O DIR.

ELF R.E.
D. EXPLOR.
DEPARTEMENT GEOLOGIQUE CENTRAL
LABORATOIRES

-

WELL HEIMDALL 25/4-1

-

ORGANIC GEOCHEMICAL REPORT

2035 n° 3/810 R
/ca

J. du ROUCHET
July 1973

1 - ORGANIC INVENTORY (Plate 1 : logs of COT and MOE)

The organic picture of the stratigraphic serie bored in HEIMDALL well is given by a systematic measurement of total organic carbone amounts (COT) and of chloroformic extract amounts (MOE).

The Bitumen Ratio (B) is defined as : (MOE/COT).100 ; it is the percentage of chloroformic extract in the total organic carbone (little different of the percentage of chloroform extract in the total organic matter).

Some Benzene-Methanol extractions were also made on selected samples.

1.1 - Indifferenciated Tertiary

1.1.1 - Lignite Serie (500 to 815 m)

- Sample 640 m : COT = 0,12 MOE = 200 ppm
  B (= 16 %) is relatively little significant because the absolute error on MOE measurements is ~100 ppm. Then the relative error on B is greater than 50 %.

- Sample 750 m : COT = 0,64 MOE = 30 ppm
  Medium COT but lowest MOE.

1.1.2 - Gumbo Clays and Brown/Green Shales Member (from 815 to 1925 m).

Good COT values, in the average of 1 %, lowest MOE values, lower than 200 ppm (except one sandstone 1040 m = 280 ppm).

The burial is not sufficient for organic matter maturation. In this condition it is not possible to say from the MOE or B values whether organic matter is a potential petroleum generator or not.

Other analysis will be necessary ; in particular we think to pyrochromatography* of the kerogen (kerogen is the word for insoluble organic matter in this early step of evolution).

In spite of favourable syncline burial effects there is probably little chance for petroleum generation in the tertiary shales of this sector of North Sea.

1.1.3 - Tuffitic/Sand Shale Member (1926 to 2067 m)

Samples	COT %	MOE ppm	B. Ratio %
Core 1 1936,9 m	1,61	580	3,6
1942,3 m	0,58	220	3,8
Cuttings 1955 m	0,93	260	2,8
2000 m	1,35	360	2,7

.../...

* or "pyrolysis gas chromatography".

Then good COT but rather poor MOE ; interpretation is like the preceding one.

1.1.4 - Heimdall Sand Formation (2067 to 2423 m)

a) Gas section (2067 to 2174 m)

Samples		COT %	MOE ppm	B. Ratio %
Cuttings	2070 m	0,85	230	2,7
Core 2	2081 m	0,02	60	30
	2084 m	0,56	930	16
Core 3	2102 m	0,05	250	50
	2112 m	0,08	270	34
Cuttings	2140 m	0,67	210	3,2

Lowest COT in clean sands, MOE rather low ; B are moderate and compatible with gas content but we have already pointed out the high relative error done in B calculations.

b) Oil section (2174 to 2176 m) : no measurements

c) Water section (2176 to 2423 m)

During drilling numerous direct fluorescences and oil shows were seen :

1) on cuttings between 2250 and 2275 m
2) on cuttings and core 4 between 2385 m and 2425 m.

These observations suggest vertical upward migration.

Samples		COT %	MOE ppm	B. Ratio %
Cuttings	2265 m	1,04	7920	76,2
	2295 m	0,67	1060	15,8
	2310 m	0,50	520	10,4
	2370 m	1,10	1380	13,7

In cuttings sands and shales are mixed ; the COT values of this mixture are higher than the true clean sand COT ; accordingly, the calculated B values are probably inferior approximations of true clean sand B values. One will notice the larger MOE and B in 2265 m cuttings.

Chromatographic analysis of these "water sand" oil traces could be interesting.

.../...

1.2 - Danian and Upper Cretaceous

1.2.1 - Basal Shales Member (2423 to 2570 m)

Numerous fluorescences and oil shows on the cuttings have also been observed.

Only one sample analysed.

Cuttings 2570 m : COT = 0,96 % - MOE = 610 ppm - B = 6,4 %

Good COT, rather high MOE but bitumen is perhaps epigenetic.

1.2.2 - Maestrichtian : shale and carbonate thin beds (2570 to 2864 m)

Seven samples have been analysed (see Plate 1).

Medium to good COT (0,5 to 1 %) ; erratic MOE from very low to high value (170 ppm (2850 m) to 2890 ppm (2625 m)) ; the B ratio values erraticaly range from 1 % to 44 %.

It is obvious that the higher B ratio values are due rather to migrated oil then to source rocks bitumen.

Besides, numerous fragments of bitume have been found in the cuttings according to the well report.

Nevertheless reliable conclusions on organic matter shall require chromatographic analysis (Saturated of the chloroform extract and Vapors "thermo-vaporized" from the rocks).

1.2.3 - Senonian (2864 to 3062 m)

Only two MOE measures on clabs :

clab 2894 m (dark grey shales) : MOE = 90 ppm (smallest)
" 2977,5m (coarse sands) : MOE = 540 ppm (fair)

1.3 - Middle Cretaceous - Upper Jurassic transition

Only three measures have been performed :

Samples	Assumed ages	COT %	MOE ppm	B %	MB ppm	MOE / MB
Cuttings 3165 m	Kimmeridgian	10,4	22300	21,5	1270	# 17
3170 m	?	6,0	10770	17,8	1400	# 8
3175 m	Kimmeridgian	6,0	7100	11,8	1170	# 6

In the preceding table the "MB" values are the amount of Benzene - Methanol (50 % B, 50 % M) extract (chloroform extraction is achieved at first on the samples).

The MOE/MB values are much higher for the epigenetic bitumen (migrated oil) than for the syngenetic bitumen (bitumen generated from kerogen), so :

The bitumen of 3175 m cuttings is very probably syngenetic ; these shales are bituminous.

A part of bitumen of 3165 m cuttings is probably epigenetic : B and MOE/MB are too high.

Nevertheless one will remark the large COT value of 3169 m cuttings : 10,4 %.

Migration of oil accross shales and carbonates is also suggested by the log of gas concentrations into the drilling mud : the first show is at 3160 m in a carbonate bed.

It is obvious that the Kimmeridgian radioactive bituminous black shales are a possible source rock.

But chromatographic analysis will be necessary for further precisions.

1.4 - Dogger to Lias (3185 to 3512,5 m)

This section includes gas-oil - water sandstone reservoirs, black carbonaceous and bituminous shales and coal levels.

One will remember that the most part of the cores even in the water wet sandstone had fair oil shows and fluorescences.

.../...

All the organic measures have been performed on core samples :

Sample		COT %	MOE ppm	B %	MB ppm	MOE / MB
Depth	Lithology					
3188,0 m	Sandstone (oil)		11090			
3189,2 m	Bituminous Coal	~ 100	127100	~ 13		
3194,0 m	Sandstone (oil)		3980			
3209,0 m	Sandstone (water)	0,26	1950	75	150	~ 13
3214,0 m	- id -	0,42	3410	80	220	~ 15
3217,6 m	- id -	0,60	5180	80	260	~ 20
3221,2 m	Black slaty shale	9,60	4700	4,9	980	~ 5
3221,9 m	Mixed shales and sandstones	9,20	7230	7,9	1890	~ 4
3232,2 m	Black silteous shales with sand laminations	2,40	1830	7,6	380	~ 5
3233,3 m	Fine sandstone/silt	1,70	1120	6,6	280	~ 4
3234,5 m	Black silteous shales	1,34	860	6,9	170	~ 5
3288,8 m	Medium to coarse sandstone (gas)	0,26	1720	66	140	~ 12
3292,3 m	Fine to medium sandstone (oil)	1,54	21890	140	290	~ 75
3297,6 m	Medium to coarse sandstone (oil)	0,84	9730	116	220	~ 44
3305,5 m	Fine to very fine sandstone (water)	0,68	6430	95	180	~ 36
3316,0 m	Black silteous shale (interbedded in sandstones)	3,00	1210	4	300	~ 4

Chromatographic analysis of saturated oil fraction of chloroformic extract and of thermovaporized vapors lacking, the effective petroleum yield power of black carbonaceous and bituminous shales cannot be yet specified ; but this power is probable.

Nevertheless the <u>main origin</u> of the oil contained in the Dogger and Lias sandstone remain questionable : Dogger/Lias or Upper Jurassic ?

Chromatographic analysis should be made on all different oil reservoirs and black shales beds.

2 - CHROMATOGRAPHIC ANALYSIS OF THE OILS AND BITUMENS

These analysis include CPG of saturated oil fractions of oils and chloroformic extracts and CPG of thermovaporized vapors of oils and rocks.

Presently four samples have been analysed :

- Oil of FIT 2 ~ 2176,9 m in Paleocene Heimdall Formation
- Chloroformic extract and rock of 3188,0 m oil sandstone
- Chloroformic extract and rock of 3194,0 m oil sandstone
- Chloroformic extract of bituminous coal at 3189,2 m (coal seam interbedded into the oil sandstone).

The detailed results of these analysis are reported in Appendix final A and B sections of the present report.

But the main results are as follows :

2.1 - Oil Samples

The chromatograms - Saturated oil and vapors - of the Paleocene reservoir oil (2176,9 m) and of the Dogger reservoir oil (3188 m and 3194 m) are very similar, almost identical ; and they are different from these of Ekofisk Paleocene oil, but part of these differences is due to a less maturation of the Heimdall oils.

The only possible difference between oil vapors chromatograms of Heimdall is, perhaps, a less development of some peaks inserted between the large n.alcanes peaks in the Paleocene oil ; but the same large toluene peaks are present, in Paleocene like in Dogger.

The most of usual geochemical indexes are also very close and they are different from those of Ekofisk Paleocene reservoir oil.

	Pristane / Phytane	Pristane / n.C17	Phytane / n.C18	Saturated Oil / Aromatic Oil
Oil from 2176,9 m	2,34	0,57	0,28	8,5
Oil from 3188,0 m	2,11	0,50	0,27	2,72
Oil from 3194,0 m	2,50	0,52	0,22	3,09
Ekofisk Oil	1,25	0,37	0,33	3,80

Pristane/n.C17 and Phytane/n.C18 are maturation indexes (Ekofisk Oil is more mature), but Pristane/Phytane is a rather good origin index.

.../...

The larger Saturated Oil/Aromatic Oil ratio of the Heimdall Paleocene oil (S/A = 8,5 instead of ∼ 3 for Dogger oils) is probably due to selective retention effect of the migration accross the shales (chromatographic adsorption of more polar aromatic molecules).

The source rocks of Heimdall oil and Ekofisk oil may be different - facies or age - but also one must consider the possibility of "pollution" by the coal bitumen, possibly extracted by oil.

Further analysis will be necessary for more precisions.

2.2 - Bituminous coal sample 3189,2 m

- The Saturated Oil fraction chromatogram shows some good analogies with those of oil sandstones but also some differences.
  Moreover the validity of this saturated oil fraction as specific component of the coal is questionable since the Saturated Oil/Aromatic oil ratio is only 0,15 and oil "pollution" of coal by oil is rather likely.

- The rock vapors chromatogram is more reliable : there are few best analogies from 6.carbons to 8.carbons molecules, but also beyond 8.carbons a lot of discrepancies (probably much more aromatics than in the oils). One will remark the high peak of toluene, still much higher than in the oil.
  It is probable that the associated carbonaceous shales have some of hydrocarbons characteristics of the analyzed coal, these shales may be source rocks.

.../...

SUMMARY OF RESULTS

- The oils from the "Heimdall Formation" and from Dogger sandstone (at least the upper level) are obviously of the same origin.
- These oils are fairly different from other oils already analysed in North Sea wells.
- The bituminous and carbonaceous black shales of Kimmeridgian and of Dogger Lias are possible oil sources of these oils.

Supplementary chromatographic analysis of other oil and rock samples would be necessary to determine the effective source (or sources) of the reservoir oils found out in HEIMDALL well.

APPENDIX "A"

	.	+	*	X
C1				
C2				
C3				
IC4			0.257	
NC4			0.694	
IC5			1.028	
NC5			1.828	
IC6			3.542	
NC6			4.571	
IC7			19.540	
NC7			7.236	
IC8			37.624	
NC8			9.601	
IC9			24.407	
NC9			9.944	
IC10			19.885	
NC10			9.714	
IC11			17.371	
NC11			9.485	
IC12			10.285	
NC12			9.257	2.615
IC13			9.257	
NC13			9.119	5.953
IC14			10.057	
NC14			8.914	7.139
C15			8.571	7.422
C16			8.281	7.818
C17			8.051	7.697
C18			7.541	6.739
C19				6.291
C20				5.893
C21				5.661
C22				5.332
C23				5.042
C24				4.864
C25				4.514
C26				3.881
C27				3.269
C28				2.690
C29				2.222
C30				1.502
C31				1.375
C32				1.116
C33				0.687

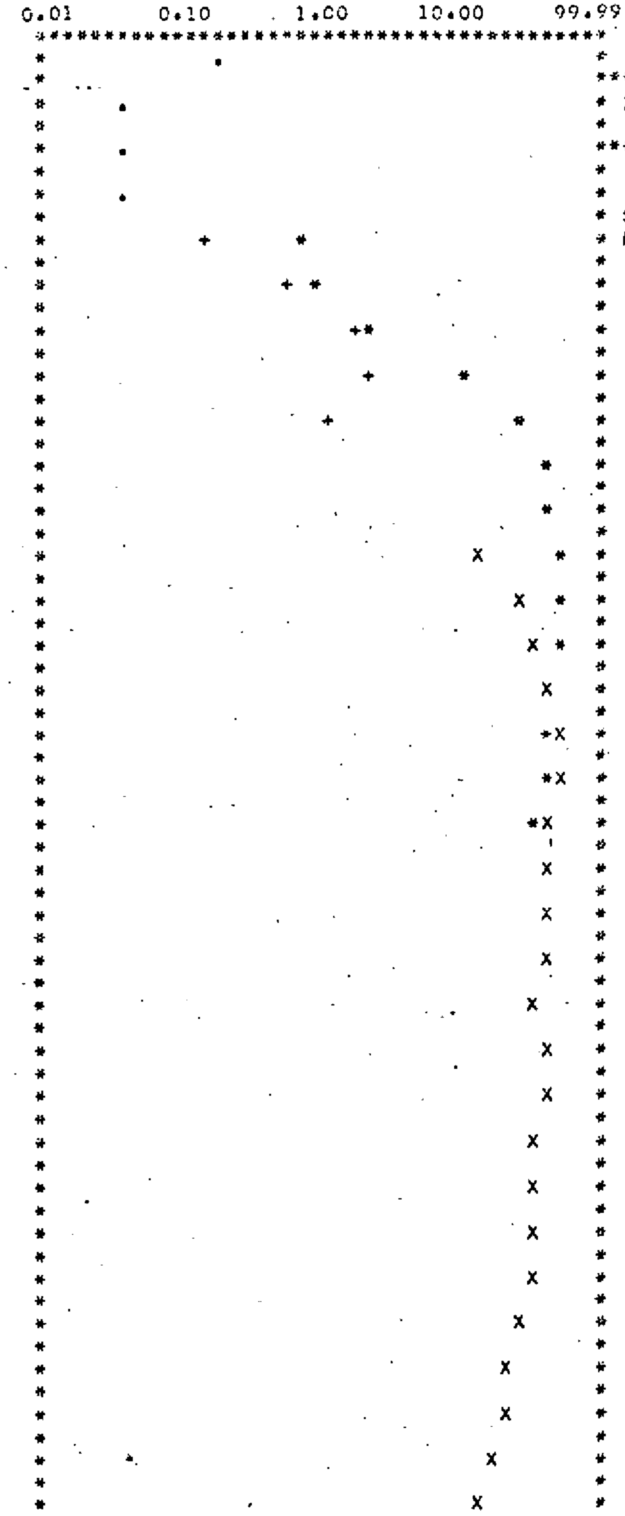
0.01 0.10 1.00 10.00 99.99 PPM 0/00

25 4 FIT 2
2176.9

S C1 A C14
MAX= 233.62

(2)

	.	+	*	X
C1	0.207			
C2	0.049			
C3	0.040			
IC4	0.010			
NC4	0.044			
IC5	0.094	0.118		
NC5	0.164	0.184	0.904	
IC6		0.502	1.273	
NC6		0.633	1.210	
IC7		5.081	6.872	
NC7		2.012	2.905	
IC8		11.024	33.326	
NC8		2.591	15.311	
IC9		5.630	63.269	
NC9		1.430	35.123	
IC10			87.652	
NC10			51.638	
IC11			114.226	
NC11			60.104	
IC12			82.086	
NC12			63.999	16.260
IC13			73.043	
NC13			66.782	33.867
IC14			129.391	
NC14			64.973	44.275
C15			62.205	57.760
C16			61.599	67.213
C17			55.266	65.213
C18			46.432	58.217
C19				57.181
C20				53.385
C21				51.548
C22				49.622
C23				52.479
C24				52.030
C25				48.185
C26				44.994
C27				41.679
C28				40.267
C29				32.227
C30				27.149
C31				27.427
C32				22.701
C33				19.035



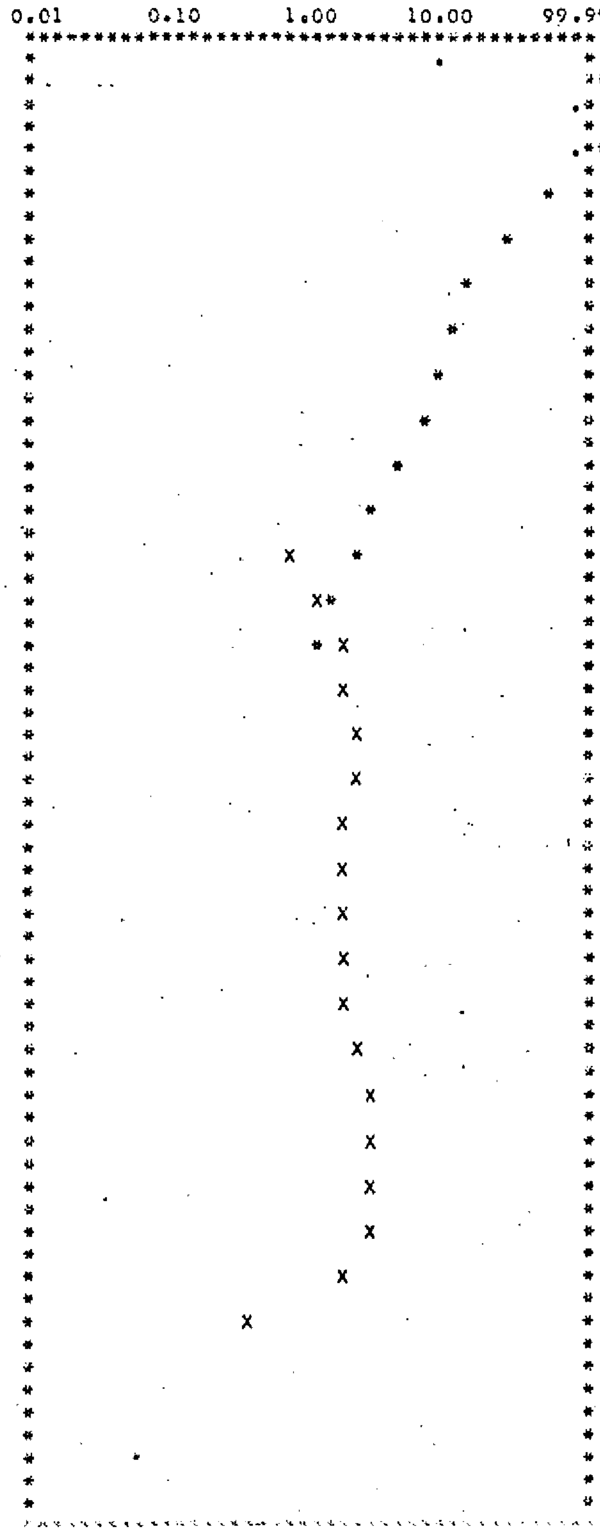
PPM
~~0400~~

25 4 1X
3188.0

S C1 A C14
MAX= 954.56

[redacted] 5 4 [redacted] K6 [redacted] 3 [redacted]

	.	+	*	X
C1	10.044			
C2	119.699			
C3	153.9/1			
IC4			18.719	
NC4			70.079	
IC5			17.493	
NC5			33.706	
IC6			21.973	
NC6			19.562	
IC7			134.419	
NC7			13.488	
IC8			162.399	
NC8			10.966	
IC9			81.203	
NC9			8.579	
IC10			52.533	
NC10			6.293	
IC11			26.666	
NC11			3.740	
IC12			10.879	
NC12			2.714	0.915
IC13			18.666	
NC13			1.973	1.553
IC14			13.679	
NC14			1.386	2.141
C15				2.486
C16				2.645
C17				2.663
C18				2.255
C19				2.174
C20				2.158
C21				2.261
C22				2.476
C23				3.138
C24				3.376
C25				3.590
C26				3.507
C27				3.263
C28				2.118
C29				0.445
C30				
C31				
C32				
C33				



PPM
0/0000

25 4 1 K6
3189.2

S C1 A C14
MAX=1015.59

(3)

APPENDIX "B"

ANALYSE D'HUILE ~~OU D'EXTRAIT CHLOROFORMIQUE DE ROCHE~~

SONDAGE : HEIMDALL 25/4-1

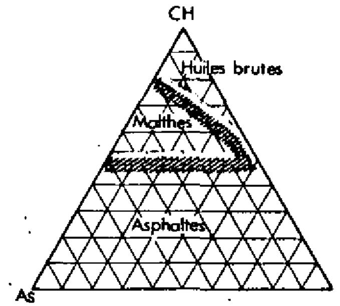
ECHANTILLON : FIT n° 2 - 2176,90 m COT = MOE = P. d'extrait Age ou Formation :

CONSTITUTION :

Asphaltènes	As=	1,4 %
Résines	R =	2,6
Constituants huileux	CH =	90,0
Pertes + Résidus: 100 -(A+R+CH) =		6,0

Asphaltènes Insolubles/CCl4 C = 1,1 %

CH Saturés =80,6; CH Aromatiques = 9,4 ; S/A = 8,5



ANALYSE DES HYDROCARBURES SATURES PAR CPG (Poids de la prise d'essai = 300mg)

Proportion des n.alcanes dans les Saturés = 17%

Proportion : du Farnesane = 0,48 du Pristane = 0,76 du Phytane = 0,33

Rapports: Pristane/Phytane = 2,34 Pristane/n.C17 0,57 Phytane/n.C18 = 0,28

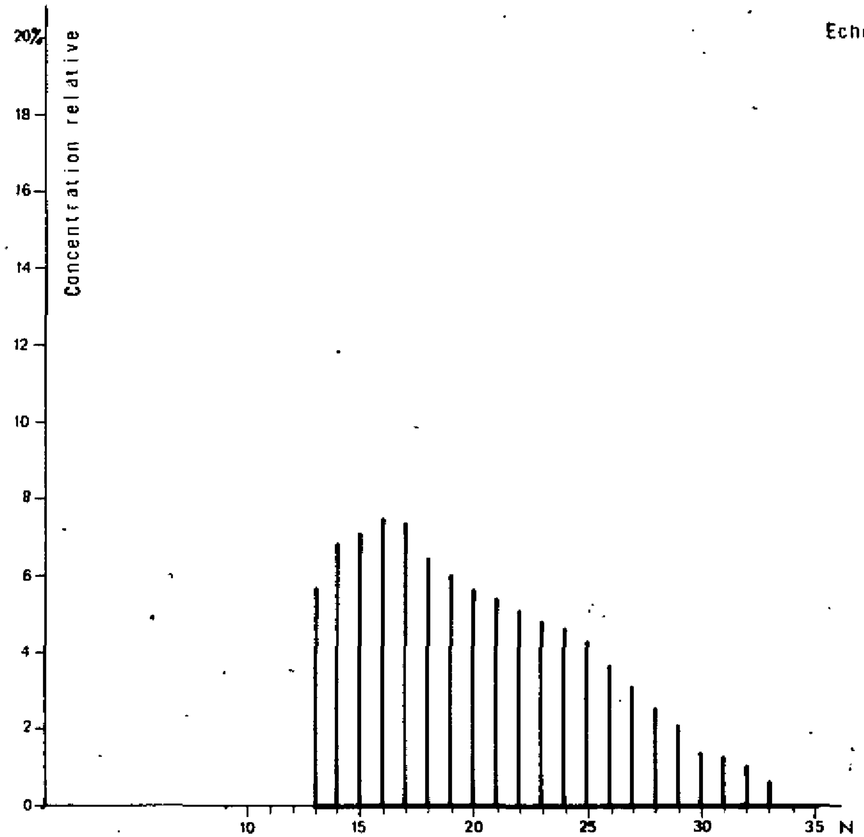
Recherche de dominance paire ou impaire par calcul du Carbon Preference Index (CPI) :

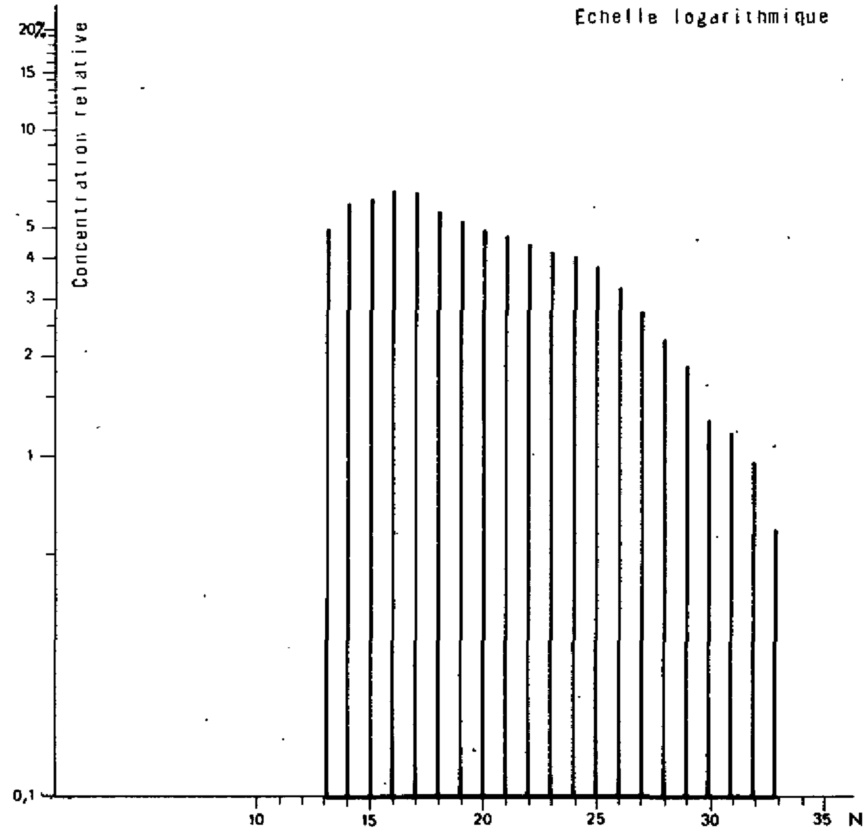
CPI entre la n.alcane 16 et la n.alcane : 32 CPI = 1,007

Distribution relative des n.alcanes :

n.C14	n.C15	n.C16	n.C17	n.C18	n.C19	n.C20	n.C21	n.C22	n.C23	n.C24	n.C25	n.C26	n.C27	n.C28	n.C29	n.C30	n.C31	n.C32	n.C33
7,16 %	7,44 %	7,84 %	7,72 %	6,76 %	6,31 %	5,91 %	5,68 %	5,35 %	5,06 %	4,88 %	4,53 %	3,89 %	3,28 %	2,70 %	2,23 %	1,51 %	1,38 %	1,12 %	0,69 %

HISTOGRAMMES DE LA DISTRIBUTION RELATIVE DES n.ALCANES EN FONCTION DU NOMBRE N DE CARBONES.





6942

ANALYSE ~~D'HUILE OU~~ D'EXTRAIT CHLOROFORMIQUE DE ROCHE

SONDAGE : HEIMDALL 25/4-1

ECHANTILLON : 3188

COT = MOE = 11290 ppm P. d'extrait

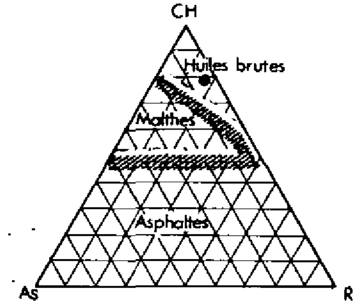
Age ou Formation :

CONSTITUTION :

Asphaltènes	As=	3,8 %
Résines	R =	14,7
Constituants huileux	CH =	77
Pertes + Résidus: 100 -(A+R+CH) =		4,5

Asphaltènes Insolubles/CCl4 C =

CH Saturés = 56,3; CH Aromatiques = 20,7 ; S/A = 2,72



ANALYSE DES HYDROCARBURES SATURES PAR CPG (Poids de la prise d'essai ≃120 mg)

Proportion des n.alcanes dans les Saturés = 15,4 %

Proportion : du Farnesane = 0,39 % du Pristane = 0,52 % du Phytane = 0,25

Rapports: Pristane/Phytane = 2,11 Pristane/n.C17 = 0,50 Phytane/n.C18 = 0,27

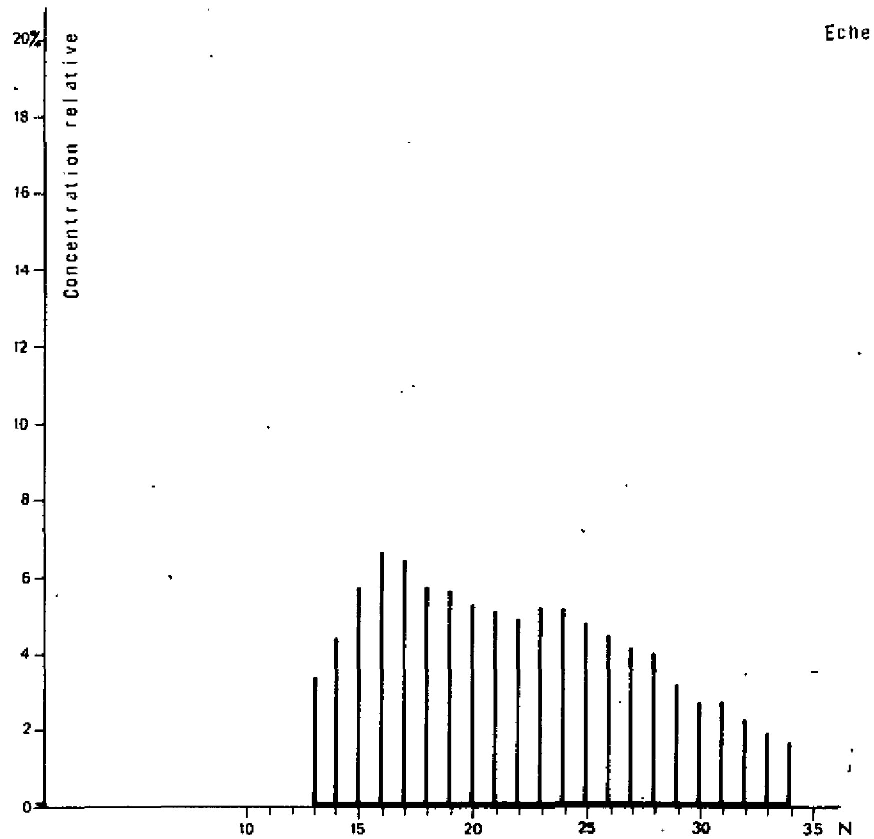
Recherche de dominance paire ou impaire par calcul du Carbon Preference Index (CPI) :

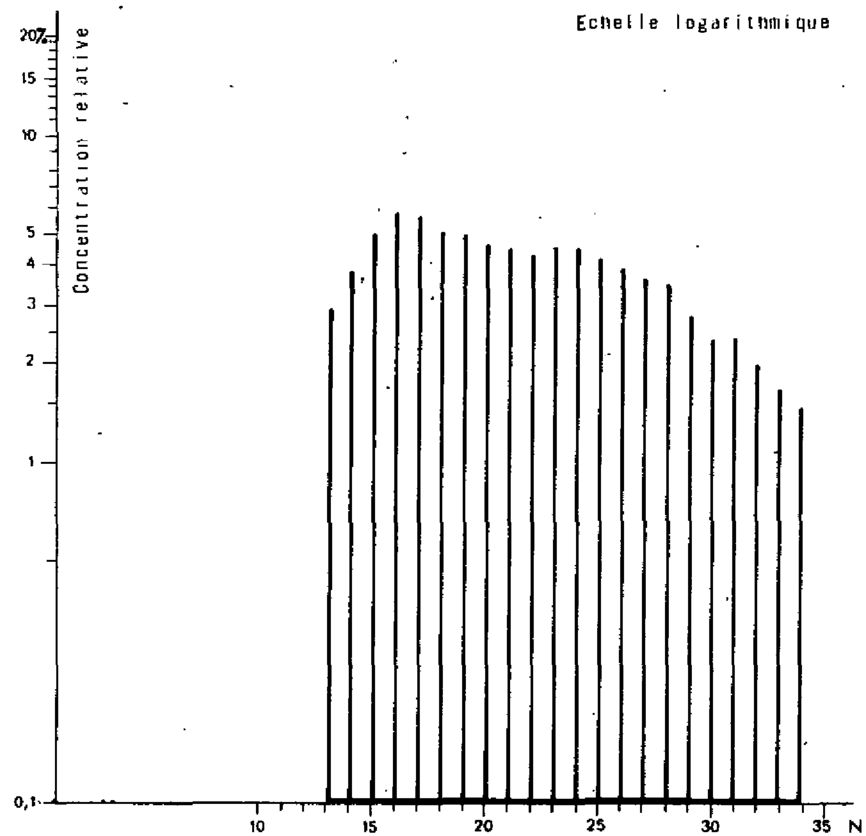
CPI entre la n.alcane 16 et la n.alcane : 32 CPI = 0,996

Distribution relative des n.alcanes :

n.C14	n.C15	n.C16	n.C17	n.C18	n.C19	n.C20	n.C21	n.C22	n.C23	n.C24	n.C25	n.C26	n.C27	n.C28	n.C29	n.C30	n.C31	n.C32	n.C33	n.C34
4,52 %	5,90 %	6,87 %	6,66 %	5,95 %	5,84 %	5,45 %	5,27 %	5,07 %	5,36 %	5,32 %	4,92 %	4,60 %	4,26 %	4,11 %	3,27 %	2,77 %	2,80 %	2,32 %	1,95 %	1,70

HISTOGRAMMES DE LA DISTRIBUTION RELATIVE DES n.ALCANES EN FONCTION DU NOMBRE N DE CARBONES.





6942

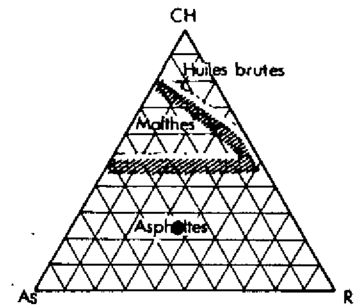
ANALYSE ~~D'HUILE OU~~ D'EXTRAIT CHLOROFORMIQUE DE ROCHE

SONDAGE : HEIMDALL 25/4-1

ECHANTILLON : Car.6 3189,20 (charbon ?) COT = MOE = 127130 P. d'extrait 1,0806 g Age ou Formation :

CONSTITUTION :

Asphaltènes	As = 36,8 %	Asphaltènes Insolubles/CCl4	C = 34,9 %
Résines	R = 26,6		
Constituants huileux	CH = 26,1	CH Saturés = 3,3 ; CH Aromatiques = 22,8 ; S/A = 0,15	
Pertes + Résidus:	100 -(A+R+CH) = 10,5		



ANALYSE DES HYDROCARBURES SATURES PAR CPG (Poids de la prise d'essai = 10 mg)

Proportion des n.alcanes dans les Saturés = 10,2 %

Proportion : du Farnesane = 0,30 du Pristane = 0,28 du Phytane = 0,10

Rapports: Pristane/Phytane = 2,7 Pristane/n.C17 = 0,45 Phytane/n.C18 = 0,19

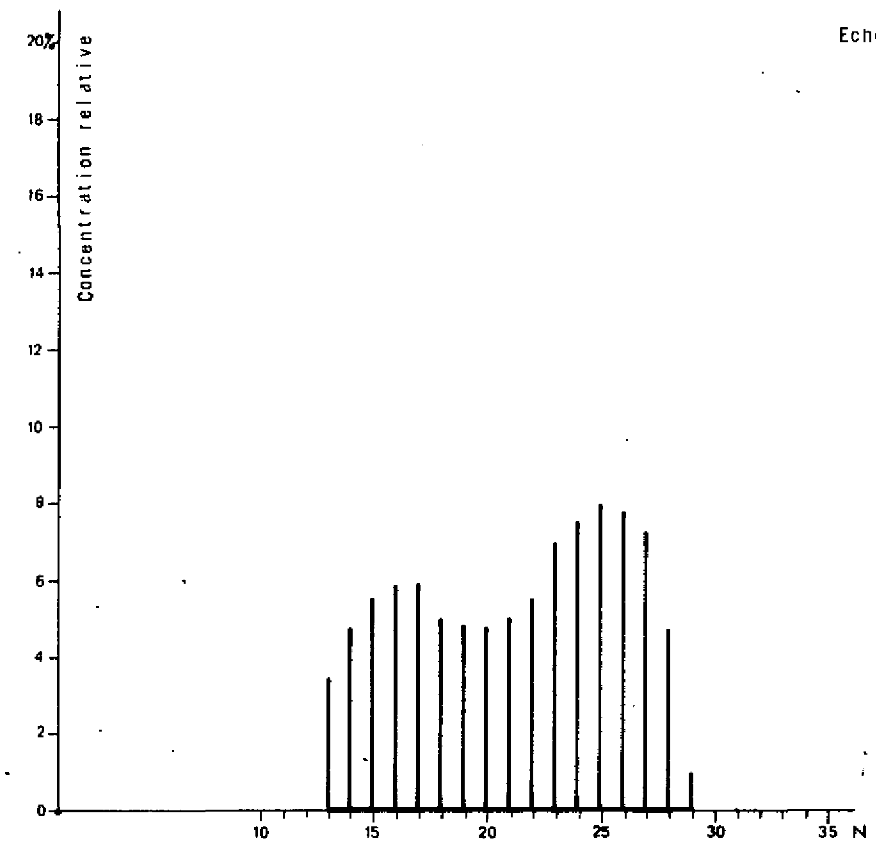
Recherche de dominance paire ou impaire par calcul du Carbon Preference Index (CPI) :

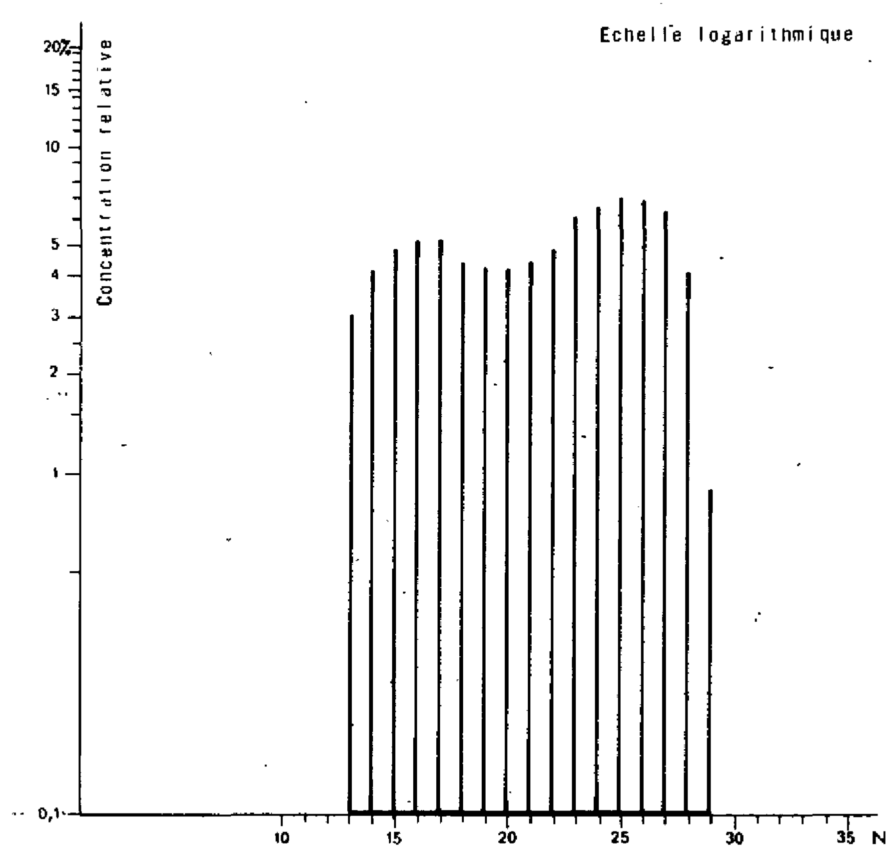
CPI entre la n.alcane 16 et la n.alcane : 28 CPI = 1,001

Distribution relative des n.alcanes :

n.C14	n.C15	n.C16	n.C17	n.C18	n.C19	n.C20	n.C21	n.C22	n.C23	n.C24	n.C25	n.C26	n.C27	n.C28	n.C29	n.C30	n.C31	n.C32	n.C33
4,96 %	5,76 %	6,13 %	6,17 %	5,22 %	5,04 %	5,00 %	5,24 %	5,74 %	7,27 %	7,83 %	8,32 %	8,12 %	7,56 %	4,91 %	1,03 %	%	%	%	%

HISTOGRAMMES DE LA DISTRIBUTION RELATIVE DES n.ALCANES EN FONCTION DU NOMBRE N DE CARBONES





6942

ANALYSE D'XXXXXX D'EXTRAIT CHLOROFORMIQUE DE ROCHE

SONDAGE : HEIMDALL 25/4-1

ECHANTILLON : 3194

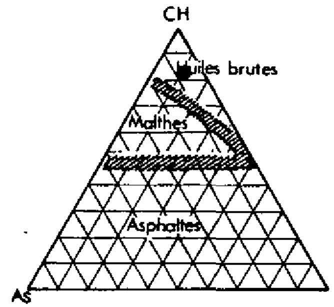
COT = MOE = 3980 ppm P. d'extrait 0,07950 g Age ou Formation :

CONSTITUTION :

Asphaltènes	As =	4,7 %
Résines	R =	10,4
Constituants huileux	CH =	82,8
Pertes + Résidus 100 -(A+R+CH) =		2,1

Asphaltènes Insolubles/CCl4 C = 0,3 %

CH Saturés = 62,5; CH Aromatiques = 20,3 ; S/A = 3,09



ANALYSE DES HYDROCARBURES SATURES PAR CPG (Poids de la prise d'essai = 224 mg)

Proportion des n.alcanes dans les Saturés = 14,1 %

Proportion : du Farnesane = 0,31 % du Pristane = 0,43% du Phytane = 0,17%

Rapports: Pristane/Phytane = 2,5 Pristane/n.C17 = 0,52 Phytane/n.C18 = 0,22

Recherche de dominance paire ou impaire par calcul du Carbon Preference Index (CPI)

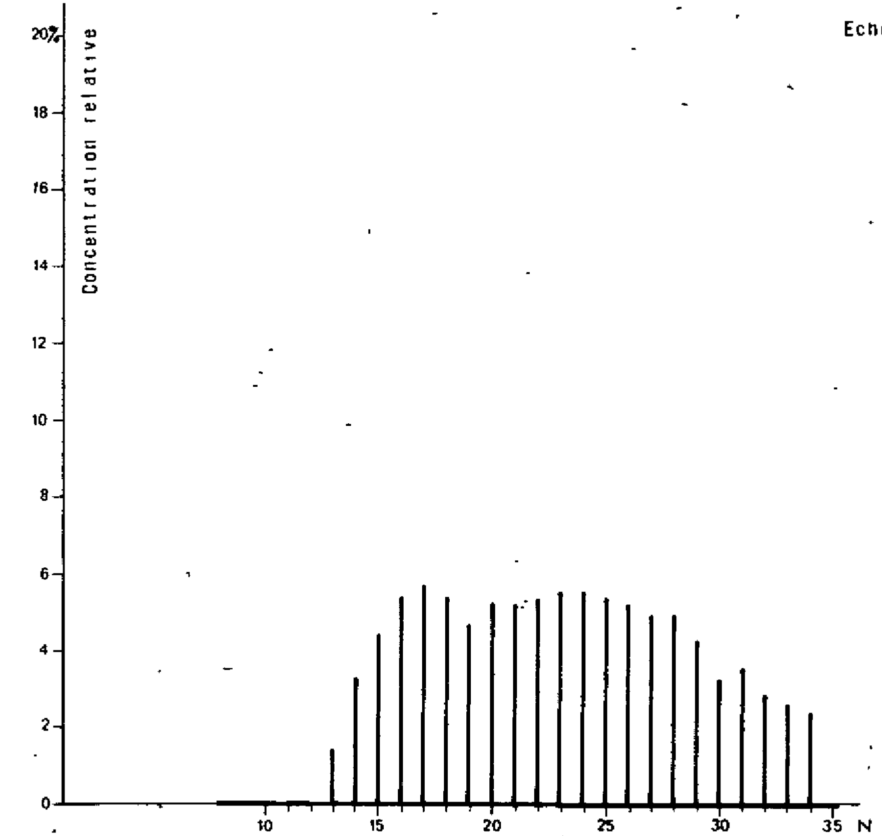
CPI entre la n.alcane C16 et la n.alcane : C32 CPI = 0,993

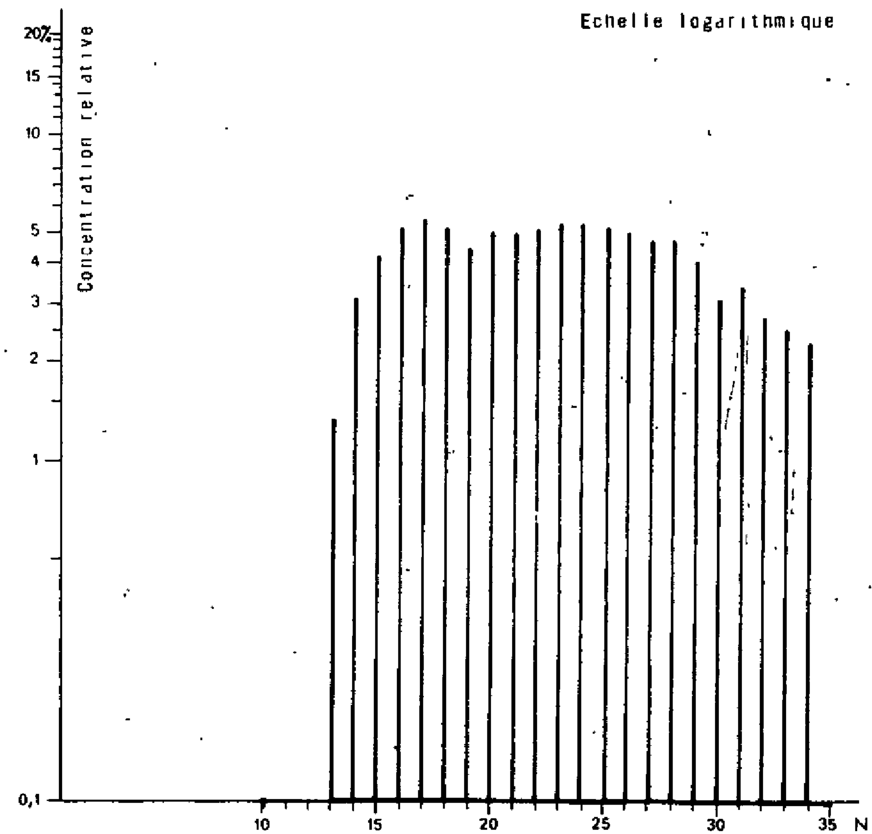
Distribution relative des n.alcanes :

n.C14	n.C15	n.C16	n.C17	n.C18	n.C19	n.C20	n.C21	n.C22	n.C23	n.C24
3,36 %	4,50 %	5,48 %	5,82 %	5,47 %	4,75 %	5,33 %	5,30 %	5,44 %	5,64 %	5,64 %

n.C25	n.C26	n.C27	n.C28	n.C29	n.C30	n.C31	n.C32	n.C33	n.C34
5,50 %	5,32 %	5,03 %	5,04 %	4,38 %	3,35 %	3,66 %	2,95 %	2,72 %	2,48 %

HISTOGRAMMES DE LA DISTRIBUTION RELATIVE DES n.ALCANES EN FONCTION DU NOMBRE N DE CARBONES





6942

25/4-1

According to the palynological examinations, the palynofacies of these samples is composed of higher plant elements and to a lesser extent of amorphous matter.

- Intermediate type :

Between these two main chromatographical types there are some chromatograms which show intermediate characteristics.

The hydrocarbons from the coal beds are also variable but are fairly close as regards the intermediate type or even the one from the type 1, e.g. the 3341.75 coal sample.

In fact, it is very probable, in view of the few common geochemical characteristics, that the whole of the hydrocarbons of the Dogger-Lias are generated by the same kind of organic material and that their minor variations are mainly due to some variations in deposit conditions; these latter are likewise accompanied by varying proportions of organic matters (amorphous matter, higher plant elements).

4.2 - Comparison of migrated and syngenetical hydrocarbons

A few migrated hydrocarbons in reservoirs of the 25/4-1 well were studied:

- two extracts from reservoir core samples in the Dogger-Lias at 3188 and 3194 m

- one crude oil in the Lias, fit n° 9 at 3299 m

- one crude oil in the Paleocene, fit n° 2 at 2176.90 m.

The chromatograms of these migrated hydrocarbons are given on plate 10. They show some undoubted elements of correlation with each other and with the syngenetical hydrocarbons extracted from Dogger-Lias, in particular the heavy n-alkane character and the high predominance of the pristane over phytane.

The valorization analyses carried out at the Boussens LCP have shown that the crude products of this well (fit n° 9 at 3299 m, fit n° 8 at 3290 m, DST n° 3 at 3179-3184 m, fit n° 2 at 2176.90 m)* "contain relatively abundant heavy n-alkanes and, particularly the hydrocarbons of fit n° 8 and n° 9, have an exceptional aromatic character in the range of vapors (Benzene, Toluene, Xylene"; these two characteristics may be linked to the ones of the Dogger-Lias source-rock.

This suggests that the main origin of the crude products in the Dogger-Lias and Paleocene reservoirs of this well is the Dogger-Lias source-rock intervals.

---

* A. BOURGEOIS

October 1972 n° 03.E.10. - 2/2.539 fit n° 2

February 1973 n° 2051 - 3/2.43 fit n° 8 and n° 9

May 1973 n° 2051 - 3/2.217 DST n° 3

5 - CONCLUSIONS

See plate 9

- There are two good source-rock intervals which have somewhat different geochemical characteristics :

  - the Upper Kimmeridgian shale interval between 3160 and 3180 m

  - the Dogger-Lias interval between 3180 and 3360 m corresponding to the shales at the base of the accretion sequences, approx 60 m, and to the coal beds at the top of the margino-littoral sequences, approx 3 m.

- The geochemical characteristics of all the migrated hydrocarbons of 25/4-1 studied, in the Paleocene and Dogger-Lias reservoirs, show that the main origin of these products is from the Dogger-Lias source-rock interval, in line with the greater thickness of this interval.

Secteur	MER DU NORD
Opérateur	elf NORGE
Permis ou Concession	Zone norvégienne 2ème attribution

elf NORGE A/S

HEIMDALL 25/4-1

ORGANIC MATTER CONTENTS ANALYTICAL RESULTS

elf ENTREPRISE DE RECHERCHES ET D'ACTIVITES PETROLIERES
DIRECTION EXPLORATION
LABORATOIRE

PL. 1

Date Juillet 1973
Auteur J. DU ROUCHET
N° class. 6941