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Report

Confidential X

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PHASE II

GEOCHEMICAL CONTACTS IN WELL 30/9-3

CORRELATION OF CRUDE OIL AND CORE

EXTRACTS IN WELL 30/9-3 AND 3A

by

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Sign.

Summary/Conclusion/Recommendation

- The oil column in 30/9-3 is, on geochemical evidence, likely to be continuous from 2734 m to 2815 m. i.e. the oil column consists of one group of oils.

- A significant degree of similarity exists between 30/9-3 extracts and 30/9-3A extracts and produced oil.

Key words
Correlation, reservoir geochemistry
Geochemistry

Subject category
Petroleum Geochemistry

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Field/Block/Well
30/9-3, 30/9-3A

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CONTENT

1. Introduction

This project is a continuation of the previous "Geochemical Establishment of the Gas and Oil-Water Contacts in Well 30/9-3" which indicated that the established oil column between 2734 m and 2815 m possibly could be divided in two parts at approximately 2770 m. The aim of this extended study is to verify or reject this possibility. This is done by extending the number of sampling points over the interval 2734 m - 2815 m and correlate the extracts within the two possible oil legs.

An other objective is to corelate the "lower" and "upper" extracts of 30/9-3 with extracts and produced oil in 30/9-3A

2. Well 30/9-3, possible split of oil colum.

Methods.

The methods used to differentiate between oil zone versus gas zone and oil zone versus water zone, are identical to those used in the previous study:

1. Bulk composition of extracts combined with the relationship between aromatic (AROM) and saturated (SAC) hydrocarbons; AROM/SAC.

2. Comparison of n-alkane distribution in extracts and mudfiltrate.

Results and discussions.

Twelve core sampeles have been extracted for residual oils. Bulk composition of these extracts are listed in Table 1. The AROM/SAC ratio is plotted in Fig. 1. This figure is based on the previons plot shown in Fig. 2.

Note that the chromatography data in Fig. 1 is complementary to that of Fig. 2.

Fig. 1 states fairly clearly that there is a continous oil column between 2734 and 2815 m. However, this does not totaly exclude the possibility of a divided oil column at 2770 m. If the trend indicated by samples 2768, 2762.50, 2750.00 and 2743,65 is extrapolated downwards a tiny aquifer or transition zone at 2770 - 2772 m can be imagined. This can be tested by analysing more samples in the intervall 2768-2772 m.

3. Correlation of upper and lower halves of the oil leg in 30/9-3 plus produced oil and extracts from 30/9-3A.

Method.

As Well 30/9-3 was drilled with oil-based mud, the core extracts are contaminated and the various correlation methods applicable in this study is rather limited. The method selected is biological markers of sterane and triterpane type which elute after the major contaminants and are therefore likely to be little effected. However, as unused mudfiltrate has not been available for analysis, combined with the fact that the high paraffinic filtrate effectively will aquire hydrocarbons containing biomarkers through extraction of source and reservoir rocks, the validity of this assumption is limited.

Results and discussions.

Seventeen extracts of reservoir cores from 30/9-3 and 3A (14 and 3 respectively) plus one produced oil from 30/9-3A, have been analysed for their biomarker content. Various calculated biomarker parameters, mainly source dependant are listed in Table 2.

Within the interval covered in Well 30/9-3, the results are generally fairly homogeneous. Although some variations exist, it is not possible based on these molecular parameters, to group the samples in a way that indicates a division of the oil column in two or more sections. It should again be noted that all core material used in this study are heavily contaminated by aliphatic rich mudfiltrate which can be carriers of biomarker contaminants such that larger variations normally found in a suit of reservoir extracts are likely to be expected. For comparison, Fig. 3 showing many of the same parameters calculated from extracts in Well 30/9-1, is enclosed.

The three core samples from 30/9-3A show similarity with the 30/9-3 extracts and most parameters vary within the boundaries set by the 30/9-3 extracts. However, the important source parameter C26/C29 (177) in sample 2913.0 m and in the 30/9-3A oil is offset relative to 30/9-3 extracts. This is an indication of possible differences between 30/9-3 extracts relative to the 30/9-3A oil and sample 2913.0 m.

4. Conclusions.

- The oil column in 30/9-3 is likely to be continous from 2734 to 2815 m as the oil column in 30/9-3 cannot be grouped into two or more oil classes.

- A high degree of similarity exists between 30/9-3 extracts and extracts and produced oil from 30/9-A. However, a slight difference is possible between the oil plus sample 2913.0 m and the 30/9-3 extracts.

5. Suggestion for further work.

The possible differences seen between 30/9-3A oil plus extract 2913.0 m may be verified by extending the number of samples of the oil zone in Well 30/9-3A.

6. References

Dahl, B: "Geochemical Establishment of the gas and oil-wather contacts in Well 30/9-3. Petroleum Geochemical analysis of 3 core samples from Well 30/9-3A." Norsk Hydro report 10.01.85.

Dahl, B. and Speers, G.C.: "Characterisation of a Tar Mat in the Oseberg Field." In press.

TABLES AND FIGURES

TABLE 1 EXTRACTION DATA WELL 30/9-3 and 30/9-3A

Sample depth (m)	EOM %	Asph % of EOM	SAC %	AROM %	NSO %
30/9-3					
2750.0	0.81	1.38	56.6	31.8	11.63
2759.0	2.21	0.25	64.3	26.03	9.64
2762.5	3.31	3.13	61.2	23.4	15.5
2768.0	2.84	1.91	60.6	29.0	13.9
2772.5	2.77	0.55	61.3	29.8	8.9
2779.0	0.85	0.02	57.1	29.1	13.9
2782.5	1.38	0.05	61.0	23.0	16.0
2785.0	1.13	1.51	56.5	27.7	16.9
2788.5	2.54	1.62	59.7	27.7	12.6
2796.5	1.35	0.05	64.0	21.44	14.53
2799.0	1.59	2.39	57.3	26.2	16.5
2807.35	0.14	0.06	80.1	12.7	7.2
30/9-3A					
2913.0	2.27	0.04	64.3	23.5	12.2

TABLE 2. BIOMARKER RATIOS OF SEDIMENT EXTRACTS AND OIL WELLS 30/9-3A AND 30/9-3.

	TRITERPANES				STERANES					TRI AROMATIC ST.		PHENANTRENES	
	%TS	$\frac{C26}{C27}$(177)	$\frac{C28}{C29}$	$\frac{C27}{C28}$	% 20S	%	C27: C28: C29	$\frac{dia}{regular}$	$\frac{C20}{C27}$	$\frac{20}{20+26+27}$	$\frac{27}{27+28R}$	MPI	$\frac{P}{C-P}$
30/9-3													
2736.10*	61	n.m	0.70	1.45	50	79	54: 19: 27	8.75+	n.m	-	-	-	-
2743.65*	55	n.m	0.48	0.94	-	-	61: 17: 22	5.5+	n.m	20	48	0.30	-
2750.0	57	0.45	0.67	0.80	n.m	n.m	-	5.6	0.45				
2762.5	58	0.53	0.42	2.25	n.m	n.m		-	0.66				
2768. *										19	47	0.42	0.65
2772.5	58	0.50	0.45	0.99	n.m	n.m	-	3.25	0.50				
2779.5	51	0.46	0.58	1.13	n.m	n.m	-	5.03	0.54				
2782.5	55	0.46	0.65	0.71	n.m.	n.m.	-	6.25	0.50				
2785.0	53	0.50	0.63	0.83	n.m	n.m	-	5.13	0.63				
2788.5	57	0.41	0.74	0.84	n.m	n.m	-	4.00	0.73				
2799.0	57	0.41	0.57	0.88	n.m	n.m	-	5.45	0.39				
2807.35	-	0.43	-	-	-	-	-	-	-				
2813.5 *	61		0.41	2.84	63	39	61: 17: 22	9.6+	n.m	18	46	0.41	0.11
2825	-	-	-	-	-	-	-	-	-	-	-	-	-
30/9-3A													
2855	-	-	-	-	-	-	-	-	-	18	48	0.22	-
2859.15*	63	n.m	0.59	2.06	62	67	58: 18: 24	-	-	14	44	0.40	0.36
2913.0	56	0.26	0.49	1.06	n.m	n.m	-	4.35	0.57	17	46	0.44	0.61
30/9-3A Oil	54	0.32	0.55	0.94	61	58	-	2.37	0.56	14	49	0.49	0.30

ALL ANALYSES by VSIR

* Analysed by SMIM

n.m. not measured

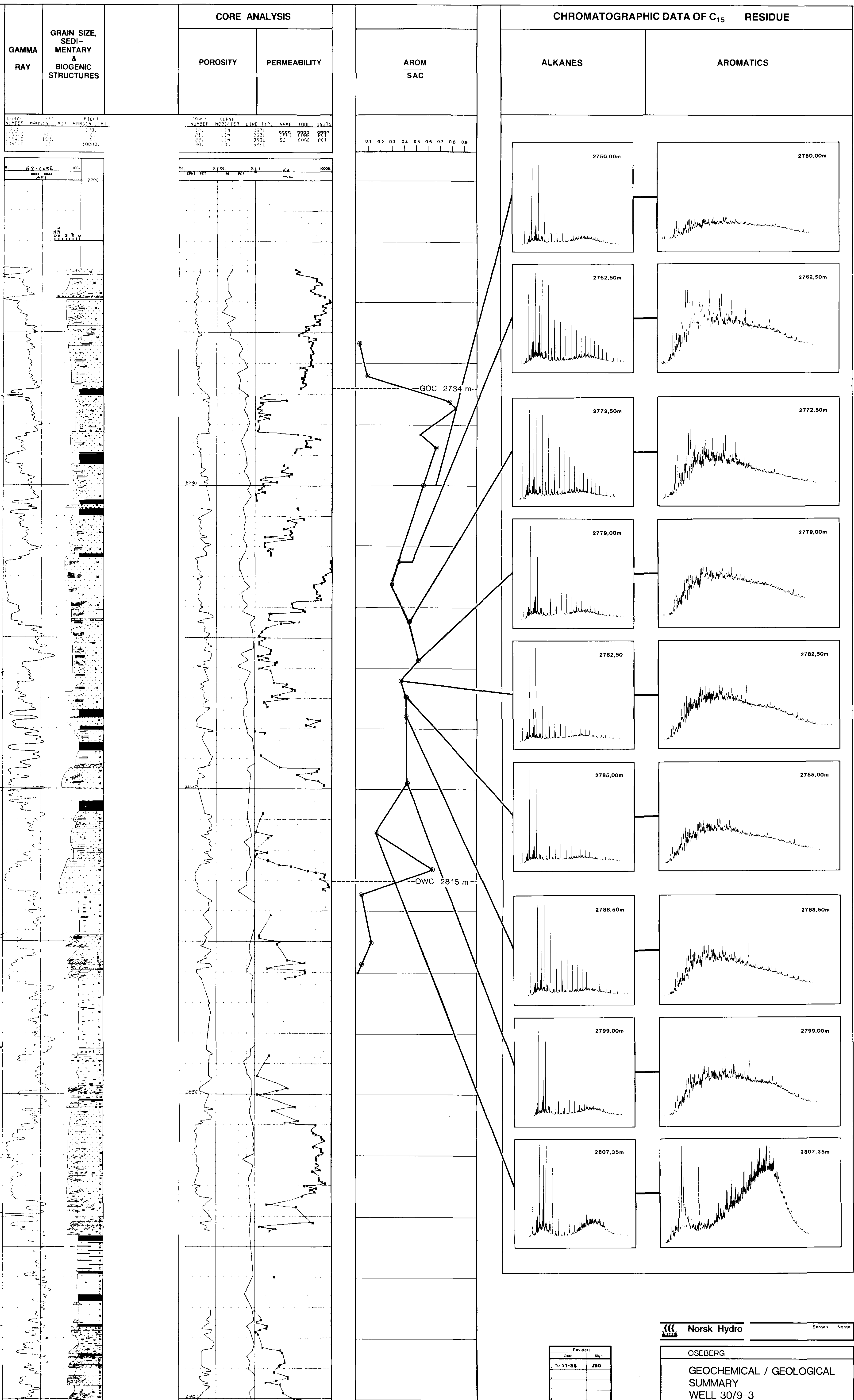
\+ C_{27} $\alpha\beta$ 20R VS C_{27} xxx 20R

$\frac{dia}{}$ C_{27} $\alpha\beta$ 20R VS C_{29} $\alpha\alpha\alpha$ 20R

WELL 30/9–3 GEOCHEMICAL/GEOLOGICAL SUMMARY (II)

HYDRO

Oseberg Field: Brent Reservoir



Revidert	
Dato	Sign.
1/11-85	JBO

Norsk Hydro — Bergen · Norge

OSEBERG

GEOCHEMICAL / GEOLOGICAL SUMMARY WELL 30/9–3

Konturintervall	Tolket av B.D. / P.E.E.	Dato Desember 1984
Målestokk	Tegnet av G.G.	Revidert
		Arkiv nr

Fig. 1.

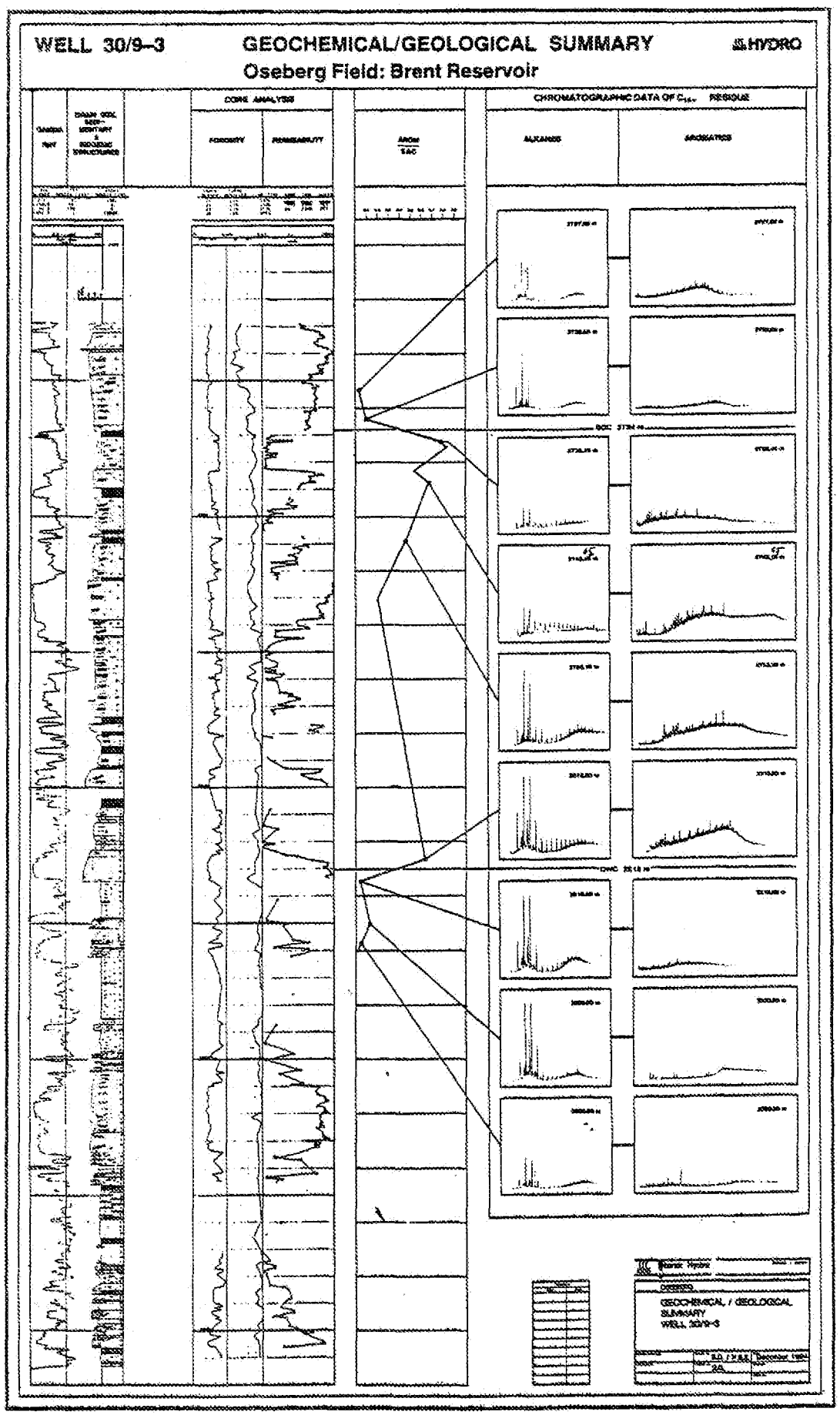


Fig. 2. Plot of extraction data produced during phase I of this study.

Sample No.	Triterpanes			Steranes				Tri-arom-steranes
	$T_s/T_s + T_M$	C_{29}/C_{29}	$C_{27}C_{28}$	20S	$\alpha\alpha\beta$	$C_{27}:C_{28}:C_{29}$	DIA/REGULAR	$C_{20} + C_{21}$/TOTAL
2	0.59	0.50	1.54	0.50	0.62	42:20:38	4.8	0.17
3	0.62	0.56	1.25	0.51	0.63	43:21:36	5.0	0.14
4	0.61	0.54	1.34	NM	NM	42:21:37	5.6	0.12
6	0.57	0.56	1.36	0.50	0.65	38:23:39	6.0	0.13
7	0.59	0.59	1.39	0.50	0.65	38:24:38	6.1	0.11
8	0.61	0.54	1.41	0.52	0.64	41:22:37	5.6	0.11
9	0.59	0.61	1.57	0.51	0.66	39:24:37	NM	0.11
10	0.61	0.54	1.32	0.51	0.62	40:25:35	5.2	0.12
11	0.60	0.57	1.41	0.50	0.65	42:22:36	5.2	0.10
				Tar zone				
14	0.58	0.55	1.34	0.51	0.66	41:23:38	4.8	0.14
15	0.59	0.58	1.42	0.50	0.64	37:24:39	5.8	0.12
16	0.59	0.60	1.53	0.50	0.66	43:19:39	5.3	0.13
18	0.61	0.58	1.36	0.51	0.64	42:22:37	4.8	0.13
19	0.59	0.66	1.22	0.51	0.64	41:22:37	NM	0.13
21	0.58	0.53	1.60	0.50	0.66	47:19:35	4.3	NM
22	0.63	0.56	1.48	0.52	0.63	42:19:39	NM	0.13
				Aquifer				
23	ND	ND	ND	ND	ND	ND	ND	0.32
24	ND	ND	ND	ND	ND	ND	ND	0.39
Oil sample	0.60	0.57	1.39	0.50	0.63	44:19:37	4.8	NM
Satellite biodeg. oil		0.44	0.69	0.80	0.52 NM	0.44	42:23:35	1.6

ND = not detected; NM = not measured.
C_{28}/C_{29}: 28,30-bisnorhopane [17α, 21β (H)]/30 norhopane.
C_{27}/C_{28}: $T_s + T_M$/28,30-bisnorhopane [17α, 21β (H)] + [17β, 21α (H)].
20S: $C_{29}\alpha\beta\beta$ (20R + 20S)/$C_{29}\alpha\beta\beta$ (20R + 20S) + $C_{29}\alpha\alpha\alpha$ (20R + 20S).
$C_{27}:C_{28}:C_{29}$: relative amounts of $\alpha\alpha\alpha$ 20R sterane isomers.
Dia/regular: $C_{27}\alpha\beta$ 20R/$C_{27}\alpha\alpha\alpha$ 20R.
All triterpane and sterane ratios calculated from peak height measurements on SMIM traces. $C_{20} + C_{21}$/total triaromatic steranes calculated from peak area measurements.

Fig. 3. Biomarker data from oil column in Well 30/9-1.