UNIT 15, PARAMOUNT INDUSTRIAL ESTATE,
SANDOWN ROAD, WATFORD WD2 4XA.
TEL: 25678 / 37347 TELEX: 8812973
CABLE: PALEOSERV.

PALEOSERVICES LTD

STRATIGRAPHICAL CONSULTANTS

Client Company

MOBIL NORWAY EXPLORATION INC.

Title

BIOSTRATIGRAPHIC CORRELATION

WITHIN THE STATFJORD FORMATION

IN WELLS 33/9-9 AND 33/9-A23.

Project No.

740.

Stratigraphers

K.J.GUEINN.

Date

October, 1981.

CONTENTS.

1. INTRODUCTION.

This report presents the results of a palynological investigation of the wells 33/9-9 (2,719.5m-2,875.8m) and 33/9-A23 (2,885m-3,021.10m). These intervals comprise principally the Statfjord Formation of these wells. Both wells were drilled by Mobil Norway Exploration Inc. in the Norwegian sector of the North Sea.

The object of the study was to determine if biostratigraphical (palynological) correlations could be made within the Statfjord Formation. The wells 33/9-9 and 33/9-A23 were selected for this study because of the relatively large amount of cored material available from the Statfjord Formation in them.

A total of 29 core samples (2,973.95m-3,021.10m) was provided from 33/9-A23 and 114 (2,719.5m-2,875.8m) from 33/9-9. The lithologies of these samples were examined to determine those most likely to yield palynomorphs. As a result 10 samples from 33/9-A23 and 11 from 33/9-9 were selected for palynological analysis. In addition palynological analysis has been carried out on five ditch samples from the basal part of the Dunlin Formation and upper part of the Statfjord Formation of 33/9-A23.

A total of twenty six samples has been analysed for palynomorph content in this study.

The Formation tops used in this report are those defined by Mobil Norway Exploration Inc.

2. CONCLUSIONS.

1. A Biostratigraphic Event, recognised by the incoming of abundant Riccisporites tuberculatus, is present in both wells. The correlation suggested by this event does not parallel the correlation between the wells of the top of Statfjord Unit 2 as suggested by Mobil Exploration Norway Inc. (See Figure 1).

2. The occurrence of abundant Riccisporites tuberculatus indicates the penetration of Late Triassic, Rhaetian sediments at 2,975.85m in 33/9-A23 and at 2,752.80m in 33/9-9.

   In 33/9-9 this is only c.38m below the base of the Dunlin Formation (2,715m as interpreted by Mobil Exploration Norway Inc.) and could indicate either a condensed Statfjord Formation sequence above 2,752.80m or that part of the Statfjord Formation above 2,752.80m is missing due to unconformity.

3. A potential correlateable Biostratigraphic Event present in 33/9-9 (incoming of flora dominated by Cyathidites spp./ Bisaccate pollen) between 2,725.90m and 2,727.70m, could not be recognised in 33/9-A23.

4. Study of further wells is required to determine whether the Biostratigraphic Events recognised in Statfjord Unit 1 are to be considered as reliable correlation indicators in the Statfjord Field.

5. No Biostratigraphic Events have been recognised in Statfjord Unit 2, because the lithologies present are unfavourable for palynomorph recovery.

3. STRATIGRAPHICAL SUMMARY.

i) 33/9-A23.

2,885m -2,975.85m:	Early Jurassic/Late Triassic; Sinemurian?-Hettangian-Rhaetian?
2,975.85m-3,021.10m:	Late Triassic; Rhaetian or older.

ii) 33/9-9.

2,719.50m-2,752.80m:	Early Jurassic/Late Triassic; Sinemurian?-Hettangian-Rhaetian?
2,752.80m-2,875.80m:	Late Triassic; Rhaetian or older.

4. PALYNOLOGY.

i) 33/9-A23.

2,885m-2,975.85m Early Jurassic/Late Triassic; Sinemurian?-Hettangian-Rhaetian?

Five ditch samples and one core sample have been examined from this interval which comprises the basal part of the Dunlin Unit and majority of Statfjord Unit 1 (as defined by Mobil Norway Exploration Inc.).

The uppermost ditch sample (2,885m-2,891m) contains no palynomorphs. The ditch sample (2,903m-2,909m) contains an assemblage dominated by spores/pollen including Chasmatosporites spp., Cerebropollenites cf. thiergartii and Cerebropollenites mesozoicus. Rare dinoflagellates present (i.e. single specimen of Nannoceratopsis gracilis) are probably the result of caving. The spore pollen assemblage is composed of long-ranging Early Jurassic taxa, but the presence of Cerebropollenites mesozoicus indicates an age not older than Sinemurian. However the possibility that this assemblage is the result of caving cannot be eliminated.

The core sample at 2,973.95m, contains a rich assemblage of spores/pollen, with abundant Calamospora mesozoica, common Trachysporites spp. and very common Osmundacidites/Baculatisporites spp. The assemblage contains no age restricted taxa, but the presence of common Trachysporites spp. is most characteristic of Sinemurian-Rhaetian age sediments.

2,975.85m-3,021.10m Late Triassic; Rhaetian or older.

The core sample at 2,975.85m is characterised by abundant Riccisporites tuberculatus which indicates penetration of sediments of Rhaetian age. It is associated with abundant Cyathidites spp., common Chasmatosporites sp. and rare striate bisaccate pollen including Protohaploxypinus microcorpus.

No palynomorphs are present in the nine core samples examined from 2,976.90m and below; therefore the precise age of this interval cannot be determined.

ii) 33/9-9.

2,719.50m-2,752.80m Early Jurassic/Late Triassic; Sinemurian?-Hettangian-?Rhaetian.

Five core samples have been examined from this interval. Rich assemblages of spores/pollen are present at 2,725.90m and 2,727.70m. These are dominated by Cyathidites spp. and bisaccate pollen.

Additional taxa present include Chasmatosporites spp., a single specimen of Riccisporites tuberculatus (2,727.70m) and Quadraeculina anellaeformis. The majority of taxa present are long-ranging but the presence of R. tuberculatus may indicate an age not younger than Hettangian at 2,727.70m.

2,752.80m-2,875.80m Late Triassic; Rhaetian or older.

The incoming of abundant Riccisporites tuberculatus at 2,752.80m marks the upper limit of this interval and indicates penetration of strata of Rhaetian age. It is associated with Kraeuselisporites reissingeri, Taeniaesporites rhaeticus and Neochomotriletes triangularis.

Below 2,754.80m lithologies present are unfavourable for the recovery of palynomorphs and therefore only a limited number of samples have been examined. No palynomorphs are present and therefore the age of the interval cannot be determined.

5. CORRELATION.

Figure 1 shows the suggested correlation between wells 33/9-A23 and 33/9-9 based upon palynological criteria and relationship of this correlation to one based upon log characteristics as interpreted by Mobil Norway Exploration Inc.

1. The incoming downhole of abundant Riccisporites tuberculatus is a Biostratigraphic Event readily distinguishable in both wells (at 2,752.80m in 33/9-9 and 2,975.85m in 33/9-A23).

The correlation suggested by this Biostratigraphic Event does not parallel that suggested by Mobil Norway Exploration Inc. based upon log characteristics. In 33/9-9, the incoming of abundant R. tuberculatus occurs c.58m above the top of Statfjord Unit 2 and in 33/9-A23 only c.7m.

Two interpretations of this are suggested:-

i) the occurrence of abundant R. tuberculatus represents a facies linked event occurring at different levels in the two wells.

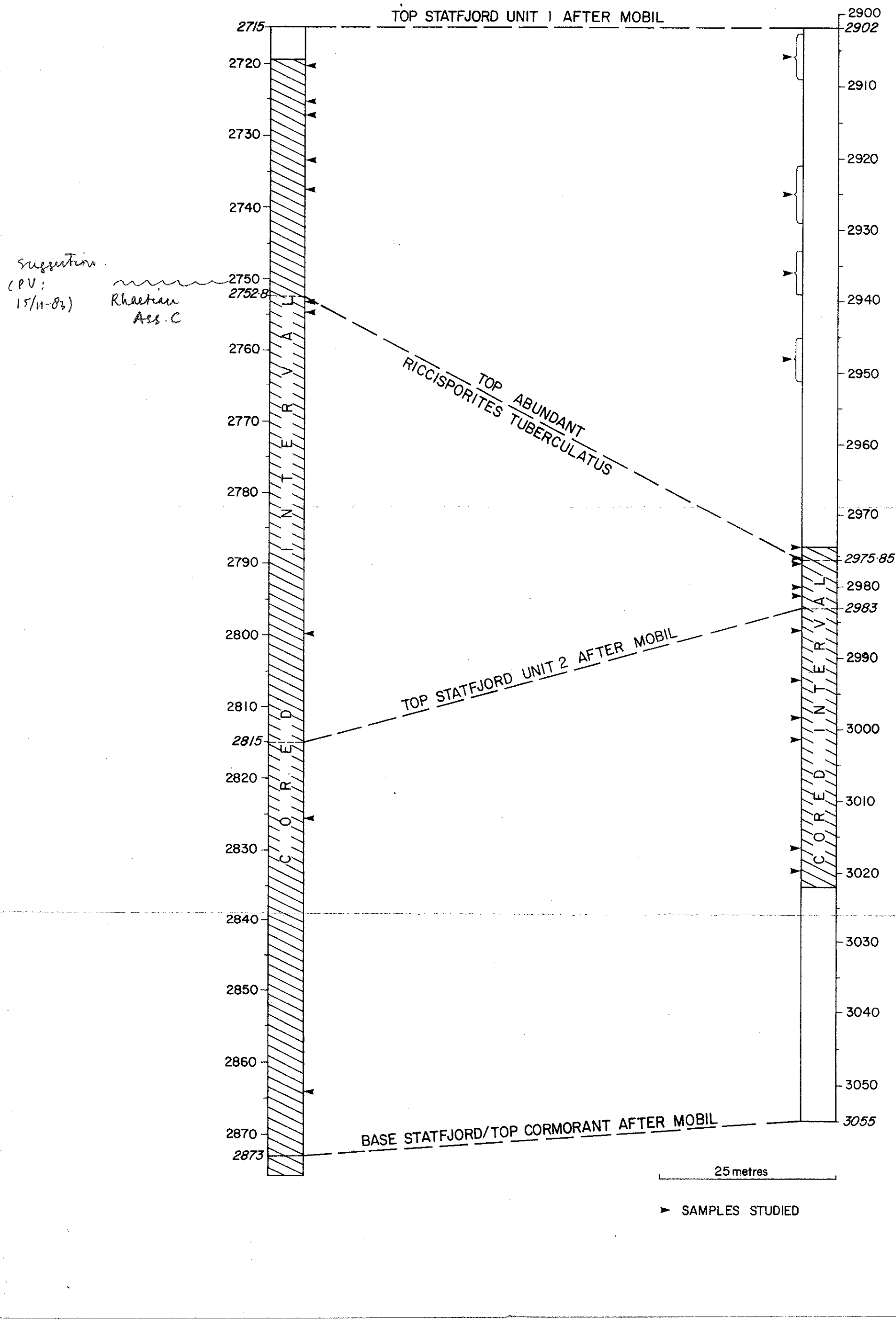
ii) that the incoming of abundant R. tuberculatus represents an approximate time related event and that there are marked lateral variations in thickness of the Statfjord Units.

On the basis of the examination of two wells only insufficient data is available to favour either interpretation. It seems likely however that this Biostratigraphic Event has considerable potential for correlation.

2. Because of the sporadic occurrence of palynofloras in the two wells above the incoming of abundant R. tuberculatus, and their absence below this level, no other correlatable Biostratigraphic Events are recognisable.

   The Cyathidites spp./Bisaccate pollen dominated microflora present at 2,725.90m and 2,727.70m in 33/9-9, cannot be recognised in 33/9-A23, but this may be due to the fact that only ditch samples have been studied from the equivalent interval (2,900m-2,951m) in this well.

SUGGESTED PALYNOLOGICAL CORRELATION BETWEEN 33/9-9 and 33/9-A23 AND ITS RELATIONSHIPS TO LOG CORRELATIONS (AFTER MOBIL EXPLORATION NORWAY INC.)



suggestion (PV: 15/11-82) Rhaetian Acs. C

FIGURE 1

MOBIL EXPLORATION NORWAY INC.	ANALYSTS	PROJECT No	DATE	ENCLOSURE No.
	K.J.G.	740	Oct 1981	1.

WELL 33/9-A23

STATFJORD A

INTERVAL : 2885m – 3021·10m

PALYNOSTRATIGRAPHIC LOG

SCALE 1 : 500

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LEGEND

CLAY/CLAYSTONE
SHALE
MARL CALCAREOUS SHALE
SILTSTONE/SILT
F M C SAND
F M C SANDSTONE
CONGLOMERATE
VOLCANICS LAVAS/TUFFS
UNDIFFERENTIATED BASEMENT
NO SAMPLES
LIMESTONE
CHALK
DOLOMITE
SALT
ANHYDRITE/GYPSUM

MEGAFOSSILS
CHERT
PYRITE
G GLAUCONITE
S SIDERITE
LIGNITE/COAL
MICA
CORES
SIDEWALL CORES
PS POOR SAMPLES

Boundary
Unconformity
TD (Total depth)
Partial or interrupted sequence

PALYNOMORPH FREQUENCY

- ● ▬ > 100 specimens per slide – abundant
- ◑ ▬ 20-100 specimens per slide – v. common
- ◐ — 5-20 specimens per slide – common
- ○ — < 5 specimens per slide – rare

F.S.E. First sample examined
L.S.E. Last sample examined

Depth	Lithology	Core sample depths	Kerogen	Palynological analyses	Main Fossils	Depths	Significant floral events	Significant lithological horizons	Environment	Formations after Mobil	Group	Age

METRES

INERTINITE/VITRINITE
VITRINITE
EXINITE/CUTINITE
SAPROPEL

Osmundacidites/Baculatisporites spp.
Bisaccate pollen
Perinopollenites elatoides
Chaamatosporites spp.
Cyathidites spp.
Lycopodiumsporites spp.
Cerebropollenites cf. thiergartii
Classopollis torosus
Quadraeculina anellaeformis
Cerebropollenites mesozoicus
Botryococcus
Lycopodiacidites sp.

Aritarch (undifferentiated)
Nannoceratopsis gracilis (cavod)

2885 m F.S.E.

2900
2950
3000

Trachysporites spp.
Calamospora mesozoica
Cycadopites nitidus
Ricciisporites tuberculatus
Contignisporites spp.
Protohaploxypinus microcorpus
Brachysaccus ovalis
Striate bisaccate indet.

2973·95
2975·85
2976·90
2980·65
2982·30
2986·80
2993·70
2998·50
3002·10
3017·60
3021·10

2975·85 m

Ricciisporites tuberculatus (abundant)

3021·10 L.S.E.

UNIT 2
STATFJORD
DUNLIN

RHAETIAN OR OLDER
LATE TRIASSIC
?RHAETIAN — HETTANGIAN — ?E. SINEMURIAN
LATE TRIASSIC — EARLY JURASSIC
MESOZOIC

MOBIL EXPLORATION NORWAY INC.	ANALYSTS: K.J.G.	PROJECT No: 740	DATE: October 1981	ENCLOSURE No: 2

WELL 33/9-9

STATFJORD A

INTERVAL 2719·5 m - 2875·8 m

PALYNOSTRATIGRAPHIC LOG

SCALE 1 : 500

PALEOSERVICES
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LEGEND

CLAY/CLAYSTONE
SHALE
MARL — CALCAREOUS SHALE
SILTSTONE/SILT
F M C SAND
F M C SANDSTONE
CONGLOMERATE
VOLCANICS LAVAS/TUFFS
UNDIFFERENTIATED BASEMENT
NO SAMPLES
LIMESTONE
CHALK
DOLOMITE
SALT
ANHYDRITE/GYPSUM

MEGAFOSSILS
CHERT
PYRITE
G GLAUCONITE
S SIDERITE
LIGNITE/COAL
MICA
CORES
SIDEWALL CORES
P.S. POOR SAMPLES

Boundary
Unconformity
T.D. (Total depth)
Partial or interrupted sequence
F.S.R. First sample received
L.S.R. Last sample received

PALYNOMORPH FREQUENCY
> 100 specimens per slide - abundant
20-100 specimens per slide - v. common
5 - 20 specimens per slide - common
< 5 specimens per slide - rare

Depth	Lithology	Core sample depths	Kerogen	Palynological analyses	Main Fossils	Depths	Significant floral events	Significant lithological horizons	Environment	Formations after Mobil	Group	Age
2700		2720·90	INERTINITE/VITRINITE	Perinopollenites elatpides		2719·5 m F.S.R.						
		2725·90	VITRINITE	Cyathidites spp.								
		2727·70	EXINITE/CUTINITE	Bisaccate pollen								
		2733·90	SAPROPEL	Trachysporites spp.								
		2737·50		Quadraeculina anellaeformis								
				Chasmatosporites spp.								
				Osmundacidites/Baculatisporites spp.								
				Cycadopites nitidus								
				Riccisporites tuberculatus								
				Eucommiidites troedssonii								
				Marattisporites scabratus								
				Apiculatisporis sp.								
				Classopollis torosus								
					Kraeuselisporites reissingeri							
					Taeniaesporites rhaeticus							
					Neochomotriletes triangulatis							
		2752·80				2752·8 m	Cyathidites spp./Bisaccate pollen (dominated assemblage)					
		2754·80					Riccisporites tuberculatus (abundant)					
2800		2799·00										
		2824·65										
2750		2863·95				2875·8 m L.S.R.						

UNIT STAFFJORD
UNIT 2 STAFFJORD
RHAETIAN - HETTANGIAN - ? E SINEMURIAN
LATE-EARLY
TRIASSIC - JURASSIC
MESOZOIC