

NORTH VIKING GRABEN

GEOCHEMICAL STUDY

GC-MS ANALYSIS

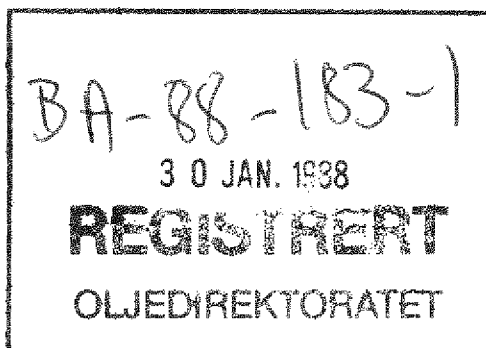
Well no. 30/6-5 NOCS

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Date: 01.03.87



RESULTS AND DISCUSSIONS

A total of ten samples was analysed by GC - MS. These included: five from the Draupne Fm. (2458 - 2470 m, 2485 - 2512 m, 2521 - 2533 m, 2545 - 2547 m and 2563 - 2581 m), three from the Heather Fm. (2599 - 2641 m, 2665 - 2701 m and 2713 - 2785 m) and two from the Dunlin Gr. (2965 - 2986 m and 3025 - 3061 m).

DRAUPNE FORMATION

Saturated Fraction

Terpanes:

The M/Z 163 fragmentogram patterns of all the samples is partially masked by a large peak which is believed to be a contaminant (probably from the septa of the sample flasks). The fragmentograms have, therefore, been split into two sections, one section with a retention time before the large peak and one with retention time after the large peak. These alterations indicate that all the samples have some minor peaks with a short retention time (i.e. at the front end of the fragmentogram). This pattern varies only slightly for the five samples from the Draupne Fm. The second section of the fragmentograms varies for the different samples. The sample from 2458 - 2470 m (2470 m) shows a distribution similar to that found for a number of other samples in the Draupne Fm. on the Bergen High, where the diasteranes are dominant. There is no indication that the 25,38,30 trisnorhopane is present in this sample. The other four samples from the Draupne Fm., 2485 - 2512 m (2512 m), 2521 - 2533 m (2533 m), 2545 - 2547 m (2547 m) and 2563 - 2581 m (2581 m) are all dominated by a large peak with a retention time of

approximately 40 minutes. This peak is also found in the M/Z 177 and 191 fragmentograms. Based on this and the retention time and the molecular ion of 384, it is believed that this peak is bisnorhopane. It is unusual to find bisnorhopane in Draupne Fm. samples. The only other Draupne Fm. sample on the Bergen High which contains this compound is one sample from well 31/4-4. The concentration of this compound varies significantly from sample to sample, showing an increase with increasing depth relative to the other peaks in the sterane/triterpane range. The sample from 2581 m also shows another feature that is not seen in the other samples. A large peak with a retention time of approximately 31 minutes was recorded. This peak was not identified.

The M/Z 177 fragmentograms have been treated in the same way as the M/Z 163 fragmentograms due to the contaminant. The M/Z 177 fragmentograms are dominated by the bisnorhopane peak from 2533 m downwards, with increasing relative abundance with increasing depth. The sample from 2581 m also shows a peak at approximately 31 minutes. This is the same peak which was found in large abundance in the M/Z 163 fragmentogram for this sample.

The M/Z 191 fragmentograms are affected in the same way as the M/Z 163 and the M/Z 177 fragmentograms by the contamination peak and the fragmentograms have, therefore, been divided into two sections. It is, however, clear from the fragmentograms that the tricyclic compounds are only minor compounds compared to the pentacyclic triterpanes. The bisnorhopane peak is not present in the sample from 2470 m while it is the dominant peak in all the other four samples from the Draupne Fm. in this well. The relative abundance compared with other pentacyclic triterpane peaks, increases with increasing depth. The T_M/T_S ratio is fairly uniform for the Draupne Fm. samples and the relatively large abundance of the $\beta\alpha$ compounds show that the samples have a low maturity. The sample from 2581 m has a large peak at

approximately 31 minutes. This peak has the same retention time as a C₂₄ tetracyclic terpane, but it has not been identified.

The M/Z 205 fragmentograms show a large unresolved envelope for the uppermost samples. This seems to decrease with increasing depth. All the samples also have a number of peaks in this fragmentogram. These have been identified by the retention time as the normal C₂₇ - C₃₁ triterpanes. There is no indication that these samples contain any methylated triterpanes.

The fragmentograms of the molecular ions, for example the M/Z 370 fragmentogram (for the C₂₇ triterpanes), are clearly affected by the contamination peak and splitting of the fragmentograms was therefore undertaken on these. The fragmentograms of the molecular ions show basically what has been discussed above.

Steranes:

The M/Z 149 fragmentograms of the Draupne Fm. samples vary significantly from sample to sample. The largest variation is for the peaks in the triterpane range, where the bisnorhopane peak shows up well in the three lowermost samples. The other large variation is in connection with a doublet with a retention time around 30 - 31 minutes. The first of these peaks is probably from the contaminant, while the second peak is probably the same peak as was observed in the terpane fragmentogram. This peak is probably indigenous to the samples, but has not been identified. There are also small variation in the relative abundance of the different steranes. There is no systematic variation for these compounds and further discussion was, therefore, not undertaken.

The M/Z 289 and 259 fragmentograms show that the

C₂₇ compounds have the largest peaks for all the samples. The M/Z 259 fragmentograms show only minor variation between the different samples, while the M/Z 189 show the same two peaks as found in the M/Z 149 fragmentograms. The ratio between these two peaks varies significantly for the different samples as well as the relative abundance when compared to the rearranged steranes. This is clearly seen on the sample from 2581 m, where the second peak in the doublet completely dominates the fragmentogram, and the rearranged steranes are only minor components.

The M/Z 217 and 218 fragmentograms show only minor variation between the Draupne Fm. samples. The rearranged steranes are more abundant than the regular steranes in all the samples.

The fragmentograms of the molecular ions verify what has been discussed above, clearly showing that the rearranged C₂₇ - C₂₉ steranes are more abundant than the regular C₂₇ - C₂₉ steranes.

Bicyclanes:

The M/Z 123, 179 and 193 fragmentograms vary slightly in the different samples. Some of this variation might be due to variation in loss of light weight material during the work up of the samples. The C₁₅ and C₁₆ compounds dominate the samples, but M/Z 179 fragmentograms show the C₁₄ compounds to be present in quite good abundance for all the Draupne Fm. samples.

Aromatic Fraction

Thiophenes:

The M/Z 84 fragmentograms vary significantly for the five

samples from the Draupne Fm. The sample from 2470 m show the thiophene peak together with the group of peaks with retention times between 23 and 27 minutes. The sample from 2512 m does not show any signals at all. This is due to the extremely low concentration which is below the detection limit. This sample will not be discussed further for any of the other aromatic parameters. The sample from 2533 m shows the same pattern of peaks as the sample from 2470 m plus a suite of peaks at higher retention time. These peaks are not identified. The sample from 2581 m shows the same two patterns as the sample from 2533 m, while the sample from 2547 m shows only the pattern of peaks with retention time between 23 and 27 minutes.

The M/Z 98 fragmentograms also show some significant variations. The sample from 2470 m shows a large peak at the very start of the fragmentogram together with some small peaks with retention time between 27 and 33 minutes. This is also seen in the sample from 2547 m, while the samples from 2533 m and 2581 m show the peaks with retention times between 27 and 33 minutes together with the same suite of peaks found in the M/Z 84 fragmentograms.

The M/Z 112 fragmentograms show also a large variation from sample to sample. The samples from 2470 m and 2547 m have similar fragmentograms and the samples from 2533 m and 2581 m are similar to each other.

The M/Z 128 fragmentograms show the same situation, the samples from 2533 m and 2581 m and from 2470 m and 2547 m are similar to each other. The M/Z 140 fragmentograms show a different situation. The samples from 2533 m and 2581 m still show some likenesses, while the samples from 2470 m and 2547 m differ. The main difference to that the sample from 2470 m has a large peak which completely masks any other peaks.

Alkyl-substituted Benzenes:

The M/Z 106 fragmentograms show the normal series of doublets for all the samples. There are only minor differences between the different Draupne Fm. samples. The situation is different for the M/Z 134 fragmentograms. The sample from 2470 m differs from the rest in the pattern of the major peaks, while the samples from 2533 m, 2547 m and 2581 m show a good resemblance to each other, with exception of the size of the peak with a retention time of approximately 43 minutes. This peak is exceptionally abundant in the sample from 2581 m. The M/Z 148 fragmentograms show a significant variation between the different samples. The sample from 2470 m shows a large unresolved envelope and a large number of small peaks over the retention time range from 20 - 50 minutes. Some of these peaks are also found for the sample from 2547 m, but the pattern is changed significantly. The samples from 2533 m and 2581 m are completely dominated by a large peak with a retention time of approximately 43 min.

Naphthalenes:

The sample from 2470 m does not show the doublet from the methyl naphthalenes. This is most probably due to loss during evaporation. The doublet is clearly seen in the other three samples, all showing 2-methylnaphthalene as the smallest of the two peaks. The M/Z 156 fragmentograms show the typical pattern for the C₂-naphthalenes. There is very small variation in this pattern for the Draupne Fm. samples. The M/Z 170 fragmentograms show the typical pattern for the C₃-naphthalenes with only minor variation between the various samples from the Draupne Fm.

Benzothiophenes and Dibenzothiophenes

The M/Z 162 fragmentograms vary considerably for the Draupne Fm. samples, but most of this variation could be due to loss of light weight material by evaporation during the work up of the samples. When this is taken into consideration, the samples from 2470 m, 2533 m and 2574 m look similar. It is difficult to evaluate the sample from 2581 m, since this sample contains a peak with a retention time of approximately 43 minutes, which completely masks all the other peaks.

The M/Z 176 fragmentograms of the samples from the Draupne Fm. show different patterns. The main variation is in the abundance of the peak with a retention time of approximately 43 minutes, that was also found in the M/Z 162 fragmentograms. This peak is not found in the samples from 2470 m and 2547 m, while it is the largest peak in the samples from 2533 m and 2581 m. It is exceptionally abundant in the sample from 2581 m where it almost completely masks all other peaks.

The M/Z 184 fragmentograms show the single peak from dibenzothiophene for all the samples. They also have a number of peaks with a lower retention time. These peaks were not identified.

The M/Z 198 fragmentograms all show the triplet from methyl-dibenzothiophenes. All the samples show 1-methyl-dibenzothiophene to be the largest peak, which indicates that samples are of low maturity. The M/Z 212 fragmentograms show the typical pattern for the C₂-dibenzothiophenes. There is hardly any difference between the different samples.

Phenanthrenes:

The M/Z 178 fragmentograms show the single peak for

phenanthrene for all the samples. The sample from 2470 m does not show any sign of anthracene, while traces were recorded in the samples from 2533 m, 2547 m and 2581 m.

The M/Z 192 fragmentograms show the typical doublets for the methyl phenanthrenes. The 3+2 methyl phenanthrene doublet is significantly smaller than the 1+9 methyl phenanthrene doublet. The ratio between the two doublets show hardly any variation for the samples from the Draupne Fm.

The M/Z 206 fragmentograms show the typical pattern for the C₂-phenanthrenes. There is no variation between the different samples from the Draupne Fm. The M/Z 220 fragmentograms show the typical pattern for the C₃-phenanthrenes. Only minor differences are found for the Draupne Fm. samples.

Aromatic Steranes:

The M/Z 253 fragmentograms show the typical pattern for the monoaromatic steranes, where the C₂₈ and C₂₉ compounds are the most abundant. There is hardly any variation between the different samples. The relatively low abundance of the C₂₁ and C₂₂ compounds indicates that samples are of low maturity.

The M/Z 231 fragmentograms show a good abundance of triaromatic steranes in all the Draupne Fm. samples. There is no variation in the pattern between the samples and the low abundance of the C₂₀ and C₂₁ compounds indicates that the samples are of low maturity.

HEATHER FORMATION

Saturated Fraction

Terpanes:

The M/Z 163 fragmentograms of the samples from the Heather Fm. show that the contaminant seen in the Draupne samples is present in the samples from 2655 - 2701 m (2701 m) and 2713 - 2785 m (2785 m), while it is in the sample from 2599 - 2541 m (2641 m). The sample from 2641 m shows that the bisnorhopane peak dominate completely the fragmentogram, while it is not present in the samples from 2701 m and 2785 m. These two samples show a normal distribution of steranes and triterpanes. There is no indication of the presence of the 25,28,30 trisnorhopane in any of the Heather Fm. samples. The peak with a retention time of approximately 31 minutes is clearly seen in the samples from 2701 m and 2785 m. In the sample from 2785 m it is the largest peak.

The M/Z 177 fragmentograms show the bisnorhopane to be the dominant peak in the sample from 2641 m, while the $\alpha\beta$ norhopane is the dominant peak in the two other samples. There is no indication of demethylated triterpanes in these samples.

The M/Z 191 fragmentograms shows that the bisnorhopane completely dominates the fragmentogram of the sample from 2641 m, while it is not registered for the other two samples. The tricyclic and tetracyclic terpanes are minor compounds in all three Heather Fm. samples. With the exception of the variation in the amount of bisnorhopane triterpanes have very similar pattern in all the samples. The M/Z 205 fragmentograms show the three samples to have very similar pattern for the triterpanes, with exception of the bisnorhopane in the sample from 2641 m. The samples from

2701 m and 2785 m also show a few peaks at the front of the fragmentogram. These were not identified. The fragmentograms of the molecular ions show the same as discussed above.

Steranes:

The M/Z 149 fragmentograms of the Heather Fm. samples vary significantly. The sample from 2641 m shows the normal sterane and triterpane patterns seen in many other samples from the Bergen High area, while the samples from 2781 m and 2785 m show two large peaks, one with a retention time of approximately 18 minutes and one of approximately 31 minutes, which completely dominate the fragmentograms. These peaks were not identified, but they are believed to be indigenous to the samples.

The M/Z 189 fragmentograms show the normal pattern of rearranged steranes for all three samples from the Heather Fm., but with a significant variation between the different samples. The sample from 2641 m shows a similar distribution to a number of the Draupne Fm. samples, in which the C₂₇ components are the dominant components. The samples from 2701 m and 2785 m show a doublet in front of the rearranged steranes, the first of these peaks is a contaminant, but it is believed that the second peak is indigenous to the sample.

The M/Z 259 fragmentograms shows that the samples from 2641 m has a distribution of rearranged steranes similar to the Draupne Fm. samples, while the samples from 2701 m and 2785 m show a different distribution, where the C₂₉ components are the most abundant peaks.

The M/Z 217 and 218 fragmentograms show the rearranged steranes to be more abundant than the regular steranes. There is a clear difference between the sample from the 2641 m and those from 2701 m and 2785 m. The relatively low

abundance of the low molecular weight steranes indicates that the samples have a low maturity. The fragmentograms of the molecular ions show a drastic change between the sample from 2641 m and the samples from 2701 m and 2785 m. The sample from 2641 m shows the same distribution as the Draupne Fm. samples with the rearranged components slightly larger than the regular steranes for the C₂₇ - C₂₉ components. The samples from 2701 m and 2785 m show a significant decrease in the regular steranes relative to the rearranged steranes for all the C₂₇ - C₂₉ components.

Bicyclanes:

The M/Z 123, 179 and 193 fragmentograms show large differences between the three samples. The sample from 2641 m shows a similar distribution to the Draupne Fm. samples, while the samples from 2701 m and 2785 m show only a background trace.

Aromatic Fraction

Thiophenes:

The M/Z 84 fragmentograms vary significantly for the three samples. The sample from 2641 m show the pattern of peaks between 23 and 27 minutes in retention time to be the most abundant peaks and it shows a good likeness to some of the samples from the Draupne Fm. The samples from 2701 m and 2785 m show only the thiophene peak.

A similar situation is seen for the M/Z 98 fragmentograms, where the sample from 2641 m shows a resemblance with some of the Draupne Fm. samples, while the samples from 2701 m and 2785 m only show a peak at the very start of the fragmentograms.

This changes for the M/Z 112 fragmentograms. The samples from 2641 m and 2785 m show a series of peaks towards the end the fragmentogram traces. These peaks have a similar pattern to a number of samples on the Bergen High, while the sample from 2701 m shows only three peaks in this part of the fragmentogram.

The M/Z 126 fragmentograms also show a significant variation between the three samples. The sample from 2641 m has a distribution similar to that of samples from the Draupne Fm., while the samples from 2701 m and 2785 m are dominated by one peak. This peak is also found in the sample from 2641 m and the Draupne Fm. samples, but is not as dominant as in the 2701 m and 2785 m samples.

The M/Z 140 fragmentograms also show marked variations between the different samples. The sample from 2641 m shows a distribution similar to that of some of the Draupne Fm. samples, while the sample from 2701 m shows mainly background material and a few peaks that were not identified. The sample from 2785 m shows a few, unidentified peaks. The sample is distinctively different from the Draupne Fm. samples.

Alkyl-substituted Benzenes:

The M/Z 106 fragmentograms vary significantly for the three samples. The sample from 2641 m shows the same distribution as the lowermost samples in the Draupne Fm. The sample from 2701 m is completely dominated by a peak at the very front end of the fragmentogram, and with this exception, the fragmentogram is similar to that found for the Draupne Fm. samples. The sample from 2785 m also has this peak at the front end of the fragmentogram, but it is not as dominant as in the sample from 2701 m. The pattern of peaks in the rest of the fragmentograms is different from the samples from the Draupne Fm.

The M/Z 134 fragmentogram also varies significantly for the Heather Fm. samples. The sample from 2641 m shows a similar pattern to the Draupne Fm. samples, while the samples from 2701 m and 2785 m show a completely different distribution, with basically only three peaks of significant peak height. The ratio between these three peaks varies strongly for the two samples. The M/Z 148 fragmentograms also show a strong variation between the different samples. The sample from 2641 m shows again a similar distribution to that found for a number of Draupne Fm. samples, while the two samples from 2701 m and 2785 m show only background material.

Naphthalenes:

The M/Z 142 fragmentogram shows the sample from 2641 m to have a similar distribution of peaks as the samples from the Draupne Fm. The doublet of the methylnaphthalenes is easily recognized, with the 2-methylnaphthalene as the smallest peak. The samples from 2701 m and 2785 m do not show any sign of the methylnaphthalene doublet, the fragmentograms of these samples show only a few peaks at the very end and of the fragmentograms.

The M/Z 156 fragmentograms also vary significantly. The sample from 2641 m shows the typical pattern for C₂-naphthalenes, while the two other samples show only a few peaks at the very end of the fragmentograms.

The M/Z 170 fragmentograms show the same kind of variation. The sample from 2641 m shows the typical pattern for C₃-naphthalenes, while the other two samples show only a few peaks at the end of the fragmentograms.

Benzothiophenes and Dibenzothiophenes:

As with the alkyl-substituted benzenes, the M/Z 162

fragmentograms vary markedly from sample to sample. The sample from 2641 m shows a strong resemblance to the samples from the Draupne Fm., while the samples from 2701 m and 2785 m show only a few peaks with high retention time.

A similar situation is also found for the M/Z 176 fragmentograms. The sample from 2641 m shows strong resemblance to some of the Draupne Fm. samples, while the samples from 2701 m and 2785 m basically show only one peak. This peak was also recorded in the Draupne Fm. samples. All three samples show the single peak for dibenzothiophene in the M/Z 184 fragmentograms and the triplet for methyl dibenzothiophenes in the M/Z 191 fragmentograms. The ratio between the three peaks changes for the three samples. The sample from 2641 m shows 1 methyl dibenzothiophene to be the largest peak similar to that found for the Draupne Fm. samples, while the two other samples show all three peaks to have approximately the same height. The M/Z 212 fragmentograms show the typical pattern for C₂-dibenzothiophenes for all three samples. Some small variation is seen for the ratio between the different peaks for the three samples.

Phenanthrenes:

All three samples show the single peak for phenanthrene in the M/Z 178 fragmentograms. The sample from 2641 m also shows a small abundance of anthracene, similar to that found for a number of the Draupne Fm. samples. This was not recorded for the samples from 2701 m and 2785 m.

The M/Z 192 fragmentograms show the two doublets for the methylphenanthrenes. The ratio between the two doublets is similar for all three samples.

The M/Z 206 fragmentograms show the typical pattern for C₂-phenanthrenes. There is only a minor variation in the

ratios between the different peaks for the three samples. The M/Z 220 fragmentograms show, however, a strong variation between the different samples. The samples from 2641 m and 2785 m show a good resemblance with the pattern found higher up in the well, while this is completely different for the sample from 2701 m.

Aromatic Steranes:

The M/Z 253 fragmentograms vary somewhat for the three samples. The sample from 2641 m shows the same pattern as the Draupne Fm. samples, while this changes drastically for the other two samples. Both these samples (from 2701 m and 2785 m) show a strong peak in front of the C₂₁ compound as well as a loss of some of the C₂₉ and C₂₈ compounds compared with the C₂₇ compounds. The two samples have almost identical patterns.

The M/Z 231 fragmentograms also show a strong variation. The sample from 2641 m shows the same pattern as found for the Draupne Fm. samples, while this changes drastically for the two other Heather Fm. samples. A large number of peaks occur before the light molecular weight triaromatic compounds. There is also a change in the pattern of the C₂₆ - C₂₈ triaromatic compounds. There are also differences between the two samples. The C₂₆ 20R + C₂₇ 20S peak is very abundant in the sample from 2701 m compared to the other peaks, while it is rather small in the sample from 2785 m. The large abundance at low molecular weight triaromatic steranes indicates that these samples have a relatively high maturity.

DUNLIN GROUP

Saturated Fraction

Terpanes:

Of the two samples from the Dunlin Gr. the M/Z 163 fragmentograms show that the sample from 2965 - 2986 m (2986 m) is affected by the contamination peak, and no other peaks are registered in the normal fragmentogram, while the sample from 3025 - 3061 m shows no sign of this contaminant. The division of the fragmentogram of the sample from 2986 m into two sections shows that the front end contains one large peak that was not identified, together with small tricyclic terpene peaks. The second section shows a large peak, together with some small peaks in the sterane/terpene range. The large peak was not identified. It seems to be present in the same samples that contain the large contaminant peak, but the ratio between the two peaks varies considerably. The peak might be a contaminant, but it might also be indigenous to the sample. The sample from 3061 m shows the typical pattern of steranes and triterpanes. There is no indication that 23,28,30 trisnorhopane is present in any of the samples.

As with the M/Z 163 fragmentograms, the M/Z 177 fragmentogram of the sample from 2986 m is also affected by the contamination peak. The division of the fragmentograms into two shows that the high molecular weight section contains the various triterpanes, with bisnorhopane and $\alpha\beta$ norhopane having approximately equal peakheight. The largest peak in the fragmentogram is one before bisnorhopane. This peak shows only a small signal in the M/Z 191 fragmentogram and has 384 as the molecular ion. It is, therefore, considered to be a demethylated triterpane. The sample from 3061 m shows a normal distribution with

$\alpha\beta$ norhopane dominating the fragmentogram. Neither bisnorhopane or the unknown demethylated triterpane were detected in this sample.

The M/Z 191 fragmentogram also shows that the contamination peak dominates the fragmentogram. The plot of the high molecular weight section of the fragmentogram shows bisnorhopane to be the largest peak with $\alpha\beta$ norhopane and $\alpha\beta$ hopane of nearly the same peak height. The largest peak is found at a retention time of approximately 31 min. This is the same peak as discussed in the M/Z 163 fragmentogram. In the sample from 3061 m the $\alpha\beta$ hopane is the largest peak. Bisnorhopane is not present in this sample, which shows the 18 α trisnorhopane and the 17 α trisnorhopane to have approximately equal peak height. The M/Z 205 fragmentograms show a large unresolved envelope for the samples together with a few badly resolved peaks in the triterpane range. The $\alpha\beta$ hopane and the homohopane doublet are the largest of these peaks. The fragmentograms of the molecular ions verify what has been discussed above.

Steranes:

The M/Z 149 fragmentograms show that the sample from 2986 m is dominated by two peaks with retention times of approximately 30 and 31 minutes, while the sample from 3061 m shows the normal sterane pattern, plus one peak at approximately 31 minutes. This is the same as seen in the sample above, but in a far lower abundance compared to the steranes. The peak is not identified.

The M/Z 189 fragmentograms show the same doublet for the sample from 2986 m, but none of these are recorded in the sample from 3061 m. This sample shows only the rearranged steranes with almost equal abundance of C_{27} and C_{29} rearranged steranes.

The M/Z 259 fragmentograms show only the rearranged steranes for both the samples. The sample from 2986 m shows a slight dominance of the C₂₉ components in comparison to the C₂₇ components, while the reverse is true for the sample from 3061 m.

The M/Z 217 and 218 fragmentograms show the two samples to be similar and only differing slightly from the lowermost samples in the Heather Fm. The fragmentograms of the molecular ions verify what has been discussed above, clearly showing the rearranged steranes to be the dominant compounds compared to the regular compounds for all C₂₇ - C₂₉ components.

Bicyclanes:

The M/Z 123, 179 and 193 fragmentograms show that the C₁₅ and C₁₆ components are dominant for these two samples. The absence of C₁₄ components might be due to loss during preparation of the samples.

Aromatic Fraction

Thiophenes:

The M/Z 84 fragmentograms show the same features as a number of samples in the Heather Fm. and Draupne Fm. and are, therefore, not discussed any further. A similar situation was also recorded for the M/Z 98 fragmentograms.

The M/Z 112 fragmentograms show the sample from 2996 m to have a few large peaks at the back end of the fragmentogram, while the sample from 3061 m has a series of peaks with a retention time of 37 minutes or greater. These peaks are not identified.

The M/Z 126 fragmentograms show that both samples have one large peak with a retention time of approximately 29 minutes. This peak was not identified. This is similar to that of the lowermost analysed sample in the Heather Fm.

The M/Z 140 fragmentograms vary considerably for the two samples in the Dunlin Gr. The sample from 2986 m has a similar pattern to the sample from 2885 m in the Heather Fm., while the sample from 3061 m mainly shows one peak with a retention time of approximately 44 minutes. This peak was not seen for the sample from 2986 m.

Alkyl-substituted Benzenes:

The M/Z 106 fragmentograms show the typical pattern of doublets found in most samples from the Bergen High area together with a large peak at the back end of the fragmentograms.

The M/Z 134 fragmentograms show some variation for the two samples. The larger peaks found in the front end of the fragmentogram in the sample from 3061 m were not recorded for the sample from 2986 m. This might be due to a loss during preparation of the fraction for analysis. Otherwise the two samples have a similar pattern.

The M/Z 148 fragmentograms show that there are differences between the two samples. The sample from 2986 m shows an unresolved envelope and a low signal to noise ratio, while the samples from 3061 m show a pattern of doublets similar to that found in the M/Z 106 fragmentogram.

The difference might be due to the low quantity of compounds producing the M/Z 148 fragmentation in the sample from 2986 m.

Naphthalenes:

None of the samples from the Dunlin Gr. show the doublet for methylnaphthalenes in the M/Z 142 fragmentograms.

The M/Z 156 fragmentograms show the typical pattern for dimethylnaphthalenes in the sample from 3061 m, while this was not recorded in the sample from 2986 m.

The M/Z 170 fragmentograms show the typical pattern for C₃-naphthalenes for both the samples. The loss of methylnaphthalenes in both the samples and C₂-naphthalenes in the sample from 2986 m could be due to evaporation during the work up of the samples.

Benzothiophenes and Dibenzothiophenes:

The M/Z 162 fragmentograms show some variation for the two samples. Most of this is due to greater losses during evaporation of the solvent from the aromatic fraction for the sample from 2986 m. The large peaks at the high molecular weight end in the fragmentogram for the sample from 3061 m are, however, real. These peaks were not recorded in the sample from 2986 m.

The M/Z 176 fragmentograms are similar for the two samples with a large peak with a retention time of approximately 29 minutes. This is similar to that for the Heather Fm. samples. The M/Z 184 fragmentograms show the peak for dibenzothiophenes, but it disappears almost in the background of other peaks with lower retention time for both samples. This would indicate either that the samples contain very small amounts of dibenzothiophene, or that there has been a strong loss due to evaporation during preparation of the samples.

The M/Z 198 fragmentograms show clearly the triplet for the

dibenzothiophenes. The relative abundance of 4-methyl-dibenzothiophene is greater in the deeper sample.

The M/Z 212 fragmentograms show the typical pattern for C₂-dibenzothiophenes for both the Dunlin Gr. samples. The two samples have a similar pattern.

Phenanthrenes:

The M/Z 178 fragmentograms show only the single peak for phenanthrene and no sign of anthracene for the Dunlin Gr. samples.

The M/Z 192 fragmentograms show the two doublets for methylphenanthrenes in both samples. The ratio of the 3+2-methylphenanthrene to 1+9-methylphenanthrene is greater than for the Heather Fm. samples.

The M/Z 206 fragmentograms show the typical pattern for the C₂-phenanthrenes. The two samples show very similar patterns.

The M/Z 220 fragmentograms show the typical pattern for the C₃-phenanthrenes and, again, the pattern is similar for the two samples.

Aromatic Steranes:

The M/Z 253 fragmentograms show a good abundance of aromatic steranes in both the samples from the Dunlin Gr. The sample from 3061 m show also some other peaks than the monoaromatic steranes in this fragmentogram. These peaks were not identified. The ratios between the various monoaromatic steranes peaks are similar to the sample from 2785 m in the Heather Fm. The sample from 2986 m shows only the monoaromatic steranes. The ratios between the different

peaks are different than that found for the sample from 3061 m. The M/Z 231 fragmentograms show the triaromatic steranes together with a large abundance of peaks in front of the C₂₀ triaromatic sterane. The ratio between the different peaks varies significantly for the two samples. The high ratio of low molecular weight compounds to high molecular compounds, indicates that these samples are mature.

Experimental, combined gas chromatography - mass spectrometry (GC-MS)

The GC-MS analyses were performed on a VG TS250 system interfaced to a Hewlett Packard 5890 gas chromatograph. The GC was fitted with a fused silica OV-1 capillary column (25m x 0.22 mm i.d.) directly into the ion source. Helium (10psi) was used as carrier gas and the injections were performed in splittless mode. The GC oven was programmed from 50°C to 150°C at 35°C/min. at which point the programme rate was 4°C/min up to 280° where the column was held isothermally for 37 min. For the aromatic hydrocarbons, the GC oven was programmed from 50°C to 280°C at 5°C/min. and held isothermally at 280°C for 22 min. The mass spectrometer was operated in electron impact (EI) mode at 70 eV electron energy, a trap current of 500 uA and a source temperature of 220°C. The instrument resolution was 2500 (10% valley) for most of the samples, but had to be decreased to 1000 for some samples to improve the sensitivity of some mass fragmentograms.

The datasystem used was a VG PDP11/73 system. The samples were analysed in multiple ion detection mode (MID) at a scan cycle time of approximately 1,8 sec.

Calculation of peak ratios was done from peak height in the appropriate mass fragmentograms.

In the discussion of the GC-MS data, the results will be discussed by area. The wells within an area will be discussed separately. In the discussion, samples within one formation are discussed together. The discussion is further divided into types of compounds as follows:

Saturated Fractions:

Terpanes:

The most commonly used fragmentations for detection of terpanes are M/Z 163 for detection of 25,28,30 trisnor-moretane or 25,28,30 trisnorhopane, M/Z 177 for detection of demethylated hopanes or moretanes, M/Z 191 for detection of tricyclic, tetracyclic- and pentacyclic terpanes and M/Z 205 for methylated hopanes or moretanes. The molecular ions M/Z 370, 384, 398, 412 and 426 are also recorded for identification of C₂₇, C₂₈, C₂₉, C₃₀ and C₃₁ triterpanes respectively.

Steranes:

The most commonly used fragmentations for detection of steranes are M/Z 149 to distinguish between 5 α and 5 β steranes, M/Z 189 and 259 for detection of rearranged steranes, M/Z 217 for detection of rearranged and normal steranes and M/Z 218 for detection of 14 β (H), 17 β (H) steranes. The molecular ions M/Z 372, 386, 400 and 414 are also recorded for identification of C₂₇, C₂₈, C₂₉ and C₃₀ steranes respectively.

Bicyclanes:

The fragmentations M/Z 123, 179 and 193 are normally used for

the detection of the bicyclanes (sesquiterpanes and diterpanes). M/Z 123 will detect all bicyclanes while M/Z 179 and 193 will show the C₁₄ and C₁₅ bicyclanes respectively.

Aromatic Fractions:

Alkyl-substituted Benzenes:

The M/Z 106 fragmentation is often used to detect the alkyl-substituted benzenes. It is especially useful for the detection of di-substituted benzenes. M/Z 134 can also be used for the detection of C₄-alkylbenzenes, but benzothiophene will also give a signal with this fragmentation. M/Z 148 can be used for the detection of C₅-alkylbenzenes, but will also give signals for methyl-substituted benzothiophenes.

Naphthalenes:

Methyl-naphthalenes are normally detected by the M/Z 142 fragmentation while C₂-naphthalenes are detected by M/Z 156 and C₃-naphthalenes by M/Z 170.

Benzothiophenes and Dibenzothiophenes:

Benzothiophene can be detected, as mentioned above, by M/Z 134. The M/Z 198 and M/Z 212 fragmentations are used for methyl-substituted dibenzothiophenes and dimethyl-substituted dibenzothiophenes respectively.

Phenanthrenes:

Phenanthrene is detected using the M/Z 178 fragmentation. Anthracene will, if present also give a signal in the M/Z 178 fragmentation. Methyl-substituted phenanthrenes give signals in the M/Z 192 fragmentation while the M/Z 206 fragmentation shows the dimethyl-substituted phenanthrenes.

Aromatic Steranes:

Monoaromatic steranes are detected using the M/Z 253 fragmentation while the triaromatic steranes are detected using the M/Z 231 fragmentation.

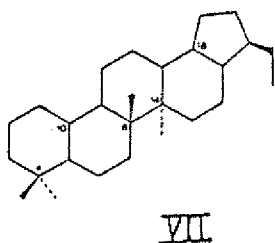
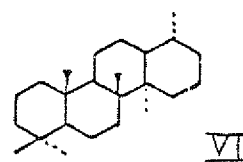
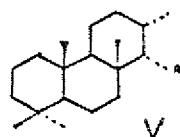
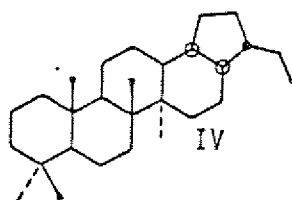
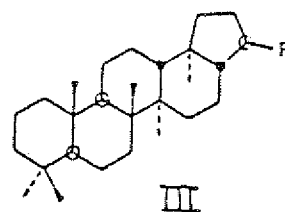
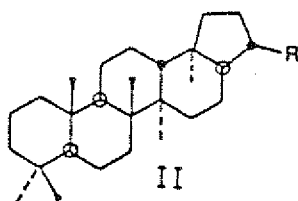
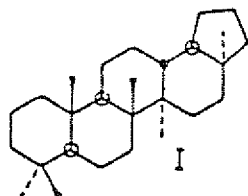
2a. Mass Fragmentograms representing Terpanes

(M/Z 163, 177, 191, 205, 370, 384, 398, 412 and 426)

Peak identification. (α and β refer to hydrogen atoms at C-17 and C-21 respectively unless indicated otherwise).

A.	18 α trisnorneohopane (T_S)	$C_{27}H_{44}$	(I)
B.	17 α trisnorhopane (T_M)	$C_{27}H_{46}$	(II, R=H)
Z.	Bisnorhopane	$C_{28}H_{48}$	(IV)
C.	$\alpha\beta$ norhopane	$C_{29}H_{50}$	(II, R= C_2H_5)
D.	$\beta\alpha$ norhopane	$C_{29}H_{50}$	(III, R= C_2H_5)
E.	$\alpha\beta$ hopane	$C_{30}H_{52}$	(II, R=i- C_3H_7)
F.	$\beta\alpha$ hopane	$C_{30}H_{52}$	(III, R=i- C_3H_7)
G.	22S $\alpha\beta$ homohopane	$C_{31}H_{54}$	(II, R=i- C_4H_9)
H.	22R $\alpha\beta$ homohopane	$C_{31}H_{54}$	(II, R=i- C_4H_9)
I.	$\beta\alpha$ homomoretane	$C_{31}H_{54}$	(III, R=i- C_4H_9)
J.	22S $\alpha\beta$ bishomohopane	$C_{32}H_{56}$	(II, R=i- C_5H_{11})
	22R $\alpha\beta$ bishomohopane	$C_{32}H_{56}$	(II, R=i- C_5H_{11})
K.	22S $\alpha\beta$ trishomohopane	$C_{33}H_{58}$	(II, R=i- C_6H_{13})
	22R $\alpha\beta$ trishomohopane	$C_{33}H_{58}$	(II, R=i- C_6H_{13})
L.	22S $\alpha\beta$ tetrakishomohopane	$C_{34}H_{60}$	(II, R=i- C_7H_{15})
	22R $\alpha\beta$ tetrakishomohopane	$C_{34}H_{60}$	(II, R=i- C_7H_{15})
M.	22S $\alpha\beta$ pentakishomohopane	$C_{35}H_{62}$	(II, R=i- C_8H_{17})
	22R $\alpha\beta$ pentakishomohopane	$C_{35}H_{62}$	(II, R=i- C_8H_{17})
P.	Tricyclic terpene	$C_{23}H_{42}$	(V, R=i- C_4H_9)
Q.	Tricyclic terpene	$C_{24}H_{44}$	(V, R=i- C_5H_{11})
R.	Tricyclic terpene (17R, 17S)	$C_{25}H_{66}$	(V, R=i- C_6H_{13})
S.	Tetracyclic terpene	$C_{24}H_{42}$	(VI)
T.	Tricyclic terpene (17R, 17S)	$C_{26}H_{48}$	(V, R=i- C_7H_{15})
N.	Tricyclic terpene	$C_{21}H_{38}$	(V, R= C_2H_5)
O.	Tricyclic terpene	$C_{22}H_{40}$	(V, R= C_3H_7)
Y.	25,28,30 trisnorhopane/moretane	$C_{27}H_{46}$	(VII)
X.	Unknown triterpene	$C_{30}H_{52}$	

STRUCTURES REPRESENTING TERPANES



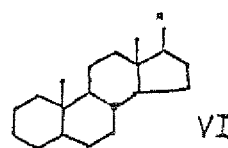
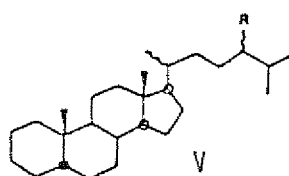
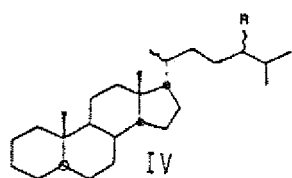
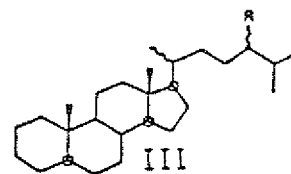
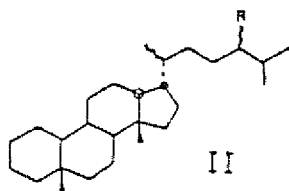
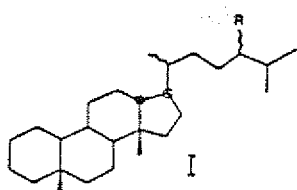
2b. Mass Fragmentograms representing Steranes

(M/Z 149, 189, 217, 218, 259, 372, 386, 400 and 414)

Peak identifications. (α and β refer to hydrogen atoms at C-5, C-14 and C-17 in regular steranes and at C-13 and C-17 in diasteranes).

a.	20S $\beta\alpha$ diacholestane	$C_{27}H_{48}$	(I, R=H)
b.	20R $\beta\alpha$ diacholestane	$C_{27}H_{48}$	(I, R=H)
c.	20S $\alpha\beta$ diacholestane	$C_{27}H_{48}$	(II, R=H)
d.	20R $\alpha\beta$ diacholestane	$C_{27}H_{48}$	(II, R=H)
e.	20S $\beta\alpha$ 24 methyl diacholestane	$C_{28}H_{50}$	(I, R=CH ₃)
f.	20R $\beta\alpha$ 24 methyl diacholestane	$C_{28}H_{50}$	(I, R=CH ₃)
g.	20S $\alpha\beta$ 24 methyl diacholestane	$C_{28}H_{50}$	(II, R=CH ₃)
	+ 20S $\alpha\alpha\alpha$ cholestane	$C_{27}H_{48}$	(III, R=H)
h.	20S $\beta\alpha$ 24 ethyl diacholestane	$C_{29}H_{52}$	(II, R=C ₂ H ₅)
	+ 20R $\alpha\beta\beta$ cholestane	$C_{27}H_{48}$	(IV, R=H)
i.	20S $\alpha\beta\beta$ cholestane	$C_{27}H_{48}$	(IV, R=H)
	+ 20R $\alpha\beta$ 24 methyl diacholestane	$C_{28}H_{50}$	(II, R=CH ₃)
j.	20R $\alpha\alpha\alpha$ cholestane	$C_{27}H_{48}$	(III, R=H)
k.	20R $\beta\alpha$ 24 ethyl diacholestane	$C_{29}H_{52}$	(I, R=C ₂ H ₅)
l.	20S $\alpha\beta$ 24 ethyl diacholestane	$C_{29}H_{52}$	(II, R=C ₂ H ₅)
m.	20S $\alpha\alpha\alpha$ 24 methyl cholestane	$C_{28}H_{50}$	(III, R=CH ₃)
n.	20R $\alpha\beta\beta$ 24 methyl cholestane	$C_{28}H_{50}$	(IV, R=CH ₃)
	+ 20R $\alpha\beta$ 24 ethyl diacholestane	$C_{29}H_{52}$	(II, R=C ₂ H ₅)
o.	20S $\alpha\beta\beta$ 24 methyl cholestane	$C_{28}H_{50}$	(IV, R=CH ₃)
p.	20R $\alpha\alpha\alpha$ 24 methyl cholestane	$C_{28}H_{50}$	(III, R=CH ₃)
q.	20S $\alpha\alpha\alpha$ 24 ethyl cholestane	$C_{29}H_{52}$	(III, R=C ₂ H ₅)
r.	20R $\alpha\beta\beta$ 24 ethyl cholestane	$C_{29}H_{52}$	(IV, R=C ₂ H ₅)
s.	20S $\alpha\beta\beta$ 24 ethyl cholestane	$C_{29}H_{52}$	(IV, R=C ₂ H ₅)
t.	20R $\alpha\alpha\alpha$ 24 ethyl cholestane	$C_{29}H_{52}$	(III, R=C ₂ H ₅)
u.	5 α sterane	$C_{21}H_{36}$	(VI, R=C ₂ H ₅)
v.	5 α sterane	$C_{22}H_{38}$	(VI, R=C ₃ H ₇)

STRUCTURES REPRESENTING STERANES

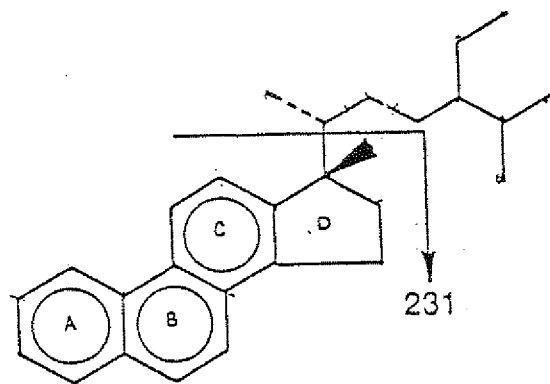


Mass Fragmentograms representing Triaromatic Steranes
 (M/Z 231)

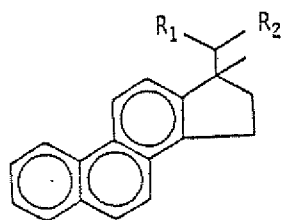
Description of ABC-ring triaromatic steroid hydrocarbons

Peak	Substituents		Abbreviation of Compound
	R ₁	R ₂	
a1	CH ₃	H	C ₂₀ TA
b1	CH ₃	CH ₃	C ₂₁ TA
c1	S(CH ₃)	C ₆ H ₁₃	SC ₂₆ TA
d1	R(CH ₃)	C ₆ H ₁₃	RC ₂₆ TA
	S(CH ₃)	C ₇ H ₁₅	SC ₂₇ TA
e1	S(CH ₃)	C ₈ H ₁₇	SC ₂₈ TA
f1	S(CH ₃)	C ₇ H ₁₅	RC ₂₇ TA
g1	R(CH ₃)	C ₈ H ₁₇	RC ₂₈ TA

STRUCTURES REPRESENTING TRIAROMATIC STERANES:



II



Mass Fragmentograms representing Monoaromatic Steranes
(M/Z 253)

Description of C-ring monoaromatic steroid hydrocarbons

Peak	Substituents				Abbreviation of Compound
	R ₁	R ₂	R ₃	R ₄	
A1					C ₂₁ MA
B1					C ₂₂ MA
C1	β(H)	CH ₃	S(CH ₃)	H	βSC ₂₇ MA
	CH ₃	H	S(CH ₃)	H	SC ₂₇ DMA
D1	β(H)	CH ₃	R(CH ₃)	H	βRC ₂₇ MA
	CH ₃	H	R(CH ₃)	H	RC ₂₇ DMA
E1	α(H)	CH ₃	S(CH ₃)	H	αSC ₂₇ MA
	β(H)	CH ₃	S(CH ₃)	CH ₃	βSC ₂₈ MA
F1	CH ₃	H	S(CH ₃)	CH ₃	SC ₂₈ DMA
	α(H)	CH ₃	R(CH ₃)	H	αRC ₂₇ MA
G1	α(H)	CH ₃	S(CH ₃)	CH ₃	αSC ₂₈ MA
	β(H)	CH ₃	R(CH ₃)	CH ₃	βRC ₂₈ MA
H1	CH ₃	H	R(CH ₃)	CH ₃	RC ₂₈ DMA
	β(H)	CH ₃	S(CH ₃)	C ₂ H ₅	βSC ₂₉ MA
I1	CH ₃	H	S(CH ₃)	C ₂ H ₅	SC ₂₉ DMA
	α(H)	CH ₃	R(CH ₃)	CH ₃	αRC ₂₈ MA
H1	β(H)	CH ₃	R(CH ₃)	C ₂ H ₅	βRC ₂₉ MA
	CH ₃	H	R(CH ₃)	C ₂ H ₅	RC ₂₉ DMA
I1	α(H)	CH ₃	R(CH ₃)	C ₂ H ₅	αRC ₂₉ MA

STRUCTURES REPRESENTING MONOAROMATIC STERANES:

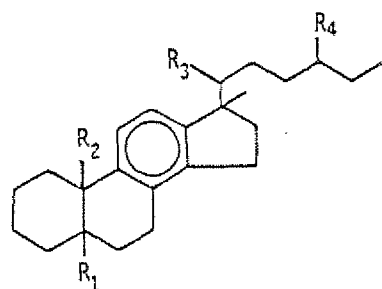
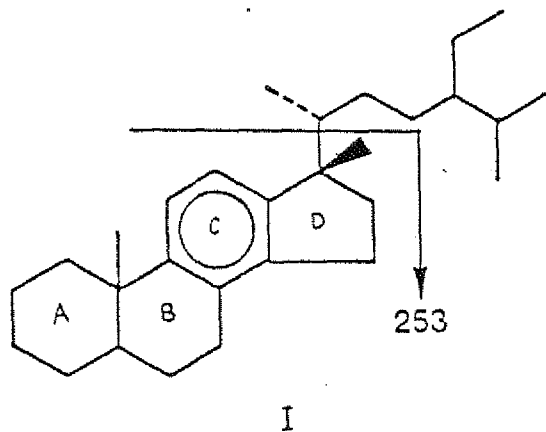


Table 1: Variation in Triterpane Distribution for Well NOCS 30/6-5

Depth unit of measure: m

Depth	Lithology	B/A	B/B+A	B		C/E	C/C+E	X/E	Z/E	Z/C	Z/Z+E	Q/E	E/E+F	C+D		J1		Sample
				B+E+F										C+D+E+F	D+F/C+E	J1+J2%		
2470.00	bulk	1.89	0.65	0.29		0.74	0.43	0.08	-	-	-	0.14	0.86	0.42	0.16	58.70	108-0	
2512.00	bulk	1.93	0.66	0.37		0.97	0.49	0.08	2.00	2.06	0.67	0.15	0.87	0.50	0.16	58.64	109-0	
2533.00	bulk	2.93	0.75	0.36		0.85	0.46	0.09	4.11	4.81	0.80	0.12	0.87	0.46	0.16	61.56	110-0	
2557.00	bulk	2.61	0.72	0.30		0.71	0.41	0.06	4.01	5.66	0.80	0.06	0.87	0.42	0.16	58.60	111-0	
2581.00	bulk	2.12	0.68	0.31		0.80	0.45	0.08	2.87	3.57	0.74	0.10	0.88	0.44	0.13	63.13	112-0	
2641.00	bulk	2.55	0.72	0.31		0.79	0.44	0.07	3.19	4.02	0.76	0.06	0.84	0.44	0.17	59.45	113-0	
2701.00	bulk	4.09	0.80	0.36		1.07	0.52	0.08	0.15	0.14	0.13	0.08	0.84	0.51	0.18	62.34	114-0	
2785.00	bulk	3.68	0.79	0.36		0.92	0.48	0.05	0.20	0.22	0.17	0.07	0.87	0.47	0.12	66.17	115-0	
2986.00	bulk	2.82	0.74	0.36		0.87	0.46	0.08	1.00	1.15	0.50	0.19	0.89	0.46	0.11	65.26	117-0	
3061.00	bulk	1.38	0.58	0.29		0.59	0.37	0.12	-	-	-	0.18	0.91	0.37	0.09	64.54	118-0	

Table 2: Variation in Sterane Distribution for Well NOCS 30/6-5

Depth unit of measure: m

<u>Depth</u>	<u>Lithology</u>	<u>Ratio1</u>	<u>Ratio2</u>	<u>Ratio3</u>	<u>Ratio4</u>	<u>Ratio5</u>	<u>Ratio6</u>	<u>Ratio7</u>	<u>Sample</u>
2470.00	bulk	0.47	31.38	56.71	1.33	0.68	0.21	0.18	108-0
2512.00	bulk	0.49	36.73	55.92	1.35	0.63	0.29	0.23	109-0
2533.00	bulk	0.49	36.74	55.30	1.17	0.63	0.25	0.19	110-0
2557.00	bulk	0.48	40.62	54.47	1.30	0.60	0.24	0.20	111-0
2581.00	bulk	0.50	41.04	54.27	1.17	0.59	0.25	0.19	112-0
2641.00	bulk	0.49	40.82	54.95	1.16	0.60	0.23	0.18	113-0
2701.00	bulk	0.64	47.02	58.95	0.83	0.60	0.21	0.15	114-0
2785.00	bulk	0.66	55.33	62.99	0.66	0.61	0.29	0.20	115-0
2986.00	bulk	0.52	55.56	69.01	0.66	0.67	0.27	0.18	117-0
3061.00	bulk	0.89	60.07	74.48	1.13	0.71	0.27	0.20	118-0

Table 3: Aromatisation of Steranes for Well NOCS 30/6-5

Depth unit of measure: m

<u>Depth</u>	<u>Lithology</u>	<u>Ratio1</u>	<u>Ratio2</u>	<u>Sample</u>
2470.00	bulk	0.63	0.43	108-0
2512.00	bulk	0.62	-	109-0
2533.00	bulk	0.63	0.55	110-0
2557.00	bulk	0.60	0.62	111-0
2581.00	bulk	0.60	0.59	112-0
2641.00	bulk	0.60	0.61	113-0
2701.00	bulk	0.64	1.00	114-0
2785.00	bulk	0.70	0.75	115-0
2986.00	bulk	0.74	0.64	117-0
3061.00	bulk	0.72	0.76	118-0

Table 4: Variation in Triaromatic Sterane Distribution for Well NOCS 30/6-5

Depth unit of measure: m

<u>Depth</u>	<u>Lithology</u>	<u>Ratio1</u>	<u>Ratio2</u>	<u>Ratio3</u>	<u>Ratio4</u>	<u>Ratio5</u>	<u>Sample</u>
2470.00	bulk	0.65	0.56	0.19	0.27	0.24	108-0
2512.00	bulk	1.00	-	0.24	1.00	0.32	109-0
2533.00	bulk	0.67	0.53	0.20	0.31	0.27	110-0
2557.00	bulk	0.66	0.58	0.24	0.32	0.31	111-0
2581.00	bulk	0.64	0.52	0.21	0.29	0.28	112-0
2641.00	bulk	0.60	0.51	0.19	0.26	0.25	113-0
2701.00	bulk	0.89	0.63	0.31	0.60	0.39	114-0
2785.00	bulk	0.84	0.77	0.51	0.58	0.63	115-0
2986.00	bulk	0.91	0.87	0.56	0.69	0.64	117-0
3061.00	bulk	0.87	0.82	0.59	0.64	0.72	118-0

Table 5: Variation in Monoaromatic Sterane Distribution for Well NOCS 30/6-5

Depth unit of measure: m

<u>Depth</u>	<u>Lithology</u>	<u>Ratio1</u>	<u>Ratio2</u>	<u>Ratio3</u>	<u>Ratio4</u>	<u>Sample</u>
2470.00	bulk	0.22	0.20	0.13	0.12	108-0
2512.00	bulk	0.24	0.52	0.13	0.23	109-0
2533.00	bulk	0.22	0.20	0.13	0.12	110-0
2557.00	bulk	0.26	0.23	0.16	0.14	111-0
2581.00	bulk	0.23	0.22	0.13	0.13	112-0
2641.00	bulk	0.21	0.18	0.12	0.11	113-0
2701.00	bulk	0.22	0.08	0.10	0.08	114-0
2785.00	bulk	0.35	0.27	0.19	0.17	115-0
2986.00	bulk	0.31	0.24	0.18	0.17	117-0
3061.00	bulk	0.36	0.38	0.19	0.21	118-0