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The micropalaeontology and palynology of a putative lacustrine clay deposit at Spittalmyre Farm, Montrose [1:50k sheet 57 (E) Montrose]

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Internal Report IR/06/031

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INTERNAL REPORT IR/06/031

The micropalaeontology and palynology of a putative lacustrine clay deposit at Spittalmyre Farm, Montrose [1:50k sheet 57 (E) Montrose]

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Foreword

This report comprises a study of the micropalaeontology and palynology of two samples of organic clay from Spittalmyre Farm, near Montrose, Scotland.

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Summary

The two samples proved to be entirely barren of calcareous faunas, indicating probable decalcification. Diatoms are present throughout and are relatively abundant in sample 1, where a freshwater (lacustrine) environment of late Quaternary age is indicated. The diatoms indicate shallow, slightly alkaline water. Sample 2 yielded poorly-preserved diatoms, which are consistent with freshwater conditions. Both samples produced abundant, typically British interglacial, pollen and spores. Marine forms are absent and hence a lacustrine setting is postulated. *Dryopteris* spores dominate both samples, and arboreal (tree)/shrub and herb pollen is present in significantly lower proportions. These associations are indicative of a shallow lake, fringed by dense stands of pteridophytes (ferns and mosses). Alternatively, the main lake or the fringes, were swampy. The palynofloras are typical of the Flandrian Stage, possibly the Atlantic or Sub-Boreal periods.

1 Introduction

Two surface/auger samples of organic clay from Spittalmyre Farm, near Montrose, Scotland [1:50k sheet 57 (E) Montrose], collected by Nick Golledge, were submitted for analysis of their microfaunas and palynology. It is thought from sedimentology and regional evidence that this deposit may be a Quaternary lacustrine sediment. The Quaternary sediments of this area are not well researched.

2 Sample Details

The samples are listed in the table below. The columns represent the (informal) sample number, the BGS collection number (prefixed NKG), the grid reference (prefixed NO), the biostratigraphy section registration number (prefixed MPA) and lithology respectively.

1	NKG 024	NO 71634 66745	MPA 54554	clay
2	NKG 025	NO 71482 66713	MPA 54555	peaty clay

3 Results

In this section of the report, the microfaunas, silicofossils and palynofloras are described. Full lists of taxa are held on the respective BGS micropalaeontology/palynology data sheets, which have been archived.

3.1 CALCAREOUS MICROPALAEONTOLOGY

Both samples proved to be entirely barren of macrofossils and calcareous microfaunas such as foraminifera or ostracods. This strongly suggests that the deposit has been decalcified.

3.2 SILICOFOSSILS (DIATOMS)

The diatom taxa recovered are listed in Appendix 1. The abundant silicofossils in sample 1 indicates a freshwater environment of late Quaternary age. The common diatom species are alkaliphilous (i.e. a pH greater than 7), and the occurrence of *Diploneis elliptica* suggests shallow standing water of moderate conductivity. A lacustrine environment is therefore indicated. Sample 2 is a particularly peaty sample and yielded poorly-preserved diatoms, the majority of which could not be positively identified. The sparse diatoms that were identifiable at generic level support the interpretation of freshwater conditions in sample 2, but further conclusions cannot be drawn.

3.3 PALYNOLOGY

The material was prepared using the sodium hexametaphosphate method of Riding and Kyffin-Hughes (2004). No marine grains were encountered, hence a freshwater setting is unequivocally indicated. This is supported by the occurrence of the fresh/brackish water alga *Botryococcus* in sample 2. The pollen and spore taxa recovered are listed in Appendix 1. Both samples proved organically-productive; the palynofloras comprises only Quaternary pollen and spores typical of

British interglacial periods. The samples are dominated by pteridophyte spores, largely *Dryopteris* (buckler fern), with significantly lesser numbers of arboreal (tree), shrub and herb pollen. Other fern spores present are *Lycopodium* (club moss), *Polypodium* (polypody fern), *Selaginella* (spike moss) and *Sphagnum* (moss) (see Appendix 2). *Sphagnum* is especially prominent in sample 2, which is consistent with its peaty nature. The principal tree and shrub taxa present are *Alnus* (alder), *Corylus* (hazel), *Erica* (heather) and *Pinus* (pine). Herbs are of low diversity and are sparse; they comprise representatives of the Caryophyllaceae (chickweeds etc.), Compositae (dandelion etc.) and Gramineae (grasses).

The dominance of pteridophytic (fern) spores indicates that the lake was probably shallow and fringed by dense stands of ferns and moss. Alternatively, the main setting or the lake fringes were swampy. The lake or mire was close to land areas supporting herbs and trees. The nature of the pollen/spore flora is consistent with an interglacial setting. The spectrum of pollen and spores is entirely typical of the Flandrian Stage (Godwin, 1975). The prominence of *Alnus* and *Pinus* pollen suggest possible deposition in the Atlantic or Sub-Boreal periods of the Flandrian Stage. This interpretation is supported by the preponderance of fern spores, indicating swampy conditions. It is recommended that this contention is tested using radiocarbon dating.

4 Summary

The two samples proved to be entirely barren of calcareous faunas, indicating probable decalcification. Diatoms are present throughout and are relatively abundant in sample 1, where a freshwater (lacustrine) environment of late Quaternary age is indicated. The diatoms indicate shallow, slightly alkaline water. Sample 2 yielded poorly-preserved diatoms, which are consistent with freshwater conditions. Both samples produced abundant, typically British interglacial, pollen and spores. Marine forms are absent and hence a lacustrine setting is postulated. *Dryopteris* spores dominate both samples, and arboreal (tree)/shrub and herb pollen is present in significantly lower proportions. These associations are indicative of a shallow lake, fringed by dense stands of pteridophytes (ferns and mosses). Alternatively, the main lake or the fringes, were swampy. The palynofloras are typical of the Flandrian Stage, possibly the Atlantic or Sub-Boreal periods.

Appendix 1 Silicofossils

SAMPLE MPA 54554 (NKG 024):

Fragilariophyceae

Fragilaria sp. cf. *capucina* (rare)

Bacillariophyceae

Cymbella lanceolata (frequent)

Diploneis elliptica (common)

Frutularia vulgaris (frequent)

Pinnularia borealis (rare)

Placoneis clementis (rare)

Coscinodiscophyceae

Stephanodiscus hantzschii (rare)

SAMPLE MPA 54555 (NKG 025)

Bacillariophyceae

Frustularia sp. (rare)

Coscinodiscophyceae

Stephanodiscus sp. (rare)

Indeterminate fragments

Appendix 2 Pollen and spores

The pollen and spore associations in the two samples studied are outlined below. The numbers are respectively, the numbers of grains counted and, in parentheses, the overall percentage. Three dots (...) indicates the absence of the respective taxon.

MPA 54554

MPA 54555

1 POLLEN GRAINS:

a *Trees/Shrubs*:

<i>Alnus</i> (alder)	16 (5.2)	12 (3.6)
<i>Betula</i> (birch)	3 (1.0)	2 (0.6)
<i>Corylus</i> (hazel)	22 (7.1)	14 (4.3)
<i>Erica</i> (heather)	27 (8.8)	7 (2.1)
<i>Juniperus</i> (juniper)	...	4 (1.2)
<i>Pinus</i> (pine)	14 (4.5)	13 (3.9)
<i>Tilia</i> (lime)	1 (0.3)	...
SUBTOTAL	83 (26.9)	52 (15.7)

b Herbs:

Caryophyllaceae (*)	7 (2.3)	1 (0.3)
Compositae (**) - undifferentiated	7 (2.3)	1 (0.3)
Gramineae (grasses)	2 (0.6)	1 (0.3)
<i>Succisa</i> (devil's bit scabious)	5 (1.6)	...
SUBTOTAL	21 (6.8)	3 (0.9)

2 SPORES:

<i>Dryopteris</i> (buckler fern)	166 (53.7)	179 (54.3)
<i>Polypodium</i> (polypody fern)	22 (7.1)	8 (2.4)
<i>Lycopodium</i> (***)	...	1 (0.3)
<i>Selaginella</i> (****)	1 (0.3)	3 (0.9)
<i>Sphagnum</i> (sphagnum moss)	16 (5.2)	84 (25.5)
SUBTOTAL	205 (66.3)	275 (83.4)

* - chickweeds, stitchworts and campions

** - daisies, dandelions and thistles – now termed the Asteraceae

*** - club mosses/ground pines

**** - club mosses, spike mosses etc.

5 References

GODWIN, H. 1975. *The history of the British flora. A factual basis for phytogeography*. Second edition. Cambridge University Press, 541 p.

RIDING, J. B. and KYFFIN-HUGHES, J. E. 2004. A review of the laboratory preparation of palynomorphs with a description of an effective non-acid technique. *Revista Brasileira de Paleontologia*, No. **7(1)**, 13-44.