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Palynology of the interval 1796.78 to 2066.83 m of well 202/03a-3, Faroe-Shetland Basin

Energy Systems and Basin Analysis Programme

Commissioned Report CR/16/213

BRITISH GEOLOGICAL SURVEY

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Summary

As part of Phase 3 of the BGS Faroe-Shetland Consortium project on the Jurassic of the UK sector of the Faroe-Shetland Basin, detailed logging of core from well 202/03a-3 was undertaken and samples were taken for palynology in order to provide additional facies information and age determinations.

The palynological assemblages were dominated by terrestrially derived pollen and spores. Marine palynomorph assemblages, were mostly made up of actitarchs and foraminiferal test linings, dinoflagellate cysts (dinocysts) being rare. A marine setting is indicated.

Rare specimens of the dinoflagellate cyst *Liasidium variabile* indicate the Late Sinemurian (Early Jurassic) in the lower core run. These palynological age determinations are compatible with ammonite specimens indicating the late Sinemurian Raricostatum ammonite zone (Raricostatoides subzone). In the other samples, negative evidence, such as the absence of heavily ornamented spores such as *Cicatricosisporites,* of the pollen genus *Callialasporites,* and of characteristic Triassic forms, suggests the Early Jurassic

1 Introduction

During detailed logging of core from well 202/03a-3, samples were taken for palynology in order to provide additional facies information and age determinations for the lithofacies analysis.

The samples were prepared for palynology using standard acid maceration techniques. The residues were mounted onto glass slides for microscopic examination. The samples, aqueous residues and microscope slides are held in the BGS collections at Keyworth, Nottingham. Sample details are given in Appendix 1.

2 Palynology

Summary descriptions of all 19 samples follow. Detailed data is set out in Appendix 2.The zones referred to are standard ammonite zones.

2.1 SAMPLES 1 TO 8 (1796.78 1820.14 M) – EARLY JURASSIC

The kerogen assemblages are dominated by amorphous organic material (AOM) with subordinate amounts of black wood, plant material and palynomorphs. The palynomorph assemblage is dominated by gymnosperm pollen with only a very small number of pteridophyte spores. Acritarchs (mostly *Micrhystridium* spp.) and foraminiferal test linings represent marine influence. Peridiniod dinocysts are present in samples 2, 5and 7 (1806.35 and 1816.63 m) but are indeterminate and no use for age determination. Prasinophyte algae (including *Tasmanites* sp.) are present in small numbers.

Pollen present include abundant undifferentiated bisaccates, *Exesipollenites scabratus*, *Perinopollenites elatoides, Classopollis classoides, Araucariacites australis, Cerebropollenites macroverrucosus* and *Chasmatosporites* spp. The spore assemblages contain *Baculatisporites commaumensis*, *Cyathidites minor, Gleicheniidites minor, Ischyosporites variegatus, Neoraistrickia* sp. *Retitriletes austroclavatidites*, *Retitriletes semimuris*, *Striatella* sp. and *Torispora* sp. These long-ranging species are of a generally Mesozoic (Jurassic) aspect. The absence of striate bisaccate pollen suggests an age younger than the Early/Mid Triassic. The absence of heavily ornamented spores such as *Cicatricosisporites* spp. suggests an age no younger than Kimmeridgian (Dörhöfer, 1979). The absence of *Callialasporites* spp. may be regarded as negative evidence for an Early Jurassic age because the range base of this genus is at the Early to Mid Jurassic boundary (Riding et al., 1991).

2.2 SAMPLES 9 TO 15 (2051.69 TO 2060.6 M) – EARLY JURASSIC, POSSIBLY LATE SINEMURIAN

The kerogen from this interval differs from samples in the upper core run by generally containing higher proportions of woody and plant material with AOM and palynomorphs being less significant elements of the assemblage (except samples 12 and 15). However, the overall composition of the palynological assemblage is unchanged from the upper core run being overwhelmingly dominated by gymnosperm pollen with the same common species. Again, acritarchs (*Micrhystridium* spp.) indicate marine influence.

Indeterminate peridinioid dinoflagellate cysts are present in samples 10 and 14 (2052.34 and 2058.57 m) but are no use for age determination. However, the similarity of the kerogen from this interval with the lower sample in the same core run suggest the same genetic unit and hence an Early Jurassic, possibly Late Sinemurian age is inferred (see sections 2.3 and 2.4).

2.3 SAMPLE 16 (2062.25 M) – LATE SINEMURIAN NO YOUNGER THAN THE RARICOSTATUM ZONE

The presence of the dinoflagellate cyst *Liasidium variabile* in sample 16 indicates a Late Sinemurian age no younger than the Raricostatum Zone (Riding and Thomas, 1992). The spore and pollen assemblage resembles those higher in the well and has a typical Early Jurassic aspect.

2.4 SAMPLES 17 TO 19 (2064.25 TO 2066.83 M) – LATE SINEMURIAN, RARICOSTATOIDES SUBZONE

The presence of the dinoflagellate cyst *Liasidium variabile* in sample 19 indicates a Late Sinemurian age no younger than the Raricostatum Zone (Riding and Thomas, 1992). Again the spore and pollen assemblage resembles those higher in the well and has a typical early Jurassic aspect.

Ammonites were recovered from this part of the core and have been identified by Dr Kevin Page of Plymouth University as indicating the Late Sinemurian Raricostatum Zone (Raricostatoides Subzone). See Appendix 3 for details.

3 Conclusions

- The presence of the dinoflagellate cyst *Liasidium variabile* in samples 16 and 19 indicates a Late Sinemurian (Early Jurassic) age (Riding and Thomas, 1992). This is compatible with the Raricostatum Zone (Raricostatoides Subzone) ammonites identified from the lower core run.
- The palynological samples from 202/03a-3 are dominated by long-ranging gymnosperm pollen of a generally Mesozoic (Jurassic) aspect. The absence of striate bisaccate pollen suggests an age younger than the Early/Mid Triassic. The absence of heavily ornamented spores such as *Cicatricosisporites* spp. suggests an age no younger than Kimmeridgian (Dörhöfer, 1979). The absence of *Callialasporites* spp. may be regarded as negative evidence for an Early Jurassic age because the range base of this genus is at the Early to Mid Jurassic boundary (Riding et al., 1991).
- The palynological assemblages are all similar in the two core runs in terms of overall composition and species present.
- Marine influence is shown in all samples (1 to 19 %) by the presence of acritarchs (mostly *Micrhystridium* spp.), occasional foraminiferal test linings and rare dinoflagellate cysts.
- The kerogen assemblages show some variation in the proportions of the different kerogen groups. There is a trend to higher levels of brown woody /plant material in the lower core run.

4 References

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Appendix 1 - Sample details (measured depths).

INFORMAL No.	BGS MPA No.	DEPTH (m)	SSK No.
1	67543	1796.78	63882
2	67542	1786.24	63881
3	67541	1791.08	63880
4	67540	1801.59	63959
5	67539	1806.35	63958
6	67538	1811.73	63957
7	67537	1816.63	63956
8	67536	1820.14	63955
9	67535	2051.69	63954
10	67534	2052.34	63953
11	67533	2052.79	63952
12	67532	2054.59	63951
13	67531	2056.09	63950
14	67530	2058.57	63949
15	67529	2060.6	63948
16	67528	2062.25	63947
17	67527	2064.25	63946
18	67526	2065.75	63945
19	67525	2066.83	63944

Appendix 2 - Palynology data

	Well 202/03-3																		
Number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**
MPA Number	67543	67542	67541	67540	67539	67538	67537	67536	67535	67534	67533	67532	67531	67530	67529	67528	67527	67526	67525
Depth	1796.78	1786.24	1791.08	1801.59	1806.35	1811.73	1816.63	1820.14	2051.69	2052.34	2052.79	2054.59	2056.09	2058.57	2060.6	2062.25	2064.25	2065.75	2066.83
Age interpretation	Early Jurassic								Early Jurassic poss. Late Sinemurian							Late Sine. NYT Raricost.	Late Sinemurian, Raricostatoides Subzone		
Palaeoenvironment	Marine																		
PTERIDOPHYTE SPORES																			
Baculatisporites commaumensis		X			X	X		X	X			X	X		X	X	X		
Cyathidites mesozoica			X																
Cyathidites minor	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X	X
Cyathidites sp.														X	X				
Gleicheniidites minor			X																
Gleicheniidites sp.			X					X											
Ischyosporites variegatus																			
Ischyosporites sp.																			X
Neoraistrickia sp.				X		X		X								X			
Retitriletes austroclavatidites		X	X	X	X	X	X	X											
Retitriletes semimuris	X	X	X		X	X		X				X	X		X				X
Spore - indeterminate						X					X		X				X		
Stratella sp.		X		X											X				
?Torispora sp.			X			X	X												
GYMNOSPERM POLLEN																			
Araucariacites australis	X	X	X	X	X	X	X	X			X	X	X	X		X	X	X	X
Bisaccate pollen undiff.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Cerebropllenites macroverrucosus	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Chasmatosporites apertus	X	X	X	X	X	X	X	X	X	X		X	X				X	X	X
Chasmatosporites hians	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Classopollis classoides	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Exesipollenites scabratus	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Monocolpate pollen			X		X	X	X												
Perinopollenites elatoides	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
DINOFLAGELLATE CYSTS																			
Liasidium variabile																X			X
Peridinioid dinocyst indet.		X			X		X			X				X				X	X
MISCELLANEOUS																			
Foraminiferal test lining													X	X	X	X	X	X	X
Micrhystridium spp.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Veryhachium spp.	X	X																	
Tasmanites sp.	X							X					X			X	X		
KEROGEN TYPE PERCENTGES																			
Wood	13	16	24	21	26	20	11	14	8	8	4	9	14	22	10	6	9	12	7
Plant fragments	23	20	30	29	24	33	20	24	84	63	92	31	61	33	21	48	14	36	33
Palynomorphs	19	10	7	9	14	9	24	18	4	14	2	7	8	4	5	7	6	1	7
Amorph. organic material (AOM)	46	54	39	41	36	38	45	44	4	15	2	53	17	37	64	39	71	51	53

Appendix 3 – Ammonite details for well 202/03a-3

Identifications were provided by Dr Kevin Page, lecturer in Earth Sciences, Plymouth University. All the identifiable ammonite specimens are assigned to the *Echioceras raricostatum* ammonite zone (latest Sinemurian). This zone can be subdivided into four subzones including the *raricostatoides* Subzone to which all the specimens from 202/03a-3 are allocated. This subzone was previously known as the *raricostatum* Subzone but the name *raricostatoides* is preferred on grounds of priority (Getty, p. 33 *in* Cope et al., 1980).

Depth	**Specimen**	**Subzone**	
2062.98 m	(SSK70422) echioceratid sp.	raricostatoides s/z	
2063.76 m	(SSK70423) *Echioceras* sp.	raricostatoides s/z	
2065.50 m	(SSK70421) ?*Crucilobiceras* sp.	raricostatoides s/z	
2065.61 m	(SSK70420) *Echioceras* sp.	raricostatoides s/z	
2065.89 m	(SSK70417) *Echioceras* sp.	raricostatoides s/z	?applanatum s/z
2066.01 m	(SSK70416) *Crucilobiceras* sp.	raricostatoides s/z	
2066.06 m	(SSK70439) *Echioceras* sp.	raricostatoides s/z	base of s/z
2066.08 m	(SSK70438) ?crucilobiceratid ammonite	raricostatoides s/z	counterpart of SSK 70416
2066.10 m	(SSK70437) indeterminate ammonite		
2066.18 m	(SSK70436) echioceratid sp.	raricostatoides s/z	
2066.57 m	(SSK70435) *Echioceras* sp.	raricostatoides s/z	or densinodulum s/z
2066.67 m	(SSK70434) *Crucilobiceras* sp.	raricostatoides s/z	
2066.80 m	(SSK70419) *Echioceras* sp.	raricostatoides s/z	
2066.89 m	(SSK70418) *Crucilobiceras* sp.	raricostatoides s/z	