# Appendix B Pernille 1 Well log description

# PERNILLE-1

# Pernille-1, Final well report

Copenhagen
01-11-1989

NORSK HYDRO UDFORSKNING a.s

# FINAL WELL REPORT

# WELL 5514/30-1, PERNILLE-1

LICENSE 5/86

November 1989

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**PREFACE**

License 5/86 was awarded the Norsk Hydro Group on 24 June 1986.

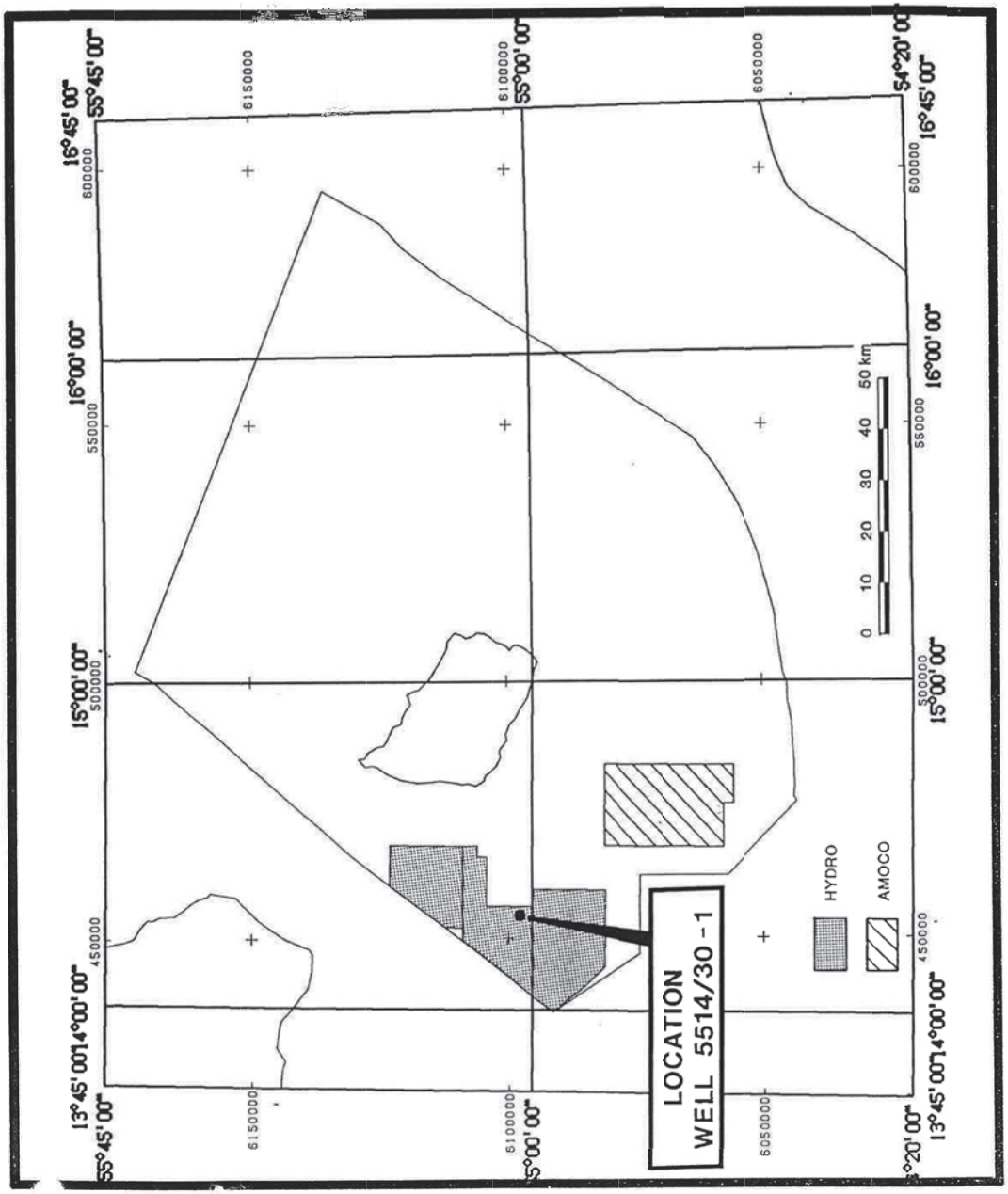
The license includes parts of blocks 5514/29, 5514/30, 5414/1 and 5414/2.

The group has the following composition:

| | |
|---|---|
| Norsk Hydro Udforskning a.s (Operator) | 19.5% |
| Enterprise Oil Denmark A/S | 19.5% |
| Gas Council (Exploration) Ltd. | 13.7% |
| Amerada Hess (Denmark) A/S | 9.8% |
| DENERCO K/S | 7.5% |
| Dansk Oliesøgning K/S | 7.5% |
| Korn og Foderstof Kompagniet A/S | 2.5% |
| Dansk Olie og Gas Produktion A/S (DOPAS) | 20.0% |

The well 5514/30-1 was drilled by Norsk Hydro Udforskning a.s on behalf of the group.

# LOCATION MAP



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(ooo)
Norsk Hydro

# General informations

Date 15/11-1989

System : BORE

Well: 5514/30-1
Field: BORNHOLM AREA  Country: DENMARK
Structure: RØNNE B  Licence: 5/86  2

| LOCATION Coordinates: | | Surface | Target |
|---|---|---|---|
| UTM | N (m) | 6096812.5 | 6096812.5 |
| UTM | E (m) | 456003.2 | 456003.2 |
| Geographical | N | 55 00'54.09" | 55 00'54.09" |
| Geographical | E | 14 18'43.14" | 14 18'43.14" |

Water depth : 44 m MSL. Rotary Table elevation: 36 m
Formation at TD: Silur, (MD) (m): 3212

Operator : HYDRO. Operators sheare (%) 19.5

| Partners (Interests) | |
|---|---|
| ENTERPRISE OIL PLC. | 19.5% |
| GAS COUNCIL EXPL. | 13.7% |
| DANSK ENERGI CONS. | 7.5% |
| DANSK OLIE SØGNING | 7.5% |
| AMARADA HESS | 9.8% |
| DOPAS | 20.0% |
| K.F.K. | 2.5% |

| | | |
|---|---|---|
| RIG name | | GLOMAR MORAY FIRTH 1 |
| RIG | contractor | GLOBAL MARINE |
| MUD | contractor | PROMUD DANMARK APS |
| CEMENT | contractor | HALLIBURTON |
| EL.LOGG | contractor | SCHLUMBERGER INLAND |
| MUD LOGG | contractor | EXLOG |
| Other | contractors | MWD: TELECO |

| Total depth (m RKB): | Measured | Vertical |
|---|---|---|
| | 3625 m | 3625 m |

TIME SUMMARY  Spudding date: 890406  Abandonment date: 890606

| MainOp: | Moving | Drill | Form Eval | Prod test | Comp letion | Work over | Well service | Plug Aband | Down time |
|---|---|---|---|---|---|---|---|---|---|
| Hours : | 30 | 1142 | 115 | 0 | 0 | 0 | 0 | 77 | 150 |
| Days : | 1.2 | 47.6 | 4.8 | .0 | .0 | .0 | .0 | 3.2 | 6.2 |
| % : | 2 | 75 | 8 | 0 | 0 | 0 | 0 | 5 | 10 |

TOTAL : 1512 hrs, 63 days

Hole and Casing record

| Hole | Depth m,MD | Casing | Depth m,MD |
|---|---|---|---|
| 30 | 105 | 30 | 105 |
| 26 | 788 | 20 | 777 |
| 17 1/2 | 1754 | 13 3/8 | 1740 |
| 12 1/4 | 3352 | 9 5/8 | 3339 |
| 8 1/2 | 3625 | | |

Well status :Permanently abandoned

# SECTION A

# G E O L O G Y

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## 1. OBJECTIVES

Well 5514/30-1, Pernille-1, was drilled on the Rønne B structure in the Rønne Graben west of Bornholm. The structure is a rotated fault block on the Jurassic and Triassic level with structural closures on several levels from assumed Middle Jurassic to basement.

The primary objective of the well was:

- To test the hydrocarbon potential of postulated sandstones within the Triassic-Jurassic Rønne Formation on the Rønne B structure.

Secondary objectives were:

- To test the hydrocarbon potential of sandstones of other stratigraphic levels than the Rønne Formation.

- To test the hydrocarbon potential of a minor four-way dip closure at the assumed Base Upper Cretaceous level and obtain stratigraphical and lithological data from this level.

- To verify the seismic interpretation and establish confident well-to-seismic ties.

In addition the well would provide important geological and geophysical information in terms of stratigraphy, reservoir data, source rock composition and maturity from an area which has not previously been drilled.

The well was planned to be drilled 150 m into rocks of Paleozoic age which could be proven non prospective, or to a depth of 4200 m whichever came first. The prognosed TD was at 3206 m RKB in Silurian shales.

## 2. RESULTS

Well 5514/30-1, Pernille-1, was permanently plugged and abandoned without any shows of hydrocarbons encountered throughout the drilled sequence.

The well was drilled to a total depth of 3624.5 m RKB (driller) terminating in the Silurian Graptolite Mudstone Formation.

A TD core was cut from 3615 to 3624.5 m RKB (driller) with 100% recovery.

Several sandstones of variable reservoir quality were found between the Base Cretaceous and the Base Permian level, all 100% water saturated:

- The main target Rønne Formation (967 - 1552 m) contains 216 m net sand with an average porosity of 24.4%.

- The Lower Jurassic Hasle Formation (943 - 967 m) found underlying the Base Upper Cretaceous contains 17 m net sand with an average porosity of 23.9%.

- Triassic Redbeds (1552 - 2747 m) includes 248 m net sand with approximately 15% average porosity.

- Rocks of Lower Permian age (2787 - 3057 m) consists entirely of tight sandstones with an estimated 4% porosity.

Cutoffs used are: $\Phi$ < 12%
$V_{sh}$ > 40%
$S_w$: none

No porosity cutoff was used in the Lower Permian.

## 3. BIOSTRATIGRAPHY

The biostratigraphic evaluation of well 5514/30-1, Pernille-1, was carried out by The Robertson Group plc, Petroleum Division. Basic material used in the analysis was ditch cuttings, sidewall cores and conventional core samples. Furthermore, a gamma ray-resistivity-sonic log was made available. A summary of the chrono- and litho-stratigraphic division is shown in the table on page 6.

Down to 105 m RKB cuttings were returned to seabed, but Quaternary deposits are believed to make up the section from seabed to 95 m.

The Upper Cretaceous extends from 95 m to 943 m. The youngest sample analyzed at 105 m is of Upper Maastrichtian age. A complete, well dated sequence consisting of chalky limestones from Upper Maastrichtian to Lower Santonian - Coniacian makes up most of the Upper Cretaceous section. At 877 m a logbreak marks an unconformity followed by marls of Lower Cenomanian age down to the base of the Upper Cretaceous.

A major unconformity at 943 m separate the Upper Cretaceous from the underlying Lower Jurassic to Upper Triassic sandstones and claystones. The uppermost 24 m of sandstone possibly belong to the Hasle Formation, whereas the Rønne Formation makes up the remaining part. A Sinemurian to Rhaetian age is given, based on palynological evidence. The Jurassic - Triassic boundary thus lies within the Rønne Formation and is set at a log break at 1500 m. The first confident indications of a Rhaetian age occur at 1510 m. Reworked Carboniferous miospores occur frequently in the Rønne Formation.

The thick Triassic section (1552-2747m) below the Rhaetian consists of reddish sandstones and conglomerates with minor interbedded claystones. The section is barren of in situ microfossils and the age is based upon the lithology and the stratigraphic position between well dated Rhaetian and Upper Permian rocks. Palynomorphs of Upper Permian age found in the redbeds below 2552 m are considered reworked from the underlying rocks.

The Upper Permian from 2747 to 2787 m is well dated by abundant palynomorphs. The section consists of 40 m of

greenish grey, calcareous claystones which are easily distinguished on the logs. These claystones are followed by reddish sandstones considered of Lower Permian age despite lack of paleontological evidence. The age is based on the stratigraphic position and the reddish colour typical of continental Rotliegendes sediments.

The base of the Permian is picked on a logbreak and colour change at 3057 m. This also coincides with a seismic marker and a dipmeter change.

The dating of the interval between the Base Permian and the sample at 3245 m, which gives a confident Silurian age, is very uncertain due to poor recovery and preservation of palynomorphs. The only age-diagnostic evidence comes from one single specimen of Knoxisporites cf. literatus recovered from the sidewall core at 3192 m which indicates a Lower Carboniferous age of this sample. Miospores recovered from sidewall cores at 3135 and 3179 m are non diagnostic, but show a preservational style and thermal maturity which is similar to the sample at 3192 m and very different from the Upper Permian palynomorphs. Thus, a Carboniferous age is tentatively ascribed to the interval from Base Permian to 3192 m.

The interval from 3192 m to 3212 m which can be distinguished on the wireline logs is considered to be of Lower Carboniferous age based on the sample at 3192 m. However, since this sidewall core was taken right at the upper boundary of the interval, it cannot be decided whether it represents the section above or below 3192 m. Miospores recovered from a ditch cuttings sample at 3210 support a Carboniferous age, but are not diagnostic. Therefore, it cannot be ruled out that the interval 3192-3212 m is older than Lower Carboniferous.

The top of the Silurian is chosen as the logbreak at 3212 m which is caused by a shift to a shale dominated lithology, although the first indication of a Silurian age comes from the sample at 3245 m. The lack of preserved palynomorphs in the interval above may be explained by Post-Silurian subaerial exposure and deep weathering of the upper part of the Silurian sequence causing oxidation of kerogen, which would destroy any palynomorphs. Post-Silurian exposure is in accordance with the inferred Lower Carboniferous age of the overlying section which implies a hiatus at 3212 m. The remaining Silurian section from 3245 to 3624.5 m (TD) is

well dated, and reflects continuous deposition during Wenlock (Homerian to Sheinwoodian) down to TD. Recycled Ordovician acritarchs occur frequently throughout the interval.

HYDRO

Copenhagen – Denmark

DEPTH RKB

ELEVATION KB: 36 m

WELL: 5514/30-1 PERNILLE – 1

NB! NOT TO SCALE

ALL DEPTH IN METERS (mRKB)

## CHRONOSTRATIGRAPHY

## LITHOSTRATIGRAPHY

| SYSTEM | SERIES/ STAGE | | DEPTH m | THICKNESS m | GROUP | FORMATION/ MEMBER |
|---|---|---|---|---|---|---|
| | SEABED | | 80 | 15 | | |
| QUAT. | NO DATA | | 95 | 10 | | 95 |
| UPPER CRETACEOUS | UP. MAASTRICHTIAN | | 105 | 30 | CHALK GROUP EQUIVALENT | |
| | LO. MAASTRICHTIAN | | 135 | 30 | | |
| | LO. MAASTRICHTIAN – UPPER CAMPANIAN | | 165 | 120 | | |
| | UPPER CAMPANIAN | | 285 | 60 | | |
| | LOWER CAMPANIAN | | 345 | 115 | | |
| | SANTONIAN | | 460 | 215 | | |
| | LOWER SANTONIAN – CONIACIAN | | 675 | 202 | | |
| | LOWER CENOMANIAN | | 877 | 66 | | 877 ARNAGER GREENSAND EQ. |
| LOWER JURASSIC | SINEMURIAN | | 943 | 91 | | 943 ? HASLE FM. |
| | HETTANGIAN | | 1034 | 466 | BORNHOLM GROUP | 967 RØNNE FORMATION |
| U. TRIAS. | RHAETIAN | | 1500 | 52 | | |
| TRIASSIC | | | 1552 | 1195 | "TRIASSIC GROUP" | 1552 KÅGERØD FORMATION |
| U. PERM. | | | 2747 | 40 | ZECHSTEIN GP. | 2747 |
| LOWER PERMIAN | | | 2787 | 270 | ROTLIEGENDES GROUP | 2787 |
| ? CARB. | | | 3057 | 135 | ? "CARBONIFEROUS GROUP" | 3057 |
| ? L. CARB | | | 3192 | 20 | | |
| SILURIAN | WENLOCK | HOMERIAN | 3212 | 140 | | 3212 GRAPTOLITE MUDSTONE FORMATION |
| | | SHEIN – WOODIAN | 3352 | 272.5 | | |
| | | | TD 3624.5 | | | |

## 4. LITHOSTRATIGRAPHY

The description of the lithostratigraphic units is based on ditch cuttings, sidewall cores and conventional cores. Additionally, information from wireline and MWD logs is used to define unit boundaries.

### 4.1 QUATERNARY 80-95m.

This interval was drilled without returns, but from the site survey is was seen to consist of dark grey to olive grey silty clays with minor fine to medium grained sand.

### 4.2 CRETACEOUS 95-943m.

**UPPER CRETACEOUS 95-943m.**

CHALK GROUP EQUIVALENT 95-943m.

95-877m.

The upper limit of this interval is taken from the site survey since the first cuttings were sampled from 105m.

The interval consists of white to light grey chalky limestone, generally firm to moderately hard, becoming harder in the lowermost 50 m. It is locally argillaceous, especially from 500 to 750m. Glauconite and minor pyrite is common and chert occurs near the top and base. Microfossils are abundant along with traces of macrofossils. Traces of quartz sand and pebbles are found in the uppermost part.

The interval represents a continuous section from Coniacian - Lower Santonian to Upper Maastrichtian.

Arnager Greensand Equivalent 877-943m.

The top of the Arnager Greensand Equivalent is easily recognized by a sudden increase in the gamma ray along with a drop in resistivity and sonic velocity.

It consists generally of marl varying in colour from light grey and light olive grey to dark greenish grey and brown grey. The marl is soft to firm and occasionally very silty. Glauconite and traces of mica, microfossils and shell fragments occur.

The interval is dated Lower Cenomanian. This is consistent with the age of the Arnager Greensand on the island of Bornholm which has been used as lithostratigraphic reference for this interval.

## 4.3 JURASSIC 943-1500m.

### LOWER JURASSIC 943-1500m.

BORNHOLM GROUP 943-1552m.

?Hasle Formation 943-967m.

The top of the assumed Hasle Formation is picked at a clear drop in resistivity and sonic velocities immediately below a peak in the gamma ray.

Loose to soft, light grey sand makes up the Formation. The sand consists of fine to medium, moderately to well sorted, clear to milky quartz grains, with a minor argillaceous matrix. Traces of glauconite, pyrite, carbonaceous material and coal fragments occur.

The presence of glauconite points to a marine environment of deposition and together with the other characteristics of the sand, a correlation with the Hasle Formation on Bornholm has tentatively been made. This makes the Hasle Formation slightly diachronous since it is dated Sinemurian in the well and Pliensbachian on Bornholm. Alternatively, the interval may be incorporated in the underlying Rønne Formation.

Rønne Formation 967-1552m.

967-1167m.

An abrupt increase in the gamma ray and resistivity marks the top of this interval.

The lithology is predominantly clay with interbedded and interlaminated sand. The clay is medium grey to olive grey at the top and becomes dark grey to brown grey towards the base. It is soft, often sticky with traces of mica and carbonaceous material, and generally non to slightly calcareous. The sand consists of loose, generally fine to

medium grained, moderately sorted, clear quartz with traces of pyrite, mica and coal fragments. Both sand and clay may grade into silt-dominated lithologies.

Occasional stringers of limestone are seen in the lower part of the interval, presumably as calcite cemented horizons rather than discrete beds. It is light yellowish brown to light grey, microcrystalline and very hard, giving rise to peaks on the sonic log.

Coal is described, mainly near the base of the interval, occurring both as fragments in the sandy parts and as separate thin beds.

The interval forms the upper part of the Rønne Formation and is dated Hettangian to Sinemurian.

1167-1500m.

This interval show lithologies much similar to the overlying section, but with a higher proportion of sand and only minor interbeds of clay. The boundary is picked where the sonic shows a shift from rapidly alternating velocities to more constant and higher values.

The composition of the sand is generally as above except that traces of feldspar, glauconite and mafic minerals are described. Furthermore, it is locally calcite cemented, forming friable to hard sandstone. Towards the base the sand/sandstone tends to become finer grained and better sorted. The clay displays generally darker colours than above, ranging from olive-, brown- and medium dark grey to occasionally brown- and olive black. The hardness is firm due to increased compaction.

Thin coal seams occur, especially around 1350 m. The coal is often impure, grading into very carbonaceous claystone.

This part of the Rønne Formation is of Hettangian age.

## 4.4 TRIASSIC 1500-2747m.

### UPPER TRIASSIC 1500-1552m.

1500-1552m.

The upper boundary of this interval is set at a sharp logbreak marking the onset of relatively high and constant gamma ray and resistivity values.

It consists of claystone with minor interbeds of sandstone. The claystone shows various shades of olive- and brown grey to olive- and brown black. It is firm to moderately hard, with varying content of silt and traces of very fine sand, mica and carbonaceous material, non to moderately calcareous. The sandstone is medium light grey to olive grey and consists of subangular, moderately sorted quartz of fine to very fine grain size, grading to siltstone. It is firm to moderately hard cemented with dolomitic and silicious cement.

This interval forms the basal part of the Rønne Formation and is of Rhaetian age.

### TRIASSIC UNDIFFERENTIATED 1552-2747m.

"TRIASSIC GROUP" 1552-2747m.

Kågerød Formation 1552-2747m.

1552-1631m.

A marked drop in sonic velocities associated with a minor decrease in resistivity and density values defines the top of the interval.

The lithology is claystone, varicoloured from pale red and greyish orange pink, becoming moderately reddish brown and -orange downwards, minor greenish and olive grey and -brown. It is firm to moderately hard, moderately silty increasing towards the base and non to moderately calcareous. Traces of spherical dolomite nodules are reported. Occasional thin beds of white to very light grey argillaceous limestone occur within the claystone.

The interval is barren of fossils, but it is believed to represent the uppermost part of the Triassic redbeds of the Kågerød Formation.

1631-1920m.

A logbreak from relatively stable to highly fluctuating resistivity values is chosen as the top of this interval. It consists predominantly of sand/sandstone with minor interbeds of claystone and stringers of limestone.

The sand/sandstone consists of poorly sorted, sub angular quartz grains, ranging from fine to very coarse. The grains are often reddish stained, loose or embedded in a reddish brown argillaceous matrix with traces of calcareous or silicious cement. Feldspar is common which, together with the argillaceous matrix, account for the high gamma ray values seen in the sand. Beds of conglomerate may occur within the sand from 1770 m, as indicated by the presence of common quartzite fragments in the cuttings.

The claystone is moderately to dark reddish brown or occasionally greenish grey, firm to moderately hard and moderately to very calcareous. Locally it grades into siltstone.

Stringers of white to very light grey and greenish grey limestone, often sandy or argillaceous, probably represent horizons of calcite cemented sandstone or claystone. Traces of white, hard, brittle anhydrite occur in the lower 50 m of the interval.

The age is undifferentiated Triassic.

1920-2068m.

The top of this interval is defined by a shift to lower density values and a good shale separation on the LDL/CNL log coinciding with an increase in gamma ray and more uniform resistivity values.

The interval consists of claystone with interbeds of sandstone and minor siltstone. The sandstone interbeds are most frequent in the lower part of the interval.

The claystone is predominantly moderately to dark reddish brown, moderately brown to grey brown, occasionally greenish grey to pale green. It is firm to moderately hard with a blocky texture, slightly to very calcareous and generally slightly to moderately silty. Locally, it grades to siltstone and very fine sandstone in thin laminae.

The sandstone is composed of clear to milky quartz grains, often reddish brown stained. The grain size is coarsening downwards, from predominantly very fine to medium in the upper part to fine to very coarse, locally grading to conglomerate, in the lower part. The grains are poorly sorted, subrounded, and loose to occasionally well cemented with calcite cement. Traces of mica are found.

The sandstone locally grades into siltstone; greyish brown to moderately brown, occasionally light greenish grey, moderately hard to hard, blocky, argillaceous, non to slightly calcareous.

A few stringers of limestone occur in the lower part of the interval. It is off-white to light grey, firm, blocky, slightly argillaceous, microcrystalline with occasional quartz inclusions.

2068-2464m.

This interval is initiated by a prominent increase in the gamma ray associated by a minor increase in sonic velocity.

The lithologies are much similar to the previous interval but in different proportions, being dominated by sandstone with only occasional interbeds of claystone and limestone.

The sandstone is both physically and chemically immature, with a poorly sorted grain size distribution ranging from fine to very coarse, grading to conglomerate in parts. The grains are mainly reddish stained quartz with locally abundant feldspar, minor lithic fragments and traces of mafic minerals and calcite, possibly as caliche nodules. The sandstone is firm to locally hard calcite cemented with a reddish brown argillaceous matrix.

The claystone is moderately to dark reddish brown, firm to moderately hard, blocky, slightly to very silty, locally grading to siltstone and slightly calcareous. It contains traces of anhydrite: white to very light grey, firm, microcrystalline, amorphous to blocky texture and argillaceous.

Stringers of limestone occur mainly in the lower half of the interval. The limestone is white to very light grey, locally mottled reddish brown, microcrystalline, moderately hard to hard with a blocky texture.

2464-2747m.

This interval only differs from the overlying in the sense that it is almost exclusively composed of sandstone, with claystone interbeds restricted to the lowermost 50 m only. The top of the interval is picked at a logbreak in the gamma ray.

In addition to the characteristics described from the previous interval the sandstone is reported to contain traces of mica and locally rare plant roots. The claystone with traces of anhydrite is similar to the above section.

The interval forms the basal part of the Triassic redbeds of the Kågerød Formation.

## 4.5 PERMIAN 2747-3057m.

### UPPER PERMIAN 2747-2787m.

ZECHSTEIN GROUP 2747-2787m.

The top of the Permian is marked on the wireline logs by a fall in the gamma ray and an increase in the resistivity.

The Zechstein Group is composed of claystone; medium dark grey to light grey to greenish grey, firm to moderately hard, blocky to subfissile, generally slightly silty, very silty in the uppermost part and shows traces of micromica and micropyrite. The claystone is very calcareous grading to marlstone in parts. Locally, it is rich in carbonaceous material with traces of coal fragments.

The age is undifferentiated Upper Permian.

### LOWER PERMIAN 2787-3057m.

ROTLIEGENDES GROUP 2787-3057m.

The upper boundary of the Rotliegendes Group is characterized by a sudden increase in both gamma ray, resistivity and density and of higher sonic readings.

The lithology is mainly sandstone with occasional interbeds of claystone and siltstone. The sandstone is dark reddish

brown and composed of clear to milky, occasionally orange to red stained quartz grains, very fine to very coarse, sometimes grading to conglomerate, angular to subrounded and very poorly sorted. In addition it contains minor to abundant fragments of quartzite and traces of igneous and gneiss fragments, feldspar, mica, iron oxides and carbonaceous material. It is poorly cemented with both siliceous and calcareous cement and contains an argillaceous and minor silty matrix.

The clay- and siltstone is moderately to dark reddish brown, dark grey to brown grey, moderately hard to hard, blocky, generally silica cemented, locally calcite cemented, minor sandy with traces of mica and mafic minerals. Much of the clay- and siltstone probably occur as matrix in the sandstone and conglomerate rather than in discrete beds.

Traces of anhydrite are described; white with minor black streaks, firm to soft and generally microcrystalline but with occasional gypsum crystals.

The undifferentiated Lower Permian age is based on stratigraphic position and lithology.

## 4.6 ?CARBONIFEROUS 3057-3212m.

"CARBONIFEROUS GROUP" 3057-3212m.

3057-3192m.

The top of the assumed Carboniferous is shown by an abrupt change in log character of both the gamma ray, resistivity, LDL/CNL and sonic log.

The dominating lithology is siltstone with interbedded claystone/shale and traces of sandstone. The siltstone is dark reddish brown to very dusky red to black red, occasionally brownish grey to very dark grey, moderately hard to hard with a blocky texture. It is poorly sorted, generally sandy, grading to very fine sandstone, with an argillaceous matrix. The cement may be both siliceous and calcareous.

The claystone is moderately to dark reddish brown to very dark red, firm to moderately hard, subfissile to platy or

blocky. It is non to moderately calcareous, and locally silty and micromicaceous. It may contain thin laminae of white to grey orange pink, microcrystalline limestone. Towards the base of the interval the claystone becomes more fissile, grading into shale.

In addition to the siltstone which may grade into very fine sandstone traces of coarser sandstone is also reported. It consists of poorly sorted, angular to rarely rounded, fine to coarse quartz grains, moderately brown to orange stained. Minor constituents are mica and traces of feldspar and quartzite fragments as well as an argillaceous matrix.

A Carboniferous age is tentatively given to the interval.

**? LOWER CARBONIFEROUS**

3192-3212m

The upper limit of this interval is set at an abrupt increase in the resistivity along with a minor increase in the sonic velocity.

The interval consists of silty sandstone alternating with shale. The sandstone is medium grey to brownish grey consisting of poor to moderately sorted, subangular quartz of very fine to silty grainsize, grading to siltstone. It is moderately hard, moderately calcite cemented and contains an argillaceous matrix and traces of mica.

The shale is described as medium dark grey to greyish black, brownish grey to brownish black, moderately hard to hard, fissile to subfissile, slightly to moderately silty, micromicaceous and slightly to very calcareous.

A questionable Lower Carboniferous age is given to this interval.

## 4.7 SILURIAN 3212-3624.5m (TD).

Graptolite Mudstone Formation 3212-3624.5m (TD).

An increase in the gamma ray coinciding with a drop in resistivity represents the top of the Silurian.

The Graptolite Mudstone Formation consists of shale with minor sand- and siltstone. The shale is medium dark grey to grey black, dusky yellowish brown to brownish grey, fissile to subfissile, moderately hard to hard, slightly to moderately silty, non to moderately calcareous and micromicaceous. Occasional carbonaceous streaks and pyrite nodules occur, mainly around 3400 m. It is locally fractured with veins filled with calcite. The shale may alternate with minor claystone which is slightly lighter in colour, more blocky and more silty.

The sandstone/siltstone is medium to medium dark grey, occasionally brownish grey to light olive grey and consists of quartz, ranging in size from predominantly silt to very fine sand, moderately sorted, in an argillaceous matrix. It is mainly calcite cemented, moderately hard to hard with traces of mica. Lamination is seen locally.

The interval is of Wenlock age, Sheinwoodian to Homerian.

## 5. HYDROCARBON SHOWS

Evaluation of hydrocarbon shows at the wellsite was carried out in a conventional manner. Below the 20" casing shoe at 105 m a complete hydrocarbon total gas detector (50 units = 1%) was operational together with a gas chromatograph for automatic and continuous gas analysis recorded as ppm by volume of C1 through nC4.

### 5.1 Gas record

Total gas readings were very low throughout the drilled section, generally less than 0.05% C1 and never exceeding 0.2%. Traces of C2 were recorded in the intervals 1815 - 1875 m and 3300 - 3624.5 m (TD). No heavier components were found.

### 5.2 Oil stain and fluorescence.

No shows were recorded on cuttings, sidewall cores or conventional cores in this well.

# 6. CORING

## 6.1 Conventional cores

A single core was cut in the well. The core was cut in shales of the Silurian Graptolite Mudstone Formation from 3615 m to TD at 3624.5 m (drillers depth) with a 100% recovery.

A detailed description of the core is given in Appendix I and also shown on the bottom of the completion log.

## 6.2 Sidewall cores

Four runs of sidewall cores were carried out covering the interval from 790 to 3349 m with a total of 120 samples requested. The results are summarized in the table below. A full description of each sample is given in Appendix II.

| Run # | Asked | Shot | Misfire | Empty | Lost | Recovery |
|---|---|---|---|---|---|---|
| 1 A | 30 | 29 | 1 | 0 | 1 | 28 |
| 1 B | 30 | 30 | 0 | 6 | 0 | 24 |
| 2 C | 30 | 17 | 13 | 2 | 0 | 15 |
| 2 D | 30 | 30 | 0 | 3 | 1 | 26 |
| Total | 120 | 106 | 14 | 11 | 2 | 93 |

# 7. WIRELINE AND MWD LOGGING

## 7.1 Wireline logs

The table below shows the type of log, date, interval and run no. for each log run in well 5514/30-1.

| LOG | DATE | INTERVAL (m) | RUN NO. |
|---|---|---|---|
| DIL/LSS/GR | 23.04.89 | 1751 - 775 | 1 A |
| LDL/CNL/GR | 23.04.89 | 1752 - 775 | 1 A |
| SHDT/GR | 23.04.89 | 1749 - 775 | 1 A |
| CST | 24.04.98 | 1745 - 1238 | 1 A |
| CST | 24.04.89 | 1232 - 790 | 1 B |
| DIL/LSS/GR/SP | 22.05.89 | 3351 - 1738 | 2 B |
| LDL/CNL/GR | 23.05.89 | 3350 - 1738 | 2 B |
| SHDT/GR | 23.05.89 | 3350 - 1738 | 2 B |
| CST | 23.05.89 | 3349 - 3051 | 2 C |
| CST | 23.05.89 | 3201 - 1862 | 2 D |
| CBL/VDL | 23.05.89 | 1732 - 472 | 2 A |
| DIL/LSS/GR/SP | 02.06.89 | 3615 - 3338 | 3 C |
| LDL/CNL/GR | 02.06.89 | 3612 - 3338 | 3 C |
| SHDT/GR | 03.06.89 | 3622 - 3338 | 3 C |
| CBL/VDL | 02.06.89 | 3336 - 2990 | 3 B |
| Vel. survey/ Checkshots | 03.06.89 | 3617 - 795 | 3 A |

## 7.2 MWD logs

A MWD log was run by Teleco from 105 to 1715 m, for continuous measurement of gamma ray, resistivity, rate of penetration and weight on bit. The resistivity tool failed from 1510 to 1715 m.

The MWD log replaced wireline logging from 105 m and down to the shoe depth for the 20" casing at 777 m (775 m loggers depth).

## 7.3 Bottomhole temperatures from logs

The bottom hole temperatures measured at each log run are listed in the table below.

| LOG RUN # | DEPTH (m) | RECORDED TEMPERATURE (°C) t1 | t2 | t3 | TIME SINCE CIRC. (hr:min) | CIRC. TIME (hr:min) |
|---|---|---|---|---|---|---|
| DIL/LSS 1A | 1751 | 55.5 | 55.5 | 55.5 | 6:45 | 1:50 |
| LDL/CNL 1A | 1752 | 55.5 | 56 | 56 | 12:00 | 1:50 |
| SHDT 1A | 1749 | 56 | 56 | 56.5 | 18:00 | 1:50 |
| DIL/LSS 2B | 3351 | 72 | 72 | 72 | 5:00 | 3:00 |
| LDL/CNL 2B | 3350 | 73 | 73 | 73 | 14:35 | 3:00 |
| SHDT 2B | 3350 | 75.5 | 75.5 | 75.5 | 21:15 | 3:00 |
| DIL/LSS 3C | 3615 | 75.5 | 75.5 | 75.5 | 7:10 | 8:25 |
| LDL/CNL 3C | 3612 | 77.8 | 77.8 | 77.8 | 11:20 | 8:25 |
| SHDT 3C | 3622 | 75.3 | 75.3 | - | 6:19 | 5:00 |
| CHECKSHOTS | 3617 | 76.6 | 76.6 | 76.6 | 10:15 | 5:00 |

## 8. STANDARD STUDIES

The biostratigraphical evaluation and analysis of thermal maturity was carried out by The Robertson Group plc, Petroleum Division and the results are presented in the report:

Norsk Hydro 5514/30-1 offshore Bornholm,
Baltic sea well:
Biostratigraphy of the interval 105m-3624.1m,
Thermal maturity of the interval 2755m-3624m

A petrophysical evaluation was made by Norsk Hydro and the results are given in:

Petrophysical evaluation report,
Well 5514/30-1 (Pernille-1)

Conventional core analysis was done by The Geological Survey of Denmark:

Conventional Core Analysis for Norsk Hydro
Well No.: 5514/30-1
Core Photos

Note that the report consists of photos of the core only.

## 9. SPECIAL STUDIES

A 1-D basin modelling of the Rønne Graben based on well 5514/30-1 and two pseudowells was performed by Norsk Hydro Research Centre. The results are presented in:

ID basin modelling of Pernille-1 and selected points in the Rønne Graben, Denmark

Norsk Hydro Research Centre also made a geochemical evaluation of the well:

Petroleum Geochemistry
Well: 5514/30-1 (Pernille-1)

# APPENDIX I

Norsk Hydro

Note: Fibre glass inner barrel used - core descriptions made every one meter only.

| Well no. | Core report | Core no's |
|---|---|---|
| 5514/30-1 | | 1 |

| Interval | Area | Cut | Date |
|---|---|---|---|
| 3615 - 3620m | Baltic Sea | 3615 - 3624.5m | 02.06.89 |
| **Scale** | **Well R.K.B.** | **Recovery** | **Geologist** |
| 1:25 | 36m | 9.5m 100% | Eide/Simpson |

| Depth scale | Re-covery | Lithological column | Depths (m) | Lithological descriptions | Shows |
|---|---|---|---|---|---|
| 3615 | | M C | 3615 | **Sh:** dk - m gy, hd - v hd, fis, occ blky, earthy, tr wxy tex, tr carb mat, micromic, tr dism Pyr, sl - non calc | No shows |
| 3616 | | M C | 3616 | **Sh:** a/a, sl more ang brk | |
| 3617 | | M C | 3617 | **Sh:** a/a | |
| 3618 | | // M // | 3618 | **Sh:** gy blk - dk gy, hd - v hd, fis - subfis, hk - ang brk, spltry, plty, wxy tex, micromic, carb - v carb, sl - non calc w/ lt - m gy Slst strk & lam | |
| 3619 | | C // M C | 3619 | **Sh:** a/a | |
| 3620 | | | | | |

Norsk Hydro

Note: Fibre glass inner barrel used - core descriptions made every one meter only.

| Well no. | Core report | Core no's |
|---|---|---|
| 5514/30-1 | | 1 |

| Interval | Area | Cut | Date |
|---|---|---|---|
| 3620 - 3624.5m | Baltic Sea | 3615 - 3624.5m | 02.06.89 |
| **Scale** | **Well R.K.B.** | **Recovery** | **Geologist** |
| 1:25 | 36m | 9.5m 100% | Eide/Simpson |

| Depth scale | Re-covery | Lithological column | Depths (m) | Lithological descriptions | Shows |
|---|---|---|---|---|---|
| 3620 | | M | 3620 | **Sh:** gy blk, hd - v hd, ang - hk brk, fis - subfis, spltry, carb, wxy tex, sl - non calc, micromic | No shows |
| 3621 | | C M | 3621 | **Sh:** a/a | |
| 3622 | | C M | 3622 | **Sh:** dk gy - gy blk, hd, fis - subfis, earthey - wxy tex, sl - non calc, micromic, tr dism Pyr, carb<br>Calc vn in frac: wh, anhed - euhed | |
| 3623 | | C M | 3623<br>sealed sample<br>3623.5 | **Sh:** a/a<br>**Sh:** a/a, spltry | |
| 3624 | | C | 3624.1 | **Sh:** a/a, w/ Calc vn along frac, micromic | |
| 3624.5 | | | 3624.55 | **Sh:** dk gy - blk, hd - v hd, fis, spltry, carb strks, occ slty lam, micromic, sl - non calc | |

# APPENDIX II

HYDRO

| Service company: | Schlumberger |
|---|---|
| Asked: | 30 |
| Shot | 29 |
| Lost | 0 |
| Empty: | 0 |
| Misfire: | 1 |
| Samples recovered: | 29 |
| Geologist: | Bang/Ladegaard |

| Well no: 5514/30-1 | Side wall core descriptions | |
|---|---|---|
| Licence: DK 5/86 | Run no: 1A | |
| Date: 24.04.89 | Page No: 1 of 2 | |

tr:trace – M:medium – G:good

| No: | Depths: mRKB | Rec: cm | Lithology | Flu tr | Flu M | Flu G | Cut tr | Cut M | Cut G |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1745 | 2 | Slst: lt - mod brn, Qtz, pr srtd, mod hd, arg, tr vf - f sd, calc cmt, w/ intbd Lst: wh - v lt gy, f - m xtl, frm - mod hd, arg. | | | | | | |
| 2 | 1710 | 3 | Lst: wh - v lt gy, mod hd, blky, gen microxln, abn Qtz, f - m, occ crs, grd calc cmt Sst. | | | | | | |
| 3 | 1674 | 2 | Lst: wh - lt grn gy - grn gy, microxln, mnr crptoxln, mod hd, blky, mnr m - crs Qtz g, sl arg. | | | | | | |
| 4 | 1638 | 3 | Sd: lt gy - lt grn gy, Qtz, f - m, ang - subrnd, pr srtd, sft, arg, pr cmt, calc in mtx. | | | | | | |
| 5 | 1629 | 3 | Sd: m lt gy - lt brn gy, Qtz, m - f, subang - subrnd, pr srtd, sft, abn mtx, calc & arg mtx, non - v sl cmt | | | | | | |
| 6 | 1605 | | Misfire | | | | | | |
| 7 | 1581 | 4 | Clyst: vgt m gy & mod - dk rd brn, sft - frm, slty, in pt non calc, in pt mod calc. | | | | | | |
| 8 | 1555 | 3.5 | Clyst: brn blk - olv gy, frm, in pt mod hd, sl stky, mod slty, non calc. | | | | | | |
| 9 | 1552 | 4 | Clyst: dusky yel - lt olv brn, frm, in pt mod hd, slty, tr f sdy, mod calc. | | | | | | |
| 10 | 1546 | 4 | Clyst: gy brn, frm, sl slty, non calc. | | | | | | |
| 11 | 1544 | 5 | Clyst: olv blk - brn blk, frm - mod hd, tr slty, non calc. | | | | | | |
| 12 | 1542 | 5 | Clyst: vgt olv gy & lt olv brn, frm, in pt mod hd, sl slty, non calc | | | | | | |
| 13 | 1536 | 3.5 | Clyst: gy blk, frm, sl fis, sl slty, non calc. | | | | | | |
| 14 | 1526 | 3 | Clyst: m gy - m dk gy, frm, slty, tr Mica, non calc. | | | | | | |
| 15 | 1514 | 2.5 | Sst: m lt gy, Qtz, alt vf & f lam, ang - subrnd, mod srtd, frm, slty, arg mtx, tr dk min. | | | | | | |
| 16 | 1510 | 3 | Slty Clyst: m dk gy, frm. tr vf sdy. tr Mica. sl calc. | | | | | | |
| 17 | 1483 | 3 | Sdy Slst: m dk gy, Qtz, mod hd, arg mtx, mod silic cmt, tr dk min, tr Mica, non calc, fnt lam, loc vf sdy grd Sst. | | | | | | |
| 18 | 1467 | 5 | Clyst: brn gy - olv gy, sft, sl stky, v slty, tr vf sdy, non calc, loc grd Slst. | | | | | | |
| | | | | | | | | | |

HYDRO

| Service company: Schlumberger | |
|---|---|
| Asked: | 30 |
| Shot | 29 |
| Lost | 0 |
| Empty: | 0 |
| Misfire: | 1 |
| Samples recovered: | 29 |
| Geologist: | Bang/Ladegaard |

| Well no: 5514/30-1 | Side wall core descriptions | |
|---|---|---|
| Licence: DK 5/86 | Run no: 1A | |
| Date: 24.04.89 | Page No: 2 of 2 | |

tr:trace — M:medium — G:good

| No: | Depths: mRKB | Rec: cm | Lithology | Flu tr | Flu M | Flu G | Cut tr | Cut M | Cut G |
|---|---|---|---|---|---|---|---|---|---|
| 19 | 1455 | 4 | Slst: m dk gy, Qtz, pr srtd, frm, arg mtx, loc vf sdy, abn carb, tr mica, w/ mnr strk Sd: lt gy, vf - f, lse. | | | | | | |
| 20 | 1447 | 4.5 | Sst: m dk gy, Qtz, vf, gen subang, pr srtd, frm, slty, abn arg mtx, pr cmt, tr carb, non calc, fnt lam. | | | | | | |
| 21 | 1414 | 2 | Sd: v lt gy - lt gy, Qtz, gen f, ang - subang, mod - w srtd, lse - fri, mnr arg mtx, slty, abn carb in lam | | | | | | |
| 22 | 1394 | 2.5 | Sd w/ intbd Clyst lam:<br>Sd: v lt gy, Qtz, f, ang - subrnd, w srtd, lse - fri, tr arg mtx, tr dk min, tr | | | | | | |
| | | | mica, pr vis intgran por.<br>Clyst: olv gy, frm, slty, tr - abn carb, non calc. | | | | | | |
| 23 | 1391 | 2 | Clyst: olv gy - m dk gy, frm - mod hd, slty, tr carb, sl calc, w/ mnr strk Sst: wh, Qtz, gen f, subrnd, mod strd, frm - hd, calc cmt. | | | | | | |
| 24 | 1370 | 2 | altg Sd & Slst in f lam, tr fnt ripples: | | | | | | |
| | | | Sd: v lt gy, Qtz, vf - f, ang - subrnd, mod srtd, lse, mnr arg mtx, tr carb.<br>Slst: dk gy - gy blk, frm, arg, abn Qtz, abn carb, sl calc. | | | | | | |
| 25 | 1349 | 5 | Clyst: m gy, frm, in pt v slty grd Slst, in pt sl slty, non calc, w/ mnr lam of vf Sd | | | | | | |
| 26 | 1318 | 2.5 | Clyst: brn gy - olv gy, frm, slty, tr carb, non calc, w/ intbd Sd: v lt gy, Qtz, vf - f, subrnd, w srtd, lse, rr tr arg mtx, gd vis por. | | | | | | |
| 27 | 1295 | 3 | Clyst: m dk gy, frm, v slty, abn carb, abn Qtz, tr Mica, w/ mnr lam of Sd: wh, Qtz, vf - f, w srtd, lse, rr tr arg mtx, gd vis por. | | | | | | |
| 28 | 1290 | | Lost | | | | | | |
| 29 | 1287 | 5 | Slst: m dk gy, Qtz, pr srtd, frm - mod hd, abn arg mtx, abn carb, non calc, w/ mnr Lst: wh - v lt gy, microxln, hd. | | | | | | |
| 30 | 1238 | 5 | Clyst: lt - m lt gy, in pt dk yel orng, sft - frm, sl slty, tr Mica, tr carb, non calc. | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

HYDRO

| Service company: Schlumberger | |
|---|---|
| Asked: | 30 |
| Shot | 30 |
| Lost | 0 |
| Empty: | 6 |
| Misfire: | 0 |
| Samples recovered: | 24 |
| Geologist: Bang/Ladegaard | |

| Well no: 5514/30-1 | Side wall core descriptions | |
|---|---|---|
| Licence: DK 5/86 | Run no: 1B | |
| Date: 24.04.89 | Page No: 1 of 2 | |

tr:trace – M:medium – G:good

| No: | Depths: mRKB | Rec: cm | Lithology | Flu tr | Flu M | Flu G | Cut tr | Cut M | Cut G |
|---|---|---|---|---|---|---|---|---|---|
| 31 | 1232 | 2.5 | Sd: alt lam lt olv gy - lt brn gy, dusky yel brn, Qtz, vf - slty, subang, mod srtd, sft, arg mtx, tr Mica, tr Fldsp, tr carb, tr mafic min, no - v pr vis por. | | | | | | |
| 32 | 1214 | 2 | Sd: olv gy - brn gy, mnr mm lam v lt gy, Qtz, vf - slty, subang, mod srtd, sft, arg mtx in olv - brn gy, tr Mica, tr Fldsp, tr carb, tr dk min, no vis por. | | | | | | |
| 33 | 1202 | 2.5 | Sd: dusky yel brn, intlam w/ lt olv gy - lt brn gy, Qtz, vf - slty, subang, mod srtd, sft, arg mtx, tr Mica, tr Fldsp, tr carb, tr mafic min, no vis por. | | | | | | |
| 34 | 1168 | 2.5 | Sd: dusky yel brn, Qtz, vf - slty, subang, mod strd, sft, arg mtx, tr Mica, tr Fldsp, tr carb, tr mafic min, no vis por. | | | | | | |
| | | | alt w/ Sd: lt olv gy, Qtz, vf - f, subang, w srtd, tr Fldsp, rr carb, gd vis por. | | | | | | |
| 35 | 1164 | 0 | Empty | | | | | | |
| 36 | 1145 | 3.5 | Sd: dusky yel brn, Qtz, vf - slty, subang, mod srtd, sft, arg mtx, tr Mica, tr Fldsp, tr carb, tr mafic min, no vis por. | | | | | | |
| | | | intlam w/ Sd: lt olv gy, Qtz, vf - f, subang, w srtd, tr Fldsp, rr carb, gd vis por. | | | | | | |
| 37 | 1125 | 0 | Empty | | | | | | |
| 38 | 1113 | 3 | Slt: dusky yel brn, crs grd vf Sd, sft - frm, arg, tr Mica, tr carb, tr micronod Pyr agg. | | | | | | |
| 39 | 1104 | 4 | Slt: dusky yel brn, v arg grd Cly, sft - plas, com Mica, tr carb, tr micropyr, tr mafic min. | | | | | | |
| 40 | 1082 | 4 | Cly: dusky yel brn, sft - plast, v slty grd Slt, tr Mica, tr carb, tr micronod Pyr, tr mafic min. | | | | | | |
| 41 | 1075 | 3 | Sd: dusky yel brn, Qtz, vf - slty, subang - ang, pr srtd, sft, arg mtx, tr Mica, tr carb, no vis por. | | | | | | |
| | | | intlam w/ Sd: lt brn gy - brn gy, Qtz, vf - tr f, subang - ang, mod - w srtd, sft, tr arg mtx, tr Mica, tr mafic min. | | | | | | |
| 42 | 1068 | 4.5 | Sd: dusky yel brn, Qtz, vf - slty, subang - ang, pr srtd, sft, arg mtx, tr Mica, tr carb, no por. | | | | | | |
| 43 | 1062 | 4 | Cly: lt brn gy - lt olv gy, sft - plast, mod slty, tr vf sdy, rr Mica, rr carb. | | | | | | |
| 44 | 1054 | 0 | Empty | | | | | | |
| 45 | 1034 | 3.5 | Cly: pl yel brn, sft - plast, mod slty, non calc. | | | | | | |
| | | | | | | | | | |

HYDRO

| Service company: Schlumberger | |
|---|---|
| Asked: | 30 |
| Shot | 30 |
| Lost | 0 |
| Empty: | 6 |
| Misfire: | 0 |
| Samples recovered: | 24 |
| Geologist: | Bang/Ladegaard |

Well no: 5514/30-1

# Side wall core descriptions

Licence: DK 5/86

Run no: 1B

Date: 24.04.89

Page No: 2 of 2

tr:trace – M:medium – G:good

| No: | Depths: mRKB | Rec: cm | Lithology | Flu tr | Flu M | Flu G | Cut tr | Cut M | Cut G |
|---|---|---|---|---|---|---|---|---|---|
| 46 | 1023 | 2.5 | Sd: olv gy - brn gy, Qtz, vf, subang - ang, mod srtd, sft, arg mtx, v slty, tr Mica, tr carb, no por. | | | | | | |
| 47 | 1002 | 0 | Empty | | | | | | |
| 48 | 982 | 0 | Empty | | | | | | |
| 49 | 972 | 3 | Slt: gy brn - dusky yel brn, crs grd vf Sd, sft, arg mtx, tr Mica, tr carb, tr mafic min. | | | | | | |
| 50 | 960 | 3 | Sd: v lt gy - lt gy, clr - mlky, Qtz, f, subang, w srtd, sft, kaol mtx, tr arg strk, tr carb, tr Pyr, tr mafic min, tr Glau, pr vis por. | | | | | | |
| 51 | 955 | 3 | Sd: v lt gy - lt gy, clr - mlky, Qtz, f, subang, w srtd, sft, kaol mtx, tr arg strk, tr carb, tr Pyr, tr mafic min, tr Glau, mod vis por. | | | | | | |
| 52 | 940 | 2.5 | Mrl/Lst: grn gy - dk grn gy, vf rexlzd Calc, sft - frm, blky, arg mtx, com micronod Pyr agg, gd tr ang Calc microfoss spic, gd tr Glau, tr Mica. | | | | | | |
| 53 | 917 | 2 | Mrl/Lst: brn gy - dk grn gy, vf rexlzd Calc, fri - firm, blky, arg mtx, tr Glau, tr Mica, com microfoss spic, tr radiolaria sph. | | | | | | |
| 54 | 905 | 2.5 | Mrl/Lst: dk grn gy, vf rexlzd Calc, fri - frm, blky, arg mtx, tr Glau, tr Mica, tr microfoss spic, tr radiolaria sph. | | | | | | |
| 55 | 895 | 0 | Empty | | | | | | |
| 56 | 879 | 5.5 | Cly: dk grn gy, frm, v calc grd Mrl, tr Glau, sl - mod slty, abn microfossils: wh - pk gy, rods < 1 mm x 0.2 mm, pshexagonal, xln, also hexagonal plates, | | | | | | |
| | | | pt connected, tr radiolaria sph. | | | | | | |
| 57 | 837 | 1.5 | Chk: wh - v lt gy, frm - mod hd, tr hd, blky, brit, mass, non - v sl arg, mod cmt, microxln. | | | | | | |
| 58 | 830 | 2 | Chk: wh - v lt gy, hd - v hd, blky, brit, mass, non - v sl arg, w cmt, microxln. | | | | | | |
| 59 | 810 | 2 | Chk: lt gy, mod hd, blky, mass, sl - mod arg, mod cmt, microxln. | | | | | | |
| 60 | 790 | 2 | Chk: lt gy, mod hd, blky, mass, sl - mod arg, mod cmt, microxln. | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

HYDRO

| Service company: | Schlumberger |
|---|---|
| Asked: | 30 |
| Shot | 17 |
| Lost | 0 |
| Empty: | 2 |
| Misfire: | 13 |
| Samples recovered: | 15 |
| Geologist: | Bang/Ladegaard |

| Well no: 5514/30-1 | Side wall core descriptions | |
|---|---|---|
| Licence: DK 5/86 | Run no: 2C | |
| Date: 23.05.89 | Page No: 1 of 2 | |

tr:trace – M:medium – G:good

| No: | Depths: mRKB | Rec: cm | Lithology | Flu tr | Flu M | Flu G | Cut tr | Cut M | Cut G |
|---|---|---|---|---|---|---|---|---|---|
| 61 | 3349 | 2 | Slst: intlam lt gy - m dk gy, frm - mod hd, mass, crs grd vf Sst, v calc grd Mrl, tr micromic, mod arg, tr calc microvn. | | | | | | |
| 62 | 3345.5 | 2.5 | Clyst: altn lam m gy - dk gy, frm - mod hd, mass, mod - v slty, tr micromic, mod - v calc. | | | | | | |
| 63 | 3337.5 | 2.5 | Sh: gy blk, fis - subfis, frm - mod hd, mod slty, mod - v calc, tr micronod Pyr, tr carb, | | | | | | |
| 64 | 3327.5 | 3.5 | Sh: dk gy - gy blk, fis - subfis, frm - mod hd, mod slty, mod - v calc, tr micronod Pyr, tr carb, tr slick. | | | | | | |
| 65 | 3323 | 1 | Sst: lt gy - lt olv gy, Qtz, vf - slty grd Slst, subang, sph, mod srtd, mod hd - hd, arg mtx, calc mtx, tr Mica, no vis por. | | | | | | |
| 66 | 3294.5 | 4.5 | Sh: dk gy - brn blk, subfis - fis, mod hd - hd, sl - mod slty, mnr mod - v slty, tr micromic, sl - mod calc. | | | | | | |
| 67 | 3280.5 | 1.5 | Sh: dk gy - brn gy - gy blk, subfis, hd - v hd, mod - v slty, tr micromic, mod - v calc. | | | | | | |
| 68 | 3275 | 1.5 | Sh: lt gy - m dk gy, subfis, mod hd - hd, sl - mod slty, tr micromic, v calc. | | | | | | |
| 69 | 3260.5 | 1.5 | Sh: m gy - lt brn gy, fis - subfis, mod hd, mod - v slty, abn micromic, v calc. | | | | | | |
| 70 | 3244.5 | 2 | Sh: dusky yel brn, fis, mod hd, mod slty, tr micromic, v calc. | | | | | | |
| 71 | 3232.5 | 3.5 | Clyst: m gy - m dk gy, frm - mod hd, mass, v slty grd Slst, micromic, mod calc. | | | | | | |
| 72 | 3225.5 | 5 | Sh: dk gy - dusky yel brn, fis, mod hd - hd, mod slty, tr - com micromic, non calc. | | | | | | |
| 73 | 3212.5 | 2.5 | Sst: lt gy - m gy - lt olv gy, Qtz, vf - slty grd Slst, subang, sph, mod srtd, mod hd, arg & calc mtx, com Mica, sl lam, no por. | | | | | | |
| 74 | 3207.5 | 2.5 | Sh: gy blk - brn blk, subfis, mod hd, mod slty, tr micromic, v calc. | | | | | | |
| 75 | 3204.5 | 1.5 | Sst: lt brn gy - brn gy, Qtz, vf - slty grd Slst, mass - sl subfis, frm - mod hd, arg mtx, mod calc cmt, silic cmt, no vis por. | | | | | | |
| 76 | 3195.5 | 0 | Empty | | | | | | |
| 77 | 3193 | 0 | Empty | | | | | | |
| 78 | 3179 | | Misfire | | | | | | |
| | | | | | | | | | |

HYDRO

| Service company: Schlumberger | |
|---|---|
| Asked: | 30 |
| Shot | 17 |
| Lost | 0 |
| Empty: | 2 |
| Misfire: | 13 |
| Samples recovered: | 15 |
| Geologist: | Bang/Ladegaard |

| Well no: 5514/30-1 | Side wall core descriptions | |
|---|---|---|
| Licence: DK 5/86 | Run no: 2C | |
| Date: 23.05.89 | Page No: 2 of 2 | |

tr:trace – M:medium – G:good

| No: | Depths: mRKB | Rec: cm | Lithology | Flu tr | Flu M | Flu G | Cut tr | Cut M | Cut G |
|---|---|---|---|---|---|---|---|---|---|
| 79 | 3135 | | Misfire | | | | | | |
| 80 | 3106.5 | | Misfire | | | | | | |
| 81 | 3067.5 | | Misfire | | | | | | |
| 82 | 3050.9 | | Misfire | | | | | | |
| 83 | | | Misfire | | | | | | |
| 84 | | | Misfire | | | | | | |
| 85 | | | Misfire | | | | | | |
| 86 | | | Misfire | | | | | | |
| 87 | | | Misfire | | | | | | |
| 88 | | | Misfire | | | | | | |
| 89 | | | Misfire | | | | | | |
| 90 | | | Misfire | | | | | | |
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HYDRO

| Service company: Schlumberger | |
|---|---|
| Asked: | 30 |
| Shot | 30 |
| Lost | 1 |
| Empty: | 3 |
| Misfire: | 0 |
| Samples recovered: | 26 |
| Geologist: | Bang/Simpson |

| Well no: 5514/30-1 | Side wall core descriptions | |
|---|---|---|
| Licence: DK 5/86 | Run no: 2D | |
| Date: 23.05.89 | Page No: 1 of 2 | |

tr:trace – M:medium – G:good

| No: | Depths: mRKB | Rec: cm | Lithology | Flu tr | Flu M | Flu G | Cut tr | Cut M | Cut G |
|---|---|---|---|---|---|---|---|---|---|
| 91 | 3201.7 | 1.5 | Sst: m gy - brn gy, Qtz, vf - slty, subang, sph, pr - mod srtd, mod hd - hd, arg mtx, mnr calc cmt, com Mica, no vis por. | | | | | | |
| | | | mnr Lst vn: wh - gy orng pk, mass, microxln, sl arg. | | | | | | |
| 92 | 3195 | 2 | Sh: m dk gy - brn gy, mod hd - hd, subfis, sl - mod slty, micromic, v calc, lam. | | | | | | |
| 93 | 3191.9 | 3.5 | Clyst: m dk gy - brn gy, hd, mass, sl - mod slty, tr micromic, mod calc. | | | | | | |
| 94 | 3183 | 2.5 | Clyst: olv gy, mod hd - hd, mass - subfis, sl - mod slty, tr micromic, non calc. | | | | | | |
| 95 | 3179 | 2 | Slst: brn gy, mod hd - hd, sub fis - fis, sl mod arg, grd vf Sst, tr micromic, sl - mod calc. | | | | | | |
| 96 | 3158 | 1 | Sh: mod brn, mod hd, subfis - fis, v slty, tr micromic, tr vf sdy, mod calc. | | | | | | |
| 97 | 3135 | 1.5 | Clyst: dusky yel brn - gy brn, mod hd, subfis - blky, mod - v slty, w/ vf Sst: mod orng pk - pl rd brn, sl mod calc. | | | | | | |
| 98 | 3106.5 | 0 | Empty | | | | | | |
| 99 | 3101.8 | 1 | Slst: mod rd brn - dk rd brn, frm, arg, blky, mod - v calc, tr Sst: Qtz, vf - f, subang, hd - v hd, w cmt, calc cmt, silic cmt, arg mtx | | | | | | |
| | | | tr Lst nod: wh - gy orng pk, microxln, sft - frm, non - sl arg. | | | | | | |
| 100 | 3076 | 0 | Empty | | | | | | |
| 101 | 3067.5 | 1 | Lst: mod yel brn, hd, plty, abn f Qtz g, Mica. | | | | | | |
| 102 | 3059 | 2.5 | Clyst: mod rd brn - dk rd brn, frm, mod slty, blky, non - sl calc, lam, Lst: wh - gy orng pk, sft, microxln, blky, non - sl arg. | | | | | | |
| 103 | 3057 | 3 | Clyst: gy rd - dk rd brn w/ rd spots, mod hd, mass - subfis, sl - mod slty, non calc. | | | | | | |
| 104 | 3051 | 2 | Slst: dk rd brn, frm, blky, arg, tr vf Sst, v calc grd Mrl. | | | | | | |
| 105 | 2793.5 | 3 | Sst: dk rd brn, speck, Qtz, vf - v crs, ang - subang, tr subrnd, sph - elg, v pr srtd, frm, mass, arg mtx, Fldsp, sed frag, ign frag, Mica, tr calc cmt. | | | | | | |
| 106 | 2787.5 | 3.5 | Clyst: m dk - dk gy, frm - mod hd, mass, sl slty, tr micromic, non calc. | | | | | | |
| | | | | | | | | | |

HYDRO

| Service company: Schlumberger | |
|---|---|
| Asked: | 30 |
| Shot | 30 |
| Lost | 1 |
| Empty: | 3 |
| Misfire: | 0 |
| Samples recovered: | 26 |
| Geologist: | Bang/Simpson |

| Well no: 5514/30-1 | Side wall core descriptions | |
|---|---|---|
| Licence: DK 5/86 | Run no: 2D | |
| Date: 23.05.89 | Page No: 2 of 2 | |

tr:trace – M:medium – G:good

| No: | Depths: mRKB | Rec: cm | Lithology | Flu tr | Flu M | Flu G | Cut tr | Cut M | Cut G |
|---|---|---|---|---|---|---|---|---|---|
| 107 | 2752.5 | 2.5 | Clyst: m gy - grn gy, mass - subfis, frm, sl plast, mod - v slty, tr micromic, v calc grd Mrl. | | | | | | |
| 108 | 2708 | 2 | Clyst: dk rd brn, frm - plast, mass, mod - v slty, tr micromic, tr Anhy: microxln, m - crs xln. | | | | | | |
| 109 | 2689 | 2 | Sst: dk rd brn, Qtz, f - vf, tr m, tr crs, subang, sph - elg, v pr srtd, arg mtx, tr calc cmt, tr Fldsp, tr plt roots, tr Anhy, no vis por. | | | | | | |
| 110 | 2660 | 2.5 | Sst: mod rd brn, Qtz, vf - f, ang - subang, sph, pr - mod srtd, arg mtx, tr Fldsp, tr Mica, bed. | | | | | | |
| 111 | 2645 | 2 | Sst: dk rd brn, speck wh, Qtz, f - m, tr crs, tr vf, subang - ang, tr subrnd, pr srtd, mod hd - fri, mass, arg mtx, tr Fldsp, non calc, tr Anhy, no vis por. | | | | | | |
| 112 | 2601 | 2 | Sst: dk rd brn, speck wh, Qtz, f - m, subang - ang, pr srtd, mod hd - fri, mass, arg mtx, tr Fldsp, tr clyst clasts, tr Anhy, non calc, no vis por. | | | | | | |
| 113 | 2576.5 | 2.5 | Sst: dk rd brn, speck wh, Qtz, f - m, subang - ang, pr srtd, frm - fri, mass, arg mtx, com Anhy, tr Fldsp, non calc, no vis por. | | | | | | |
| 114 | 2545 | 0 | Empty | | | | | | |
| 115 | 2476.5 | 4 | Sst: dk rd brn, speck wh, Qtz, vf - v crs, ang - subang, sph, v pr srtd, frm, mass, arg mtx, tr Fldsp, sl calc, sed frag. | | | | | | |
| 116 | 2285 | 3.5 | Clyst: mod rd brn - dk rd brn, frm, mass, sl - mod slty, non calc. | | | | | | |
| 117 | 2227.5 | 2 | Sst: mot dk rd brn, wh - v lt gy, Qtz, gen f - m, tr crs - v crs, subang - ang, sl elg, mass, arg mtx, mnr calc cmt, tr Anhy, tr Fldsp, tr ?Kaol, no vis por. | | | | | | |
| 118 | 2097.5 | 2 | Sst: dk rd brn - v dusky rd, Qtz, vf - v crs, ang - subang, sph, v pr srtd, frm, mass, arg mtx, tr Fldsp, non calc. | | | | | | |
| 119 | 1951.8 | 0 | Lost | | | | | | |
| 120 | 1862.5 | 4 | Clyst: dk rd brn, frm, mass, mod - v slty, sl - mod calc. | | | | | | |
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# APPENDIX III

# HYDRO WELL SUMMARY

Coord: 55 00 54.09 N UTM: N 6096812.4 m
14 18 43.14 E E 456003.2 m
ne: 33, with Control Meridian 15°E
Line: NH 87B - 101 SP. 236
Rig: GLOMAR MORAY FIRTH I
Waterdepth: 44 m.
Stopped in: Shales of Silurian age

On location: 05.04.89
Spudded: 06.04.89
At T.D.: 01.06.89
Completed: 06.06.89
T.D. Driller: 3624.5 m.
T.D. Logger: 3623.0 m.
Wireline Logging: Schlumberger.
Mudlogging: Exlog.

**WELL**
5514/30-1
PERNILLE-1

**COUNTRY**
DENMARK

**OPERATOR** Norsk Hydro

**LICENCE** 5/86

**TARGETS**
Primary: LOWER JURASSIC/UPPER TRIASSIC SANDSTONE OF THE RØNNE FORMATION
Secondary: THE ENTIRE PRE-CRETACEOUS SECTION

**OWNED BY**
Norsk Hydro/ Enterprise/ Gas Council/ Amerada Hess/ DOPAS/ DENERCO/ Dansk Oliesøgning/ KFK

**CASING**

30" At 105 m.
20" At 777 m.
13 At 1740 m.
9 At 3339 m.

**CORES**

TD. CORE
3615.0-3624.5 m.
100 % REC.

**RESULTS**

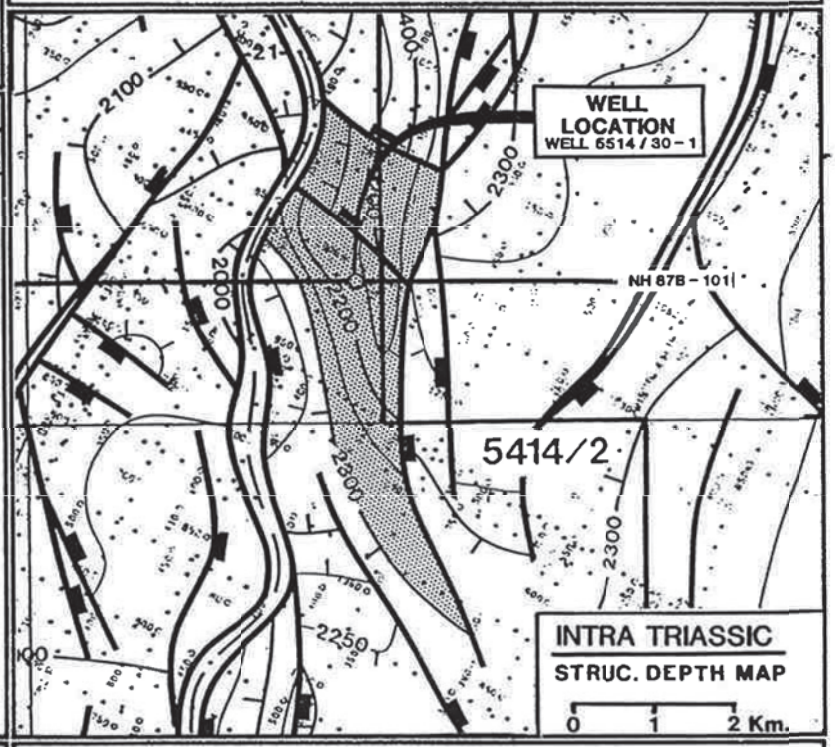
The Rønne Fm. was found waterwet in the interval 967 to 1552m. All deeper prospective sections were found waterwet.
P & A as a dry well.

**GAS RECORD**

105- 791m:
0.03-0.07% $C_1$
791-1646m:
0.01-0.17% $C_1$
1646-1790m:
0.00-0.03% $C_1$
1790-2065m:
0.00-0.12% $C_1$
2065-2457m:
0.01-0.30% $C_1$
2457-2810m:
0.01-0.10% $C_1$
2810-3255m:
0.01% $C_1$
3255-3352m:
0.01-0.03% $C_1$
352-3368m:
0.11-0.15% $C_1$
3368-3624.5m:
0.01-0.08% $C_1$

**CST**

| Run | Interval | Shot/Rec |
|---|---|---|
| 1.A | 1238-1745 m. | 29/28 |
| 1.B | 790-1232 m. | 30/24 |
| 2.C | 3195-3349 m. | 17/15 |
| 2.D | 1862.2-3201.7 m. | 30/26 |




**LOGS**

| | | |
|---|---|---|
| MWD | 105-1715m | |
| DIL/ LSS/ GR/ SP | 775-1751m | 1.A |
| | 1738-3351m | 2.B |
| | 3338-3615m | 3.C |
| LDL/ CNL/ CAL/ GR | 775-1752m | 1.A |
| | 1738-3350m | 2.B |
| | 3338-3612m | 3.C |
| SHDT/ GR | 775-1749m | 1.A |
| | 1738-3350m | 2.B |
| | 3338-3622m | 3.C |
| Velocity survey/ Checkshots | 795-3617m | 3.A |

**OIL SHOWS**

No shows of hydrocarbons were recorded throughout the drilled sequences.

# GEOLOGICAL WELL SUMMARY

LOCATED ON 55°00'54.09"N 14°18'43.14"E
LINE NH87B-101
SP 236
WATER DEPTH 44m

WELL 5514/30-1 PERNILLE-1

DEPTH m RKB | LITHO SECTION | SYSTEM | SERIES/STAGE | GROUP | FORMATION | DESCRIPTIONS. | SHOWS

36m MSL

80m SEA BED — 30° — 105m

95m — U.Maa. / L.Maa. — CHALK GROUP EQV. — Undifferentiated

135m

165m

Lst: wh - v lt gy - lt gy, fri - mod hd, blky, suc, glau, tr sdy, no vis por

U.Camp-L.Maa. — Santonian — UPPER CRETACEOUS

285m

Lst: v lt gy - lt gy - m gy, frm - mod hd, blky, suc, tr glau, loc v arg grd Mrl, no vis por

675m

20° — 777m

Lst: wh - lt gy, gen v lt gy, mod hd, some blky, loc sl arg

Coniacian-L.Sant. — L.Ceno.

877m Blue Marker

Mrl: lt gy, sft, v calc

① — ②

943m TOP LOWER JURASSIC

Sinemur. — Hettangian — LOWER JURASSIC — BORNHOLM GP. — Rønne Fm

Sd/Sst/Cly alternating

1034m

Sd: clr Qtz, lse grns, f-m, loc crs, subang - subrnd

Sst: lt gy - lt olv gy, vf - f, mod srtd, fri - mod hd, carb, arg, no vis por

Cly: dk gy - brn gy, sft - frm, tr carb, slty

NO SHOWS

1300 1350 1400 1450 1500 1550 1600 1650 1700 1750 1800 1850 1900 1950 2000 2050 2100 2150 2200 2250 2300 2350 2400 2450

LOWER JURASSIC — Hettangian — BORNHOLM GP. — Rønne Fm

TRIASSIC — undifferentiated — "TRIASSIC GROUP" — Kågerød Fm.

Coal: blk, brit, vit, grd v carb Clyst, brn blk - blk carb

1500m TOP TRIASSIC

Rhaet

1552m Top Redbeds

Clyst: varicol, pl rd - gy omg, sft - frm, sl slty

Lst: wh - off wh, occ lt gy, frm - sft, blky, micritic - mxln, sl arg

13°/8° — 1740m

Sst: clr - mlky, occ v lt gy, occ omg, Qtz, f - m, tr v crs, rnd - subrnd, lse calc cmt

Clyst: mod rd brn - dk rd brn, sft - frm, blky, slty

Sst: rd stn, clr - mlky - pl omg, Qtz, gen f - m, mnr crs - v crs, ang - subang, pr srtd, Ark, Fldsp, mafic min

occ Cgl

2235m Orange Marker

Sst: a/a pbly grd Cgl

NO SHOWS

# GEOLOGICAL WELL SUMMARY

| DEPTH m RKB | LITHO SECTION | SYSTEM | SERIES/STAGE | GROUP | FORMATION | DESCRIPTIONS | SHOWS |
|---|---|---|---|---|---|---|---|
| 2550 | | TRIASSIC | | | | Sst: clr - mlky, mod rd orng, Qtz, f - m - crs - v crs, pr srtd, ang - subang, tr silic cmt, lithic frag, pbly, mnr Fldsp, mnr mafic min, Ark, occ Cgl | NO SHOWS |
| 2600 | | | | | | | |
| 2650 | | | | | | | |
| 2700 | | | | | | | |
| 2750 | | U.P. | | ZEC | | 2747m Mrl/Clyst: lt gy, sft - frm | |
| 2800 | | | | | | 2787m | |
| 2850 | | LOWER PERMIAN | | ROTLIEGENDES GP | | Sst: clr - mlky, pred stn'd m rd brn - rd orng, Qtz, f - crs, pred m, occ v crs - pbly, ang - occ sub rnd, pr srtd, gen lse, silic + calc cmt, rare Qtzt, Fldsp, Gnes, Musc + Biot, no vis por | |
| 2900 | | | | | | | |
| 2950 | | | | | | | |
| 3000 | | | | | | | |
| 3050 | | | | | | 3057m Green Marker | |
| 3100 | | CARBONIFEROUS? | | | | Slst: dk rd brn - dusky rd, occ brn blk, mod hd - occ hd, blky, non - sl calc - dol, arg, micromic | |
| 3150 | | | | | | | |
| 3200 | | | ? | | | 3192m Sst/Slst: rd brn, f - m | |
| 3250 | | SILURIAN | U. Wenlockian | | Graptolite Mudstone Fm | 3212m TOP SILURIAN Sh: dk gy - gy blk, mod hd, fis - subfis, mod slty grd Slst | |
| 3300 | | | | | | 9½° | |
| 3350 | | | | | | 3352m intbd Sst/Slst: m gy - m lt gy, tr dusky brn - dk rd brn, Qtz, vf - slty, hd, no vis por | |
| 3400 | | | L. Wenlockian. | | | | |
| 3450 | | | | | | | |
| 3500 | | | | | | | |
| 3550 | | | | | | | |
| 3600 | | | | | | TD CORE from: 3615.0m to: 3624.5m | |
| 3650 | | | | | | TD DRILLER 3624.5m<br>TD LOGGER 3623.0m | |
| 3700 | | | | | | ① : Arnager Greensand Equivalent | |
| 3750 | | | | | | ② : Hasle Fm. | |

LOCATED ON 55°00'54.09"N 14°18'43.14"E
LINE NH87B-101
SP 236
WATER DEPTH 44m

WELL 5514/30-1 PERNILLE-1

# SECTION B

# OPERATIONS

# LIST OF CONTENT

## SECTION B

PAGE

## 1. LOCATION SURVEY

The site survey for well 5514/30-1 was performed by Master Survey from December 9th to 16th 1988. A geotechnical coring down to 27.5 m below seabed was performed by Fugro Mc clelland from December 16th to 18th 1988.
The following is a summary of the seabed and sub-seabed conditions at the location, based on the site survey and the geotechnical coring.

| | |
|---|---|
| Water depth: | Varying from 77 meters (RKB) to 82 meters (RKB) in the surveyed area. At location, it was found to be 80 meters (RKB). |
| Seabed sediments: | Soft, sandy sediments. |
| Sub-seabed geology (cored): | |

| | |
|---|---|
| 80.1 m - 80.2 m (RKB): | Clay, silty-sandy, very soft. |
| 80.2 m - 82.8 m (RKB): | Sand, fine, silty (channel sand) |
| 82.8 m - 86.1 m (RKB): | Clay, silty, very soft. |
| 86.1 m - 95.1 m (RKB): | Clay, silty, sandy, content of gravel and possible boulders at the base (at 95 m). |

| | | |
|---|---|---|
| | 95.1 m - 105.0 m (RKB): | Chalk, stiff to hard, frequent chips of chert. |

Seabed hazards: The prognosed channel sand at the location did not cause any problem when jacking up the rig.

Sub-seabed hazards: No high amplitude anomalies was prognosed and no shallow gas was penetrated.

The prognosed boulders layer at 95 m (RKB) caused problem during driving of the 30" conductor (Reduced penetration). It might also have influenced the collapse of the 30" drive shoe.

$H_2S$: No occurence of $H_2S$ was detected in the well.

## 2. POSITIONING OF THE RIG

The well was located on the seismic line NH 87B-101, shot point 236.

Planned position of the well:

| Geographical | UTM |
|---|---|
| 55° 00' 53.4" N | 6 096 794.1 mN |
| 14° 18' 43.9" E | 456 016.6 mE |

319 simultaneous 4 satellite GPS measurements were used to postion the rig. The reference station was placed at Hammeren lighthouse on Bornholm.

Final position of the well:

| Geographical | UTM |
|---|---|
| 55° 00' 54.09" N | 6 096 812.4 mN |
| 14° 18' 43.14" E | 456 003.2 mE |

The rig heading was 14.5° and the distance from the intended location was 23 meters in direction 323.1°.

## 3. OPERATION RESUME

### 3.1 Summary of operations

Well 5514/30-1 was drilled with the jack-up rig "Glomar Moray Firth I". The rig was taken over by Norsk Hydro 05.04.89 at 00:01 hrs. when it was jacked to drilling draft.

36" section:

The seabed was tagged at 80 m and the 30" conductor was driven down from 80 m to 104.5 m where no further penetration was possible.

When cleaning out the formation inside the 30" conductor, using 17 1/2" bit and 26" holeopener, it was not possible to pass the 30" muline landing runs at 77 m. The 26" holeopener was found to be 1/2" overgauged.
The holeopener was changed and the 30" conductor was cleaned out, but it was not possible to pass the 30" shoe at 104 m. The tension system was installed and a flange was welded onto the 30" conductor and the diverter was nippled up.

26" section:

This section was planned to be drilled in one run using 17 1/2" bit, MWD and 26" holeopener. Due to the hard formation experienced in the previous section, it was decided to drill 17 1/2" pilothole. The pilot hole was drilled to 787 m in one run. A negative attempt was made to drill out of the 30" shoe using a 24" holeopener.
A 24" taper mill was then used to mill out the 30" shoe which had been damaged during hammering.
The pilot hole was opened in one run from 17 1/2" to 24" using a 24" holeopener down to 788 m. Due to tight hole, KCl was added to the mud and the mudweight was increased to 1.25 r.d.
To ensure safe running of the 20" casing, it was decided to open up the hole to 26" using a 26" underreamer. The 20" casing was run and cemented with the shoe at 777 m.

17 1/2" section:

The cement and 3 m new formation was drilled. A leak off test equivalent to 1.81 r.d. was preformed on 791 m. 17 1/2" hole was then drilled from 791 m to 1263 m. While pulling out for bit change the hole was tight from 1197 m to 992 m, and from 992 m to 777 m the hole was backreamed. 17 1/2" hole was drilled further to 1508 m where the mudweight was increased from 1.16 r.d. to 1.20 r.d. to stabilize the hole. Some mudlosses appeared due to sandplugged shaker screens. The screens was changed out to courser type (50 mesh at bottom).

Tight spots were washed and reamed from 1378 m to 1387 m while running in with a new bit. 17 1/2" hole was then drilled from 1508 m to 1715 m. Tight hole was backreamed from 1615 m to 1417 m while tripping out for bitchange. While running in the hole with new bit, tight hole was washed and reamed from 1688 m to 1715 m and 7 m fill was found on bottom. 17 1/2" hole was then drilled to 1754 m which was decided to be the setting depth for the 13 3/8" casing. The planned depth for the section at 2100 m was changed due to changes in the original geological prognosis.
Five logruns were run at T.D.:

Run no.1: DIL/LSS/GR/SP
Run no.2: LDL/CNL/CAL/GR
Run no.3: SHDT
Run no.4: CST
Run no.5: CST

After a wipertrip, the 13 3/8" casing was run and cemented with the shoe at 1740 m.

12 1/4" section:

A leakoff test equivalent to 2.00 r.d. mudweight was performed at 1757 m. 12 1/4" hole was drilled to 2476 m in three bitruns. Tight hole was washed and reamed from 2188 m to 2225 m on the second trip for bitchange. Tight spots were also encountered at 2254 m and 2235 m when pulling out on the third bit tip, and the hole was washed and reamed from 2041 m to 2064 m on the trip in. Stuck pipe was worked free at 2433 m and washing continued to 2476 m. The mudweight was increased from 1.24 r.d. to 1.28 r.d. to stabilize the hole.
12 1/4" hole was then drilled from 2476 m to 2851 m in four bitruns. Some reaming were performed while tripping in with new bits. At 2851 m, a roller reamer was picked up and tight hole was reamed from 2774 m to 2851 m. Drilling then proceeded to 3139 m in three bitruns, where the string was pulled due to a loss in the pump pressure.

A washout was found in the 8" drillcollars. Drilling continued to 3178 m where a new washout was found in the 5" heavy weight drillpipe. A 3rd washout occured in the 8" jar at 3200 m. After drilling to 3217 m, a loss in torque was observed. 95 meters of the bottom hole assembly was found left in the hole due to a twist-off in a drill-collar box. The fish was retrieved with an overshot.
12 1/4" hole was then drilled to 3352 m and it was deceided to run casing. The following logs were run:

Run no.1: DIL/LSS/GR/SP
Run no.2: LDL/CNL/CAL/GR
Run no.3: SHDT
Run no.4: CST
Run no.5: CBL/VDL
Run no.6: CST.

The CST-log was rerun due to a tool failure on the first run.

The 9 5/8" casing was circulated down the last 30 meters and was cemented with the shoe at 3339 m.
The top cement plug did not bump.

8 1/2" section:

Cement was drilled out from 3267 m to 3303 m and 3 m new formation was drilled. A leakoff test equivalent to 1.84 rd mudweight was performed at 3355 m. 8 1/2" hole was drilled to 3368 m and further to 3425 m after a bitchange. At this depth the string was pulled due to a pressure drop, and a washout was found in the 5" heavy weight drillpipe.
Drilling continued to 3498 m where a single shot survey was run on wireline. The survey tool got stuck in a cross-over below the jar. The wireline parted, and the drill-string had to be pulled.
The mudweight was increased from 1.29 r.d. to 1.32 r.d. due to increasing pore pressure. 8 1/2" hole was drilled further from 3498 m to 3615 m where a loss in pump pressure was observed.

A washout was found in the 5" heavy weight drillpipe. Finally, a core was cut from 3415 m to 3625 m and this was decided to be T.D. of the well.

The following logs were run:

Run no.1: DIL/LSS/GR/SP
Run no.2: CNL/LDL/CAL/GR
Run no.3: CBL/VDL
Run no.4: SHDT
Run no.5: VSP, checkshots.

A wipertrip was performed after run no.3, and the mudweight was increased from 1.32 r.d. to 1.35 r.d. due to tight hole caused by increasing pore pressure.

The well was then permanent plugged and abandoned and the rig given over to Global Marine the 6th of June 1989 at 24:00 hours.

(((ooo)) Norsk Hydro

3.2 Daily report

System : BORE

Date 13/7-1989

Well: 5514/30-1

| Casing Size (in): | 30 | 20 | 13 3/8 | 9 5/8 |
|---|---|---|---|---|
| Setting depth m,MD: | 105 | 777 | 1740 | 3339 |

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| Report number | Mid. depth m,MD | Est.Pore Pressure (SG) | Mud Dens. (SG) | Stop time | Short Summary |
|---|---|---|---|---|---|
| 1 | 0 | 0 | | 24:00 | Skidded the upper and lower substructure packages to drilling position and rigged it up.<br>Rig at drilling air gap at 00:01 Hrs.<br>Rig on day rate at 00:01 Hrs. |
| 2 | 104 | 1.03 | | 03:30 | Rigged up the substructure and the floor. |
| | | | | 07:30 | Picked up and racked back heavy weight drill pipe and drill collars. |
| | | | | 14:00 | Rigged up to drive 30" conductor. |
| | | | | 17:00 | Ran the 30" conductor to the mudline at 80 m. |
| | | | | 19:30 | Picked up the hammer and the drive sub. |
| | | | | 20:00 | The 30" conductor fell free to 90 m. |
| | | | | 22:00 | Drove the 30" conductor from 90 m to 104.5 m. |
| | | | | 24:00 | Rigged up the Texas deck. Broke out and laid down the top 30" joint. |
| 3 | 105 | 1.03 | 1.05 | 00:30 | Laid down the drive sub and the hammer. |
| | | | | 02:30 | Rigged up to hang off the 30" conductor on the BOP hoist. |
| | | | | 06:30 | Picked up 26" bottom hole assembly and ran in the hole. |
| | | | | 07:30 | Was not able to pass the 30" landing ring at 77 m. |
| | | | | 13:00 | Worked to pass the mudline landing ring without success. Pulled out of the hole and changed out the 26" hole opener and ran back in the hole. The 26" bottom hole opener was 1/2" overgauge. |
| | | | | 16:30 | Cleaned out the 30" conductor from 80 m to 105 m. |
| | | | | 18:00 | Repaired the top drive torque wrench. |
| | | | | 19:30 | Attempted to work the hole opener through the 30" shoe at 104 m. |
| | | | | 21:30 | Pulled out of hole and laid down the 26" hole opener and the 17 1/2" bit. |
| | | | | 23:30 | Laid down hammer equipment and rigged up the 30" tensioner system. |
| | | | | 24:00 | Prepared to weld pad eyes on the 30" conductor. |
| 4 | 105 | 1.03 | 1.05 | 01:30 | Welded pad eyes on the 30" conductor. |
| | | | | 03:30 | Raised the reaction plate against pad eyes to support the 30" conductor. |
| | | | | 04:30 | Cut the 30" conductor. |
| | | | | 06:00 | Landed the 30" flanges on the 30" conductor and weld it on. |
| | | | | 07:00 | Moved the 30" diverter into position. |
| | | | | 12:00 | Made up the diverter to the 30" flange. |

| ((( (ooo) ------- Norsk Hydro | Daily report ---------- System : BORE | Date 13/7-1989 |
|---|---|---|
| | Well: 5514/30-1 | |
| | Casing Size (in): 30 \| 20 \| 13 3/8 \| 9 5/8 | |
| | Setting depth m,MD: 105 \| 777 \| 1740 \| 3339 | 3 |

| Report number | Mid. depth m,MD | Est.Pore Pressure (SG) | Mud Dens. (SG) | Stop time | Short Summary |
|---|---|---|---|---|---|
| | | | | 17:00 | Landed the diverter and installed the diverter piping. |
| | | | | 21:00 | Installed the bell nipple and the flow lines. |
| | | | | 21:30 | Laid down the slings and rigged up to pick up 17 1/2" bottom hole assembly. |
| | | | | 24:00 | Picked up the 17 1/2" bottom hole assembly. |
| 5 | 634 | 1.03 | 1.14 | 02:00 | Ran in the hole. |
| | | | | 03:00 | Function tested the diverter. |
| | | | | 24:00 | Drilled 17 1/2" pilot hole from 105 m to 634 m. |
| 6 | 787 | 1.03 | 1.14 | 02:30 | Drilled 17 1/2" pilot hole from 634 m to 705 m. |
| | | | | 03:00 | Pulled out and reamed from 675 m to 690 m. |
| | | | | 06:00 | Drilled 17 1/2" pilot hole from 705 m to 787 m. |
| | | | | 06:30 | Circulated. |
| | | | | 11:00 | Pulled out of the hole. |
| | | | | 15:00 | Repaired the top drive torque arrester. |
| | | | | 16:30 | Made up 24" hole opener and ran in the hole to 105 m. |
| | | | | 17:30 | Repaired the flow line. |
| | | | | 18:30 | Attempted to work the hole opener through the 30" shoe at 104 m without success. |
| | | | | 20:30 | Pulled out of the hole and laid down the hole opener assembly. Picked up a 24" tapered mill and ran in the hole to 105 m. |
| | | | | 22:00 | Milled on the 30" shoe. |
| | | | | 24:00 | Pulled out of the hole and laid down the milling assembly. Picked up a 24" hole opener assembly and ran in the hole to 105 m. |
| 7 | 787 | 1.03 | 1.16 | 00:30 | Opened 17 1/2" pilot hole to 24" from 105 m to 115 m. |
| | | | | 02:30 | Pulled out of the hole. Picked up 17 1/2" stabilizer and ran in the hole. |
| | | | | 07:30 | Opened 17 1/2" pilot hole to 24" hole from 115 m to 314 m. |
| | | | | 09:30 | Tripped to pick up more drill collars. |
| | | | | 24:00 | Opened 17 1/2" pilot hole to 24" hole from 314 m to 680 m. |
| 8 | 788 | 1.03 | 1.16 | 05:30 | Opened up the 17 1/2" pilot hole to 24" hole from 680 m to 787 m. Drilled 1 m of new hole to 788 m. |

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Norsk Hydro

# Daily report

System : BORE

Date 13/7-1989

Well: 5514/30-1

| Casing Size (in): | 30 | 20 | 13 3/8 | 9 5/8 |
|---|---|---|---|---|
| Setting depth m,MD: | 105 | 777 | 1740 | 3339 |

3

| Report number | Mid. depth m,MD | Est.Pore Pressure (SG) | Mud Dens. (SG) | Stop time | Short Summary |
|---|---|---|---|---|---|
| | | | | 06:30 | Circulated the hole clean. |
| | | | | 07:00 | Pulled out of the hole to 712 m. The hole was tight. Max. over pull was 70 ton. |
| | | | | 19:00 | Pulled out of the hole. Backreamed and circulated out to the shoe. |
| | | | | 24:00 | Made up new bottom hole assembly with 24" hole opener and 26" underreamer and ran in the hole to 105 m. |
| 9 | 788 | 1.03 | 1.16 | 17:00 | Underreamed 24" hole to 26" from 105 m to 785 m. |
| | | | | 19:00 | Circulated and conditioned the mud. |
| | | | | 21:00 | Performed a wiper trip to 105 m. |
| | | | | 22:00 | Underreamed the hole from 105 m to 150 m. |
| | | | | 23:00 | Ran in the hole from 150 m to 785 m. |
| | | | | 24:00 | Circulated and conditioned the mud for the 20" casing. |
| 10 | 788 | 1.03 | | 02:00 | Continued to condition the mud. |
| | | | | 04:30 | Pulled out of the hole. |
| | | | | 05:00 | Laid down the bit, the hole opener and the underreamer. |
| | | | | 06:00 | Made up the mud line suspension and the running tool. |
| | | | | 07:00 | Rigged up to run the 20" casing. |
| | | | | 15:00 | Ran the 20" casing. Landed the casing in the 30" landing ring. with the float shoe at 777 m and the float collar at 761 m. |
| | | | | 15:30 | Laid down the casing handling equipment. |
| | | | | 18:30 | Made up the cement stinger and ran in the hole to the float collar. |
| | | | | 20:00 | Rigged up the cement lines and stung into the float collar. Circulated the annulus volume. |
| | | | | 22:00 | Made up and ran 2 stands of 1.66"CS Hydrill wash pipe between the 30" conductor and the 20" casing. |
| | | | | 24:00 | Cemented the 20" casing. |
| 11 | 788 | 1.03 | | 02:00 | Finished cementing the 20" casing. |
| | | | | 04:30 | Pulled out of the hole with the cement stinger and rigged down the cement lines |
| | | | | 05:00 | Circulated the 30" X 20" annulus clean. |
| | | | | 06:30 | Rigged down the wash pipe lines. Pulled out of the hole and laid out the wash string. |
| | | | | 09:30 | Nippled down the diverter, the riser and the flow line. Picked up the riser and made a rough cut on the 20" casing. |

| ((( (ooo) ------- Norsk Hydro | Daily report ---------- System : BORE | | | | | Date 13/7-1989 |
|---|---|---|---|---|---|---|
| | Well: 5514/30-1 | | | | | |
| | Casing Size (in): | 30 | 20 | 13 3/8 | 9 5/8 | 3 |
| | Setting depth m,MD: | 105 | 777 | 1740 | 3339 | |

| Report number | Mid. depth m,MD | Est.Pore Pressure (SG) | Mud Dens. (SG) | Stop time | Short Summary |
|---|---|---|---|---|---|
| | | | | 14:30 | Laid down the diverter, the bell nipple and the valves. |
| | | | | 19:00 | Made a final cut on the 30" conductor and the 20" casing. Installed the "A" section well head and welded the section onto the 20" casing. |
| | | | | 24:00 | Nippled up the Gray crossover spool and the 21 1/4" BOP. |
| 12 | 791 | 1.03 | 1.16 | 05:00 | Continued to nipple up the 21 1/4" BOP and installed the bell niple. |
| | | | | 06:00 | Function tested the BOP. |
| | | | | 08:00 | Changed the bottom rams to 5". |
| | | | | 11:30 | Tested the casing and the BOP to 88 bar. |
| | | | | 13:00 | Laid out the test plug and ran the wear bushing. |
| | | | | 15:00 | Picked up a 60' core barrel and racked back in the derrick. |
| | | | | 21:30 | Made up 17 1/2" bottom hole assembly. Tested Teleco MWD tool and ran in the hole to 761 m. |
| | | | | 23:00 | Drilled the float collar and the float shoe and cleaned the rat hole. |
| | | | | 23:30 | Drilled 3 m of new formation to 791 m. |
| | | | | 24:00 | Circulated and conditioned mud for leak off test. |
| 13 | 1182 | 1.03 | 1.16 | 00:30 | Continued to circulated prior to perform leakoff test. |
| | | | | 01:30 | Performed a leakoff test equivalent to 1.81 SG mud weight. |
| | | | | 08:00 | Drilled 17 1/2" hole from 791 m to 885 m. |
| | | | | 09:00 | Circulated for samples. |
| | | | | 24:00 | Continued drilling 17 1/2" hole from 885 m to 1182 m. |
| 14 | 1299 | 1.03 | 1.16 | 09:30 | Drilled 17 1/2" hole from 1181 m to 1263 m. |
| | | | | 11:00 | Pulled out of the hole to 992 m. The hole was tight from 1197 m to 992 m. |
| | | | | 14:30 | Backreamed from 992 m to 777 m. |
| | | | | 18:00 | Flow checked and pulled out of the hole for bit change. |
| | | | | 21:00 | Ran back in the hole with a new bit to 1263 m. |
| | | | | 24:00 | Drilled 17 1/2" hole from 1263 m to 1299 m. |
| 15 | 1508 | 1.03 | 1.20 | 02:30 | Drilled 17 1/2" hole from 1299 m to 1360 m. |

| ((( (ooo) ------- Norsk Hydro | Daily report ---------- System : BORE | Date 13/7-1989 |
|---|---|---|
| | Well: 5514/30-1 | |
| | Casing Size (in): 30 \| 20 \| 13 3/8 \| 9 5/8 | |
| | Setting depth m,MD: 105 \| 777 \| 1740 \| 3339 | 3 |

| Report number | Mid. depth m,MD | Est.Pore Pressure (SG) | Mud Dens. (SG) | Stop time | Short Summary |
|---|---|---|---|---|---|
| | | | | 03:00 | Circulated while cleaning out sand plugged shaker screens. |
| | | | | 08:00 | Drilled 17 1/2" hole from 1360 m to 1426 m. Lost mud due to plugged shaker screens. |
| | | | | 09:30 | Changed out the shaker screens. |
| | | | | 22:00 | Drilled 17 1/2" hole from 1426 m to 1508 m. |
| | | | | 23:00 | Circulated the hole clean. |
| | | | | 24:00 | Pulled out of the hole for bit change. |
| 16 | 1646 | 1.03 | 1.20 | 04:30 | Continued pulling out og the hole. |
| | | | | 09:00 | Made up new bit and ran in the hole to 1378 m. Washed and reamed tight spots to 1387 m and continued to run in the hole to bottom at 1508 m. |
| | | | | 22:30 | Drilled 17 1/2" hole from 1508 m to 1637 m. Flow checked a drilling break and continued drilling to 1643 m. |
| | | | | 23:30 | Circulated bottoms up for samples. |
| | | | | 24:00 | Drilled 17 1/2" hole from 1643 m to 1646 m. |
| 17 | 1715 | 1.08 | 1.21 | 12:00 | Drilled 17 1/2" hole from 1646 m to 1715 m. |
| | | | | 22:30 | Pulled out of the hole for bit change. Backreamed tight hole from 1615 m to 1417 m. Laid out the bit and the MWD tool. |
| | | | | 24:00 | Made up new bit and bottom hole assembly and ran in the hole. |
| 18 | 1754 | 1.08 | 1.21 | 02:30 | Ran in the hole to 1688 m. |
| | | | | 03:00 | Washed and reamed from 1688 m to 1715 m. |
| | | | | 07:00 | Drilled 17 1/2" hole from 1715 m to 1720 m. |
| | | | | 08:00 | Repaired mud pump no.1 |
| | | | | 13:00 | Drilled 17 1/2" hole from 1720 m to 1736 m. |
| | | | | 14:00 | Repaired mud pump no.1 |
| | | | | 22:30 | Drilled 17 1/2" hole from 1736 m to 1754 m. |
| | | | | 24:00 | Circulated the hole clean prior to a wiper trip. |
| 19 | 1754 | 1.08 | 1.21 | 01:30 | Made a wiper trip from 1754 m to 1450 m and ran back to bottom. |
| | | | | 03:30 | Circulated the hole clean prior to logging. |
| | | | | 07:30 | Pulled out of the hole for logging. |
| | | | | 24:00 | Rigged up and started logging. No.1: DIL/LSS/GR/SP |

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Norsk Hydro

Daily report
System : BORE

Date 13/7-1989

Well: 5514/30-1

| Casing Size (in): | 30 | 20 | 13 3/8 | 9 5/8 |
|---|---|---|---|---|
| Setting depth m,MD: | 105 | 777 | 1740 | 3339 |

3

| Report number | Mid. depth m,MD | Est.Pore Pressure (SG) | Mud Dens. (SG) | Stop time | Short Summary |
|---|---|---|---|---|---|
| | | | | | No.2: LDL/CNLCAL/GR<br>No.3: SHDT |
| 20 | 1754 | 1.08 | 1.22 | 08:00 | Continued logging.<br>No.3: SHDT<br>No.4: CST<br>NO.5: CST |
| | | | | 11:30 | Ran in the hole for wiper trip. |
| | | | | 12:30 | Washed and reamed to 1754 m and worked the junk basket. |
| | | | | 14:30 | Circulated the hole clean. |
| | | | | 16:30 | Pulled out of the hole to 770 m. |
| | | | | 17:30 | Slipped and cut the drilling line. |
| | | | | 20:30 | Pulled out of the hole and laid down the junk sub. |
| | | | | 21:00 | Pulled the wear bushing. |
| | | | | 22:00 | Rigged up to run the 13 3/8" casing. |
| | | | | 24:00 | Ran the 13 3/8" casing. |
| 21 | 1754 | 1.08 | 1.22 | 04:00 | Ran the 13 3/8" casing to the 20" shoe. |
| | | | | 04:30 | Changed the bails and rigged up the 500 MT elevator and slips. |
| | | | | 06:00 | Rigged up the air hose to the elevator and repaired broken shackle for the top drive counter balance. |
| | | | | 13:30 | Ran the 13 3/8" casing with the shoe at 1740 m and float collar at 1714 m. |
| | | | | 15:45 | Circulated the casing volume. |
| | | | | 16:15 | Tested the cement lines to 265 bar, loaded the cement plugs and made up the cement head. |
| | | | | 19:45 | Cemented the casing, bumped the plug and tested the casing to 265 bar. |
| | | | | 21:00 | Opened the ports in the mud line suspension system, circulated the annulus clean with seawater, closed the ports and retested the casing to 265 bar for 10 minutes. |
| | | | | 23:30 | Nippled down the 21 1/4" BOP and the flowline. Lifted the stack and set the casing slips. |
| | | | | 24:00 | Made a rough cut on 13 3/8" casing. |
| 22 | 1754 | 1.08 | 1.22 | 00:30 | Continued to rough cut the 13 3/8" casing. |
| | | | | 04:00 | Nippled down the bell nipple and racked back the 21 1/4" BOP. Made a final cut on the 13 3/8" casing and removed the 20" crossover. Installed the 13 5/8" crossover and tested the seals to 159 bar. |
| | | | | 12:00 | Installed the 13 5/8" BOP. |

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Norsk Hydro

Daily report
System : BORE

Date 13/7-1989

Well: 5514/30-1
Casing Size (in): 30 | 20 | 13 3/8 | 9 5/8
Setting depth m,MD: 105 | 777 | 1740 | 3339

3

| Report number | Mid. depth m,MD | Est.Pore Pressure (SG) | Mud Dens. (SG) | Stop time | Short Summary |
|---|---|---|---|---|---|
| | | | | 17:00 | Tested the BOP stack to 265 bar and tested the casing and the wellhead against the shear ram to 265 bar. |
| | | | | 22:00 | Tested the surface equipment and the choke manifold to 265 bar. |
| | | | | 24:00 | Laid down the 17 1/2" bottom hole assembly. |
| 23 | 1790 | 1.08 | 1.22 | 02:30 | Continued to lay down the 17 1/2" bottom hole assembly. |
| | | | | 08:30 | Picked up 12 1/4" bottom hole assembly and ran in the hole. Tagged cement at 1712 m. |
| | | | | 10:30 | Drilled the cement, the float collar and the float shoe. Washed and reamed the rat hole to 1754 m. |
| | | | | 11:30 | Drilled 12 1/4" hole from 1754 m to 1757 m. |
| | | | | 12:00 | Circulated for leak off test. |
| | | | | 13:30 | Pulled back into the shoe and tested the surface lines to 204 bar. Performed a leak off test equivalent to 2.0 SG mud density. |
| | | | | 24:00 | Drilled 12 1/4" hole from 1757 m to 1790 m. |
| 24 | 1841 | 1.08 | 1.22 | 09:30 | Drilled 12 1/4" hole from 1790 m to 1810 m. |
| | | | | 10:30 | Circulated and dropped a single shot survey. |
| | | | | 15:30 | Pulled out of the hole, recovered the survey and changed out the bit. |
| | | | | 17:30 | Ran in the hole with a new bit. |
| | | | | 24:00 | Drilled 12 1/4" hole from 1810 m to 1841 m. |
| 25 | 1915 | 1.08 | 1.22 | 09:30 | Drilled 12 1/4" hole from 1841 m to 1870 m. |
| | | | | 14:30 | Pulled out of the hole to change bit. |
| | | | | 15:30 | Made up a new bit and ran back in the hole to the casing shoe. |
| | | | | 16:30 | Serviced the top drive. |
| | | | | 17:00 | Continued to run in the hole to the bottom. |
| | | | | 24:00 | Drilled 12 1/4" hole from 1870 m to 1915 m. |
| 26 | 2065 | 1.08 | 1.22 | 07:00 | Drilled 12 1/4" hole from 1915 m to 1960 m. |
| | | | | 08:00 | Repaired a leak in the bell nipple. |
| | | | | 24:00 | Drilled 12 1/4" hole from 1960 m to 2065 m. |

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Norsk Hydro

# Daily report

System : BORE

Date 13/7-1989

Well: 5514/30-1

| Casing Size (in): | 30 | 20 | 13 3/8 | 9 5/8 |
|---|---|---|---|---|
| Setting depth m,MD: | 105 | 777 | 1740 | 3339 |

3

| Report number | Mid. depth m,MD | Est.Pore Pressure (SG) | Mud Dens. (SG) | Stop time | Short Summary |
|---|---|---|---|---|---|
| 27 | 2215 | 1.08 | 1.22 | 24:00 | Drilled 12 1/4" hole from 2065 m to 2215 m. |
| 28 | 2295 | 1.08 | 1.22 | 02:30 | Drilled 12 1/4" hole from 2215 m to 2225 m. |
| | | | | 03:00 | Circulated and dropped a survey. |
| | | | | 09:00 | Pulled out of the hole and recovered the survey. |
| | | | | 12:00 | Made up a new bit and ran back in the hole to the shoe. |
| | | | | 12:30 | Serviced the top drive. |
| | | | | 13:30 | Continued to run in the hole. Washed and reamed from 2188 m to 2225 m. |
| | | | | 24:00 | Drilled 12 1/4" hole from 2225 m to 2295 m. |
| 29 | 2458 | 1.08 | 1.24 | 24:00 | Drilled 12 1/4" hole from 2295 m to 2458 m. |
| 30 | 2476 | 1.08 | 1.24 | 07:00 | Drilled 12 1/4" hole from 2458 m to 2476 m. |
| | | | | 07:30 | Circulated and dropped a survey. |
| | | | | 13:00 | Pulled out of the hole, worked through tight spots from 2254 m to 2235 m, and retrieved the survey. |
| | | | | 19:00 | Pulled the wearbushing, ran the testplug and tested the BOP. Pulled the test plug and ran the wearbushing. |
| | | | | 23:30 | Made up new bit and ran in the hole to 2041 m. |
| | | | | 24:00 | Reamed from 2041 m to 2055 m. |
| 31 | 2573 | 1.08 | 1.28 | 03:00 | Washed and reamed tight spot from 2055 m to 2064 m. Worked stuck pipe free at 2433 m and continued to wash to 2476 m. |
| | | | | 24:00 | Drilled 12 1/4" hole from 2476 m to 2573 m. |
| 32 | 2603 | 1.08 | 1.28 | 00:30 | Drilled 12 1/4" hole from 2573 m to 2575 m. |
| | | | | 01:30 | Circulated and ran a survey on slick line. |
| | | | | 11:00 | Continued to drill 12 1/4" hole from 2575 m to 2603 m. |
| | | | | 11:30 | Dropped a survey. |
| | | | | 15:00 | Pulled out of the hole and retrieved the survey. |
| | | | | 16:00 | Pulled the wear bushing. Checked for wear and reran the wearbushing. |
| | | | | 20:30 | Picked up new bottom hole assembly, made up new bit and ran in the hole. |

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Daily report

System : BORE

Date 13/7-1989

Well: 5514/30-1

| Casing Size (in): | 30 | 20 | 13 3/8 | 9 5/8 |
|---|---|---|---|---|
| Setting depth m,MD: | 105 | 777 | 1740 | 3339 |

3

| Report number | Mid. depth m,MD | Est.Pore Pressure (SG) | Mud Dens. (SG) | Stop time | Short Summary |
|---|---|---|---|---|---|
| | | | | 24:00 | Worked through tight spots and reamed from 2350 m to 2362 m. |
| 33 | 2634 | 1.08 | 1.28 | 01:30 | Washed and reamed from 2362 m to 2418 m. Continued to run in the hole to 2588 m. Washed and reamed from 2588 m to 2603 m. Worked the junk sub at bottom. |
| | | | | 06:00 | Drilled 12 1/4" hole from 2603 m to 2610 m. |
| | | | | 11:30 | Pulled out of the hole. |
| | | | | 12:00 | Cleaned out the junk sub and laid down the short drill collar and the bit sub. |
| | | | | 15:30 | Made up a new bit and ran in the hole to the casing shoe. |
| | | | | 16:00 | Serviced the top drive. |
| | | | | 17:00 | Slipped and cut the drilling line. |
| | | | | 19:00 | Continued to run in the hole. |
| | | | | 19:30 | Washed and reamed from 2547 m to 2610 m. |
| | | | | 24:00 | Drilled 12 1/4" hole from 2610 m to 2634 m. |
| 34 | 2731 | 1.08 | 1.28 | 16:00 | Drilled 12 1/4" hole from 2634 m to 2731 m. |
| | | | | 19:00 | Dropped a survey. |
| | | | | 20:00 | Pulled out of the hole and retrieved the survey. |
| | | | | 21:00 | Pulled the wear bushing. Inspected for wear, rotated the wear bushing 45 deg, and ran it back. |
| | | | | 24:00 | Made up a new bit and ran in the hole to the casing shoe. |
| 35 | 2810 | 1.08 | 1.28 | 01:00 | Continued to run in the hole to 2688 m. Washed from 2688 m to 2732 m. |
| | | | | 24:00 | Drilled 12 1/4" hole from 2732 m to 2810 m. |
| 36 | 2851 | 1.08 | 1.28 | 13:30 | Continued to drill 12 1/4" hole from 2810 m to 2851 m. |
| | | | | 18:00 | Dropped a survey. Pulled out of the hole and retrived the survey. |
| | | | | 19:00 | Installed a new wear bushing. |
| | | | | 19:30 | Serviced the top drive. |
| | | | | 23:30 | Made up new bit and roller reamer, and ran in the hole to 2576 m. The brake rim hose bursted. |
| | | | | 24:00 | Repaired the brake rim hose. |
| 37 | 2918 | 1.08 | 1.28 | 01:00 | Ran in the hole to 2774 m. |
| | | | | 01:30 | Washed from 2774 m to 2846 m and reamed from 2846 m to 2851 m. |
| | | | | 24:00 | Drilled 12 1/4" hole from 2851 m to |

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Norsk Hydro

Daily report
System : BORE

Date 13/7-1989

Well: 5514/30-1
Casing Size (in): 30 | 20 | 13 3/8 | 9 5/8
Setting depth m,MD: 105 | 777 | 1740 | 3339

3

| Report number | Mid. depth m,MD | Est.Pore Pressure (SG) | Mud Dens. (SG) | Stop time | Short Summary |
|---|---|---|---|---|---|
| | | | | | 2918 m. |
| 38 | 2947 | 1.08 | 1.28 | 07:30 | Continued to drill 12 1/4" hole from 2918 m to 2944 m. |
| | | | | 08:00 | Dropped a survey. |
| | | | | 12:00 | Pulled out of the hole and retrieved the survey. |
| | | | | 12:30 | Pulled the wear bushing. |
| | | | | 17:30 | Ran the test plug and tested the BOP. Retrieved the test plug. |
| | | | | 18:00 | Ran the wear bushing. |
| | | | | 22:00 | Made up new bit and junk basket, and ran in the hole to 2944 m. |
| | | | | 23:30 | Worked the junk basket. |
| | | | | 24:00 | Drilled 12 1/4" hole from 2944 m to 2947 m. |
| 39 | 3020 | 1.08 | 1.28 | 24:00 | Drilled 12 1/4" hole from 2947 m to 3020 m. |
| 40 | 3050 | 1.08 | 1.28 | 00:30 | Continued drilling 12 1/4" hole from 3020 m to 3022 m. |
| | | | | 01:00 | Repaired mud pump no.1 |
| | | | | 02:00 | Drilled 12 1/4" hole from 3022 m to 3025 m. |
| | | | | 02:30 | Repaired mud pump no.1. |
| | | | | 03:00 | Drilled 12 1/4" hole from 3025 m to 3027 m. |
| | | | | 03:30 | Repaired mud pump no.1. |
| | | | | 06:00 | Drilled 12 1/4" hole from 3027 m to 3032 m. |
| | | | | 06:30 | Dropped a survey. |
| | | | | 12:30 | Pulled out of the hole and retrieved the survey. Changed bit and laid down the junk basket. |
| | | | | 16:30 | Ran back in the hole to 2960 m. |
| | | | | 17:30 | Washed from 2960 m to 3032 m. |
| | | | | 24:00 | Drilled 12 1/4" hole from 3032 m to 3050 m. |
| 41 | 3128 | 1.08 | 1.28 | 24:00 | Drilled 12 1/4" hole from 3050 m to 3128 m. |
| 42 | 3153 | 1.08 | 1.28 | 01:00 | Continued to drill 12 1/4" hole from 3128 m to 3132 m. |
| | | | | 01:30 | Repaired mud pump no.2. |
| | | | | 03:30 | Drilled 12 1/4" hole from 3132 m to 3139 m. Lost 20 bar pump pressure. |
| | | | | 04:00 | Checked the surface equipment for leakage. |
| | | | | 04:30 | Dropped a survey. |
| | | | | 10:00 | Pulled out of the hole, retrieved the |

| ((( (ooo) ------- Norsk Hydro | Daily report ---------- System : BORE | Date 13/7-1989 |
|---|---|---|
| | Well: 5514/30-1 | |
| | Casing Size (in): 30 \| 20 \| 13 3/8 \| 9 5/8 | |
| | Setting depth m,MD: 105 \| 777 \| 1740 \| 3339 | 3 |

| Report number | Mid. depth m,MD | Est.Pore Pressure (SG) | Mud Dens. (SG) | Stop time | Short Summary |
|---|---|---|---|---|---|
| | | | | | survey and inspected for washout. Laid down 2 bad drill collars. |
| | | | | 11:00 | Inspected the wear bushing. |
| | | | | 15:00 | Made up a new bit and ran back in the hole. |
| | | | | 24:00 | Drilled 12 1/4" hole from 3139 m to 3153 m. |
| 43 | 3178 | 1.08 | 1.28 | 15:00 | Continued to drill 12 1/4" hole from 3153 m to 3178 m. Lost 20 bar pump pressure. |
| | | | | 15:30 | Checked the pressure loss and dropped a survey. |
| | | | | 21:30 | Pulled out of the hole and retrieved the survey. Found a washout in the heavy weight drill pipe. Replaced the joints and changed the bottom hole assembly. |
| | | | | 22:30 | Changed out the wear bushing. |
| | | | | 24:00 | Made up a new bit and ran back in the hole. |
| 44 | 3200 | 1.08 | 1.28 | 07:00 | Continued to run in the hole. Service broke the drill collars. |
| | | | | 07:30 | Washed to bottom and worked the junk sub. |
| | | | | 17:00 | Drilled 12 1/4" hole from 3178 m to 3200 m. Lost pump pressure. |
| | | | | 21:30 | Pulled out of the hole and laid down damaged jar. Cleaned the junk sub. |
| | | | | 24:00 | Made up a new bit and ran back in the hole. |
| 45 | 3217 | 1.08 | 1.28 | 01:00 | Ran in the hole to the casing shoe. |
| | | | | 02:00 | Slipped and cut the drilling line. |
| | | | | 04:00 | Continued to run in the hole. |
| | | | | 04:30 | Washed to bottom and worked the junk sub |
| | | | | 10:30 | Drilled 12 1/4" hole from 3200 m to 3217 m. Lost torque while drilling. |
| | | | | 14:30 | Pulled out of the hole. Found 95 m of the bottom hole assembly missing due to twist of in a drill collar box. |
| | | | | 19:00 | Made up an overshot and ran in the hole to the top of the fish at 3124 m. |
| | | | | 19:30 | Circulated over the fish and caught the fish. |
| | | | | 24:00 | Pulled out of the hole. Laid down damaged drill collars and the overshot. |
| 46 | 3255 | 1.08 | 1.28 | 00:30 | Continued to pull out of the hole with the fish. |
| | | | | 01:30 | Pulled the wear bushing, rotated it 90 deg. and ran it back. |

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Norsk Hydro

# Daily report

System : BORE

Date 13/7-1989

Well: 5514/30-1
Casing Size (in): 30 | 20 | 13 3/8 | 9 5/8
Setting depth m,MD: 105 | 777 | 1740 | 3339

3

| Report number | Mid. depth m,MD | Est.Pore Pressure (SG) | Mud Dens. (SG) | Stop time | Short Summary |
|---|---|---|---|---|---|
| | | | | 07:30 | Made up a new bit and ran in the hole. |
| | | | | 08:30 | Washed from 3217 m to bottom. |
| | | | | 24:00 | Drilled 12 1/4" hole from 3217 m to 3255 m. |
| 47 | 3332 | 1.08 | 1.28 | 24:00 | Drilled 12 1/4" hole from 3255 m to 3332 m. |
| 48 | 3352 | 1.08 | 1.28 | 08:00 | Continued to drill 12 1/4" hole from 3332 m to 3352 m. |
| | | | | 09:00 | Repaired the mud pumps. |
| | | | | 11:00 | Circulated the hole clean. |
| | | | | 11:30 | Dropped a survey. |
| | | | | 15:30 | Pulled out of the hole and recovered the survey. |
| | | | | 24:00 | Rigged up and start logging. No.1:DIL/LSS/GR/SP. |
| 49 | 3352 | 1.08 | 1.28 | 06:00 | Continued logging with the following logs. No.2: LDL/CNL/CAL/GR. |
| | | | | 13:00 | No.3: SHDT |
| | | | | 17:00 | No.4: CST |
| | | | | 21:00 | No.5: CBL/VDL |
| | | | | 24:00 | No.6: CST |
| 50 | 3352 | 1.08 | 1.28 | 01:00 | Continued logging. No.6: CST |
| | | | | 01:30 | Rigged down the logging equipment. |
| | | | | 04:00 | Retrieved the wear bushing, changed the upper pipe rams to 9 5/8", and tested to 265 bar. |
| | | | | 04:30 | Made up the 9 5/8" mudline suspension. |
| | | | | 05:00 | Rigged up to run the 9 5/8" casing. |
| | | | | 21:00 | Ran the 9 5/8" casing to 3310 m, where hole was tight. |
| | | | | 22:00 | Made up the circulating head. |
| | | | | 24:00 | Circulated and worked the casing free. |
| 51 | 3352 | 1.08 | 1.28 | 04:00 | Circulated the 9 5/8" casing down from 3310 m to 3337 m. |
| | | | | 04:30 | Landed the 9 5/8" casing with the shoe at 3339 m. |
| | | | | 06:00 | Rigged up and circulated the hole clean prior to cementing. |
| | | | | 12:30 | Cemented the 9 5/8" casing with 1.44 RD lead slurry and 1.90 RD tail slurry. Displaced the plug with 122.5 m3 mud. The plug did not bump. |
| | | | | 21:00 | Changed the upper pipe rams to 5". Lifted the BOP and set the casing slips. Made a rough cut of the 9 5/8" casing. |

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Norsk Hydro

Daily report
System : BORE

Date 13/7-1989

Well: 5514/30-1
Casing Size (in): 30 | 20 | 13 3/8 | 9 5/8
Setting depth m,MD: 105 | 777 | 1740 | 3339

3

| Report number | Mid. depth m,MD | Est.Pore Pressure (SG) | Mud Dens. (SG) | Stop time | Short Summary |
|---|---|---|---|---|---|
| | | | | | Removed the well head crossover and made a final cut of the casing. Instaled the "C"-section and tested to 272 bar. |
| | | | | 23:00 | Nipplled up the BOP. |
| | | | | 24:00 | Pressure tested the 9 5/8" casing to 476 bar against shear ram. |
| 52 | 3352 | 1.08 | 1.29 | 04:00 | Tested the BOP stack to 476 bar. |
| | | | | 09:00 | Laid down the 12 1/4" bottom hole assembly and the core barrel. |
| | | | | 09:30 | Ran the wear bushing. |
| | | | | 20:00 | Made up 8 1/2" bottom hole assembly with junk basket and ran in the hole. Tagged the cement at 3267 m. |
| | | | | 24:00 | Washed and reamed cement from 3267 m to 3303 m. Drilled the float collar, the cement and the shoe at 3339 m. Cleaned out the rat hole to 3350 m. |
| 53 | 3380 | 1.12 | 1.29 | 00:30 | Continued to clean out the rat hole to 3352 m. |
| | | | | 02:30 | Drilled 8 1/2" hole from 3352 m to 3355 m. |
| | | | | 03:30 | Circulated the hole clean. |
| | | | | 04:00 | Performed a leak off test equivalent to 1.84 SG mud weight. |
| | | | | 10:00 | Drilled 8 1/2" hole from 3255 m to 3368 m. |
| | | | | 14:00 | Pulled out of the hole to change bit. |
| | | | | 19:30 | Made up a new bit and ran back in the hole. Worked the junk basket at bottom. |
| | | | | 24:00 | Drilled 8 1/2" hole from 3368 m to 3380 m. |
| 54 | 3425 | 1.15 | 1.29 | 07:00 | Continued to drill 8 1/2" hole from 3380 m to 3398 m. |
| | | | | 09:00 | Made a wiper trip to 3690 m and washed back to bottom. |
| | | | | 16:00 | Continued to drill 8 1/2" hole from 3398 m to 3425 m. Lost 69 bar pump pressure. |
| | | | | 21:00 | Pulled out of the hole and found a wash out in the heavy weight drill pipe. |
| | | | | 24:00 | Made up a new bit, laid out the junk sub and ran in the hole. |
| 55 | 3498 | 1.22 | 1.29 | 02:00 | Continued to run in the hole to the casing shoe. |
| | | | | 03:00 | Slipped and cut the drilling line. |
| | | | | 03:30 | Continued to run in the hole. |
| | | | | 16:30 | Drilled 8 1/2" hole from 3425 m to 3498 m. |

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Norsk Hydro

Daily report
System : BORE

Date 13/7-1989

Well: 5514/30-1
Casing Size (in): 30 | 20 | 13 3/8 | 9 5/8
Setting depth m,MD: 105 | 777 | 1740 | 3339

3

| Report number | Mid. depth m,MD | Est.Pore Pressure (SG) | Mud Dens. (SG) | Stop time | Short Summary |
|---|---|---|---|---|---|
| | | | | 17:00 | Circulated for survey. |
| | | | | 18:30 | Ran a survey on slick line. Attempted to retrieve survey. The tool was stuck and the slick line parted. |
| | | | | 19:30 | Attempted to recover the survey tool without success. |
| | | | | 21:00 | Pulled the drill string into the casing shoe. |
| | | | | 22:00 | Attempted to recover the survey tool but the line parted. |
| | | | | 24:00 | Pulled the drill string out of the hole. |
| 56 | 3556 | 1.29 | 1.32 | 03:30 | Continued to pull the drill string out of the hole and recovered the survey tool. |
| | | | | 09:00 | Ran back into the hole with a new bit. |
| | | | | 24:00 | Drilled 8 1/2" hole from 3498 m to 3556 m. |
| 57 | 3615 | 1.3 | 1.32 | 10:00 | Continued to drill 8 1/2" hole from 3556 m to 3601 m. |
| | | | | 11:00 | Repaired the mud pump. |
| | | | | 15:30 | Continued to drill 8 1/2" hole from 3601 m to 3615 m. Had a loss in pump pressure. |
| | | | | 22:30 | Pulled out of the hole and found a washout in the heavy weight drill pipe. |
| | | | | 23:00 | Inspected the wear bushing. |
| | | | | 24:00 | Laid out the heavy weight drill pipe and the drill collars. |
| 58 | 3625 | 1.3 | 1.32 | 03:00 | Laid down excess drill collars and picked up new drill pipe. |
| | | | | 11:30 | Made up a core barrel and ran in the hole while picking up drill pipe to replace the damaged joints. |
| | | | | 13:00 | Broke circulation and washed to the bottom. Dropped the ball and recorded the circulating pressures. |
| | | | | 22:30 | Cored from 3615 m to 3625 m. |
| | | | | 24:00 | Broke off the core with 400 KN overpull, and pulled out of the hole. |
| 59 | 3625 | 1.3 | 1.30 | 03:00 | Continued to pull out of the hole with the core barrel and laid out the core. |
| | | | | 03:30 | Laid out the core barrel. |
| | | | | 16:00 | Rigged up for logging and ran the following logs.<br>No.1: DIL/LSS/GR/SP<br>No.2: CNL/LDL/CAL/GR<br>No.3: CBL/VDL |
| | | | | 21:30 | Ran in the hole for a wiper trip. Washed |

| ((( (ooo) ------- Norsk Hydro | Daily report ---------- System : BORE | | | | | Date 13/7-1989 |
|---|---|---|---|---|---|---|
| | Well: 5514/30-1 | | | | | |
| | Casing Size (in): | 30 | 20 | 13 3/8 | 9 5/8 | |
| | Setting depth m,MD: | 105 | 777 | 1740 | 3339 | 3 |

| Report number | Mid. depth m,MD | Est.Pore Pressure (SG) | Mud Dens. (SG) | Stop time | Short Summary |
|---|---|---|---|---|---|
| | | | | | and reamed from 3600 m to 3625 m. |
| | | | | 22:30 | Circulated and increased the mud weight to 1.35 r.d. |
| | | | | 24:00 | Pulled out of the hole to 3404 m where the hole was tight. Worked the pipe free and reamed from 3404 m to 3405m. Continued to pull out of the hole. |
| 60 | 3425 | 1.3 | | 00:30 | Continued to pull out of the hole to the casing shoe. |
| | | | | 02:00 | Ran back to bottom. Washed and reamed from 3454 m to 3625 m. |
| | | | | 03:30 | Pumped a high viscous pill and circulated the hole clean. |
| | | | | 08:00 | Pulled out of the hole. |
| | | | | 17:30 | Rigged up for logging and ran the following logs. No.4: SHDT No.5: VSP Checkshot survey. Rigged down the logging equipment. |
| | | | | 22:00 | Picked up the 3 1/2" drill pipe stinger and ran in the hole to 3625 m. |
| | | | | 24:00 | Set a balanced cement plug from 3625 m to 3425 m. |
| 61 | 1485 | 1.3 | | 01:00 | Rigged up and reverse circulated at 3425 m. |
| | | | | 02:00 | Set a balanced cement plug from 3425 m to 3289 m. |
| | | | | 03:30 | Pulled back to 3289 m and reverse circulated. |
| | | | | 09:00 | Pulled out of the hole and laid down excess drill pipe. |
| | | | | 12:00 | Rigged up Schlumberger and ran gauge ring and junk basket to 3259 m. Ran and set a bridge plug at 3259 m. Tested the bridge plug to 160 bar. |
| | | | | 15:30 | Ran in the hole with a 4" perforation gun and perforated the 9 5/8" casing at 1640 m with 8 shots. |
| | | | | 17:00 | Ran in the hole with the drill pipe to 1740 m. |
| | | | | 18:00 | Established injection rate at 139 bar. |
| | | | | 19:00 | Set a balanced cement plug from 1740 m to 1485 m. |
| | | | | 20:30 | Pulled back to 1450 m and attempted to squeeze cement into the perforations with 276 bar without sucsess. Circulated above the cement plug and made a second attempt to squeeze with 276 bar without success. |
| | | | | 24:00 | Pulled out of the hole and laid down |

| ((( (ooo) ------- Norsk Hydro | Daily report ---------- System : BORE | Date 13/7-1989 |
|---|---|---|
| | Well: 5514/30-1 | |
| | Casing Size (in): \| 30 \| 20 \| 13 3/8 \| 9 5/8 \| | |
| | Setting depth m,MD: \| 105 \| 777 \| 1740 \| 3339 \| | 3 |

| Report number | Mid. depth m,MD | Est.Pore Pressure (SG) | Mud Dens. (SG) | Stop time | Short Summary |
|---|---|---|---|---|---|
| | | | | | excess drill pipe. |
| 62 | 135 | 1.3 | | 00:30 | Continued to pull out of the hole and laid down the drill pipe. |
| | | | | 01:00 | Pulled the wear bushing. |
| | | | | 02:30 | Made up 9 5/8" casing cutter, ran in the hole and cut the casing at 240 m. Pulled out of the hole. |
| | | | | 08:00 | Nippled down the BOP and the C-section wellhead. |
| | | | | 11:30 | Pulled the 9 5/8" casing. |
| | | | | 14:00 | Made up the 13 3/8" casing cutter, ran in the hole and cut the casing at 238.5 m. Pulled out of the hole. |
| | | | | 19:00 | Pulled the 13 3/8" casing. |
| | | | | 20:00 | Ran in the hole to 840 m and rigged up to cement. |
| | | | | 24:00 | Set balanced cement plugs inside the 9 5/8" casing from 840 m to 540 m and from 540 m to 240 m. Set a balanced cement plug inside the 20" casing from 240 m to 135 m. |
| 63 | 135 | 1.3 | | 01:00 | Pulled back to 100 m and circulated to clean the pipe. |
| | | | | 01:30 | Cut and laid down the 20" wellhead. |
| | | | | 04:00 | Made up 20" casing cutter, ran in the hole and cut the 20" casing at 85 m. Pulled out of the hole and laid down the cutter assembly. |
| | | | | 04:30 | Made up the slings and attempted to pull the 20" casing without success. |
| | | | | 05:30 | Made up the 20" casing spear and ran in the hole. Attempted to pull the 20" casing without success. |
| | | | | 06:00 | Backed out the 20" casing in the mud line suspension hanger. Pulled out of the hole and laid down the 20" casing spear. |
| | | | | 07:30 | Pulled and laid down the 20" casing. |
| | | | | 12:30 | Made up the 30" casing cutter, ran in the hole and cut the 30" casing at 85 m. |
| | | | | 18:00 | Pulled out of the hole with the cutter assembly. Rigged down the tension plate, pulled and laid down the 30" conductor. |
| | | | | 22:00 | Laid down the drill collars and excess drill pipe from the derrick. |
| | | | | 24:00 | Prepared to skid the rig. The rig was released to Global Marine/ Amoco at 24:00 Hrs. |

## 3.3 Time distribution

The total time used to drill and permanent plug and abandon the well was 1512 hours. The time distribution is shown in Table B-1 and fig B-1.

The operation can be splitted into the following main groups:

| | | |
|---|---|---|
| - | skidding and preparation | 1.1 days |
| - | Drilling the well to total depth | 47.8 days |
| - | Plugging back | 3.2 days |
| - | Formation evaluation | 4.7 days |
| - | Lost time | 6.2 days |

Table B-1

| (((<br>(ooo)<br>Norsk<br>Hydro | Time distribution<br>System : BORE<br>Well : 5514/30-1 Depth: 3625 m,MD<br>Rig: GLOMAR MORAY FIRTH 1<br>All phases | Date<br>6/7-1989<br>7 |
|---|---|---|

| Operations | Hrs | % | Hrs | % | Subtotal |
|---|---|---|---|---|---|
| Rig moving | | | | | |
| Skidding | 29.5 | 1.95 | | | |
| Sum | | | 29.50 | 1.95 | 29.50 |
| Drilling | | | | | |
| Drilling | 600.5 | 39.72 | | | |
| Underreaming | 18.0 | 1.19 | | | |
| Opening hole | 29.0 | 1.92 | | | |
| Tripping | 243.0 | 16.07 | | | |
| Circ. and cond. hole and mud | 10.0 | 0.66 | | | |
| Formation leak off test | 5.5 | 0.36 | | | |
| Surveying | 10.0 | 0.66 | | | |
| Wellhead/BOP handling | 7.0 | 0.46 | | | |
| BOP testing/activities | 65.0 | 4.30 | | | |
| Running casing | 124.8 | 8.25 | | | |
| Primary cementing | 26.8 | 1.77 | | | |
| Slip and cut drilling line | 3.0 | 0.20 | | | |
| Other | 1.0 | 0.07 | | | |
| Sum | | | 1143.50 | 75.63 | 1173.00 |
| Formation evaluation | | | | | |
| Tripping | 3.5 | 0.23 | | | |
| Circ and cond mud/hole | 4.0 | 0.26 | | | |
| Circulating for samples | 2.0 | 0.13 | | | |
| Coring | 23.0 | 1.52 | | | |
| Logging | 80.5 | 5.32 | | | |
| Sum | | | 113.00 | 7.47 | 1286.00 |
| Plug and abandonment | | | | | |
| Tripping | 15.5 | 1.03 | | | |
| Circ and cond mud/hole | 3.5 | 0.23 | | | |
| Perforating | 3.5 | 0.23 | | | |
| Cement plug | 9.0 | 0.60 | | | |
| Mechanical plug | 3.0 | 0.20 | | | |
| Squeezing | 2.5 | 0.17 | | | |
| Cutting | 21.0 | 1.39 | | | |
| Equipment recovery | 18.5 | 1.22 | | | |
| Sum | | | 76.50 | 5.06 | 1362.50 |
| Downtime | | | | | |
| Reaming | 31.0 | 2.05 | | | |
| Wiper trip | 16.5 | 1.09 | | | |
| Fishing> due to hole equipment | 35.5 | 2.35 | | | |
| Wellhead/BOP equipment repair | 2.0 | 0.13 | | | |
| Drilling equipment repair | 56.5 | 3.74 | | | |
| Other | 8.0 | 0.53 | | | |
| Sum | | | 149.50 | 9.89 | 1512.00 |
| Reported time (100.00 % of well total 1512.00 hours) : | | | | | 1512.00 |

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Norsk Hydro

**Time distribution**

Date 6/7-1989

System : BORE
Well : 5514/30-1 Depth: 3625 m,MD
Rig: GLOMAR MORAY FIRTH 1
Phase : Mobilization

7

| Operations | Hrs | % | Hrs | % | Subtotal |
|---|---|---|---|---|---|
| Rig moving | | | | | |
| Skidding | : 27.5 | 100.00 | | | |
| Sum | | | 27.50 | 100.00 | 27.50 |

Reported time ( 1.82 % of well total 1512.00 hours) : 27.50

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Norsk HYDRO

Time distribution

Date 6/7-1989

System : BORE
Well : 5514/30-1 Depth: 3625 m,MD
Rig: GLOMAR MORAY FIRTH 1
PHASE : DRIVING OF 30" CONDUCTOR. 7

| Operations | | Hrs | % | Hrs | % | Subtotal |
|---|---|---|---|---|---|---|
| Drilling..... | | | | | | |
| Opening hole | : | 3.5 | 5.30 | | | |
| Tripping | : | 17.0 | 25.76 | | | |
| Running casing | : | 37.5 | 56.82 | | | |
| Sum ..... | | | | 58.00 | 87.88 | 58.00 |
| Downtime..... | | | | | | |
| Reaming | : | 1.5 | 2.27 | | | |
| Drilling equipment repair | : | 6.5 | 9.85 | | | |
| Sum ..... | | | | 8.00 | 12.12 | 66.00 |
| Reported time ( 4.37 % of well total 1512.00 hours) : | | | | | | 66.00 |

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Norsk Hydro

**Time distribution**

Date 6/7-1989

System : BORE
Well : 5514/30-1 Depth: 3625 m,MD
Rig: GLOMAR MORAY FIRTH 1
Phase : Drilling of 26 " hole

7

| Operations | Hrs | % | Hrs | % | Subtotal |
|---|---|---|---|---|---|
| Drilling..... | | | | | |
| Drilling | 26.5 | 14.44 | | | |
| Underreaming | 18.0 | 9.81 | | | |
| Opening hole | 25.5 | 13.90 | | | |
| Tripping | 30.0 | 16.35 | | | |
| Circ. and cond. hole and mud | 3.5 | 1.91 | | | |
| Wellhead/BOP handling | 1.5 | 0.82 | | | |
| BOP testing/activities | 15.5 | 8.45 | | | |
| Running casing | 20.0 | 10.90 | | | |
| Primary cementing | 15.0 | 8.17 | | | |
| Sum ..... | | | 155.50 | 84.74 | 155.50 |
| Downtime..... | | | | | |
| Reaming | 12.0 | 6.54 | | | |
| Wiper trip | 2.0 | 1.09 | | | |
| Wellhead/BOP equipment repair | 2.0 | 1.09 | | | |
| Drilling equipment repair | 5.0 | 2.72 | | | |
| Other | 7.0 | 3.81 | | | |
| Sum ..... | | | 28.00 | 15.26 | 183.50 |
| Reported time (12.14 % of well total 1512.00 hours) : | | | | | 183.50 |

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Norsk Hydro

**Time distribution**

Date 6/7-1989

System : BORE
Well : 5514/30-1 Depth: 3625 m,MD
Rig: GLOMAR MORAY FIRTH 1
Phase : Drilling of 17 1/2" hole

7

| Operations | Hrs | % | Hrs | % | Subtotal |
|---|---|---|---|---|---|
| **Drilling** | | | | | |
| Drilling | 98.0 | 38.66 | | | |
| Tripping | 49.0 | 19.33 | | | |
| Circ. and cond. hole and mud | 4.5 | 1.78 | | | |
| Formation leak off test | 2.0 | 0.79 | | | |
| Wellhead/BOP handling | 0.5 | 0.20 | | | |
| BOP testing/activities | 24.0 | 9.47 | | | |
| Running casing | 31.3 | 12.33 | | | |
| Primary cementing | 5.3 | 2.07 | | | |
| Slip and cut drilling line | 1.0 | 0.39 | | | |
| Sum | | | 215.50 | 85.01 | 215.50 |
| **Formation evaluation** | | | | | |
| Tripping | 2.0 | 0.79 | | | |
| Circulating for samples | 2.0 | 0.79 | | | |
| Logging | 24.5 | 9.66 | | | |
| Sum | | | 28.50 | 11.24 | 244.00 |
| **Downtime** | | | | | |
| Reaming | 4.0 | 1.58 | | | |
| Drilling equipment repair | 5.5 | 2.17 | | | |
| Sum | | | 9.50 | 3.75 | 253.50 |
| Reported time (16.77 % of well total 1512.00 hours) : | | | | | 253.50 |

(((
(ooo)
Norsk Hydro

Time distribution

Date 6/7-1989

System : BORE
Well : 5514/30-1 Depth: 3625 m,MD
Rig: GLOMAR MORAY FIRTH 1
Phase : Drilling of 12 1/4" hole

7

| Operations | Hrs | % | Hrs | % | Subtotal |
|---|---|---|---|---|---|
| Drilling..... | | | | | |
| Drilling | 407.0 | 57.89 | | | |
| Tripping | 123.0 | 17.50 | | | |
| Circ. and cond. hole and mud | 2.0 | 0.28 | | | |
| Formation leak off test | 2.0 | 0.28 | | | |
| Surveying | 9.5 | 1.35 | | | |
| Wellhead/BOP handling | 4.5 | 0.64 | | | |
| BOP testing/activities | 25.5 | 3.63 | | | |
| Running casing | 31.5 | 4.48 | | | |
| Primary cementing | 6.5 | 0.92 | | | |
| Slip and cut drilling line | 1.0 | 0.14 | | | |
| Other | 1.0 | 0.14 | | | |
| Sum ..... | | | 613.50 | 87.27 | 613.50 |
| Formation evaluation..... | | | | | |
| Logging | 34.0 | 4.84 | | | |
| Sum ..... | | | 34.00 | 4.84 | 647.50 |
| Downtime..... | | | | | |
| Reaming | 12.0 | 1.71 | | | |
| Wiper trip | 1.5 | 0.21 | | | |
| Fishing> due to hole equipment | 21.0 | 2.99 | | | |
| Drilling equipment repair | 20.0 | 2.84 | | | |
| Other | 1.0 | 0.14 | | | |
| Sum ..... | | | 55.50 | 7.89 | 703.00 |
| Reported time (46.49 % of well total 1512.00 hours) : | | | | | 703.00 |

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(ooo)
Norsk Hydro

Time distribution

Date 6/7-1989

System : BORE
Well : 5514/30-1 Depth: 3625 m,MD
Rig: GLOMAR MORAY FIRTH 1
Phase : Drilling of 8 1/2" hole

7

| Operations | Hrs | % | Hrs | % | Subtotal |
|---|---|---|---|---|---|
| Drilling..... | | | | | |
| Drilling | 69.0 | 34.50 | | | |
| Tripping | 24.0 | 12.00 | | | |
| Formation leak off test | 1.5 | 0.75 | | | |
| Surveying | 0.5 | 0.25 | | | |
| Wellhead/BOP handling | 0.5 | 0.25 | | | |
| Running casing | 4.5 | 2.25 | | | |
| Slip and cut drilling line | 1.0 | 0.50 | | | |
| Sum ..... | | | 101.00 | 50.50 | 101.00 |
| Formation evaluation..... | | | | | |
| Tripping | 1.5 | 0.75 | | | |
| Circ and cond mud/hole | 4.0 | 2.00 | | | |
| Coring | 23.0 | 11.50 | | | |
| Logging | 22.0 | 11.00 | | | |
| Sum ..... | | | 50.50 | 25.25 | 151.50 |
| Downtime..... | | | | | |
| Reaming | 1.5 | 0.75 | | | |
| Wiper trip | 13.0 | 6.50 | | | |
| Fishing> due to hole equipment | 14.5 | 7.25 | | | |
| Drilling equipment repair | 19.5 | 9.75 | | | |
| Sum ..... | | | 48.50 | 24.25 | 200.00 |
| Reported time (13.23 % of well total 1512.00 hours) : | | | | | 200.00 |

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(ooo)
Norsk HYDRO

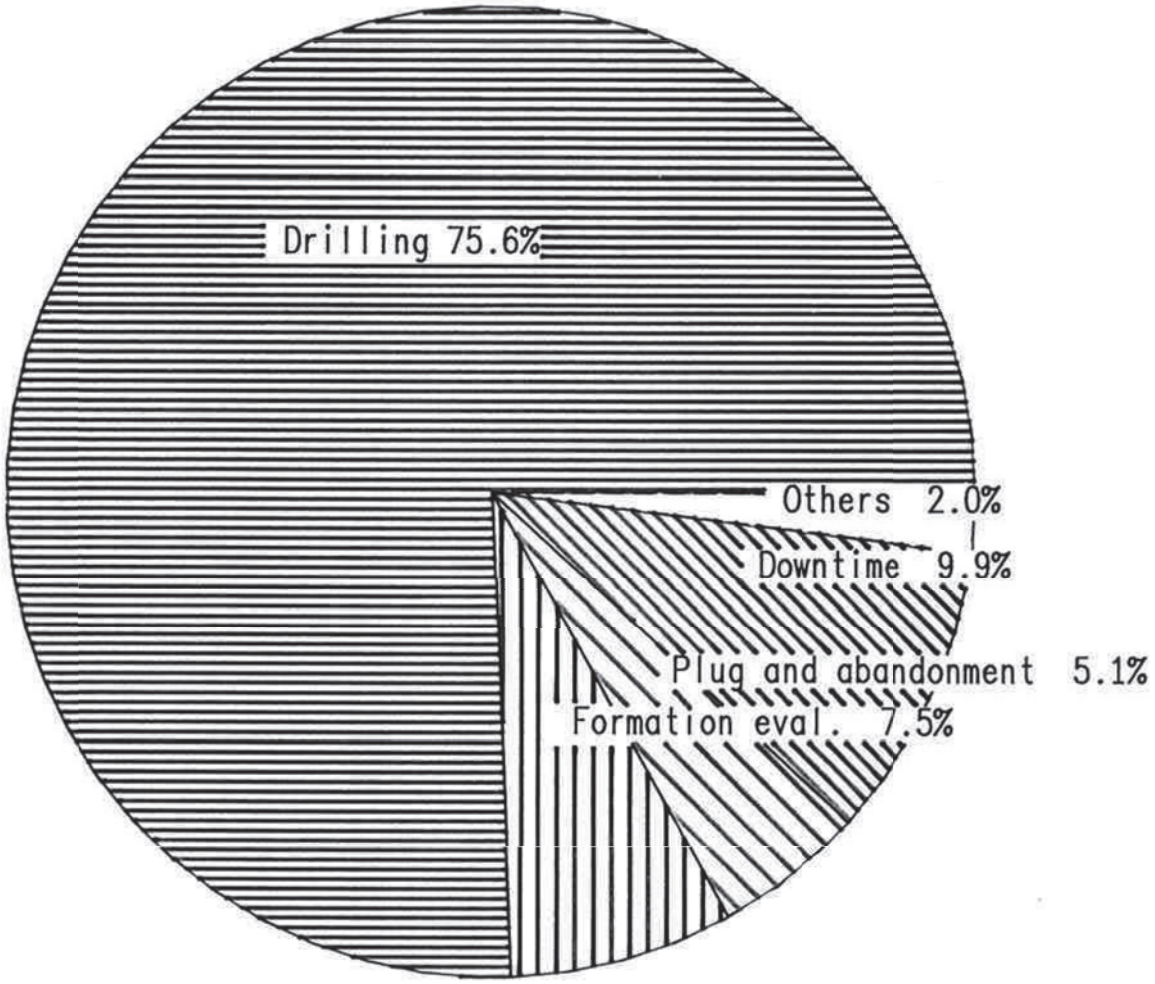
Time distribution

Date 6/7-1989

System : BORE
Well : 5514/30-1 Depth: 3625 m,MD
Rig: GLOMAR MORAY FIRTH 1
PHASE : PLUG & ABANDON

7

| Operations | | Hrs | % | Hrs | % | Subtotal |
|---|---|---|---|---|---|---|
| Rig moving..... | | | | | | |
| Skidding | : | 2.0 | 2.55 | | | |
| Sum ..... | | | | 2.00 | 2.55 | 2.00 |
| Plug and abandonment..... | | | | | | |
| Tripping | : | 15.5 | 19.75 | | | |
| Circ and cond mud/hole | : | 3.5 | 4.46 | | | |
| Perforating | : | 3.5 | 4.46 | | | |
| Cement plug | : | 9.0 | 11.46 | | | |
| Mechanical plug | : | 3.0 | 3.82 | | | |
| Squeezing | : | 2.5 | 3.18 | | | |
| Cutting | : | 21.0 | 26.75 | | | |
| Equipment recovery | : | 18.5 | 23.57 | | | |
| Sum ..... | | | | 76.50 | 97.45 | 78.50 |
| Reported time ( 5.19 % of well total 1512.00 hours) : | | | | | | 78.50 |




TIME REPORTED (HRS): 1512 OF TOTAL 1512

Others:

SKIDDING : 2.0 %

| | | | |
|---|---|---|---|
| Norsk Hydro<br>Drilling Department<br>Date:19890706 | TIME DISTRIBUTION<br>WELL: 5514/30-1 | | Rig.:<br>B-1 |

Table B-2

(((
(ooo)
Norsk Hydro

**Hole deviation**

Date 9/6-1989

System : BORE

Well: 5514/30-1. Depths, m: RKB 36. Water 44. Assumed vert. 80
Proposed direction (deg): 0 (referensed to grid north)
Coordinates are measured from the Wellhead-centre. 12

| Meas. Depth (m) | Incli-nation (deg) | Direc tion (deg) | Tool Type | Vert. Depth (m) | Coordinates North (m) | Coordinates East (m) | Depar-ture (m) | Dogleg d/30m | Build d/30m | Turn d/30m |
|---|---|---|---|---|---|---|---|---|---|---|
| 129.0 | 0.40 | 115.80 | MWD | 129.0 | -0.07 | 0.15 | 0.2 | 0.24 | 0.24 | * |
| 148.0 | 0.30 | 143.90 | MWD | 148.0 | -0.14 | 0.24 | 0.3 | 0.31 | -0.16 | 44.37 |
| 230.0 | 0.60 | 113.70 | MWD | 230.0 | -0.49 | 0.76 | 0.9 | 0.14 | 0.11 | -11.05 |
| 286.0 | 0.70 | 93.60 | MWD | 286.0 | -0.63 | 1.37 | 1.5 | 0.13 | 0.05 | -10.77 |
| 342.0 | 0.80 | 88.40 | MWD | 342.0 | -0.64 | 2.10 | 2.2 | 0.06 | 0.05 | -2.79 |
| 399.0 | 0.50 | 130.20 | MWD | 399.0 | -0.79 | 2.69 | 2.8 | 0.29 | -0.16 | 22.00 |
| 455.0 | 0.50 | 186.10 | MWD | 455.0 | -1.19 | 2.85 | 3.1 | 0.25 | 0.00 | 29.95 |
| 511.0 | 0.50 | 196.00 | MWD | 511.0 | -1.67 | 2.76 | 3.2 | 0.05 | 0.00 | 5.30 |
| 568.0 | 0.60 | 173.10 | MWD | 568.0 | -2.20 | 2.73 | 3.5 | 0.13 | 0.05 | -12.05 |
| 625.0 | 0.40 | 141.50 | MWD | 625.0 | -2.65 | 2.89 | 3.9 | 0.18 | -0.11 | -16.63 |
| 682.0 | 0.70 | 165.40 | MWD | 682.0 | -3.15 | 3.10 | 4.4 | 0.20 | 0.16 | 12.58 |
| 739.0 | 1.10 | 178.00 | MWD | 739.0 | -4.03 | 3.21 | 5.2 | 0.23 | 0.21 | 6.63 |
| 780.0 | 0.50 | 162.50 | MWD | 780.0 | -4.60 | 3.27 | 5.6 | 0.46 | -0.44 | -11.34 |
| 842.0 | 0.60 | 194.90 | MWD | 842.0 | -5.17 | 3.27 | 6.1 | 0.16 | 0.05 | 15.68 |
| 900.0 | 0.30 | 193.50 | MWD | 900.0 | -5.61 | 3.16 | 6.4 | 0.16 | -0.16 | -0.72 |
| 956.0 | 0.70 | 116.10 | MWD | 956.0 | -5.90 | 3.43 | 6.8 | 0.37 | 0.21 | -41.46 |
| 1011.0 | 0.70 | 12.40 | MWD | 1011.0 | -5.72 | 3.80 | 6.9 | 0.60 | 0.00 | * |
| 1068.0 | 1.10 | 32.10 | MWD | 1067.9 | -4.92 | 4.17 | 6.4 | 0.26 | 0.21 | 10.37 |
| 1125.0 | 1.30 | 38.80 | MWD | 1124.9 | -3.95 | 4.87 | 6.3 | 0.13 | 0.11 | 3.53 |
| 1183.0 | 1.20 | 45.20 | MWD | 1182.9 | -3.01 | 5.71 | 6.5 | 0.09 | -0.05 | 3.31 |
| 1239.0 | 1.40 | 55.70 | MWD | 1238.9 | -2.21 | 6.69 | 7.0 | 0.17 | 0.11 | 5.63 |
| 1256.0 | 1.60 | 47.90 | MWD | 1255.9 | -1.93 | 7.04 | 7.3 | 0.50 | 0.35 | -13.76 |
| 1324.0 | 1.40 | 42.00 | MWD | 1323.9 | -0.68 | 8.30 | 8.3 | 0.11 | -0.09 | -2.60 |
| 1353.0 | 1.20 | 54.60 | MWD | 1352.9 | -0.24 | 8.78 | 8.8 | 0.36 | -0.21 | 13.03 |
| 1410.0 | 1.20 | 64.80 | MWD | 1409.9 | 0.36 | 9.81 | 9.8 | 0.11 | 0.00 | 5.37 |
| 1465.0 | 1.20 | 69.20 | MWD | 1464.8 | 0.81 | 10.87 | 10.9 | 0.05 | 0.00 | 2.40 |
| 1521.0 | 0.60 | 44.80 | MWD | 1520.8 | 1.22 | 11.62 | 11.7 | 0.37 | -0.32 | -13.07 |
| 1576.0 | 0.80 | 42.70 | MWD | 1575.8 | 1.71 | 12.09 | 12.2 | 0.11 | 0.11 | -1.15 |
| 1635.0 | 0.30 | 85.60 | MWD | 1634.8 | 2.03 | 12.52 | 12.7 | 0.31 | -0.25 | 21.81 |
| 1692.0 | 0.40 | 57.00 | MWD | 1691.8 | 2.15 | 12.84 | 13.0 | 0.10 | 0.05 | -15.05 |
| 1703.0 | 0.40 | 11.00 | MWD | 1702.8 | 2.20 | 12.87 | 13.1 | 0.85 | 0.00 | * |
| 1802.0 | 1.50 | 1.00 | SING | 1801.8 | 3.84 | 12.96 | 13.5 | 0.34 | 0.33 | -3.03 |
| 2225.0 | 1.00 | 330.00 | SING | 2224.7 | 12.57 | 11.21 | 16.8 | 0.06 | -0.04 | -2.20 |
| 2476.0 | 2.00 | 350.00 | SING | 2475.6 | 18.78 | 9.36 | 21.0 | 0.13 | 0.12 | 2.39 |
| 2575.0 | 1.25 | 3.00 | SING | 2574.6 | 21.56 | 9.12 | 23.4 | 0.25 | -0.23 | 3.94 |
| 2731.0 | 1.00 | 275.00 | SING | 2730.6 | 23.38 | 7.85 | 24.7 | 0.30 | -0.05 | -16.92 |
| 2851.0 | 3.25 | 26.00 | SING | 2850.5 | 26.53 | 8.30 | 27.8 | 0.93 | 0.56 | 27.75 |
| 2944.0 | 3.00 | 22.00 | SING | 2943.4 | 31.16 | 10.36 | 32.8 | 0.11 | -0.08 | -1.29 |
| 3032.0 | 2.00 | 15.00 | SING | 3031.3 | 34.77 | 11.62 | 36.7 | 0.36 | -0.34 | -2.39 |
| 3139.0 | 2.25 | 75.00 | SING | 3138.2 | 37.12 | 14.14 | 39.7 | 0.60 | 0.07 | 16.82 |
| 3178.0 | 3.00 | 86.00 | SING | 3177.2 | 37.39 | 15.89 | 40.6 | 0.69 | 0.58 | 8.46 |
| 3352.0 | 6.00 | 85.00 | SING | 3350.6 | 38.50 | 29.50 | 48.5 | 0.52 | 0.52 | -0.17 |

## 4. PERMANENT ABANDONMENT OF WELL 5514/30-1

The permanent abandonment is shown in figure B-2 and was carried out in the following way:

1. A cement plug was set in open hole from 3625 m to 3425 m.

2. A balanced cement plug was set across the 9 5/8" casing shoe from 3289 m to 3425 m.

3. A bridgeplug was set inside the 9 5/8" casing at 3259 m and tested to 160 bar.

4. The 9 5/8" casing was perforated at 1640 m. A balanced cement plug were set inside the 9 5/8" casing from 1740 m to 1485 m. A negative attempt was made to squeeze cement into the 9 5/8" x 13 3/8" annulus.

5. A cement plug was set inside 9 5/8" from 840 m to 240 m.

6. The 9 5/8" casing was mechanically cut at 240 m and retrieved.

7. The 13 3/8" casing was cut at 238.5 m and retrieved.

8. A top cement plug was set inside the 20" casing from 240 m to 135 m.

9. The 20" casing was cut at 85 m and attempted to be retrieved without success. The casing was then unscrewed in the mudline suspension system and retrieved.

10. The 30" casings were cut at 85 m and retrieved together with the last part of the 20" casing.

All depths refers to RKB

Well status prior to abandonment

Seabed at 80 m.

30" conductor at 105 m.

13 3/8" casing cemented back to 512 m

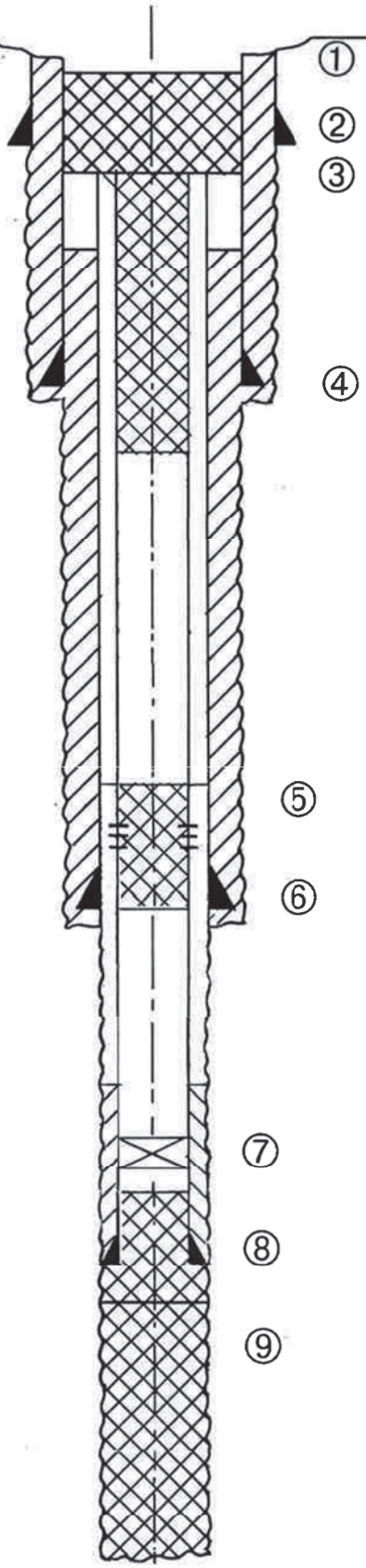
20" casing at 777 m

13 3/8" casing at 1740 m

9 5/8" casing cemented back to 3150 m

9 5/8" casing at 3339 m

Total depth at 3625 m




1. 30" and 20" casing cut at 85 m.
2. Top cement plug inside 20" casing from 135 m to 240 m.
3. 9 5/8" casing cut at 240 m and 13 3/8" casing cut at 238.5 m
4. Cement plugs from 840 m to 240 m
5. Perforation at 1640 m
6. Cement plug inside 9 5/8" casing from 1740 m to 1485 m.
7. Bridge plug at 3259 m.
8. Cement plug acros 9 5/8" casing shoe from 3289 m to 3425 m.
9. Cement plug in open hole from 3625 m to 3425 m.

| | | | |
|---|---|---|---|
| HYDRO<br>Drilling Department | Permanent Abandonment<br>Well 5514 / 30-1 | Gr. no.: | Fig.: B-2 |
| | | Date:<br>Sign: BEn | Dwg. no.: |

# 5. PORE PRESSURE, FORMATION INTEGRITY, OVERBURDEN AND FORMATION TEMPERATURE

## 5.1 Pore pressure

The final pore pressure profile that has been established for well 5514/30-1 is based on the sonic log, the Dc-exponent, flowline temperatures, drilling parameters and the hole condition.

The final profile is shown in fig. B-3.

All depths are in m TVD with reference to RKB.

The following is a description of the pore pressure development:

Both the sonic log and the Dxc are indicating a build up from normal pressure gradient (ie 1.03 rd) at 1820 m to a gradient of 1.09 rd. The pore pressure gradient seems to stay at this magnitude down to 2000 m for then to be normal in the sandstone below.

Further down the sonic log indicates another increase of the pressure gradient to 1.06 rd at 2600 m. The gradient staying at this level down to 3130 m is supported by the Dxc and flowline temperatures.

A more rapidly pore pressure increase for 3130 m to a max. gradient of 1.30 rd at TD (3624.5 m) is indicated by the sonic log, the Dxc and flowline temperatures. The situation being close to balance in the deepest part of the well is also supported by increasing ROP and the hole condition observed with fill/tight hole and splintered shale when not circulating.

## 5.2 Formation integrity

A total of three Leak Off Tests (LOT) were performed with the following results:

| Csg (in) | Csg.shoe (m) | Open hole (m) | Form.int. (rd) | Test | Formation |
|---|---|---|---|---|---|
| 20" | 777 | 791 | 1.82 | LOT | Lst/Chk |
| 13 3/8" | 1740 | 1757 | 2.0 | LOT | Clyst w/Sst |
| 9 5/8" | 3339 | 3355 | 1.84 | LOT | Clyst |

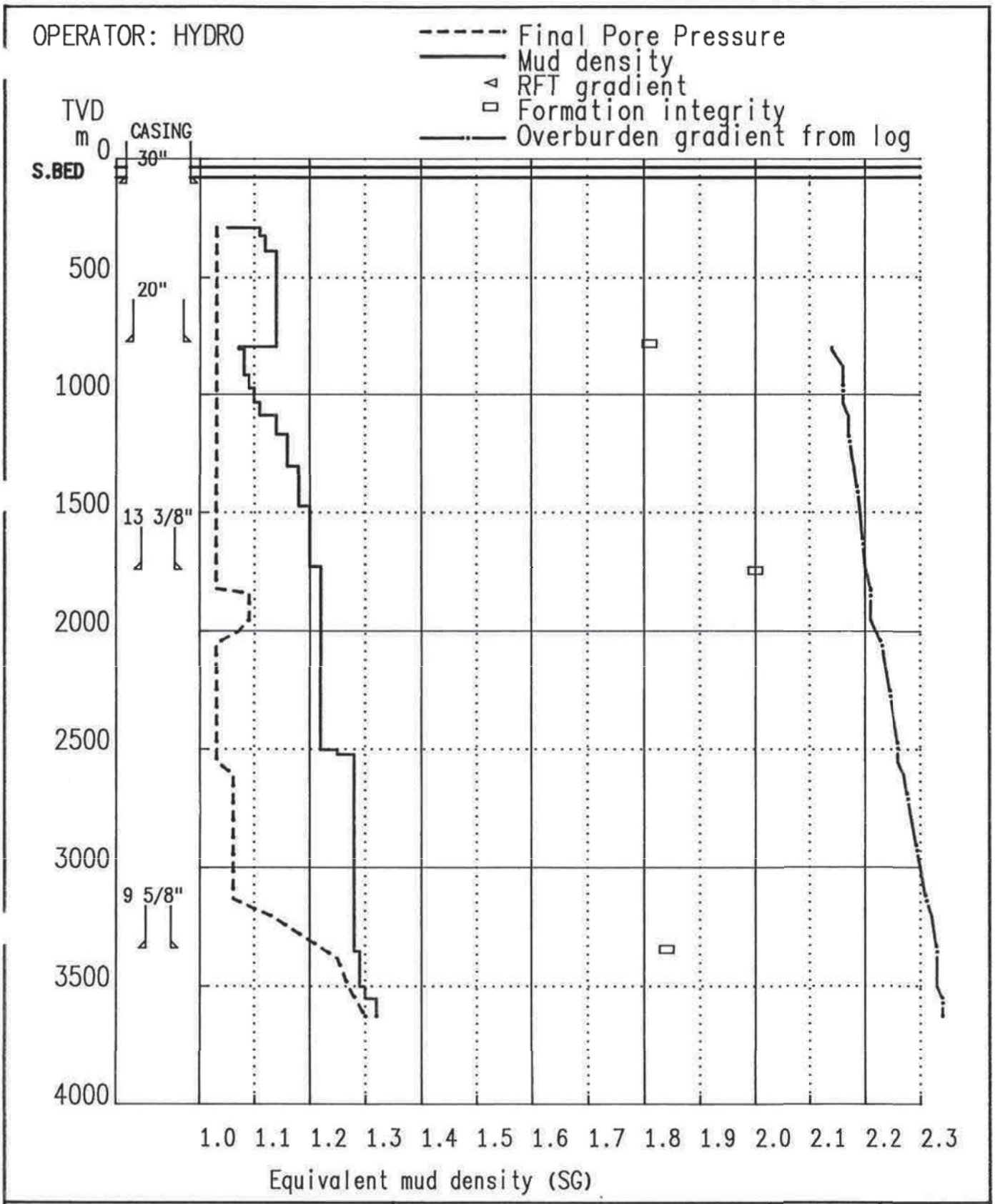
## 5.3 Overburden gradient

The overburden gradient for well 5514/30-1 has been calculated from the Litho Density Log (LDL) ran in the interval from 800 to 3600 m. In the chalk/limestone above 800 m an average bulk density of 2.25 g/a was assumed. Due to this some uncertainty is related to the magnitude of the overburden gradient.

## 5.4 Formation temperature

The final temperature profile is based on temperature measurements recorded during electric logging which have been converted to Bottom Hole Static Temperatures (BHST) by using the Horner plot method. A temperature of 5°C at sea bottom has also been assumed.

The final profile is shown in fig. B-4.



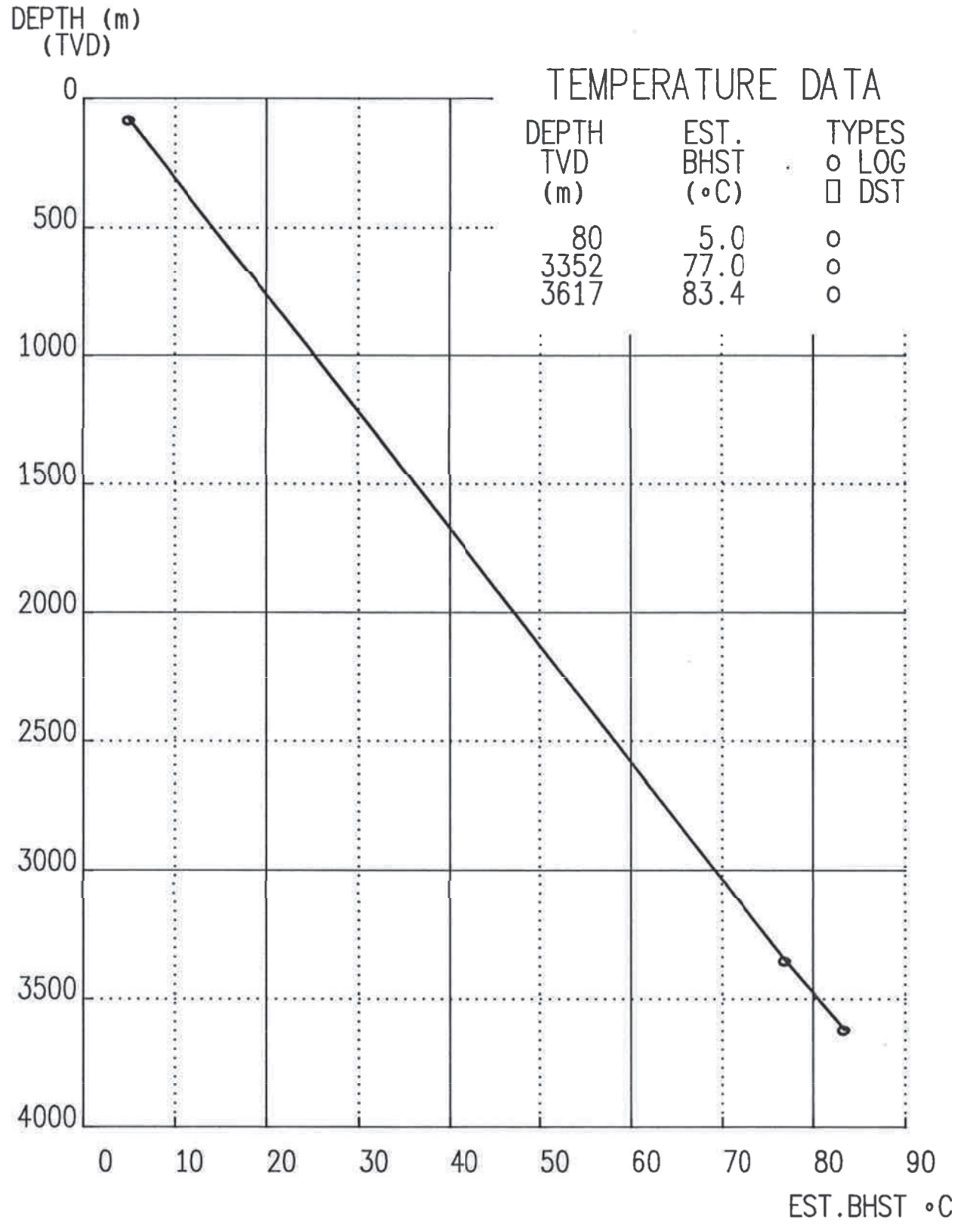

Norsk Hydro
Drilling Department

Date:19890714

FINAL PORE PRESSURE
MUD DENSITY,
RFT AND OVERBURDEN GRAD.
FORMATION INTEGRITY.
WELL: 5514/30-1

Fig.: B-3

08.08.--89 12.08 BY BORE




Norsk Hydro
Drilling Department
Date:19890808

TEMPERATURE PROFILE
WELL: 5514/30-1

Fig.: B-4

NORSK ...DRO

Table B-3

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(ooo)
Norsk Hydro

Pore pressure

System : BORE

Date 13/7-1989

Well: 5514/30-1
Seabed at : 80 m RKB
Total depth: 3625 m,MD,RKB

9

| Vertical Depth (m) | Pore Pressure from SonicLog (SG) | Pore Pressure from DC-exp. (SG) | RFT/FMT (SG) | Most probable Pore Pressure (SG) | Actual mud Density used (SG) |
|---|---|---|---|---|---|
| 80 | 1.03 | 1.03 | | 1.03 | 1.05 |
| 285 | 1.03 | 1.03 | | 1.03 | 1.11 |
| 320 | 1.03 | 1.03 | | 1.03 | 1.12 |
| 385 | 1.03 | 1.03 | | 1.03 | 1.14 |
| 777 | 1.03 | 1.03 | | 1.03 | 1.14 |
| 795 | 1.03 | 1.03 | | 1.03 | 1.07 |
| 805 | 1.03 | 1.03 | | 1.03 | 1.08 |
| 875 | 1.03 | 1.03 | | 1.03 | 1.08 |
| 915 | 1.03 | 1.03 | | 1.03 | 1.09 |
| 970 | 1.03 | 1.03 | | 1.03 | 1.10 |
| 1030 | 1.03 | 1.03 | | 1.03 | 1.11 |
| 1085 | 1.03 | 1.03 | | 1.03 | 1.14 |
| 1165 | 1.03 | 1.03 | | 1.03 | 1.16 |
| 1300 | 1.03 | 1.03 | | 1.03 | 1.18 |
| 1470 | 1.03 | 1.03 | | 1.03 | 1.20 |
| 1725 | 1.03 | 1.03 | | 1.03 | 1.22 |
| 1820 | 1.03 | 1.03 | | 1.03 | 1.22 |
| 1840 | 1.09 | 1.09 | | 1.09 | 1.22 |
| 1950 | 1.08 | 1.09 | | 1.09 | 1.22 |
| 2000 | 1.07 | | | 1.07 | 1.22 |
| 2050 | 1.03 | | | 1.03 | 1.22 |
| 2476 | 1.03 | | | 1.03 | 1.22 |
| 2500 | 1.03 | | | 1.03 | 1.25 |
| 2520 | 1.03 | | | 1.03 | 1.28 |
| 2550 | 1.03 | | | 1.03 | 1.28 |
| 2600 | 1.08 | | | 1.06 | 1.28 |
| 3129 | 1.07 | | | 1.06 | 1.28 |
| 3199 | 1.13 | | | 1.13 | 1.28 |
| 3349 | | | | 1.23 | 1.29 |
| 3378 | 1.25 | | | 1.25 | 1.29 |
| 3498 | 1.27 | | | 1.27 | 1.30 |
| 3548 | | | | | 1.32 |
| 3622 | 1.30 | | | 1.30 | 1.32 |

Table F-4

| ((( (ooo) ------- Norsk Hydro | Formation integrity ---------- System : BORE Well: 5514/30-1 Seabed at : 80 m RKB Total depth: 3625 m,MD,RKB | Date 13/7-1989 10 |
|---|---|---|

| Casing Shoe Depth (m,MD) | Open Hole Depth (m,MD) | Form Int Strenght (SG) |
|---|---|---|
| 777 | 777 | 1.81 |
| 1740 | 1757 | 2.00 |
| 3339 | 3339 | 1.84 |

# 6. MATERIALS REPORT

1. Main consumption casing and wellhead

2. Main consumption cement and additives

3. Cement report

4. Bit record

5. Bottom hole assembly

6. Mud report

Table B-5

| (((<br>(ooo)<br>-------<br>Norsk<br>Hydro | Main consumptions<br>System : BORE<br>Well: 5514/30-1<br>Wellhead:<br>Data from table 8. | Date<br>30/6-1989<br>6 |
|---|---|---|

CASING

| Size (in) | Grade | Weight (kg/m) | Threads Type | Length (m) |
|---|---|---|---|---|
| 30 | X-52 | 309.00 | RL-4 | 105 |
| 20 | X-56 | 195.60 | LS | 777 |
| 13 3/8 | N-80 | 105.20 | BUTTRES | 1576 |
| 13 3/8 | P-110 | 101.90 | BUTTRES | 164 |
| 9 5/8 | P-110 | 79.60 | NK 3SB | 642 |
| 9 5/8 | P-110 | 68.70 | NK 3SB | 2703 |

Table B-6

| (((<br>(ooo)<br>Norsk<br>Hydro | Main consumptions<br>System : BORE<br>Well: 5514/30-1<br>Cement contractor: HALLIBURTON<br>Data from table 9. | Date<br>30/6-1989<br>6 |
|---|---|---|

| Casing size (in) | Additive name | Total used (l) |
|---|---|---|
| 20 | | |
| Spacer | SEAWATER | 8000 |
| Lead- | Cement | 28254 |
| | Seawater | 101798 |
| | ECONOLITE | 3560 |
| Tail- | Cement | 4762 |
| | Seawater | 7001 |
| | CACL2 | 668 |
| Flush | | |
| 13 3/8 | | |
| Spacer | SEAWATER | 7000 |
| Lead- | Cement | 24127 |
| | Seawater | 52288 |
| | ECONOLITE | 760 |
| | HR-4L-DK | 1520 |
| Tail- | Cement | 8889 |
| | Seawater | 12880 |
| | HR-4L-DK | 210 |
| Flush | | |
| 9 5/8 | | |
| Spacer | | |
| Lead- | Cement | 21587 |
| | Seawater | 86999 |
| | HDP 100 A | 1374 |
| | FDP 365 | 367 |
| | CFR 3L | 680 |
| Tail- | Cement | 4444 |
| | Seawater | 5800 |
| | HDP 100 A | 700 |
| | CFR-3L | 379 |
| Flush | | |

Table B-7

| ((( (ooo) ------- Norsk Hydro | Cement reports<br>System : BORE<br>Well: 5514/30-1<br>Cement contractor: HALLIBURTON<br>Data from table 9. | Date<br>30/6-1989<br>11 |
|---|---|---|

| Casing Size (in) | Slurry Volume (m3) | Slurry Density (SG) | Thickening Time (hrs) | BHST (deg.C) | Cement/ Additive name | Compo-sition (l/100kg) | Total used (l) |
|---|---|---|---|---|---|---|---|
| Lead-20 | 126.0 | 1.44 | 6.00 | 33 | Cement | | 28254 |
| | | | | | Seawater | 114.38 | 101798 |
| | | | | | ECONOLITE | 4.00 | 3560 |
| Tail-20 | 11.0 | 1.90 | 3.00 | 33 | Cement | | 4762 |
| | | | | | Seawater | 46.67 | 7001 |
| | | | | | CACL2 | 4.45 | 668 |
| Lead-13 3/8 | 78.0 | 1.68 | 3.60 | 56 | Cement | | 24127 |
| | | | | | Seawater | 68.80 | 52288 |
| | | | | | ECONOLITE | 1.00 | 760 |
| | | | | | HR-4L-DK | 2.00 | 1520 |
| Tail-13 3/8 | 22.0 | 1.89 | 3.75 | 56 | Cement | | 8889 |
| | | | | | Seawater | 46.00 | 12880 |
| | | | | | HR-4L-DK | 0.75 | 210 |
| Lead- 9 5/8 | 109.0 | 1.44 | 6.33 | 73 | Cement | | 21587 |
| | | | | | Seawater | 127.94 | 86999 |
| | | | | | HDP 100 A | 2.02 | 1374 |
| | | | | | FDP 365 | 0.54 | 367 |
| | | | | | CFR 3L | 1.00 | 680 |
| Tail- 9 5/8 | 11.0 | 1.90 | 5.00 | 73 | Cement | | 4444 |
| | | | | | Seawater | 41.43 | 5800 |
| | | | | | HDP 100 A | 5.00 | 700 |
| | | | | | CFR-3L | 2.71 | 379 |

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Norsk Hydro

Cement reports

System : BORE

Well: 5514/30-1
Cement contractor: HALLIBURTON
Data from table 16

Date 5/7-1989

11

| Type of Job | Depth Bot. m,MD | Slurry Volume (m3) | Slurry Density (SG) | Compress. Strenght (Bar/hrs) | Thickening Time (hrs) | Cement/ Additive name | Compo-sition 1/100kg | Total used (1) |
|---|---|---|---|---|---|---|---|---|
| PLUG | 3625 | 8.40 | 1.90 | | 3.40 | Cement | | 3429 |
| | | | | | | Seawater | 44.70 | 4828 |
| | | | | | | HR-4L-DK | 1.70 | 184 |
| PLUG | 3425 | 8.60 | 1.90 | | 3.40 | Cement | | 3524 |
| | | | | | | Seawater | 43.96 | 4880 |
| | | | | | | HR-4L-DK | 1.97 | 219 |
| PLUG | 1740 | 9.70 | 1.90 | | 3.00 | Cement | | 3968 |
| | | | | | | Seawater | 43.32 | 5415 |
| PLUG | 840 | 12.00 | 1.90 | | 4.00 | Cement | | 5302 |
| | | | | | | Seawater | 40.72 | 6800 |

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Norsk Hydro

Bit record
System : BORE

Date 6/7-1989

Date 6/7-1989

Well: 5514/30-1

Data from table 4.

Table B-8

| BIT NUMBER | Size (in) | Manufacturer | Trade Name | Serial number | IADC Code | Nozzles diameter (../32") | BHA no. | Depth out m,MD | Bit meter (m) | Drill time (hrs) | Rot. hours (hrs) | ROP (m/h) | Rotation min/max (rpm) | Total bit revol. | Weight min/max (KN) | Flow min/max (m3/h) | Wear T | Wear B | Wear G | Wear Other | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 P | 17 1/2 | SMIT | SDGH | XH8170 | 135 | 28 28 28 16 | 1 | 105 | 25 | 3.00 | 3.00 | 8.3 | 70/70 | | 182/182 | 272/272 | 3 | 4 | 0 | | |
| 2 HO | 26 | SECU | CUSTOM | | | 14 14 14 | 1 | 105 | 25 | 3.00 | 3.00 | 8.3 | 70/70 | | 182/182 | 272/272 | 1 | 1 | 20 | | |
| 3 | 17 1/2 | SMIT | SVH | XE4411 | 215 | 24 24 24 16 | 2 | 787 | 682 | 26.50 | 16.40 | 41.6 | 20/175 | 132798 | 45/317 | 264/264 | 2 | 7 | 0 | | |
| 1PRR1 | 17 1/2 | SMIT | SDGH | XH8170 | 135 | 28 28 28 16 | 3 | 788 | 683 | 25.50 | 21.00 | 32.5 | 100/150 | | 45/317 | 278/278 | | | | | |
| 4 HO | 24 | SECU | B24 | A1410 | | 40 40 40 | 3 | 787 | 682 | 25.50 | 21.00 | 32.5 | 100/150 | 163800 | 45/317 | 278/278 | 2 | 6 | 0 | | |
| 1PRR2 | 17 1/2 | SMIT | SDGH | XH8170 | 135 | 22 22 22 16 | 4 | 788 | 683 | | | | | | | | | | | | |
| 5 UR | 26 | SMIT | SER.17000 | 1036 | | 16 16 16 | 4 | 783 | 678 | 18.00 | 10.20 | 66.5 | 80/100 | 52754 | 0/5 | 20/20 | | | | | |
| 6 | 17 1/2 | SMIT | SVH | XH1907 | 215 | 24 24 24 16 | 5 | 1263 | 501 | 32.90 | 25.20 | 19.9 | 50/130 | 193771 | 250/500 | 2/4.1 | 7 | 4 | 4 | | |
| 7 | 17 1/2 | SECU | M44NG4 | 410581 | 215 | 24 24 24 16 | 5 | 1508 | 245 | 22.50 | 19.00 | 12.9 | 130/170 | 160579 | 100/300 | 2/4.1 | 7 | 2 | 0 | | |
| 8 | 17 1/2 | HUGH | X22K | 8541 | 515 | 24 24 24 | 5 | 1715 | 207 | 25.50 | 23.20 | 8.9 | 150/150 | 187529 | 88/363 | /234 | 8 | 8 | | | |
| 9 | 17 1/2 | SMIT | 2JS | XD 0752 | 515 | 20 16 16 | 6 | 1754 | 39 | 17.50 | 16.30 | 2.4 | 80/160 | 144580 | 0/350 | 210/246 | 4 | 7 | 3 | | |
| 10 | 17 1/2 | SECU | M44N | 412750 | 215 | 24 24 24 | 7 | 1754 | 0 | | | | | | 0/0 | 240/240 | 1 | 1 | 0 | | WASHING |
| 11 | 12 1/4 | HUGH | XDV | 022TK | 215 | 16 16 14 | 8 | 1810 | 56 | 21.00 | 19.40 | 2.9 | 110/145 | 161900 | 178/222 | 180/180 | 8 | 5 | 0 | | |
| 12 | 12 1/4 | CRIS | S200 | 121 | | | 9 | 1870 | 60 | 16.00 | 13.80 | 4.3 | 160/180 | 133986 | 90/222 | 238/238 | | | | 100 % | |
| 13 | 12 1/4 | REED | HP51A | H13255 | 517 | 16 16 16 | 10 | 2225 | 355 | 57.50 | 52.10 | 6.8 | 80/100 | 284468 | 178/267 | 198/198 | 7 | 5 | 2 | | |
| 14 | 12 1/4 | HUGH | ATM22 | 77622 | 517 | 16 16 16 | 10 | 2476 | 251 | 41.50 | 39.30 | 6.4 | 90/90 | 190305 | 133/236 | 198/198 | 8 | 6 | 3 | | |
| 15 | 12 1/4 | HUGH | ATJ33 | A54BK | 537 | 16 16 16 | 10 | 2603 | 127 | 30.00 | 27.80 | 4.6 | 40/100 | 148367 | 133/236 | 198/198 | 8 | 4 | 0 | | |
| 16 | 12 1/4 | DB | TT603 | 7980338 | | | 11 | 2610 | 7 | 4.50 | 4.50 | 1.6 | 60/150 | 35166 | 90/204 | 198/198 | | | | 10 % | TFA:1.5 |
| 17 | 12 1/4 | SMIT | F27DL | KH1300 | 527 | 16 16 16 | 12 | 2731 | 121 | 20.50 | 19.20 | 6.3 | 70/85 | 82223 | 90/220 | 198/198 | 6 | 2 | 3 | | 8 BT |
| 18 | 12 1/4 | SMIT | F3L | KH5116 | 537 | 16 16 16 | 12 | 2851 | 120 | 34.60 | 34.60 | 3.5 | 80/80 | 154182 | 90/318 | 198/198 | 8 | 4 | 10 | | |
| 19 | 12 1/4 | SMIT | F27D | 222450 | 527 | 16 16 16 | 13 | 2944 | 93 | 30.00 | 29.30 | 3.2 | 70/90 | 137930 | 90/310 | 159/159 | 5 | 2 | 3 | | |
| 20 | 12 1/4 | SMIT | F3 | XJ2710 | 537 | 13 13 13 | 14 | 3032 | 88 | 30.00 | 28.00 | 3.1 | 70/90 | 153427 | 90/310 | 136/136 | 4 | 2 | 3 | | |
| 21 | 12 1/4 | SMIT | F3 | XJ2713 | 537 | 13 13 13 | 15 | 3139 | 107 | 34.00 | 30.90 | 3.5 | 70/90 | 159732 | 40/318 | 136/136 | 3 | 2 | 6 | | |
| 22 | 12 1/4 | HUGH | J33 | A55BM | 537 | 14 14 14 | 15 | 3178 | 39 | 24.00 | 22.20 | 1.8 | 88/100 | 126000 | 320/320 | 136/136 | 2 | 2 | 6 | | |
| 23 | 12 1/4 | DB | TBT16 | 7890122 | | | 16 | 3200 | 22 | 9.50 | 8.20 | 2.7 | 130/190 | 75428 | 68/227 | 176/176 | | | | 15% | TFA:75-1.2 |
| 24 | 12 1/4 | EC | S226 | 123561 | | | 17 | 3217 | 17 | 5.50 | 3.80 | 4.5 | 180/210 | 57750 | 16/16 | 625/625 | | | | 15 % | |
| 25 | 12 1/4 | HUGH | ATM22 | A79HK | 517 | 14 14 12 | 18 | 3352 | 135 | 47.50 | 45.60 | 3.0 | 80/80 | 211700 | 320/320 | 136/136 | 2 | 4 | 0 | | |
| 26 | 8 1/2 | SMIT | SDGH | XJ4329 | 135 | 12 12 12 | 19 | 3368 | 16 | 8.00 | 8.00 | 2.0 | 100/100 | | 133/133 | 106/106 | 3 | 2 | 3 | | |
| 27 | 8 1/2 | EC | S225 | 123393 | | | 20 | 3425 | 57 | 18.50 | 16.70 | 3.4 | 120/120 | 119100 | 130/150 | 140/140 | | | | 20% | |
| 28 | 8 1/2 | J K | MK1 | 103818 | | | 21 | 3498 | 73 | 12.00 | 11.70 | 6.2 | 150/150 | 113200 | 155/155 | 142/142 | | | | 20% | |
| 29 | 8 1/2 | J K | MK1 | 104187 | | | 22 | 3615 | 117 | 29.50 | 25.70 | 4.6 | 160/160 | 239800 | 180/200 | 142/142 | | | | 35% | |
| 30C | 8 1/2 | CRIS | C 315 | CP1961 | | | 23 | 3625 | 10 | 9.50 | 9.10 | 1.1 | 100/115 | 51900 | 66/80 | 65/65 | | | | 5% | |
| 31 | 8 1/2 | SMIT | SDGH | XJ4920 | 135 | 12 12 12 | 24 | 3625 | 0 | | | | | | | | 1 | 1 | 0 | | WIPER TRIP |

Table B-9

| (((<br>(ooo)<br>Norsk<br>Hydro | Bottom hole assembly<br>System : BORE<br>Well: 5514/30-1<br>Data from table 7 and table 10 ("Depth interval") | Date<br>9/6-1989<br>8 |
|---|---|---|

BHA no.:1 Item no./Name/OD,in/Length,m Depth interval md: 80-105

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | Bit | 17 1/2 | 0.43 | 5 | DC Steel | 9 1/2 | 9.38 |
| 2 | Hole Opener | 26 | 2.54 | 6 | X-over | 9 1/2 | 0.78 |
| 3 | Bit Sub | 9 1/2 | 1.12 | 7 | X-over | 6 1/2 | 0.71 |
| 4 | Nonmag collar | 9 1/2 | 9.13 | 8 | HWDP | 6 1/2 | 137.99 |

BHA no.:2 Item no./Name/OD,in/Length,m Depth interval md: 105-787

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | Bit | 17 1/2 | 0.43 | 6 | X-over | 9 1/2 | 0.78 |
| 2 | Bit Sub | 9 1/2 | 1.12 | 7 | DC Steel | 8 | 17.91 |
| 3 | MWD | 9 1/2 | 12.57 | 8 | Jar | 8 | 9.69 |
| 4 | Nonmag collar | 9 1/2 | 9.13 | 9 | DC Steel | 8 | 27.07 |
| 5 | DC Steel | 9 1/2 | 102.53 | 10 | X-over | 2 3/4 | 0.77 |

BHA no.:3 Item no./Name/OD,in/Length,m Depth interval md: 105-787

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | Bit | 17 1/2 | 0.43 | 7 | X-over | 9 1/2 | 0.73 |
| 2 | Steel stab | 17 1/2 | 2.27 | 8 | DC Steel | 8 | 17.91 |
| 3 | Hole Opener | 24 | 1.95 | 9 | Jar | 8 | 9.69 |
| 4 | Bit Sub | 9 1/2 | 1.12 | 10 | DC Steel | 8 | 27.02 |
| 5 | DC Steel | 9 1/2 | 9.73 | 11 | X-over | 7 3/4 | 0.77 |
| 6 | DC Steel | 9 1/2 | 102.53 | | | | |

BHA no.:4 Item no./Name/OD,in/Length,m Depth interval md: 105-785

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | Bit | 17 1/2 | 0.48 | 7 | DC Steel | 8 | 17.91 |
| 2 | Hole Opener | 24 | 1.95 | 8 | Jar | 8 | 6.69 |
| 3 | Under Reamer | 26 | 3.35 | 9 | DC Steel | 8 | 27.02 |
| 4 | Bit Sub | 9 7/16 | 1.12 | 10 | X-over | 7 3/4 | 0.77 |
| 5 | DC Steel | 9 1/2 | 28.09 | 11 | HWDP | 6 1/2 | 137.99 |
| 6 | X-over | 9 1/2 | 0.78 | | | | |

BHA no.:5 Item no./Name/OD,in/Length,m Depth interval md: 762-1715

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | Bit | 17 1/2 | 0.41 | 8 | X-over | 9 1/2 | 0.78 |
| 2 | Bit Sub | 9 7/16 | 1.12 | 9 | DC Steel | 8 | 17.91 |
| 3 | Bit Sub | 9 1/2 | 0.65 | 10 | Jar | 8 | 9.79 |
| 4 | MWD | 9 1/2 | 11.92 | 11 | DC Steel | 8 | 27.03 |
| 5 | DC Steel | 9 1/2 | 9.13 | 12 | X-over | 7 3/4 | 0.77 |
| 6 | Steel stab | 17 1/2 | 2.27 | 13 | HWDP | 6 1/2 | 137.99 |
| 7 | DC Steel | 9 1/2 | 149.11 | | | | |

BHA no.:6 Item no./Name/OD,in/Length,m Depth interval md: 1715-1754

| (((<br>(ooo)<br>-------<br>Norsk<br>Hydro | Bottom hole assembly<br>System : BORE<br>Well: 5514/30-1<br>Data from table 7 and table 10 ("Depth interval") | Date<br>9/6-1989<br>8 |
|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | Bit | 17 1/2 | 0.41 | 8 | X-over | 9 1/2 | 0.78 |
| 2 | Bit Sub | 9 3/16 | 1.12 | 9 | DC Steel | 7 3/8 | 17.91 |
| 3 | Nonmag collar | 9 1/2 | 9.13 | 10 | Jar | 8 | 9.79 |
| 4 | DC Steel | 9 1/2 | 3.59 | 11 | DC Steel | 8 | 27.02 |
| 5 | DC Steel | 9 1/2 | 9.29 | 12 | X-over | 7 3/4 | 0.77 |
| 6 | Steel stab | 17 1/2 | 2.27 | 13 | HWDP | 6 1/2 | 157.99 |
| 7 | DC Steel | 9 1/2 | 139.84 | | | | |

BHA no.:7 Item no./Name/OD,in/Length,m Depth interval md: 1754-1754

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | Bit | 17 1/2 | 0.41 | 8 | Steel stab | 17 1/2 | 2.27 |
| 2 | X-over | 9 1/2 | 0.78 | 9 | DC Steel | 9 1/2 | 139.84 |
| 3 | Junksub | 9 1/2 | 0.8 | 10 | DC Steel | 8 | 17.91 |
| 4 | X-over | 9 1/2 | 1.17 | 11 | Jar | 8 | 9.74 |
| 5 | Bit Sub | 9 1/2 | 1.12 | 12 | DC Steel | 8 | 27.02 |
| 6 | Nonmag collar | 9 1/2 | 9.13 | 13 | X-over | 8 | 0.77 |
| 7 | DC Steel | 9 1/2 | 3.59 | 14 | HWDP | 5 | 137.99 |

BHA no.:8 Item no./Name/OD,in/Length,m Depth interval md: 1754-1810

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | Bit | 12 1/4 | 0.3 | 7 | DC Steel | 8 | 196.45 |
| 2 | Bit Sub | 8 | 0.88 | 8 | Jar | 8 | 8.79 |
| 3 | Junksub | 8 | 0.8 | 9 | DC Steel | 8 | 35.88 |
| 4 | DC Steel | 8 | 2.77 | 10 | X-over | 8 | 0.47 |
| 5 | Nonmag collar | 8 | 8.72 | 11 | HWDP | 5 | 137.99 |
| 6 | Steel stab | 12 1/4 | 1.21 | | | | |

BHA no.:9 Item no./Name/OD,in/Length,m Depth interval md: 1810-1870

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | Bit | 12 1/4 | 0.72 | 6 | DC Steel | 8 | 133.83 |
| 2 | Bit Sub | 8 | 0.88 | 7 | Jar | 8 | 8.79 |
| 3 | DC Steel | 8 | 2.77 | 8 | DC Steel | 8 | 27.18 |
| 4 | Nonmag collar | 8 | 8.72 | 9 | X-over | 7 3/4 | 0.77 |
| 5 | Steel stab | 12 1/4 | 1.21 | 10 | HWDP | 5 | 137.99 |

BHA no.:10 Item no./Name/OD,in/Length,m Depth interval md: 1870-2603

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | Bit | 12 1/4 | 0.32 | 6 | DC Steel | 8 | 214.42 |
| 2 | Bit Sub | 8 | 0.88 | 7 | Jar | 8 | 8.97 |
| 3 | Shock Abs./Sub | 8 | 4.23 | 8 | DC Steel | 8 | 17.91 |
| 4 | Nonmag collar | 8 | 8.72 | 9 | X-over | 8 | 0.77 |
| 5 | Steel stab | 12 1/4 | 1.21 | 10 | HWDP | 5 | 137.99 |

BHA no.:11 Item no./Name/OD,in/Length,m Depth interval md: 2603-2610

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | Bit | 12 1/4 | 0.41 | 7 | DC Steel | 8 | 133.83 |

| (((<br>(ooo)<br>Norsk<br>Hydro | Bottom hole assembly<br>System : BORE<br>Well: 5514/30-1<br>Data from table 7 and table 10 ("Depth interval") | Date<br>9/6-1989<br>8 |
|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2 | Junksub | 9 1/2 | 0.81 | 8 | Jar | 8 | 8.97 |
| 3 | Bit Sub | 8 | 0.88 | 9 | DC Steel | 8 | 27.17 |
| 4 | DC Steel | 8 | 2.77 | 10 | X-over | 7 3/4 | 0.91 |
| 5 | Nonmag collar | 8 | 8.72 | 11 | HWDP | 5 | 137.99 |
| 6 | Steel stab | 12 1/4 | 1.5 | | | | |

BHA no.:12 Item no./Name/OD,in/Length,m Depth interval md: 2610-2851

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | Bit | 12 1/4 | 0.32 | 6 | DC Steel | 8 | 205.14 |
| 2 | Bit Sub | 8 | 0.88 | 7 | Jar | 8 | 8.97 |
| 3 | Shock Abs./Sub | 8 | 4.23 | 8 | DC Steel | 8 | 17.91 |
| 4 | Nonmag collar | 8 | 8.72 | 9 | X-over | 7 3/4 | 0.77 |
| 5 | Roller Reamer | 12 1/4 | 1.28 | 10 | HWDP | 5 | 137.99 |

BHA no.:13 Item no./Name/OD,in/Length,m Depth interval md: 2851-2944

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | Bit | 12 1/4 | 0.32 | 6 | DC Steel | 8 | 214.42 |
| 2 | Bit Sub | 8 | 0.88 | 7 | Jar | 8 | 8.97 |
| 3 | Shock Abs./Sub | 8 | 4.23 | 8 | DC Steel | 8 | 17.91 |
| 4 | Nonmag collar | 8 | 8.72 | 9 | X-over | 7 3/4 | 0.77 |
| 5 | Roller Reamer | 12 1/4 | 2.47 | 10 | HWDP | 5 | 137.99 |

BHA no.:14 Item no./Name/OD,in/Length,m Depth interval md: 2944-3032

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | Bit | 12 1/4 | 0.32 | 7 | DC Steel | 8 | 214.42 |
| 2 | Junksub | 9 5/8 | 0.8 | 8 | Jar | 8 | 8.97 |
| 3 | Bit Sub | 8 | 0.88 | 9 | DC Steel | 8 | 17.91 |
| 4 | Shock Abs./Sub | 8 | 4.23 | 10 | X-over | 7 3/4 | 0.77 |
| 5 | Nonmag collar | 8 | 8.72 | 11 | HWDP | 5 | 137.99 |
| 6 | Roller Reamer | 12 1/4 | 1.28 | | | | |

BHA no.:15 Item no./Name/OD,in/Length,m Depth interval md: 3032-3178

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | Bit | 12 1/4 | 0.32 | 6 | DC Steel | 8 | 214.42 |
| 2 | Bit Sub | 8 | 0.88 | 7 | Jar | 8 | 8.97 |
| 3 | Shock Abs./Sub | 8 | 4.23 | 8 | DC Steel | 8 | 17.91 |
| 4 | Nonmag collar | 8 | 8.72 | 9 | X-over | 7 3/4 | 0.77 |
| 5 | Roller Reamer | 12 1/4 | 2.47 | 10 | HWDP | 5 | 139.99 |

BHA no.:16 Item no./Name/OD,in/Length,m Depth interval md: 3178-3200

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | Bit | 12 1/4 | 0.43 | 6 | DC Steel | 8 | 115.59 |
| 2 | Junksub | 9 5/8 | 0.83 | 7 | Jar | 8 | 9.78 |
| 3 | Bit Sub | 8 | 0.88 | 8 | DC Steel | 8 | 17.81 |
| 4 | Nonmag collar | 8 | 8.72 | 9 | X-over | 7 3/4 | 0.77 |
| 5 | Steel stab | 12 1/4 | 1.45 | 10 | HWDP | 5 | 137.99 |

| (((<br>(ooo)<br>-------<br>Norsk<br>Hydro | Bottom hole assembly<br>System : BORE<br>Well: 5514/30-1<br>Data from table 7 and table 10 ("Depth interval") | Date<br>9/6-1989<br>8 |
|---|---|---|

BHA no.:17 Item no./Name/OD,in/Length,m Depth interval md: 3200-3217

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | Bit | 12 1/4 | 0.48 | 6 | DC Steel | 8 | 142.36 |
| 2 | Junksub | 9 5/8 | 0.83 | 7 | Jar | 7 3/8 | 9.7 |
| 3 | Bit Sub | 8 | 0.88 | 8 | DC Steel | 8 | 17.7 |
| 4 | Nonmag collar | 8 | 8.73 | 9 | X-over | 7 3/4 | 0.77 |
| 5 | Steel stab | 12 1/4 | 1.45 | 10 | HWDP | 5 | 137.99 |

BHA no.:18 Item no./Name/OD,in/Length,m Depth interval md: 3217-3352

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | Bit | 12 1/4 | 0.3 | 6 | Jar | 7 7/8 | 9.7 |
| 2 | Bit Sub | 8 | 0.88 | 7 | DC Steel | 8 | 17.7 |
| 3 | Nonmag collar | 8 | 8.72 | 8 | X-over | 7 3/4 | 0.77 |
| 4 | Steel stab | 12 1/4 | 1.45 | 9 | HWDP | 5 | 137.99 |
| 5 | DC Steel | 8 | 232.28 | | | | |

BHA no.:19 Item no./Name/OD,in/Length,m Depth interval md: 3352-3368

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | Bit | 8 1/2 | 0.26 | 8 | X-over | 6 7/16 | 0.73 |
| 2 | Junksub | 7 5/8 | 0.82 | 9 | DC Steel | 6 1/2 | 241.27 |
| 3 | Bit Sub | 6 1/2 | 0.92 | 10 | X-over | 6 3/4 | 0.53 |
| 4 | X-over | 6 3/4 | 0.82 | 11 | Jar | 6 3/8 | 9.25 |
| 5 | Nonmag collar | 6 1/2 | 8.74 | 12 | X-over | 6 1/2 | 0.77 |
| 6 | DC Steel | 6 1/2 | 2.37 | 13 | DC Steel | 6 1/2 | 27.24 |
| 7 | Steel stab | 8 1/2 | 1.74 | 14 | HWDP | 5 | 137.99 |

BHA no.:20 Item no./Name/OD,in/Length,m Depth interval md: 3368-3425

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | Bit | 8 1/2 | 0.35 | 8 | X-over | 6 3/8 | 0.73 |
| 2 | Junksub | 7 5/8 | 0.82 | 9 | DC Steel | 6 1/2 | 152.42 |
| 3 | Bit Sub | 6 1/2 | 0.92 | 10 | X-over | 6 3/8 | 0.53 |
| 4 | X-over | 6 7/8 | 0.82 | 11 | Jar | 6 3/8 | 9.25 |
| 5 | Nonmag collar | 6 1/2 | 8.74 | 12 | Jar | 6 1/2 | 0.77 |
| 6 | DC Steel | 6 1/2 | 2.37 | 13 | DC Steel | 6 1/2 | 27.24 |
| 7 | Steel stab | 8 1/2 | 1.74 | 14 | HWDP | 5 | 137.99 |

BHA no.:21 Item no./Name/OD,in/Length,m Depth interval md: 3425-3498

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | Bit | 8 1/2 | 0.19 | 7 | X-over | 6 7/16 | 0.73 |
| 2 | Bit Sub | 6 1/2 | 0.92 | 8 | DC Steel | 6 1/2 | 152.43 |
| 3 | X-over | 6 7/8 | 0.82 | 9 | Jar | 6 3/8 | 9.52 |
| 4 | Nonmag collar | 6 1/2 | 8.74 | 10 | X-over | 6 1/2 | 0.77 |
| 5 | DC Steel | 6 1/2 | 2.37 | 11 | DC Steel | 6 1/2 | 27.24 |
| 6 | Steel stab | 8 1/2 | 1.72 | 12 | DC Steel | 5 | 110.27 |

| (((<br>(ooo)<br>-------<br>Norsk<br>Hydro | Bottom hole assembly<br>System : BORE<br>Well: 5514/30-1<br>Data from table 7 and table 10 ("Depth interval") | Date<br>9/6-1989<br>8 |
|---|---|---|

BHA no.:22 Item no./Name/OD,in/Length,m Depth interval md: 3498-3615

| | | | | | |
|---|---|---|---|---|---|
| 1 | Bit | 8 1/2 0.23 | 5 | DC Steel | 6 1/2 241.27 |
| 2 | Bit Sub | 8 1/2 0.92 | 6 | Jar | 6 3/4 9.36 |
| 3 | Nonmag collar | 6 9/16 9.7 | 7 | DC Steel | 6 1/2 27.24 |
| 4 | Steel stab | 8 1/2 1.58 | 8 | HWDP | 5 110.27 |

BHA no.:23 Item no./Name/OD,in/Length,m Depth interval md: 3615-3625

| | | | | | |
|---|---|---|---|---|---|
| 1 | Core bit | 8 1/2 0.3 | 4 | Jar | 6 3/4 9.36 |
| 2 | Core barrel | 6 1/2 18.57 | 5 | DC Steel | 6 1/2 27.24 |
| 3 | DC Steel | 6 1/2 90.21 | | | |

BHA no.:24 Item no./Name/OD,in/Length,m Depth interval md: 3625-3625

| | | | | | |
|---|---|---|---|---|---|
| 1 | Bit | 8 1/2 0.3 | 4 | Jar | 6 3/4 9.36 |
| 2 | Roller Reamer | 8 1/2 1.5 | 5 | DC Steel | 6 1/2 27.24 |
| 3 | DC Steel | 6 1/2 90.21 | | | |

## 6.1 Mud report

### 26" hole section:

A 17 1/2" pilot hole was drilled to 787 m using a prehydrated bentonite - seawater system conditioned with PAC-polymer and Calcium Carbonate designed to give good wallbuilding properties and hole stability in the expected unconsolidated sand.

An obstruction in the 30" conductor was milled prior to opening the hole to 24". When pulling out, thigh hole was experienced with max. overpull of 70 ton, and lots of cuttings were observed when backreaming. This was assumed to be sloughing shale based on high MBT (47 kg/$m^3$) and the type of cuttings observed at surface.

Decision was made to add approx. 60 kg/$m^3$ of KCl to the mud to prevent hydration and dispersion of the clays whilst underreaming the hole to 26". The mudweight was also increased to 1.25 r.d.

Laboratory analyses, however showed that the formation consisted of mostly chalk and only 11% reactive clay. The 20" casing was run and cemented at 777 m without problems.

### 17 1/2" hole section:

The 20" shoe was drilled out with seawater and the hole displaced to KCl-Polymer mud. After drilling 3 m into new formation, a leakoff test was performed to an equivalent mud-
weight of 1.81 r.d. The 17 1/2" hole was then drilled to 1754 m.

Several intervals with tight hole was experienced when tripping. Mud weight was raised from 1.16 r.d. to 1.20 r.d. at 1299 m and futher to 1.22 r.d. at approx. 1740 m and KCl content was increased to 80 kg/$m^3$ to stabilize the hole.

Periodicly loss of mud over the shakers were observed due to blinding of screens when drilling sand.

The hole was logged and 13 3/8" casing was run and cemented without problems at 1740 m.

12 1/4" hole section:

The KCl-mud from the previous section was pretreted with bicarbonate for drilling the cement.

The 12 1/4" hole was drilled to section t.d. at 3352 m increasing the mudweight to 1.28 r.d. at approx. 2570 m, and starting to lightly disperse the mud with chrome free lignosulfonate at 2900m.
Calcium Carbonate in small amount was added to stabilize the sandsections and the KCl was allowed to drift out of the system.

Thight spots were encountered frequently and had to be washed and reamed. At 2433 m the pipe got stuck but was worked free. A twisted off bottom hole assembly was caught on first attempt and pulled out of the hole.

The hole was logged prior to run 9 5/8" casing. Due to thight hole, the casing had to be circulated down the last 28 m.

8 1/2" hole section:

This section was drilled to 3615 m, and a core was cut from 3615 m to 3625 m using the mud from the previous section.

As temperature increased, additions of chrome free lignosulfonate and Miltemp were made to maintain rheology and HTHP fluid loss within specifications.

During logging, it was experienced tight hole on the first 2 logs. A wiper trip was performed and the mudweight was increased to 1.35 r.d. It was found 15 m fill at bottom.

The hole was plugged and abandoned without problems.

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Norsk Hydro

# Daily mud properties

System : BORE

Date 6/7-1989

Well: 5514/30-1
Mud Contractor: PROMUD DANMARK APS
Data: "Mid depth" from table 3, otherwise from table 14.

| Date | Mid. depth m,MD | Mud Dens. (SG) | PV cp | YP Pa | GEL 0 Pa | GEL 10 Pa | pH | 100 psi (cc) | HP/HT (cc) | Cl- inn/out mg/l | Alkalinity Pf | Pm | Mf | Ca++ inn/out mg/l | Oil % | Sol % | H2O % | V.G. meter at 115 gr. 600 rpm | 300 rpm | 200 rpm | 100 rpm | 6 rpm | F 3 rpm | Mud Type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 890407 | 105 | 1.05 | 0 | 0 | | | | | | | | | | | | | | | | | | | | SPUD |
| 890408 | 105 | 1.05 | 7 | 9 | 1 | 2 | 10.2 | 10.0 | | 3000/ | 0.30 | 1.20 | 1.00 | 40/ | | | | 33 | 26 | 17 | 12 | 2 | 1 | SPUD |
| 890409 | 634 | 1.14 | 18 | 16 | 10 | 15 | 9.0 | 13.0 | | 6000/ | 0.80 | 1.00 | 0.80 | 80/ | | 9 | | 68 | 50 | 45 | 40 | 20 | 10 | SPUD |
| 890410 | 787 | 1.14 | 10 | 11 | 4 | 9 | 9.0 | 10.0 | | 5800/ | 1.00 | 1.00 | 0.80 | 100/ | | 7 | | 42 | 32 | 25 | 15 | 9 | 6 | SPUD |
| 890411 | 787 | 1.16 | 10 | 12 | 4 | 9 | 9.0 | 8.2 | | 6000/ | 0.10 | 1.00 | 0.60 | 68/ | | 9 | | 45 | 35 | 20 | 15 | 5 | 3 | SPUD |
| 890412 | 788 | 1.16 | 13 | 13 | 4 | 10 | 9.0 | 8.0 | | 6000/ | 0.10 | 1.00 | 0.60 | 100/ | | 1 | | 53 | 40 | 25 | 18 | 13 | 5 | SPUD |
| 890413 | 788 | 1.16 | 10 | 17 | 5 | 14 | 9.0 | 10.5 | | | | 0.80 | 0.20 | 360/ | | 12 | | 66 | 50 | 37 | 27 | 18 | 7 | KCL |
| 890416 | 791 | 1.16 | 9 | 13 | 1 | 2 | 10.5 | 6.0 | | 41000/41000 | 1.50 | 2.30 | 2.80 | 400/ | | | | 45 | 36 | 24 | 15 | 2 | 1 | KCL |
| 890417 | 1182 | 1.16 | 15 | 14 | 2 | 6 | 10.0 | 5.8 | | 38000/38000 | 0.70 | 1.50 | 1.30 | 360/ | | 12 | | 58 | 43 | 32 | 24 | 15 | 3 | KCL |
| 890418 | 1299 | 1.16 | 16 | 12 | 2 | 4 | 9.5 | 5.8 | | 40000/40000 | 0.20 | 1.30 | 0.60 | 360/ | | 14 | | 56 | 40 | 31 | 23 | 12 | 4 | KCL |
| 890419 | 1508 | 1.20 | 16 | 13 | 1 | 3 | 10.0 | 6.0 | | 33000/33000 | 0.10 | 0.50 | 0.50 | 400/ | | 10 | | 58 | 42 | 30 | 20 | 4 | 2 | KCL |
| 890420 | 1646 | 1.20 | 15 | 12 | 1 | 3 | 10.0 | 5.5 | | 34000/34000 | 0.10 | 0.60 | 0.40 | /600 | | 11 | | 55 | 40 | 29 | 18 | 5 | 2 | KCL |
| 890421 | 1715 | 1.21 | 15 | 13 | 1 | 3 | 9.5 | 5.2 | | 34000/34000 | 0.10 | 0.50 | 0.40 | 680/ | | 10 | | 56 | 41 | 27 | 16 | 5 | 2 | KCL |
| 890422 | 1754 | 1.21 | 18 | 12 | 1 | 3 | 10.0 | 5.0 | | 35000/35000 | 0.10 | 0.40 | 0.40 | 640/ | | 10 | | 60 | 43 | 29 | 18 | 4 | 2 | KCL |
| 890423 | 1754 | 1.21 | 17 | 13 | 1 | 3 | 10.0 | 50.0 | | | | 0.50 | 0.40 | 600/ | | 10 | | 60 | 43 | 31 | 19 | 6 | 3 | KCL |
| 890424 | 1754 | 1.22 | 23 | 11 | 1 | 3 | 9.5 | 5.2 | | 33000/33000 | 0.40 | 0.40 | 0.40 | 600/ | | 10 | | 68 | 45 | 35 | 22 | 5 | 3 | KCL |
| 890425 | 1754 | 1.22 | 19 | 10 | 1 | 3 | 9.5 | 5.0 | | 31000/31000 | 0.10 | 0.40 | 0.30 | 600/ | | 10 | | 58 | 39 | 28 | 16 | 5 | 2 | KCL |
| 890426 | 1754 | 1.22 | 18 | 11 | 1 | 3 | 9.5 | 5.1 | | 31000/31000 | 0.10 | 0.40 | 0.40 | 60/ | | 10 | | 58 | 40 | 28 | 17 | 6 | 2 | KCL |
| 890427 | 1790 | 1.22 | 20 | 10 | 1 | 3 | 11.5 | 5.0 | | 27000/27000 | 0.60 | 2.70 | 1.20 | 400/ | | 13 | | 60 | 40 | 28 | 17 | 6 | 2 | KCL |
| 890428 | 1841 | 1.22 | 27 | 11 | 2 | 4 | 10.0 | 4.8 | 18.0 | 28000/28000 | 0.20 | 2.40 | 0.80 | 200/ | | 13 | | 67 | 45 | 31 | 18 | 6 | 2 | KCL |
| 890429 | 1915 | 1.22 | 23 | 9 | 2 | 4 | 10.0 | 4.8 | 18.0 | 28000/28000 | 0.20 | 2.60 | 0.80 | 200/ | | 12 | | 65 | 42 | 29 | 18 | 6 | 2 | KCL |
| 890430 | 2065 | 1.22 | 23 | 9 | 2 | 4 | 10.0 | 4.9 | 18.0 | 25000/25000 | 0.10 | 2.00 | 0.60 | 220/ | | 12 | | 65 | 42 | 29 | 16 | 6 | 2 | KCL |
| 890501 | 2215 | 1.22 | 27 | 9 | 2 | 4 | 10.0 | 4.5 | 18.0 | 22000/22000 | 0.10 | 2.00 | 0.50 | 250/ | | 12 | | 72 | 45 | 32 | 19 | 6 | 2 | KCL |
| 890502 | 2295 | 1.22 | 24 | 9 | 2 | 4 | 10.0 | 4.7 | 18.0 | 23000/23000 | 0.10 | 1.70 | 0.50 | 380/ | | 13 | | 67 | 43 | 28 | 17 | 6 | 2 | KCL |
| 890503 | 2458 | 1.24 | 30 | 11 | 2 | 5 | 10.0 | 4.5 | 18.0 | 22000/23000 | | 1.60 | 0.30 | 320/ | | 14 | | 82 | 52 | 34 | 25 | 7 | 2 | KCL |
| 890504 | 2476 | 1.24 | 27 | 9 | 2 | 5 | 10.0 | 5.2 | 18.0 | 22000/23000 | 0.10 | 1.60 | 0.40 | 320/ | | 14 | | 72 | 45 | 30 | 21 | 7 | 2 | KCL |
| 890505 | 2573 | 1.28 | 27 | 10 | 3 | 7 | 10.0 | 5.0 | 18.0 | 22000/22000 | 0.10 | 1.20 | 0.30 | 320/320 | | 16 | | 75 | 48 | 37 | 25 | 8 | 5 | KCL |
| 890506 | 2603 | 1.28 | 27 | 15 | 7 | 12 | 10.0 | 5.0 | 18.0 | 20000/22000 | | 1.20 | 0.20 | 350/350 | | 16 | | 85 | 58 | 47 | 35 | 15 | 6 | KCL |
| 890507 | 2634 | 1.28 | 25 | 12 | 3 | 7 | 10.0 | 5.0 | 18.0 | 20000/20000 | 0.10 | 1.40 | 0.50 | 200/200 | | 16 | | 75 | 50 | 39 | 29 | 17 | 7 | POLYMER |
| 890508 | 2731 | 1.28 | 25 | 13 | 5 | 11 | 10.0 | 5.0 | 18.1 | 20000/20000 | 0.10 | 1.40 | 0.60 | 250/250 | | 16 | | 76 | 51 | 38 | 30 | 20 | 8 | POLYMER |
| 890509 | 2810 | 1.28 | 23 | 13 | 8 | 15 | 10.0 | 5.6 | 18.1 | 20000/20000 | 0.40 | 1.40 | 0.40 | 200/200 | | 16 | | 73 | 50 | 40 | 34 | 20 | 15 | POLYMER |
| 890510 | 2851 | 1.28 | 22 | 13 | 8 | 16 | 10.0 | 5.8 | 18.1 | 18000/18000 | 0.10 | 1.60 | 0.40 | 200/200 | | 16 | | 72 | 50 | 41 | 33 | 20 | 14 | POLYMER |
| 890511 | 2918 | 1.28 | 19 | 15 | 7 | 12 | 10.5 | 5.8 | 18.0 | 16000/16000 | 0.10 | 1.10 | 0.50 | 140/140 | | 13 | | 67 | 48 | 40 | 31 | 16 | 14 | POLYMER |
| 890512 | 2947 | 1.28 | 18 | 13 | 8 | 11 | 9.5 | 5.8 | 18.0 | 15000/15000 | 0.10 | 0.80 | 0.50 | 140/140 | | 14 | | 62 | 44 | 39 | 30 | 19 | 16 | POLYMER |
| 890513 | 3020 | 1.28 | 16 | 11 | 7 | 12 | 10.0 | 6.0 | 18.0 | 15000/15000 | 0.10 | 0.80 | 0.50 | 140/140 | | 13 | | 55 | 39 | 34 | 20 | 18 | 14 | POLYMER |
| 890514 | 3050 | 1.28 | 17 | 12 | 8 | 12 | 10.0 | 6.0 | 18.0 | 15000/15000 | 0.10 | 0.70 | 0.50 | 120/120 | | 13 | | 58 | 41 | 35 | 27 | 19 | 15 | POLYMER |
| 890515 | 3128 | 1.28 | 16 | 13 | 8 | 13 | 10.0 | 6.0 | 18.0 | 16000/16000 | 0.10 | 0.70 | 0.50 | 120/120 | | 13 | | 58 | 42 | 37 | 28 | 20 | 16 | POLYMER |
| 890516 | 3153 | 1.28 | 15 | 12 | 8 | 12 | 10.0 | 6.0 | 18.0 | 16000/16000 | 0.10 | 0.70 | 0.50 | 120/120 | | 13 | | 55 | 40 | 35 | 31 | 21 | 16 | POLYMER |
| 890517 | 3178 | 1.28 | 15 | 13 | 7 | 12 | 10.0 | 6.0 | 18.0 | 16000/16000 | 0.10 | 0.70 | 0.50 | 120/120 | | 13 | | 56 | 41 | 34 | 29 | 20 | 15 | POLYMER |
| 890518 | 3200 | 1.28 | 16 | 12 | 7 | 12 | 10.0 | 5.8 | 18.0 | 16000/16000 | 0.10 | 0.70 | 0.50 | 120/120 | | 13 | | 56 | 40 | 35 | 28 | 20 | 14 | POLYMER |
| 890519 | 3217 | 1.28 | 16 | 12 | 8 | 12 | 10.0 | 6.0 | 18.0 | 16000/16000 | 0.10 | 0.70 | 0.50 | 120/120 | | 13 | | 57 | 41 | 36 | 30 | 21 | 16 | POLYMER |
| 890520 | 3255 | 1.28 | 16 | 12 | 7 | 11 | 10:0 | 6.0 | 18.0 | 15000/15000 | 0.10 | 0.70 | 0.50 | 120/120 | | 13 | | 56 | 40 | 33 | 26 | 14 | 14 | POLYMER |
| 890521 | 3332 | 1.28 | 15 | 8 | 5 | 10 | 10.0 | 6.0 | 18.0 | 15000/15000 | 0.10 | 0.70 | 0.50 | 120/120 | | 14 | | 45 | 30 | 25 | 20 | 14 | 12 | POLYMER |
| 890522 | 3352 | 1.28 | 13 | 8 | 5 | 10 | 10.0 | 6.2 | 18.0 | 14000/14000 | 0.10 | 0.80 | 0.60 | 160/160 | | 13 | | 42 | 29 | 23 | 18 | 11 | 9 | POLYMER |

Table B-10

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Norsk Hydro

Daily mud properties

System : BORE

Date 6/7-1989

Well: 5514/30-1
Mud Contractor: PROMUD DANMARK APS
Data: "Mid depth" from table 3, otherwise from table 14.

| Date | Mid. depth m,MD | Mud Dens. (SG) | PV cp | YP Pa | GEL 0 Pa | GEL 10 Pa | pH | 100 psi (cc) | HP/HT (cc) | Cl- inn/out mg/l | Alkalinity Pf | Alkalinity Pm | Alkalinity Mf | Ca++ inn/out mg/l | Oil % | Sol % | H2O % | V.G. meter at 115 gr. F 600 rpm | 300 rpm | 200 rpm | 100 rpm | 6 rpm | 3 rpm | Mud Type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 890523 | 3352 | 1.28 | 15 | 9 | 7 | 12 | 10.0 | 6.0 | | 14000/14000 | 0.10 | 0.70 | 0.60 | 160/160 | | 13 | | 48 | 33 | 27 | 21 | 18 | 14 | POLYMER |
| 890524 | 3352 | 1.28 | 17 | 10 | 8 | 12 | 10.0 | 6.0 | | 14000/14000 | 0.10 | 0.70 | 0.60 | 160/160 | | 13 | | 54 | 37 | 31 | 25 | 20 | 16 | POLYMER |
| 890525 | 3352 | 1.28 | 15 | 9 | 7 | 12 | 10.0 | 6.0 | | 14000/14000 | 0.10 | 0.70 | 0.60 | 160/160 | | 13 | | 48 | 33 | 29 | 23 | 18 | 14 | POLYMER |
| 890526 | 3352 | 1.29 | 12 | 5 | 2 | 4 | 11.5 | 18.0 | | 14000/14000 | 2.00 | 5.00 | 3.00 | 360/360 | | 14 | | 34 | 22 | 18 | 13 | 7 | 3 | POLYMER |
| 890527 | 3380 | 1.29 | 20 | 8 | 2 | 3 | 10.5 | 5.6 | 18.0 | 14000/14000 | 1.00 | 3.00 | 2.00 | 160/160 | | 10 | | 57 | 37 | 25 | 14 | 3 | 2 | POLYMER |
| 890528 | 3425 | 1.29 | 21 | 10 | 2 | 4 | 10.5 | 5.5 | 20.0 | 14000/14000 | 0.80 | 2.60 | 2.10 | 100/100 | | 11 | | 62 | 41 | 30 | 17 | 3 | 2 | POLYMER |
| 890529 | 3498 | 1.29 | 22 | 11 | 2 | 5 | 10.0 | 4.0 | 19.0 | 14000/14000 | 0.50 | 2.60 | 2.00 | 120/120 | | 11 | | 66 | 44 | 30 | 20 | 7 | 4 | POLYMER |
| 890530 | 3556 | 1.32 | 27 | 10 | 2 | 5 | 10.0 | 4.8 | 20.0 | 12000/12000 | 0.30 | 1.20 | 0.80 | 100/100 | | 14 | | 74 | 47 | 38 | 25 | 5 | 3 | POLYMER |
| 890531 | 3615 | 1.32 | 30 | 12 | 2 | 3 | 10.0 | 4.8 | 20.0 | 12000/12000 | 0.30 | 1.40 | 1.10 | 160/160 | | 14 | | 84 | 54 | 41 | 25 | 6 | 3 | POLYMER |
| 890601 | 3625 | 1.32 | 30 | 8 | 2 | 5 | 10.0 | 5.0 | 20.0 | 12000/12000 | 0.10 | 0.90 | 0.70 | 200/200 | | 14 | | 77 | 47 | 36 | 22 | 6 | 3 | POLYMER |
| 890602 | 3625 | 1.30 | 33 | 9 | 2 | 5 | 10.0 | 5.1 | 20.0 | 12000/12000 | 0.10 | 1.00 | 0.80 | 200/200 | | 15 | | 84 | 51 | 40 | 26 | 6 | 3 | POLYMER |

Table B-11

| ((( (ooo) ------- Norsk Hydro | Mud consumption<br>System : BORE<br>Well: 5514/30-1<br>Mud company: PROMUD DANMARK APS | Date 9/6-1989<br>13 |
|---|---|---|

| | | Actual used |
|---|---|---|
| **Drilling of 26 " hole** | | |
| BARITE | Kg | 17000 |
| BENTONITE | Kg | 25650 |
| CACO3 | Kg | 12125 |
| CAUSTIC SODA | Kg | 575 |
| KCL | Kg | 25000 |
| PROPOL REG | Kg | 350 |
| PROPOL SL | Kg | 3125 |
| SODA ASH | Kg | 575 |
| **Drilling of 17 1/2" hole** | | |
| BARITE | Kg | 143000 |
| CAUSTIC SODA | Kg | 825 |
| KCL | Kg | 53000 |
| PROPOL REG | Kg | 7525 |
| PROPOL SL | Kg | 5075 |
| SODA ASH | Kg | 300 |
| XCD-POLYMER | Kg | 100 |
| PRODEFOAM | l | 300 |
| **Drilling of 12 1/4" hole** | | |
| BARITE | Kg | 99000 |
| BENTONITE | Kg | 3700 |
| CACO3 | Kg | 13800 |
| CAUSTIC SODA | Kg | 3250 |
| NAHCO3 | Kg | 750 |
| PROPOL REG | Kg | 3500 |
| PROPOL SL | Kg | 4600 |
| PROTHIN | Kg | 2530 |
| SODA ASH | Kg | 125 |
| PRODEFOAM | l | 430 |
| **Drilling of 8 1/2" hole** | | |
| BARITE | Kg | 23000 |
| BENTONITE | Kg | 1050 |
| CAUSTIC SODA | Kg | 250 |
| MILTEMP | Kg | 1525 |
| NAHCO3 | Kg | 1125 |
| PROPOL REG | Kg | 1150 |
| PROPOL SL | Kg | 1125 |
| PROTHIN | Kg | 2525 |
| PRODEFOAM | l | 180 |

## 7. Total cost report

Depth : 3.624 m
Rig rate : DKK 262.000
Exchange : USD 1 = DKK 7.20
Start date: 05.04.89 at 00.01 hr
Final date: 06.06.89 at 24.00 hr
Total days: 63.0

Estimated costs in DKK 1.000:

| | |
|---|---|
| Rig positioning & survey: | 900 |
| Rig costs incl. rig mob/demob.: | 22.810 |
| Drilling tools, H2S & Oil spill equip.: | 6.270 |
| Wellhead & mudline suspension: | 1.500 |
| Casing & casing services: | 5.860 |
| Cement & cementing services: | 2.230 |
| Mud & mud services: | 3.820 |
| Wire line logging: | 3.050 |
| Supply & stand by vessels: | 3.780 |
| Helicopter: | 1.450 |
| Misch. transport & freight: | 315 |
| Warehouse & office: | 3.340 |
| Onshore & offshore supervision: | 6.300 |
| Estimated total well cost: | 61.625 |

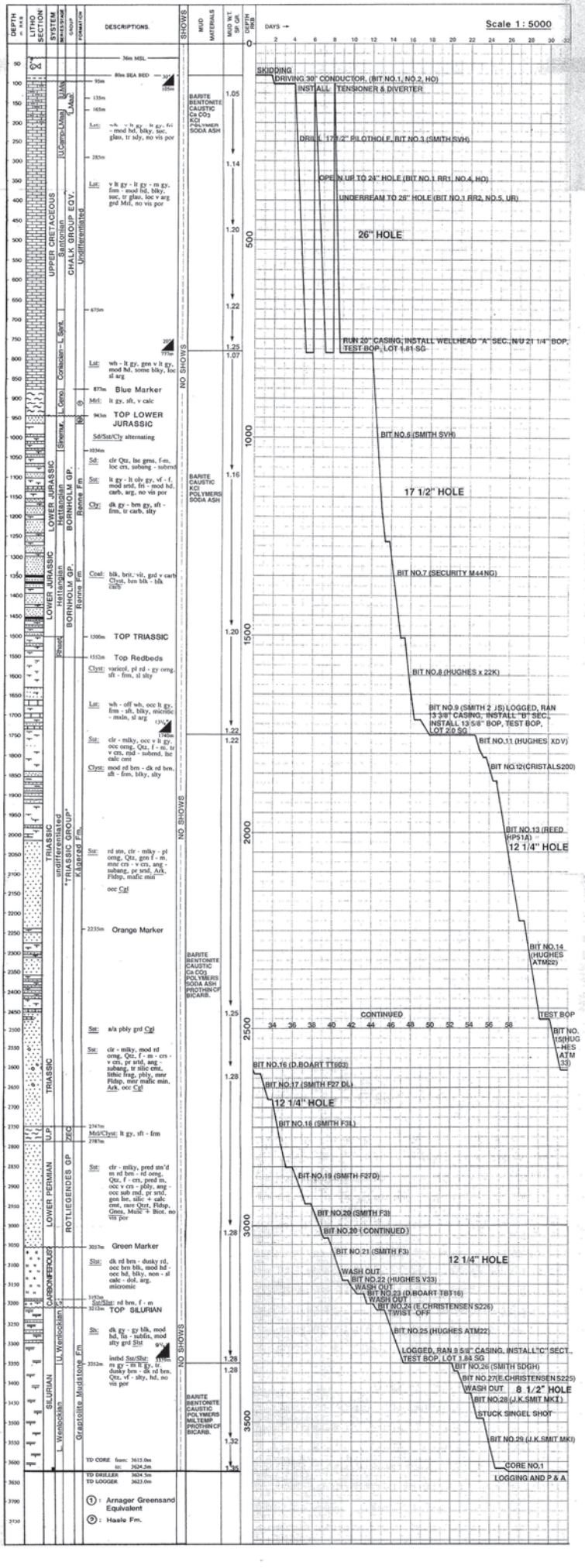
Norsk Hydro

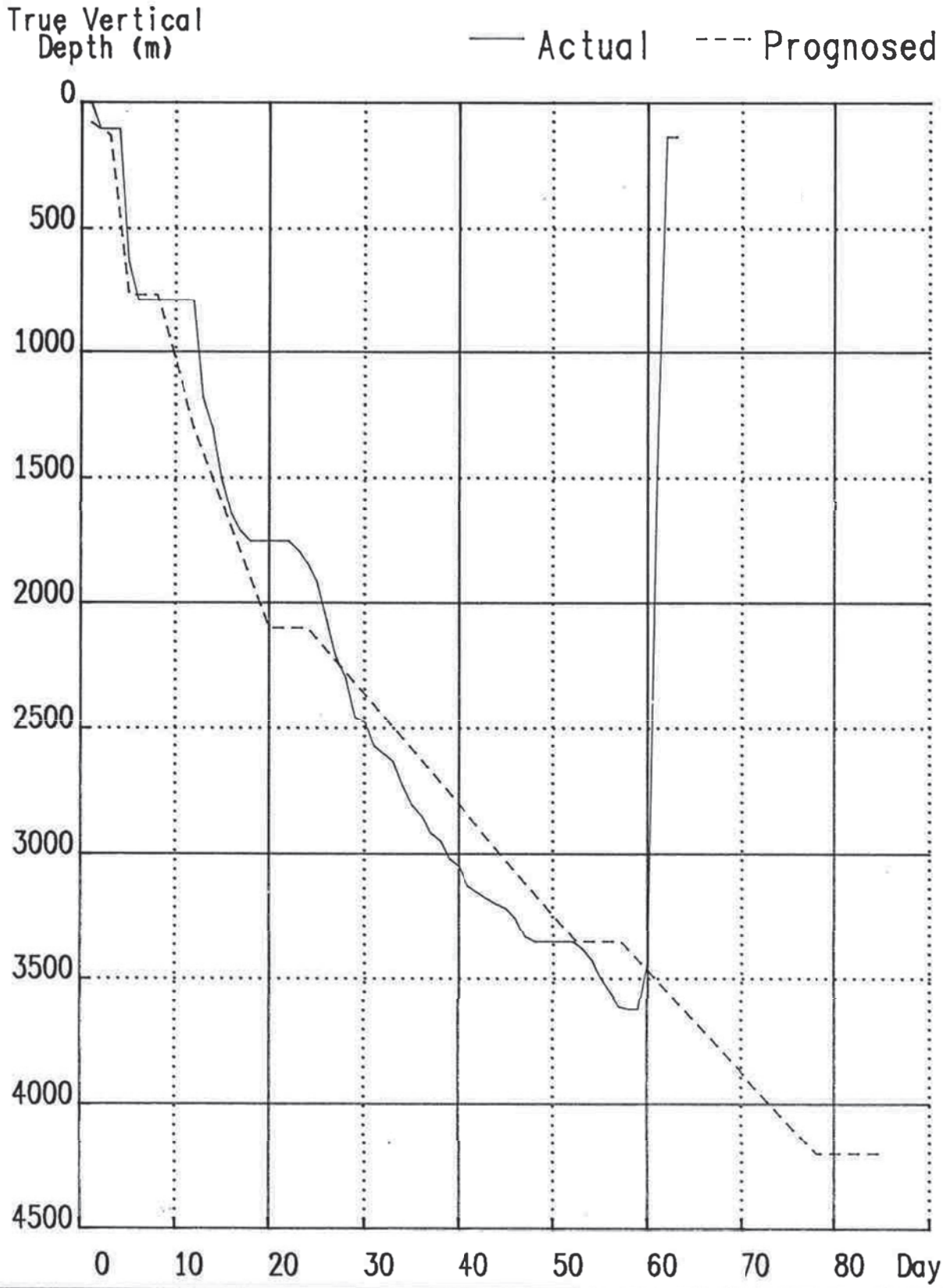
# DRILLING PROGRESS, WELL 5514/30-1

OPERATOR : NORSK HYDRO
COORDINATES : 55° 00' 54.09"N
: 14° 18' 43.14"E

SPUD IN : 06.04.89 AT 17:00 HRS
WELL COMPL. : 06.06.89 AT 24:00 HRS
RIG : GLOMAR MORAY FIRTH I

WATER DEPTH : 44m
RKB to MSL : 36m
RKB to SEABED : 80m






Norsk Hydro
Drilling Department

Date:19890609

PROGNOSED AND ACTUAL DRILLING CURVES

WELL: 5514/30-1

Fig.: B-5