

EXXON PRODUCTION RESEARCH COMPANY

HYDROCARBON SOURCE CHARACTERISTICS OF
CANNED CUTTINGS FROM THE 17/9-1 REENTRY WELL,
OFFSHORE NORWAY

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SUMMARY AND CONCLUSIONS

Samples from 9400-10,370 ft. (T.D.) in 17/9-1 (RE) were received in June 1974. These were analyzed for source characteristics by the same techniques that were applied earlier on shallower samples from this well. (See EPR. 5ES. 74 of January 1974.)

Charges for this work were billed to our Job No. 6347.

The analytical data are interpreted as follows:

<u>Interval (feet)</u>	<u>Maturity</u>	<u>Average Richness</u>	<u>Indigenous Hydrocarbons Expected if Reservoired</u>
9400- 9,900	Mature	Fair to Good	Gas; Minor Liquids
9900-10,370	Mature	a. *Gray Shales Fair to Good	Gas
		b. Other Lithologies Poor	Lean

*These shales might have been cavings.

The analytical data for both the newly drilled and the earlier drilled sections are summarized in Fig. 1 and the new data are listed in Tables I-III.

Shaly beds from the interval 9400-9900 ft gave low gas yields both from the canned cuttings (Fig. 1) and from the mud gas at the wellsite, and this is a bit puzzling. The shale chips that were analyzed averaged about 1.6 percent total organic matter, which warrants a source rating of "good". These "good source" shales are rated as gas-prone on the basis of:

- (1) predominantly woody kerogen (Table II)
- (2) relatively low percentages of C₂ -C₄ in the total hydrocarbon gas (Fig. 1)
- (3) relatively low gasoline yields despite the mature kerogen and the "good" source richness ratings.

A possible explanation for the low gas yields might be that the gas generated by these shales readily dissipated into the adjacent sands and silts and moved elsewhere.

Another explanation might be found in the timing of the maturation here. We do not know any of the stratigraphic tops for this well, so we were unable to run STOILPOR calculations to estimate the geologic history of hydrocarbon generation. This could perhaps be done by a geologist at Walton, and should be instructive in interpreting the hydrocarbon patterns here.

Related Report

EPR. 5ES. 74: "Hydrocarbon Source Characteristics of Canned Cuttings from 17/9-1, Offshore Norway" by R. E. Metter et. al., January, 1974.

TABLE IA
C₁-C₄ HYDROCARBON ANALYSES - AIR SPACE AT TOP OF CANS

SAMPLE NUMBER	R	DEPTH	GAS CONCENTRATION (VOLUME GAS PER MILLION VOLUMES CUTTINGS)							GAS COMPOSITION (PERCENT)								NOTES	
			METHANE	ETHANE	PROPANE	ISO-BUTANE	NORMAL BUTANE	WET	TOTAL	TOTAL GAS					WET GAS				
			(C ₁)	(C ₂)	(C ₃)	(iC ₄)	(nC ₄)	(C ₂ -C ₄)	(C ₁ -C ₄)	C ₂ -C ₄	C ₁	C ₂	C ₃	iC ₄	nC ₄	C ₂	C ₃		iC ₄
62147A	4	9500	603.57	263.31	585.03	218.23	301.00	1367.57	1971.14	69.3796	31.13	30.11	15.15		19.43	16.22			
62147B	4	9600	347.17	176.44	370.94	158.67	143.95	850.20	1197.37	71.0056	29.15	31.13	13.12		21.43	19.17			
62147C	4	9700	0.22	5.59	2.23	17.28	18.26	43.36	43.58	99.4952	1.13	5.40	4.1		13.54	4.2			
62147D	4	9800	450.75	223.82	305.64	76.72	100.66	706.89	1157.64	61.0630	39.19	26.7	9.9		32.43	11.14			
62147E	4	9900	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0			
62147F	4	10000	240.91	71.38	77.50	20.84	27.74	197.46	438.37	45.0441	55.16	18.5	6.6		36.39	11.14			
62147G	4	10100	947.26	162.71	256.85	72.37	90.80	582.73	1530.11	38.0842	41.11	17.5	6.6		28.44	12.16			
62147H	4	10200	408.62	136.75	126.39	35.97	44.26	337.37	746.19	45.2123	55.18	16.5	6.6		40.36	11.13			
62147I	4	10300	554.77	79.15	76.18	19.86	29.93	205.12	763.89	26.8520	73.10	10.3	4.4		38.37	10.15			
62147J	4	10370	840.96	163.20	196.72	55.74	91.80	509.46	1350.42	37.7260	62.12	15.4	7.7		32.39	11.18			

B - CUTTINGS NOT ANALYZED *C* - AIR SPACE GAS NOT RUN *BC* - NO ANALYSES RUN

TABLE IB
C₁-C₄ HYDROCARBON ANALYSES - CUTTINGS ONLY

SAMPLE NUMBER	R	DEPTH	GAS CONCENTRATION (VOLUME GAS PER MILLION VOLUMES CUTTINGS)							GAS COMPOSITION (PERCENT)								NOTES	
			METHANE	ETHANE	PROPANE	ISO-BUTANE	NORMAL BUTANE	WET	TOTAL	TOTAL GAS					WET GAS				
			(C ₁)	(C ₂)	(C ₃)	(iC ₄)	(nC ₄)	(C ₂ -C ₄)	(C ₁ -C ₄)	C ₂ -C ₄	C ₁	C ₂	C ₃	iC ₄	nC ₄	C ₂	C ₃		iC ₄
62147A	4	9500	1634.87	74.40	325.46	126.98	357.54	686.32	2526.19	35.0852	65.3	13.5	14.6		8.37	15.40			
62147B	4	9600	1623.65	50.64	123.70	114.41	379.49	702.24	2325.29	30.2001	71.3	5.5	16.6		11.18	17.54			
62147C	4	9700	2110.81	106.00	411.85	115.44	286.03	914.32	3030.13	30.3393	69.4	14.4	9.9		12.45	12.31			
62147D	4	9800	2493.44	267.36	681.56	217.87	678.26	1792.05	4285.49	41.8167	58.5	16.5	16.6		12.38	12.38			
62147E	4	9900	1035.12	76.50	116.75	36.11	80.89	304.31	2339.43	13.0078	88.3	5.1	3.3		25.38	10.27			
62147F	4	10000	1671.86	130.32	196.24	57.50	130.27	514.33	3386.21	15.1889	84.4	6.2	4.4		25.39	11.25			
62147G	4	10100	1265.64	67.92	166.78	69.93	173.81	500.44	1766.08	28.3362	71.4	11.4	10.10		14.37	14.35			
62147H	4	10200	1826.63	46.92	53.16	15.93	41.15	157.16	1977.84	7.9460	92.2	3.1	2.2		30.34	10.26			
62147I	4	10300	2514.47	65.16	104.55	29.94	76.34	278.04	2742.51	9.9566	90.2	4.1	3.3		23.39	11.27			
62147J	4	10370	1766.02	21.42	80.73	33.18	84.96	220.29	1986.31	11.0904	89.1	4.2	4.4		10.37	15.38			

B - CUTTINGS NOT ANALYZED *C* - AIR SPACE GAS NOT RUN *BC* - NO ANALYSES RUN

TABLE IC
C₁-C₄ HYDROCARBON ANALYSES - CUTTINGS AND AIR SPACE

SAMPLE NUMBER	R	DEPTH	GAS CONCENTRATION (VOLUME GAS PER MILLION VOLUMES CUTTINGS)							GAS COMPOSITION (PERCENT)								NOTES	
			METHANE	ETHANE	PROPANE	ISO-BUTANE	NORMAL BUTANE	WET	TOTAL	TOTAL GAS					WET GAS				
			(C ₁)	(C ₂)	(C ₃)	(iC ₄)	(nC ₄)	(C ₂ -C ₄)	(C ₁ -C ₄)	C ₂ -C ₄	C ₁	C ₂	C ₃	iC ₄	nC ₄	C ₂	C ₃		iC ₄
62147A	4	9500	2242.44	337.71	410.43	347.21	658.54	2253.89	4497.33	50.1162	50.8	20.8	15.15		15.41	15.29			
62147B	4	9600	1970.22	257.08	494.64	277.28	522.44	1552.44	3522.66	44.0701	56.7	14.8	15.15		17.32	18.33			
62147C	4	9700	2111.63	113.59	414.08	130.72	304.29	962.68	3073.71	31.3198	69.4	13.4	10.10		12.42	14.32			
62147D	4	9800	2444.14	431.16	944.25	244.59	778.92	2498.94	5443.13	45.9100	55.8	18.5	14.6		17.40	12.31			
62147E	4	9900	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0			
62147F	4	10000	3111.74	261.70	273.74	78.34	158.01	711.79	3824.58	18.6109	82.5	7.2	4.4		28.39	11.22			
62147G	4	10100	2213.62	230.63	445.63	142.30	264.61	1083.17	3296.19	32.8612	67.7	14.4	8.8		21.42	13.24			
62147H	4	10200	2224.56	165.67	173.55	51.90	85.41	494.53	2724.03	18.1543	82.7	6.2	3.3		38.35	10.17			
62147I	4	10300	3073.24	144.51	184.73	49.85	104.27	443.16	3556.40	13.5656	87.4	5.1	3.3		30.38	10.22			
62147J	4	10370	2666.98	184.62	274.45	68.92	176.76	724.75	3336.73	21.6702	78.6	6.3	5.5		25.39	12.24			

B - CUTTINGS NOT ANALYZED *C* - AIR SPACE GAS NOT RUN *BC* - NO ANALYSES RUN

TABLE II
Description of "Picked" Cuttings and of Visual Kerogen
 (Kerogen by J. L. Morgan)

Depth (ft)	EPR No.	Gross Lithology	GSA Color Code	Total Organic Matter (%)	Kerogen Alteration	Types of Kerogen*			Remarks	Kerogen Source Type
						Predominant	Secondary	Other		
9,500	62147-A	Shale, med. dark gray, v. sl. dol.	N4	1.71	2+	Al	W	H, C	Abundant pyrite	Oil, Gas
9,700	-C	Shale, as above, trace of pyrite	N4	1.59	2+	W	Al, H	C	Moderate pyrite	Gas
9,800	-D	Shale, med. dk. gray	N4	1.78						
10,000	-F	Shale, dark gray	N3	1.39	2+	W	H	C	Trace of pyrite	Gas
10,200	-H	Shale, med. dk. gray to olive gray	N4-5Y4/1	1.59	2+	W	A, C	H	"	Gas
10,370	-J	Shale, dark gray, grayish black, and black	N3, N2, N1	1.56	2+	W	C	A, H	"	Gas

* A - Amorphous
 Al - Algal
 H - Herbaceous
 W - woody
 C - Coaly

TABLE III

Total Organic Matter and Light Gasolines (C₄ -C₇),
17/9-1 (RE) "Picked" Cuttings

(Analyses by H. M. Fry, R. R. Dudley)

Depth (ft)	EPR No.	Total Organic Matter (%)	Total C ₄ -C ₇ (ppm)	Correlation Ratios (See Table III-A)			CH/MCP*
				C ₁ /C ₂	A/D ₂	C ₁ /D ₂	
9,500	62147-A	1.71	1.44	1.79	6.10	13.93	.34
9,700	-C	1.59	7.40	2.30	6.60	8.68	2.06
9,800	-D	1.78	16.66	1.86	4.89	6.02	1.36
10,000	-F	1.39	27.93	.75	4.29	5.04	.41
10,200	-H	1.59	25.11	.74	4.35	5.04	.38
10,370	-J	1.56	11.95	1.86	5.26	6.26	1.12

* CH - cyclohexane
MCP - methylcyclopentane

Note: on the basis of total organic matter concentrations all of these samples would be rated as "good" sources

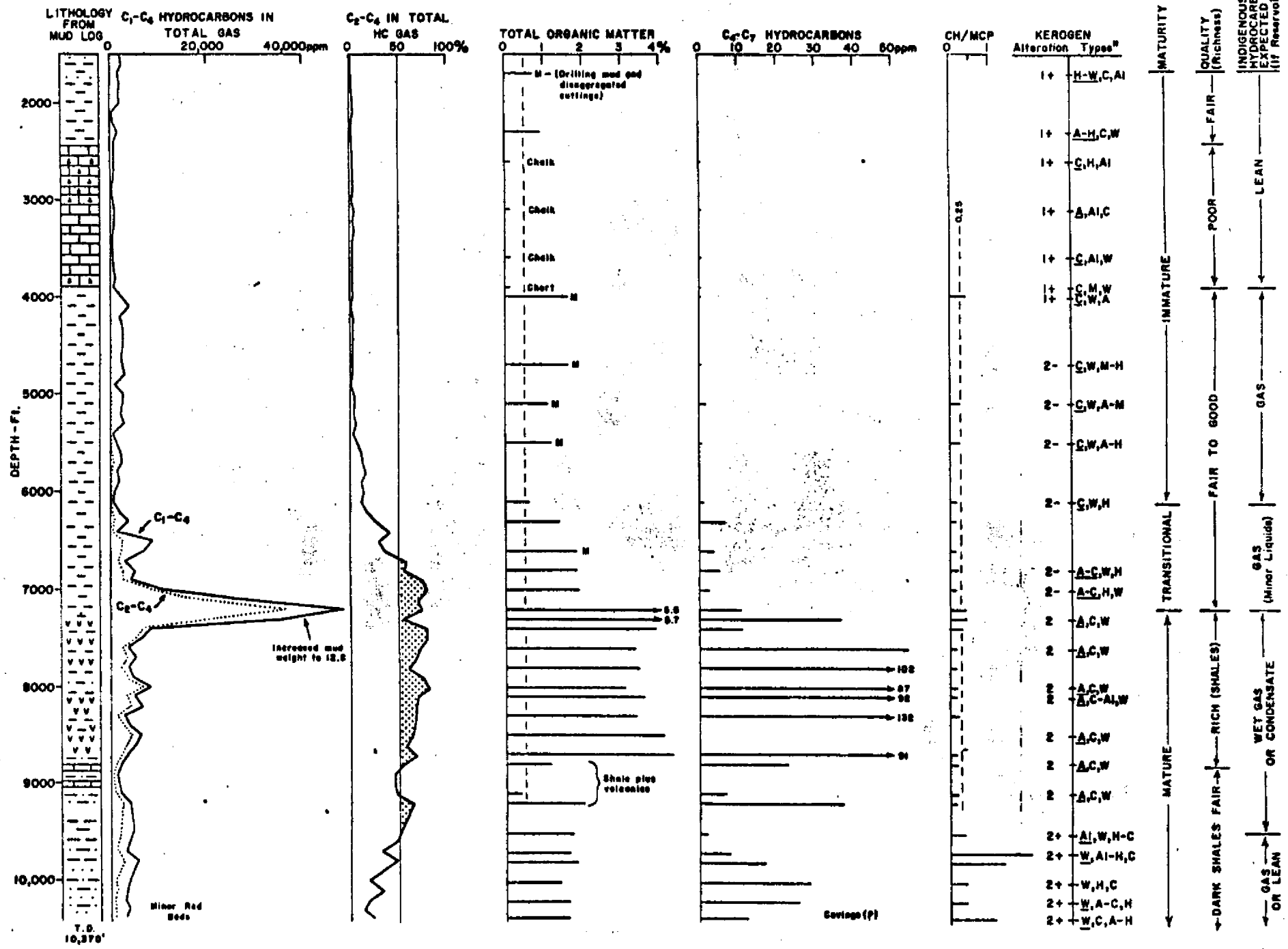


FIG. 1 - GEOCHEMICAL PROFILES, 17/9-1 CORING CUTTINGS.

^a A-Amorphous W-Woody
 AI-Algal C-Coaly
 H-Herbaceous M-Microplankton