.3 4-41 2/5-1 Lwr Cret & 2/11-1 Uppr Jur. (Kimm) TS.82.69

AMOCO PRODUCTION COMPANY
RESEARCH CENTER

SOURCE ROCK EVALUATION

- Amoco Norway 2/5-1 & 2/11-1 wells, North Sea -

Geochemistry Group

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1-20-72

INTRODUCTION

Source rock analyses have been completed on 34 cuttings samples from the Amoco Norway 2/5-1 and Amoco Norway 2/11-1 wells. The purpose of this study was to evaluate the Lower Cretaceous and Upper Jurassic shales as possible source beds for the petroleum in the Cretaceous and Danian reservoirs of the North Sea Tertiary basin. Previous technical service reports (T.S. 7963CC and 7964CC) had evaluated the Tertiary shales in these wells, and they were found to be capable of generating gas or gas condensate type hydrocarbons.

CONTAMINATION

Although the samples are described as washed cuttings (letter Soule/Walton, 9-27-71), they are all heavily contaminated by oil from the drilling mud system. The Jurassic section in the 2/11-1 well was drilled with an oil base mud and the samples reeked of hydrocarbons. The data indicate that the shales are virtually saturated with diesel oil (Table 1). Chromatographic analysis indicates that diesel oil is the contaminant in the 2/5-1 well also (Figure 1). A different type contamination is present in the Lower Cretaceous samples in the 2/11-1, because the extracted hydrocarbons are similar to the crude oil recovered from the Cretaceous pay between 8624 and 8696 feet (Figure 2). This oil may have entered the mud system while drilling the pay section or during a formation test.

Because of the contamination, the analytical data have varying degrees of reliability. Total organic carbon is not reported because it is strongly affected by the extractable contamination; however, the non-extractable organic carbon is a reliable indicator of the source rock quality. Extracts are obviously inflated by contamination and are unreliable. Elemental analyses on the 2/5-1 were totally unreliable, and those from the Jurassic of 2/11-1 provide some useful data. Difficulty was encountered previously when treating the Jurassic outcrop samples from England (T.S. 8207C).

CONCLUSIONS

1) Based on the weight percent organic carbon, the Lower Cretaceous shales have poor to fair source quality ratings, whereas the Upper Jurassic shales generally have good to very good source quality.
2) Abundant hydrogen in the Jurassic organic matter in the 2/11-1 well, 6.4-8.7 percent, indicates a high convertibility to oil. Therefore, the Jurassic appears to contain PROBABLY EFFECTIVE source beds for oil. Despite the highly variable, and unreliable, elemental carbon values which preclude diagenesis determinations, time-temperature relations indicate that the Cretaceous and Jurassic shales should be equivalent to peak or past peak generation.
3) The Jurassic section appears to contain the principal source beds for the oil in the North Sea Tertiary basin.

RECOMMENDATION

Additional samples should be analyzed in order to obtain more reliable source rock data. Washed cuttings of Lower Cretaceous and Upper Jurassic shales in the Phillips Norway 2/7-1x well have been submitted for paleontologic age dating. We recommend that a suite of samples be selected for source rock evaluation. In particular, we would seek to correlate the indigenous extracts with the accumulated oils.

Roger L. Ames

RLA:glj

OFFICE Amoco Europe AREA North Sea

AUTHORIZED BY K. D. Soule DATE 10-11-71

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SOURCE ROCK EVALUATIONS

STATE (PROVINCE) COUNTY WELL LOCATION Amoco Norway 2/5-1

SAMPLE NUMBER	SAMPLE TYPE	SAMPLE QUALITY	FORMATION	LITHOLOGY	DEPTH (ft)	INSOLUBLE RESIDUE %	ORGANIC CARBON WT. %	EXTRACTABLE ORGANIC Bbl/ACRE FT.	EXTRACT. HYDROCARBON Bbl/ACRE FT.	EXTRACT. ORG. / TOTAL ORG.	RATING
ANO-86	Cut-tings	poor	Lower Cretaceous	gry arg. ls.	11,930-12,020 90'	40.7	0.5	209.5	134.6	0.60*	poor
-87	"	"	"	"	12,030-12,120 90'	49.9	1.1	233.1	162.1	0.45*	good
-88	"	"	"	"	12,130-12,220 90'	44.0	0.6	250.4	187.2	0.60*	fair
-89	"	"	"	"	12,240-12,320 80'	34.8	0.5	181.2	105.6	0.60*	poor
-90	"	"	"	gry calc. sh.	12,330-12,420 90'	53.9	0.6	230.5	191.8	0.61*	fair
-91	"	"	"	"	12,430-12,520 90'	56.3	0.6	249.0	164.8	0.60*	"
-92	"	"	Upper Jurassic	"	12,530-12,620 90'	58.7	0.7	158.9	116.1	0.48*	"
-93	"	"	"	"	12,630-12,720 90'	60.6	0.8	165.2	118.4	0.43*	"
-94	"	"	"	blk calc. sh.	12,730-12,820 90'	66.8	1.2	189.7	122.0	0.38*	good
-95	"	"	"	"	12,830-12,920 90'	73.8	2.3	110.7	77.9	0.16*	v. good
-96	"	"	"	"	12,930-13,030 100	66.8	1.2	249.2	150.4	0.45*	good

Nonextractable

MARKS:

*All samples are strongly contaminated by diesel oil used in the drilling mud. All of the extracts consist mostly of diesel oil.

Logging temp. 258°F @ 13,000'
DST temp. 261°F @ 10,200'

ANALYST J. G. L. Williams DATE JAN

TABLE

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TECHNICAL SERVICE NUMBER 8269CC

STATE (PROVINCE) COUNTY WELL LOCATION Amoco Norway 2/11-1

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SOURCE ROCK EVALUATIONS

SAMPLE NUMBER	SAMPLE TYPE	SAMPLE QUALITY	FORMATION	LITHOLOGY	DEPTH (ft)	INSOLUBLE RESIDUE %	Nonextractable ORGANIC CARBON WT. %	EXTRACTABLE ORGANIC Bbl/ACRE FT.	EXTRACT. HYDROCARBON Bbl/ACRE FT.	EXTRACT. ORG. / TOTAL ORG.	RATING
ANO-97	Cut-tings	poor	(Aptian-Albian) Lower Cretaceous	gry arg. ls.	9,520	40.5	0.3	48.7	27.8	0.38*	nonsource
-98	"	"	(Hauterivian-Barremian) L.Cret.	gry calc. sh.	9,720	67.4	0.6	48.5	33.2	0.24*	fair
-99	"	"	"	gry arg. ls.	9,920	40.8	0.5	70.4	41.9	0.33*	poor
-100	"	"	"	gry calc. sh.	10,120	56.5	0.4	46.7	30.5	0.32*	"
-101	"	"	"	"	10,320	51.7	0.4	64.3	36.3	0.37*	"
-102	"	"	(Berriasian-Val-anginian) L.Cret.	"	10,520	54.7	0.5	61.1	38.4	0.31*	"
-103	"	"	"	"	10,720	75.2	0.6	62.3	41.4	0.28*	fair
-104	"	"	"	"	10,920	73.5	0.6	49.1	32.8	0.24*	"
-105	"	"	"	"	11,120	66.5	0.8	42.4	30.5	0.17*	"
-106	"	"	"	"	11,320	69.5	0.6	34.9	21.7	0.18*	"
-107	"	"	(Tithonian) Upper Jurassic	gry arg. ls.	11,510	38.1	0.5	979.0	805.9	0.88**	poor
-108	"	"	(Kimmeridgian) Upper Jurassic	blk sh.	11,705	76.1	4.2	2034.1	1584.4	0.65**	v. good
-109	"	"	"	"	12,210	75.5	4.6	2459.8	1962.1	0.67**	"
-110	"	"	"	"	12,360	67.3	3.6	2819.4	2313.8	0.74**	"
-111	"	"	"	"	12,760	65.7	3.4	3828.8	3120.3	0.81**	"

REMARKS:

*All samples contaminated by oil similar to Torfeld-Ekofish oils. ?

**Invert oil mud system used below 11,320 ft. Samples are virtually saturated with oil from the drilling mud. The extracts consist mostly of diesel and crude oil.

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TABLE

BHT - 266°F @ 15,084'.

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TECHNICAL SERVICE NUMBER 8269CC

STATE (PROVINCE) COUNTY WELL LOCATION Amoco Norway 2/11-1

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SOURCE ROCK EVALUATIONS

SAMPLE NUMBER	SAMPLE TYPE	SAMPLE QUALITY	FORMATION	LITHOLOGY	DEPTH (ft.)	INSOLUBLE RESIDUE %	Nonextractable ORGANIC CARBON WT. %	EXTRACTABLE ORGANIC Bbl/ACRE FT.	EXTRACT. HYDROCARBON Bbl/ACRE FT.	EXTRACT. ORG. / TOTAL ORG.	RATING
ANO-112	Cut-tings	poor	(Kimmeridgian) Upper Jurassic	blk sh.	12,960	65.8	3.1	2892.5	2303.9	0.78**	v. good
-113	"	"	"	"	13,160	70.0	3.0	3032.4	2417.6	0.80**	"
-114	"	"	"	"	13,360	68.5	2.2	924.6	734.8	0.61**	"
-115	"	"	"	"	13,760	69.9	2.8	2979.6	2605.7	0.80**	"
-116	"	"	"	"	13,960	63.9	2.4	2115.2	1808.1	0.77**	"
-117	"	"	"	"	14,260	63.3	1.7	3824.1	3279.4	0.90**	"
-118	"	"	"	"	14,660	64.0	2.0	2942.7	2535.3	0.85**	"
-119	"	"	"	"	15,060	62.5	1.9	2525.0	2141.4	0.84**	"

REMARKS:

**See footnote, Table 1(b).

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TABLE

FICE Amoco Europe AREA North Sea

THORIZED BY K. D. Soule DATE 1[illegible]11-71

CHNICAL SERVICE NUMBER 8269CC

ATE (PROVINCE) COUNTY WELL LOCATION Amoco Norway 2/11-1

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ORGANIC DIAGENESIS DATA

SAMPLE			FORMATION	LITHOLOGY	DEPTH (ft)	ELEMENTAL ANALYSIS, PERCENT				RATIO H/C	STATE OF DIAGENESIS	HYDROCAR
MBER	TYPE	QUALITY				CARBON	HYDROGEN	OXYGEN	NITROGEN			% HYDROGE
0-108	Cut-tings	poor	(Kimmeridge) Upper Jurassic	blk sh.	11,705	82.2	8.7	6.8	2.3	1.27	*	oil
-109	"	"	"	"	12,210	83.9	6.8	6.8	2.5	0.98	*	"
-110	"	"	"	"	12,360	81.0	7.8	8.9	2.2	1.16	*	"
-111	"	"	"	"	12,760	81.0	7.9	8.9	2.2	1.18	*	"
-112	"	"	"	"	12,960	79.4	7.8	10.5	2.3	1.18	*	"
-113	"	"	"	"	13,160	67.2	6.5	18.5	1.9	1.16	*	"
-114	"	"	"	"	13,360	71.8	6.5	19.7	1.8	1.08	*	"
-115	"	"	"	"	13,760	74.0	6.6	17.6	1.8	1.07	*	"
-117	"	"	"	"	14,260	73.2	6.6	18.6	1.7	1.08	*	"
-118	"	"	"	"	14,660	75.8	6.5	16.0	1.7	1.02	*	"
-119	"	"	"	"	15,060	79.3	6.5	12.0	2.2	0.99	*	"

MARKS:

*These samples were very difficult to process, and the resulting variable oxygen values obscure the state of diagenesis. However, the maximum carbonization (minimum oxygen content) is equivalent to peak hydrocarbon generation, which indicates that these shales are PROBABLY EFFECTIVE oil source beds.

ANALYST Roque E. LaPlante DATE JAN

TABLE 2

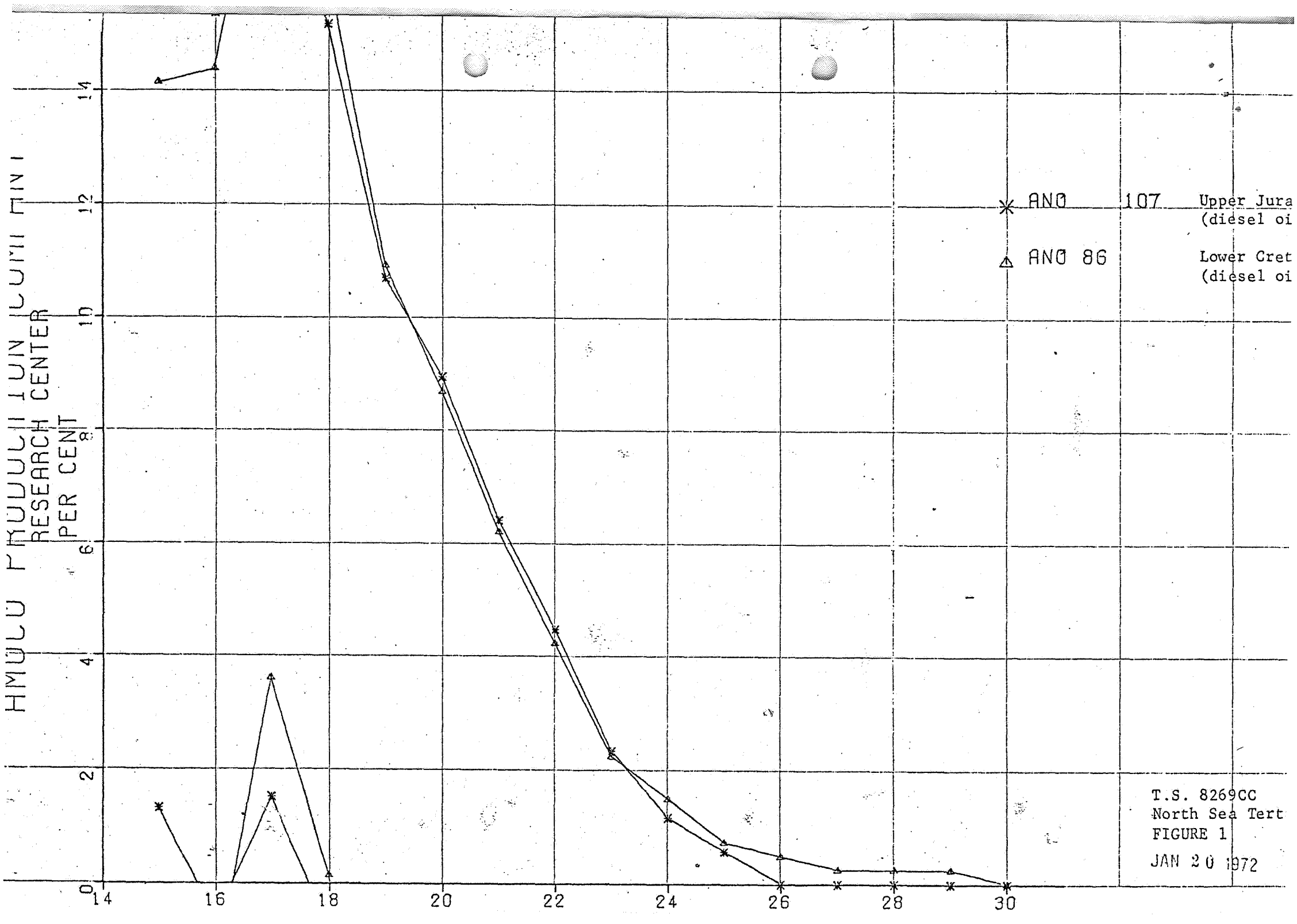
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FIGURE 1
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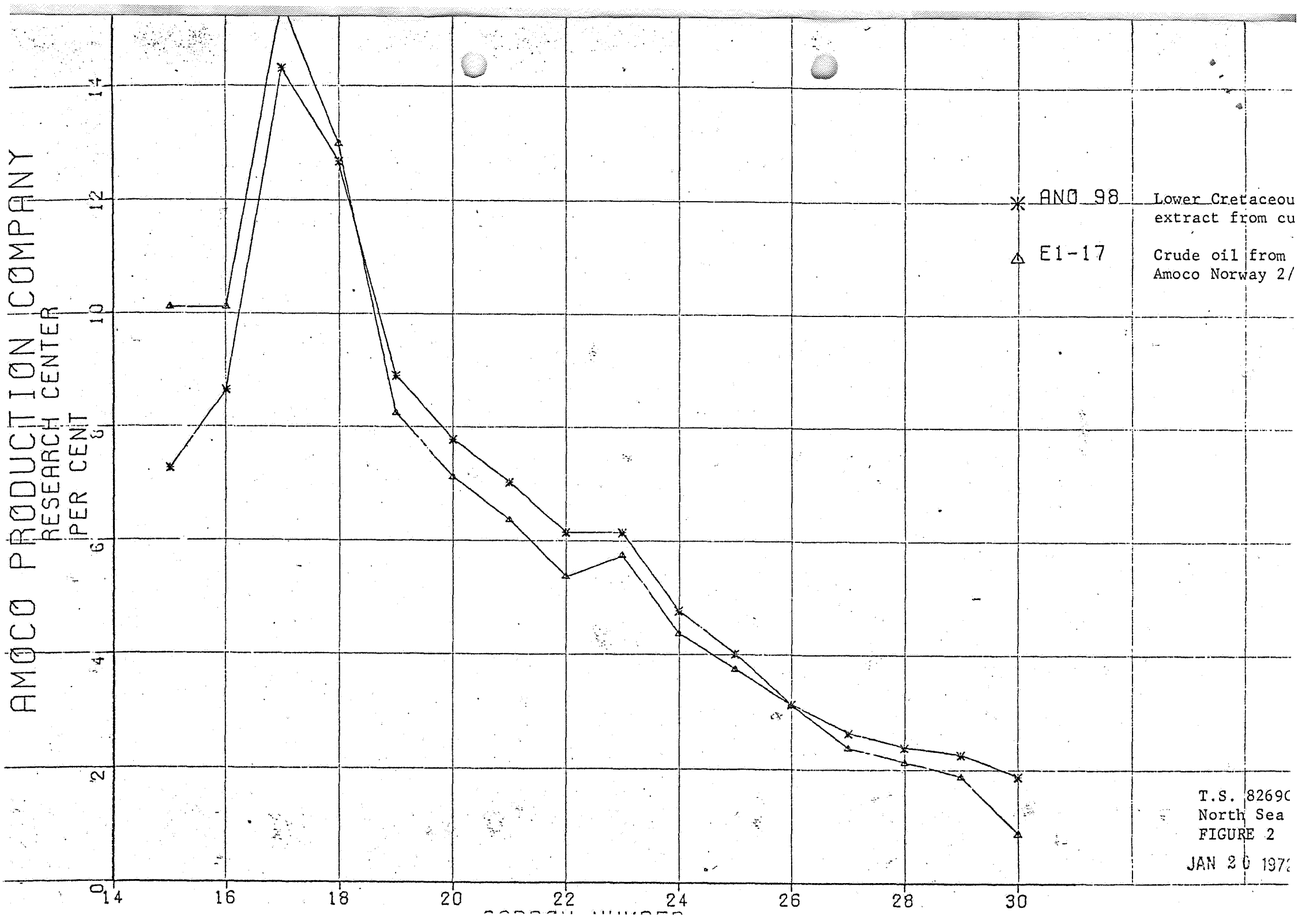
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FIGURE 2
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