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Supplement of

Phytoplankton community disruption caused by latest Cretaceous global warming

Johan Vellekoop et al.

Correspondence to: Johan Vellekoop (johan.vellekoop@kuleuven.be)

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SI Text S1 - Materials and Methods

For this study, three cores were investigated; Bass River (ODP 174AX; 39°36'42"N, 74°26'12"W (1)), drilled in 1996 by the Ocean Drilling Program and Meirs Farm (40°06'15.48"N, 74°31'37.48"W; (2)) and Fort Monmouth 3 (40°18'37.18"N, 74°02'46.25"W; (2)), drilled in 2008 by Rutgers University (K-Pg boundary drilling project (2)).

For palynological analyses, 90 oven-dried samples (~5-10 g dry mass) were analysed, 42 palynological samples from ODP 174AX Bass River, 35 palynological samples from Meirs Farm and 14 palynological samples from Fort Monmouth 3. Taxonomy used follows that of refs. (3, 4). Palynological samples were counted up to a ~250 dinocysts. Samples with a lower diversity (Shannon-H <2) were counted up to 400 dinocysts. After quantitative counts, slides were scanned for stratigraphically important taxa that were missed during quantitative counting. For benthic foraminiferal analysis, 31 samples of the Bass River core were analyzed. Samples were washed over a sieve with a mesh of 63 µm and ultrasonically cleaned. Only the size fraction of 125-630 µm was analyzed. Benthic foraminifera were identified using the taxonomy of refs (5-8).

SI Text S2 - Age Models

The age models for the studied cores are based on a combination of dinocyst, planktic foraminiferal and nannofossil biostratigraphy. Dinocyst biostratigraphy allows an excellent age control for the Maastrichtian of the New Jersey palaeoshelf (3).

The dinocyst marker taxa *Palynodinium grillator* and *Disphaerogena carposphaeropsis* have their First Appearance Datum (FAD) at ~67 Ma (9, 10) and are representative of the uppermost Maastrichtian *P. grillator* Zone of ref (11). The FO of the marker taxon *T. pelagica*, with a FAD approximately at 66.5 Ma, allows the subdivision of the *P. grillator* Zone into the *T. magdaliium* and *T. pelagica* Subzones (11)

The age models of Meirs Farm and Fort Monmouth are based on refs (2, 3). The age model of Bass River on refs (1, 12) and this study.

SI Data

All data related to this publication are available in the Supplement and at the PANGAEA database (Vellekoop et al., 2019) <https://doi.pangaea.de/10.1594/PANGAEA.907070>.

SI Table S1 – Bass River dinoflagellate record (relative abundances)

SI Table S2 – Meirs Farm dinoflagellate record (relative abundances)

SI Table S3 – Fort Monmouth 3 dinoflagellate record (relative abundances)

SI Table S4 – Bass River dinoflagellate record (concentrations)

SI Table S5 – Meirs Farm dinoflagellate record (concentrations)

SI Table S6 – Bass River benthic foraminiferal record

Figure S1 Magnitude of late Maastrichtian warming estimated for three locations at the New Jersey Shelf: Bass River, Fort Monmouth 3 and Meirs Farm. The magnitude of Deccan Traps warming was estimated by comparing the weighted mean of the TEX_{86}^H -based temperatures (TEX_{86}^H , (13)) of refs. (3) and (14) in the pre-warming interval with the highest temperature in the warming interval. The gray band indicates the weighted mean of the calculated warming magnitudes.

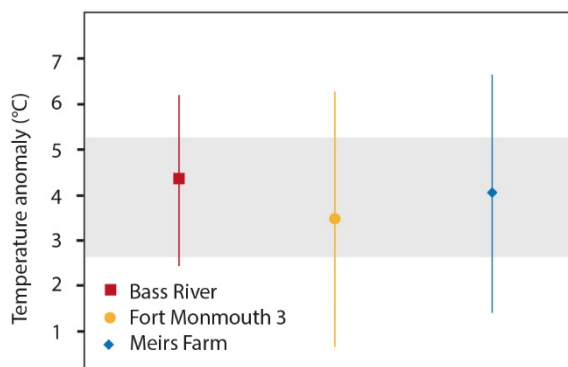


Figure S2 – Photoplate of most common dinocyst taxa A

microphotographs of some selected dinocyst taxa. Scale bar represents 50 µm.

1. *Achomosphaera ramulifera* (Deflandre, 1937) Evitt, 1963. Sample FM3 57.0-57.1 slide 1; **2.** *Achomosphaera sagena* Davey and Williams, 1966. Sample FM3 57.0-57.1 slide 1; **3-5.** *Hafniasphaera septata* Cookson & Eisenack 1967) Hansen 1977. Sample FM3 54.4-54.5 slide 1; **6.** *Spiniferites membranaceus* (Rossignol, 1964) Sarjeant, 1970. Sample FM3 58.5-58.6 slide 1; **7-8.** *Spiniferites ramosus complex* (Ehrenberg, 1838) Mantell, 1854. Sample FM3 57.0-57.1 slide 1; **9.** *Areoligera senonensis* Lejeune-Carpentier, 1938. Sample MF1 62.5-52.6 slide 1; **10.** *Areoligera volata* Drugg, 1967. Sample FM3 54.4-54.5 slide 1; **11.** *Senoniasphaera protrusa* Clarke and Verdier, 1967, emend. Prince et al., 1999. Sample FM3 54.4-54.5 slide 1; **12.** *Senoniasphaera inornata* (Drugg 1970) Stover & Evitt 1978. Sample MF1 41.7-41.8 slide 1; **13.** *Glaphyrocysta perforata* Hultberg and Malmgren, 1985. Sample MF1 44.9-45.0 slide 1; **14.** *Glaphyrocysta semitecta* (Bujak in Bujak et al., 1980) Lentin and Williams, 1981. Sample FM3 54.4-54.5 slide 1; **15-19.** *Palynodinium grillator* Gocht, 1970. Sample FM3 54.4-54.5 slide 1; **20.** *Palynodinium cf. grillator* of Machalski et al., 2016. Sample FM3 53.4-53.5 slide 1; **21.** *Palynodinium grillator* Gocht, 1970. Sample FM3 53.4-53.5 slide 1; **22.** *Membranilarnacia? tenella* Morgenroth 1968. Sample MF1 41.7-41.8 slide 1; **23.** *Hystrichosphaeridium tubiferum* (Ehrenberg, 1838) Deflandre, 1937, emend. Davey and Williams, 1966. Sample FM3 59.5-59.6 slide 1; **24.** *Hystrichosphaeridium tubiferum* (Ehrenberg, 1838) Deflandre, 1937, emend. Davey and Williams, 1966, Sample FM3 62.0-62.1 slide 1; **25.** *Operculodinium centrocarpum* (Deflandre and Cookson, 1955) Wall, 1967. MF1 52.4-52.5 slide 1; **26.** *Achilleodinium bianii* Hultberg, 1985. Sample FM3 62.0-62.1 slide 1; **27.** *Oligosphaeridium complex* (White, 1842) Davey and Williams, 1966. Sample FM3 55.1-55.2 slide 1; **28.** *Hystrichokolpoma sp. cf. Hystrichokolpoma rigaudiae* Deflandre & Cookson 1955. Sample FM3 55.1-55.2 slide 1; **29.** *Eisenackia reticulata* (Damassa, 1979) Quattrocchio and Sarjeant, 2003. Sample MF1 47.4-47.5 slide 1; **30.** *Coronifera striolata* (Deflandre, 1937) Stover and Evitt, 1978. Sample MF1 47.4-47.5 slide 1; **31.** *Coronifera oceanica* Cookson and Eisenack, 1958, emend. May, 1980. Sample FM3 62.0-62.1 slide 1; **32.** *Diphyes colligerum* (Deflandre and Cookson, 1955) Cookson, 1965. Sample FM3 61.0-61.1 slide 1; **33.** *Impagidinium sp.* Sample FM3 59.5-59.6 slide 1; **34.** *Druggidium meerensis* Slimani and Louwye, 2011. Sample FM3 57.0-57.1 slide 1; **35.** *Druggidium discretum* Slimani and Louwye, 2011. Sample FM3 57.0-57.1 slide 1.

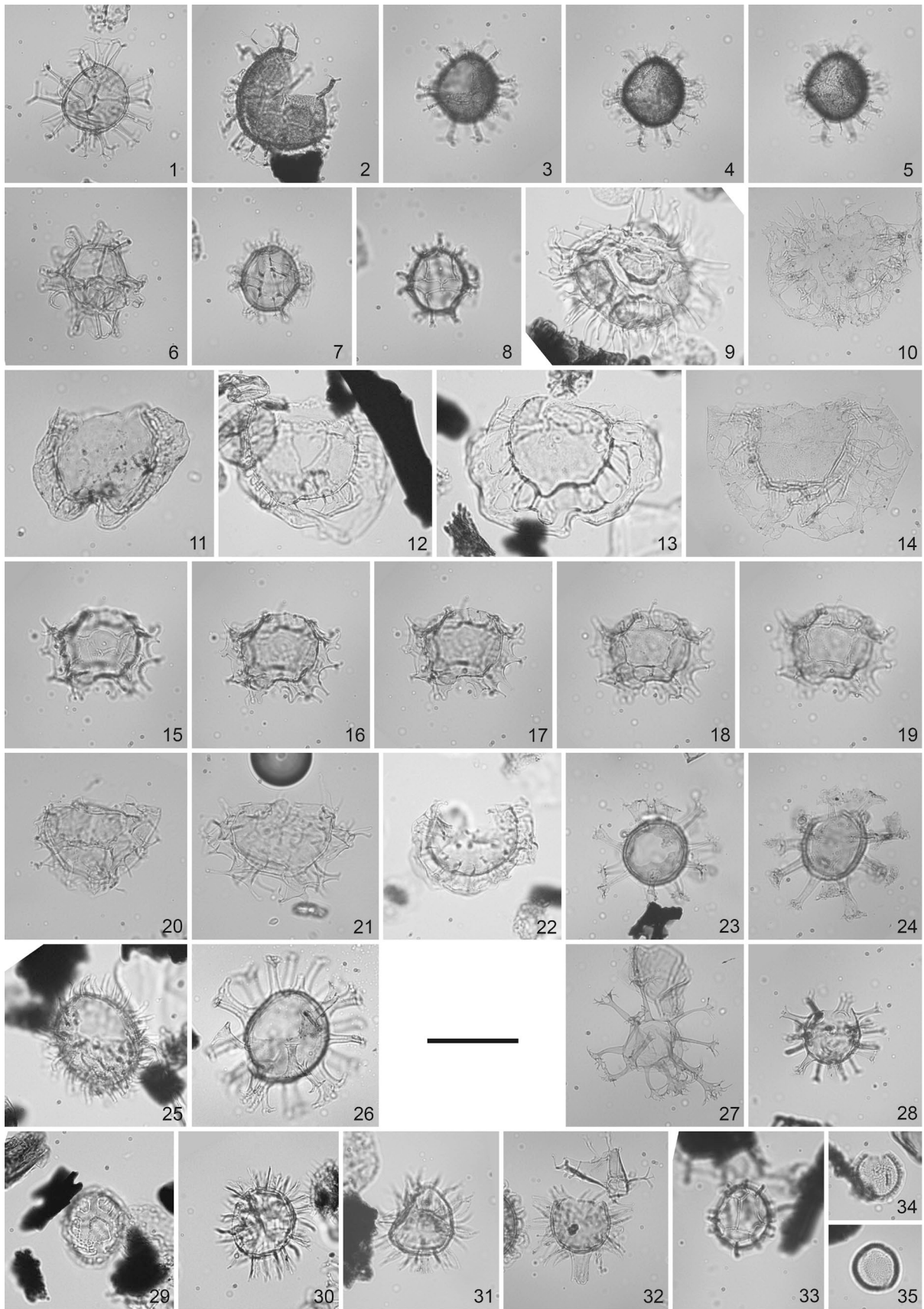


Figure S3 – Photoplate of most common dinocyst taxa B

microphotographs of some selected dinocyst taxa. Scale bar represents 50 µm.

1. *Cribroperidinium cf. pyrum* (Drugg, 1967) Stove & Evitt, 1978. Sample FM3 56.3-56.4 slide 1; **2.** *Cribroperidinium cf. pyrum* (Drugg, 1967) Stove & Evitt, 1978. Sample FM3 57.0-57.1 slide 1; **3.** *Cribroperidinium wetzeli* (Lejeune-Carpentier, 1939) Helenes, 1984, emends. Lejeune-Carpentier, 1946, and Lejeune-Carpentier and Sarjeant, 1981. Sample FM3 52.6-52.7 slide 1; **4.** *Cribroperidinium sp. A* of Brinkhuis & Schiøler 1996. Sample MF1 47.4-47.5 slide 1; **5.** *Cordosphaeridium/Dammasadinium complex*. Sample FM3 57.0-57.1 slide 1; **6.** *Microdinium inornatum* Slimani, 1994. Sample FM3 54.4-54.5 slide 1; **7.** *Membranigonyaulax wilsonii*, Slimani 1994. Sample FM3 54.4-54.5 slide 1; **8.** *Disphaerogena carposphaeropsis* Wetzel, 1933. Sample FM3 54.4-54.5 slide 1; **9.** *Disphaerogena carposphaeropsis* Wetzel, 1933. Sample FM3 53.4-53.5 slide 1; **10.** *Disphaerogena carposphaeropsis* Wetzel, 1933. Sample FM3 52.85-52.9 slide 1; **11.** *Disphaerogena carposphaeropsis* Wetzel, 1933. Sample FM3 57.0-57.1 slide 1; **12.** *Thalassiphora pelagica* (Eisenack, 1954) Eisenack and Gocht, 1960, emend. Benedek and Gocht, 1981. Sample MF1 44.5-44.6 slide 1; **13.** *Thalassiphora patula* (Williams and Downie, 1966) Stover and Evitt, 1978. Sample FM3 54.4-54.5 slide 1; **14.** *Lanternosphaeridium lanosum* Morgenroth, 1966. Sample FM3 57.0-57.1 slide 1; **15.** *Lanternosphaeridium reinhardtii* Habib in Moshkovitz and Habib, 1993. Sample FM3 56.3-56.4 slide 1; **16.** *Tanyosphaeridium sp.* Sample FM3 57.0-57.1 slide 1; **17.** *Tanyosphaeridium xanthiopyxides* (Wetzel, 1933) Stover and Evitt, 1978, emends. Morgenroth, 1968, and Sarjeant, 1985. Sample FM3 55.1-55.2 slide 1; **18.** *Xenikoon sp. A* of Foucher & Robaszynski, 1977. Sample FM3 57.0-57.1 slide 1; **19.** *Dinogymnium acuminatum* Evitt et al., 1967. Sample MF1 47.4-47.5 slide 1; **20.** *Manumiella seelandica* (Lange, 1969) Bujak and Davies, 1983, emend. Firth, 1987. Sample FM3 52.85-52.9 slide 1; **21.** *Cerodinium speciosum* (Alberti, 1959) Lentin and Williams, 1987. Sample FM3 56.3-56.4 slide 1; **22.** *Cerodinium diebelii* (Alberti, 1959) Lentin and Williams, 1987. Sample FM3 52.85-52.9 slide 1; **23.** *Phelodinium pentagonale* (Corradini, 1973) Stover and Evitt, 1978. Sample FM3 56.3-56.4 slide 1; **24.** *Palaeoperidinium pyrophorum* (Ehrenberg, 1838) Sarjeant, 1967, emends. Sarjeant, 1967, Gocht and Netzel, 1976 and Evitt et al., 1998. Sample MF1 57.4-57.5 slide 1; **25.** *Deflandrea galeata* (Lejeune-Carpentier, 1942) Lentin and Williams, 1973, emend. Lejeune-Carpentier and Sarjeant, 1981. Sample FM3 54.4-54.5 slide 1; **26.** *Chatangiella victoriensis* (Cookson and Manum, 1964) Lentin and Williams, 1976, emend. Lebedeva in Ilyina et al., 1994. Sample MF1 71.7-71.8 slide 1; **27.** *Chatangiella sp. A* of Schiøler & Wilson, 1993. Sample MF1 67.4-67.5 slide 1; **28.** *Palaeocystodinium golzowense* Alberti, 1961. Sample MF1 57.4-57.5 slide 1; **29.** *Phelodinium magnificum* (Stanley, 1965) Stover and Evitt, 1978. Sample MF1 52.4-52.5 slide 1; **30.** *Senegalinium bicavatum* Jain and Millepied, 1973. Sample FM3 54.4-54.4 slide 1; **31.** *Pierceites pentagonus* (May, 1980) Habib and Drugg, 1987. Sample FM3 55.1-55.2 slide 1; **32.** *Diconodinium wilsonii* Aurisano, 1984. Sample FM3 59.5-59.6 slide 1; **33.** *Magallanesium densispinatum* (Stanley, 1965) Quattrocchio and Sarjeant,

2003. Sample FM3 61.0-61.1 slide 1; **34.** *Trithyrodinium evittii* Drugg, 1967. Sample MF1 44.9-45.0 slide 1.

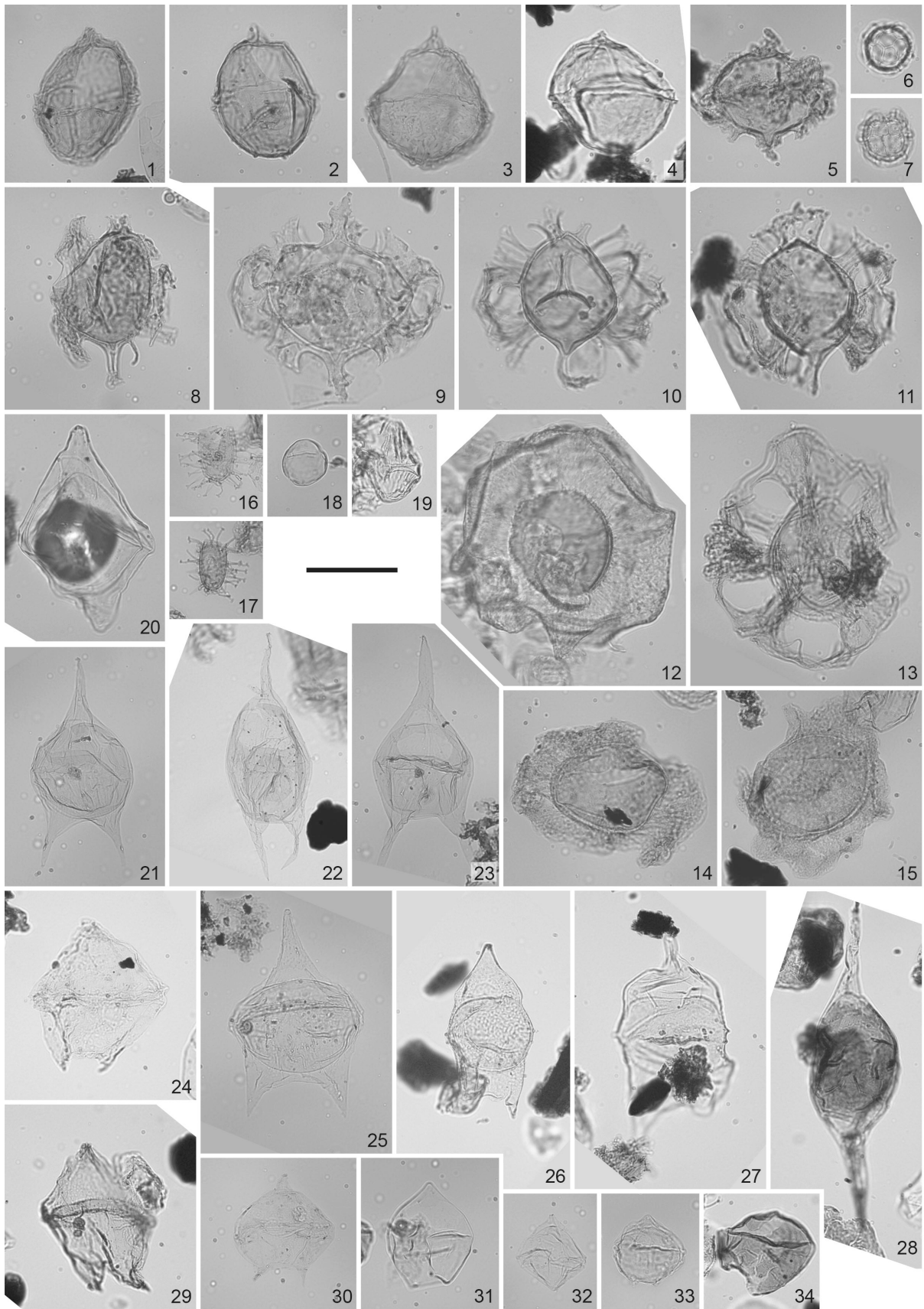


Figure S4 – Photoplate of other common palynomorphs

microphotographs of the most common non-dinocyst palynomorph taxa. Scale bar represents 50 μm .

1. *Palambages trilicius* Firth, 1993. Sample FM3 59.5-59.6 slide 1; **2.** acritarch Form D of Marheinecke 1986. Sample FM3 54.4-54.5 slide 1; **3.** *Micrhystridium fragile* Deflandre 1947. Sample FM3 54.4-54.5 slide 1; **4.** ?*Yolkinigymnium* sp. Sample FM3 55.1-55.2 slide 1; **5.** *Fromea amphora* Cookson & Eisenack 1958. Sample FM3 55.1-55.2 slide 1; **6.** *Pterospermella* sp. Sample FM3 53.4-53.5 slide 1; **7.** *Paralecaniella indentata* (Deflandre and Cookson, 1955) Cookson and Eisenack, 1970, emend. Elsik, 1977. Sample MF1 47.4-47.5 slide 1; **8.** *Paralecaniella indentata* (Deflandre and Cookson, 1955) Cookson and Eisenack, 1970, emend. Elsik, 1977. Sample FM3 57.0-57.1 slide 1; **10-15.** gymnosperm pollen grains; **16-18.** angiosperm pollen grains; **19-24.** trilete spores.

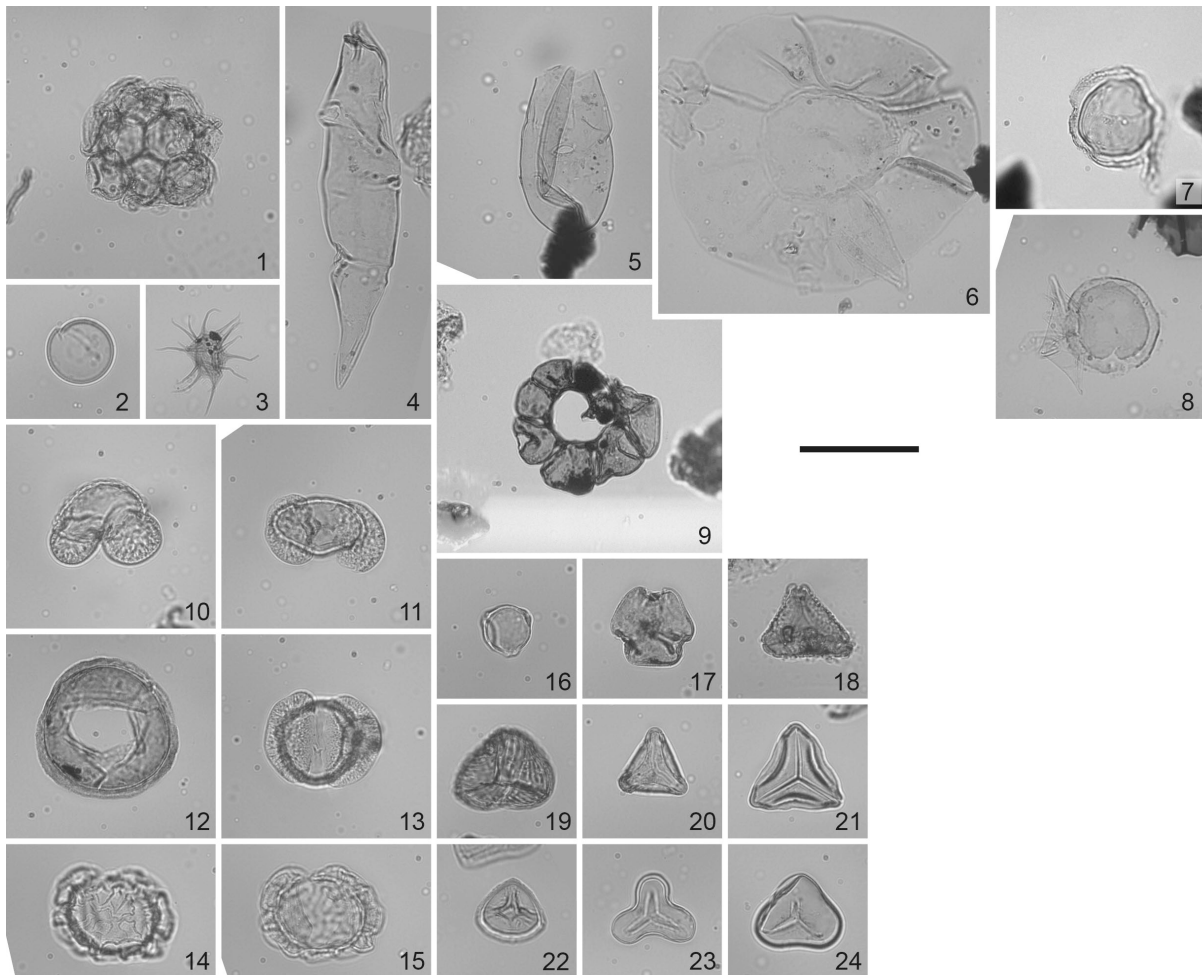


Figure S5 - Photoplate of near-monospecific aggregates of *Palynodinium grallator*.

microphotographs of near-monospecific aggregates of *Palynodinium grallator*. Scale bars represent 200 μ m. A-E: sample BR 1264.85-1264.95 ft slide 1; F-L: sample BR 1262.50-1262.55 ft slide 1.

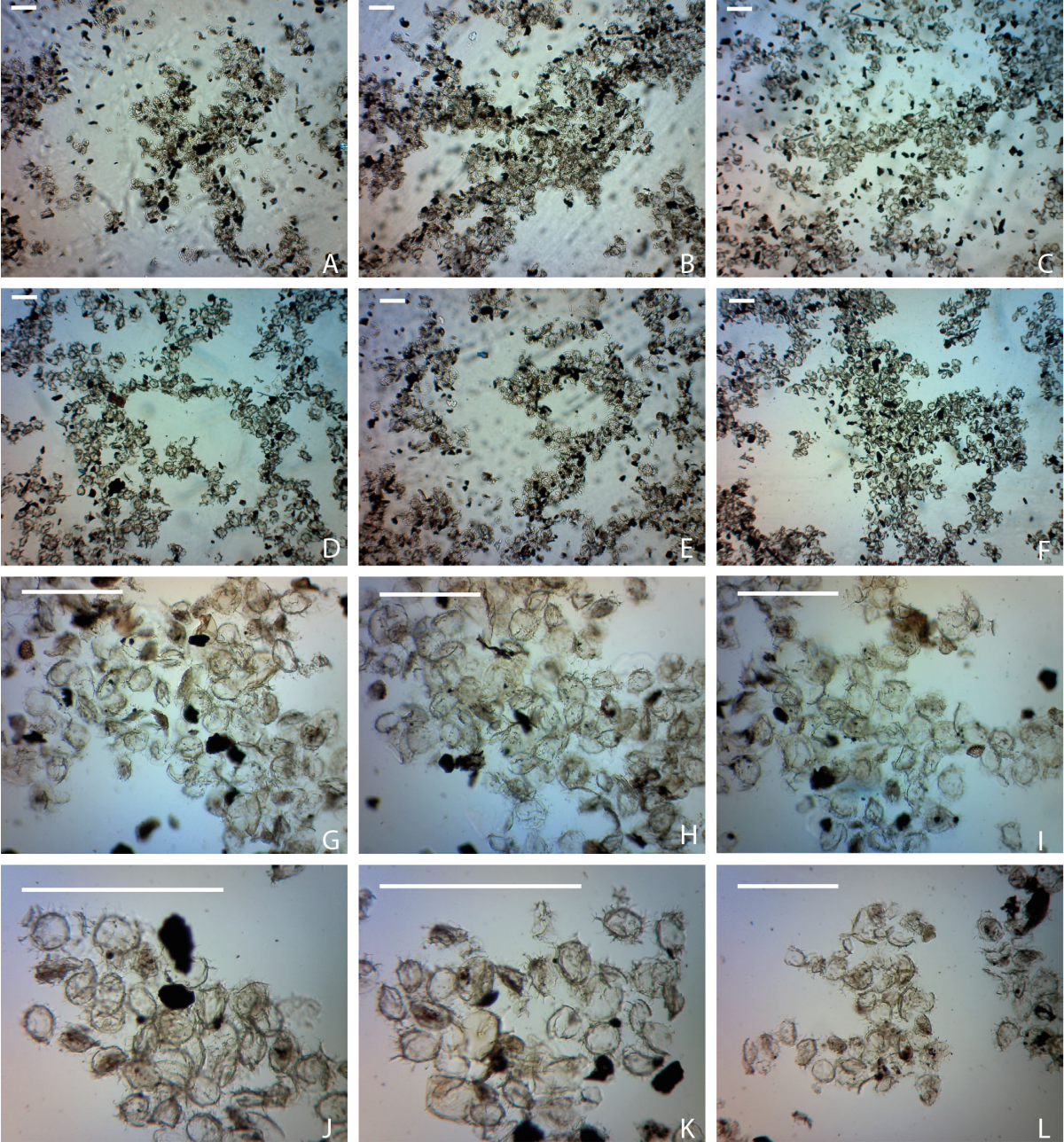


Figure S6 – Photoplate with most common benthic foraminiferal taxa

SEM images of most common benthic foraminifera found in this study.

1. *Verneuillina* sp.; **2.** *Anomalinoides midwayensis* (Plummer); **3.** *Anomalinoides* sp.; **4.** *Eponides plummerae* (Cushman); **5.** *Cibicidoides* sp.; **6.** *Cibicidoides succedens* (Brotzen); **7.** *Gyroidinoides depressa* (Alth); **8.** *Gyroidinoides imitata* (Olsson); **9.** *Bulimina arkadelphia* (Cushman and Parker); **10.** *Pulsiphonina prima* (Plummer); **11.** *Praebulimina carseyae* (Plummer); **12.** *Osangularia plummerae* (Brotzen); **13.** *Coryphostoma incrassata* (Reuss); **14.** *Coryphostoma plaitum* (Carsey); **15.** *Dorothia* sp.; **16.** *Gaudryina monmouthensis* (Olsson); **17.** *Clavulinoides trilateral* (Cushman); **18.** *Pseudouvierina seligi* (Cushman).

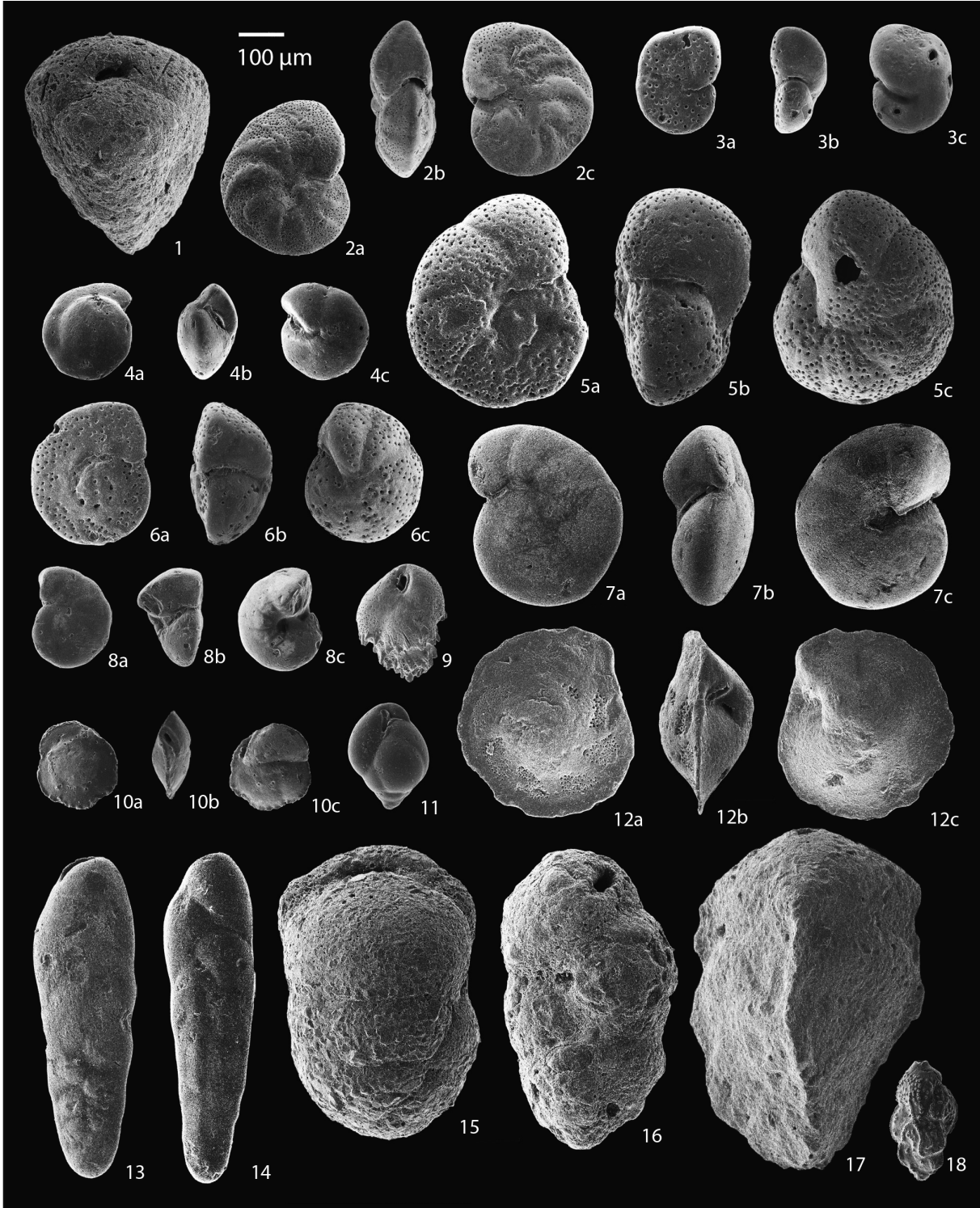
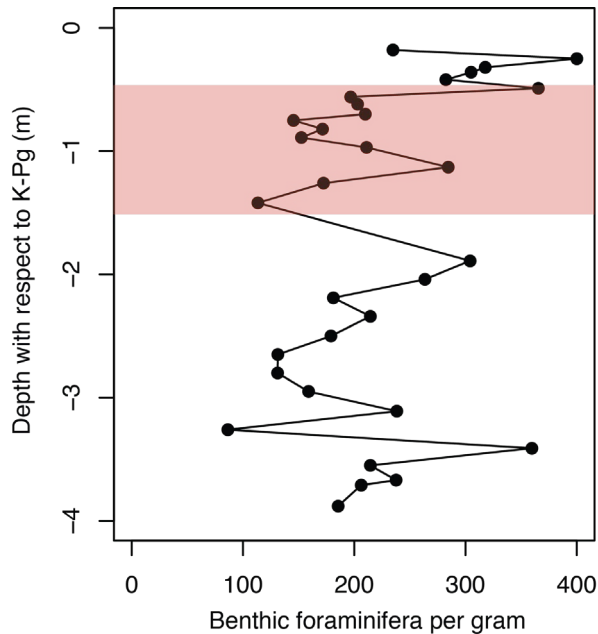


Figure S7 – Benthic foraminifera per gram at Bass River. The red zone tentatively indicates the late Maastrichtian warming interval warming interval.



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