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Ancient Monuments Laboratory
Report 40/90

THE PREHISTORIC RIVERSIDE SETTLEMENT AT RUNNYMEDE, SURREY: THE BOTANICAL STORY (FINAL REPORT).

J R A Greig

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The Middle-Late Neolithic and Late Bronze Age botanical evidence is very good from this waterlogged material, which was rich in plant remains. There are waterlogged and charred macrofossils and an extensive pollen flora too. The flora indicates the following main vegetation groups: aquatic plants, both bankside and marshland ones which are likely to have been growing close by or at the river's edge. There are many weeds, especially those which grow on light sandy soils. There are grassland plants with habitat indications ranging from damp fen or marshy grassland through to dry chalk grassland, the latter possibly having been brought to the site with animal fodder. Woodland includes alder/oak forest and some scrub around the site, and lime/elm wildwood on drier land, reduced by the late Bronze Age. There is some pollen evidence of heathland. Crop plants were emmer and spelt wheats, a little barley and some rye, flax and perhaps peas. These may have been brought there from a distance.

This report supercedes AML Report 193/87.

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THE MIDDLE NEOLITHIC AND LATE BRONZE AGE RIVERSIDE SETTLEMENT AT RUNNYMEDE BRIDGE, BERKSHIRE; THE BOTANICAL STORY. THE FINAL REPORT

James Greig

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INTRODUCTION

The site at Runnymede is one of the richest prehistoric sites available to environmental archaeologists, both in abundance and variety of remains, and this is particularly so with the plant remains. The work on these has proved very time-consuming and had to be fitted in during gaps in other work rather than being all done at once. The amount of material was so great that only a little work has been possible in some areas, notably the identification of buds and mosses. This report is presented as the best possible one that could be completed in the time available, rather than as the ideal one.

LABORATORY PROCESSING

Macrofossils

The WF1b and SS samples of 10-20 litres were sieved, floated with paraffin and sorted for beetle remains at the Ancient Monuments Laboratory by I. Tyers under the supervision of M. Girling. Plant remains were also sorted out from the beetle floats and stored in alcohol. The non-floating residues were bagged. At Birmingham, these residues were then re-sieved into fractions of >4 mm, 4-1 mm and 1-0.3 mm and were sorted for seeds; there were significant numbers of seeds in the residues because the paraffin flotation is a rather inefficient process for separating plant remains.

The bulk samples that were not processed at the Ancient Monuments Laboratory were subsampled, usually 3 or 5 litres. These botanical macrofossil samples were dispersed in water and the plant and other organic material separated by 'washing over'. The dispersed sediment was swirled in a bowl of water to help separate the lighter organic remains from the heavier sand and to wash them over into a sieve. The organic material was re-sieved on meshes of 4, 1 and 0.3 mm, giving size fractions of >4mm, 4-1 mm and 1-0.3 mm for convenience of sorting, and the inorganic residue dried and then floated in water to recover anything organic that had not washed over the first time. Sorting was done in alcohol (and subsequently in water) under a microscope at about 10x magnification, much of the work being efficiently done by Hilary Sale-Harding. The sorts were stored in ethanol to await identification.

Macrofossil identification was done using a reference collection and other published identification criteria (especially those of K-H. Knörzer), and second opinions were sought from colleagues when necessary. Lisa Moffett helped greatly with cereal identifications.

The macrofossil results from the the layer/context samples are given in Table 1, from the SS1 and WF1b profiles in Table 2, and ecological groupings in Table 3. The plant records are given in taxonomic order according to the British Flora (Clapham et al. (1962).

Sample list (new sample designations; old ones in brackets)

F6 L4 SE (F6 L10 SE): charcoal tip in LBA pit. 1 litre (whole sample), small subsample taken for pollen analysis. Charcoal saved from >4mm fraction. Other fractions sorted, dried, and floated for charcoal - very little sediment in >4mm. No residue check as it all floated.

F15 L1: LBA clay-lined bowl 3 litres sieved. Good amount in each fraction, burnt clay but negligible charcoal. All 4-1mm. fraction sorted. Residue and unsorted material kept. Bronze Fragments.

L 8 (L10): LBA layer in river channel. 5 litres sieved. No waterlogged seeds seen, only a few charred grains. All the 4-1mm fraction sorted. Residues and unsorted portion kept.

L32-37 (L12): LBA layer on occupation surface. 5 litres sieved, no plant remains seen, so very small amount sorted. residue and unsorted portion kept.

F205 (L25 F205): Neolithic channel sediment. 4 litres sieved (whole of the sample). A very few seeds, so only about 20% sorted. Residue and unsorted portion kept.

L41 (L25 8N/6E): Neolithic channel sediment. 0.5 litre (whole sample), subsampled for pollen. No plant material in >4mm fraction, and very little in other size fractions. All 4-1mm fraction sorted, residue and unsorted fractions kept.

L20 (35). About 10 litres sieved

L24 (A6 L33) 5 litres sieved on 5.6, 4, 1, and 0.3 mm meshes. >5.6: fair quantity of chert stones, many fire cracked. Volumes of the size fractions - 5.6-4.0: 35 ml, wood and charcoal. 4.0-1.0: 1150 ml. 1.0-0.3: 600 ml.

L14/20 (L40, F130): LBA layer in river channel. 1.5 litres, sample taken for pollen analysis.

L19 (L45): LBA midden deposits in edge of river channel. Midden soil, organics, sand, burnt stone etc. 5 litres soaked in water and then washed on 0.3mm mesh, then sieved on 5.6, 1 and 0.3mm meshes. Sand remained behind.

Layers: L24 (33), L 20 (35), 40. About 10 litres were sieved, with subsamples for pollen.

general comments
50-55cm wood charcoal and animal bone, practically no plant remains.

170-175 sediment worked by water so twigs worn and charcoal lumps were rounded. There was much tufa.

Pollen

The SS 1 profile samples came from those originally collected for mollusc analysis (and some for mineral analysis), thanks to Maureen Girling's very thorough work on the site. The pollen samples were taken from the inside of lumps of sediment where possible. The sediment was completely dried out by the time the pollen samples were prepared, although pollen was still well-preserved. It is now known that pollen samples should be kept in cold storage for best results.

The WF1b profile pollen samples were taken from the aluminium monolith boxes of 250 x 100 x 100 mm) collected on site by James Greig. These were subsampled at 2cm intervals with a cork borer, from cleaned-back faces of sediment. At first samples every 16cm were prepared, then every 8 cm. It was intended to prepare a closely sampled pollen diagram, but since the results are uniform and time was short, the WF1b results were left with a wide interval between samples.

The archaeological layer pollen sub-samples were saved from lumps of the bulk macrofossil samples. Time was too short to count these.

The samples were prepared and counted using usual methods of treatment with hydrofluoric acid, stained with safranin and mounted with glycerine jelly. Pollen preservation was good in some cases, but the SS1 samples were from old dry sediment and it was hard to find sufficient pollen for a count. No pollen was found to be preserved above 32cm in WF1b.

The identification was done using a reference collection, to which taxa were added to fill necessary gaps. In some cases it was not possible, for example to prepare pollen of Dianthus armeria to check whether this would be identified among the Caryophyllaceae pollen. It would have been normal to have scanned the pollen slides and checked a number of identifications, but there was too little time for such sophistication.

The results are drawn out in pollen diagrams (in two parts each) covering the SS1 column (Figure 1) and the WF1b columns (Figure 2). The pollen diagrams are drawn with taxa grouped ecologically (forest, woods, open land etc.) and within the groups in taxonomic order (right to left). The pollen percentages are based on a pollen sum of tree + shrub pollen less Alnus and Corylus, and dry land herb pollen (insofar as it can be identified). These are drawn in black bars. The pollen taxa not in the pollen sum are drawn in white bars, such as wetland plants and spores. The tree pollen percentages for both columns are drawn in Figure 3. Taxa not drawn on the pollen diagrams are listed in Table 4.

Some of the possible plant communities interpreted from the pollen and macrofossil results are represented diagrammatically in Fig 4.

RESULTS

Introduction to interpretation: European plant communities

Interpretation is based on modern European ecological results. This is just a framework for discussion, and does not suggest that the kinds of vegetation seen now are the same as those that existed in prehistoric times. The main source of this phytosociological data is that of Ellenberg (1982) which has been used here rather than the English translation (Ellenberg 1988). Ellenberg's community arrangement (1979) is used here for Table 3. Although based upon central European vegetation of the present day and the recent past, it also applies (although less directly) to the vegetation of adjoining regions such as the British Isles. It is the most useful published source of such data and is already widely used and understood, so this arrangement is adopted here. Although vegetation classifications have been done in Britain, very little has been published recently and it is difficult to relate to established arrangements such as Ellenberg's. The broad divisions of vegetation, however, are very similar to the familiar ones described by Tansley (1968) on the basis of earlier, more descriptive ecology.

The phytosociological arrangement divides vegetation according to an hierarchical scheme with names and numbers. There are eight vegetational groups; the ones relevant to Runnymede are: (1) freshwater and marshland plants, (3) weeds and wasteland plants, (5) semi-natural heathlands and grasslands (6) woodland understory herbs and shrubs and (8) broadleaved woodlands and forests. The groups are subdivided into Classes with names ending in -etea, which are used in the discussion of the Runnymede results. These Classes are in turn divided into Orders with names ending in -etalia, and further into Associations with names ending in -ion, although these fine details are not used here. Crops are not classified, so they are discussed after their weeds (Group 3). The discussion follows this order of the plant communities.

GROUP 1 FRESH WATER VEGETATION (Plate 1)

Aquatic plants (Can be compared with Classes 1.3-1.4 today)

There is a fairly rich aquatic macrofossil flora with Ranunculus subgenus Batrachium (water crowfoot), Nymphaea alba (white water-lily), Nuphar cf. lutea (yellow water-lily), Myriophyllum verticillatum (millfoil), Zannichellia palustris (horned pondweed) and Potamogetonaceae (pondweeds) present, all present in both the Neolithic SS1 (except Zannichellia) and Bronze Age WF1b material. There is a substantial pollen record of Potamogeton type in the pollen diagrams (Figs 1 & 2). These would now be found growing as part of the Potamogetonetalia (1.3) (pondweed vegetation) with rooted rather than fully floating water plants, in still or slow-moving water (Haslam et al. 1982). Ceratophyllum sp. (hornwort) was only found in the layer samples and now belongs in 1.4 Littorelletea, characteristic of slightly stiller water. These plants would probably have grown in the river, by the edge. There are no signs of free floating plants here to suggest that the water was completely still, as in an oxbow. The plant community is a natural one that is virtually unaffected by direct human activities apart from pollution, although the river environment seems to have differed from today's (see below). The prehistoric plant community represented by these remains is then likely to been similar to the present-day one.

The remains of these plants could have come from the vegetation of shallow water deposited near where it grew, or could have floated downstream and been deposited in flood debris on the riverbank, so this part of the deposit could be largely natural in origin. This evidence corresponds with that from the beetles and molluscs which feed upon these aquatic plants and others indicating slowly flowing water, evidently the conditions under which the material collected. In the WF1b pollen diagram the record of Potamogeton type (pondweeds) becomes rare above 80 cm, which might be an indication of less aquatic (or less regularly flooded) conditions.

Waterside plants (1.5 Phragmitetea) (Plate 2)

These are also well represented, by records of Ranunculus cf. lingua (greater spearwort), Rorippa sp. (pennycress), Nasturtium officinale (watercress), cf. Apium nodiflorum (fool's watercress), Oenanthe aquatica (water dropwort), Lycopus europaeus (gypsywort), Alisma sp. (water plantain), Sagittaria sagittifolia (arrow head), Sparganium sp. (bur-reed) macrofossils and Sparganium/Typha angustifolia type pollen, Iris pseudacorus, (yellow flag), Schoenoplectus (club-rush), Eleocharis sp., (spike-rush), and various species of Carex (sedges).

This vegetation is characteristic of permanently wet places such as riverbanks and pond edges, called "bankside" (Lambrick & Robinson 1979). It would have grown by the body of water in which the aquatic plants lived, along the riverside. Sparganium can also be found growing in deeper water with a fairly strong current (Haslam et al. 1982) but generally waterside vegetation acts to slow a river almost to a standstill. Although some of the plants can be used, this flora also seem to represent part of the natural vegetation of the river edge by the site. The remains would then have accumulated directly from plants growing on the spot, or brought with flood debris. There is a corresponding fauna of beetles which feed upon these plants, or which live on wet riverbanks. The Neolithic flora consists of only 5 taxa compared with some 20 is the Bronze Age samples. It is possible that forest clearance and farming in the Bronze Age led to more soil erosion into the river, and hence muddier riverbank conditions with more habitats for such taxa.

Marsh vegetation (1.7)

Three taxa, Ranunculus flammula (lesser spearwort), Hydrocotyle vulgaris (pennywort) and Menyanthes trifoliata (bogbean) were identified from macrofossils, and a grain of pollen from pennywort. There was a trace of pollen of Pedicularis type (lousewort), although surprisingly no macrofossils even though they do occur on other sites. Occasional leaves and spores of Sphagnum were also found. The modern vegetation with such taxa is usually characteristic of wetlands which are either acidic mires or base-rich fens. Menyanthes and Sphagnum moss are most characteristic of oligotrophic (nutrient-poor, acid) conditions, the other taxa representing a more mesotrophic (neutral) environment. Of course, the soils under the wildwood may well have been acid to neutral brown forest soils, allowing such communities as this to flourish in boggy land. The calcareous sediment may only have been exposed through erosion following forest clearance and farming, leading to the formation of more base-rich soils and the spread of the calcicolous flora. It is not clear whether there could have been suitable habitats right on the site, or if this might represent something brought from elsewhere, perhaps with Sphagnum moss. Other marshy vegetation is represented by some of the weed vegetation.

Discussion of wetland vegetation

The wetland vegetation detailed above (apart from the damp woodland discussed below under class 8), is fairly well represented at Runnymede. These aquatic and wetland plant communities represented by these remains are perhaps the "natural background" vegetation at Runnymede which would have been associated with the river, its edge and banks and perhaps with other damp places. The vegetation appears to have been similar to that which grows in and near rivers today, (apart from the recent additions to our flora). There is no direct sign of human influence in this wetland assemblage.

Aquatic and wetland vegetation is much less in evidence in some of the archaeological layers, so for example in the midden (L19) only Rorippa cf. palustris, Nasturtium officinale and Schoenoplectus lacustris were present. It is hard to tell whether the midden was there because it was on (relatively) dry land, or whether it just accumulated material from the dry land.

Group 3 WEED AND WASTELAND VEGETATION (Plate 3)

These communities characteristically consist of plants with requirements for rather open conditions, and colonise bare ground well. In contrast to the comparatively well-defined wetland habitats and plant communities described above, weedy vegetation is very hard to classify into communities, because it is by nature transient. The weed taxa from Runnymede are hard to group even before one starts to think about the differences between prehistoric and modern weed communities, which are likely to be very great. They are very well represented by seed records because weeds are productive, but hardly at all in the pollen diagrams because of the low level of identification possible (Caryophyllaceae) as well as low pollen dispersal.

Wet springs (3.1)
Montia fontana spp. chondrosperma (blinks) found in the midden (L19) grows on wet stony ground, although it is so insignificant that the plant is not often seen although the seeds are not uncommonly found in archaeological material. Isolepis setacea is also in this group.

Muddy waterside vegetation (3.2)
Ranunculus sceleratus (celery-leaved crowfoot) which is characteristic of rather muddy conditions, often found now in ditches. Only a few seeds were found, in one layer sample, in one SS and one WF1b column sample. The small amount of evidence for muddy bank vegetation suggests that these were not the general conditions, but rather sandy or gravelly, as argued above.

Spring-germinating annual weeds (3.3)
These plants grow on dry land, in contrast to the ones already discussed. They are especially common on disturbed ground such as in gardens, as well as in fields. The Neolithic flora contains a number of weeds in this modern vegetation grouping, such as Brassica rapa ssp. campestris (wild turnip) (exact identity suggested by Mark Robinson), Solanum nigrum (black nightshade), Linaria vulgaris (yellow toadflax) and Sonchus asper (spiny sow-thistle).

The Bronze Age weed flora is much greater, bringing the number of taxa up to 24, and the seeds represented are sometimes very abundant, for example those of Stellaria media, Chenopodium cf. album and Urtica urens which occur in hundreds. Some of the taxa grow best on light sandy soils, for example Fumaria (fumitory) and Thlaspi (penny-cress), while others are simply common weeds which have remained ubiquitous. The sediment from the site was certainly very light and sandy, and it may at least partly represent the state of the prehistoric soil. The weeds may have grown on the sand and gravel banks thrown up by the changing river course (see sediment report), on disturbed ground in and around the occupied site, or they could have been brought in with plant materials. Another weed, Hyoscyamus niger (henbane) is notably thermophilous, and much less common now than its fossil record would suggest.

Possible cornfield weeds (3.4 Secalietea)
A few weeds are now classified as being more associated with autumn-sown

cornfields than with gardens and open land, although the difference between 3.3 and 3.4 is very blurred, especially in the present oceanic climate of Britain, where many weeds succeed from germinations throughout much of the winter. The Neolithic evidence for this class is small, including Aphanes arvensis, A. microcarpa and Valerianella locusta. In the Bronze Age floras typical taxa are Papaver rhoeas/dubium/lecoqii (poppy), P. argemone (long prickly-headed poppy), Aphanes arvensis (parsley piert), and Polygonum convolvulus (bindweed). Also found was cf. Anagallis (possible pimpernel) and Valerianella locusta (corn salad). There are very few pollen records that can be attributed to this class, for reasons of poor pollen dispersal and identifiability. Many of the taxa grow particularly on sandy or light soils.

The weed seeds that are found in a charred state may provide clues that those particular weeds may have grown among cereal crops and then have been processed together with cereals and finally burnt with the remains, leaving a few charred fragments in the ashes. This is not an infallible rule, since all sorts of things get burnt, and conversely, not quite all the cereal remains were uncharred. However, among the potential cornfield weeds on modern ecological grounds, Vicia cf. hirsuta, Polygonum convolvulus (black bindweed) Galium sp. (cleavers), and Tripleurospermum inodorum were found charred. P. convolvulus was especially abundant in the midden L19. Charred Bromus (brome) was also present in many of the samples, with traces of Avena and Secale which would appear to have been weeds, although their seeds may well have been gathered up and consumed together with those of the crops themselves. Lapsana communis (nipplewort) which was found charred, may also have grown as a cornfield weed in the prehistoric period although not now classified as such (see below). Bindweed was already growing on site during excavation and the other plants grow on open ground, so their presence does not necessarily indicate cereal cultivation.

CROP PLANTS (Plates 4-9)

The cultivated plants and other useful ones are a prime feature of interest in a site such as this. One of the first pieces of environmental work on site was to mix some sediment in a bucket of water and scoop off charred grain, thus proving its abundance in the layers being excavated. The waterlogging of the site and its plant remains has provided charred cereal remains in an exceptional state of preservation, which Lisa Moffett helped identify. Some of the cereals are partly charred, and there are some waterlogged remains as well. Only a fairly small proportion of the cereal remains are exactly identifiable, notably well-preserved chaff.

No identifiable charred cereals have been found among the Neolithic material so far, but since only a trace of cereal pollen was present, there were probably not many cereals around. There was a possible charred pea.

The Late Bronze Age material contained enough good chaff and rachis material to show clearly that Triticum spelta (spelt wheat) and T. dicoccum (emmer wheat) were both present in a ratio of about 3:1 according to the identifiable chaff. A small amount of Hordeum vulgare (barley; possibly both two and six row) was found. Avena (oats) and Secale cereale (rye), were both present in trace quantities, although it is not clear whether these last two were more than weedy contaminants in the wheat and barley crops. There was a slight cereal pollen record throughout the waterfront profile, with moderate amounts at 128 cm. The coincidence of macrofossil (at ; 120 cm.) with pollen evidence of cereals shows that this pollen, at least, represents what was brought to the site with grain or straw for processing there. The smaller pollen records may represent transport of pollen by wind and water from nearby cornfields with less brought in with corn and straw. Linum usitatissimum (flax) seed and capsule was also present in the Bronze Age material, but no pollen (production is extremely low).

The crops would have been grown on well-drained open land. One can speculate that if the occupied site was in a woodland clearing, the fields were probably close by so that they could be protected against domestic and wild animals, and birds. After harvest the crops would have been stored and then processed in small batches when needed. Products such as cereal straw may have had a number of uses, including perhaps the feeding of stock.

The cereals could have been sown in autumn or in spring, but here is no indication of either season. Emmer and spelt are normally autumn sown, indeed this is the natural season for wild plants to sow themselves. Some barley is spring sown, flax always, and the spring sowing allows more land to be cleared and sown, or land occupied by failed winter crops to be recultivated and reused.

The flax straw was probably used for making linen fibre but linseed may have been eaten as well. Peas and beans may have been grown but have failed to become preserved.

Nitrophilous perennial weeds (3.5 Artemisietalia)

There are also records of a number of perennial weeds such as *Conium maculatum* (hemlock), *Urtica dioica* (stinging nettle), *Artemisia* (mugwort) (from pollen alone) which is assumed to represent *A. vulgaris* and is mainly in the middle part of the waterfront pollen diagram, and species of *Arctium* (burdock) and *Cirsium* (thistle). In the past, members of this community may have persisted in arable land, such as *Artemisia* and the *Cirsium* thistles where their roots may have proved hard to destroy with the tools available, such as ard ploughs. Other taxa grow in rather damp and shady places, such as valley scrub, for example *Rubus idaeus* (raspberry). *Eupatorium cannabinum* (hemp agrimony) may be responsible for the *Anthemis* type pollen records (mainly in WF1) since it is the only plant with a significant macrofossil record that produces this pollen type. *Lapsana communis* (nipplewort) occurs here, although its consistent occurrence in charred grain assemblages here and elsewhere (Knörzer 1971) shows that it was probably another weed of cornfields. This vegetation may have grown on the site as well, particularly if areas were abandoned for more than a year or so. The wild raspberries, and the brambles as well, may have been gathered as food although there is no supporting evidence- the excrement found was apparently all dog-turds rather than from humans, so there is no direct evidence of human diet.

Pathways and trodden places (3.7) (Plates 10-11)

There is evidence of trodden vegetation in the plants of class 3.7 (Plantaginetea), such as *Potentilla anserina* (silverweed) and *P. reptans* (creeping cinquefoil), also *Plantago major* (great plantain). *P. anserina* is a coloniser of sandy river-beaches, and would therefore have been part of the natural vegetation.

GROUP 5 HEATHLAND AND GRASSLAND VEGETATION

Heathland

There is a single Neolithic pollen record of Ericales (heathers etc.) and rather more from the Bronze Age WF1 diagram and a single heather-feeding weevil was found, slight evidence for heathland. The soils on site were light and sandy (shown by the preferences of some of the weed taxa) although at the same time somewhat base-rich (all pollen samples were strongly calcareous) certainly at river level, and it is not clear whether they would easily become podzolised to heathland after forest clearance and erosion. The sandy and gravelly soils of the Bagshot Beds which easily support heathland, outcrop about 1.5 km from Runnymede, and Tertiary sandstone was brought to the site. Heathland products might have been brought to the site in various forms and the pollen could easily have blown in the wind.

Grasslands

There are a few taxa which occur in a large range of different kinds of grasslands, such as the species of Leontodon (hawkbit). These could partly be the source of the Compositae (L) pollen which is abundant, especially in the WF1b pollen diagram. A large Compositae (L) record is occasionally found in archaeological deposits and there is often very little corresponding macrofossil record. Sometimes the pollen is simply over-represented by differential preservation (which could be the case with the upper part of the WF1b pollen diagram. Otherwise the record seems associated with other evidence for short grassland (Greig 1982a).

Sample L33 contained two seeds of Dianthus armeria (Deptford Pink) which is a plant of rather dry grassland on light soils. It is rare and decreasing in Britain now, but has recently been found at various other sites.

Dry acid grassland and heathland (5.1)

There were some macrofossil records of plants of rather acid, sandy soils such as Potentilla erecta (tormentil) and Rumex acetosella (sorrel). The pollen record of Polygala (milkwort) is included here, as some species grow in this habitat. Centaurea nigra (knapweed) pollen is included here, although in Britain it grows widely in neutral grasslands.

Dry Chalk grasslands (Class 5.3)

There is a small chalk grassland flora from the Neolithic material, represented by Plantago media (hoary plantain) and more specifically by Sanguisorba minor (small burnet). The Bronze Age flora is larger, with macrofossils of Medicago lupulina (black medick) and Scabiosa columbaria (small scabious) as well.

Grasslands on moist and wet soils (Class 5.4) (Plate 12)
There is plenty of evidence of grassland even in the Neolithic; some represents a distinctly damp habitat, with Caltha (kingcup) pollen, Hypericum cf. tetrapterum (square-stemmed St John's Wort), Lychnis flos-cuculi (ragged robin) and Filipendula ulmaria (meadowsweet). The abundant Gramineae pollen could represent grassland, or aquatic grasses such as Phragmites (reed) which do not leave a good macrofossil record.

The Bronze Age material has an increased flora with Thalictrum flavum (meadow rue) and Sanguisorba officinalis (greater burnet).

These signs of grasslands have affinities with the water meadows of the Thames such as Picksey (or Pixey) Mead near Oxford, although with only two of the taxa present in this fossil record compared with the large flora of the modern meadows. At Runnymede it is uncertain whether such grassland could have grown in a natural plant community along the damp river edge, or whether it was affected by human occupation and especially by grazing as seems likely. Further comparison is possible in the mollusc faunas, since Mark Robinson has found that these can also be characteristic of different kinds of grassland (Robinson 1988); certainly many of the Picksey Mead taxa are also present at Runnymede, while the molluscs more characteristic of grazed pasture on Port Meadow such as Anisus leucostoma, are uncommon, suggesting more meadow-like than pasture-like conditions at Runnymede.

Grassland on less obviously damp ground seems to be indicated by the Neolithic records of Ranunculus cf. acris (meadow buttercup), pollen of Trifolium repens and T. pratense (white and red clovers), of Plantago lanceolata (ribwort plantain) and seeds of Prunella vulgaris (self-heal). The Rhinanthus type pollen record seems to be confirmed by a Bronze Age macrofossil; otherwise pollen of Scrophulariaceae can be hard to identify exactly. There is also a Bronze Age record of Taraxacum (dandelion). The records of Centaurea nigra type pollen (knapweed) also probably belong in this mesotrophic grassland assemblage.

Beetles that feed on grass roots and on members of the Leguminosae are also present, providing additional evidence for this vegetation.

Meadows and pastures were traditionally mainly in the part of the river valley which regularly became flooded in winter and was therefore unsuitable for growing autumn-sown cereals. In the early Neolithic, use was made of leaf fodder (Welten 1967), but later in the prehistoric period grassy material was used which could have been obtained in woodlands and on the grasslands and heathlands developing on abandoned fields. In fact grazing pressure may have been an important factor in preventing forest regeneration. This certainly seems to have been the case at Runnymede where the signs of grasslands increase with time.

Part of the (marshier) grassland could have been growing on site or very close by. Grassland seeds and pollen could also have been brought in to the site with fodder (if it was gathered) or with dung (for which there is substantial beetle evidence). Perhaps the stock was brought in to the site from time to time, perhaps for safety, and dropped dung from grazing pastures that were some distance away. Whether this assemblage represents managed grasslands as early as the Bronze Age is a matter of debate (Greig 1988 , Robinson 1988), but one can certainly say that some of the characteristic taxa of our present-day traditional meadow and pasture plant communities were present then.

GROUP 6 WOODLAND HERBS AND UNDERSTORY

There are only a few records; _Hypericum_ cf. _perforatum_ (common St John's wort) occurs in woodland clearings (but also in grassland). _Fragaria vesca_ (wild strawberry) also grows in woodlands, but may well have been gathered for food. _Torilis japonica_ (upright hedge parsley) grows in woods and along hedgerows now, also in open places. _Sambucus nigra_ (elder) also grows under woods as a _natural_ habitat. It has a strong association with places enriched by human occupation, and the continuous pollen record in the upper part of the SS pollen diagram might be a sign that the site became overgrown after Neolithic occupation.

Group 8 **FOREST, WOODLAND, SCRUB**

Alder carr (8.2)

In the SS1 profile there are plentiful macrofossil records of _Alnus_ (alder), with seeds and catkins present, as well as a substantial pollen record throughout averaging 66% land pollen sum. In the Wf1b profile there is much less pollen, usually less than 10% L.P.S. There were also records of alder-feeding insects. The records of Salix (willow) pollen could represent willows growing along the riverbank.

Alder carr seems to be one of the most widespread kinds of vegetation on the site, although some of the evidence could have been borne there by the river. There is a considerable difference between the amount of evidence of alder carr in the Neolithic, and its reduced but still important presence in the Late Bronze Age sequence. This may be the result of a general decrease in alder carr, or just a change in the way it is represented, which would be affected by local clearance, and the amounts of other plant materials deposited at the site.

Broad-leaved woodland and forest (8.4)

The Middle Neolithic woodland and forest is rather poorly represented in the macrofossil record with a little Rhamnus catharticus, Crataegus, a few buds and many unidentified twigs in the sediment. The wood report also provides evidence for a range of readily available wood, apart from Tilia which is not readily preserved.

The pollen diagram (Figs 1 and 2) gives a somewhat different picture, and particularly the tree pollen diagram (Fig 3) which shows tree and shrub pollen (except Alnus and Corylus) averaging 56% total dry land pollen. This was mainly of Quercus (oak), Ulmus (elm) and Tilia (lime), with some Fraxinus (ash), Pinus (pine), Betula (birch), Acer (maple) and Hedera (ivy), and traces of pollen of Crataegus type (hawthorn) and Taxus (yew). This represents fairly forested conditions, which are also indicated by the old forest beetle fauna.

When one calculates the tree cover represented by these pollen records according to Andersen (1970), one gets the following figures, with and without alder:

percentage tree cover indicated by pollen (Andersen 1970), with <u>Alnus</u> included in the pollen sum (+Alnus), and excluded (-Alnus).

SS1-130cm

	number grains	factor	corr. nr.	% cover +Alnus	% cover -Alnus	
Pinus	23	x4	92	16	20	pine
Tilia	20	x8	160	28	36	lime
Acer	1	x8	8	1	2	maple
Ulmus	9	x4	36	6	8	elm
Betula	5	x1	5	1	1	birch
Alnus	124	x1	124	22	-	alder
Quercus	106	x1	106	19	24	oak
Fraxinus	5	x8	40	7	9	ash
totals	293		607	100	100	

Thus the main woodland tree is lime. If one considers it grew in a lime/elm/oak mixture on good soils it would have been responsible for about 40% of the total tree cover, and the alder/oak would have occupied the damper parts of the river valley. Even considering all the woodland together (including alder) the forest cover is still mainly of lime. Corylus (hazel) has not been included, but the large amounts of pollen show that it was certainly present as a forest understory. Other taxa such as Crataegus (haw) and Taxus (yew) are not allowed for in the calculation, and their pollen is likely to be very poorly represented, yet they may even have been locally dominant because there is a pollen and macrofossil record.

The representation of trees and shrubs by pollen, seeds and buds/twigs is very different according to each kind of evidence and is also hard to interpret in terms of forest composition, cover and nearness to the site. Further evidence of afforestation comes from the snails in terrestrial group "B" which are somewhat more abundant in the lower part of the SS1 sequence (See Evans 0000).

Bronze Age (Plates 13, 14)

In WF1b there is a modest macrofossil record of trees and shrubs. Seeds or fruiotstones of Taxus baccata (yew), Rhamnus catharticus (purging buckthorn), Cornus sanguinea (dogwood), Crataegus sp. (hawthorn), Prunus spinosa (blackthorn), Sorbus cf. torminalis (possible wild service) were found. Philippa Tomlinson identified a number of buds and bud-scales of Quercus sp. (oak) and one of cf. Betula (birch).

Pollen records add _Ulmus_ (elm), _Tilia_ (lime), _Fraxinus_ (ash), _Fagus_ (beech), _Betula_ (birch), _Acer_ (maple), and _Pinus_ (pine). There was no _Hedera_ (ivy). The diagram showing the percentage of tree pollen (Fig 3) shows a great reduction in the Bronze Age WF1b column results compared with those in the Neolithic sequence from the SS column.

The arrival of _Fagus_ (beech) pollen represents an important horizon; it was not found at all in SS1, but in there are scattered records in WF1b. Beech spread across Europe during the prehistoric period, perhaps by invading cleared land or secondary woodland and maybe also favoured by warmer winters (Huntley 1988) reaching Britain by the Bronze or Iron Age. In Britain there are few sites so far showing signs of large amounts of beech woods.

Some evidence of wooded conditions is also provided by the macrofossil records of woodland understory plants such as _Rosa_ sp. (wild rose), and _Humulus lupulus_ (hop) and herbs such as _Stellaria_ cf. _nemorum_ (wood stitchwort), _Moehringia trinervia_ (three-veined sandwort), _Mercurialis perennis_ (dog's mercury) and _Glechoma hederacea_ (ground ivy).

The pollen records seem to show that there was much less forest in the immediate surroundings of the site at Runnymede by the late Bronze Age. Even _Quercus_ (oak) pollen does not reach 10%, and the other records are much less, with _Tilia_ and _Ulmus_ discontinuous, but this is enough to represent fairly abundant woodland.

The signs of woodland in the flora are not enough to represent a forested surrounding to the site, although there does seem to have been woodland close by, with enough oak wood to provide the timber for the piles on the site. The presence of buckthorn, dogwood, blackthorn and hawthorn could represent either scrub, or the propagation of these shrubs for fencing or hedging, botanical evidence of which has been found at other sites from the neolithic onwards (Groenman-van Waateringe 1978); stock raising at Runnymede does seem to have been important, judging from Geraldine Done's report on the animal bones; hedges may have been necessary to confine such animals. There is also a hint of woodland in the find of possible Neolithic beaver. The beetle evidence is of great reduction in woodland cover (see Robinson 000), while the woodland/shade indicating molluscs, are somewhat more abundant in WF1b from 140 cm to the bottom (see Evans

000).

Some of the pollen wuld have arrived by natural dispersal with wind and water. The area represented by these pollen results (pollen catchment) is probably fairly local since the deposit seems to have been like a slowly running stream, or pool catching flood debris. The catchment would extend upstream along the river some way, although this might be a uniform environment. The riverbank vegetation such as the alder carr, to be especially well-represented. Pollen may also have been brought in to the site with plant materials, and this is shown by the peaks of cereal pollen together with cereal macrofossils. It is debatable how much pollen of non riverside vegetation such as the dry calcareous grassland could have arrived naturally or not; the pollen of taxa from this habitat such as Sanguisorba minor is found in "natural" riverside deposits also.

Change at Runnymede; comparing the Neolithic with the Bronze Age

The pollen results from the Neolithic SS1 profile shows substantial signs of forest in the Late Neolithic. Although the sequence is rather uniform, there is a slight increase in Tilia , Pinus, Hedera and Polypodium towards the top which could be a sign of forest re-growth matching the reduction in signs of an open environment noted by Mark Robinson (0000). The great drop in tree pollen between the Neolithic and the Bronze Age is shown in Figure 3. The Bronze Age WF1b pollen diagram seems to consist of more or less a single pollen assemblage. It shows that by the late Bronze Age all woodland was much reduced compared with the Neolithic, and signs of grasslands and other open vegetation are correspondingly greater, although some of this could be the result of pollen from imported material. Even the ubiquitous alder and hazel are reduced to a fraction of their former percentages. Beech appears in the Bronze Age, and ivy disappears, while among herbs there are many more records, partly because there were some well-preserved pollen samples that allowed large counts.

Although there is a clear change in sediment type, from peaty and shelly sand to alluvium, the plant remains in it seem to have remained essentially the same.

DISCUSSION

Aquatic and wetland vegetation, alluviation

The site at Anslow's Cottages in the Kennet valley (Carruthers, forthcoming) may have some parallels to Runnymede. The old river channel there had a similar (although smaller) aquatic and wetland flora to the Runnymede results. Similar floras have been identified from several apparently unoccupied river deposits), for example the Bronze Age to Iron Age remains from the banks of the river at Bidford upon Avon, Warwickshire dated to 2270bp +/- 90 bp (HAR 3069) (Greig 1987, Osborne, 1988), the Middle Bronze Age river channel deposit (dated to 3360 +/- 80 bp) at Little Waltham, Essex (Peglar & Wilson 1978), river valley deposits dated to 3750 +/- 110 bp (HAR 3954) at Beckford, Worcestershire (Greig & Colledge . 1988). In contrast, a Late Bronze Age ditch at Anslow's Cottages contained plants of still water not found at Runnymede, such as _Callitriche_ (starwort), _Glyceria_ (flote grass) and _Veronica_ (Carruthers, forthcoming). Few of these plants were found at other sites.

The river environments in which the aquatic and wetland grew were greatly affected by sedimentary changes there. The Mesolithic landscape seems to have been in an equilibrium, with stable vegetation, mainly of forest- the "wildwood" - maintaining stable soils and sediments. When Neolithic farming and forest clearance began, the balance was disturbed and erosion started, very gradually at first. The human activities would have started soil wasl down into hollows and valleys, thus causing alluvial deposits to start forming, with a spread of aquatic and wetland vegetation into the newly created habitat; such a mechanism appears to have caused the deposits at West Heath Spa to start accumulating in the early (pre-elm decline) Neolithic (Greig 1990). The present deposits at Runnymede do not cover the Mesolithic-Neolithic change. The Neolithic sequence has plenty of evidence of aquatic and waterside plants, of which Ceratophyllum was only found then. This flora does not appear to have developed much by the Bronze Age, as there are then only three more taxa, _Hydrocotyle vulgaris_, _Zannichellia palustris_ and _Iris pseudacorus_.

Other organic deposits without obvious signs of occupation which have been found along the river Avon in Warwickshire (Shotton 1978, Osborne 1988) and Little Waltham (Peglar & Wilson 1978), and they have been exposed in the valleys of even quite small streams, as at Beckford (Greig & Colledge 1988). One might have thought of these organic river sediments as natural oxbow fills or similar, but their date range and open-landscape faunas and floras seem to connect them with human activity and with the consequent soil erosion and the build-up of sediment in rivers caused by it (Shotton 1978). The biological remains in these organic deposits contain evidence of an occupied landscape, even if not of direct occupation itself. The alluvium seems to have hindered drainage so that these organic sediments could collect and then in turn become buried and thus preserved. At these sites, the local wetland floras are as might be expected from riverbank and marshland, so they tell us little about the occupied landscape. The only sign of human activities may be an indirect one in the formation of such deposits as a side-effect of erosion.

It is a little hard to visualise the appearance of these rivers in prehistoric times since almost all watercourses are now carefully controlled by the water authorities. The results from the Avon suggest a river running clean and shallow, over a stony bed in contrast to the modern turbid stream with a muddy bottom, flowing between and constricted by walls of alluvium. Of course these floras of damp habitats do not represent the usual human environment of the Bronze Age - a more typical surrounding is shown by the results from the Wilsford shaft, a deep well sunk into chalkland in which remains of very few wetland plants were found (Robinson 1989).

Weed floras and occupation

The Middle Neolithic weed and wayside flora from Runnymede, although small in number of taxa, is actually large compared with the weed floras found at most other sites, and contains <u>Valerianella locusta</u>, which does not seem to have been found at other Neolithic sites. The typical range of cornfield weeds, judging by those found charred at The Stumble, consists of <u>Vicia</u> sp., Chenopodiaceae, <u>Polygonum aviculare</u>, <u>Rumex</u> sp., and <u>Galium aparine</u> (Murphy 1989).

In the Late Bronze Age levels of Runnymede many of the summer annual weeds that are still common now are present, and most of these have also been found at other Bronze Age sites with good waterlogged weed floras such as those frtom the well at Wilsford and ditches at Berinsfield, Oxfordshire (Robinson 1989, forthcoming). A peculiar absence at Runnymede compared with most of the other sites app eared to be <u>Tripleurospermum inodorum</u> (scentless mayweed), although it does not seem to preserve well waterlogged. It was finally found charred in L45. Two cornfield weeds, <u>Lithospermum arvense</u> (corn gromwell) and <u>Sherardia arvensis</u> (field madder) (at Berinsfield) were not found at Runnymede. The former was found at Black Patch, near Uckfield, East Sussex (Hinton 1982) and the latter was found charred at Abingdon (Jones 1978). At Potterne there were also found Capsella bursa-pastoris (shepherd's purse), Lithospermum arvense (corn gromwell), Veronica hederifolia (ivy-leaved speedwell) and Odontites verna (red Bartsia) (Straker forthcoming), which were not found at Runnymede and are perhaps connected with heavier soils at Potterne. Ranunculus parviflorus (small-flowered buttercup) is present at a number of Bronze Age sites as well as at Runnymede, for example at Little Waltham (Peglar & Wilson 1978). It may have grown as a cornfield weed on light dry soils.

Weeds characteristic of light soils have been found at many of these Bronze Age sites in addition to Runnymede, and may indicate that light rather sandy soils were being cultivated. At Wilsford Fumaria, (fumitory) and Arenaria (sandwort) were found (Robinson 1989), at Potterne mineralised Thlaspi (penny-cress) and Spergula (spurrey) (Carruthers 1986). Light soils are certainly easier to cultivate, and being "warm" might have caused fewer problems with the introduction of originally near Eastern crops into a region with a rather oceanic climate, albeit possibly in an "optimum". Prehistoric occupation was soil-determined to some extent, as the distribution of the Bandkeramik in Europe seems to follow loess soils, and the quality of the soils may have affected the occupation of the landscape of Britain as well. It is sometimes difficult to study this as wholesale erosion has removed or truncated many sites, and the subsequent alluviation has then buried many others, such as Runnymede itself.

The actual weed communities in the Bronze Age probably differed from those of later times - "completely different from the crop arable weed communities of modern phytosociology" (Willerding 1988) - not only because the flora was smaller then (lacking many of the typical "winter corn weeds"), but because the possible habitats offered by the activities of people and animals may have been peculiar to the Bronze Age or at least to the prehistoric period. Thus Lapsana communis (nipplewort) seems to have been a cornfield weed then (Knörzer 1971). If charring is a guide to the weeds most likely to have been burnt along with crop processing waste, the following found as charred remains in the Wilsford Shaft may indicate some of the cornfield weeds typical of the Bronze Age: Fumaria, Stellaria media, Chenopodium, Plantago lanceolata, Galium aparine, Tripleurospermum, and Bromus (Robinson 1989). The different weed flora, compared with now, means that the balance of competition between the various taxa in this smaller prehistoric flora would have been different (Willerding 1988).

Many of the weeds could flourish wherever the ground was disturbed and enriched both in fields and around a settlement or where livestock walked to drink at the river, or where they were penned, perhaps forming combinations not seen much now. It is not hard to imagine suitable habitats for weeds right on the eyot where the site stood.

Even the Bronze Age organic deposits with little apparent sign of actual occupation on the spot contained signs of such a large weed flora of arable weeds such as at Little Waltham (Peglar & Wilson 1978), Beckford (Greig & Colledge 1988) and Bidford upon Avon (Greig 1987). These may perhaps represent the occupied nature of the landscape as a whole, even though there was no evidence of actual settlement at the sites apart from some charred grain at Beckford. The seeds and pollen from the weeds could have become preserved in a number of ways: either the arable dry land was close enough to the rivers and marshes for the seeds to have been deposited there by natural dispersal, or all the marshes had enough human activity to transport material containing these seeds there, or the material was borne downstream by the river and deposited by floods. Perhaps all three factors played a part.

The weed floras are also interesting in that they have provided earlier records of a number of plants hitherto only recorded from Iron Age or later deposits; at Runnymede the presence of Conium maculatum (hemlock) is early. Previously too little was known about such prehistoric vegetation, and the few plants recorded from Bronze Age sites said as much about the scarcity of information as about the limited nature of the floras themselves. Now these rich sites have been investigated, the true extent of the Bronze Age flora can be appreciated, although there is always room for surprises in future results.

Cultivated plants

Before the Runnymede excavation the evidence of Neolithic and Bronze Age crops was so slight that there was scarcely any further information than that provided by Jessen and Helbæk (1944). More recently there has been a flood of good data, mainly on the Bronze Age.

The Neolithic levels of Runnymede have so far only contributed two possible peas to our knowledge of crops at this time. More evidence has been compiled by Moffett and others (1989) showing that emmer, bread wheat and barley were certainly present during the Neolithic, but the actual remains found were very scarce at many of these sites - wild food plants such as crab apples and hazel nuts are often more in evidence than cereals, emphasising the process of transition between hunting/gathering and farming. From the Neolithic site at The Stumble, Peter Murphy has identified charred remains of mainly emmer wheat, with a little naked barley and a trace of einkorn, along with hazel nuts, sloe stones and unidentifiable root fragments that may represent food remains (Murphy 1989).

The Late Bronze Age crops at Runnymede and other sites are principally emmer and spelt wheats, barley, and flax; The main newcomer is spelt, and the status of this was uncertain until recently; it was not recorded at Abingdon (Jones 1978), and only tentatively at West Row, Mildenhall, Suffolk (Murphy 1983), and there were only traces found at Black Patch (Hinton 1982). Spelt has been found at Potterne (Carruthers 1986), from Lofts Farm, Maldon, Essex (Murphy in Brown 1988) and at the Early Bronze Age site at West Row Fen, Suffolk (Murphy 1983, Martin & Murphy 1988). Vanessa Straker also found bread wheat at Potterne, identified from rachis internodes, but found few other Bronze Age records for it (Straker forthcoming). Neither peas, beans, nor their pollen were detected in Bronze Age Runnymede although they may simply not have been preserved. Finds of these legumes are generally rare, although there were several Vicia faba found at Black Patch (Hinton 1982). The rye and oat appears to be from weeds rather than crops, although together with Bromus, they may have been consumed together with the cultivated grains.

The spread of prehistoric farming across Europe is shown by pie diagrams of the crops found at the sites (Körber-Grohne 1981). This shows that emmer, barley and flax are the usual crops found preserved (as at Runnymede). Spelt does occur, although less frequently and mainly in the sub-alpine lakeshore settlements. Bread wheat (not found at Runnymede) is also found in some places. There are occasional finds of einkorn, peas and beans (and sometimes bitter vetch and lentils too) at these continental sites. Only a few peas and beans seem to have been found so far in

Britain, and of these only a possible pea at Runnymede.

Other foodplants

The remains of edible fruit of wild plants including bramble, raspberry, wild strawberry, sloe, possible service tree and elder, were found at Runnymede although there is no proof that any of these were actually eaten. Rose hips and hops could also have been used. There are generally less signs of this floral element at other sites, although Prunus and Crataegus were found at Wilsford, hazel at West Row.

Heathland

The single Neolithic pollen record of Ericales from the Runnymede SS column represents slight signs of heathland, perhaps rather distant, compared with the much greater signs from West Heath Spa just after the elm decline forest clearance, also probably about Middle Neolithic in date. This is probably site related since West Heath Spa is up on the sandy Bagshot Table while the other Thames riverside sites show rather little sign of heathland filtering through the alder carr, as might be expected (Greig 1990). Evidently the early farming on some of the lighter soils started podzolisation, and perhaps continued grazing of such land prevented its regeneration. Traces of heathland development are to be seen in a number of pollen diagrams, and soil pollen analyses show this especially well since the acid soils in which pollen is preserved are also those on which heathland could easily develop: results from Ascot dated to around 1500bc (1480+/- 70bc, HAR 478) show well-developed heathland there (Bradley & Keith-Lucas 1975). Further afield, Bronze Age heath development in a suitable area is shown especially strongly on Dartmoor (Beckett 1981).

Grasslands

It is difficult to compare the plants that are now considered as grassland indicators from the few Neolithic floras apart from Runnymede, because there is too little information on these very undifferentiated communities. By the Middle Neolithic the indications are of large openings in the forest, and developing grasslands, shown mainly by the Runnymede SS1 results.

The signs of grassland floras are very much better represented in some Bronze Age remains. The insect remains often provide further evidence of grassland in the form of large dung-beetle faunas which show that pasture (or meadow or indeed undifferentiated grassland) was probably present, notably at Wilsford, but also at Bidford, Pilgrim Lock and elsewhere (Osborne 1982, 1988), and also beetles that feed upon grassland plants as well.

Similar sign of chalk grassland to those found at Runnymede came from the Wilsford Shaft for example Sanguisorba minor, and Scabiosa columbaria, together with a number of additional taxa such as Agrimonia eupatoria and cf. Gentianella (Robinson 1989). Agrimonia was present at Potterne, otherwise there was little grassland evidence there, as would be expected from a mainly charred flora (Straker forthcoming). The fen grassland taxa such as Thalictrum flavum and Sanguisorba officinalis have not yet been found at other sites. Only a few possible grassland plants have been found at other Bronze Age sites.

The development of these semi-natural grassland communities seems to have taken place in the Middle Neolithic - Bronze Age periods of agricultural expansion especially the latter (Greig 1988). By the Bronze Age the signs of this rather open and grassy landscape are very clearly shown at a number of sites by pollen, seeds, beetles (dung beetles and root feeders) and molluscs which adds up to some convincing evidence. Such an open landscape seems to have existed at least around settlements in the valleys of rivers such as the Thames and the Warwickshire Avon. Of course the results do not show anything of the proportion of arable land to grassland, but it is likely that the farming was of a mixed nature since there is evidence of both.

It is hard to tell whether these grasslands were managed, and how. The presence of tall herbs suggests that there was not just closely-cropped pasture, but taller more meadow-like vegetation as well. It is very hard to prove that the Bronze Age people were using such grassland for hay, just as their Neolithic ancestors had gathered tree branches for leaf hay as in Switzerland (Welten 1967). Since there is evidence of fairly sophisticated woodland management fairly early in the prehistoric period (Rackham 1980), perhaps grasslands were similarly well-organised at this early stage (Greig 1988). Others are more cautious (Robinson 1988).

Trees and woodland

Wildwood

At Runnymede, the Middle Neolithic SS column has an average 56% tree pollen and an old forest beetle fauna, perhaps a little surprising for an apparently occupied site to have so much evidence of forest. Other pollen sites also show signs of forest with *Tilia*, *Ulmus* and *Quercus* as well as carr with *Alnus* in the London region. For example at Hampstead Heath there was 95% tree pollen (dry land pollen sum without *Alnus* or *Corylus*) down to 25-50% after the elm decline (Greig 1990, Devoy 1979). This forest is not so well represented in the macrofossil evidence, thus only a few *Betula* seeds were found at Hampstead heath, despite the abundant pollen evidence. However, the main wildwood component, *Tilia*, was identified among the macrofossils at The Stumble (Murphy 1989).

Wildwood evidence has been found at some Bronze Age sites: The amount of tree pollen in the Later Bronze Age WF1b river channel deposits at Runnymede, containing 5%-15% tree pollen, can be compared with 17% at Bidford and 15% at Little Waltham 15% when calculated on the same basis. This points to considerable deforestation along such river valleys by this stage. One does need to be very careful, though, because a site may give signs of *relative* deforestation in reduction of tree pollen, this may have been influenced by factors such as changes in pollen dispersal caused by thinning of the forest canopy, or even inwash of pollen from disturbed soils. One needs evidence from many sources, particularly beetles. It is very hard to interpret in terms of *absolute* deforestation and say how much forest remained near a particular site, such as Runnymede. One can instead generalise and say that the dry land along river valleys seems to have been utilised during the Bronze Age, however, hence the signs of a rather open landscape with grassland, dung beetles, weeds and perhaps a trace of cereals. The levels of tree pollen suggest that they had, as might be expected, less wildwood remaining in the immediate surroundings of the sites than was the case at less occupied places such as West Heath Spa, and indeed many of the pollen sites. At Bournville, Birmingham there was a find of lime pollen in deposits *underneath* a Bronze Age mound together with a lime feeding beetle *Ernoporus caucasicus* found by Peter Osborne which shows the presence of lime forest before Bronze Age occupation there (Greig 1982b). Thus Bronze Age Runnymede was probably quite deforested if compared with the early to mid-Neolithic, but rather forested compared with later times.Of the little macrofossil evidence for forest, acorn cups were found at Anslow's Cottages (Carruthers forthcoming), and *Quercus* wood with possible Tilia fruits at Little Waltham (Peglar & Wilson 1978).

Secondary woodland

In the remains from Neolithic sites secondary woodland and scrub is generally better represented than wildwood, especially products likely to have been gathered from Malus sylvestris, Prunus spinosa, Crataegus species and Corylus avellana. The first three are very poorly represented in pollen records.

The Bronze Age sites usually have more signs of secondary woodland and scrub than the Neolithic ones. This can be seen in pollen records with the appearance of Acer (maple) pollen at Hampstead Heath, and maple macrofossils were found in the old river channel at Anslow's Cottages (Carruthers, forthcoming). At Hampstead there were slight increases in pollen from other secondary woodland trees such as Fraxinus. Macrofossil remains at most sites include thorny scrub plants such as Prunus spinosa, Crataegus and occasionally others. These may have become more frequent either because they were protected from grazing by their thorns, or they were grown specially as hedging to contain stock, an idea advanced by Groenman-van Waateringe (1978) for Neolithic sites onwards. Even at Wilsford, a chalkland region thought to have been deforested early on, there were macrofossils of Prunus, Crataegus and Corylus still present (Robinson 1989). Rhamnus catharticus and Taxus baccata (yew) seem to have only been found at Runnymede so far. It is not clear whether the seeds found on site are the result of a particular use of yew, or because it grew close by.

Alder woods

The other probable primary woodland at Runnymede seems to have been alder carr (with oak) growing along the river banks. Alnus (alder) pollen rises before 8100 bp in the lower Thames valley and together with oak accounts for most of the tree pollen there (Devoy 1979). In the probable Early Neolithic sequence at West Heath Spa alder is fairly low, around 10%, but it rises steeply with the elm decline, apparently spreading with forest clearance. At Runnymede, alder is very well represented both from pollen, macrofossils, wood and a beetle which suggests that it grew on the spot or upstream, probably in a carr together with Quercus (oak) and Salix (willow), part of the natural or semi-natural riverside vegetation. In the Middle Neolithic SS column there is an average 66% Alnus pollen, and any spread in alder would probably already have taken place.

The Bronze Age sequence at Runnymede has much less alder pollen, perhaps the result of the settlement of the site. The Little Waltham river channel had considerable evidence of alder pollen and macrofossils, likewise Anslow's Cottages, and at West Row, Mildenhall, but at Bidford-on-Avon there was only a trace of alder pollen.

Beechwoods

At West Heath Spa, Fagus (beech), starts just after the initial forest clearance/ elm decline. The Neolithic results from Runnymede have no sign of beech, and nor to the Early-Mid Bronze Age Little Waltham results. The Late Bronze Age Runnymede results have scattered beech pollen records although no macrofossils or beechwood were found. Beech seems to have been a coloniser of suitable land already cleared of wildwood, and the river valleys are unlikely to have provided a good habitat. There are few pollen diagrams with substantial beech pollen records like those from Denmark, apart from the one from Epping Forest (Baker et al. 1978). Beech's rather poor pollen record makes it hard to tell when it did arrive from the scattered grains; originally this was thought to be in the Iron Age, but now it seems to be before then.

Holly woods

Ilex (holly) also formed woods and was used for wood-pasture (Rackham 1980). These appear after elm decline clearance (the same time as heath development) at West Heath Spa (Greig 1990). Holly seems to have been present in single grain amounts during the Atlantic according to evidence from some Thames-side sites (Devoy 1979). There does not seem to have been much at Runnymede, where the sole evidence was some holly wood, but poor pollen and seed dispersal seems to cause holly to be generally under-represented. Holly shows more evidence from acid sandy sites, and therefore features in soil pollen analyses such as Ascot (Bradley & Keith-Lucas 1975) as well as from many other such results (Dimbleby 1985). Holly was found at West Row Mildenhall, (Murphy 1983).

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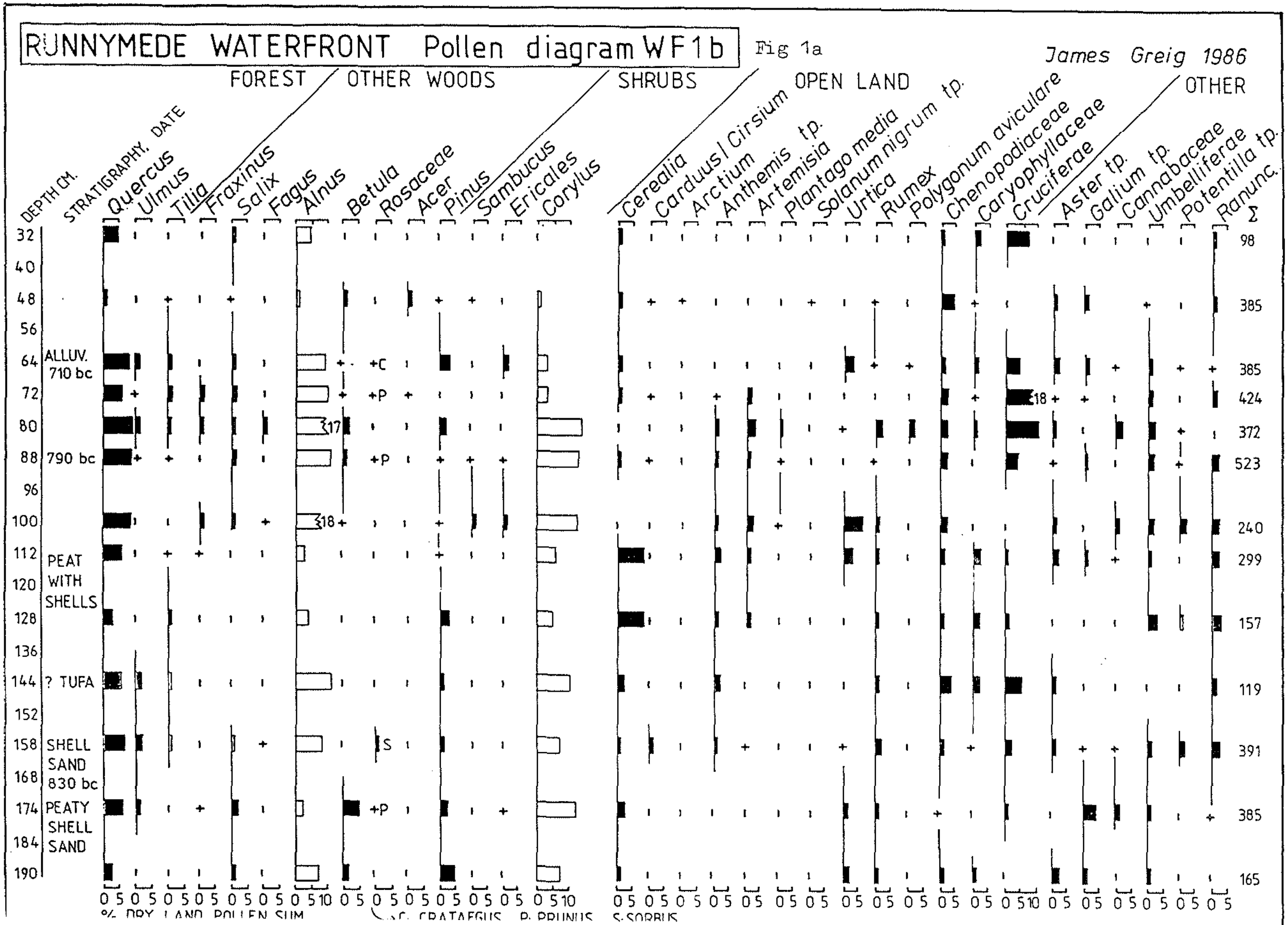
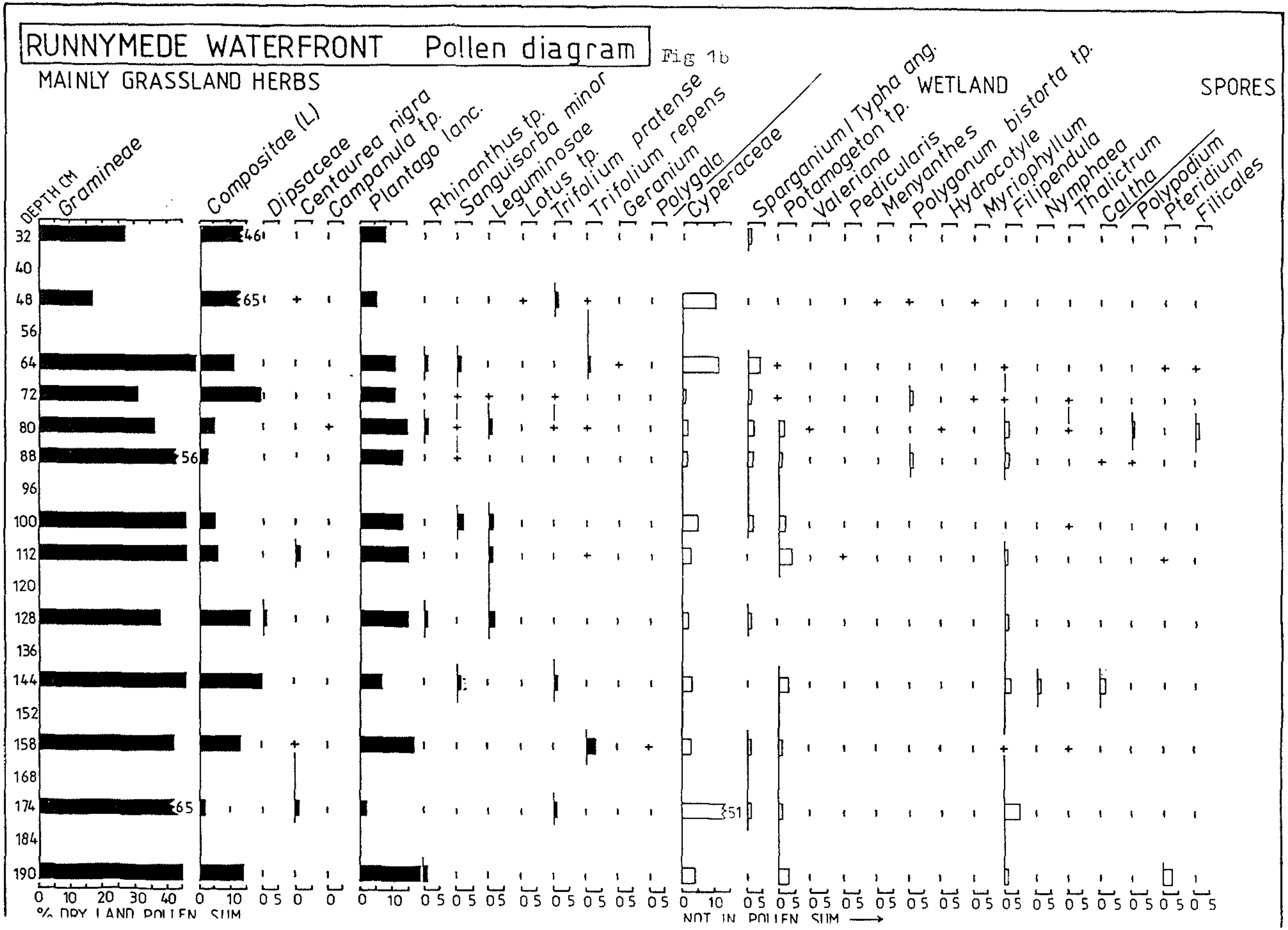
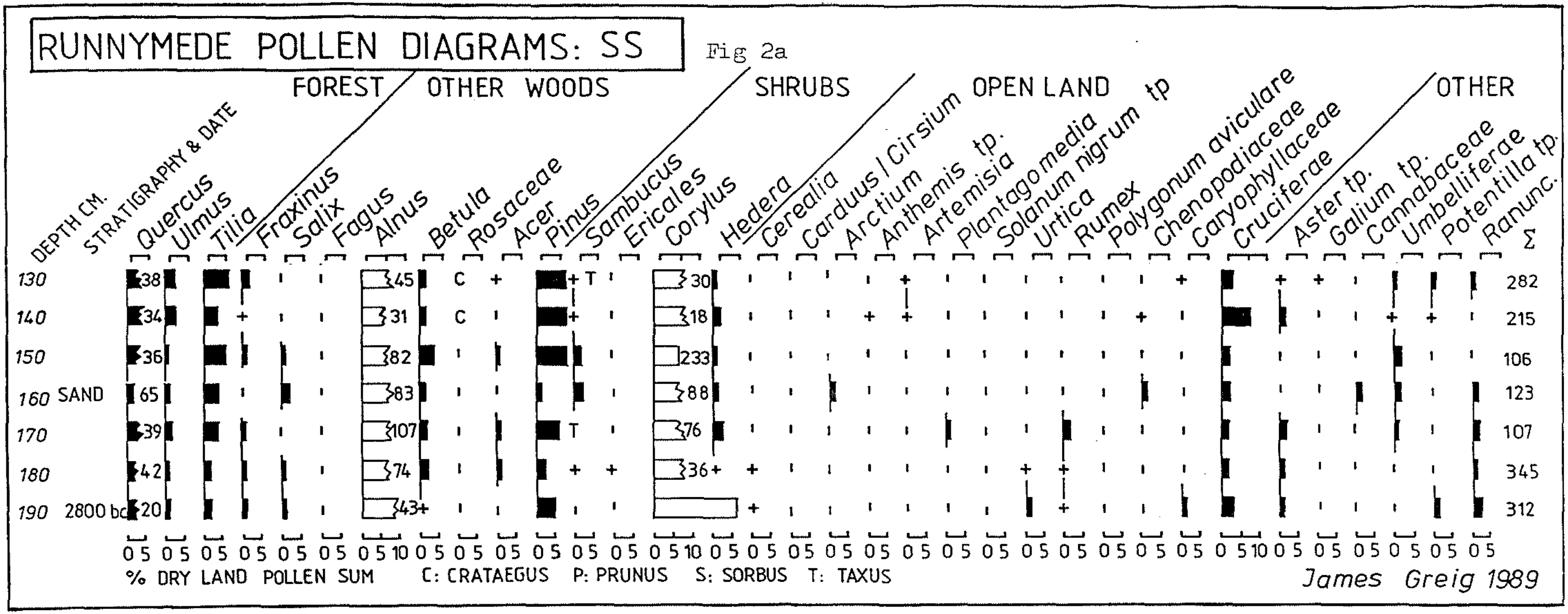
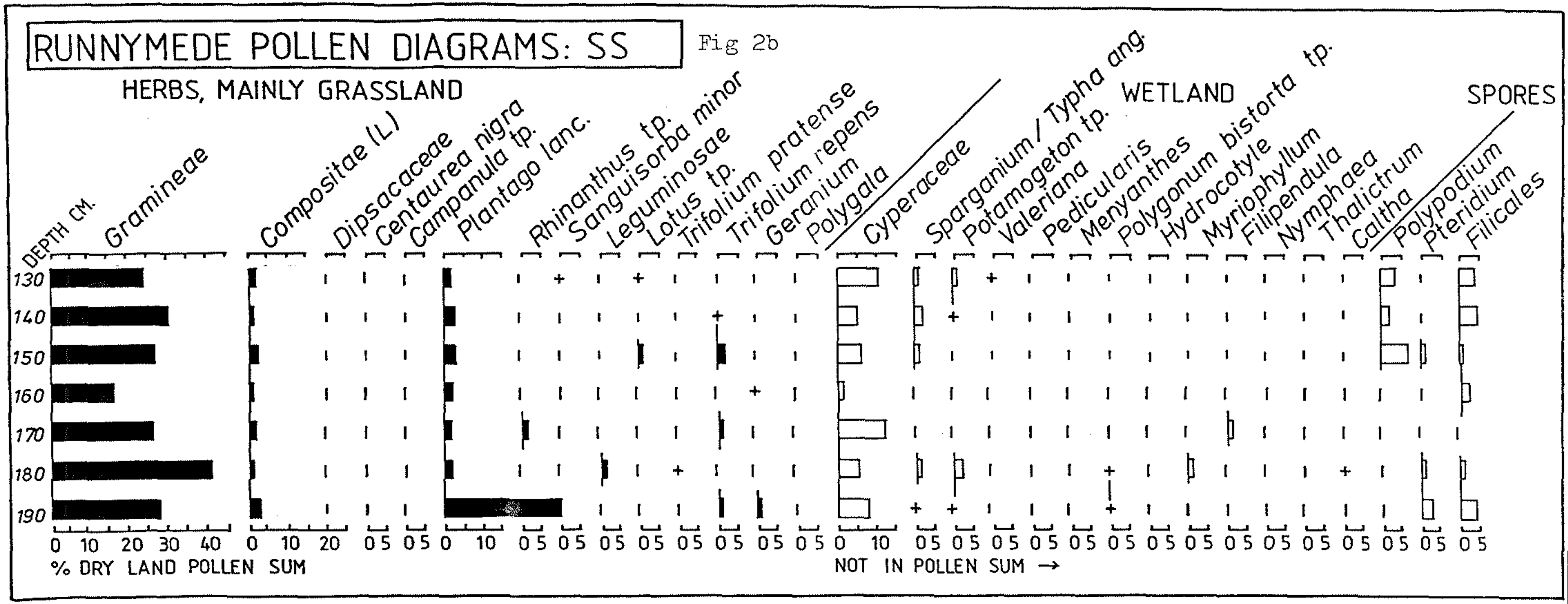
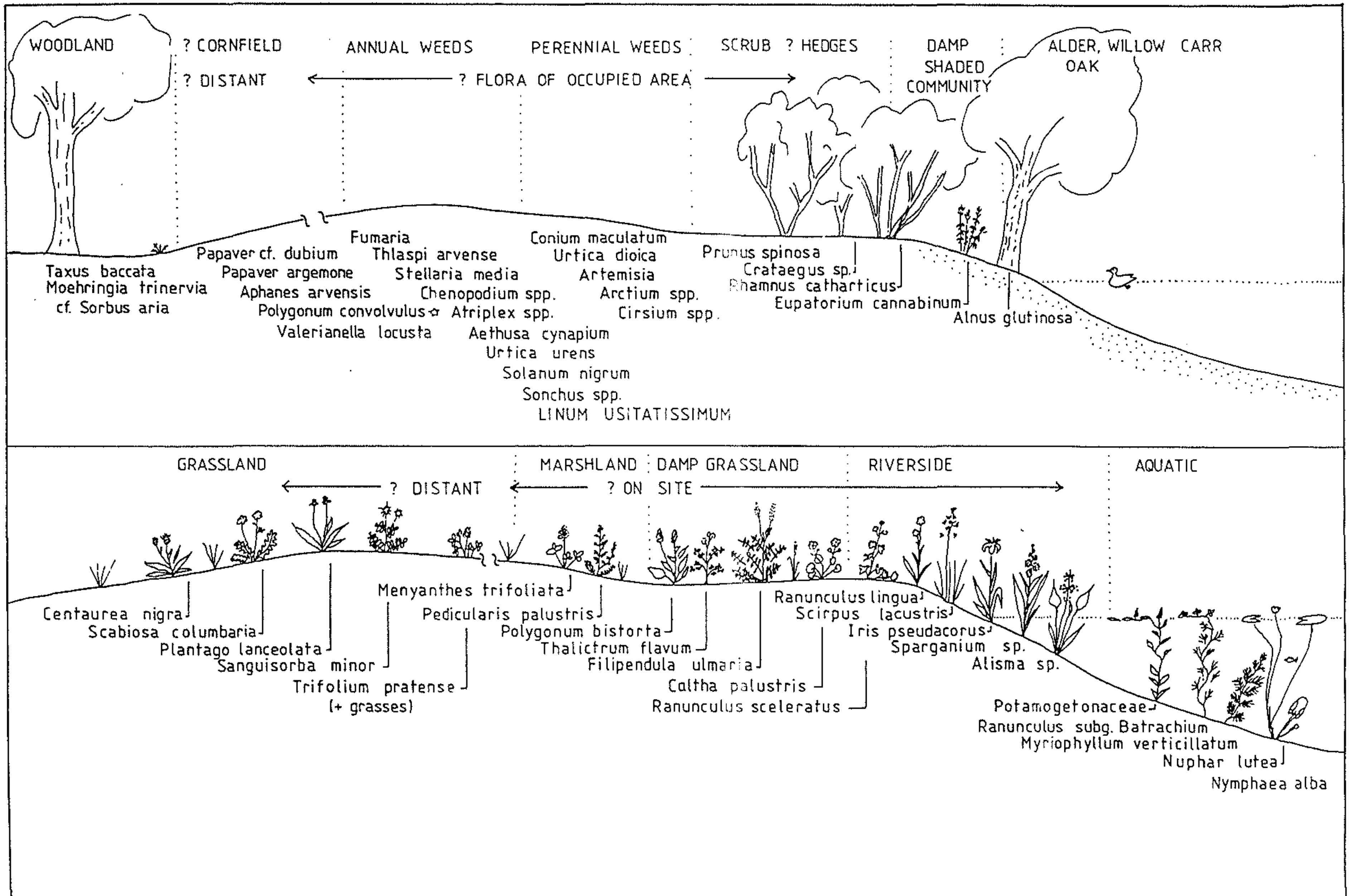


RUNNYMEDE WATERFRONT Pollen diagram WF1b
Fig 1a
James Greig 1986
FOREST
OTHER WOODS
SHRUBS
OPEN LAND
OTHER
DEPTH CM.
STRATIGRAPHY, DATE
Quercus
Ulmus
Tilia
Fraxinus
Salix
Fagus
Alnus
Betula
Rosaceae
Acer
Pinus
Sambucus
Ericales
Corylus
Cerealia
Carduus/Cirsium
Arctium
Anthemis tp.
Artemisia
Plantago media
Solanum nigrum tp.
Urtica
Rumex
Polygonum aviculare
Chenopodiaceae
Caryophyllaceae
Cruciferae
Aster tp.
Galium tp.
Cannabaceae
Umbelliferae
Potentilla tp.
Ranunc.
Σ
ALLUV.
710 bc
790 bc
PEAT
WITH
SHELLS
? TUFA
SHELL
SAND
830 bc
PEATY
SHELL
SAND
% DRY LAND POLLEN SUM
C: CRATAEGUS P: PRUNUS S: SORBUS


RUNNYMEDE WATERFRONT Pollen diagram
Fig 1b
MAINLY GRASSLAND HERBS
WETLAND
SPORES
DEPTH CM
Gramineae
Compositae (L)
Dipsaceae
Centaurea nigra
Campanula tp.
Plantago lanc.
Rhinanthus tp.
Sanguisorba minor
Leguminosae
Lotus tp.
Trifolium pratense
Trifolium repens
Geranium
Polygala
Cyperaceae
Sparganium / Typha ang.
Potamogeton tp.
Valeriana
Pedicularis
Menyanthes
Polygonum bistorta tp.
Hydrocotyle
Myriophyllum
Filipendula
Nymphaea
Thalictrum
Caltha
Polypodium
Pteridium
Filicales
32
40
48
56
64
72
80
88
96
100
112
120
128
136
144
152
158
168
174
184
190
46
65
56
65
51
% DRY LAND POLLEN SUM
NOT IN POLLEN SUM


RUNNYMEDE POLLEN DIAGRAMS: SS
Fig 2a
FOREST
OTHER WOODS
SHRUBS
OPEN LAND
OTHER
DEPTH CM.
STRATIGRAPHY & DATE
Quercus
Ulmus
Tilia
Fraxinus
Salix
Fagus
Alnus
Betula
Rosaceae
Acer
Pinus
Sambucus
Ericales
Corylus
Hedera
Cerealia
Carduus / Cirsium
Arctium
Anthemis tp.
Artemisia
Plantago media
Solanum nigrum tp
Urtica
Rumex
Polygonum aviculare
Chenopodiaceae
Caryophyllaceae
Cruciferae
Aster tp.
Galium tp.
Cannabaceae
Umbelliferae
Potentilla tp.
Ranunc.
Σ
130
140
150
160 SAND
170
180
190 2800 bc
282
215
106
123
107
345
312
% DRY LAND POLLEN SUM
C: CRATAEGUS P: PRUNUS S: SORBUS T: TAXUS
James Greig 1989


RUNNYMEDE POLLEN DIAGRAMS: SS
Fig 2b
HERBS, MAINLY GRASSLAND
WETLAND
SPORES
DEPTH CM.
Gramineae
Compositae (L)
Dipsacaceae
Centaurea nigra
Campanula tp.
Plantago lanc.
Rhinanthus tp.
Sanguisorba minor
Leguminosae
Lotus tp.
Trifolium pratense
Trifolium repens
Geranium
Polygala
Cyperaceae
Sparganium / Typha ang.
Potamogeton tp.
Valeriana
Pedicularis
Menyanthes
Polygonum bistorta tp.
Hydrocotyle
Myriophyllum
Filipendula
Nymphaea
Thalictrum
Caltha
Polypodium
Pteridium
Filicales
130
140
150
160
170
180
190
% DRY LAND POLLEN SUM
NOT IN POLLEN SUM →



Some of the main plant communities at Runnymede in the Bronze Age, based on modern vegetation Fig 3.

February 15, 1990

ERBD.WP

Table 4 : POLLEN ETC. NOT DRAWN ON DIAGRAM

SS1 profile

130cm	
cf. Mercurialis perennis	1%
Alisma	+
ignota	8%
140cm	
Alisma	+
ignota	12%
150cm	
ignota	16%
160cm	
Sphagnum	+
170cm	
Mentha type	1%
ignota	7%
180cm	
Alisma type	+
ignota	3%
190cm	
Mentha type	+
ignota	4%

WF1a profile

72cm	
cf. Carpinus	+
Lamium type	+
Leguminosae nfi	+
ignota 4%	
80 cm	
Leguminosae	2%
Rosaceae	+
cf. Anagallis	+
88cm	
cf. Agrimonia	+
ignota	1%
112cm	
Rhamnus catharticus	+
Leguminosae	1%
Mentha type	+
128cm	
Leguminosae	2%
Rosaceae	1%
144cm	
Lamium type	+
ignota	9%
158cm	
Rosaceae	1%
174cm	
Abies	+
190cm	
cf. Onobrychis	+
Trichuris	+

Table 1: RUNNYMEDE DATA: ARCHAEOLOGICAL LAYERS

dating; MN = middle neolithic, LBA = Late Bronze Age

Sample/ ecology	25 MN 41	33 LBA ??	35 LBA 20	40 LBA 14d-e	L45 LBA L19	F15 LBA F15	E
Sphagnum sp. (leaflets)	-	-	-	-	7	-	
Chara (oogonia)	-	-	7	-	-	-	
Pteridium (frond fragment)	-	10	3	-	1*	-	x
Ranunculus subg. Ran.	41	100	54	81	13	-	x
"	-	10*	-	-	8*	-	x
Ranunculus cf. acris L.	2	-	1	-	-	-	5.4
Ranunculus parviflorus L.	-	-	2	-	1	-	?
Ranunculus flammula L.	-	-	1	3	-	-	1.7.1.2
Ranunculus cf. lingua L.	-	-	2	-	-	-	1.5.1.1
Ranunculus sceleratus L.	-	-	3	-	-	-	3.2.1.1
Ranunculus subg. Batrachium	12	-	48	3	-	-	1.3.1
Thalictrum flavum L.	-	-	4	-	-	-	5.4.1
Ceratophyllum sp.	1	-	-	-	-	-	1.4.1
Nymphaea alba L.	2	-	1	-	-	-	1.3.1.2
Nuphar cf. lutea (L.) Sm.	5	-	1	-	-	-	1.3.1.2
Papaver cf. dubium L.	-	-	-	3	-	-	3.4.2.1
Papaver rhoeas L./dubium L. /lecoqii Lamotte	-	9	-	-	32	-	3.4.1
Papaver argemone L.	-	3	3	1	9	-	3.4.1
Fumaria sp.	-	18	1	3	6	-	3.3.1.1
Brassica sp.	62	10	13	1	4	-	x
Thlaspi arvense L.	-	11	2	4	3	-	3.3.1.1
Barbarea sp.	5	-	29	2	-	-	(3.5.2.1)
Rorippa cf. palustris (L.) Besser	-	-	-	-	1	-	3.2.1.1
Rorippa cf. microphylla (Boenn). Hyl.	-	-	-	1	-	-	x
Rorippa sp.	-	5	+	-	-	-	x
Nasturtium officinale R.Br.	-	-	2	-	4	-	1.5.1.3
Erysimum cheiranthoides L.	-	-	2	-	-	-	3.3
Viola cf. odorata L.	-	-	-	-	-	1	3.5.2.2
Viola sp.	-	7	1	1	1	1	x
Hypericum cf. perforatum L.	1	-	-	-	-	-	6.1
Hypericum cf. tetrapterum Fr.	1	-	2	-	-	-	5.4.1.2
Silene alba (Mill.) E.H.L. Krause	-	2	-	-	-	-	3.5.1.1
Lychnis flos-cuculi L.	2	-	2	-	1	-	5.4.1
Dianthus armeria L.	-	2	-	-	-	-	5
Cerastium cf. holosteoides Fr.	-	2	-	-	-	-	5.4
Cerastium cf. glomeratum Thuill.	-	-	4	-	-	-	3
Cerastium sp.	-	-	-	-	1		
Stellaria cf. nemorum L.	2	-	-	-	-	-	8.4.3.3
Stellaria media tp.	13	85	87	20	37	-	3.3
Stellaria palustris Retz. /graminea L.	-	8	-	8	-	-	1.7.3 x
Stellaria graminea L.	-	-	-	-	7	-	5.4.2
Moehringia trinerva L.	-	-	1	1	-	-	8.4
Arenaria sp.	-	-	1	2	10	-	(3)
Spergula arvensis L.	-	8	-	-	-	-	3.3.1
Caryophyllaceae n.f.i.	-	1*	-	-	2	-	x

Sample/ ecology	25 MN 41	33 LBA ??	35 LBA 20	40 LBA 14d-e	L45 LBA L19	L15 LBA L15	E
Montia fontana ssp. chondrosperma (Fenzl) S.M. Walters	-	-	-	-	2	-	3.1.1.1
Chenopodium cf. polyspermum L.	3	-	-	-	-	-	3.3.1
Chenopodium cf. album L.	-	347	114	49	280	6*	3.3
Chenopodium ficifolium Sm.	-	-	18	8	-	-	3.3
Atriplex sp.	5	76	62	16	41	1*	x
Chenopodiaceae	-	-	-	=52	-	-	x
Malva sylvestris L. seed	-	1	6	3	-	-	3.3.3
" capsule fragment	-	1	-	-	-	-	3.3.3
Linum usitatissimum L. seeds	-	14	4	2	8	-	crop
" capsule fragments	-	3	-	-	-	-	"
" "	-	1*	-	-	-	-	"
Linum catharticum L.	-	-	2	-	-	-	5
Rhamnus catharticus L.	-	-	4	-	-	-	8.4.1
Medicago lupulina L.	-	1*	-	-	-	-	5.3.2.1.3
" capsule	-	2	-	-	-	-	"
Vicia cf. hirsuta (L.) S.F. Gray	-	6*	-	-	-	-	3.4.2
cf. Vicia sp.	1*	+*	-	-	1*	1*	x
cf. Pisum sp.	2	-	-	-	-	-	crop
cf. Trifolium repens L.	-	-	-	-	1*	-	5.4.2.3
Trifolium cf. pratense	-	-	-	-	1*	-	5.4
Ornithopus perpusillus L. (cpsl.)	-	-	-	-	1	-	?
Filipendula ulmaria L.	-	-	-	1	1	-	5.4.1
Rubus cf. idaeus L.	-	3	-	1	-	-	3.5.2.1
Rubus fruticosus agg.	14	43	16	2	15	-	x
"	-	2*	-	-	2*	-	"
Rubus cf. fruticosus agg.	-	-	-	3	-	-	x
Rubus sp.	-	-	-	1	-	-	x
Potentilla cf. sterilis (L.) Garcke	-	-	1	-	-	-	8.4.3.2
Potentilla anserina L.	-	4	2	4	-	-	3.7.1
Potentilla erecta (L.)Räusch	-	1	-	-	3*	-	5.1
Potentilla reptans L.	1	9	12	4	7,1*	-	3.7.2.1
Aphanes cf. arvensis L.	1	-	1	-	-	-	3.4.2.1
Aphanes microcarpa (Boiss. & Reut.) Rothm.	-	1	-	-	-	-	3.4.2.2
Sanguisorba officinalis l.	-	1	-	-	-	-	5.4.1
Rosa sp.	-	2	-	-	1,1*	-	8
Rosa/Rubus (thorns)	-	1	2	-	-	-	x
Prunus spinosa L.	=1	2	1	-	-	=1*	8.4.1
Prunus/Crataegus thorns	-	1	+	-	-	-	x
Crataegus sp.	+	=1	-	-	-	-	8.4
cf. Crataegus buds	-	-	7	-	-	-	8.4
cf. Sorbus torminalis (L.) Crantz	-	-	2	-	-	-	8
Epilobium sp.	4	-	4	-	-	-	x
Myriophyllum verticillatum L.	1	-	-	-	-	-	1.3.1.2
Hydrocotyle vulgaris L.	-	-	-	1	-	-	1.7.1
Torilis japonica (Houtt.) DC	-	1	2	-	3	-	6.2.1
Conium maculatum L.	-	-	16	8	-	-	3.5.1.1
cf. Apium nodiflorum (L.) Lag.	-	-	5	-	-	-	1.5.1.3
Oenanthe aquatica (L.) Poir.	4?	-	8?	-	-	-	1.5.1.1
Aethusa cynapium L.	-	22	7	7	13	-	3.3
Pastinaca sativa L.	-	19	2	-	9,1*	-	3.3.4.2

Sample/ ecology	25 MN 41	33 LBA ??	35 LBA 20	40 LBA 14d-e	L45 LBA	L15 LBA	E
Pastinaca/Heracleum	-	-	-	3	-	-	x
Daucus carota L.	-	6	1	-	16	-	x
Umbelliferae	-	23	7	3	3	-	x
Polygonum aviculare L.	-	54	106	11	60	-	3
Polygonum aviculare L.	-	4*	-	-	1*	1*	3
Polygonum lapathifolium s.l.	3	10	7	1	?1	-	3.2.1
"	-	1*	-	-	-	-	"
Polygonum persicaria L.	-	-	-	-	1	-	3.3.1
Polygonum hydropiper L.	-	-	2	-	-	-	3.2.1.1
Polygonum cf. minus L.	-	-	7	3	-	-	3.2.1.1
Polygonum convolvulus L.	-	40	7	5	-	-	3.4.2
Polygonum convolvulus L.	-	-	1*	-	-	22*	3.4.2
Rumex acetosella agg.	-	3	1	1	7	-	5.1
Rumex conglomeratus Murr.	1	-	10	-	-	-	x
Rumex cf. conglomeratus Murr.	-	-	14	-	-	-	x
Rumex sp.	41	59	67	14	31	10*	x
Urtica urens L.	-	5	121	34	3	-	3.3
Urtica dioica L.	10	19	453	104	53	1	3.5
Betula sp.	-	-	4	-	-	-	8
Alnus glutinosa L.	165	-	48	-	-	-	8.2.1.1
Alnus catkins	=200	-	-	-	-	-	8.2.1.1
cf. Quercus sp. buds	5	-	1	-	-	-	8
cf. Anagallis sp.	-	1	-	2	-	-	(3.4)
Primulaceae	-	-	-	-	1	-	x
Solanum dulcamara L.	2	-	12	1	-	-	x
Solanum nigrum L	-	1	-	3	2	-	3.3
Linaria cf. vulgaris Mill.	-	1	6	-	1	-	3.3
Scrophularia sp.	1	-	7	-	-	-	x
Rhinanthus sp.	-	-	2	-	-	-	5.4
Verbena officinalis L.	1	-	-	1	-	-	3
Mentha cf. arvensis L.	-	-	5	-	-	-	x
Mentha cf. aquatica L.	-	1	17	-	1	-	1.5.1
Mentha sp.	3	-	18	1	1	-	x
Lycopus europaeus L.	-	-	19	-	-	-	1.5
Prunella vulgaris L.	1	2	3	1	2	-	5.4
cf. Ballota nigra L.	2	-	-	-	-	-	3.5.1.1
Lamium cf. purpureum L.	-	3	-	-	-	-	3.3.1
Galeopsis segetum Neck.	-	-	-	3	-	-	x
Galeopsis tetrahit/speciosa	-	2	5	-	-	-	(3)
Galeopsis sp.	-	-	-	1	5	-	x
Glechoma hederacea L.	1	-	1	-	-	-	8.4.1
Ajuga reptans L.	2	-	1	-	-	-	x
Labiatae	2	-	1	8	-	-	x
Plantago major L.	3	2	3	2	5	1	(3.7.1)
Campanula patula L.	-	-	-	-	1	-	5.4.2.1
Galium aparine L.	-	-	-	-	1*	-	3.5.2
Galium cf. spurium L.	-	-	3	-	-	-	3.4
Galium sp.	-	1	-	1	-	-	x
"	-	1*	-	-	-	-	"
Sambucus nigra L.	53	2	10	6	2	-	6.2.1.3
Valerianella locusta (L.) Betcke	4	4	2	-	-	-	3.4
Valerianella carinata Lois.	-	-	-	2	2	-	5.2
Valerianella dentata (L.) Pollich	-	-	-	-	1*	-	5.2

Sample/ ecology	25 MN 41	33 LBA ??	35 LBA 20	40 LBA 14d-e	L45 LBA	L15 LBA	E
Scabiosa columbaria L.	-	-	1	-	-	-	5.3.2
Eupatorium cannabinum L.	-	-	26	-	-	-	3.5.2.1
cf. Senecio sp.	2	-	-	-	-	-	x
Tripleurospermum inodorum Schultz Bip.	-	-	-	-	2*	-	3.3
Arctium lappa L.	-	-	1	-	-	-	3.5.1.1
Arctium minus Bernh. s.l.	-	-	1	-	-	-	3.5.1.1
Arctium sp.	-	-	8	4	-	-	3.5.1.1.
Carduus sp.	1	1	8	-	-	-	3.4.1.1
Cirsium cf. vulgare (Savi) Ten.	-	-	7	-	-	-	3.5.1
Cirsium cf. arvense (L.) Scop.	-	-	39	-	-	-	3
Cirsium palustre (L.) Scop. /C. arvense (L.) Scop.	-	5	-	-	-	-	x
Cirsium sp.	5	-	-	3	-	-	x
Carduus or Cirsium	2	-	-	-	-	-	x
Lapsana communis L.	-	9	-	-	1	-	3.5.2.2
cf. Lapsana communis L. *	-	-	-	1	-	-	"
Leontodon sp.	-	-	2	-	1	-	5
Picris hieracioides L.	-	5	-	-	-	-	3.3.4.2
Sonchus arvensis L.	-	-	2	-	-	-	3.3.1
Sonchus oleraceus L.	-	-	2	-	-	-	3.3
Sonchus asper (L.) Hill	6	7	31	-	4	-	3.3.1
Taraxacum sp.	-	-	1	-	-	-	(5.4.2)
Alisma sp.	4	-	6	-	-	-	(1.5)
Sagittaria sagittifolia L.	-	-	6	-	-	-	1.5
Potamogeton sp. including P. natans L.	-	1	16	-	-	-	(1.3.1.2)
Zannichellia palustris	-	-	14	?	-	-	1.3.1.1
Juncus sp.	-	-	-	-	20	-	x
Sparganium sp.	3	-	-	-	-	-	(1.5.1.3)
Eleocharis uniglumis/palustris	-	8	4	5	3,1*	-	1.5.1
Scirpus/Schoenoplectus sp.	253	-	24	3	-	-	?
Schoenoplectus maritimus L.	-	-	-	-	1	-	?
Schoenoplectus lacustris (L.) Palla	3	3	2	-	2	-	1.5.1.1
Schoenoplectus tabernaemontani C.C. Gmel.) Palla	-	1	-	-	-	-	1.5.1.1
Isolepis setacea (L.) R.Br.	-	1	-	-	1	-	3.1.1.1
Carex cf. lepidocarpa Tausch	-	-	-	3	-	-	?
Carex cf. pseudocyperus L.	-	-	2	-	-	-	1.5.1.4
Carex cf. rostrata Stokes	1	-	-	-	-	-	1.5.1.4
Carex cf. riparia Curt.	-	28	-	-	-	-	1.5.1.4
Carex cf. hirta L. + utricle	26	-	6	-	-	-	3.7.2.1
Carex cf. elata (or muricata)*	-	-	4	9	-	-	(1.5.1.4)
Carex cf. disticha Huds.	-	-	1	2	-	-	1.5.1.4
Carex cf. spicata Huds.	-	-	-	-	6	-	?
Carex cf. ovalis Good.	-	3	-	-	1	-	5.1.1
Carex sp. n.f.i	-	15	-	-	-	2*	x
Triticum dicoccum	-	8*	19*	-	-	-	crop
T. cf. dicoccum	-	2*	-	-	-	-	"
T. dicoccum spikelet forks	-	12*	-	11*	-	-	"
T. dicoccum glume bases	-	15*	-	-	22*	3*	"
T. dicoccum rachis fragment	-	1*	-	-	-	-	"
T. cf. dicoccum rachis fr.	-	1*	-	-	-	-	"

Sample/ ecology	25 MN 41	33 LBA ??	35 LBA 20	40 LBA 14d-e	L45 LBA	L15	E
T. cf. dicoccum rachis node	-	1*	-	-	-	-	"
Triticum cf. spelta grain	-	1*	16*	-	-	-	"
Triticum spelta spikelets	-	-	-	-	2*	-	"
T. spelta spikelet forks	-	44*	-	-	11*	-	"
T. spelta glume bases	-	62*	-	-	52*	2*	"
T. spelta rachis	-	5*	-	-	-	-	"
T. cf. spelta rachis	-	-	-	-	1*	-	"
T. spelta rachis node	-	1*	-	-	-	-	"
Triticum dicoccum/spelta gl/b	-	327*	-	-	222*	4*	"
T. dicoccum/spelta sp/forks	-	12*	-	-	22*	3*	"
T. dicoccum/spelta rachis fr.	-	1*	-	-	-	-	"
T. dicoccum/spelta rachis n.	-	1*	-	-	-	-	"
Triticum sp. grain	-	170*	-	-	76*	10*	"
Triticum sp. glume bases	-	56	-	-	-	-	"
Triticum sp. glume bases	-	29*	-	-	-	1*	"
Triticum sp. rachis	-	14	-	-	-	-	"
Triticum sp. basal rachis	-	1*	-	-	-	-	"
Secale cereale grain	-	1*	10*	-	-	-	"
? Secale cereale basal rachis	-	1*	-	-	-	-	"
? Secale cereale rachis node	-	1*	-	-	-	-	"
Hordeum vulgare ?/6	-	1*	-	-	-	-	"
Hordeum vulgare /6 rachis	-	2*	-	-	9*	-	"
Hordeum vulgare ?/6 rachis	-	1*	-	-	-	-	"
H. vulgare ?/2 rachis	-	-	1*	-	-	-	"
H. vulgare grain	-	10*	-	-	15*	5*	"
Hordeum sp. rachis	-	7*	-	-	13*	-	"
Hordeum sp. rachis	-	4	-	-	-	-	"
Avena sp.	-	-	5*	-	-	-	"
Avena sp.	-	?	-	-	-	-	?
? Avena flower head	-	1*	-	-	-	-	?
Cerealia n.f.i.	-	46*	-	-	-	4*	?
Cerealia culm node	-	-	-	-	3*	-	
Bromus sp.	-	-	-	-	25*	=2*	
large Gramineae	-	74*	-	-	-	-	x
small grasses	-	2*	-	-	-	-	x
Poa sp.	-	-	-	-	2,2*	-	
Poa or Agrostis sp.	-	-	4	4	-	-	x
total (less alder catkins)	844	2176	1883	589	1260	80	

Names: Clapham et al. 1962, apart from cereals
Cereals identified, or at least confirmed, by Lisa Moffett
* = charred remains
all remains are seeds unless otherwise stated
E = Present day equivalent European plant community represented (Ellenberg 1979).
Many identifications could have been done more exactly had there been more time, and the qualified identifications (cf.) could not be checked through.

Table 2 SS1 AND WF1B SAMPLES

approximate date:	3000-2600		635	710		830 bc		
	SS1	SS1	WF1b	WF1b	WF1b	WF1b	WF1b	
Depths (cm)	180	190	50	75	100	120	170	E
Chara (oogonia)	-	+	-	+	+	1	1	-
Pteridium (frond)	-	-	-	-	2	-	-	x
Taxus baccata L.	-	-	-	-	1	-	-	
Ranunculus subg. Ran.	4	+	-	8	8	18	14	x
Ranunculus cf. acris L.	-	-	-	-	-	-	-	5.4
Ranunculus cf. sardous L.	-	-	-	-	-	-	1	3
Ranunculus flammula L.	-	+	-	-	-	-	-	1.7.1.2
Ranunculus cf. lingua L.	-	-	-	-	-	2	1	1.5.1.1
Ranunculus sceleratus L.	-	+	-	3	-	-	-	3.2.1.
Ranunculus subg. Batrachium	3	+	-	12	6	3	1	1.3.1
Nymphaea alba L.	-	+	-	-	-	1	2	1.3.1.2
Nuphar lutea (L.) Sm.	2	+	-	-	1	2	7	1.3.1.2
Papaver cf. dubium L.	-	-	-	-	1	1	-	3.4.2.1
Papaver argemone L.	-	-	-	1	-	-	-	3.4.1
Fumaria sp.	-	-	-	2	-	-	3	3.3.1.1
Brassica rapa L. subsp. campestris	20	+	-	3	2	2	23	x
Thlaspi arvense L.	-	-	-	5	1	2	-	3.3.1.1
Cardamine sp.	-	-	-	1	-	-	-	x
Barbarea sp.	-	+	-	1	1	?	?	(3.5.2.1)
Rorippa sp.	-	-	-	10	390	-	-	x
Nasturtium officinale R.Br.	-	-	-	1	-	-	-	1.5.1.3
Viola sp.	-	-	-	-	-	1	1	x
Hypericum perforatum L.	-	+	-	4	-	-	-	6.1
Hypericum tetrapterum Fr.	-	+	-	6	2	-	-	5.4.1.2
Silene dioica (L.) Clairv.	-	-	-	-	-	1	2	x
Lychnis flos-cuculi L.	-	+	-	-	-	1	2	5.4.1
Cerastium cf. holosteoides Fr.	-	+	-	-	1	-	-	5.
Stellaria nemorum L.	-	+	-	-	-	-	-	8.4.3.3
Stellaria media tp.	1	+	-	10	7	26	3	3.3
Stellaria cf. neglecta Weihe	1	-	-	-	-	-	-	x
Stellaria palustris/ graminea	-	-	-	-	-	3	-	x
Stellaria sp.	-	-	-	4	-	-	-	x
Arenaria sp.	-	+	-	1	-	-	1	(3)
Chenopodium polyspermum L.	-	+	-	5	1	-	-	3.3.1
Chenopodium cf. album L.	-	+	1	74	33	29	25	3.3
Chenopodium ficifolium Sm.	-	-	-	10	1	-	-	3.3
Chenopodium rubrum L./ glaucum L.	-	-	-	2	-	-	-	x
Atriplex sp.	-	+	-	15	12	37	14	x
Malva sylvestris L.	-	-	-	1	3	-	-	3.3.3
Linum usitatissimum cpsl. fr.	-	-	-	1	1	-	-	crop
Linum catharticum L.	-	-	-	1	-	1	-	5
? Acer campestre L.	-	-	-	-	-	-	1	
Rhamnus catharticus L.	-	+	-	-	-	-	-	8.4.1
Filipendula ulmaria L.	-	-	-	-	1	-	-	5.4.1
Rubus fruticosus agg.	-	+	-	-	-	-	1	x
Rubus cf. fruticosus agg.	-	+	-	1	-	1	2	x

Depths (cm)	SS1 180	SS1 190	WF1b 50	WF1b 75	WF1b 100	WF1b 120	WF1b 170	E
Rubu sp.	-	-	-	5	-	-	4	x
Potentilla anserina L.	-	-	-	-	3	-	-	3.7.1
Potentilla cf. erecta L. Raüschel	-	+	-	1	1	1	-	5.1
Potentilla reptans L.	-	+	-	2	-	-	-	3.7.2.1
Fragaria vesca L.	1	-	-	-	-	-	+	6.2.1
Aphanes arvensis L.	-	+	-	-	2	1	-	3.4.2.1
Aphanes microcarpa L.	-	+	-	-	-	-	-	3.4.2.1
Rosa sp.	-	-	-	-	-	2	-	x
Rosa/Rubus thorns	-	-	-	-	1	-	-	x
Prunus/Crataegus thorns	-	-	-	2	-	+	3	x
Malus sylvestris L. endocarp	-	-	-	-	-	-	1	8.4
Crataegus sp.	-	+	-	-	1	3	5	8.4
Prunus spinosa L.	-	-	-	-	1	-	1	8.4.1
Lythrum salicaria L.	1	-	-	-	-	-	-	5.4.1.2
Epilobium sp.	-	+	-	-	1	-	-	x
Myriophyllum spicatum L.	-	+	-	-	1	-	-	1.3.1
Myriophyllum sp.	1	-	-	-	-	-	-	
Cornus sanguinea L.	-	-	-	-	-	-	+	
Chaerophyllum temulentum L. or T. bulbosum L.	-	-	-	-	-	1	-	
Torilis japonica (Houtt.) DC	-	-	-	-	1	-	-	6.2.1
Conium maculatum L.	-	-	-	15	4	2	-	3.5.1.1
cf. Apium nodiflorum (L.) Lag.	-	-	-	2	-	1	-	1.5.1.3
Oenanthe aquatica (L.) Poir. *	1	+	-	2	?4	-	-	1.5.1.1
Aethusa cynapium L.	-	-	-	3	1	6	3	3.3
Daucus carota L.	-	-	-	-	-	3	-	x
Mercurialis perennis L.	-	-	-	-	-	-	1	8.4.3
Polygonum aviculare L.	2	+	-	5	8	16	5	3
Polygonum persicaria L.	-	-	-	1	6	-	4	3.3.1
Polygonum lapathifolium s.l.	-	-	-	1	-	2	-	3.2.1
Polygonum hydropiper L.	-	-	-	-	-	2	2	3.2.1.1
Polygonum mite Schrank	-	+	-	-	4	4?	-	3.2.1
Polygonum convolvulus L.	-	-	-	-	1	5	2	3.4.2
Polygonum convolvulus L.*	-	-	-	-	-	-	-	3.4.2
Rumex acetosella agg.	-	-	-	-	1	3	-	5.1
Rumex conglomeratus Murr.	-	-	-	-	7	-	2	x
Rumex cf. conglomeratus Murr.	-	-	-	-	1	-	-	x
Rumex sp.	1	+	-	6	9	9	8	x
Rumex sp. *	-	-	-	1	-	-	-	x
Urtica urens L.	-	-	-	71	26	1	1	3.
Urtica dioica L.	8	+	2	375	103	47	2	3.5
cf. Humulus lupulus L.	-	-	-	-	1	-	-	8
Betula sp.	-	-	-	-	1	-	-	8
Alnus glutinosa L.	23	++	-	-	7	2	2	8.2.1.1
Alnus glutinosa L. (catkins)	-	+	-	-	-	-	3	8.2.1.1
Alnus glutinosa L. (catkin scales)	-	+	-	-	1	-	2	8.2.1.1.
cf. Quercus sp. buds	-	-	-	?	-	-	1	8
Anagallis cf. foemina L.	-	-	-	1	-	-	-	3.4
cf. Anagallis sp.	-	+	-	-	-	1	-	(3.4)

Depths (cm)	SS1 180	SS1 190	WF1b 50	WF1b 75	WF1b 100	WF1b 120	WF1b 170	E
Menyanthes trifoliata	-	+	-	-	-	-	-	1.7
Hyoscyamus niger L.	-	-	-	1	-	-	-	3.3.4.1
Solanum dulcamara L.	-	+	-	-	1	-	2	x
Solanum nigrum L	-	-	-	-	1	-	-	3.3
Linaria cf. vulgaris Mill.	-	+	-	-	1	-	1	3.3
Scrophularia sp.	-	+	-	3	-	-	1	x
Verbena officinalis L.	-	+	-	-	-	-	-	3
Mentha cf. aquatica L.	-	-	-	-	-	-	-	1.5.1
Mentha sp.	1	+	-	5	1	1	-	x
Lycopus europaeus L.	3	+	-	-	7	1	-	1.5
cf. Satureia hortensis L.	1	-	-	-	-	-	-	x
Prunella vulgaris L.	-	-	-	-	1	3	-	5.4
Stachys palustris L.	-	-	-	-	-	1	-	5.4.1.2
cf. Ballota nigra L.	-	-	-	-	-	1	1	3.5.1.1
Galeopsis tetrahit/speciosa	-	-	-	-	-	2	1	(3)
Galeopsis sp.	-	-	-	-	1	-	-	x
cf. Glechoma hederacea L.	-	-	-	2	-	-	-	8.4.1
Scutellaria galericulata L.	-	-	-	-	1	-	-	1.5.1.4
Plantago major L.	-	+	-	1	-	-	-	(3.7.1)
Galium sp.	-	-	-	4	9	-	-	x
Sambucus nigra L.	2	+	2	6	1	8	25	6.2.1.3
Valerianella dentata (L.) Pollich	-	-	-	-	-	1	-	5.2
Valerianella carinata Lois.	-	+	-	-	-	-	-	5.2
Dipsacus fullonum L.	-	-	-	-	-	-	1	3.5
Scabiosa columbaria L.	-	-	-	1	-	-	-	5.3.2
Eupatorium cannabinum L.	2	+	1	5	11	-	-	3.5.2.1
cf. Achillea sp.	-	-	-	1	-	-	-	x
cf. Senecio sp.	-	+	-	-	?	-	-	x
Arctium lappa L.	-	-	-	13	4	-	-	3.5.1.1
Arctium minus Bernh. s.l.	-	-	-	7	-	-	-	3.5.1.1
Carduus sp.	3	-	-	-	-	-	1	3.4.1.1
Carduus or Cirsium sp.	3	-	-	-	-	-	-	x
Cirsium cf. vulgare (Savi) Ten.	-	-	-	-	1	3	-	3.5.1
Cirsium cf. arvense (L.) Scop.	-	-	-	2	1	2	-	3
Cirsium cf. palustre (L.) Scop.	-	-	-	-	2	-	-	5.4.1
Cirsium sp.	-	+	-	-	-	-	-	x
cf. Lapsana communis L. *	-	-	-	-	-	2	-	3.5.2.2
Leontodon cf. taraxacoides Vill.) Mérat	-	-	-	-	1	1*	-	5
Sonchus asper (L.) Hill	-	+	-	2	3	-	-	3.3.1
Alisma sp.	2	+	-	2	3	-	1	(1.5)
Potamogeton sp. including P. natans	1	+	-	1	-	4	22	(1.3.1.2)
Zannichellia palustris L.	-	-	-	2	5	-	-	1.3.1.1
Juncus sp.	-	+	-	8	1	-	-	x
Iris pseudacorus L.	1	-	-	-	2	-	1	1.5.1
Sparganium sp.	-	+	-	-	-	-	3	(1.5.1.3)
Eleocharis uniglumis/palustris	-	-	-	-	-	3	1	1.5.1
Schoenoplectus lacustris L.	2	+	3	4	58	3	145	1.5.1.1
Carex nigra group	-	-	-	-	-	3	-	?

Depths (cm)	SS1 180	SS1 190	WF1b 50	WF1b 75	WF1b 100	WF1b 120	WF1b 170	E
Carex cf. hirta L. + utricle	-	-	-	-	3	4	4	3.7.2.1
Carex cf. disticha Huds.	-	-	-	-	-	1	-	1.5.1.4
Carex sp.	-	+	-	2	-	-	2	x
Triticum dicoccum glume bases	-	-	-	2*	-	-	-	crop
Triticum cf. spelta* grains	-	-	-	-	-	+	-	"
Triticum spelta glume bases	-	-	-	2*	-	1*	-	"
Triticum dicoccum/spelta grains	-	-	-	5*	4*	66*	1*	"
Triticum dicoccum/spelta glume bases	-	-	-	8*	-	-	-	crop
Hordeum vulgare (6 row) rachis	-	-	-	2*	-	-	-	"
Hordeum vulgare grains	-	-	1*	1*	3*	10*	-	"
Bromus sp.*	-	-	-	3*	2*	-	10*	
total	100		8	763	750	553	234	

Names: Clapham et al. 1962, apart from cereals
Cereals identified by Lisa Moffett
* = charred remains
all remains are seeds unless otherwise stated
E = Present day equivalent European plant community represented (Ellenberg 1979) .
Most of the WF1b samples seeds came from beetle floats, residues and seeds sorted at London. The SS1 sample is from the original sediment, but taxa are recorded as present (+) abundant (++) or absent (-) as there was insufficient time to count the seeds. The SS1 180 cm sample was identified by Mark Robinson - he notes the presence of Satureia hortensis with surprise.

Table 3
RUNNYMEDE DATA: list of all plant remains arranged according to modern ecological communities (Ellenberg 1979, 1982, 1988) **THE PREHISTORIC PLANT COMMUNITIES WERE NOT NECESSARILY THE SAME!**

SS = SS column, NEO = Middle Neolithic layer samples, WF1 = WF1 column, BRO = Late Bronze Age layer samples, ELL corresponding modern community (Ellenberg 1979).
+ = present, ++ present in several samples, +++ present in nearly every sample, * = charred remains, x = no corresponding identifiable pollen type.

Group 1 **WETLAND AND FRESHWATER AQUATIC PLANTS**

pondweed Class; rooted aquatics

1.3 Potamogenonetea	SSP	SSM	NEO	WFP	WFM	BRO	ELL
Ranunculus subg. Batrachium	x	+	+	x	++	++	1.3.1
Nymphaea alba L.	-	?	+	+	+	+	1.3.1.2
Nuphar cf. lutea (L.) Sm.	+	?	+	-	++	+	1.3.1.2
Myriophyllum verticillatum L.	+	?	+	+	-	-	1.3.1.2
Potamogeton sp. including P. natans L.	++	+	-	++	++	-	(1.3.1.2)
Zannichellia palustris	-	-	-	-	+	+	1.3.1.1

shore-weed class

1.4 Littorelletea	SSP	SSM	NEO	WFP	WFM	BRO	ELL
Ceratophyllum sp.	-	-	+	-	-	-	1.4.1

reed and sedge Class; waterside plants

1.5 Phragmitetea	SSP	SSM	NEO	WFP	WFM	BRO	ELL
Ranunculus cf. lingua L.	x	-	-	x	+	+	1.5.1.1
Nasturtium officinale R.Br.	x	-	-	x	+	+	1.5.1.3
cf. Apium nodiflorum (L.) Lag.	x	-	-	x	+	+	1.5.1.3
Oenanthe aquatica (L.) Poir.*	x	+	?	x	+	+	1.5.1.1
Mentha cf. aquatica L.	x	-	-	x	-	+	1.5.1
Mentha sp.	x	+	+	x	+	+	x
Lycopus europaeus L.	x	+	-	x	+	+	1.5
Scutellaria galericulata L.	x	-	-	x	+	-	1.5.1.4
Alisma sp.	+	+	+	-	++	+	(1.5)
Sagittaria sagittifolia L.	+	-	-	-	-	+	1.5
Iris pseudacorus L.	-	+	-	-	+	-	1.5.1
Sparganium sp.(Sparg/Typha poll)	++	+	+	++	+	-	(1.5.1.3)
Eleocharis uniglumis/palustris	x	-	-	x	+	+	1.5.1
Schoenoplectus lacustris (L.) Palla	x	+	+	x	+	+	1.5.1.1
Schoenoplectus tabernaemontani C.C. Gmel.) Palla	x	-	-	x	-	+	1.5.1.1
Carex cf. pseudocyperus L.	x	-	-	x	-	+	1.5.1.4
Carex cf. rostrata Stokes	x	-	+	x	-	-	1.5.1.4
Carex cf. riparia Curt.	x	-	-	x	-	+	1.5.1.4
Carex cf. elata (or muricata)*	x	-	-	x	-	+	(1.5.1.4)
Carex cf. disticha Huds.	x	-	-	x	-	+	1.5.1.4
Cyperaceae pollen	+++	x	x	+++	x	x	

	SSP	SSM	NEO	WFP	WFM	BRO	ELL
sedge mires and fens							
1.7 Scheuzerio-Caricetea nigrae							
Ranunculus flammula L.	x	-	-	x	-	+	1.7.1.2
Hydrocotyle vulgaris L.	-	-	-	+	-	+	1.7.1
Menyanthes trifoliata L.	-	+	-	+	-	-	1.7
Pedicularis palustris L.	-	-	-	+	-	-	1.7
raised bogs and mires							
	SSP	SSM	NEO	WFP	WFM	BRO	ELL
1.8 Oxycocco-Sphagnetea							
?Sphagnum sp.	+	-	+	-	+	-	

Group 3 **WEEDS AND WASTELAND PLANTS**

	SSP	SSM	NEO	WFP	WFM	BRO	ELL
Cerastium cf. glomeratum Thuill.	x	-	-	x	-	+	3
Arenaria sp.	x	-	-	x	+	+	(3)
Polygonum aviculare L.	x	+	-	x	++	++	3
Polygonum aviculare L.	x	-	-	x	-	*	3
Verbena officinalis L.	-	+	+	-	-	+	3
Galeopsis segetum Neck.	x	-	-	x	-	+	x
Galeopsis tetrahit/speciosa	x	-	-	x	+	+	(3)
Galeopsis sp.	x	-	-	x	+	+	x
Cirsium cf. arvense (L.) Scop.	x	-	-	x	+	++	3

wet springs

	SSP	SSM	NEO	WFP	WFM	BRO	ELL
3.1 Isöetea-Nanojuncetea							
Montia fontana ssp. chondrosperma (Fenzl) S.M. Walters	-	-	-	-	-	+	3.1.1.1
Isolepis setacea (L.) R.Br.	x	-	-	x	-	+	3.1.1.1

muddy bank vegetation

	SSP	SSM	NEO	WFP	WFM	BRO	ELL
3.2 Bidentetea							
Ranunculus sceleratus L.	x	+	-	x	+	+	3.2.1.1
Polygonum lapathifolium s.l.	x	-	+	x	+	+	3.2.1
Polygonum hydropiper L.	x	-	-	x	-	+	3.2.1.1
Polygonum cf. mite Schrank	x	+	-	x	-	-	3.2.1.1
Polygonum cf. minus Huds.	x	-	-	x	-	+	3.2.1

spring germinating garden and field weeds

	SSP	SSM	NEO	WFP	WFM	BRO	ELL
3.3 Chenopodetea							
Fumaria sp.	-	-	-	-	+	+	3.3.1.1
Brassica sp.	x	++	+	x	+	+	x
Thlaspi arvense L.	x	-	-	x	++	+	3.3.1.1
Erysimum cheiranthoides L.	x	-	-	x	-	+	3.3
Stellaria media tp.	x	-	+	x	++	++	3.3
Spergula arvensis L.	x	-	-	x	-	+	3.3.1
Chenopodium cf. polyspermum L.	x	+	+	x	+	-	3.3.1
Chenopodium cf. album L.	x	+	-	x	++	++	3.3
Chenopodium ficifolium Sm.	x	-	-	x	+	+	3.3
Chenopodium rubrum/botryodes	x	-	-	x	+	-	3.3
Chenopodiaceae	+	x	x	+++	x	x	

	SSP	SSM	NEO	WFP	WFM	BRO	ELL
Malva sylvestris L. seed	-	-	-	-	+	+	3.3.3
" capsule fragment	-	-	-	-	-	+	3.3.3
Aethusa cynapium L.	x	-	-	x	+	+	3.3
Pastinaca sativa L. *	x	-	-	x	-	+	3.3.4.2
Polygonum persicaria L.	x	-	-	x	+	-	3.3.1
Urtica urens L.	x	-	-	x	++	++	3.3
Hyoscyamus niger	-	-	-	-	+	-	3.3.4.1
Solanum nigrum L	-	-	-	-	+	+	3.3
Linaria cf. vulgaris Mill.	-	+	-	-	+	+	3.3
Lamium cf. purpureum L.	-	-	-	-	-	+	3.3.1
Tripleurospermum maritimum (L.) Schultz Bip.	x	-	-	-	-	*	3.3
Picris hieracioides L.	x	-	-	x	-	+	3.3.4.2
Sonchus arvensis L.	x	-	-	x	2	+	3.3.1
Sonchus oleraceus L.	x	-	-	x	2	+	3.3
Sonchus asper (L.) Hill	x	+	+	x	+	+	3.3.1

"cornfield weeds"

	SSP	SSM	NEO	WFP	WFM	BRO	ELL
3.4 Secalietea							
Papaver rhoeas L./dubium L. /lecoqii Lamotte	-	-	-	-	+	+	3.4.1
Papaver argemone L.	-	-	-	-	+	+	3.4.1
Papaver cf. dubium L.	-	-	-	-	+	+	3.4.2.1
Vicia cf. hirsuta (L.) S.F. Gray	-	-	-	-	-	+	3.4.2
Aphanes cf. arvensis L.	-	+	+	-	+	+	3.4.2.1
Aphanes microcarpa (Boiss. & Reut.) Rothm.	+	-	-	-	-	+	3.4.2.2
Polygonum convolvulus L.	-	-	-	-	++	+	3.4.2
Polygonum convolvulus L.	-	-	-	-	*	-	3.4.2
cf. Anagallis sp.	-	+	-	-	+	+	(3.4)
Anagallis cf. foemina	-	-	-	-	+	-	(3.4)
Valerianella locusta (L.) Betcke	-	-	+	-	-	+	3.4
Carduus sp.	x	+	+	x	+	+	3.4.1.1

cultivated plants

	SSP	SSM	NEO	WFP	WFM	BRO	ELL
Linum usitatissimum L. seeds	-	-	-	-	+	+	crop
" capsule fragments	-	-	-	-	+	-	"
" "	-	-	-	-	-	*	"
cf. Pisum sp.	-	-	+	-	-	-	crop
Triticum dicoccum	-	-	-	-	-	*	crop
T. cf. dicoccum	-	-	-	-	-	*	"
T. dicoccum spikelet forks	-	-	-	-	-	*	"
T. dicoccum glume bases	-	-	-	-	*	*	"
T. dicoccum rachis fragment	-	-	-	-	-	*	"
T. cf. dicoccum rachis fr.	-	-	-	-	-	*	"
T. cf. dicoccum rachis node	-	-	-	-	-	*	"
Triticum cf. spelta	-	-	-	-	*	*	"
T. spelta spikelet forks	-	-	-	-	-	*	"
T. spelta glume bases	-	-	-	-	*	*	"
T. spelta rachis	-	-	-	-	-	*	"

	SSP	SSM	NEO	WFP	WFM	BRO	ELL
T. spelta rachis node	-	-	-	-	-	*	"
Triticum dicoccum/spelta gl/b	-	-	-	-	-	*	"
T. dicoccum/spelta sp/forks	-	-	-	-	-	*	"
T. dicoccum/spelta rachis fr.	-	-	-	-	-	*	"
T. dicoccum/spelta rachis n.	-	-	-	-	-	*	"
Triticum sp.	-	-	-	-	-	**	* "
Triticum sp. glume bases	-	-	-	-	-	+	"
Triticum sp. glume bases	-	-	-	-	-	*	"
Triticum sp. rachis	-	-	-	-	-	+	"
Triticum sp. basal rachis	-	-	-	-	-	*	"
Secale cereale	-	-	-	-	-	*	"
? Secale cereale basal rachis	-	-	-	-	-	*	"
? Secale cereale rachis node	-	-	-	-	-	*	"
Hordeum vulgare ?/6	-	-	-	-	-	*	"
Hordeum vulgare /6 rachis	-	-	-	-	*	*	"
Hordeum vulgare ?/6 rachis	-	-	-	-	-	*	"
H. vulgare ?/2 rachis	-	-	-	-	-	*	"
H. vulgare	-	-	-	-	**	*	"
Hordeum sp. rachis	-	-	-	-	-	*	"
Hordeum sp. rachis	-	-	-	-	-	+	"
Avena sp.	-	-	-	-	-	*	"
? Avena flower head	-	-	-	-	-	*	"
Cerealia n.f.i.	+	-	-	++	-	*	"
large Gramineae	-	-	-	-	-	*	

Perennial nitrophilous weeds

	SSP	SSM	NEO	WFP	WFM	BRO	ELL
3.5 Artemisetea							
Barbarea sp.	x	+	+	x	+	+	(3.5.2.1)
Silene alba (Mill.) E.H.L. Krause	x	-	-	x	-	+	3.5.1.1
Rubus cf. idaeus L.	x	-	-	x	-	+	3.5.2.1
Conium maculatum L.	x	-	-	x	+	+	3.5.1.1
Urtica dioica L.	x	+	+	x	+++	+++	3.5
cf. Ballota nigra L.	x	-	+	x	+	-	3.5.1.1
Dipsacus fullonum L.	x	-	-	+	x	-	3.5
Artemisia	+	-	-	++	-	-	
Eupatorium cannabinum L.	?	+	-	?	++	+	3.5.2.1
Arctium lappa L.	-	-	-	-	+	+	3.5.1.1
Arctium minus Bernh. s.l.	-	-	-	-	+	+	3.5.1.1
Arctium sp.	-	-	-	+	-	+	3.5.1.1.
Cirsium cf. vulgare (Savi) Ten.	-	-	-	-	+	+	3.5.1
Lapsana communis L.	-	-	-	-	-	+	3.5.2.2
cf. Lapsana communis L. *	-	-	-	-	*	*	"

pathways and wet bare ground

	SSP	SSM	NEO	WFP	WFM	BRO	ELL
3.7 Plantaginetea							
Potentilla anserina L.	-	-	-	-	+	+	3.7.1
Potentilla reptans L.	-	+	+	-	+	+	3.7.2.1
Potentilla type	+	-	-	++	-	-	
Plantago major L.	-	-	+	-	+	+	(3.7.1)
Carex cf. hirta L. + utricle	x	-	-	x	++	-	3.7.2.1

Group 5

SEMI-NATURAL HEATHS AND MEADOWS

	SSP	SSM	NEO	WFP	WFM	BRO	ELL
Dianthus armeria	-	-	-	-	-	+	5
Linum catharticum L.	-	-	-	-	+	+	5
	SSP	SSM	NEO	WFP	WFM	BRO	ELL
Lotus type	+	-	-	+	-	-	5
Leontodon sp.	-	-	-	-	-	+	5
Leontodon cf. taraxacoides Vill. Mérat	-	-	-	-	+	-	5

grasslands (dry acid soils) and heaths

	SSP	SSM	NEO	WFP	WFM	BRO	ELL
5.1 Nardo-Callunetea							
Polygala	-	-	-	+	-	-	5.1
Centaurea nigra	-	-	-	+	-	-	5.1
Potentilla erecta (L.)Räusch	x	+	-	x	+	+	5.1
Rumex acetosella agg.	x	-	-	x	+	+	5.1
Carex cf. ovalis Good.	x	-	-	x	-	+	5.1.1

thin communities on sand and stone

	SSP	SSM	NEO	WFP	WFM	BRO	ELL
5.2 Sedo-Scleranthetea							
Valerianella carinata Lois.	-	+	-	-	-	+	5.2
Valerianella dentata (L.) Pollich	-	-	-	-	+	-	5.2

chalk grasslands

	SSP	SSM	NEO	WFP	WFM	BRO	ELL
5.3 Festuco-Brometea							
Medicago lupulina L.	-	-	-	-	-	*	5.3.2.1.3
" capsule	-	-	-	-	-	+	"
Sanguisorba minor	+	-	-	++	-	-	5.3
Plantago media	+	-	-	+	-	-	5.3
Scabiosa columbaria L.	x	-	-	x	+	+	5.3.2

general grassland communities (moist soils)

	SSP	SSM	NEO	WFP	WFM	BRO	ELL
5.4 Molinio-Arrhenatheretea							
Caltha palustris	+	-	-	+	-	-	5.4.1.5
Ranunculus cf. acris L.	x	-	+	x	-	+	5.4
Thalictrum flavum L.	-	-	-	+	-	+	5.4.1
Hypericum cf. tetrapterum Fr.	-	-	+	-	+	+	5.4.1.2
Lychnis flos-cuculi L.	x	+	+	+	x	+	5.4.1
Cerastium cf. holosteoides Fr.	x	-	-	x	+	-	5.4
Trifolium repens type	++	-	-	++	-	-	5.4
Trifolium pratense type	+	-	-	+	-	-	5.4
Filipendula ulmaria L.	+	-	-	++	+	+	5.4.1
Sanguisorba officinalis l.	-	-	-	-	-	+	5.4.1
Lythrum salicaria L.	-	+	-	-	-	-	5.4.1.2
Rhinanthus sp.	+	-	-	+	-	+	5.4
Plantago lanceolata L.	++	-	-	+++	-	-	5.4
Prunella vulgaris L.	x	-	+	x	+	+	5.4
Valeriana type	+	-	-	+	-	-	5.4.1
Taraxacum sp.	-	-	-	-	-	+	(5.4.2)

Woodland clearings, wood margins

	SSP	SSM	NEO	WFP	WFM	BRO	ELL
6.1 Trifolio-Geranetea							
Hypericum cf. perforatum L.	-	+	+	-	+	-	6.1

woodland glades and hedges

	SSP	SSM	NEO	WFP	WFM	BRO	ELL
6.2 Epilobetea							
Fragaria vesca L.	-	+	-	-	+	-	6.2.1
Torilis japonica (Houtt.) DC	x	-	-	x	+	+	6.2.1
Sambucus nigra L.	++	+	+	+	+++	++	6.2.1.3

8 **WOODLAND etc.**

	SSP	SSM	NEO	WFP	WFM	BRO	ELL
Rosa sp.	-	-	-	-	+	+	8
Sorbus cf. torminalis (L.)Crantz	-	-	-	+	-	+	8
cf. Humulus lupulus	-	-	-	-	+	-	8
Cannabaceae	+	-	-	+	-	-	
Betula sp.	++	-	-	+	+	+	8
cf. Quercus sp.(macros: buds)	+++	-	+	++	+	+	8
(Salix type	++	-	-	++	-	-	8)

alder carr

	SSP	SSM	NEO	WFP	WFM	BRO	ELL
8.2 Alnetea							
Alnus glutinosa L. (mac: seeds)	+++	++	++	++	++	+	8.2.1.1
Alnus catkins	x	++	++	x	+	-	8.2.1.1

mesotrophic broad-leaved woodland

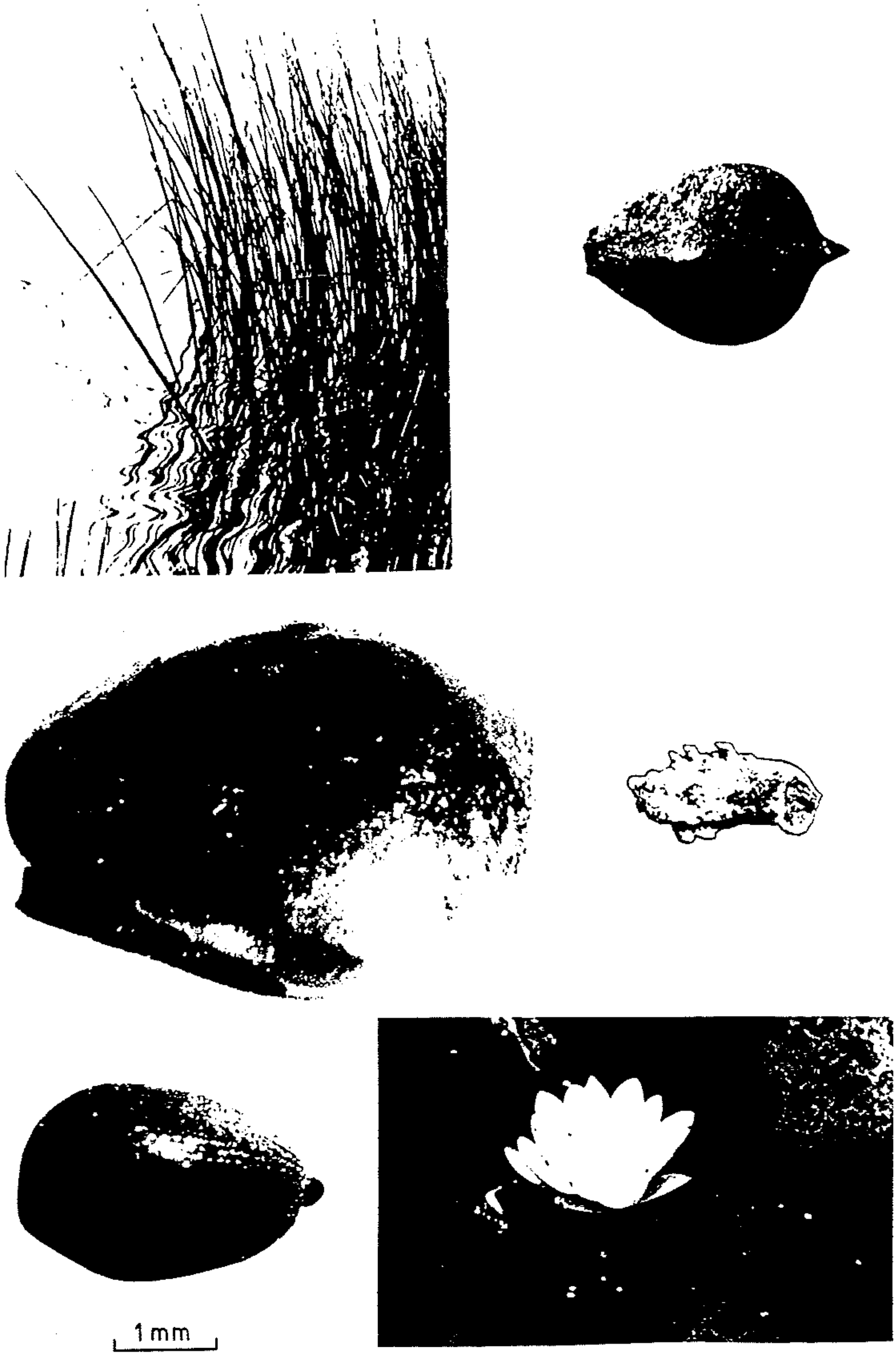
	SSP	SSM	NEO	WFP	WFM	BRO	ELL
8.4 Querco-Fagetea							
Taxus baccata	+	-	-	-	+	-	8.4.3.1
Stellaria nemorum L.	x	+	+	x	-	-	8.4.3.3
Moehringia trinervia L.	x	-	-	x	-	+	8.4
Acer	++	-	-	+	-	-	8.4
Rhamnus catharticus L.	-	+	-	+	-	+	8.4.1
Cornus sanguinea L.	-	-	-	-	+	-	8.4.1
Fraxinus excelsior	++	-	-	+	-	-	8.4.3
Prunus spinosa L.	-	-	+	+	-	+	8.4.1
Malus sylvestris L.	-	-	-	-	+	-	8.4
Crataegus sp.	+	+	+	+	+	-	8.4
cf. Crataegus buds	-	-	-	-	+	-	8.4
Mercurialis perennis L.	+	-	-	-	+	-	8.4.3
Glechoma hederacea L.	-	-	+	-	+	+	8.4.1

unclassified

	SSP	SSM	NEO	WFP	WFM	BRO	ELL
Chara (oogonia)	x	+	-	x	+	+	
Pteridium (frond fragment)	+	-	-	+	+	+	
Polypodium vulgare	++	-	-	+	-	-	
Ranunculus subg. Ran.	x	+	+	x	+	+	
"	x	-	-	x	-	*	

	SSP	SSM	NEO	WFP	WFM	BRO	ELL
Ranunculus parviflorus L.	x	-	-	x	+	+	
Rorippa sp.	x	-	-	x	+	+	
Viola sp.	-	-	-	-	+	+	
Silene dioica (L.) Clairv.	-	-	+	-			
Stellaria palustris Retz. /graminea L.	x	-	-	x	+	+	
Caryophyllaceae n.f.i.	x	-	-	x	-	*	
Atriplex sp.	x	-	+	x	++	+	
Chenopodiaceae	+	-	-	++	-	+	
cf. Vicia sp.	-	+	-	-			
Rubus fruticosus agg.	-	+	+	-	++	+	
"	-	-	-	-	-	*	
Rosa/Rubus (thorns)	-	-	-	-	+	+	
Prunus/Crataegus thorns	x	-	-	x	+	+	
Epilobium sp.	-	+	+	-	+	+	
Pastinaca/Heracleum	x	-	-	x	-	+	
Daucus carota L.	x	-	-	x	+	+	
Rumex conglomeratus Murr.	x	-	+	x	+	+	
Rumex sp.	x	+	+	x	++	++	
Solanum dulcamara L.	-	+	+	-	++	+	
Scrophularia sp.	-	+	+	-	+	+	
Mentha cf. arvensis L. *	x	-	-	x	-	+	
Ajuga reptans L.	x	-	+	x	-	+	
Galium sp.	+	-	-	++	+	+	
Galium sp.	+	-	-	++	-	*	
cf. Achillea sp	x	-	-	x	+	-	
cf. Senecio sp.	x	-	+	x	-	-	
Cirsium palustre (L.) Scop. /C. arvense (L.) Scop.	x	-	-	x	-	+	
Cirsium sp.	x	-	+	x	-	+	
Carduus or Cirsium	-	-	+	+	-	-	
Juncus sp.	-	+	-	-	+	-	
Carex nigra group	x	-	-	x	+	-	
Carex cf. lepidocarpa Tausch	x	-	-	x	-	+	
small grasses	x	-	-	x	-	*	
Poa or Agrostis sp.	x	-	-	x	-	+	

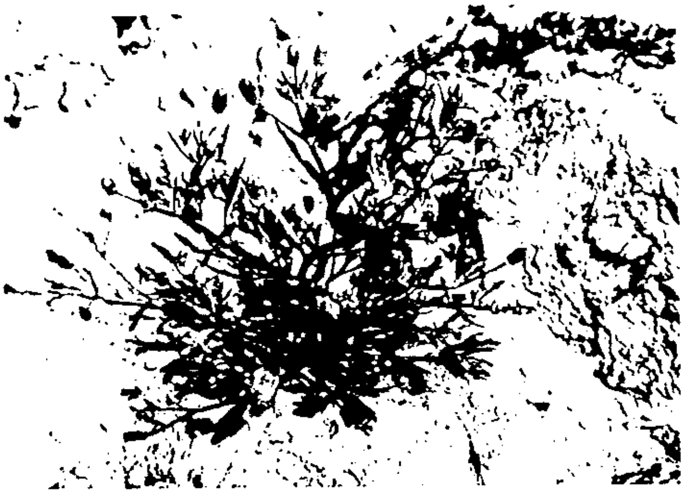
****



1. AQUATIC PLANTS
Top left: **Schoenoplectus (Scirpus)**, probably **S. lacustris** (common clubrush, bulrush), right: waterlogged seed of **Schoenoplectus lacustris** ssp. **lacustris** (L33).

middle left: seed of **Nuphar lutea** (yellow water lily), right: seed of **Myriophyllum verticillatum** (water millfoil)

Bottom left: seed of **Nymphaea alba** (white water lily) right: plant of the same.



2. WATERSIDE PLANTS
Top left: plant of **Nasturtium officinale** (watercress), right: waterlogged seed from L33.

Middle left: plant of **Ranunculus sceleratus** (celery-leaved water crowfoot), right: waterlogged seeds from 35.

1mm

3. WEEDS

Top left: plant of **Fumaria officinalis** (fumitory) middle seed of Fumaria sp.(above), seeds of **Spergula arvensis** (below) left: plant of **Spergula arvensis** (corn spurrey).

Middle left: plant of **Linaria vulgaris** (yellow toadflax), centre seed of same (L33), right: seed of **Lamium purpureum** (purple dead-nettle)

Bottom left and centre: seedcoat and seed of **Malva sylvestris** (common mallow), right: plant of **Lamium purpureum** (purple dead-nettle).

4. CROPS; WHEAT (All remains charred), L33
Top two: grain of **Triticum cf. dicoccum** (cf. emmer) from above and from the side

bottom two rows: **Triticum dicoccum** (emmer) spikelet forks and a single rachis segment.

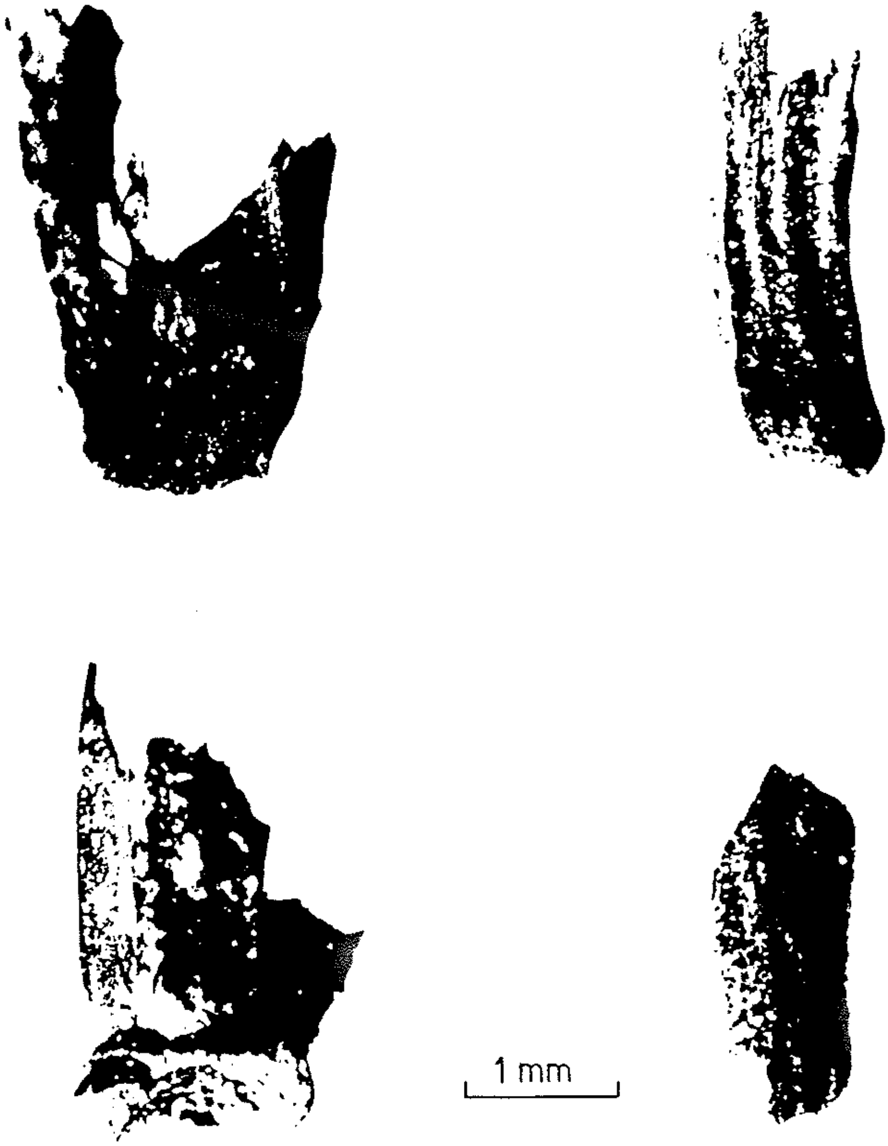
5. CROPS; WHEAT (All remains charred), L33
Top row: glume bases of **Triticum dicoccum** (emmer)

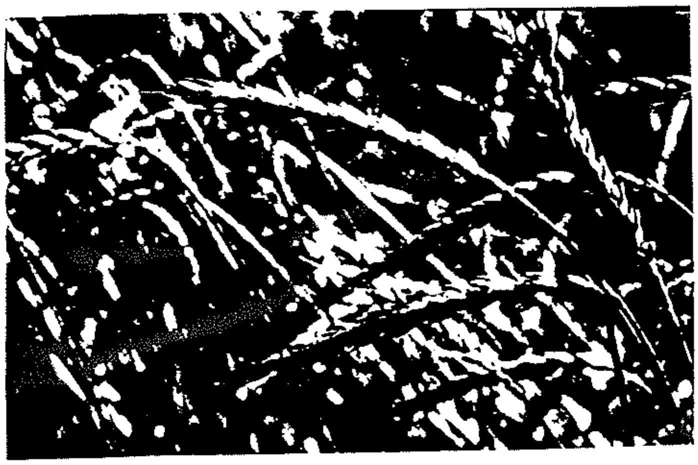
Middle row: emmer spikelet forks

Bottom row: emmer rhachis segments

6. CROPS; WHEAT (All remains charred), L33
Top: **Triticum** cf. **spelta** (spelt wheat) grain

middle and bottom: **Triticum spelta** spikelet forks

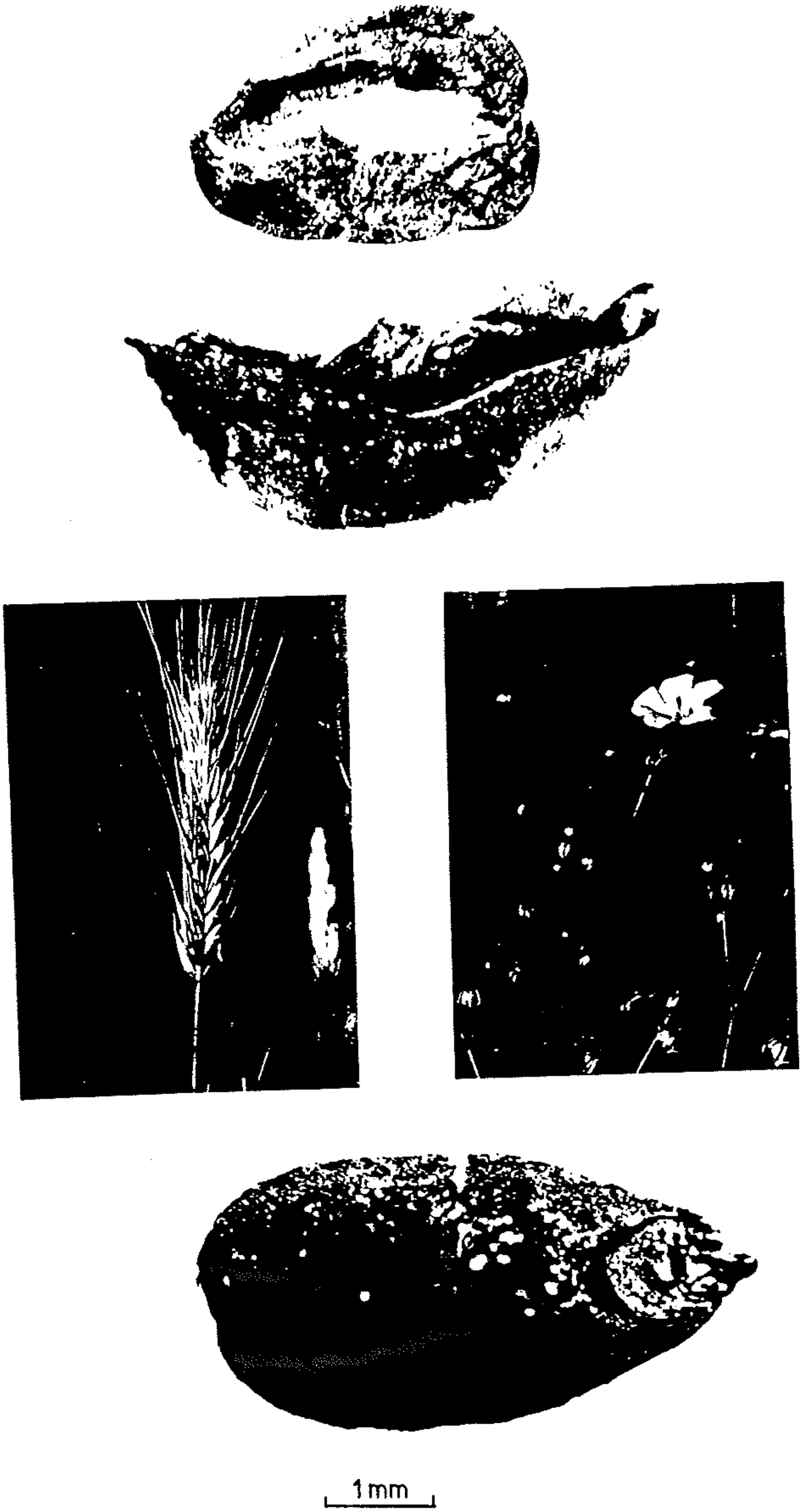




7. CROPS; WHEAT L33
Top row: **Triticum** sp. glume bases (waterlogged)

middle row: **Triticum** cf. **dicoccum** (cf. emmer) glume bases (charred)

bottom row: left, modern **Triticum spelta** (spelt wheat) and right **Triticum dicoccum** (emmer wheat)



8. CROPS; FLAX AND RYE;
Top: **Linum usitatissimum** (flax) seed (above) and capsule fragment (below) both waterlogged

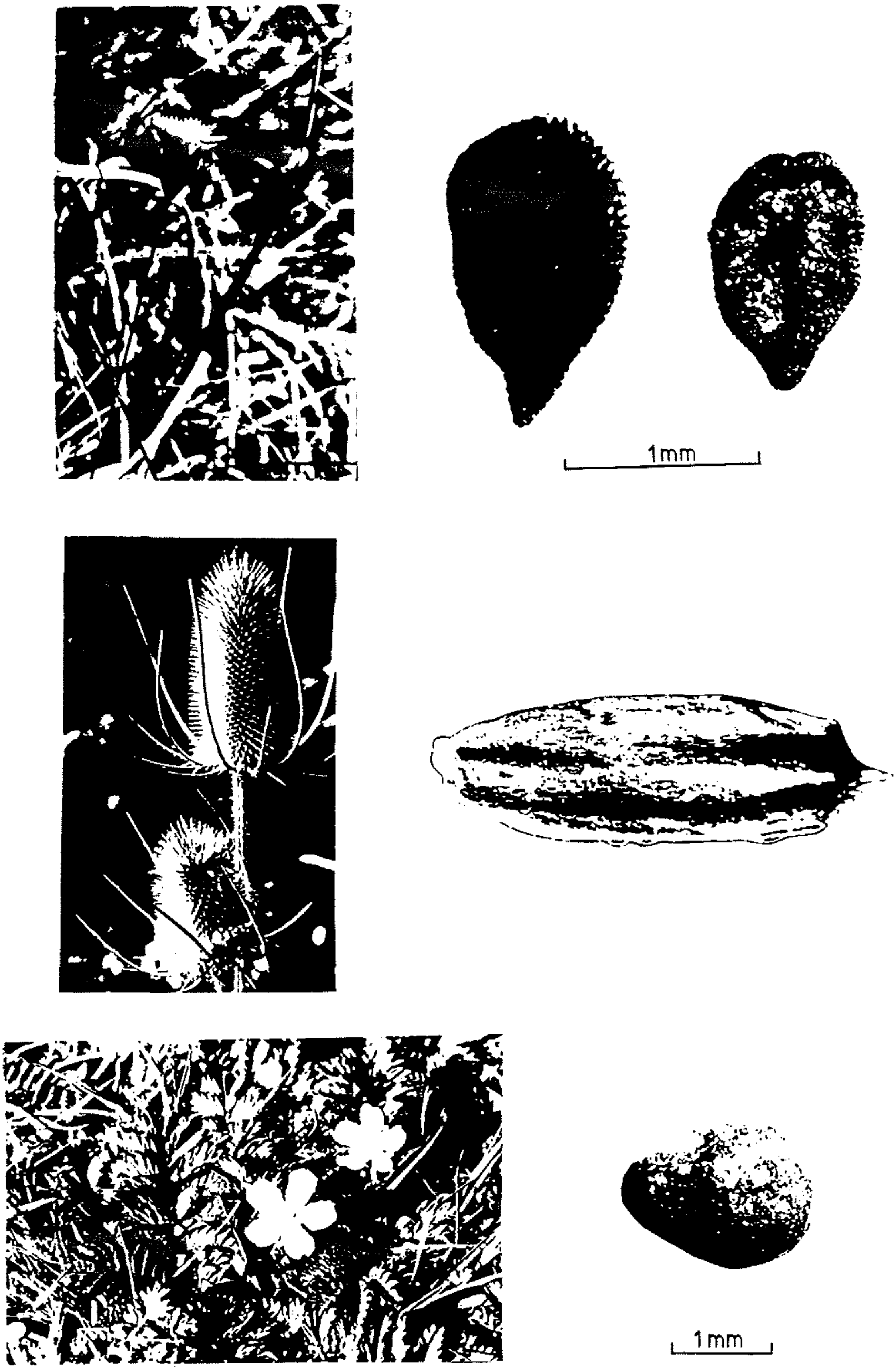
middle l: modern rye ear, r: modern flax plant

bottom **Secale cereale** (rye) grain, charred

1mm

9. **Hordeum vulgare** (barley), all charred from L33;
top row, left and centre: **Hordeum vulgare** (6-row barley) rachis segments, right H. **vulgare.**

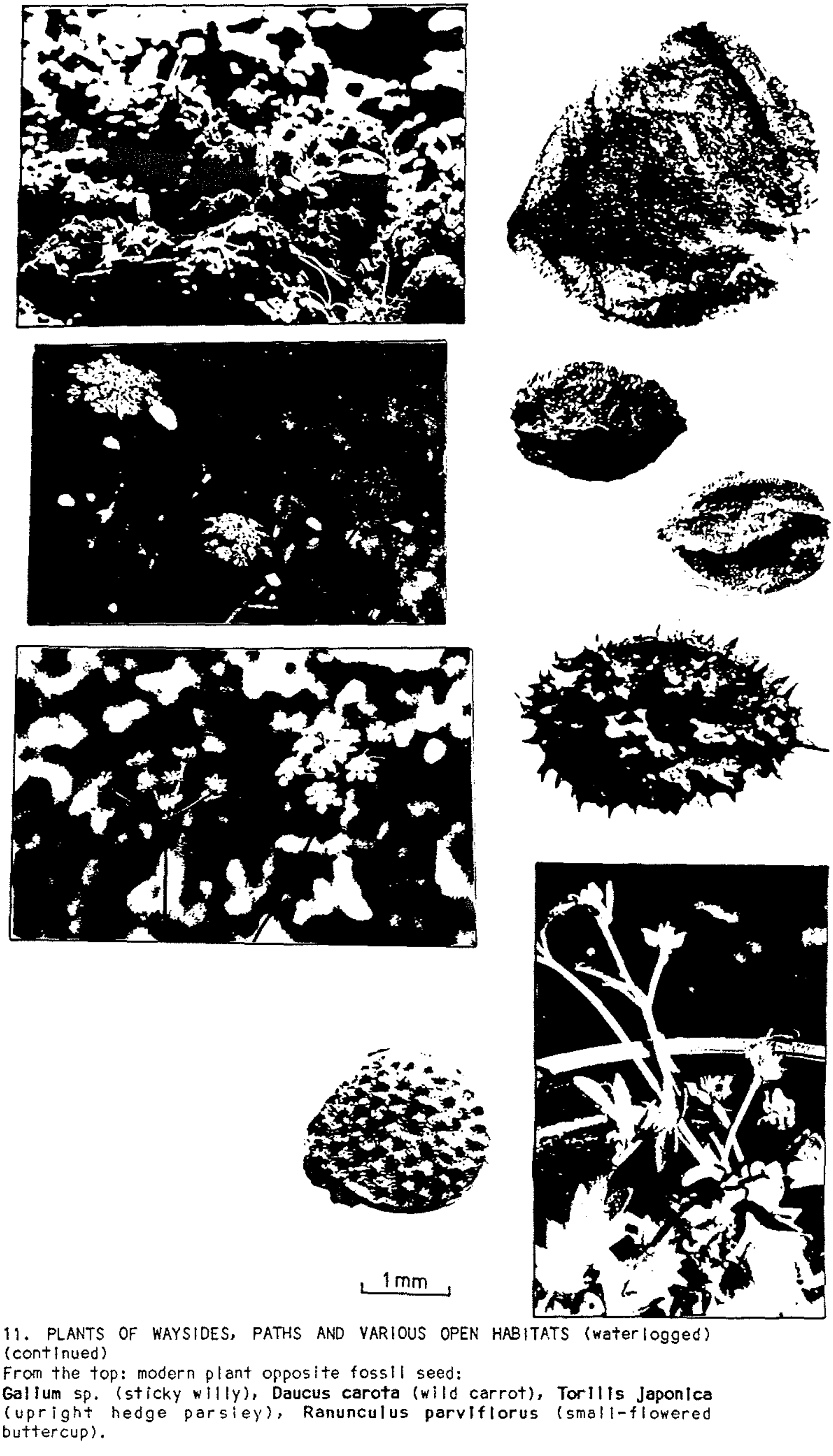
bottom: **Hordeum vulgare** grain enclosed in glumes All x20.



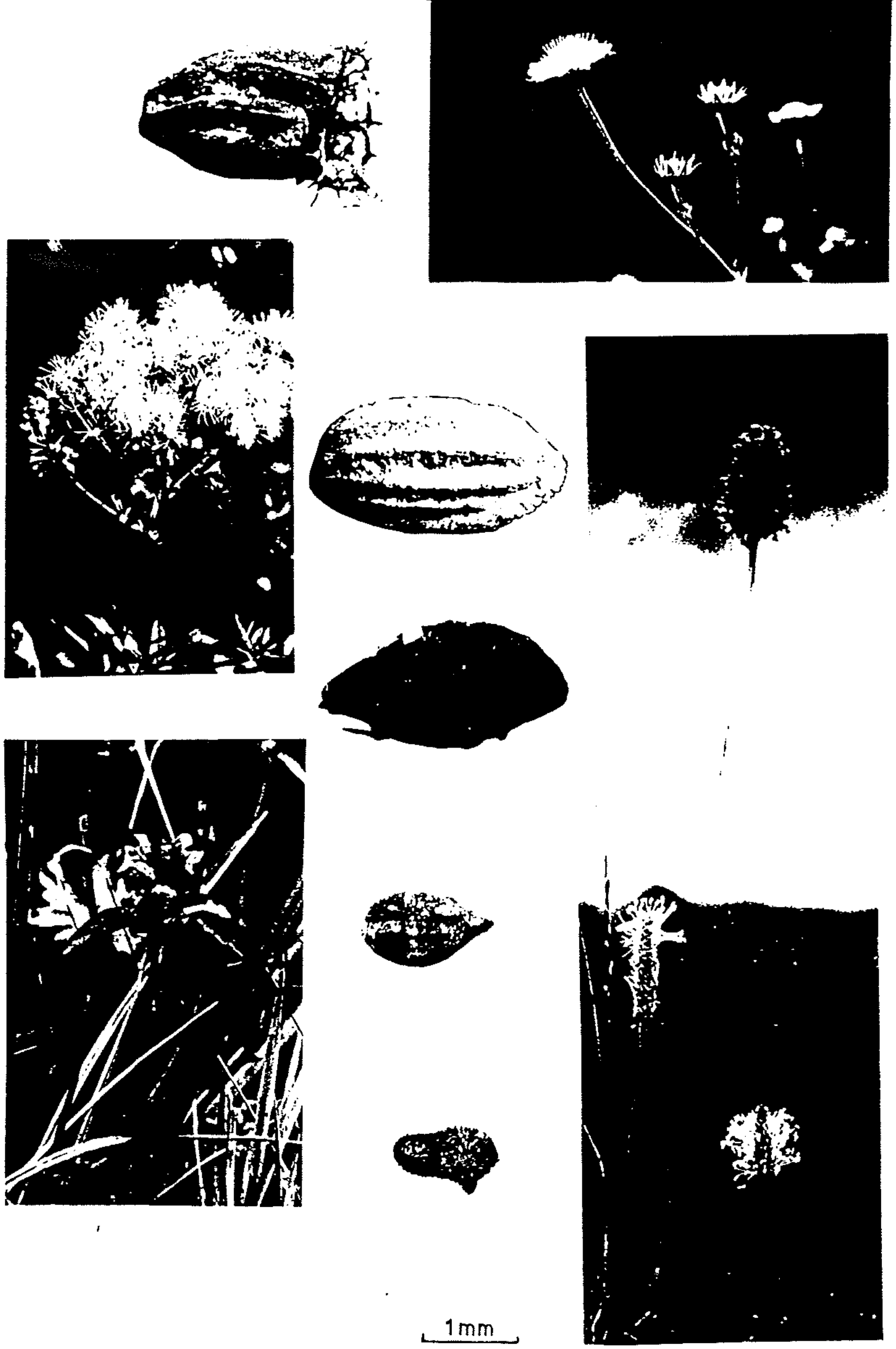
10. PLANTS OF WAYSIDES, PATHS AND VARIOUS OPEN HABITATS (waterlogged) x20
Top row: **Dianthus armeria** (Deptford pink) plant, modern seed and subfossil

Middle row: **Dipsacus fullonum** (teasel) plant and seed (WF1b 170)

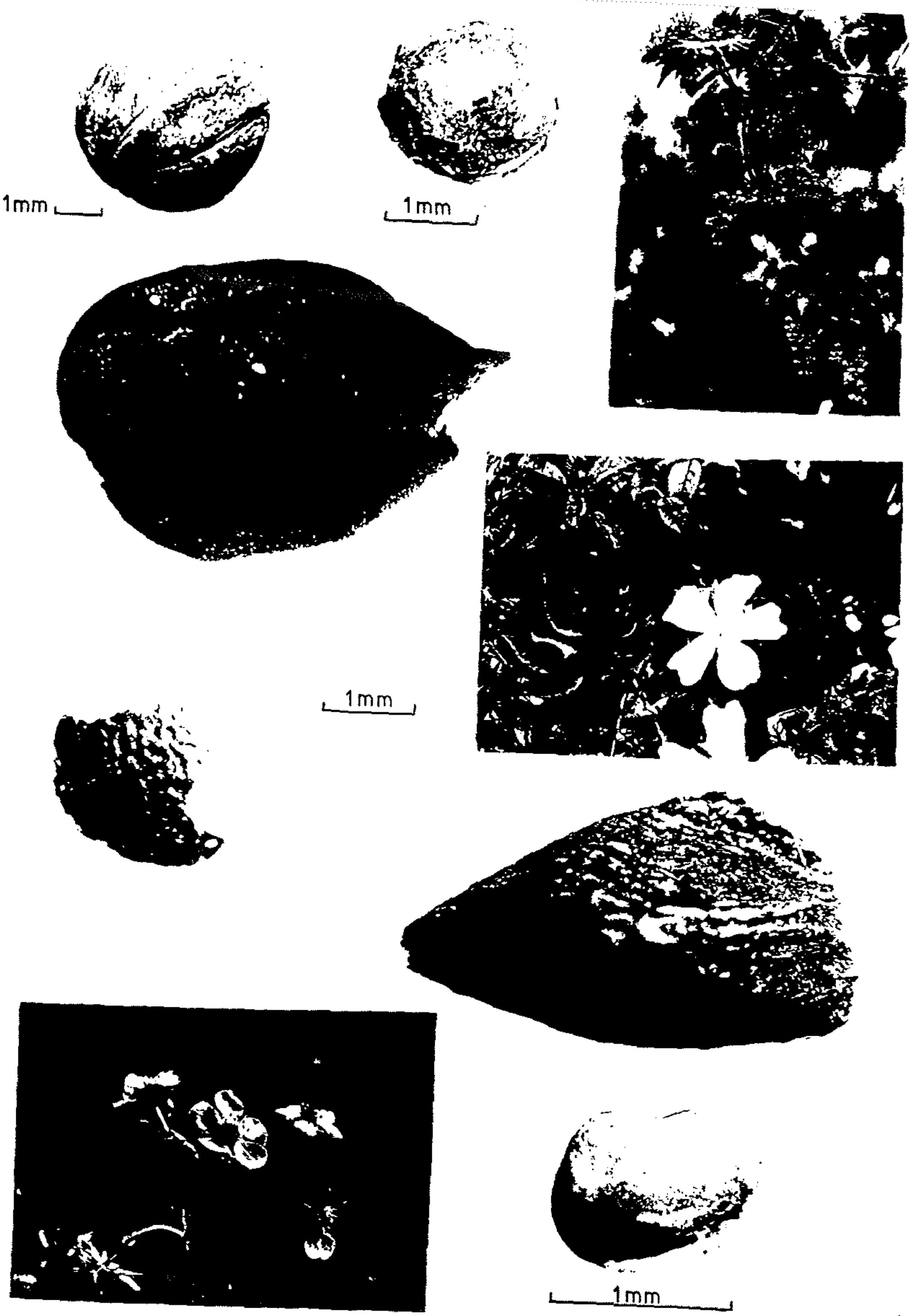
Bottom row: **Potentilla anserina** (silverweed), plant and seed



11. PLANTS OF WAYSIDES, PATHS AND VARIOUS OPEN HABITATS (waterlogged) (continued)
From the top: modern plant opposite fossil seed:
Galium sp. (sticky willy), **Daucus carota** (wild carrot), **Torilis japonica** (upright hedge parsley), **Ranunculus parviflorus** (small-flowered buttercup).



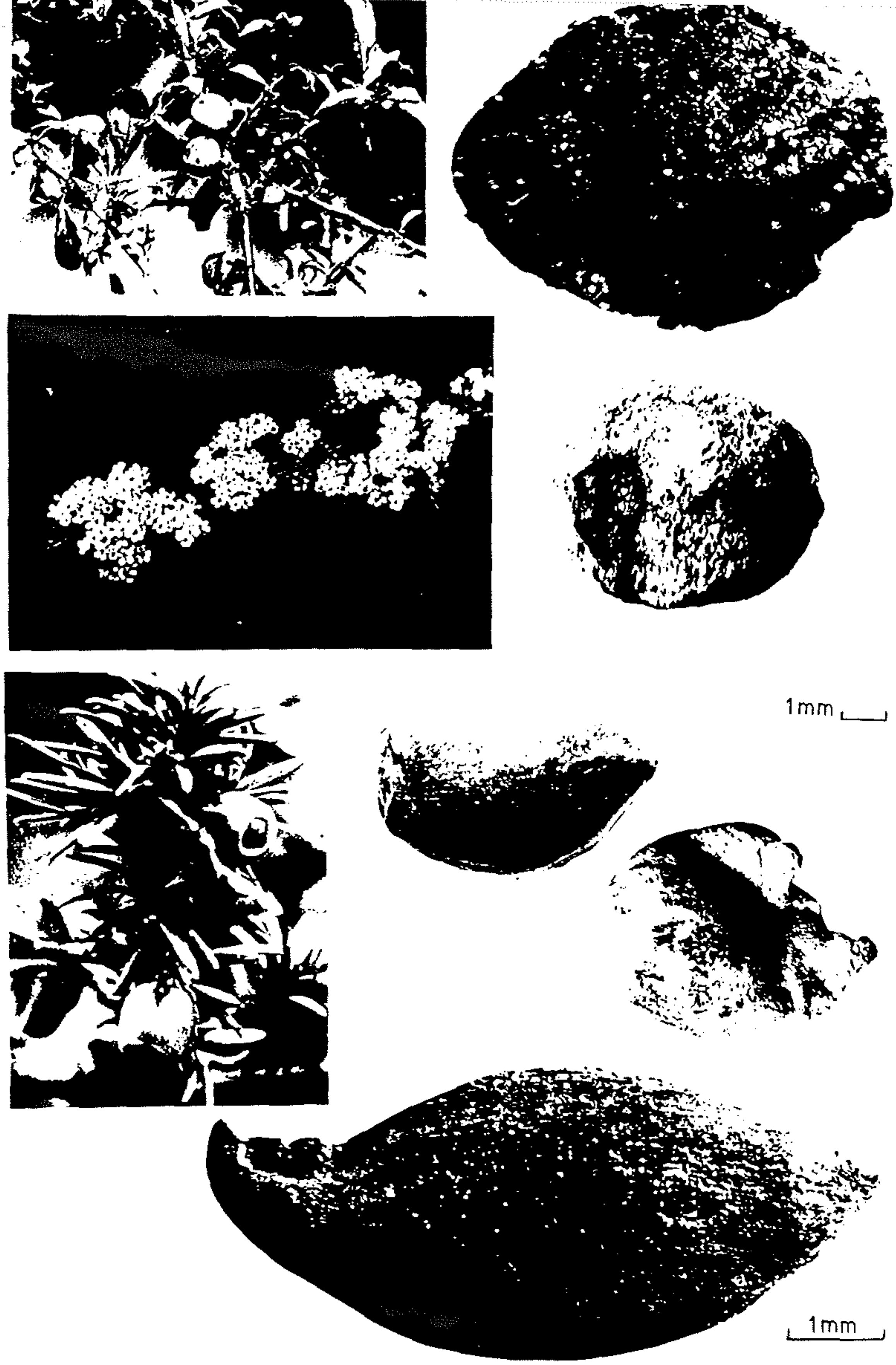
12.GRASSLAND PLANTS (waterlogged)
from the top: seed opposite picture of the plant: **Scabiosa columbaria** (small scabious)(WF1b 70), **Thalictrum flavum** (meadow rue) (sample 35), **Sanguisorba officinalis** (greater burnet), **Prunella vulgaris** (self-heal), **Plantago major** (rat-tail plantain).



13. PLANTS OF WOODLAND AND SCRUB (waterlogged)
top from left: **Cornus sanguinea** (dogwood) seed (WF1b 110), **Humulus lupulus** (hop) seed (WF1b 100) and modern plant

Middle: **Rhamnus catharticus** fossil seed (SS1 90)

Below: **Mercurialis perennis** (dog's mercury) seed (WF1b 170), **Rosa** (wild rose) pip (WF1b 120) with plant above the seed
Bottom: **Fragaria vesca** (wild strawberry) l: plant, r: fossil seed (waterfront 170 cm).



14. PLANTS OF WOODLAND AND SCRUB (waterlogged)
From the top: picture of modern plant opposite seeds:
Prunus spinosa (sloe) (WF1b 170), **Crataegus** sp. (hawthorn), **Taxus baccata** (yew) (modern seed l. and fossil one r.[WF1b 160]), cf. **Sorbus aria** (cf. whitebeam)