

REPORT NSEP 179

PALYNOFACIES INVESTIGATION IN  
THE JURASSIC INTERVAL OF THE  
NORSKE SHELL WELL 31/2-8

by

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EPXB/1

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## CONTENTS

### SUMMARY

### KEYWORDS

1. INTRODUCTION
2. SUMMARY OF RESULTS
3. DISCUSSION OF RESULTS
4. CONCLUSIONS

### REFERENCES

### ILLUSTRATIONS

Figure 1. General location map (Base Cretaceous play map scale 1:250,000)

Enclosure 1. Palynofacies sequences and their summarized environmental interpretation in 31/2-8.

## SUMMARY

A palynofacies analysis of the Jurassic strata from the Norske Shell well 31/2-8 was undertaken to assist in the interpretation of depositional environments.

Seven palynofacies sequences are recognised indicating essentially a series of prograding offlap units, many representing a gradual change of the depositional environment from lower offshore to shoreface.

During ?Bajocian palynofacies indicate a non-marine coastal plain setting. The coarse sand unit of latest Oxfordian age contain palynofacies which suggest deposition in a coastal environment possibly within, or very close to a river mouth.

The uppermost palynofacies sequence 7 of Kimmeridgian age indicates deposition in a lower offshore environment with bottom waters that were possibly at times anoxic.

## KEYWORDS

31/2-8, 31/2-1, 31/2-2, 31/2-3, 31/2-4, 31/2-5, 31/2-6, palynofacies, Norway, North Sea, offshore, environments, Jurassic, dinoflagellates, microplankton, palyno-debris.

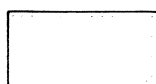
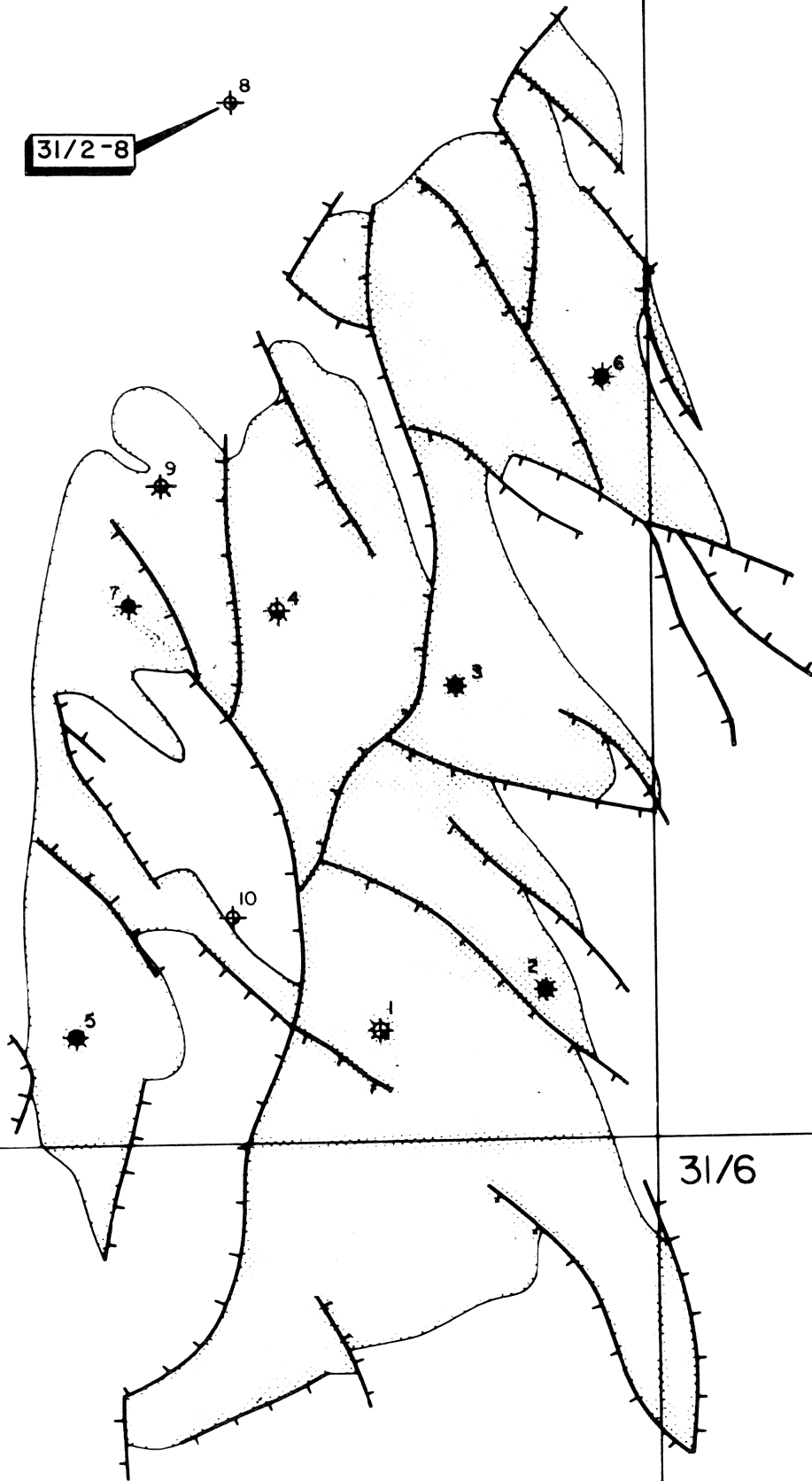
## 1. INTRODUCTION

A palynofacies analysis of the Norske Shell well 31/2-8 was undertaken in order to further the understanding of the environmental setting in which the Jurassic sediments of this area were deposited. (For general location and structural setting of the well, see figure 1). The study follows closely analysis procedures established for wells 31/2-1 and 31/2-2 in report EP-53031, and the modified terminology employed in the report of 31/2-5 EP-54927.

The driller (DD) and log depths (LD) referred to in the present study are calculated as "below derrick floor" (BDF). Enclosure 1 gives also the re-calculated subsea depths.


31/2

31/3



CLOSURE AT UPPER-MIDDLE JURASSIC  
RESERVOIR LEVEL

SCALE 1 : 150 000

a.s Norske Shell EXPLORATION & PRODUCTION FORUM			
BLOCK 31/2			
WELL LOCATION MAP			
AUTHOR EPXB	FIG. 1	DATE JUNE 1983	
REPORT NO. NSEP 179		DRAW NO. G1342/1	

## 2. RESULTS

The palynofacies study in the post Pliensbachian interval from the Norske Shell well 31/2-8 included the analysis of 71 sidewall samples and 12 cores. From the character of the palynological constituents a number of palynofacies types could be identified, which could be further grouped into 7 palynofacies sequences. By applying basic sedimentological and palaeontological principles to the distribution of their constituents, an environmental interpretation is suggested for each of these sequences.

Palynofacies sequence 7 1893,5 - 1826,0 m (LD/BDF)	Offshore lower Circulation of bottom waters may be some extent restricted
Palynofacies sequence 6 1882,6 - 1843,8 (DD/BDF)	Upper part: Highenergy/highly oxidizing conditions. Lower part: Offshore upper/ Shoreface lower
Palynofacies sequence 5 1969,8 - 1893,2 m (LD/BDF)	Upper part: Highenergy/highly oxidizing conditions, situated within or close to a river mouth Middle part: Offshore upper/shoreface Regressive setting, close to river mouth Lower part: Offshore lower Transgressive setting.
Palynofacies sequence 4 2160,5 - 1979,7 m (LD/BDF)	Upper part: Offshore upper/shore- face lower Regressive setting, close to river mouth. Lower part: Offshore upper Transgressive setting.

<p>Palynofacies sequence 3 2314,5 - 2168,5 m (LD/BDF)</p>	<p>Upper part: Shoreface, close to a river mouth. Lower part: Offshore lower</p>
<p>Palynofacies sequence 2 2532,5 - 2330,5 m (LD/BDF)</p>	<p>Upper part: Shoreface close to river mouth Middle part: Offshore lower Regressive setting Lower part: Offshore lower Transgressive setting</p>
<p>Palynofacies sequence 1 2672,5 - 2548,0 m (LD/BDF)</p>	<p>Coastal, possibly at times non-marine environment</p>

### 3. DISCUSSION AND RESULTS

#### PALYNOFACIES SEQUENCE 1 (12 SWS)

Interval: 2672,5 - 2548,0 m (LD/BDF)

Age: ?Bajocian

#### Discussion

Palynofacies are variable in character but in general indicate a marginal marine-nonmarine setting. In the lower part of the sequence, palynofacies are intermediate between types IX<sup>R</sup> VII, including rare microplankton and animal tissue, some of the material comparable to palynomacerals 2 is bleached. Such an association suggests low rates of sedimentation in a relatively high energy, marine influenced, shoreface-like setting.

Palynofacies XIV at 2632 Sm (LD/BDF), together with the sharp wedge shape to the gamma ray log character at this interval may suggest a crevasse splay type of deposition.

Palynofacies type V at 2612,0 and 2618,0 m (LD/BDF) indicates a marine upper offshore depositional environment. Above this interval however, palynofacies types XI, XIII and VII indicate a return to a more marginal marine/non.marine setting. The log character at around 2610,0 m (LD/BDF) indicates a fining upward sequence capped by a palynofacies at 2595,5 m (LD/BDF) type VII, suggesting perhaps a coastal channel. Palynofacies type XIII at 2581,5 m (LD/BDF) indicates deposition is a lagoonal like environment.

#### PALYNOFACIES SEQUENCE 2 (2SWS)

Interval: 2532,5 - 2330,5 m (LD/BDF)

Age: Early Bathonian.

#### Discussion

Palynofacies type IV<sup>T</sup> from the basal, Early Bathonian, part of this sequence suggests deposition in a marine lower offshore



#### PALYNOFACIES SEQUENCE 4 ( 15 SWS)

Interval: 2160,5 - 1979,7 m (LD/BDF)

Age: Callovian - Late Oxfordian

#### Discussion

The log character and sidewall sample lithologies indicate an interval comprised of essentially of fine micaceous silty sandstones. Palynofacies types range from  $V^B$  and  $V^T$  in the lower part to V/VII towards the top, suggesting an upper offshore depositional environment in proximity to a river mouth. Relatively impoverished microplankton assemblages suggest salinities were unfavorable, a result most likely of fresh water input.

The abundance of blade shaped palynomaceral 4 in the lower part of this sequence is probably associated with the transgressive nature of the setting at this time.

#### PALYNOFACIES SEQUENCE 5 (13 SWS)

Interval: 1969,8 - 1893,2 m (LD/BDF)

Age: Latest Oxfordian

#### Discussion

Palynofacies type  $IV^T/V^T$  at the base of this sequence, and the abundance of blade shaped palynomaceral 4 suggests deposition is an offshore environment during a period of transgression. Palynofacies V occurring only a short interval above indicates the return of a fluvial influence.

The remaining sequence is characterized by a serrate blocky gamma log character yielding palynofacies type IX, indicating the predominantly high energy and highly oxidizing nature of the environment. Lower energy conditions were at times however re-established at the sea bottom, and characterized by palynofacies type VII containing palynomacerals 1 and 2 of a relatively fresh appearance, together with an impoverished microplankton assemblage. This suggests close proximity to the source of sediment supply.

## PALYNOFACIES SEQUENCE 6 (12 cores)

Interval: 1882,6 - 1843,8 (DD/BDF)

Age: Latest Oxfordian/Earliest Kimmeridgian

### Discussion

This sequence is represented by a coarsening upward sedimentary sequence. The lower finer grained part of this sedimentary sequence includes also a few minor coarsening upward sequences, which are essentially characterized by palynofacies types VII and V indicating an upper offshore / lower shoreface setting proximal to a river mouth. Microplankton occur rarely, suggesting a prominent freshwater influence.

Palynofacies IX from the uppermost sample of the sequence, within the sand interval indicates high energy and highly oxidizing depositional setting.

## PALYNOFACIES SEQUENCE 7

Interval: 1839,5 - 1826,0 m (LD/BDF)

Age: Kimmeridgian

### Discussion

The gradually increasing gamma ray values of this interval suggests a thinning upward sequence of sediments. Palynofacies types include predominantly types IV<sup>B</sup> / II containing moderately rich microplankton assemblages suggesting a gradually decreasing coastal influence. Some palynological constituents show an intermediate character to palynomaceral 2 and structureless sapropelic organic matter. This possibly indicates the effects of bacterial degradation in a less oxygenated bottom waters perhaps due to a deeper water setting.

#### 4. CONCLUSIONS

By applying principles described in report EP-53031, the following general environmental interpretation of the post Pliensbachian Jurassic interval of the Norske Shell well 31/2-8 is suggested (see Enclosure 1).

Seven palynofacies sequences are described, which are shown to represent a series of prograding offlap units, and in some cases a possible lateral shift of depositional environment.

Palynofacies sequence 1 of ?Bajocian age, strongly suggests a coastal possibly, non-marine environmental setting.

Palynofacies sequence 2 of essentially Bathonian age begins in the lower part with palynofacies indicating an offshore lower environment, deposition taking place during a transgressive period. The middle part of the sequence continues in an offshore lower environment in which the rate of sedimentation probably increased and the depositional setting became more regressive. In the upper part the sequence becomes more fluvial dominated.

Palynofacies sequence 3 of late Bathonian/Callovian age indicates a gradual shift from an offshore lower marine environment to a fluvial dominated shoreface like setting.

Palynofacies sequence 4 of Callovian to late Oxfordian age indicates deposition in a marine offshore upper environment. The lower part was probably deposited during a transgressive period. In the upper part there is more evidence of fluvial influence.

Palynofacies sequence 5 of latest Oxfordian age, indicates in the lower part a brief return to transgressive condition before deposition becomes fluvial dominated. Much of the upper part is characterized by a coarse series of sediments deposited in a high energy, highly oxidizing environment. However, lower energy conditions were re-established at times indicating a depositional environment very close to the source of sediment supply.

Palynofacies 6 of latest Oxfordian/earliest Kimmeridgian age indicates a progradation from offshore upper/shoreface lower setting, to a higher energy and highly oxidizing environment in close proximity to a river mouth.

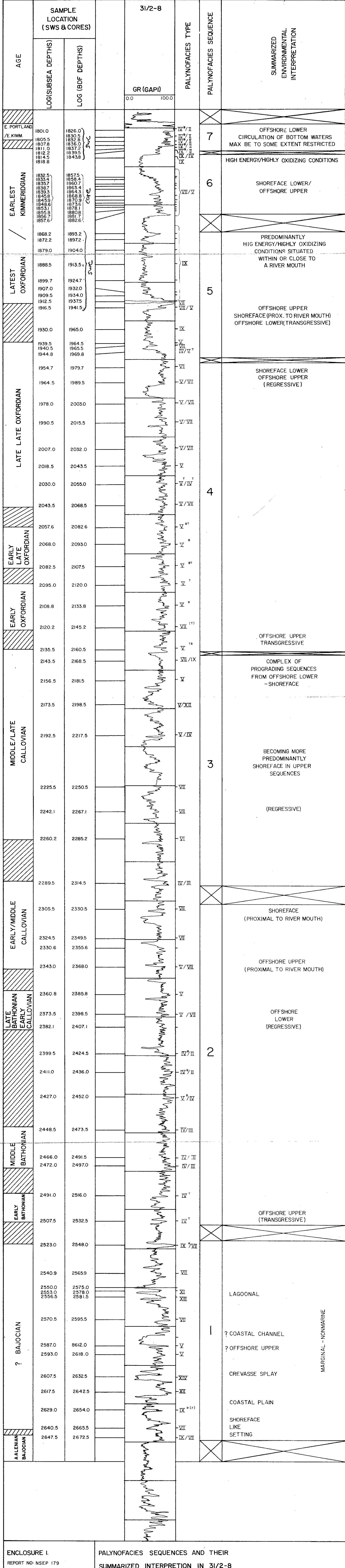
Palynofacies 7 of Kimmeridgian age indicates deposition in an offshore lower environment where bottom waters were to some extent anoxic.

A comparison with adjacent wells in the 31/2 block suggests the 31/2-8 area is for the majority of the sequences situated in an offshore setting, but often with evidence of fluvial influence. At times the area also appears to have been situated close to a source of terrestrial supply (river mouth). This is particularly apparent for period within the Callovian in the uppermost part of sequence 3, but most conspicuously in the uppermost part of the late Oxfordian/earliest Kimmeridgian interval in sequence 5.

Sequence 1 from the "Brent" equivalent appears to show more evidence of marine influence than seen elsewhere at this time, in the 31/2 block area.

The succeeding Bathonian palynofacies from the lower and middle parts of sequence 2 compare closely with those seen in 31/2-4 and 31/2-5, and suggest a continuation of offshore lower conditions along this regional line, and that the more coastal environments are limited to the east in the area around 31/2-1, 31/2-2 and 31/2-3.

The lower part of sequence 4, of Early Oxfordian and early late Oxfordian age suggests a relatively offshore setting comparable to that seen in 31/2-5. The upper part suggests more direct fluvial influence than is apparent in adjacent wells 31/2-1, 31/2-4, 31/2-5 and 31/2-6, during this part of the Late Oxfordian interval.



ENCLOSURE I. REPORT NO: NSEP 179 DRAWING NO: 1342/2 PALYNOFACIES SEQUENCES AND THEIR SUMMARIZED INTERPRETION IN 31/2-8

## REFERENCES

WHITAKER, M.F. (1981)

A palynofacies investigation in the Jurassic interval of the Norske Shell wells 31/2-1 and 31/2-2.

EP-53031

WHITAKER, M.F. (1981)

A palynofacies investigation in the Jurassic interval of the Norske Shell well 31/2-3.

EP-53465

WHITAKER, M.F. (1981)

A palynofacies investigation in the Jurassic interval of the Norsk Hydro well 31/4-2.

EP-53464

WHITAKER, M.F. (1982)

Palynofacies investigation in the Jurassic interval of the Norske Shell well 31/2-5

EP-54927

WHITAKER, M.F. (1982)

Palynofacies investigation in the Jurassic interval of the Norske Shell well 31/2-4

EP56203

WHITAKER, M.F. (1983)

Palynofacies investigation in the Jurassic interval of the Norske Shell well 31/2-6.