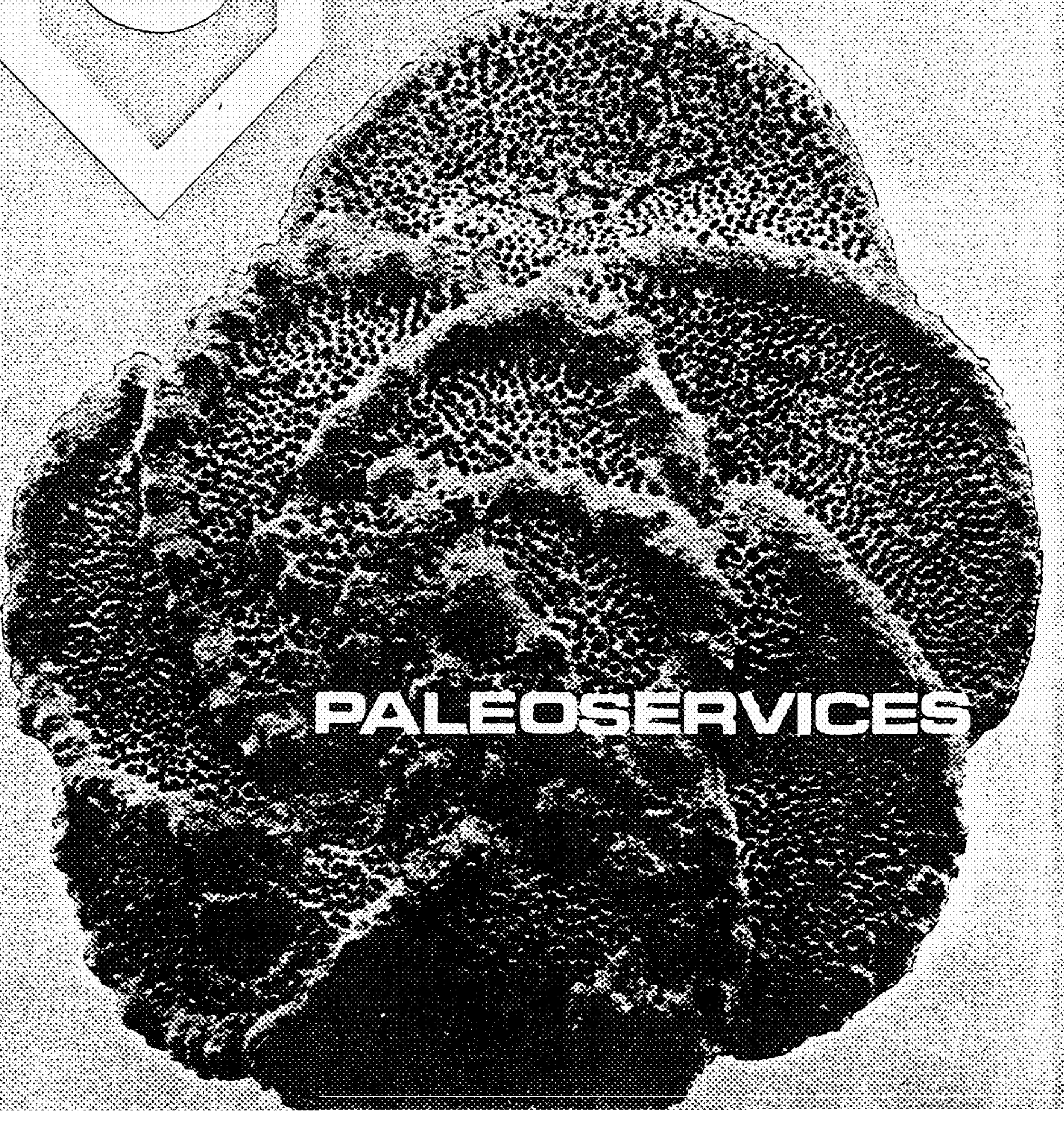

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WELL 34/10-4

NORWEGIAN OFFSHORE

(270m-2,600m T.D.)

PALAEONTOLOGICAL/STRATIGRAPHICAL FINAL REPORT.

Project No.

665.

Stratigraphers

R.W.MEYRICK. K.J.GUEINN.

Directors: Dr. V. L. Roveda, Dr. D. D. Bayliss.

Date

December, 1979.

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ENCLOSURES.

1. Stratigraphic log (scale 1:2000) 270m-2,600m.
2. Stratigraphic log (scale 1:500) 1,680m-2,600m.

1. INTRODUCTION.

This report presents the results of the stratigraphical and palaeontological study of samples from well 34/10-4, drilled by Statoil in the North Sea (Norwegian offshore) during 1979.

The information presented is based on the analysis of ditch samples collected at 10m intervals between 270m and 1,500m, and at 3m intervals from 1,500m to 2,600m (T.D.)

Sixty-six sidewall cores were analysed between 1,706m and 2,579m, and twenty-nine core chips from cores cut in the Brent and Statfjord Formations.

A total of seventy four samples (sixteen cores, forty six SWC's and twelve ditch samples) have been examined for palynology.

A 1:2000 study is presented for the whole well and a 1:500 study for the lower part, below 1,680m, to include the Cretaceous, Jurassic and Triassic section.

Interval tops are taken at sample depths although petrophysical logs were provided by Statoil.

2. CONCLUSIONS.

1. The highest sample received (at 270m) is a sandy clay dated as Pleistocene. Pleistocene to Pliocene sandy clays continue to 900m and were probably deposited in a marine, mainly inner sublittoral environment.

2. No rocks of Miocene age are present. The Pliocene rests unconformably on Oligocene at 900m.

3. The Oligocene (900m-ca.1,100m) and Eocene (ca.1,100m-1,518m) sections comprise claystone, sand and limestone. These beds were deposited in a marine, outer sublittoral to bathyal environment. The sands were probably emplaced by turbidity currents or mass flow.

4. The basal Eocene/top Paleocene section (1,518m-1,578m) is represented by the regionally distinctive 'Ash Marker' comprising tuffaceous claystones with pyritised diatoms.

5. The Paleocene section (1,578m-1,692m) comprises mainly claystones deposited in a marine, outer sublittoral to bathyal environment.

6. The Late Cretaceous section (1,692m-1,816m) is represented by a thin series of claystones and occasional limestones, of Maastrichtian-?Campanian age, which unconformably overlie beds of Middle Jurassic age at 1,816m. These were deposited in a marine outer sublittoral to upper bathyal environment.

7. The Middle Jurassic Brent Unit/Formation (1,816m-1,917m) comprises mainly fine sands in the upper part and fine-coarse poorly sorted sands (Broom Sub Unit/Member) below 1,911m.

   Palynological dating of this section suggests that the lower part of the Brent is present and is of earliest Bathonian to Early Bajocian age.

8. There appear to be no breaks within the Dunlin Unit/Formation (1,917m-2,338m), which ranges in age from Early Bajocian (=Aalenian) to Sinemurian. A number of faunal markers are mentioned in the report and these appear to be regionally consistent and can be used in correlations. Faunal/floral and lithological evidence suggests that deposition was in a marine mainly sublittoral environment.

9. The prominent lithological break between the Dunlin Unit and the Statfjord Formation, at 2,338m, may represent an unconformity, but the faunal and floral evidence is inconclusive.

10. The uppermost part of the Statfjord Formation is dated as being not older than Sinemurian in age, based on palynological evidence from core samples between 2,352 and 2,356m. Below 2,356m, due to extremely poor samples (abundant additive) and unproductive lithologies (red beds), floral evidence for the age of this section is inconclusive. An age of not older than Rhaetian is indicated for the section down to 2,579m based on very limited palynological evidence.

    Sands and sandstones (2,338m-2,431m) were deposited in a marine littoral to inner sublittoral environment. The sequence becomes more continental downhole, with the incoming of brown and purple claystones at 2,431m sideritic claystones at 2,443m and red claystones/siltstones at 2,480m. These lithological markers may be locally correlatable.

3. STRATIGRAPHICAL SUMMARY.

Interval			Age.	Thickness.
270	-	750m	Pleistocene-Pliocene	480m
750	-	900m.	Pliocene	150m
----------			Unconformity ----------	
900	-ca.	1,100m	Oligocene	200m
ca.1,100	-ca.	1,180m	?Eocene	80m
1,180	-	1,410m	Eocene	230m
1,410	-	1,450m	Eocene, ?Early	40m
1,450	-	1,518m	Eocene, Early	68m
1,518	-	1,578m	Early Eocene-Paleocene	60m
1,578	-	1,692m	Paleocene	114m
1,692	-	1,716m	Late Cretaceous, Late Maastrichtian	24m
1,716	-	1,816m	Late Cretaceous, Maastrichtian-?Campanian	100m
----------			Unconformity ----------	
1,816	-	1,901.6m	Middle Jurassic, earliest Bathonian -Early Bajocian (=Aalenian)	85.6m
1,901.6	-	1,917m	Middle Jurassic, Early Bajocian (=Aalenian)	15.4m
1,917	-	1,973m	Middle-Early Jurassic, Early Bajocian (=Aalenian)-Late Toarcian	56m
1,973	-	2,005m	Early Jurassic, Toarcian	32m
2,005	-	2,020m	" " Early Toarcian	15m
2,020	-	2,044m	" " Early Toarcian-Late Pliensbachian	24m
2,044	-	2,062m	" " ?Late Pliensbachian	18m
2,062	-	2,236m	" " Late Pliensbachian	174m
2,236	-	2,296m	" " Early Pliensbachian	60m
2,296	-	2,338m	" " Early Pliensbachian -Sinemurian	42m
----- ? ------ ? -----			Unconformity ----- ? ----- ? ----------	
2,338	-	2,356m	Early Jurassic, Sinemurian	18m
2,356	-	2,579m	" " (?Sinemurian-Hettangian), Late Triassic, (Rhaetian)	223m
2,579	-	2,600m (T.D.)	Late Triassic, Undifferentiated	21m

4. STRATIGRAPHY.

This discussion supplements the information presented on the stratigraphic logs (Enclosures 1 and 2). The lithology and biota are described and the age and depositional environments interpreted. An attempt has been made to assign the major lithostratigraphical divisions of the Mesozoic to those of Deegan and Scull (1977).

4.1 270m-900m PLEISTOCENE-PLIOCENE.

Lithology:

Sandy clay, fine to occasionally coarse grained with pyrite and glauconite; some gravel of igneous and metamorphic rocks.

Biostratigraphy:

270m-750m Pleistocene-Pliocene.

The microfauna is diverse and abundant, it includes the foraminiferids Protelphidium orbiculare, Globigerina pachyderma, G. bulloides, Elphidiella hannai, E. groenlandica, Islandiella teretis, Cibicides lobatulus grossa, Elphidium incertum clavatum, Planulina ariminiensis, Cassidulina laevigata and occasional reworked Cretaceous taxa. Ostracods including Rabilimis mirabilis and Acanthocythereis dunelmensis are also present.

This interval has been called Pleistocene or Pliocene in previous wells in this block. It is now thought that the boundary of these series lies within the interval. The top of Elphidiella hannai (=E. cf. arctica in previous report) at 500m is a regional marker of Early Pleistocene (Icenian) age.

750m-900m Pliocene.

Foraminiferids are common and diverse, and include many of the taxa present above. The interval is regionally characterised by the presence of abundant Sigmoilina schlumbergeri, Cibicides lobatulus grossa, Islandiella sp., Cibicides pseudoungerianus (below 800m), Globigerina pachyderma and G. bulloides.

Environment:

Marine, inner sublittoral. The sand and gravel debris are probably in part ice-rafted.

4.2 900m-Ca.1,100m OLIGOCENE.

Pliocene sediments rest unconformably on Oligocene sediments at 900m.

Lithology:

900m-910m Claystone, glauconitic; with sandstone, fine-medium grained, subrounded, glauconitic and pyritic.

910m-920m 'Chert' light brown glauconitic and claystone, light brown, non calcareous.

920m-960m Claystone, as above.

960m-1,100m Claystone, as above together with some sand, fine-medium grained, subangular.

Biostratigraphy:

The Oligocene section is dominated by sponge spicules, including Geodia sp., together with occasional radiolaria and diatoms and rare foraminiferids including Alabamina tangentialis. This fauna has previously been encountered in rocks of Miocene or Oligocene age but the associated lithology is regionally restricted to the Oligocene.

Environment:

Marine, outer sublittoral to bathyal.

4.3 Ca.1,100m-Ca.1,180m ?EOCENE.

Lithology:

Sand, fine-medium grained, subrounded; at 1,160m a thin bed of fine angular sandstone; rare claystone as above.

Biostratigraphy:

Rare agglutinating foraminiferids are present in the lower part of the interval.

Remarks:

This interval is mainly recognised by its lithological characteristics and is only tentatively assigned to the Eocene.

Environment:

Marine, outer sublittoral to bathyal with emplacement of the sand by turbidity currents or mass flow.

4.4 Ca.1,180m-1,518m EOCENE.

Lithology:

1,180m-1,290m Sand, fine-medium grained, subrounded; increasing amounts of claystone, light brown, downwards.

1,290m-1,430m Claystone, mainly green; sand as above and below 1,310m beds of grey dolomite. Pyrite common.

1,430m-1,470m Claystone, mainly green.

1,470m-1,518m Claystone, mainly green with beds of white and light grey limestone.

Biostratigraphy:

1,180m-1,410m Eocene, undifferentiated.

The top Eocene is tentatively taken at the first down-hole appearance of common agglutinating foraminiferids, which include Cyclammina sp., Ammodiscus glabratus, Silicosigmoilina sp., Rhabdammina discreta, Glomospira charoides and Bathysiphon eocenicus. Occasional radiolaria occur below 1,190m.

1,410m-1,450m. Eocene, ?Early.

The highest downhole occurrence of Cyclammina acutidorsata (1,410m) is usually within the Early Eocene.

1,450m-1,518m Eocene, Early.

Agglutinating foraminiferids continue throughout this interval but it is distinguished regionally by two prominent faunal markers: common Radiolaria, at 1,450m, and Globigerina gr. triloculinoides, at 1,500m.

Environment:

Marine, outer sublittoral to bathyal . The sand beds in the upper part were probably emplaced by turbidity current or mass flow.

4.5 1,518m-1,578m EARLY EOCENE-PALEOCENE.

Lithology:

Claystone, and tuffaceous claystone, grey-black and green; occasional black limestone.

Biostratigraphy:

Although agglutinating foraminiferids persist through this interval; they are probably caved.

This interval is recognised by the regionally persistent occurrence of the diatom Coscinodiscus sp. 1 which usually approximately coincides with the top of the tuffaceous claystones.

Environment:

Marine, outer sublittoral to bathyal with contemporaneous volcanic activity.

4.6 1,578m-1,692m PALEOCENE.

Lithology:

Claystone, green and grey with siderite and pyrite; occasional thin beds of limestone between 1,600m and 1,622m and fine-medium loose sand.

Biostratigraphy:

The top of the Paleocene is taken at a faunal break marked by the re-appearance of common agglutinating foraminiferids, including Bolivinopsis spectabilis, which is characteristic of the Late Paleocene in the North Sea.

It is possible that only the Late Paleocene section is represented in this well since the Middle and Early Paleocene regional paleontological markers are absent.

Environment:

Marine, outer sublittoral to bathyal.

4.7 1,692m-1,816m LATE CRETACEOUS, Maastrichtian-?Campanian.

Lithostratigraphy:

Shetland Group.

1,692m-1,698m. Claystone, grey.

1,698m-1,704m. No sample.

1,704m-1,816m. Ditch cuttings through this interval are comprised dominantly of drilling mud additive, with a very low percentage of white and light grey limestone.

Fifteen sidewall cores were examined between 1,706m and 1,811m these comprise grey calcareous claystones, occasionally silty.

Biostratigraphy:

1,692m-1,716m Late Maastrichtian.

Foraminiferids are diverse and abundant throughout this interval and include the Late Maastrichtian association of Pseudotextularia elegans, Globotruncanella havanensis, Globotruncana contusa, G. stuartiformis, Rugoglobigerina rugosa and Planomalina messinae.

1,716m-1,816m Maastrichtian-?Campanian.

The first downhole appearance of Reussella szajnochae is a consistent regional marker shown elsewhere to lie within the lower part of the Late Maastrichtian. Many of the longer ranging benthic and planktic calcareous foraminiferids continue from the interval above including Rugoglobigerina rugosa, Planomalina messinae, Globotruncanella havanensis, Gyroidia nitida etc.

Below 1,770m agglutinating foraminiferids become more common and dominate the fauna. This association is regionally typical of the Early Maastrichtian - Late Campanian, but no taxa restricted to the Campanian are present. There are no Cretaceous rocks older than those already described present in this well.

Environment:

Marine, outer sublittoral to upper bathyal, influenced by oceanic watermasses during the Late Maastrichtian.

4.8 1,816m-1,917m MIDDLE JURASSIC, Early Bathonian - Early Bajocian (=Aalenian).

Lithostratigraphy:

Brent Unit/Formation.

Ditch Cuttings - 1,816m-1,830m. Sample quality too poor to ascertain inplace lithology.

1,830m-1,911m. No cuttings received.

1,911m-1,917m. Sand, fine to coarse grained, angular to subangular, some hard dolomitic matrix (Broom Sub-Unit/Member).

Sidewall Cores - 1,816m. Sandstone, fine grained, angular, lignite and mica; heavily contaminated.

1,822m. Sandstone, fine grained, angular, oily.

1,912m. Claystone, silty, black-grey, pyritic, micaceous.

1,914m. Coal; and black, micaceous, non-calcareous claystones.

Cores - (22 core chips received between 1,826m-1,909m).
1,826m-1,890.95m. Sand/sandstone, fine grained, angular to subangular, occasional mica, rare lignitic debris.

1,896m-1,909m. Sand/sandstone as above with laminations of sandy micaceous claystone.

Biostratigraphy:

1,816m (SWC)-1,901.6m (CORE) Earliest Bathonian - Early Bajocian (=Aalenian).

Microflora:

The sidewall core at 1,816m contained an assemblage which included the dinoflagellate cyst Nannoceratopsis gracilis and the miospores Chasmatosporites spp. and Quadraeculina anellaeformis. These indicate an age not younger than earliest Bathonian, if in place and not the result of contamination.

Eight core samples examined between 1,826m and 1,896m contained no palynomorphs, only rare fragments of inertinite/vitrinite.

Microfauna:

There is no inplace microfauna in this interval. Foraminiferids present in SWC 1,816m are assumed to be contaminants.

1,901.6m (CORE) - 1,917m. Early Bajocian (=Aalenian)

Microflora:

Four core samples and two SWC's have been examined. Rich and diverse assemblages of palynomorphs are present in all of the samples. The dinoflagellate cyst Nannoceratopsis gracilis is present throughout and is overwhelmingly abundant in the sample at 1,907.20m. Significant miospore taxa present include Chasmatosporites spp., Quadraeculina anellaeformis, Callialasporites dampieri, Inaperturopollenites turbatus, Trilites minutus and Ischyosporites variegatus.

The consistent occurrence of N. gracilis, often in overwhelming numbers is characteristic of the lower part of the Brent Unit/Formation, and is considered to indicate an Early Bajocian (=Aalenian) age.

Microfauna:

"Shallow" marine - deltaic.

4.9 1,917m-2,338m. MIDDLE-EARLY JURASSIC, Early Bajocian (=Aalenian)-Sinemurian.

Lithostratigraphy:

Dunlin Unit/Formation.

1,917m-1,984m. Claystone and siltstone, dark grey, with occasional beds of brown limestone; pyrite and mica.

1,984m-1,993m. Cement.

1,993m-2,020m. Dominantly cement, small percentage of lithologies as above. Two sidewall cores at 2,003m and 2,020m shot in claystone/siltstone, grey with occasional pyrite and mica.

2,020m-2,044m. Sand, fine-medium, occasionally coarse grained, angular to subrounded, with pyrite and lignite; below 2,032m occasional sand grains are coated with pyrite. Two sidewall cores, at 2,030m and 2,038m, shot in sand, fine-medium.

2,044m-2,092m. Sandstone, fine grained, angular, calcareous.

2,092m-2,128m. Sample quality poor; in place lithology probably siltstone, claystone and fine sandstone.

2,128m-2,158m. Limestone, light brown with interbedded grey claystone and siltstone.

2,158m-2,167m. As above, with fine angular sand and abundant pyrite.

2,167m-2,197m. Sand, fine-medium grained, angular, clean with occasional beds of grey claystone and siltstone.

Intra Aalenian

2,197m-2,285m. Claystone and siltstone, grey, occasional thin limestones and fine sandstone. Pyrite present throughout and ?phosphatic pellets/ooliths are common below 2,227m.

2,285m-2,332m. Sandstone; very fine grained, angular; interbedded with siltstone and occasional grey claystone.

2,332m-2,338m. Sand, fine-medium grained, angular, with occasional grey claystone and siltstone.

Biostratigraphy:

1,917m-1,973m. Early Bajocian (=Aalenian)-Late Toarcian.

Microfauna:

Agglutinating foraminiferids, including Haplophragmoides sp. Trochammina spp. and Ammodiscus "incertus", typify this interval. The presence of the foraminiferid Nodosaria regularis indicates an earliest Middle Jurassic to latest Early Jurassic age. The ostracods Camptocythere foveolata gr. (1940m) and C. parvula (1947m) indicate an Early Bajocian (=Aalenian) age.

Microflora:

The nine sidewall cores examined from this interval are characterised by a varied assemblage of dinoflagellate cysts, several of which are undescribed and are therefore here given informal names. Taxa present include Nannoceratopsis gracilis, Comparodinium aff. punctatum (top at 1,938m), Scriniocassis weberi (top at 1,960m), a single specimen of Mancodinium semitabulatum (1,963m), Dinoflagellate Type C (top at 1,918m), Plankton Type 2 (Schulze and Mai in Doring et al. 1966) (top at 1,918m), and Dinoflagellate Type 4, together with acritarchs, which are often abundant.

Rich and diverse, well preserved miospore assemblages are also present. Age significant taxa present include Callialasporites dampieri, Inaperturopollenites turbatus, Coronatispora valdensis and Trilites minutus. The presence of these miospore species, indicates an age not older than Late Toarcian.

1,973m-2,005m. Toarcian, undifferentiated.

Microfauna:

The top occurrence of a taxon approaching Campto-cythere toarciana indicates that the section below 1,977m is of Toarcian age probably Early Toarcian.

Below 1984, poor samples may obscure the highest occurrence of the ostracods present in the interval below.

Microflora:

The single SWC (2,003m) examined contained the dinoflagellate cysts Nannoceratopsis gracilis and Scriniocassis weberi (rare), together with abundant miospores, which are not age diagnostic.

2,005m-2,020m. Early Toarcian.

Microfauna:

The fauna, includes the ostracods Kinkelinella intrepida, K. debilis and K. sermoisensis and the foraminiferid Verneuilinoides cf. mauritii, is a prominent regional marker of Early Toarcian age.

Microflora:

No samples have been examined from this interval.

2,020m-2,044m. Early Toarcian-Late Pliensbachian.

Microfauna:

Only caved and long-ranging foraminiferids and ostracods are present in this interval.

Microflora:

Three SWC's have been examined. The dinoflagellate cyst assemblages are less varied than in the overlying intervals, comprising principally Nannoceratopsis gracilis and Mancodinium semitabulatum. Between 2,020m and 2,160 Mancodinium semitabulatum is consistently present. Morbey (1978) indicates that this taxon is most common and consistent in the Late Pliensbachian, although Wille and Gocht (1979) have observed it in the early Toarcian of Germany.

Miospores are abundant, but show little diversity and no age diagnostic taxa have been recorded.

2,044m-2,062m. ?Late Pliensbachian.

Microfauna:

There are no inplace ostracods or foraminiferids in this interval.

Microflora:

No samples have been examined from this interval.

Remarks:

This interval is recognised by its lack of fauna and distinctive lithology; it is tentatively dated as Late Pliensbachian.

2,062m-2,236m. Late Pliensbachian.

Microfauna:

The ostracod Ogmoconchella gr. adenticulata first occurs at 2,086m. Ostracods of this genus are known to occur in onshore sections in the earliest Toarcian but its normal range is within the Pliensbachian.

There are a number of consistent faunal markers in this interval which can be recognised in other wells in the area, and support a Late Pliensbachian age for this interval:-

2,062m. top Ogmoconchella gr. adenticulata

2,113m. top Kinkelinella sp. (Ost. 19. Klingler-K. sermoisensis Plexus).

2,128m. top Ogmoconchella aequalis (large form)

2,179m. top Ogmoconcha amalthei amalthei.

2,197m. top Ogmoconchella contractula and Dentalina matutina.

2,221m. top Wicherella semiora. (This taxa is restricted to the lower part of A. margaritatus ammonite zone in onshore sections).

Microflora:

Nine sidewall cores, all of which yielded abundant palynomorphs have been examined. The dinoflagellates Nannoceratopsis gracilis and Mancodinium semitabulatum are present consistently until 2,185m and 2,160m respectively. Both of these taxa are known to occur rarely in strata of Early Pliensbachian age; they are however most consistently present in the Late Pliensbachian.

Nannoceratopsis aff. spiculata occurs abundantly at 2,185m. The similar form N. spiculata is not known to occur below the Late Pliensbachian (Morbey, 1978).

The miospore assemblages are rich, comprising principally long ranging, non age diagnostic taxa. Forms of Cerebropollenites definitely assignable to C. thiergartii occur consistently from 2,062m downwards although closely related forms are present intermittently higher in the sequence. This suggests a Late Pliensbachian or older age for the sequence below 2,062m.

2,236m-2,296m. Early Pliensbachian.

Microfauna:

This interval is characterised by the ostracods Gammacythere ubiquita and Ogmoconchella transversa; the former is restricted to the Early Pliensbachian.

In the lower part (2,287m) an abundance level of Ogmoconcha amalthei gr. together with Ogmoconchella cf. danica forms an important regional marker, still within the Early Pliensbachian.

Microflora:

Two SWC's (2,265m and 2,285m) have been examined. Rich assemblages of long ranging miospores are present including Cerebropollenites mesozoicus, C. thiergartii, bisaccate pollen, Classopollis spp., Quadraeculina anellaeformis and Chasmatosporites spp.

2,296m-2,338m. Early Pliensbachian-Sinemurian.

Microfauna:

This interval is distinguished by the highest occurrence of Kinkelinella spp. together with many of the ostracods and foraminiferids which occurred above. The specimens of Kinkelinella spp., are poorly preserved and are not specifically indentified; they may be Early Pliensbachian or Sinemurian taxa. At 2,332m a single poorly preserved specimen of an ostracod which approaches Cristacythere betzi indicates the presence of the Late Sinemurian.

Microflora:

No age-restricted palynomorphs have been observed in the two SWC's examined (2,315 and 2,337m).

Environment:

1,917m-2,020m. Marine, sublittoral,possibly outer.
2,020m-2,040m. "Shallow marine", possibly littoral.
2,040m-2,338m. Marine, inner sublittoral.

4.10 2,338m-2,600m (T.D.) EARLY JURASSIC - TRIASSIC.

Lithology:

Statfjord - Cormorant Formations.

2,338m-2,431m. Sand/sandstone, fine to coarse grained above 2,386m, and fine to medium below, angular - subangular; occasional pyrite and glauconite in the upper part, below 2,422m some calcareous cement and occasional lithic clasts. Extremely poor ditch cuttings 2,389m-2,422m. Six core samples between 2350.5m and 2,356m are mainly sandstones, fine - medium and fine - coarse grained, cement variably calcareous and ?kaolinite; occasional woody debris; at 2,356m dark brown claystone. Two sidewalls 2,391m and 2407.5m in similar lithologies to the sands above but a sidewall core at 2,370m in brick-red claystone.

2,431m-2,443m. As above with some purple and brown sandy claystone.

2,443m-2,461m. As above with brown sideritic sandy claystone and fine-medium sideritic sand.

2,461m-2,527m. Ditch cuttings comprised of drilling mud additive only. Sidewall core at 2,480m is brick red siltstone/claystone.

2,527m-2,600m. Sand/sandstone, fine, angular often pink - stained, with brick-red claystone and siltstone.

Biostratigraphy:

Microfauna:

No in place fauna was found in this interval.

Microflora:

Abundant palynomorphs have been recorded from core samples examined between 2,352m and 2,356m. The assemblages are principally long ranging taxa, dominantly land - derived miospores. The occurrence of rare specimens of Cerebropollenites mesozoicus, together with C. thiergartii, at 2,356m, suggests an age not older than Sinemurian for the upper part of this interval.

Rare undescribed dinoflagellate cysts (Dinoflagellate Type 7) are present at 2,356m.

Sixteen SWC's have been examined from the interval below the core; six of these contained palynomorphs. No taxa definitely indicative of an Hettangian or Rhaetian age have been recorded. The presence of rare specimens of Quadraeculina anellaeformis in the SWC's at 2,518m and 2,579m, if in place and not the result of drilling mud contamination, indicate an age not older than Rhaetian.

The small number of sidewall cores yielding palynomorphs is a result of their generally unfavourable lithology for palynomorph recovery.

Ditch cutting samples examined through this interval also yielded no taxa definitely indicating a Hettangian or Rhaetian age; many of the taxa present are probably the result of caving.

Due to a combination of unfavourable lithologies and poor quality ditch samples it has not been possible to provide a precise age stratigraphic breakdown of the interval below 2,356m. Comparable intervals in other wells in the area have been dated as of Hettangian - Rhaetian age.

Environment:

2,338m-2,431m. Marine; littoral to inner sublittoral.
2,431m-2,480m. Continental (alluvial) possibly marine - paralic in part.
2,480m-2,600m. Continental (alluvial).