MOBIL EXPLORATION NORWAY INC.

FINAL GEOLOGIC SUMMARY

33/12-3 & 33/12-4

November, 1975

Stavanger, Norway

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NORWAY OFFSHORE

STATFJORD FIELD

APPRAISAL WELL 33/12-3

WELL DATA

Well name:	33/12-3
Location:	61° 14' 19.64" N
	01° 53' 25.80" E
Classification:	Wildcat
Drilling Period:	
Spudded:	23 April, 1975
Junked/Rig released:	16 May, 1975
KB Elevation:	82 feet
Water Depth:	480 feet
Rig:	Norskald
Status:	Junked and Abandoned
Total Depth:	
Planned:	12,000 feet
Actual:	5,660 feet
Objective:	Middle Jurassic Brent Formation and Lower Jurassic Statfjord Formation
Cost: $	
Planned:	6,000,000
Actual:	1,960,000 (as of 10 October, 1975)

NORWAY OFFSHORE

STATFJORD FIELD

APPRAISAL WELL 33/12-4

WELL DATA

Well name:	33/12-4
Location:	61° 14' 19.2" N 01° 53' 27.5" E
Classification:	Wildcat
Drilling Period:	
Spudded:	17 May, 1975
Completed/ rig released:	17 July, 1975 18 July, 1975
KB Elevation:	82 feet
Water Depth:	478 feet
Rig:	Norskald
Status:	Dry hole Plugged and abandoned
Total Depth:	
Planned:	12,000 feet
Actual:	9,500 feet
Objective:	Middle Jurassic Brent Formation and Lower Jurassic Statfjord Formation
Cost: $	
Planned:	6,000,000
Actual:	4,753,000 (as of 10 October, 1975)

INTRODUCTION

The Statfjord wildcat well 33/12-3 was spudded on 23 April, 1975. This was the fourth in a series of eight obligation wildcats in License 037. Due to irreparable damage to subsea wellhead equipment this well was junked and abandoned at a depth of 5660 feet (K.B. depth) on 16 May, 1975. A replacement well, 33/12-4, was spudded 100 feet southeast of 33/12-3 and successfully penetrated an abbreviated Jurassic section, reaching a total depth of 9500 feet (K.B.) in Triassic sediments. Two thru-casing drill stem test were run to evaluate thin Brent and Statfjord Formation sands. Both tests produced water at a low rate with insignificant amounts of oil and gas. The 33/12-4 well was declared a dry hole and abandoned on 17 July, 1975.

This wildcat location was designed to test the erosional escarpment on the east flank of the Statfjord structure for possible trapping of hydrocarbons in an area downfaulted to the Statfjord Field pay section to the west. Primary objectives of the well were lower Jurassic Statfjord and possible Middle Jurassic Brent Formation sands, which are the productive reservoirs in Statfjord Field.

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Seismic mapping of the Kimmerian Unconformity ('J' horizon), which occurs at the top of the Jurassic section, indicated that closure was present at this level against the main upthrown fault block to the west. Structural configuration near the Top Triassic ('R' seismic horizon) was more difficult to correlate across the fault and its interpretation in the prospect area was less certain. Nevertheless, structural attitudes of prospective reservoirs were believed reasonably correct and a total depth of 12,000 feet was planned to ensure penetration into the Upper Triassic.

Early drilling of this well was considered particularly important in relation to Phase I of the Statfjord Field development program, as a downthrown block discovery would have a significant effect on the location of the initial production platform.

RESULTS

The Middle Jurassic Brent Formation was encountered at 8777 feet (8695 feet subsea), some 185 feet high to prognosis but, as anticipated, well below the Brent oil/water contact of 8478 feet subsea in the upthrown block of the field. Correlation of this unit with other wells is difficult but the section appears most similar to that of the 33/12-2 well. It is interpreted as an upper unit of the Brent Formation draped over older beds which subcrop an erosion surface on the east flank

of the Statfjord feature (see Enclosure 1). Gross thickness of the Brent Formation in the 12-4 well is 86 feet.

Coring was commenced at 8791 feet, some 14 feet below the top of the sand. Two cores were cut through the base of the Brent (at 8863 feet) into the underlying Dunlin Formation. Of 73 feet cored only 34 feet (47%) was recovered. Scattered poor to fair hydrocarbon indications were noted in the cores but gas readings were low. Average core porosity in the sands is 23 percent, ranging from 2 to 29 percent. Measured horizontal permeabilities average 604 millidarcies and range between 0.01 and 2028 millidarcies.

Schlumberger's final CPI log analysis, using cutoffs of 40 percent volume of clay, 12 percent porosity and 65 percent water saturation, indicated some 40 feet of prospective net pay with 23 percent average porosity and 53 percent average water saturation. Water saturations tended to increase toward the top of the reservoir and never decreased below 35 percent. Drillstem test No. 2 (8810 to 8820 feet) tested 10 feet of the most prospective section through casing. The test recovered only water at a low rate with an estimated 5 to 10 percent oil cut. (See tailpiece of composite log and Well History and Operation Report for details).

Some 182 feet of Lower Jurassic Dunlin shale is present between the Brent sand and the Statfjord sand. Cores 3 and 4 were cut in the Dunlin from 8866 to 8922 feet with full recovery.

The top of the Lower Jurassic Statfjord Formation was penetrated at 9045 feet (8963 feet subsea) and only 8 feet low to prognosis. Gross thickness of the unit, based on a top Triassic pick at 9106 feet, is 61 feet compared with a prognosed 225 feet of Statfjord section. Lithologic correlations indicate possible faulting at the top of the Statfjord and dipmeter results indicate faulting at its base and within the Upper Triassic at approximately 9106 and 9153 feet. Apparently the Statfjord Formation is located within a complex fault zone, which could explain the thin setcion found in this well and the fact that the sands were wet, although they all occur above the oil found in the Statfjord Formation in the 33/12-2 well down to 9193 feet subsea.

Core No. 5 was cut from 9070 to 9095 feet and recovered 13 feet of sand, siltstones and claystones with no shows. Averaged core porosities and horizontal permeabilities in the sands of 16 percent and .452 millidarcies, respectively, are only representative of this poorer portion of the reservoir. Poor hydrocarbon shows were observed in ditch samples above and below the cored interval and in Core No. 6 at the top of the Triassic. Using a 65 percent water saturation

cut off, Schlumberger's preliminary CPI analysis showed hydrocarbon indications over approximately 22 feet of net sand within the lower Statfjord/Upper Triassic?, with porosities ranging between 25 to 30 percent and high water saturations of 59 to 65 percent. Drillstem test No. 1 tested the most promising portion of the Statfjord/Triassic? sands from 9100 to 9115 feet and recovered water at a low rate with approximately 3 percent oil cut by the end of the test (see tailpiece of composite log and Well History and Operation Report for details).

The well was plugged and abandoned at a total depth of 9500 feet in the Triassic.

STRATIGRAPHY

The stratigraphic section penetrated in the well was much as predicted, although variances to the original prognosis were encountered. Figure 1 is a comparison of actual versus prognosed stratigraphy and tops.

Paleontological data is taken from a telexed stratigraphic breakdown by Robertson Research. Their final Paleontological Report with paleoenvironmental data is yet to be received and may contain some minor changes within the Jurassic/Triassic section. For details of lithology refer to the enclosed Final Composite Log.

The stratigraphy in 33/12-4 can be summarized as follows: the Tertiary and Upper Cretaceous sections were similar to 33/12-2 and other wells in the area, consisting of claystones and siltstones with minor sands. As anticipated, the well found a thicker, more complete Upper Cretaceous than the 12-2 well (2381 feet versus 2033 feet respectively) because of a more basinward, downdip position.

The Lower Cretaceous is represented by some 95 feet of Barremian-age carbonates, which unconformably overlie the Upper Jurassic Kimmeridgian "Hot Shale". From log characteristics, a 17 foot section of reworked 'Hot Shale' is identified within Lower Cretaceous sediments above the Barremian Limestone, below the unconformable contact of the Upper and Lower Cretaceous. Erosion of Jurassic sediments was apparently still occuring during the late Lower Cretaceous.

The Upper Jurassic in this well consists of 15 feet of typical "Hot Shale" and overlies 86 feet of Middle Jurassic "Brent" Formation. As shown on Enclosure 1, our concept is that a significant unconformity removed the older Brent units and a major part of the Dunlin shale. Following this erosional phase, a younger sand, also called "Brent" because of its stratigraphic position similar to the sand found above the eroded Dunlin in 33/12-2, was deposited on the Dunlin erosion surface. Although tentatively identified as Middle Jurassic, this sand is likely to be time transgressive and may be at least partially Upper Jurassic in age.

This younger "Brent" sand contains coarser grains and is kaolinitic, which is not typical of the "Brent" sand in 33/12-2 or the Brent Sands in other field wells. However, erosion of the Statfjord Formation, between 33/12-2 and 33/12-4 wells on the upthrown block to the west (see Enclosure 1), could have contributed both kaolin and coarser sands to the finer sands of reworked Brent Formation deposited at 33/12-4.

Faulting, as indicated on Enclosure 1, has preserved some 182 feet of Lower Jurassic Dunlin consisting primarily of gray to dark gray shales, mudstones and claystones. The amount of Dunlin and Brent section removed due to erosion and faulting is difficult to determine. These units are some 447 feet thinner than in the 33/12-2 well, where approximately 500 feet of Brent/Dunlin section could also be missing primarily due to erosion.

The 61 feet of Statfjord Formation lies within a complex fault zone, as interpreted from dipmeter data and tentative log correlations. Reliable paleontological identification of the underlying Triassic is not possible, due to the paucity of fauna. The base of the Statfjord was placed at 9106 feet on the basis of a lithologic change and a fault contact identified from dipmeter data. The sands are typical of this unit, fine to very coarse grained, with varying amounts of kaolin, calcareous cement and mica. The amount of section missing due to faulting could be as much as 574 feet as compared to the nearby 33/12-2 well.

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Some 394 feet of Triassic were drilled prior to abandoning the well. As in other wells, these sediments appear to be primarily continental and consist of fine to coarse, white to gray sands with calcareous cement and generally poor porosity, interbedded with variegated reddish-brown to green mudstones and claystones. Occasional thin limestones and calcareous siltstones are locally present.

Table I presents a summary of preliminary paleontological results from Robertson Research and Table II lists wireline logging operations. Sidewall core descriptions are included as Enclosure 4.

INTERPRETATION OF RESULTS

Although the well failed to establish the presence of commercial hydrocarbons within this portion of the east flank of the Statfjord structure, it provided critical data and altered some of our concepts in this area.

Enclosure 1 is a northwest-southeast, dip oriented cross-section through the field showing an interpretation of the structural relationship between the 12-2 and 12-4 wells. Attitudes of the various pre-Cretaceous beds and fault positions were determined primarily by well correlations and dipmeter interpretation.

Based on interpreted dips, the Triassic in the 12-4 well can be projected directly to the 33/12-2 well without any need for the previously interpreted intervening 'B' fault. This fault is now felt to be of very minor significance, if present at all. The overlying Dunlin shale in the 12-4 well must then be located on the downthrown side of a fault, as shown on the section, if dipmeter data from the two wells is to be honored. Thus, the fault zone in the 33/12-4 well at Statfjord level appears to be valid although exact placement of the fault(s) remains interpretive. Maximum throw on this fault zone could be as much as 820 feet.

Assuming this interpretation is reasonably correct, with separation of "Brent" and Statfjord reservoirs by the fault, a zone of potential Statfjord reserves remains untested. Current Statfjord reserves are limited to the Statfjord section terminated at the 'B' fault, as previously interpreted. Elimination of this fault adds an area of speculative Statfjord reserves of approximately 2500 acres between the 'B' fault and the fault zone cutting the 33/12-4 well. Additional drilling is required to confirm this interpretation.

RHK/sb
19/12/75

TABLE I

PALEONTOLOGICAL SUMMARY 33/12-4

Interval (feet)	Stage/Substage	System/Subsystem
1620 - 1740	-	Upper Miocene
1760 - 2500	-	Middle Miocene
2520 - 3040	-	Middle-Lower Miocene
3070 - 4450	-	Oligocene
4480 - 4570	-	Eocene
4600 - 5540	-	Lower Eocene - Paleocene
5560 - 6280	-	Paleocene
6300 - 6940	Maastrichtian	Upper Cretaceous
6960 - 7180	Late Campanian	Upper Cretaceous
7200 - 8220	Early Campanian	Upper Cretaceous
8240 - 8400	Santonian	Upper Cretaceous
8420 - 8620	Coniacian	Upper Cretaceous
8630 - 8670	Early Albian-Aptian	Lower Cretaceous
8672 - 8750	Barremian	Lower Cretaceous
8766 - 8770	Volgian	Upper Jurassic
8776 - 8821	Bathonian	Middle Jurassic
8848 - 8864	Early Bathonian-Bajocian	Middle Jurassic
8874 - 8889	Domerian	Lower Jurassic
8896 - 9040	Carixian - Late Sinemurian	Lower Jurassic
9060 - 9500	-	Triassic?

TABLE II

WIRELINE LOGGING SUMMARY 33/12-3 AND 33/12-4

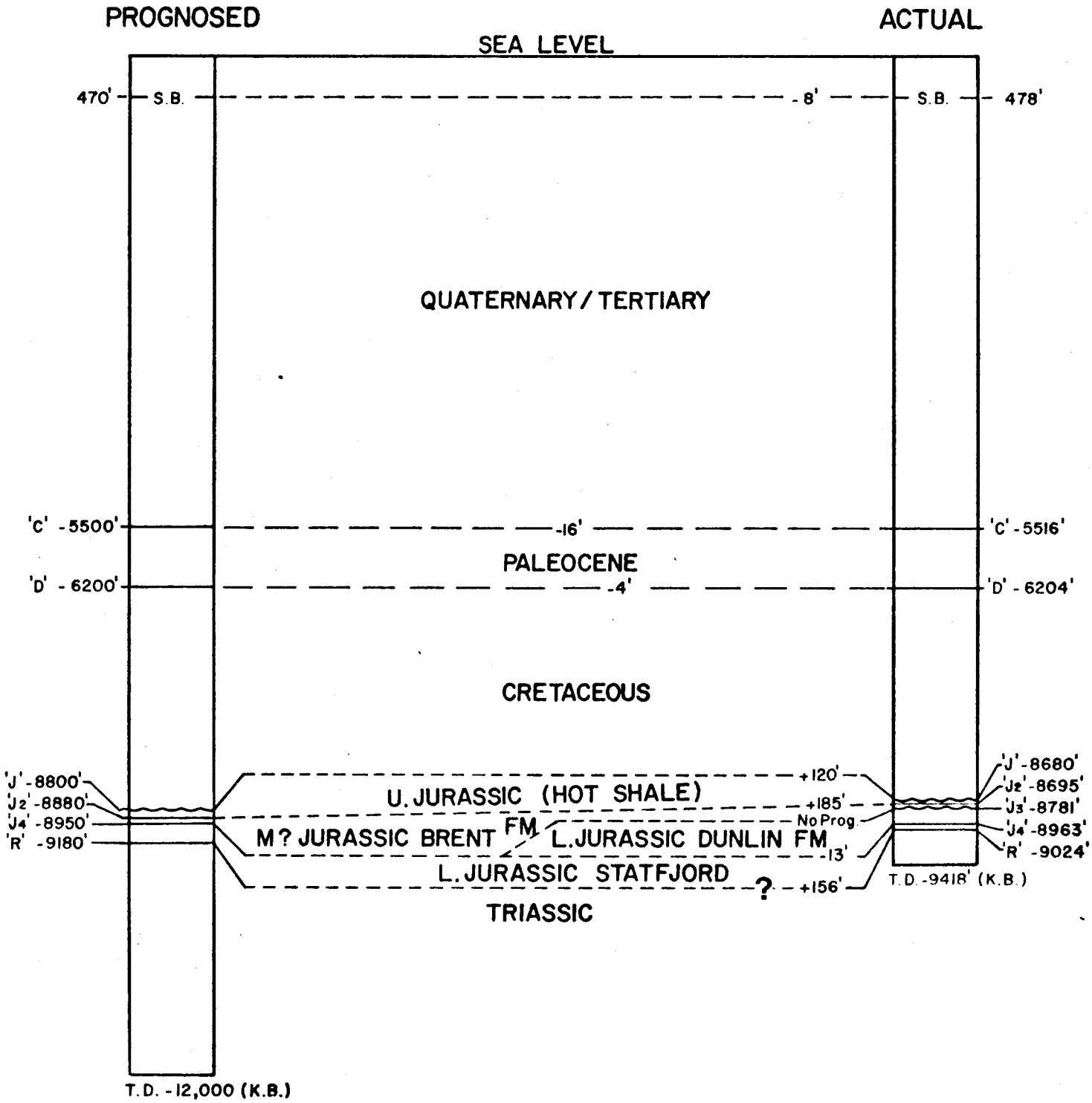
33/12-3

		Logging Operation 1	10 May, 1975
ISF/Sonic	(Run 1)	1541' - 5660'	
	(Run 1)	and 470m - 1725m	

33/12-4

		Logging Operation 1	20 June, 1975
ISF/Sonic	(Run 1)	5364' - 8349'	
HDT	(Run 1)	5364' - 8346'	
		Logging Operation 2	24 June, 1975
CBL	(Run 1)	3900' - 8250'	
		Logging Operation 3	6-8 July, 1975
ISF/Sonic	(Run 2)	8323' - 9477'	
CNL/FDC	(Run 1)	8323' - 9484'	
		and 2537.9m - 2890.7m	
DLL	(Run 1)	8450' - 9400'	
		and 2560.3m - 2865.1m	
HDT	(Run 2)	8310' - 9469'	
CST	(Run 1 & 2)	Shot: 60 SWS	
		Recovered: 59 SWS	
		Logging Operation 4	10-15 July, 1975
CBL	(Run 2)	5000' - 9388'	
Perforating Record (Run 1)		8800' - 9400'	
Perforating Depth Control (Runs 1-7)			

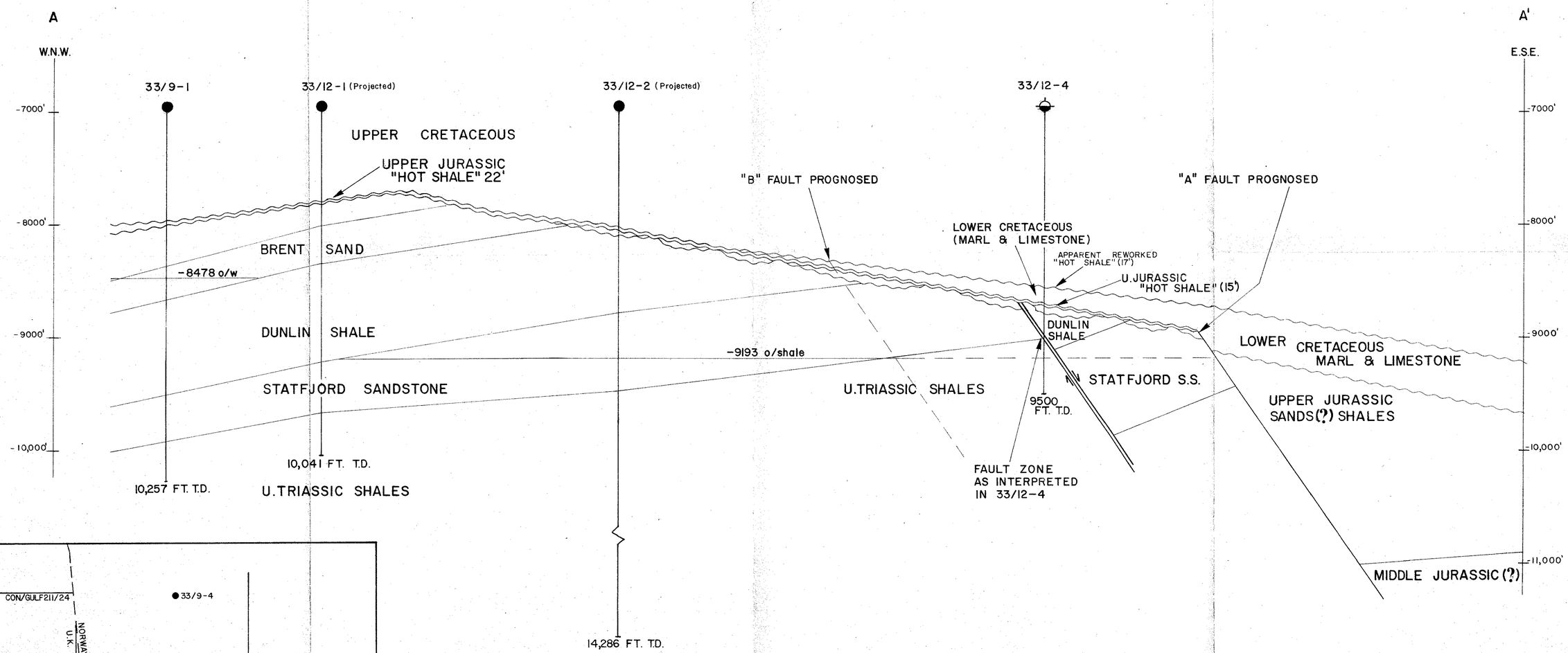
WELL 33/12-4 PROGNOSIS vs ACTUAL DEPTHS

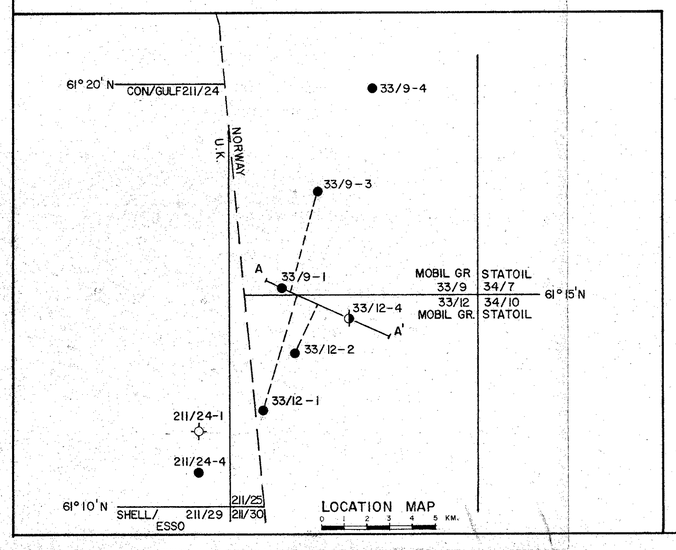


ALL DEPTHS IN FEET SUBSEA
VERTICAL SCALE 1:20,000

FIGURE 1.

STATFJORD FIELD





ENCL. I

MOBIL EXPLORATION NORWAY INC.

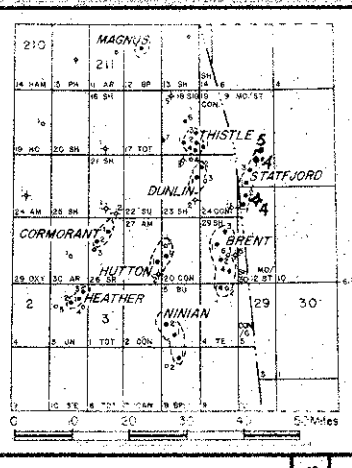
STATFJORD FIELD
STRUCTURAL CROSS SECTION
(DIP ORIENTED)

0 0.1 0.2 0.3 0.4 0.5 KM.

HORIZONTAL SCALE 1 : 7872
VERTICAL SCALE 1 : 6000
VERTICAL EXAG. 1.3 x

MOEX Nº 75/0162 W11-E10

AUTHOR H.R.T. DATE : JULY 1975



MOBIL EXPLORATION NORWAY INC.

MOBIL/STATOIL/CONOCO/ESSO/SHELL/AMOCO-SAGA

SUMMARY LOG 33/12-4

SCALE: 1:10,000

COORDINATES LAT. N61°14'19,2" LONG. E 01°53'27,5"
ELEVATION KB/ 82'
WATER DEPTH 478'
TOTAL DEPTH 9500'
RIG NORSKALD
SPUDDED 17-05 '75
COMPLETED 17-07 '75
STATUS DRY HOLE
PLUGGED & ABANDONED

METERS	STRATIGRAPHY	OIL SHOWS	CASING CORES SWS	LITHOLOGY-INDICATIONS-TEST RESULTS REMARKS	LOGS: I&F-SON, HDT, BSGRC, DLL, CNL-FDC, OTHER	DEPTH IN FT. BDF
	SEA LEVEL	FD FR PR		SL		
	SEA BED			SEA BED		
	560		30" 762'			
	NO.PALEO. 560'-1620'					1000
	? (P) 1620		20" 1574'			
500	UPPER MIOCENE (P) 1760			First samples @ 1625'		
	MIDDLE MIOCENE (P) 2520			Clay; gray, soft, fossil, occ. calc, tr vy fn sd		2000
	MID.-LOW. MIOCENE 3070			Sand; clear-opaque, vy fn-fn-occ crse grn, pr ø, abnd't glauc, foss, intb'd w/clay a/a		3000
1000	TERTIARY OLIGOCENE (P) 4480			Clay; lt brn, sft-frm, occ calc w/intb'd mdstn; brn, frm.		
	EOCENE (P) 4600			Claystone; grey-bngy-gy gn, sft-frm, tr sd, occ. calc.		4000
1500	LOWER EOCENE - PALEOCENE (L) 5560		13 3/8" 5362'	Claystone a/a w/red bn Mdstn, tr ls.		5000
	PALEOCENE (L) 6300			Tuffaceous Claystone; gy-gngy-blsh gy, sft-blky, calc, tr mica, tr sd.		6000
2000	CRETACEOUS MAESTRICHTIAN (P) 6960			Claystone a/a, tr sd, Minor Limestone; wh-gy, sft-sparry, glauc.		
	LATE CAMPANIAN (P) 7200			Sltstone-Claystone; gy, sft, glauc, pyr, tr Ls.		7000
	EARLY CAMPANIAN (P) 8240			Ls; wh-ltgy, sft. marly-frm, glauc. w/clyst a/a.		
2500	SANTONIAN (P) 8420		9 5/8" 8328'	Marl, wh-ltgy, occ. red. Ls a/a, tr glauc, tr pyr. Clystn; bn-gy grd'g to Clay and occ sd; vy fn-crse w/tr Dol; bn, microxln.		8000
	CONIACIAN 8630 (P)			Claystone; gy-gn, sft-frm, occ shale, Tr bn-gy Ls and Dol a/a. Tr Sd; fn gn.		
	ALBIAN-APTIAN 8667 (L)			Limestone; wh-crm-red, crypto-micro xln, argil. Shale blk-dy gy.		
	BARREMIAN L.S. 8762 (L)					
	HOT SHALE		2 → 1-4	SS; ltbn-gy, fn-vy crse, pr-gd ø, mica, kaolin cm't.		
	BRENT FM. 8777 (L)					
	DUNLIN FM. 8863 (L)			Shale-Mdstn; dk gy-ltgy, mica, silty, pyr.		9000
	JUR ? STATFJORD 9045 (L)		1 → 5 6-7	SS, wh-clr, fn-vy crse, pr ø, micd, kaolin cm't, calc, pyr w/intb'd clystn.		
	TRIAS. 9106 (L)					
	TRIASSIC		7" 9498'	Clystn/mdstn; red bn-ltgn-gy (variegated), sft-sub fiss, sl calc, occ mica w/intb'd Sd-SS; clr-wh-lt bn, fn-crse grn, calc cm't, pyr, pr srt'g.		
3000				T.D. 9500'		10000
3500	(P) = Paleo. Top (L) = Log Top					11000
						12000
4000						13000
4500						14000
						15000
5000						16000
						17000
5500						18000
						19000
6000						

CORES

No. 1. 8791-8838 Revd 8791-8803
2. 8840-8866 Revd 8840-8862
3. 8866-8893 Revd 8866-8893
4. 8895-8922 Revd 8895-8922
5. 9070-9095 Revd 9070-9083
6. 9106-9146 Revd 9106-9111
7. 9146-9155 Revd 9146-9152

SIDEWALL SAMPLES

Interval 8655-9410'
Shot 60 SWC
Recovered 59 SWC

DRILLSTEM TESTS

DST No#1 Interval: 9100-9115'
Formation: Statfjord/ Triassic?
Recovery: Flowed water at low rate with 3% oil cut at end of test.

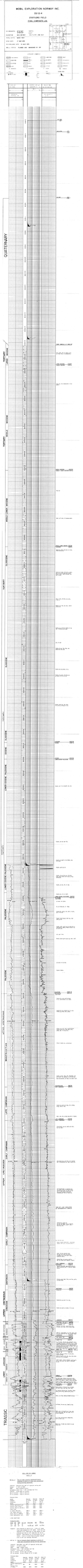
DST No#2 Interval: 8810-8820'
Formation: Brent
Recovery: Flowed water at low rate with 3 to 5% oil cut.

MOBIL EXPLORATION NORWAY INC

31/2-4

SVEALAND FIELD

ZONALOGRAMMERKER



ENCL. 4

SIDEWALL CORE DESCRIPTION

WELL 33/12-4

Run 1

	DEPTH	DESCRIPTION & REMARKS
1.	8655	Mdst, dk gy, sft-m hd, sl calc mic
2.	8658	Mdst, dk gy, m hd, sl calc mic
3.	8660	Mdst, dk gy, sft-m hd, sl calc mic
4.	8664	Mdst, dk gy-bk, m hd-hd, sl fiss
5.	8672	Mrl, rd bn, m hd mic tr ls wh-clr, wf-f xls, sft
6.	8678	Mrl, rd bn, m hd, mic
7.	8691	Mrl, rd bn, hd mic
8.	8699	a. a.
9.	8714	a. a.
10.	8750	Ls, wh-pale gn, m hd, crpxln mic
11.	8768	Mdst, dk gy-bk, m-hd, mic, fiss
12.	8770	Sh, dk gy-gk, hd, mic
13.	8773	Mdst, dk gy-bk, hd, laminated with thin calcite xls
14.	8776	Mdst, dk gy-bk, hd, mic, calc prtly slty and lt yl flor
15.	8792	Cl st, lt gy, m hd, mic, pyr intbdd sd vf, lt gy, calc cem oil odor, lst yl flor
16.	8796	s. s. vf, bndd, lt gy-dk gy, mic calc cem, p.por, oil odor, lt yl-flor
17.	8802	s. s. vf-wh gy, bndd, mic calc cem p.por. oil odor lt yl flor, weak lt bl cut
18.	8806	ss. vf, wh gy-lt tn, mil calc cem, p-por. oil odor, lt yl flor, weak lt bl cut
19.	8815	s.s. slty, vf, lt gy, mic calc cem, p-por. oil odor, lt yl flor, lt bl cloudy cut
20.	8821	s.s. & cl intbdd, mic carb mtr, calc cem nil, por
21.	9056	s.s., vf-crse, p srtd, sl ang, mic p-fr por tr lt yl flor
22.	9065	Slt st, lt fn-lt gy, mhd, mic
23.	9073	a.a.
24.	9077	Mdst, sdy, lt gn gy, m hd calc mic
25.	9085	Mdst, sdy, lt gn gy sft mic
26.	9126	Clst, gy gn, mic, sl lam
27.	9140	Mdst, sdy, rd bn, sft mic, calcite bands

SIDEWALL CORE DESCRIPTION

WELL 33/12-4

Run 1

	DEPTH	DESCRIPTION & REMARKS
28.	9145	Mdst, bl gy-rd bn-oker vgt, sft mic
29.	92085	Mdst, oker yl, sft, mil, occ, calc

Arne Linjordet 8 June, 1975

Sidewall Core Description

Well 33/12-4

Run 2

	Depth	Description and Remarks
1.	8766	Sh, dk gy-bk, m hd, mic
2.	8854	ss, lt bn, m hd, vf-f, w srtd, sl mic, lt yel flor, wh-wh bl cut
3.	8864	ss, lt gy, hd, vf-f, w srtd, mic, ferr nod, & mdst, dk gy-bk, sb fiss, mic, wxy
4.	8872	slst, gy, m hd, mic
5.	9090	ss, wh-crm, m hd, vf-vcrse, pr-srtg, sb rd-sb ang, sl mic, kao cem, lt yel flor, wh cut
6.	9206	mdst, rd bn, m hd, sl mic
7.	9264	slst, sdy, sft, v lt gy, mic
8.	9268	a/a
9.	9270	a/a
10.	9274	a/a
11.	9275	ss, v lt gy, hd, vf-crse, sb ang-sb rd, p srtd, sl mic
12.	9277	mdst, gn gy, m hd, sl mic
13.	9280	mdst, rd bn-lt gn, vtg, sl mic
14.	9282	mdst, olive-rd bn, vtg, m hd sl mic wxy
15.	9300	mdst, rd bn-lt gn, vtg, m hd sl mic
16.	9302	a/a
17.	9304	a/a
18.	9312	mdst, rd bn, m hd, sl mic
19.	9342	ss v lt gn, hd sb ang-sb rd, vf-f, w srtd, mic
20.	9344	a/a
21.	9346	a/a
22.	9348	a/a
23.	9360	mdst, dk gn gy, m hd, mic
24.	9365	mdst, rd bn, m hd, mic
25.	9370	mdst, rd bn, sticky, sl mic
26.	9375	a/a
27.	9380	mdst, rd bn-rd bk, sl mic

28.	9395	slst, v lt gn, sticky, mic
29.	9400	clyst, lt gn, sticky, mic
30.	9410	slst, lt gn, hd, sl mic, ferr, pyr nod