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Report 209/88

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Summary

In 1983, a monolith of sediments was obtained from a section exposed by the excavation of a trench at the edge of Micklemere, The sediments were analysed for macrofossil content and loss on ignition by Peter Murphy and use has been made of his data in this report. The results from the microscopical analysis of pollen, fungal remains and charcoal are presented here, The pollen was exceedingly sparse and in poor state of preservation.

Pollen analysis has shown that throughout the time period represented by the sediments analysed, the area was influenced by human activity.

Two main agricultural phases have been recognised, the later one being Saxon (the early part of the phase being dated to about A.D. 660) and the earlier one probably Roman, Arable and pastoral farming seem to have been carried out in both agricultural periods.

Pollen and microscopic charcoal evidence suggest that the water table was high before the Roman settlement, and that it might have dropped a little subsequently. The Saxon settlement seems to have co-incided with a very marked rise in lake level and this may have been due to minor soil disturbance; but it was certainly not because of massive deforestation in the immediate area since the landscape seems to have been very open before the Roman settlement.

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Introduction

In 1983, a machine trench was dug which exposed sediments at the edge of Micklemere. A monolith of approximately 2.5m was obtained by Peter Murphy. From the surface to 144cm, the deposits consisted of modern topsoil dumped over layers of debris which, themselves, were dumped over a loam with earthworm activity. Murphy recognised five distinct horizons within the underlying sediments, and he analysed each one for macrofossils. He also took thirteen individual samples (at approximately 5.0cm intervals) from the monolith for pollen analysis, from 143cm to 225cm, each major horizon being represented in the sampling.

It is unfortunate that the samples deteriorated during storage and, on examination, it was found that the sediments had developed a heavy growth of Actinomycetes. These bacteria are known to decompose pollen preferentially, but it was decided to proceed with the analysis since decomposition would, presumably, be relatively uniform; there is no evidence that Actinomycetes attack some pollen types in preference to others. However, it must be stressed that interpretation of such sparse data must be viewed with caution.

Methods

Each sample was ground gently with a rubber pestle and mortar and the matrix removed by standard techniques (acetolysis and hydrofluoric acid extraction). The concentrated remains were stained with safranin and mounted in glycerol jelly. Two slides were made for every sample and the total area of each slide was scanned for pollen, microbial remains and charcoal. All pollen and spores were counted and fungi and charcoal were given a score according to their abundance (see Table 2).

The pollen counts were too low for construction of a pollen diagram. However, the relationship between plant taxa (both pollen and macrofossils) and organic content of the sediments have been presented in graphic form.

Figure 1 is a plot of a simple species richness index (SRI) for both pollen and macrofossils:

$$SRI = \frac{\text{No. of Taxa in a sample}}{\text{Total Taxa}} \times 100$$

Figure 2 shows the relationship between cereal pollen and organic content of the sediment. Organic content was determined by loss on ignition, and cereals were expressed as a percentage of Gramineae.

Figure 3 shows the relationship between cereal and *Plantago lanceolata* pollen. Both pollen types were expressed as a percentage of Gramineae.

The macrofossil and loss on ignition data were provided by Peter Murphy.

Results

The results are shown in Table 2. The pollen was very sparse, much was unidentifiable and only those grains that could be identified with confidence were recorded. However, meaningful patterns of distribution of some taxa, the analysis of the relationship of cereal and *Plantago lanceolata* pollen, species richness, and organic content of the sediments has enabled the recognition of two phases of human activity in the area.

Two periods of raised water table (at the beginning and the end of the sedimentary sequence analysed) were also indicated from the stratigraphy, certain plant taxa, and from carbonaceous spherules, the latter often being found where sediments have been prone to flooding, or high water table.

Microscopic charcoal was found in every sample so that the area was occupied to some extent throughout the period represented by the sediments, but both the charcoal and the fungal remains were markedly more abundant during the two major phases of human settlement.

Discussion

Throughout the period of history represented by the sediments analysed, the area was open and largely treeless. Pine, oak, elm, birch and hazel were growing in the vicinity but were probably represented by a few scattered trees. Alder and willow were growing at the water's edge but the paucity of alder pollen suggests that it was present in very low density. There is no evidence for dramatic woodland clearance at any point in the sequence, but alder does seem to have been a little more abundant before the first phase of human settlement.

The microfossil assemblage at 225 cm indicates that the immediate environs of the edge of Micklemere had a vegetation dominated by weedy grassland. The relatively high level of Cyperaceae, the presence of c.f. *Berula erecta*, and the occurence of carbonaceous spherules indicate that the water table was high. These findings agree with those from the macrofossil and mollusc evidence obtained by Murphy who recognised periodic flooding at the base of the sequence. There were areas of both acid heath and flushed soils in the vicinity, evidenced by *Calluna, Pinus* and *Succisa* respectively, whilst the *Alnus* and *Salix* were probably growing at the water's edge.

At 216 cm, Cyperaceae were less abundant and no carbonaceous spherules were found. This might indicate that the water table had dropped a little. The area was still dominated by weedy grassland with only alder and willow growing locally. Cereal pollen was recorded for the first time and the number of pollen taxa rose. When the taxa are inspected, it is fairly easy to envisage a fairly rich pasture with plantains (Plantago lanceolata), dandelions (Liguliflorae), buttercups (*Ranunculus* type), docks (*Rumex*) and clovers (*Trifolium* type), with sedges (Cyperaceae), lady's smock (*Sinapis* type), and narrow-leaved water parsnip (c.f. *Berula erecta*) growing at the water's edge in amongst willow and alder. Open, disturbed soil might also be indicated by the poppy (*Papaver*).

A period of intense land use is indicated between 212 and 205 cm. Figure 1 shows that there was a marked increase in species richness during this phase of activity which was maintained up to 195cm. The pollen assemblage indicates a mixed pastoral and arable economy being practised, with both cereal pollen and pollen of the weedy pasture in evidence. Figure 2 shows that the agricultural activity (indicated by the cereal curve) behaves in a more-or-less reciprocal fashion to the organic content of the sediment. This is interpreted as mineral soil being washed into the peat due to the erosive effects of tillage and general soil disturbance. As the cereal pollen declined at the end of the settlement phase, so soil disturbance lessened and the organic content of the sediment increased.

It is interesting that high values for the fungal remains appear to be correlated with cereal pollen. The spores and hyphal fragments might have been derived from fungi associated with the crops and been disseminated by practices associated with crop husbandry. Indeed, many of the fungal spores resembled the two-celled teleutospores of *Puccinia graminis*. These spores are produced in increasing numbers from midsummer onwards as the cereal ripens, and they would certainly be dispersed by threshing and winnowing. The remains of conidial fungi were also abundant, as would be expected where crops are being grown.

It is also interesting that a pastoral economy might have continued after arable farming had been abandoned. Figure 3 shows the relationship between cereal and plantain pollen, the latter being an indicator of pasture. Plantains seem to have been less abundant during the maximum period of arable farming, but they increased and were in evidence after corn growing had ceased. It must be stressed, however, that it is possible that plantains were able to spread into old fields after abandonment. But there is no doubt that both grazing and cereal-growing were carried out during the settlement phase.

The samples at 190 and 178 cm indicate that there was a cessation of mineral inwash into the growing peat. The Species Richness Index is low during this phase and cereals and weeds were absent or sparse.This seems to indicate that farming activity was abandoned in the area, and the lands surrounding Micklemere were relatively undisturbed; but charcoal shows that people were still active in the vicinity.

At 168 cm, fungal remains and species richness increased. The surroundings became dominated by weedy pasture once again and cereal growing was started. The stratigraphy shows that conditions became very wet indeed, to the point where the level of the lake rose and flooded the surrounding area, resulting in a shelly lake mud being deposited over the peat. Aquatic plants such as lesser reedmace (*Typha angustifolium* type) and spiked water- milfoil (*Myriopyllum spicatum*) grew in the shallow water at the edge of the mere. Flooding is also indicated by the abundance of carbonaceous spherules i.e. water-borne charcoal.

Cereal growing continued up to a point represented by the sediments at 145 cm. Figure 2 shows again that this period of human settlement corresponds to an inwash of inorganic material into the sediment while Figure 3 shows a similar relationship of cereal and plantain pollen seen in the earlier settlement phase. It is possible, therefore, that renewed agricultural activity resulted in soil erosion and inwash as before. However, the lake levels must have risen quite considerably for such a depth of mud to accumulate, and this suggests either a very intensive land use to the extent that there was a marked change in local hydrology, or that there was a worsening in climate.

The sediments between 164-169 cm (just below the lake mud) have been radio-carbon dated to 1290 ± 100 b.p. or a.d. 660 (HAR-5936). Thus, the second phase of agriculture was Saxon which means that the earlier phase was Roman.

Conclusion

All the evidence presented in this report indicate that this area was subjected to human activity throughout the period represented by the sediments which were analysed. However, there were certainly two major phases of settlement, the earlier one being during Roman times and the later one during the Saxon period. Before the Roman settlement, the area around Micklemere was open, weedy grassland prone to flooding. There were areas of acid heathland with pine trees somewhere in the vicinity while birch, oak, elm and hazel were also growing, but must have been present as scattered groups, or individuals in an open landscape. Alder, willow and wetland herbs dominated the mere edge.

The farming activities of the Roman settlement probably included both pastoral and arable husbandry but, early in the history of settlement, cereal growing seems to have been very important. This gradually gave way to a more pastoral economy. The phase is characterised by an increase in species richness and disturbance of the soils which were severe enough to cause considerable erosion and deposition of mineral material into the peat which was forming at the edge of the lake.

After abandonment of farming, soil erosion diminished and *Phragmites* peat continued to grow on the site. The area seemed to be relatively undisturbed for a period but at about a.d. 660 arable and pastoral farming started again. At this time, the level of the lake rose considerably and lake mud was deposited over the underlying peat.

This renewed agricultural activity may have been extensive and intensive enough to cause wide-spread soil erosion, resulting in profound changes in local hydrology - profound enough to cause the lake level to rise. However, there is no evidence of massive tree clearance and, indeed, the immediate area seems to have been largely clear of trees since before the Roman settlement. Nevertheless, there may have been tree clearance and/or activity which caused large-scale soil erosion elsewhere in the catchment, outside the immediate environs of the lake. On the other hand, there may have been a worsening of climate.

The results of this analysis largely support the preliminary report of the macrofossil analysis, submitted by Peter Murphy.

References

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Acknowledgement

I am grateful to Mr. Peter Murphy for permission to use data from his preliminary report on the macrofossil analysis and organic content of sediments.

PAKENHAM - SUFFOLK - PKM/027

STRATIGRAPHY

Depth (cm)	143	145	155	163	168	178	190	195	202	205	212	216	225
Sandy Loam	+												
Lake Mud with Shells		+	+	+									
Phragmites Peat					+	+	+						
Sandy Peat								+	+				
Peaty Sand										+	+		
Terrestrial Sedge Peat												+	+

Table 1

				PAKENHAM - SUFFOLK - PKM/027									
						PALYNOLOGY							
Depth (cm)	143	145	155	163	168	178	190	195	202	205	212	216	225
TREES & SHRUBS													
Alnus		2				1		1			1	4	4
Betula			1					1			1		
Pinus		1				1							2
Quercus		2		2	3	1			3		5		
Ulmus								1					
Corylus			1						4	2			
Salix		3	1	1	1			1	1		1	3	1
DWARF SHRUBS													
Calluna													3
AQUATICS													
Myriophyllum spicatum		1		1									
Typha angustifolium type		9		1				1					
HERBS													
Bidens type			1	1				2	1				
Capsella type												1	
Caryophyllaceae					1						1		
Chenopodiaceae			2				2						1
Cirsium										2			
Cyperaceae		1	1		1	5	5	1			1	1	6
Equisetum													1
Gramineae <40u	1	47	19	6	13	22	29	25	17	58	65	37	14
Gramineae 40-49u		1			1						5		
Gramineae 50-59u			3	1	1			1	1	1	6	1	
Gramineae 60-69u									1				
Gramineae >75u									1	3	5		
Lamium type				1									
Leguminosae							2			3	5	2	
Liguliflorae		1			1	4	1	1	4	4	6	3	4
Papaver												1	
Plantago lanceolata		4	1	1			2	2	3	1	6	1	
Polygala											1		
Potentilla type		1										1	
Ranunculus										1		1	
Rumex acetosa		1											
Rumex undiff				1				1	1			4	
Sinapis type				1		1	2	1	2		2	1	1
c.f. Spergularia									1				
Succisa													1
Trifolium type										3	1	1	
Urtica type		2	1										
Umbelliferae undiff		6	3			1	1				6		1
Umbelliferae												31	2
(c.f. Berula erecta)													
Total Pollen Count	**1**	**82**	**34**	**17**	**22**	**36**	**44**	**39**	**40**	**78**	**118**	**93**	**41**
FUNGI	2	3	2	3	3	2	1	1	3	4	3	2	1
CHARCOAL (Angular)	1	3	1	1	1	2	2	2	3	4	3	2	1
(Spherical)		3	1	1									+
+ = Present													
1 = Frequent													
2 = Abundant													
3 = Very Abundant													
4 = Exceedingly Abundant													

Table 2

Species Richness Index (PKM/027)

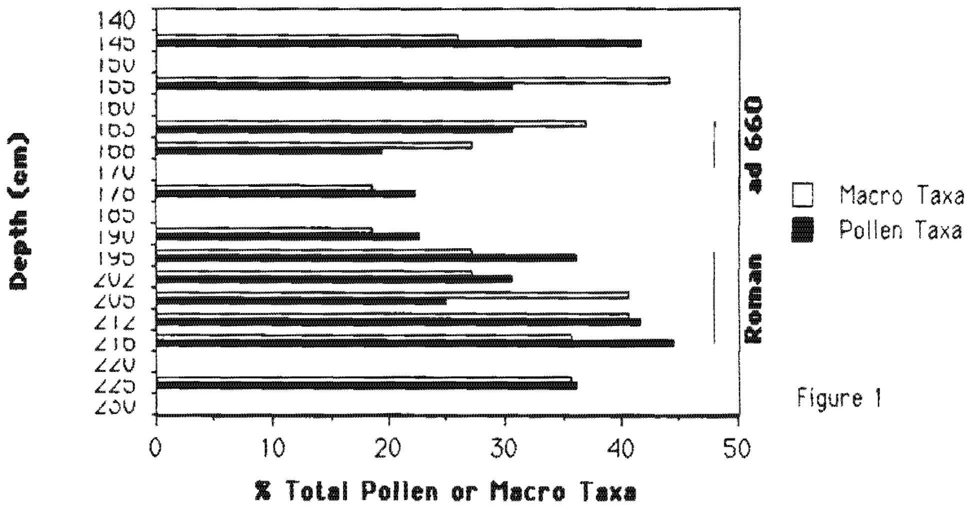

Figure 1

Relationship of Cereal Pollen to Organic Content of Sediment (PKM/027)

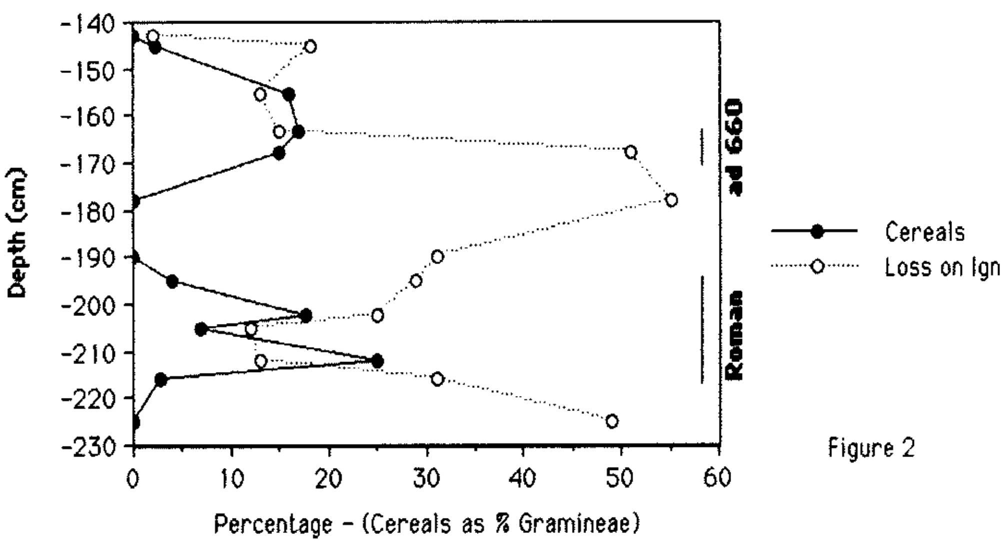

Figure 2

Relationship of Cereal to Plantago Pollen (PKM/027)

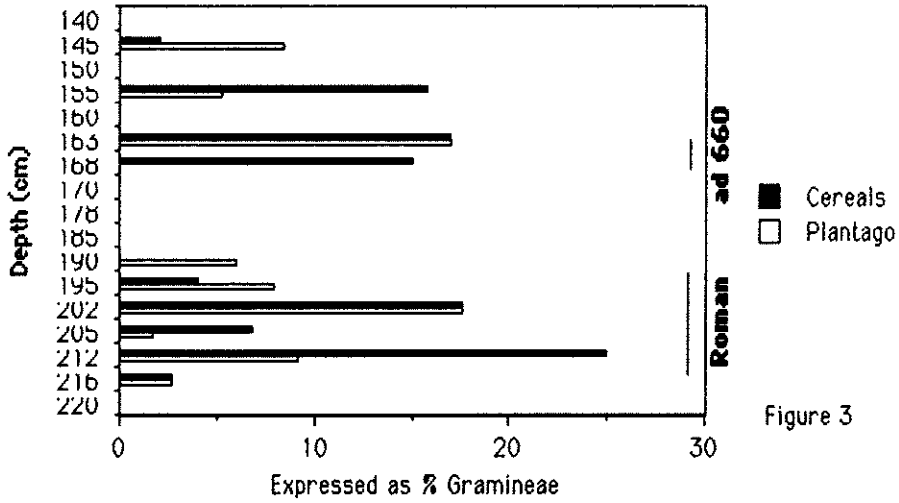

Figure 3