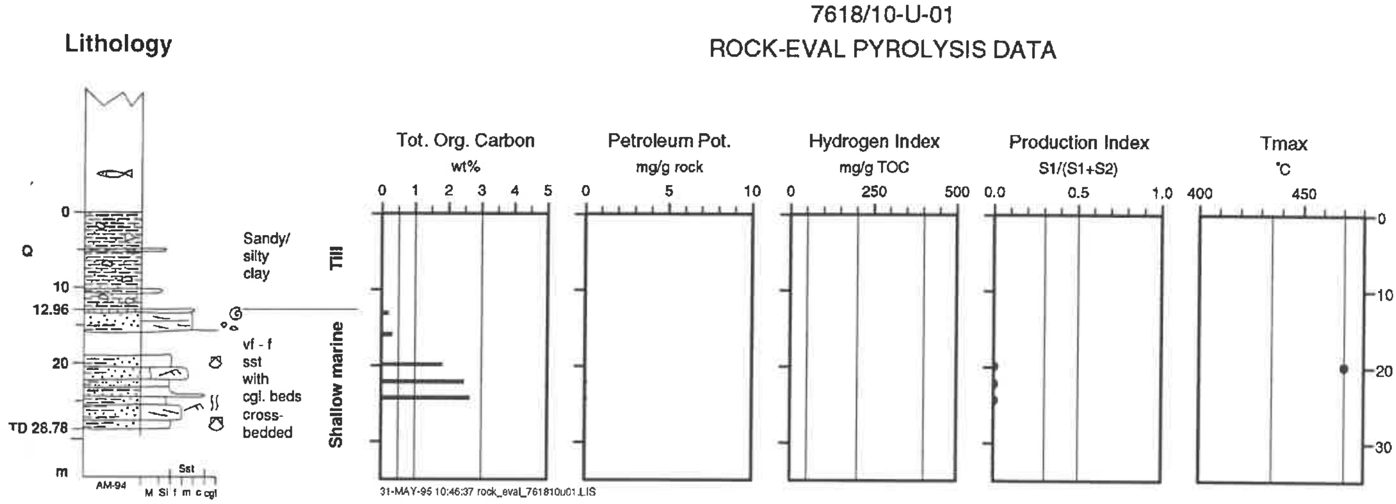

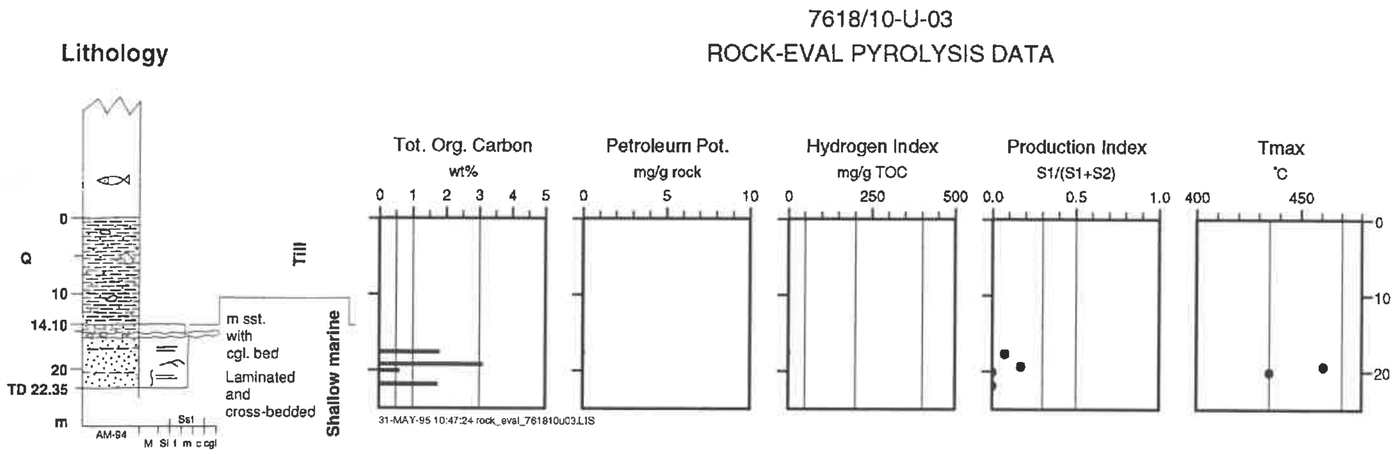

Figure 3.5.2 Total organic carbon content and Rock-Eval data from cores 7618/10-U-01 and -03.

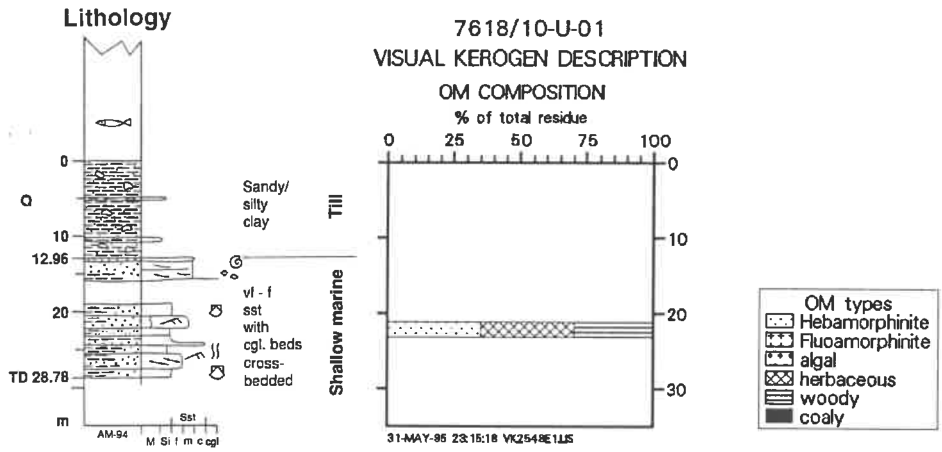

Figure 3.5.3 *Composition of organic matter in core 7618/10-U-01 determined by transmitted light microscopy.*

4. Correlation of oil staining in core 7418/01-U-01 and bitumen staining in core 7616/11-U-01 with potential arctic source rocks and oil staining

The data presented in Chapter 3 show that the visible oil staining and part of the bitumen found in core 7418/01-U-01 and core 7616/11-U-01 are non-indigenous to the rocks in which they occur. In the present chapter, an attempt will be made to correlate these hydrocarbons with some of the major known potential source rocks in the wider Barents Sea area and to compare them with oil staining found in Triassic to Tertiary rocks from the Barents shelf, the mid-Norwegian shelf and some isolated occurrences of oil staining and waxy coatings on Tertiary volcanic rocks on the Faeroe Islands and in West Greenland.

The correlation is based on stable carbon isotope ($\delta^{13}C$) and saturated biomarker data as these tend to be less strongly influenced by migration effects than the bulk composition and the overall saturated hydrocarbon composition.

4.1 Data base

The data base contained $\delta^{13}C$ data of EOM fractions and GC-MS data of saturated biomarkers from organic rich shales and oil-stained rocks. Sample locations are shown in Figure 4.1.1. The samples included:

- Triassic rocks:
  - Sassendalen Group, Svalbard (outcrop samples, IKU data)
  - Early-middle Triassic, Svalisdomen (shallow bedrock cores, IKU data)
  - Oil staining in Triassic sandstones, Hopendjupet (shallow bedrock cores, NPD/IKUdata)
- Upper Jurassic rocks
  - Hekkingen Formation, Nordkapp Basin (shallow bedrock cores, IKU data)
  - Hekkingen Formation, Bjarmeland Platform (shallow bedrock cores, IKU data)
  - Hekkingen Formation, Troms 3 (shallow bedrock cores, IKU data)
  - Agardhfjellet Mb. (Janusfjellet Fm.) Spitsbergen and Kong Karls Land (outcrop samples, IKU data).
- Cretaceous rocks:
  - Kolje Formation, western Barents Sea (exploration wells, data from various operator companies, supplied by NPD)
  - Hauterivian/Barremian, Nordland 7 (shallow bedrock cores, IKU data)
  - Oil staining in Barremian sediments, Troms 3 (shallow bedrock cores, IKU data)
- Tertiary rocks:
  - Bitumen staining (wax) in volcanic rocks and extract from Paleocene coal from the Faeroe Islands (data published by Laier et al. 1993)
  - Oil staining in Tertiary volcanites West Greenland (data published by Christiansen et al. 1994)

Before the data are discussed, it is necessary to note that data collected by different laboratories and over a long period of time will inevitably contain certain inconsistencies related to variations in instrumentation, analytical procedures and reporting style. This problem is usually negligible with stable isotope data due to the use of internationally standardised calibration samples and prodecures. The GC-MS data used in this study, however, were produced, processed and reported in different ways. Exclusion of seldomly reported variables and normalisation of uncalibrated peak data reduced the inconsistencies, but may have destroyed geochemically relevant information such as the hopane/sterane ratio. This should be borne in mind during the following discussion.

4.2 Geochemical characteristics of samples used in the correlation

In the following some significant geochemical characteristics of the samples used in the correlation will be summarised, referring to the Figures 4.2.1 to 4.2.8, in which isotope and biomarker ratios of the Nordflaket samples are compared with those of potential source rocks and associated oil staining. A more detailed discussion of the organic geochemistry of Triassic and Upper Jurassic source rocks and oil staining in the Barents Sea area can be found in Leith (1991) and Leith et al. (1993).

Lower-middle Triassic:

- Source-related parameters such as regular sterane composition appear to vary rather little.
- C_{24}-C_{30} tricyclic diterpanes occur both in moderately mature indigenous extracts (particularly those from the Botneheia Formation on Svalbard) and in migrated hydrocarbons. C_{28}-C_{29} tricyclic diterpanes occur in nearly all Triassic staining, but rarely in Upper Jurassic oil staining.
- 28,30-bisnorhopane (28$\alpha\beta$) may occur in Triassic oil staining but not in indigenous extracts.
- Oil staining in Triassic sandstones from Hopendjupet share a number of features with indigenous hydrocarbons and oil staining found in other Lower-Middle Triassic rocks, particularly the occurrence of tricyclic diterpanes up to C_{30}.

Upper Jurassic:

- The biomarker composition is much more variable than in the Triassic shales, probably due to generally higher and more variable terrestrial input to the Upper Jurassic shales
- As for the Triassic shales, 28,30-bisnorhopane occurs only in oil-stained samples, but not in indigenous extracts. This contrasts with time-equivalent shales in the North Sea, where this compound is more common.
- The Upper Jurassic extracts have generally a heavier and more variable stable carbon isotope composition than the Triassic extracts, which may reflect the larger variation in both thermal maturity and terrestrial organic input to the Upper Jurassic shales. The Hekkingen Formation of the Bjarmeland Platform, however, is isotopically similar to the Triassic shales and staining, possibly due the weaker terrestrial input in this more distal setting.

Cretaceous:

- Extracts from a very rich, moderately mature, oil-prone source rock that occurs in the Kolje Formation of well 7321/9-1 in the Bjørnøya Basin show lower diasterane / normal sterane ratios than most Upper Jurassic and Triassic rock extracts when plotted versus the %20S sterane isomerisation ratio (Figure 4.2.5; also see Augustson et al. 1993). This also applies to the extracts of Barremian rocks from the Nordland 6 area. 28,30-bisnorhopane appears to be present in low concentrations in all these extracts.
- Samples from organic-rich, rather mature intervals of the Knurr Formation in well 7219/8-1S contain relatively high concentrations of 28,30-bisnorhopane and diasteranes.
- Hydrocarbon fractions from Cretaceous rock extracts from the Troms 3 area are isotopically heavier than the hytdrocarbons from the Triassic rocks. The values show relatively little variation, suggest a predominantly marine source, and are similar to the values obtained from the visible oil staining in core 7418/11-U-01.

Tertiary:

- Seep oils found in Paleocene vesicular lavas on the Nuussuaq peninsula in West Greenland contain relatively high concentrations of oleanane and bisnorlupane whose occurrence is limited to late Cretaceous and Tertiary rocks. The oils are weakly to strongly biodegraded and are thought to be drived from an early mature source rock of terrestrial origin. The oils have a rather heavy stable carbon isotope composition ($\delta^{13}C_{ARO}$ = -26$^{0}/_{00}$ PDB).
- Coatings of solid bitumen described from a volcanic sequence of the Faeroe Islands (Laier & Nytoft 1993) have a mature biomarker composition and contain oleanane.

4.3 Comparison of selected isotope and biomarker ratios

A comparison of selected isotope and saturated biomarker ratios resulted in the following observations and conclusions:

- The oil staining at Nordflaket has a relatively immature biomarker composition. This becomes apparent from the various isomerisation ratio crossplots (Figures 4.2.1 - 4.2.5).
- Triangular plots of the regular C_{27} - C_{29} sterane composition do not allow a clear assignment between the Nordflaket staining and a particular group of potential source rocks, as their data overlap to a large degree (Figures 4.2.6 bottom and 4.2.7). A triangular plot of the C_{27}-C_{30} hopane composition shows little overlap between Triassic and Upper Jurassic rock extracts (Figure 4.2.8). The visible oil staining from Nordflaket core 7418/01-U-01 and the staining from Hopendjupet plot close together in the field of the Triassic extracts, while most of the unstained Nordflaket samples plot together with the Upper Jurassic extracts.
- The Nordflaket staining contains no C_{27}-C_{29} tricyclic diterpanes, which occur in nearly all staining associated with Triassic rocks. The Nordflaket staining also has a significantly heavier stable carbon isotope composition than most Triassic extracts included in this study despite its low maturity. These discrepancies suggest that the Nordflaket staining is unlikely to be sourced from one of the known Triassic source rocks in the area, particularly not from a Botneheia-type rock.

- The isotope values of the Nordflaket staining overlap with those of thermally immature Upper Jurassic rocks of the Bjarmeland Platform and from Nordland 7, but also with those of Cretaceous rock extracts from the Troms 3 area (Figure 4.2.1). The oil staining in Tertiary rocks of West Greenland has a significantly heavier isotopic composition than the oil staining in core 7418/01-U-01, which cannot be explained fully by its slightly higher maturity and thus may reflect a different source input.
- The occurrence of 28,30-bisnorhopane in the Nordflaket staining is inconclusive with regard to the source, as this compound can be found in oil staining associated with both Triassic and Upper Jurassic rocks. It also appears to occur, at least in low concentrations, in extracts from rocks of the Kolje Formation.
- The relatively high diasterane/normal sterane ratio of the Nordflaket staining contrasts with the rather low ratios of the Kolje Formation extracts which have similar maturity. In regard of the analytical differences and the low number of analyses, this criterion alone may not be sufficient to exclude a Cretaceous source for the Nordflaket staining.
- The occurrence of oleanane in the extracts from two bitumen-stained samples in core 7418/11-U-01 suggests that these hydrocarbons have come into contact with late Cretaceous or Tertiary rocks, but it does not necessarily indicate that such rocks are the only or major source of these migrated hydrocarbons. One should not exclude the possibility that this specific biomarker represents "contamination" which was picked up when the migrating hydrocarbons passed an organic-rich (immature?) rock of late Cretaceous or Tertiary age.

In summary, the isotope and biomarker data available to this study are not very conclusive as to the origin of the oil staining in the Nordflaket cores. It appears, however, that the known Triassic rocks in the area are the most unlikely source of these hydrocarbons.

4.4 Multivariate analysis of biomarker data

The biomarker data were statistically analysed using principal component analysis[6] (PCA) in order to evaluate whether the conclusions drawn from the comparison of selected peak ratios would be supported by the variation in the whole variable set.

As calibration information was unavailable for the Triassic samples, the terpane (m/z 191) and sterane (m/z 217) peak heights were normalised separately. Some peaks which were not consistently registered and some which are subject to coelution were removed from the data set. Each variable was scaled to a variance of 1 in order to reduce the influence of the most abundant compounds (e.g. C_{30} hopane).

Figure 4.3.1 shows the score and loading plots for the first two principal components (PC) which together explain 35.1% of the total variance in the data. PC2 separates mainly the samples of the Knurr Fm. of well 7219/8-1S from the remaining samples, probably due to the relative content in some diasteranes and diterpanes (see loading plot). Although this may indicate that the biomarker composition of these samples is

[6] Sirius software from Pattern Recognition Systems a.s. in Bergen was used

significantly different from that of the remaining samples, one should not exclude the possibility of an analytical effect, as the Knurr data are from one particular laboratory. PC1 separates the Triassic samples of Svalbard from the Triassic samples of the Svalisdomen, however does not separate Triassic from Upper Jurassic samples (Figure 4.3.2). Samples of the Hekkingen Formation (Barents Sea, Troms 3, Nordland 7) form a common group stretched along the PC3 axis with the Triassic samples from the Svalisdomen, and the scores of the Jurassic samples from Svalbard overlap to some degree with those of the Triassic on Svalbard, but are separated from the Hekkingen samples.

The Hopendjupet staining plots close to the Triassic samples of the Sassendalen Group of Svalbard and partly overlaps with the Knurr Fm. samples from well 7219/8-1S. In contrast, the scores of the Nordflaket staining are more similar to those of the Upper Jurassic rocks from Svalbard (Janusfjellet Fm./Agardhfjellet Mb.), Bjarmeland Platform (Hekkingen Fm.), Nordland 7 (Hekkingen/Spekk Fm.) and the Triassic rocks from the Svalisdomen area which show a generally lower content in tricyclic diterpanes than the Botneheia-type rocks of Svalbard.

A score plot of PC3 vs. PC 2 (not shown) separates the Knurr Fm. 7219/8-1S and Kolje Fm. 7122/2-1 from the remaining samples, but allows no further differentiation. Score and loading plots of higher principal components were examined but appeared to give no additional information.

In conclusion, the results of the multivariate analysis basically confirmed the conclusion drawn from the examination of individual peak ratios and suggests that the oil staining in core 7418/011-U-01 is different from the staining in the Hopendjupet cores, and is unlikely to be sourced from Lower-Middle Triassic rocks of the Botneheia type. No clear picture was obtained as to the relative probabilities for the remaining sources, but no arguments speak against an Upper Jurassic source.

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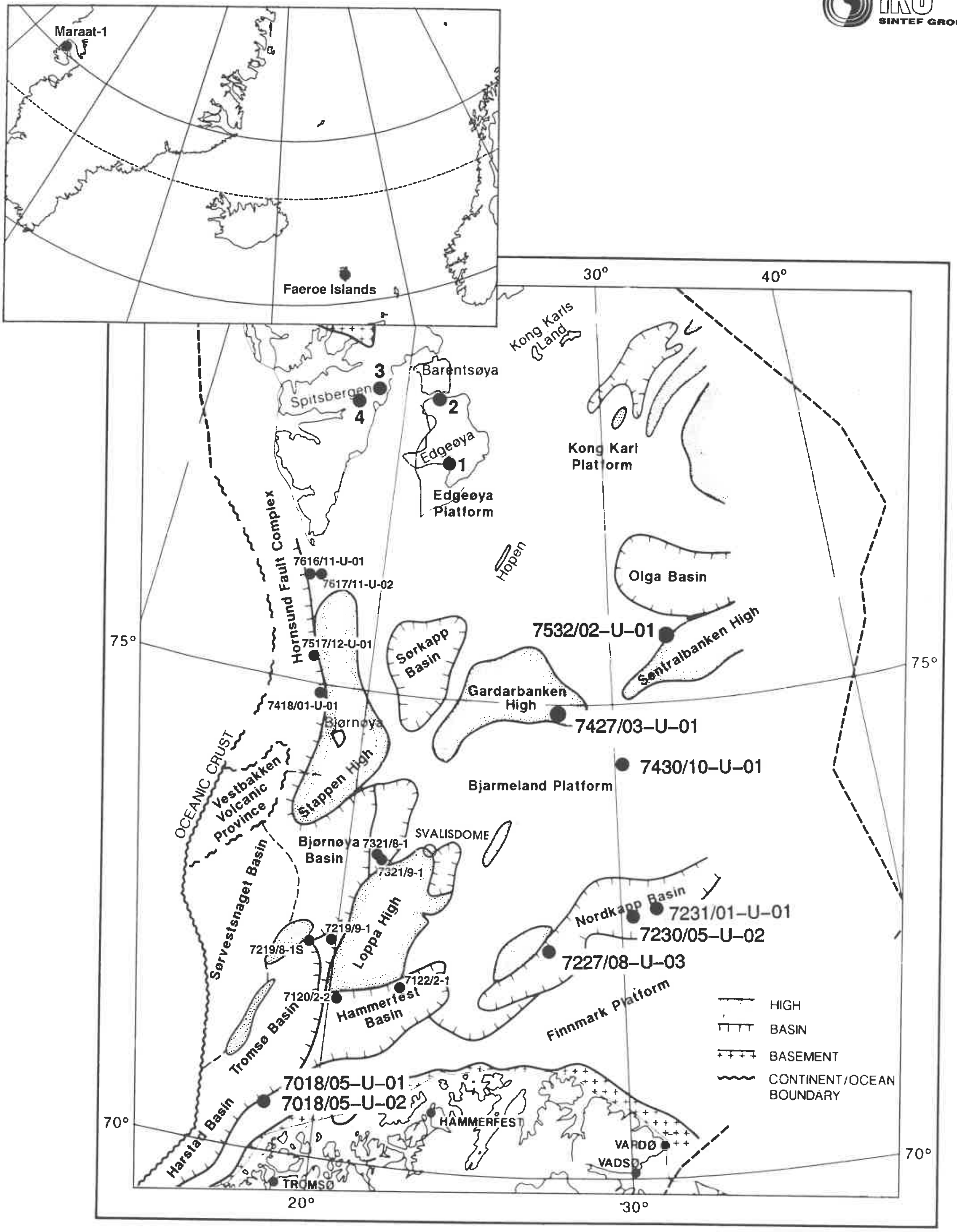
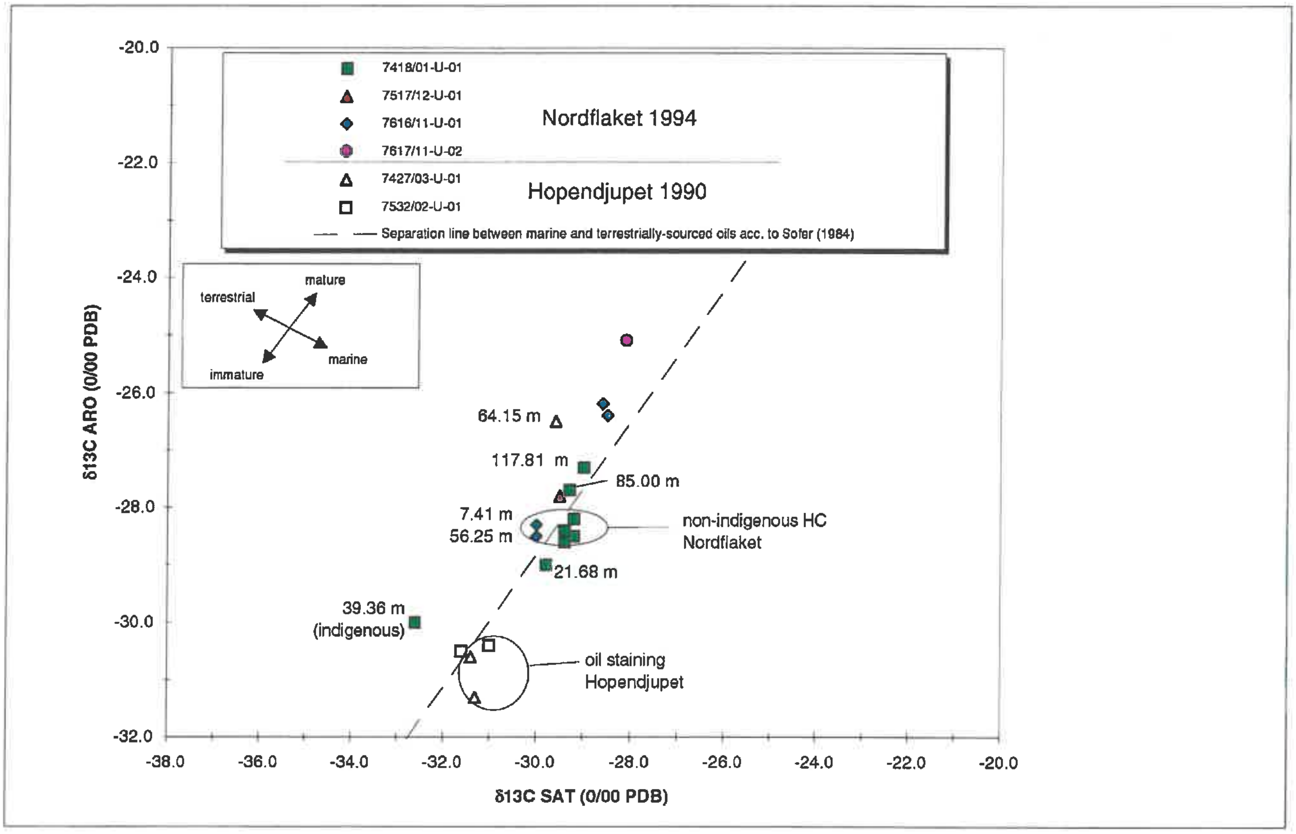


Figure 4.1.1 *Map showing the locations of shallow coring sites, outcrops and exploration wells used in this study. On Svalbard: 1 = Veidemannen, 2 = Skrukkefjellet, 3 = Roslagenfjellet, 4 = Jinbreen.*



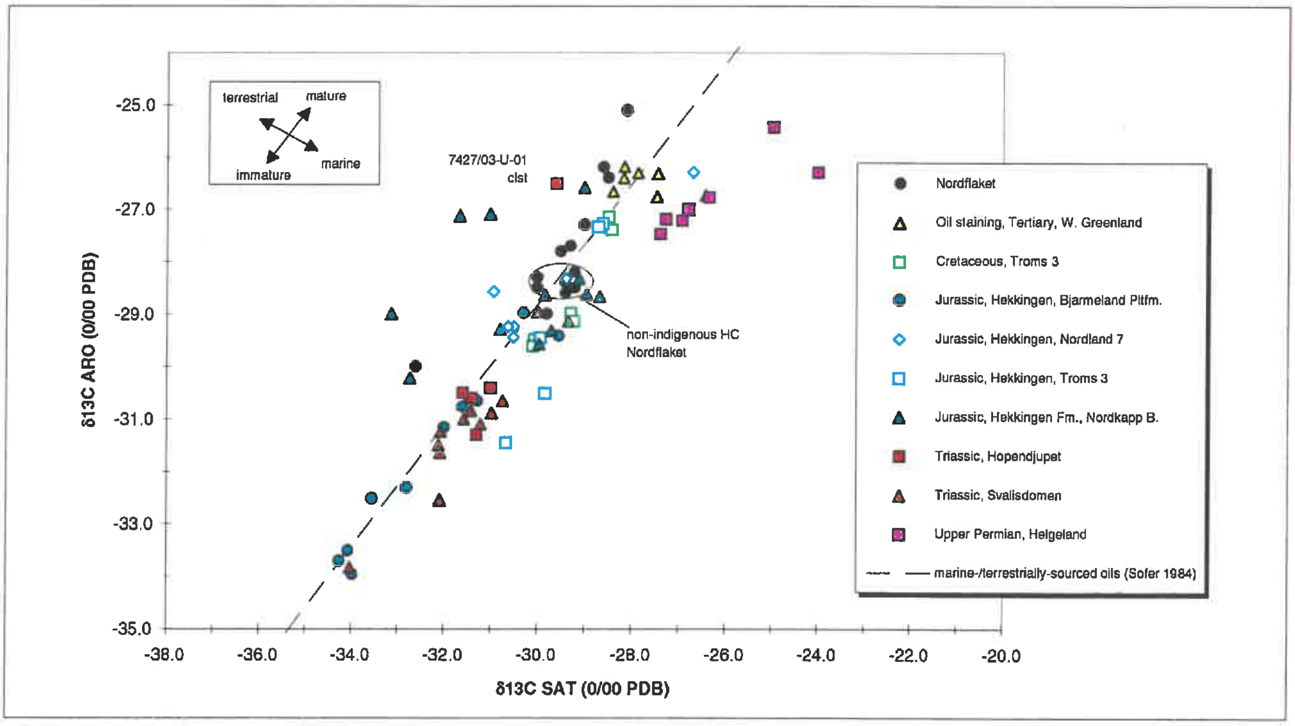


Figure 4.2.1 *Stable carbon isotope ratios $\delta^{13}C_{ARO}$ vs. $\delta^{13}C_{SAT}$ (Sofer plot): Top: Samples from Nordflaket 1994 and Hopendjupet 1990. Bottom: All samples used in this study.*

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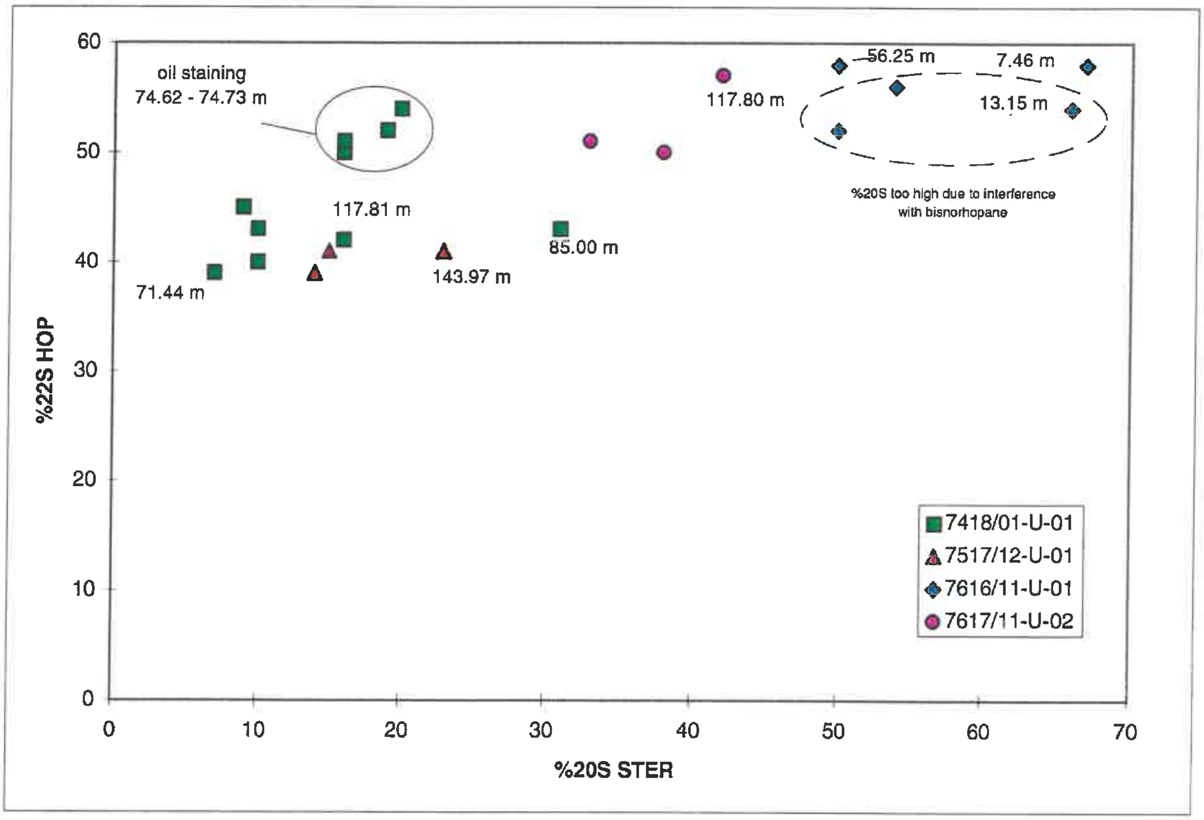


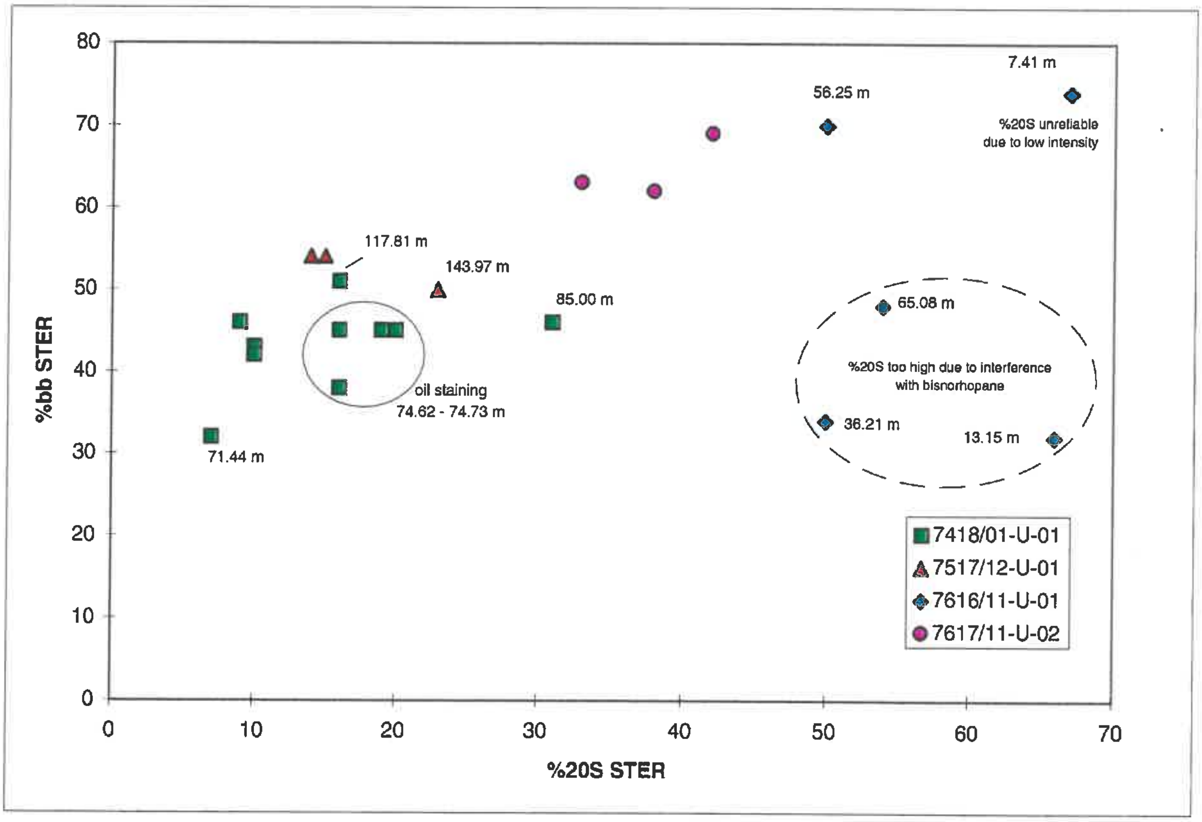


Figure 4.2.2 Hopane isomerisation ratio %22S vs. sterane isomerisation ratio %20S (top) and sterane isomerisation ratio %$\beta\beta$ vs. sterane isomerisation ratio %20S (bottom) for the samples from Nordflaket.

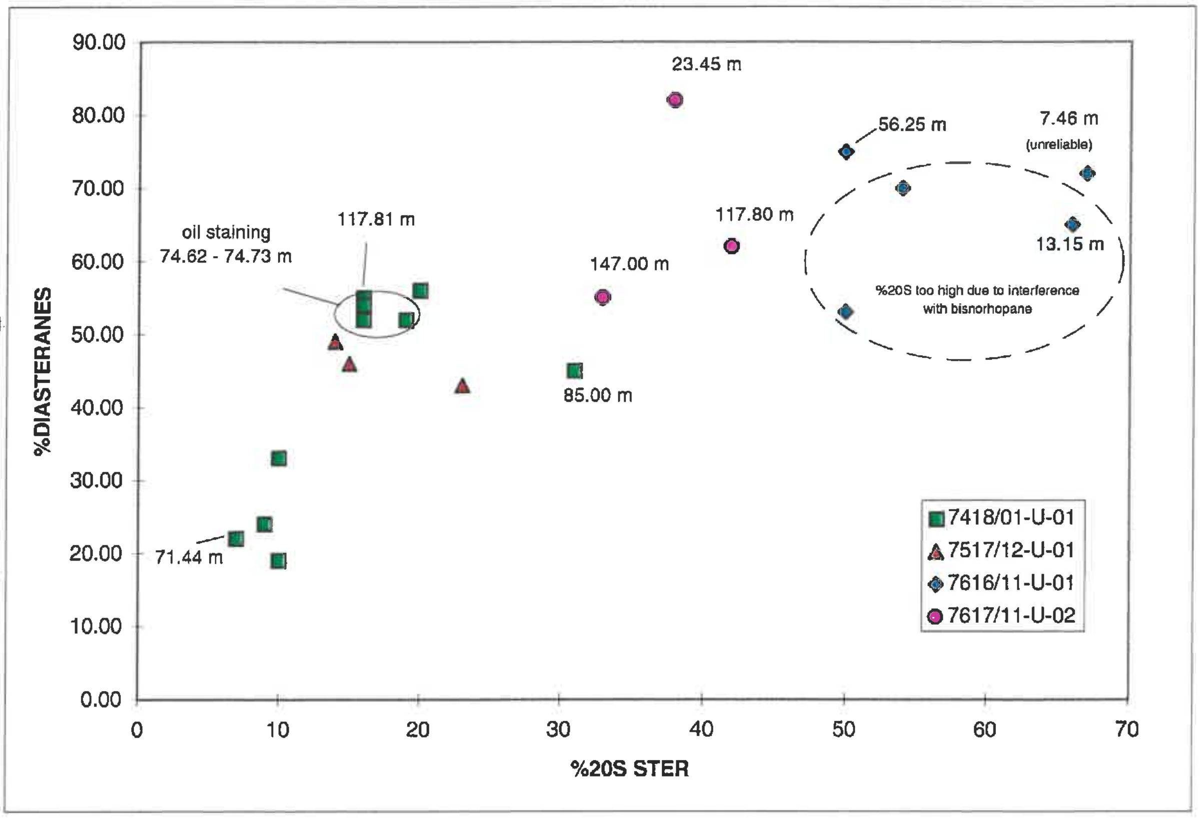


Figure 4.2.3 Relative abundance of diasteranes vs. sterane isomerisation ratio %20S for the samples from Nordflaket.

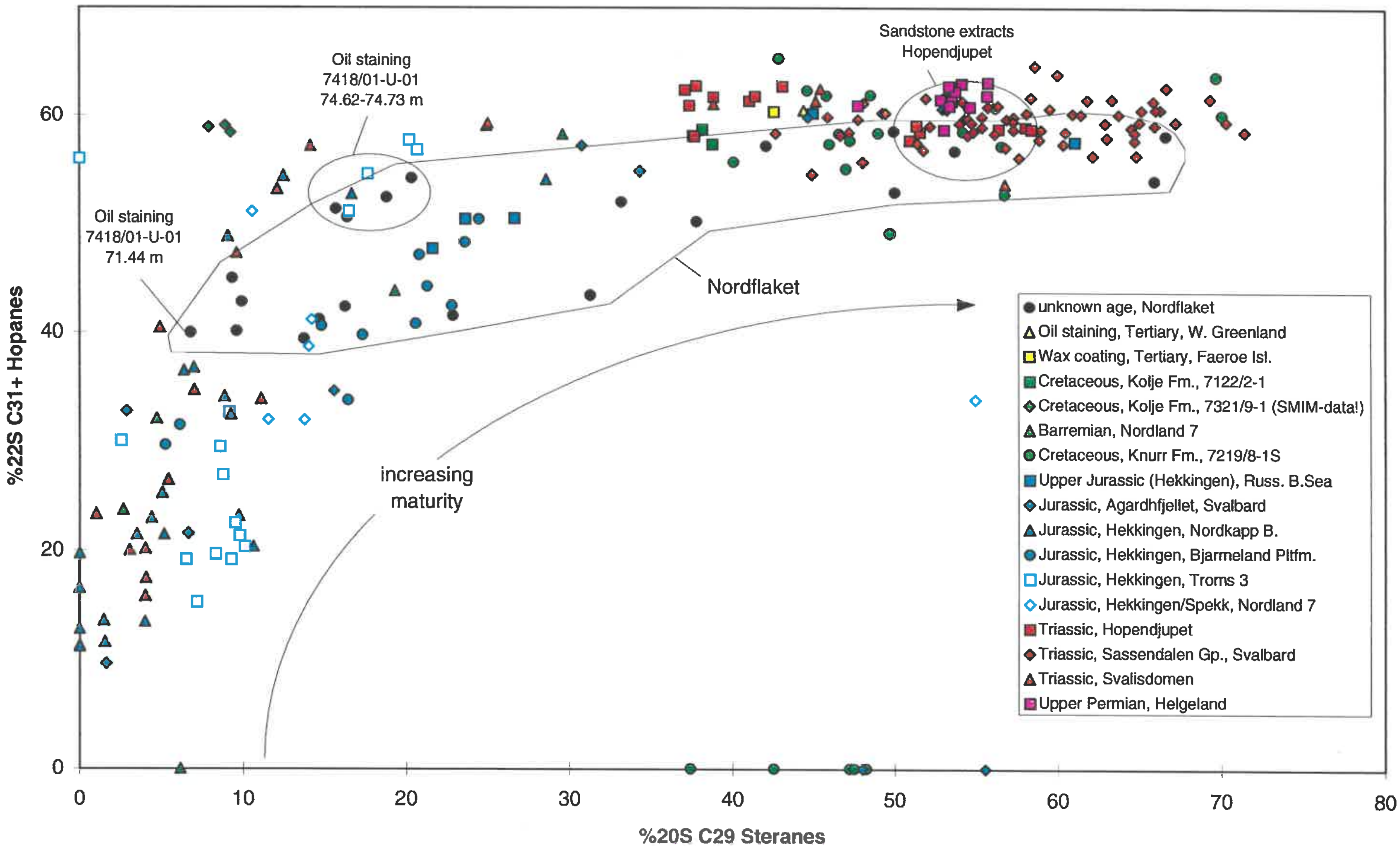


Figure 4.2.4 Hopane isomerisation ratio %22S vs. sterane isomerisation ratio %20S (top) and sterane isomerisation ratio %ββ vs. sterane isomerisation ratio %20S (bottom) for all samples used in this study.

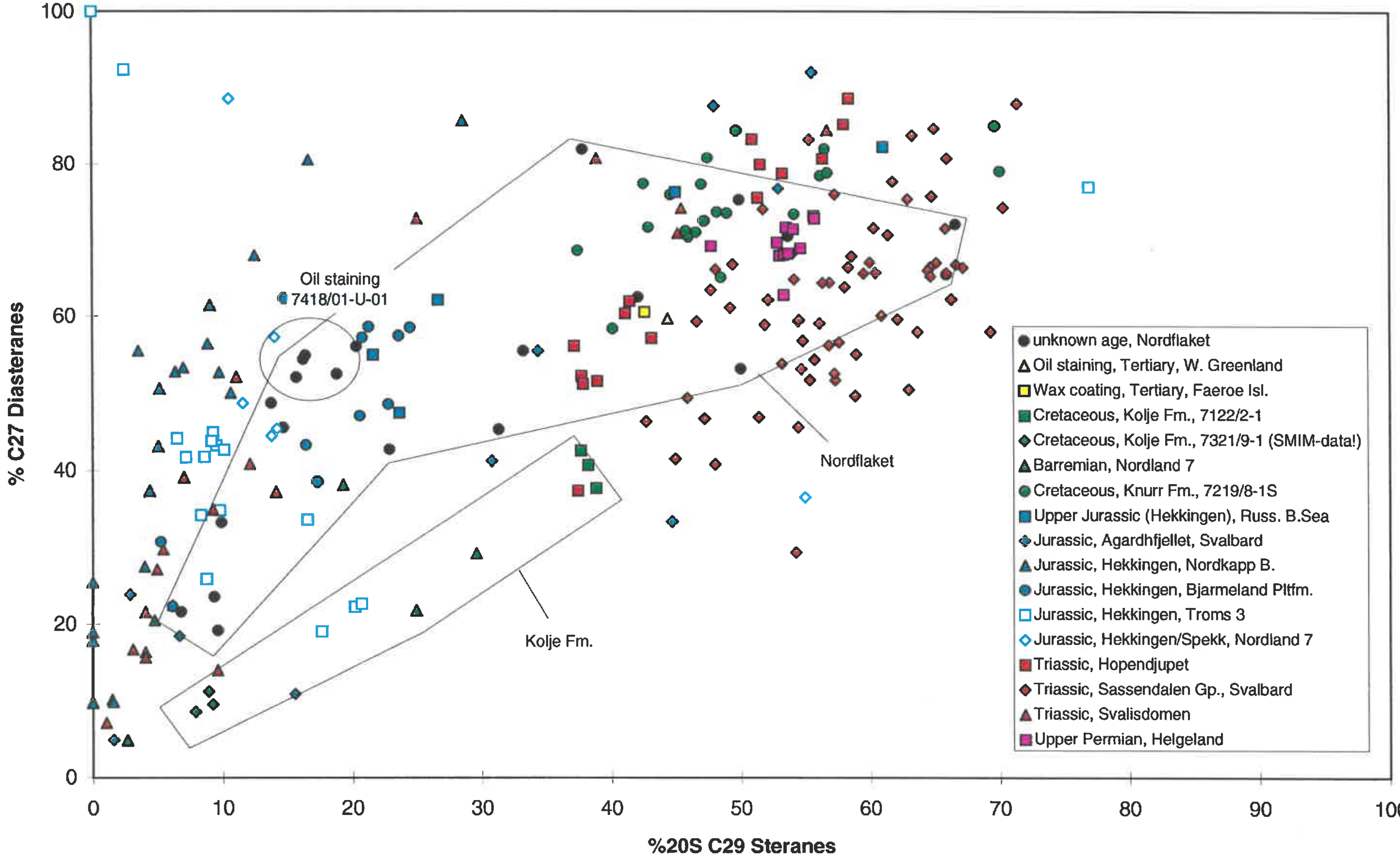
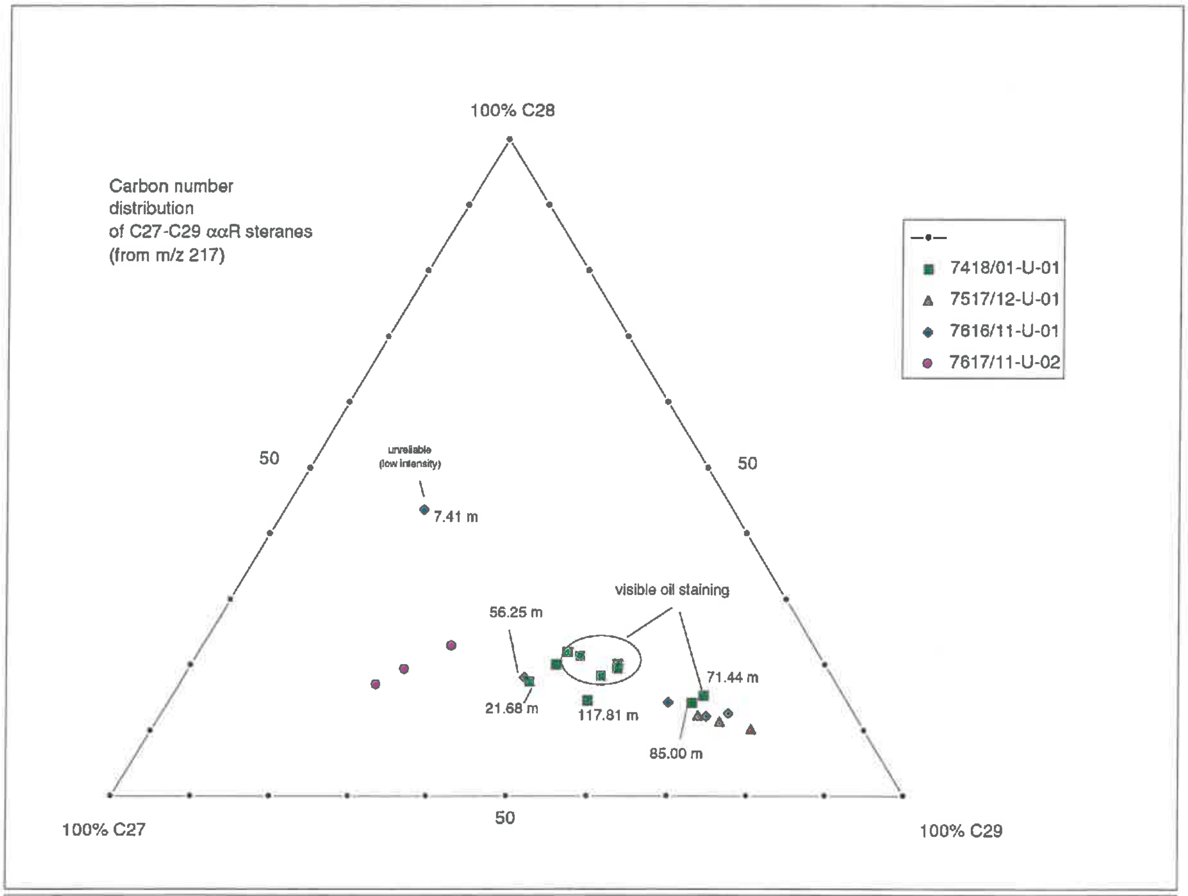


Figure 4.2.5 Relative abundance of diasteranes vs. sterane isomerisation ratio %20S for all samples used in this study.



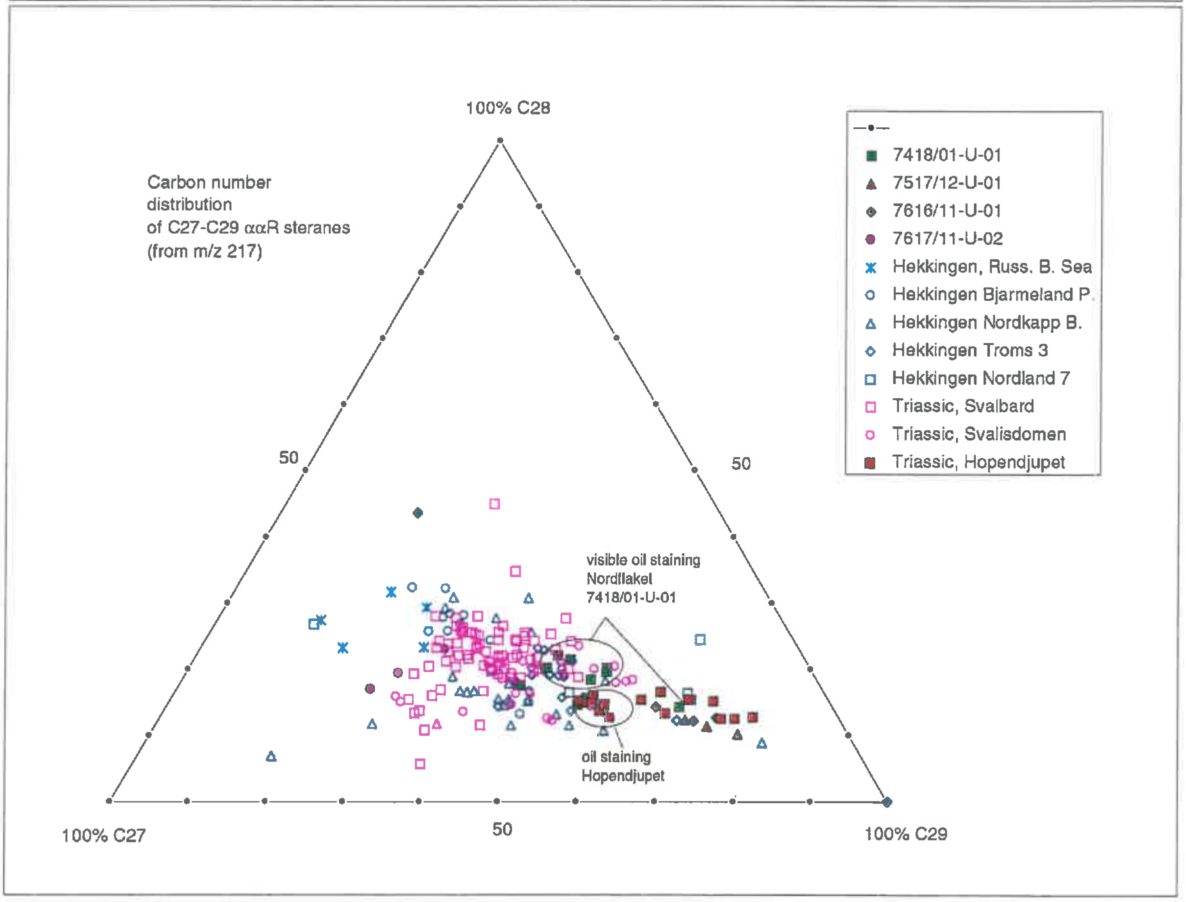


Figure 4.2.6 Internal distribution of C_{27}, C_{28} and C_{29} αααR steranes. Top: Samples from Nordflaket. Bottom: Samples from Nordflaket, Hekkingen Fm. and Triassic rocks.

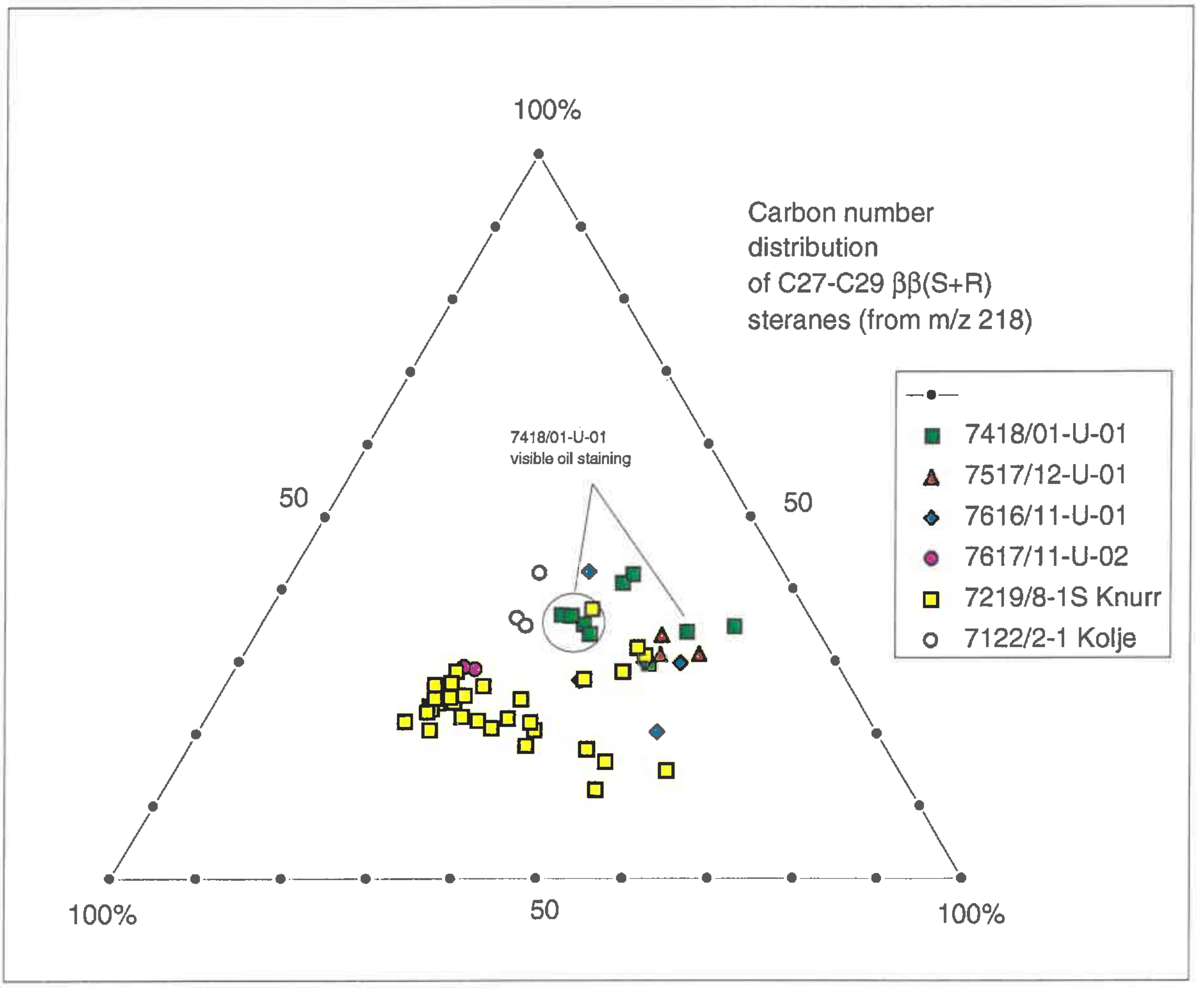


Figure 4.2.7 Internal distribution of C_{27}, C_{28} and C_{29} $\beta\beta(S+R)$ steranes. Samples from Nordflaket, Knurr Fm. well 7219/8-1S and Kolje Fm. 7122/2-1.

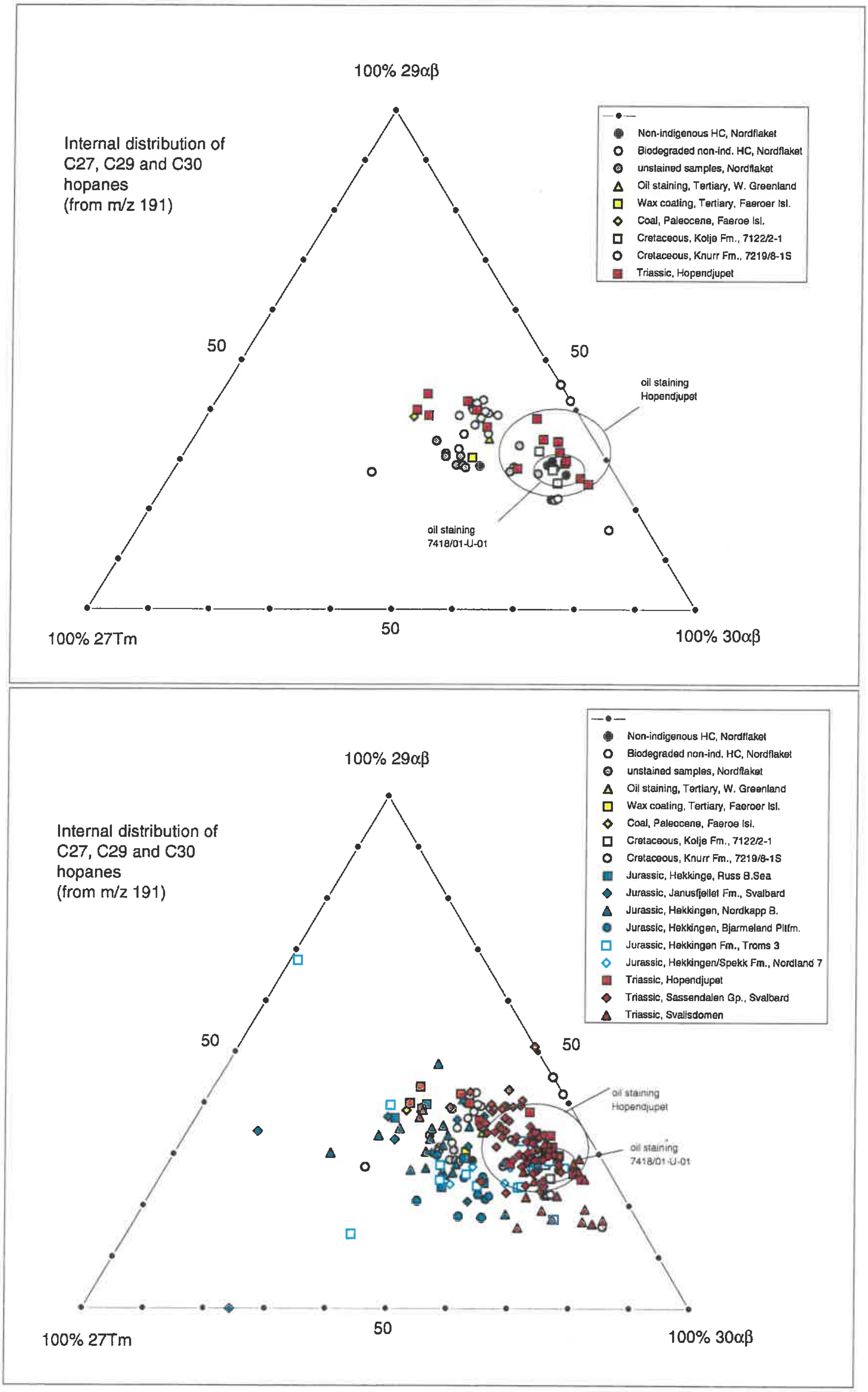


Figure 4.2.8 Internal distribution of hopanoid compounds 27Tm, 29αβ and 30αβ. Top: Samples from Nordflaket together with samples from Tertiary and Cretaceous rocks and oil staining. Bottom: Samples from Nordflaket together with samples from Tertiary, Cretaceous, Upper Jurassic and Triassic rocks and oil staining.

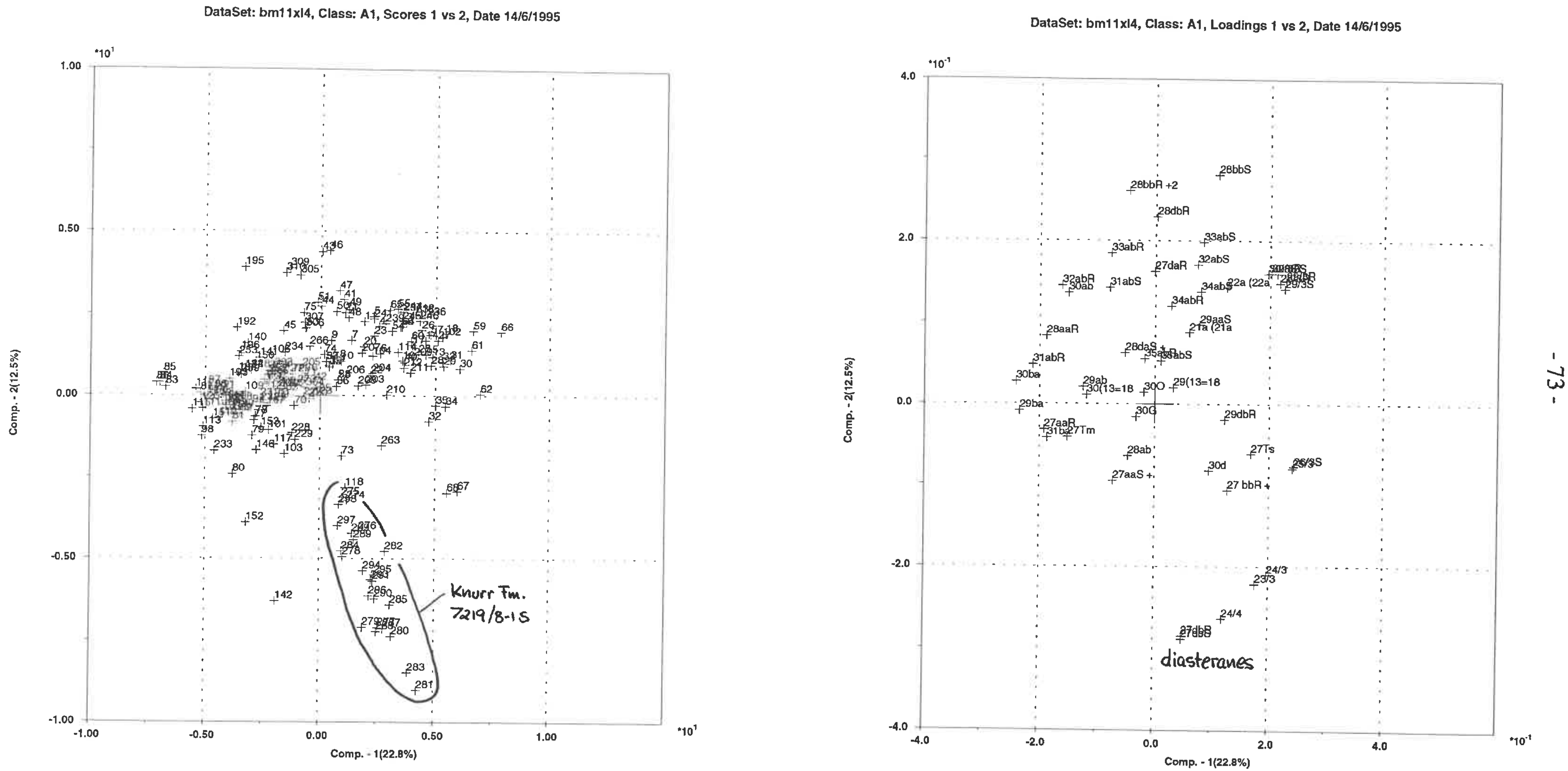


Figure 4.3.1 *Score and loading plots PC2 vs. PC1 from principal component analysis of saturated biomarker data from Triassic, Upper Jurassic, Cretaceous and Tertiary biomarker rocks and associated oil staining.*

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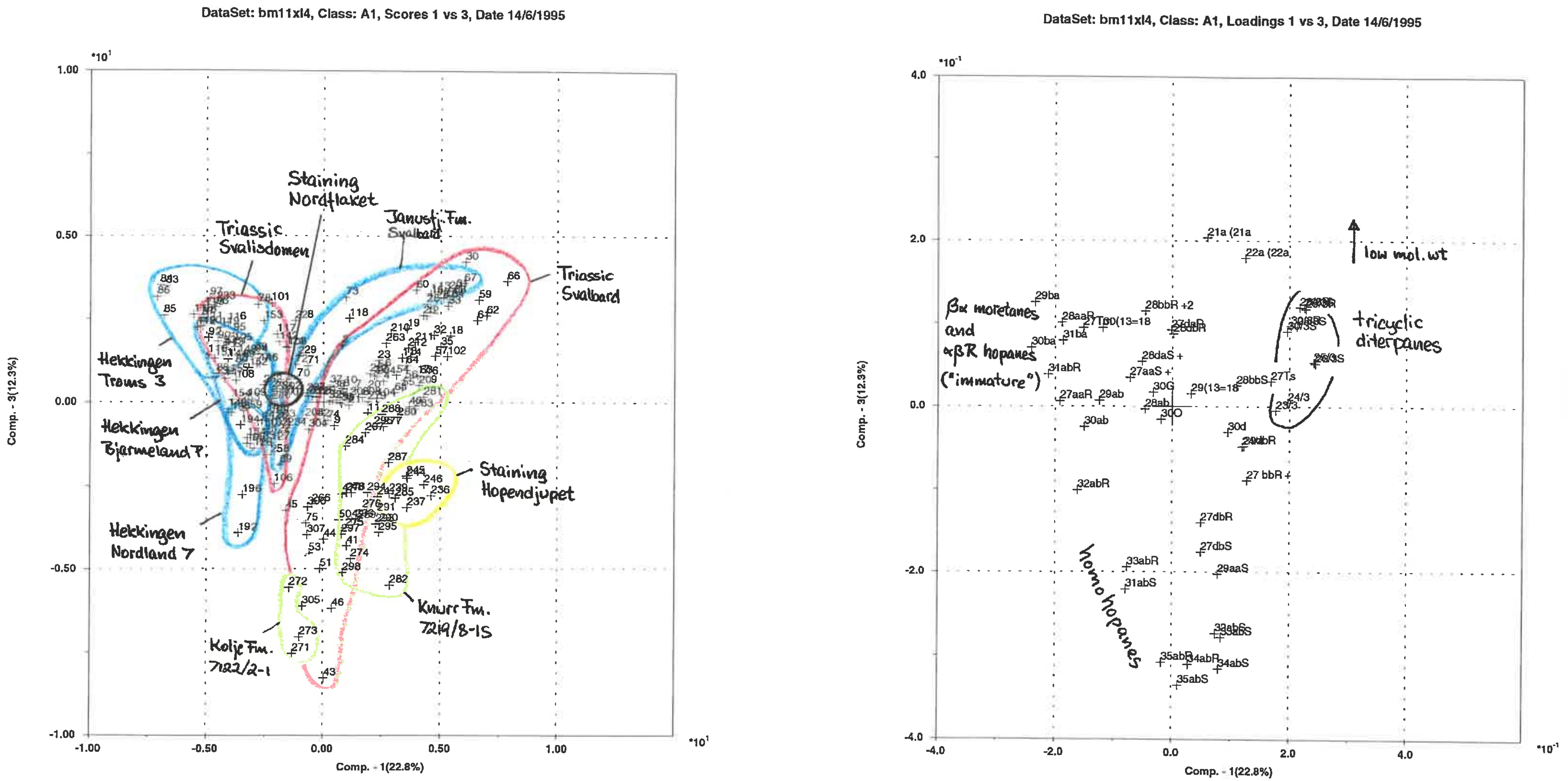

Figure 4.3.2 *Score and loading plots PC3 vs. PC2 from principal component analysis of saturated biomarker data from Triassic, Upper Jurassic, Cretaceous and Tertiary biomarker rocks and associated oil staining.*

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1. Appendix 1: Tables

2. Appendix 2: Figures

3. Appendix 3: Analytical Procedures

4. Appendix 4: Organic richness, kerogen character and thermal maturity of cored sections in the Nordflaket area

Appendix 1

Tables

Table A.1 Samples and analyses

Core	Depth	Sample ID (IKUNO)			Analyses										
					HS	RE	PYGC	VK	VR	GCO	EX	GCS	GCA	MSS	ISOF
7418/01-U-01	10.88	E	3751	Clst, mgy		RE									
7418/01-U-01	13.25	E	3755	Clst, mgy		RE									
7418/01-U-01	15.89	E	3760	Clst, mgy	HS	RE									
7418/01-U-01	17.45	E	3763	Clst, mgy		RE									
7418/01-U-01	19.87	E	3766	Clst, mgy		RE									
7418/01-U-01	21.68	E	3767	Clst, sl slty		RE		VK			EX	GCS	GCA	MSS	ISOF
7418/01-U-01	24.55	E	3769	Clst		RE									
7418/01-U-01	26.81	E	3773	Clst, dkgy		RE									
7418/01-U-01	28.97	E	3772	Clst	HS	RE		VK	VR						
7418/01-U-01	31.56	E	3777	Clst, mgy/dkgy		RE									
7418/01-U-01	34.50	E	3778	Sltst, dkgy		RE									
7418/01-U-01	35.42	E	3779	Clst, dkgy		RE									
7418/01-U-01	37.91	E	3780	Clst, slty, m-dkgy, lam		RE									
7418/01-U-01	39.36	E	3784	Clst	HS	RE	PYGC	VK			EX	GCS	GCA	MSS	ISOF
7418/01-U-01	42.39	E	3787	Clst, lt-mgy		RE									
7418/01-U-01	43.39	E	3788	Clst, m-dkgy		RE									
7418/01-U-01	47.20	E	3790	Clst, slty, m/dkgy		RE									
7418/01-U-01	49.11	E	3795	Clst	HS	RE									
7418/01-U-01	50.78	E	3796	Clst, slty, dkgy		RE									
7418/01-U-01	52.22	E	3797	Clst, slty, mgy, dkgy layer 1 cm		RE									
7418/01-U-01	54.73	E	3798	Clst, slty, mgy, dkgy layer 1 cm		RE									
7418/01-U-01	58.11	E	3800	Sltst, mgy		RE									
7418/01-U-01	61.34	E	3803	Sltst, mgy		RE	PYGC	VK	VR		EX	GCS	GCA	MSS	
7418/01-U-01	63.46	E	3807	Sltst	HS	RE									
7418/01-U-01	65.04	E	3809	Sltst, mgy		RE									

Core	Depth	Sample ID (IKUNO)			Analyses										
					HS	RE	PYGC	VK	VR	GCO	EX	GCS	GCA	MSS	ISOF
7418/01-U-01	68.80	E	3812	Clst, dkgy, slickensides, plant remains		RE									
7418/01-U-01	71.44	E	3815	Sst		RE					EX	GCS	GCA	MSS	ISOF
7418/01-U-01	74.62	E	3818	Sst, oil-stained		RE				GCO	EX	GCS	GCA	MSS	ISOF
7418/01-U-01	74.67	E	3819	Sst, oil-stained		RE				GCO	EX	GCS	GCA	MSS	ISOF
7418/01-U-01	74.70	E	3817	Sst, oil-stained		RE				GCO	EX	GCS	GCA	MSS	ISOF
7418/01-U-01	74.73	E	3820	Sst, oil-stained		RE				GCO	EX	GCS	GCA	MSS	ISOF
7418/01-U-01	77.17	E	3821	Sst, dkgy		RE									
7418/01-U-01	80.61	E	3824	Sst, ltgy/dkgy	HS	RE									
7418/01-U-01	83.13	E	3827	Sst, mgy, coaly incl.		RE									
7418/01-U-01	85.00	E	3828	Sst, lt-mgy		RE	PYGC	VK			EX	GCS	GCA	MSS	ISOF
7418/01-U-01	87.60	E	3831	Sst		RE									
7418/01-U-01	88.52	E	3833	Sst	HS	RE									
7418/01-U-01	90.70	E	3836	Sltst, dkgy		RE									
7418/01-U-01	91.40	E	3837	Sltst, dkgy		RE									
7418/01-U-01	93.55	E	3840	Sltst, dkgy		RE									
7418/01-U-01	95.20	E	3842	Sltst, dkgy		RE		VK	VR						
7418/01-U-01	96.48	E	3844	Sltst, dkgy	HS	RE									
7418/01-U-01	98.60	E	3846	Sltst, dkgy		RE									
7418/01-U-01	100.87	E	3849	Clst, blk, slickenside		RE									
7418/01-U-01	104.38	E	3851	Sltst, dkgy		RE									
7418/01-U-01	106.38	E	3852	Sltst, vdkgy		RE									
7418/01-U-01	107.53	E	3854	Sltst	HS	RE									
7418/01-U-01	110.40	E	3855	Sltst, dkgy		RE									
7418/01-U-01	112.10	E	3856	Sltst, dkgy/ltgy		RE									
7418/01-U-01	116.47	E	3859	Sltst, dkgy		RE									

Core	Depth		Sample ID			Analyses										
			(IKUNO)			HS	RE	PYGC	VK	VR	GCO	EX	GCS	GCA	MSS	ISOF
7418/01-U-01	117.81	E	3861	Sltst, dkgy			RE	PYGC	VK	VR		EX	GCS	GCA	MSS	ISOF
7418/01-U-01	120.11	E	3862	Sltst, dkgy		HS	RE									
7418/01-U-01	121.83	E	3865	Sltst, dkgy			RE									
7418/01-U-01	123.76	E	3868	Sltst, mgy-ltgy			RE									
7418/01-U-01	126.12	E	3869	Sltst			RE									
7517/12-U-01	111.15	E	3389	Clst-sltst			RE	PYGC	VK	VR		EX	GCS	GCA	MSS	
7517/12-U-01	114.87	E	3393	Sst		HS	RE									
7517/12-U-01	116.55	E	3394	Sltst			RE									
7517/12-U-01	121.22	E	3398	Sst, fgr, ltgy			RE									
7517/12-U-01	124.66	E	3400	Sltst, dkgy			RE		VK	VR						
7517/12-U-01	126.56	E	3402	Sst/Mdst	Canned ~5 min after extr.	HS	RE									
7517/12-U-01	129.97	E	3404	Sltst, cly, dkgy/ltgy laminae			RE									
7517/12-U-01	132.85	E	3406	Sst		HS	RE									
7517/12-U-01	136.63	E	3410	Sltst			RE									
7517/12-U-01	141.28	E	3417	Sltst, dk gy			RE									
7517/12-U-01	142.74	E	3418	Sltst, dk gy, bioturb.		HS	RE									
7517/12-U-01	143.97	E	3420	Sltst, dk gy			RE	PYGC	VK	VR		EX	GCS	GCA	MSS	
7517/12-U-01	145.57	E	3423	Sltst, dk gy			RE									
7517/12-U-01	150.68	E	3430	Cl, dkgy	poor sample quality		RE									
7517/12-U-01	153.97	E	3431	Sst/sltst		HS	RE									
7517/12-U-01	155.22	E	3432	Sltst, dkgy			RE									
7517/12-U-01	158.22	E	3434	Sltst, bioturb.		HS	RE									
7517/12-U-01	168.90	E	3439	Sltst, bioturb., ltgy/dkgy			RE									
7517/12-U-01	170.10	E	3441	Sltst, dkgy, sl bnish			RE									
7517/12-U-01	172.32	E	3450	Mdst		HS	RE									

Core	Depth			Sample ID (IKUNO)	HS	RE	PYGC	VK	VR	GCO	EX	GCS	GCA	MSS	ISOF
7517/12-U-01	174.68	E	3449	Mdst, dkgy		RE		VK	VR						
7517/12-U-01	175.17	E	3451	Sltst, dkgy/ltgy, bioturb.?		RE									
7517/12-U-01	177.69	E	3453	Sltst, dkgy		RE									
7517/12-U-01	178.51	E	3455	Sltst, dkgy		RE									
7517/12-U-01	180.07	E	3457	Sltst, dkgy/ltgy		RE									
7517/12-U-01	184.73	E	3461	Sltst, mgy, slickensides		RE									
7517/12-U-01	185.39	E	3462	Clst	HS	RE									
7517/12-U-01	187.27	E	3464	Slst-sltst		RE									
7517/12-U-01	194.21	E	3468	Clst	HS	RE									
7517/12-U-01	197.70	E	3471	Sltst, dkgy		RE									
7517/12-U-01	198.68	E	3474	Sltst, mgy		RE	PYGC	VK	VR		EX	GCS	GCA	MSS	ISOF
7616/11-U-01	7.41	E	3683	Sst, fgr, mgy		RE					EX	GCS	GCA	MSS	ISOF
7616/11-U-01	10.37	E	3685	Sst-sltst, dkgy		RE									
7616/11-U-01	12.30	E	3688	Sst, vfgr, vdkgy/ltgy, bioturb.		RE									
7616/11-U-01	13.15	E	3687	Sst, vfgr, vdkgy/ltgy, bioturb.	HS	RE	PYGC	VK	VR		EX	GCS	GCA	MSS	
7616/11-U-01	16.73	E	3690	Sst		RE									
7616/11-U-01	23.76	E	3695	Sst	HS	RE									
7616/11-U-01	27.59	E	3696	Sltst, dkgy		RE									
7616/11-U-01	30.62	E	3698	Clst, vdkgy, slickenside		RE									
7616/11-U-01	32.48	E	3701	Sltst	HS	RE									
7616/11-U-01	36.21	E	3704	Sltst, vdkgy		RE	PYGC	VK	VR		EX	GCS	GCA	MSS	ISOF
7616/11-U-01	38.89	E	3707	Clst, slty, vdkgy		RE									
7616/11-U-01	39.84	E	3710	Sltst, vdkgy		RE									
7616/11-U-01	41.69	E	3712	Sltst, vdkgy		RE									
7616/11-U-01	42.15	E	3713	Clst/sltst dkgy/ltgy, bioturb.		RE		VK	VR						

Core	Depth		Sample ID (IKUNO)			HS	RE	PYGC	VK	VR	GCO	EX	GCS	GCA	MSS	ISOF
						Analyses										
7616/11-U-01	43.17	E	3717	Clst, slty		HS	RE									
7616/11-U-01	48.52	E	3720	Sst/sltst, bioturb.			RE									
7616/11-U-01	53.69	E	3721	Sst		HS	RE									
7616/11-U-01	54.89	E	3724	Sst, dkgy/ltgy, bioturb.			RE									
7616/11-U-01	56.25	E	3725	Sst, dkgy/ltgy, bioturb.			RE		VK			EX	GCS	GCA	MSS	ISOF
7616/11-U-01	62.94	E	3729	Sst		HS	RE									
7616/11-U-01	65.08	E	3731	Sst, dkgy/ltgy, bioturb.			RE	PYGC	VK	VR		EX	GCS	GCA	MSS	ISOF
7616/11-U-01	66.32	E	3734	Sst, dkgy/ltgy, bioturb.			RE									
7616/11-U-02	35.95	E	3736	Clst, dkgy, homog.			RE									
7616/11-U-02	37.15	E	3738	Clst, dkgy, homog., slickens.			RE									
7616/11-U-02	39.87	E	3741	Clst, dkgy			RE									
7616/11-U-02	40.31	E	3742	Clst/sltst, skgy/ltgy	dark lithology analysed		RE									
7616/11-U-02	42.35	E	3743	Clst, dkgy			RE									
7616/11-U-02	44.15	E	3747	Clst, dkgy, lamin.			RE									
7616/11-U-02	44.61	E	3748	Clst, dkgy, lamin.			RE									
7616/11-U-02	47.70	E	3750	Clst			RE									
7617/11-U-02	10.60	E	3526	Clst, slty, blk patches			RE		VK	VR						
7617/11-U-02	18.00	E	3530	Sltst, cly, dkgy			RE									
7617/11-U-02	19.30	E	3534	Sltst		HS	RE									
7617/11-U-02	21.23	E	3535	Sltst, dkgy			RE									
7617/11-U-02	23.45	E	3537	Sltst, dkgy/ltgy, bioturb.			RE	PYGC	VK			EX	GCS	GCA	MSS	
7617/11-U-02	25.59	E	3538	Sltst, dkgy/ltgy, bioturb.			RE									
7617/11-U-02	27.75	E	3540	Sltst, mgy			RE									
7617/11-U-02	28.08	E	3543	Sltst, cly, dkgy			RE		VK	VR						
7617/11-U-02	30.18	E	3541	Sltst, dkgy/ltgy, bioturb.		HS	RE									

Core	Depth			Sample ID (IKUNO)	HS	RE	PYGC	VK	VR	GCO	EX	GCS	GCA	MSS	ISOF
7617/11-U-02	34.76	E	3549	Sltst, dkgy/ltgy, bioturb.		RE									
7617/11-U-02	41.19	E	3559	Sst, f-vfgr, mgy		RE									
7617/11-U-02	42.90	E	3563	Sst/sltst dkgy/mgy		RE									
7617/11-U-02	45.00	E	3561	Sst	HS	RE									
7617/11-U-02	54.21	E	3574	Sst, dkgy-mgy		RE									
7617/11-U-02	57.22	E	3576	Sst, dkgy-mgy, bioturb.?		RE									
7617/11-U-02	61.63	E	3582	Sltst	HS	RE		VK	VR						
7617/11-U-02	62.56	E	3584	Sltst, dkgy		RE									
7617/11-U-02	64.13	E	3586	Sst-sltst		RE									
7617/11-U-02	66.40	E	3590	Sltst		RE									
7617/11-U-02	68.82	E	3591	Sst-sltst, dkgy, bioturb.		RE		VK							
7617/11-U-02	69.76	E	3593	Sltst, dkgy, homog.		RE									
7617/11-U-02	72.20	E	3592	Sst/Sltst	HS	RE									
7617/11-U-02	74.01	E	3598	Sltst		RE									
7617/11-U-02	76.22	E	3599	Sltst, dkgy/ltgy		RE									
7617/11-U-02	79.32	E	3603	Sltst/Sst, dkgy/ltgy, bioturb.		RE									
7617/11-U-02	80.94	E	3604	Sltst/Sst, dkgy/ltgy, bioturb.		RE									
7617/11-U-02	84.42	E	3606	Sst	HS	RE									
7617/11-U-02	88.18	E	3611	Sltst/Sst, dkgy/ltgy, bioturb.		RE									
7617/11-U-02	93.34	E	3617	Sltst, dkgy/ltgy, bioturb.	HS	RE									
7617/11-U-02	94.57	E	3619	Sltst, dkgy		RE									
7617/11-U-02	97.43	E	3622	Sltst, dkgy		RE									
7617/11-U-02	99.31	E	3623	Sltst, dkgy		RE									
7617/11-U-02	101.48	E	3624	Sltst, dkgy, lam		RE									
7617/11-U-02	105.00	E	3627	Sltst, dkgy	HS	RE									

Core	Depth		Sample ID (IKUNO)			Analyses										
						HS	RE	PYGC	VK	VR	GCO	EX	GCS	GCA	MSS	ISOF
7617/11-U-02	108.01	E	3630	Sltst, dkgy			RE									
7617/11-U-02	110.88	E	3635	Sltst, dkgy/ltgy, bioturb.			RE									
7617/11-U-02	112.64	E	3637	Sltst, dkgy			RE									
7617/11-U-02	115.39	E	3642	Sltst, dkgy/ltgy, bioturb.			RE									
7617/11-U-02	117.80	E	3645	Sltst, dkgy			RE		VK	VR		EX	GCS	GCA	MSS	
7617/11-U-02	120.62	E	3650	Sltst, dkgy			RE									
7617/11-U-02	121.24	E	3653	Clst, slty		HS	RE									
7617/11-U-02	123.98	E	3656	Sltst, dkgy			RE									
7617/11-U-02	126.27	E	3659	Sltst, dkgy	small sample		RE									
7617/11-U-02	128.67	E	3660	Sltst, dkgy/ltgy, bioturb.			RE									
7617/11-U-02	129.89	E	3661	Sltst, dkgy/ltgy lamin.			RE									
7617/11-U-02	132.95	E	3662	Sltst		HS	RE									
7617/11-U-02	133.79	E	3666	Sltst, cly, dkgy, lamin.			RE									
7617/11-U-02	135.26	E	3667	Sltst, cly, dkgy, lamin.			RE									
7617/11-U-02	137.36	E	3668	Sltst, dkgy, bioturb.			RE									
7617/11-U-02	140.21	E	3670	Sltst, dkgy, bioturb.			RE									
7617/11-U-02	141.54	E	3671	Sltst, dkgy		HS	RE									
7617/11-U-02	144.74	E	3674	Sltst, dkgy, bioturb.			RE									
7617/11-U-02	147.00	E	3675	Sltst, cly, dkgy, lamin.			RE		VK	VR		EX	GCS	GCA	MSS	ISOF
7617/11-U-02	150.45	E	3676	Clst		HS	RE									
7617/11-U-02	151.50	E	3679	Sltst, dkgy			RE									
7617/11-U-02	153.77	E	3680	Clst, slty, dkgy			RE									
7618/10-U-01	13.16	E	3476	Sst		HS	RE									
7618/10-U-01	15.94	E	3478	Sh, dkgy-blk			RE									
7618/10-U-01	19.87	E	3481	Clst, dkgy, slty			RE									
7618/10-U-01	22.10	E	3483	Clst		HS	RE		VK	VR						

Core	Depth			Sample ID (IKUNO)	HS	RE	PYGC	VK	VR	GCO	EX	GCS	GCA	MSS	ISOF
7618/10-U-01	24.21	E	3486	Clst	HS	RE									
7618/10-U-03	17.65	E	3492	Sltst, dkgy		RE									
7618/10-U-03	19.25	E	3494	Sltst, dkgy		RE			VR						
7618/10-U-03	20.10	E	3496	Sh, slty, dkgy		RE									
7618/10-U-03	21.87	E	3498	Sh/sltst, dkgy/mgy, lamin.		RE									
				Total number of analyses:	40	180	11	25	20	4	21	21	21	21	15

Key to analysis types:

HS	Headspace/occluded gas analysis
RE	Rock-Eval pyrolysis
PYGC	Pyrolysis-gas chromatography
VK	Visual kerogen description
VR	Vitrinite reflectance/sporinite fluorescence
GCO	Gas chromatography of whole oil
EX	Extraction, group type separation (preparative and analytical)
GCS	Gas chromatography of saturated hydrocarbon fraction (FID detection)
GCA	Gas chromatography of aromatic fraction (FID detection)
MSS	Gas chromatography-mas spectrometry of saturated biomarkers (SIM)
ISOF	Stable carbon isotope analysis of EOM fractions

IKU SINTEF GROUP

Table A.2a Concentration of C1-C5+ hydrocarbons in headspace gas

IKU No.	Depth (m)	C1	C2	C3	iC4	nC4	C5+	SUM C1-C4	SUM C2-C4	WET-NESS (%)	iC4/ nC4
		(µl/kg dry rock)									
7418/01-U-01											
E3760	15.89	219	0	0	0	0	2	219	0	-1	-1
E3772	28.97	3019	0	3	1	0	8	3023	4	0	-1
E3784	39.36	7768	1	0	1	1	9	7771	3	0	1.00
E3795	49.11	14442	2	5	21	22	44	14492	50	0	0.95
E3807	63.46	7310	1	0	5	5	9	7321	11	0	1.00
E3824	80.61	31623	9	7	16	13	17	31668	45	0	1.23
E3833	88.52	4111	1	0	0	0	0	4112	1	0	-1
E3844	96.48	60749	3	0	0	0	0	60752	3	0	-1
E3854	107.53	51446	3	0	4	3	2	51456	10	0	1.33
E3862	120.11	46946	4	12	6	4	2	46972	26	0	1.50
7517/12-U-01											
E3393	114.87	25707	1	0	0	0	0	25708	1	0	-1
E3402	126.56	7718	0	0	0	0	0	7718	0	-1	-1
E3406	132.85	33475	2	0	0	0	1	33477	2	0	-1
E3418	142.74	30851	2	0	0	0	0	30853	2	0	-1
E3431	153.97	14698	1	5	0	0	0	14704	6	0	-1
E3434	158.22	23646	5	3	0	0	0	23654	8	0	-1
E3450	172.32	29570	2	0	0	0	0	29572	2	0	-1
E3462	185.39	38139	10	2	0	0	0	38151	12	0	-1
E3468	194.21	31981	5	3	2	1	0	31992	11	0	2.00
7616/11-U-01											
E3687	13.15	4700	3	3	2	2	1	4710	10	0	1.00
E3695	23.76	6818	186	30	0	0	0	7034	216	3	-1
E3701	32.48	46723	4	1	1	0	0	46729	6	0	-1
E3717	43.17	17467	64	35	4	4	2	17574	107	1	1.00
E3721	53.69	3917	8	4	2	3	0	3934	17	0	0.67
E3729	62.94	2850	1	1	0	0	0	2852	2	0	-1
7617/11-U-02											
E3534	19.30	2	0	0	0	0	0	2	0	-1	-1
E3541	30.18	173	0	0	0	0	0	173	0	-1	-1
E3561	45.00	360	0	0	0	0	0	360	0	-1	-1
E3582	61.63	26405	2	0	0	0	0	26407	2	0	-1
E3592	72.20	1769	3	2	1	1	1	1776	7	0	1.00
E3606	84.42	1737	14	10	1	1	1	1763	26	1	1.00
E3617	93.34	1886	20	8	1	1	1	1916	30	2	1.00
E3627	105.00	13192	2	1	0	0	0	13195	3	0	-1
E3653	121.24	2649	13	3	0	0	0	2665	16	1	-1
E3662	132.95	21657	56	12	1	1	0	21727	70	0	1.00
E3671	141.54	61003	6	0	0	0	0	61009	6	0	-1
E3676	150.45	34206	53	9	1	0	0	34269	63	0	-1
7618/10-U-01											
E3476	13.16	117	1	3	0	0	0	121	4	3	-1
E3483	22.10	35190	8	0	0	0	0	35198	8	0	-1
E3486	24.21	74186	9	0	0	0	0	74195	9	0	-1

Legend: -1 Data are not available or cannot be calculated

Table A.2b Concentration of C1-C5+ hydrocarbons in occluded gas

IKU No.	Depth (m)	C1	C2	C3	iC4	nC4	C5+	SUM C1-C4	SUM C2-C4	WET-NESS (%)	iC4/ nC4
		(µl/kg dry rock)									
7418/01-U-01											
E3760	15.89	396	50	32	0	14	3706	492	96	20	
E3772	28.97	582	24	12	0	7	1247	625	43	7	
E3784	39.36	-1	-1	-1	-1	-1	-1	-1	-1	-1	
E3795	49.11	4926	19	70	481	721	3557	6217	1291	21	0.67
E3807	63.46	9815	44	46	519	805	3728	11229	1414	13	0.64
E3824	80.61	9330	51	186	454	647	856	10668	1338	13	0.70
E3833	88.52	10570	47	19	8	9	44	10653	83	1	0.89
E3844	96.48	4710	17	10	0	0	34	4737	27	1	-1
E3854	107.53	3609	26	15	99	141	439	3890	281	7	0.70
E3862	120.11	9731	35	341	274	340	467	10721	990	9	0.81
7517/12-U-01											
E3393	114.87	11161	168	65	0	21	68	11415	254	2	-1
E3402	126.56	6267	231	90	0	15	25	6603	336	5	-1
E3406	132.85	13841	32	8	0	1	7	13882	41	0	-1
E3418	142.74	6974	25	7	0	0	12	7006	32	0	-1
E3431	153.97	12430	36	13	0	0	5	12479	49	0	-1
E3434	158.22	2854	52	23	0	6	17	2935	81	3	-1
E3450	172.32	9882	33	11	0	3	8	9929	47	0	-1
E3462	185.39	23134	50	12	0	2	11	23198	64	0	-1
E3468	194.21	9264	33	10	17	9	263	9333	69	1	1.89
7616/11-U-01											
E3687	13.15	44809	105	201	102	207	359	45424	615	1	0.49
E3695	23.76	10601	1742	1053	105	222	347	13723	3122	23	0.47
E3701	32.48	85075	118	63	153	29	231	85438	363	0	5.28
E3717	43.17	66005	2248	4204	658	1055	778	74170	8165	11	0.62
E3721	53.69	22966	205	230	76	151	476	23628	662	3	0.50
E3729	62.94	23908	52	30	9	21	626	24020	112	0	0.43
7617/11-U-02											
E3534	19.30	1193	62	18	24	8	30	1305	112	9	3.00
E3541	30.18	2315	90	30	9	4	14	2448	133	5	2.25
E3561	45.00	48456	116	22	3	0	16	48597	141	0	-1
E3582	61.63	40743	152	24	5	2	1	40926	183	0	2.50
E3592	72.20	18751	254	332	231	124	159	19692	941	5	1.86
E3606	84.42	71712	2199	2187	316	118	39	76532	4820	6	2.68
E3617	93.34	23125	1183	1114	159	68	49	25649	2524	10	2.34
E3627	105.00	164929	202	30	10	1	7	165172	243	0	10.00
E3653	121.24	193890	4116	1725	180	38	25	199949	6059	3	4.74
E3662	132.95	97536	1794	752	59	13	3	100154	2618	3	4.54
E3671	141.54	119287	219	26	7	3	87	119542	255	0	2.33
E3676	150.45	105698	2421	1029	82	22	15	109252	3554	3	3.73
7618/10-U-01											
E3476	13.16	1982	47	12	0	0	2	2041	59	3	-1
E3483	22.10	310977	216	19	0	0	0	311212	235	0	-1
E3486	24.21	158491	137	11	4	0	1	158643	152	0	-1

Legend: -1 Data are not available or cannot be calculated

IKU SINTEF GROUP

Table A.2c Concentration of C1-C5+ hydrocarbons - summation.

IKU No.	Depth (m)	C1	C2	C3	iC4	nC4	C5+	SUM C1-C4	SUM C2-C4	WET-NESS (%)	iC4/nC4
		(µl/kg dry rock)									
7418/01-U-01											
E3760	15.89	615	50	32	0	14	3708	711	96	13	-1
E3772	28.97	3601	24	15	1	7	1255	3648	47	1	0.14
E3784	39.36	7768	1	0	1	1	9	7771	3	0	1.00
E3795	49.11	19368	21	75	502	743	3601	20709	1341	6	0.68
E3807	63.46	17125	45	46	524	810	3737	18550	1425	7	0.65
E3824	80.61	40953	60	193	470	660	873	42336	1383	3	0.71
E3833	88.52	14681	48	19	8	9	44	14765	84	0	0.89
E3844	96.48	65459	20	10	0	0	34	65489	30	0	-1
E3854	107.53	55055	29	15	103	144	441	55346	291	0	0.72
E3862	120.11	56677	39	353	280	344	469	57693	1016	1	0.81
7517/12-U-01											
E3393	114.87	36868	169	65	0	21	68	37123	255	0	-1
E3402	126.56	13985	231	90	0	15	25	14321	336	2	-1
E3406	132.85	47316	34	8	0	1	8	47359	43	0	-1
E3418	142.74	37825	27	7	0	0	12	37859	34	0	-1
E3431	153.97	27128	37	18	0	0	5	27183	55	0	-1
E3434	158.22	26500	57	26	0	6	17	26589	89	0	-1
E3450	172.32	39452	35	11	0	3	8	39501	49	0	-1
E3462	185.39	61273	60	14	0	2	11	61349	76	0	-1
E3468	194.21	41245	38	13	19	10	263	41325	80	0	1.90
7616/11-U-01											
E3687	13.15	49509	108	204	104	209	360	50134	625	1	0.50
E3695	23.76	17419	1928	1083	105	222	347	20757	3338	16	0.47
E3701	32.48	131798	122	64	154	29	231	132167	369	0	5.31
E3717	43.17	83472	2312	4239	662	1059	780	91744	8272	9	0.63
E3721	53.69	26883	213	234	78	154	476	27562	679	2	0.51
E3729	62.94	26758	53	31	9	21	626	26872	114	0	0.43
7617/11-U-02											
E3534	19.30	1195	62	18	24	8	30	1307	112	8	3.00
E3541	30.18	2488	90	30	9	4	14	2621	133	5	2.25
E3561	45.00	48816	116	22	3	0	16	48957	141	0	-1
E3582	61.63	67148	154	24	5	2	1	67333	185	0	2.50
E3592	72.20	20520	257	334	232	125	160	21468	948	4	1.86
E3606	84.42	73449	2213	2197	317	119	40	78295	4846	6	2.66
E3617	93.34	25011	1203	1122	160	69	50	27565	2554	9	2.32
E3627	105.00	178121	204	31	10	1	7	178367	246	0	10.00
E3653	121.24	196539	4129	1728	180	38	25	202614	6075	3	4.74
E3662	132.95	119193	1850	764	60	14	3	121881	2688	2	4.29
E3671	141.54	180290	225	26	7	3	87	180551	261	0	2.33
E3676	150.45	139904	2474	1038	83	22	15	143521	3617	2	3.77
7618/10-U-01											
E3476	13.16	2099	48	15	0	0	2	2162	63	2	-1
E3483	22.10	346167	224	19	0	0	0	346410	243	0	-1
E3486	24.21	232677	146	11	4	0	1	232838	161	0	-1

Legend: -1 Data are not available or cannot be calculated

IKU SINTEF GROUP

Table A.3a Total organic carbon content and data from Rock Eval pyrolysis.

IKUNO	FRAC. NAME	DEPTH (m)	SAMPLE TYPE	S1 (mg/g rock)	S2 (mg/g rock)	TOC (%)	HYDRO INDEX (mg/g TOC)	PETR POTEN S1+S2	PROD. INDEX S1 / S1+S2	Tmax (°C)
7418/01-U-01										
E3751		10.88	CORE	0.04	0.23	0.52	44	0.27	0.15	428
E3755		13.25	CORE	0.03	0.20	0.44	45	0.23	0.13	428
E3760		15.89	CORE	0.04	0.22	0.44	50	0.26	0.15	427
E3763		17.45	CORE	0.05	0.24	0.56	43	0.29	0.17	429
E3766		19.87	CORE	0.07	0.22	0.50	44	0.29	0.24	434
E3767		21.68	CORE	0.08	0.21	0.50	42	0.29	0.28	434
E3769		24.55	CORE	0.05	0.24	0.52	46	0.29	0.17	431
E3773		26.81	CORE	0.02	0.24	0.49	49	0.26	0.08	432
E3772		28.97	CORE	0.02	0.16	1.12	14	0.18	0.11	429
E3777		31.56	CORE	0.02	0.15	0.37	41	0.17	0.12	430
E3778		34.50	CORE	0.02	0.12	0.43	28	0.14	0.14	434
E3779		35.42	CORE	0.03	0.23	0.52	44	0.26	0.12	425
E3780		37.91	CORE	0.04	0.27	0.60	45	0.31	0.13	427
E3784		39.36	CORE	0.06	0.39	0.44	89	0.45	0.13	427
E3787		42.39	CORE	0.04	0.29	0.59	49	0.33	0.12	428
E3788		43.39	CORE	0.06	0.38	0.70	54	0.44	0.14	430
E3790		47.20	CORE	0.06	0.30	0.66	45	0.36	0.17	426
E3795		49.11	CORE	0.07	0.40	0.51	78	0.47	0.15	428
E3796		50.78	CORE	0.05	0.39	0.63	62	0.44	0.11	429
E3797		52.22	CORE	0.04	0.27	0.61	44	0.31	0.13	425
E3798		54.73	CORE	0.06	0.47	0.61	77	0.53	0.11	432
E3800		58.11	CORE	0.05	0.32	0.54	59	0.37	0.14	432
E3803		61.34	CORE	0.07	0.58	0.73	79	0.65	0.11	437
E3807		63.46	CORE	0.04	0.42	0.56	75	0.46	0.09	437
E3809		65.04	CORE	0.07	0.55	0.71	77	0.62	0.11	435
E3812		68.80	CORE	0.06	0.56	0.68	82	0.62	0.10	437
E3815		71.44	CORE	0.14	0.38	0.68	56	0.52	0.27	445
E3818		74.62	CORE	1.75	0.28	0.57	49	2.03	0.86	435
E3819		74.67	CORE	1.34	0.69	1.06	65	2.03	0.66	436
E3817		74.70	CORE	0.97	0.46	0.63	73	1.43	0.68	436
E3820		74.73	CORE	1.08	0.29	0.61	48	1.37	0.79	436
E3821		77.17	CORE	0.08	0.27	0.60	45	0.35	0.23	433
E3824		80.61	CORE	0.08	0.55	0.88	63	0.63	0.13	436
E3827		83.13	CORE	0.06	0.30	0.55	55	0.36	0.17	441
E3828		85.00	CORE	0.04	0.52	0.71	73	0.56	0.07	443
E3831		87.60	CORE	0.03	0.17	0.38	45	0.20	0.15	443
E3833		88.52	CORE	0.05	0.35	0.66	53	0.40	0.13	437
E3836		90.70	CORE	0.00	0.33	0.96	34	0.33	0.00	395
E3837		91.40	CORE	0.04	0.34	0.86	40	0.38	0.11	424
E3840		93.55	CORE	0.03	0.37	0.99	37	0.40	0.08	433
E3842		95.20	CORE	0.05	0.44	1.08	41	0.49	0.10	432
E3844		96.48	CORE	0.03	0.48	0.61	79	0.51	0.06	433
E3846		98.60	CORE	0.03	0.55	0.93	59	0.58	0.05	439
E3849		100.87	CORE	0.01	0.36	1.03	35	0.37	0.03	441
E3851		104.38	CORE	0.03	0.50	0.82	61	0.53	0.06	441
E3852		106.38	CORE	0.03	0.26	0.73	36	0.29	0.10	439
E3854		107.53	CORE	0.04	0.40	1.01	40	0.44	0.09	439

Legend

-1 - No data available.

IKU SINTEF GROUP

IKUNO	FRAC. NAME	DEPTH (m)	SAMPLE TYPE	S1 (mg/g rock)	S2 (mg/g rock)	TOC (%)	HYDRO INDEX (mg/g TOC)	PETR POTEN S1+S2	PROD. INDEX S1 / S1+S2	Tmax (°C)
7418/01-U-01										
E3855		110.40	CORE	0.02	0.30	0.68	44	0.32	0.06	437
E3856		112.10	CORE	0.02	0.64	1.24	52	0.66	0.03	438
E3859		116.47	CORE	0.05	0.60	1.15	52	0.65	0.08	437
E3861		117.81	CORE	0.04	0.62	1.00	62	0.66	0.06	441
E3862		120.11	CORE	0.05	0.49	1.07	46	0.54	0.09	435
E3865		121.83	CORE	0.03	0.35	0.85	41	0.38	0.08	430
E3868		123.76	CORE	0.01	0.22	0.74	30	0.23	0.04	427
E3869		126.12	CORE	0.03	0.25	0.78	32	0.28	0.11	432
7517/12-U-01										
E3389		111.15	CORE	0.17	4.71	4.34	109	4.88	0.03	442
E3393		114.87	CORE	0.03	0.66	1.08	61	0.69	0.04	439
E3398		121.22	CORE	0.02	0.16	0.45	36	0.18	0.11	429
E3400		124.66	CORE	0.03	1.29	1.92	67	1.32	0.02	440
E3402		126.56	CORE	0.00	0.04	0.30	13	0.04	0.00	439
E3404		129.97	CORE	0.01	0.65	1.43	45	0.66	0.02	438
E3406		132.85	CORE	0.00	0.20	0.65	31	0.20	0.00	437
E3410		136.63	CORE	0.02	1.29	1.96	66	1.31	0.02	437
E3417		141.28	CORE	0.01	0.63	1.18	53	0.64	0.02	437
E3418		142.74	CORE	0.00	0.32	0.84	38	0.32	0.00	436
E3420		143.97	CORE	0.04	2.12	2.29	93	2.16	0.02	440
E3423		145.57	CORE	0.00	0.64	1.10	58	0.64	0.00	438
E3430		150.68	CORE	0.05	0.32	0.80	40	0.37	0.14	433
E3431		153.97	CORE	0.01	0.46	0.98	47	0.47	0.02	436
E3432		155.22	CORE	0.02	1.21	1.74	70	1.23	0.02	442
E3434		158.22	CORE	0.01	0.59	1.18	50	0.60	0.02	437
E3439		168.90	CORE	0.01	0.55	1.04	53	0.56	0.02	435
E3441		170.10	CORE	0.00	0.14	0.54	26	0.14	0.00	429
E3450		172.32	CORE	0.00	0.19	0.50	38	0.19	0.00	437
E3449		174.68	CORE	0.04	1.80	2.08	87	1.84	0.02	440
E3451		175.17	CORE	0.02	0.86	1.32	65	0.88	0.02	436
E3453		177.69	CORE	0.07	1.56	1.95	80	1.63	0.04	438
E3455		178.51	CORE	0.07	1.33	1.67	80	1.40	0.05	438
E3457		180.07	CORE	0.06	0.66	1.31	50	0.72	0.08	436
E3461		184.73	CORE	0.03	1.28	1.56	82	1.31	0.02	436
E3462		185.39	CORE	0.04	1.90	2.51	76	1.94	0.02	438
E3464		187.27	CORE	0.06	0.64	1.68	38	0.70	0.09	431
E3468		194.21	CORE	0.06	1.93	2.40	80	1.99	0.03	437
E3471		197.70	CORE	0.08	1.32	1.63	81	1.40	0.06	437
E3474		198.68	CORE	0.09	2.21	2.05	108	2.30	0.04	441
7616/11-U-01										
E3683		7.41	CORE	0.77	0.48	0.48	100	1.25	0.62	432
E3685		10.37	CORE	0.20	2.27	2.64	86	2.47	0.08	437
E3688		12.30	CORE	0.14	3.00	3.09	97	3.14	0.04	435
E3687		13.15	CORE	0.29	6.08	4.08	149	6.37	0.05	432
E3690		16.73	CORE	0.20	3.45	2.47	140	3.65	0.05	436

Legend

-1 - No data available.

IKU SINTEF GROUP

IKUNO	FRAC. NAME	DEPTH (m)	SAMPLE TYPE	S1 (mg/g rock)	S2 (mg/g rock)	TOC (%)	HYDRO INDEX (mg/g TOC)	PETR POTEN S1+S2	PROD. INDEX S1 / S1+S2	Tmax (°C)
7616/11-U-01										
E3695		23.76	CORE	0.02	0.13	0.58	22	0.15	0.13	437
E3696		27.59	CORE	0.10	2.21	2.48	89	2.31	0.04	433
E3698		30.62	CORE	0.05	2.37	2.28	104	2.42	0.02	436
E3701		32.48	CORE	0.03	0.66	1.02	65	0.69	0.04	439
E3704		36.21	CORE	0.16	2.99	2.84	105	3.15	0.05	438
E3707		38.89	CORE	0.13	1.77	2.63	67	1.90	0.07	438
E3710		39.84	CORE	0.11	1.85	2.41	77	1.96	0.06	440
E3712		41.69	CORE	0.15	2.31	2.72	85	2.46	0.06	440
E3713		42.15	CORE	0.17	3.00	3.09	97	3.17	0.05	440
E3717		43.17	CORE	0.14	2.30	2.54	91	2.44	0.06	438
E3720		48.52	CORE	0.24	1.40	1.19	118	1.64	0.15	440
E3721		53.69	CORE	0.21	1.26	1.14	111	1.47	0.14	441
E3724		54.89	CORE	0.16	0.68	0.71	96	0.84	0.19	437
E3725		56.25	CORE	0.48	1.41	1.19	118	1.89	0.25	435
E3729		62.94	CORE	0.25	1.25	1.11	113	1.50	0.17	442
E3731		65.08	CORE	0.31	2.16	1.62	133	2.47	0.13	436
E3734		66.32	CORE	0.12	0.71	0.94	76	0.83	0.14	440
7616/11-U-02										
E3736		35.95	CORE	0.03	1.53	1.81	85	1.56	0.02	437
E3738		37.15	CORE	0.06	1.91	2.00	96	1.97	0.03	438
E3741		39.87	CORE	0.03	1.43	1.49	96	1.46	0.02	442
E3742		40.31	CORE	0.04	1.77	1.60	111	1.81	0.02	441
E3743		42.35	CORE	0.03	2.32	1.96	118	2.35	0.02	441
E3747		44.15	CORE	0.03	1.87	1.60	117	1.90	0.01	441
E3748		44.61	CORE	0.02	1.34	1.71	78	1.36	0.02	441
E3750		47.70	CORE	0.04	2.31	2.38	97	2.35	0.02	445
7617/11-U-02										
E3526		10.60	CORE	0.13	0.38	1.48	26	0.51	0.25	500
E3530		18.00	CORE	0.04	0.13	0.70	19	0.17	0.24	506
E3534		19.30	CORE	0.11	0.35	1.81	19	0.46	0.24	484
E3535		21.23	CORE	0.11	0.40	1.53	26	0.51	0.22	499
E3537		23.45	CORE	0.17	0.53	1.61	33	0.70	0.24	499
E3538		25.59	CORE	0.05	0.27	1.04	26	0.32	0.16	500
E3540		27.75	CORE	0.05	0.18	1.10	16	0.23	0.22	489
E3543		28.08	CORE	0.04	0.47	1.53	31	0.51	0.08	499
E3541		30.18	CORE	0.07	0.18	1.06	17	0.25	0.28	479
E3549		34.76	CORE	0.08	0.24	1.13	21	0.32	0.25	495
E3559		41.19	CORE	0.02	0.05	0.44	11	0.07	0.29	484
E3563		42.90	CORE	0.06	0.14	1.16	12	0.20	0.30	476
E3561		45.00	CORE	0.02	0.09	0.70	13	0.11	0.18	488
E3574		54.21	CORE	0.11	0.33	1.54	21	0.44	0.25	502
E3576		57.22	CORE	0.06	0.16	0.80	20	0.22	0.27	501
E3582		61.63	CORE	0.05	0.34	1.80	19	0.39	0.13	478
E3584		62.56	CORE	0.11	0.20	1.20	17	0.31	0.35	484
E3586		64.13	CORE	0.13	0.19	1.24	15	0.32	0.41	480

Legend
-1 - No data available.

IKUNO	FRAC. NAME	DEPTH (m)	SAMPLE TYPE	S1 (mg/ rock)	S2 mg/ rock)	TOC (%)	HYDRO INDEX (mg/g TOC)	PETR POTEN S1+S2	PROD. INDEX S1 ----- S1+S2	Tmax (°C)
7617/11-U-02										
E3590		66.40	CORE	0.08	0.13	0.74	18	0.21	0.38	502
E3591		68.82	CORE	0.11	0.16	1.04	15	0.27	0.41	483
E3593		69.76	CORE	0.06	0.17	0.81	21	0.23	0.26	501
E3592		72.20	CORE	0.03	0.07	0.52	13	0.10	0.30	504
E3598		74.01	CORE	0.03	0.07	0.49	14	0.10	0.30	490
E3599		76.22	CORE	0.08	0.18	0.92	20	0.26	0.31	500
E3603		79.32	CORE	0.10	0.15	1.02	15	0.25	0.40	497
E3604		80.94	CORE	0.12	0.29	1.43	20	0.41	0.29	494
E3606		84.42	CORE	0.07	0.17	1.03	17	0.24	0.29	489
E3611		88.18	CORE	0.06	0.14	1.06	13	0.20	0.30	496
E3617		93.34	CORE	0.02	0.06	0.43	14	0.08	0.25	505
E3619		94.57	CORE	0.14	0.36	1.93	19	0.50	0.28	489
E3622		97.43	CORE	0.09	0.38	1.55	25	0.47	0.19	506
E3623		99.31	CORE	0.11	0.51	1.86	27	0.62	0.18	50[illegible]
E3624		101.48	CORE	0.09	0.29	1.48	20	0.38	0.24	50[illegible]
E3627		105.00	CORE	0.07	0.25	1.67	15	0.32	0.22	484
E3630		108.01	CORE	0.07	0.23	1.63	14	0.30	0.23	499
E3635		110.88	CORE	0.05	0.15	1.28	12	0.20	0.25	494
E3637		112.64	CORE	0.03	0.14	1.22	11	0.17	0.18	501
E3642		115.39	CORE	0.03	0.11	1.11	10	0.14	0.21	500
E3645		117.80	CORE	0.05	0.25	1.63	15	0.30	0.17	510
E3650		120.62	CORE	0.05	0.30	1.59	19	0.35	0.14	514
E3653		121.24	CORE	0.04	0.31	1.74	18	0.35	0.11	514
E3656		123.98	CORE	0.02	0.18	1.27	14	0.20	0.10	515
E3659		126.27	CORE	0.06	0.35	1.95	18	0.41	0.15	517
E3660		128.67	CORE	0.03	0.19	1.55	12	0.22	0.14	503
E3661		129.89	CORE	0.04	0.22	1.75	13	0.26	0.15	504
E3662		132.95	CORE	0.04	0.21	1.81	12	0.25	0.16	498
E3666		133.79	CORE	0.06	0.36	2.25	16	0.42	0.14	511
E3667		135.26	CORE	0.04	0.37	2.22	17	0.41	0.10	513
E3668		137.36	CORE	0.04	0.31	1.92	16	0.35	0.11	511
E3670		140.21	CORE	0.02	0.24	1.87	13	0.26	0.08	508
E3671		141.54	CORE	0.01	0.22	1.93	11	0.23	0.04	509
E3674		144.74	CORE	0.01	0.20	1.61	12	0.21	0.05	514
E3675		147.00	CORE	0.05	0.30	2.10	14	0.35	0.14	512
E3676		150.45	CORE	0.02	0.13	1.47	9	0.15	0.13	490
E3679		151.50	CORE	0.02	0.20	1.63	12	0.22	0.09	51[illegible]
E3680		153.77	CORE	0.02	0.26	1.91	14	0.28	0.07	51[illegible]
7618/10-U-01										
E3476		13.16	CORE	0.00	0.00	0.21	0	0.00	-1	-1
E3478		15.94	CORE	0.00	0.00	0.33	0	0.00	-1	-1
E3481		19.87	CORE	0.00	0.02	1.82	1	0.02	0.00	470
E3483		22.10	CORE	0.00	0.11	2.48	4	0.11	0.00	540
E3486		24.21	CORE	0.00	0.11	2.65	4	0.11	0.00	541
7618/10-U-03										
E3492		17.65	CORE	0.01	0.11	1.80	6	0.12	0.08	539
E3494		19.25	CORE	0.01	0.05	3.11	2	0.06	0.17	461
E3496		20.10	CORE	0.00	0.01	0.62	2	0.01	0.00	435
E3498		21.87	CORE	0.00	0.06	1.75	3	0.06	0.00	541

Legend
-1 - No data available.

Table A.3b Rock Eval analysis of BVM rock standard.

Std.No.	Date	Weight mg	S1 mg/g rock	S2 mg/g rock	Tmax C
Black Ven Marl (BVM) norm. valves			0.47	19.00	420
223	95.01.20	97.2	0.48	19.21	418
224	95.01.25	104.0	0.48	19.43	422
225	95.01.26	97.5	0.51	18.54	421
226	95.01.27	98.8	0.52	20.98	422
227	95.01.30	94.4	0.49	20.44	422
229	95.01.31	100.3	0.51	18.99	418
230	95.01.31	99.7	0.33	18.73	420
231	95.02.01	101.5	0.52	18.74	418
232	95.02.01	102.5	0.40	19.24	418
233	95.02.01	104.3	0.44	18.83	418
234	95.02.02	106.9	0.44	18.52	418
235	95.02.02	99.7	0.46	18.76	419
236	95.02.03	104.8	0.46	18.42	418
237	95.02.06	97.4	0.49	19.08	418
238	95.02.06	97.5	0.46	18.32	419
239	95.02.06	103.0	0.49	18.87	418
240	95.02.07	97.4	0.51	18.78	417
241	95.02.08	100.5	0.49	18.75	418
242	95.02.08	99.9	0.52	18.80	419
243	95.02.08	95.9	0.44	18.89	421
244	95.02.08	103.6	0.48	18.88	420
245	95.02.10	102.6	0.48	18.93	420
246	95.02.13	102.9	0.59	20.15	420
247	95.02.13	103.7	0.52	20.17	421
248	95.02.14	103.2	0.46	18.94	421
249	95.02.14	100.2	0.47	19.15	423
250	95.02.16	99.5	0.46	19.02	419
251	95.03.30	100.0	0.43	18.85	420
minimum			0.33	18.32	417
maximum			0.59	20.98	423
average			0.48	19.09	420
standard deviation			0.05	0.62	2
number of measurements			28	28	28

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Table A.4 Data from pyrolysis-gas chromatograms

Core	IKU No.	Depth m	(m+p)-xylene[1)] / n-octene	C1 %	C2-C5 %	C6-C14 %	C15+ %
7418/01-U-01	E3784	29.36	0.61	8.17	33.66	54.24	3.92
	E3803	61.34	0.50	11.35	32.57	50.65	5.44
	E3828	85.00	0.61	17.58	33.80	43.12	5.50
	E3861	117.81	0.97	18.57	32.50	44.38	4.55
7517/12-U-01	E3389	111.15	0.96	13.59	22.40	39.11	24.91
	E3420	143.97	0.90	13.36	21.62	39.54	25.48
	E3474	198.68	0.89	11.86	24.67	38.72	24.75
7616/11-U-01	E3687	13.15	1.31	9.29	16.73	30.45	43.54
	E3704	36.21	2.16	16.35	15.37	35.21	33.08
	E3731	65.08	0.67	6.57	16.26	30.41	46.76
7617/11-U-02	E3537	23.45	n.d.p.	42.17	40.48	15.90	1.45

[1)] Peak height ratio

Table A.5 *Vitrinite reflectance data*

		Main Population			Secondary Population			Tertiary Population				
Depth (m)	**IKU Number**	**Mean1**	**Count1**	**StdDev1**	**Mean2**	**Count2**	**StdDev2**	**Mean3**	**Count3**	**StdDev3**	**Sporinite Fluor.**	**Sporinite Abun.**
7418/01-U-01												
28.97	E-3772	0.94	3	0.18							4	Rare
61.34	E-3803	0.49	4	0.07	0.90	4	0.10				4-6	Rare
95.20	E-3842	0.68	1								4-6	Rare
117.81	E-3861	0.50	3	0.06	0.84	6	0.06	1.18	2	0.16	4-5	Low
7517/12-U-01												
111.15	E-3389	0.80	17	0.11	1.21	3	0.12				4-6	Low
124.66	E-3400	0.58	10	0.08	0.98	5	0.13				7-8	Rare
143.97	E-3420	0.64	9	0.07	0.40	3	0.07	1.02	3	0.18	6,7-8	Rare
174.66	E-3449	0.53	19	0.16							3-4?	V Rare
198.68	E-3474	0.55	10	0.09							3-4?	V Rare
7616/11-U-01												
13.15	E-3687	0.43	2	0.06	0.78	13	0.15				3-4?	V Rare
36.21	E-3704	0.48	8	0.12	1.04	2	0.22				Very dull	Mod
42.15	E-3713	0.49	4	0.04	0.86	6	0.14				3-4?	V Rare
65.08	E-3731	0.39	13	0.05	0.61	2	0.07				4-6?	Rare
7617/11-U-02												
10.60	E-3526	0.78	16	0.14	0.45	2	0.06				7	V Rare
28.08	E-3543	0.89	1	0.00	1.34	9	0.18				7-8	Mod
61.63	E-3582	0.92	8	0.08	0.46	1	0.00	1.30	6	0.13	6-7	Rare
117.80	E-3645	0.77	16	0.10	0.44	4	0.07				7-8	Mod
147.00	E-3675	0.90	1	0.00	0.41	2	0.04				8	V Rare
7618/10-U-01												
22.10	E-3483	1.21	13	0.14	1.73	4	0.20				Very dull	Rare
7618/10-U-03												
19.25	E-3494	1.97	12	0.17								Barren

Table A.6 *Visual kerogen description*

Sample ID	Depth (m)	Composition of residue (%)						Particle size	Preservation of palynomorphs	TAI	Remarks
		FA	HA	AL	HE	WO	CO				
Core 7418/01-U-01											
E3767	21.68	0	70	0	15	10	5	s-m	poor-fair	4	Dinocysts embedded in degraded material. ?Heated during a short period.
E3772	28.97	0	55	0	25	15	5	s-m	poor	4	Brown fluorescence (cysts).
E3784	39.36	0	35	0	30	30	5	m-s	poor	4	Resin bodies. Cuticles. Radiolaria. Cysts show brown fluorescence.
E3803	61.34	0	70	0	15	10	5	s	poor	?4	Fluffy aggregates.
E3828	85.00	0	45	0	5	45	5	s-m-l	poor	4-5	Degraded wood and cuticles. Fluffy material. Brown to orange-brown fluorescent cysts and pollen.
E3842	95.20	0	60	0	10	20	10	s-m	poor	5	Granular aggregates, some radiolaria. Faint brown fluorescence.
E3861	117.81	0	45	0	15	35	5	s-m-l	poor-fair	5	Granular aggregates. Cuticles, leaves, wood. Orange-brown fluorescence. Rare algae with yellow fluorescence.
Core 7517/12-U-01											
E3389	111.15	0	30	0	10	50	10	s-m-l	poor-fair	5	Flakes of wood. Cuticles. Pollen shows orange-brown fluorescence.
E3400	124.66	0	30	0	10	50	10	s-m-l	poor	5	Brown fluorescence.
E3420	143.97	0	10	0	25	55	10	s-m-l	fair-poor	5	Brown fluorescence. Occasionally red-brown to orange fluorescence from algae.
E3449	174.66	0	45	0	10	35	10	s-m	very poor	4	Granular amorphous material. Brown fluorescence.
E3474	198.68	0	30	0	20	30	20	s-m	poor	4	Cysts show brown fluorescence.
Core 7616/11-U-01											
E3687	13.15	0	50	0	15	25	10	s-m	poor	5	Granular amorphous material.
E3704	36.21	0	50	0	10	30	10	s-m	very poor	5	Granular amorphous material. Debris shows faint brown fluorescence.
E3713	42.15	0	50	0	15	25	10	s-m	poor	5	Granular amorphous material. Pollen shows orange-brown fluorescence.
E3725	56.25	0	50	0	20	20	10	s-m	very poor	?	Granular aggregates.

Table A.6 *Continues...*

Sample ID	Depth (m)	Composition of residue (%)						Particle size	Preservation of palynomorphs	TAI	Remarks
		FA	HA	AL	HE	WO	CO				
E3731	65.08	0	30	0	0	55	15	s-m	poor	?5	Plankton. Pollen and cysts show occasionally orange brown fluorescence.
Core 7617/11-U-02											
E3526	10.60	0	40	0	10	30	20	s-m	very poor	5	Grey-brown granular amorphous material. Very thin palynomorphs.
E3537	23.45	0	40	0	10	45	5	s-m	very poor	?6	Fluffy amorphous, degraded.
E3543	28.08	0	55	0	5	35	5	s-m	poor	6	Granular amorphous material.
E3582	61.63	0	60	0	0	35	5	s-m	very poor	?6	Granular amorphous material.
E3591	68.82	0	50	0	15	25	10	s	very poor	?6 - 7	Granular amorphous material. Dark degraded aggregates. No fluorescence.
E3645	117.80	0	50	0	15	30	5	s-m	very poor	?6 - 7	Granular amorphous material. Dark degraded aggregates. No fluorescence.
E3675	147.00	0	50	0	15	30	5	s-m	very poor	6 - 7	Granular amorphous material. Dark degraded aggregates. Poor pollen with dark yellow to brown colour.
Core 7618/10-U-01											
E3483	22.10	0	35	0	35	30	0	s-m-l	very poor	?6	Unreliable data. Dark residue, strongly degraded, granular amorphous material.

Key: Composition of residue:

HA	Hebamorphinite (non-fluorescent amorphous organic matter)
FA	Fluoramorphinite (fluorescent amorphous organic matter)
HE	Herbaceous organic matter
AL	Algal organic matter
WO	Woody organic matter
CO	Coaly (opaque) organic matter

Particle size:

s	small
m	medium
l	large

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Table A.7a Extraction and TLC-FID data.

IKU no.	Depth m	Rock g	EOM	Asph.	Maltenes	SAT	ARO	POL1	POL2	% SAT	% ARO	% POL
			mg			TLC-FID peak area %				weight % of maltene fraction		
7418/01-U-01												
E3767	21.68	14.00	5.4	3.7	1.7	6.5	8.4	80.1	5.1	30.5	40.8	28.7
E3784	39.36	10.12	6.6	2.4	2.8	4.3	6.2	89.0	0.5	25.1	37.5	37.5
E3803	61.34	15.26	8.6	3.7	3.5	2.7	5.9	70.0	21.5	17.4	39.7	43.0
E3815	71.44	50.60	25.1	9.2	16.0	34.5	20.6	44.0	0.9	53.7	41.3	5.0
E3818	74.62	51.00	143.9	6.6	132.3	69.9	18.3	11.2	0.6	74.0	25.1	0.9
E3819	74.67	48.30	118.3	14.2	100.3	74.8	16.7	7.9	0.6	77.1	22.3	0.6
E3817	74.70	40.80	71.5	9.8	59.4	69.9	18.5	11.2	0.4	73.8	25.3	0.9
E3820	74.73	40.40	109.5	8.9	96.7	73.4	17.2	9.1	0.3	76.2	23.1	0.7
E3828	85.00	12.10	8.3	4.7	3.4	3.8	10.6	84.0	1.6	18.4	52.0	.6
E3861	95.20	12.04	7.0	4.3	3.1	2.9	11.3	83.8	1.9	14.1	55.9	30.0
7517/12-U-01												
E3389	111.15	30.02	46.0	23.1	21.7	2.6	25.9	69.3	2.3	7.5	77.7	14.9
E3420	143.97	25.11	33.8	20.4	12.0	2.9	22.5	72.6	2.0	8.9	74.0	17.2
E3474	198.68	20.18	33.0	22.8	10.8	1.5	20.7	75.1	2.7	5.2	75.3	19.5
7616/11-U-01												
E3683	7.41	32.92	99.6	27.1	70.9	11.6	10.1	77.8	0.5	41.7	38.0	20.4
E3687	13.15	3.91	19.6	15.6	5.1	1.7	22.4	74.6	1.3	5.4	76.7	17.9
E3704	36.21	21.16	28.7	21.7	7.7	1.5	29.7	67.9	0.8	4.0	82.8	13.2
E3725	56.25	25.02	63.6	25.8	37.8	9.5	46.4	42.9	1.1	15.5	79.3	5.2
E3731	65.08	20.42	31.8	22.9	8.5	2.2	31.1	66.3	0.5	5.5	82.3	12.2
7617/11-U-02												
E3537	23.45	25.54	8.1	6.1	2.4	7.7	44.4	47.3	0.7	13.3	80.7	.0
E3645	117.80	12.38	3.5	0.7	2.4	2.9	34.5	61.7	0.9	6.7	82.8	10.5
E3675	147.00	17.83	6.1	1.8	3.5	2.5	40.3	55.3	1.9	5.2	86.2	8.6
										Nominal values:		
Standard oil 1994						61.7	23.9	13.2	1.2	65.9	33.0	1.1
Standard oil 1995						59.2	28.3	11.7	0.8			

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Table A.7b Bulk composition of EOM.

IKU no.	Depth m	EOM mg / g rock	SAT	ARO	POL	ASPH	HC	Non-HC	SAT / ARO *100	HC / Non-HC *100
			wt% of EOM							
7418/01-U-01										
E3767	21.68	0.386	9.6	12.9	9.0	68.5	22.4	77.6	74.7	28.9
E3784	39.36	0.652	15.9	23.9	23.8	36.4	39.8	60.2	66.8	66.1
E3803	61.34	0.564	9.9	22.6	24.5	43.0	32.5	67.5	43.8	48.2
E3815	71.44	0.496	34.0	26.2	3.2	36.7	60.2	39.8	130.0	151.1
E3818	74.62	2.822	70.6	23.9	0.9	4.6	94.6	5.4	294.8	1736.5
E3819	74.67	2.449	67.8	19.6	0.5	12.0	87.5	12.5	345.7	698.0
E3817	74.70	1.752	63.7	21.8	0.8	13.7	85.5	14.5	291.7	590.5
E3820	74.73	2.710	70.0	21.2	0.6	8.1	91.2	8.8	329.9	1040.1
E3828	85.00	0.686	8.0	22.5	12.9	56.6	30.5	69.5	35.4	43.9
E3861	95.20	0.581	5.4	21.6	11.6	61.4	27.0	73.0	25.2	37.0
7517/12-U-01										
E3389	111.15	1.532	3.7	38.7	7.4	50.2	42.4	57.6	9.6	73.6
E3420	143.97	1.346	3.5	29.3	6.8	60.4	32.8	67.2	12.0	48.9
E3474	198.68	1.635	1.6	23.3	6.0	69.1	24.9	75.1	6.9	33.1
7616/11-U-01										
E3683	7.41	3.026	30.3	27.6	14.8	27.2	58.0	42.0	109.9	137.9
E3687	13.15	5.013	1.1	15.6	3.7	79.6	16.8	83.2	7.1	20.1
E3704	36.21	1.356	1.0	20.2	3.2	75.6	21.2	78.8	4.9	26.9
E3725	56.25	2.542	9.2	47.1	3.1	40.6	56.4	43.7	19.5	129.1
E3731	65.08	1.557	1.5	23.0	3.4	72.0	24.6	75.4	6.7	32.6
7617/11-U-02										
E3537	23.45	0.317	3.3	19.9	1.5	75.3	23.2	76.8	16.5	30.2
E3645	117.80	0.283	5.4	66.2	8.4	20.0	71.6	28.4	8.1	251.7
E3675	147.00	0.342	3.6	60.8	6.1	29.5	64.4	35.6	6.0	181.1

Concentrations calculated from gravimetric EOM data, gravimetric asphaltene precipitation data and TLC-FID weight% data.

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Table A.7c Concentration of EOM and chromatographic fractions.

IKU no	Depth	TOC	EOM	SAT	ARO	POL	ASPH	HC
	m	wt%	mg / g TOC					
7418/01-U-01								
E3767	21.68	0.50	77.1	7.4	9.9	7.0	52.9	17.3
E3784	39.36	1.50	43.5	4.6	6.9	6.9	15.8	11.5
E3803	61.34	2.50	22.5	1.6	3.6	3.9	9.7	5.2
E3815	71.44	3.50	14.2	4.9	3.7	0.5	5.2	8.6
E3818	74.62	4.50	62.7	42.7	14.5	0.5	2.9	57.1
E3819	74.67	5.50	44.5	29.1	8.4	0.2	5.3	37.5
E3817	74.70	6.50	27.0	16.5	5.7	0.2	3.7	22.2
E3820	74.73	7.50	36.1	24.3	7.4	0.2	2.9	31.7
E3828	85.00	8.50	8.1	0.6	1.7	1.0	4.6	2.3
E3861	95.20	9.50	6.1	0.4	1.5	0.8	3.8	1.9
7517/12-U-01								
E3389	111.15	4.34	35.3	1.2	12.9	2.5	17.7	14.2
E3420	143.97	2.29	58.8	1.9	15.4	3.6	35.5	17.3
E3474	198.68	2.05	79.8	1.4	19.7	5.1	55.1	21.0
7616/11-U-01								
E3683	7.41	0.48	630.3	187.1	170.3	91.4	171.5	357.3
E3687	13.15	4.08	122.9	1.7	24.5	5.7	97.8	26.2
E3704	36.21	2.84	47.8	0.5	10.6	1.7	36.1	11.1
E3725	56.25	1.19	213.6	19.7	100.7	6.6	86.7	120.4
E3731	65.08	1.62	96.1	1.4	21.1	3.1	69.2	22.6
7617/11-U-02								
E3537	23.45	1.61	19.7	0.8	4.7	0.4	14.8	5.5
E3645	117.80	1.63	17.3	0.8	9.8	1.3	3.5	10.6
E3675	147.00	2.10	16.3	0.5	8.1	0.8	4.8	8.5

Concentrations calculated from gravimetric EOM data, gravimetric asphaltene precipitation data and TLC-FID weight% data.

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Table A.8 Ratios derived from gas chromatograms of saturated hydrocarbons

IKUNO	DEPTH (m)	LITHO.	CPI1	A= Pr / n-C17	B= Ph / n-C18	A / B	Pr / Ph	n-C17 / n-C17+n-C27
7418/01-U-01								
E3767	21.68	clst	1.2	1.2	0.5	2.2	2.2	0.5
E3784	39.36	clst	1.1	2.6	1.4	1.8	1.7	0.4
E3803	61.34	sltst	1.4	3.1	1.2	2.6	2.5	0.3
E3815	71.44	sst	1.2	0.6	0.2	3.1	3.9	0.9
E3818	74.62	sst	1.1	0.6	0.2	3.2	3.4	0.9
E3819	74.67	sst	1.1	0.6	0.2	3.5	3.8	0.9
E3817	74.70	sst	1.2	0.6	0.2	3.2	3.3	0.9
E3820	74.73	sst	1.1	0.6	0.2	3.5	3.9	0.9
E3828	85.00	sst, ar	1.6	6.0	1.6	3.7	3.2	0.3
E3861	117.81	sltst	1.6	2.7	0.6	4.3	3.4	0.3
7517/12								
E3389	111.15	coal	1.9	3.4	0.4	8.5	7.4	0.2
E3420	143.97	sltst,	1.8	4.3	0.6	7.7	6.3	0.2
E3474	198.68	sltst	1.7	4.5	0.8	5.4	5.2	0.3
7616/11								
E3683*	7.41	sst	n.d.p.	n.d.p.	n.d.p.	n.d.p.	n.d.p.	n.d.p.
E3687	13.15	sst	1.5	3.5	0.7	4.9	4.0	0.3
E3704	36.21	sltst	1.4	3.1	1.0	3.0	3.2	0.3
E3725	56.25	sst	1.1	1.0	0.9	1.2	1.1	0.2
E3731	65.08	sst, ar	1.2	1.5	0.6	2.7	4.7	0.7
7617/11								
E3537	23.45	sltst	1.1	0.5	0.2	3.1	2.9	0.8
E3645	117.8	sltst	1.1	0.5	0.5	1.0	1.1	0.7
E3675	147.00	clst	1.0	0.6	0.6	1.0	0.6	0.4

Legend:

* = Sample is strongly biodegraded
-1 = No data available or computed

$$CPI = 1/2 \cdot \left(\frac{C25+C27+C29+C31}{C24+C26+C28+C30} + \frac{C25+C27+C29+C31}{C26+C28+C30+C32}\right)$$

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Table A.9 *Ratios derived from gas chromatograms and mass fragmentograms of aromatic hydrocarbons.*

Core	Sample ID	Depth m	P uVs	3-MP uVs	2-MP uVs	9-MP uVs	1-MP uVs	MPI-1	F1	F2
7418/01-U-01	E3767	21.68	14135	25445	11218	13552	13427	1.34	0.58	0.18
	E3784	29.36	21250	15985	15459	19031	17272	0.82	0.46	0.23
	E3803	61.34	64728	30588	26225	48724	29548	0.60	0.42	0.19
	E3815	71.44	15080	3696	3502	7495	4249	0.40	0.38	0.18
	E3818	74.62	n.d.p.	n.d.p.	n.d.p.	n.d.p.	n.d.p.	n.d.p.	n.d.p.	n.d.p.
	E3819	74.67	n.d.p.	n.d.p.	n.d.p.	n.d.p.	n.d.p.	n.d.p.	n.d.p.	n.d.p.
	E3817	74.70	n.d.p.	n.d.p.	n.d.p.	n.d.p.	n.d.p.	n.d.p.	n.d.p.	n.d.p.
	E3820	74.73	n.d.p.	n.d.p.	n.d.p.	n.d.p.	n.d.p.	n.d.p.	n.d.p.	n.d.p.
	E3828	85.00	59333	28233	30394	48082	33406	0.62	0.42	0.22
	E3861	117.81	66787	36652	29325	44733	36780	0.67	0.45	0.20
7517/12-U-01	E3389	111.15	72645	60964	32847	130842	61656	0.53	0.33	0.11
	E3420	143.97	103866	68920	62697	137397	71254	0.63	0.39	0.18
	E3474	198.68	165995	55457	45900	104325	60772	0.46	0.38	0.17
7616/11-U-01	E3383	7.41	n.d.p.	n.d.p.	n.d.p.	n.d.p.	n.d.p.	n.d.p.	n.d.p.	n.d.p.
	E3687	13.15	335163	97293	66889	124542	58641	0.48	0.47	0.19
	E3704	36.21	380796	91773	81806	150740	91453	0.42	0.42	0.20
	E3725	56.25	n.d.p.	n.d.p.	n.d.p.	n.d.p.	n.d.p.	n.d.p.	n.d.p.	n.d.p.
	E3731	65.08	942104	226566	155798	305102	160074	0.41	0.45	0.18
7617/11-U-02	E3537	23.45	769818	664206	643465	220266	126603	1.76	0.79	0.39
	E3645	117.80	532771	356477	434798	118632	79847	1.62	0.80	0.44
	E3675	147.00	666535	380085	496089	109334	77791	1.54	0.82	0.47

Legend:

$$\mathrm{MPI-1} = \frac{3/2(2-\mathrm{MP}+3-\mathrm{MP})}{\mathrm{P}+1\mathrm{MP}+9\mathrm{MP}}$$

$$\mathrm{F1} = \frac{3\mathrm{MP}+2\mathrm{MP}}{3\mathrm{MP}+2\mathrm{MP}+9\mathrm{MP}+1\mathrm{MP}}$$

$$\mathrm{F2} = \frac{2\mathrm{MP}}{3\mathrm{MP}+2\mathrm{MP}+9\mathrm{MP}+1\mathrm{MP}}$$

n.d.p. - no determination possible

IKU SINTEF GROUP

Table A.10a Internal distribution of 14α(H),17α(H), 20R and 14β(H),17β(H), 20R + 20S, C27, C28 and C29 regular steranes.

IKU No.	Depth (m)	from m/z 217 1) C27 (%)	C28 (%)	C29 (%)	from m/z 218 2) C27 (%)	C28 (%)	C29 (%)
7418/01-U-01							
E3767	21.68	38.4	17.5	44.1	27.0	35.0	37.9
E3784	39.36	33.8	20.1	46.1	19.6	40.8	39.6
E3803	61.34	29.0	18.4	52.6	17.9	42.0	40.1
E3815	71.44	17.8	15.3	66.9	15.5	34.0	50.4
E3818	74.62	31.4	22.0	46.6	27.9	36.2	35.9
E3819	74.67	26.1	20.1	53.8	28.9	36.4	34.7
E3817	74.70	26.4	19.5	54.0	27.9	36.3	35.8
E3820	74.73	30.1	21.4	48.5	27.0	33.7	39.3
E3828	85.00	19.8	14.2	65.9	9.6	34.8	55.6
E3861	117.81	32.6	14.6	52.8	22.1	29.7	48.2
7517/12-U-01							
E3389	111.15	14.3	10.2	75.5	15.6	31.1	53.4
E3420	143.97	17.7	11.4	71.0	18.6	33.6	47.7
E3474	198.68	20.0	12.3	67.7	20.1	31.0	48.9
7616/11-U-01							
E3683	7.41	38.5	43.6	17.8	22.7	42.4	34.9
E3687	13.15	22.7	14.3	63.0	22.6	29.9	47.5
E3704	36.21	19.0	12.2	68.8	18.4	29.8	51.8
E3725	56.25	38.7	18.1	43.2	31.3	27.4	41.3
E3731	65.08	16.0	12.6	71.4	25.8	20.2	53.9
7617/11-U-02							
E3537	23.45	45.4	23.0	31.8	44.1	29.0	26.9
E3645	117.80	57.9	17.0	25.1	42.8	28.9	28.4
E3675	147.00	53.1	19.4	27.6	44.0	29.1	26.9

Legend:

1) distribution of peaks 27aaR,28aaR,29aaR in m/z 217.

2) distribution of peaks (27bbR+27bbS),(28bbR+28bbS),(29bbR+29bbS) in m/z 218.

Ratios are based on peak heights.

IKU SINTEF GROUP

Table A.10b Molecular ratios from terpane and sterane mass fragmentograms. Maturity-dependent ratios.

IKU no.	Depth (m)	ab/ab+ba hopanes 1)	%22S hopanes 2)	%22S hopanes 3)	%22S hopanes 4)	%20S steranes 5)	%bb steranes 6)	%bb steranes 7)
7418/01-U-01								
E3767	21.68	0.74	45	42	45	9	46	30
E3784	39.36	0.76	47	38	40	10	43	27
E3803	61.34	0.67	49	41	43	10	42	26
E3815	71.44	0.86	44	40	39	7	32	19
E3818	74.62	0.87	50	57	54	20	45	29
E3819	74.67	0.88	51	53	50	16	45	29
E3817	74.70	0.87	50	54	51	16	38	23
E3820	74.73	0.87	50	54	52	19	45	29
E3828	85.00	0.78	50	42	43	31	46	30
E3861	117.81	0.65	52	38	42	16	51	34
7517/12-U-01								
E3389	111.15	0.59	53	41	41	15	54	37
E3420	143.97	0.56	52	39	41	23	50	34
E3474	198.68	0.59	52	38	39	14	54	37
7616/11-U-01								
E3683	7.41	(0.69)	(50)	(61)	(58)	(67)	(74)	(59)[1]
E3687	13.15	0.70	57	55	54	(66)	(32)	(19)[2]
E3704	36.21	0.61	52	53	52	(50)	(34)	(20)[2]
E3725	56.25	0.83	59	60	58	(50)	(70)	(54)
E3731	65.08	0.73	59	56	56	(54)	(48)	(31)[2]
7617/11-U-02								
E3537	23.45	0.72	52	49	50	38	62	45
E3645	117.80	0.88	52	59	57	42	69	53
E3675	147.00	0.81	48	55	51	33	63	46

Legend:

1) 100 * 30ab/(30ab+30ba) in m/z 191.
2) 100 * 31abS/(31abS+31abR) in m/z 191.
3) 100 * 32abS/(32abS+32abR) in m/z 191.
4) 100 * average of 31abS/(31abS+31abR),.......35abS/(35abS+35abR) in m/z 191.
5) 100 * 29aaS/(29aaS+29aaR) in m/z 217.
6) 100 * 2 * (29bbR+29bbS)/(29aaS+29aaR+2(29bbR+29bbS)) in m/z 217.
7) 100 * (29bbR+29bbS)/(29aaS+29aaR+29bbR+29bbS) in m/z 217.

Ratios are based on peak heights.

[1] poor data quality (noisy mass fragmentogram)

[2] sterane isomerisation ratios strongly influenced by interference between 27ααS and 28αβ (28,30-bisnorhopane).

Table A.10c Molecular ratios from terpane and sterane mass fragmentograms. Maturity and source-dependent ratios.

IKU no.	Depth (m)	Tricyclic terpanes 1)	Tm/Ts terpanes 2)	30d/30ab terpanes 3)	28 bisnorhopanes 4)	%C27 diasteranes 5)
7418/01-U-01						
E3767	21.68	0.02	3.4	0.02	0.02	24
E3784	39.36	0.01	2.1	0.03	0.07	19
E3803	61.34	0.01	2.8	0.07	0.06	33
E3815	71.44	0.01	1.6	0.04	0.11	22
E3818	74.62	0.01	0.9	0.08	0.26	56
E3819	74.67	0.01	0.9	0.07	0.26	55
E3817	74.70	0.01	1.0	0.07	0.31	52
E3820	74.73	0.01	1.0	0.08	0.27	52
E3828	85.00	0.02	5.6	0.05	1.38	45
E3861	117.81	0.03	11.4	0.04	0.11	54
7517/12-U-01						
E3389	111.15	0.00	328.7	0.03	-1	46
E3420	143.97	0.01	87.5	0.03	-1	43
E3474	198.68	0.01	58.0	0.05	-1	49
7616/11-U-01						
E3683	7.41	1.56	5.2	3.24	-1	(72)[1]
E3687	13.15	0.04	18.4	0.07	1.46	65
E3704	36.21	0.01	44.5	0.05	0.44	53
E3725	56.25	0.11	1.2	0.21	0.22	75
E3731	65.08	0.02	16.9	0.06	0.93	70
7617/11-U-02						
E3537	23.45	0.30	3.4	0.07	-1	82
E3645	117.80	0.36	1.0	0.06	0.18	62
E3675	147.00	0.45	1.1	0.05	0.14	55

Legend:

1) (24/3)/30ab in m/z 191.
2) 27Tm/27Ts in m/z 191.
3) 30d/30ab in m/z 191.
4) 28ab/30ab in m/z 191.
5) 100 * 27dbS/(27dbS+27aaR) in m/z 217.
-1 Data are not available or cannot be calculated.

Ratios are based on peak heights.

[1] unreliable due to low intensity

IKU SINTEF GROUP

Table A.10d Molecular ratios from mass fragmentograms of aromatic steroid hydrocarbons.

IKU No.:	Depth (m)	Cracking ratios 20/20+27 TA 1) (%)	20/20+28 TA 2) (%)	Aromatisation ratios 21/21+28 MA 3) (%)	27TA/ 27TA+28MA 4) (%)	28TA/ 28TA+29MA 5) (%)
7418/01-U-01						
E-3815	71.44	54	76	33	16	14
E-3818	74.62	20	38	38	31	27
E-3819	74.67	29	53	40	28	24
E-3817	74.70	22	41	35	28	25
E-3820	74.73	22	42	58	73	-1

Legend:

1) 100 * C20TA/(C20TA+(C26TA+C27TA)) in m/z 231
(Mackenzie et al. 1981, main text).
2) 100 * C20TA/(C20TA+C28TA) in m/z 231
(Mackenzie et al. 1981, note added in proof).
3) 100 * C21MA/(C21MA+(C28MA+C29MA)) in m/z 253
(Mackenzie et al. 1981, note added in proof).
4) 100 * (C26TA+C27TA)/((C26TA+C27TA)+(C28MA+C29MA)) in m/z 231 and 253
(Mackenzie et al. 1981, main text).
5) 100 * C28TA/(C28TA+C29MA+((C28MA+C29MA) *(C28TA/(C28TA+C27TA))))
in m/z 231 and 253 (Mackenzie et al. 1981, note added in proof).

-1: - Data are not available.

TA: - tri-aromatic steroid
MA: - mono-aromatic steroid.

Ratios are based on peak heights.

Table A.11 Carbon isotope data of chromatographic fractions.

Core	Sample ID	Depth (m)	d13C SAT (o/ooPDB)	d13C ARO (o/ooPDB)	d13C POL (o/ooPDB)	d13C ASPH (o/ooPDB)
7418/01-U-01	E3767	21.68	-29.8	-29.0	-29.3	-28.9
	E3784	39.36	-32.6	-30.0	-30.5	-29.2
	E3815	71.44	-29.2	-28.5	-29.4	-27.6
	E3818	74.62	-29.4	-28.4	-29.4	-28.1
	E3819	74.67	-29.4	-28.6	-28.8	-27.4
	E3817	74.70	-29.2	-28.2	-28.8	-27.8
	E3820	74.73	-29.2	-28.2	-28.9	-27.4
	E3828	85.00	-29.3	-27.7	-28.3	-27.3
	E3861	117.81	-29.0	-27.3	-28.1	-27.0
7517/12-U-01	E3474	198.68	-29.5	-27.8	-27.9	-26.9
7616/11-U-01	E3683	(7.41	-30.0	-28.5	-29.4	-28.9)[1]
	E3704	36.21	-28.6	-26.2	-26.9	-25.7
	E3725	56.25	-30.0	-28.3	-28.7	-26.9
	E3731	65.08	-28.5	-26.4	-27.4	-26.2
7617/11-U-02	E3675	147.00	-28.1	-25.1	-28.5	-26.8

[1] unreliable due to low intensity

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Table A.12

Whole oil peak data

(GC)

Sample E-3818, 74.62 m was injected two times. The oil was re-analysed, because of column overload during the first injection. Peak data from both injections are presented.

[244422MC] 14 HEL_OLJE_NOV94,2,1
Reported on 13-DEC-1994 at 09:46

IKU SINTEF GROUP

Injection Report

Acquired on 3-NOV-1994 at 14:34

Sample Name : E-3818,74.62m,Whole oil
Sample Id : E3818
Sample Type : Sample Amount=1.00000
Bottle No : 1

PEAK INFORMATION

Peak	RT mins	Hght uV	Area uVs	Peak name
5	3.277	8590	23799	2,2DMC4
11	5.800	146949	471647	n-C6
13	6.648	71852	205023	MCyC5
17	8.029	59039	302765	CyC6
19	8.952	228116	1058336	2MC6+2,3DMC5
22	9.365	213271	1219553	3MC6
23	9.509	74949	330561	1T3DMCyC5
24	9.653	131801	507537	1T2DMCyC5
29	10.635	420833	1640298	n-C7
34	11.173	679282	1098795	MCyC6
73	15.715	725370	2895057	n-C8
122	20.557	944785	1894759	n-C9
158	25.000	939606	10573773	n-C10
185	29.120	923378	11019882	n-C11
208	32.944	808021	9937759	n-C12
230	36.533	761401	8652439	n-C13
251	39.923	718090	7841726	n-C14
272	43.112	651530	7193198	n-C15
290	46.123	603098	6338304	n-C16
308	49.008	497834	5925554	n-C17
309	49.248	435486	3673544	Pristane
324	51.723	516146	5182065	n-C18
325	51.947	162640	950266	Phytane
340	54.320	483846	4705656	n-C19
358	56.781	425739	3836669	n-C20
374	59.136	374892	3039472	n-C21
390	61.389	330129	2430844	n-C22
407	63.563	299615	2108720	n-C23
423	65.640	255003	1614750	n-C24
441	67.637	216111	1244930	n-C25
457	69.547	153722	705293	n-C26
469	71.397	110759	457715	n-C27
484	73.176	65728	268309	n-C28
495	74.907	44218	168342	n-C29
509	76.587	21501	89946	n-C30
520	78.213	35199	125742	n-C31

Totals		
Unknowns	35162468	167149792
Quantified	13538530	109733032
Grand Total	48701000	276882816

[244422MC] 14 HEL_OLJE_NOV94,3,1
Reported on 13-DEC-1994 at 12:50

IKU SINTEF GROUP

Injection Report

Acquired on 3-NOV-1994 at 17:54

Sample Name : E-3818,74.62m,Whole oil,2.injection
Sample Id : E3818
Sample Type : Sample Amount=1.00000
Bottle No : 1

PEAK INFORMATION

Peak	RT mins	Hght uV	Area uVs	Peak name
7	5.731	5093	9388	n-C6
8	6.595	2489	4835	MCyC5
11	7.968	2803	7525	CyC6
14	8.877	14390	29260	2MC6+2,3DMC5
15	9.261	14041	31257	3MC6
16	9.312	4623	9207	1C3DMCyC5
17	9.437	4016	8922	1T3DMCyC5
18	9.573	7663	15313	1T2DMCyC5
20	10.528	48889	103798	n-C7
21	11.019	47803	109625	MCyC6
48	15.523	137956	358580	n-C8
82	20.267	230484	769407	n-C9
122	24.699	295244	1270221	n-C10
156	28.813	325798	1558900	n-C11
189	32.648	308815	1471414	n-C12
219	36.243	276301	1365502	n-C13
248	39.629	255352	1226040	n-C14
273	42.819	227782	1110891	n-C15
301	45.837	201648	906619	n-C16
323	48.701	172481	771593	n-C17
324	48.965	107950	562818	Pristane
345	51.427	155823	654212	n-C18
347	51.720	29693	167843	Phytane
369	54.029	138117	599902	n-C19
386	56.509	120303	482243	n-C20
404	58.885	107224	414698	n-C21
423	61.157	94382	349559	n-C22
437	63.347	85119	316807	n-C23
452	65.435	69080	240740	n-C24
469	67.456	59797	198795	n-C25
484	69.395	41644	130354	n-C26
496	71.269	30168	96672	n-C27
509	73.077	17854	61296	n-C28
520	74.832	12728	44383	n-C29
529	76.523	6283	26943	n-C30
539	78.147	8282	31528	n-C31

Totals		
Unknowns	6241007	26004852
Quantified	3668117	15517089
Grand Total	9909124	41521940

[244422MC] 14 HEL_OLJE_NOV94,4,1
Reported on 13-DEC-1994 at 11:15

IKU SINTEF GROUP

Injection Report

Acquired on 4-NOV-1994 at 08:56

Sample Name : E-3819,74.67m,Whole oil
Sample Id : E3819
Sample Type : Sample Amount=1.00000
Bottle No : 1

PEAK INFORMATION

Peak	RT mins	Hght uV	Area uVs	Peak name
4	3.253	1719	2922	2,2DMC4
9	5.765	38568	71439	n-C6
10	6.621	19832	36689	MCyC5
13	7.995	17172	50102	CyC6
16	8.904	66184	154809	2MC6+2,3DMC5
17	9.285	65522	169158	3MC6
18	9.339	24808	46654	1C3DMCyC5
19	9.459	19071	46213	1T3DMCyC5
20	9.592	37373	83572	1T2DMCyC5
22	10.560	184183	383900	n-C7
24	11.059	222616	487934	MCyC6
52	15.571	257052	874975	n-C8
89	20.301	330478	670400	n-C9
130	24.715	305218	1376420	n-C10
165	28.816	291963	1365054	n-C11
200	32.640	254804	1154407	n-C12
230	36.232	230387	1014009	n-C13
259	39.613	208455	884747	n-C14
283	42.808	189760	796905	n-C15
309	45.827	164355	672087	n-C16
328	48.696	144135	591035	n-C17
329	48.952	68105	331291	Pristane
350	51.421	129530	514451	n-C18
352	51.720	16737	89473	Phytane
372	54.024	116457	457729	n-C19
390	56.509	106100	382916	n-C20
406	58.885	92694	325280	n-C21
419	61.160	79806	269920	n-C22
434	63.347	69060	235511	n-C23
448	65.437	55320	181911	n-C24
462	67.459	47716	156697	n-C25
474	69.397	34142	104175	n-C26
486	71.275	26839	80989	n-C27
499	73.085	15403	52528	n-C28
509	74.835	10448	32704	n-C29
518	76.525	5038	16576	n-C30
528	78.160	5007	21375	n-C31

Totals		
Unknowns	6513390	23570322
Quantified	3952059	14186957
Grand Total	10465449	37757280

[244422MC] 14 HEL_OLJE_NOV94,1,1
Reported on 12-DEC-1994 at 12:10

IKU SINTEF GROUP

Injection Report

Acquired on 3-NOV-1994 at 12:37

Sample Name : E-3817,74.70m,Whole oil
Sample Id : E3817
Sample Type : Sample Amount=1.00000
Bottle No : 1

PEAK INFORMATION

Peak	RT mins	Hght uV	Area uVs	Peak name
7	10.541	2790	5441	n-C7
8	11.037	3000	7089	MCyC6
28	15.501	15356	35529	n-C8
60	20.208	28415	63536	n-C9
95	24.611	33063	84397	n-C10
122	28.707	33181	89925	n-C11
148	32.539	31390	84517	n-C12
172	36.133	29443	82098	n-C13
195	39.517	27988	79481	n-C14
213	42.715	25383	74651	n-C15
224	45.741	23836	66984	n-C16
235	48.613	20611	59750	n-C17
236	48.883	8082	39071	Pristane
245	51.349	18123	52907	n-C18
246	51.677	1885	10739	Phytane
255	53.955	14556	41257	n-C19
261	56.437	10491	30497	n-C20
265	58.816	7062	20962	n-C21
269	61.099	4794	14410	n-C22
270	63.288	3561	10568	n-C23
271	65.387	2434	7247	n-C24
272	67.411	1854	5502	n-C25
273	69.360	1247	3610	n-C26
274	71.237	907	2760	n-C27
275	73.053	549	1707	n-C28
276	74.811	439	1266	n-C29
277	76.512	231	653	n-C30
278	78.144	287	1067	n-C31

Totals		
Unknowns	346605	1108100
Quantified	350958	977621
Grand Total	697563	2085721

[244422MC] 14 HEL_OLJE_NOV94,5,1
Reported on 13-DEC-1994 at 12:29

IKU SINTEF GROUP

Injection Report

Acquired on 4-NOV-1994 at 10:56

Sample Name : E-3820,74.73m,Whole oil
Sample Id : E3820
Sample Type : Sample Amount=1.00000
Bottle No : 1

PEAK INFORMATION

Peak	RT mins	Hght uV	Area uVs	Peak name
3	5.771	1167	2312	n-C6
4	6.616	722	1457	MCyC5
7	7.992	1579	4797	CyC6
10	8.896	13942	29655	2MC6+2,3DMC5
11	9.280	16066	34986	3MC6
12	9.333	4423	9296	1C3DMCyC5
13	9.456	4710	9030	1T3DMCyC5
14	9.592	7741	16819	1T2DMCyC5
16	10.547	52363	117747	n-C7
17	11.037	57944	140415	MCyC6
45	15.547	158627	495248	n-C8
80	20.285	221222	753274	n-C9
120	24.691	234326	907863	n-C10
154	28.795	229448	940213	n-C11
188	32.624	209703	836337	n-C12
218	36.219	193149	771766	n-C13
246	39.603	176386	701741	n-C14
270	42.800	161999	646680	n-C15
297	45.821	146846	560517	n-C16
317	48.691	124151	490975	n-C17
318	48.952	69977	331707	Pristane
338	51.419	114931	424889	n-C18
340	51.733	17270	93725	Phytane
360	54.024	104436	379170	n-C19
377	56.507	89156	317517	n-C20
393	58.880	76812	267117	n-C21
411	61.160	67562	226593	n-C22
425	63.344	59726	200231	n-C23
441	65.437	48829	156186	n-C24
456	67.459	40531	133246	n-C25
469	69.403	27166	87625	n-C26
479	71.280	21445	68247	n-C27
490	73.085	12682	43928	n-C28
501	74.843	8241	27272	n-C29
510	76.533	4059	14259	n-C30
520	78.163	4746	19608	n-C31

Totals		
Unknowns	4309199	16113993
Quantified	2784083	10262445
Grand Total	7093282	26376438

IKU SINTEF GROUP

Table A.13

Saturated hydrocarbon peak data

(GC)

[232548MC] 6 23254800_SAT,8,1
Reported on 2-MAY-1995 at 10:20

IKU SINTEF GROUP

Injection Report

Acquired on 16-MAR-1995 at 15:30

VAX MULTICHROM

Analyst Name : Kristin Lind
Lims Id :
Comment : Varian 3400, DB-1, 30m, Kol.id.4463141
Method Title : standard metode for sat-prøver
Sample Name : E-3767, SAT
Sample Id : E3767
Sample Type : Sample Amount=0.00000
Bottle No : 8

PEAK INFORMATION

Peak	Cal	Flags	RT mins	Hght uV	Area uVs	Area %		Peak name
22			16.512	4076	12184	0.20	7.8E-2	n-C15
30			19.427	40668	113437	1.89	0.7	n-C16
44			22.232	65198	195880	3.26	1.3	n-C17
45			22.501	51574	227441	3.79	1.5	Pristane
59			24.909	63485	196598	3.27	1.3	n-C18
60			25.224	20548	101769	1.70	0.7	Phytane
71			27.472	62477	169603	2.82	1.1	n-C19
87			29.928	55133	166387	2.77	1.1	n-C20
97			32.267	58340	181873	3.03	1.2	n-C21
108			34.517	59079	179157	2.98	1.2	n-C22
124			36.680	63236	209396	3.49	1.3	n-C23
140			38.760	65047	195752	3.26	1.3	n-C24
155			40.765	66763	225112	3.75	1.4	n-C25
167			42.704	55491	181451	3.02	1.2	n-C26
180			44.568	69998	217021	3.61	1.4	n-C27
190			46.368	46581	151970	2.53	1.0	n-C28
203			48.120	59197	190329	3.17	1.2	n-C29
213			49.805	43248	143204	2.39	0.9	n-C30
223			51.437	37815	120777	2.01	0.8	n-C31
231			53.032	19585	91302	1.52	0.6	n-C32
240			54.573	22270	79401	1.32	0.5	n-C33
247			56.083	11927	55893	0.93	0.4	n-C34
249			57.568	9346	40305	0.67	0.3	n-C35

Totals	Hght uV	Area uVs	Area %	
Unknowns	2667348	12090561	201.37	N/A
Quantified	1051080	3446242	57.40	22.2
Grand Total	3718428	15536803	258.77	22.2

[232548MC] 6 23254800_SAT,2,1
Reported on 2-MAY-1995 at 10:19

IKU SINTEF GROUP

Injection Report

Acquired on 15-MAR-1995 at 14:16

VAX MULTICHROM

Analyst Name : Kristin Lind
Lims Id :
Comment : Varian 3400, DB-1, 30m, Kol.id.4463141
Method Title : standard metode for sat-prøver
Sample Name : E-3784, SAT
Sample Id : E3784
Sample Type : Sample Amount=0.00000
Bottle No : 2

PEAK INFORMATION

Peak	Cal	Flags	RT mins	Hght uV	Area uVs	Area %		Peak name
23			13.584	3819	8854	0.06	3.5E-2	n-C14
27			16.520	14773	44182	0.28	0.2	n-C15
39			19.435	55157	168527	1.05	0.7	n-C16
56			22.240	88492	299073	1.87	1.2	n-C17
57			22.525	178108	773174	4.84	3.1	Pristane
76			24.920	96403	308466	1.93	1.2	n-C18
78			25.261	94465	442936	2.77	1.8	Phytane
92			27.485	97336	363532	2.28	1.4	n-C19
108			29.933	108203	357896	2.24	1.4	n-C20
125			32.280	101616	338340	2.12	1.3	n-C21
144			34.531	109395	372690	2.33	1.5	n-C22
159			36.699	112898	393350	2.46	1.6	n-C23
179			38.779	105514	358011	2.24	1.4	n-C24
194			40.784	108424	385697	2.41	1.5	n-C25
208			42.723	100643	331432	2.07	1.3	n-C26
222			44.595	130220	424181	2.65	1.7	n-C27
236			46.392	93642	290218	1.82	1.1	n-C28
249			48.144	114726	411131	2.57	1.6	n-C29
258			49.832	139866	561544	3.51	2.2	n-C30
272			51.464	80464	290238	1.82	1.1	n-C31
283			53.112	44483	155618	0.97	0.6	n-C32
293			54.595	43086	163918	1.03	0.6	n-C33
302			56.101	31010	148247	0.93	0.6	n-C34
305			57.589	21624	86525	0.54	0.3	n-C35

Totals	Hght uV	Area uVs	Area %	
Unknowns	4131440	17820304	111.52	N/A
Quantified	2074367	7477780	46.80	29.6
Grand Total	6205808	25298084	158.32	29.6

[232548MC] 6 23254800_SAT,4,1
Reported on 2-MAY-1995 at 10:19

IKU SINTEF GROUP

Injection Report

Acquired on 16-MAR-1995 at 08:47

VAX MULTICHROM

Analyst Name : Kristin Lind
Lims Id :
Comment : Varian 3400, DB-1, 30m, Kol.id.4463141
Method Title : standard metode for sat-prøver
Sample Name : E-3803, SAT
Sample Id : E3803
Sample Type : Sample Amount=0.00000
Bottle No : 4

PEAK INFORMATION

Peak	Cal	Flags	RT mins	Hght uV	Area uVs	Area %		Peak name
21			13.573	3985	10029	0.04	2.9E-2	n-C14
24			16.512	14975	43733	0.18	0.1	n-C15
35			19.427	80096	243630	0.98	0.7	n-C16
51			22.237	143067	464182	1.88	1.4	n-C17
52			22.531	307575	1452230	5.87	4.2	Pristane
69			24.925	161347	500887	2.03	1.5	n-C18
70			25.253	118481	592322	2.39	1.7	Phytane
83			27.485	183544	700773	2.83	2.0	n-C19
102			29.933	176467	618558	2.50	1.8	n-C20
119			32.285	207782	688038	2.78	2.0	n-C21
136			34.533	192045	663006	2.68	1.9	n-C22
152			36.701	247004	871958	3.53	2.5	n-C23
168			38.787	225978	780651	3.16	2.3	n-C24
182			40.795	269251	955869	3.86	2.8	n-C25
196			42.725	247076	789600	3.19	2.3	n-C26
207			44.603	267048	967684	3.91	2.8	n-C27
223			46.411	176546	575268	2.33	1.7	n-C28
236			48.157	263272	874303	3.53	2.5	n-C29
246			49.827	157144	533139	2.16	1.6	n-C30
259			51.480	154859	506333	2.05	1.5	n-C31
270			53.061	70972	245628	0.99	0.7	n-C32
282			54.608	86540	318733	1.29	0.9	n-C33
291			56.101	46527	219581	0.89	0.6	n-C34
299			57.592	42306	168751	0.68	0.5	n-C35

Totals	Hght uV	Area uVs	Area %	
Unknowns	4697296	20597896	83.27	N/A
Quantified	3843886	13784886	55.73	40.1
Grand Total	8541182	34382784	139.00	40.1

[244422MC] 6 24442200_SAT,1,1
Reported on 13-DEC-1994 at 14:06

IKU SINTEF GROUP

Injection Report

Acquired on 25-NOV-1994 at 09:57

VAX MULTICHROM

Analyst Name : Kristin
Lims Id :
Comment : VARIAN 3400, DB-1(30m*0.25mm),Kol.id.4463141
Method Title : standard metode for sat-prøver
Sample Name : E-3815,71.44m,Saturated hydrocarbons
Sample Id : E3815
Sample Type : Sample Amount=0.00000
Bottle No : 1

PEAK INFORMATION

RT mins	Hght uV	Area uVs	Peak name
4.971	593	1166	n-C11
7.451	7073	17383	n-C12
10.357	80285	288537	n-C13
13.427	160908	789362	n-C14
16.451	182433	1030711	n-C15
19.352	161522	912014	n-C16
22.139	139904	753507	n-C17
22.376	75801	428653	Pristane
24.800	113393	594181	n-C18
25.064	19827	109034	Phytane
27.344	92429	478024	n-C19
29.765	81353	352438	n-C20
32.104	72484	305449	n-C21
34.344	62161	243892	n-C22
36.493	52228	214063	n-C23
38.552	42401	156228	n-C24
40.547	36806	133627	n-C25
42.467	28135	93756	n-C26
44.341	27993	97037	n-C27
46.133	16776	56850	n-C28
47.883	20014	83884	n-C29
49.539	9996	70375	n-C30
51.179	10841	42328	n-C31
52.768	7704	28542	n-C32
54.301	6070	22440	n-C33
55.800	2548	15503	n-C34
57.264	2950	11423	n-C35

Totals		
Unknowns	1091843	4783654
	1514626	7330410
	2606469	12114064

[244422MC] 6 24442200 SAT,3,1
Reported on 13-DEC-1994 at 14:07

Injection Report

Acquired on 25-NOV-1994 at 13:08

VAX MULTICHROM

Analyst Name : Kristin
Lims Id :
Comment : VARIAN 3400, DB-1(30m*0.25mm),Kol.id.4463141
Method Title : standard metode for sat-prøver
Sample Name : E-3818,74.62m,Saturated hydrocarbons
Sample Id : E3818
Sample Type : Sample Amount=0.00000
Bottle No : 3

PEAK INFORMATION

RT mins	Hght uV	Area uVs	Peak name
4.968	30099	58118	n-C11
7.475	89848	264640	n-C12
10.371	124633	499474	n-C13
13.405	143721	701492	n-C14
16.424	164446	892313	n-C15
19.339	167749	950706	n-C16
22.144	153456	950253	n-C17
22.384	102017	583960	Pristane
24.819	150365	896798	n-C18
25.067	31016	169814	Phytane
27.368	136153	844361	n-C19
29.800	120496	668656	n-C20
32.128	104467	545106	n-C21
34.352	90453	439849	n-C22
36.504	78269	362014	n-C23
38.571	64967	274706	n-C24
40.557	53385	212459	n-C25
42.475	39542	143269	n-C26
44.325	32013	115883	n-C27
46.117	20697	67389	n-C28
47.851	16382	59823	n-C29
49.525	8345	44911	n-C30
51.155	6258	24013	n-C31
52.747	5016	17752	n-C32
54.283	2513	10131	n-C33
55.771	1403	7267	n-C34
57.235	830	3369	n-C35

Totals		
Unknowns	1443105	6347387
	1938540	9808527
	3381645	16155914

[244422MC] 6 24442200_SAT,4,1
Reported on 13-DEC-1994 at 14:07

IKU SINTEF GROUP

Injection Report

Acquired on 25-NOV-1994 at 14:26

VAX MULTICHROM

Analyst Name : Kristin
Lims Id :
Comment : VARIAN 3400, DB-1(30m*0.25mm),Kol.id.4463141
Method Title : standard metode for sat-prøver
Sample Name : E-3819,74.67m,Saturated hydrocarbons
Sample Id : E3819
Sample Type : Sample Amount=0.00000
Bottle No : 4

PEAK INFORMATION

RT mins	Hght uV	Area uVs	Peak name
4.981	33065	63194	n-C11
7.488	95463	280486	n-C12
10.379	117520	466113	n-C13
13.405	130373	576607	n-C14
16.411	130426	659053	n-C15
19.315	124445	631616	n-C16
22.115	115847	594726	n-C17
22.355	66994	357899	Pristane
24.787	107521	545999	n-C18
25.056	18306	94717	Phytane
27.336	103675	523098	n-C19
29.779	88299	413369	n-C20
32.112	83298	375801	n-C21
34.344	73328	314979	n-C22
36.488	60985	271378	n-C23
38.560	50747	207531	n-C24
40.555	44604	168642	n-C25
42.477	32858	114502	n-C26
44.333	26940	94029	n-C27
46.123	16484	55359	n-C28
47.853	13730	50348	n-C29
49.528	7640	37735	n-C30
51.157	5103	19242	n-C31
52.752	4088	15003	n-C32
54.288	2179	8916	n-C33
55.781	1219	5556	n-C34
57.245	951	3777	n-C35

Totals		
Unknowns	1148644	4733044
	1556086	6949675
	2704731	11682719

[244422MC] 6 24442200_SAT,2,1
Reported on 13-DEC-1994 at 14:06

IKU SINTEF GROUP

Injection Report

Acquired on 25-NOV-1994 at 11:33

VAX MULTICHROM

Analyst Name : Kristin
Lims Id :
Comment : VARIAN 3400, DB-1(30m*0.25mm),Kol.id.4463141
Method Title : standard metode for sat-prøver
Sample Name : E-3817,74.70m,Saturated hydrocarbons
Sample Id : E3817
Sample Type : Sample Amount=0.00000
Bottle No : 2

PEAK INFORMATION

RT mins	Hght uV	Area uVs	Peak name
4.981	19034	37978	n-C11
7.491	90825	277849	n-C12
10.392	131939	558303	n-C13
13.419	145107	734735	n-C14
16.435	157558	877564	n-C15
19.341	154915	891529	n-C16
22.152	141803	885023	n-C17
22.389	92783	521014	Pristane
24.824	138259	838891	n-C18
25.080	27812	156509	Phytane
27.384	132868	809341	n-C19
29.824	125656	705068	n-C20
32.160	109210	602749	n-C21
34.389	100869	500733	n-C22
36.531	87144	426270	n-C23
38.595	69974	315970	n-C24
40.581	59999	248828	n-C25
42.493	44340	163996	n-C26
44.349	35788	131721	n-C27
46.131	22045	74868	n-C28
47.867	18084	69583	n-C29
49.539	9801	50383	n-C30
51.165	6855	25840	n-C31
52.757	5540	20282	n-C32
54.296	2964	11900	n-C33
55.789	1644	8049	n-C34
57.253	1182	4789	n-C35

Totals		
Unknowns	1444208	6435048
	1933998	9949764
	3378206	16384812

[244422MC] 6 24442200 SAT,5,1
Reported on 13-DEC-1994 at 14:07

IKU SINTEF GROUP

Injection Report

Acquired on 25-NOV-1994 at 15:58

VAX MULTICHROM

Analyst Name : Kristin
Lims Id :
Comment : VARIAN 3400, DB-1(30m*0.25mm),Kol.id.4463141
Method Title : standard metode for sat-prøver
Sample Name : E-3820,74.73m,Saturated hydrocarbons
Sample Id : E3820
Sample Type : Sample Amount=0.00000
Bottle No : 5

PEAK INFORMATION

RT mins	Hght uV	Area uVs	Peak name
4.979	47832	93548	n-C11
7.488	109559	346399	n-C12
10.376	128696	522914	n-C13
13.397	130196	588295	n-C14
16.397	125818	617143	n-C15
19.299	117248	574944	n-C16
22.091	104878	513348	n-C17
22.339	58756	308572	Pristane
24.765	95112	462529	n-C18
25.043	14868	78645	Phytane
27.320	88583	444477	n-C19
29.760	77658	351401	n-C20
32.091	74524	321332	n-C21
34.331	66448	274032	n-C22
36.477	58553	236169	n-C23
38.552	47526	182668	n-C24
40.555	41574	148165	n-C25
42.475	29393	101295	n-C26
44.328	23764	83475	n-C27
46.123	14852	49867	n-C28
47.864	12124	42840	n-C29
49.536	6718	38175	n-C30
51.160	4673	17255	n-C31
52.755	3845	13461	n-C32
54.283	1833	7723	n-C33
55.784	1040	4670	n-C34
57.245	686	2138	n-C35

Totals		
Unknowns	1109804	4338086
	1486759	6425481
	2596563	10763566

[232548MC] 6 23254800_SAT,3,1
Reported on 2-MAY-1995 at 10:19

Injection Report

Acquired on 15-MAR-1995 at 15:54

VAX MULTICHROM

Analyst Name : Kristin Lind
Lims Id :
Comment : Varian 3400, DB-1, 30m, Kol.id.4463141
Method Title : standard metode for sat-prøver
Sample Name : E-3828, SAT
Sample Id : E3828
Sample Type : Sample Amount=0.00000
Bottle No : 3

PEAK INFORMATION

Peak	Cal	Flags	RT mins	Hght uV	Area uVs	Area %		Peak name
21			13.571	4195	13075	0.07	4.6E-2	n-C14
31			16.509	14238	43353	0.24	0.2	n-C15
47			19.419	38620	118752	0.65	0.4	n-C16
61			22.221	67003	204104	1.11	0.7	n-C17
62			22.515	276341	1219639	6.63	4.3	Pristane
77			24.904	72330	239279	1.30	0.8	n-C18
79			25.224	77895	383089	2.08	1.3	Phytane
95			27.469	101423	374807	2.04	1.3	n-C19
113			29.920	111962	369996	2.01	1.3	n-C20
129			32.259	126956	469632	2.55	1.7	n-C21
145			34.509	134768	450377	2.45	1.6	n-C22
162			36.672	141147	492078	2.68	1.7	n-C23
178			38.760	122202	418990	2.28	1.5	n-C24
189			40.768	139452	482861	2.63	1.7	n-C25
202			42.704	111340	350020	1.90	1.2	n-C26
215			44.571	138657	511338	2.78	1.8	n-C27
231			46.384	84625	286129	1.56	1.0	n-C28
243			48.136	173341	710891	3.87	2.5	n-C29
253			49.797	76693	378449	2.06	1.3	n-C30
266			51.451	92734	303819	1.65	1.1	n-C31
276			53.091	34034	116823	0.64	0.4	n-C32
285			54.581	55682	209764	1.14	0.7	n-C33
292			56.085	24667	100901	0.55	0.4	n-C34
298			57.568	28027	113951	0.62	0.4	n-C35

Totals				
Unknowns	4587856	20064970	109.09	N/A
Quantified	2248333	8362115	45.46	29.4
Grand Total	6836189	28427086	154.56	29.4

[232548MC] 6 23254800_SAT,9,1
Reported on 2-MAY-1995 at 10:20

IKU SINTEF GROUP

Injection Report

Acquired on 16-MAR-1995 at 17:56

VAX MULTICHROM

Analyst Name : Kristin Lind
Lims Id :
Comment : Varian 3400, DB-1, 30m, Kol.id.4463141
Method Title : standard metode for sat-prøver
Sample Name : E-3861, SAT
Sample Id : E3861
Sample Type : Sample Amount=0.00000
Bottle No : 9

PEAK INFORMATION

Peak	Cal	Flags	RT mins	Hght uV	Area uVs	Area %		Peak name
19			13.573	702	1813	0.01	6.9E-3	n-C14
22			16.512	11464	34482	0.21	0.1	n-C15
34			19.424	55080	167249	1.01	0.6	n-C16
49			22.232	99761	315053	1.90	1.2	n-C17
50			22.515	171030	841494	5.08	3.2	Pristane
70			24.917	128545	406877	2.46	1.6	n-C18
72			25.240	52042	251151	1.52	1.0	Phytane
89			27.480	153843	503200	3.04	1.9	n-C19
105			29.925	186364	634056	3.83	2.4	n-C20
120			32.277	207614	669488	4.04	2.6	n-C21
137			34.533	213768	694623	4.19	2.7	n-C22
154			36.696	229322	811519	4.90	3.1	n-C23
169			38.779	199784	659011	3.98	2.5	n-C24
183			40.784	240114	823247	4.97	3.2	n-C25
197			42.715	157734	521045	3.14	2.0	n-C26
211			44.597	227405	767425	4.63	2.9	n-C27
224			46.381	116530	379494	2.29	1.5	n-C28
237			48.141	202551	709873	4.28	2.7	n-C29
250			49.816	95386	330839	2.00	1.3	n-C30
263			51.453	110805	369843	2.23	1.4	n-C31
272			53.096	44391	266730	1.61	1.0	n-C32
281			54.592	67141	235104	1.42	0.9	n-C33
289			56.088	21218	100311	0.61	0.4	n-C34
293			57.579	28759	111796	0.67	0.4	n-C35

Totals				
Unknowns	3579306	15501194	93.55	N/A
Quantified	3021354	10605722	64.01	40.6
Grand Total	6600660	26106916	157.56	40.6

[232548MC] 6 23254800_SAT,10,1
Reported on 2-MAY-1995 at 10:20

Injection Report

Acquired on 16-MAR-1995 at 19:31

VAX MULTICHROM

Analyst Name : Kristin Lind
Lims Id :
Comment : Varian 3400, DB-1, 30m, Kol.id.4463141
Method Title : standard metode for sat-prøver
Sample Name : E-3389, SAT
Sample Id : E3389
Sample Type : Sample Amount=0.00000
Bottle No : 10

PEAK INFORMATION

Peak	Cal	Flags	RT mins	Hght uV	Area uVs	Area %		Peak name
117			13.531	179037	533056	0.84	0.7	n-C14
141			16.536	211642	641294	1.01	0.9	n-C15
164			19.448	227134	781788	1.23	1.1	n-C16
186			22.251	280858	958247	1.51	1.3	n-C17
187			22.560	625860	3302640	5.20	4.5	Pristane
209			24.936	333541	1105492	1.74	1.5	n-C18
211			25.248	91897	448250	0.71	0.6	Phytane
231			27.504	423026	1578147	2.48	2.2	n-C19
250			29.960	463784	1686802	2.65	2.3	n-C20
266			32.312	598128	2383733	3.75	3.3	n-C21
282			34.573	628246	2480195	3.90	3.4	n-C22
297			36.765	814577	4111396	6.47	5.6	n-C23
313			38.821	632678	2520134	3.97	3.5	n-C24
330			40.856	876080	4299567	6.77	5.9	n-C25
345			42.757	475061	1926049	3.03	2.6	n-C26
358			44.664	781594	3428124	5.40	4.7	n-C27
374			46.432	383855	1275826	2.01	1.8	n-C28
388			48.211	599127	2704062	4.26	3.7	n-C29
399			49.848	356443	1362307	2.14	1.9	n-C30
412			51.504	377939	1406071	2.21	1.9	n-C31
424			53.147	219350	747784	1.18	1.0	n-C32
435			54.624	239249	844687	1.33	1.2	n-C33
446			56.104	66251	260963	0.41	0.4	n-C34
454			57.595	97427	385506	0.61	0.5	n-C35

Totals	Hght uV	Area uVs	Area %	
Unknowns	9336337	31727560	49.93	N/A
Quantified	9982783	41172120	64.80	56.5
Grand Total	19319120	72899680	114.73	56.5

[232548MC] 6 23254800_SAT,5,1
Reported on 2-MAY-1995 at 10:19

IKU SINTEF GROUP

Injection Report

Acquired on 16-MAR-1995 at 10:34

VAX MULTICHROM

Analyst Name : Kristin Lind
Lims Id :
Comment : Varian 3400, DB-1, 30m, Kol.id.4463141
Method Title : standard metode for sat-prøver
Sample Name : E-3420, SAT
Sample Id : E3420
Sample Type : Sample Amount=0.00000
Bottle No : 5

PEAK INFORMATION

Peak	Cal	Flags	RT mins	Hght uV	Area uVs	Area %		Peak name
67			13.523	25936	88195	0.23	0.2	n-C14
92			16.528	82563	252840	0.67	0.5	n-C15
116			19.440	117777	363271	0.96	0.8	n-C16
139			22.251	156107	521262	1.37	1.1	n-C17
140			22.549	433824	2242985	5.90	4.7	Pristane
162			24.933	200831	640260	1.68	1.3	n-C18
164			25.259	73069	357223	0.94	0.8	Phytane
184			27.501	280198	1010002	2.66	2.1	n-C19
203			29.955	325257	1088805	2.86	2.3	n-C20
220			32.309	451515	1574732	4.14	3.3	n-C21
235			34.568	461063	1663884	4.38	3.5	n-C22
252			36.749	657356	2646393	6.96	5.6	n-C23
267			38.816	430181	1585345	4.17	3.3	n-C24
284			40.845	595950	2637316	6.94	5.5	n-C25
301			42.741	331246	1133079	2.98	2.4	n-C26
314			44.648	499240	1964829	5.17	4.1	n-C27
329			46.421	217178	712067	1.87	1.5	n-C28
341			48.184	370806	1393216	3.66	2.9	n-C29
353			49.843	227171	868806	2.29	1.8	n-C30
368			51.485	211398	703739	1.85	1.5	n-C31
379			53.125	142387	516918	1.36	1.1	n-C32
390			54.616	117517	409455	1.08	0.9	n-C33
401			56.107	39317	181819	0.48	0.4	n-C34
409			57.589	41963	179812	0.47	0.4	n-C35

Totals				
Unknowns	5387291	22818322	60.02	N/A
Quantified	6489851	24736254	65.07	52.0
Grand Total	11877142	47554576	125.09	52.0

[232548MC] 6 23254800_SAT,1,1
Reported on 2-MAY-1995 at 10:19

Injection Report

Acquired on 15-MAR-1995 at 12:36

VAX MULTICHROM

Analyst Name : Kristin Lind
Lims Id :
Comment : Varian 3400, DB-1, 30m, Kol.id.4463141
Method Title : standard metode for sat-prøver
Sample Name : E-3474, SAT
Sample Id : E3474
Sample Type : Sample Amount=0.00000
Bottle No : 1

PEAK INFORMATION

Peak	Cal	Flags	RT mins	Hght uV	Area uVs	Area %		Peak name
81			13.501	42695	126126	0.41	0.3	n-C14
107			16.507	98522	291583	0.95	0.7	n-C15
130			19.421	122021	383358	1.26	1.0	n-C16
152			22.227	153206	491496	1.61	1.2	n-C17
153			22.525	440927	2199678	7.20	5.5	Pristane
170			24.909	157071	513796	1.68	1.3	n-C18
172			25.216	90441	424082	1.39	1.1	Phytane
190			27.472	209629	706123	2.31	1.8	n-C19
208			29.925	185037	635863	2.08	1.6	n-C20
223			32.275	247732	871104	2.85	2.2	n-C21
238			34.528	244153	827143	2.71	2.1	n-C22
255			36.699	354748	1298277	4.25	3.2	n-C23
270			38.771	245766	832026	2.72	2.1	n-C24
285			40.784	371817	1392170	4.56	3.5	n-C25
301			42.707	201457	717632	2.35	1.8	n-C26
314			44.600	354322	1292657	4.23	3.2	n-C27
330			46.384	157751	550943	1.80	1.4	n-C28
342			48.157	296781	1144778	3.75	2.8	n-C29
355			49.829	185391	641839	2.10	1.6	n-C30
367			51.464	179749	639364	2.09	1.6	n-C31
378			53.109	133821	628310	2.06	1.6	n-C32
387			54.587	107485	388441	1.27	1.0	n-C33
397			56.083	44713	201223	0.66	0.5	n-C34
405			57.565	40915	167436	0.55	0.4	n-C35

Totals				
Unknowns	5409097	22863510	74.86	N/A
Quantified	4666153	17365446	56.86	43.2
Grand Total	10075249	40228956	131.72	43.2

[232548MC] 6 23254800 SAT,6,1
Reported on 2-MAY-1995 at 10:19

IKU SINTEF GROUP

Injection Report

Acquired on 16-MAR-1995 at 12:12

VAX MULTICHROM

Analyst Name : Kristin Lind
Lims Id :
Comment : Varian 3400, DB-1, 30m, Kol.id.4463141
Method Title : standard metode for sat-prøver
Sample Name : E-3687, SAT
Sample Id : E3687
Sample Type : Sample Amount=0.00000
Bottle No : 6

PEAK INFORMATION

Peak	Cal	Flags	RT mins	Hght uV	Area uVs	Area %		Peak name
16			13.499	7529	23293	0.11	7.5E-2	n-C14
33			16.499	38641	113354	0.52	0.4	n-C15
53			19.413	67373	205535	0.94	0.7	n-C16
70			22.221	99368	338700	1.55	1.1	n-C17
71			22.501	256281	1200003	5.48	3.9	Pristane
85			24.896	130108	420067	1.92	1.4	n-C18
87			25.208	61589	300700	1.37	1.0	Phytane
101			27.467	177741	652639	2.98	2.1	n-C19
119			29.915	179852	611432	2.79	2.0	n-C20
134			32.267	180621	641726	2.93	2.1	n-C21
148			34.523	175129	604706	2.76	2.0	n-C22
166			36.685	208330	754376	3.45	2.4	n-C23
182			38.768	173689	592222	2.70	1.9	n-C24
197			40.784	211622	814898	3.72	2.6	n-C25
212			42.701	152771	524526	2.40	1.7	n-C26
226			44.587	231971	731571	3.34	2.4	n-C27
240			46.381	137873	447310	2.04	1.4	n-C28
252			48.141	189782	646803	2.95	2.1	n-C29
264			49.821	142038	448596	2.05	1.5	n-C30
274			51.464	124560	461214	2.11	1.5	n-C31
285			53.051	60906	200083	0.91	0.6	n-C32
294			54.587	81181	337468	1.54	1.1	n-C33
304			56.096	43947	165829	0.76	0.5	n-C34
310			57.581	49038	196218	0.90	0.6	n-C35

Totals	Hght uV	Area uVs	Area %	
Unknowns	5520502	19452012	88.85	N/A
Quantified	3181939	11433270	52.22	37.0
Grand Total	8702441	30885282	141.07	37.0

[232548MC] 6 23254800_SAT,12,1
Reported on 2-MAY-1995 at 10:20

IKU
SINTEF GROUP

Injection Report

Acquired on 17-MAR-1995 at 10:30

VAX MULTICHROM

Analyst Name : Kristin Lind
Lims Id :
Comment : Varian 3400, DB-1, 30m, Kol.id.4463141
Method Title : standard metode for sat-prøver
Sample Name : E-3704, SAT
Sample Id : E3704
Sample Type : Sample Amount=0.00000
Bottle No : 12

PEAK INFORMATION

Peak	Cal	Flags	RT mins	Hght uV	Area uVs	Area %		Peak name
139			13.509	19511	80650	0.34	0.2	n-C14
164			16.517	65638	197391	0.83	0.6	n-C15
191			19.432	92251	291081	1.23	0.9	n-C16
217			22.235	123597	369738	1.56	1.1	n-C17
218			22.523	238218	1135586	4.78	3.4	Pristane
240			24.912	106929	340787	1.43	1.0	n-C18
242			25.224	79162	352633	1.48	1.1	Phytane
259			27.475	131453	475467	2.00	1.4	n-C19
278			29.925	135793	432366	1.82	1.3	n-C20
290			32.277	153358	527917	2.22	1.6	n-C21
306			34.523	149230	526026	2.21	1.6	n-C22
325			36.685	205982	707082	2.98	2.1	n-C23
341			38.771	153591	556498	2.34	1.7	n-C24
359			40.773	196486	755957	3.18	2.3	n-C25
373			42.709	158329	512836	2.16	1.5	n-C26
386			44.589	215450	760369	3.20	2.3	n-C27
404			46.387	135803	453039	1.91	1.4	n-C28
417			48.144	198963	672154	2.83	2.0	n-C29
431			49.827	157036	578348	2.43	1.7	n-C30
444			51.467	136395	457037	1.92	1.4	n-C31
457			53.107	66716	209192	0.88	0.6	n-C32
466			54.605	88984	303242	1.28	0.9	n-C33
476			56.093	36780	142154	0.60	0.4	n-C34
485			57.589	48024	195489	0.82	0.6	n-C35

Totals

	Hght uV	Area uVs	Area %	
Unknowns	7462049	22497212	94.71	N/A
Quantified	3093679	11033039	46.45	32.9
Grand Total	10555728	33530252	141.16	32.9

[232548MC] 6 23254800_SAT,13,1
Reported on 2-MAY-1995 at 10:20

IKU SINTEF GROUP

Injection Report

Acquired on 17-MAR-1995 at 12:08

VAX MULTICHROM

Analyst Name : Kristin Lind
Lims Id :
Comment : Varian 3400, DB-1, 30m, Kol.id.4463141
Method Title : standard metode for sat-prøver
Sample Name : E-3725, SAT
Sample Id : E3725
Sample Type : Sample Amount=0.00000
Bottle No : 13

PEAK INFORMATION

Peak	Cal	Flags	RT mins	Hght uV	Area uVs	Area %		Peak name
157			22.237	28695	118623	0.81	0.5	n-C17
159			22.496	26406	120487	0.82	0.5	Pristane
186			24.920	38275	122598	0.83	0.5	n-C18
189			25.237	22856	106163	0.72	0.4	Phytane
211			27.483	47001	140941	0.96	0.6	n-C19
236			29.939	69702	209577	1.43	0.9	n-C20
260			32.283	83285	266663	1.81	1.1	n-C21
285			34.536	111946	347979	2.37	1.4	n-C22
308			36.707	116647	369020	2.51	1.5	n-C23
334			38.781	122638	368134	2.50	1.5	n-C24
357			40.795	113882	419307	2.85	1.7	n-C25
376			42.728	105702	354602	2.41	1.5	n-C26
397			44.592	111816	412037	2.80	1.7	n-C27
416			46.405	91862	287477	1.96	1.2	n-C28
432			48.149	94656	320551	2.18	1.3	n-C29
448			49.837	97343	329546	2.24	1.4	n-C30
466			51.475	65558	203719	1.39	0.8	n-C31
483			53.067	46853	219375	1.49	0.9	n-C32
497			54.621	44692	176128	1.20	0.7	n-C33
514			56.109	32153	109879	0.75	0.5	n-C34
529			57.608	21742	90287	0.61	0.4	n-C35

Totals				
Unknowns	6210210	19053296	129.65	N/A
Quantified	1493710	5093093	34.66	21.1
Grand Total	7703920	24146388	164.30	21.1

[232548MC] 6 23254800 SAT,14,1
Reported on 2-MAY-1995 at 10:20

IKU SINTEF GROUP

Injection Report

Acquired on 17-MAR-1995 at 14:03

VAX MULTICHROM

Analyst Name : Kristin Lind
Lims Id :
Comment : Varian 3400, DB-1, 30m, Kol.id.4463141
Method Title : standard metode for sat-prøver
Sample Name : E-3731, SAT
Sample Id : E3731
Sample Type : Sample Amount=0.00000
Bottle No : 14

PEAK INFORMATION

Peak	Cal	Flags	RT mins	Hght uV	Area uVs	Area %		Peak name
45			13.504	19156	57009	0.31	0.2	n-C14
69			16.512	90019	256816	1.38	0.9	n-C15
93			19.432	118612	375071	2.01	1.3	n-C16
108			22.240	214278	693326	3.72	2.5	n-C17
109			22.509	232770	1055700	5.67	3.8	Pristane
127			24.915	121067	402612	2.16	1.4	n-C18
129			25.232	46174	223773	1.20	0.8	Phytane
146			27.480	194860	680555	3.65	2.4	n-C19
162			29.928	118244	378761	2.03	1.3	n-C20
176			32.277	118843	416522	2.24	1.5	n-C21
191			34.523	109699	337852	1.81	1.2	n-C22
207			36.688	113926	384010	2.06	1.4	n-C23
223			38.768	96727	311813	1.67	1.1	n-C24
237			40.776	102906	377559	2.03	1.3	n-C25
252			42.715	71760	241624	1.30	0.9	n-C26
264			44.571	84367	303843	1.63	1.1	n-C27
280			46.379	60826	201710	1.08	0.7	n-C28
291			48.133	78212	246704	1.32	0.9	n-C29
302			49.821	72649	271378	1.46	1.0	n-C30
311			51.464	55780	202749	1.09	0.7	n-C31
322			53.064	29919	161099	0.86	0.6	n-C32
330			54.603	34902	139580	0.75	0.5	n-C33
338			56.096	22024	96582	0.52	0.3	n-C34
344			57.592	19338	83602	0.45	0.3	n-C35

Totals	Hght uV	Area uVs	Area %	
Unknowns	5436804	20218528	108.56	N/A
Quantified	2227060	7900250	42.42	28.1
Grand Total	7663864	28118778	150.98	28.1

[232548MC] 6 23254800_SAT,7,1
Reported on 2-MAY-1995 at 10:19

IKU SINTEF GROUP

Injection Report

Acquired on 16-MAR-1995 at 13:46

VAX MULTICHROM

Analyst Name : Kristin Lind
Lims Id :
Comment : Varian 3400, DB-1, 30m, Kol.id.4463141
Method Title : standard metode for sat-prøver
Sample Name : E-3537, SAT
Sample Id : E3537
Sample Type : Sample Amount=0.00000
Bottle No : 7

PEAK INFORMATION

Peak	Cal	Flags	RT mins	Hight uV	Area uVs	Area %		Peak name
36			13.493	37060	103134	0.25	0.2	n-C14
52			16.515	295549	942089	2.32	1.9	n-C15
74			19.440	491251	1810612	4.46	3.6	n-C16
93			22.251	554792	2122524	5.22	4.2	n-C17
94			22.507	202826	1049834	2.58	2.1	Pristane
112			24.933	560818	2211268	5.44	4.4	n-C18
114			25.213	65266	356106	0.88	0.7	Phytane
129			27.493	537199	2144245	5.28	4.3	n-C19
144			29.944	512452	1925728	4.74	3.8	n-C20
160			32.288	449928	1713734	4.22	3.4	n-C21
174			34.531	404228	1503405	3.70	3.0	n-C22
188			36.691	355970	1294682	3.19	2.6	n-C23
202			38.768	307367	1147061	2.82	2.3	n-C24
218			40.776	268600	959745	2.36	1.9	n-C25
230			42.696	223680	748354	1.84	1.5	n-C26
243			44.571	184032	625653	1.54	1.2	n-C27
254			46.371	137351	473166	1.16	0.9	n-C28
265			48.112	123216	409523	1.01	0.8	n-C29
276			49.792	84969	270063	0.66	0.5	n-C30
285			51.429	69436	230289	0.57	0.5	n-C31
292			53.024	45041	144101	0.35	0.3	n-C32
296			54.560	44151	191539	0.47	0.4	n-C33
303			56.075	24073	121660	0.30	0.2	n-C34
306			57.549	16729	73022	0.18	0.1	n-C35

Totals				
Unknowns	7845815	27491608	67.65	N/A
Quantified	5995984	22571538	55.54	45.1
Grand Total	13841799	50063148	123.19	45.1

[232548MC] 6 23254800 SAT,19,1
Reported on 19-MAY-1995 at 14:07

IKU SINTEF GROUP

Injection Report

Acquired on 19-MAY-1995 at 10:37

VAX MULTICHROM

Analyst Name : Kristin Lind
Lims Id :
Comment : Varian 3400, DB-1, 30m, Kol.id.4463141
Method Title : standard metode for sat-prøver
Sample Name : E-3645, SAT
Sample Id : E3645
Sample Type : Sample Amount=0.00000
Bottle No : 19

PEAK INFORMATION

Peak	Cal	Flags	RT mins	Hght uV	Area uVs	Area %		Peak name
21			13.360	1062	2768	0.07	2.1E-2	n-C14
22			16.352	5293	14567	0.37	0.1	n-C15
28			19.261	31571	89075	2.29	0.7	n-C16
41			22.059	46736	140494	3.61	1.1	n-C17
42			22.320	12863	75997	1.95	0.6	Pristane
56			24.739	42863	131583	3.38	1.0	n-C18
57			25.051	16887	71783	1.84	0.6	Phytane
67			27.293	33839	98513	2.53	0.8	n-C19
77			29.739	32100	96719	2.48	0.7	n-C20
85			32.085	29708	91360	2.35	0.7	n-C21
97			34.331	32772	104462	2.68	0.8	n-C22
110			36.483	28891	93988	2.41	0.7	n-C23
123			38.568	23723	79910	2.05	0.6	n-C24
134			40.568	19792	72863	1.87	0.6	n-C25
146			42.491	16261	51636	1.33	0.4	n-C26
153			44.365	14455	47698	1.22	0.4	n-C27
158			46.168	11069	34204	0.88	0.3	n-C28
162			47.907	10822	35583	0.91	0.3	n-C29
167			49.595	8115	29525	0.76	0.2	n-C30
170			51.232	7860	24188	0.62	0.2	n-C31
173			52.832	5600	21241	0.55	0.2	n-C32
176			54.365	4341	15193	0.39	0.1	n-C33
178			55.872	3543	14856	0.38	0.1	n-C34
179			57.339	2265	8055	0.21	6.2E-2	n-C35

Totals				
Unknowns	4196815	11488833	295.01	N/A
Quantified	442433	1446261	37.14	11.2
Grand Total	4639248	12935094	332.15	11.2

[232548MC] 6 23254800 SAT,20,1
Reported on 19-MAY-1995 at 14:09

IKU SINTEF GROUP

Injection Report

Acquired on 19-MAY-1995 at 12:19

VAX MULTICHROM

Analyst Name : Kristin Lind
Lims Id :
Comment : Varian 3400, DB-1, 30m, Kol.id.4463141
Method Title : standard metode for sat-prøver
Sample Name : E-3675, SAT
Sample Id : E3675
Sample Type : Sample Amount=0.00000
Bottle No : 20

PEAK INFORMATION

Peak	Cal	Flags	RT mins	Hght uV	Area uVs	Area %		Peak name
19			16.341	3505	10330	0.20	7.0E-2	n-C15
25			19.251	16708	51993	1.01	0.4	n-C16
32			22.048	28819	84091	1.63	0.6	n-C17
33			22.328	8803	46585	0.90	0.3	Pristane
46			24.731	42049	132774	2.57	0.9	n-C18
47			25.048	15142	73420	1.42	0.5	Phytane
57			27.277	37706	119136	2.31	0.8	n-C19
70			29.739	48230	159593	3.09	1.1	n-C20
84			32.077	49146	146428	2.84	1.0	n-C21
98			34.331	69483	223800	4.33	1.5	n-C22
117			36.488	76386	243071	4.71	1.7	n-C23
139			38.571	78620	247435	4.79	1.7	n-C24
156			40.571	56992	190351	3.69	1.3	n-C25
173			42.504	53005	165301	3.20	1.1	n-C26
183			44.363	41779	132311	2.56	0.9	n-C27
193			46.163	32188	95224	1.84	0.6	n-C28
206			47.912	28731	92966	1.80	0.6	n-C29
216			49.589	22097	76455	1.48	0.5	n-C30
224			51.227	20723	65017	1.26	0.4	n-C31
228			52.824	13531	46361	0.90	0.3	n-C32
233			54.365	10391	48191	0.93	0.3	n-C33
237			55.864	7542	34461	0.67	0.2	n-C34
241			57.339	5190	17882	0.35	0.1	n-C35

Totals	Hght uV	Area uVs	Area %	
Unknowns	3820022	12170620	235.65	N/A
Quantified	766766	2503176	48.47	17.1
Grand Total	4586788	14673796	284.12	17.1

Table A.14

Saturated biomarker peak data

(m/z 191, 217, 218)

For key to peak identification see Figure A.5

IKU SINTEF GROUP

E3767 SAT
7418/01-U-01(A) 21.68m Clst.

RT	QM	AREA	HEIGHT	ID
30.778	191	5569964	350785	23/3
32.954	191	4230593	238183	24/3
37.211	191	3831382	124623	25/3
39.189	191	10194836	549270	24/4
40.449	191	2029570	113610	26/3
40.734	191	2257260	136061	26/3
50.551	191	22463114	1165068	27Ts
51.822	191	72586736	3912285	27Tm
52.934	191	27995606	1258618	4
55.031	191	7519060	321186	28ab
56.285	191	12605152	550959	
56.582	191	127284208	6419106	29ab
56.748	191	34787792	1920674	29Ts
57.516	191	10644032	304667	30d
58.084	191	67986288	3027618	29ba
59.375	191	258797552	12907996	30ab
59.713	191	12395936	692849	
60.486	191	86454200	4584673	30ba
62.545	191	80814344	4470234	31abS
62.924	191	103145408	5378773	31abR
63.381	191	13944900	857353	
63.887	191	43967960	2078299	
65.099	191	20555628	1113181	32abS
65.408	191	17957462	938333	
65.625	191	30973708	1514077	32abR
66.686	191	11997280	554588	
68.029	191	12164904	517612	33abS
68.742	191	15159121	700275	33abR
70.161	191	33365360	1606587	
71.072	191	7132775	272902	34abS
71.953	191	7282089	311254	34abR
72.560	191	21591020	918144	
74.067	191	3673829	152415	35abS
74.394	191	13077678	498438	
75.115	191	5327718	167622	35abR
27.230	217	4781948	233491	21a
31.340	217	3474651	146966	22a
43.914	217	11947177	619621	27dbS
45.185	217	8320564	431782	27dbR
46.075	217	3491272	175114	27daR
46.713	217	3236082	176316	27daS
46.917	217	3891056	202044	28dbS
47.164	217	3723118	196651	28dbS
48.481	217	6329747	199024	28dbR
49.298	217	16171661	550315	27aaS+28daR
49.549	217	2520132	142634	
49.736	217	11185200	370858	29dbS+27bbR
50.050	217	2776062	87722	28daS+27bbS
50.545	217	37630992	2015716	27aaR
51.202	217	6922056	246511	29dbR
51.808	217	3155847	183505	29daR
52.581	217	4743689	139329	28aaS
52.964	217	11558566	480712	29daS+28bbR

IKU SINTEF GROUP

53.305	217	2186967	110187	28bbS
54.134	217	25068472	918359	28aaR
55.252	217	6089705	238657	29aaS
55.988	217	18461488	555178	29bbR+29bbS
56.753	217	4540480	215964	
57.181	217	54008200	2312930	29aaR
57.429	217	5341638	107395	30aaS
58.084	217	1694607	52942	
58.529	217	3216430	100500	
59.357	217	2425474	114381	
59.695	217	8408407	411413	30aaR
49.555	218	3671517	193601	27bbR
49.890	218	3382552	163485	27bbS
52.964	218	6827282	297683	28bbR
53.299	218	3444680	165107	28bbS
55.851	218	5101479	235370	29bbR
56.100	218	6616222	265849	29bbS
58.183	218	2743732	100744	30bbR
58.512	218	924021	34736	30bbS

IKU SINTEF GROUP

E3784 SAT
7418/01-U-01(A) 39.36m Clst.

RT	QM	AREA	HEIGHT	ID
30.843	191	13296456	813064	23/3
33.024	191	10057620	513833	24/3
37.288	191	10257465	269607	25/3
39.266	191	57401676	2952232	24/4
40.515	191	3713905	224684	26/3
40.817	191	8426752	441006	26/3
50.687	191	94297856	3969108	27Ts
51.985	191	185113776	8173338	27Tm
53.103	191	54960196	2193283	4
53.493	191	67101584	2991763	
54.773	191	38025740	1617229	
55.194	191	59229236	2292253	28ab
56.848	191	716380672	20958478	29ab
57.022	191	256064288	11572239	29Ts
57.726	191	37819952	1136208	30d
58.297	191	295392864	11917882	29ba
59.174	191	73334800	3680070	30O
59.624	191	1046636224	34723496	30ab
59.921	191	117198248	6096941	
60.106	191	80954192	4595729	
60.365	191	68758304	4107174	
60.670	191	208095584	11094781	30ba
62.686	191	314611360	15270348	31abS
63.099	191	381968608	17556958	31abR
63.512	191	41205904	2235125	
64.025	191	136437568	6225513	
65.213	191	109741632	5405145	32abS
65.516	191	58975128	3165657	
65.750	191	173082976	8955645	32abR
66.785	191	53415100	2483812	
68.118	191	86144184	4160629	33abS
68.835	191	124412128	5407182	33abR
69.960	191	31890992	1488428	
71.146	191	46936664	2029108	34abS
72.038	191	75093960	3505718	34abR
73.195	191	18648044	899194	
74.121	191	44381988	1741086	35abS
75.198	191	77283496	3095054	35abR
27.288	217	28317938	1318126	21a
31.395	217	17315328	660281	22a
43.990	217	58441188	2903666	27dbS
45.295	217	54074752	2665516	27dbR
46.173	217	22038702	1150210	27daR
46.815	217	20926248	1003486	27daS
47.013	217	23180344	1105886	28dbS
47.273	217	22099092	1131558	28dbS
48.590	217	49265516	1389799	28dbR
49.429	217	103002728	3292572	27aaS+28daR
49.850	217	73733344	1977639	29dbS+27bbR
50.198	217	18617448	570523	28daS+27bbS
50.728	217	257063664	12268681	27aaR
51.378	217	51693988	1707998	29dbR
51.940	217	48531096	1030239	29daR

IKU SINTEF GROUP

52.572	217	44355744	1024756	28aaS
53.132	217	99646136	3581261	29daS+28bbR
53.442	217	33926448	1174349	28bbS
54.371	217	240120768	7306857	28aaR
55.397	217	49184576	1786921	29aaS
56.218	217	144644256	3578707	29bbR+29bbS
57.004	217	77102688	2883432	
57.412	217	430904640	16748593	29aaR
57.653	217	17566836	851505	30aaS
58.297	217	14573133	528777	30bbR
58.722	217	22325890	866585	30bbS
59.886	217	101021632	5731612	30aaR
49.844	218	18908584	817636	27bbR
50.036	218	17739162	805205	27bbS
53.132	218	53605604	2124842	28bbR
53.455	218	27024350	1258870	28bbS
56.052	218	35680836	1498426	29bbR
56.223	218	73436200	1780016	29bbS
58.377	218	21714080	844879	30bbR
58.728	218	8843653	394700	30bbS
51.378	177	40118584	961699	25nor28ab
56.130	177	62303416	1270578	25nor30ab

IKU SINTEF GROUP

E3803 SAT
7418/01-U-01(A) 61.34m Sltst.

RT	QM	AREA	HEIGHT	ID
30.933	191	12462371	728973	23/3
33.123	191	10548278	470498	24/3
37.379	191	10429192	261785	25/3
39.394	191	34657664	1659336	24/4
40.655	191	6450664	284081	2673
40.941	191	7996601	334740	26/3
50.908	191	96173360	2992897	27Ts
52.234	191	244748656	8313663	27Tm
53.343	191	94241352	3340496	4
53.723	191	53194404	2080242	
55.013	191	42092524	1931649	
55.609	191	93547456	2223435	28ab
57.045	191	722407360	18091544	29ab
57.249	191	300416832	11891346	29Ts
57.938	191	60587612	2715332	30d
58.522	191	386148128	12667764	29ba
59.241	191	132569168	3761094	30O
59.842	191	1574648192	40187848	30ab
60.163	191	190299504	8665030	
60.315	191	106771112	5765869	
60.560	191	73591240	3593966	
60.887	191	435671712	19461066	30ba
62.913	191	635147776	23376860	31abS
63.322	191	682340992	24500680	31abR
63.719	191	75487144	3935195	
64.245	191	279891296	10276831	
65.395	191	171377632	7801690	32abS
65.704	191	111803384	5592039	
65.914	191	252788992	11449505	32abR
66.685	191	35452996	1641451	
66.948	191	90349920	3943403	
68.268	191	110673576	5150670	33abS
68.986	191	152546608	6666649	33abR
70.101	191	53269608	1992688	
70.381	191	66708504	2906096	
71.269	191	63991240	2867981	34abS
72.156	191	91009120	4325529	34abR
74.235	191	39034108	1657017	35abS
75.292	191	73324848	2385137	35abR
27.389	217	27915414	1351949	21a
31.488	217	15285269	505405	22a
44.147	217	91744536	3627824	27dbS
45.449	217	74685784	2970972	27dbR
46.336	217	35690684	1564689	27daR
46.996	217	38355744	1530630	27daS
47.189	217	49396328	2223589	28dbS
47.434	217	54685100	2206960	28dbS
48.795	217	100209896	2048627	28dbR
49.612	217	107368352	2437963	27aaS+28daR
50.073	217	148327552	3854079	29dbS+27bbR
50.406	217	48605616	1222142	28daS+27bbS
50.908	217	177084752	7291018	27aaR
51.615	217	112804240	3372929	29dbR

52.193	217	101071712	2243231	29daR
52.818	217	49656832	804568	28aaS
53.367	217	115421584	3907633	29daS+28bbR
53.664	217	43115620	1455528	28bbS
54.552	217	163919936	4630472	28aaR
55.626	217	48412696	1458325	29aaS
56.409	217	149141024	2662651	29bbR+29bbS
57.232	217	72115840	2290820	
57.594	217	320174560	13225776	29aaR
57.833	217	10981480	442399	30aaS
58.528	217	21128788	656239	30bbR
58.896	217	22658428	557659	30bbS
60.081	217	69295160	2808462	30aaR
50.062	218	64689868	1273518	27bbR
50.412	218	9328874	371750	27bbS
53.367	218	66514000	2209307	28bbR
53.688	218	42121444	1657392	28bbS
56.263	218	57222140	1680249	29bbR
56.560	218	79532856	2016197	29bbS
58.581	218	26718694	897424	30bbR
58.896	218	7465585	258155	30bbS
51.615	177	64495584	1309886	25nor28ab
56.309	177	64583524	1663420	25nor30ab

IKU SINTEF GROUP

E-3815SAT
7418/01-U-01(A) 71.44m Sst.

RT	QM	AREA	HEIGHT	ID
32.113	191	3723904	233776	23/3
33.630	191	7031415	243047	24/3
37.625	191	3840623	185219	25/3
40.586	191	16032609	847682	24/4
51.999	191	33164674	1918928	27Ts
53.267	191	58786472	3028934	27Tm
56.503	191	57977524	2779154	28ab
58.068	191	190899888	10078952	29ab
58.261	191	89227008	4454425	29Ts
58.973	191	15117570	854016	30d
59.551	191	99326736	3949630	29ba
60.854	191	447074080	24285312	30ab
61.993	191	74533520	4061780	30ba
64.049	191	102167976	5523392	31abS
64.435	191	125049440	6919706	31abR
66.631	191	26451358	1341558	32abS
67.151	191	41448312	2046275	32abR
69.593	191	16871742	773651	33abS
70.305	191	23760304	1059377	33abR
72.642	191	8721502	338680	34abS
73.535	191	11524912	522528	34abR
75.644	191	3860363	165464	35abS
76.713	191	9532964	319757	35abR
28.549	217	13542647	728157	21a
32.686	217	7891583	290218	22a
45.270	217	13198292	712232	27dbS
46.563	217	11665466	613688	27dbR
47.442	217	4647635	258464	27daR
48.116	217	4327303	230648	27daS
48.301	217	5034011	324337	28dbS
48.525	217	5407496	304813	28dbS
49.879	217	14066678	375463	28dbR
50.714	217	24759356	764510	27aaS+28daR
50.959	217	2471800	171474	
51.111	217	22042114	1013697	29dbS+27bbR
51.269	217	1343309	112306	28daS+27bbS
51.952	217	51237080	2589867	27aaR
52.274	217	3772887	204172	
52.636	217	15242764	586928	29dbR
53.214	217	13167751	278756	29daR
53.851	217	10819156	264201	28aaS
54.411	217	27283378	1114463	29daS+28bbR
54.762	217	11260934	383969	28bbS
55.574	217	71516816	2220731	28aaR
56.684	217	22434292	709792	29aaS
57.449	217	67939944	2198004	29bbR
57.712	217	6404821	298225	29bbS
58.646	217	203557152	9711570	29aaR
60.842	217	4734198	221786	30aaR
61.158	217	16260701	739092	

IKU SINTEF GROUP

50.953	218	4350039	270775	27bbR
51.281	218	3232743	194710	27bbS
54.411	218	14009159	652133	28bbR
54.738	218	9485177	366705	28bbS
57.449	218	19452270	871217	29bbR
57.501	218	12356105	639612	29bbS

IKU SINTEF GROUP

E-3818 SAT
7418/01-U-01(A) 74.62m Sst.

RT	QM	AREA	HEIGHT	ID
32.327	191	12785184	747060	23/3
33.787	191	13363780	489166	24/4
37.791	191	8055302	370504	25/3
40.760	191	39907376	2160780	24/4
52.126	191	106772200	6483250	27Ts
53.384	191	102932160	5770349	27Tm
56.607	191	193754432	10300875	28ab
58.167	191	370594464	17591914	29ab
58.333	191	155873488	7920595	29Ts
59.038	191	50763896	2979709	30d
59.619	191	148421632	6025956	29ba
60.938	191	727879936	38926484	30ab
62.038	191	92509712	5625191	30ba
64.094	191	175591568	10102988	31abS
64.472	191	162426784	10136906	31abR
66.662	191	71164648	3868559	32abS
67.176	191	55679844	2932310	32abR
69.604	191	33961104	1607593	33abS
70.322	191	25669014	1245490	33abR
72.653	191	13478152	589964	34abS
73.530	191	9665995	443497	34abR
75.638	191	3760147	173528	35abS
76.727	191	4373406	169992	35abR
28.746	217	32103202	1786026	21a
32.897	217	10996401	698907	22a
45.401	217	45800084	2727559	27dbS
46.683	217	28461284	1465412	27dbR
47.566	217	12001246	638025	27daR
48.227	217	11546563	656876	27daS
48.401	217	18228706	1074256	28dbS
48.629	217	21003894	1040679	28dbS
49.980	217	32570040	1005325	28dbR
51.062	217	9618580	573105	27aaS+28daR
51.221	217	32819520	1400700	29dbS+27bbR
51.384	217	8202306	481283	28daS+27bbS
52.051	217	45415348	2143049	27aaR
52.380	217	10221977	419800	
52.696	217	21870602	744864	29dbR
53.588	217	17160340	391027	29daR
54.096	217	14466668	344268	28aaS
54.492	217	30329340	1475933	29daS+28bbR
54.852	217	24301098	816977	28bbS
55.681	217	47954604	1502955	28aaR
56.782	217	28835808	813628	29aaS
57.443	217	14480117	650259	29bbR
57.516	217	29178130	996380	29bbS
58.687	217	66923516	3186745	29aaR
59.019	217	7185285	343671	30aaS
60.932	217	7388627	359284	30aaR
61.205	217	7381288	350905	

IKU SINTEF GROUP

51.062	218	14001120	823270	27bbR
51.384	218	9931513	607219	27bbS
54.492	218	20241358	1059968	28bbR
54.827	218	18951244	801336	28bbS
57.369	218	21187338	896990	29bbR
57.629	218	24957126	947340	29bbS

IKU SINTEF GROUP

E-3819 SAT
7418/01-U-01(A) 74.67m Sst.

RT	QM	AREA	HEIGHT	ID
32.251	191	12032104	741254	23/3
33.706	191	14555028	474517	24/3
37.730	191	9113909	363285	25/3
40.697	191	39595504	2031136	24/4
52.082	191	100865472	5712984	27Ts
53.332	191	97978784	4991860	27Tm
56.568	191	175303584	8754339	28ab
58.121	191	341057600	16550678	29ab
58.308	191	138166544	6401247	29Ts
59.009	191	42585912	2403306	30d
59.593	191	133903864	5378730	29ba
60.902	191	654288128	34153552	30ab
62.012	191	84529960	4651394	30ba
64.074	191	157316560	8370434	31abS
64.442	191	150272560	7954355	31abR
66.649	191	61351976	3046812	32abS
67.169	191	53535904	2690220	32abR
69.599	191	29035730	1311054	33abS
70.312	191	24661062	1131964	33abR
72.657	191	10922421	474309	34abS
73.536	191	8965168	416362	34abR
75.645	191	3150808	147677	35abS
76.724	191	5576308	209717	35abR
28.688	217	33413696	1695553	21a
32.818	217	12576249	672306	22a
45.347	217	41967228	2338511	27dbS
46.638	217	26172884	1230671	27dbR
47.526	217	11141157	565719	27daR
48.180	217	10826447	544078	27daS
48.355	217	15884672	910569	28dbS
48.595	217	17099136	879238	28dbS
49.938	217	28510260	798635	28dbR
50.645	217	30192106	815351	27aaS+28daR
51.019	217	7598256	466499	
51.182	217	32449660	1320646	29dbS+27bbR
51.340	217	5466720	352538	28daS+27bbS
52.012	217	41879796	1926053	27aaR
52.654	217	19570520	657045	29dbR
53.542	217	17997756	345218	29daR
53.898	217	14217120	301066	28aaS
54.441	217	28732864	1281332	29daS+28bbR
54.798	217	23427014	696420	28bbS
55.633	217	49533572	1483912	28aaR
56.743	217	27459196	779635	29aaS
57.485	217	43103080	978693	29bbR+29bbS
58.665	217	86341520	3974021	29aaR
58.992	217	4895594	239222	30aaS
60.896	217	7018769	313563	30aaR
61.188	217	8799406	376909	
51.019	218	14045205	721974	27bbR

IKU SINTEF GROUP

51.340	218	10083942	528949	27bbS
54.447	218	17863084	873083	28bbR
54.786	218	17143942	700805	28bbS
57.345	218	17539102	732899	29bbR
57.590	218	20757076	766432	29bbS

IKU SINTEF GROUP

E-3817 SAT
7418/01-U-01(A) 74.70m Sst.

RT	QM	AREA	HEIGHT	ID
32.371	191	16852348	1098108	23/3
33.837	191	17982978	667454	24/3
37.832	191	9170090	457202	25/3
40.815	191	52782104	2922960	24/4
52.190	191	141928320	7436288	27Ts
53.440	191	143139024	7378026	27Tm
56.676	191	304047584	15147106	28ab
58.224	191	489547648	22356068	29ab
58.399	191	205080384	10412131	29Ts
59.106	191	63096560	3621517	30d
59.690	191	201194848	8130895	29ba
60.993	191	1012650752	48404868	30ab
62.103	191	140947232	7518260	30ba
64.153	191	247074832	13045477	31abS
64.521	191	240133184	12941762	31abR
66.700	191	98277232	5065546	32abS
67.219	191	79616160	4332632	32abR
69.637	191	47119640	2312171	33abS
70.350	191	40262876	1907052	33abR
72.681	191	20543120	914707	34abS
73.569	191	17378970	787127	34abR
75.677	191	6436915	301127	35abS
76.746	191	9057922	384976	35abR
28.804	217	46422316	2516175	21a
32.940	217	15798919	969106	22a
45.467	217	58272076	3297858	27dbS
46.740	217	34854372	1807160	27dbR
47.619	217	13929401	801976	27daR
48.278	217	11103877	722862	27daS
48.465	217	19561998	1225590	28dbS
48.693	217	20850948	1116028	28dbS
50.044	217	38205632	1177749	28dbR
50.756	217	39965936	1109741	27aaS+28daR
51.136	217	11221240	670945	
51.265	217	42822760	1871579	29dbS+27bbR
51.438	217	7712778	519046	28daS+27bbS
52.114	217	67816376	3046135	27aaR
52.412	217	18015708	601271	
52.774	217	30777216	1009056	29dbR
53.995	217	20192692	439483	28aaS
54.550	217	41746184	1822139	29daS+28bbR
54.889	217	34301872	1029496	28bbS
55.718	217	69474736	2251104	28aaR
56.816	217	40262052	1159976	29aaS
57.471	217	17175168	877349	29bbR
57.587	217	46924380	1422369	29bbS
57.844	217	5776296	266383	
58.744	217	123617008	6224313	29aaR
59.059	217	7806133	417991	30aaS
60.993	217	10587951	470318	30aaR

IKU SINTEF GROUP

61.256	217	12895202	584807	
51.130	218	17347194	984274	27bbR
51.438	218	11524806	768352	27bbS
54.550	218	26329020	1260500	28bbR
54.883	218	24127280	1021030	28bbS
57.441	218	25735692	1064311	29bbR
57.675	218	31874030	1186038	29bbS

E-3820 SAT
7418/01-U-01(A) 74.73m Sst.

RT	QM	AREA	HEIGHT	ID
32.287	191	10206919	639585	23/3
33.767	191	11203602	408452	24/3
37.773	191	6601358	291931	25/3
40.761	191	33091542	1910070	24/4
52.138	191	84219256	4905622	27Ts
53.392	191	87311096	5059043	27Tm
56.622	191	156153824	8068413	28ab
58.168	191	313604352	14392800	29ab
58.354	191	113511648	6821460	29Ts
59.058	191	38516816	2348427	30d
59.645	191	112287640	4800653	29ba
60.950	191	587858944	30419152	30ab
62.068	191	83484472	4643917	30ba
64.118	191	145590784	8133794	31abS
64.488	191	139032432	8012860	31abR
66.676	191	59420148	3078709	32abS
67.194	191	47500340	2588363	32abR
69.618	191	28434410	1366615	33abS
70.338	191	22992750	1153666	33abR
72.638	191	11786941	538173	34abS
73.554	191	9189770	450948	34abR
75.660	191	4397686	195741	35abS
76.723	191	5394992	208067	35abR
28.709	217	27775778	1461674	21a
32.852	217	8687251	590167	22a
45.392	217	35252600	2022172	27dbS
46.679	217	22292774	1161520	27dbR
47.575	217	8248418	480614	27daR
48.224	217	8007013	480064	27daS
48.417	217	13323903	779761	28dbS
48.651	217	14564392	798160	28dbS
49.982	217	23280194	715646	28dbR
50.701	217	26096524	732234	27aaS+28daR
51.080	217	6894137	441524	
51.236	217	23309538	1097069	29dbS+27bbR
51.401	217	6939483	374213	28daS+27bbS
52.070	217	37189960	1836013	27aaR
52.372	217	9281534	361296	
52.738	217	17840202	638555	29dbR
53.332	217	13472059	280835	29daR
54.099	217	10246839	250406	28aaS
54.500	217	23744436	1124842	29daS+28bbR
54.848	217	14684040	587376	28bbS
55.652	217	41012920	1302469	28aaR
56.801	217	23865320	684649	29aaS
57.524	217	33850340	764011	29bbR+29bbS
58.704	217	60878180	2951666	29aaR
59.039	217	4733351	266593	30aaS
60.937	217	6409156	307383	30aaR
61.221	217	7746831	333730	

51.074	218	10773357	621865	27bbR
51.394	218	9599249	502068	27bbS
54.500	218	15359407	785438	28bbR
57.309	218	11751809	618536	28bbS
57.449	218	21119526	884251	29bbR
57.642	218	20501278	752292	29bbS

E3828 SAT
7418/01-U-01(A) 85.00m Sst.

RT	QM	AREA	HEIGHT	ID
30.758	191	5023723	294441	23/3
32.947	191	6196835	313606	24/3
37.266	191	6037877	124054	25/3
39.146	191	9441576	554306	24/4
40.413	191	1560775	99185	26/3
40.691	191	1851854	106855	26/3
50.577	191	11148416	586395	27Ts
51.832	191	76418280	3280994	27Tm
53.000	191	32666750	1455770	4
53.421	191	81572384	3873338	
55.294	191	856314560	22716632	28ab
56.038	191	66217248	2745574	25nor30ab
56.541	191	129063952	5567426	29ab
56.693	191	132317392	7764930	29Ts
56.880	191	69095560	2264002	
57.591	191	23656498	878663	30d
58.142	191	99190824	3364832	29ba
58.946	191	125466264	6517328	30O
59.087	191	98436064	5571761	
59.420	191	303884736	16519969	30ab
59.762	191	31475734	1708991	
59.941	191	14789173	823503	
60.212	191	10844036	696009	
60.509	191	91190816	4750912	30ba
61.701	191	9849721	576919	
62.544	191	127301824	6926711	31abS
62.920	191	127625856	6997533	31abR
63.373	191	13046922	699302	
63.867	191	58513312	2718300	
65.084	191	32392968	1639153	32abS
65.399	191	19743700	1000433	
65.602	191	44285840	2225580	32abR
66.425	191	5002701	297452	
66.673	191	13287115	662771	
68.013	191	21575330	882974	33abS
68.736	191	25935500	1159284	33abR
69.863	191	8137847	337950	
70.134	191	9237389	399902	
71.056	191	11360624	482777	34abS
71.941	191	14522905	666109	34abR
74.050	191	7263834	309717	35abS
75.106	191	13768324	476721	35abR
27.198	217	6032507	318163	21a
31.307	217	4357548	174535	22a
43.884	217	26234388	1444463	27dbS
45.168	217	20981458	1058358	27dbR
46.047	217	11811503	555600	27daR
46.714	217	8510462	469089	27daS
46.912	217	9633296	516283	28dbS
47.134	217	9948929	489457	28dbS
48.481	217	21831164	538150	28dbR
49.321	217	24198684	663295	27aaS+28daR
49.756	217	51691368	1785259	29dbS+27bbR

50.065	217	3830426	242808	28daS+27bbS
50.205	217	3511309	156555	
50.560	217	32438880	1748579	27aaR
51.282	217	38395588	1217325	29dbR
51.893	217	38741024	1053559	29daR
52.504	217	12961975	274691	28aaS
53.058	217	31419614	1258433	29daS+28bbR
53.403	217	11641123	448236	28bbS
54.060	217	32833722	1064195	
54.226	217	39642412	1256069	28aaR
55.319	217	96938168	2651766	29aaS
56.087	217	60899068	1842392	29bbR+29bbS
56.520	217	18910040	800151	
56.910	217	18974638	760797	
57.271	217	126764288	5817077	29aaR
58.586	217	7585281	288249	
58.946	217	5405731	167368	
59.414	217	5334351	200569	
59.724	217	17580186	807593	30aaR
49.588	218	3569261	239167	27bbR
49.966	218	976310	57834	27bbS
53.058	218	14613321	597606	28bbR
53.397	218	10383031	476433	28bbS
56.081	218	25429142	804686	29bbR
56.198	218	22661826	913582	29bbS
58.234	218	25013404	1412046	30bbR
58.592	218	2390367	109032	30bbS
51.146	177	32018624	1242480	25nor28ab
56.045	177	67640408	2315640	25nor30ab

E3861 SAT
7418/01-U-01(A) 117.81m Sltst.

RT	QM	AREA	HEIGHT	ID
30.723	191	4445344	284859	23/3
32.890	191	3606793	212854	24/3
37.162	191	3549727	106805	25/3
39.121	191	8399616	441755	24/4
40.390	191	1237203	71118	26/3
40.668	191	1452230	76714	26/3
50.467	191	5459391	302210	27Ts
51.752	191	61794564	3455407	27Tm
52.857	191	18972898	958117	4
54.976	191	18466780	887067	28ab
56.222	191	6422166	288483	
56.518	191	91369944	4668204	29ab
56.675	191	9206612	534025	29Ts
57.429	191	8895145	334291	30d
58.015	191	62844960	2909376	29ba
59.279	191	149365792	8123272	30ab
59.649	191	11446696	615590	
60.422	191	80265536	4297694	30ba
62.483	191	105071616	5741149	31abS
62.860	191	103576080	5339084	31abR
63.322	191	7616352	344616	
63.843	191	58880456	2899259	
65.043	191	19892026	941799	32abS
65.338	191	8691168	417425	
65.562	191	32333836	1520465	32abR
66.636	191	14299376	690781	
67.986	191	7632066	336839	33abS
68.693	191	12772326	554974	33abR
71.016	191	3329730	140283	34abS
71.908	191	5432325	227616	34abR
74.000	191	1948111	73344	35abS
75.064	191	2619513	87418	35abR
27.175	217	2651402	136054	21a
31.270	217	2222592	92696	22a
43.838	217	8105391	455226	27dbS
45.118	217	5025151	263118	27dbR
46.003	217	2552726	126177	27daR
46.646	217	2263592	128100	27daS
46.844	217	2974273	165067	28dbS
47.085	217	3005422	147027	28dbS
48.396	217	4808089	129930	28dbR
49.125	217	6331519	173448	27aaS+28daR
49.664	217	9028503	317161	29dbS+27bbR
50.003	217	1744853	61439	28daS+27bbS
50.467	217	7391332	382907	27aaR
51.166	217	6462232	228508	29dbR
51.746	217	6016581	200545	29daR
52.529	217	2554040	61604	28aaS
52.902	217	5926597	262708	29daS+28bbR
53.211	217	2161429	80507	28bbS
54.079	217	4722537	170998	28aaR
55.179	217	3235821	120246	29aaS
55.895	217	7954847	195556	29bbR+29bbS

IKU SINTEF GROUP

56.525	217	1507632	76212	
56.687	217	1508648	73979	
57.101	217	14224730	619140	29aaR
58.004	217	1431005	52496	30bbR
58.476	217	1365041	39822	30bbS
59.643	217	2396889	104616	30aaR
49.491	218	1857866	105305	27bbR
49.817	218	1305343	87273	27bbS
52.896	218	3216313	151891	28bbR
53.230	218	2419046	106708	28bbS
55.772	218	3608033	151751	29bbR
56.031	218	7301375	268101	29bbS
58.115	218	2373651	90558	30bbR
58.450	218	356551	14462	30bbS
51.351	177	9612588	443449	25nor28ab
55.839	177	3949120	153006	25nor30ab

IKU SINTEF GROUP

E3389 SAT
7517/12-U-01(B) 111.15m Clst.-sltst.

RT	QM	AREA	HEIGHT	ID
30.901	191	2028466	110511	23/3
32.723	191	2323407	87029	24/3
36.722	191	8169735	174410	25/3
39.356	191	28627856	1422385	24/4
40.395	191	3289850	137125	26/3
40.594	191	5102161	139990	2673
50.467	191	1447285	81643	27Ts
52.277	191	940721856	26838070	27Tm
53.322	191	255890224	11035987	4
54.905	191	49575824	1366510	
56.604	191	44946780	1795306	
57.036	191	933589696	31050196	29ab
57.900	191	44493692	1259349	30d
58.548	191	621141184	21801820	29ba
59.810	191	1398987008	49540144	30ab
60.101	191	117270064	6763992	
60.417	191	38018244	1333264	
60.890	191	855024512	34908812	30ba
62.974	191	1348061056	46136920	31abS
63.383	191	1130265856	41644052	31abR
64.317	191	701969088	22950036	
65.380	.191	155810448	8006273	32abS
65.911	191	232407440	11545054	32abR
66.682	191	37797780	1973436	
66.962	191	130437200	6547604	
68.241	191	43249236	1921322	33abS
68.948	191	75487688	3409034	33abR
71.242	191	15329653	575857	34abS
72.118	191	23562982	1072610	34abR
27.327	217	3152556	145952	21a
31.450	217	1846934	72563	22a
44.074	217	13996617	551331	27dbS
45.364	217	4828479	191866	27dbR
46.281	217	4196259	197046	27daR
46.905	217	3056769	143559	27daS
47.092	217	3861330	191875	28dbS
47.367	217	5000530	186897	28dbS
48.558	217	8058985	198515	28dbR
49.562	217	11540090	274666	27aaS+28daR
50.029	217	28910116	859126	29dbS+27bbR
50.321	217	3081887	96882	28daS+27bbS
50.853	217	18856898	660368	27aaR
51.559	217	20647962	808934	29dbR
52.172	217	37073776	1019727	29daR
52.797	217	7540006	175308	28aaS
53.293	217	28133496	1091198	29daS+28bbR
53.568	217	3858128	149536	28bbS
54.449	217	16514488	585486	
54.905	217	14710517	468915	28aaR
55.588	217	15203366	598424	29aaS
56.347	217	49318376	1200582	29bbR+29bbS
57.036	217	27224496	808821	
57.544	217	96118928	3474016	29aaR

IKU SINTEF GROUP

58.542	217	13902667	478266	30bbR
59.010	217	7389842	149844	30bbS
59.815	217	13527387	449927	
60.090	217	5973232	201528	30aaR
50.023	218	13400628	279318	27bbR
50.181	218	2300911	104108	27bbS
53.293	218	15074448	568400	28bbR
53.603	218	5292990	197198	28bbS
56.394	218	36778916	657917	29bbR+29bbS

IKU SINTEF GROUP

E3420 SAT
7517/12-U-01(B) 143.97m Sltst.

RT	QM	AREA	HEIGHT	ID
30.807	191	4137576	266476	23/3
32.993	191	4248405	184869	24/3
37.248	191	3393556	98578	25/3
39.250	191	27611694	1448924	24/4
40.815	191	1968994	100793	26/3
50.678	191	5798127	218606	27Ts
52.094	191	565183040	19120990	27Tm
53.172	191	175912576	7931633	4
56.863	191	728476352	23362464	29ab
57.727	191	27032778	815625	30d
58.372	191	462298848	17162250	29ba
59.620	191	881031488	32273612	30ab
59.923	191	76877576	4814001	
60.259	191	45647008	1942895	
60.728	191	582477376	25696950	30ba
62.819	191	874632384	29080250	31abS
63.228	191	745443776	27371828	31abR
64.163	191	462529056	17207116	
65.258	191	121646968	6450502	32abS
65.778	191	184829744	9885462	32abR
66.557	191	33160350	1649946	
66.827	191	89982280	5064371	
68.126	191	48724528	2076571	33abS
68.842	191	70349152	3396050	33abR
69.528	191	16274591	673741	
69.967	191	31101454	1382571	
70.240	191	15230916	631211	
70.510	191	18365204	811789	
71.142	191	14370034	639877	34abS
72.019	191	27332644	1211783	34abR
73.177	191	9907211	446465	
74.086	191	6471028	244495	35abS
75.155	191	10136664	312556	35abR
27.233	217	3497153	185660	21a
31.359	217	2322845	101993	22a
43.963	217	11882153	561822	27dbS
45.256	217	5929693	239504	27dbR
46.164	217	4022610	191478	27daR
46.794	217	3374969	159360	27daS
46.986	217	4167296	219058	28dbS
47.232	217	4954215	203890	28dbS
48.413	217	14941074	581719	28dbR
49.427	217	11991205	303548	27aaS+28daR
49.892	217	25779528	763328	29dbS+27bbR
50.195	217	3486458	105369	28daS+27bbS
50.707	217	24266982	754839	27aaR
51.424	217	21475238	841734	29dbR
52.001	217	24256228	749875	29daR
52.757	217	8373152	185760	28aaS
53.132	217	20537466	899741	29daS+28bbR
53.423	217	4031426	154781	28bbS
54.307	217	16400819	485497	28aaR
55.427	217	20156650	899319	29aaS

IKU SINTEF GROUP

56.183	217	39339108	1020065	29bbR+29bbS
56.893	217	25110474	800877	
57.371	217	75383408	3030478	29aaR
57.592	217	5508460	180777	30aaS
58.359	217	9926594	426964	30bbR
58.841	217	5135490	137512	30bbS
59.923	217	6297439	213381	30aaR
49.886	218	10192601	242697	27bbR
50.022	218	2792468	111062	27bbS
53.132	218	10928108	461486	28bbR
53.448	218	4662560	177226	28bbS
56.065	218	8529564	368043	29bbR
56.244	218	21307160	537850	29bbS
58.359	218	6812563	266348	30bbR
58.846	218	1635361	40258	30bbS

IKU SINTEF GROUP

E3474 SAT
7517/12-U-01(B) 198.68m Sltst.

RT	QM	AREA	HEIGHT	ID
30.765	191	3582444	221758	23/3
32.931	191	3980045	170117	24/3
37.200	191	3893190	74966	25/3
39.173	191	21332926	1111934	24/4
40.440	191	1411792	70018	26/3
40.738	191	1857090	94718	26/3
50.625	191	5138770	228838	27Ts
52.021	191	385877856	13260559	27Tm
53.095	191	121356984	5518159	4
54.695	191	11669151	664034	
56.056	191	17002714	680824	
56.762	191	421295840	15935948	29ab
57.656	191	35114728	1195605	30d
58.269	191	297151008	11502817	29ba
59.536	191	682519744	26084416	30ab
59.863	191	83690672	4652476	
60.195	191	36548400	1193534	
60.633	191	406258944	17840702	30ba
62.724	191	638057088	23483158	31abS
63.121	191	598343168	22063076	31abR
63.506	191	27454172	1475940	
64.067	191	346443392	12747542	
65.188	191	94346184	4931532	32abS
65.474	191	25614396	1445197	
65.713	191	164239744	7968643	32abR
66.507	191	29203342	1421022	
66.770	191	82659296	4083529	
68.078	191	39417092	1660050	33abS
68.796	191	71994008	3241273	33abR
71.103	191	14707728	607382	34abS
71.979	191	27262148	1216630	34abR
74.063	191	12722659	237218	35abS
75.132	191	12118909	357597	35abR
27.215	217	4937368	240196	21a
31.314	217	2692210	98508	22a
43.909	217	15707041	774056	27dbS
45.193	217	10831292	439969	27dbR
46.104	217	5837826	274319	27daR
46.746	217	4585944	225983	27daS
46.939	217	4081088	233657	28dbS
47.202	217	4585459	211464	28dbS
48.535	217	8919990	213255	28dbR
49.376	217	14933075	405610	27aaS+28daR
49.825	217	33788380	1025421	29dbS+27bbR
50.158	217	4530416	123774	28daS+27bbS
50.631	217	18002886	817070	27aaR
51.355	217	24841120	903136	29dbR
51.939	217	30147150	912164	29daR
52.704	217	9779183	225007	28aaS
53.095	217	24725138	1049177	29daS+28bbR
53.393	217	4824612	186212	28bbS
54.257	217	15159056	500517	28aaR
55.372	217	12547649	440965	29aaS

IKU SINTEF GROUP

56.126	217	42625560	969826	29bbR+29bbS
56.780	217	15861742	462994	
57.317	217	70792672	2764068	29aaR
57.533	217	5245246	137988	30aaS
58.269	217	7425192	295418	30bbR
58.736	217	5371764	128996	30bbS
59.822	217	6532742	225085	30aaR
49.825	218	9738934	309765	27bbR
49.966	218	3458120	179397	27bbS
53.089	218	11934605	518346	28bbR
53.422	218	5691514	234095	28bbS
55.980	218	13039105	564128	29bbR
56.225	218	24017704	623050	29bbS
58.274	218	4826498	168827	30bbR
58.648	218	2357310	46313	30bbS

E3683 SAT
7616/11-U-01(C1) 7.41m Sst.

RT	QM	AREA	HEIGHT	ID
30.785	191	19344980	1120423	23/3
32.939	191	14782802	838553	24/3
37.179	191	10229826	297511	25/3
39.140	191	11315306	606887	24/4
40.402	191	5811878	297869	26/3
40.670	191	5345368	284287	26/3
48.839	191	4609591	259704	
49.446	191	3325915	180180	
50.953	191	2878587	125280	27Ts
52.015	191	13740857	649525	27Tm
52.950	191	3468223	103915	4
54.549	191	13130942	594485	
54.818	191	9439914	349801	
55.892	191	14868295	554297	25nor30ab
56.488	191	14171236	451256	29ab
57.481	191	41036528	1742680	30d
57.691	191	4688527	163793	29ba
59.285	191	13080748	538007	30ab
59.507	191	5724189	262641	
59.670	191	7281652	345833	
60.435	191	7194668	246361	30ba
60.908	191	8088451	317615	
61.177	191	8830338	309227	
61.766	191	5377962	150534	
62.502	191	5622279	249310	31abS
62.864	191	6199049	252639	31abR
63.355	191	9273868	419393	
63.559	191	3113336	132018	
63.793	191	5185564	180943	
64.009	191	4462104	143356	
65.089	191	3545761	165467	32abS
65.608	191	2472279	106298	32abR
67.010	191	3413464	119435	
68.043	191	3112492	119186	33abS
68.756	191	2272712	73172	33abR
71.074	191	2012898	52991	34abS
71.967	191	805044	35617	34abR
27.679	217	5599925	341276	21a
31.264	217	3780293	191495	22a
43.864	217	3805836	160491	27dbS
45.166	217	3782864	153321	27dbR
46.030	217	2993504	162248	27daR
46.690	217	2446186	122309	27daS
47.041	217	1267696	76155	28dbS
47.157	217	2532384	102779	28dbS
48.430	217	4472296	123366	28dbR
48.687	217	4331372	119875	
49.160	217	3443336	94569	27aaS+28daR
49.703	217	1044070	56679	29dbS+27bbR
50.112	217	1854461	58495	28daS+27bbS
50.328	217	840068	58549	
50.433	217	956756	62549	27aaR
50.684	217	2139903	99615	