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ELF AQUITAINE NORGE A/S
Exploration Division
Ref.no.: 311D/82/109-R
CL/AC/mm

GEOLOGICAL COMPLETION REPORT
WELL 15/3-4

Approved by:
J. Dupuy
Geological Dept. Manager

Authors: C. Legorjus
A. Conort

Stavanger, October 1982

LIST OF CONTENTS

- SUMMARY
1. General data
2. Hole records
3. Objectives and main results
4. Lithology
5. Stratigraphy
6. Sedimentology
7. Geochemistry - Analyses of fluids
8. Structural data
9. Hydrocarbon shows
10. Coring
11. Logging
12. Reservoirs
13. Formation Pressures
14. Formation temperature
15. Correlations
16. Conclusions

LIST OF FIGURES

1. Position map
2. Position of block 15/3 in the Viking Graben
3. Well summary sheet
4. Stratigraphy of well 15/3-4
5. "
6. Well core description no. 2 to 5
7. Well velocity data
8. Seismic line 783 402
9. "
10. Isochron map M2
11. " J2
12. " Bottom Dogger
13. " F
14. Isopach map M2-J2
15. " J2-Bottom Dogger
16. Pressure vs depth
17. Revised estimates of hydrocarbons in place
18. Formation temperature
19. Correlation map

LIST OF APPENDICES

1. Bore Card 1/5000
2. Core description, K1
3. " , K2
4. " , K3
5. " , K4
6. " , K5
7. Side wall core description, run 1
8. " , run 2
9. " , run 3
10. Well history summary

LIST OF PLATES

Pl. 1 : Composite Log
Pl. 2 : Line 783 402
Pl. 3 : An interpretation of the seismic line 873 402
Pl. 4 : Isochron map M2, 1/25000, 15/3-4 accumulation
Pl. 5 : " J2, " , " "
Pl. 6 : " Bottom Dogger, 1/25000, 15/3-4 accumulation
Pl. 7 : " F , " , "
Pl. 8 : Isopach map M2-J2 = Hot Shales, 1/25000
Pl. 9 : " J2-J3 = Equivalent Brent Sand, 1/25000
Pl. 10: Calibrated sonic log
Pl. 11: Correlations

SUMMARY

The exploration well 15/3-4 was drilled between October 3rd 1981 and March 30th 1982.

Objective

The main target of the well was represented by the sandstones of the upper and middle Jurassic which were found hydrocarbon bearing (gas with condensate) in wells 15/3-1 and 15/3-3.

A sedimentological study based on cores was planned in the upper Eocene sands where oil shows were encountered in the 15/5-3 well and which may represent a prospective target.

Results

Oil accumulations have been found in three of the four sandstones reservoirs encountered in mid-Jurassic "Brent equivalent", the fluid content of the fourth one being uncertain (hydrocarbon or water?). The pressure gradients are lower than expected. Coring of the upper Eocene sands was unsuccessful, probably due to their unconsolidation. A DST performed in the upper Sandstone level gave a flow rate of 615 m^3/day of oil and 245224 m^3/day of gas.

POSITION MAP

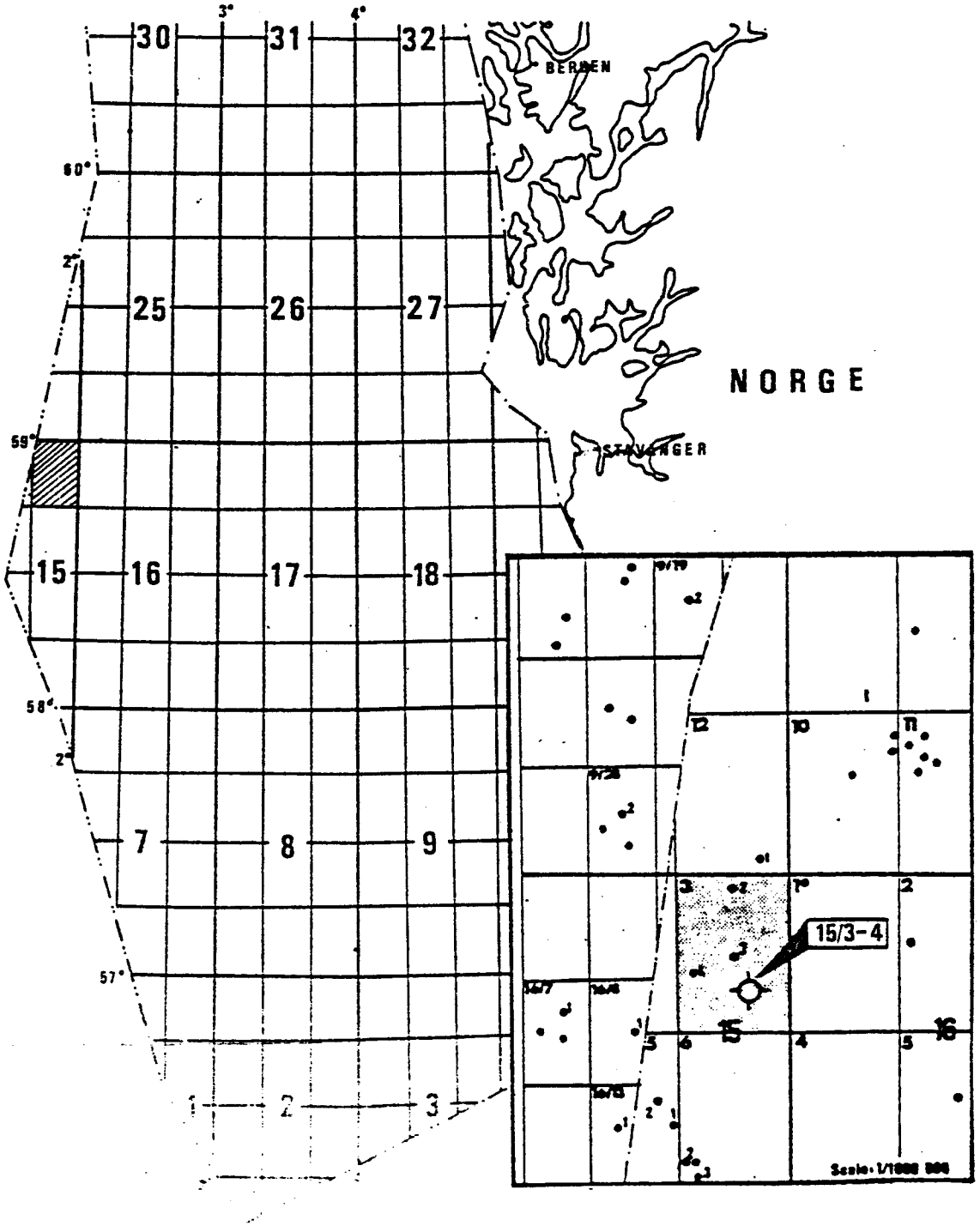
BLOCK : 15/3

WELL : 15/3-4

OWNER : PETRONORD GROUP

COORDINATES : X: 01°52'59.82"E
Y: 58°49'05.28"N

Scale: 1/2500000 Seismic line 783 402 S.P. 490 Date: 07.82

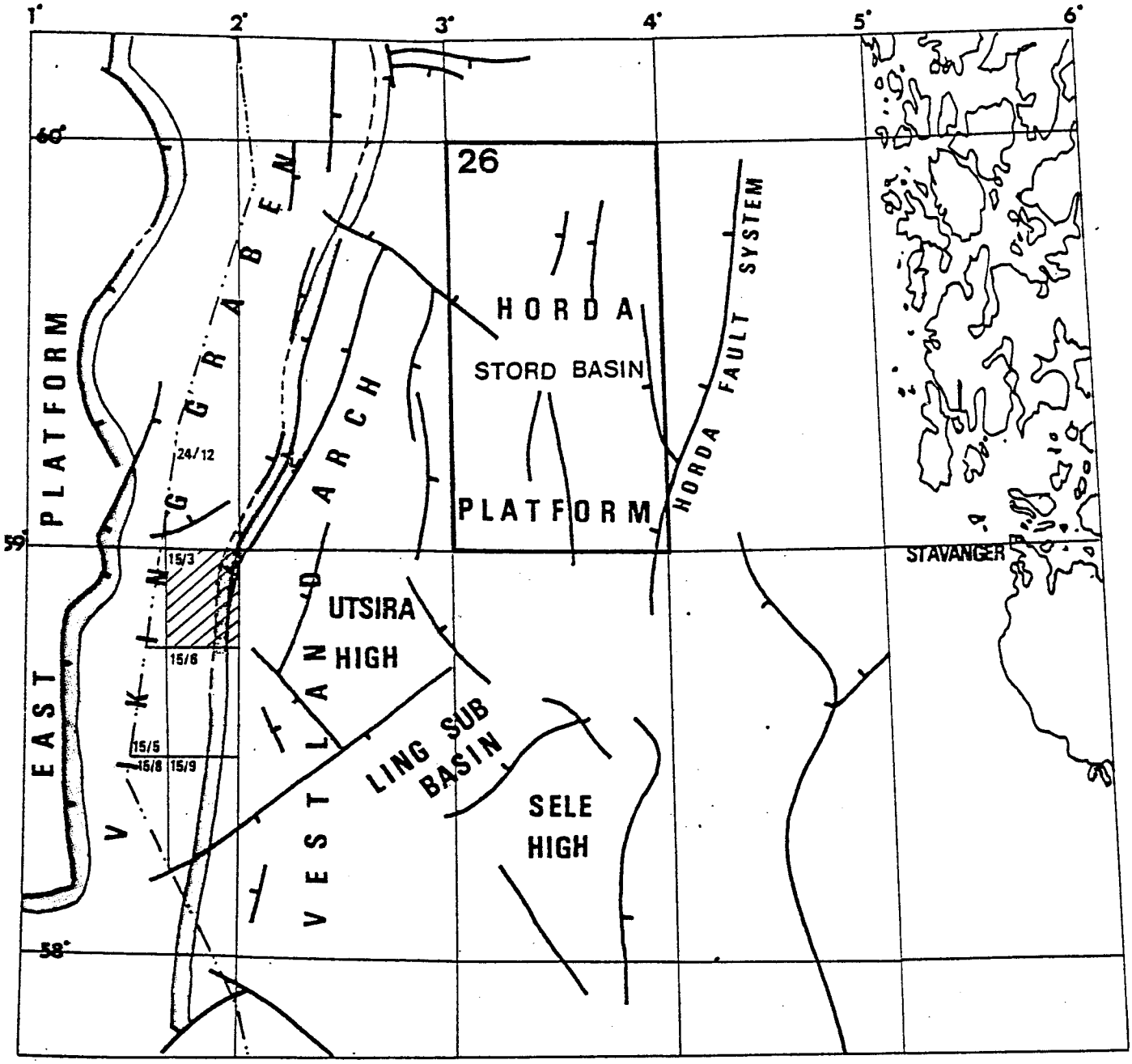


EXPLORATION DIVISION

Fig.1

1 GENERAL DATA (Fig. 1 and 2)

Country:	Norway offshore	
Licence:	025	
Area:	Block 15/3	
Well identification:	15/3-4	
Owner:	Petronord	
Operator:	Elf Aquitaine Norge A/S	
Partners:	Elf Aquitaine Norge A/S	43.6%
	Total Marine Norsk A/S	21.8%
	Norsk Hydro Prod. A/S	19.6%
	Norsk Hudbay A/S	15.0%
Well classification:	Wildcat	
Coordinates:	X 01°52'59",817 E	
	Y 58°49'05",279 N	
Seismic location:	Seismic line 783 402	
	Shot point: 490	
Drilling Rig:	Borgsten Dolphin	
Water Depth:	107 m	
RKB-Sea level:	25 m	
TD:	4258,5 m RKB	
Rig assigned to EAN:	26.9.1981 at 07.40	
On location:	01.10.1981 at 07.00	
Well spudded:	03.10.1981 (at 11.00)	
At TD:	24.02.1982	
Completion started:	06.03.1982	
Off location:	30.03.1982	
Contractors:	Drilling: Dolphin A/S	
	Mud logging: Geoservices	
	El. logging: Schlumberger	



Approximal limit of Viking graben.

Faults (down throw indicated).

U.K.— Norway Limit.

Position of Block 15/3 in the Viking Graben.

Scale: 1/500.000

FIG. 2

1 GENERAL DATA

1.1 Location

The wildcat 15/3-4 was designed to explore a new area in the eastern part of the block 15/3, located to the East and South East of the 15/3-1 and 15/3-3 wells (Gudrun field).

The area corresponds to a long panel dipping to the North West and affected by faulting generally trending N.S. In comparison with Gudrun it constitutes a higher step of the eastern flank of the Viking Graben towards the Utsira High and close to this latter (fig. 2). An important fault separates the two entities.

1.2. Objective

The main objective was represented by the sandstones of upper and middle Jurassic which were found hydrocarbon bearing (gas with condensate) in the 15/3-1 and 15/3-3 wells. According to the pressures recorded in these wells, high pressure gradients were expected.

1.3 Structural features

Initially the prospect consisted of the truncation of the Jurassic series below the Kimmerian unconformity (M2 marker) combined with a structural closure. A re-interpretation of the seismic after migration of all the lines showed instead of a truncation of the pre-M2 marker, a roll-over with counterdip to the East against the fault which delineates the panel. The maps used for the estimation of accumulations are based on this re-interpretation (pl. 6 and 7).

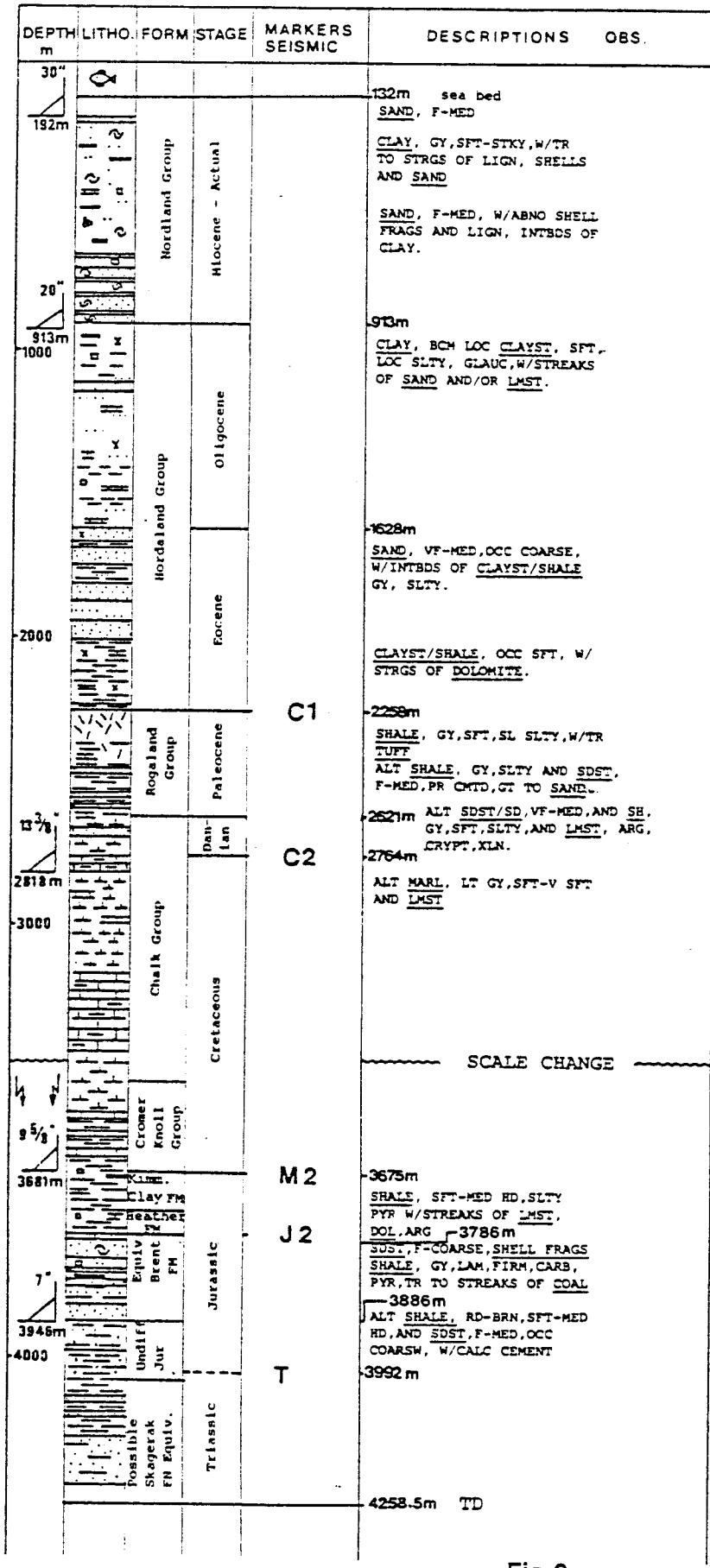
2 HOLE RECORDS

Drilling 36" hole from 132 to 192 m
    set 30" casing at 192 m
Drilling 26" hole from 192 to 937 m
    set 20" casing at 925 m
Drilling 17 1/2" hole from 937 to 2833 m
    set 13 3/8" casing at 2819 m
Drilling 12 1/4" hole from 2833 to 3700 m
    set 9 5/8" casing at 3682 m
Drilling 8 1/2" hole from 3700 to 3948 m
    set 7" liner at 3946 m
Drilling 5 7/8" hole from 3948 m to 4258,5 m (TD)

One "fish" was lost in the hole: top fish at 4099 m.

Five cores have been cut (see annexes).

The T.D. (4258,5 m) was reached in 154,2 days.



COORD:

X: 01°52'59.817"E
Y: 58°49'05.297"N

WELL: 15/3-4

COUNTRY: NORWAY

LIC: 025

DEPTH REF: RKB

NOTA :

CASINGS

30" at 192 m
20" at 921 m
13 3/8" at 2818 m
9 5/8" at 3681 m
7" at 3946 m

TARGETS:

Upper and Middle Jurassic sandstones

RESULTS:

LEVEL1: (3786-3816.5 m RKB)
NET/GROSS = 15/30.5
$\bar{\phi}$ = 14-17%, $\bar{S}w$ = 20%, $\bar{K}$ = 60 md

TEST: 3789 m / 3807.5 — $615m^3/d + 245224m^3/d$, Pt= 8250 PSI at 37895m

LEVEL 2: (3821-3826 m RKB)
NET/GROSS = 5/5
$\bar{\phi}$ = 9-14%, $\bar{S}w$ = 66%, $\bar{K}$ = 8.5 md
FIT: (3822.5 m)

10 l of water (25 g/l) w/dissolved gas
Pt = 8190 psig at 3822.5 m

LEVEL 3: (3849.6-3854.4 m RKB)
NET/GROSS = 48/48
$\bar{\phi}$ = 15%, $\bar{S}w$ = 18%
FIT: (3852.5 m)
5 l gas + 3 l oil (44 API)+21 emulsion
Pt = 7865 psig at 3852.5 m

LEVEL 4: (3872-3876 m RKB)
NET/GROSS = 4/4
$\bar{\phi}$ = 15%, $\bar{S}w$ = 20%
FIT: (3873.5 m)
4 l oil + 3 l emulsion + 3 l gas

Pt = 7699 psig at 3873.5 m

DATE 15.10-82 KF

Fig.3

3 OBJECTIVES AND MAIN RESULTS (see bore card; appendix 1)

3.1 Objectives

The 15/3-4 well was designed to explore a new area in the eastern part of the 15/3 block, extending to the East and South East of the 15/3-1 and 15/3-3 wells (Gudrun field).

The area corresponds to a large panel dipping to the North West and affected by faults generally trending North-South. In comparison with Gudrun structure it constitutes a higher step of the eastern flank of the Viking Graben towards the Utsira High and close to this latter (fig. 3). An important fault separates the two entities.

The main objective was represented by the sandstones of upper and middle Jurassic which were found hydrocarbon bearing (gas with condensate) in 15/3-1 and 15/3-3 wells. According to the pressures recorded in these wells, high pressure gradients were expected.

Coring of the top of the upper eocene sands was planned in order to perform a sedimentological study as they displaid oil shows in 15/5-3 and accumulations in some surrounding wells.

3.2 Main results

The Eocene sands were found waterbearing. The Jurassic sandstones were found hydrocarbon bearing. Three levels found oil and gas bearing were tested.

Level 1: 3786 - 3817.0 m
Level 3: 3849.9 - 3854.8 m
Level 4: 3872.2 - 3876.4 m
Level 2: 3819.5 - 3826.5 m is indeterminate due to contradictory results.

4 LITHOLOGY (see composite log pl. 1)

the 15/3-4 lithology is summarized below (RKB depths).

Miocene to Actual

132 - 192 m:	Mainly sand, fine to medium
192 - 690 m:	Clay, grey, soft and sticky, with traces to streaks of lignite, shells and sand.
690 - 913 m:	Mainly sand, fine to medium, with abundant shell fragments and lignite. Interbeds of clay grading to silt.

Oligocene

913 - 1628 m:	Clay becoming locally claystone, soft, locally silty and glauconitic with streaks of sand and/or limestone.

Eocene

1628 - 2025 m:	Sand, very fine to medium, occasionally coarse with interbeds to alternations of shale grey, silty.
2025 - 2255 m:	Shale, grey to brown, medium hard, occasionally soft with stringers of dolomite.

Paleocene

2255 - 2464 m:	Shale grey, soft, slightly silty with traces of tuffs.
2464 - 2621 m:	Alternating shale grey, silty and sandstone, fine to medium, poorly cemented gradding to sand.

Danian

2621 - 2719 m:	Alternating sandstone to sand, very fine to medium; shale grey, soft, silty; and limestone argillaceous to cryptocristalline.
2719 - 2764 m:	Marl, light grey, soft to very soft.

Upper Cretaceous

2764 - 3525 m: Alternating marl, light grey, soft to very soft, and limestone argillaceous, pink to white.

Lower Cretaceous

3525 - 3675 m: Shale light to dark grey, silty with interbeds of limestone white, medium hard, argillaceous.

Upper Jurassic

3675 - 3786 m: Mainly shale brown, soft or medium hard, silty pyritic with streaks of limestone, light brown to light grey, dolomitic or argillaceous.

Middle Jurassic

3786 - 3825 m: Mainly sandstone fine to coarse, occasionally very rich in Pelecypodae.

3825 - 3886 m: Mainly shale grey, laminated, firm, carbonaceous, pyritic, with traces or streaks of coal, two levels of sandstone, fine to medium have to be noticed.

Middle Jurassic - Dogger?

3886 - 4042 m: Alternating shale red and grey, soft or medium hard and siltstone, light grey, compact.

Possible Triassic

4042 - 4258,5 m (TD): Alternating shale, red brown, soft to medium hard and sandstone, fine to medium occasionally coarse with calcareous cement.

STRATIGRAPHY OF WELL 15/3-4

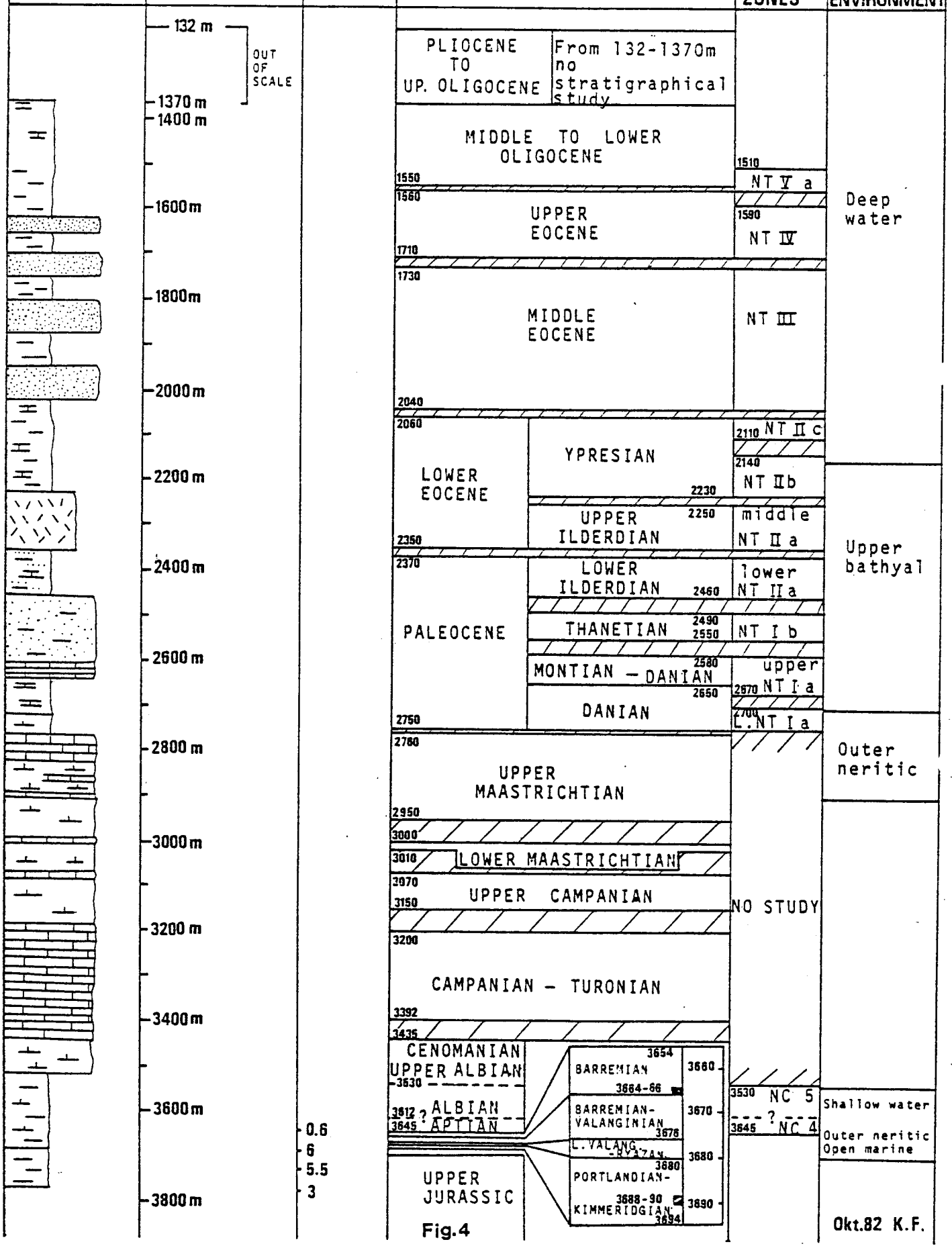


Fig.4

5 STRATIGRAPHY (see fig. 4.5, appendix 1)

5.1 Stratigraphical results

The fig. 5-6 summarizes the results of the biostratigraphical studies including microstratigraphy, palynology and nannofossil study, performed on the stratigraphical series recognized by the well. Below the Kimmerian unconformity the drilling entered a 116 m thick upper Jurassic exclusively shaly without any detritics.

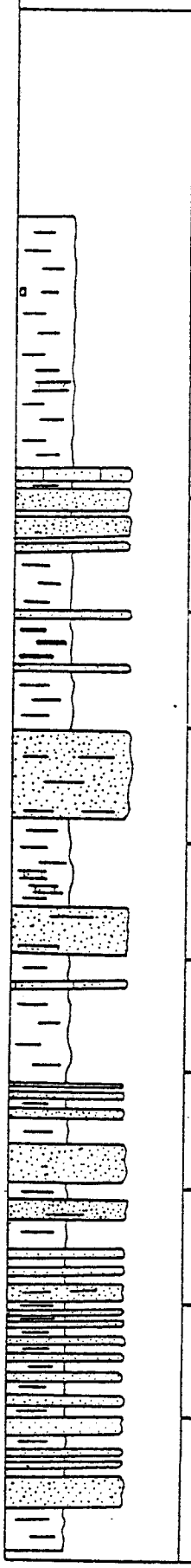
The middle Jurassic was reached at 3786 m down to 3886 m, well dated from Bajocian and Bathonian it may be subdivided into 3 parts

- the upper part 3786 to 3826,5 m consists of sandstones interbedded with shales. The environment is marine and the sandstones are considered as storm deposits.
- the median part 3826,5 to 3849,9 m is exclusively shaly from marine environment.
- the lower part 3849,9 to 3886 m exhibits to main ~~sepias~~ sequences in a fluvio continental environment with shales, sands and coal beds.

All these deposits are considered as an equivalent of Brent formation.

Underlaying the middle Jurassic are 372 m of red series (with shales and sandstones) down to 4258 m (total depth) where middle Triassic was identified at 4006 m.

STRATIGRAPHY OF WELL 15/3-4 ; JURASSIC



LITHOLOGY	DEPTHS (m RKB)	TOC	VR	STRATIGRAPHY	PALYNO-ZONES	DEPOSITIONAL ENVIRONMENT
	3600m					
		7	0.5% to 0.6%	3680		
		5.5		3694 PORTLANDIAN - KIMMERIDGIAN		Open marine
	3700m	3				
		5.5		UPPER JURASSIC		Azoic
		6		3736		
		3.5		3750	3755	
				LOWER OXFORDIAN - CALLOVIAN	NJ 5b	Marine
		2.5			3774.5	
			0.6%	3790		
	3800m			3792.5		
				BATHONIAN	NJ 4b	Restr. marine brackish
		2.5			3839	Shallow marine
		28		3864	NJ 4ind. 3860	
		4			3877.5 NJ 4	Azoic
	3900m	2		BATHONIAN - BAJOCIAN		
		0.5		3926.5		
			0.7%			
		1		DOGGER ?		
				3972		
		0.1		indeterminated		
	4000m			4006		
		0.3				
		0.2				
		0.1				
				MIDDLE TRIASSIC		
	4100m					
				PROBABLY MAISIAN		
	4200m					
				4258		

Fig.5

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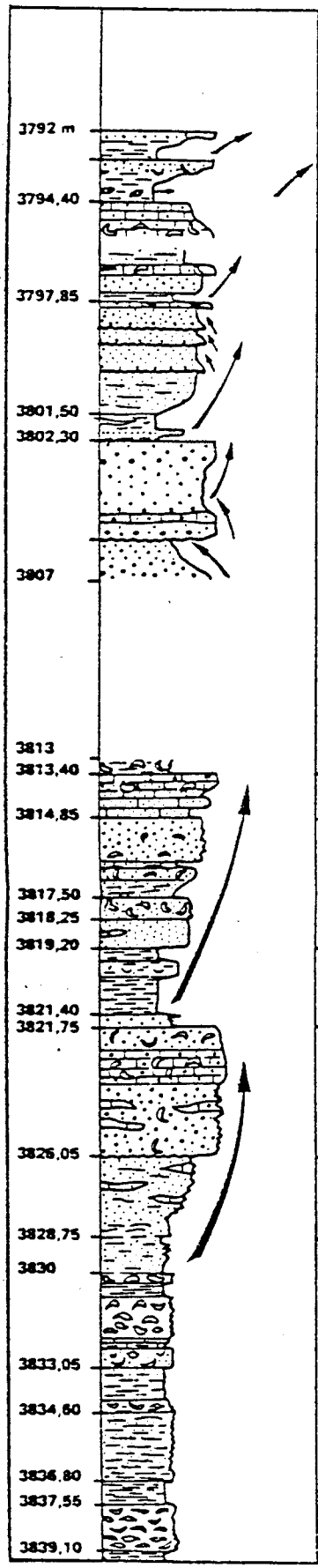
15/3-4 WELL CORE DESCRIPTION No.2 to 5



Metric coarsening up sequences : Grey brown, fine to coarse, porous sandstone, Grey brown, fine, micaceous, sandstone and dark grey brown, ligneous, pyritic shale.

Light grey, fine to coarse, sparitic sandstone, local Oysters, interbedded, light brown, fine, micaceous sandstone.

Coarsening up sequence with erosional basal surfaces and small fining up sequences : light brown medium sandstone, local micropebbles, light brown, fine, argillaceous sandstone, dark grey, micaceous shale, with lenticular sandstone.

Coarsening up and fining up sequences with light brown, medium to coarse, porous sandstone, light grey brown, fine, argillaceous sandstone.

Grey pyritic shale with lumachellic Oysters.

Light grey, fine to microconglomeratic, sparitic sandstone, local Oysters.

Coarsening up with local fining up, light brown, fine to medium sandstone with local frequent Oysters, microvuggy porosity ; light brown, fine, argillaceous, ligneous, smoothy bioturbated sandstone.

Dark grey silty shale and light grey, silty, argillaceous, microbioturbated sandstone.

Light grey fine to coarse sparitic sandstone and light brown, fine to coarse, porous sandstone, frequent debris of Oysters. local nodular sparitization.

Light brown, fine to silty sandstone with horsetailed shale local light grey, fine, sparitic sandstone.

Grey silty, micaceous shale with metric, interbedded lumachellic shells (Oysters) with argillaceous, silty matrix. Interbeds of light brown, silty, bioturbated sandstone.

Fig.6

Scale 1 / 200

6 SEDIMENTOLOGY

A sedimentological study has been performed on cores 2 to 5 in the Bathonian deposits which constitute the main reservoir of the well. These deposits are represented by sandstones laid down by periodic wave action (storm deposits) in a subtidal environment. Their marine character is indicated by:

- an abundance of large Oyster shells and some Mytilus,
- frequent pyritized microforaminifera,
- the presence of encrusting Annelids and boring sponges
- the presence of rare Echinoids

In the succession shown on fig. 6 there are two kinds of sediments:

- shales/silts/bioturbated sandstones, deposited in a subtidal, low energy environment,
- coarse sandstones and lumachellic shales related to high energy by basal erosional surfaces, abundance of debris flow, immature production (coarse, poorly sorted sandstone with more or less argillaceous matrix), accumulation of shells, presence of resedimented weathered rocks.

Most of these characteristics have been interpreted as being the result of storm process.

7 GEOCHEMISTRY - ANALYSES OF FLUIDS

Geochemical analyses have been carried out on 32 samples from 3654 to 4040 m and on the oil sample of DST 1 (3789 - 3807,5 m) the main results are as follows:

Organic matter content: Lower Cretaceous = TOC < 1%

- Upper to middle Jurassic (3680 - 3900 m) = 2 < TOC < 7% with 28,18% at 3860 m in a coaly sample.
- Middle Jurassic (3900 - 4040 m) = TOC < 1%

Thermal evolution:	TAI	VR	
3670 m :	2.5	0.55/0.6% :	3680 m
3770-3860:	3	0.6/0.65% :	3786 m
3890 m :	3 +/3.5	0.7 :	3934 m

T max (Rock Eval.) increases from 425/430°C in Upper Jurassic to 440/445°C in Bajocian.

The upper Jurassic section is at the beginning of the oil generation zone, the rest of the section being in the middle of this zone.

Nature of organic matter: 6 samples analysed 3680-3740-3786-3830 (coal) -3934 and 4040 m.

The upper Jurassic has a sapropelic marine facies with algae (Tasmanaceae) and numerous fluorescent bitumens. The rest of the section is mostly humic with vitrinites, exinite.

Oil potential: Rock Eval. analyses were carried out only on samples with TOC>0.4% (17 samples), the hydrogen indices of kerogen are:

Lower Cretaceous	Hi<20 mg HC/g TOC
Upper Jurassic	180 - 365
Oxfordian	75 - 280
Bathonian (coaly)	215 - 335
Bajocian	80 - 120

Compared to 15/3-3 equivalent series, 15/3-4 has the same kind of organic matter but with a lower degree of maturation consistent with is structural location.

The potential is high to very high in the Malm, low to medium in the Dogger (except for coaly levels).

Oil analysis; from DST 1: this oil is very similar to the oil from 15/5-1: they have the same gross composition and the genetical indices show they have the same upper Jurassic origin. However, the 15/3-4 oil is slightly more mature than the oil from 15/5-1.

PVT studies: PVT studies have been carried out on the oil sample from DST 1. The PVT studies of FIT samples are planned to be performed in May/June 1983.

Co2 study: the follow up of this study initiated with the samples from 15/3-1 and 15/3-3 will come after the PVT studies on the FIT samples.

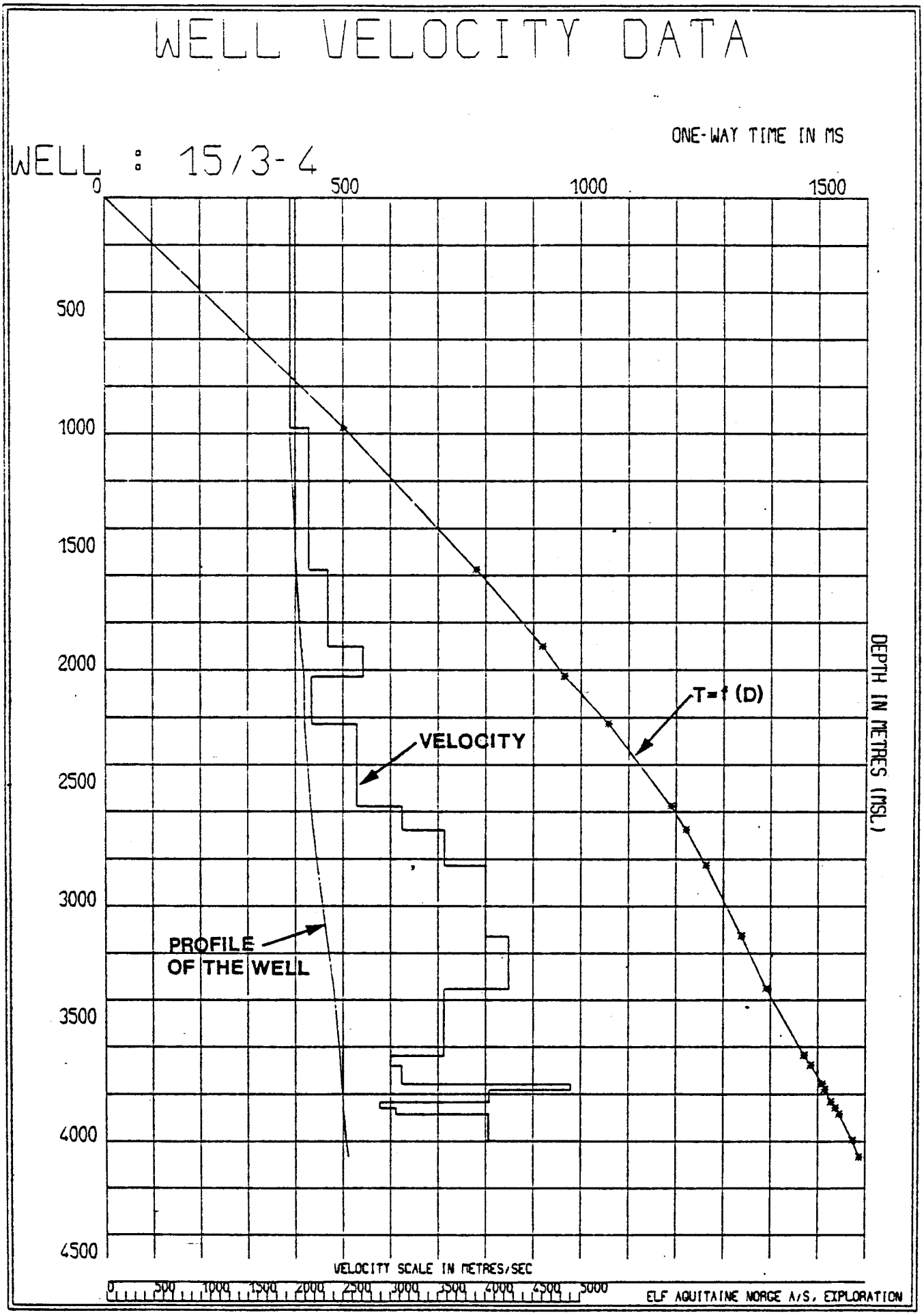

WELL VELOCITY DATA
WELL : 15/3-4
ONE-WAY TIME IN MS
0
500
1000
1500
500
1000
1500
2000
2500
3000
3500
4000
4500
DEPTH IN METRES (MSL)
T=f (D)
VELOCITY
PROFILE
OF THE WELL
VELOCITY SCALE IN METRES/SEC
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
ELF AQUITAINE NORGE A/S, EXPLORATION

Fig.7

8 STRUCTURAL DATA

8.1 Geophysical Results

8.1.1 Well Velocity Survey and Calibrated Sonic Log

A vertical seismic profile (VSP) has been made on this well (26 shots between 4090 and 1000 m).

A calibrated sonic has been produced (see plate 10). Fig. 7 shows the T = f (D) curve.

8.1.2 Comparison Prognosis Versus Results

The 15/3-4 well is located at shot point 490, seismic line 783402.

The table below compares prognosis to calibrated results.

Horizon	Depth MSL(m)		Discrepancy
	Prognosis	Results	
C1 Top of Tuff	-2250	-2233	- 17
C2 Top of Chalk Group	-2725	-2694	- 31
M1 Top of Plenus Marl	-3320		
M2 Top of Kimmeridge Clay	-3640	-3650	+ 10
J2 Top of Reservoir	-3793	-3761	- 32
Bottom Reservoir	-3866	-3861	- 5

New calibration of seismic marker have been used in order to draw new maps of the Jurassic marker.

Revised isochron maps and isopach maps are presented for:
- Isopachs M2, Top of Kimmeridge Clay (fig. 10)
- Isopacks J2, Top of Reservoir (fig. 11)
- Bottom Dogger (fig. 12)
- Top Trias (fig. 13)
- Isopachs M2-J2 (fig. 14)
- Isopachs J2 - Bottom Dogger: fig. 15

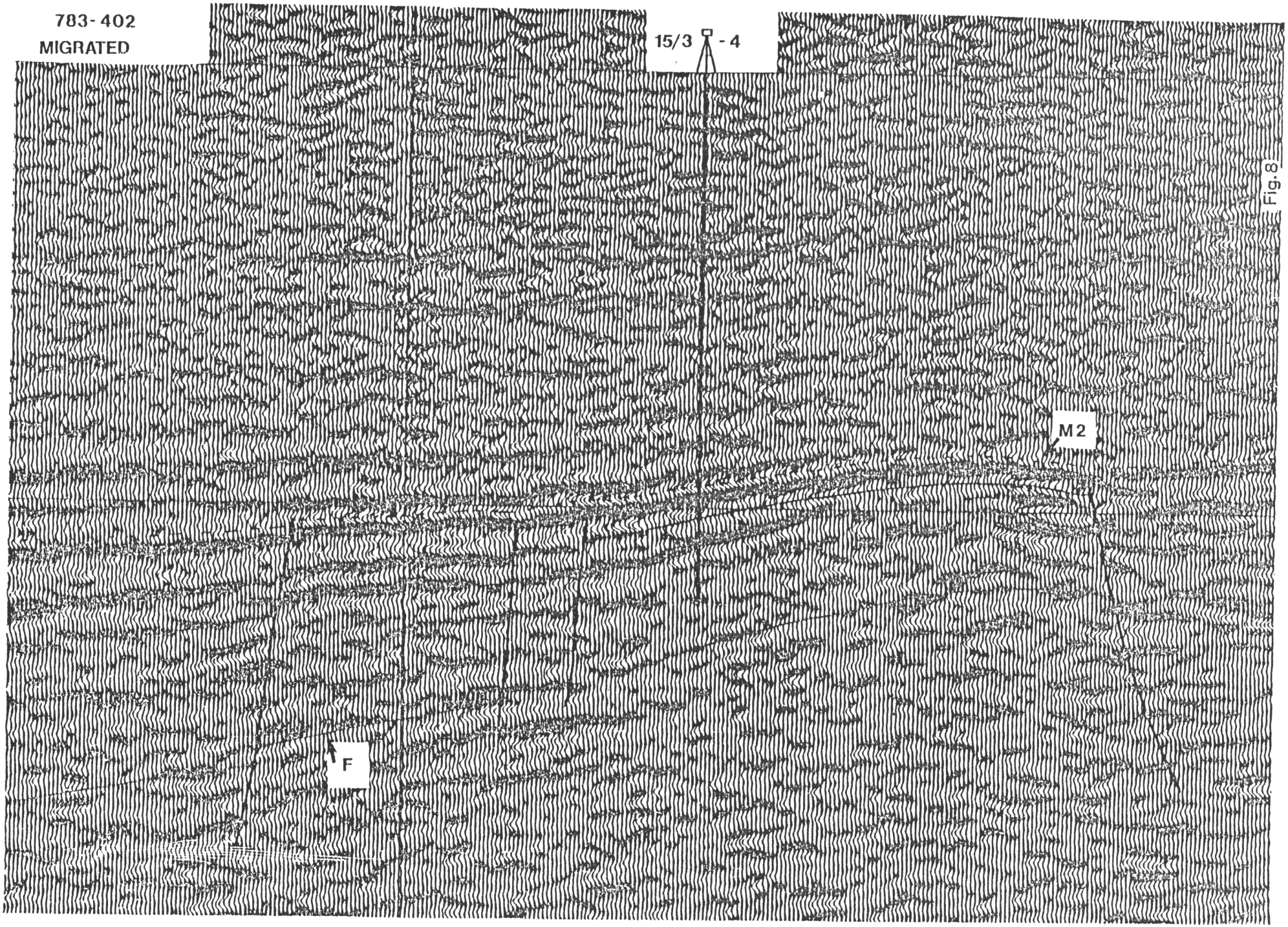


Fig. 8

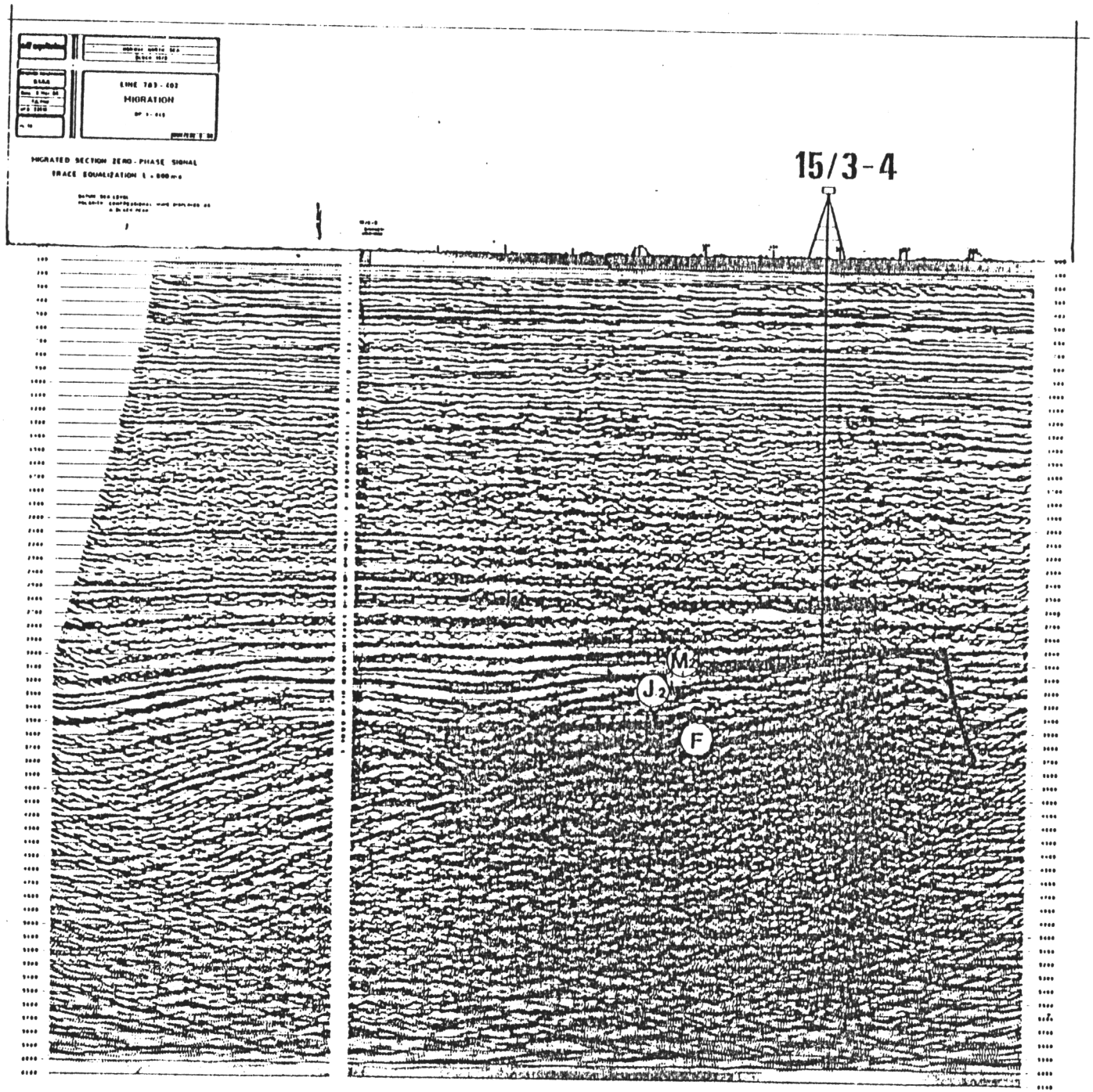

LINE 703 - 402
MIGRATION
MIGRATED SECTION ZERO-PHASE SIGNAL
TRACE EQUALIZATION
15/3-4
M2
J2
F

Fig. 9

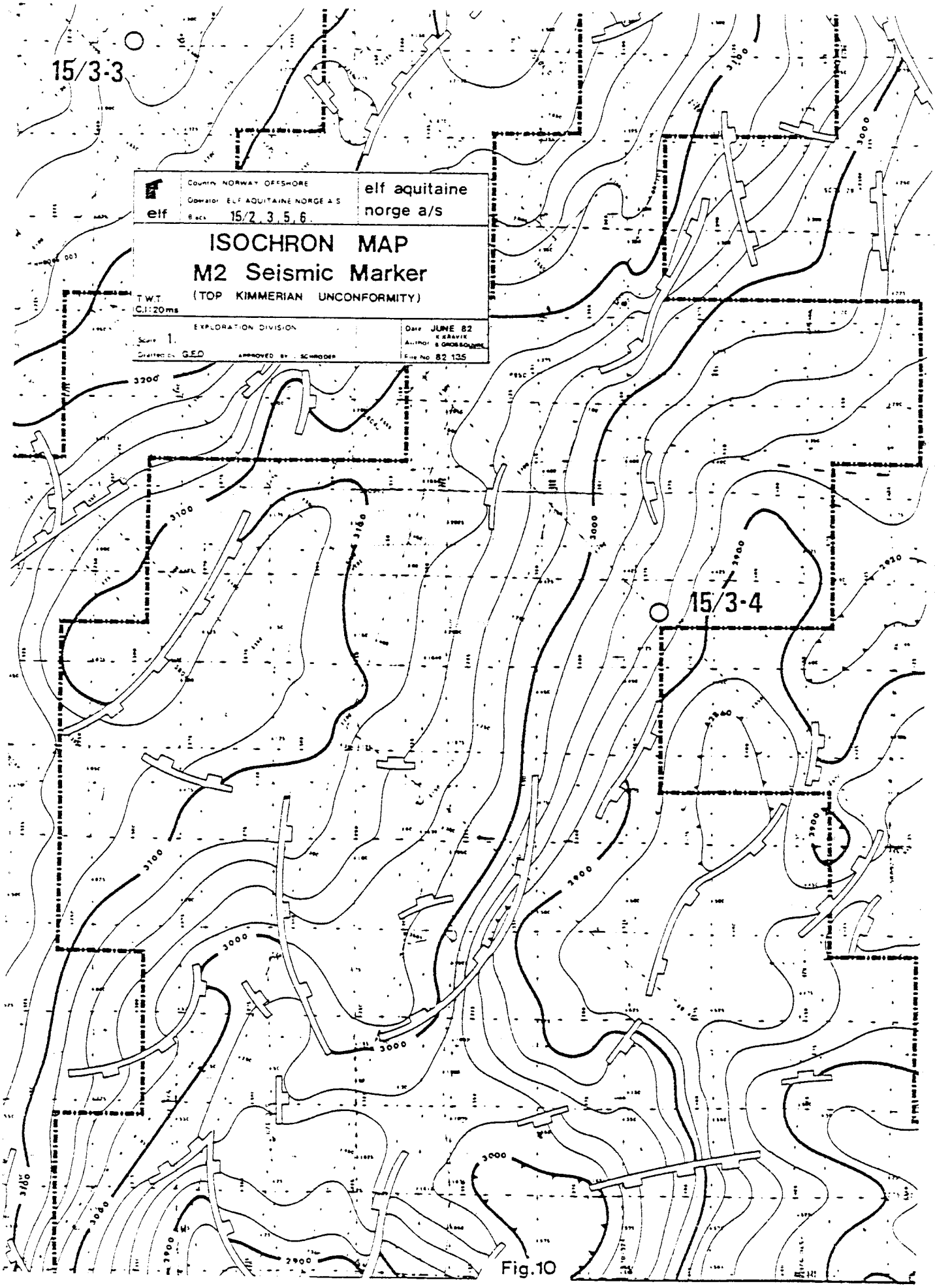

15/3-3
15/3-4
elf
Country NORWAY OFFSHORE
Operator ELF AQUITAINE NORGE A.S
Block 15/2, 3, 5, 6.
elf aquitaine norge a/s
ISOCHRON MAP
M2 Seismic Marker
(TOP KIMMERIAN UNCONFORMITY)
T.W.T.
C.I.: 20ms
EXPLORATION DIVISION
Scale 1.
Drafted by G.E.O
APPROVED BY SCHRODER
Date JUNE 82
File No 82 135
3200
3100
3000
2900
2800

Fig.10

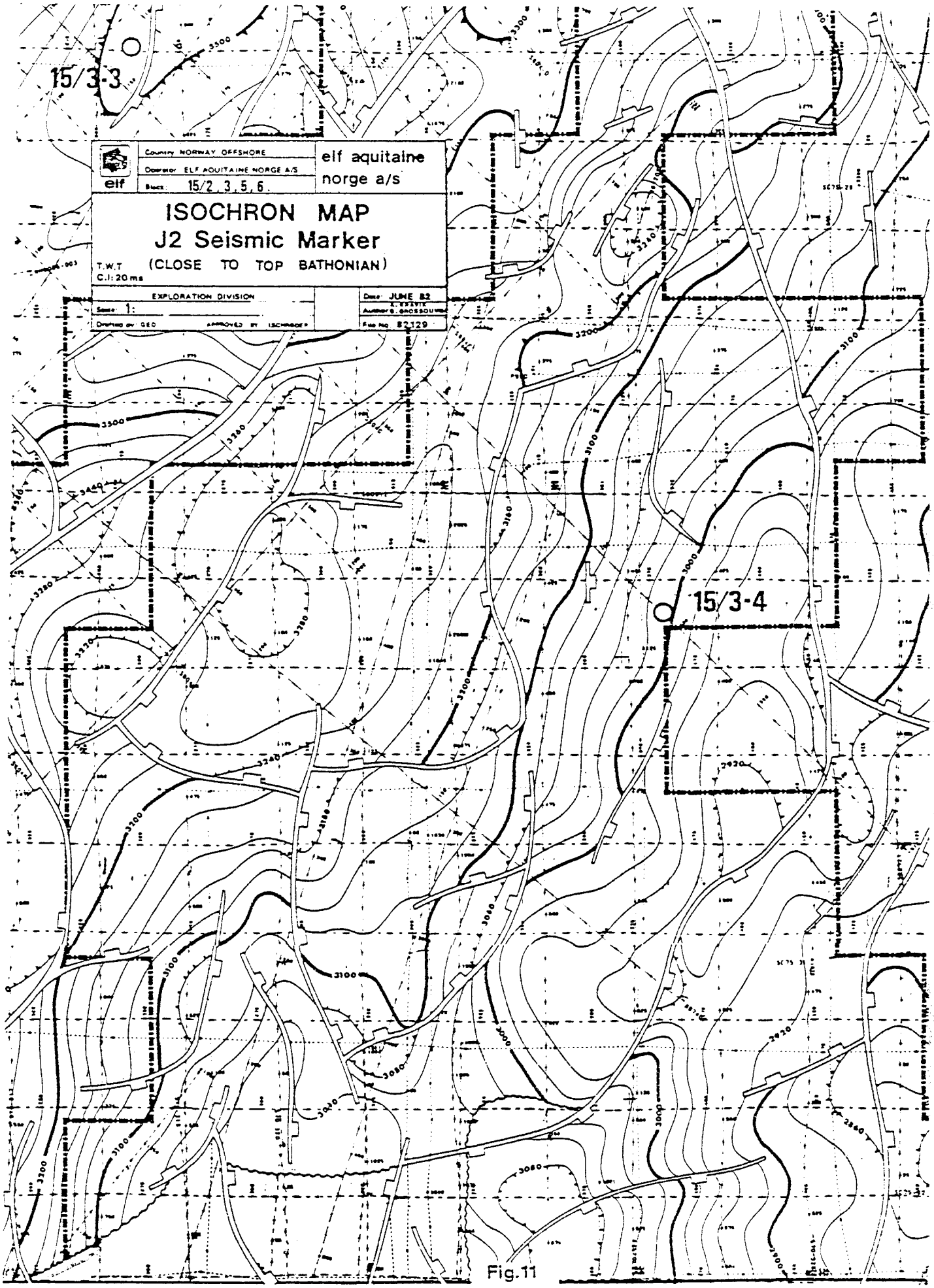

15/3-3
15/3-4
elf
Country NORWAY OFFSHORE
Operator ELF AQUITAINE NORGE A/S
Block 15/2, 3, 5, 6.
elf aquitaine
norge a/s
ISOCHRON MAP
J2 Seismic Marker
(CLOSE TO TOP BATHONIAN)
T.W.T
C.I: 20 ms
EXPLORATION DIVISION
Scale 1:
Drafted by GEO
APPROVED BY
Date JUNE 82
Author
File No 82129

Fig.11

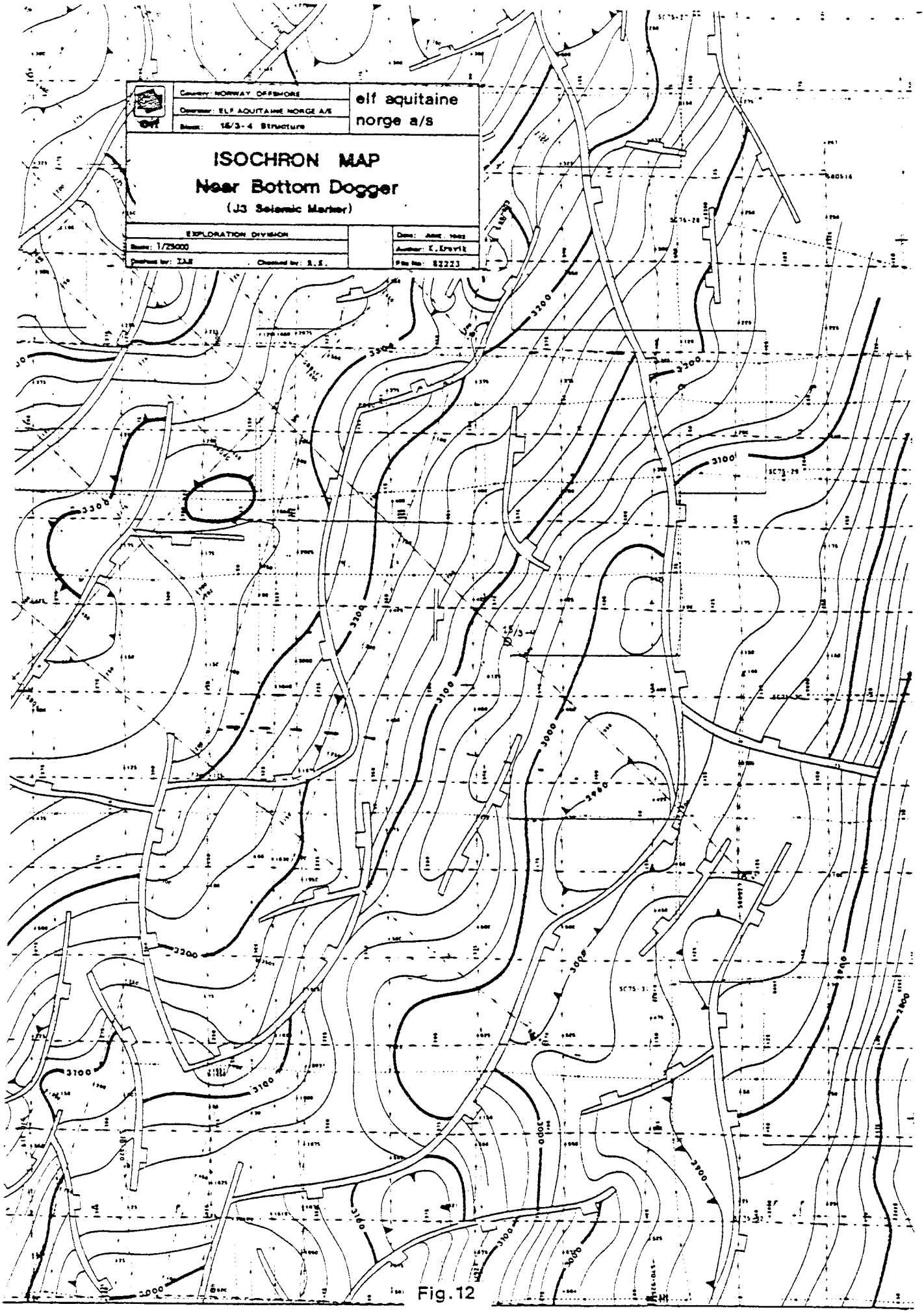

Country: NORWAY OFFSHORE
Operator: ELF AQUITAINE NORGE A/S
Block: 16/3-4 Structure
elf aquitaine
norge a/s
ISOCHRON MAP
Near Bottom Dogger
(J3 Seismic Marker)
EXPLORATION DIVISION
Scale: 1/25000
Drawn by: TAB
Checked by: S.E.
Date: JUNE 1992
Author: E.Kravik
File No: 82223
3300
3200
3100
3000
2900
2800
16/3-4

Fig.12

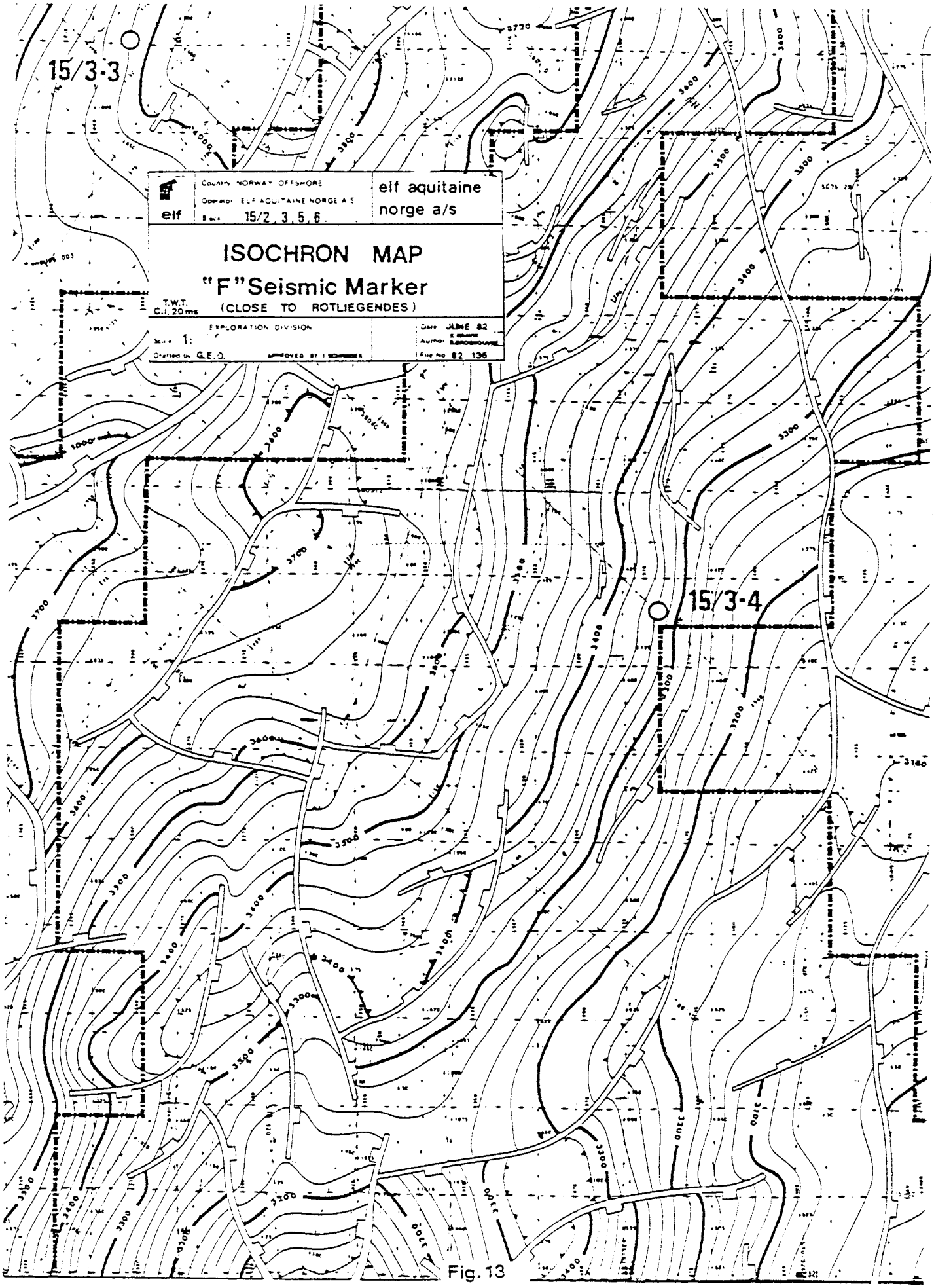

15/3-3
15/3-4
elf
Country NORWAY OFFSHORE
Operator ELF AQUITAINE NORGE A.S
Block 15/2, 3, 5, 6.
elf aquitaine
norge a/s
ISOCHRON MAP
"F" Seismic Marker
(CLOSE TO ROTLIEGENDES)
T.W.T.
C.I. 20 ms
EXPLORATION DIVISION
Scale 1:
Drafted by G.E.O.
APPROVED BY I. SCHRIEBER
Date JUNE 82
Author
File No 82 136

Fig. 13

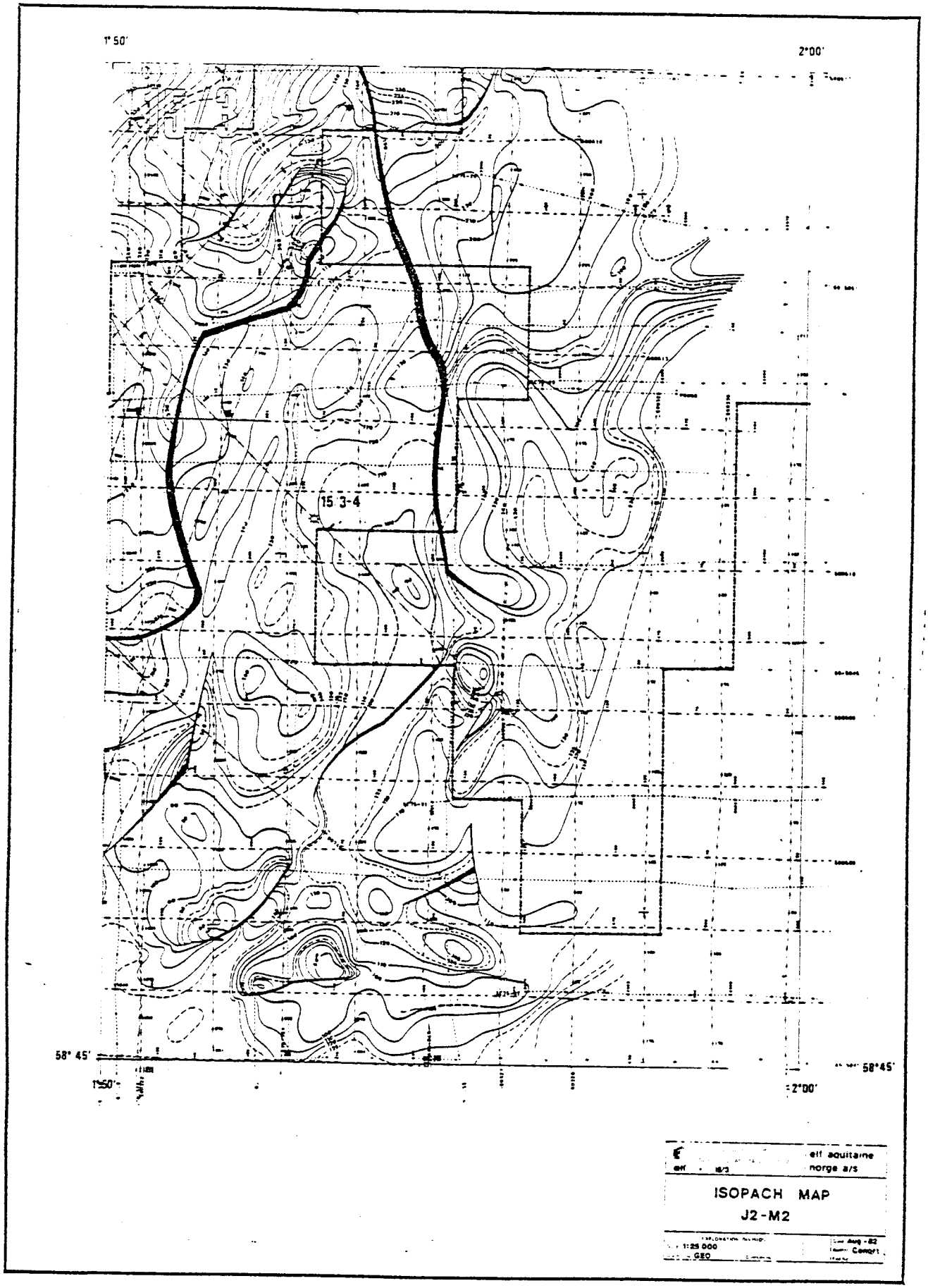

1°50'
2°00'
15/3-4
58° 45'
58°45'
1°50'
2°00'
elf aquitaine
norge a/s
ISOPACH MAP
J2-M2
1:25 000
GEO

Fig.14

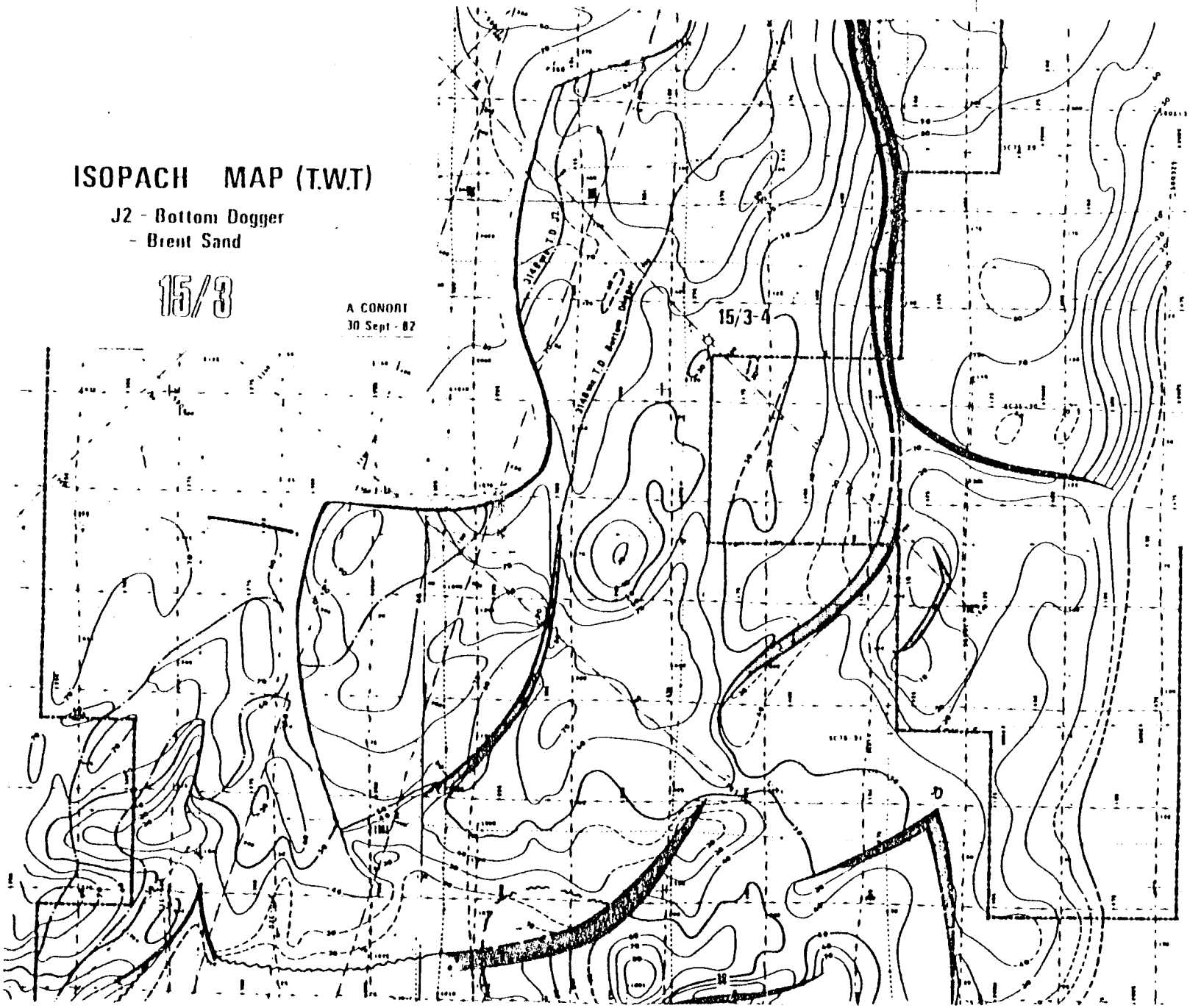

ISOPACH MAP (T.W.T)
J2 - Bottom Dogger
- Brent Sand
15/3
A CONORT
30 Sept - 82
15/3-4

Fig. 15

8.1.3 Comments

As the former table shows, the results of this well are in a good agreement with the geophysical interpretation.

8.2 Dipmeter interpretation

The dipmeter has been run between 2819 m and 4095 m.

8.2.1 Cretaceous (down to 3675 m)

Down to 2980, dipmeter readings are in the 0° to 5° range with a general north western azimuth (300° to 350°). Due to the low dip angle it is difficult to infer anything.

Between 2980 and 3080 m, dipmeter readings are in the 2 to 28° range. In the upper part the azimuth is mainly west, in the lower part the direction is south-west, in the lower part the direction is south west then south east and finally north west. Between 3050 and 3070, we have a little accident (fault or undulation).

Between 3080 and 3475 m, dipmeter readings are very low in the 2 to 4° range with a general north western azimuth (280 - 300°). This is the structural dip.

Between 3475 and 3675 m, dipmeter readings are in the 2 to 15° range with a general west and north western azimuth. This zone is slightly disturbed.

8.2.2 Jurassic (from 3675 m)

From 3675 to 3786 m, dipmeter readings are in the 2 to 27° range with no preferential direction. The differences correspond differences in the lithology.

In the reservoir (3786 - 3825 m), the regional dip angle is around 4°. The dip direction is mainly west. Dip angle is never more than 10°. Despite this low dip angle, the patterns show accretion deposits. Between 3825 and 3950, the dip angle is in the 3 to 20° range with a direction standing between west and north-west. These patterns are also significative for accretion deposits and channel sedimentation.

9 HYDROCARBON SHOWS

9.1 Chromatograph Recordings

Gas shows are listed below:

230 - 360 m:	1 to 8 % C1
360 - 380 m:	0.8 to 1 % C1
380 - 515 m:	2 to 9 % C1
515 - 545 m:	0.8 to 2 % C1
545 - 935 m:	1 to 5 % C1
935 - 1510 m:	0.1 to 1 % C1
1510 - 1555 m:	1 to 4 % C1, traces of C2
1555 - 1890 m:	0.1 tr 0.5 % C1
1890 - 1930 m:	1 to 5 % C1
1930 - 2375 m:	Traces to 1 % C1
2375 - 2385 m:	2.75 % C1, 0.02 C2, traces of C3
2385 - 3668 m:	Traces of C1
3668 - 3707 m:	0.2 to 2 % C1
3707 - 3790 m:	Traces to 0.8 % C1
3790 - 3890 m:	Up to 35% TG with C1 to nC4
3890 - 4258,5m:	Traces of C1

9.2 Shows from Coring

On the cores several kind of shows have been noticed.

Locally, on cores 2-3-4 and 5, some gas bubbles appear.

Oil stains at depths: 3792 - 3792,6 m
3793 - 3793,3 m
3796 - 3807,0 m
3813 - 3821,13 m
3823,7 - 3824,8 m
3826,2 - 3828,2 m

Strong direct fluorescences mainly bright yellow locally gold orange and copper:

- core 1: no fluorescence
- core 2: yellow fluorescences and rare red copper
- core 3: strong yellow fluorescences and dark straw cuts
- core 4: yellow fluorescences
- core 5: strong yellow fluorescences and straw cuts

10 CORING

10.1 Conventional Coring

Five cores have been cut: K1 in the Eocene sand and K2 to K5 in Middle Jurassic sandstones.

Core 1: 1678 - 1694 m (RKB), cut 18 m, recovered 5 m, recovery 27 %. Shale, grey-green, compact, not silty and at the bottom: sandstone fine to medium, with some coarse grains, poor sorted, subrounded - subangular, siliceous cement, glauconitic.

The purpose of this core was the evaluation of the Eocene sand, which were found hydrocarbon bearing in some surrounding wells.

Core 2: 3792 - 3796 m (RKB), cut 4 m, recovered 3.62 m recovery 91%. Mainly shale medium to dark grey, laminated with bivalve, firm but interbeds of sandstone medium grey to dark grey coarse to medium, subangular, provided direct fluorescence.

Core 3: 3796 - 3813 m (RKB), cut 17 m, recovered 11 m, recovery 65%. Mainly sandstone medium to light grey, fine to medium, occasionally coarse, medium hard to friable, with laminae of carbonaceous matter, and levels of Pelecypodae, locally good visual porosity, strong hydrocarbon odour, oil stains, gas bubbles, strong yellow fluorescences and dark straw cuts.

Core 4: 3813 - 3821 m (RKB), cut 8.13 m, recovered 8.13 m, recovery 100 %. Mainly sandstone, medium grey, fine to medium, locally coarse to very coarse, with interbeds of Pelecypodae with good shows, gas bubbles, oils stains, yellow fluorescences; from 3819 m shale dark grey, silty, laminated with bivalve debris and siltstone dark grey, argillaceous.

Core 5: 3821 - 3839 m, cut 18.27 m, recovered 18.27, recovery 100%. Mainly shale, medium grey, medium hard, micromicaceous with some Pelecypodae levels near the top (3821,5 - 3826 m), sandstone grey brown, fine to medium, with abundant Pelecypodae.

Good shows with hydrocarbon smell, gas bubbles, oil stain, strong yellow fluorescences and straw cuts.

10.2 Sidewall Coring

Three runs of wireline coring have been performed

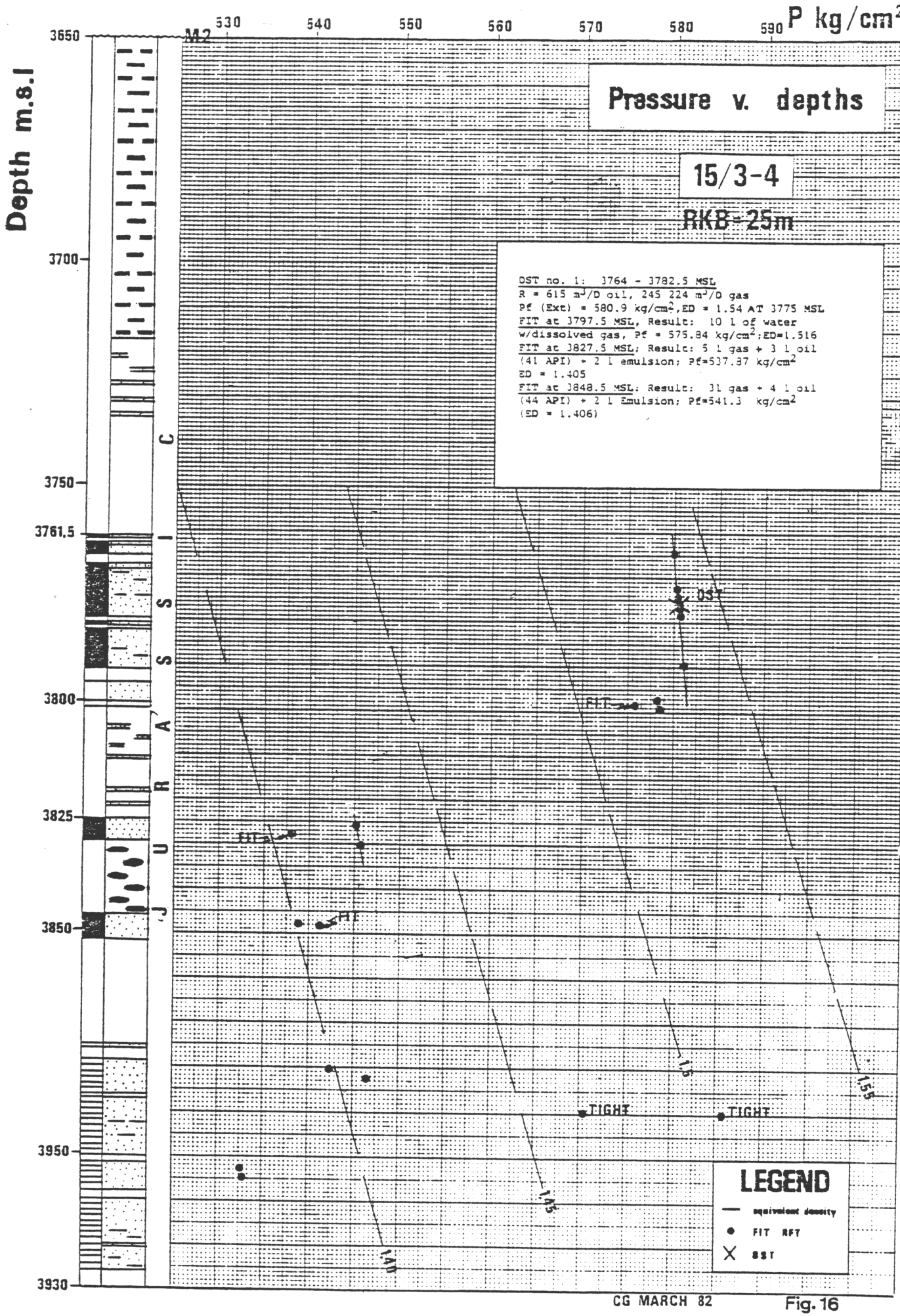
Run 1: shot 30, recovered 28
Run 2: shot 30, recovered 18
Run 3: shot 8, recovered 8

Sidewall core description is found in appendices 7,8,9.

11 LOGGING

The wire line logging operations are summarized as following.

ISF - GR - BHCSL	LDT - CNL - GR - CAL
-1- 132 - 934 M -2- 921 - 2831 M -3- 2819 - 3708 M -4- 3682 - 3838 M -5- 3682 - 3949 M -6- 3948 - 4094 M -7- BHC 3948 - 4094	-1- 192 - 931 M -2- 921 - 2825 M -3- 2819 - 3702 M -4- 3682 - 3839 M -5- 3682 - 3949 M -6- 3940 - 4096 M
MSFL - DLL - GR - CAL	**RFT**
1. DLL 3682 - 3949 M 2. DLL 3682 - 3935 M	RFT 1: Misrun - Failed RFT 2: 35 pressure tests Sampling at 3802,5 m / 3850,2 m. RFT 3: 4 pressure tests Sampling at 3823,5 m
CYBERLOOK	
1. 3775 - 3830	
HDT / CYBERDIP	**CST**
-1- 2819 - 3706 M -2- 3682 - 3946 M -3- 3948 - 4095 M	Run 1 = 3700 - 2850 23/30 Run 2 = 3949 - 3720 15/30 Run 3 = 4095 - 3949 8/24
	OTHER LOGS
	BGT : 921 - 2823 M CBL : 175 - 2819 M CBL : 3382 - 3682 M NGT : 3682 - 3946 M CBL : 3436 - 3944 M



CG MARCH 82

Fig. 16

12 RESERVOIRS

12.1 General Description

On the interval 3786 - 3886 m the well encountered a complex of sandstones, shales and coaly beds from where oil and gas were produced.

In this complex, the repartition of sandstones and the pressures recorded by RFT, FIT and DST enable to differenciate 4 reservoir levels (cf. fig. 16):

Level 1: 3786 - 3817 m: consisting of sandstones interbedded with shales. Locally the sandstones are well cemented, rich in shell debris and consequently tight. The cumulative thickness of porous and tight sandstones is 23,5 m (or 75 % of the thickness of the level 1). The thickness of porous sandstones, corresponding to the net pay is 15,7 m. This level is oil bearing.

Level 2: 3819,5 - 3826,5 m: consisting exclusively of sandstones, the upper part of which (2 m thick) being tight. The fluid content of this level is uncertain: in spite of good shows on core 5 the Sw logs is 66,9 % and the samples obtained by RFT and FIT were mudfiltrate.

Level 3: 3849,9 - 3854,8 m: exclusively porous sandstones, oil bearing.

Level 4: 3872,2 - 3876,4 m: exclusively porous sandstone, oil bearing.

12.2 Petrophysical Evaluation

12.2.1 Core Analysis

Cores were taken in levels 1 and 2 only. After correlating with logs, a difference of 2 m was found between the coring depth and the logging depth, the logging depth being shallower.

From core analysis:
Level 1 (3786 - 3817 m RKB)
Average Ø core: 16,5 %
Average K core: 19,4 MD

Level 2 (3819,5 - 3826,5 m RKB)
Average Ø core: 13,0 %
Average K core: 4,3 MD

Comparing the porosity from the core analysis with the log porosity the core porosity appears 2-4% higher. This may be due to the ground surface decompression.

12.2.2 Log Interpretation

The interpretation of the logs was performed using the Schlumberger Coriband program. The main results are:

Level 1: Top : 3786 m RKB (Top of Brent)
Bottom : 3817 m RKB
Gross : 31 m
Net : 15,7 m
α : 0,507
Average Ø : 13,4%
Average Sw : 17,9%

Level 2: Top : 3819,5 m RKB
Bottom : 3826,5 m RKB
Gross : 7 m
Net : 5 m
α : 0.714
Average Ø : 8,7 %
Average Sw : 66,9 %

BOTTOM HOLE FLUID SAMPLING - RFT / FIT

Table 1

LEVEL	OPERATION	DEPTH (H RKB)	FLOW DATA		BUILD UP DATA		SAMPLING	OBSERVATIONS
			TIME (MIN)	FINAL PRESSURE (BARG)	TIME (MIN)	FINAL PRESSURE (BARG)		
1	RFT	3802,5	4	548,9	6,2	568,3	10,4 l Mudfiltrate Surface pressure: 13,8 BARG	2 3/4 gallon chamber
2	RFT	3823,2	2,5	466,1	5,1	364,89	10,4 l Mud + Mudfiltrate and 0,75 l Mudfiltrate Surface Pressure : 0	2 3/4 gallon + 1 gallon CHAMBERS
3	RFT	3850,2	15,5	133,3	15,9	533,3	3 l Mudfiltrate 7,4 l Gas Surface pressure: 134,4 BAR	2 3/4 gallon chamber. Gas heated out before chamber was opened.
2	FIT	3822,5	6	Upper Amerade: 322,9 Lower Amerada: 321,0	2,9	Upper Amerada: 564,7 Lower Amerade: 566,1	10,4 l Mudfiltrate with Gas in solution Surface pressure: 55 BARG	2 3/4 gallon chamber Gas 70 l
3	FIT	3852,5	13	Upper Amerada: 58,7 Lower Amerada: 62,1	76	Upper Amerade: 527,4 Lower Amerada: 528,2	Ca. 5 l Gas " 3 l Oil " 24 l oil/mudfiltrate emulsion Surface pressure: 131 BAR Oil and gas transferred to 20 l bottle at 37 BARG.	2 3/4 gallon chamber Find B.U. pressure not quite stabilized
4	FIT	3873,5	5	Upper Amerada: Not working Lower Amerada: 529	62	Upper Amerada: Not working Lower Amerada: 530,8	Ca. 3 l Gas " 4 l Oil " 3,4 l Oil/Mudfiltrate Emulsion Surface pressure: 110,3 BARG All transferred to 20 l bottle at 37 BARG	2 3/4 gallon + 600 CC Segregated chamber Only small quantities of gas and some mudfiltrate in 600 CC chamber. This was not transferred.

Note: The samples from FIT No. 1 and FIT No. 2 BIS are considered as representative samples and a PVT analysis will be performed on them.

Level 3: Top : 3849,9 m RKB
Bottom : 3854,8 m RKB
Gross : 4,9 m
Net : 4,9 m
α : 1
Average Ø : 14,3 %
Average Sw : 13,9 %

Level 4: Top : 3872,2 m RKB
Bottom : 3876,4 m RKB
Gross : 4,2 m
Net : 4,2 m
α : 1
Average Ø : 14,3 %
Average Sw : 22,4 %

The net pay is obtained by consideration of the following cut off values:

Ø < 8%
Sw > 60%
Vclay > 35%

12.3 Testing

Two runs of RFT, four runs of FIT (including one failure) and 1 DST were performed.

12.3.1 RFT

The two runs include 29 pressure pre-tests and three samplings. The sampling did not give any important result as they all recovered mud filtrate except for the gas in the sample from 3850,2 m RKB (which unfortunately leaked out before being recovered due to chamber failure). Results are summarized on table 1.

Table 2

RESULTS - DST NO. 1 - BRENT LEVEL NO. 1

WELL 15/3-4

PRESSURE DATA (BHP FROM SPERRY SUN NO. 2046 - WHP FROM DWT)										FLOW DATA (SEPARATOR)					
INITIAL FLOW			INITIAL B.U.		FINAL FLOW			FINAL B.U.		INITIAL FLOW		FINAL FLOW			
PERIOD (MIN)	FINAL BHP (BARG)	FINAL WHP (BARG)	PERIOD (MIN)	FINAL BHP (BARL)	PERIOD (MIN)	FINAL BHP (BARG)	FINAL WHP (BARG)	PERIOD (MIN)	FINAL BHP (BARG)	CHOICE	FLOW M3/D	CHOICE	OIL (STM 3/D)	GAS (STDM 3/D9)	GTC (M3/M3)
7	490,5	79,3	65	569,3	716	435,5	133,8	1821	565 (T=121,7°C)	24/64	596 (Water)	40/84	615	245224	399

FLUID CHARACTERISTICS MEASURED AT THE WELL SITE	TEST INTERPRETATION RESULTS
OIL = 0,816 g/cc at 60° F (after 24 hrs) GAS = 0,803 (air = 1,0) Co2 = 7,5 % H2S = 0	Pi = 569,7 BARG (extrapolated from horner plot) K = 24 MD S = + 4.15 PRODUCTIVITY RATION = 0,63

SURFACE FLUID SAMPLING

5 x 20 l GAS
2 x 4 l OIL
} TAKEN AT THE END OF FINAL FLOW AT THE SEPARATOR
SEPARATOR CONDITIONS: 27,8°C , 33,1 BARG

2 x 200 . OIL + 4 l OIL FROM THE STOCK TANK

20 l GAS
4 l OIL
} TAKEN AT THE BEGINNING OF FINAL FLOW IN CASE OF TEST BREAK DOWN

12.3.2 FIT

A FIT fluid sampling together with an Amerada pressure recorder was run in levels 2,3 and 4 (one failure in level 3). Oil and Gas were recovered in levels 3 and 4. In level 2, only mud filtrate and some dissolved gas were recovered.
Results are summarized on table 1.

12.3.3 DST

A DST was carried out in level 1 with the main purpose of getting information about the nature of the fluid content and the formation productivity. The following zones were perforated:

1) 3789 - 3791 m RKB
2) 3794,5 - 3799,5 m RKB
3) 3800,5 - 3807,5 m RKB

} Loggers depth

From the results of the DST in level 1, a build up analysis was performed. From this, an extrapolated initial reservoir pressure was found as well as permeability, skin and productivity ratio. The results are shown in table 2.

12.4 Accumulations

The revised estimates are based on isopach maps of the interval between the J2 and J3 markers. The isopach was converted in meters by applying the depth vs time relationship found in the well 15/3-4. Since rock volumes are estimated from time maps, they should be regarded as provisional.

The downdip closure is chosen as 3140 ms (corresponding to a depth of 3987 m MSL).

Fig. 17 REVISED ESTIMATES OF HYDROCARBONS IN PLACE

Oil volumes are in 10^6 stock tank m^3. Gas volumes in 10^9 std m^3.

- 15/3-4 STRUCTURE

HYPOTHESIS 1:

	PROVED		UP DIP		DOWN DIP		TOTAL	
Level	Oil	Ass.Gas	Oil	Ass.Gas	Oil	Ass.Gas	Oil	Ass Gas
1	1.7	0.85	8.8	4.4	18.7	9.3	29.2	14.55
2	-	-	2.1	1.05	-	-	2.1	1.05
3+4	0.2	0.1	6.6	3.3	7.3	3.6	14.1	7.0
Total	1.9	0.95	17.5	8.75	26.0	12.9	45.4	22.60

HYPOTHESIS 2:

	PROVED		UP DIP		DOWN DIP		TOTAL	
Level	Oil	Ass Gas	Oil	Ass Gas	Oil	Ass Gas	Oil	Ass Gas
1	2.2	1.1	9.3	4.6	25.2	12.6	36.7	18.3
2	-	-	2.4	1.2	-	-	2.4	1.2
3+4	0.2	0.1	6.3	3.1	4.6	2.3	11.1	5.5
Total	2.4	1.2	18.0	8.9	29.8	14.9	50.2	25.0

- POSSIBLE SOUTH EAST STRUCTURE:

Oil: 27 10^6 ST m^3

Ass. Gas: 13.4 10^9 std m^3

- PROBABILISTIC ESTIMATES (Hypothesis 1)

	MINI (1)		PROBABLE (2)		MAXI 1 (3)		MAXI 2 (4)	
Level	Oil	Ass Gas	Oil	Ass Gas	Oil	Ass Gas	Oil	Ass Gas
1	0.9	0.45	10.0	5.0	58.4	29.1		
2	-	-	1.1	0.5	4.2	2.1		
3+4	0.1	0.05	5.2	2.6	28.2	14.0		
Total (Hypo1)	1.0	0.5	16.3	8.1	90.8	45.2	118	59
Total (Hypo2)	1.2	0.6	17.7	8.8	100.4	50.0	127	63

(1) Mini = 1/2 Proved, due to extension uncertainties

(2) Probable = Mini + 1/2 updip + 1/4 Downdip

(3) Maxi 1 = 2 x Total of 15/3-4 structure

(4) Maxi 2 = 2 x Total of 15/3-4 structure + SE possible extension

14 FORMATION-TEMPERATURE

The plot of values of BHT logs indicate a geothermal gradient of 2.6 °C/100 m above the M2. Below the geothermal gradient is increasing to 3°C/100 m.

CORRELATIONS 15/3-1, 15/3-2, 15/3-3 AND 15/3-4

TOPS DEPTHS IN METER	15/3-1		15/3-2		15/3-3		15/3-4	
	DEPTH RKB	THICKNESS	DEPTH RKB	THICKNESS	DEPTH RKB	THICKNESS	DEPTH RKB	THICKNESS
Oligocene	953		670		851		213	
		448		690		619		621
Eocene	1401		1360		1470		1534	
		745		716		702		780
C1 Paleocene (Tuffitic zone)	2146		2076		2172		2314	
		647		727		592		450
C2 Upper Cretaceous	2793		2803		2764		2764	
		1019		1110		979		626
Lower Cretaceous	3812		3913		3743		(3390)	
		59		146		158		277
Neocomian	3871		4059		3901		3667	
		72		179		116		8
M2 Upper Jurassic Km - Portl.	3943		4238		4017		3675	
		265		163		208		67
(J1) Callovian Oxfordian	4208		4401		4225		3742	
		778		150		298		44
J2 Dogger/Bathonian/Bajocian	4986		4551		4523		3706	
				94		245		100
J3 Intra Middle Jurassic Close to bottom Dogger	-		4645		4768		3886	
						199		106
J4 Lias	-		-		4967		-	
						64		
Triassic (Middle)	-		-		5051		3992	
Permian	-		-		-		-	
RKB Sea Level (m)	25		25		24		25	

Estimated total rock volumes between J2 and J3 markers (above the downdip closure):

15/3-4 structure: 3500 10^6 m^3 (90% within licence area)

Possible South-East extension: 1900 10^6 m^3 (85% within licence area)

2 hypotheses concerning the reservoir were considered:

Hypothesis 1: The rock volume is split between the 4 levels according to the results of well 15/3-4.

Hypothesis 2: The base of the two upper levels is assumed parallel to the bottom marker. This corresponds to a thickening of the two upper levels downdip and a thinning out towards the top.

The fluids are assumed to be light oil in all 4 levels (level 2 is assumed hydrocarbon bearing up dip of the well, with a water saturation of 20%).

PVT analysis of DST 1 sample gives:

Oil FVF: 2.38

GOR: 499 m^3/m^3

Fig. 17 gives proved, updip and downdip accumulations of oil in place and associated gas in standard conditions, for the two hypotheses considered. Probabilistic estimates are also indicated.

15 CORRELATIONS

The opposite table shows the correlations between wells 15/3-1, 15/3-2, 15/3-3 and 15/3-4.

- 15/3-1 is located 10.5 km in the West North West,
- 15/3-2 is located 20 km in the North North West,
- 15/3-3 is located 9 km away in the North West.

Oligocene is thinner on 15/3-1. Paleocene is thinner on 15/3-4. On this well the Upper Cretaceous is four to five hundred meters thinner than on the other wells but the Lower Cretaceous is 100 to 200 m thicker.

The thickness of Upper Jurassic is respectively 1043 m on 15/3-1, 498 m on 15/3-3, 313 m on 15/3-2 and 111 m on 15/3-4. There is an important variation from one well to the others.

More details on the origine of the sediments and tentative correlations within the Jurassic and Triassic series are given on fig. 19.

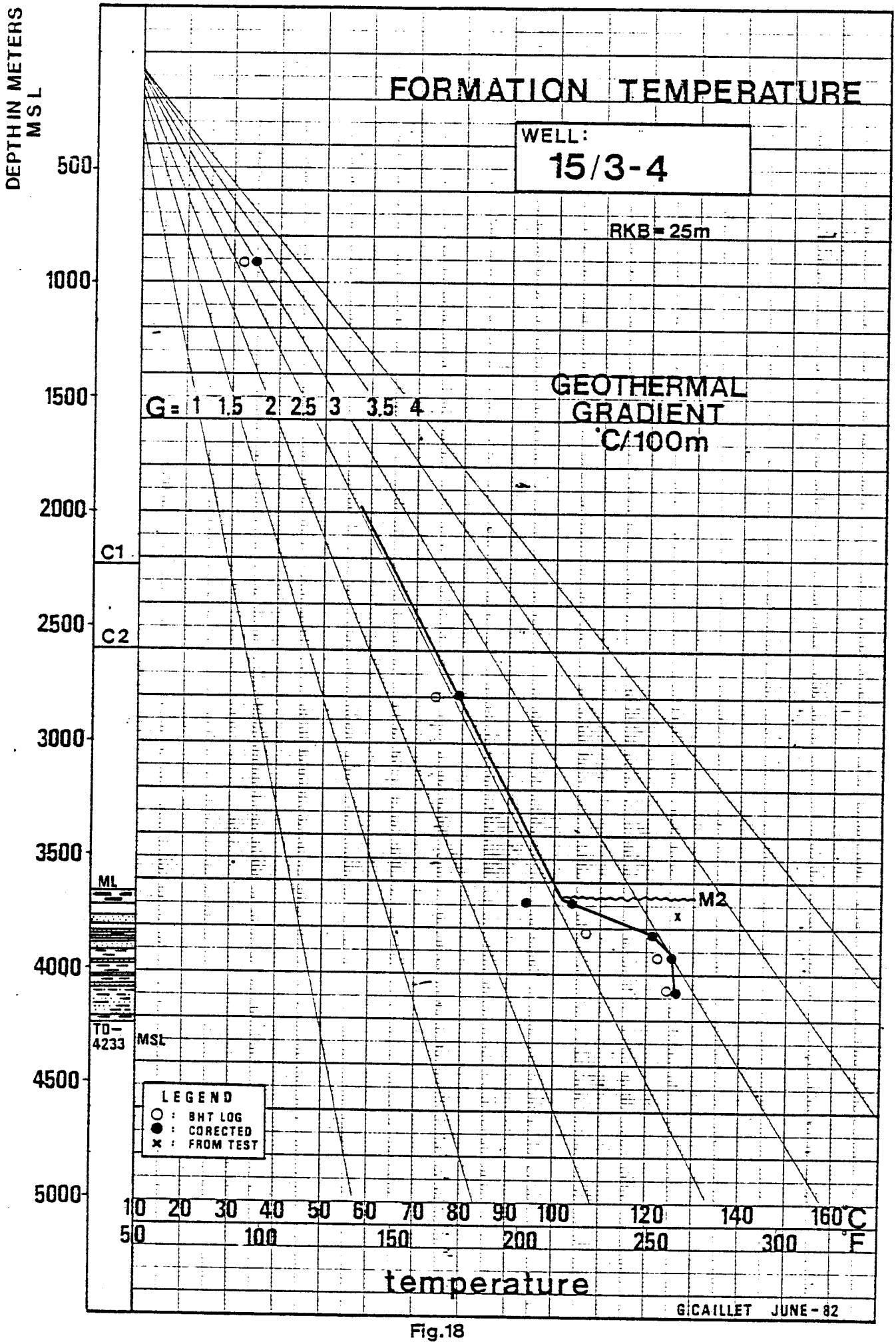

FORMATION TEMPERATURE
WELL:
15/3-4
RKB = 25m
GEOTHERMAL GRADIENT °C/100m
G = 1 1.5 2 2.5 3 3.5 4
DEPTH IN METERS MSL
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
C1
C2
ML
M2
TD-4233
MSL
LEGEND
○ : BHT LOG
● : CORECTED
× : FROM TEST
10 20 30 40 50 60 70 80 90 100 120 140 160°C
50 100 150 200 250 300 °F
temperature
G.CAILLET JUNE-82

Fig.18

13 FORMATION-PRESSURES

The formation pressure was increasing slowly between 1000 and 1900 m from 1 to 1.10. Below 1900 m it started to build up to reach 1.50 at 3700 m in the Jurassic. the DST and FIT performed in Jurassic sandstones (cf fig. 16) indicate a formation pressure of 580.9 kg/cm^2 at 3775 MSL giving a formation pressure gradient of 1.54 gr/cc. Below this reservoir 1, FIT performed in reservoir 3 and 4 give a formation pressure gradient of 1.41 g/cc. We have a lower gradient below 3825 MSL and the different reservoirs are not connected, each reservoir having its own pressure gradient.

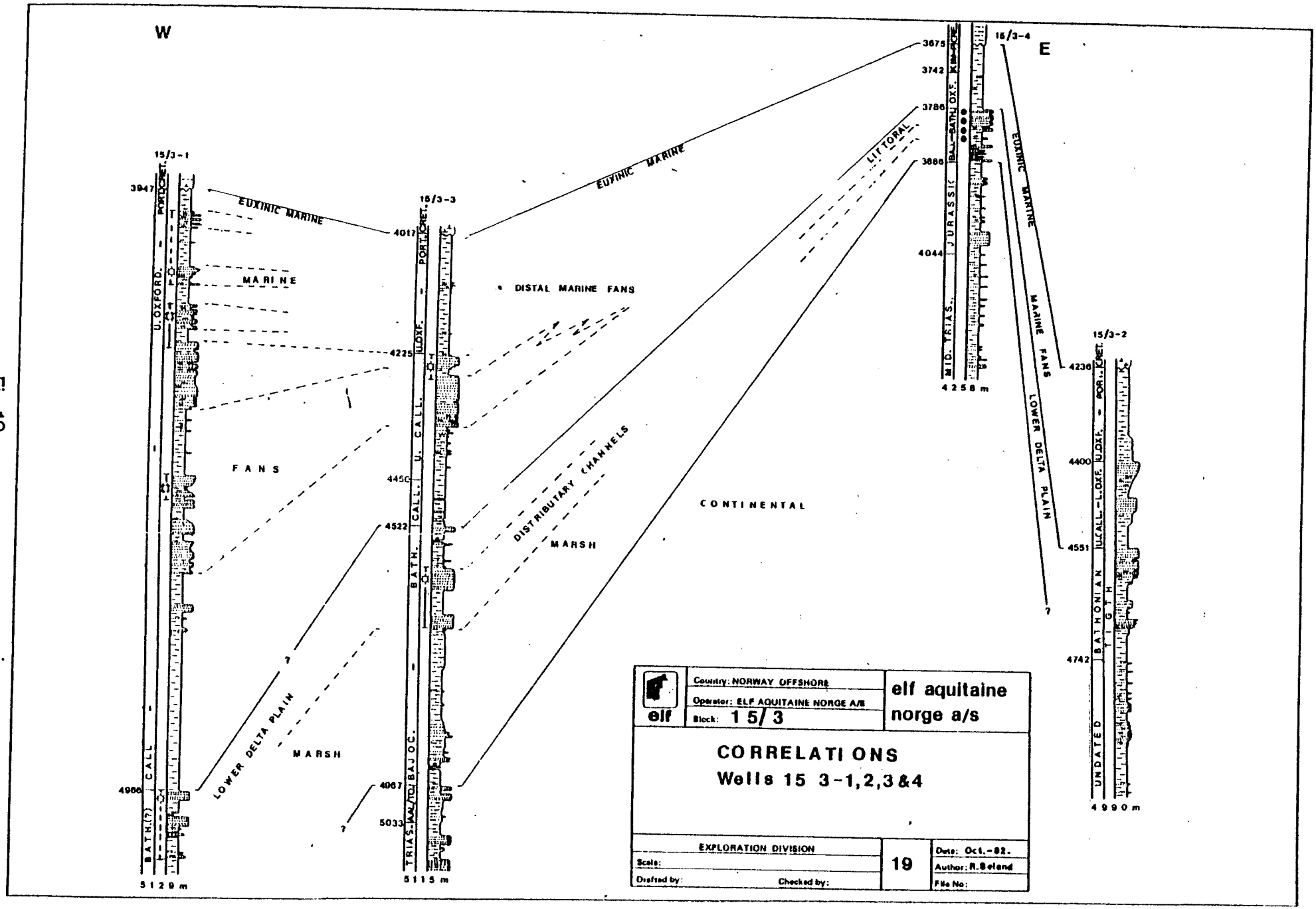

W
E
15/3-1
15/3-3
15/3-4
15/3-2
3947
4017
3875
3742
3780
3880
4044
4225
4450
4522
4986
4067
5033
4236
4400
4551
4742
5129 m
5115 m
4258 m
4990 m
EUXINIC MARINE
MARINE
FANS
DISTAL MARINE FANS
DISTRIBUTARY CHANNELS
MARSH
CONTINENTAL
LITTORAL
LOWER DELTA PLAIN
MARINE FANS
U. OXFORD.
CALL
BATH.(?)
PORTLANDIET.
U. CALL.
BATH.
TRIAS.-JUR./TOU BAJOC.
JURASSIC
MID. TRIAS.
BATH.-OXF.
BATHONIAN
UNDATED
Country: NORWAY OFFSHORE
Operator: ELF AQUITAINE NORGE A/S
Block: 15/3
elf
elf aquitaine norge a/s
CORRELATIONS
Wells 15 3-1,2,3&4
EXPLORATION DIVISION
Scale:
Drafted by:
Checked by:
19
Date: Oct.-82.
Author: R.Øeland
File No:

Fig.19

From a sedimentological point of view, the thinning of the Jurassic series, in the monocline explored by the 15/3-4 well, running along the Utsira High is obvious. Also, the drain of hydrocarbons from the basin or its flanks is confirmed. The study of mid Jurassic sediments suggests a very shallow marine or lagoonal to brackish environment , very close to the shore line, at the vicinity of land (richness of continental microflora). The relatively reduced thickness of sands may be related to the supratidal to intertidal conditions of deposition, with mainly possible storm deposits. Thickening of sands can possibly be expected in two areas:

- either, at the approach of the Utsira High, not yet emerged, where a subsident compartment was filled by acreation sequences, at the North-East of the 15/3-4 well location;
- or, most probably, all along an WNW-ESE axis, South of the 15/3-4 well location, which corresponds to a possible large distributary channel, carrying in a lower delta plain, detritals. These sediments could be deposited in mouth-bars or in lobes, then distributed Northward or Southward, along the shore line by marine current, and from there partly retaken and distributed on a "storm-beach". Therefore, a particular attention should be paid on this open zone.

The deepest seismic marker (horizon F) still remains unexplored; it is related to bottom of Triassic: top of Upper Permian (salt?) or to top of Rotliegendes. The horizon was expected at around 4500 m, but it could not be reached due to technical problems. So, it could be considered as an additional target for the future.

CONCLUSIONS

The well 15/3-4 has been bottomed at 4258,5 m (RKB). The different geological formations and seismic horizons have been encountered according to the prognosis. The proposed deepening down to the lowest visible marker (horizon "F") expected at around 4500 m failed for technical reasons (fish left in the hole).

Four separated sandy reservoirs have been tested in the Dogger. Three of them provided light insaturated oil (GOR: 499 m^3/m^3, FVF = 2.38 in DST 1 3789 - 3807,5 m RKB); the fluid content of the fourth one remains uncertain (shows on the core; log estimated water saturation about 66%, only mud filtrate recovered from FIT). The different reservoirs have different pressure gradient, ranging from 1.54 to 1.41.

The cumulated thickness of the hydrocarbon bearing reservoirs is of 29.8 meters (Net Pay). The accumulation figures have been computed.

The study of the oil, from DST 1, indicates a Kimmeridgian source rock, with a slightly higher maturation degree than source rocks on location. This indicates a migration from the deeper areas, either early from the graben or later from the outer flank. The estimated volume of hydrocarbons generated in the area is much higher than the volume of the known reservoirs. The reservoirs may thus be completely filled with hydrocarbons.

From a study of source rocks (maturation and migration), the possibility of finding accumulations of hydrocarbons on block 15/3 may be regarded as high.

Additional sands, interbedded in red shales, have been encountered below the hydrocarbon bearing sands. They were identified from 4050 m as of middle Triassic age. They were found water bearing.

Coord X: 01°52'59,817"E Y: 58°49'05,279"N	Z ground: -107m Z RKB: + 25m	Spudded: 03.10.1981. Started drilling: 03.10.1981. At T.D: Completed: 30.03.82.	Well 15/3-4
Line: 783 402	SP: 490	T.D Driller: 4258.5m T.D. Logger: 4096m	Country NORWAY OFFSHORE
Depths datum:			
Rig: BORGSTEN DOLPHIN			
Stopped in: TRIASSIC			
OPERATOR EAN		LICENCE 025	OWNED BY PETRONORD

TARGETS

Upper and middle Jurassic sandstones.

RESULTS

M.JURASSIC SANDSTONE: UNSATURATED OIL LEVELS

CASINGS

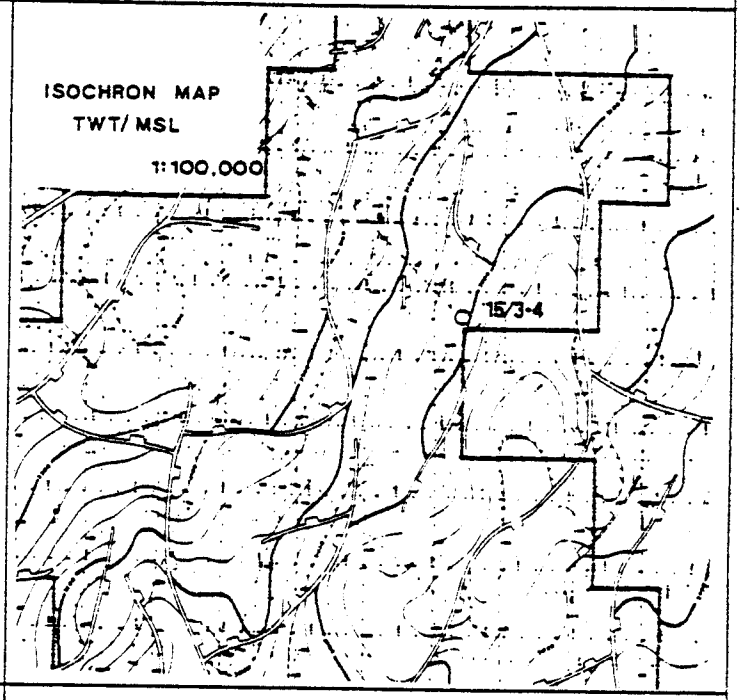
30"	at 192m
20"	at 921m
13 3/8"	at 2818m
9 5/8"	at 3681m
7"	at 3946m

CORES

No.1	1678-1696m
No.2	3792-3796m
No.3	3796-3813m
No.4	3813-3821m
No.5	3828-3839m
CST 1	2850-3700m Rec 23/30
CST 2	3720-3949m Rec 15/30
CST 3	3949-4095m Rec 8/24

SHOWS

132-1000 m: max 1-9% C1
1000-2600m: BG o.1-o.5% C1
2600-3675m: Tr C1
3675-3786m: Tr-o.5% C1,2,3
3786-3886m: BG o.2-1% C1-C4 max 35%
3886-4258m: Tr C1



LOGS

	RKB		
ISF GR-BHCSL Run 1	192- 931m	LDT-CNL GR-CAL Run 1	192- 931m
2	921-2831m	2	921-2825m
3	2819-3708m	3	2819-3702m
4	3682-3838m	4	3682-3839m
5	3682-3949m	5	3682-3949m
6	3948-4094m	6	3940-4096m
BHC 7	3948-4094m	MSFL-DLL-GR CAL Run 1	3682-3949m
HDT cyber-dip run 1	2819-3706m	2	3682-3935m
2	2682-3946m		
3	3948-4095m		

TESTS

RFT 3802.5m	10.31 MUD+FILTRATE(35G/1) P_f=8258 PSIG
DST 3789m / 3807.5m	415m³/d OIL(41.5 API)+245224m³/d GAS $P_{f_{ext}}$ =8262 PSIG
RFT 3823.5m	10 1 MUD + FILTRATE(32.8 G/1) P_f =8225 PSIG
FIT 3822.5m	10 1 WATER(28.5G/DW/DISSOLVED GAS P_f =8190 PSIG
RFT 3850.2m	10.3 1 MUDFILTRATE (31.5G/1) P_f = 7749 PSIG
FIT 3852.5m	5 1 GAS-3 1 OIL(44 API)-2 1 EMULSION P_f = 7650 PSIG
FIT 3873.5m	3 1 GAS -4 1 OIL(44 API) -2 1 EMULSION P_f =7699 PSIG

Checked AC / KF
Date JUL .1982

Form 134 Randaberg Trykk A.S

Appendix 1

Depths m | Litho-section | Formations | Stages | Shows | Description, Obs.

Z: RKB 25 m
Z: Ground or Sea bottom 132 m

Well: 15/3-4

- Sea level

132m Sea Bed

No samples above 192m. Lith. derived fr. GR as sandy.

30°

192m

Sd. sub.ang.to w.rded,f. to md.,white to transp.

Clay,grey,silty,soft ad sticky Lign.fragm.Shell frgms.Pyrite.Tr.of Glc. Sd.a.a.,less then 5%.

Sand,qtz.trsp,f.to md., subang. to w. rded.
Shell frags.,ursin spin foram,etc.
Shale md.fine,alm.Sltst gy.dk,gy.to gnish,heter og.,md.hd.to soft.
Clay a.a.,grey,silty very soft
Pyr.,Glc.,micas,Lignite

20°

913m

921m

Claystone
Clay,gry,v.soft,slty, glauc.,sl.calc.

Clay,grey,soft,silty

Claystone w/streaks of sand

Clay becoming claystone grey,soft,silty w/streak of limestone

NORDLAND GROUP

MIOCENE TO ACTUAL

OLIGOCENE

Clay w/stringers of sand

1347m

Clay grey,grading to clyst,w/tr.of limestone.

1534m

Clay grad.to shale v. soft,grey,to gry brn, silty,glauc.

1628m

Alt.of SHALE gry-grn and SAND transl.v.f,f,occ med. 1707m

K1

SHALE gy to gy-brn,slty, mic,
SAND f.to med,occ, coarse,subrnd-subang.

SHALE gy-grn,gy-brn, med hd,silty,mic.mic.pyr Glauc.
SAND A/A.

2025m

SHALE A/A w/tr.of DOL, beige micxln.

SHALE gy to brn A/A, occ bluish.

Tr.of LMST wh chalky.

2255m

SHALE grey to grey-brn, med hd,slty.Tr.of DOL.
TUFF.lgt grey.

2314m

HORDALAND GROUP

L-M. OLIGOCENE

U. EOCENE

MIDDLE EOCENE

EOCENE

LOWER

Depths m | Litho-section | Formations | Stages | Shows | Descriptions Gas.

Z: RKB 25 m
Z: Ground or Sea bottom 132 m

Well: 15/3-4

ROGALAND GROUP — PALEOCENE

SHALE gy to gy-brn,sft, mic.mic.het,pigm. tuffitic.

SHALE grey to lgt gy, soft,Tr.of SANDST.f. to med,silic.and LMST. wh to beige to bol beige SHALE,gy to dk-gy,occ. gy.brn,silty.

SAND f to cs,subang-subrnd and Shale A/A.

CHALK GROUP — DANIAN

2621m

LMST white,med.hd, cryptoxln,argil, MARL lgt brn to pink, gy,v.soft. SAND v.f.to med. SHALE gy to drk gy,ind.

2719m.

MARL wh to cream,bec pink and gy to lgt gy,v.soft.

2764m

LMST wh to cream,hd,arg, and MARL lgt gy,v.soft.

13 3/8"

2818m

CHALK GROUP — UPPER MAESTR

LMST wh to beige,hd to microxln

MARL a.a.,tr.of SHALE, grey,silty

2940m

CHALK GROUP — L.MAESTR

MARL,soft w/LMST wh to beige

3017m

CHALK GROUP — U.CAMPAN

Arg.,LIMESTONE,pink to white

Arg.,LMST.a.a.intbd.with MARL

SHALE,LMST,a.a.red/pink,soft, w/marl

MARL,grey,very soft,a.a.

CHALK GROUP — TURON to CAMP

MARL,lgt-gy to bg,soft w/limestone white to beige, med.hard.

MARL,lgt grey v.soft /w/strgr of SHALE,greyto dark,loc. silty.

SHALE,grey to dk grey,calc. w/strgs of MARL and LMST.

3390m

CHALK GROUP — to CENOMANIAN

SHALE,lgt-grey to med grey , silty calc.,f.to med hard,loc. black, MARL,a.a.LMST.a.a.

SHALE ,lgt-grey
SHALE,m-dk grey,silty,mic mic.

CROMER KNOLL GROUP — ALBIAN

3526m

SHALE,dk gy,silty,mic mic Tr of LIMESTONE,wh,silty

3608m

9 5/8"

SHALE,lt-dk gy,silty,mic mic w/intbds of LMST,wh,md hd,arg w/tr of CLAYSTONE,rd-brn

APT

12000

NEOC

3667

3675 (M2)

3682

KIMMI CLAY FORM

SHALE,brn,v silty to sdy,md hd, LMST,lt brn-lt gy,md crs,

3742m

LMST,lt brn-lt gy,arg,loc PYR OOL,beige,hd,micxtaline Tr of SHALE,rd and Tr of COAL

HEAT FORM

3786m

SDST,md gy-dk gy,md crs,ang-subang, pr sort,arg,mic,carb strgs, calc SHELL FRAGS,occ LUMASHELL SHALE,md-dk gy,lamin.,firm carb,pyr occ calc SHELL FRAGS

Cores 2-5

EQUI BRENT

SDST,aa,COAL,SHALE gy-brn

SHALE,rd-gy,loc grn,soft-md hd, Tr of PYR and LIMESTONE,wh,soft

3886m

SLST,lt gy-grn,compact

3946

DOGGER ?

SHALE,brn-rd brick and SANDST,f-med,calc silic.

3992m

SHALE red-brown

4042

SHALE,brn-rd,gy-grn.

SANDST,f-med,silic cmtd.

POSSIBLE SKAGERAK FM EQUIP. — MIDDLE TRIASSIC

SANDST,rd,transl,w srtd silic cmtd w/SHALE,rd,grn-gy.

SHALE,rd-brn.

TD 4258.5m

Form 132 Randaberg Trykk A.S

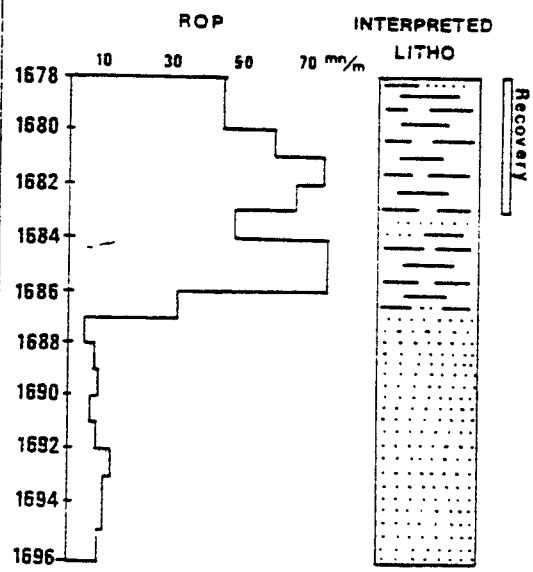
CORE DESCRIPTION

CUT: 18 m
RECOVERED: 5 m 27 %
LOSS: 13 m

COMPANY: E.A.N.
WELL Nº: 15/3-4
CORE Nº: 1

DATE: 25.10.81.
DEPTHS: 1678-1696

DEPTHS	% CO_3 CO_2	PERM	POROS	SHOWS	DIPS	LOG	DESCIPTION
1678			none	none	Apparent no dips		SHALE grey-green compact not silty.
1679							
1680							
1681							
1682							SANDSTONE fine to medium,w.some coarse grains, poor sorted,subrounded-subangular,siliceous cement,glauconitic. Trace of SAND non consolidated.
1683							



CORE DESCRIPTION

CUT: 4m
RECOVERED: 3,62m 91 %
LOSS: 0,38m

COMPANY: E.A.N.
WELL N°: 15/3-4
CORE N°: 2

DATE: 15/1/82
DEPTHS: 3792-3795,62m

DEPTHS	% CO_3Ca	PERM	POROS	SHOWS	DIPS	LOG	DESCIPTION
3792	sl.calc.	1.56	12.3				SST,md gy-dk gy,coarse,ang.-subang,poorly sorted, flaces of mica 2-3mm,argill.,qtz grns up to 3mm,bivalve.
						Sample	SST,md gy,medium,laminated,argillous,carbonaceous str., subang,micaceous.
		0.15	7.8	Direct fluo and flash cut ★)			SST,med,m.gy,laminated,sl.calc,mudfl.,sh(mica)laminae, good por.and perm.
							SST a/a.
							SST a/a,in parts more calcitic.
							SH,md-dk gy,laminated,fri.-mod hd,carb.,non calc.,pyritic
							SH a/a,w/ab.carb.mat.(plant remnts?). nod.pyrite,micaceous.
		0.08	3.0				SH a/a,sl.calc.,centrimetric nod.and bands of pyrite.
							SH a/a,pyritic nod.
	sl.calc.						SH a/a
							SH a/a,bivalve, lustrous.
							SH a/a,some pyrite.
3793							SH a/a.
		2.64	13.7	Direct fluo & flash cut ★)			SST,coarse to medium,subang,qtz gr.up to 2mm,arg.and calc.cement,bivalvae,mica.
							SST a/a,occ.v.coarse,mod.srted,ab.bivalve.
	sl.calc.						SST a/a. LOCALLY REDDISH DIRECT FLUO
						Sample	
							SH,md.to dk gr.,firm,laminated,mica,non calc.
		0.06	3.1				SH a/a,ab.bivalves.
							SH a/a.
							SH a/a.
		1.09	4.0				SH a/a.
3794		0.17	2.9				SH a/a.
							SH a/a.
	Non calcareous			Show as above,slow wht.cut			SH a/a.
		0.26	3.3				

★) SHOWS:
Direct fluo,bright yellow in patches,associated with brown staining.White flash cut followed by slow streaming white cut.

elf norge - EXPLORATION

Appendix 3

CORE DESCRIPTION

CUT: 4m
RECOVERED: 3,62m 91 %
LOSS: 0,38

COMPANY: E.A.N.
WELL Nº: 15/3-4
CORE Nº: 2

DATE: 13/1/82
DEPTHS: 3792-3795,62m

DEPTHS	% CO3 CO	PERM	POROS	SHOWS	DIPS	LOG	DESCIPTION
							SH a/a
		0.47	5,3				SST,grey,coarse to v.coarse,subangular,mod.to well sorted heavily calc.cement.bivalves. probably cemented with large penetrations calcite crystal
		0.07	6.6				SST a/a
							SST a/a,micaceous
3795		0.03	3,7	★			SST a/a,very well cemented.Bivalves.
	very calcareous			Minor fluorescence and cut			SST a/a,bluish qtz.gr. up to 3mm.
						Sample	
							SST a/a, ab.bivalves.
3795.62		0.05	4,0				SST a/a,very ab.bivalves,very coarse,very hard, very calc.,qtz.gr.up to 5mm. Well sorted.

★ SHOWS:

Tiny specs of dull to bright yellow direct fluo
minor to no slow white cut.

CORE DESCRIPTION

CUT: 17 m
RECOVERED: 11 m 65 %
LOSS: 6 m

COMPANY: EAN
WELL N°: 15 3-4
CORE N°: 3

DATE: 18/1-82
DEPTHS: 3796 - 3813

3/3

DEPTHS	% CO_3 CO_2	PERM	POROS	SHOWS	DIPS	LOG	DESCIPTION
3806			FAIR VIS . POR .	STAIN, SMELL, FLUO AND CUT AS BEFORE	10-20°		SST, lt brn gy, m-fine, ripples?, occ lam of SH
3807						Sample	SST, m gy, vf, hd, micac, ab COAL frags

CORE DESCRIPTION

CUT: 8,13 m
RECOVERED: 8,13 m 100 %
LOSS: 0

COMPANY: EAN
WELL Nº: 15/3-4
CORE Nº: 4

DATE: 19.1.82
DEPTHS: 3813 - 3821.13 m

1/2

DEPTHS	% $CaCO_3$	PERM	POROS	SHOWS	DIPS	LOG	DESCIPTION
3813							SST, mgy, f-m, w.srtd, w.cmtd (silic), micaceous abundant bivalves locally coquinaceous. Patchy dull yell direct fluo, fast white cut.
							grading to SST, mgy, m-crse, w.cmtd, micac with sparse shell debris, becoming -
3814							SST, mgy, crse, w.srted, w.cmted (calcareous), poorer in mica, some carbonaceous debris.
	CALC						SST, a/a crse to vy crse with compacted laminae of SH (stylolites?)
							SH SST, a/a, m-crse
							SH
3815							SST, m-lt gy, f, w.srtd, sbrnd, (sl micac, w.cmtd (silicic) scattered carbonaceous debris, occasionally in irregular laminae (stylolites?)
						Sample	
	Calcite generally restricted to fossils		POOR TO FAIR VIS. POR.	OIL STAIN AND SMELL, PATCHY DIR.FLUO, MOSTLY DULL YELL, LOC BR YELL, WH CUT, FLASH TO SLOWLY STRMG.			SST, a/a with abundant shell debris
3816							stylolite? ab.bivalves
3817							SST, m-lt gy, f, w.srtd, sbrnd, hd, w.cmtd (silicic) micaceous, fine irregular laminae of carb.material, scarce bivalve debris.
							SST, m.dk.gy, f to vf, wsrtd, subang, ab.carbonaceous material, micaceous, ab.bivalves - whole and debris, decr. downwards.

CORE DESCRIPTION

CUT: 8.13
RECOVERED: 8.13 m 100 %
LOSS: 0

COMPANY: EAN
WELL N°: 15/3-4
CORE N°: 4

DATE: 19.1.82
DEPTHS: 3813 - 3821.13 m

2/2

DEPTHS	% CO3Ca	PERM	POROS	SHOWS	DIPS	LOG	DESCIPTION
3817.70	Calcite generally restricted to fossils	POOR TO FAIR VIS . POR .		STAIN, SMELL, FLOO AND CUT AS BEFORE			
3818							SST, lt gy, f, w.srtd, subang, w cmtd (silicic), micac, ab carb. material, loc-bivalves.
3819						Sample	
							SH, dk,gy, slty, lam, micac, bivalve debr. SST, vf, dk gy , argill, w thin sh laminae, ab carb.mt, mic SST, lt gy-mgy, micac, scattered bivalve debr, becoming argillaceous and grading to SH, dk gy a/a w. abundant carb.material.
3820							
3821							
3821.13							

elf norge - EXPLORATION

CORE DESCRIPTION

CUT: 17 m
RECOVERED: 11 m 65 %
LOSS: 6 m

COMPANY: EAN
WELL N°: 15 3-4
CORE N°: 3

DATE: 18.1.82
DEPTHS: 3796 - 3813
2/3

DEPTHS	% CaCO3	PERM	POROS	SHOWS	DIPS	LOG	DESCIPTION
3800.70							
					10°		SST, a/a, lt-m gy, oilstain, fluo and cut a/a x-bed
38001							
							SH, m-dk gy, hd-vyhd, loc lenses of SST, loc. oilstain, fluo and cut a/a
							SST, crse, m-lt gy
38002							SST, lt gy-gy brn, fine, hd, micac, w-cmtd.
					10°		SH, m-dk gy, lam, w thin intbds of SST a/a, fragments of COAL
							SST, mgy-gy brn, crse-med, sl.mic, loc. fragm. of COAL
			POOR VIS · POR ·	DARK BROWN OIL STAIN, OIL SMELL. PATCHY DIRECT FLUO, BR TO DULL YELL. WH CUT, FLASH TO SLOWLY STRMG.		Sample	
3803							SST a/a
							(Erosion)
							SST, brn-gybrn a/a, coarse at base, fining up to med
							(Erosion)
							SST, gy brn, m, hd, silicated, fair yel fluo, slow wh. cut.
3804						Sample	
							SST, brngy-brn, m, a/a
3805							SST, mgy, crse, w.srtd, hd, silic cmt.
							(Erosion)
							SST, m-lt gy, med, hd, w.cmtd, ab.shell and COAL frags loc.bioturbated
					10-20°		Erosion - SST, coarse wh. large frags of COAL at base
							Erosion - SST, crse, gy brn-brn, hd, sil cmtd, x bedded

CORE DESCRIPTION

CUT: 17 m
RECOVERED: 11 m 65 %
LOSS: 6 m

COMPANY: EAN
WELL N°: 15/3-4
CORE N°: 3

DATE: 18/1-82
DEPTHS: 3796 - 3813

1/3

DEPTHS	% $CaCO_3$	PERM	VIS POROS	SHOWS	DIPS	LOG	DESCIPTION
3796			POOR	DARK BROWN OIL STAIN, OIL SMELL. PATCHY DIRECT FLUO, BR TO DULL YELL. WH CUT, FLASH TO SLOWLY STRMG.			SST, m-lt gy, f to vf, argill, micac, loc lam of SH, mgy.
							SH m-dk gy, slty, vy micac, lenses and centimetric beds of SLTST, m-ltgy, calc, and SH, dk gy.
							SST, gy-brngy, fine, mic, vy calc, ab.bivalves
							SST, gy-brngy, crse to vy crse, calc cmt.ab bivalves
3797							SST, m gy, med, vy micac, hd, well cemtd, noncalc, oilstain, smell, dull yel. fluo, fast wh. cut.
					20°		SST brn / gy crse, w.srtd, hd, w.cmtd x-bed, dull yel. dir fluo
							SST, gy/brn, med, micac, ripples, thin lam. of SH, mgy.
							SH, m.gy, hd, lam, minor dull yell fluo, no cut
3798			POOR/FAIR				SST, m-ltgy, crse, ab.bivalves (coquinae in prts) micac, w.cmtd, in pockets, SST, brn, crse, erosional contacts on top and btm.
							SST, gy brn, med, hd, occ.lam of SH
							SST, crse a/a w.ab, bivalves (coquinaceous) grading to-
							SST, gy-dkgy, m, vry micac, w. thin lam. of SH
3799							SST, crse, a/a grading to
							SST, gy brn, med, micac, hd, w.cmtd, occ lam of SH Direct fluorescence, dull yell, and wh.cut assoc.w.stain.
			POOR				
3800						Sample	SST, crse to med, m.gy, micac, w.cmtd, Erosion
							SST, med to fine, brn gy to gy, micac, loc. lam of SH
							Erosion
					10°		Low angle x-bed

CORE DESCRIPTION

CUT: 18,27 m
RECOVERED: 100 %
LOSS: 0

COMPANY: EAN
WELL N°: 15/3-4
CORE N°: 5

DATE: 22.1.82
DEPTHS: 3821 - 3839,27

1/4

DEPTHS	% $CaCO_3$	PERM	POROS	SHOWS	DIPS	LOG	DESCIPTION
3821	Carbonate restricted to fossils only		Fair visible porosity	no show			SH, mgy, lam, brittle,
							SST, gy-brn, f-m, w srtd, subrnd-subang, micac, carb, hd, w cmtd (silicic) ab bivalves grading to coquinaceous The sandstone is parting along STYLOLITES, penetrating 1-2 cm w blk carb. residue and concentrations of mica
3822				wk dirfluo and cut		Sample	
3823				no show			
3824				Stain and smell very weak dir.fluo and cut			SST, mgy, m-crse, loc vy crse, subrnd-subang, hd, w cmtd (silicic), scattered frags of bivalves
3825						Sample	SST, a/a crse to vy crse
						Sample	

elf norge - EXPLORATION

Appendix 6

CORE DESCRIPTION

CUT: 18,27 m
RECOVERED: 100 %
LOSS: 0

COMPANY: EAN
WELL N°: 15/3-4
CORE N°: 5

DATE: 22.1.82
DEPTHS: 3821 - 3839,27
2/4

DEPTHS	% CO_3 Co	PERM	POROS	SHOWS	DIPS	LOG	DESCIPTION
3826	Carbonate restricted to fossils only		Poor to fair visible porosity	Erratic weak direct fluorescence and cut associated with stain and smell		Sample	SST, crse-vy crse a/a grading to SST, f-vf, brnish gy to gy, hd, silic. cmt with laminae of SH, mgy, mic
3827							Bioturbation x-bed
							Isolated streaks of SH SH, mgy SST, a/a
3828							SH, m-dk gy, lam, mic mic, w. lenses and thin bands of SST, f-vf a/a
3829							SH, m-dk gy, mod hd, finely laminated, silky luster on the bedding planes. Thin beds and lenses of SST, vf, m-lt gy. Bioturbation Pyrite nodules
				Frac 35-40°			Striations on fractures
3830				Frac 45°			Localized concentrations of bivalves
				Fracs 10-40°			

CORE DESCRIPTION

CUT: 18,27 m
RECOVERED: 100 %
LOSS: 0

COMPANY: EAN
WELL N°: 15/3-4
CORE N°: 5

DATE: 22.1.82
DEPTHS: 3821 - 3839,27

4/4

DEPTHS	% $CaCO_3$	PERM	POROS	SHOWS	DIPS	LOG	DESCIPTION
	Carbonate restricted to fossils			NO SHOWS			Lenses and thin bands of SLTST in SH Some bioturbation, thin (2-3 mm) CHONDRITES (?) resembling tubes.
3836							SH a/a, slty w scattered bands of SLTST only Becoming gradually less silty downwards
3837							Bivalves SH, dk-mcy, hd, lam, dull luster, micac, abundant bivalves, scattered and concentrated in thick bands.
3838							Large concentrations of bivalves in SH a/a
3839							
3839.27							Sample for datation Remeasured core bottom 3839,27 m

CORE DESCRIPTION

CUT: 18,27 m
RECOVERED: 100 %
LOSS: 0

COMPANY: EAN
WELL N°: 15/3-4
CORE N°: 5

DATE: 22.1.82
DEPTHS: 3821-3839,27

3/4

DEPTHS	% $CaCO_3$	PERM	POROS	SHOWS	DIPS	LOG	DESCIPTION
3831	Carbonate restricted to fossils		POOR VIS. POR.	NO SHOW	Fracs 5-30°		
3832							SH, a/a, w carbonaceous debr. and mica
							SST, lt brnish gy, vf, w srtd, hd, w cmtd (silicic) scattered bivalves, stylolites
3833							SH, m-dk gy, frm-hd, lam, mic mic
3834							
3835							SH, m-dk gy a/a vy slty, gra SLTST

SIDE WALL CORES DESCRIPTION

WELL : 15/3-4	RUN N° : 1
LICENCE :	PAGE N°: 1
	DATE : 4/1/82

SERVICE COMPANY :	SCHLUM
ASKED :	30
RECOVERED :	28
SHOT :	30
LOST :	2
FULL BULLET :	23

tr : trace - M : medium - G : good

N°	DEPTHS	REC CM	LITHOLOGY	Fluorescence		CUT
1	2850	3	MARL: LIGHT GREY, SOFT, MICROMICACEOUS			
2	2875	2.5	LIMESTONE: WHITE, CHALKY, VERY CLEAN, SOFT TO MEDIUM HARD			
			CLAYSTONE: DARK BROWN, SILTY, MICROMICA, SOFT, CALCAREOUS			
3	2890	2	MARL: LIGHT GREY, TO WHITE, SOFT			
4	2950	2	CLAYSTONE: LIGHT GREY, SOFT, SILTY, CALCAREOUS			
5	2994	1	CLAYSTONE: a/a			
6	3000	1	LIMESTONE: WHITE, CHALKY, SOFT			
7	3010	1.5	CLAYSTONE: LIGHT GREY, SOFT, SILTY, CALCAREOUS			
8	3070	2	MARL: LIGHT GREY, SOFT			
9	3150	1.5	MARL: a/a			
10	3200	1	LIMESTONE: WHITE, CHALKY, VERY CLEAN, MEDIUM HARD			
11	3300	1	LIMESTONE: GREENISH GREY, GLAUCONITIC, VERY ARGILACEOUS			
12	3385	2	LIMESTONE: a/a			
13	3392	2	LIMESTONE: a/a			
14	3435	1	MARL: LIGHT GREY, SOFT TO MEDIUM HARD, NON GLAUCONITIC			
15	3500	1	MARL: a/a			
16	3530	3.5	SHALE: GREY, TO DARK GREY, MICROMICA, SILTY, CALCAREOUS, INDURATED			
17	3600	2.75	SHALE: a/a			

Appendix 7

SIDE WALL CORES DESCRIPTION

WELL : 15/3-4	RUN N° : 1
LICENCE :	PAGE N°: 2
	DATE : 4/1/82

SERVICE COMPANY :	SCHLUM
ASKED :	30
RECOVERED :	28
SHOT :	30
LOST :	2
FULL BULLET :	23

tr : trace - M : medium - G : good

N°	DEPTHS	REC	LITHOLOGY	Fluorescence	CUT
18	3625	2	SHALE: GREY TO DARK GREY, MICROMICA, SILTY, CALCAREOUS, INDURATED		
19	3638	3.5	CLAYSTONE: RED BROWNICH, SILTY, SOFT, MICROMICA, NONCALCAREOUS		
20	3645	2.5	SHALE: a/a		
21	3655	1	MARL: RED BROWNISH, MEDIUM HARD		
22	3678	2	SHALE: DARK GREY BROWN, DULL, NON CALCAREOUS		
23	3700	1.5	SHALE: a/a		

SIDE WALL CORES DESCRIPTION

WELL : 15/3-4	RUN N° : 2
LICENCE : 025	PAGE N°: 1
	DATE : 26.01.1982

SERVICE COMPANY :	SCHLUM
ASKED :	30
RECOVERED :	18
SHOT :	30
LOST :	12
FULL BULLET :	15

tr : trace - M : medium - G : good

N°	DEPTHS	REC %	LITHOLOGY	Fluorescence		CUT
1	3935		EMPTY			
2	3926,5	70	SHALE, Lt Gv, Med-Hd, Sltv, Sl Mic, Calc, w/Incl. ot Slst Gv			
3	3921		LOST			
4	3915		EMPTY			
5	3913	30	SHALE: Lt-Green, Soft, Mic, Sltv, Calc, w/S.D, vF to Silt Lt beige			
6	3907	30	SANDSTONE: Lt-beige, vF to F, argil, Subang, poor cmt., occ friable			
7	3900	100	SHALE, Gv-Green, Med. Hd., Sltv, Sl Calc, w/incl. of SST a/a			
8	3897,5	30	MARL, Kaki, Ind Co^3Ca : 68%			
9	3895	100	MARL, Red-brick, Grv-Green, Mod Ind, Sltv, Sl Mic w/incl. of SST Lt beige			
10	3892,5	60	SHALE, strongly calc / MARL a/a Co^3Ca = 36%			
11	3890		LOST			
12	3887,4	60	SHALE, Red-brown, Ind, Sltv, Sl Calc, w/incl of SST a/a			
13	3885		LOST			
14	3882,5		LOST			
15	3880		LOST			
16	3877,5	30	SHALE, Red-brown a/a and Sandstone, beige-brown, F to Med, Subang, argil - silic., coal			
17	3873		EMPTY			
18	3872		LOST			

Appendix 8

Appendix 10

WELL HISTORY SUMMARY

MOVING IN

The well 15/3-4 started September 26, 1981, at 07.40 hrs with all anchors locked up and the semi submersible "BORGSTEN DOLPHIN" ready for tow to well location 15/3-4.

The S.S. BORGSTEN DOLPHIN arrived on location October 1, 1981, at 08.00 hrs and dropped the first anchor at 08.40 hrs.

Well coordinates 58°49'05"19 N
01°52'59"68 E

Water depth on location = 107 m
Distance RKB/mud line = 132 m

DRILLING

The well was spudded October 3rd, 1981, at 06.30 hrs and the drilling was finished March 06, 1982 at 11.30 hrs, which gives 154.2 days of drilling.

The following operations were performed:
- Drilled 36" hole and set 30" at 192 m
- Drilled 17 1/2 Pilot hole and undereamed 26" to 937 m after logging
- Set 20" Casing at 921 m
- Drilled 17 1/2 hole to 1678 m
- Cut core 1 from 1678 to 1696 m
- Drilled 17 1/2 hole from 1696 to 2833 m
- Ran logs and set 13 3/8 casing at 2818 m

The combination of W.O.W and several repairs on the BOP stack involved a 13 days interruption of drilling operations after the 13 3/8" casing has been cemented.

- Drilled 12 1/4 hole to 3700 m
- Ran logs and set 9 5/8" casing at 3681 m
- Drilled 8 1/2 hole to 3792 m
- Cut cores 2,3,4 and 5 from 3792 to 3839 m
- Drilled 8 1/2 hole from 3839 to 3949 m
- Ran logs and set 7" liner at 3946 m - liner hanger at 3440 m
- Drilled 5 7/8 hole to 4258,5 m

While running in hole, the new turbine drillstring got stuck while reaming through a dog leg. After unsuccessful fishing, the open hole has been logged and plugged back (top of fish at 4099 m) up to 3840 m.

Testing and abandonment

After 3 FIT and one casing test had been performed the well was plugged back. The testing and abandonment phase was 23.4 days long and the last anchor was on bolster March 30, 1982 at 20.00 hrs. Then, S.S. BORGSTEN DOLPHIN was towed to 25/2-7 location.

SIDE WALL CORES DESCRIPTION

WELL : 15/3-4	RUN N° : 3
LICENCE :	PAGE N°: 1
	DATE : 6-03-82

SERVICE COMPANY:	SPE
ASKED:	24
RECOVERED:	8
SHOT :	8
LOST :	0
FULL BULLET :	8
16 misfire	

tr : trace - M : medium - G : good

N°	DEPTHS	REC	LITHOLOGY	Fluorescence	CUT
1	4081		SANDSTONE: white, f.occ. med, subang. to ang., calcitic, cement, friable.		
2	4077		SANDSTONE: reddish, fine, subang, argilo-calc, cement, friable		
3	4075		SANDSTONE: reddish, fine, subang, argilacecus cement, sl. calc.		
4	4068		SANDSTONE: white, fine, subang. to subround., calcitic cement, friable.		
5	4064		SHALE: grey to reddish, silty to v. silty, sl. calc., w/intb. SDST f. to v.f. reddish a/a		
6	4057		SHALE: reddish v. silty to sandy, sl. calc. (to SDST, very arg.)		
7	4052		SANDSTONE: reddish arg. and sandstone white, calcitic, f. to v.f. subround to subang.		
8	4048		SHALE: grey to reddish, silty and sandstone reddish, f. to v.f arg. sl. calc.		
			16 misfire from 4042 to 3960		

Appendix 9

SIDE WALL CORES DESCRIPTION

WELL : 15/3-4	RUN N° : 2
LICENCE : 025	PAGE N°: 2
	DATE : 26.01.1982

SERVICE COMPANY:	SCHLUM
ASKED:	30
RECOVERED:	18
SHOT :	30
LOST :	12
FULL BULLET :	15

tr : trace - M : medium - G : good

N°	DEPTHS	REC %	LITHOLOGY	Fluorescence		CUT
19	3868	20	SHALE, Drk. Brown, Ind, Slty, Sl Mic			
20	3860	100	SHALE, Gv-Brown, Med-Hd, w/incl of coal			
21	3845		LOST			
22	3780		LOST			
23	3774,9	20	SHALE, Gv- Black, Ind, V, Mic, carb, w/Pyr incl.			
24	3765	30	SHALE, Drk-Gv, Med-Hd, w/coal incl.			
25	3755	40	SHALE, a/a sl mic			
26	3750		LOST			
27	3745		LOST			
28	3735		LOST			
29	3720	10	SHALE, Gv-Black, Ind, Mic, Carb, w/Thin incl of SST lt beige			
30	3710		LOST			

Rev.	Date	Drawn	Checked	Check

PETROBRAS | **TS-3-6** | **SAM**

COMPOSITE LOG

SERGIPE
AR-Mnd

scale 1/500

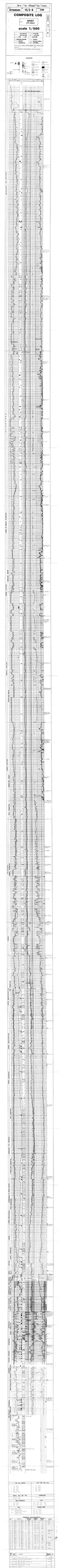
Kelly Bushing	15.00
Ground Level	0.00
Water Depth	0.00
Total Depth	4.500
Date	11-1-80
Run No.	ONE
Bit Size	8 1/2"
Casing	9 5/8" @ 1.000
Mud Type	Gel Chem
Mud Density	1.08
Viscosity	40
Fluid Loss	4.0
Max. Rec. Temp.	100°C

Recorded Mode: Digital Sonic, Digital Dual Induction, Digital Compensated Neutron, Digital Compensated Density, Digital Gamma Ray, Digital Caliper, Digital Temperature

Recorded Mode: Digital Sonic, Digital Dual Induction, Digital Compensated Neutron, Digital Compensated Density, Digital Gamma Ray, Digital Caliper, Digital Temperature

LEGEND

Sonic	
Dual Induction	
Neutron	
Density	
Gamma Ray	
Caliper	
Temperature	



Sonic	
Dual Induction	
Neutron	
Density	
Gamma Ray	
Caliper	
Temperature	

LINE 783402
S.P. 1 TO 645
FILTERED MIGRATION

PL.2

ELF NORGE A/S
N.SEA BLOCK 15/3

LINE 783402
S.P. 1 TO 645

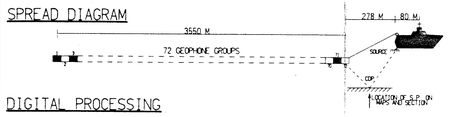
134 DEGREES

FILTERED MIGRATION

FIELD DATA

DATA SHOT BY	- GSI PARTY 2438
DATE SHOT	- OCTOBER 1977
RECORDING INSTRUMENTS	- DFS V
RECORDING FILTERS	- HIGH FILTER AND SLOPE 90 HZ 72 DB/OCT LOW FILTER AND SLOPE 8 HZ 18 DB/OCT
RECORDING POLARITY	- A POSITIVE PRESSURE AT THE GEOPHONE PRODUCES A NEGATIVE NUMBER ON TAPE AND DOWNWARD DEFLECTION ON THE FIELD MONITOR RECORD
DIGITAL TAPE FORMAT	- SEG B PHASE ENCODED 1600 BPI
RECORD LENGTH / SAMPLE RATE	- 6 SECONDS AT 4 MILLISECOND SAMPLE RATE
ENERGY SOURCE	- 2000 CU.IN. AIRGUN ARRAY OPERATING AT 1900 PSI
GUN DELAY	- 51 MILLISECONDS
GUN DEPTH	- 6.4 METRES AVERAGE
GUN TO ANTENNA DISTANCE	- 81 METRES FROM GUN CENTRE
SHOTPOINT INTERVAL	- 25 METRES POP PER SHOTPOINT
SHOTPOINT ANNOTATION	- SHOTPOINTS ANNOTATED AT CDP POSITION
CABLE LENGTH	- 3550 METRE 72 GROUPS
CABLE DEPTH	- 14 METRES AVERAGE
GEOPHONES	- 30 TI ACH GEOPHONES PER GROUP
COVERAGE	- 72 FOLD 72 TRACE
PRIMARY NAVIGATION SYSTEM	- DECCA
BACKUP NAVIGATION SYSTEM	- GEONAV AND MAINCHAIN

SPREAD DIAGRAM



DIGITAL PROCESSING

POLARITY CONVENTION	- THE POLARITY OF THE FIELD RECORDING WAS MAINTAINED THROUGHOUT THE PROCESSING AND REVERSED IN DISPLAY
RECORD LENGTH	- 6.0 SECONDS
SAMPLE RATE	- 4 MILLISECONDS
2 FOLD VERTICAL STACK	- STACK OF ADJACENT FIELD RECORDS GIVING AN EFFECTIVE CONFIGURATION OF 72 TRACE 36 FOLD
STATIC CORRECTIONS APPLIED	- SHOT AND STREAMER STATIC 14 MILLISECONDS AIRGUN DELAY 51 MILLISECONDS
TRUE AMPLITUDE RECOVERY	- 4.0 DB PER SECOND FROM 0-4.0 SECONDS SPHERICAL DIVERGENCE CORRECTIONS APPLIED
VELOCITY FILTERING	
DECONVOLUTION	- 2X200 MSEC FILTER DESIGN GATES (35 PER CENT OVERLAP) TR1 3500 - 5500 MSEC TR72 500 - 5500 MSEC
TIME VARIANT SCALING	- USING 1300 MSEC NON OVERLAPPING GATES
VELOCITY INTERPRETATION	- USING VELSCAN TYPE OF ANALYSIS LOCATED FROM BRUTE STACK
NORMAL MOVEOUT CORRECTION	- USING ANNOTATED VELOCITIES DERIVED FROM ABOVE
FIRST BREAK SUPPRESSION	- SEE TAPER ON
COMMON DEPTH POINT STACK	- 36 FOLD CDP STACK
DECONVOLUTION	- 1X400 MSEC FILTER DESIGN GATE 152-5500 MSEC
MIGRATION	- 2-D WAVE EQUATION MIGRATION USING 5 PERCENT FASTER SMOOTHED STACKING VELOCITIES
TIME VARIANT FILTERING	- PASSBAND(HZ) TIME(MSECS) 15 - 60 0 15 - 50 1000 15 - 40 2000 10 - 40 3500 8 - 35 3200 5 - 30 5000 - 6000

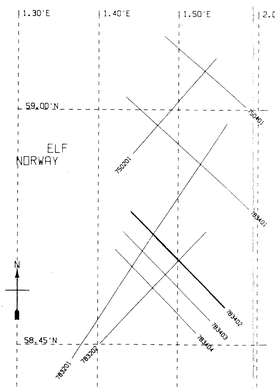
DISPLAY

HORIZONTAL SCALE	-	(10 .CM) 40 TR/KM
VERTICAL SCALE	-	(10 .CM.SEC)
POLARITY	-	REV
BIAS (PER CENT)	-	30
DATUM	-	SEA LEVEL
DISPLAY UNIT	-	761856

DISPLAY GAIN

CDP INPUT GAIN	ALL TIME WIDE
90 .75 2	2500

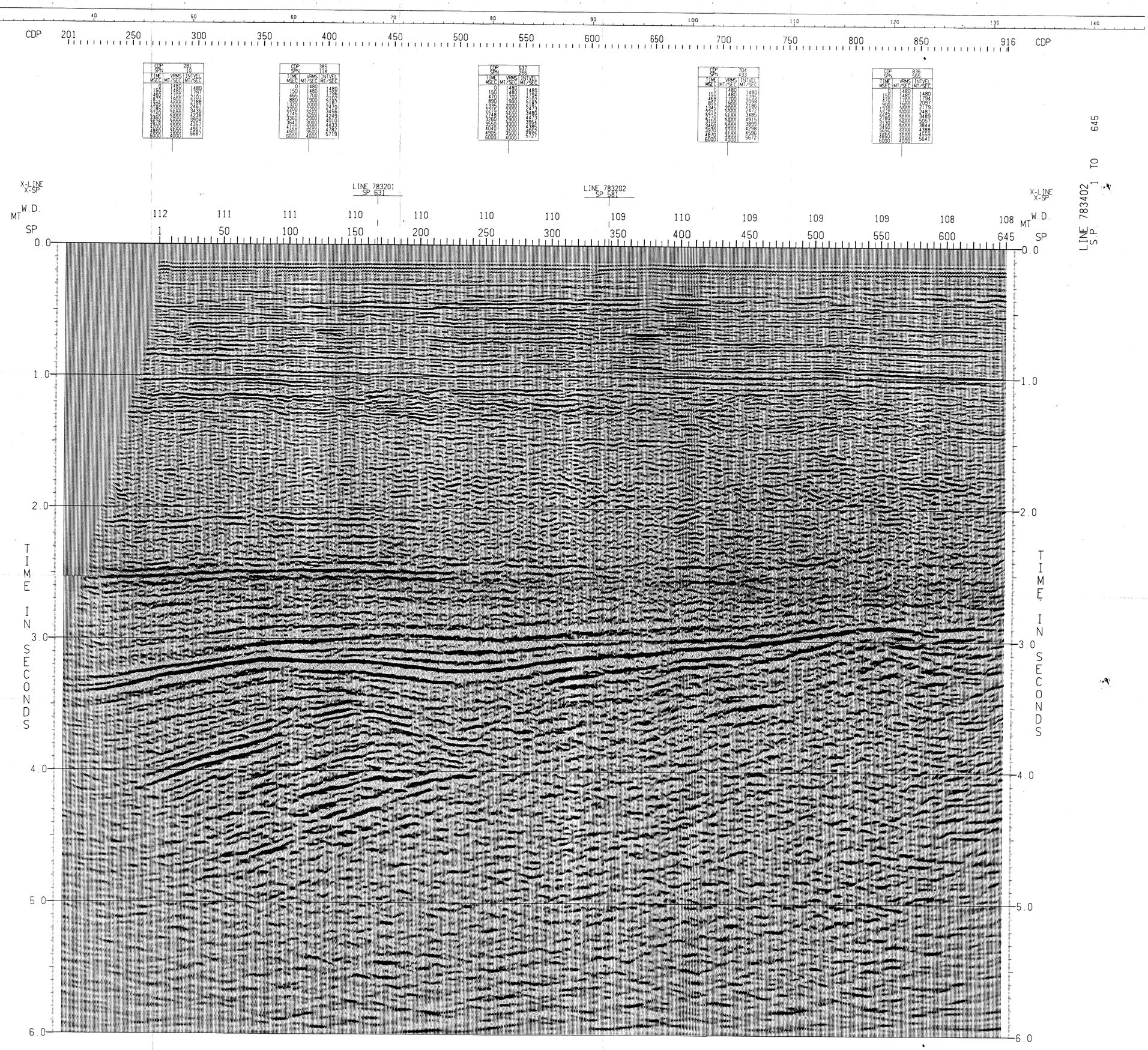
0KM 0.5KM 1KM 2KM



01 DEC 1977

PARTY 6720

GEOPHYSICAL SERVICE INTERNATIONAL
(A DIVISION OF TEXAS INSTRUMENTS LIMITED)



LINE 783402
S.P. 1 TO 645
FILTERED MIGRATION

PL.3

ELF NORGE A/S
N.SEA BLOCK 15/3

LINE 783402

S.P. 1 TO 645

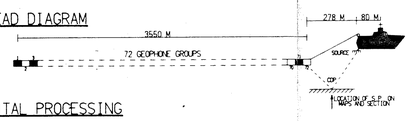
134 DEGREES

FILTERED MIGRATION

FIELD DATA

DATA SHOT BY	- GSI PARTY 2438
DATE SHOT	- OCTOBER 1977
RECORDING INSTRUMENTS	- DFS V
RECORDING FILTERS	- HIGH FILTER AND SLOPE 90 HZ 72 DB/OCT LOW FILTER AND SLOPE 8 HZ 18 DB/OCT
RECORDING POLARITY	- A POSITIVE PRESSURE AT THE GEOPHONE PRODUCES A NEGATIVE NUMBER ON TAPE AND DOWNWARD DEFLECTION ON THE FIELD MONITOR RECORD
DIGITAL TAPE FORMAT	- SEG B PHASE ENCODED 1600 BPI
RECORD LENGTH / SAMPLE RATE	- 6 SECONDS AT 4 MILLISECOND SAMPLE RATE
ENERGY SOURCE	- 2000 CU.IN. AIRGUN ARRAY OPERATING AT 1900 PSI
GUN DELAY	- 51 MILLISECONDS
GUN DEPTH	- 6.4 METRES AVERAGE
GUN TO ANTENNA DISTANCE	- 81 METRES FROM GUN CENTRE
SHOTPOINT INTERVAL	- 25 METRES. 1 POP PER SHOTPOINT
SHOTPOINT ANNOTATION	- SHOTPOINTS ANNOTATED AT CDP POSITION
CABLE LENGTH	- 3550 METRE 72 GROUPS
CABLE DEPTH	- 14 METRES AVERAGE
GEOPHONES	- 30 TI ACH GEOPHONES PER GROUP
COVERAGE	- 72 FOLD. 72 TRACE
PRIMARY NAVIGATION SYSTEM	- DECCA
BACKUP NAVIGATION SYSTEM	- GEONAV AND MAINCHAIN

SPREAD DIAGRAM



DIGITAL PROCESSING

POLARITY CONVENTION	- THE POLARITY OF THE FIELD RECORDING WAS MAINTAINED THROUGHOUT THE PROCESSING AND REVERSED IN DISPLAY
RECORD LENGTH	- 6.0 SECONDS
SAMPLE RATE	- 4 MILLISECONDS
2 FOLD VERTICAL STACK	- STACK OF ADJACENT FIELD RECORDS GIVING AN EFFECTIVE CONFIGURATION OF 72 TRACE, 36 FOLD
STATIC CORRECTIONS APPLIED	- SHOT AND STREAMER STATIC 14 MILLISECONDS AIRGUN DELAY 51 MILLISECONDS
TRUE AMPLITUDE RECOVERY	- 4.0 DB PER SECOND FROM 0.4-4.0 SECONDS SPHERICAL DIVERGENCE CORRECTIONS APPLIED
VELOCITY FILTERING DECONVOLUTION	- 2X200 MSEC FILTER DESIGN GATES (25 PER CENT OVERLAP) TR1 3500 - 5500 MSEC TR72 500 - 5500 MSEC
TIME VARIANT SCALING	- USING 1300 MSEC NON-OVERLAPPING GATES
VELOCITY INTERPRETATION	- USING VELSCAN TYPE OF ANALYSIS LOCATED FROM BRUTE STACK
NORMAL MOVEOUT CORRECTION	- USING ANNOTATED VELOCITIES DERIVED FROM ABOVE
FIRST BREAK SUPPRESSION	- SEE TAPER ON
COMMON DEPTH POINT STACK	- 36 FOLD CDP STACK
DECONVOLUTION	- 1X400 MSEC FILTER DESIGN GATE TR2-5500 MSEC
MIGRATION	- 2-D WAVE EQUATION MIGRATION USING 5 PERCENT FASTER SMOOTHED STACKING VELOCITIES

TIME VARIANT FILTERING - PASSBAND(HZ)	TIME(MSECS)
15 - 60	0
15 - 50	1000
15 - 40	2000
10 - 40	2500
8 - 35	3200
5 - 30	5000 - 6000

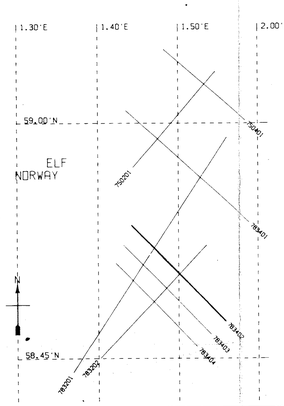
DISPLAY

HORIZONTAL SCALE	- (10 CM) 40 TR/KM
VERTICAL SCALE	- (10 CM.SEC)
POLARITY	- REV
BIAS (PER CENT)	- 30
DATUM	- SEA LEVEL
DISPLAY UNIT	- 761856

DISPLAY GAIN

INPUT CDP	ALL
GAIN DB	TIME MSEC
-15.2	2500

0KM 0.5KM 1KM 2KM



01 DEC 1977

PARTY 6720

GEOPHYSICAL SERVICE INTERNATIONAL
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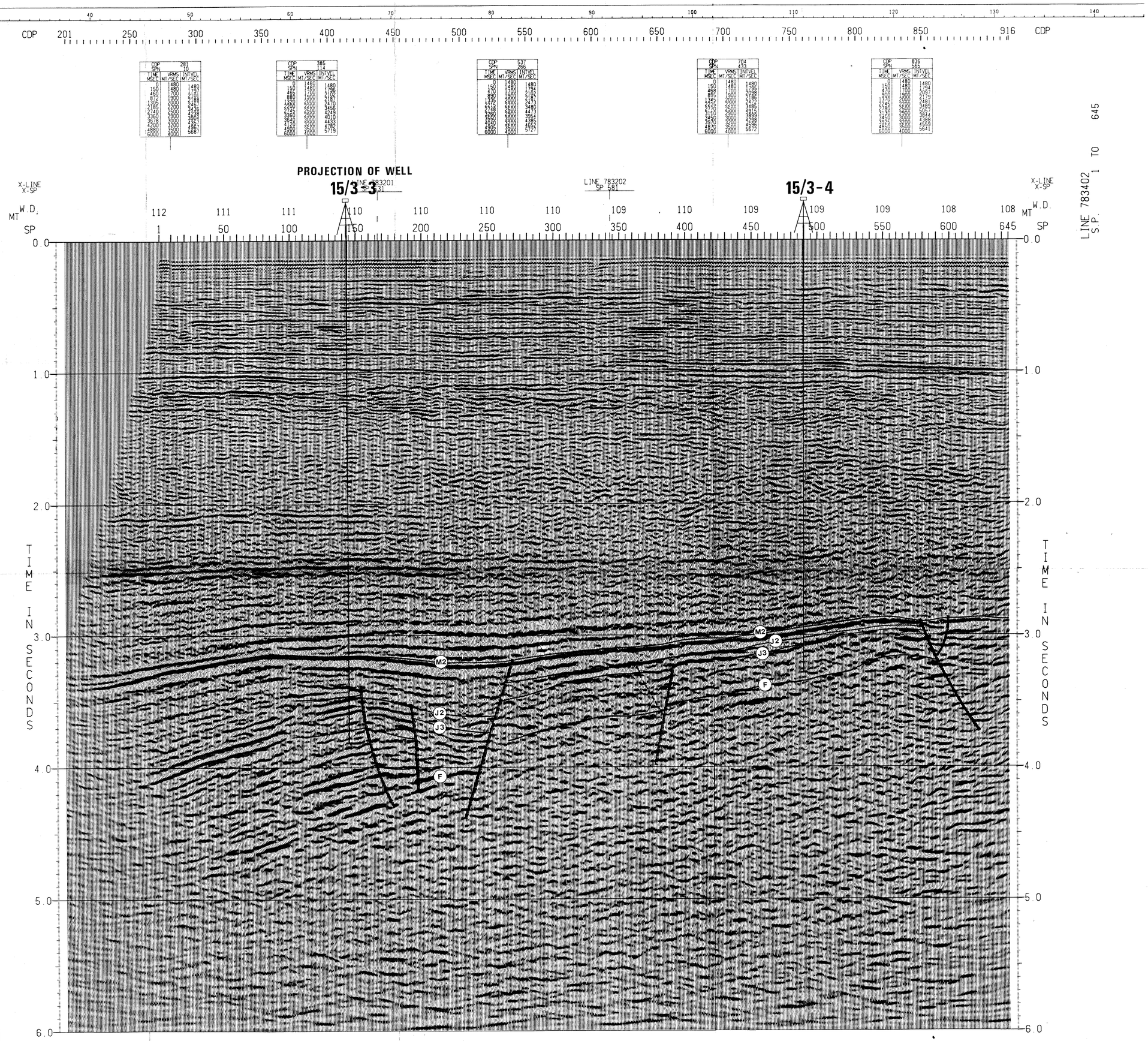
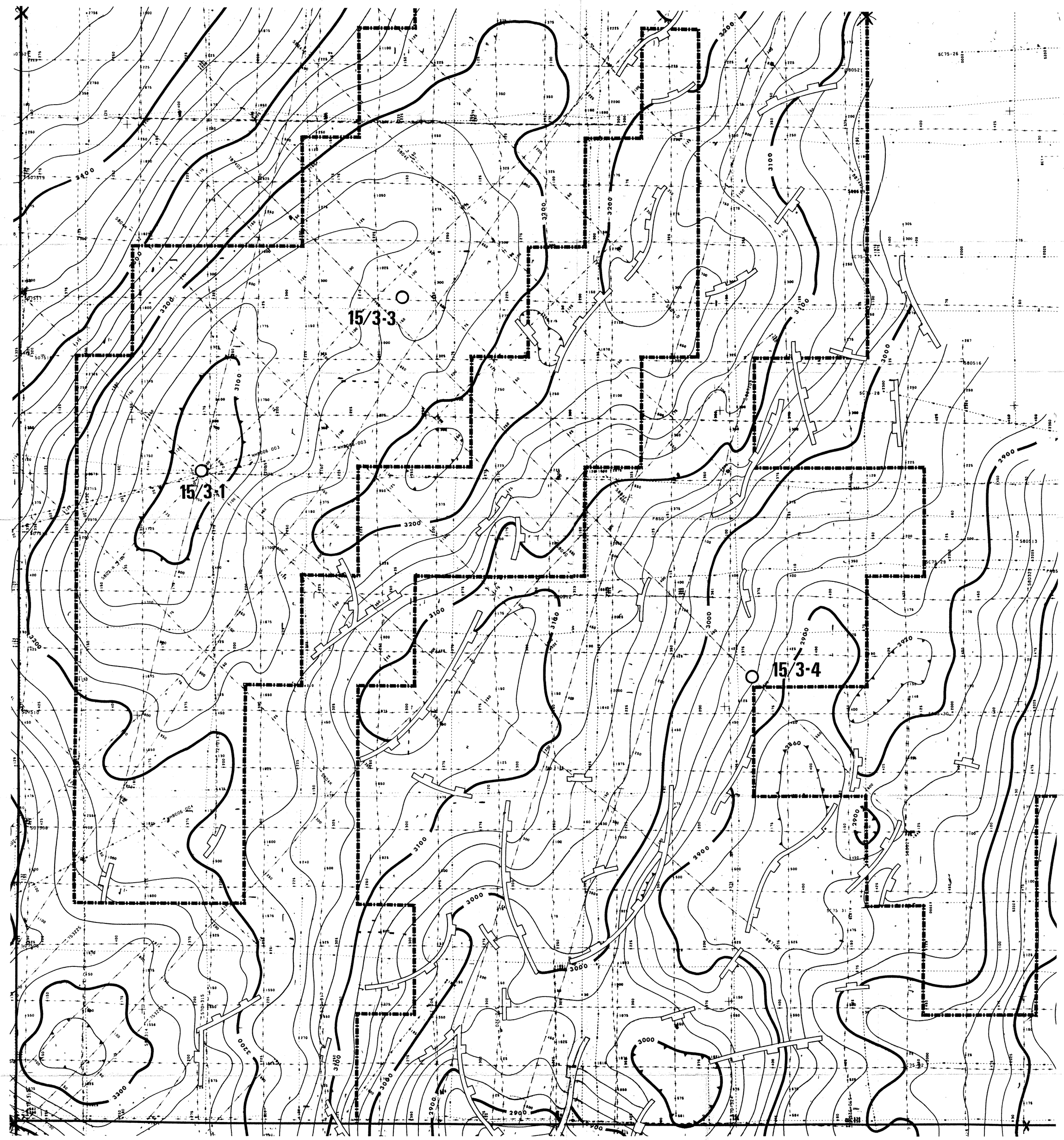




Scale 1:25.000

0 0,5 1 1,5 2 2,5 KM

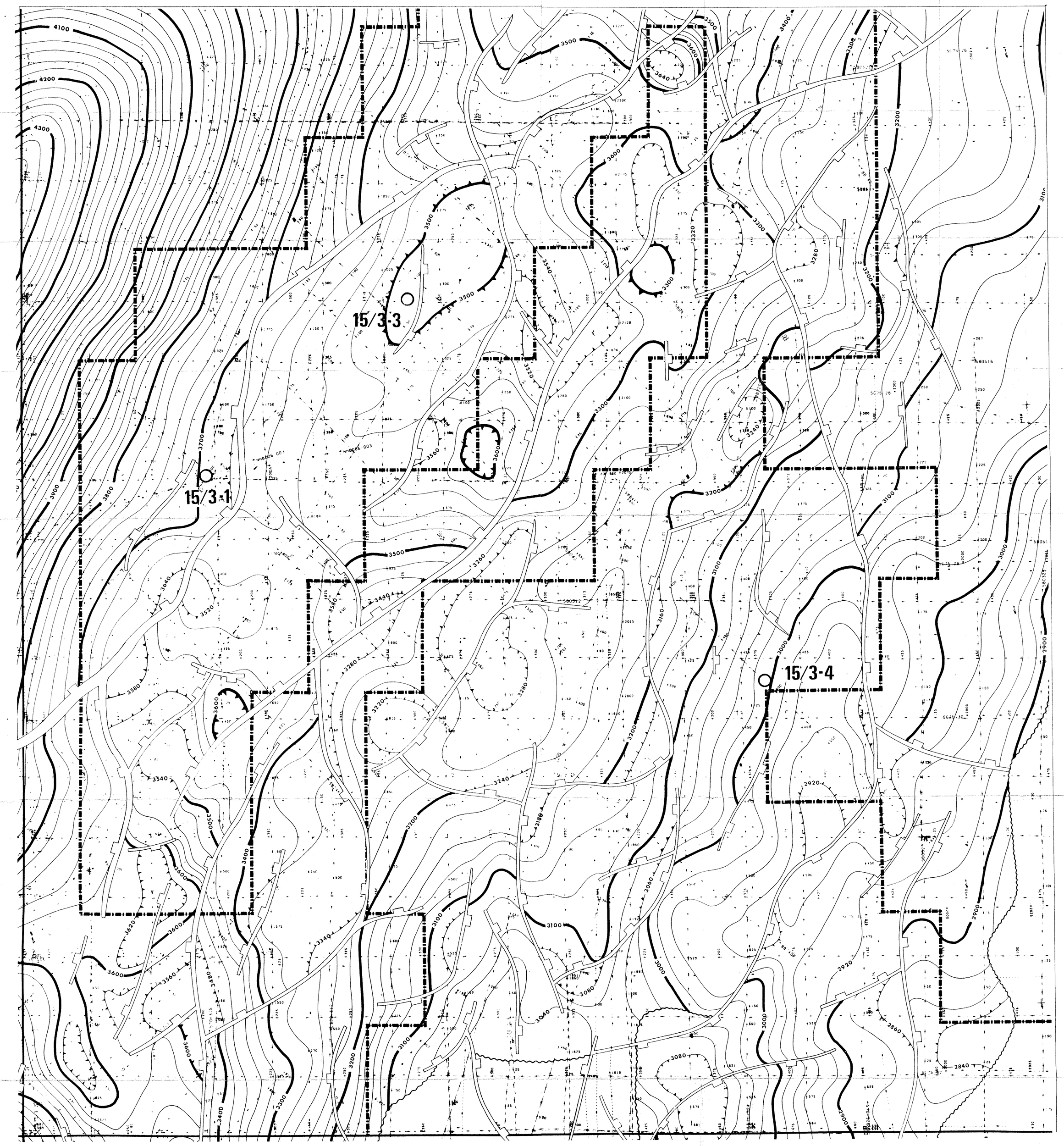
0 0,5 1 1,5 2 2,5 MILES

elf	Country: NORWAY OFFSHORE Operator: ELF AQUITAINE NORGE A/S Block: 15/2, 3, 5, 6.	elf aquitaine norge a/s

ISOCHRON MAP
M2 Seismic Marker
(TOP KIMMERIAN UNCONFORMITY)

T.W.T.
C.I.: 20ms

EXPLORATION DIVISION Scale: 1:25 000 Drafted by: G.E.O. APPROVED BY: J. SCHRØDER	PL.4	Date: JUNE 82 Author: K.KRAVIK B.GROSSOUVRE File No: 82 135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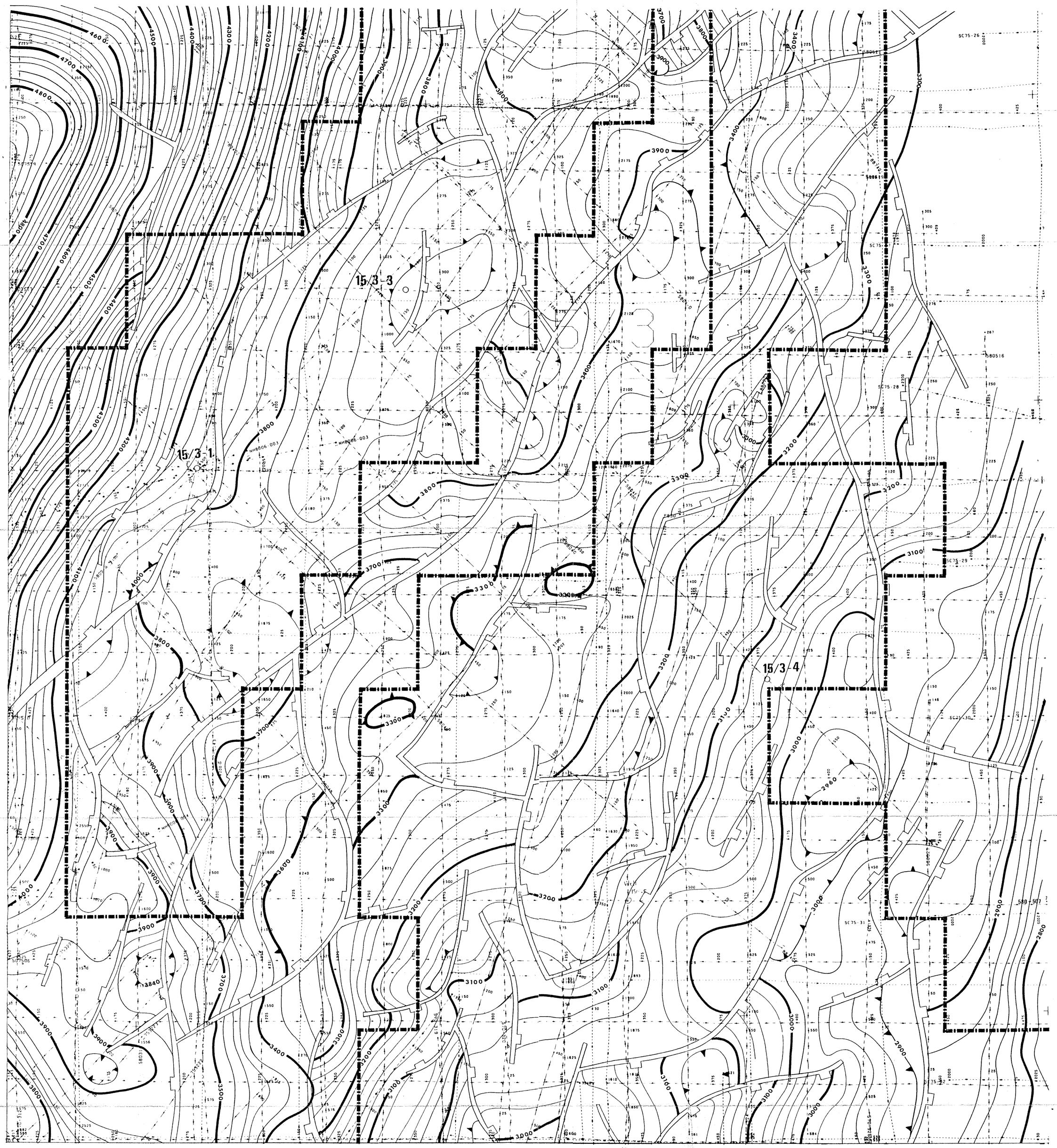


Scale 1:25.000

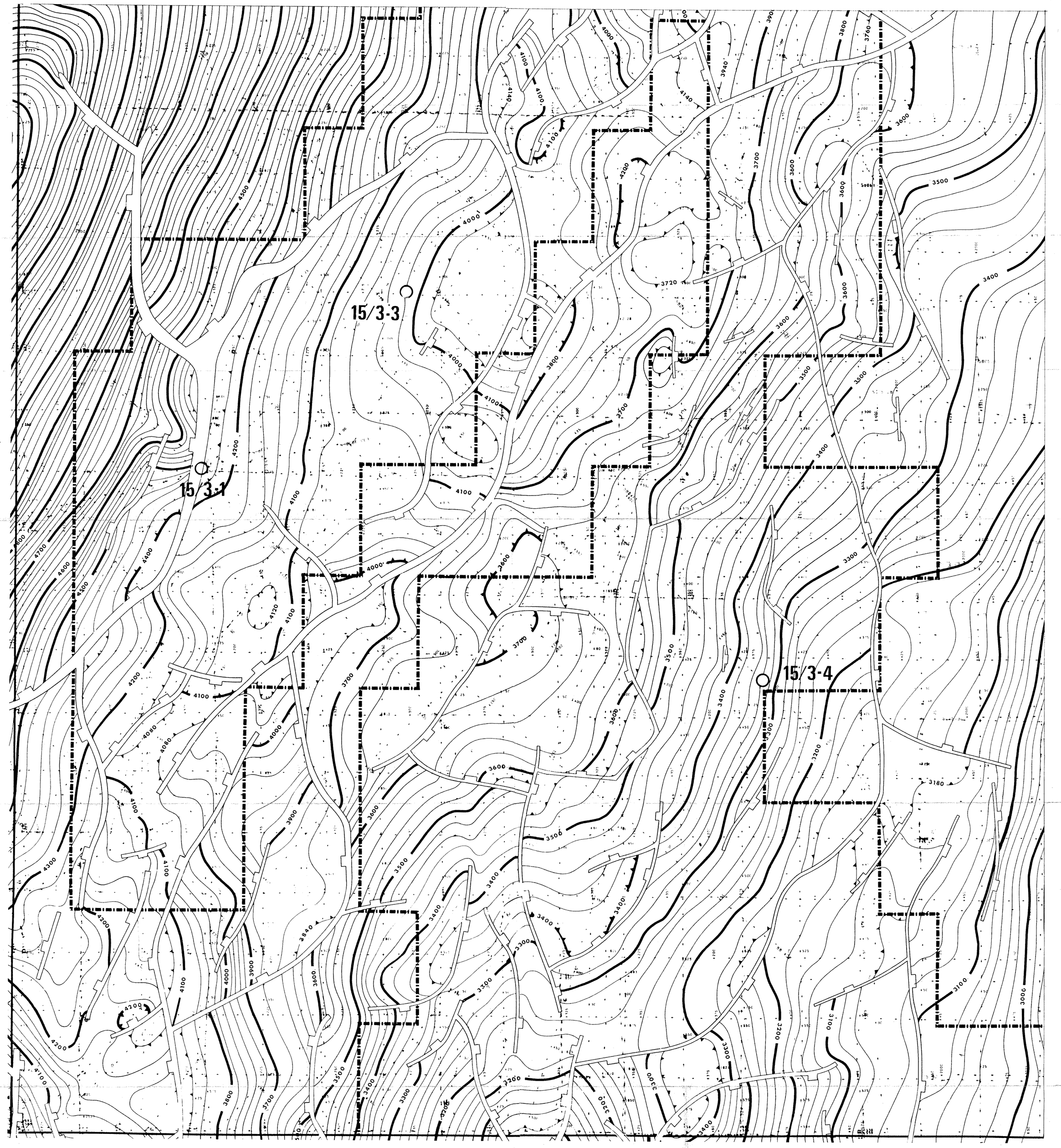
0 0.5 1 1.5 2 2.5 KM

0 0.5 1 1.5 2 2.5 MILES

elf	Country: NORWAY OFFSHORE Operator: ELF AQUITAINE NORGE A/S Block: 15/3-4 Structure	elf aquitaine norge a/s

ISOCHRON MAP
Near Bottom Dogger
(J3 Seismic Marker)

EXPLORATION DIVISION Scale: 1/25000 Drafted by: IAH Checked by: R.S.	PL.6	Date: JUNE 1982 Author: K.Kravik File No: 82223



Scale 1:25.000

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elf	Country: NORWAY OFFSHORE Operator: ELF AQUITAINE NORGE A/S Block: 15/2, 3, 5, 6.	elf aquitaine norge a/s

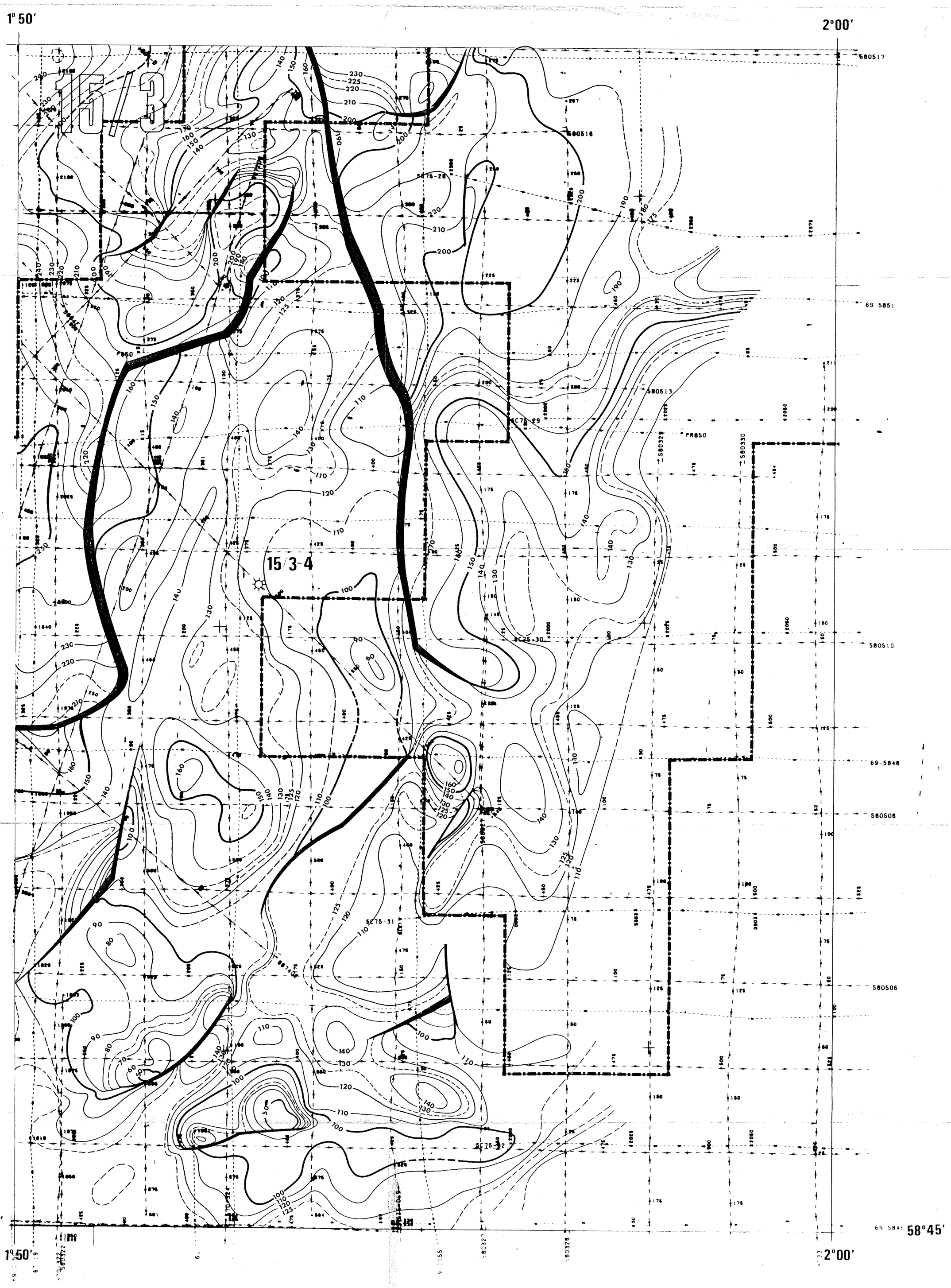
ISOCHRON MAP

"F" Seismic Marker

T.W.T.
C.I. 20ms

(CLOSE TO ROTLIEGENDES)

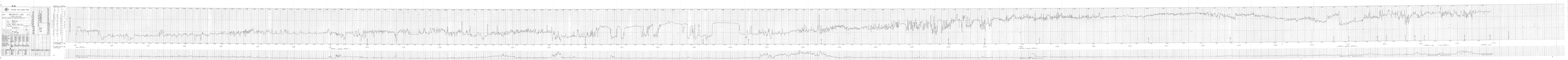
EXPLORATION DIVISION	PL.7	Date: JUNE 82
Scale: 1:25 000		Author: K.KRAVIK / B.GROSSOUVRE
Drafted by: G.E.O. Checked by:		File No: 83045



elf	Country: NORWAY OFFSHORE Operator: ELF AQUITAINE NORGE A/S Block: 15/3	elf aquitaine norge a/s

ISOPACH MAP
J2 - M2

EXPLORATION DIVISION Scale: 1:25 000 Drafted by: GEO Checked by:	PL.8	Date: Aug - 82 Author: Conort File No: 83046


Fetal Heart Rate
Uterine Contractions
Maternal Heart Rate
Maternal Blood Pressure
Maternal Temperature
Maternal Respiration
Maternal Pulse Oximetry
Maternal Blood Glucose
Maternal Blood Ketones
Maternal Urine Output
Maternal Urine Protein
Maternal Urine Glucose
Maternal Urine Ketones
Maternal Urine Specific Gravity
Maternal Urine PH
Maternal Urine Bilirubin
Maternal Urine Blood
Maternal Urine Nitrite
Maternal Urine Leukocyte Esterase
Maternal Urine Ascorbic Acid
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