ppCo summary

At the beginning of the Lower Cretaceous, a general deepening of the sea took place. In fact, the condensed Valanginian to Aptian-Albian section from 6130' to 5795' was deposited in moderately deep waters with argillaceous sedimentation. The advent of the Upper Cretaceous marks a change to carbonatic sedimentation and the Chalk was laid down in a comparatively shallow open sea with clear waters (5740-5350').

Lower Cretaceous:

The sediments of this age, occurring from 5795' to 6130' are represented mainly by grey clays, abundantly fossiliferous, as follows:

5795-5830': small Arenaceous and Gavelinella sp., (possibly Aptian-Albian).

5830-5890': Conorotalites intercedens, Lenticulina wisselmanni, L. ouachensis and Gavelinella cf. barremiana. - (Barremian).

5890-6010': Epistomina caracolla, Lenticulina multireticulosa, Protocythere triplicata and Lenticulina guttata. - (Hauterivian).

6010-6130': smooth Ostracoda, among which Schuleridea tribeli and Ammovertella cellensis. - (Valanginian).

The Lower Cretaceous sea gradually changed from shallow during Valanginian to moderately deep during Hauterivian, and such persisted until the presumed Albian.

Palynology

Summary

Lower Creataceous Stages (Aptian, Barremian, Valangianian and Berriasian) have been recognised on the basis of microplankton between 5800 - 6538 feet.

TABLE 1. Summary of sample ages and general environment indication.

Depth	Age	Environment
5800	Lower Aptian	Marine
6100	Barremian	Marine
6112	(?U) Barremian	Marine
6117	Barremian	Marine
6128	(?L.) Barremian	Marine
6200	(?L.) Barremian	Marine
6300	Valanginian	Marine
6460	Berriasian	Marine
6538	(?L.) Berriasian	Marine

Conclusions

A fairly complete marine Lower Creataceous succession appears to be present ranging from Berriasian to Aptian in age. The plankton dominated assemblages are similar in general composition and stage recognition is based on the restricted ranges of specific taxa (see sample lists). The non-recognition of Hauterivian reflects the lack of diagnostic elements for that stage.

Depth 5800 feet

(i) Microplankton

Prolixosphaeridium deireuse	-	Barrem - Apt.
Hystrichosphaeridium complex	-	L. Cret. - Cenom
Odontochitina operculata	-	V. Hauter - Cenom
Achomosphaera ramulifera	-	L. Cretac.
*Hystrichosphaera ramosa	-	Hauter - Rec.
Apteodinium granulosum	-	L. Cretac.
Canningia colliveri	-	Apt.
Gonyanlacysta orthoceras	-	Barrem - Apt.
Heliodinium voigti	-	Berrias - Apt.
Protoellipsoidinium spinooristatum	-	Alb.
*Circulodinium deflandrea	-	Barrem - Alb.

(ii) Spores and Pollen

Very few spores.

Callialasporites trilobatus	-	Hettang - Albian
Abietineaepollenites microalatus	-	Lias - Albian

(iii) Age

Age lies between U. Barremian and Aptian. Most probably L. Aptian, on basis of increased proportions of Cenomanian and Albian species.

Depth 6100 feet

(i) Microplankton

Pseudoceratium pelliferum	-	Valang. Barrem
*Heliodinium voigti	-	Berrias - Apt.
Hystrichosphaeridium complex	-	L. Cret. - Cenom.
Dingodinium europeum	-	Apt.
Tenua hystrix	-	Neocom
Hystrichosphaera ramosa	-	Barrem - Rec.
Prolixosphaeridium deireuse	-	Barrem
Caningian colliveri	-	Apt.
Chlanydophorella sp.	-	U. Jur. - L. Cret.
*Gonyaulacysta serrata	-	Berrias - Apt.
Broomen longicornuta	-	Hauter - Barrem
Muderongia crucis	-	Hauter
*Hystrichosphaera sp.	-	Barrem - Rec.
Dingodinium cerviculum	-	Hauter - Apt.

/ 3

(ii) Spores and Pollen

Abietineaspollenites microalatus	-	Post-Wealden
Parvisaccites radiatus	-	Post-Wealden
Vitreisporites sp.	-	Jurassic - Cretaceous

(iii) Age

Age is between Hauterivian and Aptian. Dominant characteristics indicate Barremian.

Depth 6112 feet

(i) Microplankton

Pseudoceratium pelliforum	-	Valang. Barrem
Heliodinium voigti	-	Berrias - Apt.
*Hystrichosphaeridium complex	-	L. Cret. - Cenom
Tenua hystrix	-	Neocom
Prolixosphaeridium deireuse	-	Barrem
Caningia colliveri	-	Apt.
Chamydophorella sp.	-	U. Jur. - L. Cret.
Apteodinium granulosum	-	L. Cret.
Gonyaulacysta serrata	-	Berrias - Apt.
Achomosphaera neptuni	-	Neocom
*Hystrichosphaeridium recurvatum	-	L.U. Cret.
Hystrichosphaerina schindewolfi	-	Barrem
*Hystrichosphaera sp.	-	Barrem - Rec.
Rhynchodiniopsis aptiana	-	Berrias - Apt.
Dingodinium cerviculum	-	Hauter - Apt.
Gonyaulacysta orthocera	-	Barrem - Apt.
Apteodinium macilatum	-	Barrem

(ii) Spores and Pollen

A few spores and disaccate pollen

(iii) Age

Age is Barremian, probably Upper.

Depth 6117 feet

(i) Microplankton

Heliodinium voigti	-	Barrias - Apt.
Hystrichosphaeridium complex	-	L. Cret. - Cenom
Tenua hystrix	-	Neocom
Hystrichosphaera ramosa	-	Barrem - Rec.
Cordosphaeridium eoinodes	-	Berrias - Apt.
Prolixosphaeridium deireuse	-	Barrem
*Caningia colliveri	-	Apt.
Hystrichosphaeridium ramulifera	-	L. Cret.
*Chlamydophorella sp.	-	U. Jur./L. Cret.
Apteodinium granulosum	-	L. Cret.
Gonyaulacysta serrata	-	Berrias - Apt.
Achomosphaera neptuni	-	Neocom

/4

Hystrichosphaeridium recurvatum	-	L. - U. Cret.
Cleistosphaeridium polypes?	-	Alb. - Cenom
*Hystrichosphaera sp.	-	Barrem - Rec.
Wetzeliella neccomica	-	Hauter - Apt.
Pareodinia spinosa	-	Barrem
Dingodinium cerviculum	-	Hauter - Apt.
Apteodinium maculatum	-	Barrem

(ii) Spores and Pollen

Concavissimisporites apiverricatus app.	-	Berrias - L. Aptian
Foraminopsis cf. dailyi	-	U. Berrias - Alb.
Cicatricosisporites raricicatricosus	-	U. Berr. - Hauter.
Aequitaradites sp.	-	Berrias - Apt.
Concavisporites punctatus	-	Berrias - Apt.
Cyathidites australis	-	Lias. - Apt.
Parvisaccites radiatus	-	Bathon - Apt.
Alisporites grandis	-	Bajoc - Alb.
A. similis	-	Callov. Alb
Podocarpidites sp.	-	Mesozoic

(iii) Age

Age is Barremian.

Depth 6128 feet

(i) Microplankton

Heliodinium voigti	-	Berrias - Apt.
Hystrichosphaeridium complex	-	L. Cret. - Cenom
Tenua hystrix	-	Meocom
Hystrichomsphaera ramosa	-	Berrm- Rec.
Cordosphaeridium eoniodes	-	Berrias - Apt.
Prolixosphaeridium deireuse	-	Barrem
Canningia colliveri	-	Apt.
Hystrichosphaeridium ramulifera	-	L. Cret.
Chlamydophorella sp.	-	U. Jur./L. Cret.
*Apteodinium granulosum	-	L. Cret.
Gonyaulacrysta serrata	-	Berrias - Apt.
*Achomosphaera neptuni	-	Neocom.
Hystrichosphaeridium recurvatum	-	L. - U. Cret.
*Hystrichosphaeridium stellatum	-	Hauterin - Barrem
Cleistosphaeridium polypes?	-	Alb. - Cenom
Scriniodinium campanula	-	Berrias - Apt.
Muderongia tetracauthum	-	Valang - Barrem

(ii) Spores and Pollen

Concavissimisporites apiverricatum	-	Berrias - Aptian
Cicatricosisporites spp.	-	Kimm. - Albian
Concavisporites punctatus	-	Berrias - Aptian
Matonisporites phlebopteroides	-	Lias - Aptian

(iii) Age

Age lies between Hauterivian and Barremian. Most likely L. Barremian.

Depth 6200 feet

(i) Microplankton

Pseudoceratium gochti	-	Purbeck,-Valang,Berrias - Valangian,Barrem
*Heliodinium voigti	-	Berrias - Apt.
Hystrichosphaeridium complex	-	L. Cretac. - Cenom
" ramulifera	-	L. Cretac.
*Tenua hystrix	-	Neocom
Hystrichosphaera ramosa	-	Barremian - Rec.
Phoberocysta ceratoides	-	Alb. - Cenom.
*Cordrosphaeridium coinodes	-	Berrias - Apt.
Prolixosphaeridium deireuse	-	Barrem
Canningia colliveri?	-	Apt.
Chlamydophorella sp.	-	U. Jurr. - L. Cret.
Apteodinium granulosum	-	L. Cret.
Gonyaulacysta serrata	-	Berrias - Apt.
Scriniodinium campanula	-	Berrias - Apt.
Dinogodinium europeum	-	Apt.

(ii) Spores and Pollen

Consacissimisporites apiverricatus	-	Berrias - Aptian
Cicatricosisporites spp.	-	Kimm. - Aptian
Klukusporites pseudoreticulatus	-	Berrias - Hauter
Todisporites sp.	-	Jurassic

(iii) Age

Age lies between Berriasian and Barremian. ?L. Berremian.

Depth 6300 feet

(i) Microplankton

*Pseudoceratium gochti	-	Purbeck - Valangin - Valangin, Barrem.
Heliodinium voigti	-	Berrias - Apt.
* " patriciae	-	Valangin - Hauteriv
Hystrichosphaeridium recurvatum	-	U. Kim. - L. Cret.
" complex	-	L. Cret. - Cenom
Apteodinium granulosum	-	L. Cret.
" ciliatum	-	L. Cret.
* " cf. neptuni	-	Berrias - Hauter
Gonyaulacysta culmula	-	Purbeck
" ?scolea	-	?U. Kim. - Purb.
" ?palla	-	?Barrem
* " Serrata	-	Berrias - Apt.
Pareodinia sp. A.	-	Valang (Speeton)
Scriniodinium campanvla	-	Valang. - Apt.
Tenua eminula	-	Purbeck

(ii) Spores and Pollen

Callialasporites cf. trilobatus	-	Hettang - Alb.
Cyathidites punctatus	-	Bajoc - Apt.
Civatricosisporites spp.	-	Kimm. - Alb.
Gleichenidites delcourti	-	U. Berrias - Aptian
Leptolepidites sp.	-	Jurassic

(iii) Age

Most close comparison is with Valanginian of Speeton. Jurassic elements practically vanished.

Depth 6460 feet

(i) Microplankton

*Tubotuberella rhombiformis	-	Up. Jur (Siberia), Berrias (Speeton)
Chlamydophorella sp.	-	U. Jur. - L. Cret.
Imbatodinium villosum	-	U. Jur.(Siberia), Berrias (speeton)
" kondratjevi	-	U. Jur (Siberia), Berrias (Speeton)Portland
Heliodomium voigti	-	Berrias - Apt.
Gonyaulacysta serrata	-	Berrias - Apt.
Cannosphaeropsis caulleryi	-	U. Jur. - L. Cret.
Tenua hystrix	-	L. Cret.
Leptodinium ?panneum	-	?U. Kim.- Purb.
Hystrichosphaeridium complex	-	L. Cret. - Cenom
* " cf. palmatum	-	Berrias (Speeton)
Apteodinium sp. A.	-	Berrias (Speeton)
Cordosphaeridium coinodes	-	Berrias - Apt.
Apteodinium granulatum	-	L. Cret.
Ellipsoidinium sp. A.	-	Berrias (Speeton)
Tanyosphaeridium cf. toryum	-	Tothon - Neocom

(ii) Spores and Pollen

Concavissimisporites apiverricatus	-	Berrias - Aptian
C. bernissartensis	-	Kimm. - Apt.
Variugosisporites lentiformis	-	Berrias - Hauter
Toroisporites planitorosus	-	Berrias - Valang.
Callialasporites dampieri	-	Hettang - Albian
C. trilobatus	-	Hettang - Albian

(iii) Age

Most close comparison is with Berriasian of Speeton. Jurassic elements persist.

Depth 6538 feet

(i) Microplankton

Cymatiosphaera imparojubata	-	Purbeck/Valang.
Cannosphaeropsis caulleryi	-	U. Jur. - L. Cretac.
*Gonyaulacysta serrata	-	L. Port. - L.Cretac.
" cf. longicornis	-	Kim. ?
" scolea	-	L. Port - Purbeck
Systematophora expatiata	-	U. Kim.-Port.
Tubotuberrella rhombiformis	-	U. Jur.(Siberia), Berrias (Speeton)
Hystrichosphaeridium pulcherrimom	-	U. Kim.-L. Cret.
Leptodinium panneum	-	U. Kim. - L. Purbeck (Tothon)

Cannosphaeropsis mirabilis	-	Tithonian
Pterospermopsis aureolata	-	U. Jur. - L. Cret.
*Heliodinium voigti	-	Berrias - Apt.
Tenua teleoventralis	-	U. Kim. - Purbeck

(ii) Spores and Pollen

Disaccate pollen

(iii) Age

A mixture of Lower Cret. and U. Jurassic species. The boundary is near. Age probably Low Berrias.

CONOCO 9/11-1

In 9/11-1, the Upper Jurassic beds (Oxfordian?-Kimmeridgian?), lying directly on the continental Trias, represent deltaic-alluvial deposits (6825-6680').

In Kimmeridgian times, marine conditions were established, initially (Lower Kimmeridgian) with restricted water circulation (6680-6450') and later (Middle-Upper Kimmeridgian) with normal saline waters (6450-6130'). Only sediments of Upper Jurassic age were observed in the well they occur from 6130' to 6825' and can tentatively be subdivided as follows:

6130-6450': grey clays with frequent mcrofossils, such as Haplophragmium cf. aequale, Ammobaculites cf. erectum, Conorboides sp., Epistomina parastelligera and Schuleridea tribeli. This assemblage is tentatively referred to the Kimmeridgian on the basis of the prensence of Epistomina parastelligera.

6450-6540': grey clays with flat Trochammina sp., Hamplophragmoides cf. volgensis and smooth ostracods, dated as Kimmeridgian on the basis of analogies with other North Sea wells.

6540-6680': dark grey clays with very small Arenaceous (Ammobaceulties, Reophax, Trochammina, etc.), rare Galliaecytheridea wolburgi and Mandelstamina rectilinea, dated as Lower Kimmeridgian on the basis of the ostracode content.

6680-6825'; dark grey to black shales, greyish siltstone and sandstone with coal. The palynological analysis of the samples from 6750' yielded a poorly diagnostic microflora composed by Cycadopites , Alisporites, Concanisporites, Marattisporites.
A much better assemblage was found in the samples from 6780' and from 6796' with Tsugaepollenites dubius, T. dampieri, Pteruchipollenites microsaccus, Eucommiidites troedssonii, Neosaistrichia, Tripartina, Lycopodiumsporites, Reticulumsporites, etc. The presence of T. dampieri suggest Oxfordian-Kimmeridgian age, while P. microsaccus and T. dubius have a longer range, from Bathonian to Kimmeridgian.

The environment of deposition of these various intervals ranges from deltaic-fluciatile (6680-6825') to shallow marine with restricted circulation (6450-6680') and finally to normally saline marine (6130-6450').

Palynology

Summary:

Upper Kimmeridgian occured at 6600 and 6650 feet and was underlain by Middle Jurassic (Bathonian) microfloras between 6680 and 6796 feet

DEPTH	AGE	ENVIRONMENT
6600	(?U.) Kimmeridgian	Marine
6650	Kimmeridgian	Marine
6680	Bathonian	Paralic
6695	-	Paralic/Coal
6759	Bajocian - Callovian	Paralic
6767	-	Paralic
6780	Bathonian	Paralic
6796	-	Paralic/?Coal
6828	Bajocian - Callovian	Paralic

Conclusions

The distinctive Upper Kimmeridgian association was restricted to a narrow zone and two sampled horizons. There is clearly a non-sequence above and below this section.

The Middle Jurassic microflora of spores and pollen was comparatively sparse (compare section in 8/12-1) however restricted range taxa occur as a minor element in several assemblages and indicate a Bathoniah age.

Depth 6600 feet.

(i) Microplankton

Scriniodinium cf. luridum	-	Oxf. - Kim.
*Cyclonephelium downiei	-	U. Kim - L. Port.
*Scriniodinium pygodesmium	-	U. Kim. - L. Port.
* " apatelum	-	Oxf. - Kim.
*Gonyaulacysta longicornis	-	U. Kim.
Ascodinium neophytense	-	U. Kim - L. Port.
Cannosphaeropsis caulleryi	-	Oxf. - L. Cret.
Leptodinium panneum	-	U. Kim -L.Purbeck (Tithon)

(ii) Spores and Pollen

Cingulatisporites problematicus	-	Baj - Berrias
Classopollis totosus	-	Rhaetian - Albian

(iii) Age

Age is most likely U. Kim.(rotunda Zone), certainly between U. Kim. and Lower Portland.

Depth 6650 feet

(i) Microplankton

Cyclonephelium downiei	-	U. Kimm. - L. Port.
Scriniodinium pygodesmium	-	U. Kimm.-L. Port
Gonyaluacysta longicornis	-	U. Kimm.
Ascodinium neophytense	-	U. Kimm. - L. Port.
Leptodinium panneum	-	U. Kimm - Tithonian

(ii) Spores and Pollen

Disaccate pollen very common
Abietinaepollenites spp.
Piceites sp.

(iii) Age

Upper Kimmeridgian

Depth 6680 feet

(i) Microplankton

No microplankton

(ii) Spores and Pollen

Calamospora mesozoica	-	Jurassic - Cret.
Imperturopollenites dettmanni	-	Bajoc - Callov
Callialasporites dampieri	-	Hettang - Alb.
C. trilobatus	-	Lias - Cretaceous
Triangulopsis discoidalis	-	Bajoc - Callov.

No disaccates
Wood and cuticle

(iii) Age

Age compatible with Middle Jurassic - Bathonoan probably.

Depth 6695 feet

(i) and (ii) Wood and poor cuticles. Few spores.
(iii) Age No age indication

Depth 6759 feet

(i) Microplankton

No microplankton

(ii) Spores and Pollen

Callialasporites dampieri	-	Hettang. - Alb.
Triangulopsis discoidalis	-	Bajoc - Callov.

Abietineaepollentites microalatus - Lias - Alb.

Wood/resinous, unstructed material

(iii) Age

Weak indication of Middle Jurassic only.

Depth 6767 feet

(i) Microplankton

No microplankton

(ii) Spores and Pollen

Callialasporites dampieri	-	Hettang - Alb.
C. crenulatus	-	Baj. - Apt.
Calamospora mesozoica	-	Jurassic-Cretaceous
Inaperturopollenites cf. dettmanni	-	Baj. - Call.

Wood/cuticles/very few dissacates

(iii) Age

Age not conclusive.

Depth 6780 feet

(i) Microplankton

No Microplankton

(ii) Spores and Pollen

Callialasporites cf.infrapunctats	-	Bajoc - Port.
Calamospores mesozoica	-	Lias - Cretaceous
Piceites latens	-	Bajoc - Oxford
Triangulopsis discoidalis	-	Baj - Call.
Vitriesporites spp.	-	Mesozoic
Callialasporites dampipieri	-	Lias - Alb.
Cerebropollenties macroverrucosus	-	Lias - Apt.

Inaperturopollenites dettmanni	-	Bajoc - Callov.
Stereisporites clacii	-	Bathon - Kimm
Cycadopites sp.	-	Jurassic - Cretaceous

(iii) Age

Age is Middle Jurassic and compares favourably with Fuller(s Earth i.e. Bathonian.

Depth 6796 feet

(i) and (ii) Detrital Wood. Rare spores as above.

(iii). Age. No indication of age.

Depth 6828 feet

(i) Microplankton

Abundant caved L. Cretaceous microplankton.

(ii) Spores and Pollen

Callialasporites dampieri	-	Hettang - Alb.
C. crenulatus	-	Baj. - Apt.
Inaperturopollentites dettmanni	-	Baj - Call
Calamospora mesozoica	-	Jurassic-Cretaceous
Abietineaepollenites spp.	-	Mesozoic

(iii) Age

Middle Jurassic spore flora overshadowed by caved Cretaceous microplankton.

CONOCO 9/11-1

Trias :

The red mudstones, siltstones and sands occurring from 6825' to 7200' have been tentatively referred to the Upper Trias, Keuper, on the basis of lithological analogies with sediments of this age in other North Sea wells. The palynological analysis at 6832' and 7150' proved to be negative (barren). No sediments which could be referred to the Raethic were identified on top of the Trias.

Palynology

Summary:

Keuper pollen was recovered from sidewall core at 7083 feet.

DEPTH	AGE	ENVIRONMENT
6832	-	Caved
6872	-	?Terrestrial
6995	-	?Terrestrial
7083	Keuper	Terrestrial

Depth 6832 feet

(i) and (ii) Inadequate organic residue
Some dark, carbonised wood fragments and rare Cretaceous microplankton
(iii) Age No age indication.

Depth 6872 feet

(i) and (ii) Caved Cretaceous microplankton, spores and dissacate pollen. No lower startigraphic taxa seen.

(iii) Age No age indication.

Depth 6995 feet

(i) and (II) No organic residue

(iii) Age No age indication.

Depth 7083 feet

(i) Microplankton

No micrplankton

(ii) Spores and Pollen

Verrucosisporetites morulae

Chordasporites singulichorda

Vitreisporites pallidus

Lueckisporites cf. virrkiae

(iii) Age

Poor organic residue with probable KEUPER micro-flora.

ERILOG

9/11-1

ROCK MATERIALS

CORES

CUTTINGS

SURFACE SAMPLES

DEPTH

POROSITY

TOTAL

BP

0 10 20 30 40

PERMEABILITY

L Md.

.05 .1 1 10 100

WP SPACE

O OPEN
X SPAR
S SILICA
M LmMUD
K KAOLIN
D DOLO.

ALIGNED

MICRO-FABRIC

TEXTURAL VARIATIONS

MUDSTONE
WACKESTONE
PACKSTONE
SKELETAL SILT & VF SAND

BIOTIC CONSTITUENTS

PLANKTONIC

FORAMINIFERS
MONOSPHERES
MINISPHERES
BENTHONIC INDEX

BENTHONIC

BRYOZOANS
ECHINODERMS
MOLLUSCS
FORAMINIFERS

1 2 3 4 5 6

COARSE SKELETAL
CHALK
CHERT
COLLOPHANE
GLAUCONITE
GLASS
KAOLIN
PYRITE
DETRITAL SILT
DETRITAL SAND
MICA
MUSCOVITE
BIOTITE
SPICULES
NEOMORPHIC SPAR
FINELY DIVIDED CARBONATE

// ALIGNED GRAINS

P PRISMATIC

ZONATION

4800

5000

5100

5200

5300

5400

3 1 5 5 3 1 — Well sorted sub-rounded to angular sand size quartz grains (100-200μ)

1 3 3 5 5 3 1 1 — Well sorted sand size quartz grains a/a

1 3 2 // 5 5 3 1 — Sand size quartz and felspar grains (100 μ)

2 1 // 5 5 2 1 — Sand size quartz and felspar grains (<100μ)

2 1 // 5 3 3 1 — Angular sand size quartz and felspar grains occasionally with siliceous cement

2 // 2 5 4 3 1 — Moderatly sorted sand size quartz and felspar grains (150-250μ)

1 // 5 2 2 1 2

1 2 5 3 2 1 — Sand size quartz and felspar grains (<100μ)

1 // 2 5 3 2 — Poorly sorted sand size quartz and felspar grains

1 // 3 3 2

1 // 2 5 2 2

1 // 4 2 2 2

1 // 4 3 2 2

2 // 3 3 1 3

2 // 3 3 1 3

2 // 3 2 4

1 1 2 2 2

2 2 2

2 3 2

1 1 1 2 1

FORAM/MONOSPHERE WACKESTONE

-?

D7

M4