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ENTREPRISE DE RECHERCHES ET D'ACTIVITES PETROLIERES

elf

BRISLING 17/12-2 WELL (NORGE)

GEOCHEMICAL STUDY

X

reg

DIRECTION EXPLORATION

LABORATOIRES

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BRISLING 17/12-2 WELL (NORGE)

GEOCHEMICAL STUDY

X

reg.

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14 DES 1978
REGISTRERT
OLJE DIREKTORATET

2035 n° 4/968 R
/mn

B. PHILIPPE
July 1974

REFERENCE : COMMANDE n° 031011

Cette étude a été réalisée au Centre de Recherche ELF-R. E.
à BOUSSENS par le Dpt. G. C. - Laboratoire.

Les documents énoncés ci-dessous et concernant la même
commande vous ont déjà été envoyés.:

J. DUCAZEAUX - P. DURIEFF : Rapport n° 4/963 R : Well Brisling 17/12-2, Biostrati-
graphical report on Jurassic and Permian (6 440 to 7 630').

I - GENERAL REMARKS

. Analyses are carried out on small volumes of cuttings between 5 600' and 7 650'. The organic inventory and the characterization of organic matter are consequently partial.

. Characterization of crude oil from the D.S.T. 2 test and comparison with crude oil from 17/12-1.

ANALYSES :

- On washed (with water and teepol) and sorted cuttings

. 15 measurements of total organic carbon (T.O.C.) contents ;

. 4 "minianalyses" - G.P. Chromatography on saturated fraction of extract by Hexane from rock, separated on a minicolumn with alumina. Quantity of rock necessary is lower than ; g. ;

. 2 "minianalyses" on the very fine particles which are representative of the mud : "Contamination-test" ;

. 2 analyses of vapors.

- On crude oil from D. S. T. 2 test :

. "Composition" of chloroformic extract ;

. G. P. Chromatographies of saturated and aromatic oil fractions, obtained by "Composition" ;

. Vapor analysis.

PRESENTATION OF RESULTS :

- Plates (Loose-leaf) :

. Plate 1 : one log of T. O. C.

. Plate 2 : Photographic reductions of the oil characterization chromatograms.

- Appendix :

. "A" : Histogram (D.S.T. 2 - oil)

. "B" : Analytical cards of oil and rock extracts.

. "C" : Comments on the cutting-extract chromatograms. The reductions of these chromatograms are attached.

II - R E S U L T S

2-1 - ORGANIC INVENTORY

(see plate 1)

The "graph" of T. O. C. measurements shows contents between 1 and 1.5 % for almost the whole of the zone studied. The contents are about 2.5 to 3.5 %, between 6 700' and 7 200'.

These values are slightly in excess for the cuttings are contaminated by gas-oil, even after being washed (see appendix "C")

The E.O.M. measurements could not be carried out (insufficient quantity).

2-2 - PALYNOFACIES EXAMINATION OF THE RADIOACTIVE SHALES BETWEEN 6 950' and 7 050' - J. F. RAYNAUD.

The palynofacies is of a chiefly sapropelic type, "clean" (little ligneous waste). It seems identical to the palynofacies of the sapropelic source-rocks recognized in the norwegian zone. The thermal alteration index (T. A. I.) is very low.

2-3 - CHARACTERIZATION OF CRUDE OIL FROM THE D.S.T. 2 TEST.

(see plate 2)

The Saturated Aromatic ratio (S/A) is low (S/A = 1.8) : crude oil slightly migrated.

The chromatogram of the saturated oil fraction shows some well-developed normal-paraffins which are, however, irregularly distributed. There is not a regular decrease in n-alkane contents as the molecular mass increases. The peaks of isoprenoids are still well-developed : Pristane and Phytane are more developed than nC. 17 and nC. 18. The chromatogram of vapors (lighter fraction) also still shows a fairly extensive development of the peaks between the n-alkane peaks.

It is therefore a crude oil of rather low maturation. This oil is less mature than that of Bream 17/12-1 :

. S/A ratio (1.8.) lower than those of Bream (2.94 and 2.86) ;

. The Pristane and Phytane peaks are more developed than their "accompanying peaks" - nC. 17 and nC. 18.

This ratio is reversed for the oil from Bream.

III - C O N C L U S I O N S

- The kerogen from the radioactive shales - 6 950' to 7 050' - , with medium T.O.C., seems favorable - in view of the palynofacies - to oil generation, but the diagenesis - in view of the low T.A.I. - is not very advanced : probable source-rock with good petroleum potential but of low maturity (beginning of main phase of oil generation) ;

- The oil from the test is little evolved. It is less mature than in Bream (17/12-1x) ;

- The low diagenetical evolution of the organic matter and the oil is linked with the low burial depth \approx 7 000' - and a mean local paleo-geothermal gradient (deduced by Reflectance) : shelf conditions.

A N N E X E S "A"

HISTOGRAMME GENERAL DES N-ALCANES

(SORTIES DU PROGRAMME HYDROTAL)

Le programme HYDROTAL traite les résultats de 4 analyses chromatographiques : gaz désorbés "courts", gaz désorbés "longs", gaz thermovaporisés, huile saturée de l'extrait chloroformique. On trouvera :

Colonne 1 : nomenclature des alcanes

Colonne 2 : (figuré.) résultats de l'analyse des gaz désorbés : C1 à C5

Colonne 3 : (figuré+) résultats de l'analyse des gaz désorbés : C5 à C10

Colonne 4 : (figuré*) résultats de l'analyse par THER. EVAPORISATION : C5 à C15/C17

Colonne 5 : (figuré x) résultats de l'analyse de la fraction "Huile Saturée" : C15 à C35

Tous les résultats sont exprimés en parties par million (ppm) en masse de l'échantillon de roche .
en % masse pour les échantillons d'huiles

La courbe figurée dans la partie droite de la planche est le report des teneurs en alcanes normaux obtenues par chaque technique, l'échelle des concentrations étant de forme logarithmique.

L'indication marginale supérieure reproduit enfin la somme des teneurs en iso et n-alcane les plus légers jusqu'à C14

	①	②	③	④	⑤					
		•	+	*	x	0.01	0.10	1.00	10.00	99.99
C1										
C2										
C3										
i.C4										
n.C4										
										S C1 à C14 =

ANNEXE "B"

ANALYSE D'HUILE ~~OU D'EXTRAIT CHLOROFORMIQUE DE ROCHE~~ (sur 0,1587g)

SONDAGE : BRISLING 17/12-2
Age ou Formation Huile D S T 2

ECHANTILLON Huile D S T 2 prise au séparateur Non distillée Non désulfurée

COT MOE totale
MOE désulfurée

CONSTITUTION

Asphaltènes	As	3,5%	Asphaltènes Insolubles 'CC14	C	2,7%
Resines	R	17,5	CH Saturés	39,6%	CH Aromatiques 21,6% S/A 1,8
Constituants huileux	CH	61,2			
Pertes + Residus	100 - (A+R+CH) = 17,8				

ANALYSE DES HYDROCARBURES SATURÉS PAR CPG (Poids de la prise d'essai = 57,2mg)

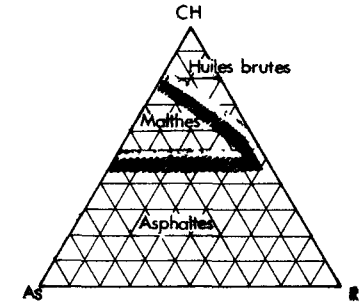
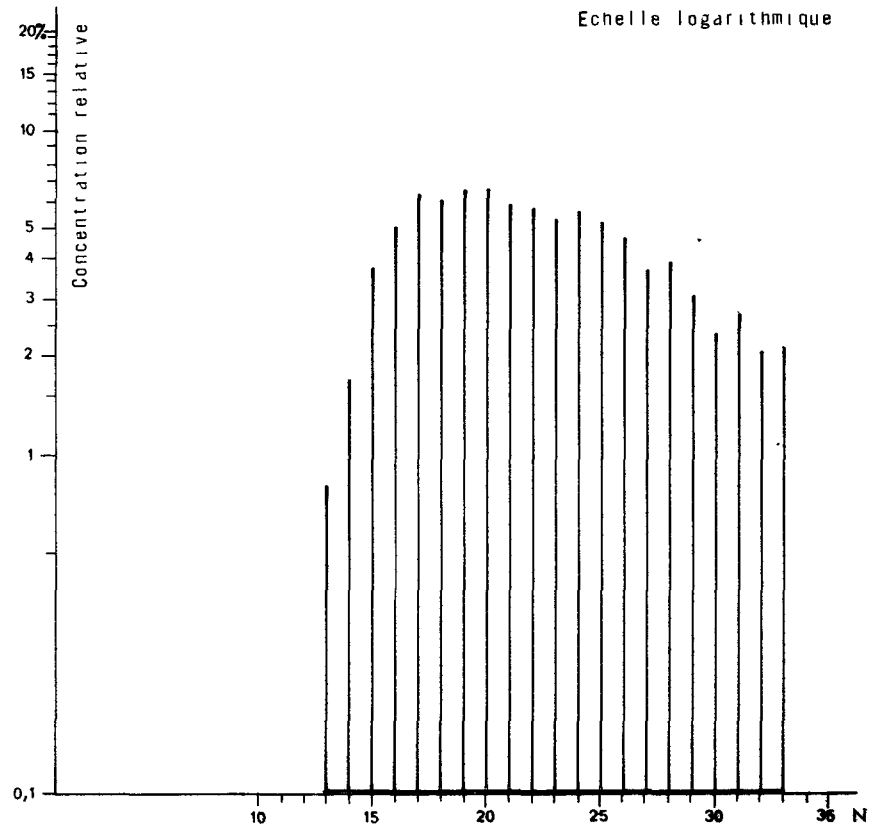
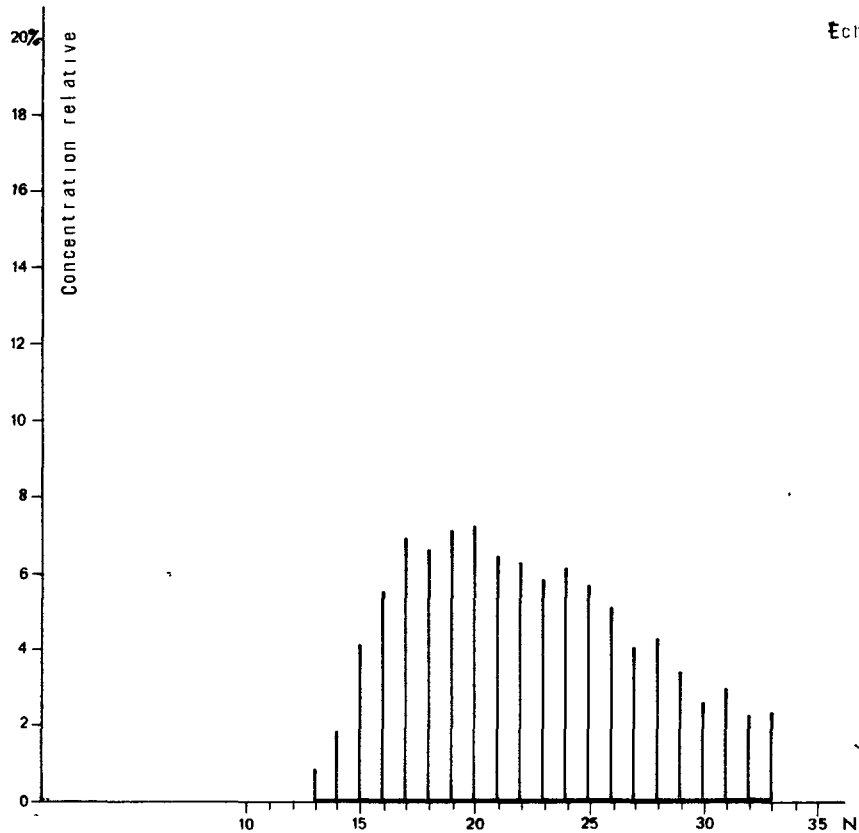
Proportion des n.alcanes dans les Saturés	16,89%					
Proportion du Farnésane	0,73%	du Pristane	1,51	du Phytane	1,48	
Rapports	Pristane/Phytane	1,02	Pristane/n.C17	1,26	Phytane/n.C18	1,28

Recherche de dominance paire ou impaire par calcul du Carbon Preference Index (CPI)
CPI entre la n.alcane C17 et la n.alcane C29 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	n.C25	n.C26	n.C27	n.C28	n.C29	n.C30	n.C31	n.C32	n.C33
1,89%	4,21%	5,66%	7,11%	6,83%	7,29%	7,41%	6,60%	6,44%	5,98%	6,29%	5,82%	5,21%	4,15%	4,39%	3,47%	2,63%	3,03%	2,31%	2,39%

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



ANALYSE ~~D'HUILE OU~~ D'EXTRAIT CHLOROFORMIQUE DE ROCHE (sur mg)

SONDAGE : 17/12-2 6580²-6600'

ECHANTILLON

COT = MOE totale

Age ou Formation

CONSTITUTION

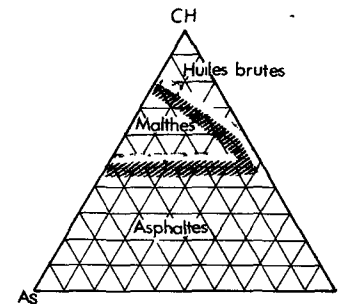
Asphaltènes As = Asphaltènes Insolubles/CCl4 C =
 Résines R =
 Constituants huileux CH = CH Saturés - , CH Aromatiques = , S/A =
 Pertes + Résidus 100 - (A+R+CH) =

ANALYSE DES HYDROCARBURES SATURÉS PAR CPG (Poids de la prise d'essai)

Proportion des n.alcane dans les Saturés =
 Proportion du Farnésane = du Pristane = du Phytane =
 Rapports Pristane/Phytane = 1,42 Pristane/n.C17 = 0,45 Phytane/n.C18 = 0,41

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

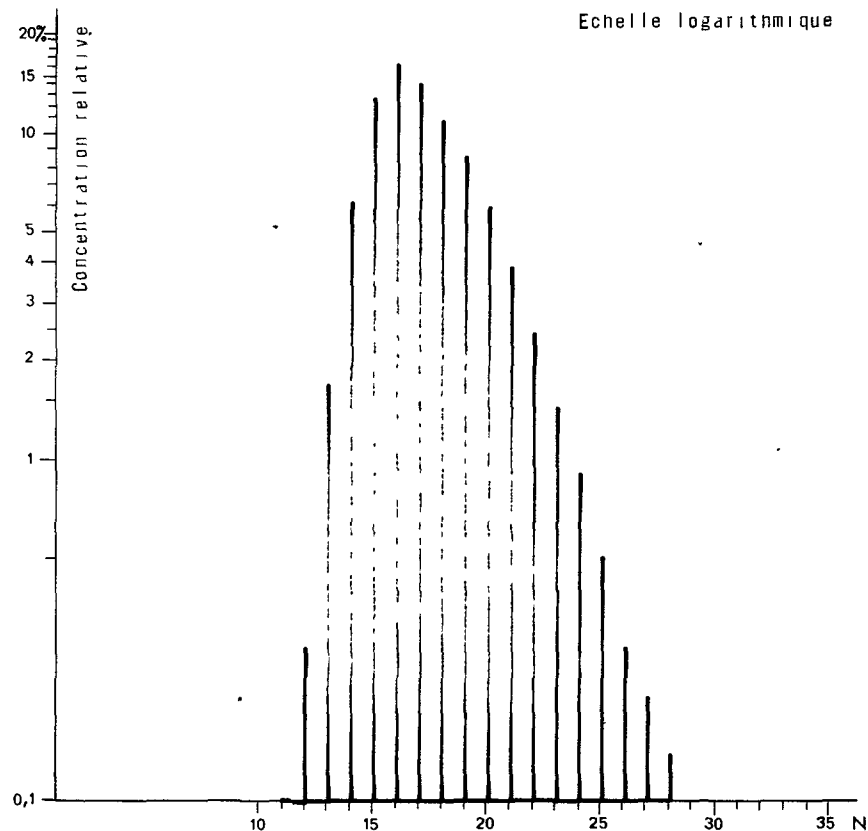
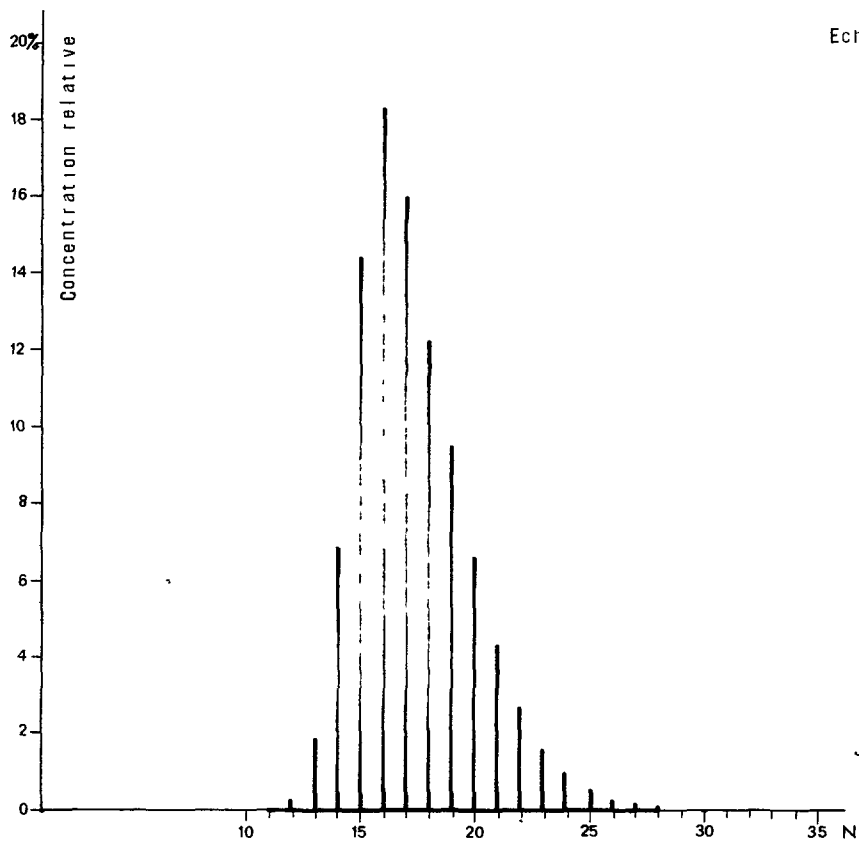
CPI entre la n.alcane et la n.alcane CPI =



Distribution relative des n.alcane

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
7,10%	14,86%	18,85%	16,47%	12,63%	9,78%	6,84%	4,47%	2,79%	1,66%	1,03%	0,57%	0,30%	0,21%	0,14%					

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



ANALYSE ~~D'HUILE CRU~~ D'EXTRAIT CHLOROFORMIQUE DE ROCHE (sur mg)

SONDAGE : 17/12-2 6980'-7000'

ECHANTILLON

COT = MOE totale
MOE desulfuree

Age ou Formation

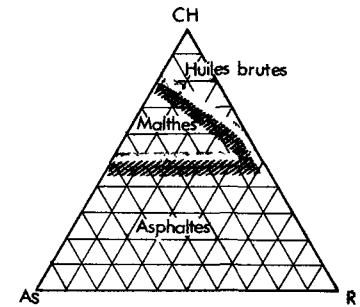
CONSTITUTION

Asphaltènes	As =	Asphaltènes Insolubles/CCl4	C =	
Resines	R =			
Constituants huileux	CH =	CH Saturés =	CH Aromatiques =	S/A =
Pertes + Residus	100 -(A+R+CH) =			

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

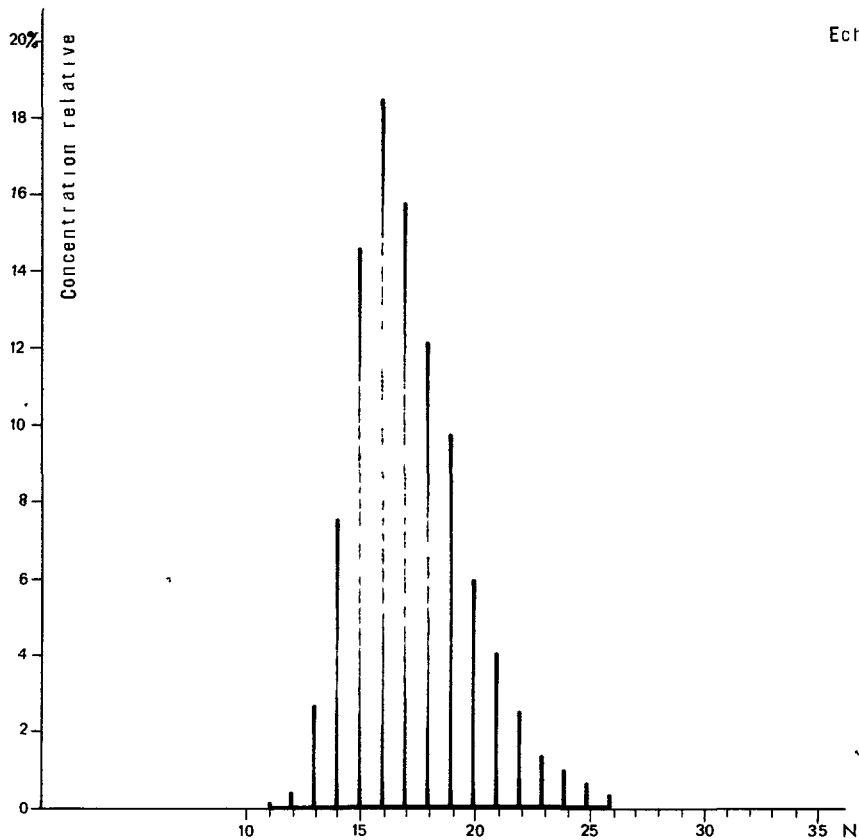
Proportion des n.alcane dans les Satures =
 Proportion du Farnesane = du Pristane = du Phytane =
 Rapports Pristane/Phytane = 1,38 Pristane/n.C17 = 0,46 Phytane/n.C18 = 0,43

Recherche de dominance paire ou impaire par calcul du Carbon Preference Index (CPI)
 CPI entre la n.alcane et la n.alcane CPI =

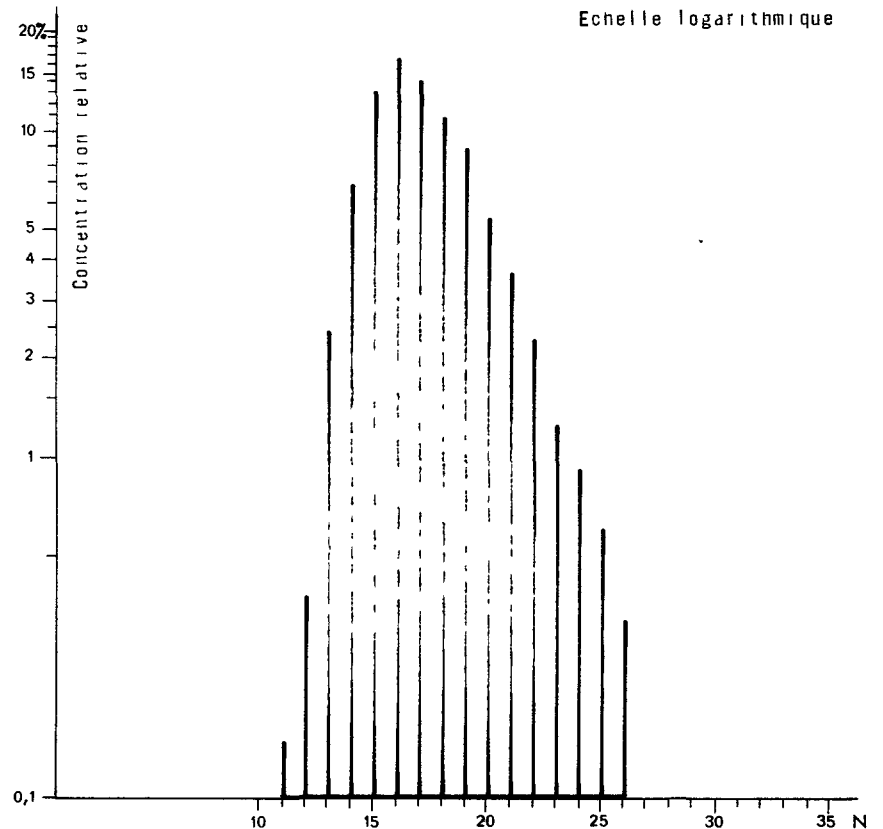


Distribution relative des n.alcane																				
n.C14	n.C15	n.C16	n.C17	n.C18	n.C19	n.C20	n.C21	n.C22	n.C23	n.C24	n.C25	n.C26	n.C27	n.C28	n.C29	n.C30	n.C31	n.C32	n.C33	
9,44%	16,23%	18,25%	14,24%	11,04%	8,87%	6,12%	4,18%	2,79%	1,65%	1,38%	0,57%	0,54%	0,45%	%	%	%	%	%	%	%

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



Echelle arithmetique



Echelle logarithmique

ANALYSE ~~D'HUILE CH~~ D'EXTRAIT CHLOROFORMIQUE DE ROCHE (sur mg)

SONDAGE : 17/12-2 6980'-7000' ("MUD")

ECHANTILLON

CONSTITUTION

Asphaltenes As
 Resines R -
 Constituants huileux CH -
 Pertes + Residus 100 -(A+R+CH) -

Asphaltenes insolubles/CCl4 C
 CH Saturés CH Aromatiques

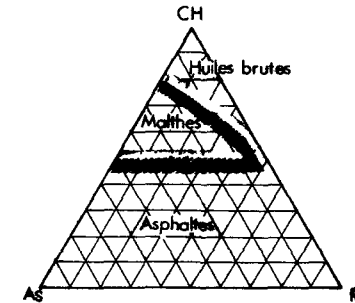
S/A

Age ou Formation

ANALYSE DES HYDROCARBURES SATURES PAR CPG (Poids de la prise d'essai -)

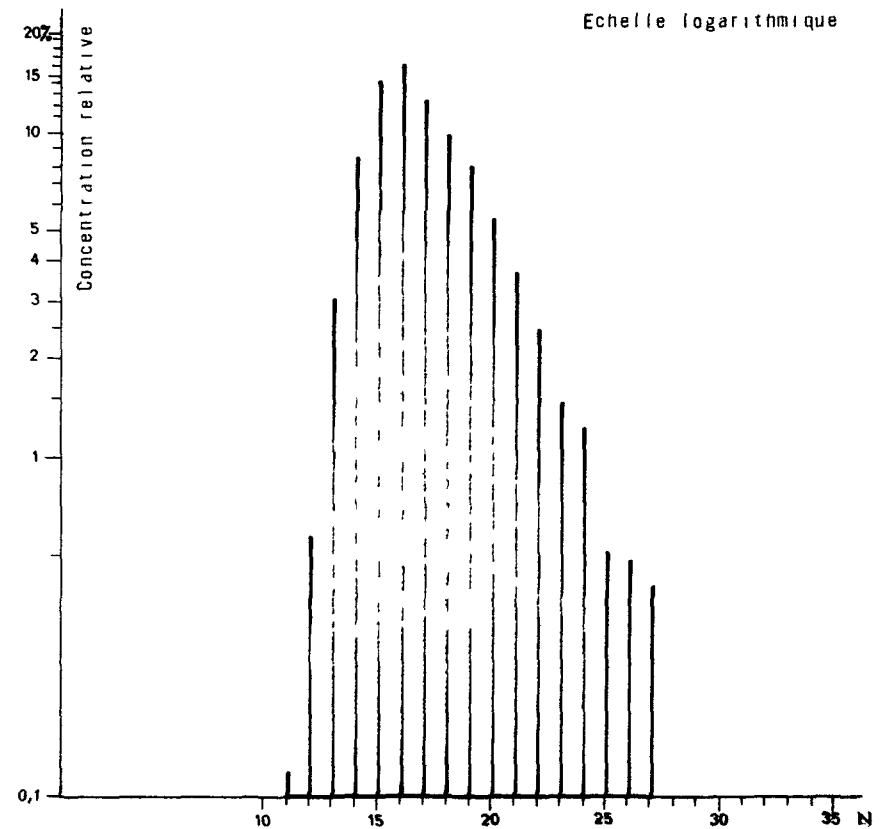
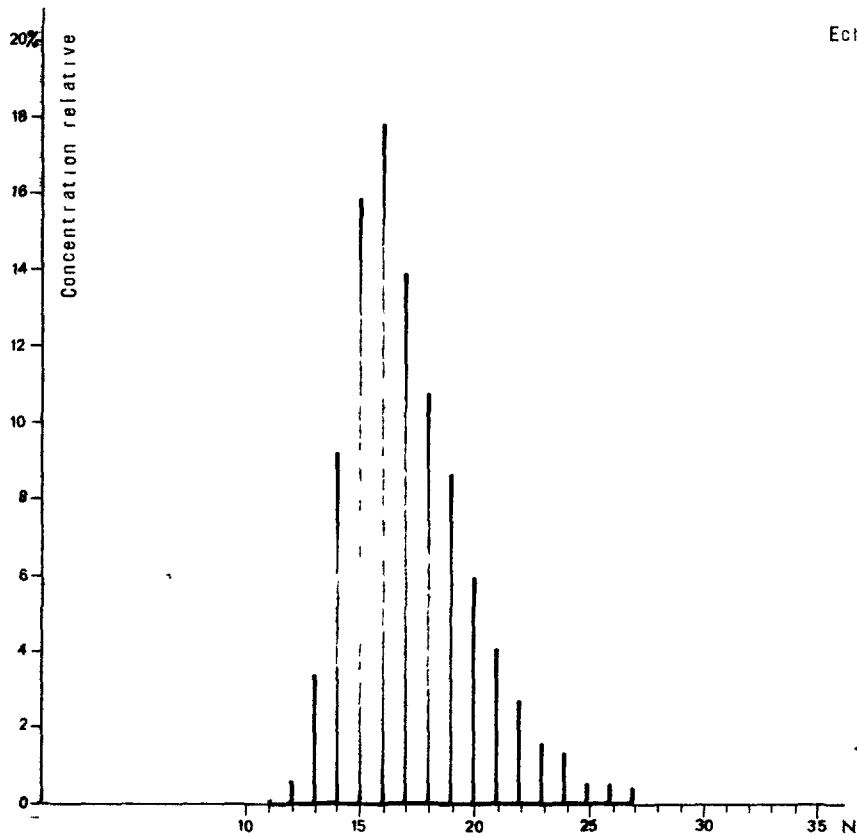
Proportion des n. alcanes dans les Saturés -
 Proportion du Farnesane = du Pristane = du Phytane
 Rapports Pristane/Phytane - 1,38 Pristane/n.C17 0,40 Phytane/n.C18 0,38

Recherche de dominance paire ou impaire par calcul du Carbon Preference Index (CPI)
 CPI entre la n.alcane et la n.alcane CPI



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
7,75%	14,99%	18,99%	16,21%	12,48%	10,00%	6,12%	4,14%	2,57%	1,40%	1,02%	0,67%	0,35%							

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



ANALYSE ~~DE LA~~ D'EXTRAIT CHLOROFORMIQUE DE ROCHE (sur mg)

SONDAGE : 17/12-2 7140'

ECHANTILLON

COT

MOE totale

Age ou Formation

CONSTITUTION

Asphaltenes	As	Asphaltenes insolubles/CCl4	C
Resines	R =		
Constituants huileux	CH =	CH Saturés	CH Aromatiques
Pertes + Residus	100 -(A+R+CH) =		S/A -

ANALYSE DES HYDROCARBURES SATURÉS PAR CPG (Poids de la prise d'essai =)

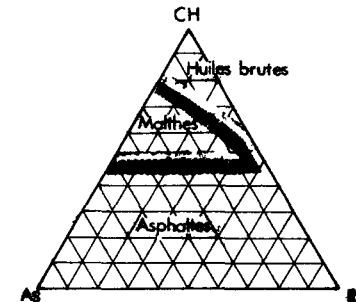
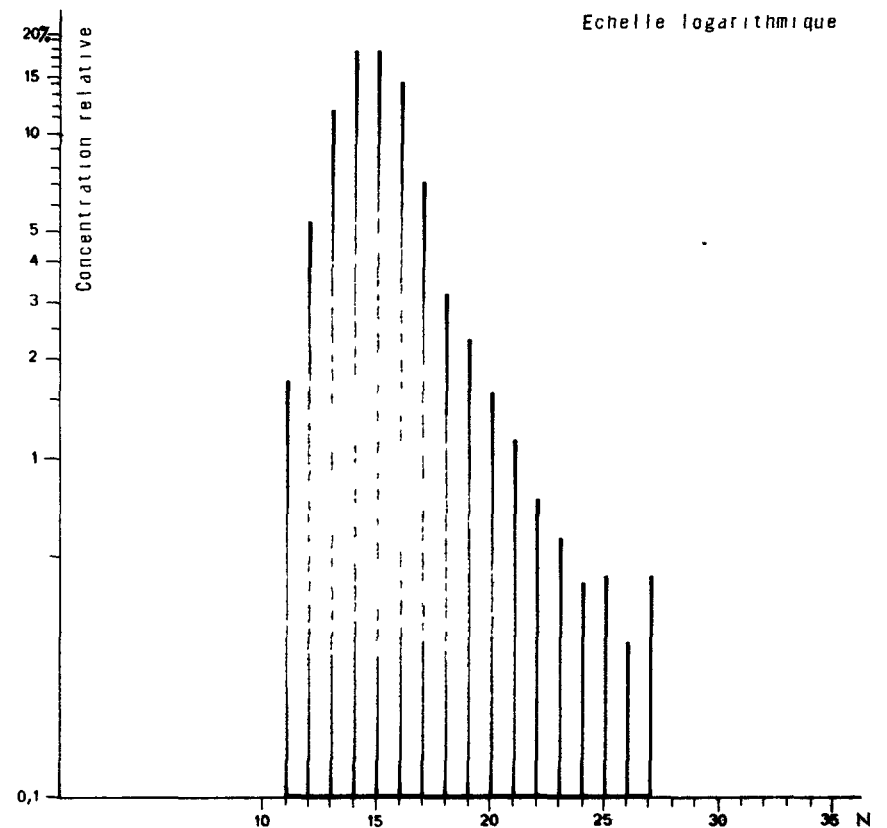
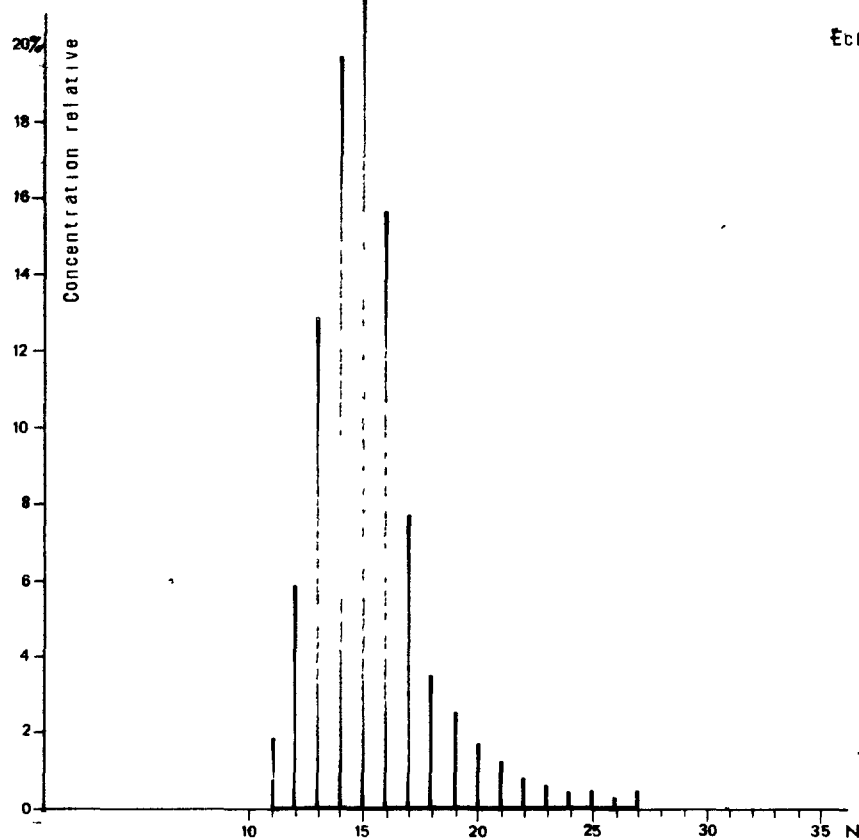
Proportion des n.alcane dans les Saturés -
 Proportion du Farnesane = du Pristane = du Phytane =
 Rapports Pristane/Phytane = 2,04 Pristane/n.C17 = 0,39 Phytane/n.C18 = 0,42

Recherche de dominance paire ou impaire par calcul du Carbon Preference Index (CPI)
 CPI entre la n.alcane et la n.alcane CPI =

Distribution relative des n.alcane

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	
20,17%	22,52%	16,02%	7,87%	3,56%	2,58%	1,16%	1,26%	0,83%	0,63%	0,46%	0,48%	0,30%	0,48%	%	%	%	%	%	%	%

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



ANALYSE ~~D'HUILE CRU~~ D'EXTRAIT CHLOROFORMIQUE DE ROCHE (sur mg)

SONDAGE : 17/12-2 7390'

ECHANTILLON

COT MOE totale
MOE desulfuree

Age ou Formation

CONSTITUTION

Asphaltènes	As	Asphaltènes Insolubles CCl4	C
Resines	R =		
Constituants huileux	CH =	CH Saturés	CH Aromatiques
Pertes + Residus	100 - (A+R+CH) =		S/A

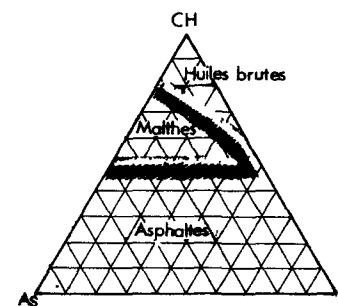
ANALYSE DES HYDROCARBURES SATURES PAR CPG (Poids de la prise d'essai =)

Proportion des n.alcanes dans les Saturés =
 Proportion du Farnesane = du Pristane = du Phytane =
 Rapports Pristane/Phytane = 1,75 Pristane/n.C17 = 0,37 Phytane/n.C18 = 0,33

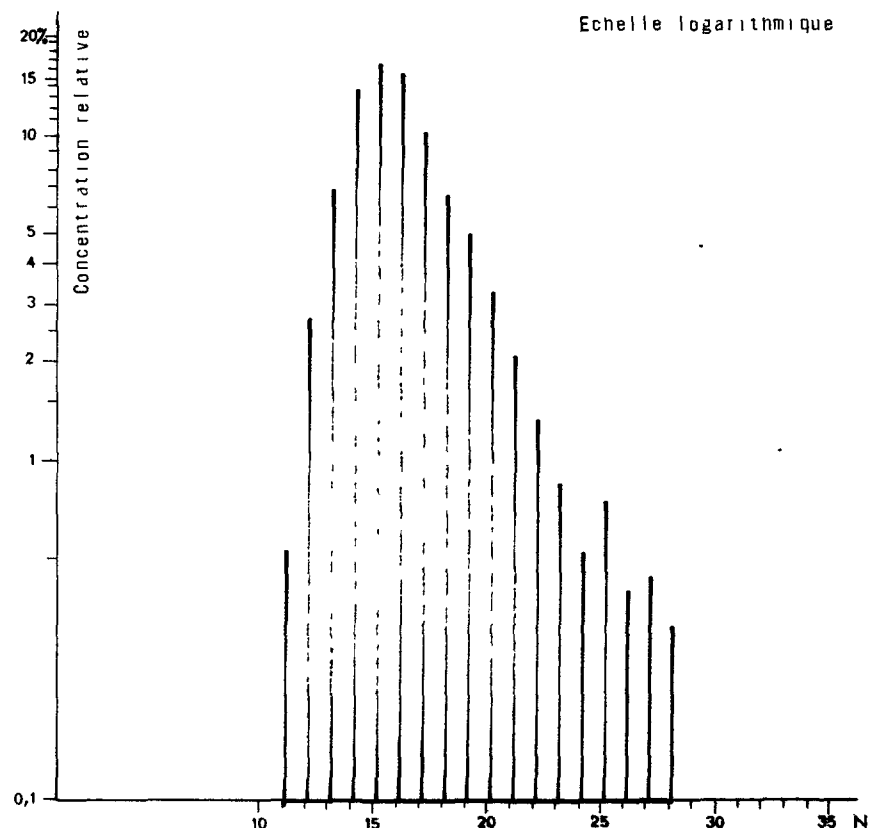
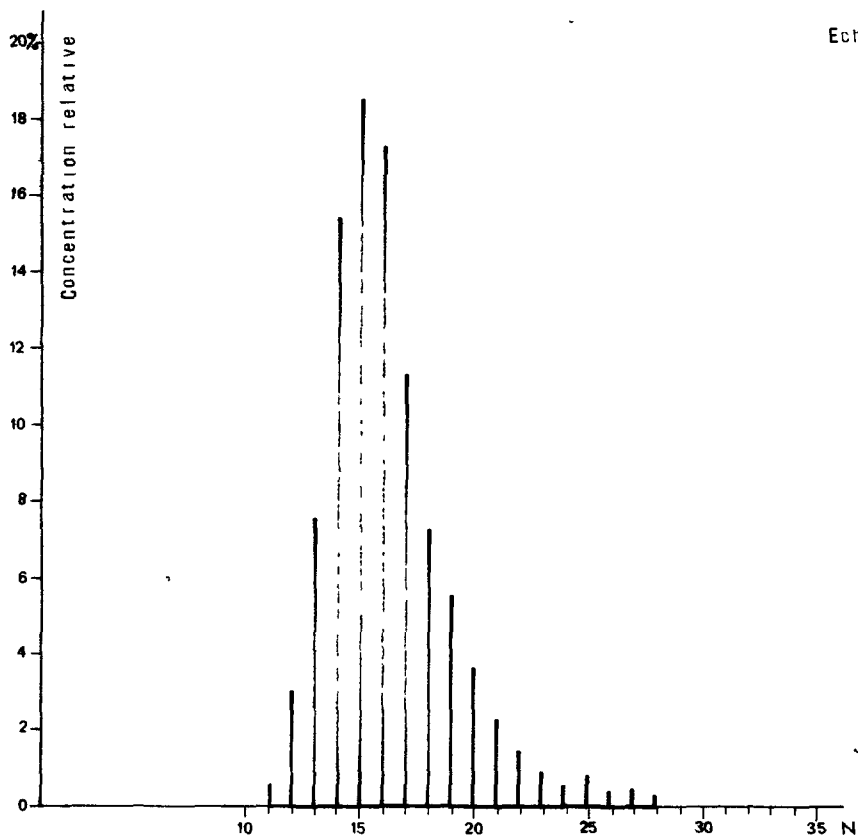
Recherche de dominance paire ou impaire par calcul du Carbon Preference Index (CPI)
 CPI entre la n.alcane et la n.alcane CPI =

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
15,19%	18,97%	17,69%	11,60%	7,46%	5,70%	3,75%	2,39%	1,51%	0,96%	0,59%	0,85%	0,45%	0,50%	0,35%	%	%	%	%	%



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



A P P E N D I X "C"

CONTAMINATION

Depending on its lithological nature a sample is -to a greater or lesser extent- "receptive" to gas-oil contained in mud. Another very important factor is the preservation of the sample. It must be preserved wet : this prevents a major loss of light molecules and slows down penetration by gas-oil.

When gas-oil is superficial it can be eliminated fairly well by surface washing with water and teepol.

In the case of the samples studied the pollution could not be eliminated. The analyses show the probable occurrence of two different contaminants :

- Normal gas-oil :

Vapor analysis - 6 320' - and "minianalyses" on rock-extracts - 6 580' to 6 600' ; 6 980' to 7 000' - and the very fine particles show a distribution of normal-paraffins typical of gas-oil.

- "Lighter contaminant" ?

The "minianalyses" - 7 140' and 7 390' - shows different chromatographical spectrum.

The spectrum of n-paraffins extends towards lighter molecules. This lighter nature is corroborated by vapor analysis of 7 140' sample.

Two hypotheses are possible :

- Epigenetic gas with condensate :

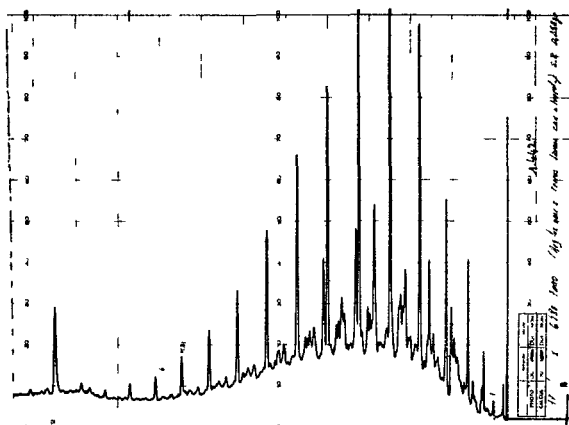
Comparison with the gas and condensate from C.O.D. 1 shows some disparities regarding isoprenoid/n-alkane ratios. The distribution of n-paraffins shows a very sharp exponential fall : $nC_{16}/nC_{21} = 6.5$; For gas with condensate from C. O. D. 1 $nC_{16}/nC_{21} = 2$.

- "Light Contaminant" :

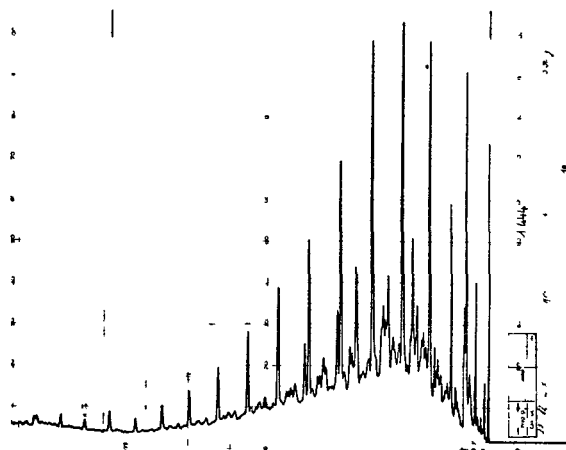
This is the hypothesis that we shall adopt in view of the very sharp differences from the C.O.D. 1 gas with condensate and of the exponential decrease comparable with that of an industrial distillation product.

17 / 12-2

"MINIANALYSES"



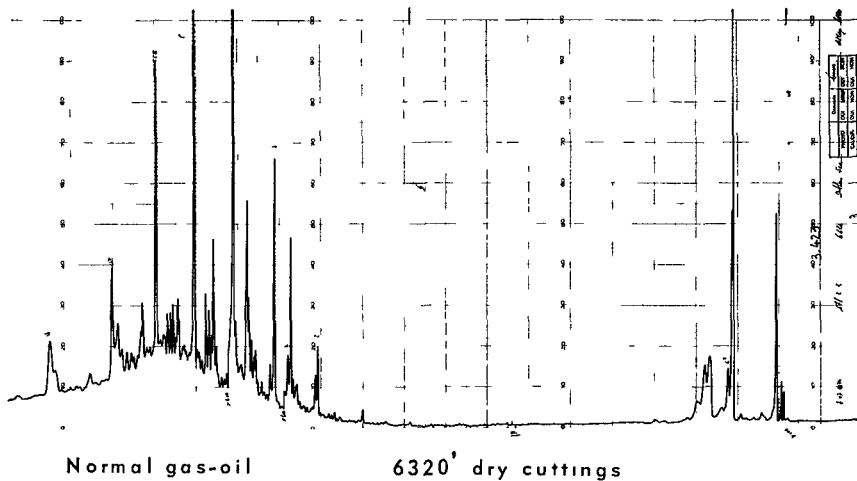
Normal gas-oil
6980'-7000'
black shales
Washed and sorted



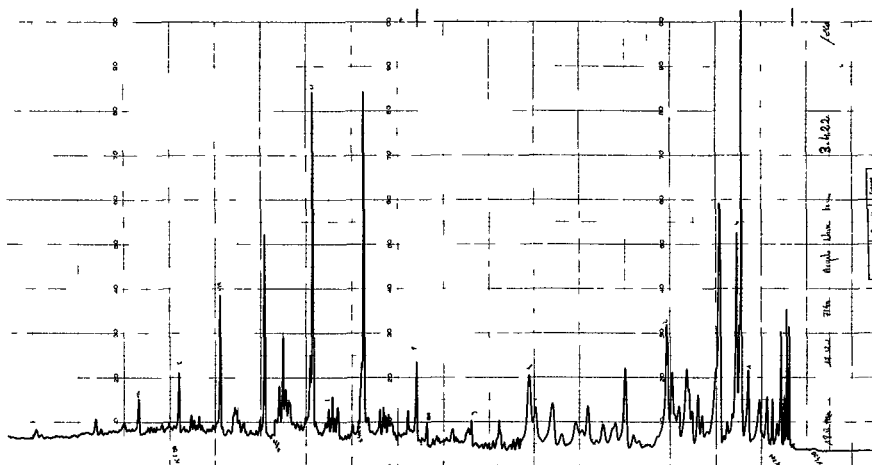
"Light contaminant"
7390'
Grey-black shales
Washed and sorted

17 / 12 - 2

VAPOR ANALYSES



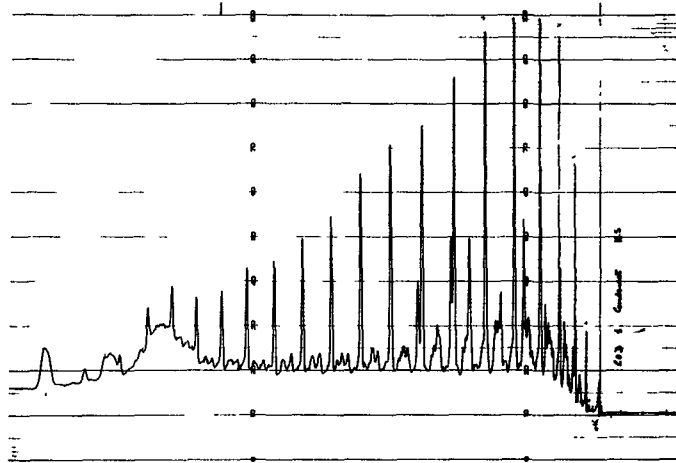
Normal gas-oil 6320' dry cuttings



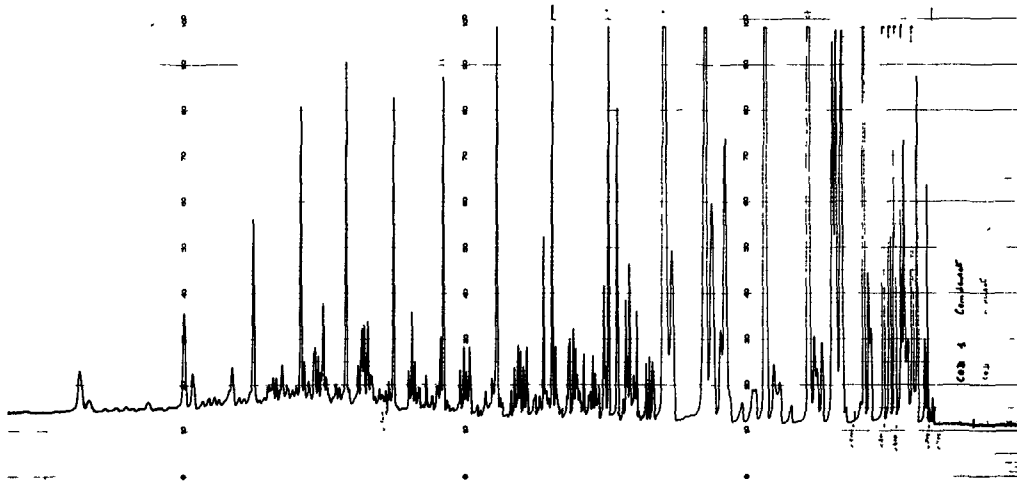
"Light contaminant" 7140' black shales - sorted

C O D. 1

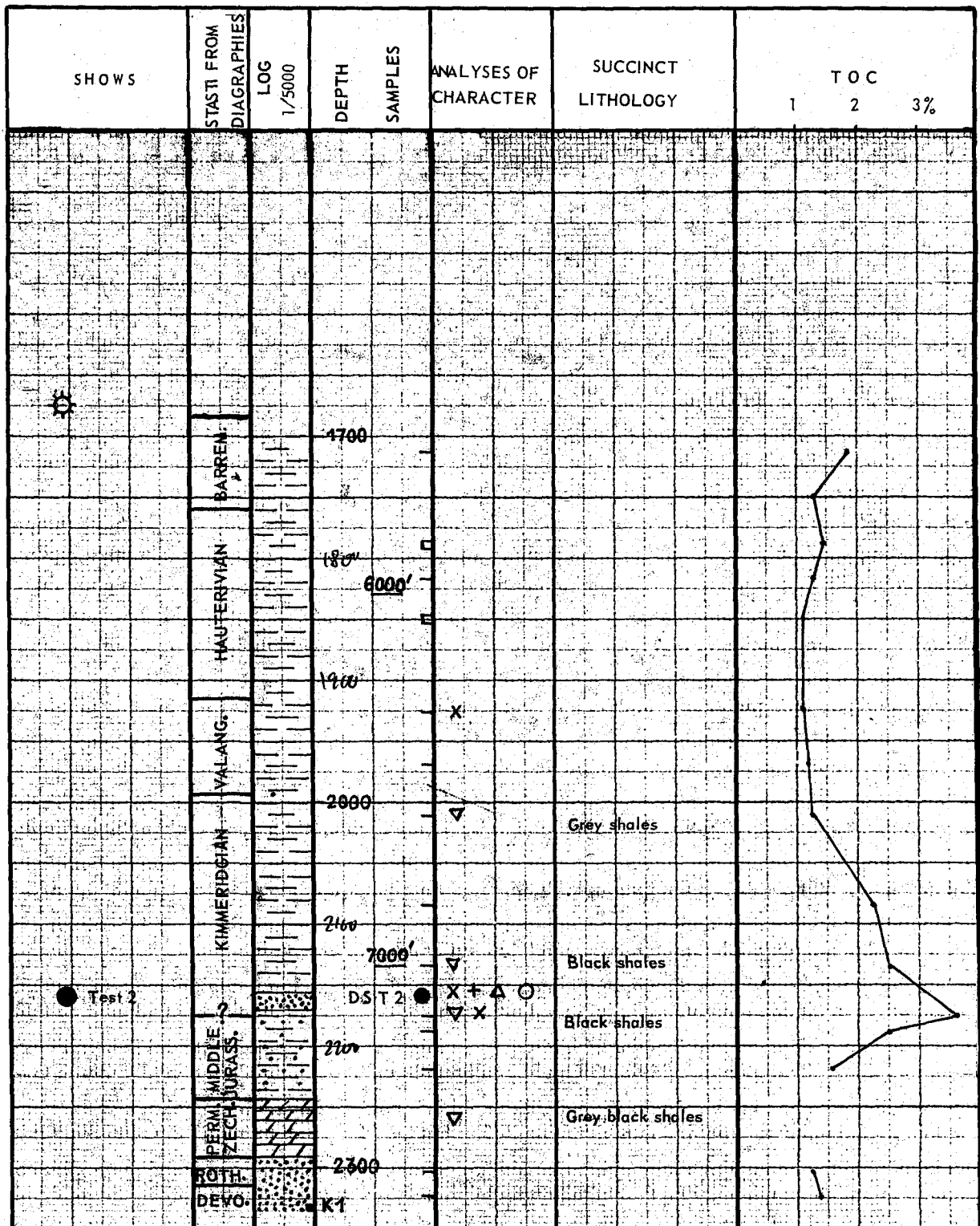
GAS WITH CONDENSATE



Chromatogram of saturated oil fraction



Chromatogram of vapors



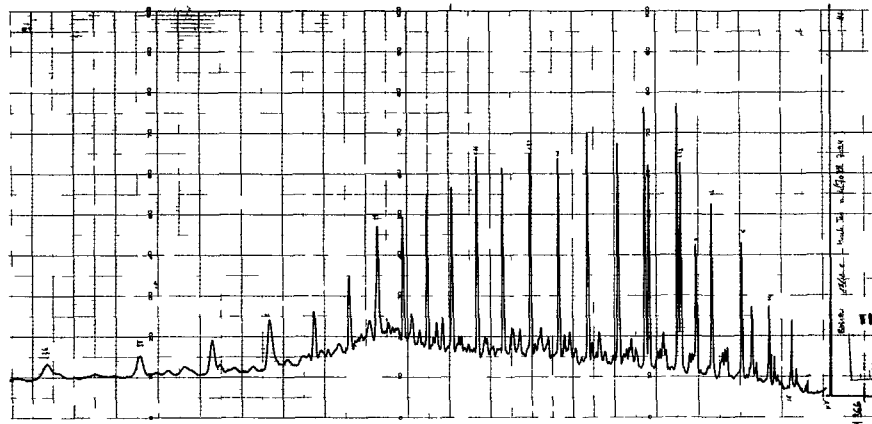
ANALYSES OF HYDROCARBONS CHARACTERIZATION

- + "Composition" of extract by chloroform
- X Vapor analysis
- △ Analysis of saturated oil fraction
- ▽ Minianalysis
- Analysis of aromatic oil fraction

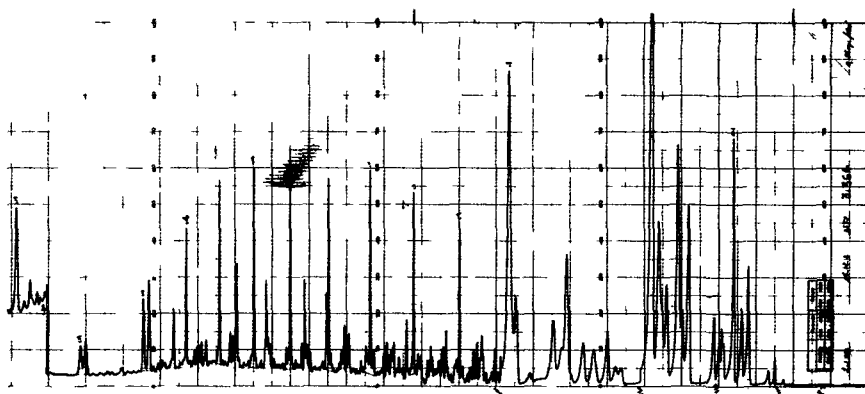
	Secteur MER DU NORD	
	Opérateur	
	Permis ou Concession Zone Norvegienne	
BRISLING 17/12-2 WELL RESULTS OF TOC		
Echelle : 1/5000		
OIF ENTREPRISE DE RECHERCHES ET D'ACTIVITES PETROLIERES DIRECTION EXPLORATION LABORATOIRE	PL. 1	Date Juillet 74 B. PHILIPPE N°classé 7557

BRISLING 17/12-2 WELL

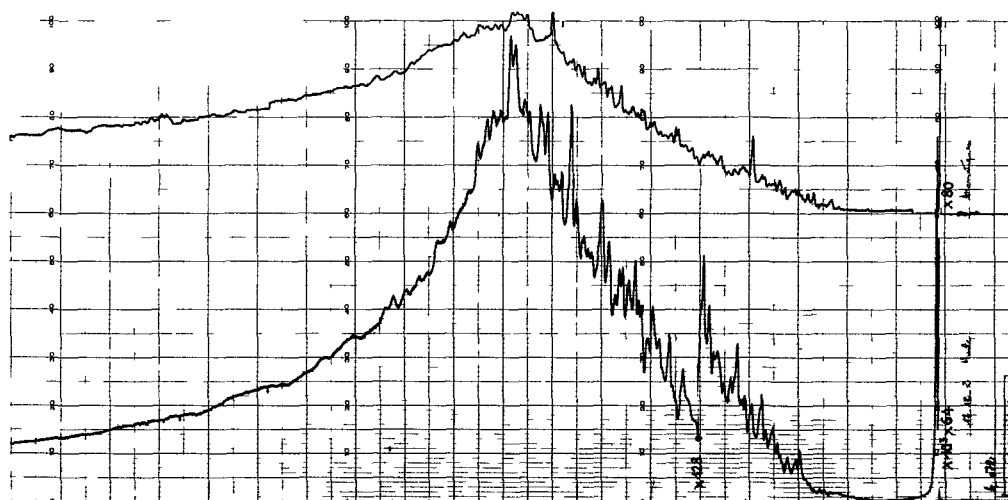
CRUDE OIL OF THE D S T 2



Chromatogram of saturated oil fraction



Chromatogram of vapors



Chromatogram of aromatic oil fraction