

MICROPALAEONTOLOGY NOTEBOOK

The occurrence of dinoflagellate cysts in calcareous/siliceous microfossil preparations from the Eocene of southeast England

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INTRODUCTION

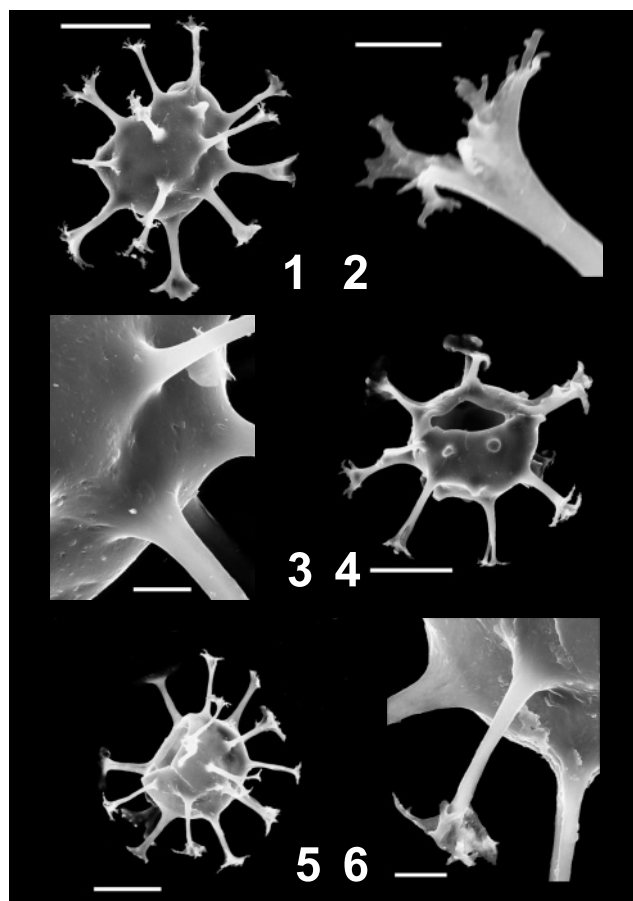
During routine analysis of some calcareous and siliceous microfossils from the London Clay Formation of southeast England (Wilkinson, 2004a, b), some extremely well-preserved, dinoflagellate cysts were observed. These are all large, chorate (spine-bearing) forms, the overwhelming majority of which are referable to *Cordosphaeridium gracile* (Eisenack, 1954) Davey & Williams, 1966 (Fig. 1). This observation confirms that palynomorphs can be extracted effectively from clay-rich samples using a combination of clay deflocculation and sieving, as described recently by Riding & Kyffin-Hughes (2004).

PROCESSING

The London Clay Formation from 25 localities in southeast England was processed for calcareous and siliceous microfossils (diatoms, foraminifera, ostracods and radiolaria) (Wilkinson, 2004a, b). The standard British Geological Survey (BGS) procedure for the extraction of calcareous/siliceous microfossils from poorly- or non-indurated sediments was used. Samples were disaggregated by soaking in a mixture of warm water and detergent and agitated periodically. The majority of the clay fraction was removed using a 72 µm sieve. The residue was then boiled in sodium hexametaphosphate [(NaPO₃)₆] before being sieved again and dried. The sieving will have removed the majority of the palynomorphs, except the larger dinoflagellate cysts. Virtually all pollen and spores and most dinoflagellate cysts of this age are less than 72 µm in at least one dimension.

MICROFOSSIL ASSEMBLAGES

Specimens of *Cordosphaeridium gracile* were recovered from three clay quarries. These are Brambledown Pit, Kent [TQ 967 715], Bull's Lodge Pit, Chelmsford, Essex [TL 7470 0850] and Heckfordbridge Pit, Colchester, Essex [TL 9550 2260], although only two are discussed here to illustrate the types of assemblages with which they are associated. A sample of London Clay Formation from Brambledown Pit (BGS sample MPA 52879) contained, in addition to *Cordosphaeridium gracile*, the diatom *Fenestrella antiqua* (Grunow, 1882) Swatman, 1990, fish debris, foraminifera including *Gyroidinoides* cf. *angustumbrilicatus* (Ten Dam) and fragmentary *Lenticulina* sp. and the radiolarian *Cenosphaera* sp. *sensu* King (1983). The clay pit northeast of Heckfordbridge (BGS sample MPA 52953) differed by containing abundant wood fragments, common worm tubes of *Ditrupa plana* (Sowerby), together with bivalve fragments, diatoms, including common *Fenestrella antiqua*, and broken gastropods. Similar pockets of wood have been described from South Ockendon by George & Vincent (1978).



Explanation of Figure 1.

Cordosphaeridium gracile (Eisenack, 1954) Davey & Williams, 1966. All specimens from the London Clay Formation of Brambleton Clay Pit, Kent [TQ 967 715]. Note the sub-spherical cyst body, the relatively thick autophragm, the cylindrical, apparently solid, plate-centred processes that are expanded proximally and distally, and the precingular archaeopyle. The processes indicate a distinct gonyaulacacean tabulation. The distally-branched processes and the autophragm are not fibrous, as indicated by Davey & Williams (1966, p. 85). All specimens are curated in the palynological collections of the British Geological Survey, Nottingham, UK. The scale bar in figs 1, 4 and 5 is 50 µm. The scale bar in figs 2, 3 and 6 is 10 µm. **figs 1–3.** Specimen MPK 13374: **1**, entire cyst in right lateral view; **2**, detail of a distal process termination; **3**, detail of the proximal ends of the processes – note the irregularly punctuate autophragm on the cyst body. **fig. 4.** Specimen MPK 13375, entire cyst in dorsal view; note the single plate precingular archaeopyle. **figs 5, 6.** Specimen MPK 13376: **5**, entire cyst in right lateral view; **6**, detail of a single process.

Figure 1 illustrates six scanning electron photomicrographs of three specimens of *Cordosphaeridium gracile*. The material is extremely well-preserved and is uncrushed. This species is known to be prominent in the Paleocene and Eocene; its full stratigraphical range being latest Maastrichtian to Early Oligocene (Costa & Davey, 1992; Stover *et al.*, 1996). A virtually monospecific assemblage of *Cordosphaeridium gracile* was recovered. This is due to the relatively large overall size of this species.

THE SIGNIFICANCE OF THE PRESENCE OF PALYNOMORPHS IN THIS MATERIAL

Williams & Downie (1966, p. 20) mentioned the presence of dinoflagellate cysts in preparations for foraminifera from the London Clay Formation of Isleworth, Middlesex. Murray J. Hughes of the BGS, noted clumps of abundant dinoflagellate cysts in disaggregated London Clay Formation samples and sent some picked specimens for identification to Charles Downie at Sheffield University in 1958. These samples had been prepared using standard, non-destructive methods for extracting calcareous microfossils. Subsequently, Eagar & Sarjeant (1963) described a technique used to extract dinoflagellate cysts from the London Clay Formation of southern England using a modification of the standard calcareous microfossil preparation procedure. Soaked and sieved clay samples were boiled with sodium carbonate (Na_2CO_3) to deflocculate the clay and re-sieved using a 64 μm mesh. These authors found that the dinoflagellate cyst assemblages obtained are entirely comprised of large chorate forms, presumably including *Cordosphaeridium gracile*. The smaller forms would have been removed during the sieving process.

This occurrence of well-preserved dinoflagellate cysts in calcareous/silicofossil preparations confirms that palynomorphs can be extracted readily from relatively unindurated clay-rich lithotypes by a simple disaggregate and sieve procedure. The palynological preparation method of Riding & Kyffin-Hughes (2004) also uses $(\text{NaPO}_3)_6$ as a clay deflocculating agent. This method should be tested on other lithostratigraphical units and lithologies in order to assess precisely which rock types are suitable. It appears that the hazardous, expensive and poten-

tially polluting mineral acid-based palynological preparation technique can be avoided for many relatively soft, clay-rich sediments and sedimentary rocks.

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