7/12-2 W42
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GEOLOGICAL SURVEY
Geochem Laboratories (U.K.) Limited

GEOCHEMICAL SERVICE REPORT

Prepared for
CONOCO NORWAY INC.

GEOCHEMICAL EVALUATION OF CRUDE OIL SAMPLES 1A and 3A FROM CONOCO NORWAY'S 7/12-2 WELL

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GEOCHEMICAL EVALUATION OF CRUDE OIL SAMPLES 1A AND 3A FROM CONOCO NORWAY'S 7/12-2 WELL

SUMMARY

Crude oil samples 1A and 3A from Conoco Norway's 7/12-2 Well are grossly similar and were probably derived from mature source rocks in which amorphous kerogen constitutes a significant proportion of the total organic matter.

However these oils do display differences which cannot be attributed to a greater degree of inspissation (weathering) in sample 1A and instead, are source-dictated.

It is suggested that, although the parent source rocks for these two crudes are geochemically similar, that responsible for sample 3A contains a higher proportion of non-amorphous kerogen and is perhaps, slightly less mature.

N J L Bailey
GEOCHEM LABORATORIES (UK) LIMITED

INTRODUCTION

This report presents the results of an evaluation of crude oil samples 1A and 3A from Conoco Norway's 7/12-2 Well. The study was designed to provide a rapid preliminary evaluation of whether the two oils were derived from a common parent source rock.

This study was authorised by Mr R Simpson, Conoco Norway Inc.

A. ANALYTICAL DATA

Two crude oil samples were submitted for analysis from Conoco Norway's 7/12-2 Well. Sample 1A was collected at the surface on top of a water cushion during reverse-out whereas sample 3A was taken from the separator at the end of a six hour flow. They were assigned the Geochem job number 108 and sample numbers -001 and -002.

In carrying out this study, two whole oil analyses, two chromatographies, two paraffin-naphthene analyses and two gasoline range analyses were performed.

The data are reported in tables 1 through 3 and graphically in figure 1.

B. GENERAL INFORMATION

Ten (10) copies of this report have been forwarded to Mr R Simpson, Conoco Norway Inc., Stavanger. A copy of the data has been retained by Geochem for future consultation with authorised Conoco personnel.

All of the data and interpretations related to this study are proprietary to Conoco Norway Inc.

RESULTS AND INTERPRETATION

As sample 3A was taken from the separator at the end of a flow period whilst sample 1A was collected at the surface during a reverse-out, it is possible that the latter suffered more oxidation and inspissation.

A. COMPARISON OF ANALYTICAL DATA

The gasoline-range fractions of the two oils show several apparently significant differences, particular in the C_6-C_7 range. Aromatic hydrocarbons constitute a very low proportion of the total in both samples but particularly in sample 3A. Although these light C_4-C_7 hydrocarbons respond to weathering, sample 3A and not sample 1A shows the most pronounced "alteration" effects, suggesting that the differences are source-induced and do not reflect alteration. This being the case, the data suggest a higher proportion of non-amorphous kerogen in the source rock responsible for 3A.

Gas chromatograms of the whole oils and of the C_{15+} paraffin-naphthene hydrocarbons indicate the following:

- a higher proportion of the light ends in 3A with a sharp break at nC_{15}-nC_{16} as opposed to nC_{14}-nC_{15} in 1A.
- a more rapid decrease in normal paraffin abundances as chain lengths become larger in sample 3A with only poorly developed peaks beyond nC_{35}.
- a higher pristane to phytane ratio and a higher ratio of these isoprenoids to the adjacent normal paraffins in sample 3A
- differences in the lighter non-paraffins (whole oil chromatogram).

The lower proportion of light ends in sample 1A tallies with the liquid chromatography data (81.7% of sample in C_{15+} fraction compared with 63.4% in sample 3A) and could reflect a higher degree of inspissation but that other differences cannot be explained in this manner.

B. CONCLUSIONS

In a gross sense, both of these crude oils are similar, being of medium gravity and probably derived from mature parent source rocks in which amorphous kerogen constitues a significant proportion of the total. Nevertheless, there are some significant differences, some of which could reflect a degree of "weathering" (?) in sample 1A whereas others are definitely source related.

Both the light (C_4-C_7) and heavy (C_{15+}) fractions suggest that

there is a higher proportion of non-amorphous kerogen in the source rock responsible for the 3A crude.

C. RECOMMENDATIONS

In order to qualify these conclusions, it is recommended that:

- the carbon isotopic composition of the oils should be determined
- the source rocks within 7/12-2 should be evaluated using samples collected on a spacing of not more than fifty (50) feet and then compared to the oils.

TABLE 1
DETAILED GASOLINE RANGE ($C_4 - C_7$) ANALYSIS

GEOCHEM SAMPLE NUMBER	108-001	108-002
DEPTH	DST 1A	DST 3A
NORMALISED COMPOSITION		
isobutane	0.5	1.4
n - butane (nB)	47.6	53.9
isopentane	17.4	13.9
n - pentane (nP)	17.4	17.8
2,2 - dimethylB	-	-
cyclopentane (CP)	0.5	1.0
2,3 - dimethylB	-	-
2 - methylP	3.2	3.8
3 - methylP	1.5	1.0
n - hexane (nH)	4.0	2.8
methylCP (MCP)	1.2	1.3
2,2 - dimethylP	-	-
benzene	1.2	0.4
2,4 - dimethylP	-	-
2,2,3 - trimethylB	-	-
cyclohexane (CH)	1.2	0.8
3,3 - dimethylP	-	-
1,1 - dimethylCP	0.1	-
2 - methylH	0.8	0.3
2,3 - dimethylP	-	-
1,c,3 - dimethylCP	-	-
3 - methylH	0.5	0.3
1,t,3 - dimethylCP	-	-
1,t,2 - dimethylCP	0.3	0.2
3 - ethylP	-	-
n - heptane	1.2	0.4
1,c,2 - dimethylCP	-	-
methylCH (MCH)	0.8	0.4
toluene	0.1	-
ABUNDANCE (ppm)		
MCP/benzene	1.00	3.25
MCP/MCH	1.50	3.25
CH/MCP	1.00	0.62
iP/nP	1.00	0.78
%n - PARAFFINS	22.6	21.0
% ISOPARAFFINS	23.4	19.3
% NAPHTHENES	4.1	3.7
% AROMATICS	1.3	0.4

TABLE 2A

WEIGHT (GRAMMES) OF C_{15+} EXTRACTS AND CHROMATOGRAPHIC FRACTIONS

GEOCHEM SAMPLE NUMBER	INTERVAL	OIL EXTRACTED	TOTAL EXTRACT OBTAINED	TOTAL EXTRACT		nC_5 SOLUBLE FRACTION				
				Preciptd. Asphaltenes	nC_5 soluble	Paraffin – Naphthenes	Aromatics	Eluted NSO's	Non-eluted NSO's	Sulphur
108-001	DST 1A	0.0230	0.0188	0.0068	0.0120	0.0080	0.0026	0.0014	–	–
108-002	DST 3A	0.0254	0.0161	0.0040	0.0121	0.0086	0.0023	0.0012	–	–

TABLE 2C

COMPOSITION (NORMALISED %) OF C_{15+} MATERIAL EXTRACTED FROM ROCK

GEOCHEM SAMPLE NUMBER	INTERVAL	HYDROCARBONS			NON HYDROCARBONS					HC / NON HC
		Paraffin – Naphthenes	Aromatics	P – N / AROM	Preciptd. Asphaltenes	Eluted NSO's	Non eluted NSO's	Sulphur	ASPH / NSO	
108-001	DST 1A	42.55	13.83	3.08	36.17	7.45	–	–	4.86	1.29
108-002	DST 3A	53.42	14.29	3.74	24.84	7.45	–	–	3.33	2.10

TABLE 3

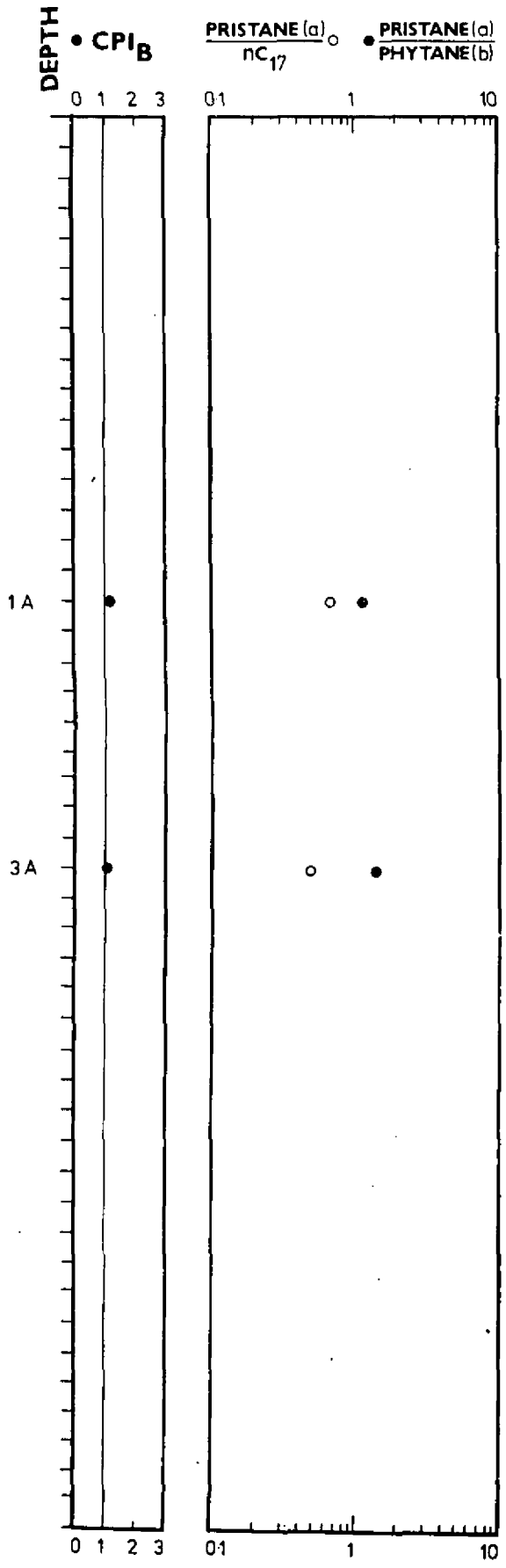
COMPOSITION (NORMALISED %) OF C_{15+} PARAFFIN – NAPHTHENE HYDROCARBONS

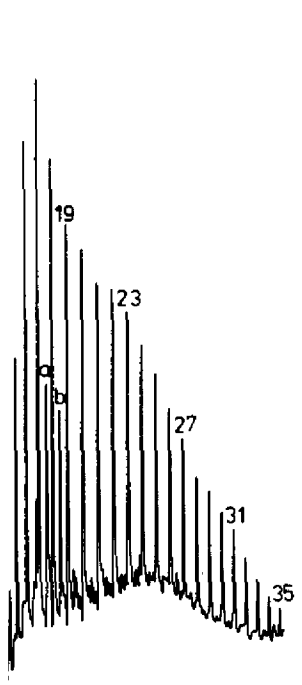
GEOCHEM SAMPLE NUMBER	108-001	108-002
DEPTH	DST 1A	DST 3A
SAMPLE TYPE		
nC_{15}	5.8	10.2
nC_{16}	9.9	12.4
nC_{17}	11.1	11.9
nC_{18}	9.5	9.4
nC_{19}	8.1	7.9
nC_{20}	7.4	7.1
nC_{21}	6.6	6.1
nC_{22}	6.3	5.9
nC_{23}	5.6	5.3
nC_{24}	4.9	4.5
nC_{25}	4.3	3.8
nC_{26}	3.6	3.3
nC_{27}	3.2	2.7
nC_{28}	2.7	2.2
nC_{29}	2.5	2.0
nC_{30}	2.3	1.8
nC_{31}	2.0	1.3
nC_{32}	1.5	0.9
nC_{33}	1.2	0.7
nC_{34}	0.9	0.5
nC_{35}	0.6	0.2
PARAFFIN	33.2	31.9
ISOPRENOID	3.1	3.3
NAPHTHENE	63.7	64.8
CPI INDEX A	1.00	1.00
CPI INDEX B	1.04	1.02
PRISTANE/PHYTANE	1.14	1.33
PRISTANE/nC_{17}	0.44	0.50

FIGURE 1

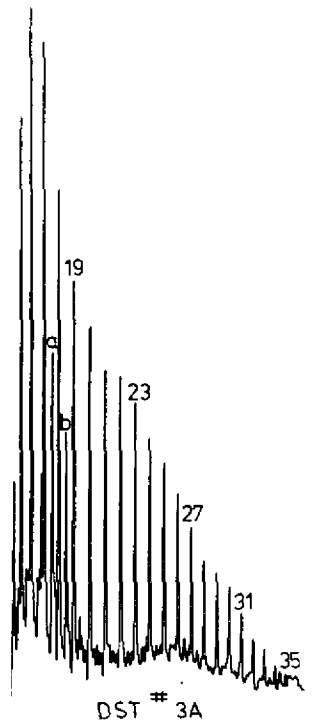
C_{15+} PARAFFIN — NAPHTHENE HYDROCARBONS

PRESENTATION OF ANALYTICAL DATA



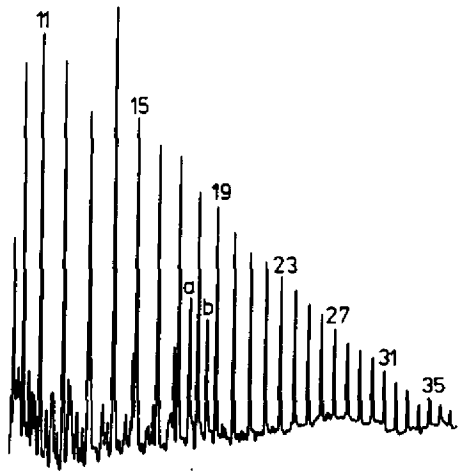


DST # 1A

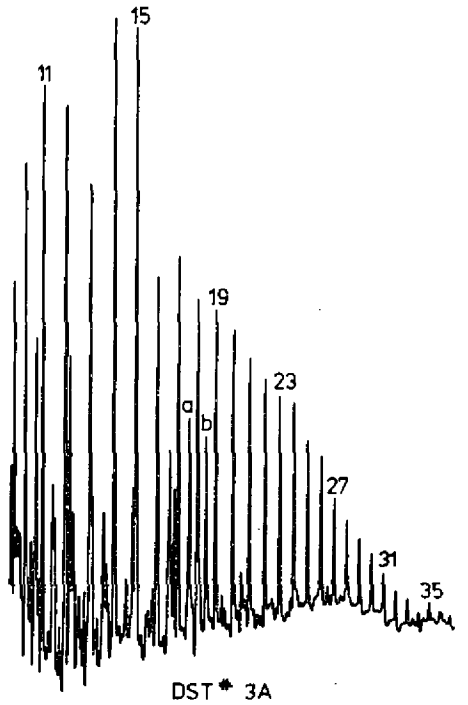


DST # 3A

WHOLE OILS



DST * 1A



DST * 3A

a = pristane
b = phytane

carbon numbers of normal paraffins indicated (19 = nC_{19})