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THE HISTORY OF COWICK MOAT (ca. 1323-1520 AD) AS SHOWN BY THE PLANT REMAINS

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(with contributions by Sandra Nye (mosses) and Philippa Tomlinson (various plant macrofossils)

SUMMARY
The evidence from the plant remains, supported by that from other sources (summarised in Fig. 3) shows that the moat originally contained an aquatic and bankside flora in flowing water. There was a range of overhanging trees and shrubs by the moat, and the surrounding land probably supported mixed farming with arable land and meadow. It is not possible to judge the amount of woodland. Rubbish and sewage were dumped into the moat, and together with naturally deposited material this shows something of the plant materials used at the site: the cereals wheat, rye and oats were present , and other field crops were flax, broad bean, brassicas and hemp, and fennel was found. Damson, apple and sour cherry were found (and probably grown locally), and the pollen shows that there were walnut trees. Fig and grape were there, probable imports. All the edible plants are likely to have been deposited in the moat as food waste or sewage, although the flax and hop/hemp records and those of other field crops such as cereals could also represent crop waste products such as straw. The moat seems to have become progressively overgrown, but any phases of clearing-out cannot be detected. The destruction of the buildings is probably marked by stone in the profile, and the upper deposits are probably comparatively recent.

Introduction

The fieldwork was carried out by the author during the excavation of the moat in 1976. The present day vegetation consisted of a quite well developed woodland which grew on the area within the moat. There were mature ash trees with trunk diameters up to about 3 ft and a single specimen each of oak and lime. Around the moat itself grew alder, with an understory of hawthorn and elder (although the latter did not appear to be flowering in the shade from the overstory) and some hazel. There was a ground flora of woodland herbs such as bluebells, enchanters nightshade (Circaea lutetiana) etc. with plants which are also common in hedgerows and waste places, like Urtica (nettle) Alliaria petiolata (hedge mustard), Galium aparine (goosegrass), Veronica (violet), Ranunculus (buttercup), Arctium (burdock), Poa (grass), and Rumex (dock). The edges of the moat were much disturbed by the dredging work which occasioned the excavation, but Ranunculus sceleratus (celery leaved water crowfoot) was seen, and there had probably been a fairly rich aquatic and bankside flora while the moat was still undisturbed. The surrounding fields have a light sandy soil which was planted with peas immediately next to the moat, and

with spring barley further away, at the time of the fieldwork.

The sampling
A profile was cleared in the moat sediment which provided 110cm of sediment, sampled by J. Greig (Fig. 3). At the top there was leaf litter which probably represented the present moat bed. 20cm down there were fragments of sandstone which may be from the destruction of the buildings on the site in about 1520, thus sealing the lower layers. Beneath the stony layer there was organic material right down to the basal clays into which the moat had been cut in 1323. The stratigraphy diagram shows this pictorially Fig 3).

The excavation was carried out under conditions of salvage archaeology. Samples of sediment for macrofossil analyses were collected by P. Buckland and M. Dolby from suitable places , such as under the timbers from the bridge (see p---) and one such sample was investigated for plant macrofossils; The wealth and diversity of the flora from the one sample meant that no time was available for investigation of the others, although there are a few extra results from another sample. Insect remains were studied from separate samples, although the results from these studies are probably comparable with the plant data.

METHODS
Pollen analysis
Pollen analysis was done in the usual way. Preservation was very good and permitted more than usually detailed identifications to be made. After a count of 350-400 grains (not counting Alnus, Corylus and aquatics) had been made from each preparation, the queried grains were checked thoroughly, and the rest of the slide scanened under low power to record the presence of rarer grains. The pollen diagram (Figures 1 &2) is drawn up in ecological sections, such as "trees" or "grassland", inasmuch as they can be accurately identified from pollen records. Inevitably, there is a fairly large section labelled "various", although the accompanying macrofossil records often give clues to the plant species likely to be represented by some of these pollen types. Thus the Umbelliferae records are among aquatics because most of the Umbellifer seeds were of Oenanthe aquatica (water dropwort) which belongs in this group, and the presence of other non-aquatic Umbellifers was ignored. Within the ecological groups, the pollen types are listed in reverse taxonomic order. The pollen records are also listed in the plant list.

Macrofossils
The sample from which these came is described as "Area 2, under bridge, sealed by plank". It was a generally organic material in which plant remains would normally be abundant, and indeed this was the case. 1 litre subsamples of this material were broken down in warm water and sieved on different meshes so that there were three size fractions for sorting: more than 4 mm (150 ml), 4-1mm (200 ml) and 1-0.3mm (100 ml). The remains from the first litre were used for seed counts, which are given as absolute numbers, while succeeding litre subsamples were used to find the

rarer seeds (the presence of which is given as "+"), or to provide better specimens to make the identifications of various taxa more certain. The scanning of further samples was extremely worthwhile and provided many important records, such as those of apple, grape and fennel, as well as a number of other taxa. Apart from seeds, there were many remains of buds, thorns and some mosses, which could be identified. There was a mass of rotten wood fragments and twigs, lumps of charcoal and a few worked wood chips. The plant names and taxonomic order are according to Clapham et al 1962 for higher plants and ferns, and Watson 1955 for mosses, with a few new names from Jahn 1983).Non plant material included insect remains (reported in Maureen Girling's section), fish scales and bones, small mammal bone, molluscs (which could only just be detected as they were largely decalcified), caddis cases, fly puparia, small pieces of coal and a scrap of leather.The pollen preparation from this sample contained an ovum of the intestinal parasite Trichuris. A few macrofossils from another sample (sample 8 Area 2 Column 1)were studied,

RESULTS

These are listed in Table 1 (all plant remains) and set out in the pollen diagram (Figs. 1 & 2).The main macrofossil sample (Sample 1) seems to correspond to a level around 80 cm on the pollen diagram, according to its pollen spectrum, and its results are used to interpret the pollen results throughout the diagram because the changes are not very great; it is only with difficulty that the pollen diagram can be divided into three sub-zones, C1, C2 and C3.

The results are discussed in the following order: first the pollen, then the macrofossil evidence for the main kinds of vegetation found, woodland, wetland, grassland, arable crops and arable weeds, heathland and other plant communities.

Woodland and scrub

There is fairly plentiful evidence of woodland and scrub vegetation in the form of 25-50% tree and shrub pollen (in which Corylus (hazel) and Alnus (alder) are not counted). Quercus (oak), Fraxinus (ash) and Sambucus nigra (elder), listed in descending abundance of pollen, are the most important pollen records and may reflect how abundantly and close to the moat they grew in the past, too. Hazel and alder were abundant, too. It is not possible to tell whether the site was rather overgrown, or whether there were just a few trees in a position for their pollen to fall directly into thhe moat. Crataegus (hawthorn), Prunus type (sloe etc.) and Viburnum (guelder rose etc.) have rather a slight pollen record, although they distribute so little pollen that almost any pollen record at all indicates that they might have been abundant.

There are some interesting records, such as Juglans (walnut), Ligustrum (privet) and Buxus (box), which were probably planted rather than growing wild. A slight trend in the tree and shrub pollen records is that they are increased in C2 (70-30cm)showing that the moat and its surroundings became more overgrown at that stage.

The macrofossil evidence of trees and shrubs parallels that from the pollen, with finds of macrofossils from most of the trees and shrubs on the pollen diagram, although represented differently: a single acorn and oak buds, ash fruit remains and leaf scars (this compares with abundant oak and ash pollen), willow fruit capsules and buds, little sign of birch and none of walnut but plenty of seeds and catkins of alder. Hawthorn seeds were found, and the thorns were therefore probably from this rather than sloe, and rose thorns and possible hips were found. The shrubs elder and hazel showed up in many seeds and nutshells respectively, but macrofossils of holly, maple, pine were not found. A Populus cf. tremula (poplar) bud scale was found, a cherry stone and a damson stone, the last two corresponding to the slight Prunus type pollen record. The bud, twig and some other identifications were done by P.R. Tomlinson, as indicated by an asterisk in Table 1 (Tomlinson 1985). These records show which trees may have grown around the moat thus overhanging it, so providing extremely good conditions for the preservation of some remain or other (apart from the fruit trees). There is a very close correlation between pollen and macrofossil finds, which is not always the case with remains of this kind. Many of the mosses identified by Sandra Nye are usually found in woodland, therefore providing more evidence of the wooded nature of the surroundings. The trees and scrub could have been growing very locally around the moat in an otherwise very open landscape, for all we can tell. Macrofossils from trees are generally poorly dispersed and are therefore likely to be found only where there are good conditions for the preservation of remains close by where they grew, such as here. The evidence of 'old forest' insects, and the very presence of a hunting lodge may, however, provide some evidence that there was a wooded landscape in the vicinity.

Woodland grades into scrub and also hedge without there being many clear ecological signs to show which is represented, although in the very large Cowick flora there are numerous records of plants that would seem to indicate the local presence of scrub vegetation with some trees, rather than more undistirbed woodland. Prominent among the possible scrub indicators are the thorny rosaceous plants such as Rosa (wild rose), Rubus (bramble), Prunus (sloe) and Crataegus (hawthorn), and herbs such as Galium aparine (sticky willy), Calystegia (bindweed), Epilobium (willowherb), Torilis (hedge-parsley), Urtica (nettle) and Malva (mallow) whixh are commonly found in scrub even though they also grow in other places too. The type of site, with occupation and activity close by, would also make the presence of scrub likely.

Wetland vegetation; aquatic and marsh.
The wetland plant records often dominate in a water-lain sediment, but here they do not. What the pollen results seem to show is that the lower sediment (sub-zone C1), up to about 70cm, has more signs of plants like Sparganium (bur-reed), Potamogetonaceae (pondweeds) and Myriophyllum (millfoils) which are fully aquatic and which therefore represent standing water

rather than marsh or wet ground. It therefore seems that the moat started out as a water-filled ditch which later became marshy and choked with accumulations. This corresponds to the evidence from the tree pollen that the site may have become more overgrown.

There are macrofossil records of several plants which are indicative of aquatic habitats, and therefore of a moat filled with water for most of the time: Ceratophyllum (hornwort), Oenanthe aquatica (water dropwort), Alisma lanceolatum (water plantain), Potamogetonaceae (pondweeds), Lemna (duckweed). Scirpus, Sparganium (bur ~ reed), some of the Carices (sedges) and Glyceria (reed-grass) grow in standing water at the edge of a ditch of moat and are therefore some indication of wet conditions as well. As the macrofossil sample comes from the lowest deposits, the evidence agrees with that from the pollen even though the samples probably come from slightly different places, in showing that the moat was water filled at the beginning of its career.
Marshland plants which would grow on damp ground rather than in water are present, although those plants might have been growing along the edges of the moat: Ranunculus cf. lingua and Ranunculus flammula (spearworts), also R. sceleratus (which was noted during the excavations), Montia fontana (blinks), Filipendula (meadowsweet), Rorippa (watercress), Apium inundatum (a wild celery), Sonchus palustris (marsh sow thistle), Polygonum hydropiper (water-pepper), Menyanthes trifoliata (bogbean), Galium palustre (marsh cleavers), Achillea ptarmica (sneezewort) and many of the rushes and sedges. It seems likely that in the relative absence of signs of aquatic plants in the upper part of the moat sediment, that the marshland flora there represents the growing over of the moat.

Fish and other bones, molluscs.
A very small number of bones were recovered from the botanical samples, and although this cannot count as proper sampling, the results obtained by Andrew Jones are useful: there was a precaudal vertebra and a pelvic skeleton of Gasterosteus aculeatus (stickleback), a scale from a young Esox lucius (pike) and an ilium from Rana temporaria (frog). Although frogs and sticklebacks will inhabit very small ponds and ditches, the presence of pike could suggest that the moat was large and well filled enough to support this size of fish, or it could merely have come from bird droppings, from a travelling heron, perhaps. An humerus of Microtus agrestis (field vole), was identified by Terry O'Connor, but it or the remains must have somehow fallen in. The beetle evidence is also helpful, and the presence of Elmids in the aquatic part of the fauna indicates that the water was flowing. The ground water seems to have verged on the acid, for mollusc remains were few, and some seemed to show signs of being dissolved. Pisidium (pea mussel) was noted, along with the remains of a larger kind of mussel in a very fragmentary state, possibly a pond mussel, and the opercula of an aquatic snail such as a species of Lymnaea. This is extra evidence for fairly clean water during the early stages.

Grassland

The pollen records thought to be most likely to represent grassland are grouped in the second part of the pollen diagram (Fig 2). There is abundant Gramineae (grass) pollen of which at least some probably came from grassland on dry land, although the presence of seeds of aquatic grasses (Glyceria) shows that some of the grass pollen came from wetland vegetation. The same problem exists with Ranunculus type pollen (buttercups etc.) which could have come from wetland or dry land Ranunculi, both of which are present. The Compositae L pollen seems more likely to be from grassland (taxa like Leontodon, hawkbit) and other dry land vegetation. Other pollen types provide very clear evidence of grassland, such as Plantago lanceolata (ribwort plantain), Trifolium repens and T. pratense (white and red clover), Medicago lupulina (black medick), Lotus type (birdsfoot trefoil and Centaurea nigra (knapweed). There are some indications of rather damp grassland from Sanguisorba officinalis, and perhaps from Filipendula (meadowsweet) and Caltha (kingcup) pollen. The grassland records are greatest at the bottom of the pollen diagram (C1) and the top (C3).

There is reasonably good macrofossil evidence for grassland with 25 fairly characteristic grassland taxa identified, although the evidence is somewhat different in character; grass records are very slight, and plantain or knapweed nonexistant. In many cases the macrofossil records correspond to pollen types already mentioned: ? Poa (Gramineae), Leontodon (Compositae L), Trifolium sp. calyx, Medicago lupulina seed, Caltha palustris, Filipendula ulmaria. In many cases, however, the macrofossil identifications are to species, showing the presence of grassland plants such as Ranunculus acris (meadow buttercup), Cerastium fontanum (mouse-ear chickweed), Anthriscus sylvestris (hedge parsley), Heracleum sphondylium (hogweed), Daucus carota (wild carrot), Prunella vulgaris (self-heal), Achillea ptarmica (sneezewort) and Leontodon taraxacoides (hawkbit).

Grassland is difficult to classify when it is present in remains which may themselves be mixed (Greig 1984, 1986), but the range represented seems to include hay meadow, some of it damp, with a range of tall growing plants that do not tolerate much grazing, such as the umbellifers Anthriscus and Heracleum and Centaurea nigra the knapweed. Drier conditions are shown by plants like Daucus (wild carrot) and Medicago (medick),and light soils by Rumex acetosella (sheeps sorrel).

Not all this grassy material seems to have become preserved as pollen or seeds that just fell into the moat by natural dispersal from grassland growing close by; the habitat range would seem rather too great. Further evidence comes from the beetle evidence which includes elements of a 'compost heap' fauna that would be found in rotting plant material such as animal fodder and bedding, and the dung feeding element is suggestive of dung. Some natural dispersal might be indicated by the plant feeding insects (phytophages) which are present, although some of these are even present in deposits which seem to have very little naturally-

dispersed contents, as at Hen Domen (Greig et al. 1982).

The grassy meadow vegetation grades into a rough wayside flora with plants like Arctium (burdock) and Malva sylvestris (mallow).

Cultivated plants and their weeds

Cereals are the main crops which show up well in the pollen records. Some, like wheat, barley and oats are self pollinated, and do not scatter a great deal of pollen themselves, although threshing debris, straw etc. can contain large amounts (Vuorela 1973, Greig 1982). Others, like rye, liberate plenty of pollen. Both types of pollen were noted in the Cowick sediment, and wheat macrofossils show that the source of at least some of the pollen was from the remains of the whole plant, or grain as well as possibly having come on the wind from the adjacent fields. There is more cereal pollen in the lower part of the diagram (C1), which probably represents more deposition of cereal material in the moat, rather than more local cereal growing or less local woody vegetation growing over the site.

There is a small but constant record of Cannabaceae (hops or hemp) throughout the pollen diagram, with a peak of 9% at 20cm, an amount that may show that Cannabis sativa (hemp) was deposited in the moat in some form, either for retting to extract the fibres or as hempen waste. The smaller amounts of Cannabaceae pollen in the rest of the diagram could also be from hemp, or from Humulus lupulus (hop) growing wild in the scrub, which would have provided an ideal habitat for it. It is not known whether wild hops growing in such condit give a strong pollen record, but pollen diagrams from natural deposits do not often seem to show the rather constant pollen record which might be expected of wild hops, as opposed to the fluctuating peaks from hemp. The question was not resolved by macrofossil evidence despite the sieving and scanning of larg amounts of extra material in the hope of finding either hemp or hop seeds.

Linum usitatissimum (flax) is also present in the pollen records which is slightly unusual since flax seems to be such an extremely small producer of pollen. Macrofossil records also confirm the presence of flax. This area was formerly known for flax cultivation.

A single pollen grain of Vicia faba (bean) was found. Beans do not produce much pollen, and so the pollen records are scarce, and macrofossil records are likewise scarce as beans do not survive well in the waterlogged state. Beans are, however, considered a fairly important medieval foodstuff, and occasional finds of charred foodstores are sometimes rich in bean remains (Buurman (1981).

A few whole remains of cereals were found in the form of waterlogged pericarp (bran), culm nodes, and some possible wheat rhachis (identified by Lisa Moffett). This shows that at least some of the abundant cereal pollen arrived in this way, and that cereal growing was not necessarily done locally. As in the case of the grassland plants, this cereal debris is most likely to have arrived in the deposit as animal dung or bedding, or with the remains of human food. Among the beetles were found grain weevils.

Brassica seeds were found, which could represent a kind of cabbage although the precise identification is difficult.

Linum (flax) was found, both seeds and as capsule fragments. It is hard to say whether these rather few remains are more likely to be from flax straw used for animal bedding, or whether flax was retted in the moat.

Two very interesting crop finds are Ficus carica (fig) and Vitis vinifera (grape). These are very probably imports, although it has recently been shown that figs grown in Britain can produce some fully-formed seeds (Robinson, personal communication), and there is some documentary evidence of viticulture. Figs and raisins were very popular in the medieval period, it is known, both from historical and archaeobotanical evidence (Greig 1983), but they are rather remarkable finds from such a rural site even though Cowick has royal connections. These, and the other fruit pips of Malus sylvestris (apple) and stones of Prunus cerasus (sour cherry) and Prunus institia (damson/bullace) and also the seed of the spice Foeniculum (fennel), most probably arrived in the moat deposits in the form of sewage from human extrement. Some other edible plants such as bramble could have been deposited in this way as well, but as it could so easily have been growing on the spot it is not really considered a certain food plant in this material. A further sign of sewage contamination is the find in a pollen preparation of Trichuris ova, from an intestinal parasite possibly living in a human (otherwise probably a pig).

Crop weeds

The pollen of Centaurea cyanus (cornflower) shows the presence of a characteristic weed of cornfields until the introduction of modern agriculture at the beginning of this century. It is of interest that this moat provides a closely dated horizon of 1329 at which point the cornflower is already present. The plant either appears, or seems to become much more common, in medieval deposits around 1200, although the difficulties in dating many medieval deposits accurately means that hitherto there have been very few securely dated early horizons with evidence of cornflower. Cornflower is one plant which can be very accurately detected to species level by pollen analysis; seed remains are less common, although they do occur here. Other weeds identified from characteristic pollen types are Papaver, and some of the Compositae (T) pollen seems to be from weeds too.

The weeds of arable land identified from seeds include several which are mainly found on acid sandy soils, such as Raphanus raphanistrum (charlock), Spergula arvensis (corn spurrey) and Chrysanthemum segetum (corn marigold) (which could be the source of some of the Compositae (T) pollen), while most of the other weeds of arable land would also grow on this kind of soil:

Papaver dubium, (long-headed poppy), Polygonum aviculare (knotgrass) and P. convolvulus (black bindweed), for instance. Agrostemma githago (corn cockle) is a typical weed of arable fields before modern farming methods arrived, and Viola cf. tricolor (wild pansy) is still a weed of arable land. Only a single seed of Anthemis cotula (stinking mayweed) was found. It is most common on heavy and sometimes calcareous clay soils, and therefore this soil type may not have occurred much in the locality.

Some weeds are not specifically those of arable land (although many could have been weeds of field crops). Some like Ranunculus sardous (a buttercup) now have a rather restricted (coastal) range although their medieval archaeological record suggests that they were far more common inland in the past. Other weed records could represent a range of vegetation which can grow in too many places for it to be possible to be more specific: this is particularly the case with weeds like Stellaria media (chickweed), Chenopodium (goosefoot) and Atriplex (orache) species or taxa such as Coronopus squamatus (swine cress). Others, however could easily be found in rank vegetation growing very near the moat, with Rubus fruticosus (bramble), Epilobium (willowherb), Conium (hemlock), various Rumices (docks), Urtica (nettle), Calystegia (bindweed), Solanum dulcamara (bittersweet), Galeopsis (hemp-nettle), Galium aparine (sticky willy), Arctium (burdock) and Cirsium (various thistles).

Heathland

Although there are several signs from the pollen and macrofossil records (see below) that this area was mainly one of sandy soils, the signs of heathland are somewhat slight; there is just a trace of Ericacaceae (heaths and heathers) pollen to show that there was some heathland somewhere in the area - nothing more.

Other pollen records

Some pollen records have no macrofossil counterparts like Campanulaceae (bellflowers) which includes quite a range of different taxa, as does Geranium type, although many of the members of this last group are woodland plants, and would thus belong locally.

Discussion

Until quite recently the idea of preparing a pollen diagram from a deposit of archaeological origin like a moat was considered hardly worthwhile because of the difficulties of interpretation (Dimbleby 1976). Various enthusiasts have persisted in this type of study in the belief that it can be valid, especially when the pollen data is not used alone, but combined with all the other obtainable information on the deposit, particularly that from plant macrofossils and insects, which is available here. Palynology in this form now seems to have achieved some kind of respectibility (Dimbleby 1985).

The moat can be seen as a preserving medium (because it was waterfilled) which can show what arrived there naturally, such as

the very local flora and fauna, and what was flung in by people, ranging from boots and shoes, through pottery to plant materials such as remains of hay, straw and food. This then provides a valuable chance to find out about those aspects of medieval rural life at Cowick which leave identifiable remains.

The discussion can put the results from Cowick in context with those from other medieval sites, such as those with moats, and also make some points about the study of moats as a whole.There are results from surprisingly few moats, considering that almost all of these are waterlogged and therefore offer good preservation of organic remains, and also that a number of moats have been excavated over the last several years. The main moat sites with comparable results are the pollen analyses by Jim Innes from a number of Merseyside sites, Bewsey Old Hall, Speke Hall and Bromborough Court Hall, with macrofossil analyses by Philippa Tomlinson (Innes & Tomlinson 1978, and various unpublished reports),the post-medieval Birmingham Moat (Greig 1981) and the 12th Century ditch at Nantwich (Colledge 1980). In addition, the results from another castle site, Hen Domen,perhaps a century earlier than the deposits at Cowick, (Greig et al. 1982) are also relevant.

All the other moats and ditches show somewhat similar accumulations of woody remains in the form of substantial amounts of tree pollen, seeds, buds and other such macro remains, and of course larger fragments of wood, with oak, ash, willow, elder, hazel and alder generally well represented. Moats obviously act as good places for evidence of overhanging trees to be preserved in some form or other. In some sites like Bewsey, there is a noticeable increase in shrub records (elder, hawthorn, guelder rose and holly) which may be a sign that the site was abandoned and became overgrown by scrub. The Birmingham site had Acer campestre (field maple) and Ilex (holly) seeds. This difference could be because the representation of moat-side vegetation varies along the moat, or it might be a regional difference probably related to soil type; field maple is common in hedgerows in the Birmingham area today. In all cases, ash pollen was abundant but macrofossils almost nonexistant, even though the seeds are very widely distributed. The writer had not recognised the presence of any ash macrofossils until they were pointed out by Philippa Tomlinson, so part of the problem lay in the recognition of ash fragments (Tomlinson 1985) and part in their general scarcity. The pollen records of Ligustrum (privet) and Buxus (box) are interesting because these are hedging plants, of which there have been few medieval records, if any, apart from at Bewsey Old Hall, although box leaves have been found at Roman sites. The pit in the bailey of the castle at Hen Domen was not so rich in tree and shrub remains, which is understandable as the means of deposition were apparently different, with no sign of overhanging vegetation.

The records of Juglans (walnut) from Cowick are interesting, because they help show more of the rather obscure history of this non-native tree. Walnut shells have been found in Roman and Saxon

deposits (cited in Greig 1983) but the pollen grains, which would show that the trees were growing here, as opposed to nuts being imported, have not been found from deposits of that age. There is therefore no good evidence that walnuts were actually grown in Britain before medieval times, which is on contrast with the substantial pollen curves from northern France which seem to be of Roman date. The pollen record from Cowick, and the somewhat earlier 12th C one from Nantwich (Colledge 1980), show that this tree was growing at these two medieval sites, although its absence from the pollen records of other sites shows that it was by no means ubiquitous.

Wetland vegetation is usually in evidence in results from moats, and as with the trees and shrubs, the list from the other ditches was similar in all cases, with a range of common wetland and aquatic plants, and others which occurred at one site and not another without any apparent explanation. The record of Ceratophyllum (hornwort) is slightly uncommon. At Nantwich, however, there were practically no aquatic plants, so the ditch there must have been merely damp rather than waterfilled.

Grassland plants are present in most assemblages of plant remains from archaeological sites, although sometimes there are enough for there to be some substantial evidence of the remains of grass or its products, as at Cowick. In sites of this kind the amount of evidence of a particular vegetation seems to depend upon chance, whether one particular kind of rubbish or other was dumped, or whether natural local vegetation grew and was preserved relatively undisturbed. At Hen Domen there was a substantial amount of grassland indicated, but not at the other sites, where cornfield weeds were mainly found, as at Nantwich.

Crop plant records in such sites depend on chance preservation, and sometimes this brings interesting results like the fig and grape pip find from Cowick, and the signs of flax and hemp. Hemp or hop pollen was also found at Birmingham in quite large amounts, but not at the other sites. Food remains like fig, grape and fennel are probably the result of sewage getting into the moat, also damson, apple and cherry, although these could also have come from rubbish. It is often assumed that moats and ditches, particularly those of castles, were used as sewers, with the garderobes, or latrines, emptying from the battlements into the ditch beneath, and this was probably so. The Cowick moat seems to have acted as a drain for the building inside the moated area. Parasite ova also provide good evidence of faeces, and these were plentiful at Birmingham, too. In the Cowick material an ovum was found, evidence that suggests presence rather than abundance of sewage, for latrine deposits rich in sewage can have more ova than pollen grains. Cereal remains are commonly found at all such sites, but may not so directly represent remains of food; they are usually found together with a large range of associated cornfield weeds that probably represent deposition of weedy straw. This may not prove informative about food that was eaten, but it does provide useful clues about field crops, their

weeds, and the soil upon which they grew. For example, the land around Cowick seems to have been light and sandy, with little of the heavy clay land which would favour weeds such as Anthemis cotula (stinking mayweed), which were rare at Cowick but fairly abundant at the other sites (such as Nantwich).

Although moats and ditches can provide similar information to that obtained from organic deposits in cities like York and Bristol, they have the advantages of better preservation and less disturbance of the deposits, and sometimes, if the site is rural, this is also interesting as well.

Conclusions

The pollen, plant macrofossil and insect results complement each other in showing how the deposits in the moat formed and what they contained: a selection of the rubbish and waste that was disposed of there. The preserved evidence has a considerable bearing on the occupation of this medieval site as well as the more natural historical evidence about conditions in the moat. There is no sign that the moat was cleaned out other than by water flow, but there is an element of uncertainty about the exact way in which the remains were deposited.

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FLORA OF THE COWICK MOAT

Identifications by J. Greig except those marked x (S. Nye), * (P. Tomlinson) and o (L. Moffett). Samples: S1, S1P, "area 2 under bridge", macros and pollen. S2, "sample 8, area 2, column 1", macros. PD, records from pollen diagram. The data appears in absolute numbers (S1), presence only (S2) and percentage of pollen sum (PD, S1P). + = present, less than 1% of pollen. Order and taxonomy after Clapham et al. 1962, 1981 (higher plants), Smith 1980 (mosses).

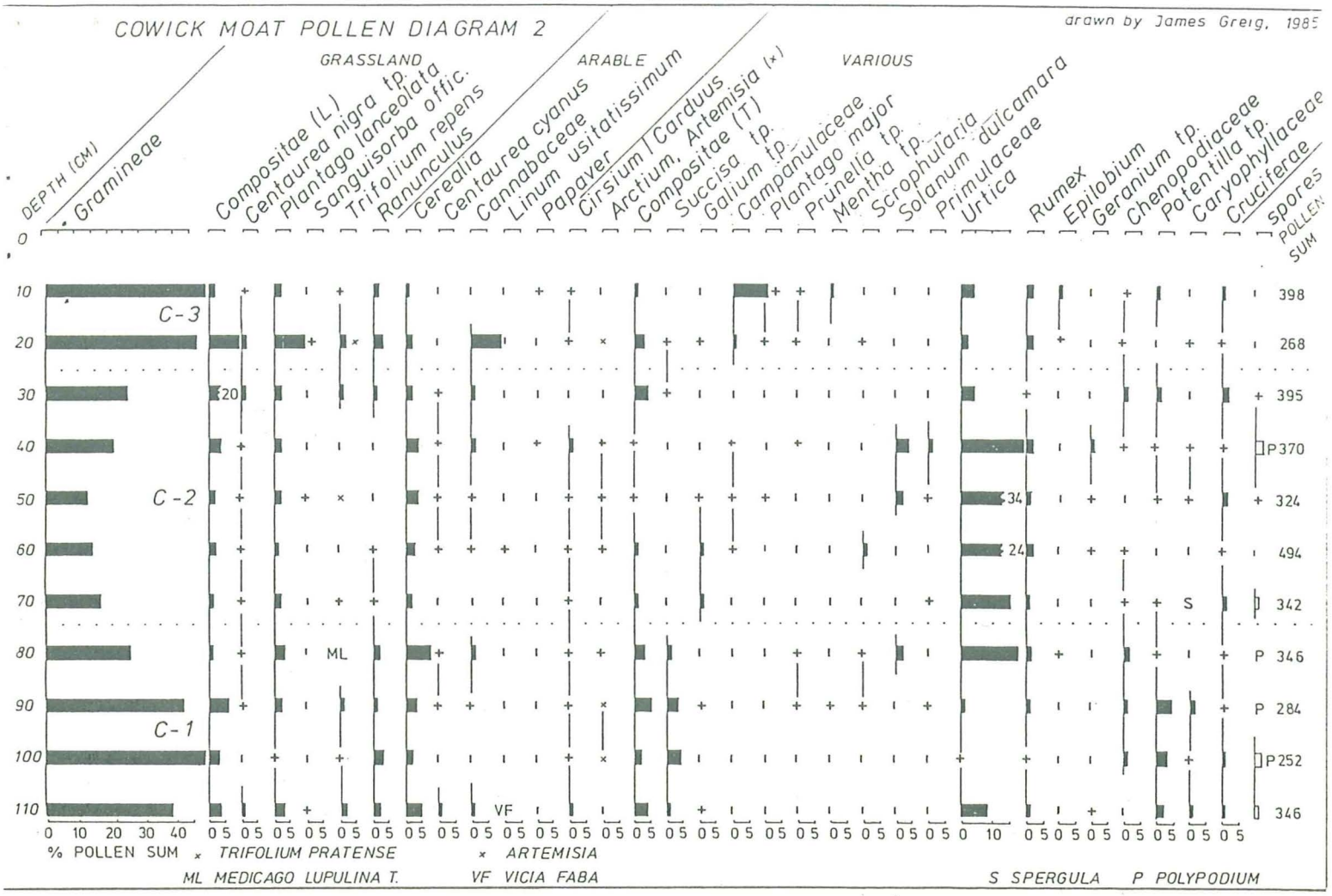
SEEDS etc	SAMPLE				POLLEN / SPORE TYPE	HABITAT	COMMON NAME
	-	-	+	+	PEDIASTRUM	PEDIASTRUM	
x Bryum sp. (Hedw.)	+	-	-	-			mosses do not, by and large, have common names
x Plagiomnium rostratum (Schrad.)Kop.	+	-	-	-			
x Aulacomnium palustre Hedw. Schwaegr.	+	-	-	-			
x Climacium dendroides (Hedw.) Web & Mohr	+	-	-	-			
x Leucodon sciuroides (Hedw.) Schwaegr.	+	-	-	-			
x Acrocladium cuspidatum (Hedw.) Lindb.	+	-	-	-			
x Isothecium myosuroides var. myosuroides Brid.	+	-	-	-			
x Homalothecium sericeum Hedw.	+	-	-	-			
x Hypnum cupressiforme Hedw.	+	-	-	-			
Pteridium aquilinum L. (leaf fragments)	+	-	+	-	PTERIDIUM	G (acid)	bracken
-	-	-	+	-	POLYPODIUM		polypody fern
-	-	-	+	+	PINUS		pine
-	-	-	-	+	NUPHAR	A	yellow water-lily
Caltha palustris L.	-	+	+	+	CALTHA tp.	M, wet G, W	kingcups
-	-	-	+	-	cf. ANEMONE	W	wood anemone
Ranunculus cf. acris L.	1	+	+	1	RANUNCULUS tp.	G	buttercup
Ranunculus subg. Ranunculus	4	+	"	"	" "		" "
Ranunculus sardous Crantz	-	+	"	"	" "	M, Da	" "
Ranunculus cf. lingua L.	1	-	"	"	" "	M	greater spearwort
Ranunculus flammula L.	5	+	"	"	" "	M	lesser spearwort
Ranunculus sceleratus L. L	1	+	"	"	- -	B	celery-leaved crowfoot
Ceratophyllum demersum L.	+	+	-	-		A	hornwort
Papaver dubium L.	-	+	-	+	PAPAVER	Da	long-headed poppy
Papaver argemone L.	-	+	-	"	" "	Da	long prickly-headed poppy
Brassica sp.	+	+	+	+	CRUCIFERAE	?C, Da	cabbages etc.
Raphanus raphanistrum L.	=4	-	"	"	" "	Da, acid	charlock
Coronopus squamatus (Forsk.) Aschers.	-	+	"	"	" "	Da	swine-cress
Rorippa cf. microphylla (Boenn.) Hyland	-	+	"	"	" "	A, M.	one-rowed watercress
Viola cf. tricolor L.	+	+	-	-		Da	? wild pansy
Agrostemma githago L.	=1	+	+	+	CARYOPHYLLACEAE	Da	corn cockle
Cerastium fontanum Baumg.	1	+	"	"	" "	G, Da	common mouse-ear chickwee
Stellaria media (L.) Vill. s.l.	+	+	"	"	" "	Da	chickweed
Stellaria cf. palustris Retz	-	+	"	"	" "	M	marsh stitchwort
Spergula arvensis L.	=1	-	+	-	SPERGULA tp.	Da, acid	corn spurrey
Montia fontana ssp. chondrosperma (Fenzl.) Walters	+	+	-	-		M, G, Da	blinks
-	-	-	+	-	TILIA	W	linden
Chenopodium cf. album L.	22	+	+	+	CHENOPODIACEAE	Da	goosefoot
Atriplex sp.	+	+	"	"	" "	Da	orache
Malva sylvestris L.	4	-	-	+	MALVA tp.	D	common mallow
Linum usitatissimum L.(sd + cpsl frg)	+	+	+	-	LINUM USITATISSIMUM tp.	C	flax
-	-	-	+	-	GERANIUM tp.	G, W, D	cranesbill
-	-	-	+	+	ACER	W	maple
-	-	-	+	-	ILEX AQUIFOLIUM	W	holly
-	-	-	+	-	BUXUS		box
Vitis vinifera (L.) Gmel.	-	+	-	-		C (?import)	grape
Medicago lupulina L. (seedpod)	1	-	+	-	MEDICAGO tp.	G	nonsuch
Trifolium sp. (flower parts)	+	-	+	-	TRIFOLIUM REPENS tp.	G	white clover
" "	"	-	+	+	TRIFOLIUM PRATENSE tp.	G	red clover

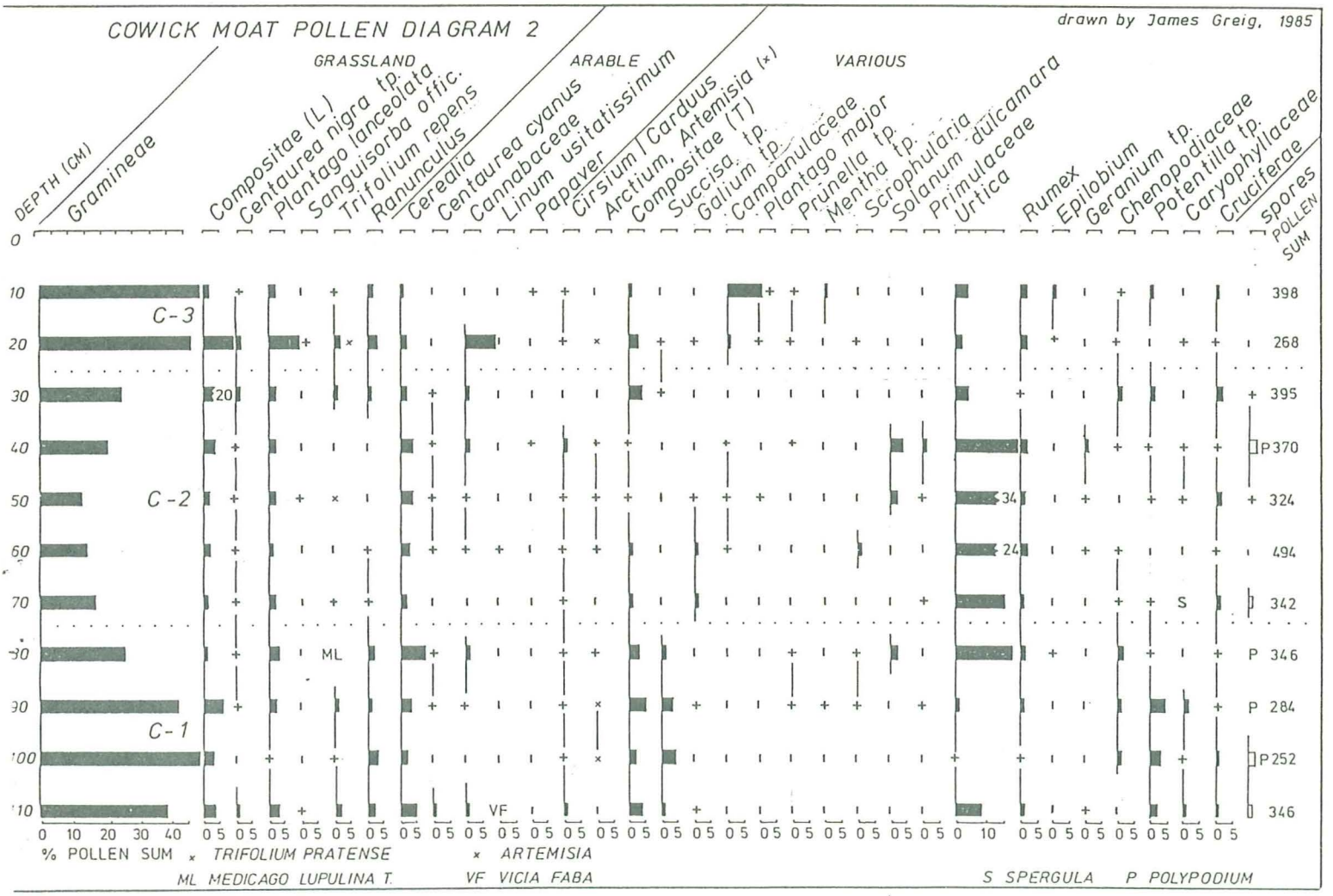
/2 Cowick flora continued

Plant macrofossils	S1	S2	PD	S1P	Pollen type	habitats	common name
-	-	-	-	+	LOTUS tp.	G	birdsfoot-trefoil
-	-	-	+	-	VICIA FABA	C	broad bean
Filipendula ulmaria L.	1	+	+	+	FILIPENDULA	M, G, W	meadowsweet
Rubus fruticosus agg.	4	+	-	+	RUBUS FRUTICOSUS tp.	S	bramble
Rubus/Rosa (thorns)	+	+	-	-			bramble or rose
Potentilla anserina L.	-	+	+	+	POTENTILLA tp.	D	silverweed
Potentilla erecta (L.) Räuschel	1	+	"	"	" "	G, M, W,(acid)	common tormentil
? Agrimonia eupatoria L.	1	-	-	-		S, W, D	common agrimony
-	-	-	+	-	SANGUISORBA OFFICINALIS	G	greater burnet
Rosa sp.	*1	+	-	-		S	wild rose
Prunus institia L.	-	+	+	+	PRUNUS tp.	?C	bullace, damson
Prunus cerasus L.	-	+	"	"	" "	?C	sour cherry
Prunus/Crataegus (thorns)	-	+	-	-			sloe or hawthorn
Crataegus cf. monogyna Jacq.	+	+	+	1	CRATAEGUS tp.		hawthorn
Malus sylvestris Mill.	-	+	-	-		C	apple, prob, cult.
Epilobium sp.	1	-	+	-	EPILOBIUM tp.	M, W, D, S.	willowherb
Myriophyllum verticillatum L.	-	+	+	+	MYRIOPHYLLUM VERTICILLATUM	A	whorled water-millfoil
-	-	-	+	+	HEDERA	W	ivy
Hydrocotyle vulgaris L.	-	+	-	-		M	pennywort
Anthriscus sylvestris (L.) Hoffm.	2	+	+	+	UMBELLIFERAE	G, S.	cow parsley
Oenanthe aquatica (L.) Poiret	19	+	"	"	" "	A (slow/stagn.)	fine-leaved water dropwort
Aethusa cynapium L.	-	+	"	"	" "	Da	fool's parsley
Conium maculatum L.	1	+	"	"	" "	D, M.	hemlock
cf. Apium inundatum (L.) Reichenb.fil.	-	+	"	"	" "	A	-
Foeniculum vulgare Mill.	-	+	"	"	" "	?C	fennel
Heracleum sphondylium L.	+	-	"	"	" "	G, W.	hogweed
Daucus carota L.	1	-	"	"	" "	G	wild carrot
Polygonum sect. avicularia	8	+	-	-		Da	knotgrass
Polygonum lapathifolium L.	2	+	+	-	P. PERSICARIA tp.	B, Da	pale persicaria
Polygonum hydropiper L.	1	-	"	"	" "	M, A	water-pepper
Polygonum convolvulus L.	4	-	"	"	" "	Da (acid)	black bindweed
Rumex acetosella agg.	1	+	+	1	RUMEX tp.	G (acid)	sheep's sorrel
Rumex cf. obtusifolius L. (perianth)	5	+	"	"	" "	G, Da	broad-leaved dock
Rumex conglomeratus Murray (perianth)	-	+	"	"	" "	G, W, Da	sharp dock
Rumex sp. (seeds)	+	+	"	"	" "		dock
Urtica urens L.	-	+	+	7	URTICA	Da	small nettle
Urtica dioica L.	10	+	"	"	" "	W, S, B, D.	stinging nettle
-	-	-	+	+	CANNABACEAE		hemp/hops
-	-	-	+	-	ULMUS		elm
Ficus carica L.	1	-	-	-		C (imported)	fig
-	-	-	+	-	JUGLANS	C	walnut
Betula sp.	-	+	+	1	BETULA	W	birch
Alnus glutinosa (L.) Gaertner (sd, ctk)	18	+	+	(20)	ALNUS (not in pollen sum)		alder
Corylus avellana L.	=1	+	+	(5)	CORYLUS (" ")		hazel
Quercus sp. (acorn)	1	-	+	37	QUERCUS	W	oak
Quercus sp. (buds)	*=19	+	"	"	" "	"	"
Populus cf. tremula (bud-scale)	*1	-	-	-			aspen
Salix sp. (buds, seed capsules)	*1	+	+	1	SALIX		willow
-	-	-	+	+	ERICALES	heathland etc	heathers etc.
-	-	-	+	-	PRIMULACEAE		? yellow loosestrife
Fraxinus excelsior L.(fruit, twig)	*+	+	+	10	FRAXINUS		ash
-	-	-	+	-	LIGUSTRUM		privet
Menyanthes trifoliata L.	1	-	-	-		A, M	bogbean
-	-	-	+	-	CALYSTEGIA	S	larger bindweed
Solanum dulcamara L.	-	+	+	1	SOLANUM DULCAMARA	D, S, W	woody nightshade
-	-	-	+	-	RHINANTHUS tp.	G	yellow rattle etc.
Scrophularia sp.	-	+	-	+	SCROPHULARIA	M, B	figwort

Plant macrofossils	S1	S2	PD	S1P	pollen type	habitat(s)	common name
Lycopus europaeus L.	1	-	+	-	MENTHA tp.	M, B.	gypsywort
Prunella vulgaris L.	1	+	+	-	PRUNELLA tp.	G, W, D	self-heal
Stachys cf. sylvatica L.	-	+	-	-		W, S	hedge woundwort
Lamium sp.	1	-	-	-		? Da	dead-nettle
Galeopsis tetrahit/speciosa	+	+	-	-		Da	hemp-nettle
Glechoma hederacea L.	-	+	-	-		W, G, D	gound ivy
Plantago major L.	1	-	+	+	PLANTAGO MAJOR tp.	Da	hoary plantain
-	-	-	+	2	PLANTAGO LANCEOLATA		ribwort plantain
-	-	-	+	-	CAMPANULACEAE		bellflowers
Galium palustre L.	1	-	+	1	GALIUM tp.	M	marsh bedstraw
Galium aparine L.	1	-	"	"	" "	S, Da	sticky willy
Sambucus nigra L.	9	+	+	3	SAMBUCUS NIGRA	S, W, D.	elder
-	-	-	-	+	VIBURNUM	S	guelder rose
-	-	-	+	-	LONICERA	S, W	honeysuckle
-	-	-	+	+	DIPSACACEAE	M, G.	scabiouses
Anthemis cotula L.	-	+	+	+	COMPOSITAE (T)	Da	stinking mayweed
Achillea ptarmica L.	1	-	"	"	" "	M, wet G	sneezewort
Chrysanthemum segetum L.	2	+	"	"	" "	Da (acid)	corn marigold
-	-	-	+	1	ARTEMISIA	D	mugwort
Arctium sp.	3	+	+	-	ARCTIUM tp.	G, S, D.	burdock
Cirsium spp.	2	+	+	+	CIRSIUM/CARDUUS tp.		thistles
Centaurea cyanus	-	+	+	-	CENTAUREA CYANUS	Da	cornflower
-	-	-	+	+	CENTAUREA NIGRA tp.	G	knapweed
Leontodon taraxacoides (Vill.) Merat	2	+	+	1	COMPOSITAE (L)	G	hairy hawkbit
Picris echioides L.	1	-	"	"	" "	G, S.	bristly ox-tongue
Sonchus palustris L.	-	+	"	"	" "	M	marsh sow-thistle
Sonchus oleraceus L.	1	-	"	"	" "	Da	sow-thistle
Sonchus asper (L.) Hill	+	+	"	"	" "	Da	sow-thistle
Alisma sp.	1	+	+	-	ALISMATACEAE	A, B.	water-plantain
Potamogeton cf. natans L.	1	+	+	1	POTAMOGETONACEAE	A	pondweed
Juncus sp.	+	-	-	-			rush
Lemma sp.	1	-	-	-			duckweed
Sparganium cf. erectum L.	-	+	+	-	SPARGANIUM/TYPHA ANGUSTIFOLIA		bur-reed
Sparganium cf. minimum Wallr.	-	+	"	"	" "		small bur-reed
Eleocharis uniglumis/palustris	1	+	+	+	CYPERACEAE	M	spike-rush
Scirpus tabernaemontani(CC Gmel.) Palla	1	+	"	"	" "	M, B	'glaucous bulrush'
Isolepis setacea L	-	+	"	"	" "	M, wet G	'bristle scirpus'
Carex pseudocyperus L.	13	+	"	"	" "	M, B	'cyperus sedge'
Carex cf. pallescens	1	-	"	"	" "	damp W	'pale sedge'
Carex cf. hirta L.	1	-	"	"	" "	M, wet G	hammer sedge
Carex nigra group (? C. acuta)	5	-	"	"	" "	B, wet G	? tufted sedge
Carex ovalis Good.	2	1	"	"	" "	G	oval sedge
? Poa sp.	2	+	+	21	GRAMINEAE	G etc.	? meadow-grass
Glyceria cf. maxima (Hartm.) Holmberg	1	+	"	"	" "	A	reed-grass
Triticum sp. (charred grain)	-	+	+	7	CEREALIA tp.	C	wheat
Triticum sp. (chaff fragments)	o+	-	"	"	" "	C	wheat
Avena sp. (charred grain)	-	+	"	"	" "	C	oat
Cerealia (culm node , pericarp)	+	-	"	"	" "	C	cereals

Habitat indications: A = aquatic, M = marsh, B = bankside, G = grassland, W = woodland, D = disturbed ground, Da = disturbed arable land, C = cultivated crop, S = scrub.


COWICK MOAT POLLEN DIAGRAM 2
drawn by James Greig, 1985
GRASSLAND
ARABLE
VARIOUS
DEPTH (CM)
Gramineae
Compositae (L)
Centaurea nigra tp.
Plantago lanceolata
Sanguisorba offic.
Trifolium repens
Ranunculus
Cerealia
Centaurea cyanus
Cannabaceae
Linum usitatissimum
Papaver
Cirsium/Carduus
Arctium, Artemisia (x)
Compositae (T)
Succisa tp.
Galium tp.
Campanulaceae
Plantago major
Prunella tp.
Mentha tp.
Scrophularia
Solanum dulcamara
Primulaceae
Urtica
Rumex
Epilobium
Geranium tp.
Chenopodiaceae
Potentilla tp.
Caryophyllaceae
Cruciferae
spores
POLLEN SUM
C-3
C-2
C-1
398
268
395
P370
324
494
342
P 346
P 284
P252
346
% POLLEN SUM
x TRIFOLIUM PRATENSE
x ARTEMISIA
ML MEDICAGO LUPULINA T.
VF VICIA FABA
S SPERGULA
P POLYPODIUM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GRASSLAND
ARABLE
VARIOUS
DEPTH (CM)
Gramineae
Compositae (L)
Centaurea nigra tp.
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Sanguisorba offic.
Trifolium repens
Ranunculus
Cerealia
Centaurea cyanus
Cannabaceae
Linum usitatissimum
Papaver
Cirsium/Carduus
Arctium, Artemisia (x)
Compositae (T)
Succisa tp.
Galium tp.
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Plantago major
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Scrophularia
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POLLEN SUM
C-3
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398
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P 346
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% POLLEN SUM
x TRIFOLIUM PRATENSE
x ARTEMISIA
ML MEDICAGO LUPULINA T.
VF VICIA FABA
S SPERGULA
P POLYPODIUM

Cowick moat

drawn by James Greig 1985