

ID/OLJE
00070 -- 7.1.71
SAKSB:
ARKIV:

BA 71-2399-1

NORSKE MURPHY OIL COMPANY

Well 9/10-1
Offshore Norway

COMPLETION REPORT

C O N T E N T S

<u>SECTION</u>		<u>PAGE NO.</u>
I	SUMMARY	1
II	DRILLING HISTORY	
	Dates of Operations	1
	Details of Operations	1
	Mud Programme	2
	Drilling Problems	2
	Logging Surface Hole & Loss of Fish	3
	Weather	3
	Coring	3
	Testing	3
	Plugging & Abandoning	3
III	DAILY DRILLING SUMMARY	4
IV	CASING & CEMENTING RECORD	13
V	BIT RECORD	14
VI	MUD SUMMARY & MATERIAL CONSUMPTION	15
VII	SEA BED CLEARANCE REPORT	16
VIII	GEOLOGY	
	Geological Objectives	20
	Stratigraphy	20
	Lithology	20
	Structure	21
	Hydrocarbon Shows	21
	Logging Program	22
	Analysis of Electrical Logs	23
	Drill Stem Tests & Cores	24
	Core Analysis	26
	Paleontological Final Report	27
	Paleontological Summary	28
	Geological History	29
	Correlations	30
	Zonation	31

I. SUMMARY

WELL: NORSKE Murphy 9/10-1

CLASSIFICATION: Wildcat

AREA: Licence 022 block 9/10 Norwegian North Sea

CONTRACTOR & RIG: Canan - "Gulftide"

LOCATION: Latitude 57° 00' 04.021" North
 Longitude 04° 00' 33.521" East

WATER DEPTH: 194 feet to mudline

ROTARY TABLE ELEVATION: 96 feet above mean sea level

OBJECTIVES: Oligocene sands (stratigraphic test)
 Danian limestone ("L" structure test)

RESULTS: Dry hole

STATUS: Plugged and abandoned

TOTAL DEPTH: 7233 feet

II. DRILLING HISTORY

Dates of Operations

START RIG CONTRACT: 29th August 1970, 17.50 hours

SPUD DATE: 30th August 1970, 16.00 hours

AT TOTAL DEPTH: 14th September 1970

PLUGGED & ABANDONED: 18th September 1970

RELEASED RIG: 19th September 1970, 04.00 hours

Details of Operations

CASING PROGRAM: 36" conductor set at 405 feet R.T. in 38" hole. Driven with D-44 hammer from 399 feet to 405 feet.

20" Casing set at 814.5 feet R.T. in 26" hole and cemented with 1000 sacks of class "B" 8% gel cement and tailed in with 300 sacks of class "B" neat cement. Due to lack of returns on job an additional 300 sacks of class "B" neat was spotted in the 20" x 36" annulus below 332 feet.

13 $\frac{3}{8}$ " casing set at 3149.78 feet R.T. in 17 $\frac{1}{2}$ " hole and cemented with 1600 sacks of class "B" 8% gel with 3 of 1% HRT and tailed in with 300 sacks of class "B" neat cement.

Mud Programme

<u>Depth</u>	<u>Weight</u>	<u>Viscosity</u>	<u>Water Loss</u>
0-825'	8.7	41	N.C.
825-3125	10.7	40	N.C.-10
3125-3160	10.5	40	7.2
3160-3445	11.5	54	6.4
3445-6390	12.4	52	7.0
6390-7233	12.6	48	7.0

A 38" hole was drilled to 470' with sea water. After spotting a gel slurry, 36" drive pipe was set at 405'.

Drilling was continued with a 26" bit to 724' using sea water where lost circulation became excessive. Attempts with a 50 barrel L.C.M. slurry and a 300 sack cement plug were unsuccessful in sealing off the thief zone. The drilling was continued "blind" to 825' where a 450 sack gel slurry was spotted and 20" casing run to 814' and cemented.

After installing 20" b.o.p., 17½" hole was drilled to 3125' using a 10.7lb gel mud. Three attempts were made to log this surface section but hole bridging conditions occurring at 914 feet and 1500 feet would not permit deeper penetration. After the second logging attempt a fish was lost in the hole. (Refer to section Logging Surface Hole and Loss of Fish for details). Two attempts to recover the fish were unsuccessful. Went into the hole with the bit, tagged bottom, and then drilled 15 feet with no obstruction. The hole was conditioned and logged from 1500 feet to 290 feet after failing to reach bottom with the tool again. Rigged up b.h.a. and went to bottom with the bit, cleaned out to 3140 feet, and drilled an additional 20 feet. The hole was reconditioned for running the surface string. The 13¾" casing was then run and set with no problems to a depth of 3149 feet.

Drilling continued from under the 13¾" casing to 7036' making 12½" hole. Shale and gumbo made necessary the maintenance of 12.4 to 12.5 lb/gal. mud to prevent hole problems. Considerable water was necessary to keep the viscosity and solids content within a reasonable level.

A 30' core was cut from 7036 feet to 7066 feet after which drilling continued with 12½" bit to 7233'. The pipe became stuck at the collars while making a connection. The freepoint was determined at 7190 feet. It was freed after spotting 50 bbl. of diesel oil mixed with Pipe Lax. No problems were encountered while logging at total depth after conditioning the hole. The hole remained stable for the entire 30 hour logging operation with only marginal fill-up.

Drilling Problems

Drilling 26" Hole: While drilling the 26" surface hole with sea water, loss of returns became excessive at about 724 feet. About 50 barrels of lost circulation material were spotted at 402 feet and a 300 sack plug was set over the suspected interval. The operation proved unsuccessful in restoring returns. Went into the hole with a bit, washed down to 724 feet and drilled to 825 feet without returns. Gelled mud was spotted and 20" casing was run to 814.5 feet without any incident.

Cementing 20" Pipe: After successfully running the 20" casing it was cemented with 1000 sacks of class "B" gelled cement and tailed in with 300 sacks of class "B" neat cement. No returns were received throughout the operation. Ran 2½" tubing to 332 feet in an attempt to fill the 20" x 36" annulus with sea-water. Could not establish returns. An additional 300 sacks of class "B" neat cement was pumped down the 20" x 36" annulus below 332 feet to cover the 20" string.

Logging Surface Hole
and Loss of Fish

After drilling 12½" hole to 3125 feet, the hole was conditioned in preparation to log. Schlumberger was commencing into the hole when the line became kinked presumably after encountering a bridge. The hole was reconditioned while Schlumberger repaired the line. Rigged up Schlumberger for run No. 2 and ran IES - GR to 914 feet where a bridge was encountered. Pulled up Schlumberger and started to make up the b.h.a. for reconditioning the hole when the bit sub was dropped into the hole although the hole-cover was in place. Went into the hole with 9½" overshot with a 16" skirt and could not get past 954 feet. A second attempt with overshot equipped with 11½" skirt did not recover the fish. It was then decided to go into the hole with a bit and tag bottom for the fish. Got to bottom but could not feel any obstruction. Drilled an additional 15 feet to ensure that the bit sub was not on bottom. The hole was again reconditioned for logging. Schlumberger rigged up and ran to 1500 feet again encountering a bridge.

After logging from 1500 feet to 290 feet, Schlumberger was rigged down and the hole was drilled to 3160 feet and conditioned to run 13¾" foregoing any additional attempts to complete the logging of the surface section at this juncture.

Weather

There was no shut-down due to the weather during this operation. Weather threatened at two critical points however. First, at the stage requiring the onloading of the long string pipe and supplies, and second, at the point of jacking down the rig for release for tow. In both instances it had subsided to acceptable levels for safe operation. A report of the weather conditions are given daily in the "Daily Drilling Summary" of this report.

Coring

A conventional core was taken from 7036 to 7066 feet with 100% recovery. Sidewall cores were taken at 30 selected intervals with a recovery of 21 cores. The results of these programs are tabulated and discussed in detail on pages 23-25 of this report

Testing

A complete assembly of testing equipment was available on board the barge, but no test operation was deemed necessary for the further evaluation of this well.

Plugging & Abandoning

The well was plugged as follows:

<u>Plug No.</u>	<u>Interval Plugged</u>	<u>No.Sacks</u>	<u>Type Plug</u>
1	7233 to 6400 feet	350	Class "B" 8% gel W/.4 of 1% HR7
2	4400 to 3200 feet	210 510	Class "B" neat on top Class "B" 8% gel W/.4 of 1% HR7 on bottom
3	Cement retainer-3115 feet	50 - 50	Class "B" neat on top 13¾" Cement retainer Class "B" neat squeezed below.
4	540 to 330 feet	150	Class "B" neat

All pipe and conductor was cut or backed off to facilitate no obstruction on the sea bed. An inspection by the diver confirmed that the sea bed was clean. The 36" conductor stub is 6 feet below the mudline.

III. DAILY DRILLING SUMMARY

Report Date

Total Depth

Summary of Operations

1970
Aug.30

-

Rig in preparation for Murphy's account on August 29 at 17.50 hours. Legs were raised to No.1 tow position. Tugs Yorkshireman and Hullman secure at 22.30 and 00.30 hours, respectively.

<u>Tugs</u>	<u>Arrival Time</u>
Welshman	10.00 hrs on Aug. 29
Superman	16.00 hrs on Aug. 29
Yorkshireman	22.00 hrs on Aug. 29
Hullman	24.00 hrs on Aug. 29

Weather:
Sea 2-3' SW Wind 12 m.p.h. SW
46° F - cloudy

Aug.31

470'

Approached location and lowered legs. Jacked barge to 55' air gap. Leg penetration 3'6" - 5'6" - 3'0" - 4'6". Water depth 194 feet & R.K.B. 96 feet above mean sea level.

Location Coordinates:

57° 00' 04.021" North
04° 00' 33.521" East

Note:
Rig positioned 42.5 meters @ .052°
From intended location.

All tugs released at 12.00 hours
August 30th

Picked up B.H.A. and went in hole with 38" hole opener. Tagged bottom at 290 feet R.K.B. Drilled 38" hole with sea water to 470 feet, spotted Hi-Vis mud and rigged to run 36" casing Spud date at 16.00 hours on 30th August.

Weather:
Sea 6-9' SW Wind 25 m.p.h. SW
59° F, cloudy - rain

Report Date

Total Depth

Summary of Operations

Sept. 1

470'

Welded and ran 10 joints of 36' drive pipe with a 36" Halliburton-Flat (3') to 399'. Rigged D-44 hammer driver and drove to 405 feet. Secured 36", cut off, and installed flow-line. Penetration below sea bed was 115 feet.

Casing detail:

<u>Jt.</u>		<u>Jt.</u>	
<u>No.</u>	<u>Feet</u>	<u>No.</u>	<u>Feet</u>
1	47.10' 1½" wall	11	26.92 1" wall
2	49.07' 1" wall	12	37.92 1" wall
3	48.84' 1" wall	13	48.85 1" wall
4	40.00' 1½" wall	113.69' Total	
5	37.85' 1½" wall	Additional on location	
6	49.90' 1" wall		
7	48.68' 1" wall		
8	40.32' 1" wall		
9	38.05' 1" wall		
10	39.70' 1" wall		
439.38' Total			

Casing Dimension & Weights:

<u>Size</u>	<u>O.D.</u>	<u>I.d.</u>	<u>Weight</u>
1" wall	36"	34"	360 lb/ft.
1½" wall	36"	33½"	456 lb/ft.

Weather:

Sea 11' SW Wind 30 m.p.h. SW
56° F - partly cloudy

Sept. 2

825'

Rigged up BHA and went into the hole with 26" Bit. Drilled to 724 feet and lost returns. Mixed and spotted 50 barrels of L.C.M. at 402 feet. Pulled out of the hole and went back in with drill-pipe. Mixed and spotted 300 sacks of class "B" neat + 2% CaCl₂. Waited on cement six hours. Still could not fill hole. Went in the hole with the bit and drilled and washed down to 724 feet with no resistance on the plug. Drilled without returns to 825 feet, and then spotted 450 barrels of Hi-Vis mud. Pulled out of hole to run 20" casing.

Weather:

Sea 6' SW Wind 10 m.p.h. SW
55° F - partly cloudy

Report
Date

Total Depth

Summary of Operations

Sept. 3

825'

Ran 20 Jts. of 94 lb. x-52 Vetco connector casing to 814.5 feet. Cemented 20" with 1000 sacks of class "B" 8% gel and tailed in with 300 sacks of class "B" neat cement. Received no returns. Ran 2 $\frac{7}{8}$ " tubing to 332 feet in an attempt to fill the 20" x 36" annulus with sea water. No returns. Cemented 36" x 20" annulus with 300 sacks of class "B" cement. Secured 36" casing, cut off and laid down 20" and 36" casing. Installed 48" baseplate and welded on 20" head. Tested head to 1500 psi and nipped up 20" Hydril.

Casing Detail in Running Order:

<u>No.</u>		<u>Length</u>
1	- shoe	2.00'
12 jts.-	20" casing	501.03'
1	- Cameron mudline suspension	6.51'
8 jts	- 20" casing	309.96'
		819.50'
	Less excess casing	5.00'
	Total setting depth	814.50'

Mudline hanger at 307.30' R.T., 17.3' below mudline.

Weather:

Sea 10' SW Wind 18 mph SW
58 F - rain

Sept. 4

2103'

Picked up BHA and went into hole with 17 $\frac{1}{2}$ " bit. Tagged cement at 762 feet. Drilled cement and 20" shoe. Drilling at 2103 feet.

Mud:

Mud wt. 9.6 lb./gal
vis 38
W.L. 35
pH 10
salt 22,000 ppm

Weather:

Seas 16-22' NW Wind 26 mph WNW
50 F. - partly cloudy

Report Date Total Depth

Sept. 5 3125' Drilled to 3125', circulated and conditioned hole. Made a short trip into the 20" and then went back to recondition in preparation to log with Schlumberger. Rigged up Schlumberger and began running into the hole with tools. Schlumberger kinked the line while going into the hole. Went into the hole with drill pipe and bit to circulate while Schlumberger repair the line.

Weather:
Seas 8-10' NNW Wind 22 mph NNW
52°F - cloudy

Sept. 6 3140' Circulated and conditioned hole for log run No. 2. Rigged up Schlumberger and ran I.E.S. - Gamma Ray to 914 feet where a bridge was encountered. Rigged down Schlumberger and prepared B.H.A. for conditioning the hole. The bit sub was lost into the hole while making up the assembly. Went into the hole with 9½" overshot with 16" skirt. Could not get below 954 feet. Pulled out of the hole and rigged up 11½" skirt. Went to bottom and pulled out of the hole. Still no fish. Went in hole with bit and tagged bottom. Drilled 15 feet to ensure sub was not on bottom. Circulated and conditioned hole for logging. Logged with I.E.S.-GR from 1500 feet to 290 feet. Could not reach bottom. Rigged up BHA to run to bottom to condition hole in preparation to run 13¾" casing.

Weather:
Max. seas 12-15' NNW Wind 35 mph NNW
51° - cloudy

Sept. 7 3160' Went to bottom with the bit. Hit bridge at 1500 feet. Cleaned out to 3140 feet then drilled to 3160 feet to assure clean bottom and conditioned hole. Pulled out of hole to run 13¾". Rigged up and ran 74 joints of 68 lb/ft J-55 ST & C 8rd. casing to 3149.7 feet. Cemented 13¾" casing with 1600 sacks of class "B" 8% gel W/.3 of 1% HR7. Tailed in with 300 sacks of class "B" neat. Bumped plug after 460 barrels of mud with 1500 psi pressure. Held OK., good circulation throughout job.

Rigged up and ran 1½" tubing to the top of the 13¾" hanger at 365.65' down the 20" x 13¾" annulus. Cleaned with sea water and spotted 50 barrels of fresh water with 5 lb/bbl. of sodium chromate. Present operation nipling down 20" B.O.P. to set slips and cut casing.

Casing Detail

1 - 13¾" shoe	2.00'
2 jts. - 13¾" casing	76.25'
1 - 13¾" float collar	1.60'
72 jts. 13¾" casing	2752.76'
1 - 13¾" pup joint	8.86'
1 - Cameron hanger assembly below	.90'
1 - Cameron hanger assembly above	2.35'
1 - 13¾" pup joint	9.05'
8 jts. - 13¾" casing	302.36'
	<u>3156.18'</u>
Less excess	6.40'
Total run	<u>3149.78'</u> R.T.

Weather:
Seas 5-6' NNE Wind 5 mph NNE
Max. seas 16' Maximum wind 40 mph
52°F - partly cloudy

Report Date

Total Depth

Summary of Operations

Sept. 8

3256'

Cleaned 13 $\frac{3}{8}$ " casing, installed bushing, packed and tested to 2000 psi. Nipped up 16 $\frac{1}{2}$ " B.O.P. and tested.

Drilled plug and float collar and tested casing to 2500 psi. Drilled 76' of cement and shoe. Present operation drilling 12 $\frac{1}{4}$ " hole at 3256 feet.

Mud:

Mud wt	11.5 lb/gal
Vis.	54
W.L.	6.4
pH	11.0
Salt	23,000 ppm
Oil	3%

Weather:

Sea 8-10' Wind 18-20 mph
56° F - cloudy

Sept. 9

4145'

Present operation drilling. Made 889' in 17.5 hours.

Mud:

Mud wt.	12.3 lb/gal
Vis.	47
W.L.	8.4
pH	11.5
Oil	4%
Salt	22,000
Solids	44

Weather:

Sea 8-10' Wind 15-17 mph SSW
56° F - partly cloudy

Sept. 10

4880'

Present operation drilling

Mud:

Mud wt	12.4 lb/gal
Vis	43
W.L.	7.2
pH	12
Oil	4%
Solids	21
Salt	21,000 ppm

Weather:

Sea 15-18' SW Wind 40-48 mph SW
53° F - partly cloudy

Sept. 11

5526'

Present operation drilling. Made 646' in 21 hours.

Mud:

Mud wt	12.4 lb/gal
Vis	63
W.L.	7.2
pH	11.0
Oil	3%
Solids	23
Salt	21,000 ppm

Weather:

Sea 16-18' SW Wind 18-26 mph SW
Max. sea 22' Max. wind 60 mph
50° F - partly cloudy

Report Date

Total Depth

Summary of Operations

Sept. 12

6052'

Present operation drilling. Made 526 feet in 20 hours.

Mud:

Mud wt.	12.3 lb/gal
Vis	52
W.L.	6.0
pH	12.0
Oil	3%
Solids	21
Salt	21,000 ppm

Weather:

Sea 4-6' W Wind 10 mph W
56° F - partly cloudy

Sept. 13

6600'

Present operation drilling. Made 548' in 19.5 hours.

Mud:

Mud wt	12.4 lb/gal
Vis	47
W.L.	4.9
pH	12
Oil	2%
Solids	19
Salt	22,000 ppm

Weather:

Sea 2-3' NW Wind 8 mph NW
53° F - partly cloudy

Sept. 14

7036'

Drilling to 7036', found core point. Pulled out of the hole. Present operation is rigging up core barrel.

Mud:

Mud wt.	12.6 lb/gal
Vis	53
W.L.	8
pH	7
Oil	2%
Solids	22
Salt	22,000 ppm

Weather:

Seas 1-2' N Wind 2-3 mph N
53° F - partly cloudy

Sept. 15

7233'

Went into hole with core barrel. Cut core from 7036 to 7066 feet. Recovered 30 feet. Reamed hole from 7036 to 7066 feet & drilled to 7233 feet. Pipe stuck at 7190 feet. Spotted 50 barrels of diesel oil with Pipe Lax and pulled up free. Conditioned hole & pulled pipe in preparation to run logs. Present operation rigging Schlumberger.

Mud:

Mud wt.	12.7 lb/gal
Vis.	49
W.L.	6
pH	12
Oil	2%
Solids	20
Salt	22,500 ppm

Weather:

Seas 3' SW Wind 10 mph SW
53° F - clear

Report Date

Total Depth

Summary of Operations

Sept.
16

7233'

Completed run with I.E.S. at 7229' feet. Ran BHC sonic log - Gamma Ray. Went in hole with side-wall core gun No. 1. Shot 15 cores; recovered 9 (see side-wall core description). Then ran Microlaterolog-Microlog with caliper, Gamma Ray Neutron, and Continuous Dipmeter. Ran into hole with SWC gun No. 2. Recovered 12 cores out of 16 shots. Present operation running velocity survey.

<u>Log</u>	<u>Running Time</u>	<u>Schlumberger Interval Logge</u>
IES	3.0 hours	3163 to 7228'
Cal BHC Sonic-GR	5.0 hours	3160 to 7216'
MLL - ML - Cal	-	4100 to 4200'
MLL - ML - Cal	-	5400 to 5560'
MLL - ML - Cal	3.0 hours	6850 to 7230'
GR - N	3.0 hours	1400 to 4200'
Dipmeter	3.5 hours	3160 to 7222'
Velocity Survey	6.0 hours	12 shot-points

Weather:

Seas 2-3' N Wind 10 mph N
58° F - cloudy

Sept.
17

7233'
(PBD 3184')

Completed Velocity Survey and rigged down Schlumberger. Went into hole and set 350 sack class "B" 8% gel W/.4 of 1% HR7 cement plug No. 1 from 7233 to 6400 feet. Set plug No. 2 from 4400 to 3200 feet in two stages with 210 sacks class "B" neat followed by 510 sacks of class "B" 8% gel W/.4 of 1% HR7. Waited on cement and then tagged plug at 3184 feet.

Weather:

Seas 3-4' SW Wind 14 mph SW
55 F - occasional clouds

Sept. 18

7233'
(PBD 330')

Went into the hole and set 13 $\frac{3}{8}$ " cement retainer at 3115 feet. Broke formation down with 1500 psi and squeezed 50 sacks of class "B" neat cement below retainer and spotted 50 sacks of class "B" neat cement on top of the retainer (plug No. 3). Set plug No. 4 from 540 feet to 330 feet with 150 sacks of neat cement. Nipped down B.O.P and cut 13 $\frac{3}{8}$ " casing at 313 feet. Backed off 20" at 307 feet.

Casing Recovery:

285' - 13 $\frac{3}{8}$ "
280' - 20"

Weather:

Seas 6-8' SW Wind 20 mph SW
56° F - clear

Report
Date

Total Depth

Summary of Operations

Sept. 19

7233.
(PBD 296')

Dressed cutting tool, and attempted to cut 36". First try unsuccessful. Re-dressed 42" knives and cut 36" at 296 feet. Pulled out of the hole with the cutting tools. Laid down 36" conductor pipe. Diver checked sea bed for obstructions. Sea bed was clear. Lowered drilling platform to 4 feet air gap and secured tugs Dan Bridle, Sealion and Welshman. Lowered platform into the water and assumed the No.1 tow position at which time, 04.00 hours September 19, the Gulftide was released to Phillips Petroleum Company's account.

Casing Recovery:

269 feet - 36"

Weather:

Seas 3-4' NNW Wind 7 mph NNW
Partly cloudy

Mud Data:

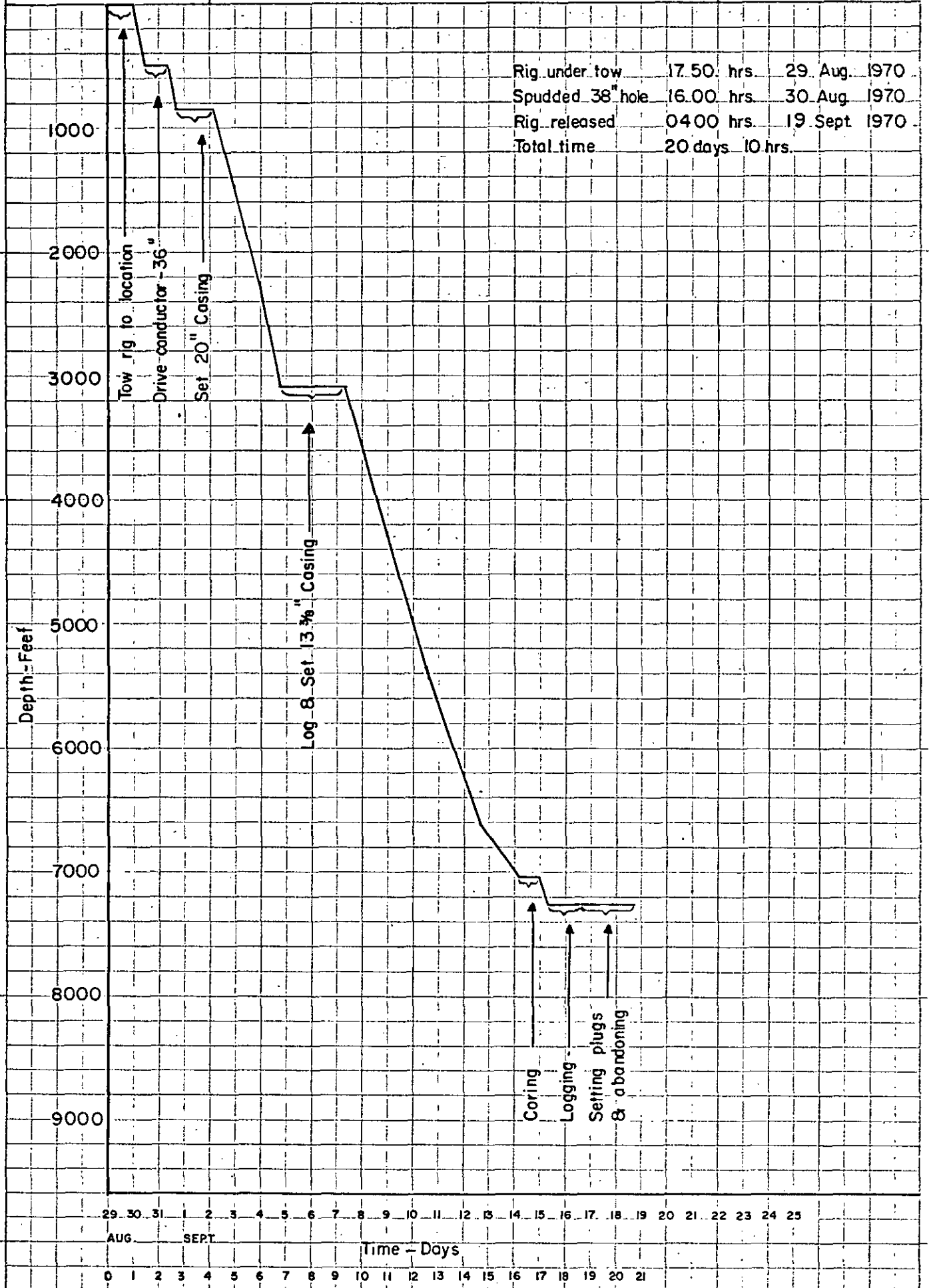
Estimated mud cost at \$40,000

Cost Data:

Estimated total cost	\$600,000
Estimated inventory increase	<u>\$50,000</u>
Total cash outlay 9/10-1	<u>\$650,000</u>

NORSKE MURPHY
 9/10-1 WELL
 OFFSHORE NORWAY
 DRILLING PROGRESS

R.A.G.
 Compl. Sept. 19, 1970
 7,233'



Rig under tow 17.50 hrs. 29 Aug. 1970
 Spudded 38" hole 16.00 hrs. 30 Aug. 1970
 Rig released 0400 hrs. 19 Sept. 1970
 Total time 20 days 10 hrs.

IV CASING AND CEMENTING RECORD

LOCATION: NORWEGIAN NORTH SEA

LEASE: 9/10

WELL NO. 1

AFE:

LOCATION COORDINATES:

Latitude 57° 00' 04.021 North
Longitude 04° 00' 33.521 East

ELEVATIONS:

RT. - 96 feet AMSL
Mudline hanger - 307.30 feet RKB
17.3 feet below ML

MUD COST:

\$39,604

WATER DEPTH:

194 feet

CASING

Date	Size	Weight (per ft.)	Grade	Setting Depth	No. Sacks	Type	CEMENT	Remarks
<u>1970</u> Aug. 31	36"	360 lb 456 lb	1" wall 1 1/4" wall	405 feet	-	-		Drilled to 470 Ft.R.T. with 38" hole opener & ran 36" to 399'. Drove to 405' W/D 44 hammer. No cement.
Sept. 2	20"	94 lb	X - 52 W/Vetco Type "L" RH. mod. Butt threads.	814.5 feet	1000 300 300	Class "B" W/8% gel. Class "B" neat. Class "B" neat.		Ran 2 1/2" tubing and cemented annulus (20" x 36") with an additional 300 sacks of neat cement. Sea water was used throughout job.
Sept. 6	13 3/8"	68 lb	J-55, ST & C 8rd. threads	3149.78 feet	1600 300	Class "B" 8% gel W/.3 of 1% HR7 class "B" neat		Drilled 17 1/4" hole to 3160 feet and ran casing. Cemented with 1600 sacks of gelled cement and tailed in with 300 sacks of neat cement. Good circulation throughout. Bumped plug with 1500 psi after displacing 460 barrels. Seawater was used throughout job. Fresh water was spotted in the 20' x 13 3/8" annulus from mudline to surface.

V. B I T R E C O R D

COUNTRY: North Sea FIELD: W.C. STATE: Norway SECTION: Well RANGE: 9/10-1 SPUD US: UNDER INTER: SEP SAND STRI

CONTRACTOR: ODECO/Rimrock Gulfride RIG NO.: LEASE: 9-10 WELL No.: 1 COMPANY: Norske Murphy TOOL PUSHER: Beall - Glaze

MAKE RIG: National TYPE: 1625 DE RIG POWER: Diesel Electric PUMP POWER: Diesel Electric BOILER'S NO. RTD. HP.: Nat. 1600 PUMP NO. 1: Nat. 1600 LINER: 7

DRILL PIPE: 4.1/2 TOOL JOINT TYPE: PH DRILL COLLARS: 9 1/2 - 8 1/4 O.D.: I.D.: 3 LENGTH: MUD TYPE: Sea Water-Speresence-XP-20 SALESMA: 7

Run No.	Size	Make	Type	Jet Size	Serial	Depth Out	Feet	Hours	Feet Accum. per Drlg. Hour	WT. 1000 Lbs.	RPM	Vertil- Cal Dev.	Pump Pres Sure	Pump Oper- Ation	SPM		WT.	MUD VIS.	W.L.	Dull:			REMARK		
															1	2				T	B	G		Other	
1	17 1/2	HTC R.R.	OSC 2AJ	1/2	95189	470	470	7 1/2	60.2	15	70/90	1/4	400	P	40	40	8.8	40	UNC	1	1	1	I		
	38	Sec. RR.	Hole Op- ener	5/8		470	470	7 1/2	60	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
2	26	HTC RR.	OSC3	Reg.	NZ955	825	355	8 1/2	41	20	90	3/4	600	P	50	50	9.3	38		1	1	1	I		
3	17 1/2	Reed	YT3A	1/2	676999	3160	2345	36	86	30	140	1/2	3000	P	58	58	10.3	35	14	4	4	4	I		
4	12 1/4	Reed	YT3A	1/2	NJN210	3445	285	4	71	25	160	1/2	3000	P	43	43	12.3	47	8.4	6	2	2	I		
5	12 1/4	Reed	YT1A	1/2	NGP616	4500	1055	23 1/2	44	20	180	3/4	3000	P	42	41	12.3	48	6.2	5	5	5	I		
6	12 1/4	Reed	ST3	15/32	MRT416	5526	1026	33	31	25	120	3/4	3000	P	38	38	12.4	63	7.2	6	5	5	I		
7	12 1/4	Reed	ST3	14/32	NJN103	6128	602	24 1/2	24	30	120		3000	P	34	34	12.3	52	6	6	6	6	I		
8	12 1/4	Reed	STG	14/32	NHK213	6858	730	24	28.5	40	120		3000	S	65		12.5	48	4.8	6	7	7	I		
9	12 1/4	Reed	STI	15/32	NHK214	7036	178	5 1/2	34.2	40	120		3000	S	68		12.6	52	8	8	1	1	I	BT	
10	8 7/16	CHR IST	Core		58764	7066	30	1 1/2	20	10	90		1000	S	30		12.6	52	8	8	1	1			
11	12 1/4	Reed	RRN 09 STIG	15	NHK214	7233	197	5	39.5	40	110		3000	S	66		12.6	48	6	2	1	1	I	BT	

VI. MUD SUMMARY

COMPANY: NORSKE MURPHY

WELL: 9/10-1

DATE	DEPTH	WT.	VIS.	AV.	PV	YP	GELS	PH	W/L	Pf	SALT CL PPM.	CA PPM.	SOL %	OIL %	MAGCOBAR (BULK) S.T.	SALT GEL MAGCOBAR (SX) 80 lb.	MAGCOGEL 100 lb.	CAUSTIC 56 lb.	SPERSENE 80 lb.	X P 70 50 lb.	MY-20-JEL 56 lb.	CMC TECH 56 lb.	LIME 56 lb.	SODIUM CARBONATE 112 lb.	SODIUM CHROMATE 112 lb.	MAGCOBROS 56 lb.	MICA CSE 56 lb.	FN RIVIKSEAL 40 lb.	D.D. 55 GAL.	PIPE LAX 55 GAL.	MAGCONOL 55 GAL.	SOLTEX 50 lb.	ALUMINUM STERATE 56 lb.	OIL GAL				
31 AUG 470	724																																					
1 SEPT 825	874																																					
2 1633																																						
3 1280	104	40																																				
4 2040	96	38	17	4	25																																	
5 3125	103	41	18	11	14																																	
6 3125	103	35	12	9	6																																	
7 3125	108	40	16	11	9																																	
8 3125	107	40	16	11	10																																	
9 3160	112	40	20	15	10																																	
10 3160	114	53	29	23	12																																	
11 3445	115	54	29	20	18																																	
12 3630	125	43	24	18	12																																	
13 4054	123	47	28	24	17																																	
14 4340	123	40	21	17	8																																	
15 4680	126	51	27	21	11																																	
16 4850	124	43	25	21	8																																	
17 5110	124	53	31	23	15																																	
18 5526	125	68	41	29	23																																	
19 5608	124	50	27	20	13																																	
20 6025	123	52	28	22	12																																	
21 6250	122	56	40	22	25																																	
22 6390	121	43	23	15	15																																	
23 6564	124	47	28	20	15																																	
24 6825	126	46	26	20	13																																	
25 7035	126	53	28	22	14																																	
26 7210	125	48	31	23	16																																	
27 7233	127	49	30	23	15																																	

AG-16-1

COMPANY:

WELL:

IV.

BONA.

ROMA

MAGCOBROS

56 lb.

MICA CSE

56 lb.

FN RIVIKSEAL

40 lb.

D.D.

55 GAL.

PIPE LAX

55 GAL.

MAGCONOL

55 GAL.

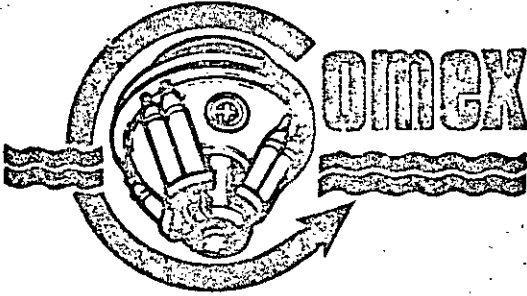
SOLTEX

50 lb.

ALUMINUM

STERATE 56 lb.

OIL GAL



Managing Director
J. R. BYFORD
Sales Director
R. E. LLOYD

COMEX DIVING LTD.
BLOCK 3
FISHWHARF
GREAT YARMOUTH
NORFOLK
Tel. Gt. Yarmouth 55680
Telex 97103

A subsidiary of Comex International Corporation

GULFTIDE

18th SEPTEMBER 1970

MURPHY 9/10-I

Divers carried out bottom (Sea-Bed) clearance dive at I726 on the 18th September, in position 57 - 00' - 03" N. 04 - 00' - 35" E. The sea bed was found to be clear of all obstructions.

D. Higham Diving Superintendent.

A handwritten signature in dark ink, appearing to read 'D. Higham', with a horizontal line extending to the right.

Comex Diving Ltd.



MATERIAL CONSUMPTION BREAKDOWN BY INTERVAL

OPERATOR: Norske Murphy Oil Co.

WELL: 9/10 - 1

LOCATION: North Sea

Spud to 825'

INTERVAL	PRODUCT	UNIT	COST
	Magcogel	255 sx. 100 lb.	\$ 828.75
	Caustic Soda	28 sx. 56 lb.	138.88
	Salt Gel	255 sx. 80 lb.	1.190.85
	Lime	34 sx. 56 lb.	63.58
	Mica Coarse	5 sx. 56 lb.	28.45
	Mica Fine	5 sx. 56 lb.	28.45
	Kwik Seal	5 sx. 40 lb.	74.40
			<u>\$ 2.353.36</u>

825' to 3125'

INTERVAL	PRODUCT	UNIT	COST
	Barite	74 Sh.Tons	\$ 4.440.00
	Magcogel	156 sx. 100 lb.	507.00
	Caustic Soda	127 sx. 56 lb.	629.92
	Spersene	261 sx. 50 lb.	2.448.18
	Salt Gel	67 sx. 80 lb.	312.89
	Lime	30 sx. 56 lb.	56.10
	Al. Stearate	3 sx. 56 lb.	63.09
	My-Lo-Jel	30 sx. 56 lb.	213.30
	Magcophos	4 sx. 56 lb.	52.32
	D.D.	2 dr. 55 gal.	484.00
	Magconol	1 dr. 55 gal.	361.40
	C.M.C. Tech L.V.	38 sx. 56 lb.	459.04
			<u>\$10.027.24</u>



MATERIAL CONSUMPTION BREAKDOWN BY INTERVAL

OPERATOR: Norske Murphy Oil Co.

WELL: 9/10 - 1

LOCATION: North Sea

3125' to 7233'

<u>INTERVAL PRODUCT</u>	<u>UNIT</u>	<u>COST</u>
Barite	274 Sh.Tons	\$16.440.00
Magcogel	118 sx. 100 lb.	383.50
Caustic Soda	105 sx. 112 lb.	1.043.70
Spersene	398 sx. 50 lb.	3.733.24
XP-20	209 sx. 50 lb.	2.014.76
Lime	56 sx. 56 lb.	104.72
Al. Stearate	2 sx. 56 lb.	42.06
My-Lo-Jel	28 sx. 56 lb.	199.08
Magcophos	2 sx. 56 lb.	26.16
D.D.	7 dr. 55 gal.	1.694.00
C.M.C. Tech L.V.	5 sx. 56 lb.	60.40
Sod. Chromate	4 sx. 112 lb.	93.04
Sod. Carbonate	15 sx. 112 lb.	76.05
Diesel Oil	6894 gals	661.83
Pipe Lax	1 dr. 55 gal.	400.00
Soltex	12 sx. 50 lb.	251.76
		<hr/>
		\$27.224.30
 <u>INTERVAL</u>	 <u>Total cost</u>	 39.604.90



TOTAL MATERIAL CONSUMPTION

OPERATOR Norske Murphy Oil Co.

WELL 9/10 - 1

LOCATION North Sea

PRODUCT	UNITS	COST
Barite	348 Sh.Tons	\$ 20.880.00
Magcogel	529 sx. 100 lb.	1.719.25
Spersene	659 sx. 50 lb.	6.181.42
XP-20	209 sx. 50 lb.	2.014.76
Caustic Soda	155 sx. 56 lb.	768.80
Salt Gel	322 sx. 80 lb.	1.503.74
Lime	120 sx. 56 lb.	224.40
D.D.	9 dr. 55 gal.	2.178.00
My-Lo-Jel	58 sx. 56 lb.	412.38
C.M.C. Tech L.V.	43 sx. 56 lb.	519.44
Magconol	1 dr. 55 gal.	361.40
Pipe Lax	1 dr. 55 gal.	400.-
Al. Stearate	5 sx. 56 lb.	105.15
Mica Coarse	5 sx. 56 lb.	28.45
Mica Fine	5 sx. 56 lb.	28.45
Kwik Seal	5 sx. 40 lb.	74.40
Magcophos	6 sx. 56 lb.	78.48
Sod. Chromate	4 sx. 112 lb.	93.04
Sod. Carbonate	15 sx. 112 lb.	76.05
Diesel Oil	6894 gals	661.83
Soltex	12 sx. 50 lb.	251.76
Caustic Soda	105 sx. 112 lb.	1.043.70
		<hr/>
		\$ 39.604.90

TOTAL

VIII. GEOLOGY

Geological Objectives

The main objectives were the first and second Oligocene sands which were gas bearing in the 2/3-1 well. The location, in addition, tested for presence of the Danian section which has been proved to be oil bearing in the Phillips Eko Fisk area approximately 40 miles to the Southwest. There was also a possibility of the development of gas bearing zones within the Miocene section.

Stratigraphy
(Depths in Feet)

<u>Unit</u>	<u>Top</u>	<u>Base</u>	<u>Thickness</u>
Recent & Pleistocene	290(- 194)	1760(-1664)	1470
Pliocene	1760(-1664)	3080(-2984)	1320
Miocene	3080(-2984)	4123(-4027)	1043
Oligocene	4123(-4027)	6150(-6054)	2027
L.Eocene/ Paleocene	6150(-6054)	6928(-6832)	778
Danian	6928(-6832)	6942(-6846)	14
Maestrichtian	6942(-6846)	t.d. (7233)	291 +

Lithology

QuaternaryQuaternary undifferentiated (1470' thick):

The hole was drilled from 290' (sea floor) to 470' without return of drilling fluid; therefore no evidence regarding lithology was gained through this interval.

From 470' to 1520' the lithology consists of unconsolidated, fine to coarse grained, fairly well rounded sand interbedded with soft gray calcareous clay. Abundant shell fragments are associated with the sands. Lignite is fairly common in the interval 980' to 1250'. The section from 1520' to 1760' is soft greenish-grey gummy clay.

TertiaryPliocene (1320' thick):

The top and base of this unit have been selected on paleontological determinations using 30 foot sample intervals so precision is limited. The section is composed of greyish to greenish clay or shale with some bands of shell fragments and lignite.

Miocene (1043' thick):

Determined on 30 foot paleontological samples this unit is defined with limited precision as is the overlying Pliocene.

The lithology is predominantly brown clay or shale, slightly carbonaceous and with a few thin microcrystalline limestone bands.

Oligocene (2027' thick):

The section is brown clay or shale with a thin gas-bearing interval comprising dark brown siltstone and amorphous limestone stringers and inclusions

between 4132 and 4149 feet near the selected top. Partly from lack of samples and partly for paleontological reasons, it is impossible to locate the top of the Oligocene in 9/10-1 with precision. A sonic log event, rather similar to that at which the top of the Oligocene is placed in 2/3-1, has been used for depth reference. Some fine unconsolidated sand occurring at about 4530 feet may correlate in part with the lower gas-bearing Oligocene sand of 2/3-1. This subject has been discussed in a separate report "The Oligocene Sands in 9/10-1" which concludes that the interval 4327 to 4538 feet may represent the mainly shaled out equivalent of the sand-bearing section of 2/3-1 and 2/3-2.

Lower Eocene/Paleocene (778' thick):

This section, composed mainly of dark grey shale with some brown siltstone and very subordinate limestone and sandstone bands, is exceptionally barren of diagnostic fauna in 9/10-1.

Paleoservices suggest the deposit was formed in a lagoon with fresh water influence.

The top has been selected at a gamma ray event which marks the base of Middle Oligocene fauna. This gamma ray event has a similarity to that at which the top of the Paleocene has been placed in our interpretations of some other wells such as 1/3-1 and 2/4-1. Although this similarity may give a spurious correlation and would imply that Lower Eocene is extremely thin or absent, a marked thickening of the presumed Paleocene interval is seen on seismic sections from 2/3-1 and 2/3-2 to 9/10-1.

Danian (14' thick):

Whitish chalky limestone with some reworked Upper Cretaceous fossils has been diagnosed as Danian by the presence of Globigerina triloculinoides.

Upper Cretaceous (291' + thick):

Drilling terminated in hard whitish-grey chalky limestone of Maestrichtian age.

Structure

The location was selected to explore the N.E. regional limit of the Oligocene sands at a non-structural site and to reach the Danian very low on the South flank of the seismic "L" structure.

A four-arm high resolution continuous dipmeter was run from 3160 feet to 7223 feet. Results were satisfactory and show horizontal bedding from 3160 to 4535 feet. Below this depth a south to south-south-east dip of about 2° increases more or less steadily with depth to 7°-8° in the Danian and 10° at t.d.

These results are in full accord with the seismic interpretation on which the location was made.

Hydrocarbon Shows

Methane gas shows were first recorded at 640' where approximately 10 to 25 units of gas were measured by the programmed hydrocarbon detector (PHD) down to 710', and from 850' to 975'. This show is believed to be associated with low-grade lignite fragments found in samples.

975' - 1225' (Pleistocene):

PHD readings of 10 to 350 units of methane were recorded in this interval with no evidence of heavier fractions. Lignite with some gradation to coal was logged through this same interval and is believed to be the source of the gas. Approximately 50 units of gas continued to be recorded below 1225' and gradually diminished to zero at 2200'. The continued readings are assigned to carbonaceous clay with traces of lignite logged through the interval.

PHD readings of approximately 5-55 units of methane were recorded through most of the interval 2575' to 3290'; these gas readings are believed to come from carbonaceous clays.

3290' - 3600' (Miocene):

More than 50 units of methane as measured by PHD were recorded through this interval; further, the readings peaked out at about 250-600 units at 3300'-30', 3365' - 3400', 3480' - 3500' and 3585' - 3600'. Also, ethane readings of 1-9 units were recorded in the interval 3465' - 3535'. These shows appear to be associated with brown carbonaceous shale, at least in part, with a few thin beds of white dense limestone. No reservoir rock was logged in the show interval.

3970' - 4040' (Miocene):

PHD recordings of 210 units of methane in this interval are believed to result from a concentration of very minor gas percentages caused by blockage of the mud flowline.

4075' - 4325' (Miocene - Oligocene):

PHD readings of methane were greater than 50 units through this interval; peaks of 180 units and 340 units were recorded at 4100' and 4285' respectively. The shows are believed to be associated with a few very thin streaks of dense limestone, and dark brown shale having some inclusions of limestone and sandstone; these units occur largely in the interval 4130' - 4150'. Sidewall cores indicate the strong probability that no effective reservoir exists in this interval.

5750' - 5950' (Oligocene):

PHD readings up to 85 units of methane in this interval are believed to be due to shale gas and at least partially resultant of a short trip made with drill pipe.

6515' - 6890' (L.Eocene/Paleocene):

PHD readings of approximately 5 to 130 units methane were made in this interval with readings exceeding 40 units between 6540' and 6695'. Traces of dirty sandstone were logged in this interval and, while not considered to constitute an effective reservoir, the probably thin bedded tight sands are thought to be responsible for the gas show.

Logging Programme

<u>Log</u>	<u>Run No.</u>	<u>Interval</u>
Induction - Electrical with Gamma Ray	1	815' - 1499' (IES)
	2	290' - 1475' (GR) 3163' - 7228' (IES)
Gamma Ray - Sonic - Caliper	1	1200' - 7197' (GR)
		3160' - 7216' (S)
		3160' - 7220' (C)
Gamma Ray - Neutron	1	1400' - 4200'
Microlaterolog - Microlog	1	4100' - 4200'
		5400' - 5560'
		6850' - 7228'
Four Arm High Resolution Continuous Dipmeter	1	3160' - 7222'

A Core Laboratories, three-man cuttings and mud logging unit with hot wire and programmed hydrocarbon detector, and with continuous H₂S detector was employed from 470' to 7233' (T.D.).

A velocity survey was made with shots taken successively at 1597', 4638', 6150', 7233', 6929', 6406', 5810', 5488', 4876', and 4133'.

Analysis of Electrical Logs

4130' - 4148' & 6940' - 7145'

4130' - 4148'

	T	Ø	F	R _{IL}
4140-48	105	40	7	2.5
4130-35	65	12	70	5.0

As there is no SP character and due to the small interval involved, a computation or plot for R_w becomes impossible.

1. Assume R_w = R_{mf} at that depth,
then R_w = .1 and

$$S_w^2 = \frac{7 \times .1}{2.5} = .17$$

$$S_w = 41\% \quad 4140-48$$

$$S_w = 100\% \quad 4130-4135$$

Conclusion: Assuming matrix velocity of 21,000 and $F = \frac{1}{\phi^2}$, interval 4140-48 is shown to be hydrocarbon bearing. The accuracy of these computations is questionable due to the shale volume present. No corrections have been made for shale.

6940' - 7145'

Computation from SP.

$$SSP = -22 \text{ MV}$$

$$\text{From (SP - 1)} \quad \frac{(R_{mf})_e}{(R_w)_e} = 1.8$$

$$R_{mf} \text{ at } 140^\circ\text{F} = .093$$

$$\text{From (SP - 2)} \quad (R_{mf})_e = .1$$

$$(R_w)_e = .056$$

$$R_w = 0.6$$

	T	Ø	F	R _{IL}	S _w
6940-60	94	32	10	.5	100
6990-7010	86	27	14	.6	100
7030-7060	78	22	20	.8	100
7130-7145	70	14	50	1.2	100

* Assuming matrix velocity of 21,000 and $F = \frac{1}{\phi^2}$

CONCLUSION: Zone is water bearing.

Drill Stem Tests & Cores

No drill stem tests were made on the 9/10-1 well. One diamond core was cut and twenty-one (21) sidewall cores were recovered from thirty attempts; descriptions follow:

Diamond Core No. 1:

7036' - 7066' Cut 30' and recovered 30'

Coring time: 3-3-3-3/3-3-3-3-2/2-2-2-2-2/3-2-2-2-2/2-2-2-3-3/4-3-3-3-4 in minutes per foot units.

Limestone, whitish grey, chalky, hard, porous, very slightly permeable, stylolitic.

Breccia zone at 7047', half inch wide, inclined 70° consisting of limestone pebbles with in infilling of crystalline calcite. One inch pyrite inclusion at same depth. Incipient fractures present but no oil or gas shows.

Sidewall Core Descriptions

Gun No. 1

Attempted 14 Recovered 9

4132 Shale, dark brown, plastic, micaceous, slightly calcareous, numerous shell fragments.

4136 No Recovery.

4138 Siltstone & very fine grained sandstone (core separated 50-50 by vertical plane into 2 lithologies) Siltstone dark brown, shaley, micaceous, calcareous, glauconitic; Sandstone, tan, silty-argillaceous, ver calcareous, questionably porous, no permeability, no show.

4140 Limestone, dark brown, amorphous, brittle, dense, few inclusions white to light tan calcite, no show.

4142 No Recovery.

4144 No Recovery.

4146 Shale, as at 4132, with inclusions of limestone as at 4140, no show.

4148 Shale, dark brown, very micaceous, with inclusions of dark brown dense limestone, no show.

4149 Shale, dark brown, very micaceous, calcareous, with inclusions of dark brown dense limestone, no show.

4150 Shale, same as at 4149, no show.

4151 Shale, same as at 4149, no show.

4153 Shale, dark brown, numerous white chalk specks, calcareous, micaceous, few small pockets tan very fine grained sandstone, no show.

4155 No Recovery.

4158 No Recovery.

Sidewall Core Descriptions

Gun No. 2

Attempted 16 Recovered 12

4879	No Recovery.
5489	No Recover.
5497	No Recovery.
6915	Shale, dark gray.
6925	Shale, dark gray.
6935	Limestone, chalky, white, porous, questionably permeable, no show.
6941	Same as 6935.
6950	Same as 6935.
6955	Same as 6935.
6965	Same as 6935.
6970	Same as 6935.
6979	Limestone, white, chalky, porous, questionably permeable, stylitic, no show.
7011	Same as 6979.
7152	No Recovery
7172	Limestone, white, fair porosity, questionable permeability, stylitic, no show.
7220	Same as 7172.

Core Analysis

SAMPLE NUMBER	DEPTH FEET	PERMEABILITY MILLIDARCYs		POROSITY PER CENT	RESIDUAL SATURATION PER CENT PORE		SAMPLE DESCRIPTION AND REMARKS
		KA	KL		OIL	TOTAL WATER	
<u>CORE NO. 1</u>							
1	7036	0.29	0.18	18.2		97.8	
2	7039	0.14	0.08	18.6		96.8	
3	7042	0.48	0.31	20.2		92.1	
4	7045	0.21	0.13	19.8		96.0	
5	7048	0.46	0.29	22.1		94.2	
6	7051	0.42	0.27	20.7		91.8	
7	7054	9.5	7.4	21.4		96.8	Increase permeability along stylolites.
8	7057	1.28	0.9	27.2		92.7	
9	7060	0.42	0.27	18.5		93.5	
10	7063	0.30	0.19	19.4		94.4	

PALEOSERVICES LTD.

PALEONTOLOGICAL AND PETROGRAPHICAL CONSULTANTS

DIRECTOR: DR. V. L. ROVERA (It.)

LONDON W.1. Y OBP
77 NEW BOND STREET
Tel: 01-493-3321/3

WATFORD, WD1 3NY
NOCTON RISE, STRATFORD ROAD
Tel: 92-25678

27th. November, 1970

MURPHY EXPLORATION CO.

Well 9/10-1

Paleontological Final Report

In this report we present the results of the paleontological and stratigraphical study of the samples from well 9/10-1, drilled by Murphy Exploration Co. in the Norwegian offshore, block 9.

The samples received were represented by cuttings collected every 10' and 20'; side wall cores were available from the intervals 4132-4153' (nine samples) and 6915-6925' (two samples). Fragments from Core 1 were also received. All the samples have been washed and studied.

All data presented in this report are solely the results of the investigations carried out by Paleoservices staff, no other information (electric logs, mud log, etc.) being available or consulted.

SUMMARY

Although the attached Biostratigraphic Log is self-explanatory, we are indicating here below the most significant points:

- (1) There is a remarkably thick Pliocene-Pleistocene section (nearly 3,000').
- (2) There is nearly 4,000' of monotonous Oligo-Miocene section, represented by clay with occasionally some thin limestone interbeddings. No sands have been observed in the available samples. There are, however, indications of very shallow marine and littoral conditions which may be seen in the horizon rich of coral debris at 4280-4310'. From the paleontological point of view, it is impossible to draw sharp boundaries between the Miocene and the Oligocene, and between the Upper and Middle Miocene. Probably the most noticeable event is the microfaunal change occurring between 4390' and 4670' (disappearance of *Asterigerina staeschei*; occurrence of *Globigerina ciporensis*, *Silicosigmolina* and Arenaceous).
- (3) The Lower Eocene and Paleocene is represented by extremely unfossiliferous clays. The age is given in accordance with the stratigraphical position and on the basis of correlations with other North Sea wells. Presumably, this section was deposited in a lagoon, with fresh water influence and was unfavourable to life conditions.
- (4) There is very little Danian (10' or 20' ?). In fact, *Globigerina triloculinoides* were observed only in the samples from 6930' and 6940', together with some reworked Upper

Cretaceous fossils. From 6940' downwards, there is a remarkable increase in frequency of Upper Cretaceous fossils, the appearance of several diagnostic Upper Maastrichtian fossils and the disappearance of all possible Paleocene (including Danian) fossils.

- (5) The well bottomed in Upper Cretaceous, Maastrichtian white chalk.

GEOLOGICAL HISTORY

The geological history of well 9/10-1 is very similar to that of wells 2/3-1 and 2/3-2 previously studied.

At the top of the Maastrichtian (well documented by good microfaunal assemblages) very little Danian (Lower Paleocene) is left, either due to reduced deposition or to the Middle Paleocene ^{???} transgression.

From Middle Paleocene until the late Lower Eocene, the environmental conditions were unfavourable to life, as suggested by the scanty scattered fossils which indicate the presence of lagoons, possibly with fresh water influence.

The Oligocene is transgressive on the Lower Eocene. Shallow marine conditions persisted in the basin until the top of the Miocene, occasionally with connections with the open sea, resulting in the incoming of planktonic foraminifera.

At the end of the Middle Miocene the sea became shallower and with the Pliocene the waters became cooler, reflecting a gradual chilling of the climatic conditions which characterise the Pleistocene.

CORRELATIONS

Tentative correlations are shown in the attached table (Enclosure No.2) taking into consideration the wells 9/10-1, 2/3-1 and 2/3-2.

Primary importance has been given to the correlations between the first occurrence (in the drilling sense) of some diagnostic microfossils (markers) rather than to the correlations of the paleontological zones previously established in our reports.

The attached table is self-explanatory so there is no necessity to elaborate on the details.

ZONATION

In the following paragraphs we are presenting a resumé of the lithological and paleontological characteristics of the zones or intervals we were able to distinguish in well 9/10-1.

Working in descending order we have:

470-1760'

Rare and undiagnostic microfossils zone

Lithology: grey sandy clays with coarse sands and gravel interbeddings.

Fossils: the more common fossils in this interval are mollusks, generally occurring as fragments except at 1490' where they are so abundant as to represent a shell bank. Associated forms are Balanus barnacles and extremely rare foraminifera such as Elphidium clavatum, Nonion orbiculare and Sigmoilina coelata.

Environment: mainly littoral

Age: Pleistocene

1760-2220'

Streblus pseudotepidus & Uvigerina peregrina zone

Lithology: grey clays, slightly sandy.

Fossils: this interval is characterised by good microfossil assemblages composed by Elphidium incertum, Buccella frigida, Streblus pseudotepidus, Cassidulina laevigata, Gavel nonion barlecanum, Cibicides pseudo-ungarianus, Loxostomoides lammersi, Nonion communis, Bulimina echinata, Nonion pompiloides, Uvigerina peregrina, Textularia decrescens, Globigerina bulloides, Textularia sculpturata, Elphidium bartletti and Cassidulina pliocarinata. Pyrite concretions in the form of elongated shapes are also very abundant and continue to be so until the top of the Miocene.

Environment: shallow marine

Age: Pliocene

2220-3080'

Not zoned

Lithology: grey clays

Fossils: several of the fossils observed in the above interval are still present in this interval. New forms which occur are *Epistomina elegans*, *Cassidulina crassa* and *Globigerina aff. eggeri*.

Environment: shallow marine

Age: Pliocene

3080-3230'

Rare Radiolaria & Spongia spiculae zone

Lithology: grey clays, becoming brownish towards the base of the interval. The samples from 3140' to 3230' are of very poor quality, containing a lot of cement from the well.

Fossils: very few in place fossils have been observed in this interval. The new diagnostic forms are represented only by conical *Radiolaria (Lithostrodus ?)*, *Spongia spiculae* and *Ehrembergina serrata*.

Environment: shallow marine

Age: Upper Miocene on the basis of the correlations with other North Sea wells.

3230-3680'

Asterigerina staeschei, Uvigerina tenuipustulata & Globorotalia scitula zone

Lithology: brown clays becoming glauconitic from 3400' downwards. Brown limestone with yellow calcite veins occurs from 3140-3500' approx.

Fossils: this interval is characterised by the presence of *Asterigerina staeschei*, *Uvigerina tenuipustulata* and *Globorotalia scitula*, associated with *Globigerina angustiofficialis*, *Bulimina alsatica*, *B. elongata*, *Ceratobulimina contraria*, *Nodosaria ewaldi*, Diatoms, *Coscinodiscus sp. 3*, *Asterigerina guerichi*, Diatoms, *Coscinodiscus sp. 1 & 2*, *Globigerina aff. ouachitensis*.

Environment: shallow marine

Age: Middle Miocene.

3680-3980'

Hyperammina sp.1 zone

Lithology: brown clays

Fossils: in this interval, several of the fossils observed in the above interval have disappeared. *Hyperammina sp.1* and *Valvulineria petrolei* occur for the first time.

Environment: shallow marine

Age: probably Lower Miocene.

3980-4130'

No samples.

4130-4280'

Sigmomorphina regularis zone

Lithology: brown clays. However, the samples are of poor quality since they contain several lithologies caved from above.

Fossils: this interval is characterised by the presence of *Sigmomorphina regularis* (observed also in a side wall core), associated with *Nonion granosum*, *Miliolids*, *Baggotella sp.* and *Hyperammina sp.1*

Environment: shallow marine

Age: most probably Upper Oligocene.

4280-4670'

Cyclammina, Hyperammina sp.1 & Globigerina ciperensis zone

Lithology: very abundant coral debris characterises the top of this interval. However, it may be that these fossils are contaminants since we have never encountered them in this part of the section in any other North Sea offshore well. Otherwise, the interval is represented by the usual brown clays.

Fossils: in the upper half of the zone, presence of *Asterigerina staeschei*, *Hyperammina sp.1*, *Valvulineria petrolei*, *Gyroidina cf. octocamerata* and *Angulogerina oligocenica*. In the lower half of the interval, presence of *Globigerina ciperensis* & *cf. obesa* and *Globorotalia cf. obesa*, together with *Nonion pompiloides*, *Robertina declivis*, *Bulimina pupoides*, "Tentaculites" and *Cyclammina cancellata gr.*

Environment: shallow marine

Age: Middle-Upper Oligocene.

4670-5170'

Spirolocamina, Recurvoides & Hyperamina sp.2 zone

Lithology: brown clays, slightly sandy and glauconitic from 4800' downwards.

Fossils: this interval is characterised by prevailing arenaceous foraminifera such as Cyclamina cancellata gr., Hyperamina sp.2, Spirolocamina sp. (=Silicosygmolina sp.), Recurvoides sp. and Trochammina sp. (distorted). Some Asterigerina guerichi are still present in this interval and we think they are in place.

Environment: shallow marine

Age: Middle-Upper Oligocene.

5170'-5700'

Rotaliatina buliminoides zone

Lithology: brown clays with pyrite concretions.

Fossils: this interval is characterised by the presence of Rotaliatina buliminoides, associated with Chilostomella cf. cylindroides, Diatoms, Coscinodiscus sp.4, Alabamina tangentialis, Bathysiphon sp., plus several of the arenaceous observed in the above intervals.

Environment: shallow marine

Age: Middle Oligocene

Remark: the lower boundary is hypothetical.

5700-6140'

Trochammina, Ammobaculites zone

Lithology: brown clays with several brown limestone interbeddings (in place?).

Fossils: this interval contains mainly arenaceous foraminifera such as Ammobaculites sp. (small), Puzosina/Pelosina sp., Trochammina sp. (distorted) and Hyperamina sp.2. Some Bathysiphon sp. are still present, probably in place.

Environment: shallow marine

Age: probably Middle Miocene.

Oligocene

*Syner a matte
vane Eocene etc
fauna
fall*

6140-6930'

Undiagnostic fossils (mainly barren) zone

Lithology: light green-grey clays, becoming darker from 6600' downwards. Frequent siderite pellets and small pyrite crystals.

Fossils: this thick interval is mainly barren. A few fossils have been observed in its upper part, such as Diatoms, Coscinodiscus sp.1, ?Radiolaria? and very small Arenaceous (in the clay). Some

Spongia spiculae have been observed towards the base of the interval, together with extremely rare *Bolivinoidea paleocenicus*.

Environment: mainly lagoonal with unfavourable life conditions. Towards the top of the zone life conditions improved, as shown by the presence of some micro-organisms.

Age: Paleocene-Lower Eocene. A more detailed age determination is not possible since the fossils are undiagnostic.

6930-6940'

Globigerina triloculinoides zone

Lithology: the two samples from this interval are represented by grey clays with a few fragments of white chalk.

Fossils: a few in place *Globigerina triloculinoides* are associated with reworked *Pseudotextularia elegans* and *Globotruncana contusa*.

Environment: marine open sea

Age: Danian on the basis of the presence of *Globotruncana contusa*.

6940-7030'

Praeglobotruncana mayaroensis, Pseudotextularia elegans zone

Lithology: white chalk with some white chert. Grey clays are still present in abundance as a result of caving.

Fossils: this interval is clearly characterised by *Praeglobotruncana mayaroensis*, *P. petaloidea*, *Planomalina messinae* and *Rugoglobigerina rugosa*, small, associated with *Pseudotextularia elegans* (reworked), *Bolivinoidea draco draco*, *Stensioina pommerana*, *Praebulimina parvula* and *Bolivina incrassata*.

Environment: open sea

Age: Upper Cretaceous, probably Maastrichtian.

7030-7230'

Rugoglobigerina rugosa & Stensioina pommerana zone

Lithology: white and creamy chalk.

Fossils: several of the fossils observed in the previous interval have disappeared and therefore this interval is characterised by the presence of

only Stensioida pommerana, large Rugoglobigerina
rugosa, Globotruncana arca and Bolivinoides
giganteous.

Environment: open sea

Age: Upper Cretaceous, Maastrichtian.

V.L. Roveda

V.L. ROVEDA