DANMARKS OG GRØNLANDS GEOLOGISKE UNDERSØGELSE RAPPORT 1997/100

Microfaunal and nannofloral analysis of the Lower cretaceous of the Iris-1 well

- a contribution to the EFP-93 project: Lower and Upper Cretaceous stratigraphy in the Central Trough

David J. Jutson, Emma Sheldon and
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MINISTRY OF ENVIRONMENT AND ENERGY

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Contents

1. Introduction

As part of the EFP-93 Cretaceous Stratigraphy Project, microfaunal and nannofossil analyses of ditch cutting, sidewall core and conventional core samples covering the interval of the Valhall to Farsund Formations (Hauterivian to Volgian) well were undertaken. A stratigraphic subdivision has been produced and is presented in this report.

The chronostratigraphic subdivision of the Valhall Formation that has been established for this project and which has been used in the interpretation of the results of the Iris-1 material is based on research together with published and confidential proprietary schemes from the North Sea and adjacent areas (Fig. 1).

1.1 Materials and methods

All samples were collected using normal techniques appropriate to the discipline involved. In the case of nannofossils, this required stringent precautions to avoid contamination from sample to sample. Implements used to take samples were cleaned with mild acid before a new sample was taken.

Preparation techniques for microfaunas were as follows. The samples were cleaned in water and then crushed by use of a hammer. The resultant material was soaked in hydrogen peroxide for a period not less than 12 hours. They were then heated to just below boiling point and left to cool. The peroxide which had soaked into the sample material caused the sediment particles to disaggregate due to the release of oxygen in the form of small bubbles. The residues of this were separated through a 63µ sieve and the remaining material was dried under infra-red lamp and bagged for future analysis.

The nannofossil samples were prepared by smear technique. That is, the samples were crushed and put into solution with distilled water in a test tube. This was physically agitated and left to stand for ten seconds to allow the larger fragments to fall out of suspension. A small amount of the dissolved material was removed from the top 1 cm of solution by use of a dropper pipette. The sediment solution was then spread on a cover slip and left to dry. When it had dried, the cover slip was set onto a standard thickness microscope slide with an epoxy resin (Norland Optical Adhesive) and set under ultra violet light. At all stages, precautions to avoid contamination were taken. Nannofossils are small enough to be transported in the air around a room so a positive pressure environment would be desirable. Unfortunately, this was not available for this project.

Number of samples analysed: Microfaunal: 64

Nannofossil: 64

A full sample list is given in Appendix 1. Preparations for this project are catalogued and stored in the GEUS laboratory or with the stratigraphic laboratory of B.P. plc (Aberdeen).

2. Biostratigraphic summary

All depths quoted are in feet and inches and are measured depth from rotary table (MDRT). The stratigraphic distribution of micro and nannofossils are summarised in Summary Charts 1- 4.

2.1 Compiled biostratigraphy: Iris-1 well

INTERVAL AGE	MICROZONE	DEPTH	NANNOZONE	DEPTH	COMBINED ZONE
Lower Hauterivian (top not seen)	M18	11370'	α	11370'	VH4
	M19	11440'	α		VH5
			$\beta 1$	11500'	
Upper Valanginian	M20	11510'	$\beta 1$		VH6a
			$\beta 2$	11680'	VH6b
	------- *stratigraphic break* -------				
Lower Valanginian	M21	11740'	$\gamma 1$	11740'	VH7a
			$\gamma 2 - \gamma 3$	12280'	VH7b-c
Upper Ryazanian			δ	12400'	VH8
	M22	12430'			
			ε	12800'	
Lower Ryazanian	M23	13010'		*poor recovery*	F1
Upper Volgian (Jurassic)	*No zonation*	13080'		*poor recovery*	

Last sample examined at 13230'

2.2 Biostratigraphic description

Iris-1 well: Microfauna

11370' (first sample examined) - 11510': Lower Hauterivian

The occurrence at 11370" of the radiolarian *Praeconocaryomma* sp.1 (in-house) together with ostracods including *Pontocyprella superba* and *Pontocyprella* sp.2 (in-house) suggest a Lower Hauterivian age for the interval. The ostracods recorded from this interval were in general, smooth forms. The majority of these smooth forms have not been formally described as they do not appear in coeval sections in adjacent areas where most of the research into this group has been undertaken (Germany, England). At 11380', a small fragment of the agglutinated foraminifera *Haplophragmoides inconstans gracile* supports Lower Hauterivian age (Bartenstein & Brandt, 1951). Microfaunal assemblages were moderately diverse but contained significant caving mainly from the Barremian.

An influx of the radiolarian cyrtid sp.4 (in-house) together with common actinommid radiolaria at 11440' is additional evidence of Lower Hauterivian age. At 11490', an agglutinated foraminiferal influx including *Triplasia emslandensis* and *Reophax minutissima* indicates proximity to the base of the Lower Hauterivian interval.

11510' - 11740': Upper Valanginian

An additional agglutinated foraminiferal influx which included *Bigenerina clavellata* and *Ammobaculites eocretaceus* indicates the top of the Upper Valanginian interval. The calcareous benthic foraminifera , *Epistomina tenuicostata* was also recorded at this depth. Supporting this age determination at 11630' was the first downhole occurrence of *Palaeomiliolina lanceolata*. and the occurrence of *Epistomina caracolla anterior* at 11690'. Microfaunal recovery was not good in this interval. Diversity and abundance both declined downhole.

11740'- 12430': Lower Valanginian

The first downhole occurrence of *Falsoguttulina wolburgi* and the occurrence of *Frondiculina concinna* are evidence that the Lower Valanginian has been reached. This is confirmed by the incoming of *Buliminella loeblichi* at 11750'. At the same depth, the agglutinated foraminifera, *Ammovertella cellensis* was present. This species ranges into the Lower Hauterivian but has a minor acme in the Late Valanginian of onshore England. The top in this well may be equivalent to the acme in adjacent areas and that the caving may have obscured the full acme. Microfaunal recovery was poor in this interval.

12430' - 13010': Upper Ryazanian

The consistent occurrence of *B. loeblichi* from the sidewall core at 12426.00' suggests that the Late Ryazanian has been reached. It is also coincident with the base occurrence of common radiolaria and agglutinated foraminifera (mainly *Glomospira* spp.). Additional stratigraphically significant species include *Trocholina infragranulata* s.l. at 12510', *Trocholina* sp.2 (in-house) at 12570' and *Lenticulina nodosa* at 12600'. The top of this interval is lower than the corresponding nannofossil top. This may be accounted for by the masking of the true increase of *B. loeblichi* by caving in the ditch cutting sample at 12400'.

13010' - 13080': Lower Ryazanian

Iris-1 well: Calcareous Nannofossils

11370' (first sample examined) - 11500': Lower Hauterivian

Evidence for Lower Hauterivian age in this interval was poor. The nannofloras were typical of the "*Watznaueria* deserts" recorded in the Lower Cretaceous of the North Sea. That is, low diversity nannofloras dominated by *Watznaueria barnesae* and/or *Watznaueria communis*. At 11380', the occurrence of *Tegalulithus septentrionalis* is indicative of Hauterivian age, as is *Cruciellipsis cuvillieri* at 11490'

11500' - 11740': Upper Valanginian

The first possible stratigraphic markers for Upper Valanginian age were recorded at 11500' which was 10' above a more reliable microfaunal marker. This was the incoming of common *Diazomatolithus lehmanii* together with *Sollasites lowei*. This is a stratigraphic top that can be employed locally in the Danish Sector of the North Sea. A more reliable and widely used markers were recorded at 11620' with the top occurrence of *Rucinolithus wisei* and at 11630' with the top occurrence of *Triquetrorhabdulus*(?) *shetlandensis*. *Nannoconus steinmanni minor* , an Upper Valanginian species was recorded at 11680'. Accompanying this species was *Micrantholithus speetonensis* which has previously been recorded from the Lower Valanginian. Taylor (1982) also recorded this species from the Upper Valanginian of Speeton in England. Subsequent studies of the Valanginian have been almost all on sections with little or no Upper Valanginian and the occurrence in Iris-1 is probably the first confirmation of Taylor's observations.

11680' - 11740': Lower Valanginian

The top of the Lower Valanginian is marked by an increase in the abundance of *Corolithion achylosum* at 11740'. At 11750', *Tranolithus gabalus* becomes very common which may also be significant but has not been recorded in other sections in the neighbouring onshore areas. The first occurrence of very common *T. gabalus* at this depth which is just below a possible unconformity , suggests that the basal part of the Upper Valanginian is missing. Additional evidence of this is the absence of both *Nannoconus dolomiticus* and

Diadorhombus rectus, which are markers for the VH6c subzone at the base of the Upper Valanginian. At 11870' *M. speetonensis* becomes consistently common and is associated with *Micrantholithus brevis* and the top of very common *Crucibiscutum salebrosus*. Intra Lower Valanginian markers were recorded at 12280' and 12340' with the top occurrences of *Kokia borealis* and *K. borealis 'minor'* respectively.

12400' - 12850': Upper Ryazanian

The consistent occurrence of Sollasites arcuatus at 12400' is considered to indicate to top of the Upper Ryazanian. This is a marker that has been used by both Crux (1989) and Perch Nielsen (pers. comm.). It is 30' above the recognised microfaunal top for this age. The occurrence *of Kokia curvata* at 12500' is possibly low in this section as it's top is normally associated with the Lower Valanginian. The base of *S. arcuatus* at 12800' marks the rapid decline of both nannofossil diversity and abundance as the lithology changes from a calcareous claystone to a claystone proper, probably formed under near anoxic conditions (Farsund Formation).

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Enclosures

Fig. 1 and Summary Sheets 1-4

EFP 93

HAUTERIVIAN TO RYAZANIAN BIOSTRATIGRAPHIC ZONATION

MAY 1997

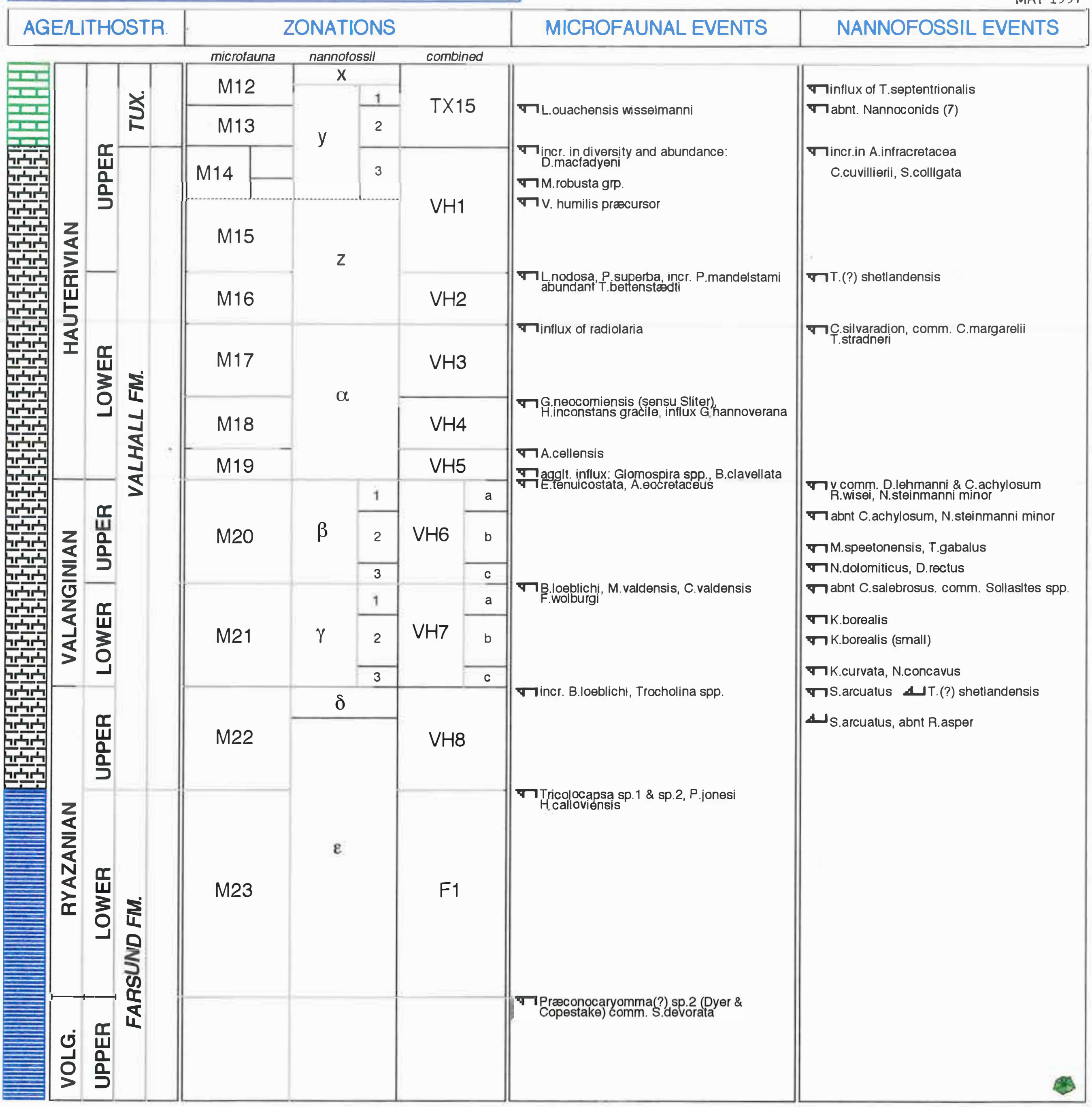

Fig.1

GEUS

BIOSTRATIGRAPHIC SUMMARY SHEET

1

EFP 93

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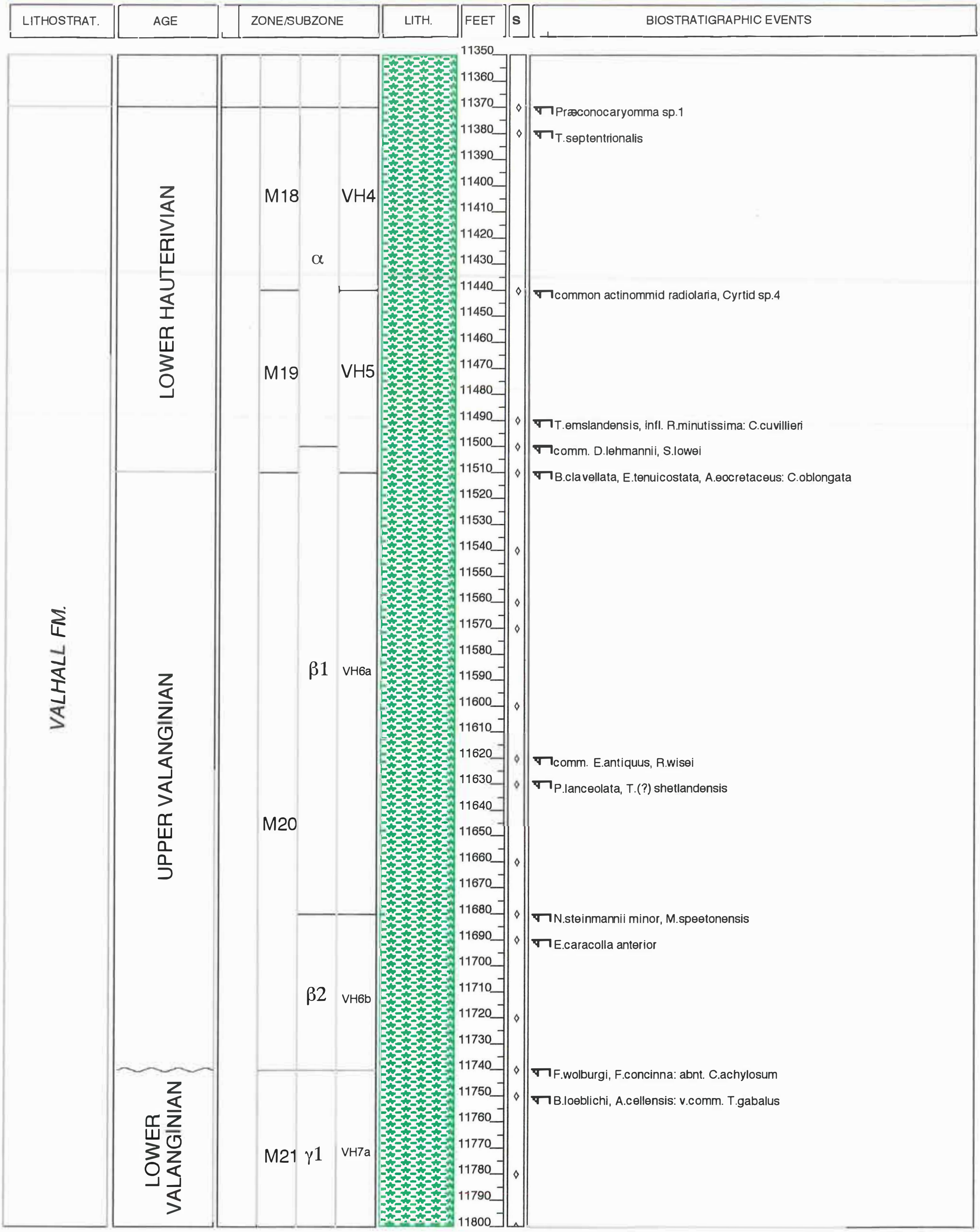
Operator: *BRITOIL*
Country: *OFFSHORE DENMARK*
Analyst(s): *D. JUTSON*
Date: *JUNE 1996*



GEUS

BIOSTRATIGRAPHIC SUMMARY SHEET

2

EFP 93

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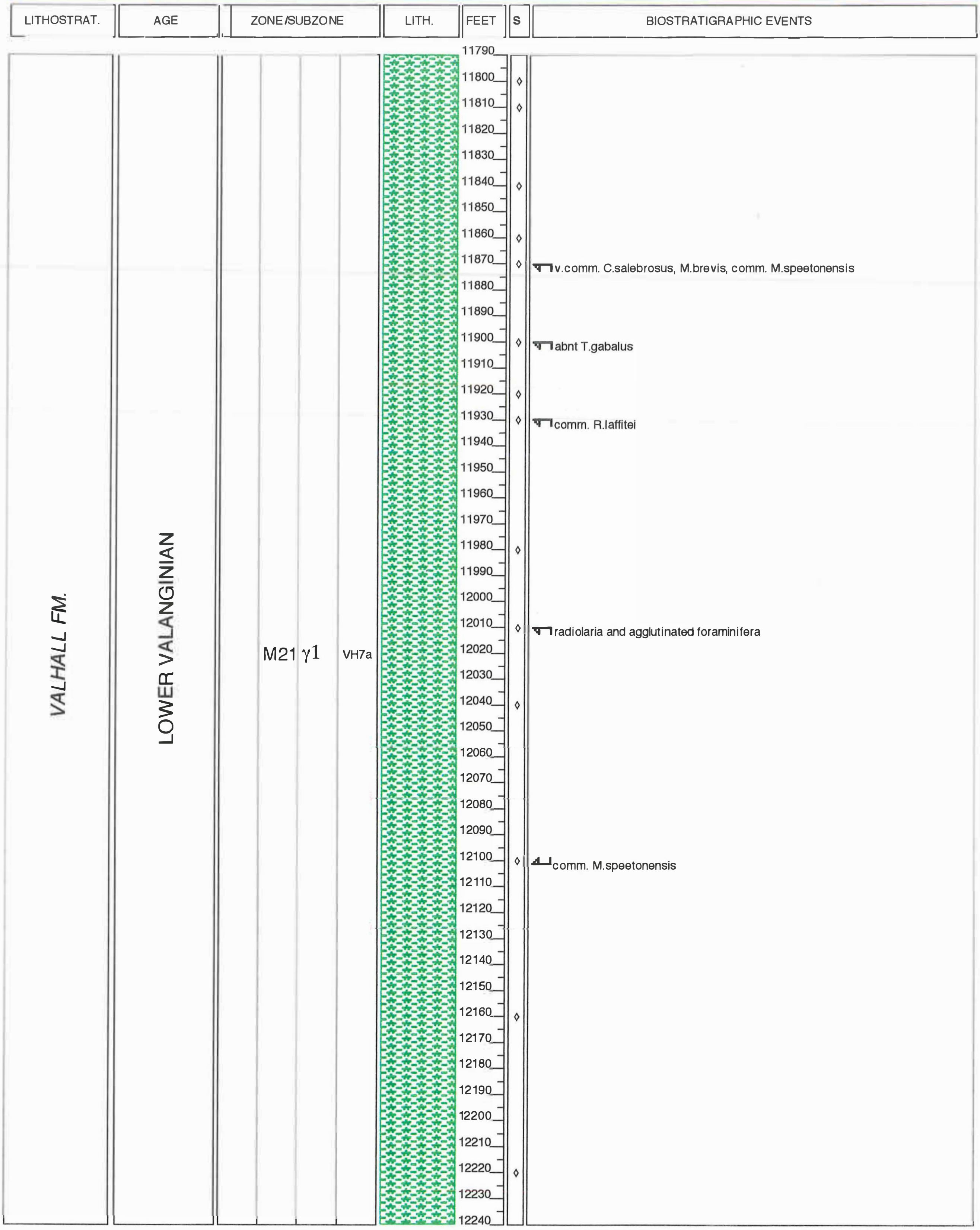
Operator:	*BRITOIL*
Country:	*OFFSHORE DENMARK*
Analyst(s):	*D. JUTSON*
Date:	*JUNE 1996*



BIOSTRATIGRAPHIC SUMMARY SHEET

3

EFP 93

GEUS

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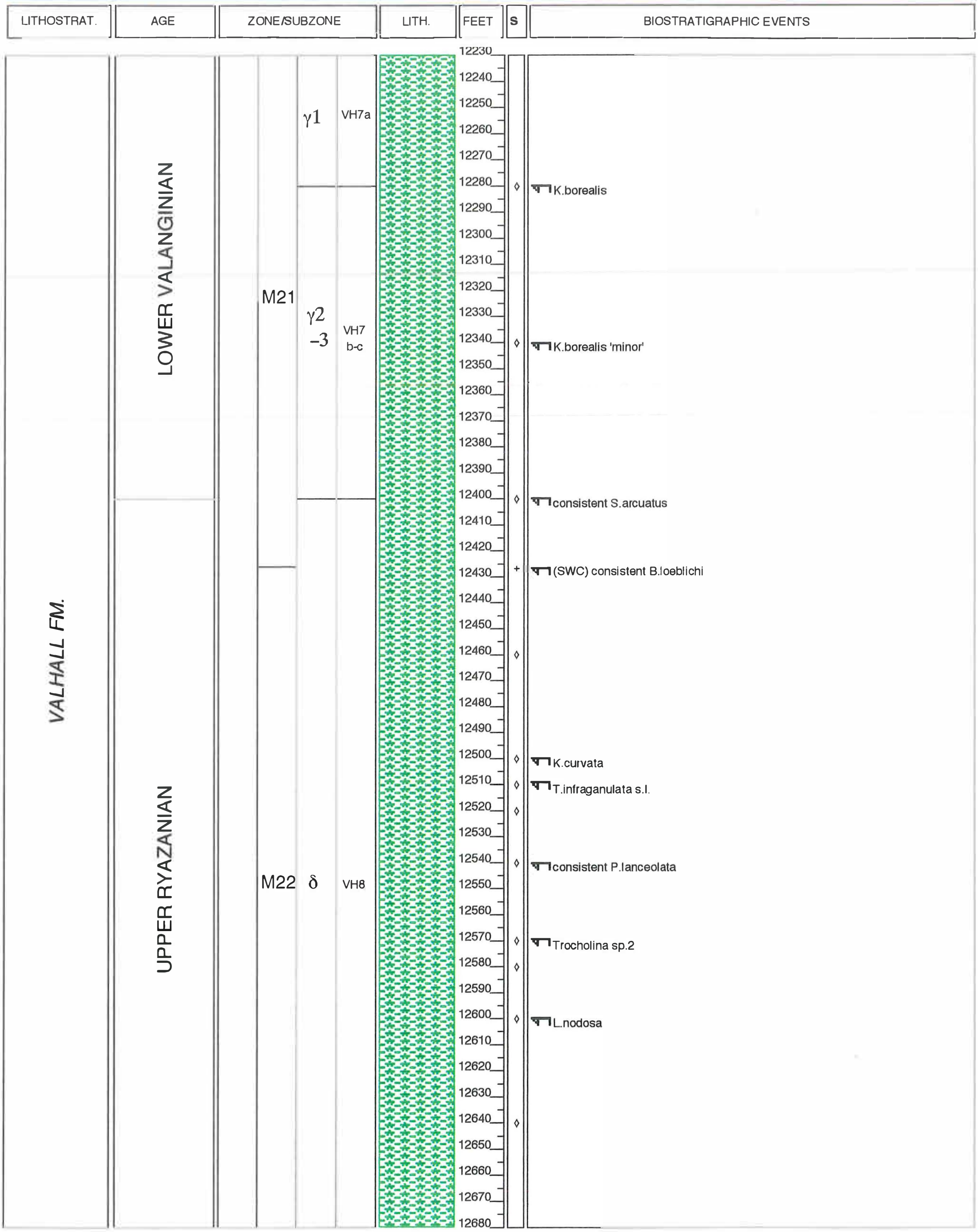
Operator: *BRITOIL*
Country: *OFFSHORE DENMARK*
Analyst(s): *D. JUTSON*
Date: *JUNE 1996*



BIOSTRATIGRAPHIC SUMMARY SHEET

4

GEUS

EFP 93

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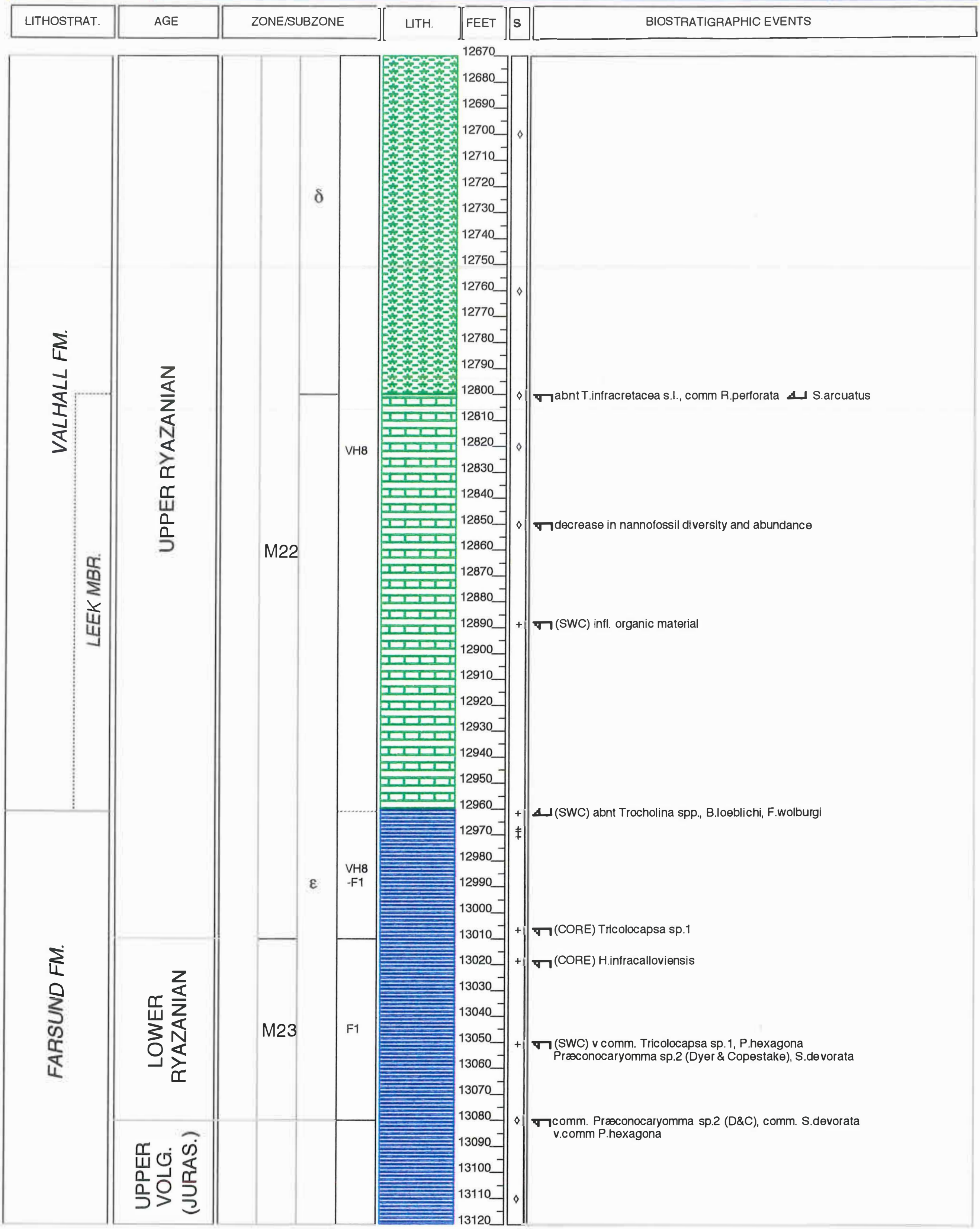
Country: OFFSHORE DENMARK
Analyst(s): D. JUTSON
Date: JUNE 1996



Appendix 1

Samples Analysed for Micro/nannopaleontology

Iris-1

Microfossils & Nannofossils

11370'
11380'
11440'
11490'
11500'
11510'
11540'
11560'
11570'
11600'
11620'
11630'
11660'
11680'
11690'
11720'
11740'
11750'
11780'
11800'
11810'
11840'
11860'
11870'
11900'
11920'
11930'
11980'
12010'
12040'
12100'
12160'
12220'
12280'
- 12340'
12400'
12426'
12460'
12500'
12510'
12520'
12540'

12580'
-12600'
12640'
12700'
12760'
12800'
12820'
12850'
12890'
12961'
12968'
12970'
12967'
13006'
13018'
13050'
13080'
13110'
13140'
13170'
13200'
13230' 64 samples

Total number of samples:	Microfaunas	64
	Nannofossils	64

N.B. all samples are ditch cutting samples unless marked