

75. 764 CC.

2/11/2/11-1 Pleistocene-  
Paleocene.

02342

NORWAY CORPORATION	
Location: <u>NBS 2/11-1 W 254</u>	ID: <u>01014409</u>

AMOCO PRODUCTION COMPANY  
RESEARCH CENTER

SOURCE ROCK EVALUATION

- Amoco Norway 2/11-1, North Sea Tertiary Basin -

Geochemistry Group

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Technical Service 7964CC  
Amoco Europe, Inc.

*James A Momper*  
4-23-71

#### DISCUSSION

Source rock and organic diagenesis measurements have been completed on 14 Tertiary shale samples from the Amoco Norway 2/11-1 well. The samples were unwashed and partially dried when received, and they were impossible to clean. Consequently, most of the samples were badly contaminated by drilling mud additives.

Most of the Tertiary shales have fair to very good source rock potential based on the weight percent organic carbon (Table 1). These organic values are inflated to some extent by contamination, as discussed below; hence they should be regarded as maximum values.

Except for the Paleocene sample at 8500 feet, elemental analyses (Table 2) show no significant increase in carbon percentage with depth. This contrasts with the carbonization trend shown by the sidewall cores from Amoco Norway 2/8-2, and suggests that the organic matter in the 2/11-1 well has been contaminated by a mud additive such as lignite. The higher degree of carbonization in the Paleocene sample at 8500 feet indicates less contamination from the mud system. More importantly, the degree of carbonization observed in this sample signifies that the organic matter has not attained peak hydrocarbon generation; thus it apparently has not been an effective source.

Hydrogen content of the residual organic matter (Table 2) indicates that gas and gas condensate would be the most favored type of hydrocarbons generated in the Tertiary shales. However, the Oligocene sample ANO-5 possibly has oil generating capability.

The heavy hydrocarbon patterns (Figures 1, 2 and 3) show that the shales have a strong diesel oil component in the extractable hydrocarbons. However, the frequency and percentage of  $> C_{24}$  constituents, usually indicative of indigenous oil, tend to increase with increasing depth, which suggests that some hydrocarbon generation has taken place. The heavy hydrocarbon pattern of the deepest Paleocene sample, ANO-58, shows no sign of diesel oil. It resembles the pattern for the crude oil produced from the interval from 8680-8696 feet (T.S. 7965CC). However, the oil extracted from sample 58 probably represents the show of oil recovered on a DST only 10 feet deeper (8510-8543', rec. 562' oil and gas cut mud).

In summary, the Tertiary shales have above average hydrocarbon-generating capability, but none appear to be effective sources. Contamination of the samples by drilling mud additives obscures the stage of diagenesis of the organic matter.

The contamination of these samples points out the importance of sample quality in providing useful data. The most desirable samples, of course, are conventional or sidewall cores, but well-washed cuttings are also suitable.

*Raymond Jones*

OFFICE Amoco Europe, Inc. AREA North Sea  
 AUTHORIZED BY K. D. Soule DATE 10-28-70  
 TECHNICAL SERVICE NUMBER 7964CC  
 STATE (PROVINCE) \_\_\_\_\_ COUNTY \_\_\_\_\_ WELL LOCATION Amoco Norway 2/11-1

AMOCO PRODUCTION COMPANY  
 PAN AMERICAN PETROLEUM CORPORATION  
 RESEARCH CENTER  
 SOURCE ROCK EVALUATIONS

SAMPLE NUMBER	SAMPLE		FORMATION	LITHOLOGY	DEPTH	INSOLUBLE RESIDUE %	ORGANIC CARBON WT. % *	EXTRACTABLE ORGANIC Bbl/ACRE FT.	EXTRACT. HYDROCARBON Bbl/ACRE FT.	EXTRACT. ORG. TOTAL ORG.	RATING *	REMARKS
	TYPE	QUALITY										
-45	Cuttings	Poor	Pleistocene	gray clay	2070-2100'	78	0.70	66.5	38.8	0.26	fair	Potential
-46	"	"	Pliocene	"	2670-2700'	85	0.37	14.3	9.1	0.13	nonsource	
-47	"	"	Miocene	"	3090-3120'	80	0.78	39.6	24.7	0.16	fair	Potential
-48	"	"	"	"	3570-3600'	78	1.44	44.1	33.4	0.10	good	"
-49	"	"	"	"	3990-4020'	81	1.54	21.2	15.2	0.05	v. good	"
-50	"	"	"	"	4500-4530'	83	1.39	36.1	25.9	0.09	good	"
-51	"	"	Oligocene	gry-brn sh	4980-5010'	80	2.12	19.1	11.6	0.03	v. good	"
-52	"	"	"	"	5370-5400'	80	2.11	19.2	7.5	0.03	"	"
-53	"	"	Middle Eocene	"	5880-5910' 5970-6000'	83	3.05	16.8	9.8	0.02	"	"
-54	"	"	"	"	6480-6510' 6570-6600'	82	1.58	17.5	11.1	0.04	"	"
-55	"	"	Lower Eocene	gry sh	6990-7020' 7080-7110'	80	0.92	7.9	4.5	0.03	fair	"
-56	"	"	Paleocene	gry-brn sh	7470-7500'	70	0.73	7.1	4.3	0.04	"	"
-57	"	"	"	"	7980-8010'	74	0.73	5.4	3.9	0.03	"	"
-58	"	"	"	"	8490-8500'	78	1.51	110.0	70.6	0.22	v. good	"
Most of the extractable material in these samples appears to be diesel contaminant.												

5013/C12  
 extract.  
 HCB

-27.6  
 -27.3  
 -28.0  
 -27.7  
 -27.7  
 -27.4  
 -27.4  
 -27.4  
 -27.3  
 -27.5  
 -27.3  
 -27.7  
 -27.5  
 -27.3

REMARKS:

REFERENCES: T.S. 7965CC, 11-23-70  
 T.S. 8065CC, 2-23-71  
 T.S. 7890CC, 12-2-70  
 T.S. 7963CC, 4-8-71

Log temp. 260°F @ 15,084'

ANALYST J. Williams

DATE APR 23 1971  
 TABLE 1

The organic carbon values for these samples are believed to be somewhat high due to contamination by drilling mud additives. As a result, the ratings based on organic carbon content may actually be less favorable than indicated.

- AMOCO PRODUCTION COMPANY

OFFICE Amoco Europe, Inc. AREA North Sea

AUTHORIZED BY K. D. Soule DATE 10-28-70

TECHNICAL SERVICE NUMBER 7964CC

STATE (PROVINCE)

COUNTY

WELL LOCATION Amoco Norway 2/11-1

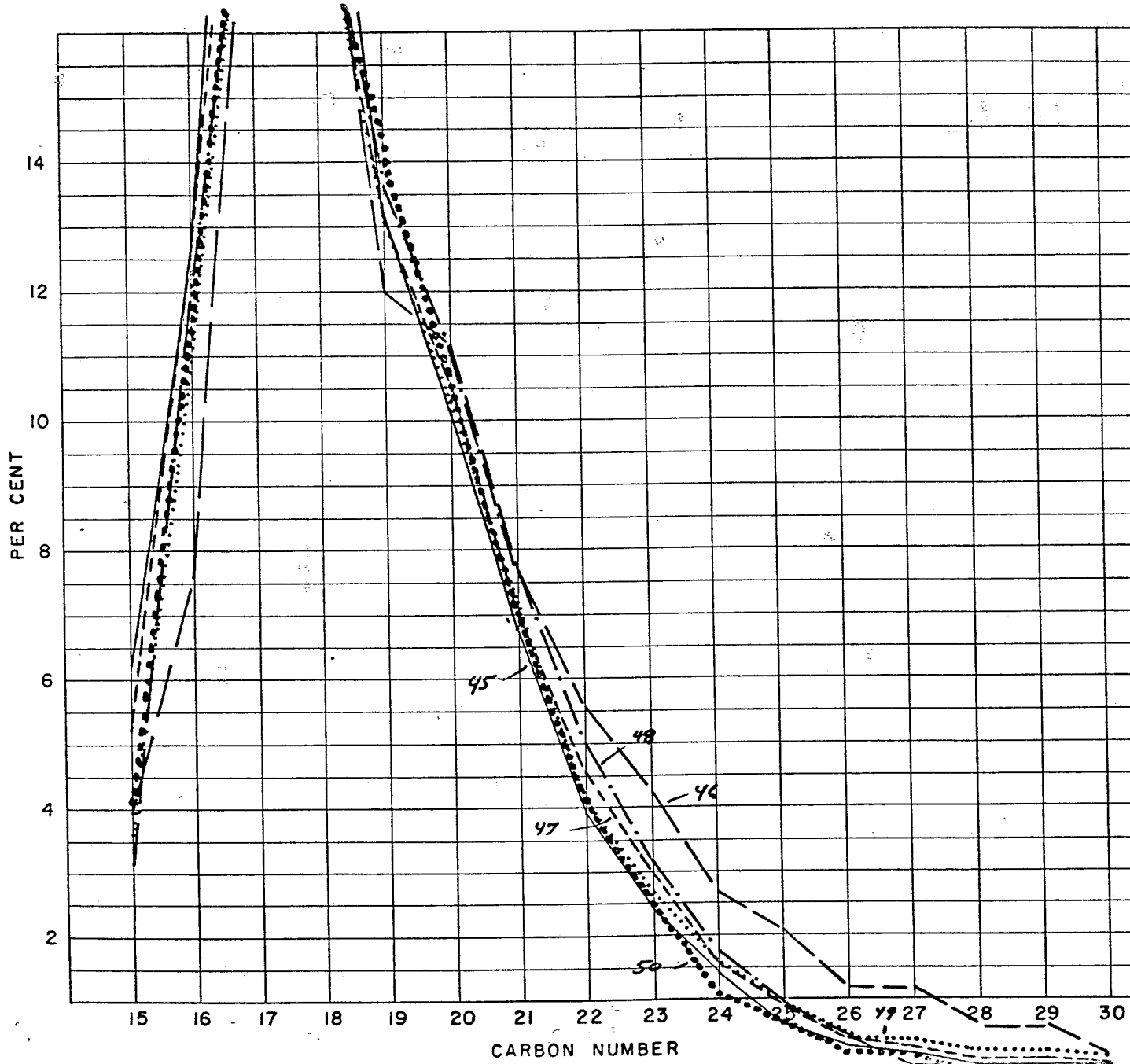
~~PAN AMERICAN PETROLEUM CORPORATION~~  
RESEARCH CENTER  
ORGANIC DIAGENESIS DATA

SAMPLE			FORMATION	LITHOLOGY	DEPTH	ELEMENTAL ANALYSIS, PERCENT				RATIO H/C	STATE OF DIAGENESIS	HYDROCARBON TYPE BY	
NUMBER	TYPE	QUALITY				CARBON	HYDROGEN	OXYGEN	NITROGEN			% HYDROGEN	PYROLYSIS
ANO-45	Cuttings	Poor	Pleistocene	gry clay	2070-2100'	69.64	5.12	23.90	1.33	0.88	*	gas	
-46	"	"	Pliocene	"	2670-2700'	71.56	4.75	22.12	1.56	0.80	*	"	
-47	"	"	Miocene	"	3090-3120'	69.90	5.44	22.34	2.31	0.93	*	"	
-48	"	"	"	"	3570-3600'	69.77	5.28	23.03	1.92	0.91	*	"	
-49	"	"	"	"	3990-4020'	69.51	5.64	22.52	2.34	0.97	*	gas or gas condensate	
-50	"	"	"	"	4500-4530'	69.98	5.53	22.65	1.84	0.95	*	"	
-51	"	"	Oligocene	gry-brn sh	4980-5010'	71.83	6.65	19.27	2.30	1.11	*	poss. oil	
-52	"	"	"	"	5370-5400'	70.59	5.67	21.62	2.12	0.96	*	gas condensate	
-53	"	"	Middle Eocene	"	5880-5910' 5970-6000'	70.62	5.54	22.00	1.85	0.94	*	"	
-54	"	"	"	"	6480-6510' 6570-6600'	70.84	6.03	20.76	2.37	1.02	*	"	
-55	"	"	Lower Eocene	gry sh	6990-7020' 7080-7110'	70.85	5.72	21.80	1.63	0.97	*	gas condensate	
-56	"	"	Paleocene	gry-brn sh	7470-7500'	71.01	5.53	21.37	2.09	0.93	*	"	
-57	"	"	"	"	7980-8010'	70.00	5.76	22.11	2.13	0.99	*	"	
-58	"	"	"	"	8490-8500'	77.00	6.88	13.77	2.35	1.07	early hydrocarbon generation	gas cond. or oil	

REMARKS:

\*Constant elemental composition throughout wide interval indicates contamination by a low rank organic substance, such as lignite. The presence of this type of contaminant makes the sample unsuitable for determining state of diagenesis.

ANALYST Roger E. LaPlante DATE APR 23 1971  
TABLE 2



OIL  ROCK EXTRACT   
HEAVY HYDROCARBON  
DISTRIBUTION

AMOCO NORWAY 2/11-1

Paraffinic hydrocarbons extracted  
from Pleistocene-Miocene shales

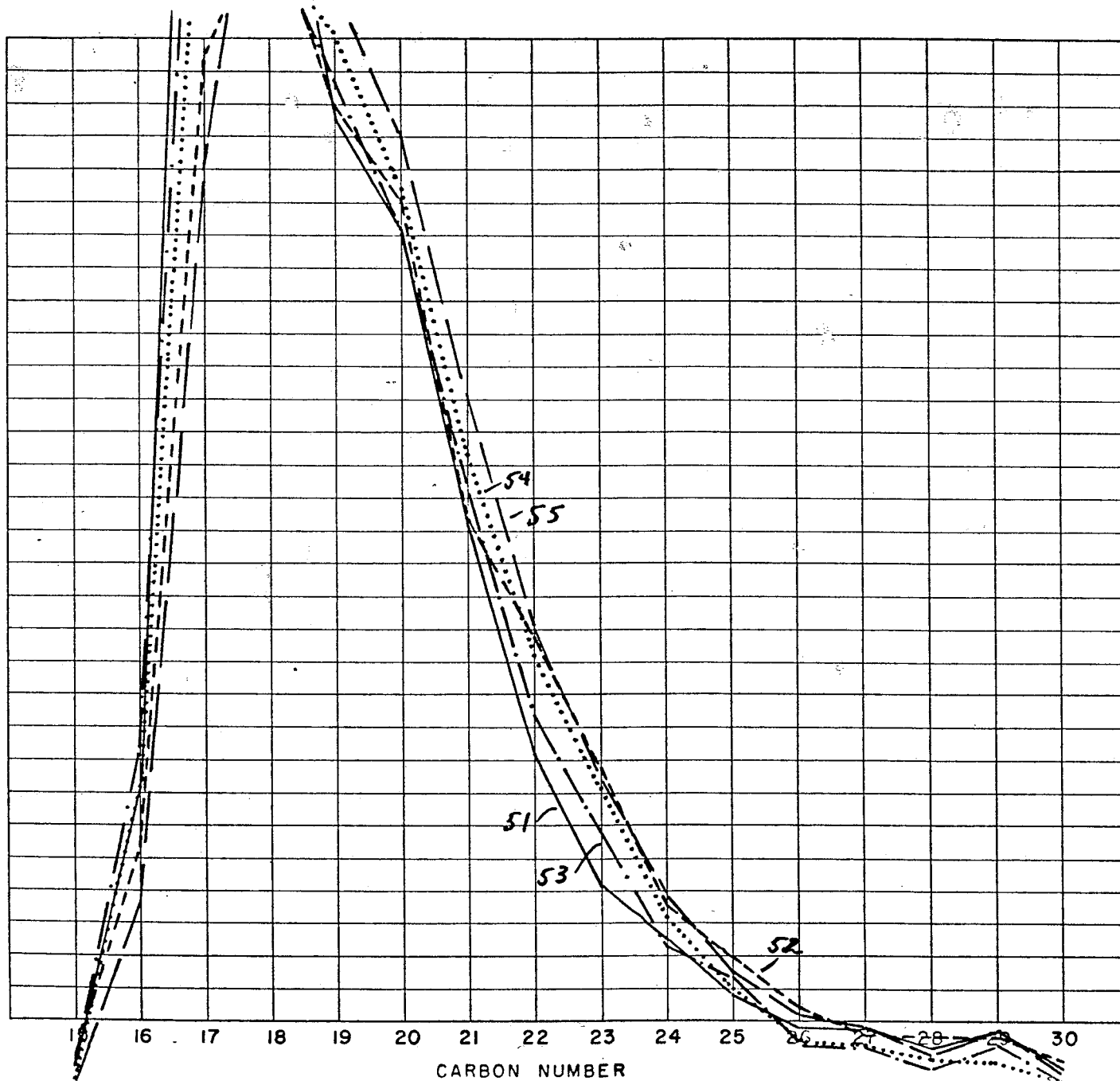
ANO 45, 47-50 diesel oil indicated  
by dominance of > C<sub>24</sub> paraffins

ANO 46 contribution of indigenous  
immature paraffins shown by  
slight odd-carbon preference  
in C<sub>24</sub>-C<sub>30</sub> range.

TECHNICAL SERVICE 796400  
AREA North Sea Tertiary Basin  
DATE APR 13 1971 FIGURE 1

RESEARCH CENTER

PER CENT



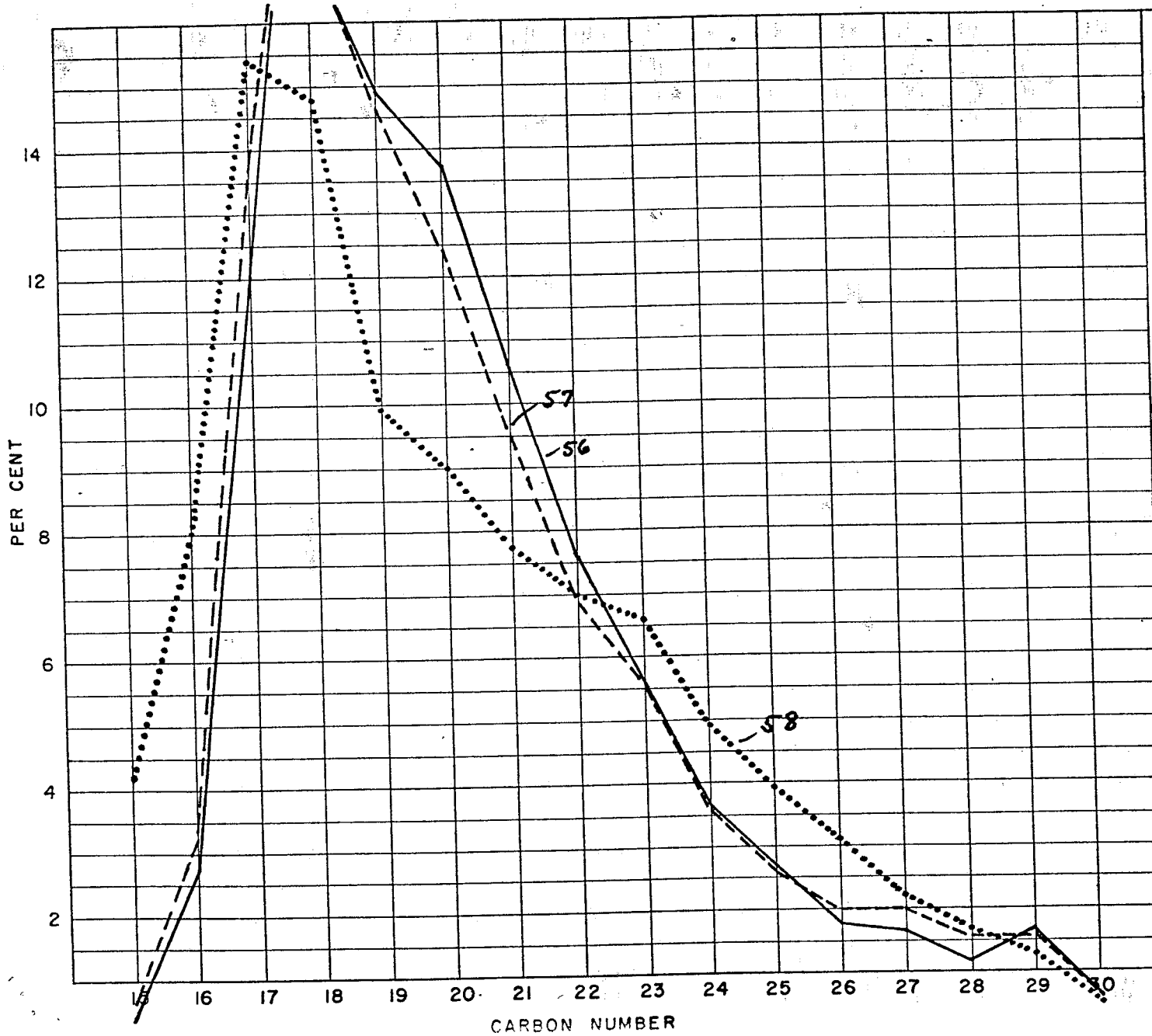
OIL  ROCK EXTRACT   
HEAVY HYDROCARBON  
DISTRIBUTION

AMOCO NORWAY 2/11-1

Paraffinic hydrocarbons extracted  
from Oligocene through Eocene shales

ANO 51, 53, and 55 contain a minor  
contribution of indigenous,  
slightly immature oil.

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AREA North Sea Tertiary Basin



OIL  ROCK EXTRACT   
 HEAVY HYDROCARBON  
 DISTRIBUTION

AMOCO NORWAY 2/11-1

Paraffinic hydrocarbons extracted from Paleocene shales

ANO 56, 57 contain a significant contribution of indigenous hydrocarbons

ANO-58 - This pattern is nearly identical with the crude oil produced from the Cretaceous at 8680-8696'. A DST at 8510-45' recovered 562' of gas and oil cut mud.

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