LOCATION: NORWEGIAN NORTH SEA WELL 33/9 - 9

CLIENT: MOBIL EXPLORATION NORWAY INC.

CHART No. 1 — 254m -1700m

ROBERTSON RESEARCH INTERNATIONAL LIMITED
BIOSTRATIGRAPHICAL ANALYSIS CHART

SCALE: 1:2000 — ANALYST: M.C. — DATE: JAN. 1978

LITHOLOGY: CLAY; SHALE/CLAYSTONE/MARLSTONE; SILTY / SANDY CLAY; SILTY SHALE/CLAYSTONE/MARLSTONE; SILT / SILTSTONE; Very fine - medium; Coarse sand - granules; SANDY SANDSTONE; Pebbles; ARGILLACEOUS SANDSTONE; LIMESTONE; SILTY/SANDY LIMESTONE; ARGILLACEOUS LIMESTONE; DOLOMITE; CHALK; ARGILLACEOUS SEDIMENTARY ROCKS; COAL / LIGNITE; VOLCANICS; RED SEDIMENTARY ROCKS; PYRITE; GLAUCONITE; SIDERITE/SPHAEROSIDERITE; SHELL FRAGMENTS

O PRESENT; ● COMMON; ■ ABUNDANT; C CAVED; R REWORKED; ⊗ DIAGENETIC; ? REWORKED / ? CAVED; IN SITU; KEROGEN: V VITRINITE, I INERTINITE, E EXINITE, S AMORPHOUS SAPROPEL

SIDEWALL CORE; CORE; CASING POINT

ENVIRONMENT: TERRESTRIAL, LACUSTRINE / FLUVIAL, CONTINENTAL; LITTORAL, TRANSITIONAL; INNER SHELF, OUTER SHELF, MARINE

FORAMINIFERA AND OSTRACODA — OTHER FOSSILS

INTERPRETED LITHOLOGY	DEPTH IN METRES	SYSTEM / SUB-SYSTEM	STAGE / FORMATION	ASSEMBLAGES: MICRO-FAUNAL	ASSEMBLAGES: MACRO-FAUNAL	COMMENTS
	250	PLIOCENE		CIBICIDES LOBATULUS VAR. GIROSSA		Cibicides lobatulus var. gross
	500					REWORKING
	525	LATE MIOCENE		EPIROD. SUB-G. OTICE		Pyrgo bulloides
	550			BOLIVINA SPP.		Siphonina estata
	575	MIDDLE MIOCENE		CIBICIDES LOBATULUS VAR. GIROSSA		
	700					INCREASE IN NUMBERS OF Cibicides spp.
	800			CIBICIDES LOBATULUS VAR. GIROSSA / CARDIOLARIA LAEVIGATA / NONION SPINAE		
	850					Schwagerina bulloides
	925	LOWER MIOCENE		ANGULOGERINA GRACILIS VAR. TENUISTRIATA		A. gracilis var. tenuistriata
	975			ELPHIDIUM SUBANDEANUM		Elphidium sylvanoblasum
	1000	OLIGOCENE		SPONGE SPICULES TYPES A,B,C		APPEARANCE OF MICROFAUNAS DOMINATED BY SPONGE SPICULES.
	1125			BATHYSIPHON SP.		INCREASE IN NUMBERS OF AGGLUTINATING FORAMINIFERA
	1200					CAVING
	1350					Cyclammina challinori
	1375	LATE EOCENE		CYCLAMMINA CHALLINORI / BATHYSIPHON SP. / CLAVULINOIDES CARAPITANUS		Asterigerina pentacamerata
	1400	M. EOC.				Epistomiaroides spectabilis
						Asterigerina schlagintweiti
	1425	PALAEOCENE – LOWER EOCENE		LARGE - FLAT RADIOLARIA		APPEARANCE OF LARGE, FLAT RADIOLARIA
	1575			SMALL ROUND/OVATE RADIOLARIA		FLOOD OF SMALL, ROUND/OVATE RADIOLARIA
	1625	PALAEOCENE		CORONIDOSIGNOS SP.1		INCREASE IN NUMBERS OF UNPYRITISED Coronidosignos sp.1
	1675					

COMMUNITY KEROGEN COMPOSITION: Aquatic / Terrestrial; Oxidising / Reducing; Proximity

Drg. No. 329/1142/4073

LOCATION: NORWEGIAN NORTH SEA WELL 33/9 - 9

CLIENT: MOBIL EXPLORATION NORWAY INC.

CORE ANALYSIS CHART

ROBERTSON RESEARCH INTERNATIONAL LIMITED
BIOSTRATIGRAPHICAL ANALYSIS CHART

SCALE: NOT TO SCALE | ANALYST: DJS/JU LAR/KAL | DATE: JAN. 1978

CLAY
SHALE/CLAYSTONE/MUDSTONE
SILTY/SANDY CLAY
SILTY/SANDY SHALE/CLAYSTONE/MUDSTONE
SILT / SILTSTONE
SAND/SANDSTONE: Very fine - medium; Coarse sand - granules; Pebbles
ARGILLACEOUS SANDSTONE
LIMESTONE
SILTY/SANDY LIMESTONE
ARGILLACEOUS LIMESTONE
DOLOMITE
CHALK
CALCAREOUS SEDIMENTARY ROCKS
COAL / LIGNITE
VOLCANICS
red RED SEDIMENTARY ROCKS
P PYRITE
G GLAUCONITE
S SIDERITE/SPHAEROSIDERITE
SHELL FRAGMENTS

o PRESENT
● COMMON
■ ABUNDANT
C CAVED
R REWORKED
✻ DIAGNOSTIC

KEROGEN
V VITRINITE
I INERTINITE
E EXINITE
S AMORPHOUS SAPROPEL

NOTE - CORE DEPTHS UNCORRECTED FOR CORES 1 - 16. CORRECTED FOR CORES 17 - 23.

FORAMINIFERAL ASSEMBLAGES: Agglutinated; Calcareous benthonic; Planktonic

ENVIRONMENT: CONTINENTAL (TERRESTRIAL, LACUSTRINE / FLUVIATILE); TRANSITIONAL (DELTAIC, LITTORAL); MARINE (INNER SHELF, OUTER SHELF, BATHYAL)

FORAMINIFERA: 1 Barren of foraminifera; 2; 3; 4 Agglutinating forams. indet; 5 Trochammina cf. squamata*; 6 Verneuilinoides sp.; 7 Ammodiscus sp.; 8; 9; 10; 11; 12; 13 Monoceratina aff. vulsa; 14; 15; 16; 17; 18

OSTRACOD: 19 Barren of recognizable palynomorphs; 20; 21; 22 Leptodinium sp.; 23 Mendicodinium spp.*; 24 Pareodinia ceratophora; 25 Cleistosphaeridium sp.; 26 Microforaminifera; 27 Pareodinia sp.; 28 Chytroeisphaeridia pocockii; 29 Chytroeisphaeridia spp.; 30 Nannoceratopsis gracilis*; 31 Meudicodinium greenlandium*; 32 Nannoceratopsis gracilis (reticulate var.)*; 33 Tasmanitids; 34 Kallyptea halosa; 35 Acanthomorph acritarchs; 36 Chytroeisphaeridia chytroeides; 37 Crassosphaerids; 38 Chytroeisphaeridia "gigantea"; 39 Leiosphaeres; 40; 41; 42; 43

MICROPLANKTON: 44; 45 Bisaccates; 46 Callialasporites spp.; 47 Cerebropollenites mesozoicus; 48 Deltoidospora spp.; 49 Osmundacidites/Baculatisporites group; 50 Spheripollenites spp.; 51 Todisporites spp.; 52 Araucariacites australis; 53 "Circumpollis" group; 54 Perinopollenites elatoides; 55 Lycopodiumsporites spp.; 56 Spheripollenites/Sphaeromorph group; 57 Callialasporites dampieri; 58 Callialasporites turbatus; 59 Striate bisaccates R; 60 Klukisporites spp.; 61 Uvaesporites spp.; 62 Densoisporites spp.; 63 Sestrosporites pseudoalveolatus; 64 Callialasporites segmentatus; 65 Densoisporites velatus; 66 Gleicheniidites senonicus; 67 Indet. Palaeozoic spore R; 68 Neoraistrickia sp.; 69 Chasmatosporites spp.; 70 Contignisporites sp.; 71 ? Cerebropollenites cf. thiergartii; 72 Classopollis torosus; 73 Lycopodiacidites rugulatus; 74 Neochomotriletes triangularis; 75 Cerebropollenites cf. thiergartii; 76 Neoraistrickia cf. taylorii; 77 Converrucosisporites sp.; 78; 79; 80; 81; 82; 83; 84; 85; 86; 87; 88; 89; 90; 91; 92; 93; 94; 95; 96; 97; 98; 99; 100

MIOSPORES

INTERPRETED LITHOLOGY	DEPTH IN METRES	SYSTEM/SUB-SYSTEM	STAGE / FORMATION	ASSEMBLAGES: MICRO-FAUNAL	ASSEMBLAGES: PALYNO-FLORAL	COMMENTS	DOMINANT KEROGEN COMPONENTS
	CORES 1-8	MIDDLE JURASSIC	BATHONIAN $V_1/?t$	? P. CERATOPHORA / N. SPICULATA ? XVII/XVI		IMPOVERISHED PALYNOFLORAS	VITRINITE / SPOROPOLLENIN
	2404.5 – 2417.2						
	2422.2 – 2433.0		EARLIEST BATHONIAN – BAJOCIAN V_1		N. SPICULATA XVII	N. gracilis/INCREASE IN MIOSPORE ABUNDANCE AND DIVERSITY; INTERVAL WITH Klukisporites	
	2435.5 – 2489.3		EARLY BAJOCIAN V_2	IMPOVERISHED	N. GRACILIS XVIII; XVIIIA	INFLUX OF N. gracilis; "Middle Jurassic Miospore Assemblages"/ Callialasporites	
	2489.4 – 2491.5						
	2492.5 – 2506.5	LOWER JURASSIC	LATE TOARCIAN W	SMALL FINE GRAINED AGGLUTS.	? XVIIIB	TOP DUNLIN SHALE; "Lower Jurassic Miospore Assemblages"; FINE GRAINED SMALL AGGLUTS.	AMORPHOUS SAPROPEL / MIXED HUMICS
	CORES 9-23						
	2715.7 – 2757.5		? EARLY SINEMURIAN ? HETTANGIAN ? Z		? P. LANGI XIX	LOCALISED INFLUX OF MIOSPORES	
	2769.5 – 2876.0	INDETERMINATE (? TRIASSIC)		IMPOVERISHED	NON - DIAGNOSTIC	CORE SAMPLES BARREN OR ONLY CONTAIN RARE, POORLY PRESERVED, NON - DIAGNOSTIC PALYNOMORPHS	POOR KEROGEN RECOVERY – ? INERTINITE

DEPTH IN METRES

Drg. No. 325/1142/4076

ROBERTSON RESEARCH INTERNATIONAL LIMITED

SUMMARY LOG 33/9-9

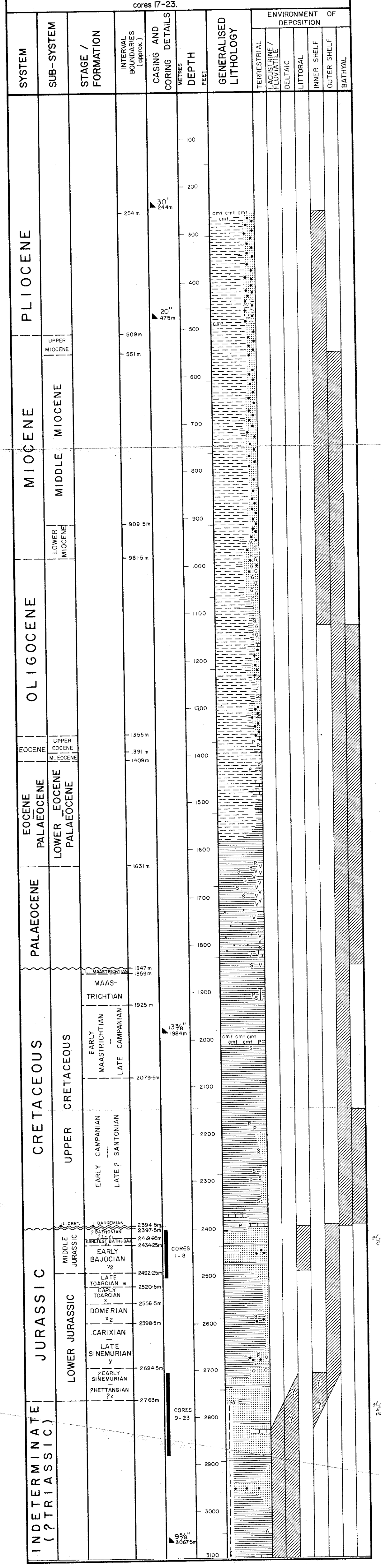
AREA : NORWEGIAN NORTH SEA — SPUD DATE : 27-7-77

COMPANY : MOBIL EXPLORATION NORWAY INC. — COMPLETION DATE : 19-11-77

INTERVAL STUDIED : 254 m - 3100 m — T. D. 3100 m

Dr. No. 325/1142/4077 — SCALE 1 : 5000 — Date : 3 Feb'78

▌ Cored Interval : depths uncorrected for cores 1-16; corrected for cores 17-23. ◣ Casing Shoe



LOCATION: NORWEGIAN NORTH SEA WELL 33 / 9 - 9

CLIENT: MOBIL EXPLORATION NORWAY INC.

CHART No. 2b — 1700m - 3100m

ROBERTSON RESEARCH INTERNATIONAL LIMITED
BIOSTRATIGRAPHICAL ANALYSIS CHART

SCALE: 1:2000 | ANALYST: LAR/KAL | DATE: JAN. 1978

CLAY
SHALE/CLAYSTONE/MUDSTONE
SILTY / SANDY CLAY
SILTY/SANDY SHALE/CLAYSTONE/MUDSTONE
SILT / SILTSTONE
SAND/SANDSTONE: Very fine - medium; Coarse sand - granules; Pebbles
ARGILLACEOUS SANDSTONE
LIMESTONE
SILTY/SANDY LIMESTONE
ARGILLACEOUS LIMESTONE
DOLOMITE
CHALK
CALCAREOUS SEDIMENTARY ROCKS
COAL / LIGNITE
VOLCANICS
red — RED SEDIMENTARY ROCKS
P — PYRITE
G — GLAUCONITE
S — SIDERITE/SPHAEROSIDERITE
SHELL FRAGMENTS

o PRESENT
● COMMON
■ ABUNDANT
C CAVED
R REWORKED
✱ DIAGNOSTIC

KEROGEN
V VITRINITE
I INERTINITE
E EXINITE
S AMORPHOUS SAPROPEL

SIDEWALL CORE
CORE DEPTHS UNCORRECTED FOR CORES 1 - 16 CORRECTED FOR CORES 17 - 23

DOMINANT KEROGEN COMPONENTS: Agglutinated; Calcareous benthonic; Plankton(ic)

FORAMINIFERAL ASSEMBLAGES

ENVIRONMENT: TERRESTRIAL; LACUSTRINE / FLUVIATILE; DELTAIC; LITTORAL; INNER SHELF; OUTER SHELF; BATHYAL; CONTINENTAL; TRANSITIONAL; MARINE

INTERPRETED LITHOLOGY: SEE CHART NO. 2a

DEPTH IN METRES

SYSTEM/SUB-SYSTEM: PALAEOCENE; UPPER CRETACEOUS; MIDDLE JURASSIC; LOWER JURASSIC; INDETERMINATE (? TRIASSIC)

STAGE / FORMATION: LATE MAASTRICHTIAN; MAASTRICHTIAN; EARLY MAASTRICHTIAN; LATE CAMPANIAN; LATE ? SANTONIAN - EARLY CAMPANIAN; L. CRET; BARREMIAN; ? BATH - ONIAN; EARLIEST BATH-BAJ; EARLY BAJOCIAN; LATE TOARCIAN; EARLY TOARCIAN; DOMERIAN; CARIXIAN; LATE SINEMURIAN; ? EARLY SINEMURIAN; ? HETTANGIAN

ASSEMBLAGES: MICRO-FAUNAL; PALYNO-FLORAL

CORES 8; CORES 9 - 23

COMMENTS

- ABUNDANT UPPER CRETACEOUS DINOCYSTS INCLUDING ABUNDANT O. striatoperforata ? MINOR PALYNOFACIES BREAK BETWEEN 2396M AND 2399M.
- N. gracilis / INFLUX MIOSPORE ABUNDANCE AND DIVERSITY — Klukisporites
- INFLUX OF N. gracilis
- OBSERVED BASE OF "Middle Jurassic Miospore Assemblages" — Callialasporites IN CORE SAMPLES
- "Lower Jurassic Miospore Assemblages" — Callialasporites / P. ceratophora IN CUTTING SAMPLES
- INFLUX OF ABUNDANT N. gracilis IN ASSOCIATION WITH SIMPLE Sphaeromorphs
- INFLUX OF PERSISTANT AND COMMON Chasmatosporites / C. cf. thiergartii
- INFLUX OF ABUNDANT Chasmatosporites
- BASE OF COMMON N. gracilis IN CUTTINGS
- N. gracilis ABSENT IN CORE SAMPLES AT AND BELOW 2715.7M
- CORE SAMPLES AT AND BELOW 2757.5M BARREN OR ONLY YIELDED RARE, POORLY PRESERVED PALYNOMORPHS.
- CUTTINGS SAMPLES 2831M - 3100M DOMINATED BY CAVED UPPER LIASSIC, MIDDLE JURASSIC AND CRETACEOUS PALYNOMORPHS — RED BEDS DOMINANT

? P. CERATOPHORA / N. SPICULATA ? XVI / XVI; N. SPICULATA XVI; N. GRACILIS XVIII; XVIIIA; ? XVIIIB; XVIIIC; P. LANGII - N. GRACILIS XIX - XVIIIC; P. LANGII XIX; IMPOVERISHED / NON DIAGNOSTIC

DOMINANT KEROGEN COMPONENTS: AMORPHOUS SAPROPEL / EXINITE; VITRINITE / EXINITE; ? AMORPHOUS SAPROPEL / VISTRINITE; ? AMORPHOUS SAPROPEL / MIXED HUMICS; ? AMORPHOUS SAPROPEL; POOR KEROGEN RECOVERY IN CORE SAMPLES; ? HUMIC KEROGENS IN CUTTINGS (LATE DIAS-ABOVE)

core 1 — 2402.7 — 2421

MICROPLANKTON

1 Deflandrea spp.
2 Lejeunia spp.
3 Chlamydophorella spp.
4 Spiniferites spp.
5 Spiniferites ramosus s.l.
6 Oligosphaeridium spp.
7 Cleistosphaeridium spp.
8 Deflandrea cf. pallucida
9 Oligosphaeridium complex
10 Canningia spp.
11 Kleithriasphaeridium sp.
12 Odontochitina operculata
13 Exochosphaeridium spp.
14 Palaeoperidinium spp.
15 Astrocysta cretacea
16 Cyclonephelium distinctum
17 Chlamydophorella discreta
18 Odontochitina striatoperforata *
19 Hystrichodinium pulchrum
20 Adnatosphaeridium sp.
21 Hystrichosphaeridium spp.
22 Stephanodinium coronatum
23 Spiniferites cingulatus s.l.
24 Achomosphaera spp.
25 Diconodinium sp.
26 Scrinodinium sp.
27 Pseudoceratium ceratioides *
28 Cribroperidinium edwardsi
29 Cleistosphaeridium tiarum *
30 Leiospheres
31 Indet. gonyaulacids
32 Aff. Paredinia ceratophora
33 Aff. Phoberocysta neocomica
34 Eisenackia sp.
35 ? Perossigmopsis aureolata
36 Mendicodinium groenlandicum *
37 Nannoceratopsis gracilis *
38 Acanthomorph acritarchs
39 Paredinia ceratophora *
40 Chyreisphaeridia "gigantea"
41 Microforaminifera
42 Indet. ? Liassic dinocysts
43 Crassosphaeridis
44 cf. Mendicodinium reticulatum *
45 Indet. reticulate cyst.
46 ? Paredinia "fusiformis" *
47 aff. Lusitanides spinosa *
48 Tasmanitids
49 Mendicodinium spp. *
50 ? Mendicodinium sp.
51 ? Polysphaeridium sp.
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MIOSPORES

57 Cerebropollenites mesozoicus
58 Bisaccates
59 Spheripollenites spp.
60 Deltoidospora spp.
61 Osmundacidites / Baculatisporites group
62 Callialasporites trilobatus
63 Sphaeromorph - Spheripollenites group
64 Perinopollenites elatoides
65 Classopollis torosus
66 Araucariacites australis
67 Klukisporites sp.
68 Callialasporites dampieri
69 "Circumpolles" group
70 Cerebropollenites cf. thiergartii *
71 Lycopodiumsporites spp.
72 Duplexisporites sp.
73 Stapinisporites caminus
74 Chasmatosporites spp.
75 Gleichenidites senonicus
76 Granulatisporites sp.
77 Densosporites sp. R
78 Lunatisporites sp. R
79 Lycopodiacidites sp.
80 Striate bisaccate R
81 Corollina sp.
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Drg. No. 325/1142/4075

LOCATION: NORWEGIAN NORTH SEA WELL 33 / 9 - 9

CLIENT: MOBIL EXPLORATION NORWAY INC.

CHART No. 2a — 1700M - 3100M

ROBERTSON RESEARCH INTERNATIONAL LIMITED
BIOSTRATIGRAPHICAL ANALYSIS CHART

SCALE: 1 : 2000 — ANALYST: MC / DJS / JU — DATE: JAN. 1978

LEGEND: CLAY; SHALE/CLAYSTONE/MUDSTONE; SILTY / SANDY CLAY; CLY / SANDY SHALE / CLAYSTONE/MUDSTONE; SILTY / SILTSTONE; Very fine - medium, Coarse and granules, Pebbles — SAND/SANDSTONE; ARGILLACEOUS SANDSTONE; LIMESTONE; SILTY/SANDY LIMESTONE; ARGILLACEOUS LIMESTONE; DOLOMITE; CHALK; CALCAREOUS SEDIMENTARY ROCKS; COAL / LIGNITE; VOLCANICS; RED SEDIMENTARY ROCKS

PYRITE; GLAUCONITE; SIDERITE/SPHAEROSIDERITE; SHELL FRAGMENTS

PRESENT; COMMON; ABUNDANT; CAVED; REWORKED; DIAGNOSTIC

SIDEWALL CORE (CORE DEPTHS INCORRECTLY FOR CORES 1 - 9 CORRECTLY FOR CORES 17 - 23)

KEROGEN: VITRINITE; INERTINITE; EXINITE; AMORPHOUS SAPROPEL

FORAMINIFERAL ASSEMBLAGES: Agglutinated; Calcareous Benthonic; Planktonic

ENVIRONMENT: CONTINENTAL; TRANSITIONAL; MARINE — TERRESTRIAL; LACUSTRINE / FLUVIATILE; DELTAIC; LITTORAL; NERITIC; OUTER SHELF; BATHYAL

FORAMINIFERA — OSTRACODA — OTHER FOSSILS

INTERPRETED LITHOLOGY	DEPTH IN METRES	SYSTEM / SUB-SYSTEM	STAGE / FORMATION	ASSEMBLAGES: MICRO-FAUNAL	ASSEMBLAGES: PALYNO-FLORAL	COMMENTS
	1700–1850	PALAEOCENE	LATE MAASTRICHTIAN	BATHYSPHON SP. / A. INCERTUS / CL. CHAROIDES		
	1850–2050	UPPER CRETACEOUS	EARLY MAASTRICHTIAN – LATE CAMPANIAN; MAASTRICHTIAN	RUGOGLOBIGERINA RUGOSA / G. ASPER / HETEROHELIX SPP.	PROTOSTELIDIA SPP.	TERTIARY CAVING; LATE CRETACEOUS CAVING; RED-STAINED FORAMS
	2050–2375	UPPER CRETACEOUS	LATE ? SANTONIAN – EARLY CAMPANIAN	AGGLUTINATING FORMS		Globorotalites cf. multisepta; Rzehakina epigona; INCREASING NUMBERS OF AGGLUTINATING FORMS
	2375–2400	CRET. / EARMERIAN				
	2400–2900	MIDDLE JURASSIC	BATH – ONIAN; EARLIEST BATHONIAN; EARLY BAJOCIAN	IMPOVERISHED		CUTTINGS FROM CORED INTERVAL CONSIST ESSENTIALLY OF CAVED MATERIAL. FOR DETAILS OF CORE SAMPLES SEE CORE ANALYSIS CHART.
	2900–3000	LOWER JURASSIC	LATE TOARCIAN; EARLY TOARCIAN	SMALL, FRAGMENTED AGGLUTE.		SMALL, FINE GRAINED AGGLUTINATING FORAMINIFERA; TERTIARY AND CRETACEOUS CAVING
	3000–3700	LOWER JURASSIC	CARIXIAN; LATE SINEMURIAN; DOMERIAN	HUNGARELLA / LENTICULINA VARIANS		NUMEROUS OSTRACODES; RICH IN CALCAREOUS BENTHONIC FORAMS AND OSTRACODES
	3700–3100	INDETERMINATE (? TRIASSIC)	? EARLY SINEMURIAN / ? RETTANGIAN			CUTTINGS AND CORE SAMPLES BELOW 3700M ONLY CONTAIN CAVED FORAMINIFERA. FOR LITHOLOGICAL DETAILS SEE CORE ANALYSIS CHART.*; FIRST RED SHALE; RED BEDS DOMINANT

DEPTH IN METRES

Drg. No. 325/1142/4.074