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A palynological study of a chalk-rich diamicton from Abbey Farm, near Hanworth, North Norfolk

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A palynological study of a chalk-rich diamicton from Abbey Farm, near Hanworth, North Norfolk

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Foreword

This report describes the palynology of a single sample of chalk-rich diamicton from a trial pit at Abbey Farm, Alby, near Hanworth, North Norfolk.

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Summary

The single sample examined produced an abundant, well preserved palynomorph assemblage. The derived palynomorphs recognised are of Carboniferous, Cretaceous Palaeogene and Quaternary age; no Jurassic specimens were recognised. Carboniferous spores probably derived from north-east England comprise 4.3% of the palynomorphs. These include markers for the Viséan-Namurian transition and the Westphalian. A single specimen of a characteristically Lower Cretaceous spore was recorded and may have been derived from the north-west. Diverse Chalk Group dinoflagellate cysts comprise 21.9% of the palynoflora; this reflects the macroscopic nature of this deposit. The key markers are indicative of the Campanian and Maastrichtian stages. The overlapping ranges of selected species indicates derivation from latest Campanian strata, assuming no significant mixing of the Chalk Group input. This proves that the Chalk Group input to this sample is locally derived from the Upper Chalk. Low levels of Palaeogene dinoflagellate cysts are present. The presence of *Eatonicysta ursulae* indicates the incorporation of Early-Mid Eocene strata, probably from the North Sea Basin. Typically Quaternary spores and pollen were recognised in low proportions; these may have been derived from the Quaternary of the North Sea Basin.

1 Introduction

A single sample of chalk-rich diamicton from Trial Pit 2 at Abbey Farm, Alby, near Hanworth, North Norfolk was studied for its palynomorph content. Analysis of palynofloras helps determine the provenance of glaciogenic sediments and may help in the characterisation of specific units (e.g. Riding, 2001a,b,c,d). Table 1 gives both numbers and percentages of specimens per microscope slide in age-related groupings.

2 Sample Details

Trial Pit 2 at Abbey Farm, Alby, near Hanworth, North Norfolk is located at TG 205 335. The sample of chalk-rich diamicton was registered as BGS micropalaeontological sample MPA 50990. The horizon sampled lies within the Hanworth Till Member of the Beeston Regis Formation. The sample was prepared using the disaggregant sodium hexametaphosphate as an alternative to traditional mineral acid dissolution techniques.

3 Palynology

In this section, the palynoflora is described. A full listing of all palynomorphs recognised, including quantitative data, are held on the BGS micropalaeontology/palynology data sheet for MPA 50990, which has been archived. The numbers and percentages of palynomorphs per microscope slide in age-related groupings are given in Appendix 1.

The sample produced abundant kerogen and palynomorph associations. The organic fraction is dominated by well preserved palynomorphs and wood fragments; other plant tissues and amorphous organic material are less common. The palynomorphs are abundant and diverse; 3066 specimens were counted per microscope slide (Appendix 1). The age diagnostic fraction is dominated by derived forms of Carboniferous, Cretaceous Palaeogene and Quaternary age. No specimens characteristic of the Jurassic were observed.

Carboniferous spores are present in relatively small proportions and comprise 4.3% of the palynoflora. They are dominated by *Densosporites* spp. (127 specimens per slide). Other forms recorded are *Endosporites globiformis*, *Reticulatisporites polygonalis*, *Tripartites trilinguis* and *Tripartites vetustus*. *Tripartites trilinguis* and *Tripartites vetustus* are indicative of the Viséan-Namurian transition (Owens *et al.*, 1977); however, *Endosporites globiformis* is characteristic of the Westphalian (Clayton and Butterworth, 1984). This indicates that at least two levels in the Carboniferous have been incorporated into this diamicton. The Carboniferous input probably was derived from the Northumberland-Durham area, north-east England. No characteristically Jurassic palynomorph species were encountered.

Cretaceous palynomorphs are prominent. A single specimen (0.1%) of the characteristically Lower Cretaceous spore genus *Cicatricosisporites* was observed. This may be derived from the East Midlands Shelf to the north-west. The overwhelming majority of Cretaceous palynomorphs, however, are dinoflagellate cysts characteristic of the Chalk Group. This clearly reflects the obvious chalk-rich nature of this diamicton. These taxa comprise 21.9% of the palynoflora and include *Cribroperidinium "reticulatum"* of Wilson (1974), *Cribroperidinium wetzelii*, *Exochosphaeridium* spp., *Gillinia hymenophora*, *Hystrichosphaeridium salpingophorum*, small *Microdinium* spp. (and related partiform genera), *Neoeurysphaeridium glabrum*, *Odontochitina operculata*, *Odontochitina porifera*, *Senoniasphaera protrusa*,

Spongodinium delitiense, *Xenascus ceratioides* and *Xenascus "wetzeli"* of Slimani (1996). Many of these forms have restricted stratigraphical ranges and are indicative of derivation largely from late Campanian strata. For example, *Xenascus "wetzeli"* of Slimani (1996) is a marker for the Campanian Stage (Slimani, 1996). Furthermore, species with range tops within the late Campanian are *Odontochitina porifera* and *Senoniasphaera protrusa* (Costa and Davey, 1992). A number of forms typify the Campanian-Maastrichtian transition, including *Cribroperidinium "reticulatum"* of Wilson (1974), *Gillinia hymenophora*, *Neoeurysphaeridium glabrum* and *Spongodinium delitiense* (Wilson, 1974; Foucher in Robaszynski, 1985; Slimani, 1994). The most reliable of these is *Neoeurysphaeridium glabrum*, which is confined to the *Belemnitella mucronata* and *Belemnella lanceolata* standard (belemnite) zones (Slimani, 1994). In summary, this flora is deemed to be of latest Campanian age based on the overlapping ranges of *Neoeurysphaeridium glabrum*, *Odontochitina porifera*, *Senoniasphaera protrusa* and *Xenascus "wetzeli"*. This assumes that there has been no significant mixing of the Chalk Group input to this sample. This age determination is conclusive proof that the Chalk Group input to this sample is from the Upper Chalk and is locally derived.

Palaeogene dinoflagellate cysts were observed in small proportions (0.5%). These comprise *Cordosphaeridium gracile*, *Eatonicysta ursulae* and *Spiniferites cornutus*. *Eatonicysta ursulae* ranges from the Early Eocene (Ypresian) to the Mid Eocene (Lutetian) (Powell, 1992). These forms are believed to have been derived from the North Sea Basin. Low levels of typically Quaternary spores and pollen were recognised; these may be derived from Quaternary strata in the North Sea Basin. High proportions of palynomorphs which are non-age diagnostic were recorded. Many of these (1537 specimens per microscope slide) are bisaccate pollen grains.

4 Summary/Conclusions

Sample MPA 50990 produced an abundant, well preserved palynomorph assemblage. The derived palynomorphs recognised are of Carboniferous, Cretaceous Palaeogene and Quaternary age; no Jurassic specimens were recognised. Carboniferous spores probably derived from north-east England comprise 4.3% of the palynomorphs. These include markers for the Viséan-Namurian transition and the Westphalian. A single specimen of a characteristically Lower Cretaceous spore was recorded and may have been derived from the north-west. Diverse Chalk Group dinoflagellate cysts comprise 21.9% of the palynoflora; this reflects the macroscopic nature of this deposit. The key markers are indicative of the Campanian and Maastrichtian stages. The overlapping ranges of selected species indicates derivation from latest Campanian strata, assuming no significant mixing of the Chalk Group input. This proves that the Chalk Group input to this sample is locally derived from the Upper Chalk. Low levels of Palaeogene dinoflagellate cysts are present. The presence of *Eatonicysta ursulae* indicates the incorporation of Early-Mid Eocene strata, probably from the North Sea Basin. Typically Quaternary spores and pollen were recognised in low proportions; these may have been derived from the Quaternary of the North Sea Basin.

Appendix 1 Numbers and percentages of palynomorphs in age-related groupings in sample MPA 50990

	Number per micro. slide	Percentage
Carboniferous spores:	133	4.3%
Lower Cretaceous spores:	1	0.1%
Upper Cretaceous dinoflagellate cysts:	672	21.9%
Palaeogene dinoflagellate cysts:	16	0.5%
Quaternary spores and pollen:	37	1.2%
Non-age diagnostic palynomorphs:	2207	72.0%
Total	3066	100%

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