DeVli Project

Palynology of core samples from Jurassic-Cretaceous intervals of six wells from the West Netherlands and Broad Fourteens basins, The Netherlands

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Appendices

1 Introduction

In this report the results of palynological analyses on cored intervals from wells Gouda-01 (GOU-01), Hazerswoude-01 (HZW-01), Oisterwijk-01 (OIW-01), Delft-02 (DEL-02), Berkel-02 (BRK-02), K15-01 and P15-07. Wells K15-01 and P15-07 are from the Broad Fourteens Basin, all others are from the West Netherlands Basin, see Figure 1 and 2.

The palynological analyses are carried out as part of the DeVli project, which aims to stratigraphically constrain the Upper Jurassic and Lower Cretaceous deposits of the Broad Fourteens and West Netherlands basins. The project deliverables will consist of thickness maps and cross sections, which will be achieved by seismic mapping of six horizons which will be integrated with stratigraphic analyses of most wells occurring in the study area. The DeVli project is a joint collaboration of TNO Geological Survey of the Netherlands and EBN. The project is fully sponsored by EBN. The results of DeVli will serve as input for the GEODE project (GEODE Atlas).

Note that the original plan for palynological analyses within the DeVli project was to study the cored sections and side-wall cores of the Delft Sandstone and Rodenrijs Claystone members of the newly drilled geothermal wells DEL-GT-01 and DEL-GT-02. Initially, it was not possible to gain access to this material so an alternative plan was conceived with samples from small cored intervals of old wells, the results of which are reported in this document.

The core samples were collected in May 2024 by Roel Verreussel (TNO). The samples were subsequently processed by Nico Janssen (TNO) and analysed and interpreted by Roel Verreussel.

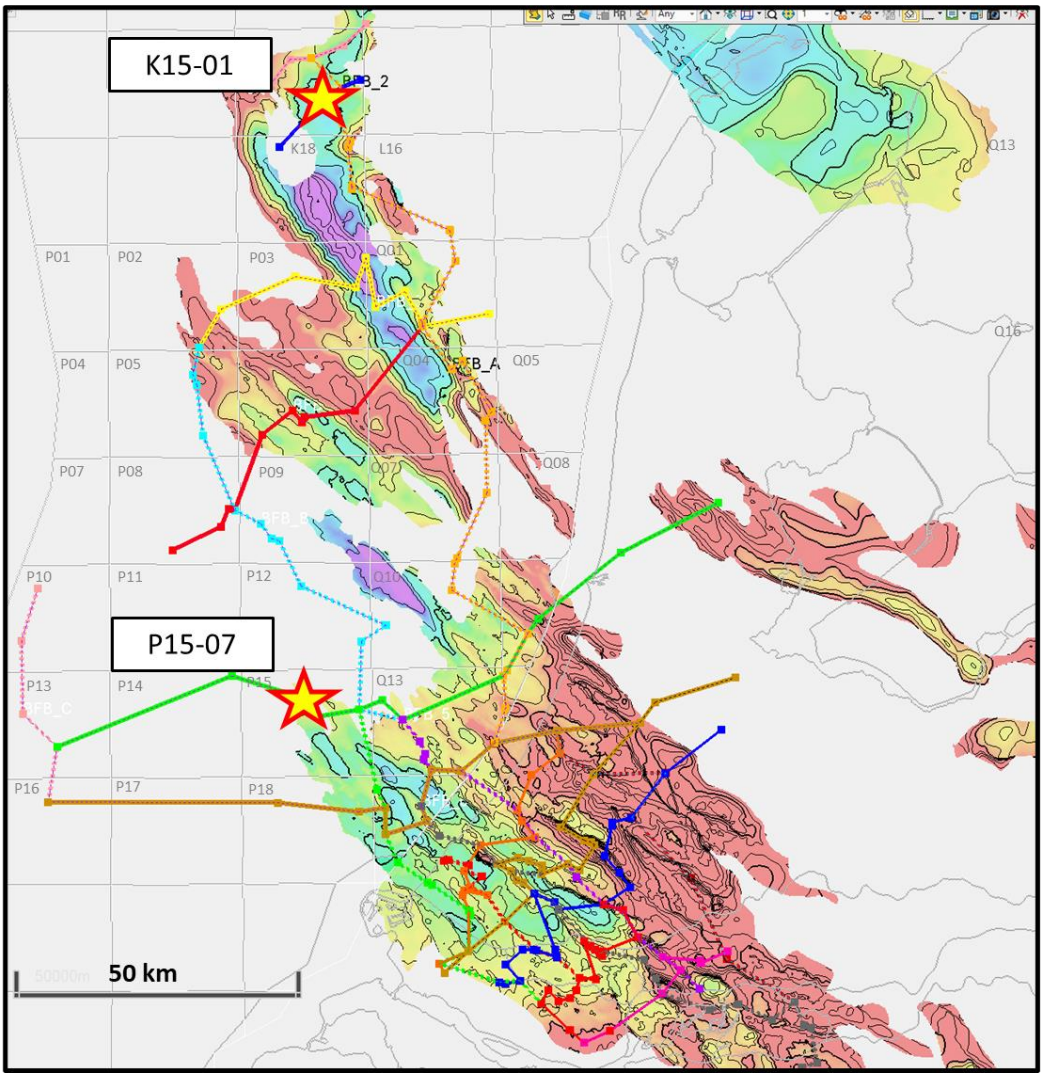


Figure 1 Location map of the studied wells from the offshore Broad Fourteens Basin. The underlying map represents the time-depth of the base of the Schieland Group (purple and blue = deep; orange and yellow = shallow).

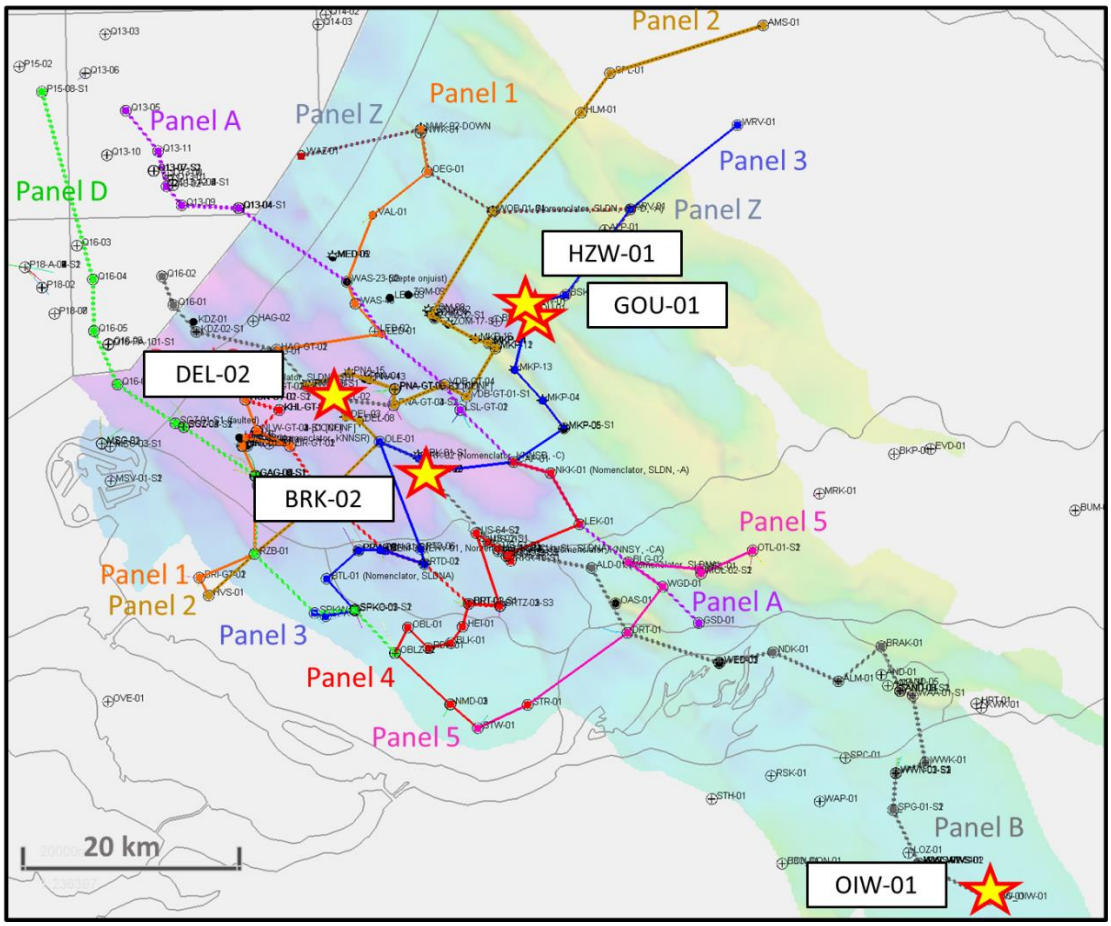


Figure 2 Location map of the studied wells from the onshore West Netherlands Basin. The underlying map represents the time-depth of the base of the Schieland Group (purple and blue = deep; orange and yellow = shallow).

2 Material and Methods

2.1 Abbreviations used

TNO's standard abbreviations as used in palynology reports are listed in Table 1.

Table 1 List of abbreviations

CO	Core sample
SC	Side-wall core sample
CU	Cuttings sample
m	Meter
ft	Feet
MD	Measured Depth
LOD	Last Occurrence Datum
FOD	First Occurrence Datum
ND	Not Diagnostic

2.2 Samples

A total of 48 samples was collected at TNO's core shed in Zeist. The main targets were the Nieuwerkerk and Breeveertien formations. An overview of the amount of samples per well and the targeted units is provided in Table 2.

Table 2 Overview of samples per well and target intervals

well	Samples	Type	Target
GOU-01	7	CORE	Nieuwerkerk?
HZW-01	10	CORE	Nieuwerkerk?
BRK-02	5	CORE	Delft Sandstone & Alblasserdam
DEL-02	2	CORE	Rodenrijs
OIW-01	11	CORE	"Old" Alblasserdam
K15-01	8	CORE	Delfland-Vlieland transition
P15-07	5	CORE	Nieuwerkerk or Breeveertien?
total	**48**		

2.3 Sample preparation and counting procedure

The samples were processed by Nico Janssen (TNO), using the standard sample processing procedures. This involves crushing and treatment with HCl to digest the carbonate. After that, the mineral bonds of the silicates are destroyed by applying HF, which releases the acid-resistant organic matter. The organic residue is then concentrated by sieving over a 7 micron mesh. The organic residue is put on a glass slide, fixed by a mounting medium such as glycerine jelly and covered by a thin glass cover slip. The palynological slides are studied using a transmitted light microscope with magnifications varying between 100 and 1000 microns. The dinoflagellate cysts and pollen and spores are identified on species level and counted up to 100 specimens (if possible). The occurrences of the different species are displayed on palynological distribution charts. These charts are the basic modules for the age and palaeoenvironmental interpretation (Appendix 2).

2.4 Lithostratigraphy

DeVli in the DeVli project stands for Delfland-Vlieland. These names represent lithostratigraphic units, viz. the Delfland Subgroup of the Schieland Group and the Vlieland Subgroup of the Rijnland Group. The Delfland Subgroup is the oldest of the two and mainly consists of non-marine deposits. The Vlieland Subgroup is the youngest and consists mostly of marine deposits. The two subgroups occur in both the West Netherlands as the Broad Fourteens Basin, but on formation and member level, significant differences exist, see Figure 3 and 4.

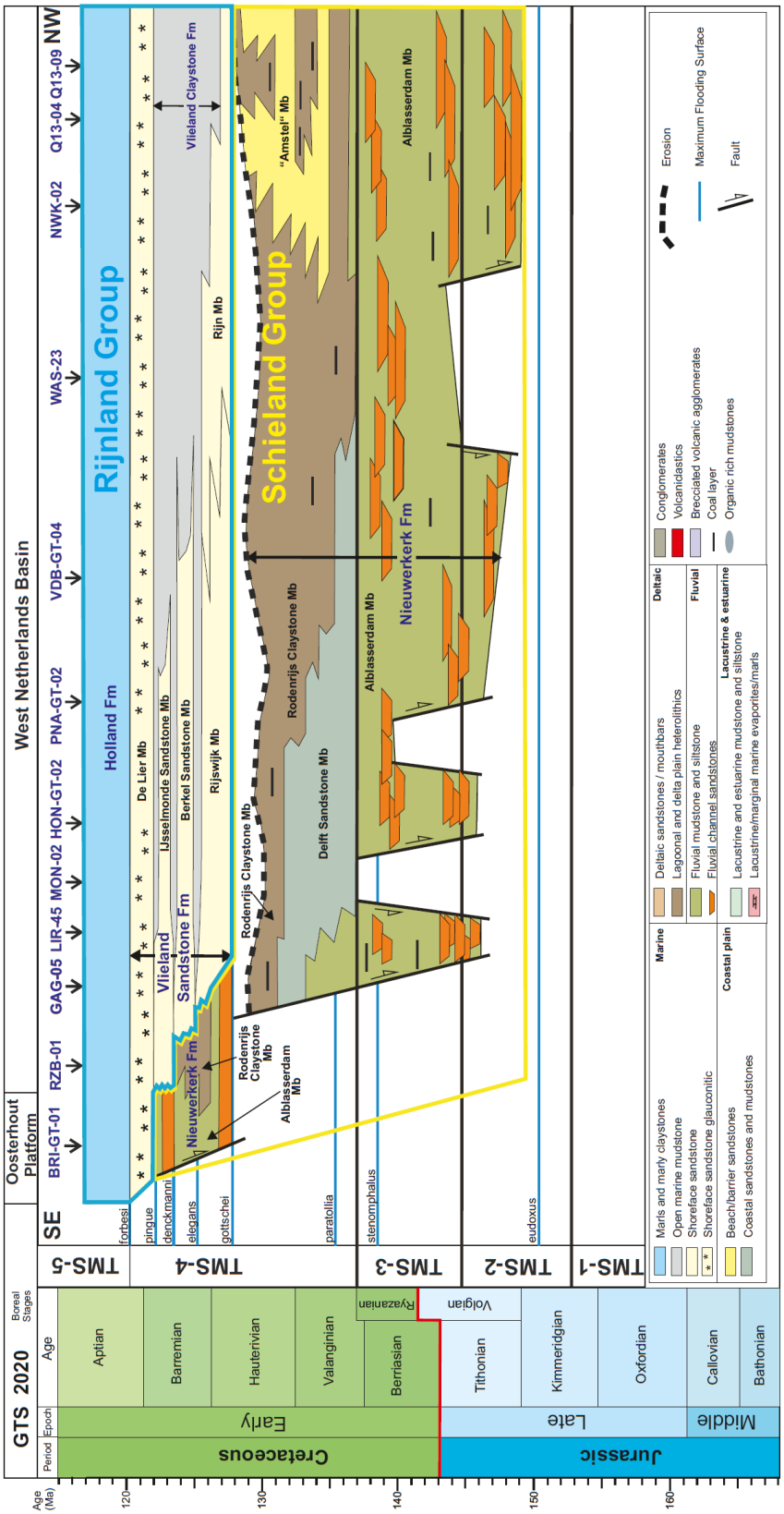


Figure 3
Lithostratigraphy of the Upper Jurassic-Lower Cretaceous from the West Netherlands Basin (Verreussel et al., in press).

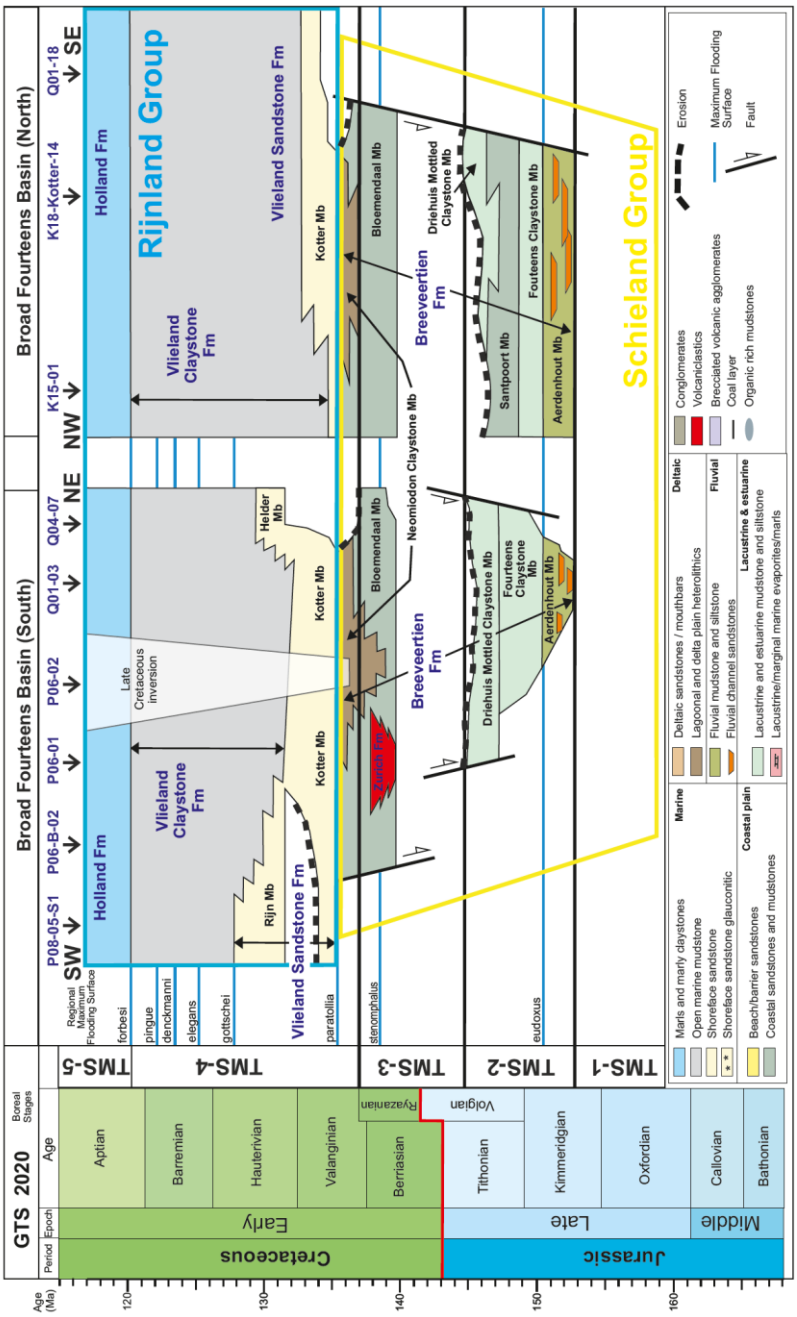


Figure 4 Lithostratigraphy of the Upper Jurassic-Lower Cretaceous from the Broad Fourteens Basin (Verreussel et al., in press).

2.5 Methodology age assessment

Note that many palynological studies on the Nieuwerkerk Formation were published in reports (Munsterman 2012; 2015; 2017; 2018; 2019a; 2019b), but most of these were based on cuttings samples, which limits the accuracy of the age datings since only last occurrences (LOD's) of palynomorphs can be used.

For the age assessments, recent publications on the Valanginian to Barremian interval from Stan Duxbury proved to be most useful (Duxbury, 2018; 2019; 2023).

2.6 Methodology paleoenvironmental interpretation

Palynologists study acid-resistant organic matter from sedimentary rocks. Organic matter is classified into palynomorphs (organic microfossils within a certain size range) and palynodebris (all other organic material such as plant-tissue, wood fragments, amorphous organic matter etc.). The combination of palynomorphs and palynodebris is called palynofacies or organofacies. Within the palynomorph category, two groups are considered the most important: the dinoflagellate cysts, or dinocysts, and the pollen and spores, or sporomorphs. Because palynology straddles both the marine and the terrestrial realm, it is ideally suited for the study of shallow- to non-marine sedimentary rocks. Palynomorphs and palynodebris are always subject to transport, the palynology-based depositional environment is therefore broader than the depositional setting such as derived from *in-situ* sedimentological, geochemical or paleontological features and parameters. The link between depositional setting and palynology-based depositional environment is display in Figure 3. A summary of the most relevant environmental interpretations based on palynology are listed below:

Open marine
Dominance of dinoflagellate cysts indicates open marine environments, in particular when the dinoflagellate cyst assemblages are highly diverse (many species).

Restricted marine
Dinoflagellate cyst associations of the type High Dominance – Low Diversity indicate a restricted marine environment, such as a lagoon, embayment or estuary.

Non-marine
Absence or near-absence of dinoflagellate cysts generally indicates non-marine or marginal marine environments.

Transgression
An increase in the ratio between dinoflagellate cysts and pollen and spores indicates a sea level rise.

Regression
A decrease in the ratio between dinoflagellate cysts and pollen and spores indicates a sea level fall.

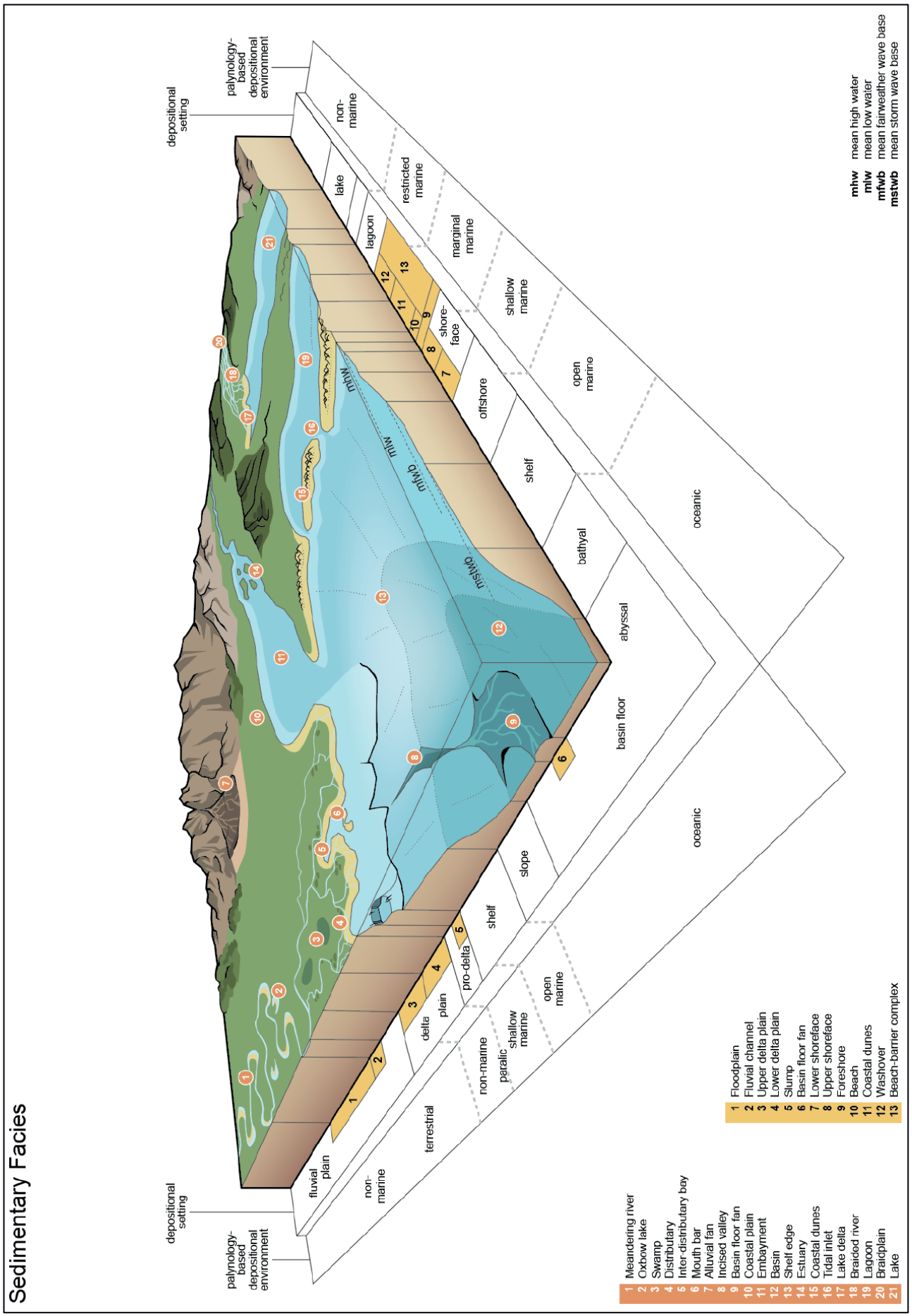
Low energy conditions

Excellent physical preservation of palynomorphs and other organic matter particles may indicate low energy conditions such as for instance a lagoon or a lake.

High energy conditions

Poor physical preservation of palynomorphs may indicate high energy conditions such as for instance a river channel, basin floor fan or a beach.

Figure 5 (next page) Depositional environments inferred from palynolgical analyses compared to depositional settings inferred from sedimentology.


Sedimentary Facies
depositional setting
palynology-based depositional environment
fluvial plain
non-marine
terrestrial
delta plain
pro-delta
shelf
slope
basin floor
abyssal
bathyal
oceanic
non-marine
peralic
shallow marine
open marine
lake
lagoon
restricted marine
marginal marine
shallow marine
shore-face
offshore
shelf
open marine
oceanic
non-marine
mhw
mlw
mfwb
mstwb
1 Meandering river
2 Oxbow lake
3 Swamp
4 Distributary
5 Inter-distributary bay
6 Mouth bar
7 Alluvial fan
8 Incised valley
9 Basin floor fan
10 Coastal plain
11 Embayment
12 Basin
13 Shelf edge
14 Estuary
15 Coastal dunes
16 Tidal inlet
17 Lake delta
18 Braided river
19 Lagoon
20 Braidplain
21 Lake
1 Floodplain
2 Fluvial channel
3 Upper delta plain
4 Lower delta plain
5 Slump
6 Basin floor fan
7 Lower shoreface
8 Upper shoreface
9 Foreshore
10 Beach
11 Coastal dunes
12 Washover
13 Beach-barrier complex
mean high water
mean low water
mean fairweather wave base
mean storm wave base

3 Background information

For each of the studied wells, relevant background information is provided in bitmap format. The bitmaps are derived from a powerpoint file that was presented in the second progress meeting of the DeVli project. The information provided includes a clipped section of the composite well-log, previous age datings, sample quality, sample depths and personal observations and interpretations regarding the lithostratigraphy.

3.1 Well GOU-01

GOU-01 is a very old well, it was drilled in 1944 and appears to have been cored for a large part, based on the composite well log. In the core shed in Zeist, only loose core samples were available. The interval has been assigned to the Nieuwerkerk Formation, according to NLOG (https://www.nlog.nl).

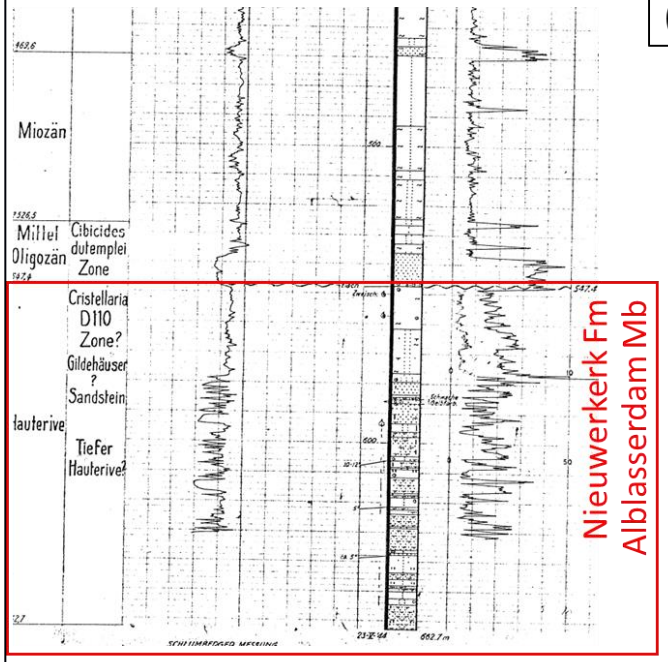
An old report (1974) by palynologist Waldemar Herngreen from the former RGD indicates predominant terrestrial palynomorphs but also 'weak marine influence'.

A total of 7 core samples was collected over the interval 586m – 658m.

Samples Alternative plan

GOU-01	586	CORE
GOU-01	595	CORE
GOU-01	608,5	CORE
GOU-01	617	CORE
GOU-01	636,5	CORE
GOU-01	651	CORE
GOU-01	658	CORE

GOU-01



RGD Paleobotanisch Laboratorium Rapport 2106
(Herngreen, 1974) available on NLOG but no range chart

De monsters 625-630 m en 635-640 m worden gekenmerkt door relatief hoge waarden van Cicatricosisporites spp.(18.5 -19.5 %) en Ischyosporites (8-12%)
Gleicheniidites is in de onderste monsters zeer zwak vertegenwoordigd (3-5%) doch bereikt in de overige 3 monsters percentages van 20-35 %. De groep psilatrileten neemt aanvankelijk sprongsgewijs, later geleidelijk af.
De bisaccaten, met sporadisch Vitreisporites pallidus, nemen van onder naar boven toe.
Opvallend is de verschijning van Perinopollenites (11.5 - 19.5%) in de bovenste twee monsters, dit gaat vergezeld van een zwakke presentie en toename van Classopollis (2-4%), acritarchen en dinoflagellaten resp. 1-2 % en 1-11.5% t.o.v. de pollensom.

Waarschijnlijk hebben we in de monsters 625-30 m en 635-640 m te doen met een terrestrische vegetatie vnl bestaande uit Cicatricosisporites, Ischyosporites en psilatrileten producerende varens waarvan de sporen ± in situ zijn afgezet.
Hoger in de sectie (590-610 m) tonen de miosporen associaties. meer een gemengd karakter wat toe te schrijven is aan de toenemende verbrakking waarop de mariene organismen, Classopollis en Perinopollenites wijzen.

Het totale beeld van de microflora wijst op een Boven Malm-onder Onder Krijt (Berriasien-Valanginien) ouderdom. Gezien de hoge frequenties van Cicatricosisporites en de differentiatie binnen deze groep is de B. Malm evenwel uit te sluiten.

Met behulp van de door Hughes (1969, 1973, 1974) beschreven methode zal alsnog getracht worden een nauwkeuriger stratigrafische indeling te verkrijgen, en correlatie met de Engelse "Wealden" mogelijk te maken. Gezien de vraagstelling is het niet verantwoord met het uitbrengen van dit rapport te wachten op de resultaten van dit tijdrovend onderzoek.

MATERIAAL	De nog beschikbare monsters, maximaal ca. 15 cm kern per 5 m interval over het trajekt 590-650 m, bestaan grotendeels uit zandsteen. Enkele dunne schalielaagjes of kleiige zandsteem lenen zich voor palynologisch onderzoek.

CONCLUSION (Roel Verreussel): very old well but very long cores in the Nieuwerkerk (and in the Miocene). Marine influence in the upper part of the studied section (590m – 650m). Most probably Hauterivian, possibly Valanginian

5

3.2 Well HZW-01

HZW-01 is also an old well, dating back to 1948. The entire interval has been assigned to the Alblasserdam Member of the Nieuwerkerk Formation, according to NLOG (https://www.nlog.nl).

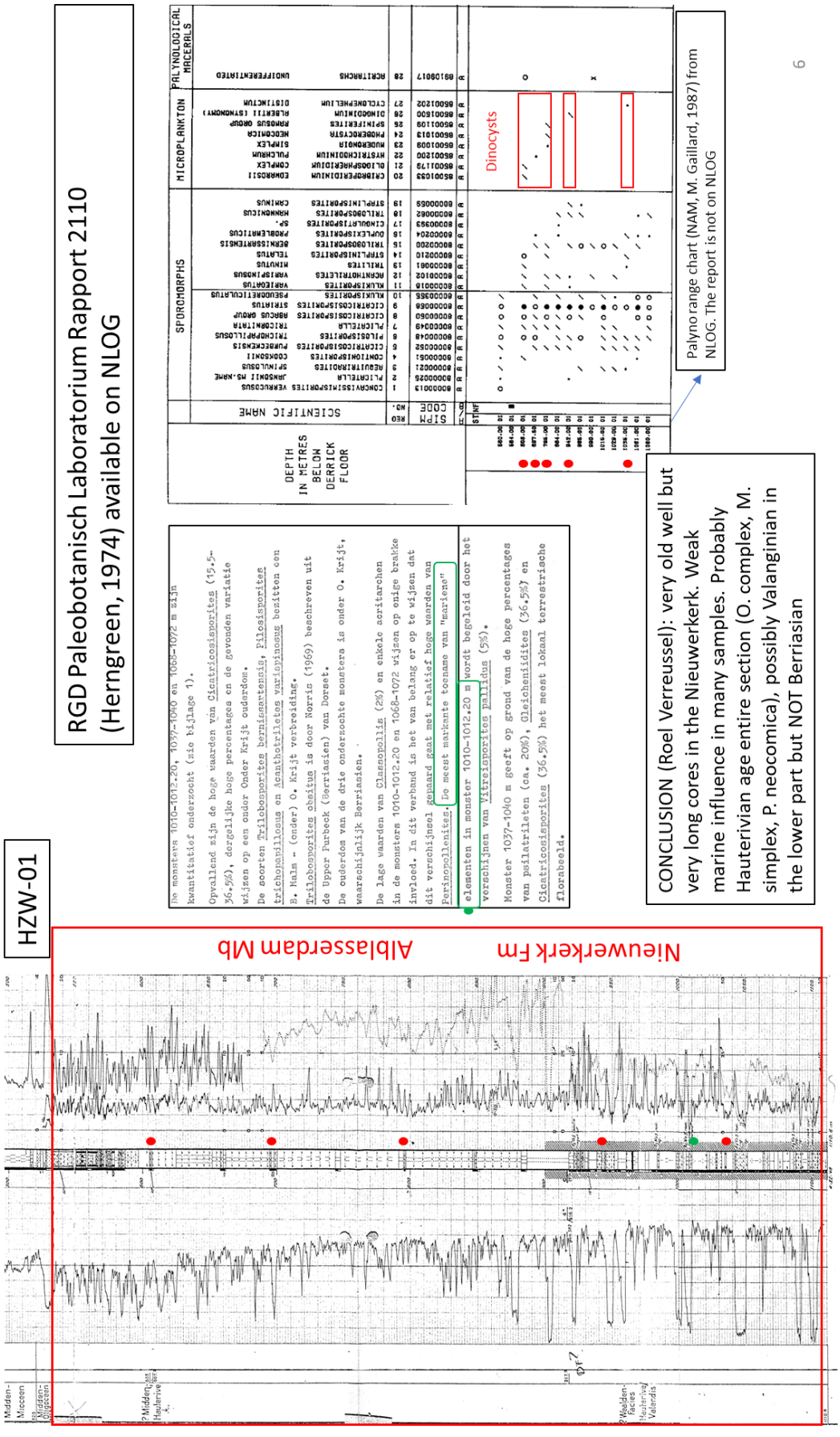
Biostratigraphic information available on NLOG (an old RGD report from 1974 and a palynological distribution chart from NAM) indicates predominant terrestrial palynomorphs but also some spot samples with dinoflagellate cysts.

Eleven core samples were collected over the interval 583m – 1060.5m.

Samples Alternative plan

HZW-01	583	CORE
HZW-01	605,5	CORE
HZW-01	695	CORE
HZW-01	796	CORE
HZW-01	882,5	CORE
HZW-01	985	CORE
HZW-01	1011	CORE
HZW-01	1033	CORE
HZW-01	1054,5	CORE
HZW-01	1060,5	CORE

RGD Paleobotanisch Laboratorium Rapport 2110
(Herngreen, 1974) available on NLOG



3.3 Well BRK-02

Also well BRK-02 is old, it was spudded in 1953. According to the lithostratigraphic interpretation provided by NLOG, only a quite thin Rodenrijs Claystone Member (interval 1737m – 1826mAH) is present above a very thick Alblasserdam Member (interval 1826m – 2649mAH). An alternative - and more logical interpretation - would be to assign a larger interval (1737m – 2016mAH) to the Rodenrijs Claystone Member and assume that the underlying sandy interval (2016m – 2160mAH) belongs to the Delft Sandstone Member.

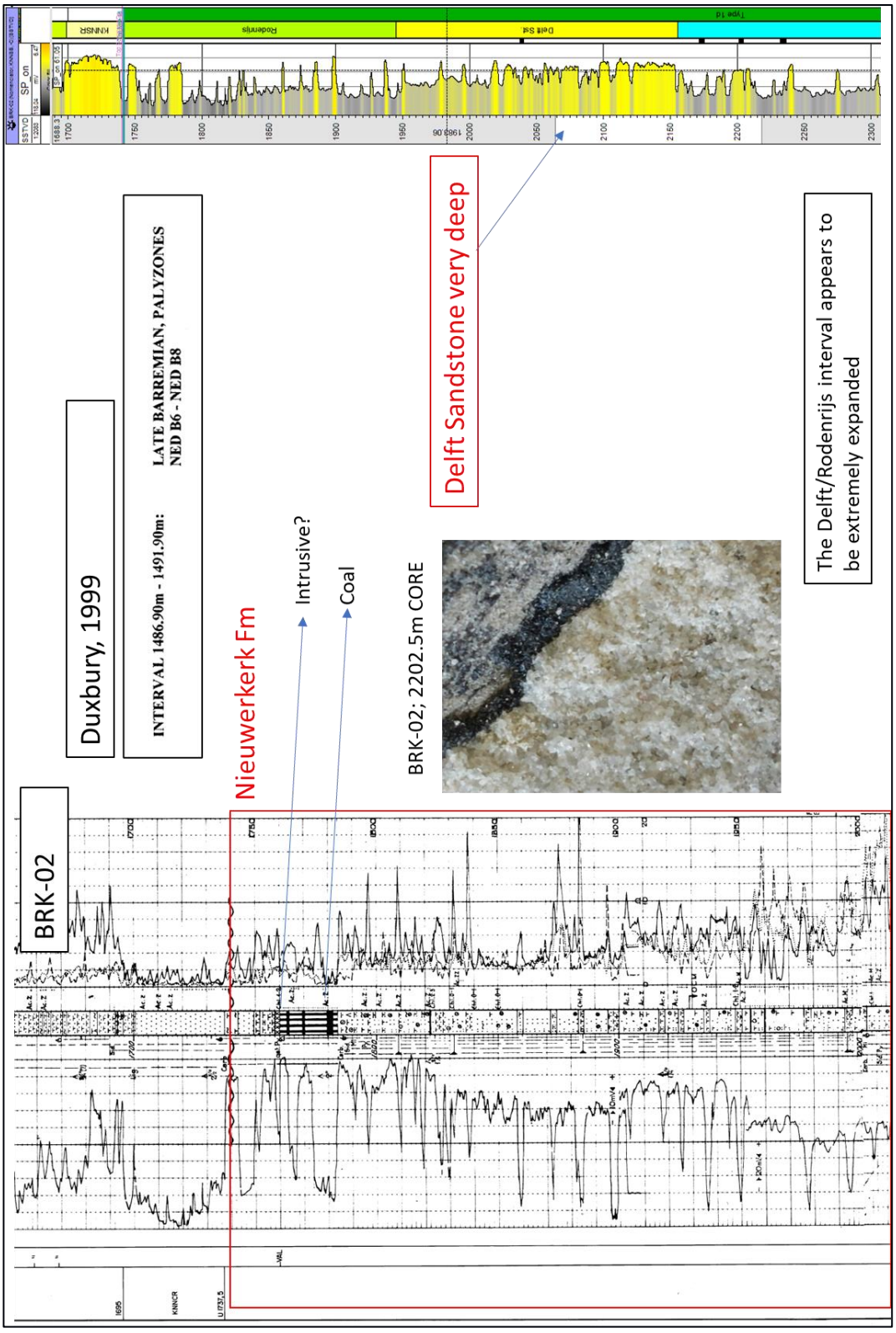
An old RGD report from 1974 on NLOG provides quite detailed palynological data. The report did not record any dinoflagellate cysts in the interval 2039m – 2237m, but acritarchs were recorded in three samples (2202.5m, 2204m, 2233m), indicating weak marine influence at those levels.

Note the presence of volcanics (1760m) and coal (1780m).

Five samples were collected for palynological analyses.

Samples Alternative plan

BRK-02	2040,4	CORE
BRK-02	2206	CORE
BRK-02	2236	CORE
BRK-02	2237	CORE
BRK-02	2502	CORE


Duxbury, 1999
INTERVAL 1486.90m - 1491.90m:
LATE BARREMIAN, PALYZONES
NED B6 - NED B8
Nieuwerkerk Fm
Intrusive?
Coal
BRK-02; 2202.5m CORE
Delft Sandstone very deep
The Delft/Rodenrijs interval appears to be extremely expanded
BRK-02

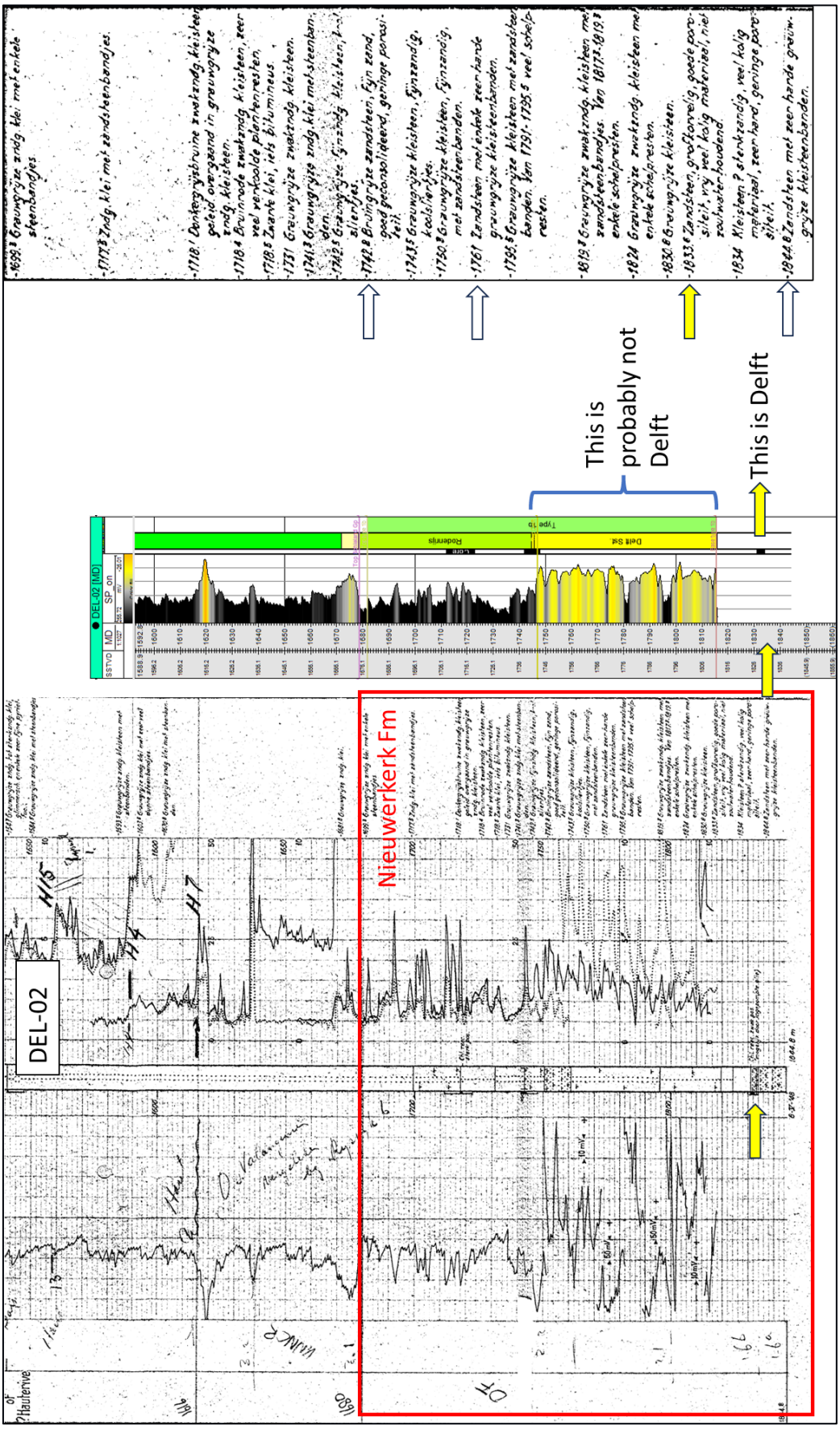
3.4 Well DEL-02

Well DEL-02 was spudded in 1948 and only an SP log is available. According to the lithostratigraphic interpretation provided by NLOG, only Rodenrijs Claystone Member is present below the Rijswijk Member. An alternative interpretation would be to assign the sandy interval (1745m – 1844.8mAH) to the Delft Sandstone Member, but that interpretation is rejected because according to the lithological descriptions, the first coarse-grained sandstones occur at 1833mAH (see next page).

Only two core samples could be collected for palynological analyses.

Samples Alternative plan

DEL-02	1718	CORE
DEL-02	1830,75	CORE


DEL-02
Nieuwerkerk Fm
This is probably not Delft
This is Delft
Delft Sst
Rodenrijs
Type Tb
DEL-02 (MD)
SP on

3.5 Well OIW-01

Well OIW-01 dates back to 1959. According to the lithostratigraphic interpretation provided by NLOG, only Rodenrijs Claystone Member is present below the Rijswijk Member. An alternative – and more logical – interpretation would be to assign the sandy interval (1745m – 1844.8mAH) to the Delft Sandstone Member.

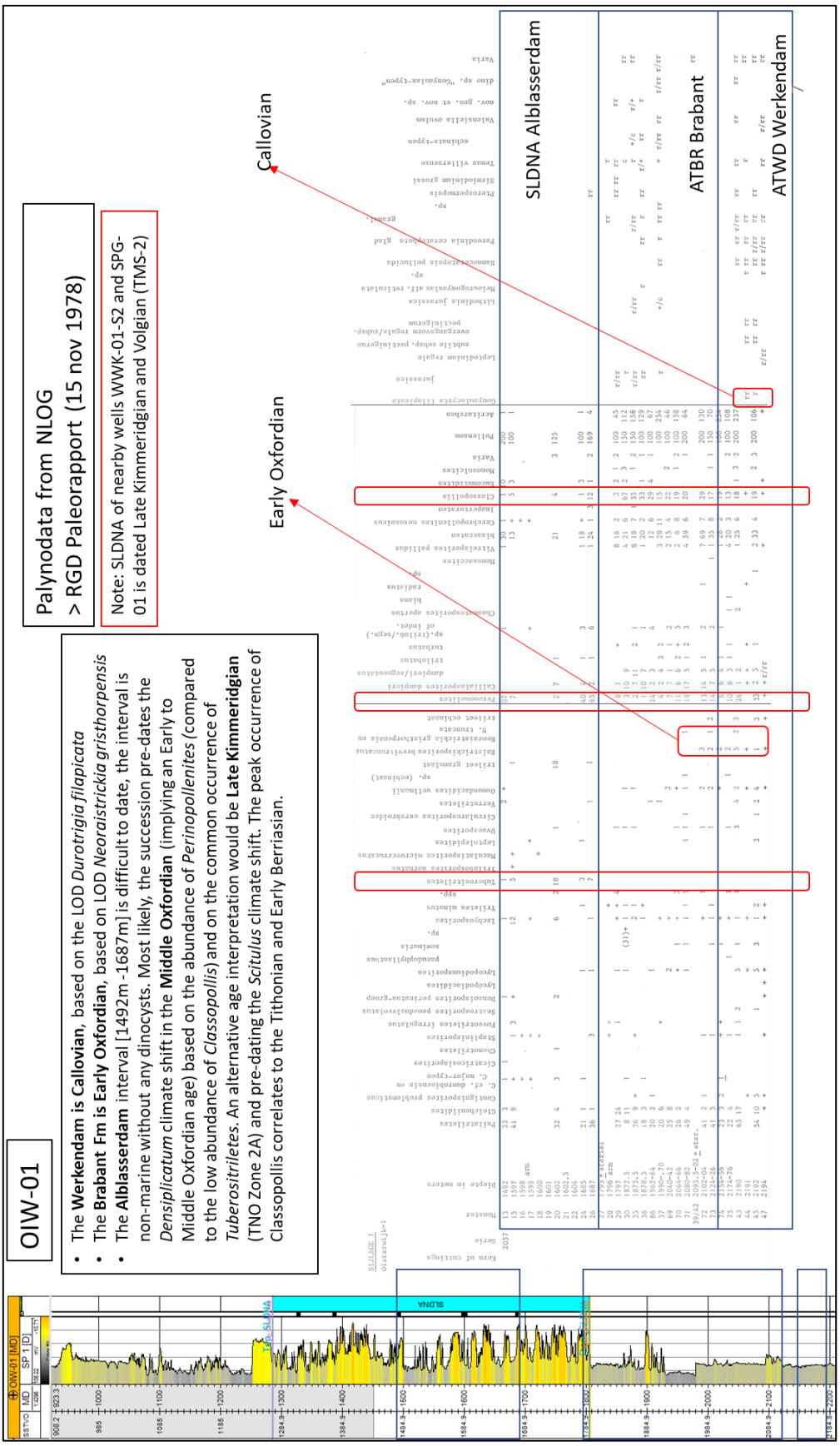
An RGD report from 1978 provides quantitative palynological information. Based on these data, it is suggested that

- the Werkendam Fm can be dated as Callovian, based on the LOD *Durotrigia filapicata [INTERVAL}*
- the Brabant Fm. is Early Oxfordian, based on LOD *Neoraistrickia gristhorpensis* [Level? Interval].
- the Alblasserdam Mb of the Nieuwerkerk Fm (interval 1492m -1687m) is difficult to date, the interval is non-marine without any dinocysts. Most likely, the succession pre-dates the *Densiplicatum* climate shift in the Middle Oxfordian (implying an Early to Middle Oxfordian age) based on the abundance of *Perinopollenites (*compared to the low abundance of *Classopollis*) and on the common occurrence of *Tuberositriletes.* An alternative age interpretation would be Late Kimmeridgian (TNO Zone 2A) and pre-dating the *Scitulus* climate shift.

A total of 11 core samples was collected for palynological analyses.

Samples Alternative plan

OIW-01	1329	CORE
OIW-01	1388	CORE
OIW-01	1598	CORE
OIW-01	1602	CORE
OIW-01	1602,5	CORE
OIW-01	1604	CORE
OIW-01	1875,5	CORE
OIW-01	1876,5	CORE
OIW-01	2193	CORE
OIW-01	2194	CORE
OIW-01	2275	CORE


OIW-01
Palynodata from NLOG
> RGD Paleorapport (15 nov 1978)
Note: SLDNA of nearby wells WWK-01-S2 and SPG-01 is dated Late Kimmeridgian and Volgian (TMS-2)
Callovian
Early Oxfordian
SLDNA Alblasserdam
ATBR Brabant
ATWD Werkendam
• The Werkendam is Callovian, based on the LOD Durotrigia filapicata
• The Brabant Fm is Early Oxfordian, based on LOD Neoraistrickia gristhorpensis
• The Alblasserdam interval [1492m -1687m] is difficult to date, the interval is non-marine without any dinocysts. Most likely, the succession pre-dates the Densiplicatum climate shift in the Middle Oxfordian (implying an Early to Middle Oxfordian age) based on the abundance of Perinopollenites (compared to the low abundance of Classopollis) and on the common occurrence of Tuberositriletes. An alternative age interpretation would be Late Kimmeridgian (TNO Zone 2A) and pre-dating the Scitulus climate shift. The peak occurrence of Classopollis correlates to the Tithonian and Early Berriasian.

3.6 Well K15-01

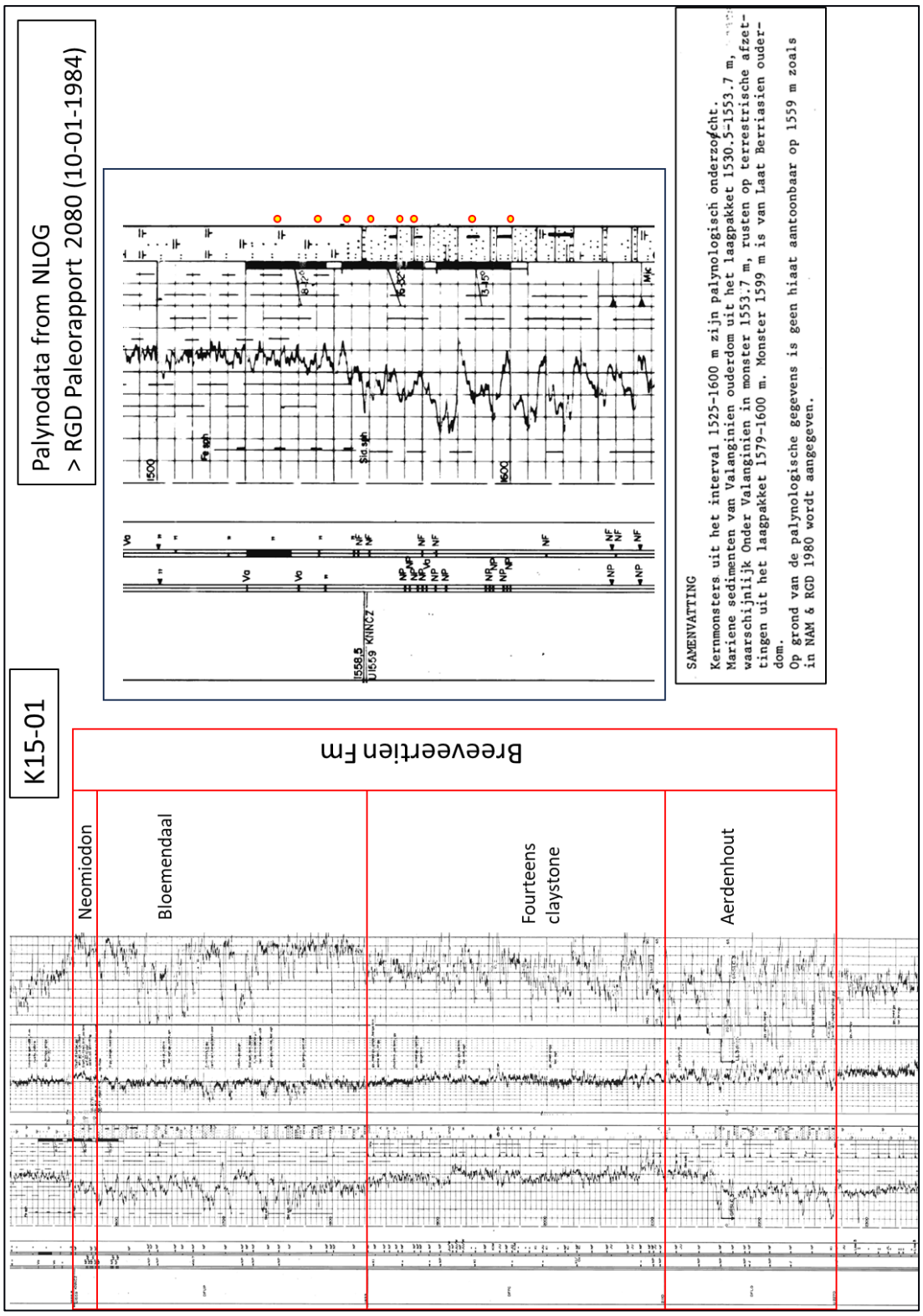
Well K15-01 was spudded in 1971. According to NLOG, a 2 meter thick interval 1557m – 1559m is assigned to the Kotter Member of the Vlieland Sandstone Formation. The interval 1559m – 2270m has been assigned to the Breeveertien Formation (see next page).

An RGD report from 1984 indicates Valangian and Berriasian ages to the cored interval 1538m – 1600m.

Eight samples were collected for palynological analyses.

Samples Alternative plan

K15-01	1538,5	CORE
K15-01	1546,5	CORE
K15-01	1554,7	CORE
K15-01	1561,5	CORE
K15-01	1569,5	CORE
K15-01	1573,5	CORE
K15-01	1589	CORE
K15-01	1600	CORE


Palynodata from NLOG
> RGD Paleorapport 2080 (10-01-1984)
K15-01
Breeveertien Fm
Neomiodon
Bloemendaal
Fourteens claystone
Aerdenhout
SAMENVATTING
Kernmonsters uit het interval 1525-1600 m zijn palynologisch onderzocht.
Mariene sedimenten van Valanginien ouderdom uit het laagpakket 1530.5-1553.7 m,
waarschijnlijk Onder Valanginien in monster 1553.7 m, rusten op terrestrische afzettingen uit het laagpakket 1579-1600 m. Monster 1599 m is van Laat Berriasien ouderdom.
Op grond van de palynologische gegevens is geen hiaat aantoonbaar op 1559 m zoals in NAM & RGD 1980 wordt aangegeven.

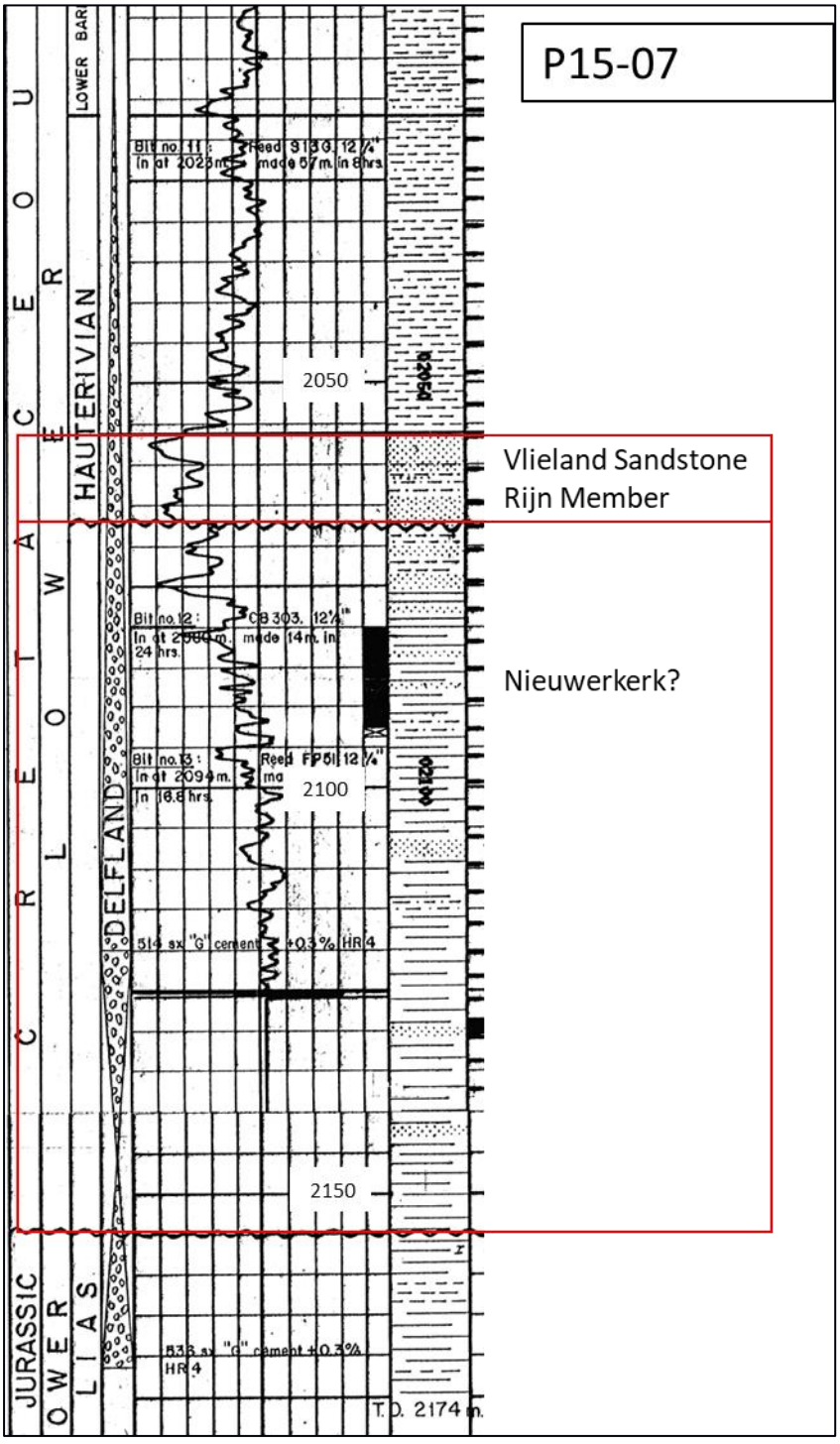
3.7 Well P15-07

Well P15-07 was drilled in 1983 and is situated in the Rijn oilfield. According to NLOG, the Rijn Member of the Vlieland Sandstone Formation occurs at 2067m – 2075m and is separated from the thin, underlying Alblasserdam Member of the Nieuwerkerk Formation by a fault. The cored section has been assigned to the Lower Werkendam Member on NLOG.

Five samples were selected for palynological analyses.

Samples Alternative plan

P15-07	2080,1	CORE
P15-07	2082,7	CORE
P15-07	2086,3	CORE
P15-07	2089,9	CORE
P15-07	2092,75	CORE


P15-07
CRETACEOUS
LOWER
HAUTERIVIAN
DELFLAND
JURASSIC
LOWER
LIAS
2050
2100
2150
Vlieland Sandstone
Rijn Member
Nieuwerkerk?
T.D. 2174 m.

4 Results

The palynological recovery of the studied samples varied substantially. The samples from well P15-07 for example, were completely barren. All other wells yielded palynomorphs that allowed age and paleoenvironmental assessments. The results are discussed per well. For each well an age assessment is provided and an interpretation in terms of paleoenvironment. The age breakdown is presented from the top of the studied sections downwards.

Nine photo-plates with micro-photographs of palynomorphs and organofacies are added in Appendix 1.

Palynological distribution chart showing the results of the palynological analyses are added in Appendix 2.

4.1 Gouda-01 (GOU-01)

A palynological distribution chart showing the results of the palynological analyses is added in Appendix 2.

Age assessment

Interval 586.0m – 658.0m **late Early to Late Hauterivian**

Based on the common occurrence of *Hystrichosphaeridium arborispinum*. The LOD *Cymososphaeridium validum* suggests an Early Hauterivian age, but the (common) occurrence of *Subtilisphaera* indicates a slightly younger Late Hauterivian age.

Paleoevironmental interpretation

The uppermost sample 586.0mCORE is rich in amorphous organic matter and contains fari amounts of the brackish water algae *Botryococcus,* indicating restricted marine conditions such as a back-barrier lagoon or an estuary. The remaining interval 595m – 658m is interpreted to have been deposited in a nearshore, coastal setting. The samples are very rich in pollen and spores but dinoflagellate cysts do occur, albeit in low numbers.

4.2 Hazerswoude-01 (HZW-01)

A palynological distribution chart showing the results of the palynological analyses is added in Appendix 2.

Age assessment

Sample 583.0m **Age dating not possible**

Very poor sample.

Interval 605.0m – 796.0m **late Early to Late Hauterivian**

Based on the presence of *Palaecysta complicata, Subtilisphaera terrula, Nexosispinum vetusculum* and *Muderongia simplex.*

Interval 882.5m – 1060.5m **Hauterivian and/or Valanginian**

Dinocysts are absent in this interval. The pollen and spore assemblage reflects the relatively wet Wealden facies, which would comply with a Valanginian or Hauterivian age.

Paleoevironmental interpretation

Interval 605.0m – 796.0m **Nearshore, coastal**
The upper part of the studied section 605.0m – 796.0m contains dinoflagellate cysts, indicative of marine influence. Particularly sample 796.0m is very rich in dinoflagellate cysts that may reflect a maximum flooding surface. Overall, pollen and spores dominate the assemblages, suggesting a nearshore to coastal depositional setting.

Interval 882.5m – 1060.5m **Fluvial and coal forming swamps**
The absence of dinoflagellate cysts and abundance of pollen and spores indicate non-marine environments. The pioneer indicator *Gleichenites* is abundant in this interval, pointing to dynamic, riparian environments. In combination with the presence of coals, a fluvial setting is inferred, interrupted occasionally by coal forming swamps.

4.3 Berkel-02 (BRK-02)

A palynological distribution chart showing the results of the palynological analyses is added in Appendix 2.

Age assessment

Interval 2040.5m – 2237.0m **Hauterivian and/or Valanginian**

Due to the absence of dinoflagellate cysts, a precise age dating is not possible. The pollen and spore assemblages are diverse and contain common *Cicatricosisporites, Pilosisporites* and *Gleicheniidites* but *Classopoliis* is rare. These assemblages rule out a Ryazanian or older age and point to the Valanginian and/or Hauterivian age.

Sample 2502.0m **Age dating not possible**

Barren sample.

Paleoevironmental interpretation

Interval 2040.5m – 2237.0m **Non-marine to coastal**

The absence of dinoflagellate cysts indicates a non-marine depositional setting for the studied samples.

Note however, that the presence of acritarchs, as recorded in the RGD report, points to weak marine influence in the interval 2205m – 2233m.

4.4 Delft-02 (DEL-02)

A palynological distribution chart showing the results of the palynological analyses is added in Appendix 2.

Age assessment

Sample 1718.0m **Hauterivian or Valanginian**

Only one species of dinoflagellate cysts is present: *Hystrichosphaeridium arborispinum.* The pollen and spore assemblage is quite diverse and contains common *Cicatricosisporites*. The assemblage points to a Valanginian or Hauterivain age.

Sample 1830.75m **Age dating not possible**

Barren sample.

Paleoevironmental interpretation

Sample 1718.0m **Marginal marine**

The rare presence of dinoflagellate cysts indicates a marginal marine depositional environment.

4.5 Oisterwijk-01 (OIW-01)

A palynological distribution chart showing the results of the palynological analyses is added in Appendix 2. A summary of the results is listed in table xxx.

Age assessment

Interval 1329m – 1388m **Age dating not possible**

Barren sample.

Sample 1598m **Probably Kimmeridgian**

Only pollen and spores are present. The FOD *Cingulatisporites* sp. A Abbink 1998 and *Leptolepidites psarosus* indicate a Kimmeridgian age, or younger. The relatively low abundance of *Classopollis* indicates an age older than Tithonian – the base of the Tithonian is marked by an increase in *Classopollis,* knows as the *scitulus* Climate shift.

1602m – 1604m **Age dating not possible**

Barren interval.

Interval 1875.5m – 1876.5m **Middle to Late Callovian**

The interval yielded rich dinoflagellate cyst assemblages. Many dinoflagellate cysts are recorded with a LOD in the Early or Middle Oxfordian: *Rigaudella aemula, Gonyaulacysta jurassica adecta* var. *adecta* (LOD Middle Oxfordian), *Gonyaulacysta centriconnata , Gonyaulacysta jurassica adecta* var. *longicornis* (LOD Early Oxfordian) and *Ctenidodinium continuum* (LOD earliest Oxfordian). The LOD *Durotrigia filapicata* in sample 1576.5mCORE indicates a Callovian age or older. The FOD *Gonyaulacysta centriconnata* (Middle Callovian) limits the age of the interval to the Middle to Late Callovian.

2193m – 2275m **Late Bajocian**

The FOD *Korystocysta gochtii* indicates a Late Bajocian or younger age. The total range of *Acanthaulax crispa* (late Early to Late Bajocian) confines the age to the Late Bajocian. Additional support is provided by the FOD *Hystrichogonyaulax regalis* (early Late Bajocian).

Paleoevironmental interpretation

Interval 1329m – 1388m **Palaeoenvironmental interpretation not possible**

Barren interval.

Sample 1598m **Non-marine to marginal marine**

Dinoflagellate cysts are absent, suggesting a non-marine palaeoenvironment. The presence of prasinophyte algae and transparent sheets points to minor marine influence. Among the pollen and spore assemblages, the spore type *Densoisporites* is abundant. This type has been linked to tidally influenced habitats (Abbink, 1998). Therefore, a non-marine to marginal marine environment with possible tidal influence is suggested.

1602m – 1602.5m **Palaeoenvironmental interpretation not possible**

Barren interval.

Interval 1875.5m – 2275m **Open marine**

Rich and diverse palynological assemblages dominated by dinoflagellate cysts, indicate open marine palaeoenvironments.

4.6 K15-01

A palynological distribution chart showing the results of the palynological analyses is added in Appendix 2.

Age assessment

Interval 1538.5m – 1554.7m **Early Valanginian**

Many marker species are present that have a LOD in the Early Valanginian: *Cymososphaeridium arcuatum, Palaecysta palmula, Vexillocysta spinosa.* The FOD *Cymososphaeridium arcuatum* is base Valanginian, so an Early Valanginian age can be assigned to this interval with a high degree of confidence.

Interval 1561.6m – 1600m Probably Ryazanian

Dinocysts and age diagnostic sporomorphs are absent. Nevertheless, the common presence of *Cicatricosisporites* and rare abundance of *Classopollis* probably indicates a Ryazanian age.

Paleoevironmental interpretation

Interval 1538.5m – 1554.7m **Open marine**

Rich and diverse dinoflagellate cyst assemblages indicate an open marine palaeoenvironment for this interval.

Interval 1561.6m – 1600m Non-marine to marginal marine

Dinoflagellate cysts are absent, indicating non-marine environments. The presence of amorphous organic matter and delicate cuticulae fragments point to weak (low-energy) marine influence.

4.7 P15-07

All samples from well K15-01 were barren. Therefore, no palynological distribution chart and age and palaeoenvironmental interpretations were made.

5 Implications on regional stratigraphy

Some of the results that were achieved during this study have an impact on the regional stratigraphy of the West Netherlands Basin.

<u>The Nieuwerkerk Fm in the Hazerswoude - Gouda area</u>

The late Hauterivian ages of the cored Alblasserdam intervals 580m – 658m from well GOU-01 and 605m – 796m from well HZW-01 correlate with equivalent ages of the Rodenrijs Claystone member in wells PNA-GT-02, VDB-GT-04 and MKP-16 which are situated 5 to 15 km SW of GOU-01 and HZW-01 (Figure 7 & Figure 7). The observed palaeoenvironments, nearshore marine to back-barrier lagoonal reflect the same depositional setting, albeit slightly more proximal, as the upper Rodenrijs Claystone Member in the West Netherlands Basin. Apparently, marine influence during that time spread as far as Gouda and Hazerswoude. It also shows that the Late Cretaceous erosion left most of the Nieuwerkerk Formation intact. Note that because of the correlation with the Rodenrijs, the presence of Delft Sandstone would be expected below the intervals. However, massive sandstones are lacking in well HZW-01. Maybe the Hazerswoude-Gouda area was too far away from the source area of the Delft sandstones.

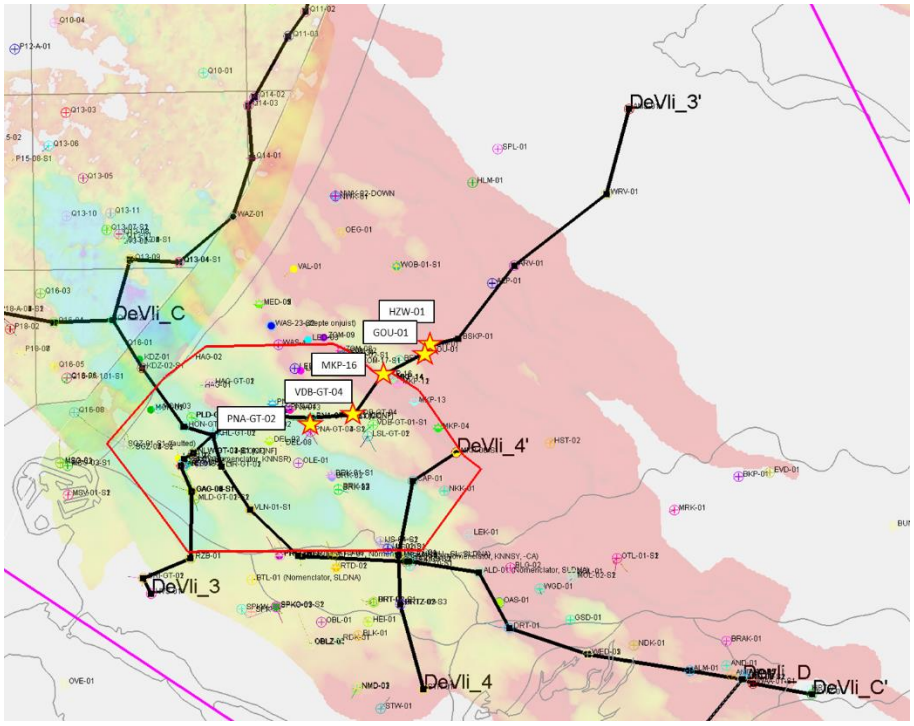


Figure 6 Location map of the wells discussed in the text.

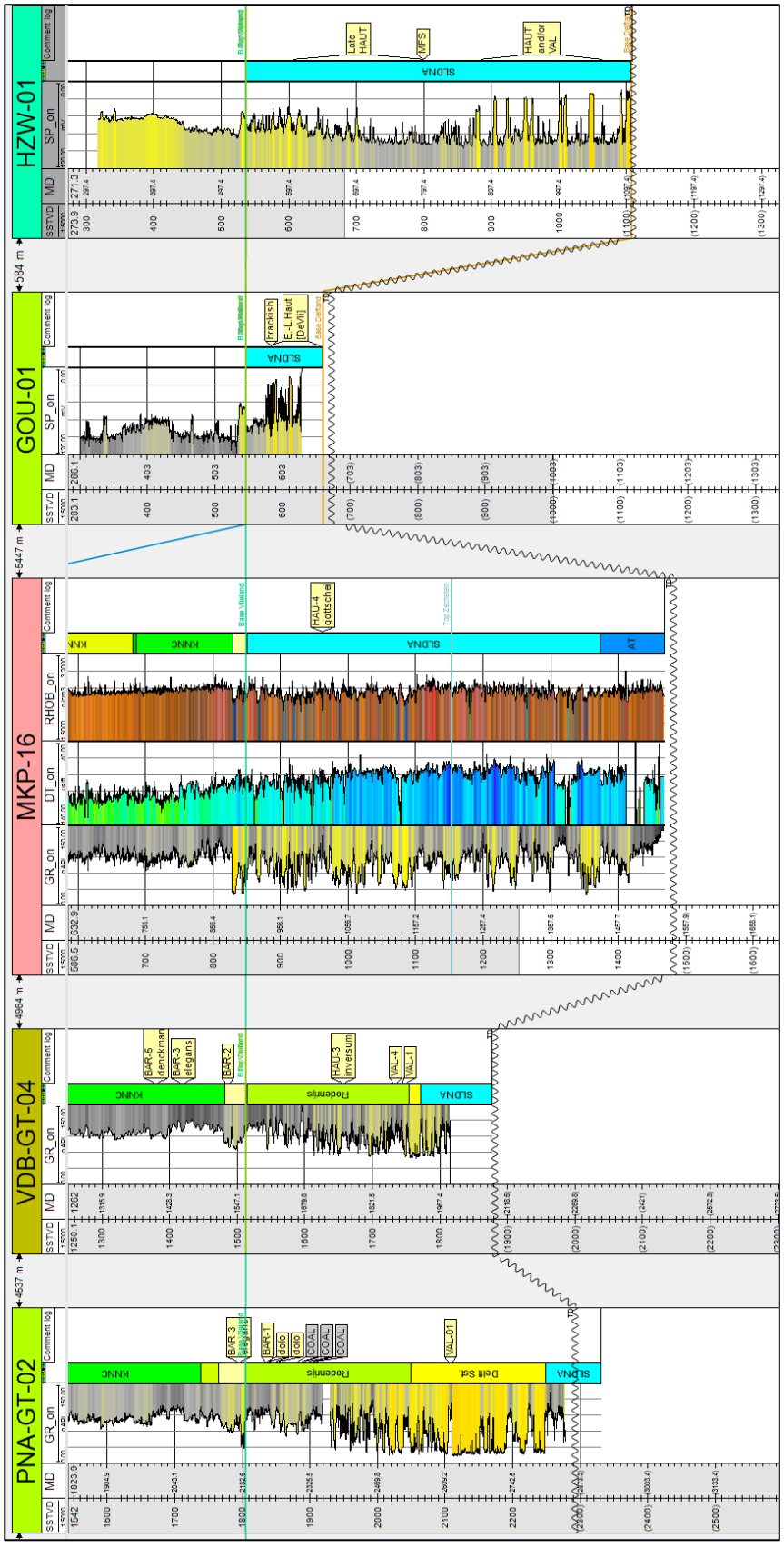


Figure 7 Correlation panel from PNA-GT-02 to HZW-01

The Nieuwerkerk Fm in the Berkel area

The Valanginian and/or Hauterivian age that was assigned to the interval 2040m – 2237m of well BRK-02 implies that the Nieuwerkerk section above this interval is Valanginian or younger. In other words, the age of the Delft Sandstone at 2020m – 2155m in well BRK-02 is Valanginian or Hauterivian, which confirms our working model that the base Delft Sandstone is the base TMS-4. Also interesting are the acritarchs occurrences at and near the base of the Delft Sandstone (interval 2202m – 2233m, see RGD report 2110). These occurrences point to (weak) marine influence near the base of the Delft Sandstone Member.

The Nieuwerkerk Fm in the Delft area

The Valanginian – Hauterivian age in combination with a marine palaeoenvironment is in line with the lithostratigraphic interpretation (Rodenrijs Claystone Member).

The Nieuwerkerk, Brabant and Werkendam formations in the Oisterwijk area

The probable Kimmeridgian age of sample 1598mCORE in the Alblasserdam Member of well OIW-01 supports the working model that "old" Alblasserdam is present East of the Rijen Fault in that area (well SPG-01-S2 and WWK-01 have confirmed marine TMS-2 in the Alblasserdam). The Late Bajocian age for the Upper Werkendam confirms the previously establish age for that member, as does the Middle to Late Callovian age for the Upper Brabant Marl Member.

The base of the Vlieland Subgroup and the Breeveertien Fm in the K15 block

The base of the Vlieland Subgroup in well K15-01 could be dated earliest Valanginian with a high of confidence. The top of the Breeveertien could be dated although weak marine influence was noted. The earliest Valanginian age confirms the working model that the base of TMS-4 is an important regional event.

6 Conclusions

Based on the palynological results, the following conclusions were reached:

- The top of the Nieuwerkerk Fm in the northeasterly wells GOU-01 and HZW-01 is interpreted as regular Rodenrijs Claystone intervals with (minor) marine influence.
- There are no massive sandstone layers that could be attributed to the Delft Sandstone Member in wells GOU-01 and HZW-01. Possbly, the area is too far away from the actual source of the Delft Sandstone.
- The combined Delft Sandstone and Rodenrijs Claystone interval in well BRK-02 is very thick (400 meters).
- The base of the Delft Sandstone Member in BRK-02 displays weak marine influence.
- The presence of "old" Alblasserdam on the eastern side of the of the Rijen Fault is confirmed. Marine and/or non-marine sediments with a Kimmeridgian to Volgian age (TMS-2) are present in wells OIW-01, SPC-01 ond WWK-01.
- A Late Bajocian age for the Upper Werkendam Mb is confirmed.
- A Middle to Late Callovian age for the Upper Brabant Marl Member is confirmed.

Table 3 (next page)
Summary of results. SLDN = Nieuwerkerk Fm; SLDNA = Alblasserdam Mb; SLDND = Delft Sandstone Mb; SLDNR = Rodenrijs Claystone Mb; SLDB = Breeveertien Fm; SLDBN = Neomiodon Mb; SLDBB = Bloemendaal Mb; KNNC = Vlieland Claystone Fm; ATBRU = Upper Brabant Marl Mb; ATWDU Upper Werkendam Mb; ATWDL = Lower Werkendam Mb

Well	MD (m)	sample type	Lithostrat NLOG	Preferred lithostrat	Age assessment
			1-12-2024	this report	
GOU-01	586	CORE	SLDN	SLDNR	late Early to Late Hauterivian
GOU-01	595	CORE			
GOU-01	608,5	CORE			
GOU-01	617	CORE			
GOU-01	636,5	CORE			
GOU-01	651	CORE			
GOU-01	658	CORE			
HZW-01	583	CORE	SLDNA	SLDNR	not possible
HZW-01	605,5	CORE			late Early to Late Hauterivian
HZW-01	695	CORE			
HZW-01	796	CORE			
HZW-01	882,5	CORE			Hauterivian and/or Valanginian
HZW-01	985	CORE			
HZW-01	1011	CORE			
HZW-01	1033	CORE			
HZW-01	1054,5	CORE			
HZW-01	1060,5	CORE			
BRK-02	2040,4	CORE	SLDNA	SLDND	Hauterivian and/or Valanginian
BRK-02	2206	CORE		SLDNA	
BRK-02	2236	CORE			
BRK-02	2237	CORE			
BRK-02	2502	CORE			not possible
DEL-02	1718	CORE	SLDNR	SLDNR	Hauterivian or Valanginian
DEL-02	1830,75	CORE			not possible
OIW-01	1329	CORE	SLDNA	SLDNA	not possible
OIW-01	1388	CORE			
OIW-01	1598	CORE			probably Kimmeridgian
OIW-01	1602	CORE			
OIW-01	1602,5	CORE			
OIW-01	1604	CORE			
OIW-01	1875,5	CORE	ATBRU	ATBRU	Middle to Late Callovian
OIW-01	1876,5	CORE			
OIW-01	2193	CORE	ATWDU	ATWDU	Late Bjocian
OIW-01	2194	CORE			
OIW-01	2275	CORE			
K15-01	1538,5	CORE	KNNC	KNNC	Early Valanginian
K15-01	1546,5	CORE			
K15-01	1554,7	CORE			
K15-01	1561,5	CORE	SLDBN	SLDBB	Ryazanian
K15-01	1569,5	CORE			
K15-01	1573,5	CORE			
K15-01	1589	CORE	SLDBB		
K15-01	1600	CORE			
P15-07	2080,1	CORE	ATWDL	ATWDL	not possible
P15-07	2082,7	CORE			
P15-07	2086,3	CORE			
P15-07	2089,9	CORE			
P15-07	2092,75	CORE			

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8 Signature

Name and signature reviewer

ValidSigned by Alexander Houben
on 2025-02-03 15:25:24

Dr. MSc A. Houben

Signature

ValidSigned by Roel Verreussel
on 2025-02-03 17:20:45

Drs. R.M.C.H. Verreussel
Author

Authorisation of release

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on 2025-02-03 15:58:14

Drs. D. Maljers
Research manager

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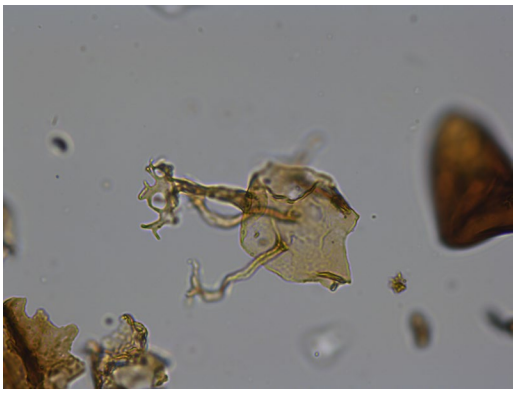
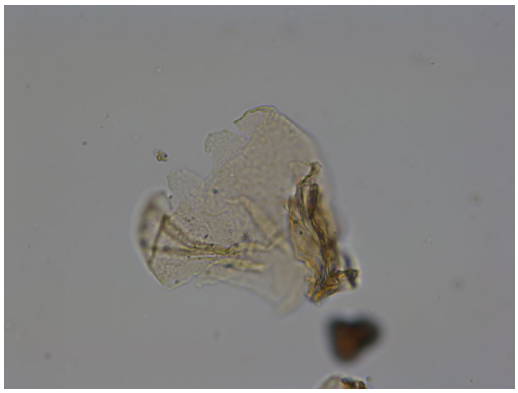
APPENDIX 1

Photoplates

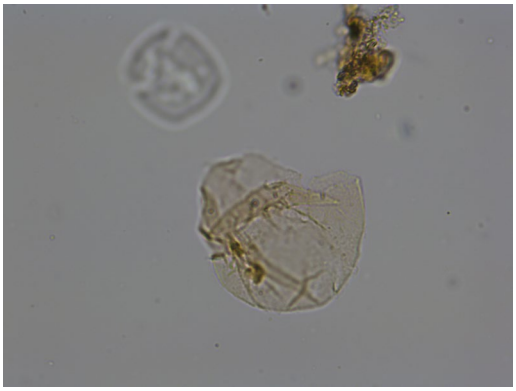
Plate 1



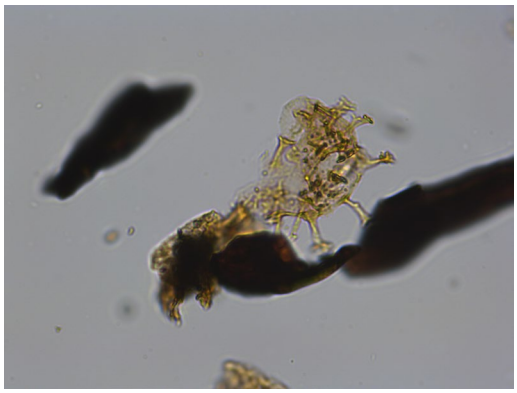
Cymososphaeridium validum
GOU-01; 595mCORE
40x; Operculum



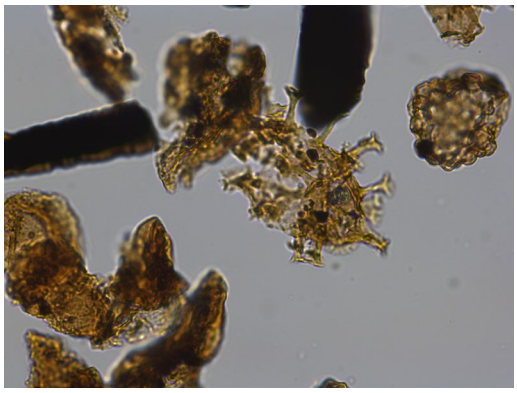
Batiacasphaera sp.
GOU-01; 636.5mCORE
40x



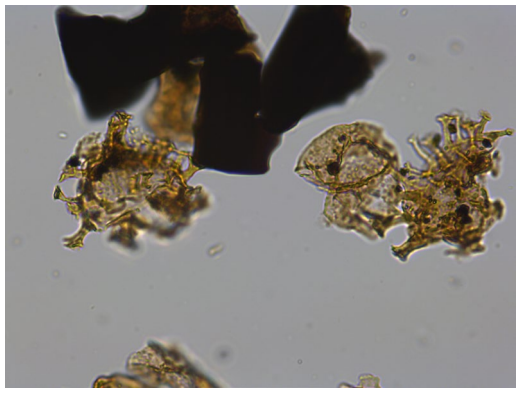
Batiacasphaera sp.
GOU-01; 636.5mCORE
40x



Hystrichosphaeridium arborispinum prolatum
GOU-01; 658.0mCORE
40x

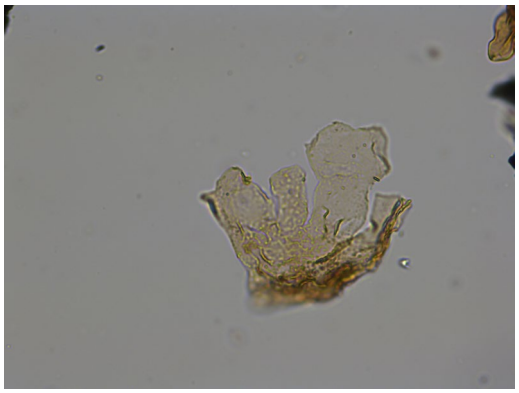


Hystrichosphaeridium arborispinum prolatum
GOU-01; 658.0mCORE
40x

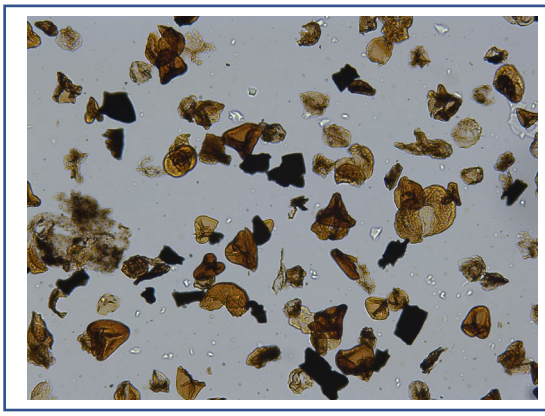


Hystrichosphaeridium arborispinum prolatum
GOU-01; 658.0mCORE
40x; 2 specimens

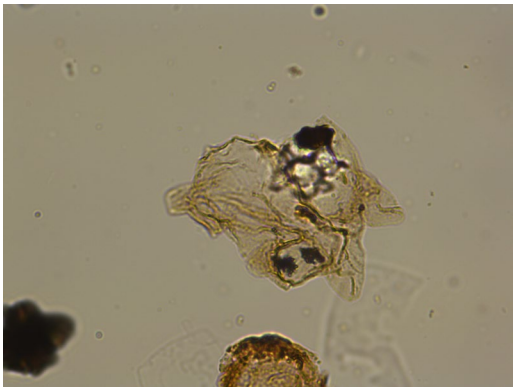
Plate 2



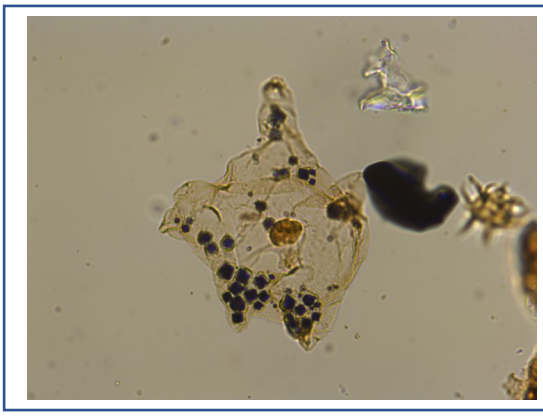
Dissiliodinium sp.
DEL-02; 1718mCORE
40x



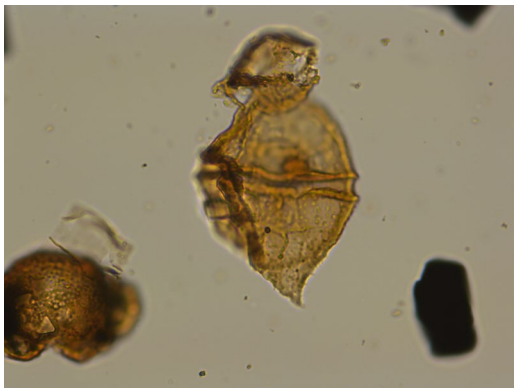
Overview palynological assemblage
BRK-02; 2237mCORE
10x; note extreme abundance pollen & spores



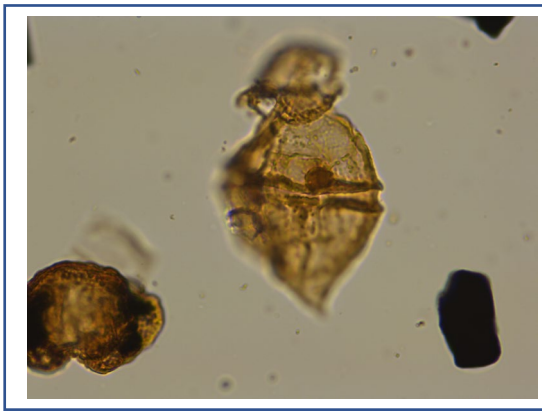
Vesperopsis sp. A
HZW-01; 605mCORE
40x



Vesperopsis sp. A
HZW-01; 605mCORE
40x

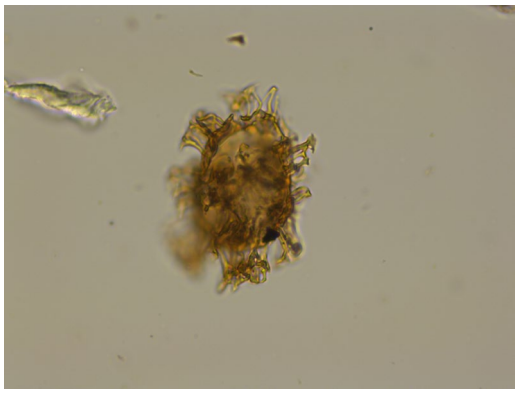


Subtilisphaera terrula
HZW-01; 605mCORE
40x

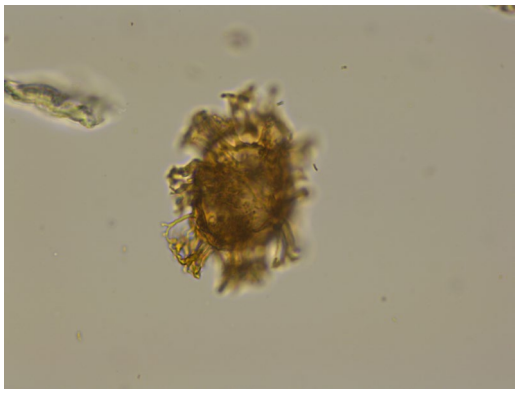


Subtilisphaera terrula
HZW-01; 605mCORE
40x

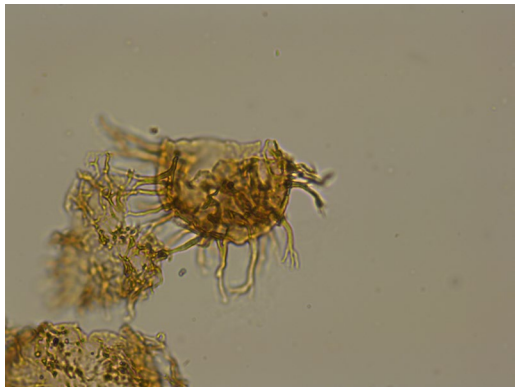
Plate 3



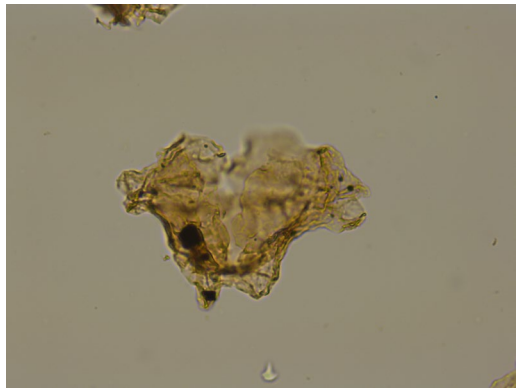
Nexosispinum vetusculum
HZW-01; 796mCORE
40x; Upper Focus



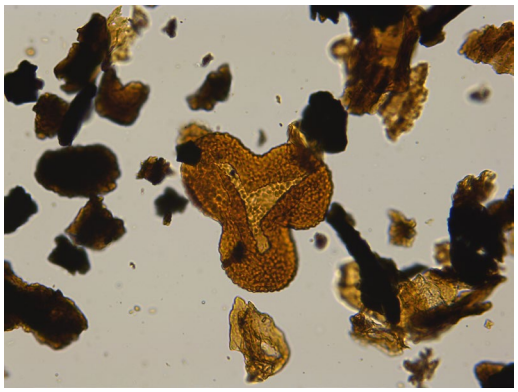
Nexosispinum vetusculum
HZW-01; 796mCORE
40x; Lower Focus



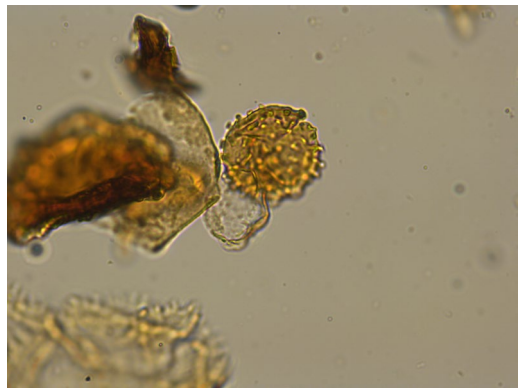
Palaecysta complicata
HZW-01; 796mCORE
40x



Muderongia simplex
HZW-01; 796mCORE
40x

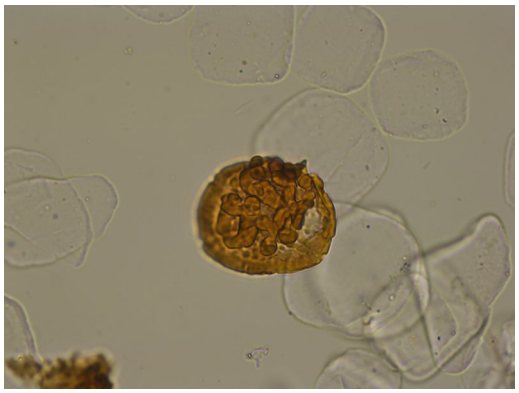


Concavissimisporites verrucosus
HZW-01; 695mCORE
40x; note the large size

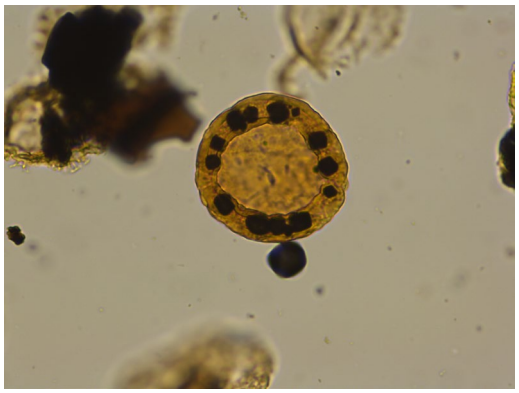


Neoraistrickia gristhorpensis
OIW-01; 1875.5mCORE
40x

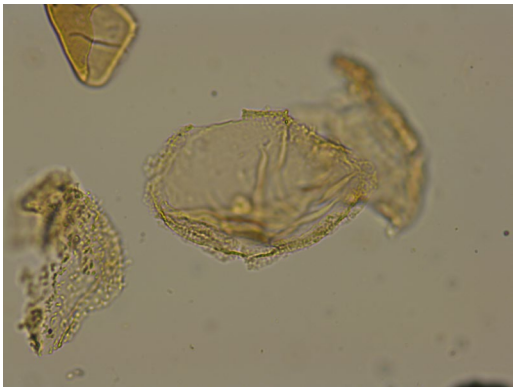
Plate 4



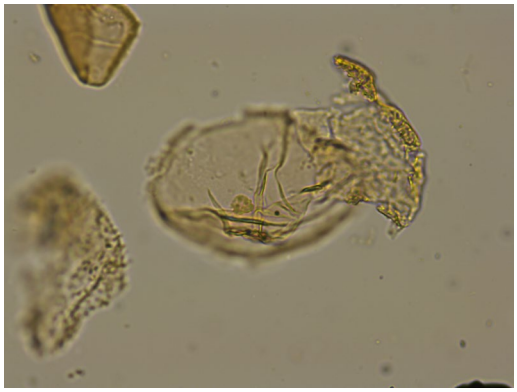
Cingulatisporis sp. A Abbink 1998
OIW-01; 1898.5mCORE
40x



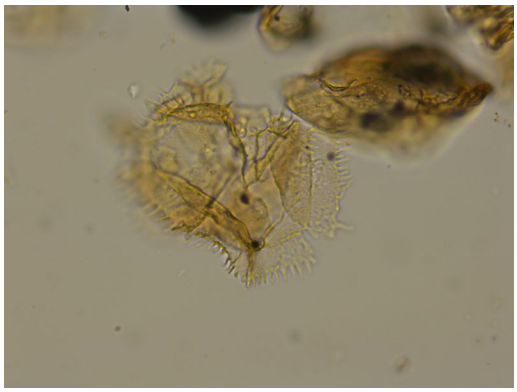
Chasmatosporites apertus
OIW-01; 2275mCORE
40x



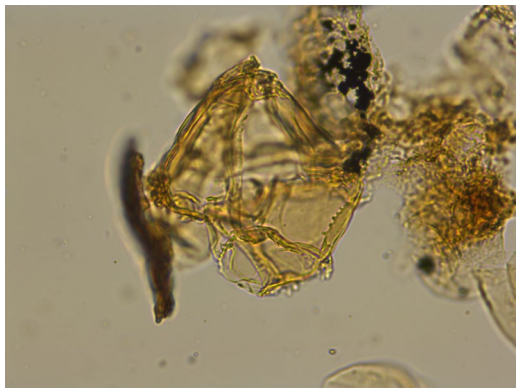
Energlynia acollaris
OIW-01; 1875.5mCORE
40x; Upper Focus



Energlynia acollaris
OIW-01; 1875.5mCORE
40x; Lower Focus

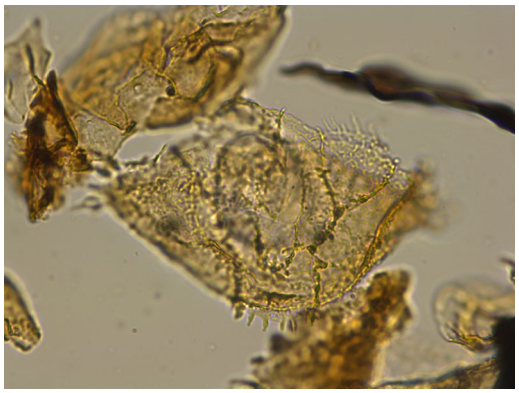


Ctenidodinium continuum
OIW-01; 1875.5mCORE
40x

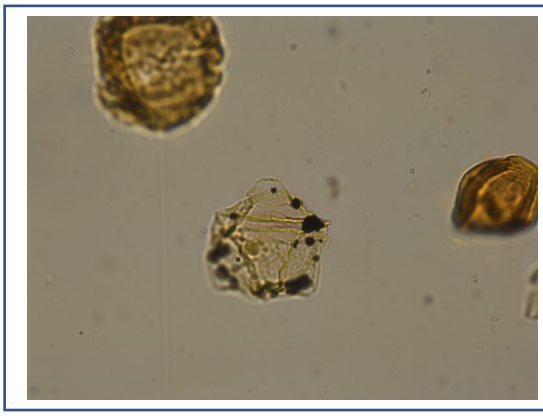


Gonyaulacysta centriconnata
OIW-01; 1875.5mCORE
40x

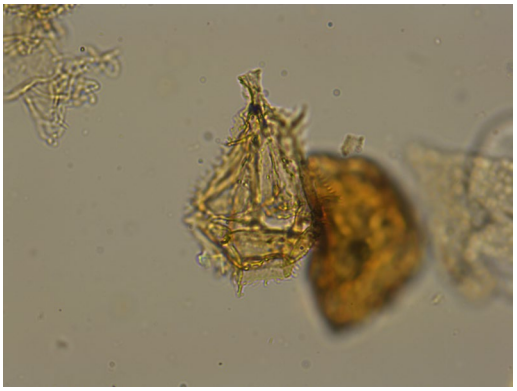
Plate 5



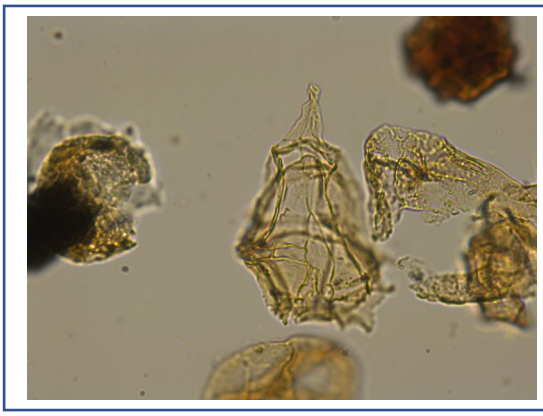
Korystocysta kettonensis
OIW-01; 1875.5mCORE
40x



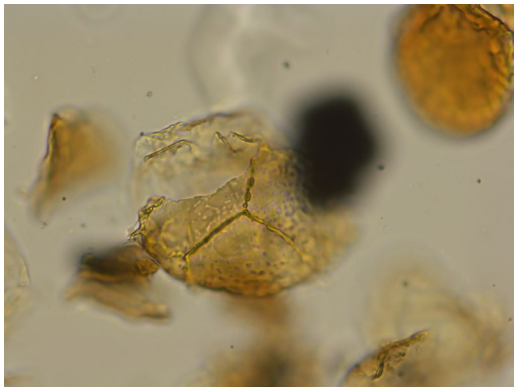
Parvocysta bullula
OIW-01; 1875.5mCORE
40x



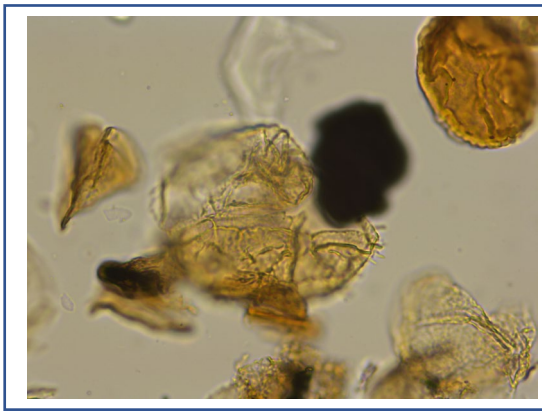
Gonyaulacysta adecta adecta
OIW-01; 1875.5mCORE
40x



Gonyaulacysta adecta var. *longicornis*
OIW-01; 1875.5mCORE
40x

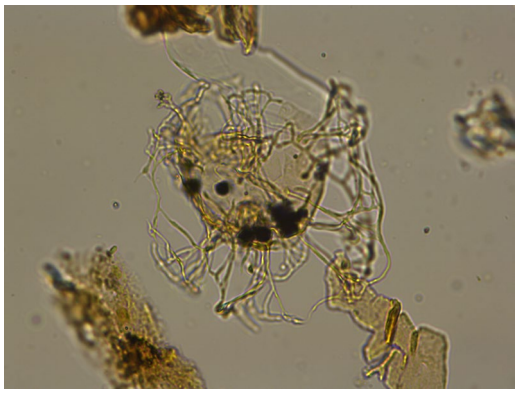


Durotrigia filapicata
OIW-01; 1876.5mCORE
40x; Upper Focus

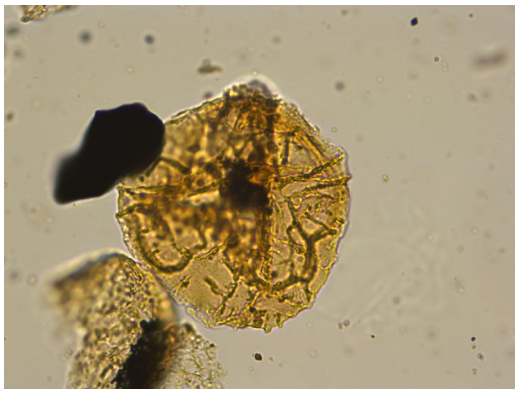


Durotrigia filapicata
OIW-01; 1876.5mCORE
40x; Lower Focus

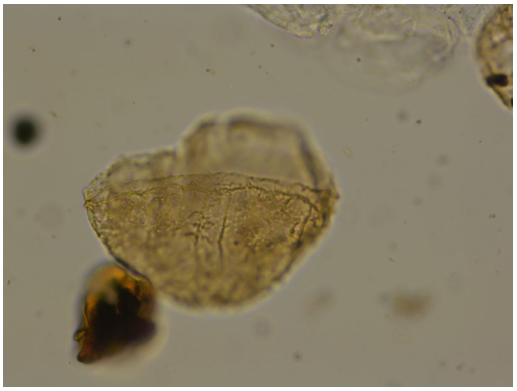
Plate 6



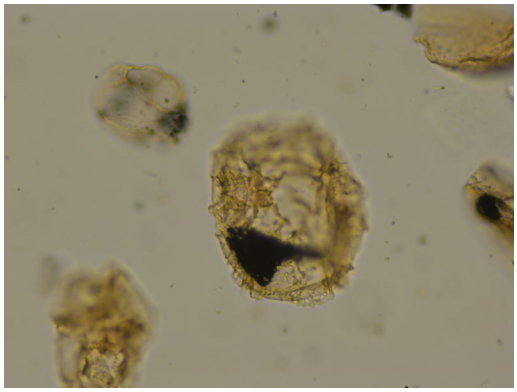
Rigaudella aemula
OIW-01; 1875.5mCORE
40x; Upper Focus



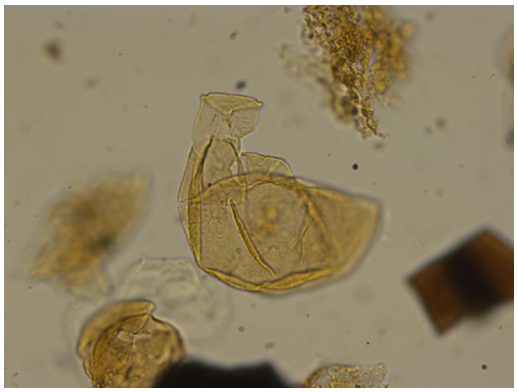
Acanthaulax crispa
OIW-01; 2275mCORE
40x; Upper Focus



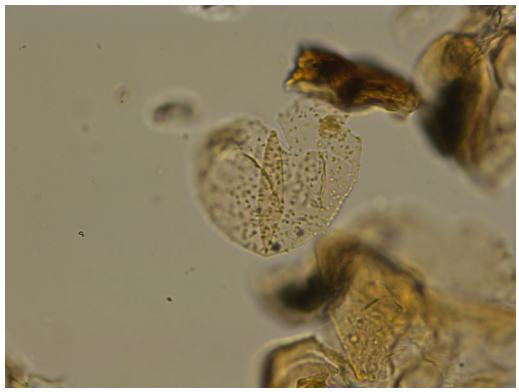
Korystocysta gochtii
OIW-01; 2275mCORE
40x



Hystrichogonyaulax regalis
OIW-01; 2275mCORE
40x

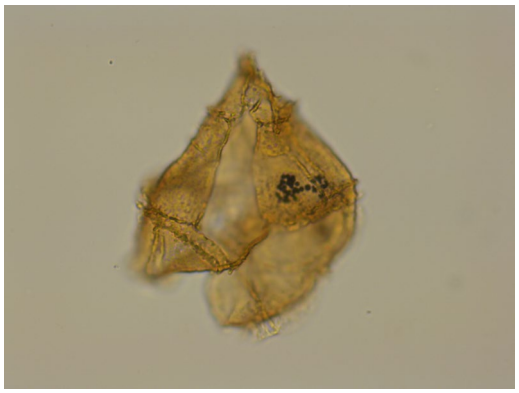


Dissiliodinium sp.
OIW-01; 2275mCORE
40x

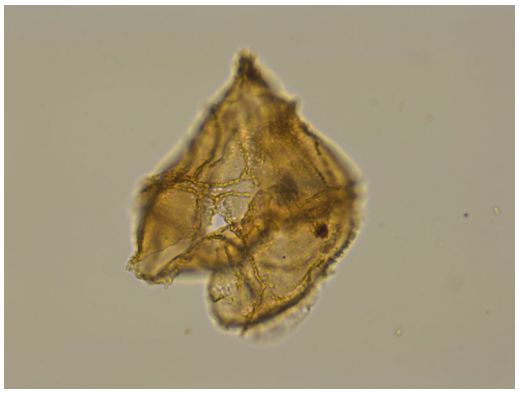


Dissiliodinium sp.
OIW-01; 2275mCORE
40x

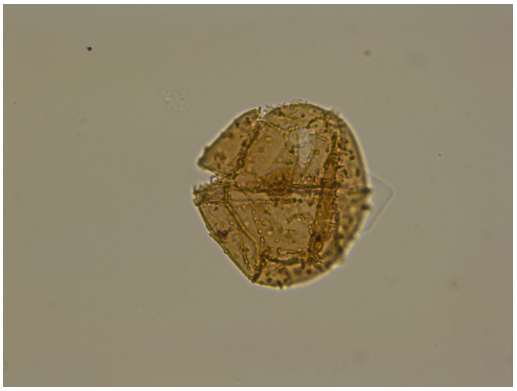
Plate 7



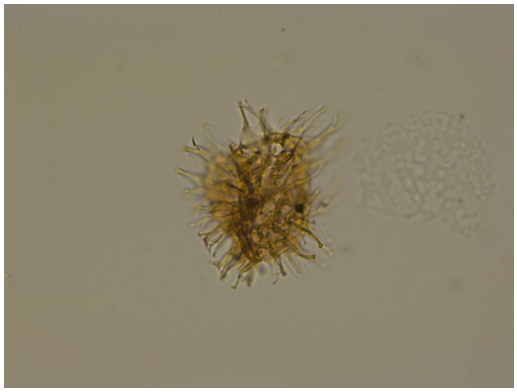
Cribroperidinium sepimentum
K15-01; 1538.5mCORE
40x; Upper Focus



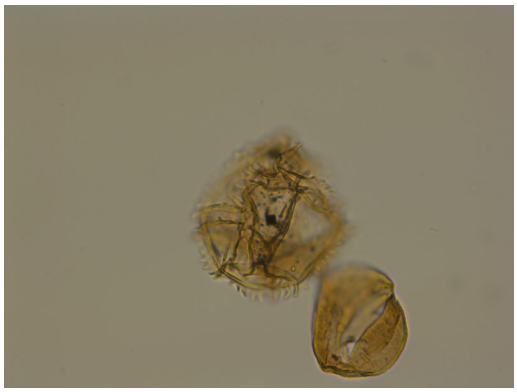
Cribroperidinium sepimentum
K15-01; 1538.5mCORE
40x; Lower Focus



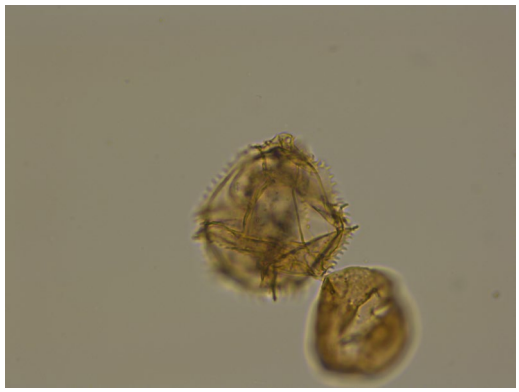
Exeguisphaera phragma
K15-01; 1538.5mCORE
40x



Vexillocysta spinosa
K15-01; 1538.5mCORE
40x

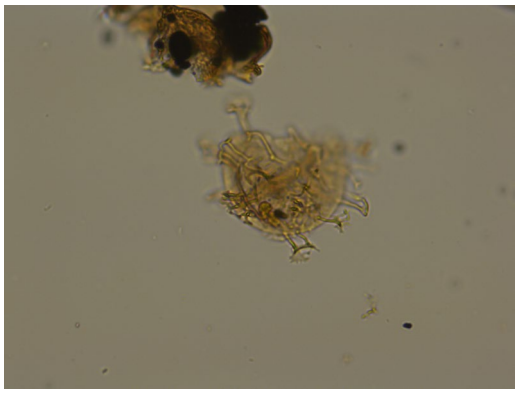


Wrevittia cretaceae
K15-01; 1538.5mCORE
40x; Upper Focus

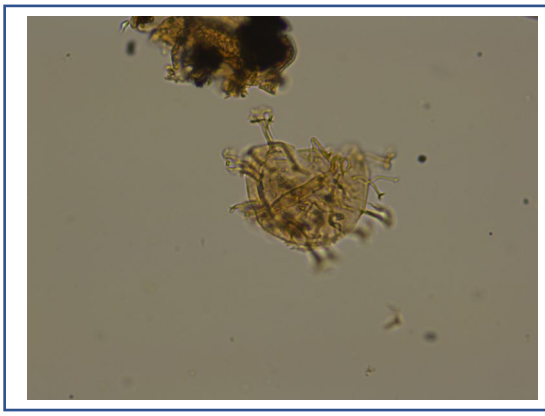


Wrevittia cretaceae
K15-01; 1538.5mCORE
40x; Lower Focus

Plate 8



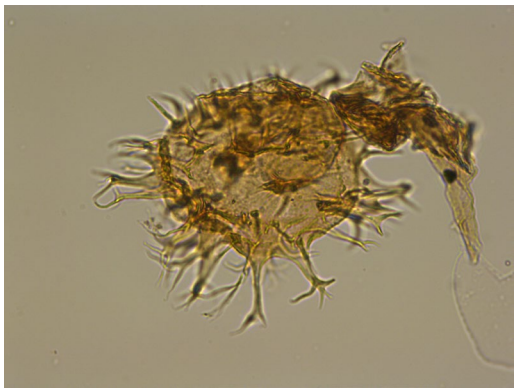
Palaecysta complicata
K15-01; 1538.5mCORE
40x; Upper Focus. Note the comparatively small size



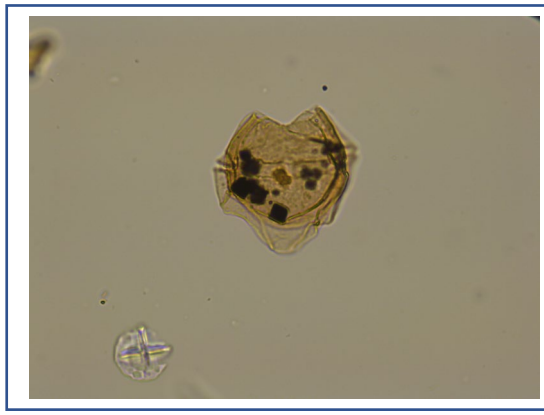
Palaecysta complicata
K15-01; 1538.5mCORE
40x; Lower Focus

Palaecysta palmula
K15-01; 1538.5mCORE
40x; Upper Focus

Palaecysta palmula
K15-01; 1538.5mCORE
40x; Lower Focus

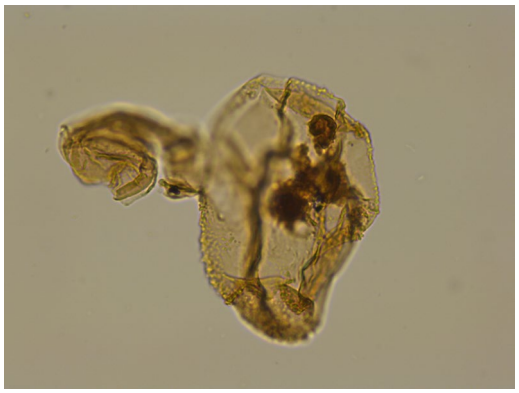


Spiculodinium alatum
K15-01; 1538.5mCORE
40x

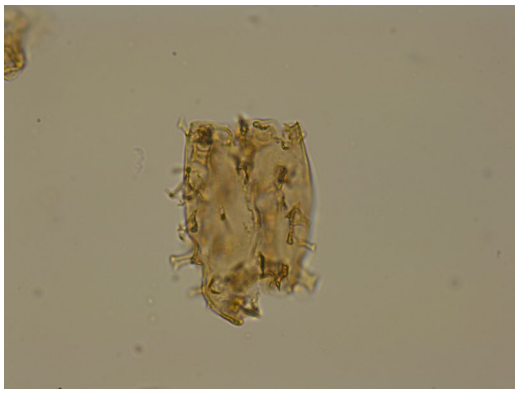


Sirmiodiniopsis frisia
K15-01; 1546.5mCORE
40x

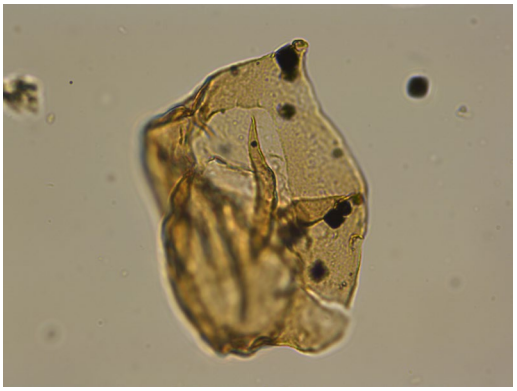
Plate 9



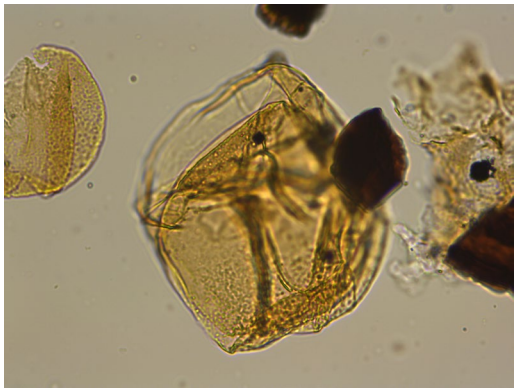
Atopodinium prostatum
K15-01; 1546.5mCORE
40x



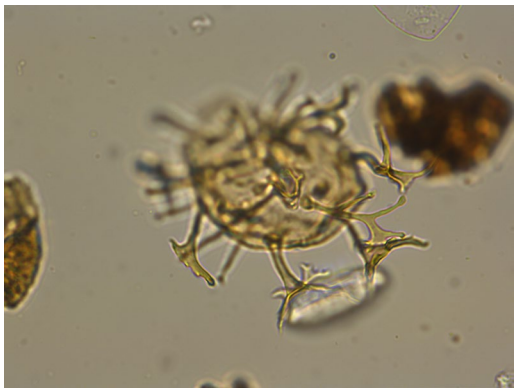
Egmontodinium torynum
K15-01; 1546.5mCORE
40x



Lagenorhytis delicatula
K15-01; 1546.5mCORE
40x



Scriniodinium hauterivianum
K15-01; 1546.5mCORE
40x



Cymososphaeridium arcuatum
K15-01; 1546.5mCORE
40x

Micrometer scale
40x objective
Each bar is 10 µ (micron)

APPENDIX 2

Palynological distribution charts

Well Name : Berkel-02

Interval : 1800m - 2600m

Scale : 1:3000

Chart date: 08 July 2024

TNO-NITG
Utrecht

Depth

DC

Sample depth is BASE of depth range

Samples (metres)

Barren

Sporomorphs Pre-Quaternary

Semi-quantitative, ()
Analyst(s): RVE

SP	*Bisaccates*
SP	*Callialasporites dampieri*
SP	*Cerebropollenites mesozoicus*
SP	*Cicatricosisporites* spp.
SP	*Classopollis* spp.
SP	*Ischyosporites* spp.
SP	*Perinopollenites elatoides*
SP	*Pilosisporites trichopapillosus*
SP	*Plicatella* spp.
SP	*Psilatrilete spores*
SP	*Staplinisporites caminus*
SP	*Converrucosisporites* spp.
SP	*Gleichenidites* spp.

Sample depth is BASE of depth range

Samples (metres)

Barren

1800m
1850m
1900m
1950m
2000m
2040.50
2050m
2100m
2150m
2200m
2206.00
2236.00
2237.00
2250m
2300m
2350m
2400m
2450m
2500m
2502.00
2550m
2600m

2040.50
2206.00
2236.00
2237.00
2502.00

Well Name : Delft-02

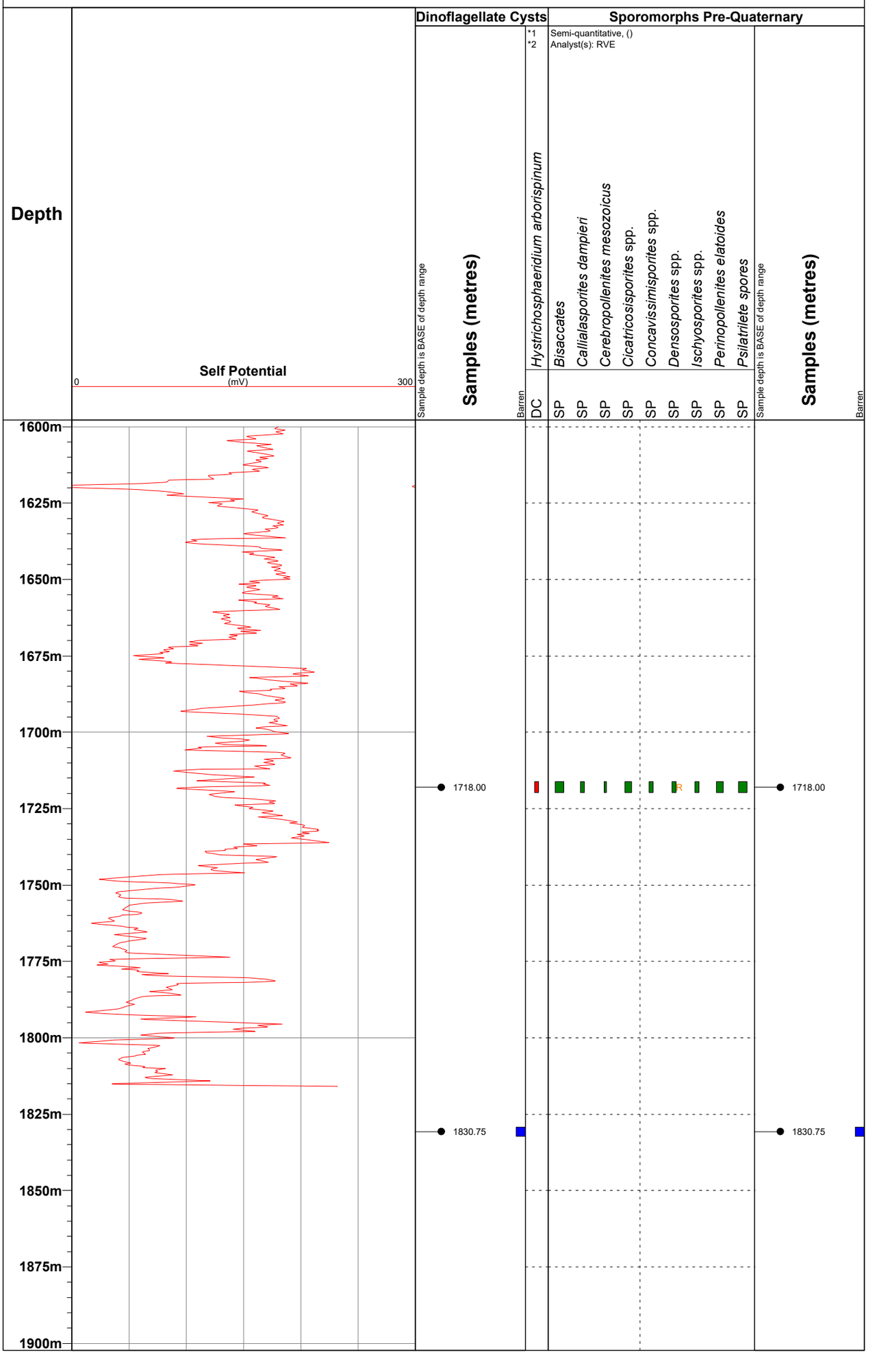
Interval : 1600m - 1900m

Scale : 1:1500

Chart date: 08 July 2024

Delft-02

TNO-NITG
Utrecht



Well Name : Gouda-01

Interval : 500m - 700m

Scale : 1:1000

Chart date: 08 July 2024

Gouda-01

TNO-NITG
Utrecht

Depth

Self Potential
-100 (mV) -300

Dinoflagellate Cysts

Semi-quantitative, ()
Analyst(s): RVE

Sample depth is BASE of depth range

Samples (metres)

Barren

DC *Hystrichosphaeridium arborispinum prolatum*
DC *Pseudoceratium pelliferum*
DC *Subtilisphaera perlucida*
DC *Batiacasphaera* spp.
DC *Cauca parva*
DC *Hystrichosphaeridium arborispinum*
DC *Muderongia simplex*
DC *Subtilisphaera terrula*
DC *Taleisphaera hydra*
DC *Circulodinium hirtellum*
DC *Cribroperidinium* spp.
DC *Cymososphaeridium validum*
DC *Subtilisphaera* spp.

Sporomorphs Pre-Quaternary

Semi-quantitative, ()
Analyst(s): RVE

SP *Bisaccates*
SP *Callialasporites dampieri*
SP *Cerebropollenites mesozoicus*
SP *Cicatricosisporites* spp.
SP *Perinopollenites elatoides*
SP *Psilatrilete spores*
SP *Gleichenidites* spp.
SP *Ischyosporites* spp.
SP *Contignisporites* spp.
SP *Pilosisporites trichopapillosus*
SP *Trilobosporites bernissartensis*
SP *Densosporites* spp.
SP *Classopollis* spp.
SP *Osmundacidites* spp.

Sample depth is BASE of depth range

Samples (metres)

Barren

500m
520m
540m
560m
580m
600m
620m
640m
TD 660m
680m
700m

586.00
595.00
608.50
617.00
636.50
651.00
658.00

R

Well Name : Hazerswoude-01

Interval : 500m - 1100m

Scale : 1:3000

Chart date: 08 July 2024

Hazerswoude-01

TNO-NITG
Utrecht

Depth

Undefined column

0 — 100

Dinoflagellate Cysts

Semi-quantitative, ()
Analyst(s): RVE

Sample depth is BASE of depth range

Sample (metres)

Barren

Muderongia simplex
Nexosispinum vetusculum
Palaecysta complicata
Subtilisphaera perlucida
Circulodinium hirtellum
Cribroperidinium spp.
Hystrichosphaeridium arborispinum
Oligosphaeridium complex
Pseudoceratium pelliferum
Subtilisphaera terrula
Vesperopsis sp. A
Kiokansium spp.

DC DC DC DC DC DC DC DC DC DC DC DC

Sporomorphs Pre-Quaternary

Semi-quantitative, ()
Analyst(s): RVE

Sample depth is BASE of depth range

Sample (metres)

Barren

Aequitriradites spinulosus
Bisaccates
Callialasporites dampieri
Cicatricosisporites spp.
Pilosisporites trichopapillosus
Psilatrilete spores
Gleichenidites spp.
Apiculatisporis spp.
Araucariacites spp.
Cerebropollenites mesozoicus
Contignisporites spp.
Converrucosisporites spp.
Costatoperforosporites spp.
Densosporites spp.
Rubinella major
Tuberositriletes montuosus
Foveotriletes spp.
Plicatella spp.
Impardecispora apiverrucata
Ischyosporites spp.
Perinopollenites elatoides
Concavissimisporites spp.
Concavissimisporites verrucosus
Classopollis spp.
Lycopodiacidites spp.
Osmundacidites spp.

SP SP SP SP SP SP SP SP SP SP SP SP SP SP SP SP SP SP SP SP SP SP SP SP SP SP SP SP SP

R R R

500m
550m
600m
650m
700m
750m
800m
850m
900m
950m
1000m
1050m
1100m

583.00
605.00
695.00
796.00
882.50
985.00
1011.00
1011.10
1033.00
1054.50
1060.50

Well Name : K15-01

Interval : 1450m - 1650m

Scale : 1:1500

Chart date: 08 July 2024

K15-01

TNO-NITG
Utrecht

Depth

Gamma Log (API) 0 — 150

1450m
1475m
1500m
1525m
1550m
1575m
1600m
1625m
1650m

Dinoflagellate Cysts

Semi-quantitative, ()
Analyst(s): RVE

Sample depth is BASE of depth range	Samples (metres)	Analyst	Barren
1538.50		RVE	
1546.50		RVE	
1554.70		RVE	
1561.60		RVE	
1573.50		RVE	
1600.00		RVE	

Canningia spp.	DC
Cymososphaeridium arcuatum	DC
Hystrichodinium pulchrum	DC
Hystrichodinium voigtii	DC
Isthmocystis distincta	DC
Kleithriasphaeridium fasciatum	DC
Lagenorhytis spp.	DC
Palaecysta palmula	DC
Pseudoceratium pelliferum	DC
Scriniodinium hauterivianum	DC
Tubotuberella apatela	DC
Wrevittia spp.	DC
Atopodinium prostatum	DC
Cauca parva	DC
Cymososphaeridium validum	DC
Egmontodinium torynum	DC
Gochteodinia villosa	DC
Lagenorhytis delicatula	DC
Pareodinia ceratophora	DC
Sirmiodiniopsis frisia	DC
Spiculodinium alatum	DC
Wrevittia cretaceae	DC
Cribroperidinium edwardsii	DC
Cyclonephelium spp.	DC
Exiguisphaera phragma	DC
Heslertonia heslertonensis	DC
Muderongia simplex	DC
Occisucysta tentoria	DC
Palaecysta complicata	DC
Vexillocysta spinosa	DC

Sporomorphs Pre-Quaternary

Semi-quantitative, ()
Analyst(s): RVE

Sample depth is BASE of depth range	Samples (metres)	Analyst	Barren
1538.50		RVE	
1546.50		RVE	
1554.70		RVE	
1561.60		RVE	
1573.50		RVE	
1600.00		RVE	

Aequitriradites spinulosus	SP
Bisaccates	SP
Callialasporites dampieri	SP
Cicatricosisporites spp.	SP
Classopollis spp.	SP
Converrucosisporites spp.	SP
Gleicheniidites spp.	SP
Osmundacidites spp.	SP
Perinopollenites elatoides	SP
Psilatrilete spores	SP
Rubinella spp.	SP
Cingulatisporites sp. A Abbink 1998	SP
Striatella jurassica	SP
Pilosisporites trichopapillosus	SP
Aequitriradites spp.	SP
Impardecispora spp.	SP

Well Name : Oisterwijk-01

Lat/Long : 0° 0' 0.00"N 0° 0' 0.00"E

Interval : 1200m - 2300m

Scale : 1:3000

Chart date: 08 July 2024

Oisterwijk-01

TNO-NITG
Utrecht

Project : DEVLI
Chart : OIW-01

Depth

Undefined column

0 100

Dinoflagellate Cysts

Semi-quantitative, ()
Analyst(s): RVE

Sample depth is BASE of depth range

Samples (metres)

Barren

DC	*Acanthaulax crispa*
DC	*Dissiliodinium* spp.
DC	*Hystrichogonyaulax regalis*
DC	*Kallosphaeridium hypornatum*
DC	*Korystocysta gochtii*
DC	*Mendicodinium groenlandicum*
DC	*Meiourogonyaulax valensii*
DC	*Nannoceratopsis gracilis*
DC	*Pareodinia ceratophora*
DC	*Ctenidodinium continuum*
DC	*Durotrigia filapicata*
DC	*Gonyaulacysta jurassica adecta var. adecta*
DC	*Kalyptea stegasta*
DC	*Rigaudella aemula*
DC	*Valensiella* spp.
DC	*Energlynia acollaris*
DC	*Evansia* spp.
DC	*Gonyaulacysta centriconnata*
DC	*Gonyaulacysta jurassica adecta var. longicornis*
DC	*Korystocysta kettonensis*
DC	*Parvocysta bullula*
DC	*Tubotuberella dangeardii*

Sporomorphs Pre-Quaternary

Semi-quantitative, ()
Analyst(s): RVE

SP	*Bisaccates*
SP	*Cerebropollenites mesozoicus*
SP	*Chasmatosporites apertus*
SP	*Classopollis* spp.
SP	*Lycopodiacidites irregularis*
SP	*Ricciisporites tuberculatus*
SP	*Neoraistrickia gristhorpensis*
SP	*Quadraeculina anellaeformis*
SP	*Callialasporites dampieri*
SP	*Chasmatosporites hians*
SP	*Cingulatisporites* sp. A Abbink 1998
SP	*Densoisporites velatus*
SP	*Exesipollenites tumulus*
SP	*Leptolepidites psarosus*
SP	*Psilatrilete spores*
SP	*Staplinisporites caminus*

Sample depth is BASE of depth range

Samples (metres)

Barren

1200m
1250m
1300m
1350m
1400m
1450m
1500m
1550m
1600m
1650m
1700m
1750m
1800m
1850m
1900m
1950m
2000m
2050m
2100m
2150m
2200m
2250m
2300m

1329.00
1388.00
1598.00
1602.00
1602.50
1875.50
1876.50
2193.00
2194.00
2275.00