



# Supplementary material: Coniacian–Campanian palynology, carbon isotopes and clay mineralogy of the Poigny borehole (Paris Basin) and its correlation in NW Europe

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## 1. Supplemental Material A: Poigny Craie 701 borehole: analytical methods

### 1.1. Carbon isotopes

A total of 763 bulk sediment samples (50 g) were taken between 399.65–59.20 m depth (average spacing 45 cm) for stable isotope analysis by NT and MM from the Poigny core at the University of Rennes 1. Samples were analysed by JM and CVU at the University of Exeter using a Sercon 20-22 gas source

isotope ratio mass spectrometer (GS-IRMS) in continuous flow setup. The analytical method is analogous to Ullmann et al. [2020, supplementary information] and is here explained only in brief.

Approximately 500 µg of bulk carbonate were weighed into borosilicate vials at 1 µg precision to minimise weight-dependent analytical biases. Samples and in-house standards CAR (Carrara Marble,  $\delta^{13}\text{C}_{\text{carb}} = +2.10\text{‰}$  VPDB;  $\delta^{18}\text{O}_{\text{carb}} = -2.03\text{‰}$  VPDB) and NCA (Namibian carbonatite,  $\delta^{13}\text{C}_{\text{carb}} = -5.63\text{‰}$  VPDB;  $\delta^{18}\text{O}_{\text{carb}} = -21.90\text{‰}$  VPDB) were flushed with He for 80 s and reacted with nominally anhydrous phosphoric acid (103%) at 70 °C. Instrumental drift as well as analytical bias were corrected using the two

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in-house standards yielding a reproducibility (two standard deviations; 2 sd) of 0.07‰ for  $\delta^{13}\text{C}_{\text{carb}}$  and 0.15‰ for  $\delta^{18}\text{O}_{\text{carb}}$  ( $n = 917$ ) over the year in which the analyses were conducted.

## 1.2. Palynology

For palynological analysis, 73 samples were selected from the carbon isotope sample set at approximately 5 m intervals (Figures 2, 3). Weighed (20–30 g) samples were treated with HCl and HF to remove the carbonate and silicate matrix, and the organic residue was concentrated with a 15  $\mu\text{m}$  sieve mesh [see Jarvis *et al.*, 2021]. Samples were spiked with *Lycopodium clavatum* spore tablets (Department of Geology, Lund University) to enable the determination of palynomorph absolute abundances [cf. Pearce *et al.*, 2003]. Oxidation was not required.

Palynology slides were analysed with a Leica DM1000 LED microscope with  $\times 63$  and  $\times 100$  oil-immersion objectives. A full count was reached when 200 identified dinocysts (excluding spores and pollen, acritarchs and unidentified specimens) were recorded. Subsequently, whole slides were visually scanned for the presence of additional taxa. These were recorded as present (crosses on range chart Figure 3) but were not included in the numerical count data.

## References

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- Pearce, M. A., Jarvis, I., Swan, A. R. H., Murphy, A. M., Tocher, B. A., and Edmunds, W. M. (2003). Integrating palynological and geochemical data in a new approach to palaeoecological studies: Upper Cretaceous of the Banterwick Barn Chalk borehole, Berkshire, UK. *Mar. Micropaleontol.*, 47, 271–306.
- Ullmann, C. V., Boyle, R., Duarte, L., Hesselbo, S., Kasemann, S. A., Klein, T., Lenton, T. M., Piazza, V., and Aberhan, M. (2020). Warm afterglow from the Toarcian Oceanic Anoxic Event drives the success of deep-adapted brachiopods. *Sci. Rep.*, 10, 11.

## 2. Supplemental Material B

### 2.1. Poigny Craie 701 borehole: taxonomic list of taxa

**Division Dinoflagellata (Bütschli 1885) Fensome *et al.*, 1993b**

**Subdivision Dinokaryota Fensome *et al.*, 1993b**

**Class Dinophyceae Pascher, 1914**

**Subclass Gymnodiniphyceidae Fensome *et al.*, 1993b**

**Order Ptychodiscales Fensome *et al.*, 1993b**

**Family Ptychodisceaceae Willey and Hickson, 1909**

**Subfamily Dinogymnioideae (Sarjeant and Downie, 1974) Fensome *et al.*, 1993b**

*Alisogymnium euclaense* (Cookson and Eisenack, 1970a) Lentin and Vozzhennikova, 1990

*Dinogymnium acuminatum* Evitt *et al.*, 1967

*Dinogymnium undulosum* Cookson and Eisenack, 1970a

**Subclass Peridiniphyceidae Fensome *et al.*, 1993b**

**Order Gonyaulacales Taylor, 1980**

**Suborder Cladopyxiineae Fensome *et al.*, 1993b**

**Family Cladopyxiaceae Stein, 1883**

*Fibradinium annetorpense* Morgenroth, 1968

*Gillinia hymenophora* Cookson and Eisenack, 1960a

*Microdinium glabrum* Cookson and Eisenack, 1974

*Microdinium granocarinaratum* (Below, 1987b) Lentin and Williams, 1989

*Microdinium reticulatum* Vozzhennikova, 1967

*Microdinium setosum* Sarjeant, 1966b

*Microdinium* sp. A FitzPatrick 1992

*Microdinium* spp. Cookson and Eisenack, 1960a

**Family uncertain**

*Rhiptocorys veligera* (Deflandre, 1937b) Lejeune-Carpentier and Sarjeant, 1983

**Suborder Goniodomineae Fensome *et al.*, 1993b**

**Family Goniodomaceae Lindemann, 1928**

**Subfamily Pyrodinioideae Fensome *et al.*, 1993b**

*Alisocysta circumtabulata* (Drugg, 1967) Stover and Evitt, 1978

*Dinopterygium alatum* (Cookson and Eisenack, 1962b) Fensome *et al.*, 2009

*Dinopterygium cladoides* Deflandre, 1935

*Dinopterygium cf. cladoides* Deflandre, 1935

*Dinopterygium tuberculatum* (Eisenack and Cookson, 1960) Stover and Evitt, 1978

*Eisenackia? knokkensis* Louwye, 1997  
*Fetchamium prolixispinosum* (Davey and Williams, 1966b) Pearce and Williams 2018  
*Hystrichosphaeridium bowerbankii* Davey and Williams, 1966b  
*Hystrichosphaeridium conispiniferum* Yun Hyesu, 1981  
*Hystrichosphaeridium recurvatum* (White, 1842) Lejeune-Carpentier, 1940  
*Hystrichosphaeridium salpingophorum* Deflandre, 1935  
*Hystrichosphaeridium* spp. Deflandre, 1937b  
*Hystrichosphaeridium tubiferum* subsp. *brevispinum* (Davey and Williams, 1966b) Lentin and Williams, 1973  
*Hystrichosphaeridium tubiferum* subsp. *ovale* Marheinecke, 1992  
*Hystrichosphaeridium tubiferum* subsp. *tubiferum* (Ehrenberg, 1837b) Deflandre, 1937b  
*Hystrichosphaeridium? paracostatum* Cookson and Eisenack, 1974  
*Biconidinium reductum* (May, 1980) Kirsch, 1991

#### Suborder Gonyaulacineae (Autonym)

#### Family Gonyaulacaceae Lindemann, 1928

#### Subfamily Leptodinioideae Fensome *et al.*, 1993b

*Dimidium striatum* (Clarke and Verdier, 1967) Pearce, 2010  
*Eatonicysta* spp. Stover and Evitt, 1978  
*Eatonicysta? mutabilireta* Pearce 2010  
*Kleithriasphaeridium cooksoniae* (Singh, 1971) Fensome *et al.*, 2009  
*Kleithriasphaeridium loffrense* Davey and Verdier, 1976  
*Kleithriasphaeridium readei* (Davey and Williams, 1966b) Davey and Verdier, 1976  
*Litosphaeridium siphoniphorum* subsp. *siphoniphorum* (Cookson and Eisenack, 1958) Davey and Williams, 1966b  
*Membranigonyaulax granulata* Slimani, 1994  
*Membranigonyaulax promineseptata* Slimani, 1994  
*Membranigonyaulax wilsonii* Slimani, 1994  
*Oligosphaeridium complex* (White, 1842) Davey and Williams, 1966b  
*Oligosphaeridium pulcherrimum* (Deflandre and Cookson, 1955)  
*Rhynchodiniopsis saliorum* Louwye, 1997  
*Rhynchodiniopsis* sp. F (Foveolate)

#### Subfamily Cribroperidinioideae Fensome *et al.*, 1993b

*Apteodinium deflandrei* (Clarke and Verdier, 1967) Lucas-Clark, 1987  
*Cordosphaeridium catherineae* Pearce 2010  
*Cribroperidinium* spp. Neale and Sarjeant, 1962  
*Cribroperidinium wetzelii* (Lejeune-Carpentier, 1939) Helenes, 1984  
*Cribroperidinium wilsonii* (Yun Hyesu, 1981) Poulsen, 1996  
*Florentinia buspina* (Davey and Verdier, 1976)  
*Florentinia deanei* (Davey and Williams, 1966b) Davey and Verdier, 1973  
*Florentinia ferox* (Deflandre, 1937b) Duxbury, 1980  
*Florentinia hypomagna* Yun Hyesu, 1981  
*Florentinia mayi* Kirsch, 1991  
*Florentinia radiculata* (Davey and Williams, 1966b) Davey and Verdier, 1973  
*Florentinia* spp. Davey and Verdier, 1973  
*Hystrichokolpoma proprium* (Marheinecke, 1992) Foucher in Fauconnier and Masure, 2004  
*Hystrichokolpoma sequanaportum* Deflandre and Deflandre-Rigaud, 1958  
*Spongodinium delitiense* (Ehrenberg, 1837b) Deflandre, 1936b

#### Subfamily Gonyaulacoideae (Autonym)

*Achomosphaera cf. granulata* Mao Shaozhi, 1989  
*Achomosphaera crassipellis* (Deflandre and Cookson, 1955) Stover and Evitt, 1978  
*Achomosphaera ramulifera* (Deflandre, 1937b) Evitt, 1963  
*Achomosphaera regiensis* Corradini, 1973  
*Cannosphaeropsis utinensis* Wetzel, 1933b  
*Flandrecysta furcata* Slimani, 1994  
*Hystrichosphaeropsis ovum* Deflandre, 1935  
*Hystrichosphaeropsis quascribrata* (Wetzel, 1961) Gocht, 1976  
*Hystrichostrogylon membraniphorum* Agelopoulos, 1964  
*Hystrichostrogylon membraniphorum* subsp. *granulatum* Heilmann-Clausen in Heilmann-Clausen and Costa, 1989  
*Impagidinium rigidaseptatum* Slimani, 1994  
*Psaligonyaulax deflandrei* Sarjeant, 1966b  
*Pterodinium cingulatum* subsp. *cingulatum* (Wetzel, 1933b) Below, 1981a  
*Pterodinium cingulatum* subsp. *granulatum* (Clarke and Verdier, 1967) Lentin and Williams, 1981

- Pterodinium cingulatum* subsp. *reticulatum* (Davey and Williams, 1966a) Lentin and Williams, 1981  
*Rottnechia wetzelii* (Deflandre, 1937b) Slimani, 1994  
*Spiniferites* aff. *porosus* (Manum and Cookson, 1964) Harland, 1973  
*Spiniferites foveolatus* Schiøler, 1993  
*Spiniferites jarvisii* Pearce 2010  
*Spiniferites membranaceus* (Rossignol, 1964) Sarjeant, 1970  
*Spiniferites multispinulus* Pearce 2010  
*Spiniferites porosus* (Manum and Cookson, 1964) Harland, 1973  
*Spiniferites pseudofurcatus* (Klumpp, 1953) Sarjeant, 1970  
*Spiniferites ramosus* subsp. *aquilus* Pearce 2010  
*Spiniferites ramosus* subsp. *ginakrogiae* Pearce 2018  
*Spiniferites ramosus* subsp. *gracilis* (Davey and Williams, 1966a) Lentin and Williams, 1973  
*Spiniferites ramosus* subsp. *granomembranaceus* (Davey and Williams, 1966a) Lentin and Williams, 1973  
*Spiniferites ramosus* subsp. *granosus* (Davey and Williams, 1966a) Lentin and Williams, 1973  
*Spiniferites ramosus* subsp. *maeandriiformis* (Corradini, 1973) Lentin and Williams, 1975  
*Spiniferites ramosus* subsp. *pteroceolus* Slimani, 1996 ex Slimani, 2001b  
*Spiniferites ramosus* subsp. *ramosus* (Ehrenberg, 1837b) Mantell, 1854  
*Spiniferites ramosus* subsp. *reticulatus* (Davey and Williams, 1966a) Lentin and Williams, 1973  
*Spiniferites scabrosus* (Clarke and Verdier, 1967) Lentin and Williams, 1975  
*Spiniferites* spp. Mantell, 1850  
*Spiniferites twistringiensis* (Maier, 1959) Fensome *et al.*, 1990  
*Turnhosphaera hypoflata* (Yun Hyesu, 1981) Slimani, 1994  
*Wilsonisphaera petila* (Corradini, 1973) Slimani, 1994
- Subfamily uncertain**  
*Cometodinium obscurum* Deflandre and Courteville, 1939  
*Coronifera oceanica* Cookson and Eisenack, 1958  
*Coronifera striolata* (Deflandre, 1937) Stover and Evitt, 1978 *sensu* Schiøler 1992  
*Corradinisphaeridium horridum* (Deflandre, 1937b) Masure, 1986
- Hystrichodinium pulchrum* Deflandre, 1935  
*Pervosphaeridium elegans* Louwye, 1997  
*Pervosphaeridium intervalum* Kirsch, 1991  
*Pervosphaeridium monasteriense* Yun Hyesu, 1981  
*Pervosphaeridium pseudhystrichodinium* (Deflandre, 1937b) Yun Hyesu, 1981  
*Pervosphaeridium septatum* Slimani, 1996 ex Slimani, 2001b  
*Pervosphaeridium truncatum* (Davey, 1969a) Below, 1982c  
*Scriniodinium campanula* Gocht, 1959  
*Sentusidinium euteichum* (Davey, 1969a) Wood *et al.*, 2016  
*Sentusidinium explanatum* (Bujak in Bujak *et al.*, 1980) Wood *et al.*, 2016  
*Sentusidinium ringnesiorum* (Manum and Cookson, 1964) Wood *et al.*, 2016  
*Sentusidinium* spp. Sarjeant and Stover, 1978  
*Sepispinula? ambigua* (Deflandre, 1937b) Masure in Fauconnier and Masure, 2004  
*Surculosphaeridium belowii* Yun Hyesu, 1981  
*Surculosphaeridium convocatum* Fensome *et al.*, 2016  
*Surculosphaeridium longifurcatum* (Firtion, 1952) Davey *et al.*, 1966  
*Surculosphaeridium? cassospinum* Yun Hyesu, 1981  
*Trichodinium castanea* Deflandre, 1935 ex Clarke and Verdier, 1967
- Family Areoligeraceae Evitt, 1963b**  
*Adnatosphaeridium buccinum* Hultberg, 1985c  
*Areoligera coronata* (Wetzel, 1933b ex Deflandre, 1937b) Lejeune-Carpentier, 1938a  
*Areoligera medusettiformis* Wetzel, 1933b ex Lejeune-Carpentier, 1938a  
*Areoligera senonensis* Lejeune-Carpentier, 1938a  
*Areoligera* spp. Lejeune-Carpentier, 1938a  
*Areoligera volata* Drugg, 1967  
*Canningia glomerata* Fensome *et al.*, 2019  
*Canningia reticulata* Cookson and Eisenack, 1960b  
*Canningia senonica* Clarke and Verdier, 1967  
*Canninginopsis bretonica* Marshall, 1990b  
*Circulodinium distinctum* (Deflandre and Cookson, 1955) Jansonius, 1986  
*Circulodinium latoaculeum* (Yun Hyesu, 1981) Prince *et al.*, 1999  
*Glaphyrocysta* sp. A  
*Palynodinium* cf. *helveticum* Kirsch, 1991  
*Renidinium rigidum* Prince *et al.*, 1999

*Senoniasphaera congregata* (Prince *et al.*, 2008) Fensome *et al.*, 2019  
*Senoniasphaera filoreticulata* (Slimani, 1994) Fensome *et al.*, 2019  
*Senoniasphaera macroreticulata* Prince *et al.*, 2008  
*Senoniasphaera protrusa* Clarke and Verdier, 1967  
*Senoniasphaera turonica* (Prössl, 1990 ex Prössl, 1992b) Pearce *et al.*, 2011  
*Tenua colliveri* (Cookson and Eisenack, 1960b) Fensome *et al.*, 2019  
*Tenua hystrix* Eisenack, 1958a  
*Trimuradinium whitenessense* (Prince *et al.*, 2008) Fensome *et al.*, 2019

### **Suborder Ceratiineae Fensome *et al.*, 1993b**

#### **Family Ceratiaceae Willey and Hickson, 1909**

*Odontochitina costata* Alberti, 1961  
*Odontochitina cribropoda* Deflandre and Cookson, 1955  
*Odontochitina diducta* Pearce, 2010  
*Odontochitina operculata* (Wetzel, 1933a) Deflandre and Cookson, 1955  
*Odontochitina porifera* Cookson, 1956  
*Odontochitina* spp. Deflandre, 1937b  
*Xenascus australensis* Cookson and Eisenack, 1969  
*Xenascus ceratioides* (Deflandre, 1937b) Lentin and Williams, 1973  
*Xenascus gochtii* (Corradini, 1973) Stover and Evitt, 1978  
*Xenascus wetzelii* Slimani, 1996 ex Slimani, 2001b  
*Xenascus yunii* Prince *et al.*, 2008

### **Suborder uncertain**

#### **Family uncertain**

*Atopodinium haromense* Thomas and Cox, 1988  
*Caligodinium aceras* (Manum and Cookson, 1964) Lentin and Williams, 1973  
*Caligodinium amiculum* Drugg, 1970b  
*Caligodinium* spp. Drugg, 1970b  
*Cassiculosphaeridia alta* Pearce, 2010  
*Cassiculosphaeridia pygmaeus* Stevens, 1987 (or *Chytreisphaeridia* sp. A Kirsch 1991)  
*Cassiculosphaeridia reticulata* Davey, 1969a  
*Cassiculosphaeridia? intermedia* Slimani, 1994  
*Chlamydothorella discreta* Clarke and Verdier, 1967  
*Chlamydothorella nyei* Cookson and Eisenack, 1958  
*Chlamydothorella* spp. Cookson and Eisenack, 1958  
*Culversphaera velata* (Clarke and Verdier, 1967) Prince *et al.*, 2008

*Dapsilidinium laminaspinosum* (Davey and Williams, 1966b) Lentin and Williams, 1981  
*Dapsilidinium? pumilum* (Davey and Williams, 1966b) Lentin and Williams, 1981  
*Dapsilidinium? simplex* (White, 1842) Bujak *et al.*, 1980  
*Desmocysta plekta* Duxbury, 1983  
*Desmocysta simplex* Duxbury, 2001  
*Disphaeria macropyta* Cookson and Eisenack, 1960a  
*Disphaeria* sp.S (spiny)  
*Downiesphaeridium armatum* (Deflandre, 1937b) Islam, 1993  
*Downiesphaeridium* spp. Islam, 1993  
*Downiesphaeridium? aciculare* (Davey, 1969a) Islam, 1993  
*Ellipsodinium membraniferum* Prince *et al.*, 2008  
*Elytrocysta circulata* (Clarke and Verdier, 1967) Stover and Helby, 1987d  
*Exochosphaeridium arnace* Davey and Verdier, 1973  
*Exochosphaeridium majus* (Lejeune-Carpentier, 1940) Peyrot, 2011  
*Exochosphaeridium majus* (Lejeune-Carpentier, 1940) Peyrot, 2011 (robust type)  
*Exochosphaeridium phragmites* Davey *et al.*, 1966  
*Exochosphaeridium? masureae* Slimani, 1996 ex Slimani, 2001b  
*Heterosphaeridium difficile* (Manum and Cookson, 1964) Ioannides, 1986  
*Heterosphaeridium heteracanthum* (Deflandre and Cookson, 1955) Eisenack and Kjellström, 1972  
*Impletosphaeridium* spp. Morgenroth, 1966a  
*Membranilarnacia polycladiata* Cookson and Eisenack in Eisenack, 1963a  
*Membranilarnacia pterococoides* (Wetzel, 1933b) Eisenack, 1963a  
*Membranilarnacia wilsonii* Pearce, 2010  
*Montanarocysta aemiliana* Corradini, 1973  
*Neosphaerodictyon filiosum* Slimani, 2003  
*Raetiaedinium evittigratia* Kirsch, 1991  
*Raetiaedinium truncigerum* (Deflandre, 1937b) Kirsch, 1991  
*Raphidodinium fucatum* subsp. *fucatum* Deflandre, 1936b  
*Tanyosphaeridium xanthiopyxides* (Wetzel, 1933b ex Deflandre, 1937b) Stover and Evitt, 1978

*Trigonopyxidia ginella* (Cookson and Eisenack, 1960a) Downie and Sarjeant, 1965  
*Wallodinium luna* (Cookson and Eisenack, 1960a) Lentin and Williams, 1973

**Order Peridiniales Haeckel, 1894b**

**Suborder Peridiniineae (Autonym)**

**Family Peridiniaceae Ehrenberg, 1831**

**Subfamily Palaeoperidinioideae (Vozzhennikova, 1961) Bujak and Davies, 1983**

*Palaeohystrichophora infusorioides* Deflandre, 1935  
*Palaeoperidinium pyrophorum* (Ehrenberg, 1837b ex Wetzell, 1933a) Sarjeant, 1967b  
*Palaeoperidinium? parvum* (Harland, 1973) Lentin and Williams, 1976  
*Subtilisphaera pontis-mariae* (Deflandre, 1936b) Lentin and Williams, 1976  
*Subtilisphaera* spp. Jain and Millepied, 1973

**Subfamily Deflandreoideae Bujak and Davies, 1983**

*Alterbidinium* spp. Lentin and Williams, 1985  
*Amphidiadema* spp. Cookson and Eisenack, 1960a  
*Cerodinium* spp. Vozzhennikova, 1963  
*Chatangiella ditissima* (McIntyre, 1975) Lentin and Williams, 1976  
*Chatangiella eminens* Pearce, 2010  
*Chatangiella granulifera* (Manum, 1963) Lentin and Williams, 1976  
*Chatangiella islae* Pearce *et al.*, 2019  
*Chatangiella madura* Lentin and Williams, 1976  
*Chatangiella manumii* (Vozzhennikova, 1967) Lentin and Williams, 1976  
*Chatangiella* spp. Vozzhennikova, 1967  
*Chatangiella tripartita* (Cookson and Eisenack, 1960a) Lentin and Williams, 1976  
*Chatangiella williamsii* Yun Hyesu, 1981  
*Isabelidinium cooksoniae* (Alberti, 1959b) Lentin and Williams, 1977a  
*Isabelidinium glabrum* (Cookson and Eisenack, 1969) Lentin and Williams, 1977a  
*Isabelidinium microarmum* (McIntyre, 1975) Lentin and Williams, 1977a  
*Nelsoniella incomposita* Pearce, 2010  
*Nelsoniella* spp. Cookson and Eisenack, 1960a  
*Spinidinium echinoideum* (Cookson and Eisenack, 1960a) Lentin and Williams, 1976  
*Trithyrodinium* aff. *sabulum* Mao Shaozhi and Norris, 1988

*Trithyrodinium evittii* Drugg, 1967  
*Trithyrodinium sabulum* Mao Shaozhi and Norris, 1988  
*Trithyrodinium suspectum* (Manum and Cookson, 1964) Davey, 1969b  
*Trithyrodinium vermiculatum* (Cookson and Eisenack, 1961a) Lentin and Williams, 1976  
*Xenikoon? "borealis"* = *Xenikoon* sp. A of Foucher and Robaszynski (1977)

**Subfamily Ovoidinioideae (Norris, 1978) Bujak and Davies, 1983**

*Bosedinia* spp. He Chengquan, 1984b  
*Leberidocysta chlamydata* (Cookson and Eisenack, 1962b) Stover and Evitt, 1978  
*Leberidocysta defloccata* (Davey and Verdier, 1973) Stover and Evitt, 1978  
*Leberidocysta? flagellichnia* Schiøler, 1993  
*Leberidocysta? flagellichnia* Schiøler, 1993 "*laevigata*"  
*Leberidocysta? microverrucosa* Slimani, 1994

**Subclass Peridiniphycidae Fensome *et al.* 1993b**

**Order uncertain**

**Family Dollidiniaceae Fensome *et al.*, 1993b**

*Horologinella* spp. Cookson and Eisenack, 1962a

**Family uncertain**

*Membranosphaera* spp. Samoilovitch in Samoilovitch and Mtchedlishvili, 1961  
*Palaeotetradinium silicorum* Deflandre, 1936b  
*Whitecliffia spinosa* (Clarke and Verdier, 1967) Pearce, 2010

**Subclass uncertain**

**Order uncertain**

**Family uncertain**

Dinoflagellate sp. Z Antonescu *et al.*, 2001  
*Prolixosphaeridium? nanus* (Wetzell, 1933b ex Lentin and Williams, 1985) Sarjeant, 1985b  
 Unknown sp. C Heine 1991

**Additional marine palynomorphs**

algal cyst (reticulate) (*incertae sedis*)  
 algal cyst (scabrate/granulate) (*incertae sedis*)  
 algal cyst (smooth) (*incertae sedis*)  
 algal cyst? (diffuse edge) (*incertae sedis*)  
*Cithariplana caperata* Srivastava, 1984 (acritarch)  
*Comasphaeridium cometes* Valensi 1949 (acritarch)

*Crassosphaera* spp. Cookson and Manum, 1960 (Prasinophyceae)  
*Cymatiosphaera* spp. Wetzel, 1933 (Prasinophyceae)  
*Fromea amphora* Cookson and Eisenack, 1958 (acritarch)  
*Fromea laevigata* (Drugg, 1967) Stover and Eviit, 1978 (acritarch)  
 incertae sedis of Jarvis *et al.*, 2021  
*Leiosphaeridia* spp. Eisenack, 1958 (fusiform) (Prasinophyceae)  
*Leiosphaeridia* spp. Eisenack, 1958 (large) (Prasinophyceae)  
*Leiosphaeridia* spp. Eisenack, 1958 (Prasinophyceae)  
*Michrhystridium* spp. Deflandre, 1937 (acritarch)  
 Microforaminiferal-test-lining (uniserial, biserial, planispiral, trochospiral)  
*Multicorisphaeridium bisphaera* Marheinecke, 1992 (acritarch)  
*Multicorisphaeridium* sp.a (acuminate) (acritarch)  
*Multiplicisphaeridium? cruciatum* (Wetzel, 1933b ex Lejeune-Carpentier, 1940) Stancliffe and Sarjeant, 1994 (acritarch)  
*Nummus similis* (Cookson and Eisenack, 1960b) Burger, 1980b (acritarch)  
*Ovoidites parvus* Nakoman 1966 (Zygomatophyceae)  
*Ovoidites spriggii* (Cookson and Dettmann) Zippi 1998 (Zygomatophyceae)  
*Palaeostomocystis reticulata* Deflandre, 1937 (acritarch)  
*Palambages morulosa* Wetzel, 1961 (Chlorophyceae)  
*Paralecaniella indentata* (Deflandre and Cookson, 1955) Cookson and Eisenack, 1970 (acritarch)  
*Pterospermella aureolata* (Prasinophyceae)  
*Pterospermella australiensis* (Prasinophyceae)

*Pterospermella eurypteris* (Prasinophyceae)  
 Scolecodont (polychaete annelid jaw element)  
*Veryhachium* spp. Denuff, 1954 (acritarch)

### Additional terrestrial palynomorphs

*Appendicisporites* spp.  
*Araucariacites australis*  
 bisaccate pollen  
*Camarozonosporites* spp.  
*Cerebropollenites thiergartii*  
*Cicatricosporites* spp.  
*Classopollis torosus*  
*Clavatipollenites* spp.  
*Cyathidites minor*  
*Deltoidospora* spp.  
*Deltoidospora toralis*  
*Dictyophyllidites crassexinus*  
*Dictyophyllidites harrisii*  
*Echinatisporis* spp.  
*Extratropopollenites* spp.  
*Foveotriletes* spp.  
 fungal hyphae  
*Inaperturopollenites hiatus*  
*Inaperturopollenites* spp.  
*Microfoveolatisporis* spp.  
*Multiporopollenites* spp.  
 normapolles pollen (undiff.)  
*Oculopollis* spp.  
*Proteacidites* spp.  
*Retitricolpites* spp.  
*Retitriletes* spp.  
*Stereisporites* spp.  
*Striatricolpites* spp.  
*Tricolpites* spp.  
*Trilobosporites* spp.  
*Tripoporopollenites* spp.  
*Trudopollis* spp.  
 undifferentiated zooclats