PALYNOLOGICAL RESULTS OF WELL 31/2-14

A/S Norske Shell
Exploration and Production

PALYNOLOGICAL RESULTS OF WELL 31/2-14

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EPXT/2

NSEP 230

SUMMARY (LGD = log depths; all others are drillers depths)

"interval"		Age	Zone
1480.0M	- 1527.0M (LGD)	Probably PALEOCENE	
1531.5M (LGD)		BERRIASIAN/LATE PORTLANDIAN	
1532.8M	- 1542.0M (LGD)	KIMMERIDGIAN	NS 9
1551.5M	- 1551.55M	LATEST OXFORDIAN/ KIMMERIDGIAN	NS 8.3/9
1555.0M (LGD)	- 1561.5M	LATEST OXFORDIAN	NS 8.3/8.2
1592.0M	- 1604.5M (LGD)	LATE LATE OXFORDIAN	NS 8.2
1620.0M	- 1653.0M (LGD)	LATE LATE OXFORDIAN	NS 8.1
1660.0M (LGD)		EARLY LATE OXFORDIAN	NS 7
1666.5M	- 1675.5M (LGD)	EARLY OXFORDIAN	NS 6
1683.5M	- 1701.5M (LGD)	CALLOVIAN	NS 5

DISCUSSION OF RESULTS

Interval: 1480.0 - 1527.0 m

Age: Probably PALEOCENE

Top and Base: Presence of Cordosphaeridium gracilis, Hystrichosphaeridium deanei, together with Areoligera spp. and Deflandrea spp.

Palynofacies: Type III^T suggests an offshore lower depositional setting within an open well ventilated sea.

Interval: 1531.5 m

Age : BERRISIAN/PORTLANDIAN
(Possibly Berriasian/late Portlandian)

Top: Occurrence of sapropelic structureless organic matter (SOM)

Base: Lower limit of Polystephanoceras sarjeantii, and Endoscrinium pharo.

Palynofacies: Type II indicates an offshore lower depositional setting with anoxic/dysaerobic bottom conditions.

Interval: 1532.8 - 1542.0 m

Age : KIMMERIDGIAN (Zone 9)

Top: Absence of forms indicating a Portlandian age, together with general similarity of the assemblage with Zone 9 of adjacent wells.

Base: Occurrence of Egmontodinium polyplacophorum together with forms comparable to Cribroperidinium granulatum.

Palynofacies: Type VI^{BLT} in the lower and IX^{R} is the upper part of the sequence suggests deposition resulting from transgressive activity. The abundance of palynomacerals 1 and 2 in the lower part of the sequence indicates the proximity of a terrestrial source.

Interval: 1551.5 - 1551.55 m

Age : LATEST OXFORDIAN/KIMMERIDGIAN (subzone 8.3/9)

Top: Uppermost limit of Endoscrinium galeritum and Scriniodinium crystallinum.

Base: Absence of forms associated with subzone 8.2 (e.g. G. dimorphum, Stephanelytron spp., Dinocyst type A) together with the occurrence of Endoscrinium spp.

Discussion
This "interval" is characterized by the common occurrence of Lithodinia sp. 3 (de Haan) and Ambonosphaera of calloviana and is very similar to an assemblage recorded in 31/2-11 at a comparable stratigraphic horizon ("interval" 1565.04 - 1568.94) Endoscrinium sp. is a form frequently coinciding with the base of Zone 9. The transgressive nature of the palynofacies in this "interval" may indicate the presence of E. galeritum is due to reworking.

Palynofacies: Type IV^{TBL} is believed to indicate deposition in an offshore lower environment and to represent a period of reniewed transgressive activity. This "interval" is believed correlatable with 31/2-11 and 31/2-10 (subzone 8.3/9.2)

Interval: 1555.0 - 1561.5 m

Age : LATEST OXFORDIAN (subzone 8.3/(8.3))

Top: Upper limit to the common occurrence of Endoscrinium galeritum.

Base: Above the top occurrence of Dinocyst type A and G. dimorphum (local range).

Palynofacies: Type IV^{BTL} in the finer grained lower part, and IX^{R} in the more sandy upper part, is believed to represent renewed transgressive activity within an offshore lower depositional setting.

Interval: 1592.0 - 1604.5 m

Age : late Late Oxfordian (subzone 8.2)

Top: Upper limit of Dinocyst type A

Base: Lower limit of Glossodinium dimorphum

Palynofacies: The interval 1587.5 - 1604.5 represents a palynofacies sequence from type IV^{T}/VI^{T} - $VI^{(T)}$ -IX. Palynomaceral 1 is abundant. It is envisaged this interval represents sediments deposited as a result of storm or transgressive activity, and relatively proximal to a source of terrestrial organic material.

The interval 1565.0 - 1571.5 is characterized by the palynofacies sequence V^{BT}, VI^{BLT} - IX. It is envisaged the sequence represents a similar depositional setting to the interval immediately below but deposited in a setting more proximal to the terrestrial source.

Interval: 1620.0 - 1626.0 m

Age : LATE LATE OXFORDIAN (Subzone 8.1)

Top: Immediately below lower limit of Glossodinium dimorphum

Base: Immediately above upper limit of Gonyaulacysta jurassica var. longicornis

Palynofacies: This interval is characterized by the palynofacies type VI^{T} and VII^{T} and the association of Endoscrinium galeritum and Hystrichogonyaulax cladophora.

Interval: 1634.0 - 1660.0 m

Age : EARLY LATE OXFORDIAN (Subzone 7)

Top: Upper limit of Gonyaulacysta jurassica var.longicornis.

Base: Immediately above upper limit of Gonyaulacysta scarburghensis

Palynofacies: Type IV^{T} at the base of the interval indicates deposition in offshore lower depositional environment within a transgressive setting. Type $VI^{(T)}$ in the upper part indicates increased terrestrial influence.

Interval: 1666.5 - 1675.5 m

Age: EARLY OXFORDIAN (Zone 6)

Top: Upper limit of Gonyaulacysta scarburghensis

Base: Lower limit of G.scarburghensis

Palynofacies: Type IV^T and IV^T/VII^T indicate deposition in an offshore lower environment within a transgressive setting.

Interval: 1683.5 - 1701.5

Age : CALLOVIAN (Zone 5)

Top: Upper limit of Lithodinia jurassica

Base: Presence of forms comparable to Lithodinia sp.D

Palynofacies: At 1683.5 m type $IV^{B(T)}$ suggests deposition in an offshore lower environment within a transgressive setting. The presence of Lithodinia jurassica, Nov. gen F sp.1 (de Haan) and blade-shaped palynomaceral 4 suggests this interval corresponds to subzone 5.3. At 1689.0 type IX^R suggests these sands are (submarine) reworked and may represent redeposited sediments resulting from transgressive activity. Interval 1696.0 - 1701.5 m is characterized by palynofacies type VI and suggesting proximity of a terrestrial source. The presence of forms comparable to Lithodinia sp.D and the absence of blade-shaped palynomaceral 4 suggests this interval corresponds to subzone 5.2.

WELL
31/2 - 14
GAMMA RAY RESPONS
0 API 100
1525m
1550.0 m
1575.0 m
1600.0 m
1625.0 m
1650 m
1675 m
1700 m
TD
PALYNOLOGICAL ZONE
AGE
LEGEND
• 1 specimens
/ 2-5 specimens
X 6-10 specimens
○ 11-20 specimens
● 21-100 specimens
COMMENTS
SAMPLE TYPE
PALYNOFACIES TYPE
DEPTH
MICROPLANKTON
Areoligera spp.
Deflandrea spp.
Cordosphaeridium gracilis
Florentinia deanei
Pterospermellae
Leiospheres (large size)
Polystephanophorus sarjeantei
Endoscrinium pharo
Acritarch
Egmontodinium polyplacophorum
Cribroperidinium granulatum
Pterodinium sp.
Leptodinium sp.
Microforam test linings
Sirmiodiniopsis sp.
Hystrichogonyaulax cladophora
Lithodinia nov. sp. 3 (M.S.)
Parvocavatus (D.7) sp.
Endoscrinium sp.
Dinocyst type
Lithodinia nov. sp.3/Valensiella sp.
Ambonosphaera cf. calloviana
Endoscrinium galeritum
Pareodinia tabulata (M.S.)
Chytroeisphaeridia chytroeides
Systematophora cf. vestitum
Scriniodinium crystallinum
Problematicum 12 (de Haan)
Gonyaulacysta jurassica
Pareodinia ceratophora
Fromea sp.
Exiguisphaera phragma
Dinocyst type A.
Leptodinium mirabile
Dingodinium cf. jurassicum
Endoscrinium luridem
Occisucysta cf. evittii
Kalyptea diceras
Sirmiodinium grossii
Stephanelytron sp.
Glossodinium dimorphum
Chytroeisphaeridia cf. cerastes
Prolixosphaeridium cf. capitatum
Adnato sphaeridium aemulum
Gonyaulacysta jurassica var. longicornis
Gonyaulacysta scarburghensis
Nov. gen F. sp. (de Haan)
Lithodinia jurassica
Valensiella ovula
Gonyaulacysta eisenackii
Lithodinia sp. A (m.s.)
Lithodinia sp. D (m.S.)
Probably PALEOCENE
Cordosphaeridium gracilis
Florentinia deanei
Areoligera spp.
Deflandrea spp.
III¹ 1527,0
II 1531,5
IX 1532,5
IX* 1532,8
Local correlation with adjacent wells (absence of Portlandian indications)
9
KIMMERIDGIAN
IX* 1534,0
IX 1535,5
C. granulatum
E. polyplacophorum
1542,0
VI 1543,0
1545,0
LATEST OXFORDIAN /KIMMERIDGIAN
IV 1551,5
IV 1551,55
1552,5
1553,0
1555,0
8.3/9
E. galeritum, S.crystallinum
Common E. galeritum
8.3 / (8.2)
LATEST OXFORDIAN
IX 1557,0
1560,0
IV 1561,0
1561,5
IX 1561,5
IX 1565,0
IX 1567,5
IX 1569,0
IX* 1570,5
V/VI 1571,5
VI 1571,7
IX 1572,7
IX 1573,8
IX 1574,0
VI/VII 1574,5
IX* 1575,0
IX 1577,0
1579,0
V 1581,0
1582,5
1587,5
IX 1589,0
Dinocyst type A
1592,0
VI 1595,0
1597,0
8.2
V 1598,5
IV/VI 1601,0
LATE LATE OXFORDIAN
G. dimorphum
IV/VI 1604,5
VI 1611,5
VI 1620,0
8.1
Interval characterized by palynofacies type VI and common E. galeritum and H. cladophora
VII 1626,0
VI 1629,0
G. jurassica var. longicornis
IV 1634,0
VI 1638,0
7
EARLY LATE OXFORDIAN
A. aemulum
VI 1647,0
1653,0
G. jurassica var. longicornis
IV 1660,0
G. scarburghensis
IV 1666,5
6
EARLY OXFORDIAN
G. scarburghensis
Base common P. 4
IV/VII 1675,5
L. jurassica
Base blade-shaped P. 4
VI 1683,5
5
CALLOVIAN
IX* 1689,0
VI/VII 1696,0
? L. sp. D
VI 1701,5
?IX 1713,5
INTERVAL STUDIED ONLY FOR MARKER TYPES
NSEP 230 G.1776