A study of the botanical material from three medieval Scottish sites.

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Summary

Plant remains from soil samples taken during the archaeological excavations of three medieval Scottish sites, Perth, Aberdeen and Elgin, were studied. Three different methods were used to extract plant remains : paraffin flotation, water flotation and wet sieving. Macrofossils were identified and counted for each sample. The resultant plant assemblages were related where possible to their archaeological contexts. An annotated species list was compiled with information on identification of fossils, history, ecology and possible uses. Brassica seeds were studied in detail. A comparison was made between modern arable weed floras and medieval weed floras represented in the samples. Plant species recovered were considered in relation to diet and other uses of plants in the medieval Scottish economy.

Chapter 1

Introduction

1.1 Aim of project

The aim was to provide information on the medieval urban environments of Perth, Aberdeen and Elgin. Present-day observations of plant remains are used as evidence in conjunction with that from other areas of archaeological research and historical sources. The identifications of plant macrofossils add to the fossil record and increase knowledge of the history of the Scottish flora.

Kenward *et al* (forthcoming)summarise the principal reasons for examination of biological remains from archaeological sites as follows:

1. their intrinsic interest to biologists and ecologists
2. to reconstruct diet and activity
3. to reconstruct past environments, both local and regional and including human living conditions.

In addition to the plant remains studied in this project, animal bones and insect remains from the three sites have been studied by other specialists.

1.2 Literature on paleobotany of archaeological sites

The literature is large and increasing. Many excavation reports include a section written by a specialist on botanical material recovered from the site. Usually an attempt is made to interpret the significance of the plants and to integrate the results with the archaeology. Specialist papers dealing, for example, with a single category of plants or methodology are also increasing in number. In Europe and the Near East the discovery of large deposits of carbonised grain has allowed detailed studies to be carried out. These have provided valuable information on domestication and utilisation of many of our important crop plants from prehistoric up to medieval times. Important specialist works include van Zeist (1968, 1974) which give detailed accounts of the study of carbonised seed finds from the Netherlands, covering the period 2350BC - 900AD. Behre has published detailed accounts of sites in northern Germany including the early medieval settlement of Haithabu (Behre, 1969). Körber-Grohne's (1967) investigation of plant remains from the Iron Age site of Feddersen-Wierde in northern Germany includes full descriptions of the macrofossils.

In recent years the redevelopment of the centres of many cities in Britain and northern Europe has given archaeologists access to rich organic layers belonging to the period of medieval occupation. The excavations at Perth High Street were carried out on a site which Messrs Marks and Spencer Ltd were about to redevelop. Excavations at the Farquhar and Gill site at Aberdeen were made possible when a warehouse was taken over by Aberdeen Corporation and demolished in 1977. The site at Elgin was on the line of the new relief road.

Examples of papers on botanical material from medieval urban sites in England and Ireland include:

Plymouth	Dennell 1970
Southampton	Dimbleby 1975
Hull	Williams 1974
Hull	Underdown 1979
Chester	Wilson 1975
Gloucester	Green 1979a
Durham	Donaldson 1979
Beverley	Hall and Kenward 1980
Dublin	Ríordáin 1971

Extensive work is also being carried out on the medieval layers of Winchester and Hamwih (Southampton) by F.J. Green and Viking and medieval York by A.R. Hall.

The study of plant remains from Perth, Aberdeen and Elgin described here is the first to be carried out on medieval urban material in Scotland. However studies of plant remains from archaeological excavations from earlier periods in Scotland have been undertaken, for example:

Neolithic	Knap of Howar, Papa Westray, Orkney	C.A. Dickson (pers comm)
Iron Age	Dun Mor Vaul, Tiree	Renfrew (1974)
	Crosskirk Broch, Caithness	Dickson (1979a)
	Bu Broch, Orkney	C.A. Dickson (pers comm)
	Gurness Broch, Orkney	C.A. Dickson "
	Leckie Dun and Broch	C.A. Dickson "
	Buchlyvie Broch, Stirlingshire	C.A. Dickson "
	Balloch Hillfort, Kintyre	C.A. Dickson "
Roman	Newstead Fort	Tagg (1911)
	Forth and Clyde Canal	Jessen and Helbaek (1944)
	Birrens Fort, Dumfriesshire	Wilson (1975a)
	Bearsden Fort	Dickson et al (1979)
		Dickson (1979b)
Pictish	Dundurn Hillfort, Perthshire	Brough (1980)
Viking	Barvas, Lewis	C.A. Dickson (pers comm)

Other sites are mentioned in Jessen and Helbaek (1944) and Godwin (1975).

Grains of Hordeum vulgare were recovered from the stone built houses and middens at Knap of Howar, Papa Westray, the earliest Neolithic settlement excavated in Orkney. Iron Age plant remains have been studied from brochs, for example Dun Mor Vaul on Tiree where Renfrew identified hulled and naked 6-row barley. Over forty species of plant macrofossils were identified from Crosskirk Broch, Caithness by C.A. Dickson including oats, barley and flax. Seeds of the wild subspecies of *Brassica campestris* (turnip) were identified from Bu Broch, Orkney, *Avena strigosa* from the Broch of Gurness and three grains of *Triticum dicoccum* (emmer) from Balloch Hillfort in Kintyre.

Plant remains have been studied from a number of Roman forts in central and southern Scotland. A large number of plants have been identified from a ditch close to the bath house at Bearsden Fort. Biological and chemical studies of material from this ditch have shown the presence of sewage, coming from the bath house latrines.

1.3 Reasons for sampling plant macrofossils

Since it is impossible to examine all material produced during the excavation of a large and complex site, a sampling programme which will allow valid deductions to be made about conditions in the past has to be designed. Recently there has been a large output of literature on sampling methods in archaeology. Articles in the volume "Sampling in Contemporary British Archaeology" (Cherry et al 1978) lay repeated stress on the importance of a carefully thought out sampling programme. This should be designed to facilitate the answering of questions and problems which have been formulated largely in advance of the excavation. This problem-orientated approach is emphasised rather than the alternative which is to identify everything and then to attempt to derive statements from the data - this leads to a "multiplication of useful but unrelated case studies which avoid the central problems of explaining variability because there is no framework of expectations against which any analytical results can be evaluated."

The following is a list of possible topics for investigation in a study of plant remains:
(adapted from Gamble, 1978)

1. Census data
   a) species lists
   b) relative proportions of major species
   c) spatial and chronological distribution within site and between sites.
2. Reconstruction of past environment, both local and regional.
3. Domestication and use of flora.
   a) native species - economic uses (evidence from the context and from historical sources). Were these plants selectively gathered or were they weeds producing large quantities of persistent seeds?

b) alien species - were these established by chance importation or intentionally cultivated? Evidence for import of fruits or other economically important plant organs.

4. Economy and plant husbandry of the society - information on crop processing, direct information on diet from coprolites and sewage.

The integration of this information with that from archaeological context, artifacts found, faunal remains and historical sources, hopefully will allow a reasonable picture of the medieval urban economy to be built up.

1.4 Design of sampling programme

The urban archaeological site is not a random phenomenon nor is it likely to show continuous variation, rather it is more or less discretely subdivided into a number of contexts which are both spatially and chronologically separated.

Samples must therefore be representative

a) spatially

b) chronologically

c) contextually,

Consequently neither random sampling nor sampling with a grid is suitable for a complex archaeological site. This has led to a situation where in general the archaeologist takes a soil sample for examination for environmental evidence from each layer or feature he considers interesting, ensuring that his samples are representative according to the three criteria listed above. Thus effort can be directed to those areas which are most likely to yield useful information although negative evidence from other areas is also of importance. Ideally the specialist should be on site during the excavation to aid the archaeologist in selection of samples but this is often not practicable, as was the case in the three excavations considered here. In addition to soil samples for analysis, botanical material may be recognised during excavation and recovered and sampled in the same way as small finds. Hand-picked botanical samples from Perth, for example, included collections of hazelnuts and wads of mosses.

The specialist receiving the samples collected for analysis then has the task of examining them and relating the data obtained to the archaeological contexts. Any pattern of the plant assemblages contained within the samples can then be detected.

In order to compare assemblages the samples or subsamples from them must be standardised. This can be done on either a weight or a volume basis, the numbers of extracted macrofossils being recorded thus giving a measure of seed density within the soil. Replicate samples (or subsamples) may be needed from the same deposit in order to establish a full species range and if more detailed information is required on a particular species or group of species. An alternative is to count an arbitrary number of macrofossils (for example 200) and calculate percentages of each taxa present. Ideally the number counted should be sufficiently large so that the percentages of the taxa no longer fluctuate. This however may be difficult to achieve due to the distribution of macrofossils within a given deposit, concentrations of seeds for example may occur where whole fruiting plants have been incorporated. Other areas may be particularly poor in macrofossils for example if local conditions are unfavourable to preservation.

As a result most workers use samples of a standard weight or volume of soil. This theoretically should allow comparison of results from subsamples taken from the same site and from different sites. However there are many dangers to be aware of.

1. seed productivity within and between species is variable

2. differential preservation

3. difficulty of choosing a representative sample size due to uneven distribution of macrofossils. Any increase in accuracy gained by taking a larger sample unit has to be offset by the greater time required to examine it.

1.5 Preservation of plant remains

Plant parts may be preserved on archaeological sites by the following processes:

1. carbonisation
2. waterlogging
3. mineralisation
4. a) desiccation
   b) freezing
5. impressions on pottery and other materials.

The first two occurred at the sites studied.

Organic materials may become carbonised for the following reasons (Hubbard, 1976):

1. they are burned intentionally: such is the case of wood in fires, chaff in bonfires or stubble-burning etc.
2. they are burned accidentally, as a hazard of their usual functions; such as the cooking of food, the parching of crops, or the fire-hardening of a wooden tool.
3. they are burned accidentally, during a calamitous fire.

Preservation under waterlogged conditions is due to the exclusion of air creating an anaerobic environment in which the organisms of decay cannot thrive. The majority of plant remains recovered in the present study were preserved in this way. Plant remains vary greatly in their resistance to decay, pollen grains being the most resistant although they were not considered here. Seeds and fruits are frequently encountered in archaeological samples and are an important source of information since determinations can usually be made at the species level. The extent of waterlogging may vary greatly from sample to sample thus affecting the preservation conditions. Waterlogged evidence frequently provides long lists of species, the majority of which are usually wild plants and weeds. Plants of economic significance tend to be poorly represented in comparison with evidence preserved by carbonisation. Green (1979b) discusses interpretation of information obtained under different methods of preservation.

1.6 Seeds and seed banks

Seeds represent a stage of arrested development of the young plant, the dormant period varying considerably in length. Dormancy enables members of the population to remain insulated from recurrent or sporadic environmental hazards. Thus it ensures continuation of the population through seasons unfavourable for growth or environmental catastrophes to which the growing plant is not adapted (Harper et al, 1970). Dormant seeds are frequently of low weight and thus offer the plant an opportunity for dispersal on a relatively large scale. Plant species vary in the proportion of their net annual assimilated income which they devote to reproductive effort. Perennials and particularly woody species devote a greater part of their energy resource to persistent vegetative organs. Herbaceous annuals in contrast often produce large numbers of seeds which are readily dispersed.

The following table outlines two extreme strategies of plant adaptations; a continuum of intermediate types is present in nature.

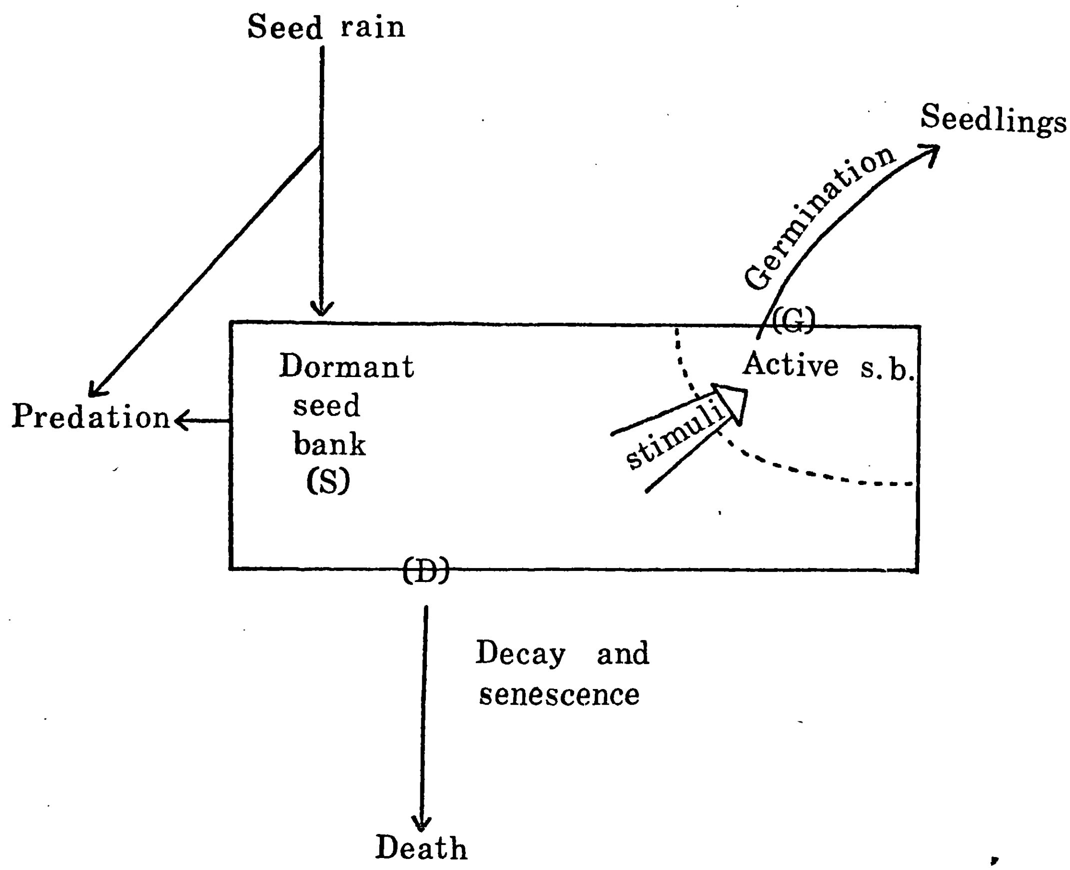
opportunist species (r-selected species)	specialist species (K-selected species)
annuals	perennials
herbaceous	woody
colonising species - occupying early stages in succession (unstable habitats)	climax species - occupying late stages in succession (stable habitats)
high reproductive effort	low reproductive effort and high competitive ability
large numbers of wind-dispersed seeds produced	small numbers of seeds produced dependent on specialist dispersal habits of animals and birds
persistent seed banks	transient seed banks

The r- and K-selection terminology was introduced by MacArthur and Wilson (1967). r is the maximal intrinsic rate of natural increase and r- selection leads to high productivity. K is the carrying capacity and K-selection leads to increasing efficiency of utilisation of environmental resources (Pianka, 1970). The concept is a useful one for comparing life histories of organisms. We can expect seed banks to contain a large proportion of r-selected species.

Seed assemblages recovered from archaeological excavations are examples of seed banks formed under conditions where man plays a dominating role. In order to attempt a satisfactory interpretation it is worthwhile to consider the state of knowledge of seed banks formed under natural circumstances. Harper (1977) provides a useful review of the topic. Figure 1, taken from Harper, summarises factors affecting seeds in the soil.

A lack of correlation has repeatedly been found between the vegetation present on the surface and the composition of the seed bank beneath. This is most marked when the seed bank studied is under mature or climax

Figure 1



communities. For example, many viable buried seeds under a woodland belong to species of earlier successional stages and plants of these species may no longer be present in the vegetation, although given the right environmental conditions the seeds will germinate. The seed bank therefore gives an indication of vegetation present during earlier stages in the succession. These species have seeds which persist in the soil in a dormant state. Seeds of late successional species such as many trees, whose reproduction is delayed for several years, are infrequent in the seed bank. Their seeds are often large and are unable to persist in the seed bank for long.

The time of year at which the seed population of the soil is studied is important as species vary widely in their dormancy and germination patterns. Thomson and Grime (1979) in a recent study of the seasonal variation of seed banks have categorized seed banks of individual species into four types according to germination pattern:

seed bank Type I : species with transient seed banks present during the summer

seed bank Type II : species with transient seed banks present during the winter

seed bank Type III: species a proportion of whose seeds fail to germinate directly and become incorporated in persistent seed banks

seed bank Type IV : species with large persistent seed banks which change little with season.

Seeds of K-selected species with type I seed banks germinate rapidly soon after release while those with type II seed banks delay germination until the beginning of the growing season. They are thus adapted to relatively stable habitats in which regular gaps are formed seasonally. r-selected species with persistent seed banks of types III and IV are adapted to unstable habitats where opportunities for germination are unpredictable. Thus in studies of the seed bank flora under natural circumstances a heavy bias of species with persistent seed banks can be expected.

The seed population of arable soils has received much attention from Roberts and his co-workers. Cultivation of the soil involves periodic disturbance bringing seeds to the surface where dormancy breaking stimuli are most pronounced (Roberts and Neilson, 1980). In the absence of cultivation and fresh seed input, Roberts and Dawkins (1967) have shown that the viable seed content of agricultural soil decreases exponentially. If the soil is cultivated (Roberts and Feast, 1973) this decrease is generally two to three times greater. This more rapid decline may be accounted for by the emergence of seedlings as a result of soil disturbance caused by cultivation.

Many arable weeds are adapted to particular cropping systems and some knowledge of the periodicity of seedling emergence is useful in their control.

Arable weed seeds are commonly wind-dispersed but others depend for their dispersal on possession of seeds of similar size to the crop seeds thus enabling transport through harvesting to sowing the following season. Agrostemma githago, corn cockle, is an example of such a species; it is now nearly extinct in this country due to improved seed cleaning. Seed banks of cultivated arable soil contain a flora specially adapted to periodic disturbance; the population consists largely of annual weed species while seeds of perennials and crop plants are scarce.

Ødum (1978) has made an extensive study of dormant seeds in Danish ruderal soils. He uses the term ruderal soil in a wide sense as a collective term for "uncultivated soils within and around existing or abandoned settlements showing traces of human activity". Ruderal soils, in contrast to arable soils, present an extremely heterogeneous situation and as a consequence the seed bank varies widely over short distances. Examination of seedlings which germinated from soil samples of ruderal soils and on experimental plots, where the upper layer of soil was removed and the surface covered by a small diameter mesh net, showed that a large proportion of the seeds present belonged to the earliest stages of succession on disturbed ruderal soil. These species often did not form part of the surrounding vegetation being r-selected pioneer species with persistent seed banks.

The longevity of seeds forming persistent seed banks varies. Ødum (1965) has given minimum datings for dormant seeds from a number of his sites. Seeds of many weed species were found to remain viable in the soil for at least 100 to 600 years. Seedlings of Hyoscyamus niger germinated from seeds in the soil dated to 1300 while Chenopodium album and Spergula arvensis seeds germinated from Iron Age culture layers dated to 200A.D.

1.7 Plant assemblages from archaeological contexts

A large proportion of r-selected weedy species with persistent seed banks may be expected to be found when examining soil samples from archaeological contexts. Seeds of species with transient seed banks may be incorporated at certain times of the year coinciding with seed release. Most species possessing transient seed banks are however likely to be incorporated in the soil as a result of the action of man. The anaerobic environment resulting from the building of occupation layers and the waterlogged, often acid, conditions greatly reduce the decay factor and have thus allowed the seeds to preserve to the present.

The archaeological context in which the plant remains occur is important when interpreting the resultant assemblages. Samples may come from contexts such as pits, soak aways and ditches or from the interior of buildings, for example floor levels and hearths, or from specific objects such as the Elgin barrel. The resultant assemblages of plant remains are artificial in nature. They often contain a mixture of plants growing on or near the site and those brought in. Plants may be brought intentionally to the site, for example crop plants and flooring materials, or they may arrive accidentally along with these materials or in animal dung, bird droppings or on the soles of feet.

It is frequently impossible to get direct evidence for the use of plants recovered from waterlogged samples. Plant assemblages from archaeological contexts may be indicators of what was thrown away rather than what was consumed or used in some other way. Examination of cess pit material however can result in evidence for consumption of certain plants although only that portion which is capable of surviving digestion will be represented. Care must be taken to distinguish between cess and rubbish material and between human and animal dung. Animal dung will often provide evidence of a rich weed flora. Cereal pericarp debris, in particular wheat fragments, will generally indicate a human origin. Work has been carried out on the identification of coprosterols present in samples from the Roman fort of Bearsden containing large quantities of cereal debris (Dickson et al, 1979 - addendum, Knights et al, forthcoming).

Papers by Dennell (1974, 1976) stress the importance of considering crop-processing activities when attempting to deduce the possible economic importance of plants found on the site. His approach is "that of distinguishing those plants that were prepared for storage or consumption from those that were not, rather than assuming that if a potentially edible plant is present on a site, it was necessarily utilised." His examples deal with carbonised assemblages of plant remains which do not give an overall picture of the arable agriculture. For example, cereals requiring parching to free their grains are more likely to be accidentally carbonised than free-threshing cereals and legumes which do not require parching. Deductions as to the importance of a species must therefore be made with care. Factors such as the quantity of seeds produced by a species, size of seeds, their ability to be dispersed and to persist in the soil, must be taken into consideration when using numbers of seeds as a comparison between samples. To take an obvious example, bramble seeds are likely to be far more numerous than cherry stones.

It must also be remembered that interpretations of wild plant assemblages in particular are based on the assumption that the ecology of the plants, has not altered significantly since the time of deposition.

Chapter 2

Historical background

2.1 History of the three towns

A climatic optimum was reached in northern Europe between the years 1000 and 1300 with temperatures being raised slightly and accompanied by mild wet winters (Lamb, 1977). This was one factor allowing the land to sustain an increase in population. The same period also witnessed the development and growth of towns. In Scotland there is a lack of good evidence for urban life in the first half of the 12th century. The earliest charters making grants to burgesses of a burgh date from the 1160's, but it is nevertheless likely that burghs were in existence before then (Duncan, 1974).

David I is regarded as being the creator of many burghs since he granted the priveleges necessary for the further development of urban life to already existing settlements (Duncan, 1974). Duncan makes the point that "we should distinguish between the town which is a settlement and a way of life on the one hand, and the burgh which is an agglomeration of priveleges designed to further that way of life, on the other". Medieval towns were characterised by division of labour with inhabitants engaged in different occupations and crafts. Trade developed as goods were produced and sold. The burghs exercised a monopoly of trade and craft over large rural areas, which in turn supplied raw materials and food.

In general towns developed at nodal points of communication. The three burghs considered are all on the eastern seaboard of Scotland (figure 2) Perth developed as a port on the River Tay where the land and sea routes met. The Tay is tidal as far as Perth and could bear ships to and from sea. At the same time it was shallow enough at low tide to be forded, thus being an important river crossing on north-south and east-west routes. Aberdeen developed from probable beginnings as a settlement of fishermen's huts to become a port at the mouth of the River Dee and principal burgh of northern Scotland. The Laigh of Moray, with its naturally free-draining soils and mild climate, was attractive to early settlers. Communications were limited and Moray was often largely independent of the central lowlands and the Scottish kings. It was not until 1135 when the earldom was annexed to the crown that the Scottish monarchy took over direct control of Moray (Cant, 1976). Royal burghs with associated castles were established at Elgin, Nairn and Inverness. Thus in Elgin, more so than Aberdeen or Perth, the burgh had a "civilising" and controlling function.

Perth became the second most important town in Scotland, after Berwick, being far more important than Edinburgh or Aberdeen. The Scottish kings frequently resided at nearby Scone with its abbey and thus there were many business dealings between the king's household and the burgh (Duncan, 1974). A flourishing business community became established in Perth which attracted foreign merchants and craftsmen. Flemings in particular were persuaded by David I to settle in Perth and other burghs (Duncan, 1975).

Figure 3 is a plan of medieval Perth, It shows the systematic layout of the burgages on either side of the main thoroughfares. At Elgin the properties were similarly laid out on either side of the High Street. The backlands behind the buildings on the street front in Elgin were in early times laid out as a small croft. Later they were built up, by the erection of houses at right angles to the street forming closes, but each burgher still retained an opportunity for crofting on the "Borough Briggs" or "Town's Crofts" to the north and south of the burgh (Cant, 1946). It is probable that in early medieval times some small-scale cultivation was carried out by the burghers in the riggs behind their dwelling houses. Some animals were perhaps also kept. At Forres, a neighbouring burgh to the west of Elgin, the properties were so narrow that houses were erected with the gable facing the street and the door opening from a lane or close. The land surrounding the town was also divided into riggs which were cultivated by the townspeople, the riggs being allotted by lot each year (Forbes, 1975).

Much of the food consumed in the burghs was however brought in from surrounding rural areas and also imported from England and the Low Countries in times of need (see section 2.2 on trade). Aberdeen differs from Perth and Elgin in not being surrounded by a zone of fertile land capable of supplying the town with the bulk of its necessary provisions. Instead Aberdeen is surrounded on three sides by a zone of relatively unproductive land with the sea to the east. According to an eighteenth century source (Anderson, 1794), this barren zone was from six to eight miles in width and meal, butter and cheese had to be brought from beyond. The same source tells us that for fresh produce the town relied on a few acres of flat sandy land in the neighbourhood which were well fertilised with dung from the town. It is not improbable that a similar situation existed in medieval times.

The only fertiliser available was dung; allowing cattle to feed on the stubble also manured the arable fields. Supplies of dung were limited by the number of animals grazed which was itself directly in ratio to the pasture and rough grazing available (Duncan, 1975). Arable land not receiving additional nutrients from dung was exhausted after two or three years. Manure may have been transported from the burghs to surrounding arable fields.

2.2 Trade in the medieval burghs

The burghs were important trading centres. They provided markets for the surrounding rural areas and in addition important burghs like Perth were also ports and traded with England and the Low Countries. Perth had a thriving trade in hides and woolfells; Hodgson (1979) suggests that the burghal monopoly in the selling of animal products may have affected animal husbandry in the agricultural hinterland of the sheriffdom by determining time of slaughter of animals to coincide with the anticipated arrival and

and departure of ships. Berwick and Perth were the chief Scottish ports engaged in overseas trade. Even the burgesses of Elgin however had a trading vessel in 1383: the Statistical Account (1793) tells us that it was named Farcost and that it sailed up the Lossie which then had direct communication with the Loch of Spynie, at that time an arm of the sea. This vessel was loaded with barrels of beer, tallow and flour.

During the 12th and 13th centuries grain was imported to Scotland, principally to the ports of Berwick and Perth. Scottish cereal production was probably insufficient to supply the needs of an increasing population, much of the land being totally unproductive and waterlogged. For example, even in the early 18th century the now extremely fertile Carse of Gowrie was "in many places overrun with rushes, disfigured by pools of water..... and the whole people subject to ague" (Donaldson 1794). Drainage and reclamation of the fenland had however begun in medieval times in England and production from the English cornfields resulted in the expansion of the ports of the Wash, in particular Lynn and Boston (Carus-Wilson, 1962-63). The surname Lynn appears at Perth in the 12th century indicating that trade with the Wash ports was already growing (Duncan, 1974). Quantities of corn together with malt and ale were shipped north from Lynn (Carus-Wilson, 1962-63), the monastic houses probably being the largest single customer (Duncan, 1975). Hides and wool-fells were the major goods shipped south from Perth (Duncan, 1974).

Wine was imported to Scotland during the same period from the north of France and from Bordeaux which grew in importance as a wine port throughout the 13th century (Duncan, 1975). The ports of the Wash also exported wine, brought mainly from Bordeaux, to Scotland (Carus-Wilson, 1962-63). By the year 1246 the merchants of Perth had debts in Bordeaux which were doubtless incurred in wine purchases (Duncan, 1975). The royal housefold was the most important single customer but as time went on more people desired to drink wine and it became "a stimulant to agrarian and pastoral expansion and to the growth of the Scottish economy" (Duncan, 1975).

Other imported foods are mentioned in the section on diet in medieval Scotland.

Other imports included high quality cloth, dyestuffs for native cloth manufacture, manufactured goods and also the raw materials, timber and iron (Duncan, 1975).

Chapter 3

3.1 Description and dating of the three sites

Perth

Figure 4 is a plan of the site at Perth High Street showing the positions of the excavated areas. Biological samples examined for their macrofossil content came from areas 7, 9 and 10 which were excavated in the 1977 season. The samples looked at cover a wide range of archaeological contexts both within and outwith buildings and from pits and cess pits (see Table 2).

Dendrochronological studies of timbers from the site and studies of imported pottery have shown that most of the deposits lie within the period 1150 to 1300. Timber from a pit under Building 18 gave an estimated felling date of 1161 ± 9 (or later) while timber from inside the building gave a date of 1194 ± 9. Sherds of Rouen pottery dating to around 1250 were found associated with the same building.

Aberdeen

The Farquhar and Gill site lies between St. Paul Street, a vennel or lane, and Upperkirkgate which leads to the parish kirk of St. Nicholas (figure 5). Figure 6 shows the layout of the areas excavated during 1977-78. Samples were looked at from a wide range of contexts in areas A-F (see Table 3).

The following is a summary of activity during the site phases (approximate dates are determined from the associated pottery etc., see Table 4).

a) Phases 2-6, 13th century. Series of irregular plots c. 3.7-5.0m wide. Some buildings, constructed of post and wattle, in most phases. The buildings tend to be towards the south or centre of the plots. There are few pits, except in phase 4, when one plot appears to have been vacant (or perhaps incorporated with a plot and building on Upperkirkgate) and used for dumping rubbish.

b) Phases 7-10, 14th century. Reorganisation of the plots, more regular c. 5.4-6.0m wide. Fewer buildings, many more pits, suggesting that these plots may have come into possession of the buildings in the Upperkirkgate and used more as backlands.

A smaller site in Queen Street was excavated prior to 1976. Samples dating to 13th and 14th century were looked at from two areas.

Elgin

Figure 8 is a plan of the site which consists of backlands immediately north of the High Street. The site is small, maximum dimensions being 15m by 17m. Height varies between 17 and 19m O.D., the site sloping gently down towards the River Lossie with the Castle Hill and Blackfriars Monastery to the west (see Figure 7).

The main activity of the site belongs to the 14th century although the earliest ditch cutting across the site is dated to the 12th or 13th century. Most of the pits are of 13th/14th century date; a Dutch pottery vessel accurately dated to the mid 14th century was found inside the barrel. The soak away, a timber built structure, belongs to the 15th century. A series of 18th century longitudinal trenches which may have been deep beds for agricultural purposes or latrine slots are present in the north-east corner of the site.

Samples examined for macrofossils came from four types of contexts: seven samples were from pits, four from the soak away, four from the barrel and one from a post-hole under a pit (see Table 5). See also Plates 1 and 2.

3.2 Extraction methods and sample sizes

Samples were collected by the excavators at each of the three sites. Table 1 gives details for each site of the contexts from which samples were examined for macrofossils, methods of extraction and sample sizes.

Paraffin flotation was carried out by J.A.W. Lock, insect specialist, at Perth and water flotation by W.J. Lindsay, archaeologist, at Elgin.

Flotation

This depends on the relative specific gravities of the floating medium and the material to be recovered. Surface tension of the liquid also helps to catch lighter particles at or just below the surface. Paraffin has a higher specific gravity than water; seeds and other plant remains with small pockets of trapped air as a result float more easily.

Paraffin is the preferred medium for the extraction of insect remains; plant remains however must be sorted from both the float and the residue.

Wet sieving

Samples were washed through a sieve of mesh width 250µ using a gentle stream of warm water. This mesh width is sufficiently small to retain the smallest seeds such as Juncus species. Samples were previously dispersed, if necessary, in a dilute solution of NaOH. Samples were examined in sub-sample volumes of 100 cm^3, replicate subsamples being looked at for many contexts.

The resulting plant remains were sorted and identified using a binocular microscope. They were subsequently preserved in a fluid of equal volumes of methanol, glycerol and formaldehyde inside small labelled tubes.

Botanical samples

These were "small finds" hand-picked by the archaeologists during the excavations at Perth. A large number consisted of hazelnuts and clumps of

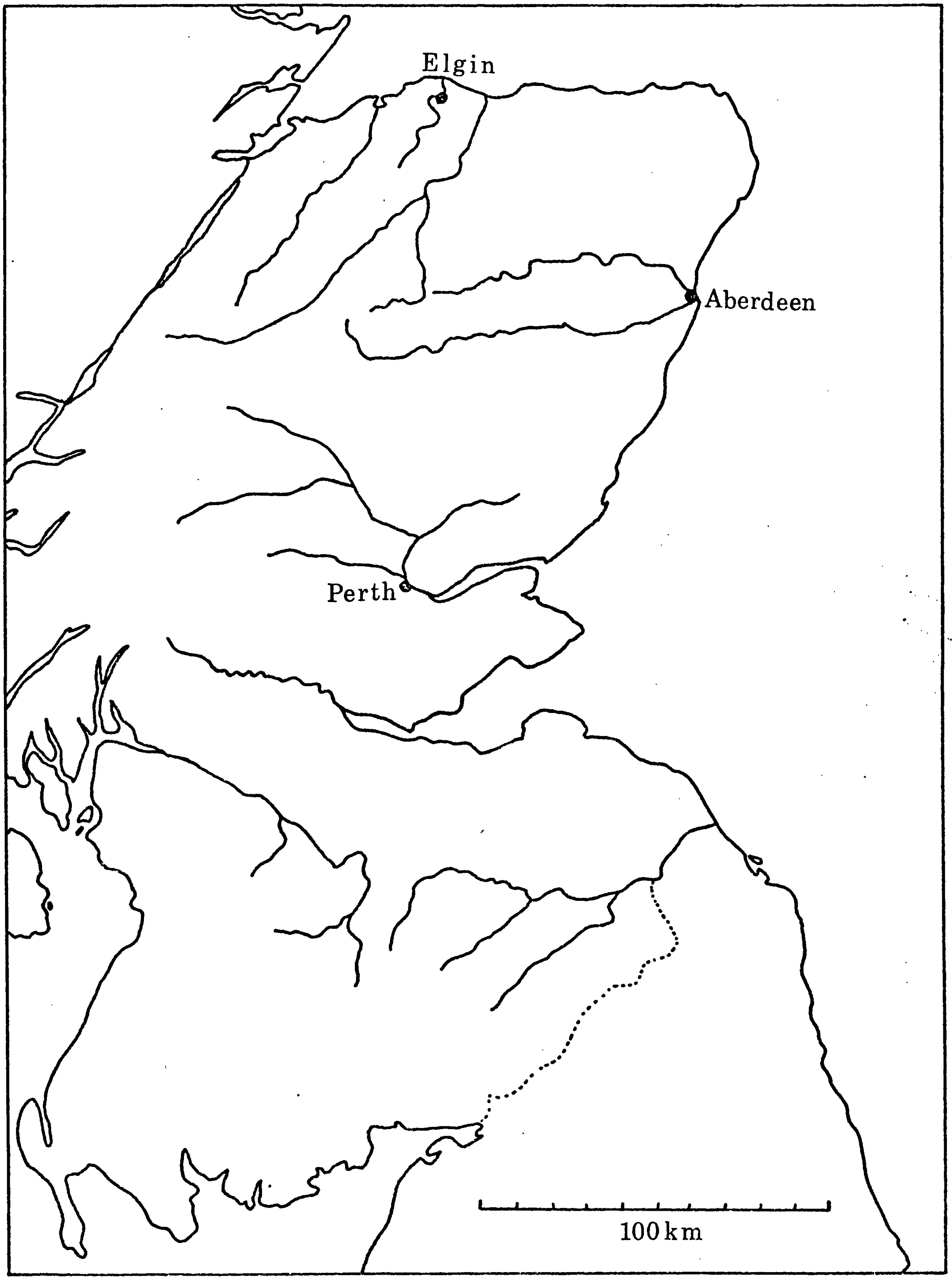


Figure 2. Map of Scotland showing position of Perth , Aberdeen
and Elgin.

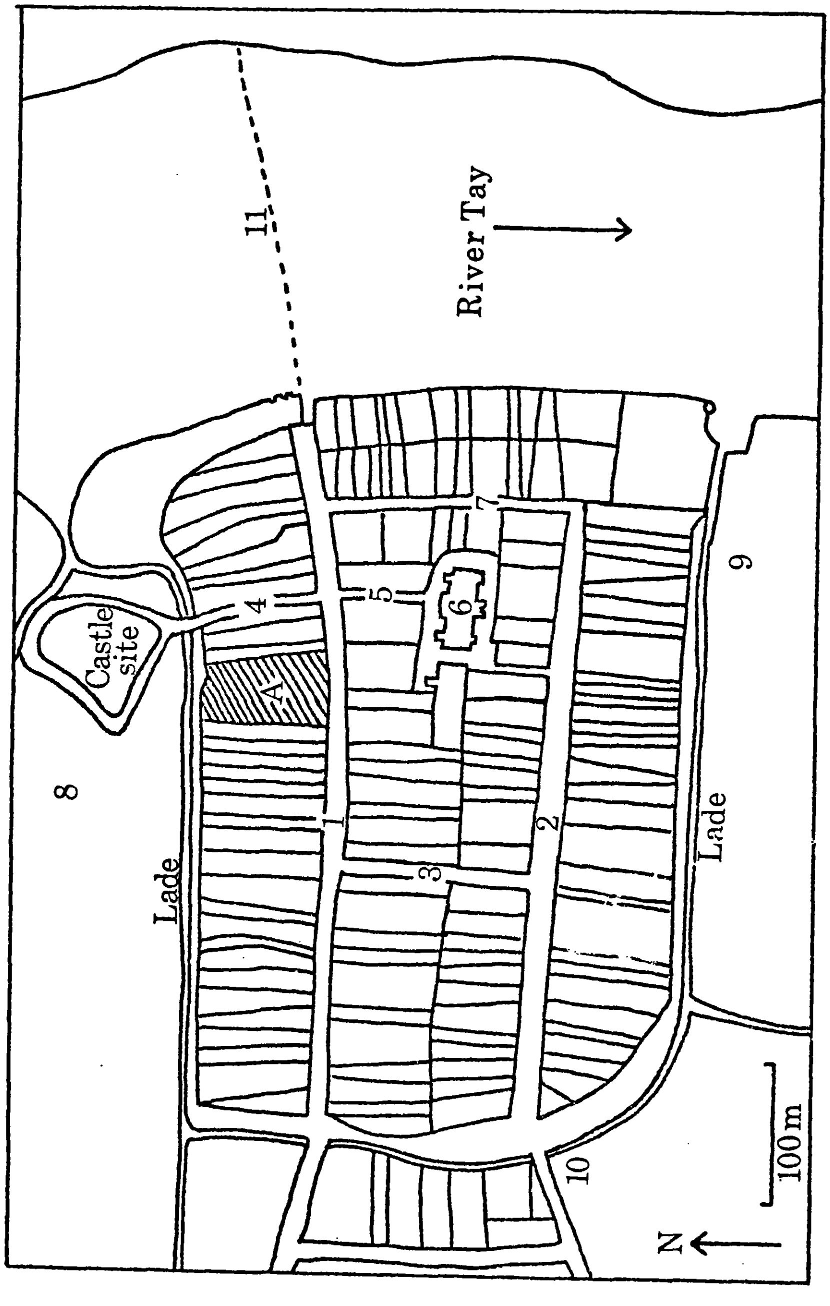


Figure 3. Plan of medieval Perth.

A : Perth High Street Site
1 : High Street
2 : South Street
3 : Meal Vennel
4 : Skinnergate
5 : Kirkgate
6 : St. John's Kirk
7 : Watergate
8 : Blackfriars Monastery
9 : Greyfriars Monastery
10 : Carthusian Monastery
11 : Approximate line of early ford and bridge

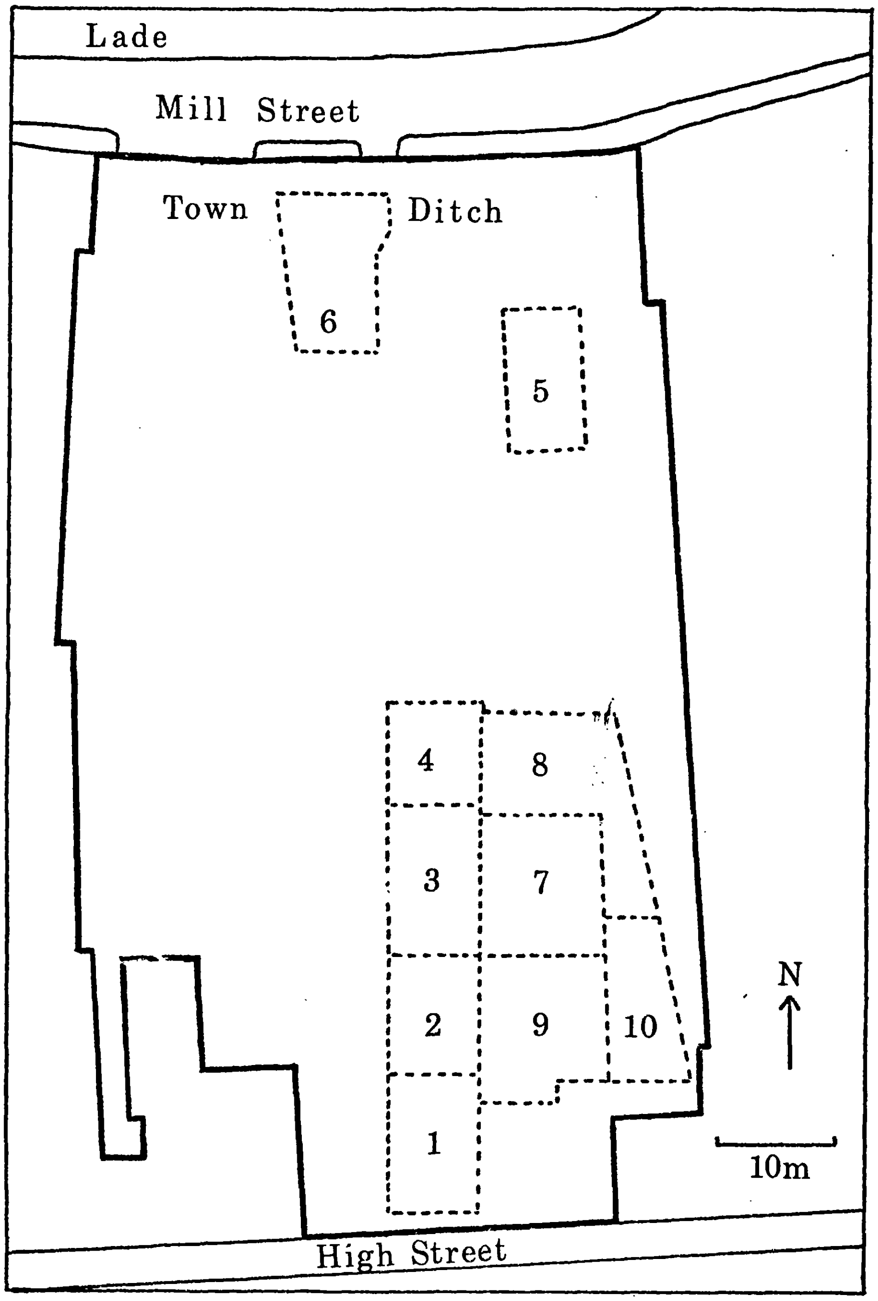


Figure 4. Plan of Perth High Street showing positions of excavated areas.

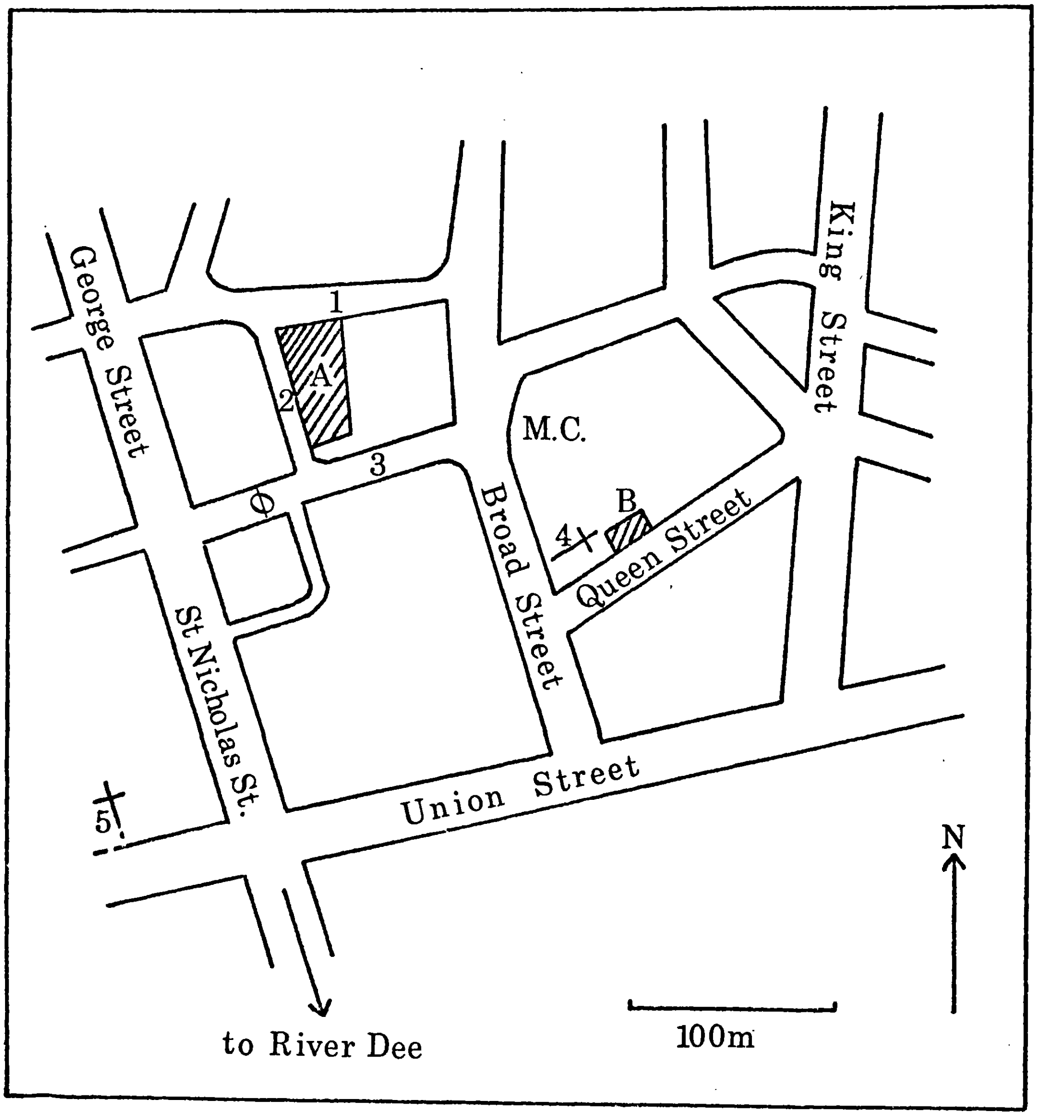


Figure 5. Map of Aberdeen showing location of sites.

A : Farquhar and Gill site
B : Queen Street site
1 : St. Paul Street
2 : Drum's Lane
3 : Upperkirkgate
4 : Greyfriars Church
5 : St. Nicholas Church
Φ : Site of port
M.C.: Marischal College

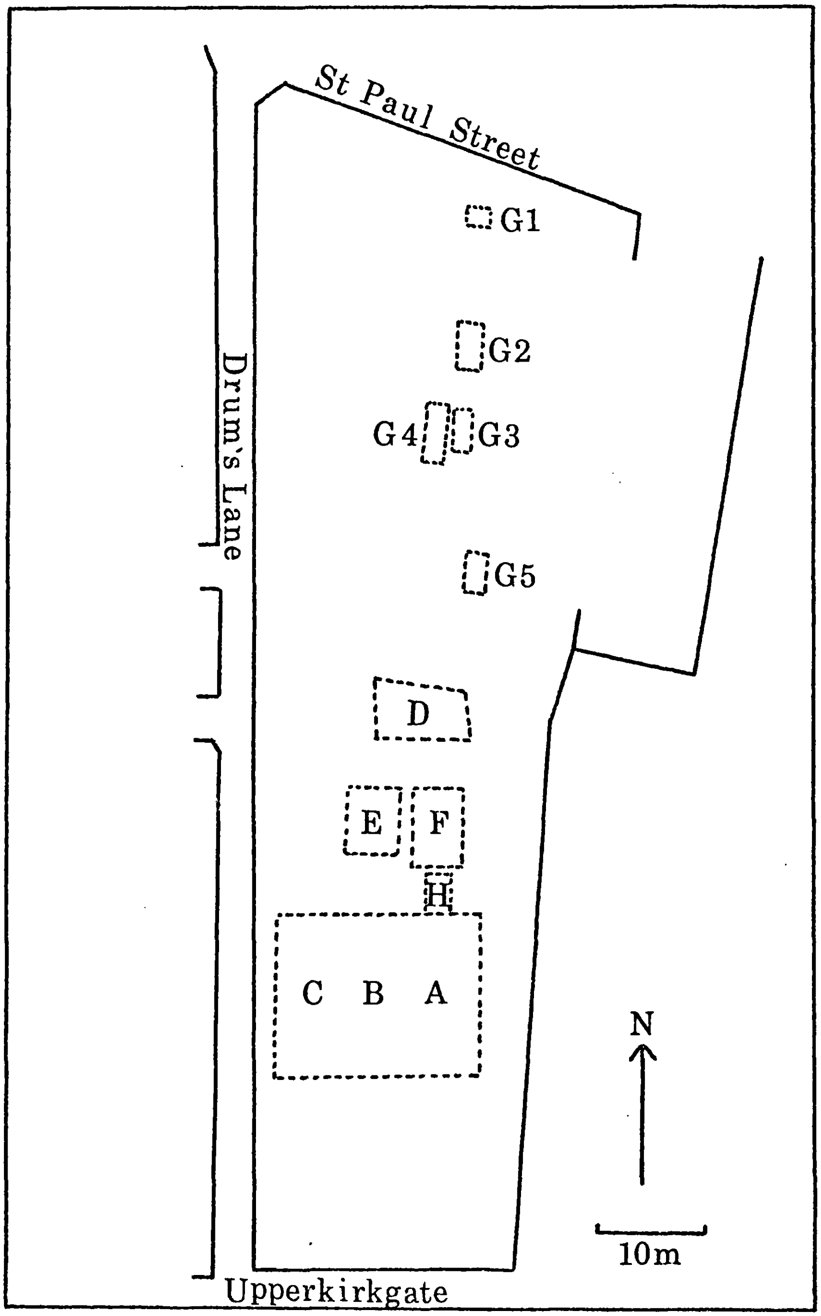


Figure 6. Plan of Farquhar and Gill site showing position of excavated areas.

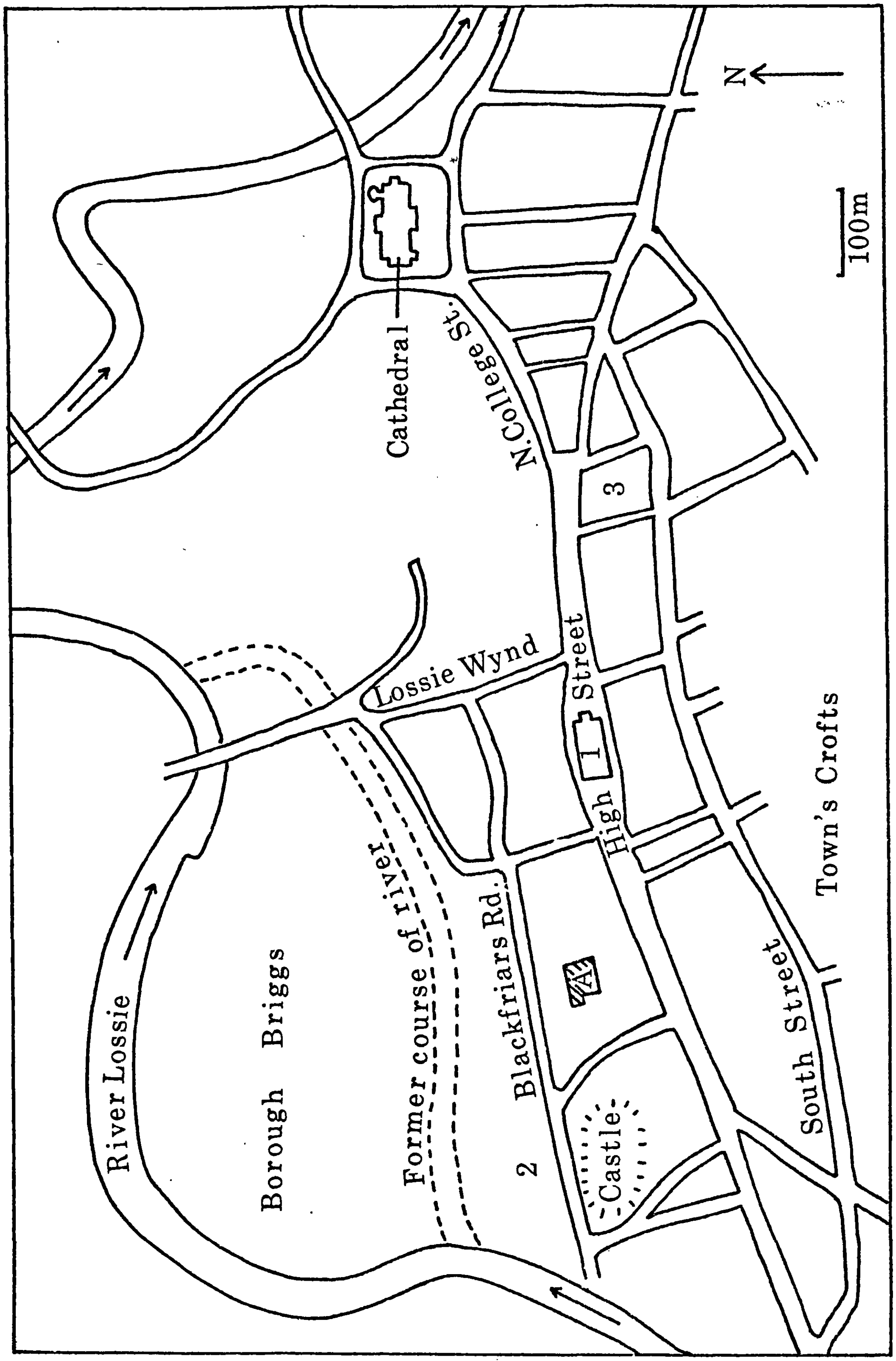


Figure 7. Map of Elgin showing location of site.

A : Elgin High Street site
1 : St. Giles' Kirk
2 : Site of Blackfriars Monastery
3 : Site of Greyfriars Monastery

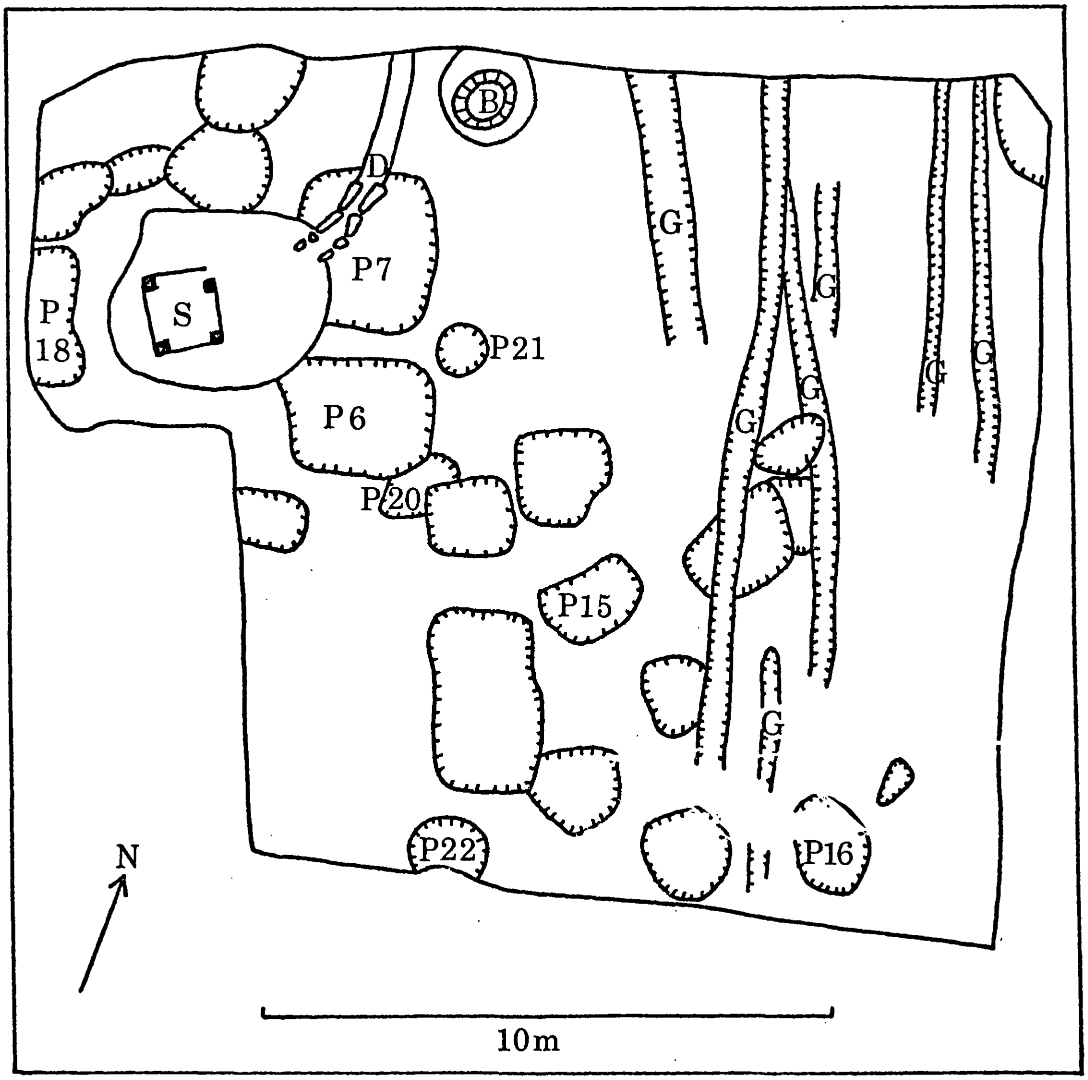


Figure 8. Plan of Elgin High Street site showing main features.

P : pit
S : soak away
B : barrel
G : gully

Only pits from which samples were examined are labelled.

mosses. Only four samples are included in table 2 .

3.3 Preservation and identification of macrofossils

Most of the plant material in the deposits from all three sites was preserved as a result of waterlogged conditions. The majority of the samples from the Aberdeen site had a pH value in the range 4.0-5.0, the high acidity increasing the resistance of the plant material to decomposition.

Some carbonised plant remains were however found on all three sites. These included:

1. cereal grains
2. grape pips
3. legume seeds
4. small numbers of seeds of weeds, heathland and wetland plants
5. shoots and leaves of *Calluna vulgaris* and *Erica tetralix*.

Plant remains were identified by comparison with modern reference material. In some cases it was necessary to heat reference seeds or fruits in dilute NaOH for a short time in order to facilitate comparison with fossils. After examination of most samples there was a small residue of unidentified remains.

The main reference book used was the "Atlas and Keys of Fruits and Seeds Occurring in the Quaternary Deposits of the U.S.S.R." (Katz, Katz and Kipiani, 1965). Also frequently consulted were Körber-Grohne (1964, 1967) Knörzer (1970) and Ross-Craig's "Drawings of British Plants" (1948-1973).

Nomenclature of plants follows Clapham, Tutin and Warburg (1962) and Smith (1978). It was not possible to determine some fossils at the species level, with these the genus name is followed by "sp". In cases where the determination of the species is uncertain "cf." is used. Taxonomic problems are dealt with individually in the annotated species list.

3.4 Description of tables of results

The results from the investigations are presented in Tables 12-15. Table 11 is a summary table of the species found on the three sites giving an indication of their relative abundance.

The plants are divided into the following groups:

Plants useful to Man

Weeds of waste places and arable land

Heathland plants

Trees

Plants of wet habitats

Bryophytes

Boundaries between these groups are not rigid, some plants fit into more than one group while others do not fit well into any.

The freshwater invertebrates, Daphnia and Plumatella, and the intestinal parasites, Trichuris and Ascaris, are also listed.

The main tables for each site (Tables 12-15) include numbers of macrofossils of each species present in the samples. Details of the cereals are given separately at the end of each table.

As mentioned earlier great care must be taken if the numbers of species are used to compare plant assemblages from different samples. The following points must be taken into account:

1. variation in seed productivity and size both within and between species
2. variation in the ability of the macrofossil to be dispersed and persist in the soil
3. variation in preservation conditions
4. variation in sample size and method of extraction of macrofossils.

Fragments may also vary considerably in size.

3.5 Brassica study

Subfossil seeds of Brassica and related genera from all three sites were examined in detail along with reference material. Scanning electron micrographs of both fossil and reference material were produced.

See Chapter 6 for results and details of study.

3.6 Modern weed flora

Lists of weeds present in fields of wheat, barley and oats were compiled from three fields in east Scotland and from a field of bere in Benbecula.

For details and comparison with medieval weed flora see Chapter 7.

Table 1 Extraction methods and sample sizes

	PERTH	ABERDEEN	ELGIN
Number of contexts from which samples examined	35	32	16
Methods of extraction of plant remains	1. paraffin flotation (31 samples) 2. wet sieving (5 samples) 3. hand-picked botanical samples (4 samples)	1. wet sieving (32 samples)	1. water flotation (15 samples) 2. wet sieving 5 samples)
Size of samples	1. paraffin flotation: 1kg. 2. wet sieving: 4 x 100cm^3 1 x 300cm^3	1. wet sieving Farquhar and Gill site: 14 x 100cm^3 15 x 300cm^3 Queen Street site: 1 x 100cm^3 1 x 200cm^3 1 x 600cm^3	1. water flotation: 1500cm^3 2. wet sieving: 4 x 100cm^3 1 unknown small quantity

Table 2 Perth High Street

Contexts of samples examined

P.F.	:	paraffin flotation
P.F. R only	:	paraffin flotation, residue only examined for plant remains
W.S.	:	wet sieved
botanical sample	:	hand-picked during excavation

Context numbers starting with 6 : Area 10
7 : Area 7
9 : Area 9

* : sample from a pit

**: sample from a possible cess pit.

context number	extraction method	context
6048	P.F.	** moist organic soil in pit 6132
6078	P.F.	moist peaty and clayey soil with much dung
6100	P.F.	dungy material
6104	P.F.	dung with wood fragments (possibly same as 6078)
6131	W.S. 100cm^3	** well-preserved organic debris with straw and many woodchips, filling pit 6127
7125	P.F.	no details
7129	P.F.	clayish soil with straw in B53
7168	P.F. R only	clayish soil with much organic material under B53
7169	1. P.F. 2. botanical sample	organic clayish soil in a pathway
7175	P.F.	* fibrous material filling pit 7183
7205	P.F.	clayish soil with patches of mortar
7213	P.F.	loose silty soil with some fibrous material filling hollow 7212
7218	P.F.	dungy soil with some wood chips, ash patches and areas of burning over B18
7223	P.F.	charcoal and dungy soil, filling feature (hearth?) 7224
7225	P.F.	sand with woodchips
7234	1. P.F. 2. W.S. 100cm^3	** dung with much straw, some peat and seeds, much moss, filling for cess pit 7230.

context number	extraction number	context
7320	botanical sample	mixed clayish soil and sand with many woodchips in B18
7323	W.S. 100 cm^3	** dung in pit 7314
9016	botanical sample	garden/midden
9137	P.F.	compact dung layer
9153	1. P.F. 2. W.S. 100 cm^3	dung with many woodchips and some ash and sand in B18
9235	1. P.F. 2. W.S. 300 cm^3	compact brown soil in B18
9240	P.F.	patch of peaty soil, in a pathway
9251	P.F, R only	clay, partially burnt, lining for hearth 9244 in B18
9261	1. P.F. R only 2. botanical sample	grey ash, possibly floor level in B18
9273	P.F.	* organic soil filling pit 9270 in B18
9275	P.F.	sandy soil with some woodchips filling pit 9276
9277	P.F.	organic soil with lenses of ash in B18
9279	P.F.	ash with lenses of black organic material in B18
9280	P.F.	* dung and mortar with soil filling pit 9242 in B18
9282	P.F. R only	no details
9285	P.F.	dung with ash and woodchips, occupation level in B18
9302	P.F.	* dungy soil with woodchips, filling pit 9301 in B18
9317	P.F.	* dung with patches of ash and sand filling pit 9301 in B18
9325	P.F.	ash with lens of dung in B18

Table 3 ABERDEEN Contexts of samples examined

Farquhar and Gill Site

Area	Sample No.	Layer No.	Site Phase No.	Subsample vol. cm^3	Context
A	209	92	9	300	Base fill of a cellar-pit could be associated with primary use of pit - later used as general rubbish/cess pit.
	211	74	9	300	Main general organic layer over much of area A. Area open yards and pits at this stage.
	213	115	9	300	Fill in pit TB
	223	149	7	300	One of fills in a boundary ditch TO/TQ. The archaeological impression is that the ditches were cut to mark out new property but once established were fairly quickly filled with rubbish etc.
	229	228	5	300	Below and around hearth in post-and-wattle building SAN
	237	212	3	300	Subsoil, directly over natural ultivated earth?
	239	247	2	300	Fill pit TAH. Small pit - possibly sump associated with boundary/drainage ditch.
	241	169	4	300	General layer
	245	233	3	300	Subsoil directly over natural same as S237
	248	257	8	300	Midden layer in yard area used for general dumping for short period
	249	259	5	300	Dump layer full of rubbish, much pottery
	251	176	6	300	General layer
	252	177	3	300	Dump layer

Table 3 continued

Area	Sample No.	Layer No.	Site Phase No.	Subsample vol. cm^3	Context
B	110	79	3	100	Midden/dump
C	43	133	9	100	Fill in pit BN.
	47	159	8	100	General layer built up probably contemporary to a wattle building BQ, near wall of building.
	48	163	9	100	Fill in pit BE.
	54	185	9	100	Fill in pit BN.
	66	234	5	100	Filled a slot along outside of wattle wall CR, one of external walls of CO.
	68	270	5	100	General layer
	73	300	3	100	Lower fill of boundary ditch DX.
D	305	25	9	100	Top layer of what may be a boundary bank.
	315	66	10	100	Fill in pit WK.
E	120	21	7	100	General layer.
F	704	44	8	100	Fill in pit UG.
	707	55	8	100	Fill in pit UG.
	715	59	7	300	Primary fill in pit UG. - thin layer in base, sealed by silting of natural sand.
	720	78	3	300	Fill in pit UUA - cess pit?
	725	79	3	100	Fill in pit UUA - cess pit?
	730	80	3	100	Base fill UUA - cess pit?

<u>Queen Street Site</u>

Area	Sample No.	Layer No.	Site Phase No.	Subsample vol. cm^3	Context
I		3	13/14th C.	100	Midden/dump area.
II	FN	22	13/14th C.	200	Channel/ditch cut through subsoil.
	FN	57/57A/57B	13/14th C.	600 (six 100cm^3 subsamples)	Two pits cut into subsoil and filled with organic material.

Table 4 ABERDEEN

Dates corresponding to site phase numbers for Farquhar and Gill Site.

Site phase number	Date
2	late 12th - early 13th century
3	late 12th - early 13th century
4	early - mid 13th century
5	mid 13th century
6	late 13th century
7	c. 1300
8	early 14th century
9	late 14th century
10	late 14th century

Approximate dates determined from the pottery etc.

Table 5 ELGIN HIGH STREET

Contexts of samples examined

A : subsample of untreated soil examined (in addition to floated sample, with the exception of X629 for which no floated material was examined).

Sample number		Context
123		Pit 15
168		Pit 16
524		Pit 22
550		Pit 20
556	A	Pit 21
X602	A	Pit 18
X629	A	Pit 7
561		Post-hole under Pit 6
558		Soak away
X601		Soak away
X618		Soak away
X623	A	Soak away
656		Barrel
661		Barrel
662		Barrel
664		Barrel

Chapter 4

Integration of results with archaeological context.

The plant assemblages were related as far as possible to the archaeological contexts from which they were recovered. The heterogeneous nature of the assemblages made this a difficult task. It was most satisfactory in the case of the Elgin site where samples came from four separate types of contexts. The complex nature of the Perth site, its variety of contexts, sampling and extraction methods, made interpretation of assemblages difficult. The sites are treated separately in the following accounts. More detailed information on identification of macrofossils, history, ecology and uses of the plants is given in the annotated species list (Chapter 5).

4.1 Perth

The samples were remarkably rich in terms of number of species. A total of 147 taxa were recorded, including 24 bryophytes. Of these however only 26 were placed in the group "plants useful to man", the great majority being weeds and plants of wet places and heathland. Of the potentially useful plants some, such as bramble and hazel, probably grew wild nearby. The waterlogged conditions are favourable to the preservation of seeds of wild plants, many of which are weedy species producing large quantities of persistent seeds. Remains of economic plants such as cereal grains and flax seeds were present only in small quantities. However the sample from context 9153, an occupation layer inbbuilding 18, contained over 40 cereal grains. Of the cereals, carbonised grains of oats were the most frequent with barley (bere), wheat and rye also present. Rye was not found at either of the other sites. For further information on the cereals see page 97 . Fig seeds, normally very abundant in medieval cess pits (for example at Elgin and

Aberdeen), were extremely scarce. Other economic plants recovered, included walnut, apple, Prunus species, Brassica species,henbane, opium poppy. Hazel nutshells were abundant in numerous samples, including many hand-picked samples.

Cereal debris in the form of pericarp fragments of wheat, oats and barley was present in cess pits, for example contexts 6131, 7234, 7323. The paraffin-floated samples produced only tiny quantities of cereal debris suggesting that the small fragments are generally not retrieved using this processing method. Eggs of the roundworm, Trichuris, were found on wheat fragments in the sample from context 7323. Fragments of Agrostemma githago seeds were abundant in this sample. Seeds of this weed are poisonous so presumably this food was rather unpalatable to the consumer. Large robust mosses were particularly abundant in the sample from context 7234 and were possibly used for toilet paper or for stuffing and packing.

Many of the samples come from layers of dung and in these seeds of weed species are particularly frequent. It is not always simple to distinguish between human and animal dung although evidence of cereal debris will usually indicate the former. Seeds of many wild plants may have been consumed by animals and humans alike. Many of the weeds are common species of arable land and waste ground. Some may have been growing on the site, for example Urtica spp and Rumex spp, while others, such as Centaurea cyanus and Anthemis cotula, were probably brought to the site, perhaps in association with crops or in animal dung. Petals and calyces of Trifolium species and grass caryopses may indicate presence of fodder. Grass caryopses were generally poorly represented in the samples; many grasses possess transient seed banks which are present only during the summer (Thomson and Grime, 1979) and thus the likelihood of incorporation in the deposits is reduced. The meadow grasses (Poa spp), whose caryopses were frequent in the wet-sieved samples, produce a quantity of "seeds" a proportion of which fail to germinate directly and some of these are incorporated into a persistent seed bank (Thomson and Grime, 1979). This may account for their greater frequency along with the relative ease of their identification. The commonest weed seeds recovered were Polygonum lapathifolium, P. persicaria, Chenopodium album, Rumex acetosella, Galeopsis tetrahit, Spergula arvensis, Stellaria media, Urtica dioica and U. urens. These are all very frequent in waterlogged samples from archaeological contexts and, though some may have been gathered in times of scarcity, it is likely that most have no economic significance.

Heathland plants were frequent in most samples, in particular shoots of heather and achenes of tormentil. Half a seed of Rubus chamaemorus, a plant of high level blanket bogs was recovered from context 9235 (see page 61) Heathland mosses were abundant in some samples.

A large variety of wetland plants were present in the samples. Most of these probably grew close by on wet ground bordering the Tay although some such as Menyanthes trifoliata and Isolepis setacea were probably brought into the site. The river was liable to flood, as it did for example in 1209 when castle and bridge were swept away, thus helping to produce the waterlogged conditions in which the plant remains are preserved. Nuts of sedges were very frequent; sedges may have been gathered along with rushes, seeds of which were also common, for use as floor covering although no direct evidence of this was found on the site. A few fruits of Filipendula ulmaria were also found. The sweet-scented flowers and leaves were formerly used for floor covering.

Egg cases of the freshwater invertebrates, Daphnia and Plumatella, were common in some samples. The Tay is tidal as far upstream as Perth but these creatures may have lived in lades, ditches and streams flowing into the main river.

4.2 Aberdeen

A total of 103 taxa including 23 mosses were recovered from the samples.

Farquhar and Gill Site

Most of these samples contained a range of seeds of weedy plants which either grew on the site or were present in nearby arable fields and subsequently brought into the town with produce. Heathland plants including mosses were well represented although usually only by small fragments. Peat was probably brought in from nearby bogs for use as fuel. Rush seeds were present in almost all samples along with small numbers of other plants of wet habitats. Little can be deduced from the numbers of rush seeds in any sample since large quantities are produced by each flower-head.

Scattered representatives of plants potentially useful to man were found. The bulk of the material from sample A S229 L228, which came from below and around the hearth of the post - and - wattle building SAN, consisted of carbonised florets and floret bases of oats (Avena sativa). This may be a result of accidental burning during parching of the oats to release the grains from the surrounding husks (see page I03). Many small pieces of charcoal were also present; hazel and alder were identified. Sample A S239 L247 which came from the fill of pit TAH likewise contained a lot of burnt material.

Two samples (A S237 L212 and A S245 L233) consisted of subsoil directly over the natural. The initial medieval activity on the site is considered to have been cultivation as gardens or fields. Several possible cultivation marks, made perhaps by spades or hoes, were found cutting through the subsoil into the top of the natural. The samples contained primarily weed seeds which are common in arable soils along with small quantities of heathland plants which may have blown in.

Sample C S48 L163, the fill of pit BE, was of interest being the only sample from the Farquhar and Gill site to contain fig seeds. Other food plants were present: one carbonised grape pip, raspberry and blaeberry seeds, uncarbonised pericarp fragments of wheat and oats. There is therefore a distinct possibility that this pit was used as a cess pit.

Sample C S66 L234, which filled a slot along the outside of wattle wall CR, contained large quantities of short lengths of hair. These were matted together and may have been used to bind wall cladding.

The bulk of the organic material in C S68 L270, which came from an archaelogical layer lacking in structure, consisted of delicate transparent caryopses of oats.

Three samples from pit UG in area F were looked at. Sample F S715 L59 was a very thin layer in the base sealed by silting of natural sand and therefore might be expected to provide information about the original use of the pit. However although a wide variety of plants, including some food plants, was recovered no specific function for the pit was indicated suggesting that either it was a general purpose cess/rubbish pit or that the sample consisted of secondary rubbish fill, the primary fill having been removed or destroyed. The single opium poppy seed fragment from this sample is noteworthy. Other samples of fill from the same pit consisted of secondary rubbish fill above the silted sand. They contained a much smaller range of plants and very few useful plants.

The pit UUA, also in area F, which contained extremely smelly cess-fill did not produce much in the way of food plants with the exception of occasional pericarp fragments of wheat.

Queen Street

The richest material produced from the Aberdeen excavations came from Queen Street Area II FN 57/57A/57B. The samples were from two medieval pits cut into subsoil and filled with organic material.

Six 100cm^3 subsamples were looked at; these contained a variety of plants of economic use as well as many weeds. Mosses were present in large quantities in three of the subsamples. From the combination of possible food plants present (figs, raspberries, brambles, blaeberries, pericarp fragments of cereals) there is a strong possibility that the pit was used as a cesspit. A large proportion of organic material in the subsamples was cereal debris which was similar in appearance to material from a ditch at Bearsden Roman fort which has been shown by biochemical means to be sewage (Knights et al, forthcoming). Further evidence supporting this hypothesis comes from the presence of numerous eggs of the roundworm parasite *Trichuris* which were seen on slide preparations of cereal grain fragments and on leaves of the moss *Rhytidiadelphus loreus*. One egg of another worm, *Ascaris*, was also seen. *Ascaris* and *Trichuris* are common intestinal parasites of man and his domestic animals, especially pigs. Also present in these subsamples were large numbers of fly puparia which suggest the presence of stagnant conditions (Pike, 1975). Other animal remains found included quantities of small bones, feather fragments and animal hair.

Robust hypnoid mosses (e.g. *Hylocomium splendens*, *Rhytidiadelphus loreus*, *Hypnum cupressiforme*) were abundant in most of these subsamples. These are heathland and woodland mosses and may have been used as toilet paper.

The large number of flax seeds is interesting and may indicate a local textile industry. No flax fibres were however observed and it is possible that flax was grown for its oil-rich seeds.

4.3. Elgin

A total of 119 taxa (including 20 mosses) were recovered from the Elgin samples showing a rich and varied flora. Macrofossils belonging to plants useful to man were generally in greater abundance than at the other two sites.

Pits

Most of the pits date from the 13th/14th century. They were cut into fine sand with a few having traces of wattling on their sides. The pits were holes dug for the purpose of taking midden/cess material. Preservation was good and there was little interference or cross-contamination between pits. They are all of similar date and the midden material may have come from another source which was disposed of in several pits at the same time as the cess material.

Samples were looked at from seven pits. All contained a range of plants useful to man and in most cases large numbers of seeds of weedy plants. Heathland plants and plants of wet habitats were generally infrequent as were mosses.

Pits 21, 18 and 7 were the richest in terms of number of taxa recovered. (36 taxa identified from pit 7). The assemblages from these three pits were similar to those from the soakaway which is located nearby. The wet sieved sample from pit 7 contained evidence of sewage in the form of abundant cereal pericarp fragments (wheat mainly but also oats and barley). Pit 21 contained a large number of carbonised cereal grains (over 80), while no cereal debris was recovered from the wet sieved sample. Seeds of bramble and raspberry were extremely abundant in the floated sample from this pit and in addition one carbonised grape pit was present. This was a very small pit and contemporary with the soak away (15th century). The sample from pit 15, taken from rich organic basal layers, also contained a large quantity of bramble and raspberry seeds. Fig seeds were present in five of the pit samples but only in small numbers.

The samples probably represent a mixture of rubbish and cess material. The carbonised cereal grains in particular would be an unlikely component of sewage. It is not possible to say whether the material came from one or several sources since in either case variation in the composition and distribution of the plant parts would be expected.

Barrel

The barrel dates from the mid 14th century and was set into the ground. The original bottom was knocked out and supporting pieces in the form of a cylinder of thirteen withies tied with fine binding were added to provide internal strength. About 15cm of the top were cut off and the pieces were found inside, as was a replacement lid. The barrel was probably used as a water receptacle although it does not seem to have been emptied. One possibility is that it was used as a plunge or dousing bath for tempering heated metals. The fill contained water-vole bones suggesting the barrel was left open. Ultimately it seems to have been filled with midden material.

Four samples were looked at from the barrel (664, 662, 661, 656 in order from bottom to top). All were taken from the inner fill and are therefore unlikely to provide indication of the primary use of the barrel. Table 6 lists the useful plants which were found in these samples, along with those found in the soak away.

Carbonised cereal grains were frequent in the upper samples while in the wet sieved sample looked at from 664 approximately 90% of the organic matter consisted of pericarp fragments, mostly wheat. Eggs of the roundworm parasite, Trichuris, were frequently seen on grain fragments providing further evidence for sewage in the basal layers. In the floated sample from 664, seeds of figs, raspberries and brambles were exceedingly abundant and blaeberry seeds frequent. The seeds of these fruits are small and pass through the digestive tract. However a large number of cherry and bullace stones were also found:

Prunus avium (Gean, Wild Cherry)	362 stones + 15 fragments
P. domestica ssp institia (Bullace)	32 + $\frac{1}{2}$
P. padus (Bird-Cherry)	21
P. spinosa (Blackthorn, Sloe)	35

These stones are all large enough to be spat out rather than swallowed so they would be expected to be associated with rubbish material rather than cess. The concentration of stones suggests that perhaps the fruits had been made into a drink possibly contained in the Dutch pottery vessel, the broken pieces of which were found associated with the stones. Since all fruit around the same time a mixture could have been used. A few apple pips and 24 carbonised grape pips were also found in this sample.

There is historical evidence for the existence of orchards at Elgin in the 16th century, although they may well have been present much earlier in association with the cathedral, building of which was begun in 1224, or the nearby Blackfriars Monastery. In 1556 the Dean of Moray made a contract with his gardeners that they would "labor the gryt orcheart and gardings of the said Dene's manss within the Channorie of Elgin indewring the space of thrie yeirs and sall dycht and sned (prune) all the tries and sall gude (manure) theme with sufficient muk" (Dunbar 1866). Another possible site for the fruit trees is the King's Garden which was situated close to the site on the south side of the High Street (MacIntosh, 1914).

Particularly abundant weed species were Chenopodium album, Lapsana communis, Raphanus raphanistrum, Stellaria media, Urtica spp all of which may have been gathered intentionally or may be the result of seed cleaning processes.

Heathland plants were infrequent in the barrel samples; wetland plants were more numerous particularly in sample 662 where fruits and seeds of sedges, rushes and Ranunculus sceleratus were common. One can speculate that soiled flooring materials were dumped in the barrel along with other rubbish.

Mosses were present in small quantities although in the basal samples over 100 shoots of Ceratodon purpureus were found. This species is common on heathland and also in urban habitats; it could conceivably have grown on the surface of the barrel itself.

Like the pits the infill of the barrel seems to represent a mixture of rubbish and cess material with sewage being predominantly present in the basal layers.

Jørgensen (1980) describes the contents of a barrel from medieval Svendborg, Denmark, dated to about 1350-1400, which contained excrement and kitchen rubbish. It is interesting to compare the list of plants recovered (see Table 7) with those from the Elgin barrel, many species being common to both. Fifty five taxa including four mosses were identified from the Svendborg barrel, while eighty six taxa including nine mosses were identified from the Elgin barrel.

Soak away

Four samples were examined from the soak away (X623, X618, X601, 558 in order from bottom to top). This was a structure built of oak and cut into natural sand. It dates from the 15th century thus being later than the majority of the pits and barrel. Sample X623, which was from the basal deposit, contained 70 taxa, excluding mosses. A wide variety of useful plants were found in the soak away; Table 6 lists these. Some cereal pericarp fragments (wheat and barley) were found in the wet sieved sample from X623 providing evidence of sewage in the primary fill. Carbonised grains of oats and barley were frequent as were seeds from a wide range of fruits. Shell fragments of hazelnuts and half a walnutshell were also found. Other economic plants were Brassica species, flax and hemp. A single seed of caper spurge (Euphorbia lathyrus) and a suprisingly large number (over 140) of seeds of deadly nightshade (Atropa belladonna) were recovered.

Seeds of weed species were extremely abundant in the samples, in particular large quantities of Chenopodium album, Rumex spp., Polygonum spp., Stellaria media, Urtica dioica and U. urens. Some of these may have been gathered in times of scarcity to supplement produce from cultivated plants. Most of the seeds were recovered whole and not in fragments as would be expected if they had already been consumed. It is possible that many of the weeds grew on the site itself, for example on midden heaps.

A few seeds of heathland plants were present which were probably brought in. Fruits and scales of birch and willow were present in the soak away and pit 18. These may have blown in from nearby trees though it is surprising that they are completely absent from the barrel samples.

Seeds of plants of marshy or riverside habitats were frequent, in particular nuts of sedges and achenes of Ranunculus sceleratus. A natural ditch, Harvey's Stank, is near to the site and the River Lossie, is liable to flood occasionally, The plots were always probably relatively wet.

Post-hole

One floated sample was examined from 561, a post-hole of 14th century date under pit 6. Very little organic material was present; the few macro-fossils found were two seeds of Chenopodium album, one Rubus idaeus seed and a fruit fragment of Raphanus raphanistrum.

Table 6 : LIST OF PLANTS USEFUL TO MAN FROM THE ELGIN BARREL AND SOAK AWAY

B present in barrel

S present in soak away

Cereals			
Oats	(Avena sativa)	B	S
Barley	(Hordeum vulgare)	B	S
Wheat	(Triticum aestivum)	B	S
Fruits and Nuts			
Fig	(Ficus carica)	B	S
Grape	(Vitis vinifera)	B	
Apple	(Malus sylvestris s.l.)	B	S
Bramble	(Rubus fruticosus agg.)	B	S
Raspberry	(R. idaeus)	B	S
Wild Strawberry	(Fragaria vesca)	B	S
Blaeberry	(Vaccinium myrtillus)	B	S
Bullace	(Prunus domestica spp institia)	B	S
Blackthorn, Sloe	(P. spinosa)	B	S
Gean, Wild Cherry	(P. avium)	B	S
Bird Cherry	(P. padus)	B	
Dog Rose	(Rosa canina agg.)	B	S
Elder	(Sambucus nigra)	B	S
Rowan	(Sorbus aucuparia)	B	S
Hazel	(Corylus avellana)		S
Walnut	(Juglans regia)		S
Others			
Turnip	(Brassica campestris)	B	S
Flax	(Linum usitatissimum)	B	S
Hemp	(Cannabis sativa)	B	S
Weld, Dyer's Rocket	(Reseda luteola)	B	S
Deadly Nightshade	(Atropa belladonna)	B	S
Caper Spurge	(Euphorbia lathyrus)		S

Table 7:

List of plants from medieval barrel, Svendborg from Jørgensen (1980)

* indicates plant also present in Elgin barrel

Plants useful to man

* Avena sativa
Secale cereale
Anethum graveolens
* Brassica cf. campestris
Coriandrum sativum
Corylus avellana
* Fragaria vesca
Humulus lupulus
* Linum usitatissimum
* Malus sylvestris s.l.
Papaver somniferum
Prunus cerasus
* P. domestica ssp. institia
* P. spinosa
Pyrus communis
Rubus caesius
* R. fruticosus
* R. idaeus
Vaccinium vitis-idaea

Weeds of waste places and arable land

* Agrostemma githago
Anchusa arvensis
* Chenopodium album
Cirsium arvense
Echinochloa crus-galli
Euphorbia helioscopia
* Galeopsis tetrahit/speciosa
* Galium aparine
* Lapsana communis
* Polygonum aviculare
* P. convolvulus
* P. lapathifolium
* P. persicaria
Prunella vulgaris

Weeds of waste places and arable land

- * Ranunclulus repens
- * Raphanus raphanistrum
- * Rumex acetosella
- R. conglomeratus
- * R. obtusifolius
- Setaria viridis
- Silene alba
- * Sinapis arvensis
- Stachys cf. arvensis
- * Stellaria media
- * Thlaspi arvense
- Viola cf. arvensis

Heathland plants

- Myrica gale

Plants of wet habitats

- Carex echinata
- C. vesicaria
- * Eleocharis palustris
- Menyanthes trifoliata
- Nymphaea alba

Mosses

- Antitrichia curtipendula
- Climacium dendroides
- Hypnum cupressiforme
- Neckera complanata

Chapter 5

Annotated species list

The following is a species list with notes, where relevant, on identification, history and other fossil records, ecology and uses.

The main sources of reference used were:

1. Godwin (1975) "History of the British Flora" and accounts of plant remains from other archaeological sites.
2. Clapham, Tutin and Warburg (1962) and local floras.
3. Herbals and modern works such as Grigson (1975). There are unfortunately no specifically Scottish herbals.
4. The Statistical Account for Scotland (1792 -).
5. Martin (1716) "A description of the Western Islands of Scotland". This is one of the earliest historical accounts providing information on uses of plants in Scotland.

RANUNCULACEAE

Caltha palustris L. Kingcup, Marsh Marigold

The black seeds, up to 2.5mm in length, are easily reconizable. Most were constricted in the middle. Kingcups are common in marshes and ditches. Seeds are frequent in waterlogged samples from medieval sites.

Ranunculus repens L. Creeping Buttercup

Achenes were frequent in samples from all sites. Well preserved achenes were identified as R. repens; pits of R. repens achenes are generally larger than those of R. acris and R. bulbosus (Dickson, 1970). It is possible that the latter two species may be present among less well preserved achenes.

Sarukhán (1974) has shown that R. bulbosus, R. acris and R. repens constitute a series, in which R. bulbosus has the least and R. repens the most persistent seed bank. Thus achenes of R. repens would be expected to turn up with greatest frequency. Although it has great seed longevity, R. repens also has weak flowering and seed production but dependable vegetative reproduction. This contrasts strikingly with the other two species which have high seed output, rapid germination, a short life of the buried seed and little or no vegetative reproduction.

The buttercups contain a poisonous constituent proto-anemonin (Forsyth, 1968) and are dangerous to cattle, though generally grazing animals avoid them. This toxic agent is present in the sap and breaks down on storage (Dimbleby, 1978) therefore hay containing buttercups is quite harmless. Their ability to produce blisters is also well known.

Ranunculus flammula L. Lesser Spearwort

Achenes are easily distinguished from those of section Ranunculus by their small size and shape which is not greatly compressed. This is a common plant in wet places, achenes have been frequently found in medieval archeological contexts. The plant's ability to produce blisters is described by Martin (1716): "Flamula-Jovis, or Spire-wort, being cut small, and a Limpet-shell fill'd with it, and apply'd to the Thigh-bone, causes a Blister to rise about the Bigness of an Egg, which being cut, a Quantity of watry Matter issues from it: the Blister rises three times, and being empty'd as often, the Cure is perform'd". He also mentions that "Crow-foot of the Moor" (probably R. repens or acris) is more effective for raising a blister and curing sciatica than R. flammula.

Ranunculus sceleratus L. Celery-leaved Crowfoot

Achenes were very numerous particularly in the Elgin soakaway and barrel. R. sceleratus is found scattered in muddy pools in the lowlands of Moray (Webster, 1978). According to Thomson (1900) "the bruised foliage" applied to the skin produces ugly blisters and beggars are said to take advantage of this and use poultices to raise sores in order to stimulate compassionate benevolence".

Ranunculus sp. subgenus Batrachium Water Crowfoot

Specific identification of the achenes, which are characterised by the presence of transverse ridges, was not possible. Water crowfoots are found in shallow water habitats.

PAPAVERACEAE

Papaver dubium L. Long-headed Poppy

The seeds are small and elliptical with a pattern of irregular polygonal compartments on the surface. In one of the Queen Street samples from Aberdeen a capsule lid was preserved. This is formed from the persistent stigmatic disk. In P. dubium the stigma rays (eight in the Queen Street specimen) do not reach the margins of the disk.

It is a common weed of arable land and waste places.

Papaver somniferum L. Opium Poppy

Seeds are larger (average length 1.2mm) than those of other Papaver species and fragments were also recognizable. The outer seed coat has large polygonal compartments, some of which are elongated longitudinally. The inner coat has a more or less hexagonal pattern.

The narcotic properties of this plant have long been used to alleviate pain. The poppy seed was probably imported and the plant grown for the opium which is obtained from the latex of the capsule. Opium was used to alleviate malaria (ague) in the Fenland and poppyhead tea was often given to children during teething (Godwin, 1978). Poppy seeds may also have been sprinkled on bread. Trail (1923) mentions opium poppy as "a frequent casual on town refuse and on waste ground around Aberdeen".

Seeds have been found at other medieval sites (for example Hull, Williams (1974), Dublin, Mitchell (in Godwin, 1975) and at the Roman fort of Bearsden (Dickson et al, 1979).

FUMARIACEAE

Fumaria officinalis L. Fumitory

The yellow nutlets of fumitory are very distinctive. They have a characteristic 8-shaped hole on the concave side (see Griffin, 1977). Fumitory is a common weed of cultivated and waste ground and surprisingly macrofossils have not been recorded from any other medieval archaeological site in Britain although one nutlet is recorded from medieval Oslo (Griffin, 1977). It has also been recorded from horse dung from Roman Lancaster (Wilson, 1979).

CRUCIFERAE

Brassica campestris L.
Sinapis arvensis L. — see Chapter 6
Raphanus raphanistrum L.

Thlaspi arvense L. Field Penny-cress

Even small fragments of the distinctly ribbed seeds were recognised.

Thlaspi is a weed of arable land and waste places. Godwin (1975) describes it as an almost constant associate of flax crops. It occurred in all the samples containing Linum from Elgin, while in 5 out of 7 samples containing Thlaspi from Perth Linum was also present. Webster (1978) describes it as doubtfully native; it is a common weed in the lowlands of Moray today. White (1898) however describes it as very local and a colonist in fields in Perthshire. Roberts and Feast (1973) recovered large numbers of viable seeds of Thlaspi in experiments where they assessed the seed content of undisturbed agricultural soil.

Seeds are recorded from two other medieval British sites: Chester, Wilson (1975b) and Durham, Donaldson (1979).

Capsella bursa-pastoris (L) Medic. Shepherd's Purse

Fossil seeds of Shepherd's Purse are small, about 1mm long, and delicate. There are, surprisingly for a common weed which has an average output of 3500-4000 seeds per plant (Salisbury, 1961), no other records of seeds from medieval sites in Britain.

Barbarea vulgaris R. Br. Yellow Rocket

The small black seeds of Barbarea are superficially like diminutive Atropa belladonna seeds. Average seed length was 1.3mm. Barbarea is common on waste ground and river shingle in Moray today (Webster, 1978). The only other record from a British archaeological site is from Roman Godmanchester (Dickson in Godwin, 1975).

RESEDACEAE

Reseda luteola L. Weld, Dyer's Rocket

The small yellow seeds, about 1mm long, were found on all three sites.

According to De Wit in Godwin (1975) the family Resedaceae is not naturally part of the British flora, Reseda luteola probably having been introduced intentionally as a dye plant and R. lutea (wild mignonette) adventitiously.

Dickie (1860) mentions weld as being rare and found in waste places. He lists five sites for Aberdeenshire including three in Aberdeen itself. Trail (1923) mentions that it is "not native near Aberdeen, probably surviving as little more than a casual, from the time when it was cultivated as a useful plant". It occurs locally on waste ground in Moray today (Webster, 1978). Weld, which produces a yellow dye, was one of the three staples of the dyer's craft along with madder (Rubia tinctoria) and wood (Isatis tinctorum) (Grigson, 1975). Thurstan (1949) states that it produces the best and most permanent of all vegetable dyes. Weld seeds have also been found in medieval York (Godwin and Bachem, 1959), Beverley (Hall and Kenward, 1980) and Roman London (Willcox, 1977). Willcox comments that weld seeds, unlike woad seeds, occur at the place of dyeing. It is interesting to note that Thurstan recommends that care should be taken to collect weld before it seeds as otherwise the colour is very poor. Grigson also mentions the odd practice of sowing weld with corn (barley or oats). It would be interesting to find out if this was also practised in Scotland.

VIOLACEAE

Viola palustris L. Marsh violet

Viola sp. subgenus Viola

V. sp. subgenus Melanium

Seeds of V. palustris have a clear punctate cell pattern which makes them distinct from other species (Dickson, 1970). It is a common plant of bogs and marshes.

Other seeds belonging to the subgenus Viola were not determinable at species level. V. riviniana the common dog violet, is the most likely species represented.

Seeds of the subgenus Melanium were distinguishable by their particularly asymmetrical apex (Dickson, 1970). Pansies are common weeds of cultivated and waste ground.

POLYGALACEAE

Polygala sp. Milkwort

The fossil seeds were approximately 2.5mm long and with the strophiole (appendage outside the testa) preserved. This was black in the fossils, it is yellow in fresh seeds. White hairs at the base of the seed were preserved in the specimen from the Elgin barrel.

P. serpyllifolia is a common plant of acid moorland. There are no other records of seeds from archaeological contexts.

HYPERICACEAE

Hypericum cf. maculatum St. John's Wort

Seeds of Hypericum species are small cylindrical and with a reticulate surface pattern. H. maculatum seeds are small (0.8mm long), with abundant small reticulations on the surface (Watts, 1959). The two fossil seeds resembled seeds of this species more closely than other species. H. maculatum is found in damp places, wood margins and hedgebanks. It has been tentatively recorded from the following medieval sites in Europe: Haithabu (Behre, 1969), Cracow (Wasylikowa, 1978), Trondheim (Tallantire, 1979).

CARYOPHYLLACEAE

Silene sp. section Melandriformes Campion

This section includes Silene dioica, Red Campion, and S. alba, White campion.

The seeds were black and generally bluntly tubercled suggesting that they belong to S. alba, seeds of S. dioica being more acutely tubercled.

S. alba is a common weed of waste places and cultivated land. There are several fossil records.

Lychnis flos-cuculi L. Ragged Robin

Seeds are small with prominent pointed tubercles. It is a common plant in damp meadows and has numerous fossil records.

Agrostemma githago L. Corn Cockle

Whole seeds and fragments of corn cockle were found on all three sites. The seeds are large, 3-3.5mm across, black and tubercled.

Agrostemma was formerly a very common and troublesome weed. Godwin (1975) mentions it as being very closely associated with rye crops although Gardiner (1848) in his Flora of Forfarshire states that it is very plentiful in wheat fields but seldom seen among other cereal crops. Today it is very rare in fields in Scotland due to increased seed cleaning.

Its seeds contain a toxic saponin, githagenin, which is not destroyed by heating, thus making bread and flour unpalatable (Long, 1924). The seeds were also used for medicinal purposes. Wilson (1975b) gives much detail on the poisonous nature and possible uses of corn cockle.

Most of the seeds were recovered as fragments. The presence of corn cockle in the samples may be due to poor seed cleaning of cereal crops, some of the seeds remaining with the grain after winnowing. On all three sites seed coat fragments were found in association with pericarp fragments of wheat and oats suggesting that the seeds had been ingested, doubtless with adverse effects on the consumer.

There are numerous records from archaeological contexts.

Cerastium fontanum Baumg. Mouse-ear Chickweed

Seeds of *Cerastium* species are usually brown and fragile. *C. fontanum* is a common weed. It is possible that other species of the genus were present. Fossil records of *Cerastium* species are frequent.

Stellaria media (L.) Vill. Chickweed

Chickweed seeds were extremely abundant on all three sites. The seeds are blackish with rounded tubercles. Most are in the size range 0.9 - 1.3mm. It is possible that other species of the genus were present in the samples.

Chickweed seeds are among the most common macrofossils recovered from archaeological sites. One plant produces on average 2200 to 2700 seeds and several generations of fruiting plants are produced in a single year (Salisbury, 1961). Seeds along with those of other wild plants may have been gathered in times of scarcity. Martin (1716) notes a medicinal use of chickweed to procure sleep after fever in the island of Skye.

Spergula arvensis L. Corn Spurrey

The small round dull black seeds of *Spergula* were numerous on all three sites. They have a narrow wing round the equator and the sinuous cell margins are visible under high power. Two varieties are recognised in Britain, var. *arvensis* with papillate seeds and var. *sativa* with non-papillate seeds. There is a cline in frequency of these seed forms in a northwest direction with the non-papillate form increasing towards the northwest (New, 1961). None of the fossils were papillate but papillae may have not preserved well.

It is a very common weed of cultivated and waste land. Godwin (1975) mentions it as being a constant weed in flax crops. Known as Yarr in north-east Scotland, Anderson (1794) mentions that "it rushes up in such abundance among the crops as not only to choke the grain sown, but even to stint the growth of the weed itself to such a degree as to make it a weak dwarfish plant".

Spergula has been used as a utility plant in Denmark and the seeds, known as meldi seeds, ground into meal in Shetland in historic times (Jakobsen, 1932). Remains of *Spergula* seeds were found in the gut contents of bog corpses from Grauballe and Tollund (Helback, 1954). Var. *sativa* was formerly grown as a forage plant, the knowledge of its culture being brought from Holland around 1740 (McNeill, 1910). Seeds are frequent from medieval sites.

Scleranthus annuus L. Annual Knawel

The thick-walled indehiscent fruits of *Scleranthus* survive as fossils (Dickson, 1970). The structure found is the hardened wall of the perigynous tube which is deeply 10-furrowed and encloses the 1-seeded nutlet and is shed with it. One of the Elgin fruits was carbonised.

S. annuus is a weed on sandy soil. It is also recorded from medieval Hull (Underdown, 1979).

PORTULACACEAE

Montia fontana L. ssp *fontana* Blinks

Seeds of *Montia fontana* ssp. *fontana* resemble small *Chenopodium* seeds being also black and shiny. The cell pattern of the testa is very distinct forming a reticulate pattern lacking tubercles, characteristic of subspecies *fontana* (Walters, 1953). This is the common subspecies in Scotland and is abundant in wet places.

CHENOPODIACEAE

Chenopodium album L. Fat Hen

Fat hen seeds were extremely abundant on all three sites. The seeds are black and shiny with a faint reticulate pattern. No other *Chenopodium* seeds were positively identified. The plant is abundant on cultivated and waste ground and has a large persistent seed bank. It was the most frequently recorded species in Ødum's investigation of ruderal soils in Denmark (Ødum, 1978).

Both the seeds, which contain fat and albumen, and the green leaves have been eaten by man to supplement produce from cultivated plants in times of scarcity. In Bronze Age time it is thought to have been cultivated for its own sake (Dimbleby, 1978). A granary with a heap of Chenopodium album seeds was found in a first century village in Jutland along with grains of barley and oats (Helbaek, 1960). In Colonsay until last century the leaves were boiled, pounded, buttered and eaten like spinach (McNeill, 1910).

A large proportion of the seeds in the samples were recovered whole even in postulated cess pit samples, for example the Elgin soakaway. Fat hen seeds have been found from many archaeological sites in Britain and Europe.

Atriplex sp. Orache

Seeds were identified as Atriplex sp. from Aberdeen and Elgin. Specific identification of Atriplex seeds is difficult, particularly between the common weeds, A. hastata and A. patula.

LINACEAE

Linum usitatissimum L. Flax

Seeds of flax were recovered from all three sites and capsule fragments from Aberdeen and Elgin. Fibres were looked at from Perth and shown to be other than flax. No linen has been reported by the textile specialists from Perth or Elgin. Flax fibres can be distinguished from those of other types by the "drying-twist" test (Kirby, 1963). The majority of fibres twist in a clockwise direction when wetted and allowed to dry, while those of flax twist anticlockwise. Microscopically flax fibres also differ in possessing nodes (Dimbleby, 1978).

Flax and also hemp both require to be retted by steeping in water which allows bacteria to destroy substances binding the fibre bundles in the stem (Kirby, 1963). Seeds of flax and hemp are therefore likely to be more frequent on waterlogged sites such as we are dealing with here (Green, 1979a). Generally prior to retting, flax seeds, which contain protein-rich linseed oil, were removed by combing from the tips ("rippling") (Turner, 1972). Flax grown for its linen fibres tends to have small seeds whereas that cultivated for linseed has been selected to produce larger seeds.

A small patch of flax was grown in most places for domestic purposes, each family making its own linen (Handley, 1953, Smout, 1969). Flax growing was already practised in Scotland during the Bronze Age (Jessen and Helbaek, 1944). Flax was commonly grown as an alternative crop to oats or as a companion crop for grasses but it was not however until the 18th century that linen manufacture became Scotland's greatest industry (Turner, 1972). Flax is mentioned in the medieval rentals, for example, William I around 1187 commands "all his responsible and faithful men of Moray to pay to their churches.... all teinds of corn, wool, flax, foals, calves, piglets and lambs, butter and cheese, and fisheries, and of everything else, which by God's grace has annual increase" (Barrow, 1960).

VITACEAE Plate 8

Vitis vinifera L. Grape

One carbonised grape pip was recovered from the Farquhar and Gill site, Aberdeen and thirty, all carbonised to a greater or lesser extent, from the two lowest barrel samples and one from pit 20 of the Elgin site.

Grapes were probably imported to medieval Aberdeen and Elgin as raisins as well as in the form of wine. The pips were presumably carbonised after being removed or spat out, perhaps onto the hearth. The possibility exists that the grape pips in the samples originated from wine which was badly sieved, as suggested by Lange (1971).

During the medieval warm period (around 1100 to 1300) temperatures in southern England were sufficiently high and frosts rare enough to allow the cultivation and ripening of grapes. Climatic worsening during the later Middle Ages put an end to successful viticulture in Britain (Lamb, 1977). There is a record of a single pollen grain from near Lanercost Priory

(1150 - 1350 A.D.) in Yorkshire (Barker in Godwin, 1975) which must lie near the northern limit of medieval viticulture. It is unlikely that the climate was ever sufficiently warm in north-east Scotland for grapes to ripen, even in favourable situations like walled gardens and despite the fact that temperatures in richly organic medieval towns were probably several degrees higher than surrounding rural areas (Addyman et al, 1976). For information on the wine trade see Chapter 2.

Grape pips have been recovered from medieval Hereford (Mitchell, 1971), Plymouth (Dennell, 1970), Southampton (Dimbleby, 1975; Buckland et al, 1976).

LEGUMINOSAE

Trifolium repens L. White Clover

T. pratense L. Red Clover

One flower of T. repens was found in an Elgin pit and several petals from Perth. The fossil standards were distinctive being folded down the midline with the dark brown venation especially clear. Side veins branch out with more or less equal spacing from the mid vein along which the standard is folded. This type and manner of branching is characteristic of T. repens (see Körber-Grohne, 1967).

One well preserved calyx of T. pratense was recovered from Perth. The funnel-shaped calyx has by a vein round the upper border. Five teeth protrude from the upper edge. Hairs on the calyx tube were preserved.

Flower parts of Trifolium species have been recorded from Roman horse dung, Lancaster (Wilson, 1979), medieval Hull (Williams, 1974; Underdown, 1979), medieval Larkfield, Kent (Grove, 1963).

Plants such as the clovers would have been important components of hay dried for fodder, although it was not until centuries later that their cultivation for this purpose was introduced.

Vicia cf. hirsuta (L.) S.F. Gray Hairy Tare

V. cf. cracca L. Tufted Vetch

Vicia sp.

Five carbonised Vicia seeds were recovered. The Elgin seed was tentatively identified as V. hirsuta and of the remaining seeds from Perth one was tentatively identified as V. cracca. The following table gives measurements in mm of the seeds. (The hilum was not preserved in the Perth seed from context 9240).

	seed		hilum		
context	length	width	length	width	
E.H.S. 661 barrel	2.27	2.22	1.53	0.07	V. cf. hirsuta
P.H.S. 7213	3.70	2.78	1.85	0.07	v. cf. cracca
P.H.S. 7218	2.31	2.27	1.94	0.23	V. sp.
P.H.S. 6104	2.22	1.76	0.92	0.14	V. sp.
P.H.S. 9240	2.04	1.85	-		V. sp.

The hilum was parallel sided in all the Perth seeds. The testa was present in patches on most of the seeds. Tufted vetch is a common plant of roughly grassy places.

The Elgin seed matched reference seeds of V. hirsuta. It is a common weed of waste and cultivated ground. It was formerly a very troublesome weed of cereal crops clinging to the corn by its tendrils (Salisbury, 1961).

Small seeded legumes are frequent weeds in cereal crops and as a result are often accidentally carbonised along with cereal grains.

ROSACEAE

Filipendula ulmaria (L.) Maxim. Meadowsweet

Four "man-in-the-moon"-like fruits of meadowsweet were recovered from Perth samples. This is a very common plant of marshes and river banks.

Fruits have been found from the following medieval sites in Britain: Hull (Williams, 1974), Durham (Donaldson, 1979).

Meadowsweet was probably gathered along with rushes and sedges for strewing on the floors of buildings although there was no direct evidence for this from the site. Gerard (1597) gives the following description, "the leaves and flowers far excell all other strowing herbes,... for the smell thereof maketh the hart merrie, delighteth the senses." Meadowsweet was also used to flavour mead in early times (see for example Dickson, 1978).

Rubus chamaemorus L. Cloudberry Plate 9

Half a seed of cloudberry was found in the paraffin floated sample from Perth context 9235, compact brown soil from building 18. 300cm^3 of untreated soil from the same context were wet sieved but no further seeds were found. The seed found was pale brown and 4.1mm long.

Cloudberry is a native species, more or less confined to the drier aspects of wet, acidic peat bog in Upland Britain. It is characteristic of high-level blanket bogs in which Calluna vulgaris and Eriophorum vaginatum are co-dominant. In the Eastern Highlands it is found between altitudes of 300 and 1100m (Taylor, 1971). Matthews (1955) classifies it as arctic-subarctic in distribution. Seed set is erratic and localised in Britain, presumably being influenced by grazing, burning and climatic events. The plant is strictly dioecious and Raven and Walters (1956) suggest that a greater frequency of male plants may be partly responsible for poor fruiting.

Wild forms of Rubus chamaemorus and other Rubus species are popular in Scandinavia, for example in jams and desserts and for making liquors. Lightfoot (1777) mentions the fruits being produced at table as a dessert in the Scottish Highlands. Gerard (1597) tells us that "the fruit quencheth thirst, cooleth the stomacke, and alaieth inflammation being eaten as whortes are, or the decoction made and drunk."

There appear to be no records of seeds of cloudberry in the British fossil record. Tallantire (1979) records it from archaeological deposites from medieval Trondheim in Norway. To account for the Perth seed we must either assume that cloudberries were deliberately brought to the site by man or else the seed reached the site in animal dung, perhaps goat droppings since goats were frequently grazed in upland areas.

Rubus idaeus L. Raspberry

R. fruticosus agg. Bramble

Raspberry and bramble seeds were abundant, particularly in Elgin samples, for example pit 21 and the barrel. In general seeds of the two species could be distinguished although they overlap in size ranges.

Plants of both were probably common at or near the three sites and the fruits gathered and eaten in season. Seeds of both are very common macrofossils from archaeological sites.

Potentilla palustris (L.) Scop. Marsh Cinquefoil

Achenes were recovered from Perth and lack any ridges or surface pattern. It is a common plant of marshes and bogs.

Potentilla erecta (L.) Räusch. Tormentil.

Achenes were frequent on all three sites. The wrinkled ridges on some fossils were worn away but the achenes generally still recognizable.

It is an abundant plant of grassland and heaths, especially on light acid soils. Achenes are frequent in archaeological deposits.

The woody roots were formerly boiled in milk and the milk given to relieve colic (Grigson, 1975). The roots also give a red dye. Yet another use of the roots was in tanning leather. Martin (1716) mentions this in his description of Orkney: "the common people dress their leather with the roots of Tormentil, instead of Bark". It is likely that this use was restricted to areas where oak bark was unavailable or scarce.

Fragaria vesca L. Wild Strawberry

The small achenes have distinctive ridges which are pale in colour. Wild strawberries are frequent on banks, woods and scrub on base-rich soil and must have been a welcome delicacy. Achenes are frequent in archaeological contexts.

Aphanes arvensis L. Parsley Piert

The small pale achenes of Aphanes are superficially similar to achenes of Urtica dioica but they are distinctly asymmetrical. Nevertheless during early stages of the study some may have been identified mistakenly as Urtica.

Aphanes is a common plant of arable land and bare places in grassland. Aphanes arvensis is recorded from Roman Silchester (Reid 1901-9) while the closely related A. microcarpa is recorded from Roman horse dung, Lancaster (Wilson, 1979) and medieval Beverley (Hall and Kenward, 1980).

Rosa canina agg. Dog Rose

Achenes were particularly frequent in the Elgin barrel. Rose hips may have been gathered for use in drinks or making jelly.

Rosa achenes have been recorded from the Iron Age Bu Broch in Orkney (C.A. Dickson pers. comm.), medieval Hull (Williams, 1974) and Dublin (Mitchell in Godwin, 1975) and from Roman sites.

Prunus spinosa L. Blackthorn, Sloe

The stones, which were present at all three sites and frequent in the Elgin barrel, are rounded with a rough and wrinkled surface. Blackthorn is common in scrub and by ditches and burns. The fruits may have been gathered for making drinks; sloe wine and gin are still made (Grigson, 1975), or for preserves. They may also have been used for dyeing (Thurstan, 1949). Stones have been recovered from a number of medieval sites in Britain.

Prunus domestica ssp. institia (L.) C.K. Schneid Bullace Plate 11

Bullace stones were frequent in the Elgin barrel, a few were also found in the soak away. One stone was recovered from a cess pit on the Perth site.

The stones are larger and more flattened than the other Prunus species described. They are extremely variable and small stones resemble those of P. spinosa. This may be a result of hybridisation. A similar range of fruit stones has been observed from medieval Chester (Wilson, 1975b). Stones of ssp. domestica, cultivated plum, are still larger, more flattened and sharply angled. The Perth stone measured 19.6 x 13.3 x 9.2mm. The Elgin stones measured in length 14.82 (9.8 - 20.9)mm, breadth, 9.97 (6.2 - 12.2)mm, thickness 7.17 (4.5 - 9.5)mm.

Plums and damsons originated as a hybrid between P. spinosa and P. cerasifera in Asia Minor. Cultivated plums have been present in Britain at least since Iron Age and Roman times, damson also being cultivated by the Romans (Godwin, 1975). Damsons are regarded as a derivative of bullace. Gerard (1597) sums up the situation: "The Bullesse and the Sloe tree are wilde kindes of Plums, which do varie in their kinde, even as the greater and manured Plums do". Clapham, Tutin and Warburg (1962) state that bullace is "more thoroughly naturalised and probably longer established than the other subspecies, and often found more remote from houses, often considered native." In the Elgin area bullace is introduced and planted in hedges and by houses (Webster, 1978).

Stones of ssp. institia have also been recorded from medieval Chester (Wilson, 1975b)and Gloucester (Green, 1979a). Plum stones have been recorded from Anglo-Saxon York (Godwin and Bachem, 1959), medieval Plymouth (Dennell, 1970), Durham (Donaldson, 1979) and Dublin (Ríordáin, 1971).

Prunus avium (L.) L. Gean, Wild Cherry

The stones are pale yellow and smooth with a low dorsal ridge. They were extremely abundant in the Elgin barrel. Cultivated sweet cherries are descended from this wild species which is frequent in woods and hedges though becoming less common in northern Scotland (Clapham, Tutin and Warburg, 1962). Wild cherries can be made into drinks such as cherry brandy (Grigson, 1975) and also into gean jam (McNeill, 1974).

These are the first records from medieval archaeological sites although 24 stones were recovered from a suspected coprolite from the Pictish hill fort of Dundurn in Perthshire (Brough, 1980).

Prunus padus L. Bird Cherry

The relatively small stones of bird cherry have distinct raised ridges on the surface forming a reticulum. Stones were found only in the Elgin barrel. The fruits are usually considered to be of little use (Grigson, 1975). Bird cherry is very common by rivers, burns and in woods (Webster, 1978). This is the first record of the species from an archaeological site in Britain although fruitstones have been found in natural deposits.

Sorbus aucuparia L. Rowan

Rowan seeds were particularly abundant at the Aberdeen site. The seeds vary in size with most being around 4mm in length. Some very small seeds were frequent in Aberdeen samples but of the same shape and cell pattern; these were considered to be abortive.

Rowan trees have many superstitions associations, being primarily a plant for warding off evil. Its berries can be used in drinks and rowan jelly (McNeill, 1974). Seeds have also been found at medieval Southampton (Dimbleby, 1975), Durham (Donaldson, 1979) and Dublin (Ríordáin, 1971).

Malus sylvestris Mill. sensu lato Apple Plate 10

The two pips from Perth and six Elgin pips were measured:

context	length	breadth (mm)
P.H.S. 7168	7.4	5.0
9279	7.2	4.3
E.H.S. 664 barrel	6.9	3.9
"	6.8	3.8
"	6.3	4.2
"	6.2	4.3
"	5.9	3.4
"	5.8	3.2

In both Perth pips the pointed base was damaged so the original lengths will have been greater. They are both larger than the Elgin pips which were all under 7mm in length. They probably belong to a cultivated rather than wild (crab) variety. The true crab apple is local and uncommon in Perthshire (White, 1898) and absent from Moray (Webster, 1978). There is historical evidence for orchards in Elgin (Dunbar, 1866).

Apple pips have also been recovered from medieval Hull (Williams, 1974), Durham (Donaldson, 1979), Gloucester (Green, 1979a) and Dublin (Mitchell _in_ Godwin, 1975).

ONAGRACEAE

Epilobium parviflorum Schreb. Willow-herb

Three seeds were recovered from Perth, one of which was carbonised. The seeds fitted the description given in Clapham, Tutin and Warburg (1962) for _E. parviflorum_: seeds 0.9 - 1mm, narrowly obovoid, rounded at the base, densely and acutely tubercled.

It is a plant of wet places. White (1898) states that it is "not very common" in Perthshire. This is the first record of the species from an archaeological context in Britain although it has been found in several natural Flandrian deposits.

UMBELLIFERAE

Hydrocotyle vulgaris L. Marsh Pennywort

Two fruits were recovered from Perth. The fruits are small (length 1.1mm), compressed and with two ridges on each face. The plant is common in bogs and marshes on acid soils. It is reputed to be used as a cure for whooping cough in Danish folk medicine (Tutin, 1980).

There are no other records of fruits from medieval archaeological sites in Britain although fruits are commonly preserved in natural deposits.

Torilis japonica (Houtt.) DC. Upright Hedge-Parsley

Eight fruits were recovered from Perth and one from Aberdeen. The hooked spines were preserved in the fossils, also the recurved style in some. This umbel is very common in hedges and grassy places. According to Godwin (1975) it is "historically a camp-follower".

Aethusa cynapium L. Fool's Parsley

Fruits of Aethusa were frequent in Elgin samples particularly from Pit 21 where 81 fruits and 43 fragments were recovered. The fruits are broadly ovoid with the carpels compressed dorsally. The fruit has broad ridges and even fragments were distinctive.

Aethusa contains poisonous polyacetylenes. These do not withstand drying, so that hay containing Aethusa is not poisonous to livestock (Tutin, 1980). In Moray it is doubtfully native, being rare on rubbish tips and as a garden weed (Webster, 1978), while in other areas it is a weed of cultivated ground. The fruits probably arrived accidentally along with cereal crops although, unlike corn cockle, bread containing fruits of fool's parsley is presumably palatable.

Aethusa has also been recorded from medieval Durham (Donaldson, 1979), Hull (Underdown, 1979) and Beverley (Hall and Kenward, 1980).

Heracleum sphondylium L. Hogweed

One fruit was recovered from Aberdeen. Fruits of Heracleum are relatively large and flattened. It is a common plant of grassy places and roadsides. There are records from late Anglo-Saxon York (Godwin and Bachem, 1959) and medieval Hull (Williams, 1974).

EUPHORBIACEAE

Euphorbia lathyrus L. Caper Spurge Plate 12

One seed was found in sample X601 of the Elgin soak away. It was 4.5mm in length, of a pale brown colour with a wrinkled surface.

The plant is doubtfully native in Britain being found locally as a garden weed and escape in waste places (Clapham, Tutin and Warburg, 1962). Webster (1978) records it as present on an Elgin tip in 1975. This appears to be the first fossil record of the species in Britain and no records of it from archaeological contexts in Europe were found.

The plant contains an acrid, emetic and highly purgative milky juice. The fruits were formerly cultivated in herb gardens and used as a purgative and pickle. However they are highly dangerous and can give rise to fatal poisoning (Salisbury, 1961).

Euphorbia helioscopia L. Sun Spurge

The seeds are approximately 2mm long, black with a very poisonous surface network of ridges. Half seeds were easily recognizable.

E. helioscopia is a summer annual, common in cultivated land particularly on the more basic types of soil (Salisbury, 1961). There are no fossil records from Britain although seeds have been found from several archaeological sites in northern Europe.

POLYGONACEAE

Polygonum aviculare agg. Knotgrass

Fruits were abundant on all three sites. They are usually trigonous, brown or black with punctate surface. Many of the Elgin fruits had one narrow and two broad sides and a number were biconvex; these may belong to the species P. arenastrum Bor. of the aggregate.

P. aviculare agg. is a very common weed of cultivated ground and waste places. There are many records from archaeological contexts.

Polygonum persicaria L. Red Shank

Two fruit shapes of P. persicaria are found (Timson, 1965)

(i) lenticular or biconvex to planoconvex

(ii) angular or trigonous with three concave faces.

This is an example of somatic polymorphism; the two morphs which do not differ genetically are found in varying proportions (Harper et al, 1970). Both fruit shapes are generally found on the same plant.

This is another very common weed with many fossil records from archaeological contexts.

Polygonum lapathifolium L. Pale Persicaria

P. lapathifolium fruits are similar to P. persicaria being black and shining. They are generally flattened and biconcave. There may be some confusion over the identifications of the fruits of these two species.

It is found in similar places to P. persicaria and has many fossil records.

Polygonum convolvulus L. Black Bindweed

The fruits of this species are larger than those of the other species above. They are dull black, punctate and trigonous with slightly concave sides.

Like the other species this is a very common weed in arable land and waste places. According to Mercer (1948), P. convolvulus is the most common weed found in fields of oats and barley and the second most common in wheat. Fossil records are frequent.

A large number of whole fruits and fragments of Polygonum persicaria, P. lapathifolium and P. convolvulus were found in analysis of the stomach contents of Iron Age bog corpses from Denmark (Helbaek, 1950). Over 60 species of plants, many of which today are regarded as weeds, were recovered. The corpses were ritual sacrifices and the men may have eaten a ritual meal before death.

The closely related buckwheat, Fagopyrum esculentum Moench, has been cultivated since prehistoric times for its nutritious fruits and also for green fodder (Dimbleby, 1978).

Rumex species

Fruits of Rumex species are generally triquetrous with smooth surfaces. Apart from fruits of R. acetosella agg. perianth segments are necessary for specific identification. Large numbers of fruits are produced by individual plants, for example 30,000 fruits may be produced in one year by R. crispus (Salisbury, 1961), and these survive well in the soil. Fossil records of Rumex species are frequent.

Rumex acetosella agg. Sheep's Sorrel

Fruits were abundant on all three sites. The shiny trigonous fruits are smaller (0.8 - 1.5mm) than those of other *Rumex* species. The sinuous cell walls characteristic of the family were often very distinct in the fossils. Perianths were rarely preserved. The fossils most probably belong to the species *R. acetosella* L. It is a common weed particularly on acid soils; it is also found on moorland.

Rumex acetosa L. Sorrel

One fruit was identified from both Perth and Aberdeen. The orbicular-cordate perianth segments of the fruit lack tubercles.

It is a common plant of waste places, grassland and open woods. The leaves were formerly much used as a salad, also boiled, made into sauces and added to ale (Grigson, 1975).

Rumex crispus L. Curled Dock

A few fruits were identified from Aberdeen and Perth. According to Clapham, Tutin and Warburg (1962) the fruit perianth segments are "broadly ovate-cordate, usually all three with tubercles, one larger than the other two or all equal, margin entire or minutely denticulate".

This is an abundant weed.

Rumex obtusifolius L. Broad-leaved Dock

Fruits were very abundant, particularly in the Elgin soak away. According to Clapham, Tutin and Warburg (1962) the perianth segments are "triangular, one (rarely all three) with a prominent tubercle, margin with 3 - 5 long teeth."

This is another very abundant weed. Creels were formerly made from stalks of dockens, as they were from straw, rushes, heather and willow, for back transport (Fenton, 1976).

Rumex cf. conglomeratus Murr. Sharp Dock

One fruit was tentatively identified from Perth. "Fruit perianth segments ovate to oblong, obtuse, all with oblong tubercles, margins entire." (Clapham, Tutin and Warburg, 1962).

This species is rare in Scotland occurring in damp grassy places.

URTICACEAE

Urtica urens L. Small Nettle

The small nettle is an annual with achenes which are larger (c. 1.6mm) than those of the perennial U. dioica.

It is an abundant weed in cultivated ground and waste places. There are numerous fossil records.

Urtica dioica L. Stinging Nettle

The achenes are c. 1.2mm in length. It is an abundant weed near buildings, on waste land and in woods. It thrives in nitrogen-rich areas.

Nettle leaves can be consumed as a green vegetable, boiled or made into soup. However when the plants are seeding they are too fibrous for this purpose. In the Old Statistical Account (1792) the Rev. Patrick Grant of the Parish of Duthil in Moray tells that during the famine of 1680 "the poorer sort of people frequented the churchyard, to pull a mess of nettles, and frequently struggled and fought about the prey, being the earliest spring greens which they greedily fed upon." Gardiner (1847) mentions that nettles are sometimes used in place of rennet to curdle milk and that the young tops are frequently gathered by the peasantry to make nettle brose. In Ireland nettles have been used repeatedly in times of scarcity (Lucas, 1959). Martin (1716) mentions a medicinal use of the tops of nettles for inducing sleep. Textiles have also been produced from the fine fibres of nettles although no evidence was found of this here.

Again there are numerous fossil records from archaeological sites.

CANNABIACEAE

Cannabis sativa L. Hemp Plate 13

Six fruits and three fragments were recovered from the Elgin barrel and soak away. The fruits (commercial "seeds") were between 3.0 and 3.5mm in length. They showed slight traces of reticulate pattern on the surface. Reference fruits were boiled for comparison.

Hemp is an Asiatic species which according to Godwin (1967, 1975) was brought into general cultivation in England in Anglo-Saxon times. Subspecies sativa is cultivated in temperate regions for its bast fibres and oily "seeds" while subspecies indica is grown in tropical countries for the powerful narcotic drug obtained from the resin of the female inflorescences (Small and Cronquist, 1976; Vaughan, 1970). Fibres of hemp are longer than those of flax but they tend to be less flexible and coarser. It is probable that small patches of hemp were grown for the spinning of ropes (Smout, 1969). Oil from hempseeds can be used as a substitute for linseed oil.

Hemp is still occasionally found growing on rubbish tips in Elgin, probably as a result of introduction with foreign grain (Webster, 1978). Cannabis pollen has been identified in cores from Lindores Loch, near Lindores Abbey, Fife (G. Whittington, pers. comm.) Hemp seeds are recorded from medieval Hull (Williams, 1974) and Gloucester (Green, 1979a).

MORACEAE

Ficus carica L. Fig

The small yellow seeds of figs are distinctive being ovoid in shape with one sharp edge. The abundance of seeds in the lower two samples from the Elgin barrel suggests the presence of sewage. However it has to be remembered that one fig may contain over 1600 seeds. The fruiting behaviour of figs is complicated, pollination depending on a close relationship which has evolved between the fig plant and the fig wasp. Empty parthenocarpic drupelets are however produced without pollination by some varieties (Storey, 1976).

Figs are native to the Middle East and Eastern Mediterranean region. It is possible that during the medieval warm period the climate in Scotland was sufficiently warm for figs to ripen. According to the Collectanea de Rebus Albanicus of 1098 (quoted in Murray, 1973), Bjorn Cripplehand, a Nordic skald observed fire playing in the fig trees of Liodhus (Lewis). Also in the statistical Account (1793) the Rev. John Grant in his description of the ruins of Pluscarden Priory in the parish of Elgin writes the following: "their gardens were excellent. A fig-tree was there a few years ago which annually produced fruit". Nevertheless dried figs were probably imported from the continent in medieval times. It is historically known that figs were imported to medieval Dublin (Mitchell *in* Godwin, 1975) and figs and raisins were imported from Spain to the medieval ports of Boston and Lynn on the Wash (Carus-Wilson, 1962-63).

The Romans first brought figs to Britain; seeds have been found at many Roman sites including the fort of Bearsden (Dickson *et al*, 1979). There are many records from medieval sites in Britain.

JUGLANDACEAE

Juglans regia L.

Walnut shells were recovered from Perth and Elgin. Walnuts are native from southeastern Europe to China. It is probable that the Romans were the first to introduce the nut to Britain (Godwin, 1975). The tree may have been planted in medieval times; trees are found more or less naturalised in southern England today (Clapham, Tutin and Warburg, 1962). As with figs, it is impossible to say whether the walnuts from the site were locally grown or imported. *Juglans* pollen has been identified in cores from Lindores Loch near Lindores Abbey, Fife (G. Whittington pers. comm.). Walnut shells have also been recovered from medieval Plymouth (Dennell, 1970) and King's Lynn (Clarke and Carter, 1977).

MYRICACEAE

Myrica gale L. Bog Myrtle

Fruits and leaf fragments were recovered from Perth and Aberdeen and a group of anthers in one Aberdeen sample. The Aberdeen fruit was carbonised.

The fruits are two-winged by the bracteoles which become larger after flowering. The leaf fragments were distinguished by their usually serrate margins and conspicuous scattered sessile glands on both sides. Anthers were identified by their pollen grains.

Myrica is a small shrub common in bogs and wet acid moorland. It is a plant with numerous uses such as flavouring ale or beer, for use as brooms, repelling insects and as a yellow dye. Use of the plant as a broom may account for the carbonised fruit in the hearth sample from Aberdeen.

Fruits of Myrica have been recovered from several medieval Scandinavian sites as well as from natural deposits in Britain.

BETULACEAE

Betula pubescens L. Birch

Fruits and fruit scales were recovered from Aberdeen and Elgin and fruits from Perth. Most of the fruits were sufficiently well preserved to identify the species as B. pubescens. The fruits are flattened with two stigmas and translucent wings, the upper edges of which do not project beyond the stigmas in this species. The scales, which are formed from the fused bract and bracteoles are three-lobed. The lateral lobes in B. pubescens are rounded or nearly square, and more or less spreading or ascending (cf. B. pendula where they curve downwards).

The fossils in the samples probably blew in from nearby trees. Birch is a very common tree, this species being tolerant of wet places. It is a successional species often colonising heathland. It is one of the few tree species whose propagules naturally occur in seed banks; trees belonging to climax stages tend to have larger seeds which do not persist in the soil (Harper, 1977).

Birch twigs and branches have been used to make brooms as well as other implements and the bark can be used in tanning leather. Birch wine can be made from sap extracted from the live tree by tapping. Pennant (1769) mentions birk wine in the Aberdeenshire highlands (McNeill, 1974).

Alnus glutinosa (L.) Gaertn. Alder

Small pieces of charcoal were identified as twigs of alder from the hearth sample A S229 L228 from Aberdeen. It is a very common tree by rivers and lake shores.

CORYLACEAE

Corylus avellana L. Hazel

Most of the finds were of nutshell fragments although in the Perth samples half shells were frequent and the occasional whole nut. Many of the hand-picked botanical samples from Perth consisted of finds of hazelnuts. Only one or two pieces showed signs of gnawing, most of the fragments are presumably the result of being broken by man.

Hazel shrubs are common in woods and scrub and the nuts were a major item in the diet of mesolithic man (Dimbleby, 1978). The kernel can be ground into flour for baking and probably continued to be a convenient food in medieval times. Nutshell fragments are common from many medieval sites in Britain.

Corylus charcoal was identified from the Aberdeen hearth sample.

FAGACEAE

Quercus sp. Oak

One whole acorn (24 x 14.5mm), was recovered from Perth context 9261, a possible floor level in building 18. It was not possible to determine the species present. Acorns, like hazelnuts, have been used to make flour (Renfrew, 1973). Oak bark was important for tanning leather.

SALICACEAE

Salix sp. Willow

Fruits were recovered from Perth and Elgin and bud scales from Aberdeen and Elgin. The budscales are thimble-like structures varying in length but often about 6mm. They have a small notch at the apex and many of the fossils retained their golden brown colour. Budscales were particularly abundant in the same Elgin samples as the birch fruits and scales were found. It is surprising that both species are completely absent from the barrel samples. A few fruits containing seeds with long silky hairs were also recovered. Specific identification was not possible.

ERICACEAE

Calluna vulgaris (L.) Hull Heather

Flowers and globose fruit capsules with persistent styles were easily recognized. The delicate seeds are tiny with wavy cell walls. The leaves have strongly revolute margins making them trigonous; the epidermal cells are wavy.

Calluna and Erica species produce high densities of small seeds and this combined with the acid and/or waterlogged conditions of the habitats they grow in favours seed preservation in natural seedbanks (Harper, 1977). They characteristically possess type IV seed banks (Thomson and Grime, 1979) - see section 1.6 on seeds and seed banks.

Calluna is an extremely abundant plant of acid moorland and doubtless had many uses in medieval towns such as thatching, bedding, packing. Martin (1716) gives a description of heather beds in Skye: "They lie for the most part on Beds of Straw, and some on Beds of Heath; which latter being made after their way, with the tops uppermost, are almost as soft as a Featherbed, and yield a pleasant scent after lying on 'em once." Heather is also used in making ale (McNeill, 1974). There are medieval records of heather from sites in the north of England.

Erica tetralix L. Bog Heather, Cross-leaved Heath

The Elgin leaf and a large proportion of the Aberdeen leaves were carbonised. The seeds are small with more or less isodiametric cells which have thick densely pitted walls. The walls are often slightly wavy in outline (Watts, 1959; Jessen et al, 1959). The leaves are glandular-ciliate, revolute but with midrib visible. The epidermal cells, which were particularly clear in carbonised leaves that had lost their hairs, are polygonal.

E. tetralix is a very common plant in bogs and wet moorland. It was the kind of heather most preferred in the Highlands for brooms, scouring brushes etc. owing to its fine wiry nature (McNeill, 1910).

There are few fossil records of Erica species from archaeological sites in Britain but this is probably a reflection of the concentration of investigations in lowland England.

Erica cinerea L. Bell Heather

The seeds are slightly larger than those of E. tetralix and Calluna and the fossils were distinctly more robust and solid. The cells are usually hexagonal with thick pitted walls which have straight and distinct middle lanellae. The leaves are relatively long, glabrous and with cells longitudinally elongated.

It is common on drier moors.

Vaccinium myrtillus L. Blaeberry

Seeds of Vaccinium are small with distinct cell walls. They were numerous in postulated sewage samples from both Aberdeen and Elgin. Blaeberries were probably gathered in surrounding moorland areas.

Seeds have been recovered from the Roman fort of Bearsden (C.A. Dickson pers. comm.). Fruits have been found along with those of other plants in association with a fruit press or similar structure in medieval Dublin (Godwin, 1975). The berries are still made into jam (McNeill, 1974). Martin (1716) mentions that in Skye "Fluxes are cur'd by taking now and then a spoonful of the Syrup of the Blue Berries that grow on the Mertillus."

EMPETRACEAE

Empetrum nigrum L. Crowberry

The fossil stones were brown with a rough surface, average length 2mm.

Crowberry is a common plant of dry moorland. The black fruits are edible though not sweet. Fossil stones have been found at the Iron Age Bu Broch, Orkney (C.A. Dickson, pers. comm.), the Roman fort of Birrens in Dumfriesshire (Wilson, 1975a) as well as in many natural deposits.

MENYANTHACEAE

Menyanthes trifoliata L. Bogbean

Seeds of Menyanthes are shiny, black, around 2.3mm long and with the cells of the testa elongated. It is a common plant of loch margins and bogs. It has strong medicinal properties being used for colic and internal upsets (Grant, 1961) and according to Tait (1947) was specific for jaundice in Shetland.

Menyanthes seeds are very abundant in natural Quaternary deposits and seeds have been found in medieval Hull (Williams, 1974; Underdown, 1979).

BORAGINACEAE

Myosotis arvensis (L.) Hill Forget-me-not

The fossil nutlets are shiny, dark brown or black. Their shape is ovoid and acute and one face is keeled.

M. arvensis is an abundant weed of cultivated ground. There are no other fossil records for this species from archaeological contexts in Britain.

SOLANACEAE

Atropa belladonna L. Deadly Nightshade Plate 14

The occurrence of more than 160 seeds of Atropa in the Elgin samples is of great interest. A large proportion of these seeds were found in the soak away. The seeds are ovoid with a raised reticulate surface pattern.

Atropa is extremely poisonous due to the presence of alkaloids and hyoscyamine (Forsyth, 1968). However its use as a cosmetic (for dilating the pupil) has long been known and it is a powerful drug when administered with care in small doses. A preceptory of Maison Dieu with a hospital for entertaining strangers and maintaining poor infirm people was founded in the first half of the 13th century on the outskirts of Elgin (Comrie, 1932). It may well have had an attached herb garden for growing medicinal plants such as deadly nightshade. It may also have been grown in the King's Garden which was situated much closer to the site. Gerard (1597) however recommends that the plant should be banished from gardens and no longer used since it is "a plant so furious and deadly: for it bringeth such as have eaten thereof into a dead sleepe wherein many have died".

It is native in England and Wales in woods and thickets on calcareous soils (Clapham, Tutin and Warburg, 1962). In northern Scotland it is introduced; Webster (1978) records it at Kinloss Abbey in the Elgin area at present. This appears to be the first medieval record of the plant although it seems to have been frequent in Roman Britain (e.g. Greig, 1976).

Hyoscyamus niger L. Henbane

Seven seeds were recovered from Perth samples. They are generally smaller than those of _Atropa_ and with coarser reticulation. Like deadly nightshade the plant is poisonous and narcotic. It contains the alkaloids hyoscyamine and scopolamine (Clapham, Tutin and Warburg, 1962). Early physicians found it a plant more easily handled than deadly nightshade (Grigson, 1975). Gerard (1597) tells us that "Henbane causeth drowsiness and mitigateth all kinds of paine. It is good against hot and sharpe distillations of the eies and other parts". In Denmark seeds were placed in hollow teeth as a local anaesthetic (Jensen, 1979).

Henbane is native in southern England but occurs as a casual in Scotland. Seeds of _Hyoscyamus_ have remarkable longevity; seeds capable of germinating were found at habitation sites from the 14th century in Denmark (Ødum, 1965). There are fossil records from Roman and Anglo-Saxon York (Greig, 1976; Goodwin and Bachem, 1959) and medieval Beverley (Hall and Kenward, 1980).

SCROPHULARIACEAE

Pedicularis palustris L. Red-rattle

The brown seeds recovered from Perth were of average length, 2.6mm and often split down the middle. They had a characteristic surface pattern of longitudinally elongated cells.

It is a common plant of wet moorland and bogs. Fossils have also been recorded from medieval Durham (Donaldson, 1979) and Beverley (Hull and Kenward, 1980).

Rhinanthus sp. Yellow-rattle

Six seeds of Rhinanthus were recovered from Perth. The seeds are winged with the cells clearly visible in the translucent wing. The seeds probably belong to R. minor L.

Yellow-rattle is a common grassland plant. Seeds have been found at medieval Dublin (Mitchell in Godwin, 1975) and Hull (Underdown, 1979).

Melampyrum pratense L. Cow-wheat

Ten seeds were recovered from Elgin. They were up to 3.5mm long but appeared shrunken and wrinkled. Many had a thin covering like whitish tissue paper.

Cow-wheat is common of woods and moors. It has also been recorded from medieval Larkfield in Kent (Grove, 1963).

Odontites verna (Bell.) Dun. Red Bartsia

The Perth seed was carbonised while the Aberdeen seeds were of a pale colour. They were about 1.5mm long with longitudinal ridges connected by small transverse ridges.

It is a common plant of waste places and fields. It has been recorded from medieval Hull (Underdown, 1979), Roman horse dung, Lancaster (Wilson, 1979).

LABIATAE

Lycopus europaeus L. Gipsy-wort

Nutlets are tetrahedral, bordered and with a truncate apex. The Perth fossils were well preserved and easily recognised.

Lycopus is found on the banks of rivers and ditches. White (1898) lists the plant as being very local and rare in Perthshire. He mentions it as present on the shores of the Tay near Errol and casual at Perth Harbour. Nutlets are frequently found in Quaternary deposits. They have been found in late Anglo-Saxon layers at Hungate, York (Godwin and Bachem, 1959).

Prunella vulgaris L. Self Heal

The oblong nutlets have a longitudinal groove down one face; some retained the shining papery outer layer but this was lost in many of the fossils.

Prunella is a very common plant of grassland and is also found in waste places. There are frequent records from archaeological sites. Gerard regarded it and Ajuga reptans as the two best herbs for healing wounds (Grigson, 1975).

Stachys sylvatica L. Hedge Woundwort/Stacnys palustris L. Marsh Woundwort

The nutlets are obovoid and rounded at the apex. Reference nutlets of S. palustris had sharper edges with slight ridges and were slightly smaller than nutlets of S. sylvatica. The fossil nutlets fit better with S. sylvatica but identification was not certain.

Both are common: S. sylvatica in shady waste places and S. palustris in bog, ditches and by streams. Marsh woundwort in particular is recommended in the herbals for healing wounds.

S. sylvatica is recorded from late Anglo-Saxon Hungate, York (Godwin and Bachem, 1959), Stachys sp from medieval Dublin (Mitchell in Godwin, 1975).

Lamium purpureum L. Red Dead-nettle

Nutlets were recovered from Elgin. They are small and oblong, trigonous when fresh but often collapsed in the fossils.

L. purpureum is an abundant weed of cultivated ground and waste places. There are records from Roman sites in Britain and a tentative record from medieval Hull (Williams, 1974).

Galeopsis tetrahit agg. Hemp-nettle

Nutlets of Galeopsis are large (average length 3mm) and trigonous with rounded apex. The scar at the point of attachment is large. The fossils were most similar to nutlets of G. tetrahit agg. although other Galeopsis species may be present.

Pericarp fragments which were tentatively referred to Galeopsis species were recovered from Aberdeen and Perth. They were examined microscopically by placing on a slide. At first they were identified as testa fragments of leguminous seeds. The cells are angular and polygonal with small irregular lumina which appear stellate in surface view. However no distinct Malpighian cells, characteristic of Leguminosae, are present. The fragments were later found to closely resemble those of reference material of Galeopsis species.

Some of the nutlets may have been milled along with cereal grains accounting for the fragments present along with cereal debris in the Perth samples.

G. tetrahit agg. is an abundant weed of arable and waste land. Fossil records of Galeopsis species from archaeological contexts are numerous.

Ajuga reptans L. Bugle

The single nutlet from Perth was coarsely reticulate with a very distinct attachment scar. It was 2.1mm long.

Bugle is common in damp woods and pastures. It is recorded from medieval Hull (Underdown, 1979).

PLANTAGINACEAE

Plantago major L. Great Plantain

One seed only was found from Perth. It was 1.9mm in length. P. major is a very common weed in open habitats such as by tracks and in cultivated ground.

It is surprising that Plantago seeds are not encountered more frequently in archaeological deposits considering the abundance of the plants in man-made environments.

The use of this and the following species for poultices or dressings to draw inflammation from sores is remembered by people in the Highlands according to Grant (1961). Martin (1716) recommends use of plantains to cure fluxes.

Plantago lanceolata L. Ribwort Plantain

Five seeds of P. lanceolata were recovered from Perth and Elgin, all were carbonised.

P. lanceolata is an abundant plant in grassland. In pollen analysis an increase in the frequency of its pollen is often used as evidence for decrease in forest cover and increase in activity of man and neolithic farming. It produces new leaves in the autumn and can be a valuable source of winter fodder (Salisbury, 1961).

RUBIACEAE

Galium saxatile L. Heath Bedstraw

Fruits of Galium species are formed of two one-seeded mericarps. The testa of the seed is adherent to the pericarp. One fossil "fruit" in the tables refers to a single mericarp.

One fruit of G. saxatile was recovered from Perth. It was 1.5mm in length and the tubercles on the surface were preserved. The cell pattern was visible in parts.

It is common on moors and grassland on acid soil. There are no records for this particular species from archaeological contexts.

Galium palustre L. Marsh Bedstraw

Fruits were recovered from Perth. They are small (average length 1.4mm), spherical, black and with a distinctive cell pattern on the surface (reference fruits were first boiled for comparison).

It is a common plant in ditches and marshes. The only record is from Roman Silchester (Reid, 1901-9).

Galium aparine L. Sticky Willie

One fruit was recovered from Elgin. It was 2.4mm in diameter, black with irregular ridges.

Sticky willie is abundant in waste places and hedgerows. It is recorded from medieval Dublin (Mitchell in Godwin, 1975).

CAPRIFOLIACEAE

Sambucus nigra L. Elder

The reddish brown seeds with their distinctive ridged surface are easily identified.

Elder is common in scrub and waste places, being especially characteristic of disturbed, base-rich and nitrogen-rich soils (Clapham, Tutin and Warburg, 1962). It is introduced in north Scotland (Webster, 1978).

Elder, like rowan, was thought to have supernatural powers and was often planted as a protection from evil spirits. Elderberry wine is still commonly made. Buckland et al (1974) suggest that the quantities of elder seeds found from medieval York may have been used to make an acid ferment for treating hides.

The seeds are common fossils from archaeological sites.

COMPOSITAE

Bidens tripartita L. Bur-Marigold Plate 16

One achene was recovered from Perth. The large size of the achene (7mm long) made the fossil very distinctive. The oblong compressed achene is prolonged upwards into two barbed bristles.

It is a plant of ditches and pond margins. According to White (1898) it is rare and often sporadic in Perthshire. It is recorded from medieval

Gloucester (Green, 1979a) and tentatively from Beverley (Hall and Kenward, 1980).

Senecio cf. aquaticus Hill Marsh Ragwort

Achenes of Senecio species are cylindrical and ribbed. Senecio aquaticus achenes, which were tentatively identified from Perth samples are glabrous and 2.5-3mm in length. It is found in damp places.

Senecio vulgaris L. Groundsel

Achenes were recovered from all three sites. They are small, 1.5-2mm in length, and densely hairy on the ribs. In the fossils the embryo was often lost and only the delicate cylindrical outer structure remained. However the ribs were preserved and comparison of the cell patterns with treated reference achenes helped to identify them as S. vulgaris.

Groundsel is very frequent on cultivated ground and waste places. The average output of a plant is 1000 to 2000 achenes, several generations of fruiting plants being produced in a single year (Salisbury, 1961). Martin (1716) mentions that some women of the Western Isles "make use of the root of Groundsel as an Amulet against such charms (designed to steal milk from neighbours' cows) by putting it among their Cream".

Both the above species are slightly poisonous to stock although less so than S. jacobea which results in staggers when eaten in appreciable quantity by animals.

Fossil records from archaeological sites in Britain are at the genus level e.g. medieval Hull (Williams, 1974), Beverley (Hall and Kenward, 1980), Dublin (Mitchell in Godwin, 1975).

Anthemis cotula L. Stinking Mayweed

Achenes were recovered from Perth and Aberdeen. They are around 2mm long, yellowish, ribbed and with conspicuous tubercles. They were abundant in the sample from context 9137 from Perth, a compact dung layer. This weed of arable land is rare, or overlooked, in Perthshire (White, 1898). Addyman et al (1976) mention A. cotula as a very characteristic weed of post-Roman to medieval agriculture. There are several records from medieval archaeological sites in England.

Achillea millefolium L. Yarrow

The achenes are strongly compressed lacking ribs but with a wing which is broader in achenes from disk florets. The fossils, recovered from Perth and Elgin, were under 2mm long.

Yarrow is common in short grass and waysides. It contains two alkaloids, including achillein (Clapham, Tutin and Warburg, 1962) and is used medicinally, principally as a wound herb. Martin (1716) mentions its use in Skye, boiled in milk, to treat consumption.

Achenes have also been recovered from medieval Durham (Donaldson, 1979).

Tripleurospermum maritimum ssp. inodorum (L.) Hyl. ex Vaarama Scentless Mayweed

One of the Perth achenes was carbonised. Most of the remaining fossils consisted solely of the inner fruit. The achenes are ribbed on the inner face and bordered. Subspecies inodorum is distinguished by the two oil-glands at the top of the outer face which are circular or slightly elongated. The inner fruit fossils were delicate transparent oval structures similar to grass caryopses. They measured about 1.6mm in length and had a very distinctive wavy cell pattern. A faint line of vascular tissue was visible down the middle.

Scentless mayweed is a very abundant weed of arable and waste ground. There are fossil records from medieval Hull (Underdown, 1979) and Beverley (Hall and Kenward, 1980).

Chrysanthemum segetum L. Corn Marigold

Achenes were recovered from Perth and Elgin. One of the Perth achenes was carbonised. None of the fossils were winged therefore they probably came from disk florets. The achenes are strongly ribbed, about 2.5mm long and with a large rectangular cell pattern.

The plant is probably introduced. It is tolerant of acid soils and was once regarded as Scotland's worst weed but has since been reduced in abundance by liming (Symon, 1959; Clapham, Tutin and Warburg, 1962). It not only repressed grain crops but its succulent stems prevented rapid drying of cut grain. Early laws punished offenders guilty of allowing gule (corn marigold) to infest their fields.

"The Guell, the Gordon and the hoodie craw,
Are the three warst faes that Moray ever saw." (Symon, 1959).

Achenes have been found at a number of medieval sites in England.

Carduus sp. Thistle

One achene was recovered from Elgin. The fossil was 3mm long, broader than Cirsium species and with fine transverse wrinkles. The species is probably C. tennuiflorus Curt., slender thistle.

Carduus sp. has been recorded from Roman horse dung, Lancaster (Wilson, 1979).

Cirsium vulgare (Savi) Ten. Spear Thistle

The fossil achenes, recovered from Perth and Elgin, were around 3.5mm long and longitudinally streaked.

Spear thistle is abundant in waste ground and fields. Fossil records are generally at the genus level although there is a tentative fossil record for this species from medieval Hull (Williams, 1974).

Cirsium arvense (L.) Scop. Creeping Thistle

A few achenes were recorded from all three sites. They are generally smaller and smoother than those of C. vulgare.

This common and troublesome weed spreads rapidly vegetatively.

Centaurea cyanus L. Cornflower

Achenes were recovered from Perth and Elgin. They varied between 3 and 4mm in length. Achenes of Centaurea species are yellowish, compressed, smooth and with an oblique attachment scar. C. cyanus has a short pappus of rough hairs which was preserved in some fossils. The achenes are broader than those of C. nigra.

C. cyanus was formerly a very common weed but has decreased markedly in recent years, probably as a result of improved seed cleaning. According to Godwin (1975) it has a very close association with rye and the diminished culture of this cereal may have contributed to the decrease in abundance of the weed. It is probably native to the eastern Mediterranean and western Asia.

There are fossil records from medieval Hull (Underdown, 1979) and (tentatively) medieval Chester (Wilson, 1975b).

Centaurea nigra L. Lesser Knapweed

The fossil achenes were generally smaller (3-3.5mm) and narrower than those of C. cyanus.

It is a common plant of grassland and waysides with several fossil records.

Lapsana communis L. Nipplewort

The pale brown achenes varied in length from 2.5 to over 4mm. They are slightly compressed, often curved in shape, narrow and with many ribs. They were very common on all three sites and even fragments were recognizable.

Nipplewort is common on waste ground and at the edges of woods. The leaves were formerly used for salad plants (Clapham, Tutin and Warburg, 1962). There are frequent fossil records.

Hypochoeris radicata L. Cat's Ear

One achene was recovered from Perth. It was cylindrical, dark brown, ridged with short projections and narrowing above into a beak.

Cat's ear is abundant in short grassland and waysides. There are records of Hypochoeris species from medieval sites in England.

Leontodon autumnalis L. Autumnal Hawkbit

Achenes were recovered from Perth. They are 3.5-5mm long, reddish brown (dark brown/black in fossils), longitudinally ribbed with numerous fine transverse ridges.

L. autumnalis is common on grassy banks and dry places on moors. There are numerous fossil records of Leontodon species.

Sonchus oleraceus L. Sow-Thistle

Achenes were recovered from Perth and Elgin. They are oval, compressed, longitudinally three-ribbed on each face and transversely rugose.

S. oleraceus is an abundant weed of cultivated land and waste places. There are fossil records of both Sonchus species from archaeological sites in England.

Sonchus asper (L.) Hill Prickly Sow-Thistle

Achenes were found on all three sites. They are distinguished from those of S. oleraceus by the lack of tranverse wrinkles.

This is another weed species strongly associated with cultivated land.

Taraxacum officinale Weber, sensu lato Dandelion

Achenes were recovered from Elgin. They are cylindrical, ribbed, narrowing at the apex where they are rough with short teeth. There is a short beak.

The plant is still used in salads and for making wine. There are surprisingly few fossil records for the species. It is recorded from Roman Silchester (Reid, 1901-9), Anglo-Saxon York (Godwin and Bachem, 1959).

POTAMOGETONACEAE

Potamogeton cf. natans L. Broad-leaved Pondweed

One fruitstone was recovered from Aberdeen. The outer fleshy layer tends to disappear in fossil fruits and the reference fruits have to have this thin layer removed before comparison is possible. The fossil was pale yellow and compressed, measuring 2.5mm long and 1.5mm wide.

P. natans is common in lochs and ditches. Potamogeton fruit stones are frequent in natural deposits but there are few records from archaeological contexts in Britain. The genus is recorded from medieval Hull (Williams, 1974).

Potamogeton polygonifolius Pourr.

Two fruitstones were recovered from Perth. The fossil from context 7175 measured 1.9mm in length (excluding beak and stalk) and 0.9mm wide. The fruitstone has a central depression and roof shaped lid with a narrow low distinct ridge. It ends abruptly in a narrow beak.

It is common in acid bogs, lochans and small streams. There are fossil records from the Pictish hillfort of Dundurn, Perthshire (Brough, 1980) and Viking Barvas in Lewis (C.A. Dickson, pers. comm.).

JUNCACEAE

Juncus species

The tiny seeds of Juncus species were very abundant in some samples. However seeds were infrequent in paraffin floated samples from Perth, their small size probably resulted in their being overlooked. Seeds were mounted on slides and identified under high power. The diagnostic outer coats were lacking from some fossils but most were well preserved. Juncus seeds are often not differentiated in plant lists from archaeological sites. Juncus species produce very large numbers of small seeds which persist in the seed bank and are therefore a common component of soil samples. An individual large plant of J. effusus, for example, may produce in a single season a total output of 700,000 seeds (Salisbury, 1961).

Juncus squarrosus L. Heath Rush

Seeds were recovered from Perth and Aberdeen. They were generally darker than those of other species recovered and distinctive with thick pitted cell walls.

This is a very common moorland plant. There are fossil records from the Roman fort of Birrens, Dumfriesshire (Wilson, 1979a) and Iron Age Bu Broch, Orkney (C.A. Dickson, pers. comm.).

Juncus bufonius L. Toad Rush

The seeds have notably small cells in longitudinal rows and at the basal end there are wart-like thickenings. The mucilagenous seeds are readily dispersed. Unlike the other rush species encountered this is a slender annual which is a common weed on open ground.

Juncus effusus L. Soft Rush

J. effusus seeds were extremely abundant in many samples. They are difficult to distinguish from those of J. conglomeratus L. which may also be present. The seeds were usually pale yellow in colour and with relatively large transverse hexagonal cells.

J. effusus is abundant in wet fields, bogs and ditches. Rushes and sedges may have been gathered for use as flooring materials and at a later date dumped in the areas where their seeds are now found. However as Hall and Kenward (1980) point out we can only be certain that they were thus used when remains of vegetative parts of rushes and sedges are found with indisputable archaeological evidence for their utilisation.

A small piece of rush pith was found in the Elgin soak away X623 sample. Peeled rushes were used until quite recently for rushlights (Tait, 1947). Animal fat or possibly linseed oil may have been used for fuel.

There are numerous fossil records.

Juncus articulatus L. Jointed Rush

The seeds of this species are difficult to distinguish from those of J. acutiflorus Ehrh. ex Hoffm. which may also be present. The seeds have cell walls in the form of curved bows, with toothed projections on shorter cell walls (Körber-Grohne, 1967).

It is a common plant in wet fields and ditches. Seeds are recorded from the Roman fort of Birrens, Dumfriesshire (Wilson, 1975a) and Roman horse dung, Lancaster (Wilson, 1979).

Luzula multiflora (Retz.) Lej. Many-headed Woodrush

The seeds which were found on all three sites resemble large Juncus seeds. They are oblong in shape, nearly twice as long as broad.

L. multiflora is common on moors and woodland. There are several fossil records of Luzula species from archaeological contexts.

IRIDACEAE

Iris pseudacorus L. Yellow Flag

A number of Iris seeds were present in hand-picked botanical samples from Perth in addition to the two seeds recovered from paraffin-floated samples. The fossil seeds were black and shining and around 7mm long. The surface has an elongated cell pattern. The embryo was easily removed from the fossils.

Iris is common in ditches and bogs. Martin (1716) mentions a medicinal use in Skye for the roots of Flags. A Fenland doctor last century maintained that the roasted seeds made an excellent and healthy drink like coffee (Grigson, 1975).

Surprisingly there appear to be no other records of this plant from medieval contexts in Britain.

CYPERACEAE

Eriophorum vaginatum L. Cotton Grass

The highly resistant sclerenchymatous spindles from the leaf bean were abundant in Aberdeen samples. They are black, fusiform and with a wavy cell pattern (see plate in Dickson, 1970). No nutlets of Eriophorum were found.

Cotton grass is abundant in bogs. The cottony perianths were formerly used in Iceland to make wicks for oil lamps (Dimbleby, 1978).

Spindles have also been recorded from Roman horse dung, Lancaster (Wilson, 1979).

Eleocharis palustris (L.) Roem & Schult. Common Spike-rush

Nuts were recovered from all three sites. They are biconvex with a swollen style base. Most of the fossils retained their shiny outer coat and yellow colour and bristles were still present in some. It is possible that E. uniglumis (Link) Schult. may also be present.

E. palustris is common in ditches, loch margins. There are several fossil records.

Isolepis setacea (L.) R. Br. Bristle Club-rush

The distinctive nuts, found at Perth and Elgin, are tiny (0.75mm diameter), trigonous-obovoid with longitudinal ribs.

It is a small plant frequent in wet gravelly places in moorland ditches. It is recorded from medieval Beverley (Hall and Kenward, 1980).

Carex species Sedges

Nuts of sedges were very frequent at all three sites but were not identified to species level. Nearly all lacked their utricles. The nuts have cell patterns of square to polygonal cells with raised margins which distinguish them from fruits of Polygonaceae species. The nuts were divided into two groups:

Carex spp. tristigmatae - ovary trigonous and stigmas 3

Carex spp. distigmatae - ovary biconvex and stigmas 2

The first group includes common species such as C. binervis, C. demissa, C. rostrata, C. panicea. The second group includes common species such as C. nigra, C. echinata, C. ovalis, C. pulicaris.

The small trigonous nutlets of C. rostrata Stokes (Bottle Sedge) were recognized to be frequent. This is the most commonly identified fossil Carex (Godwin, 1975).

Sedges were probably gathered for use as flooring materials - see notes on Juncus effusus. There are numerous records of Carex species from archaeological contexts.

GRAMINEAE

Grass caryopses are probably under-recorded from archaeological deposits. This is partly due to their being overlooked and also to difficulties in identification. For all three sites there remained small residues of unidentified caryopses. Caryopses were mounted on slides and examined under high power.

The most easily recognized caryopses were those of Poa species, particularly Poa annua. This grass is known to accumulate great numbers of "seeds" in the soil and has a type III seed bank where a proportion of the seeds fail to germinate directly and become incorporated into a persistent seed bank (Thomson and Grime, 1979). Other common grass species with persistent seed banks include Agrostis tenuis, A. canina, Anthoxanthum odoratum and Holcus lanatus. However only three caryopses of Agrostis species and one of Anthoxanthum were recognized in the samples. A number of common grasses have type I seed banks which are transient and present during the summer only. The seeds germinate rapidly after they are shed. These include Festuca rubra, F. ovina, Dactylis glomerata and Bromus mollis. A number of caryopses of the last named species were however recovered. Studies have shown that the proportion of grass seeds in the seed bank from grassland areas may be very low. For example, in an area of pasture dominated by Molinia caerulea caryopses of this species made up only 0.3% of the seed bank (Harper, 1977).

Glyceria fluitans (L.) R. Br. Floating Sweet Grass

One caryopsis was identified from Perth and one, tentatively from Elgin. The Perth caryopsis was carbonised. It measured 3.0mm in length and the outer layer of polygonal cells and long hilum were visible.

G. fluitans is common in stagnant or slow flowing shallow water. Its succulent foliage is very palatable to cattle (Hubbard, 1968). McNeill (1910) mentions that in Germany and Poland the grains were ground to make bread which was only slightly inferior to that made from wheat.

Caryopses are common in natural Quaternary deposits. It is recorded from the Pictish hillfort of Dundurn, Perthshire (Brough, 1980) and medieval Hull (Underdown, 1979)

Poa annua L. Annual Meadow Grass

The small transparent caryopses were easily recognizable on account of the single layered pericarp of hexagonal cells. The hilum is small, dark and round.

This is an extremely common weed. Roberts (1958) records over 128 million seeds per acre in the top 15cm of agricultural soil.

Caryopses have been recovered from pits from medieval York (A. Hall, pers. comm.).

Poa pratensis L./Poa trivialis L. Meadow Grass

Caryopses occurred on all three sites. Both species were identified, P. trivialis being more frequent. Cell walls are not evident in the pericarp which consists of two twin-walled layers of cells. The hilium is round in P. pratensis and oval in P. trivialis. Caryopses of P. trivialis are darker than those of P. pratensis due to strong deposition in the pericarp cells.

Both are common in fields and waste places.

Bromus mollis agg. Lop-Grass

Caryopses were recovered from all three sites. They are large, comparable in length with those of cereals and therefore may escape removal during seed cleaning. The well preserved Aberdeen caryopses were of a shiny rich brown colour, the narrow hilum distinct and terminating before the apex. The longitudinal rays of cells at the apex of the grain were visible. According to P.M. Smith (pers. comm. to C.A. Dickson) it is not possible to distinguish B. secalinus L. (rye-brome, chess) from B. hordeaceus L. (B. thominii Hard. of B. mollis agg.). B. secalinus was at one time cultivated and became a very common cornfield weed in England (Salisbury, 1961).

Bromus species have been recorded from medieval Hull (Underdown, 1979), Roman horse dung, Lancaster (Wilson, 1979) and Viking Barvas, Lewis (C.A. Dickson, pers. comm.).

Agrostis sp. Bent

Three grains were identified from Aberdeen. The hilum of Agrostis species is longitudinally elliptical or pointed, generally more than twice as long as broad (Körber-Grohne, 1964). The grains are small, 0.9-1.5mm long.

The species of bent are common in grassland and moorland, A. stolonifera L. is also common in waste places.

Agrostis sp(p) is recorded from medieval Hull (Underdown, 1979).

Alopecurus geniculatus L. Marsh Foxtail

Three grains were identified from Aberdeen. Alopecurus caryopses are distinguished by the tubular appendage (remains of style) at the apex of the caryopsis. The hilum is at the base of the caryopsis. The fossil grains were dark brown from depositions in the cell walls.

A. geniculatus is common in wet places. It is recorded from Roman horse dung, Lancaster (Wilson, 1970) and tentatively from medieval Hull (Underdown, 1979).

Anthoxanthum odoratum L. Sweet Vernal-Grass

One grain was identified from Aberdeen. The fossil was small and delicate with the transparent pericarp walls appearing structureless. The hilum was round.

Anthoxanthum is common in grassland and moors. There are no other fossil records.

Cereals

Avena sativa L. Common White Oat

Florets and grains, both carbonised and uncarbonised, and pericarp fragments were recovered. Data for pericarp fragments are misleading. These small fragments of cereal debris were generally only recovered from wet-sieved samples and were not normally recovered from paraffin- or water-floated samples.

Well preserved carbonised grains were measured from all three sites (all measurements in mm).

	length	breadth	thickness	number measured
Perth	5.49 (3.6-8.7)	1.95 (1.1-3.0)	1.67 (1.0-2.3)	110
Aberdeen	4.44 (4.0-5.0)	1.63 (1.4-1.9)	1.53 (1.4-1.7)	13
Elgin	4.74 (3.1-6.5)	1.65 (1.0-2.3)	1.44 (0.8-2.0)	107

The evidence from all three sites points towards the majority of carbonised oat grains and florets belonging to Avena sativa, with the exception of the distinct carbonised florets of A. fatua recovered from Perth. It is possible that some of the carbonised grains identified as A. sativa may be A. fatua. Unfortunately the diagnostic lemma tips were broken off the carbonised florets. The hearth samples from Aberdeen (A S229 L228) contained an abundance of carbonised florets and floret bases; none of these floret bases were noticeably prolonged into a short stalk as they are in A. strigosa Schreb. (black or bristle-pointed oat) nor did any have a distinctive sucker-mouth base such as is characteristic of A. fatua. There was no sign of an awn on the better preserved florets from this or the Perth samples. A. sativa bears a short weakly twisted awn on its lower floret but the upper floret is always awnless, in contrast to A. strigosa and A. fatua which have awns on both upper and lower florets.

Pericarp fragments of oats were recognised by their distinctive elongate cells in groups of varying direction (Körber-Grohne, 1964). They are extremely delicate and without the brown coloration of fragments of Hordeum and Triticum.

The evidence suggests that oats were the main cereal crop grown. The lack of evidence for A. strigosa is surprising as in later centuries this was the species commonly grown, particularly on poor acid soils. It was sown on the poorest soil in the outfields of the high-lying districts, its tough stem holding the grains in gales or storms (Findlay, 1956). In the present century A. strigosa is a more frequent weed in fields of A. sativa than A. fatua, which is restricted to better soils. There is an Iron Age record of carbonised florets of A. strigosa from the broch of Gurness, Orkney (C.A. Dickson, pers. comm.) and from a Roman and early medieval site in central Scotland (Jessen and Helbaek, 1944).

According to Handley (1953), A. sativa was uncommon in the Highlands until after 1746, while in the rest of the country it was confined to the infields of the best farms for a considerable time after the Union of 1707. However Anderson (1794) states that "the great corn included all the diversities of the common oat cultivated throughout this Island (Avena sativa)". The Statistical Account (1792) for the parish of Ardclach in Nairnshire mentions that the principal crops grown were "black and white oats, scotch bear, rye and potatoes". There is also a record from 1548 of a tenant on Coupar Abbey estate having to provide five bolls of "quhyt aitis" as part of his rent (Symon, 1959). Oatmeal was the staple which formed the main food of the poorer people; see section 8.1 on diet in medieval Scotland.

Oats are recorded from numerous medieval sites in Britain.

Avena fatua L. Wild Oat

Six carbonised florets of A. fatua were recovered from Perth samples. They are easily distinguished by their distinctive suckermouth base from other species of oat likely to be encountered.

In addition to behaving as a weed, A. fatua may have been grown in mixed crops. Anderson (1794) mentions that wild oats was so abundant in Aberdeenshire as often to constitute nearly half of the bere crop. The size of the grains makes them difficult to separate from bere by winnowing. Wild oats is an introduced species, there are Iron Age records from Crosskirk Broch, Caithness (Dickson, 1979), Buchlyvie Broch, Stirlingshire (C.A. Dickson, pers. comm.) and Roman records from Scottish forts (Jessen and Helbaek, 1944).

Hordeum vulgare L. Barley

Grains, all carbonised except three from Elgin, and pericarp fragments were recovered from all three sites. Rachis internode segments were recovered from Perth and Aberdeen.

GRAINS	length	breadth	thickness	number measured
Perth	5.84 (4.5-8.0)	2.94 (2.0-3.9)	2.38)1.6-3.2)	20
Aberdeen	4.1	2.6	1.8	1
Elgin	4.86 (3.0-6.4)	2.66 (1.6-3.8)	1.98 (1.2-3.0)	87

RACHIS INTERNODE SEGMENTS	length	breadth
Perth 7323	3.2	1.0
" "	2.9	0.9
" "	2.8	1.1
" "	2.6	1.1
" "	2.6	1.2
" 7129	2.5	1.0

The barley grains were generally hulled, i.e. palea and lemma fused together with the grain surface and therefore not removed by threshing. However the palea and lemma may be lost in carbonised grains. The grains showed no signs of sprouting to indicate malting. Rachis segments (from the axis of the spike) indicated that the lax-eared variety, bere (Hordeum vulgare tetrastichum, was grown. This is often referred to as 4-row barley, the grains being in four longitudinal rows, and has a nodding spike (cf. dense-eared 6-row H. vulgare which has an erect spike). The spike type can be determined if rachis internodes are preserved. In the lax-eared form the internodes are more slender than in the dense-eared form where they are broad in proportion to length. However the two or three lowermost internodes of lax-eared spikes are also short and broad (van Zeist, 1974).

Pericarp fragments of Hordeum have cells which are irregularly transverse near the hilum and more or less polygonal at the side of the caryopsis (Körber-Grohne, 1964).

Anderson (1794) states that "the four-rowed bear or big is the only variety of this grain cultivated in Aberdeenshire. It is found to produce much more weighty crops than barley". Two-row barley, H. distichon L., which is less tolerant of soil acidity apparently did not come into common use until liming was practised (Symon, 1959). Bere however is still grown in the Western Isles and Orkney today.

Straw from bere and other cereals, as well as heather, was probably used for thatch and bedding. In Lewis soot-impregnated bere-straw thatch was formerly used as a top-dressing on potato shoots (Fenton, 1976). Use of thatch as manure was once widespread in the Highlands, the sootier the better.

Hordeum grains are recorded from several medieval sites in Britain.

Triticum aestivum L. sensu lato Wheat

Pericarp fragments and uncarbonised grains were recovered from all three sites, carbonised grains from Perth and Elgin and a husk fragment from Aberdeen.

GRAINS	length	breadth	thickness	number measured
Perth	4.52 (4.0-5.1)	3.12 (2.6-3.7)	2.47 (2.0-3.1)	6
Elgin	4.87 (4.2-5.6)	2.98 (2.5-3.6)	2.31 (2.2-2.6)	10

Triticum aestivum s.l. includes both bread wheat and club wheat (T. compactum) grains.

The husk fragment from Aberdeen had elongated cells with highly pitted walls. It corresponded closely with reference fragments. Pericarp fragments have transverse cells which are pitted. When this transverse layer has disappeared owing to poor preservation, a layer with diagonally running long cells is seen (Körber-Grohne, 1964). Fragments were generally brown in colour, the hilum thick and distinct. They were extremely abundant in some samples, far more so than fragments of other cereals.

Wheat was cultivated only on the more fertile land. For example it was grown by the monks of Kinloss, near Elgin, who held much of the best land, and also had a daily allowance of white flour for bread (Forbes, 1975). It was also particularly grown for the King's needs. For example, around the year 1170, William I commanded "Archibald and Hugh, sons of Swain of Forgan, to render to Scone Abbey every year eight chalders of wheat, being the teind of the King's wheat at Longforgan" (Barrow, 1960). Duncan (1975) states that in the royal accounts for the 1260's the Sheriff of Perth received rents in oatmeal, bere and oats, but bought wheat for the King's service. Grain was also imported from England, see section 2.2 on trade in the medieval burghs.

There are several records of wheat from medieval contexts.

Secale cereale L. Rye

Ten carbonised grains were recovered from eight Perth samples.

GRAINS	length	breadth	thickness	number measured
Perth	5.06 (4.2-5.4)	2.44 (1.9-3.1)	2.02 (1.2-2.4)	8

The grains are slender and lop-sided, strikingly corrugated and have the upper end broadly truncate, the lower pointed (Godwin, 1975).

Rye is thought to have originally been introduced as a weed of other cereals and that it gradually assumed the status of a crop plant itself (Godwin, 1975). By medieval times it was an important cereal in England on poor soils where wheat would not thrive. In Scotland, according to Duncan (1975), rye is scarcely mentioned in the medieval rentals but was grown on a small scale in central Scotland in the early 14th century. He continues:

"In general, therefore, wheat was grown more widely in southern Scotland, the land of open fields, where it had perhaps taken over some acreage devoted earlier (in the twelfth century) to rye; it was, however, still grown only in lesser amounts than oats and bere. North of Tay the land of smaller fields was also the land of oats and bere and almost exclusively so." These records of rye grains from 12th century Perth are therefore of great interest. Martin (1716) mentions rye being cultivated in the Western Isles along with barley and oats. In the 18th century oats and rye were sometimes sown together on poor land in the north of Scotland and ground to make a coarse meal. However by the end of that century rye had gone out of cultivation (Handley, 1953).

Rye grains are recorded from Roman sites in Scotland (Jessen and Helbaek, 1944) and medieval sites in England.

Processing of cereal grains

(Notes compiled from literature and historical sources)

In general processing of cereal grains for human consumption involves three main processes: drying, threshing and grinding.

Drying of the grain, prior to grinding was necessary in the damp climate of Scotland, in particular for oats. An early method of drying oats was known as "graddanning". Martin (1716) gives a detailed description of graddan which was at that time still used in several of the Western Isles. A woman held a handful of oats in a fire so that the ears were set alight; "she has a Stick in her right hand, which she manages very dextrously, beating off the Grain at the very instant when the Husk is quite burnt." Doubtless this process resulted in many grains being charred and perhaps ending up on midden heaps. The mass of carbonised floret bases and florets of oats in the hearth of the post-and-wattle building SAN at the Aberdeen site may be the result of this process. Graddan, in addition to drying the grain, also threshes it as the husks are burnt off. Bread wheat is free threshing and may therefore be less likely to be found accidentally carbonised than cereals needing parching to free grains (Dennell, 1976).

Kilns, fired by peat or wood, may also have been used to dry grain. Legislation by King David in the 12th century showed that they were then widespread in lowland Scotland (Fenton, 1976). The kilns generally consisted of a stone hearth in which the fuel was burned. Beams were laid on top of this, then straw on which the sheaves of oats or threshed grain were spread. It was not until the 18th century that the husks (known as shillings) were universally used as fuel (Findlay, 1956).

Threshing, to remove the husks from the kernel, may have been done using a flail. In later times the miller shelled the oats. These were then taken up to a windy place where the husks were blown away and the kernels or groats collected (hence the place names Shillinghill, Shielhill - Findlay, 1956).

The earliest method of grinding was with a knocking stone. Here grain was placed on a slightly hollowed stone and beaten with the "knocking stone". Bere was prepared in this way for centuries. Grains of bere are harder than those of oats and drying is less necessary, although they were often parched first. The knocking stone dehusked the bere and the resultant "knockit bere" was used for making broth (Forbes, 1975). Malt for making ale was also prepared by being knocked. It was first dried to stop growth of the shoots (Fenton, 1976).

Saddle querns are another ancient device. Here the fixed stone is concave and the grain is crushed into meal with a cylindrical rubbing stone. Rotary querns first appeared in Scotland about A.D. 80 but their use spread slowly (Findlay, 1956). The lower stone is fixed while the upper one, with a hole in the centre through which the grain is fed, can be rotated by a fixed handle.

Water-operated grinding mills were introduced about A.D. 500 to 600 but it was a long time before they were much used (Findlay, 1956). Many of the earliest water wheels were horizontal (like the "click mills" which functioned until recently in Orkney) but later vertical wheels became commonplace. Windmills were few in Scotland.

Mills were an important source of revenue to medieval landlords. Peasants were thirled to a particular mill by the landlord and were expected to keep it and the lade in good repair. A proportion of the flour or meal leaving the mill had to be given to the miller as "multure" (Duncan, 1975). The landowner also attempted to suppress the use of querns by the tenants, although probably with little success (Findlay, 1956).

PTERIDOPHYTA

Selaginella selaginoides (L.) Link Lesser Clubmoss

Tiny magapores (0.5mm diameter) were recovered from Perth and Elgin. They are trilete with small protrusions on the surface.

Selaginella is a small plant found in damp grassy of mossy ground, mainly on mountains (Clapham, Tutin and Warburg, 1962). Megaspores are frequently found in natural deposits; it has also been recorded from the Iron Age Crosskirk Broch, Caithness (CA Dickson, pers comm) and medieval Hull (Underdown, 1979).

Pteridium aquilinum (L.) Kuhn Bracken

Pinnule fragments were frequent in many samples particularly those from Aberdeen. The segments have dichotomously branched veins and incurved membranous margins.

Bracken is common in woods and heaths on light acid soils and is often dominant on areas formerly occupied by acid grassland or heather (Clapham, Tutin and Warburg, 1962). Bracken can be used as a fuel, for thatch, flooring and bedding while both rhizomes and fronds can be eaten. For details on the variety of possible uses see Rymer (1976).

Macrofossils of Pteridium are frequently found. There are records from medieval archaeological sites in England.

BRYOPHYTA

A total of 32 taxa of mosses and a single liverwort were identified from the three sites. Mosses were present in varying amounts in the majority of samples. Most were recovered from wet-sieved samples. Paraffin flotation in general is unsuitable for their recovery. The Elgin mosses, which had been dried subsequent to water flotation, were shrivelled scraps although they were identifiable after a period of immersion in water. A number of hand-picked botanical samples from Perth consisted of large masses of robust mosses, in particular Polytrichum commune and Hylocomium splendens.

The most frequent and abundant species were mosses of heathland and woodland areas. Hylocomium splendens was the most frequent, this is so in many other archaeological contexts, for example Vindolanda (Seaward and

Williams, 1976) Dundurn (Brough, 1980). Other large hypnoid mosses which were well represented included Hypnum cupressiforme, Rhytidiadelphus species, Thuidium tamariscinum, Pleurozium schreberi and Eurhynchium praelongum. Large acrocarpous species such as Aulacomnium palustre, Dicranum scoparium and Polytrichum species were found in smaller quantities.

Since it is unlikely that any of the mosses found (with the possible exceptions of Bryum species and Ceratodon purpureus) were actually growing on the site, the mosses must have been brought in from nearby heathland and woods. Some may have been gathered fortuitously with heather etc. but it is probable that many were gathered for use as packing and insulating materials, for bedding and for their absorbant qualities. Evidence of the use of mosses as toilet "paper" was recovered from the Aberdeen Queen Street pits. Robust hypnoid mosses (e.g. Hylocomium splendens, Rhytidiadelphus loreus, Hypnum cupressiforme) were abundant in most of the sub-samples examined. Eggs of the roundworm parasite Trichuris were seen on leaves of R. loreus in slide preparation of moss shoots from samples in which cereal debris was abundant.

Shoots of Sphagnum, a genus which still has economic uses, were frequent in many samples but in small quantities. Capsule fragments and opercula were also recovered.

A piece of plaited rope (diameter 3cm) of Polytrichum commune was recovered from context 9016 (garden/midden) on the Perth site. Small Polytrichum ropes have been found on other medieval sites such as Durham (Donaldson, 1979). A piece of basket work made of cleaned cores of stems of Polytrichum was found at the Roman fort of Newstead (Tagg, 1911).

Large quantities of the robust pleurocarpous moss Antitrichia curtipendula were found in samples from contextx 7129 and 7234 on the Perth site. This is an interesting moss which is one of the commonest subfossils in British Pleistocene deposits (Dickson, 1973) with numerous archaeological records. Today it is a local plant forming mats on boulders or about tree bases in the west of Britain. Its decrease or extinction in south and east England has been attributed to atmospheric pollution (Dickson, 1973).

Ulota crispa, which was present at the Aberdeen and Perth sites is another species which is sensitive to atmospheric pollution. It differs from the other mosses found in being characteristically epiphytic, occurring in small tufts on branches of trees and shrubs (Smith, 1978).

A single shoot of the liverwort Plagiochila asplenioides was recovered from context 7234, a cesspit on the Perth site. Subfossil liverworts are uncommon in comparison with mosses this is probably due to differential preservation. Plagiochila asplenioides is one of the more robust speces and is common in moist shady places. One stem was also recovered from Winetavern Street, medieval Dublin (Dickson, 1973).

FRESHWATER INVERTEBRATES

Daphnia sp.

Plumatella sp.

Daphnia ephippia (eggcases) were present in samples from all three sites. Plumatella statoblasts were present in Perth samples.

Daphnia are small crustaceans and Plumatella species are bryozoans. Both are inhabitants of freshwater.

NEMATODES

Trichuris sp.

Ascaris sp.

Eggs of Trichuris were present in samples from all three sites and one egg of Ascaris was identified from Aberdeen. The parasite eggs were observed on slide preparations of cereal pericarp fragments and also, from the Aberdeen site, on leaves of the moss Rhytidiadelphus loreus. Average measurements of these eggs are given in Pike and Biddle (1966):

Trichuris	0.0281 x 0.0608mm
Ascaris	0.0593 x 0.0737mm

Both are roundworms and common intestinal parasites of man and his domestic animals, especially pigs. The eggs are released in the faeces of the infected host (Pike, 1975). Hodgson suggests that pigs were poorly exploited in medieval Perth, Aberdeen and Elgin, but nevertheless a minimal number of 93 pigs was obtained from the Perth High Street (Hodgson, 1979). Therefore the possibility that the eggs are of animal origin cannot be excluded although their presence on wheat grain fragments and moss leaves strongly suggests a human origin.

FUNGI

Cenococcum sp.

The small black spherical sclerotia of this imperfect fungus were frequent in samples from all three sites. It has a nearly ubiquitous distribution.

Chapter 6

Study of Brassica seeds

Seeds belonging to the genera Brassica, Sinapis and Raphanus were recovered from all three sites. The identification of seeds of Brassica species in particular is a difficult matter and it was decided to make a study of these seeds. An extensive literature search for information on Brassica seeds was also carried out.

Brassica is an important genus containing many crop plants including the cabbage and turnip. The parts consumed, generally the leaves and roots, are unlikely to be preserved and usually the seeds provide the only evidence for these plants. However Kenward (pers. comm.) has suggested that the presence of Brassica aphids, whose chitinous exoskeleton can survive digestion and preserve in deposits, may be used to infer the consumption of Brassica crop plants.

6.1 Taxonomy

Table 8 outlines the nomenclature of Brassica species and related genera. The taxonomy of Brassica species is rather confusing particularly for the turnip and relatives. Linnaeus named B. campestris L., the turnip rapes and B. rapa L., turnip. Ollson (1954) put these morphologically distinct but interfertile forms with 2n = 20 into one species, B. campestris s.l.. Wellington and Quartley (1972) point out that Metzger in 1833 first united B. rapa L. and B. campestris L. under B. rapa L. which thus ought to be the correct name for the enlarged species described by Ollson. Nevertheless B. campestris seems to be the name in current usage (e.g. Simmonds, 1976; Vaughan et al, 1976).

Table 8

Taxonomy of Brassica and related genera

Brassica oleracea L.	cabbages and relatives	2n = 18
ssp. oleracea	wild cabbage	Mitchell and Richards, 1979
var. acephala	kail	Musil, 1948
var. capitala	hearting cabbage	"
var. gemmifera	brussel sprout	"
var. botrytis	cauliflower	"
etc.		
Brassica napus L.	swedes and rapes	2n = 35
var. annua	winter rape	Musil, 1948
var. biennis	summer rpae	"
var. napobrassica	swede	"
Brassica campestris L.	turnip and relatives	2n = 20
ssp. eu-campestris	wild turnip, wild navew	Ollson, 1954
ssp. oleifera	turnip rape	"
ssp. rapifera	turnip	"
Brassica nigra (L.) Koch	black mustard	2n = 16
Sinapis arvensis L.	charlock, wild mustard, skellochs	2n = 18
Sinapis alba L.	white mustard	2n = 24
Raphanus raphanistrum L.	wild radish, runch	2n = 18
Raphanus sativus L.	radish	2n = 18

6.2 Early history of Brassica and related genera with particular reference to Scotland

Wild cabbage (Brassica oleracea ssp. oleracea) is probably native in the British Isles being found on sea cliffs in southern England and Wales. It occurs further north on sea cliffs and waste ground but it is likely that such populations have escaped from cultivation (Mitchell, 1976; Mitchell and Richards, 1979).

The many cultivated varieties of cabbage, kail etc. were anciently domesticated from the variable wild species in the Mediterranean area. Varieties of kail were probably the earliest cultivated types. Cabbage is thought to have been first brought to Britain by the Romans (Gates, 1950). Both red and white cabbages were known in England by the 14th century although it was probably not until the 16th century that cabbage was introduced as a commercial crop (Mitchell, 1976; Thompson, 1976). In Scotland "kail" was grown from at least the 15th century although it is uncertain exactly what variety is meant by kail. By the 16th century several varieties were being grown, for example cabbage kail, white kail, red kail, hard kail; the word kail itself becoming restricted in sense to borecole, in particular the curly variety. Kail was cultivated in dyke-enclosed kail-yards for protection from animals (Fenton, 1976). It was an important green vegetable providing a valuable source of vitamin C. "Colworts" are recorded by Martin (1716) as being part of the diet of inhabitants of the island of Skye.

Fossil records of Brassica oleracea are few. This may be due to difficulty in determining Brassica seeds at the specific level and also perhaps due to the fact that the utilised parts of the plant, the leaves in the case of kail, do not survive. In Britain there are the following tentative records (taxonomy of records is as given in the literature):

cf. B. oleracea	Roman sewer, York	Greig, 1976
B. cf. oleracea	Late Anglo-Saxon, Hungate, York	Godwin and Bachem, 1959

Wild turnip or wild navew (Brassica campestris ssp. eu-campestris) is native in Europe, less certainly so in Britain. It is a slender-rooted branching annual. Its relatively nutritious seeds may well have been gathered and the leaves cooked as a green vegetable. The cultivated turnip (ssp. rapifera) with its tuberous "root" was, like the cabbage, probably introduced to Britain by the Romans (McNaughton, 1976). Gerard (1597) describes the root of turnip as being eaten raw by poor people in Wales but most commonly boiled, while the young shoots, springs, were also eaten. In Scotland turnips were known as garden crops from the late 17th century, even as far north as Orkney. They were not however to become regular field crops until half a century later (Fenton, 1976). Cultivation of turnips for both forage and root crops provided winter feed for stock resulting in the provision of fresh meat during the winter months. Cultivation of turnip rape (ssp. oleifera) for its oil containing seeds is thought to have begun in Europe in the 13th century (McNaughton, 1976); it is uncertain whether it was ever grown in Scotland.

Fossil records of B. campestris are considerably more frequent both in Britain and Europe than records of other Brassica species. Early records may well be the wild subspecies eu-campestris. In medieval times seeds may also have originated from turnip plants allowed to go to seed and from escaped weedy plants. In Britain there are the following records:

B. campestris	Late Bronze Age	Itford Hill	Helbaek, 1952
B. campestris ssp. eu-campestris	Iron Age	Bu Broch, Orkney	C.A. Dickson pers. comm.
B. campestris	Roman	Bearsden Fort	"
cf. B. rapa	Roman	Sewer, York	Greig, 1976
B. rapa	Roman	Pevensey, Sussex	Salzmann, 1908
B. rapa	Medieval	Durham	Donaldson, 1979
cf. B. rapa	Medieval	Hull	Williams, 1974
B. rapa	Medieval	Dublin	Mitchell in Godwin, 1975

B. campestris	Medieval	Perth	M.J. Fraser
B. campestris	Medieval	Aberdeen	M.J. Fraser
B. campestris	Medieval	Elgin	M.J. Fraser

Swede, Brassica napus (2n = 38) is an amphidiploid of B. campestris (2n = 20) and B. oleracea (2n = 18). Spontaneous hybridisation of the parents is likely to have been an extremely rare event due to various barriers but it is nevertheless possible that swede could have originated in medieval gardens where turnip and kail grew side by side. The first record of swede however is a description in 1620 by the Swiss botanist Bauhin (McNaughton, 1976). Swedes with their large "bulb" belong to var. napobrassica while oil-seed and forage rapes belong to the other varieties. Rape has been recorded as an oil-seed crop in Europe at least since medieval time (McNaughton, 1976) but there are no records of its cultivation in Scotland.

There are two tentative fossil records of B. napus in Britain (see also section 6.7):

B. cf. napus	Late Anglo-Saxon	Hungate, York	Godwin and Bachem, 1959
cf. B. napus	Medieval	Hull	Williams, 1974

Black mustard (Brassica nigra) is probably native in England and also occurs as an escape. It was an early commercial spice and until recently, when Brassica juncea took over, was grown in England for the mustard trade. The young leaves may be used in salads and the seeds also yield oil (Hemingway, 1976). There are no historical records of it being grown in Scotland in early times.

There are the following fossil records from England:

B. nigra	Iron Age	Glastonbury Lake Village	Godwin, 1956
B. nigra	Roman	Silchester	Reid, 1901-9
cf. B. nigra	Roman	Sewer, York	Greig, 1976
B. nigra	Medieval	Plymouth	Dennell, 1970
cf. B. nigra	Medieval	Chester	Wilson, 1975b

Undetermined Brassica seeds have been recorded from the following additional sites:

Roman	Car Dyke	Allison in Godwin, 1975
Roman	Caerwent	Lyell, 1911
Roman	horse dung, Lancaster	Wilson, 1979
Medieval	Hull	Underdown, 1979
Medieval	Northampton	Straker, 1979

Sinapis arvensis (charlock, wild mustard, skellochs) is a common and troublesome weed which can turn fields yellow when in flower. It is more abundant on calcareous and heavy soils than poor acid soils. Findlay (1959) considers it to be possibly the most widespread weed in fields of oats. It is interesting to note that Anderson in his General View of the Agriculture of the county of Aberdeen (1794) states that "charlock, so abundant in badly cultivated fields in other parts of Scotland is not a prevalent weed here." Charlock has also been used as a famine food in times of scarcity (McNeill, 1910; Lucas, 1959).

There are the following fossil records:

S. arvensis	Neolithic	Porstewart, Antrim	Jessen and Helbaek, 1944
"	Roman	Newstead	Tagg, 1911
"	Medieval	Dublin	Mitchell in Godwin, 1975
"	Medieval	Perth	M.J. Fraser
"	Medieval	Elgin	"

White mustard (Sinapis alba) is introduced in Britain and cultivated for the mustard trade and also as a green manure and fodder crop and for use in salads. Forms of S. alba, like B. nigra, have been cultivated in Europe from medieval time (Hemingway, 1976).

There are the following fossil records:

S. alba	Roman	Silchester	Reid, 1901-9
"	Roman	London	Willcox, 1977

Wild radish or runch (Raphanus raphanistrum) is another common weed like charlock. It is however more difficult to deal with since the seeds are enclosed in pod segments which separate when ripe and are not removed by sieving or winnowing (Findlay, 1959). It is most frequent on non-calcareous soils. Like charlock it was also consumed in times of scarcity. The plants are anti-scorbutic, the name runch being derived from roynish, mangy (Tait, 1947).

There are the following records:

	Roman	Mersea Island, Essex	Warren, 1914
	"	Pevensey, Sussex	Salzmann, 1908
	"	Caerwent	Lyell, 1911
	"	Silchester	Reid, 1901-9
	"	StarVilla, Somerset	Jefferies in Godwin, 1975
	"	Godmanchester	Dickson in Godwin, 1975
(pods)	"	Isca, Caerleon	Helbaek, 1964
"	"	horse dung, Lancaster	Wilson, 1979
	Medieval	Hull	Williams, 1974
	"	Durham	Donaldson, 1979
	"	Perth	M.J. Fraser
	"	Aberdeen	"
	"	Elgin	"

Radish (Raphanus sativus) is an introduced plant of unknown origin which is sometimes also found as an escape. Radishes have a long history, their probable source being in the eastern Mediterranean area (Banga, 1976).

There are no fossil records from Britain although this may be due to difficulty in distinguishing the seeds from those of R. raphanistrum. The fruits of R. sativus are distinguished by lacking the contrictions between the seeds present in fruits of R. raphanistrum.

6.3 Seed morphology of Brassica and Sinapis seeds

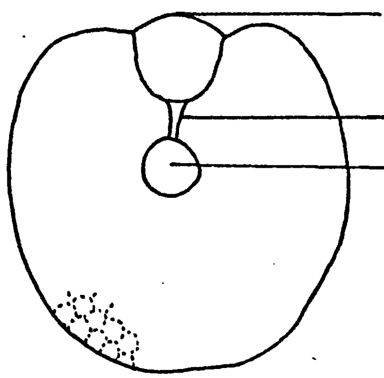


Figure 9 :
Structural features of a seed of Brassica campestris

Seeds of Brassica and Sinapis species may be broadly oblong, spherical or slightly flattened laterally. Under low magnification the testa of many species appears reticulate. Under higher power tiny pits or stipples are visible over the entire seed surface. The cotyledons are longitudinally folded, the radicle ridge being normally distinct on the seed surface. The hilum is usually also distinct. (Musil, 1948; Vaughan, 1970).

Size and surface features of Brassica and Sinapis seeds are highly variable both within and between species. The features of the testa are important in distinguishing species.

The testa may consist of (Vaughan, 1970):

(i) an epidermal layer, one cell thick, which may be mucilagenous;

(ii) a subepidermal layer;

(iii) a palisade layer, the walls of which may be thickened and pigmented;

(iv) a layer of parenchyma cells, some of which may contain pigment.

Variation in height of the palisade cells gives rise to the reticulate appearance in surface view. The stipples seen on the surface are the lumina of palisade cells.

On ripening the epidermis dries up and follows ridges and depression, distinctly showing the outline of lumina and the relief of the reticulum

(Berggren, 1962). In subfossil seeds the epidermal and subepidermal layers are frequently lost leaving the palisade layer distinctly visible.

The degree of reticulation is a highly variable feature although relative size of interspaces has frequently been used as a character for identification. Vaughan (1970) regards this as a very variable feature which can be influenced by the extent of the clearing procedure. He recommends the production of testa sections for identification.

Berggren (1962) claimed that hilum size is a useful character for distinguishing species. According to Musil (1948) however the hilum does not appear to have any reliable diagnostic value and my own observations and measurements of the hilum of Brassica spp. would seem to bear this out.

Descriptions of recent seeds were compiled from studies in the literature. Musil (1948), Berggren (1962) and Vaughan (1970) provide detailed accounts of seed morphology. The other main works consulted were Knörzer (1968, 1970), Körber-Gröhne (1967), Mitchell and Richards (1979), Vaughan and Whitehouse (1974).

The most important features for identification of Brassica seeds seen in surface view are summarised below:

B. oleracea
- shape irregular but roughly spherical
- epidermal tissue persisting, slightly sunken over lumina in ripe seeds
- reticulations narrow well defined lines
- interspaces small

B. napus
- roughly spherical
- epidermis slightly, or rarely distinctly, sunken over lumina in ripe seeds
- reticulations broad and thick, but not sharply defined
- interspaces large

B. campestris - spherical

- epidermis distinctly to conspicuously sunken over lumina in ripe seeds
- reticulations distinct and well defined, occasionally coarse and prominent, sometimes obscure or lacking
- interspaces small, or larger in seeds with coarse reticulations

B. nigra - broadly oblong or slightly flattened

- epidermis thick, in ripe seeds not sunken over lunima
- reticulations thick and cord-like
- interspaces large

Measurements of the diameter of reference Brassica, Sinapis and Raphanus seeds were made. Twentyfive seeds of each species were measured except for B. oleracea ssp. oleracea, B. campestris ssp. eu-campestris and B. nigra for which fewer measurements were made due to lack of suitable ripe material.

Diameter ranges of recent and subfossil seeds of Brassica, Sinapis and Raphanus species from a number of sources are given in Table 10.

These measurements show that for recent B. oleracea, B. napus and B. campestris the seed diameter most commonly fall into the range 1.5-2.5mm. It would thus seem that size is not a reliable character to use in distinguishing between seeds of these species. Seeds of Sinapis arvensis are generally smaller than those of the Brassica species mentioned above but there is some overlap between ranges. However the faintly reticulate surface which appears smooth under low magnification should enable seeds of S. arvensis to be distinguished. Brassica nigra seeds are also usually smaller than seeds of other Brassica species and in addition the thick cord-like reticulations help to distinguish them.

6.4 Identification of subfossil seeds

Subfossil seeds of *Brassica*, *Sinapis* and *Raphanus* are relatively easy to recognize as a group but more difficult to identify at species level. The problem of distinguishing between wild and cultivated forms adds to the difficulty in deciding whether or not a plant was utilised, although wild plants may well have been gathered. Underdown (1979) states that "seeds of *Brassica* are not readily identifiable to species so no conclusions can be drawn about their significance in these deposits."

Separation of *Brassica* and *Sinapis arvensis* seeds can be problematic. Behre (1969) distinguished between the genera on the coarser reticulation of *Brassica* species in comparison with *Sinapis arvensis*. Knörzer (1970) distinguished them on a size basis, seeds of *Brassica* species being in general larger than *Sinapis arvensis*. His seeds from Roman Novaesium were carbonised and lacking much of the testa thus making distinction on the basis of the surface pattern more or less impossible.

The degree of reticulation and relative size of the interspaces along with seed size and shape are the characters most frequently used in identification of fossil seeds. Variation in all these characters is however great, in particular the size of the reticulate pattern. Körber-Grohne (1967) has shown that in *Brassica campestris* from the Iron Age the reticulation is coarser than in recent seeds. Van Zeist (1974) and Fredskild (1978), studying Iron Age settlements in the Netherlands and Neolithic Switzerland respectively, refer seeds to *Brassica campestris* which are more coarsely reticulate than modern reference material.

Whole fossil seeds of *Raphanus raphanistrum* are usually recognizable by their relatively large size, round-ovoid shape and fine surface reticulation. The pods are distinctive and even small fragments can be readily identified. Frequent whole segments of pods containing seeds were recovered from the medieval sites of Perth and Elgin.

6.5 Subfossil seeds from medieval Perth, Elgin and Aberdeen

Around 150 seeds and numerous fragments of Brassica species were recovered from 29 Perth samples. A few seeds were present in most samples; seeds were not concentrated in any particular sample. Two of the seeds were carbonised, the remainder being uncarbonised, many still with intact embryo. The diameter and interspace size of the surface reticulation of 133 of the better preserved seeds were measured (see Table 9).

From Elgin nearly 70 uncarbonised seeds and numerous fragments were recovered from 6 samples. Two samples contained more than 20 seeds. Measurements were taken of 56 seeds.

Eight uncarbonised seeds and numerous fragments were recovered from 4 Aberdeen samples. Measurements were taken of 7 seeds.

Five Sinapis arvensis seeds were recovered from 5 Perth samples and 2 seeds from 2 Elgin samples.

Pod segments and fragments of Raphanus raphanistrum were frequently identified from all three sites. Whole seeds were present though less frequent; identification of testa fragments was less certain.

Fossil Brassica seeds were divided into four categories:

1. B. campestris	Marked reticulation. Reticulation fairly coarse i.e. large interspaces (average size 100µ).
2. B. campestris*	As type 1 but with epidermal tissue persisting on ridges of reticulation. Medium interspaces (average size 75µ).
3. B. cf. campestris	Marked reticulation. Reticulation medium to fine i.e. small interspaces (average size 75µ).
4. B. sp.	Faint reticulation or surface smooth. Reticulation poorly defined. Interspaces small (average size 45µ).

The fossil seeds were referred to Brassica campestris on account of their surface reticulation and spherical shape. The first three types may represent the range in degree of coarseness of reticulation of Brassica campestris seeds. Many seeds of type 1 had a reticulate pattern which was markedly more coarse than that of modern reference material. Körber-Grohne (1967), van Zeist (1974) and Fredskild (1978) have also noted this in seeds from the Iron Age and Neolithic. The reason may be loss of epidermal and subepidermal layers which can partially obscure the palisade cells, variation in height of which causes the reticulate pattern. Seeds of type 2 with medium-sized interspaces retained epidermal tissue on the ridges of the reticulum.

Seeds of the wild subspecies eu-campestris are generally smaller than those of subspecies rapifera although the diameter ranges overlap. Distinction on the basis of seed morphology alone does not seem possible but nevertheless it is likely that some of the smaller seeds at least belong to the wild subspecies.

Some seeds referred to the fourth category, Brassica sp, may also be B. campestris ; it is uncertain whether any other Brassica species are represented.

6.6 Scanning electron microscopy

It was decided to look at the surface of both recent and fossil Brassica seeds under the scanning electron microscope in order to clarify the seed surface. The only published photograph of a Brassica seed taken with the S.E.M. so far to come to notice is of a seed of Brassica nigra in Vaughan et al (1976).

Photographs of the surface appearance of recent and fossil Brassica seeds were taken at magnifications of x 320 and x 1250. See plates 17 - 21 (of original size).

Many of the fossil seeds had marked reticulations (plates 19, 21) ; these are seeds of type 1, B. campestris. Under the S.E.M. the lumina and walls of the palisade cells are extremely clear (plate 20). Recent material of *B. campestris* shows the epidermis distinctly sunken over the lumina (plate 18).

6.7 *Brassica* seeds from Hungate, York

Brassica seeds from late Anglo-Saxon layers from Hungate, York (Godwin and Bachem, 1959) were obtained from the Department of Botany, University of Cambridge. The identification of one seed as *B.* cf. *oleracea* was agreed with but the seed identified as *B.* cf. *napus* was considered to be *B.* cf. *campestris*. Other seeds labelled as *Brassica* sp. were also considered to be *B.* cf. *campestris*. One seed of *Raphanus raphanistrum* was wrongly labelled as *Brassica* sp.

Table 9 Measurements of subfossil Brassica and Sinapis seeds from Perth, Elgin and Aberdeen

	number of seeds measured		mean diameter and range (mm)
PERTH			
B. campestris	81		1.63 (1.30 - 1.99)
B. campestris*	6		1.71 (1.62 - 1.85)
B. cf. campestris	12		1.75 (1.34 - 2.08)
B. sp.	34		1.72 (1.43 - 2.13)
total	133	overall mean	1.64

One carbonised seed of B. campestris and one of B. cf. campestris measured but excluded from mean diameter.

Sinapis arvensis	4		1.52 (1.39 - 1.66)
ELGIN			
B. campestris	21		1.43 (0.92 - 1.80)
B. campestris*	3		1.36 (1.20 - 1.57)
B. cf. campestris	7		1.56 (1.34 - 1.90)
B. sp.	25		1.59 (1.39 - 1.85)
total	56	overall mean	1.54
Sinapis arvensis	2		1.52 (1.39, 1.66)
ABERDEEN			
B. campestris	3		1.45 (1.43 - 1.48)
B. campestris*	2		1.46 (1.43, 1.48)
B. cf. campestris	1		1.66
B. sp.	1		1.80
total	7	overall mean	1.53

Table 10

Diameter ranges of recent and subfossil seeds of Brassica, Sinapis and Raphanus species

Source	species/variety (as given in literature)	number of seeds measured	diameter range (mm)
RECENT			
Mitchell and Richards 1979	B. oleracea ssp. oleracea	50	1.88 (1.5-2.0)
M.J. Fraser	B. oleracea ssp. oleracea	15	1.90 (1.53-1.13)
Clapham, Tutin and Warburg 1962	B. oleracea ssp. oleracea	-	2 - 4
M.J. Fraser	B. oleracea var. acephala	25	1.84 (1.43-2.22)
Musil 1948	B. oleracea var. capitata	500	2 - 3
Knörzer 1970	B. oleracea var. sabauda	10	1.93 (1.6-2.0)
Berggren 1962	B. oleracea	50	1.7-2.1
Vaughan and Whitehouse 1971	B. oleracea	5	2.0
Musil 1948	B. napus var. biennis	500	2 - 3
Musil 1948	B. napus var. napobrassica	500	2 - 3
M.J. Fraser	B. napus	25	1.85 (1.71-2.22)
Berggren 1962	B. napus	50	1.6-2.0
Knörzer 1968	B. napus	-	1.82 (1.6-2.0)
Vaughan and Whitehouse 1971	B. napus	5	1.8
Clapham, Tutin and Warburg 1962	B. napus	-	1.5-2.5
M.J. Fraser	B. campestris ssp. eu-campestris	10	1.53 (1.48-1.66)
M.J. Fraser	B. campestris ssp. rapifera	25	1.84 (1.71-2.22)
Knörzer 1970	B. rapa ssp. oleifera	10	1.77 (1.6-1.9)
Knörzer 1968	B. rapa	-	1.49 (1.4-1.6)
Berggren 1962	B. campestris	50	1.5-1.8
Vaughan and Whitehouse 1971	B. campestris	5	1.8
Vaughan 1970	B. campestris	-	2.0
Clapham, Tutin and Warburg 1962	B. rapa	-	1.5-2.0
Brouwer and Stählin 1975 (in Jensen, 1979)	B. campestris	-	1.8-2.8

Table 10

Source	species/variety (as given in literature)	number of seeds measured	diameter range (mm)
MEDIEVAL			
Perth M.J. Fraser	B. campestris	81	1.63 (1.30-1.99)
Aberdeen M.J. Fraser	B. campestris	3	1.45 (1.43-1.48)
Elgin M.J. Fraser	B. campestris	21	1.43 (0.92-1.80)
Svendborg Jensen 1979	B. campestris	2	1.38, 1.66
Visby Hjelmqvist 1968	B. campestris	10	1.2-1.7
Cracow Wasylikowa 1978	B. campestris	-	1.26 (1.1-1.6)
Neuss Knörzer 1968	B. cf. rapa	290	1.39 (1.2-1.7)
ROMAN			
Novaesium Knörzer 1970	Brassica sp. (carbonised)	11	1.82 (1.7-2.0)
Bearsden fort C.A. Dickson pers. comm.	B. campestris	2 x ½	1.1, 1.3
IRON AGE			
Bu Broch, Orkney, C.A. Dickson, pers. comm.	B. campestris ssp. eu-campestris (carbonised)	33	1.1-1.5
Feddersen Wierde, Körber-Grohne 1967	B. campestris	c. 50	1.2-2.1
Tritsum, Netherlands van Zeist 1974	B. campestris	42	1.7 (1.3-2.1)
Shiedam, Netherlands van Zeist, 1974	B. campestris	84	1.7 (1.4-2.2)
Tollund Man Helbaek 1954	cf. B. campestris	fragments	c. 1.0-1.5mm
LATE BRONZE AGE			
Itford Hill Helbaek 1952	B. campestris (carbonised)	12	0.87-1.25
NEOLITHIC			
Robenhausen Switzerland C.A. Dickson pers. comm.	B. campestris	several 100	1.0-1.5
Weier Switzerland Fredskild 1978	B. campestris	18	1.27 (1.1-1.4)
RECENT			
M.J. Fraser	B. nigra	10	1.12 (1.02-1.20)
Vaughan and Whitehouse 1971	B. nigra	5	1.3
Knörzer 1968	B. nigra	-	1.2 (1.1-1.3)
Clapham, Tutin and Warburg 1962	B. nigra	-	1.5

Table 10

MEDIEVAL			
Cracow, Wasylikowa 1978	*B. nigra*	2	1.1, 1.2
RECENT			
M.J. Fraser	*S. arvensis*	25	1.43 (0.97-1.71)
Knörzer 1970	*S. arvensis*	10	1.47 (1.2-1.7)
Vaughan and Whitehouse 1971	*S. arvensis*	5	1.5
Musil 1963 (<u>in</u> Renfrew 1973)	*S. arvensis*	-	c. 1.6
MEDIEVAL			
Perth M.J. Fraser	*S. arvensis*	4	1.52 (1.39-1.66)
Elgin M.J. Fraser	*S. arvensis*	2	1.52 (1.39, 1.66)
Visby Hjelmqvist 1968	*S. arvensis*	7	1.45 (1.1-1.8)
Cracow Wasylikowa 1978	*S. arvensis*	-	1.6-1.7
ROMAN			
Novaesium Knörzer 1970	cf. *S. arvensis* (carbonised)	24	1.28 (1.0-1.5)
IRON AGE			
Tritsum, Netherlands van Zeist 1974	*S. arvensis*	8	1.9 (1.8-2.1)
Tzumarum, Netherlands van Zeist 1974	*S. arvensis*	6	1.8 (1.6-2.1)

Chapter 7

Comparison of modern arable weed flora with medieval weed flora

Lists of weeds present in fields of wheat, barley and oats were compiled from three fields in an intensive arable farming area of east Scotland and compared with a list from a field of mixed bere and oats on the machair of the Outer Hebrides.

7.1 Results :-

* : very abundant

8.8.80 Carmyllie, Angus district, Tayside

Area of predominantly arable farming with barley (for malting) the major crop.

(i) Field of 2-row barley, Hordeum distichon

Matricaria matricarioides

* Poa pratensis

* Polygonum aviculare

Spergula arvensis

*Stellaria media

Tripleurospermum maritimum ssp. inodorum

Edge of field : Anthriscus sylvestris

Cirsium arvense

Lolium perenne

Rumex obtusifolius

Trifolium repens

(ii) Field of wheat, Triticum aestivum s.l.

Galeopsis cf. speciosa

Poa pratensis

Polygonum aviculare

P. persicaria

* Tripleurospermum maritimum ssp. inodorum

Edge of field : Achillea millefolium

Lolium perenne

(iii) Field of oats, Avena sativa

Galeopsis cf. speciosa

Poa pratensis

* Polygonum aviculare

* P. persicaria

* Stellaria media

Edge of field : Arrhenatherum elatius

3.8.80 South of Nunton, west coast of Benbecula, Western Isles.

Area of machair grassland with some small arable fields behind low coastal dunes. Light sandy soil.

Field of mixed bere, Hordeum vulgare, and bristle-pointed oat, Avena strigosa

Achillea millefolium

Anagallis arvensis

Anchusa arvensis

Brassica campestris

Bromus mollis agg.

Chenopodium album

* Chrysanthemum segetum

Erodium cicutarium

Euphorbia helioscopia

Lamium purpureum

Ranunculus acris

Senecio jacobaea

Sonchus asper

Trifolium pratense

Tripleurospermum maritimum ssp. inodorum

Open patches : Plantago lanceolata

Potentilla anserina

7.2 Discussion

The Carmyllie field of barley was very dense and uniform with few weeds in the centre. The main weeds were Poa pratensis, Polygonum aviculare and Stellaria media. Matricaria matricarioides is a weed introduced from North America in the late 19th century (Salisbury, 1961).

The wheatfield was less dense than the field of barley and here Tripleurospermum maritimum ssp. inodorum was the dominant weed, more or less covering the ground between the stalks of wheat.

Stellaria media was the most abundant weed in the field of oats followed by Polygonum aviculare and P. persicaria. The oat crop was considerably taller than the barley and wheat crops which presumably were varieties selected for tough short stalks. Oats are only cultivated on a very small scale in the area.

The weed flora from the Benbecula field was in contrast much richer. Mixtures of bere and Avena strigosa are still grown today in a few places in the Western Isles, being a relic from more primitive crofting methods. The seed is presumably saved locally. The two species appear to help keep each other erect (Fraser Darling, 1956). A. strigosa also appears as a weed in many localities in the Western Isles. A. sativa does not grow well on the shellsand machair due to nutrient dificiencies of the soil and susceptibility to disease. A. strigosa, though it yields poorly as grain, gives a forage crop of high feeding value (Fraser Darling, 1956). Bere is the only form of barley grown in the Western Isles and is ground into meal. Martin (1716) mentions the great produce of barley on the neighbouring island of North Uist and describes the soil of the Western Isles as being "very grateful to the Husbandman provided it is well manured."

The cereals in the Benbecula field were thinly spread out on the light sandy soil allowing a rich weed flora to compete for the remainder of the space. The adjacent machair grassland has a rich flora including many annual species which provide a seed source.

Chrysanthemum segetum was the dominant weed. Corn marigold has been much reduced on the mainland due to improved seed cleaning, use of herbicides and increase in liming, although it is still turns fields golden in areas such as the Western Isles today. Also of interest was the presence of Brassica campestris These plants had non-tuberous tap roots and probably belonged to the wild subspecies eu-campestris. Raphanus raphanistrum and Sinapis arvensis were present in other fields looked at.

The Benbecula field with its rich weed flora is probably much closer to a medieval field than the species poor Carmyllie fields. Reduction in weeds has been brought about by introduction of screening methods of seed cleaning, the use of chemical herbicides and in particular selective weed killers.

Examples of weeds which were formerly very abundant, whose seeds occurred on the medieval sites investigated, and which today are rare or infrequent include:

Agrostemma githago

Centaurea cyanus

Chrysanthemum segetum .

- Sinapis arvensis was also formerly, extremely abundant but can today be effectively controlled with selective herbicides.

Another factor encouraging the growth of weeds in medieval times was the broadcasting of cereal grains and other seeds by hand. This inevitably precluded effective weeding by hoeing between the crop plants. Seeds were not sown in drills until the beginning of the 18th century (Salisbury, 1961).

Chapter 8

Contribution of botanical studies to the knowledge of the sites

The plant assemblages recovered from samples from certain contexts provide supporting evidence for the archaeologist's interpretation of the site and its structures. The most common instance of this is the recovery of sewage from postulated cess-pits. The presence of cereal pericarp debris (first recognised by C.A. Dickson) is used in conjunction with other evidence as indication of material which has passed through the digestive system. Intestinal parasite eggs and coprosterol (typical of sterols produced by the mammalian digestive tract) provide supporting evidence for the presence of faecal material and make it unlikely for the cereal fragments to originate from (unconsumed) flour or bread. The wheat fragments suggest human sewage; wheat is the most frequent cereal preserved in this way although fragments of oats and barley were also found from the three sites. Cess pit samples from many sites are now being shown to contain cereal debris (for example from medieval York, A.R. Hall pers. comm).

The majority of samples however simply contained an array of species, particularly weeds, which could not be related directly to their archaeological context. Most also contained species from a diverse range of habitats. Nevertheless these samples provide information on the nature of the weed flora and wild plants present in the vicinity of the site. Nettles and Rumex species, for example, can be imagined as flourishing in the nutrient rich soil of the backlands. It must be remembered that the samples looked at come from only a very small portion of the area of the burghs and cannot be expected to provide a comprehensive picture of the role of plants in the urban economy. Referring to the Perth High Street Site, the animal bone specialist, G.W.I. Hodgson suggests that the bone remains (from the 1975 excavations) represent a mixture of domestic refuse and commercial waste (Hodgson, 1979). The large numbers of cattle and goat horncores found and the almost complete absence of the skulls from which they came are suggestive of commercial waste from a horner's industry. He adds that "the preponderance of low meat yielding bones at Perth may be construed as evidence that we are dealing with poorer people e.g. craftsmen rather than merchant burgesses and that the high meat yield joints were sold to a more rich district of the burgh." The question of the social set-up of a site is problematic. The recovery of remains of figs, walnuts, grapes and other fruits and also wheat pericarp debris may indicate the presence of the upper classes at the Perth site. In addition gilded spurs and silks were recovered. However it is uncertain whether spatial division of classes had originated within the burghs at this time; late medieval evidence from Edinburgh suggests that nobles and beggars apparently lived in the same tenements (N.Q. Bogdan pers. comm.).

The preserved plant remains provide information on the use of plants in the medieval economy. This is dealt with in the following two sections:

Food plants and diet in medieval Scotland

Other uses of plants in the medieval economy.

8.1 Food plants and diet in medieval Scotland

Dennell (1979) argues that archaeological data are generally more suitable for modelling the production of food than its consumption and nutritive value. However data from cess pits, if we can be fairly certain that the faecal material is of human origin, does provide information on food actually consumed by the inhabitants of the site. Nevertheless frequent decisions have to be made as to how a potential resource recovered from a site was used, for example whether it was eaten or used for some other purpose or is just an accidental component such as a weed. This is particularly difficult in the case of minor food resources and generally we are only able to speculate.

Several important categories of food do not preserve well and therefore archaeological studies provide little information on their role. Examples are milk products, leaf and root crops, sweeteners such as honey (although see Dickson (1978) for detection of mead by pollen analysis). Dennell (1979) discusses these problems.

Oats was by far the most important cereal grown in medieval Scotland and oatmeal formed the staple of the poorer people. With water it was mixed to form gruel or brose when uncooked, with milk to form porridge, and when made into paste oatbread or bannocks. This reliance on oats meant that failure of the crop led to famine. In addition a diet of oats if not balanced by vegetables and other foods can bring on skin disorders.

Bere was used in broths and stews and for brewing ale. Duncan (1975) suggests that perhaps as much as a third of the grain grown in Scotland each year in medieval times was used for brewing. None of the barley grains recovered however showed signs of malting. Ale was the only beverage available to the vast majority of people, other than milk much of which was required for suckling calves (Forbes, 1975).

Bread made from wheat was a prestige food, wheat cultivation being possible only on the most fertile land. It is probable that only the wealthier burgesses in the burghs were able to afford wheaten bread. The preponderance of wheat grain fragments in the cereal debris recovered from cess pits is therefore surprising. Perhaps wheat fragments preserve better than those of oats and barley. Loaves of bread were baked by baxters; ovens were too costly for poorer individuals to build and fire (Duncan, 1975). In the documents which survive from medieval Perth some trade names, including those of the victual trades, flesher, baxter and brewster do not appear. These were apparently too lowly to register even in the chance sample of surviving documents (Duncan, 1974).

Rye and oats may have been sown together, generally on land in poor condition, and ground together to make a coarse meal as was done in the north of Scotland in the 18th century (Handley, 1953). Mixtures of cereal grains and also of legumes deliberately grown and ground together are known from the 15th century and were called mashlum (Fenton, 1976). Different kinds of flour may have also been mixed by hand.

Meat was available to the upper classes and salted fish to the lower. Some mutton and goat meat was probably also available to the lower classes. Many cattle were slaughtered in autumn and the meat salted as they were unable to support the beasts over winter. For further information on the role of animal foods see the reports by G.W.I. Hodgson on the animal remains from the three sites.

Milk products such as butter and cheese are mentioned in the medieval rentals. Cattle and ewes were milked after calving and lambing for cheese-making (Duncan, 1975).

The importance of vegetables in medieval times is uncertain. Certainly lack of vegetables would lead to vitamin deficiencies, particularly of vitamin A. The *Brassica* seeds recovered from the three sites may indicate cultivation of greens. As mentioned in Chapter 6 kail was grown in Scotland from at least the 15th century (Fenton, 1976) and probably earlier. There is no evidence from the literature of Brassica root crops being grown in medieval times. However the identification of seeds of B. campestris from the sites may possibly indicate turnip cultivation but the seeds could equally come from the slender-rooted wild subspecies.

No evidence of leguminous crops was recovered. Large-seeded legumes in general do not preserve well and are unlikely to be carbonised since they do not require parching. According to Duncan (1975) there is no historical evidence of leguminous crops being grown in Scotland in medieval times. In fact peas and beans were imported in the 13th century along with corn and salt and even in the 14th century they occur among purchases but not in rents (Duncan, 1975). Cultivation of these protein-rich crops with nitrogen fixing root nodules became important only in later centuries.

Fresh fruit was available seasonally to supplement the diet, from wild plants only for the lower classes and additionally from planted fruit trees for the landowners and upper classes. The gardens of the medieval monasteries probably included orchards.

Imported dried figs, grapes and walnuts were luxuries for those who could afford them. Figs were an important source of sugar, sugar itself was imported to Scotland from the late 15th century onwards (Fenton, 1976). Honey was another seasonally available sweetener. Wine was imported in the 13th century and drunk by the wealthy, however the vintage lasted only a few months before turning sour.(Duncan, 1975).

The Statistical Account (1793) for the Parish of Elgin tells us that in 1232 there were gardens of pot herbs. These may have been for flavouring foods or for medicinal purposes. Spices were important commodities which were imported. Pepper and cumin were the most important of these, being in demand for seasoning meat (Duncan, 1975). Rents were sometimes paid in pepper. For example Henry Bald, one of the burgesses of Perth was granted land in the burgh of Perth about the year 1196 for which he had to render annually into the King's chamber one pound of pepper at Michaelmas (Barrow, 1960). Salt was another essential commodity used for salting both meat and fish. Other imported foods mentioned in the customs treatises, apart from pepper and cumin, were onions and garlic, ginger, almonds and rice (Duncan, 1976).

In times of food shortage the lower classes at least had to resort to various weeds as emergency provisions and in the last extremity the seed corn was consumed. We can only speculate as to the significance of wild plants in the diet under normal circumstances.

Martin (1716) gives the following description of the diet of the people of Skye:

"Their ordinary Diet is Butter, Cheese, Milk, Potatoes, Colworts, Brochan i.e. Oatmeal and Water boil'd; the latter taken with some Bread is the constant Food of several Thousands of both Sexes in this and other Isles, during the Winter and Spring : yet they undergo many Fatigues both by Sea and Land, and are very healthful."

Donaldson (1794) in "A General View of the Agriculture of Elgin or Moray" describes the diet of farm servants which was probably basically similar to that of the ordinary inhabitants of medieval Elgin :

"The ordinary breakfast being pottage made of oatmeal, which is ate warm, with milk, or small beer; for dinner, a kind of flummery, called sowens, made from bran of oatmeal, ate generally with milk; and for supper, greens or cabbage, either cut small or mashed, and afterwards boiled with an addition of oatmeal and salt; and at each meal there is an addition of bread made from a mixture of oats, bear and pease meal. On Sundays and other holidays the dinner is broth made of pot barley, with greens or roots, and butcher's meat."

8.2 Other uses of plants in the medieval economy

One of the most obvious uses was in construction, the buildings being made of post and wattle. At Perth the wattle was mainly composed of birch with the larger load-bearing timbers usually of oak or ash; roofs appeared to have been made of heather or turf (Bogdan and Wordsworth, 1978). Timbers from the Perth site are being used by Dr. M.G.L. Baillie of The Queen's University, Belfast for dendrochronological studies. Plants were also probably used as flooring materials. A large amount of worked wood was recovered from the Perth site including bowls, platters, staves of barrels and buckets. Wood was the basic raw material and used for manufacturing all kinds of articles.

Another important use of plant material was for fuel; wood, charcoal and peat were all probably used. Animal fats and oils were generally used for lighting although linseed oil and rush wicks may have been used.

Flax seeds were recovered from all three sites but no fibres were observed and neither was any linen cloth recovered. The majority of textile fragments recovered from the Perth site were coarse undyed woollens but some were dyed and examples of silk were found. The lack of linen is surprising since <u>Linum</u> is mentioned in the medieval rentals. We can only speculate about the use of the seeds for linseed oil. The other major fibre plant was hemp, used for making ropes and sacks.

Dyestuffs from wild plants were probably more important in the rural weaving industry although most cloth was left undyed. The following is a list of plants recovered from the sites which may have been used for dyeing (see Thurstan, 1949; Grigson, 1975; Dimbleby, 1978). The dye is obtained from different parts of the plants, for example, the rhizome of <u>Pteridium</u>, flowering shoots of <u>Calluna</u>, berries of <u>Vaccinium</u> and bark of <u>Sambucus</u>.

Reseda luteola
Filipendula ulmaria
Rubus fruticosus
Prunus spinosa
P. padus
Malus sylvestris
Calluna vulgaris
Vaccinium myrtillus
Lycopus europaeus
Sambucus nigra
Taraxacum officinale
Iris pseudacorus
Pteridium aquilinum

In the burghs, where the cloth industry was more highly developed, dyestuffs were imported : woad from England, brasil, vermilion and grain from abroad. Mordants to fix the dyes were also imported (Duncan, 1975).

Leather working was an important occupation in the Skinnergate close to the Perth High Street site. Oak bark was used for tanning leather.

As detailed in the annotated species list many of the plants from the sites have been used in the past for medicinal purposes. However it is not possible to do much more than speculate on their uses in the majority of cases.

Plants were of extreme importance as foodstuffs for livestock as well as for the human population. Work on animal remains from the three sites by G.W.I. Hodgson shows that large numbers of cattle, goats and sheep were kept in medieval Scotland. Overwintering of stock was a problem and large numbers were slaughtered every autumn. Some of the more primitive breeds of live stock were probably overwintered at low stocking densities without receiving additional fodder, but for improved breeds winter fodder was essential. Animals were grazed on the stubble from cereals crops and also given straw during the winter. Cultivation of sown grasses for hay goes back only to the early 18th century (Fenton, 1976). In earlier centuries grasses from wet meadows and marshes were probably gathered and dried for hay. Crushed shoots of whin were another source of winter fodder (Fenton, 1976) though it is not known whether this practice went back to medieval times. Anderson (1794) mentions young shoots of Scots pine being used as fodder in addition to whin in times of necessity. Weeds growing in between the riggs were also considered to be a valuable reserve of winter fodder (Forbes, 1975).

Chapter 9

Conclusion

The study demonstrates the contribution of botanical material to the general knowledge and understanding of the sites. The value of the botanical studies to the archaeologists will increase as other specialist reports become available and the environmental data are synthesised.

At a basic level the macrofossil species lists provide palaeoecological information and contribute to the British fossil record. With the exception of certain weeds mentioned in Chapter 7, the composition of the flora is similar to that of modern times. Macrofossils cannot be expected to give a representative picture of vegetation types and amount of woodland cover in the vicinity of the sites. For this, pollen analysis of suitable deposits needs to be carried out.

The three sites, as mentioned in Chapter 1, are the first medieval urban sites in Scotland to have their plant remains studied. Their situation on the eastern seaboard of Scotland close to upland areas provides a contrast to earlier work on medieval urban sites in Britain, all of which were situated in lowland England. This is reflected particularly in the contribution of heathland plants, especially Ericaceae, to the resultant plant assemblages. The variety of useful plants recovered also shows that, despite the northerly latitudes, a wide range of plants for food and other uses was available.

As indicated in Chapter 8 the botanical material provides a basis for discussion of the use of plants in the medieval economy. For medieval sites it is particularly important that contemporary historical documents are consulted as they may provide valuable aids to interpretation. As information becomes available from other archaeological sites it is hoped that more positive evidence for uses of plants will emerge.

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Appendix 1

Table 11 Summary Table of Results

Abundance		
	+	1- 5 fossils
	*	6- 15 fossils
	**	16-100 fossils
	***	over 100

Total number of contexts from which samples examined :

Perth	31
Aberdeen	32
Elgin	16

Symbol in left hand column for each site gives a measure of abundance of the fossil.

Number in right hand column refers to the number of contexts in which the fossil occurs.

		PERTH		ABERDEEN		ELGIN	
Plants useful to Man							
Avena sativa	floret	**	19	***	3	+	1
	grain	***	29	***	10	***	15
	pericarp fragment	**	4	***	4	+	2
Hordeum vulgare	rachis internode	*	2	*	3		
	grain	**	15	+	2	***	14
	pericarp fragment	**	1	*	2	*	2
Secale cereale	grain	*	7				
Triticum aestivum s.l.	grain	*	9	+	1	*	7
	pericarp fragment	***	6	***	4	***	3
	husk fragment			+	1		
Cereals - unidentified	grain	+	4			**	7
Atropa belladonna	seed					***	8
Brassica sp.	seed	***	29	*	4	**	6
Cannabis sativa	fruit					*	4
Corylus avellana	nutshell	***	29	***	10	**	5
Euphorbia lathyrus	seed					+	1
Ficus carica	seed	*	8	**	2	***	13
Fragaria vesca	achene	*	6	+	1	*	2
Hyoscyamus niger	seed	*	6				
Juglans regia	stone (walnut)	+	1			+	1
Linum usitatissimum	seed	**	10	**	5	**	5
	capsule fragment			*	3	**	2
Malus sylvestris s.l.	seed	+	2			*	2
Papaver somniferum	seed	+	2	+	1		

Table 11 continued..... (1)

Plants useful to man		PERTH		ABERDEEN		ELGIN	
Prunus avium	stone	**	1			***	3
Prunus domestica ssp institia	stone	+	1			**	7
P. padus	stone					**	2
P. spinosa	stone	+	1	+	11	**	4
Quercus sp.	acorn						
Reseda luteola	seed	**	9	*	4	*	4
Rosa canina agg.	achene	+	3			**	4
Rubus chamaemorus	seed	+	1				
R. fruticosus agg.	seed	*	5	*	2	***	15
R. idaeus	seed	+	1	***	7	***	16
Sambucus nigra	seed	*	7			*	8
Sorbus aucuparia	seed	*	3	***	7	**	4
Vaccinium myrtillus	seed	**	8	***	4	**	3
Vitis vinifera	seed			+	1	**	3
Polytrichum commune	moss rope	+	1				

Weeds of waste places and arable land							
Achillea millefolium	achene	*	7			+	1
Aethusa cynapium	fruit					***	9
Agrostemma githago	seed	**	14	***	6	**	3
Agrostis sp.	caryopsis			+	1		
Anthemis cotula	achene	**	6	+	1		
Aphanes arvensis	achene	**	8			+	1
Atriplex sp.	seed			*	2	+	1
Avena fatua	floret	*	4				
Barbarea vulgaris	seed					**	3
Bromus mollis agg.	caryopsis	+	2	*	3	+	1
Capsella bursa-pastoris	seed	**	4	*	4		
Carduus sp.	achene					+	1
Centaurea cyanus	achene	*	5			+	1
C. nigra	achene	+	2	+	1	**	6
Cerastium fontanum	seed	**	15	+	4	+	1
Chenopodium album	seed	***	32	***	24	***	16
Chrysanthemum segetum	achene	*	6			+	1
Cirsium arvense	achene	+	2	+	2	+	1
C. vulgare	achene	+	2			**	5
Euphorbia helioscopia	seed	+	3			+	3
Fumaria officinalis	nutlet					**	6

Table 11 continued..... (2)

Weeds of waste places and arable land		PERTH		ABERDEEN		ELGIN	
Galeopsis tetrahit agg.	nutlet	***	29	**	8	**	6
G. tetrahit agg.	pericarp fragment	+	1	**	5		
Galium aparine	fruit					+	1
Heracleum sphondylium	fruit			+	1		
Hypochoeris radicata	achene	+	1				
Juncus bufonius	seed	**	11	***	23	***	7
Lamium purpureum	nutlet					**	10
Lapsana communis	achene	***	24	***	21	***	9
Leontodon autumnalis	achene	**	13				
Myosotis arvensis	nutlet	**	12	*	3		
Odontites verna	seed	+	1	+	1		
Papaver dubium	seed	*	5	+	1	**	3
	capsule lid			+	1		
Plantago lanceolata	seed	+	3			+	1
P. major	seed	+	1				
Poa annua	caryopsis	*	3	***	15	**	2
P. pratensis/trivialis	caryopsis	**	8	***	17	*	2
Polygonum aviculare	fruit	***	25	**	13	***	7
P. convolvulus	fruit	**	24	**	23	**	7
P. lapathifolium	fruit	***	32	***	21	***	8
P. persicaria	fruit	***	31	**	12	**	11
Prunella vulgaris	nutlet	***	27	+	1	+	1
Ranunculus repens	achene	***	31	**	11	**	11
Raphanus raphanistrum	seed	*	5	**	19	**	4
	fruit fragment	**	18	***	24	***	16
Rhinanthus sp.	seed	*	1				
Rumex acetosa	fruit	+	1	+	1		
R. acetosella	fruit	***	29	***	23		
R. cf. conglomeratus	fruit	+	1				
R. crispus	fruit	+	2	*	1		
R. obtusifolius	fruit			***	10	***	5
R. sp.	fruit	***	27	***	22	***	9
Scleranthus annuus	fruit	+	1			*	3
Senecio vulgaris	achene	+	2	**	3	+	1
Silene sp. section Melandriformes	seed	*	5	+	1		

Table 11 continued..... (3)

Weeds of waste places and arable land		PERTH		ABERDEEN		ELGIN	
Sonchus asper	achene	*	8	*	5	*	4
S. oleraceus	achene	*	5			+	1
Spergula arvensis	seed	***	32	***	24	**	8
Stachys palustris/ sylvatica	nutlet	+	1	+	1	**	9
Stellaria media	seed	***	30	***	27	***	14
Taraxacum officinale s.l.	achene					**	6
Thlaspi arvense	seed	*	7			***	7
Torilis japonica	fruit	*	7	+	1		
Trifolium pratense	calyx	+	1				
Trifolium repens	flower/petal	**	2			+	1
Tripleurospermum maritimum ssp. inodorum	achene	*	6	*	5	+	1
Urtica dioica	achene	***	23	***	18	***	14
U. urens	achene	**	12	**	11	***	11
Vicia cf. cracea	seed	+	1				
V. cf. hirsuta seed	seed					+	1
V. sp.	seed	+	3				
Viola sp. subgenus Melanium	seed	**	17	+	1	*	7
Compositae	achene	*	2	+	1	+	2
Gramineae	caryopsis	**	13	**	9	+	1
Labiatae	nutlet	+	1				
Umbelliferae	fruit	+	4	+	1	+	1
Undetermined seeds		**	18	**	7	**	10
Heathland plants							
Anthoxanthum odoratum	caryopsis			+	1		
Calluna vulgaris	flower/fruit	***	24	***	22	+	2
	seed	**	11	**	10		
	shoot/leaf	***	23	***	28	*	5
Empetrum nigrum	stone			+	1	+	1
Erica cinerea	seed	**	13				
	shoot/leaf	+	4	*	2		
E. tetralix	seed	+	3	***	11		
	shoot/leaf	***	14	***	23	+	1
Eriophorum vaginatum	leaf base spindle	+	2	***	23		
Galium saxatile	fruit	+	1				
Juncus squarrosus	seed	**	12	*	3		
Luzula multiflora	seed	+	3	+	1	+	2

Table 11 continued..... (4)

		PERTH		ABERDEEN		ELGIN	
<u>Heathland plants</u>							
Melampyrum pratense	seed					*	2
Myrica gale	anther			*	1		
	fruit	+	3	+	1		
	leaf fragment	+	1	**	5		
Polygale sp.	seed					+	2
Potentilla erecta	achene	***	22	**	19	**	5
Pteridium aquilinum	frond fragment	**	5	***	21	*	2
Selaginella selaginoides	megaspore	+	2			+	2
Viola sp. subgenus Viola	seed	+	2			+	2
<u>Trees</u>							
Betula pubescens	fruit	*	7	**	9	***	4
	fruit scale			+	5	***	4
Salix sp.	fruit	*	11			+	1
	bud scale			+	1	***	4
<u>Plants of wet habitats</u>							
Ajuga reptans	nutlet	+	1				
Alopecurus geniculatus	caryopsis			+	1		
Bidens tripartita	achene	+	1				
Caltha palustris	seed	*	7				
Carex spp. Distigmatae	nut	***	30	**	10	**	8
Tristigmatae	nut	***	28	**	11	***	10
Eleocharis palustris	nut	**	16	+	3	*	2
Epilobium parviflorum	seed	+	1				
Filipendula ulmaria	fruit	+	4				
Galium palustre	fruit	*	6				
Glyceria fluitans	caryopsis	+	1			+	1
Hydrocotyle vulgare	fruit	+	2				
Hypericum cf. maculatum	seed					+	1
Iris pseudacorus	seed	+	2				
Isolepis setacea	nut	**	4			**	7
Juncus articulatus	seed	**	7	**	18	*	3
J. effusus	seed	***	9	***	30	***	7
J. sp.	seed	+	1	***	24	*	4
Lychnis flos-cuculi	seed	*	8	+	1	+	1
Lycopus europaeus	nutlet	**	14				
Manyanthes trifoliata	seed	*	5			+	1
Montia fontana	seed	*	5	*	8	+	2
Pedicularis palustris	seed	**	11				

Tablell continued..... (5)

Plants of wet habitats		PERTH		ABERDEEN		ELGIN	
Potamogeton cf. natans	fruit			*	1		
P. polygonifolius	fruit	+	2				
Potentilla palustris	achene	**	12				
Ranunculus flammula	achene	**	18	**	8	*	4
R. sceleratus	achene	+	3			***	9
R. sp. Subgenus Batrachium	achene	+	1			*	5
Senecio cf. aquaticus	achene	*	5				
Viola palustris	seed	+	3				
Bryophytes	**Habitat**						
Antitrichia curtipendula	Wd	***	2				
Aulacomnium palustre	W	+	3	**	16		
Brachythecium rutabulum	W/Wd	+	1				
Bryum sp.		+	2	+	2	+	1
Calliergon cordifolium	W			+	2		
C. cuspidatum	W					**	2
Ceratodon purpureus	H/U	+	1	*	9	***	3
Dicranum scoparium	H/Wd	*	3	**	5	+	1
Eurhynchium praelongum	H/Wd	*	5	***	20	***	8
Hylocomium brevirostre	Wd	**	1				
H. splendens	H/Wd	***	15	***	29	***	7
Hypnum cupressiforme	H/Wd	**	16	***	20	**	6
Isothecium myosuroides	Wd	+	3				
I. myurum	Wd					*	1
Mnium hornum	Wd	*	3	+	1		
Neckera complanata	Wd	+	1	+	1	+	1
Plagiomnium affine	Wd	+	2			+	1
Pleurozium schreberi	H	*	3	***	16	*	3
Polytrichum commune	H/W	***	1	**	4		
P. formosum	H/Wd	*	4			+	1
P. juniperinum	H			*	3	*	1
Pseudoscleropodium purum	H	+	2	*	4		
Rhizomnium punctatum	W/Wd			+	1	+	1
Rhytidiadelphus loreus	Wd	***	3	***	1		
R. squarrosus	H/Wd			+	3	+	1
R. triquetrus	Wd(H)			***	3	**	3
Scorpidium scorpioides	W			*	1		

Tablell continued..... (6)

Bryophytes		Habitat	PERTH		ABERDEEN		ELGIN	
Sphagnum palustre		W	*	7	**	23	+	3
S. papillosum		W			**	12	*	1
S. sp. Section Acutifolia		W					+	1
S. sp.	shoot	W	+	3				
	operculum		+	1	**	5		
	capsule				*	2		
Thuidium tamariscinum		Wd	**	4	***	12	**	4
Ulota crispa		Wd	+	2	*	1		
cf. Plagiochila asplenioides		Wd	+	1				

Appendix 2

(Plates)

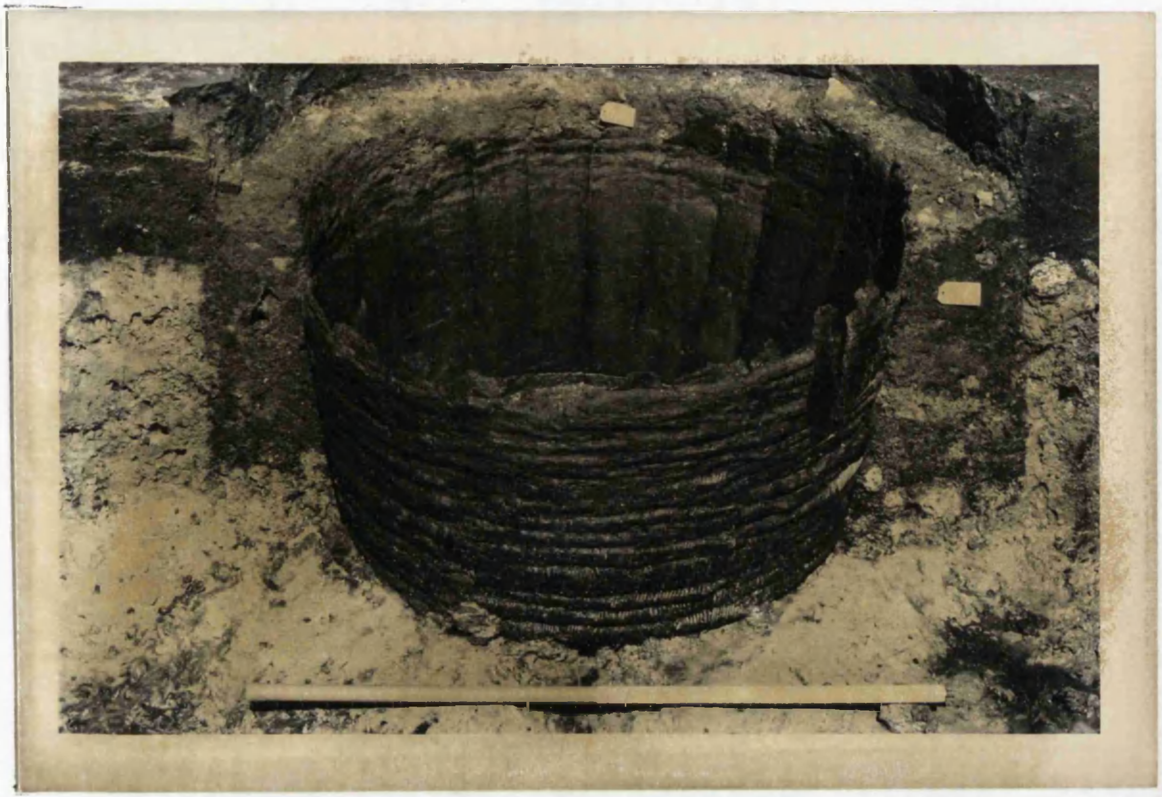

Plate 1 View of barrel, Elgin

Plate 2 View of soak away, Elgin

Plate 3 Carbonised florets and floret bases of Avena sativa from below and around hearth of post-and-wattle building SAN, Aberdeen x 7.5

Plate 4 Triticum aestivum grain fragments, Queen Street pits, Aberdeen x 12.5

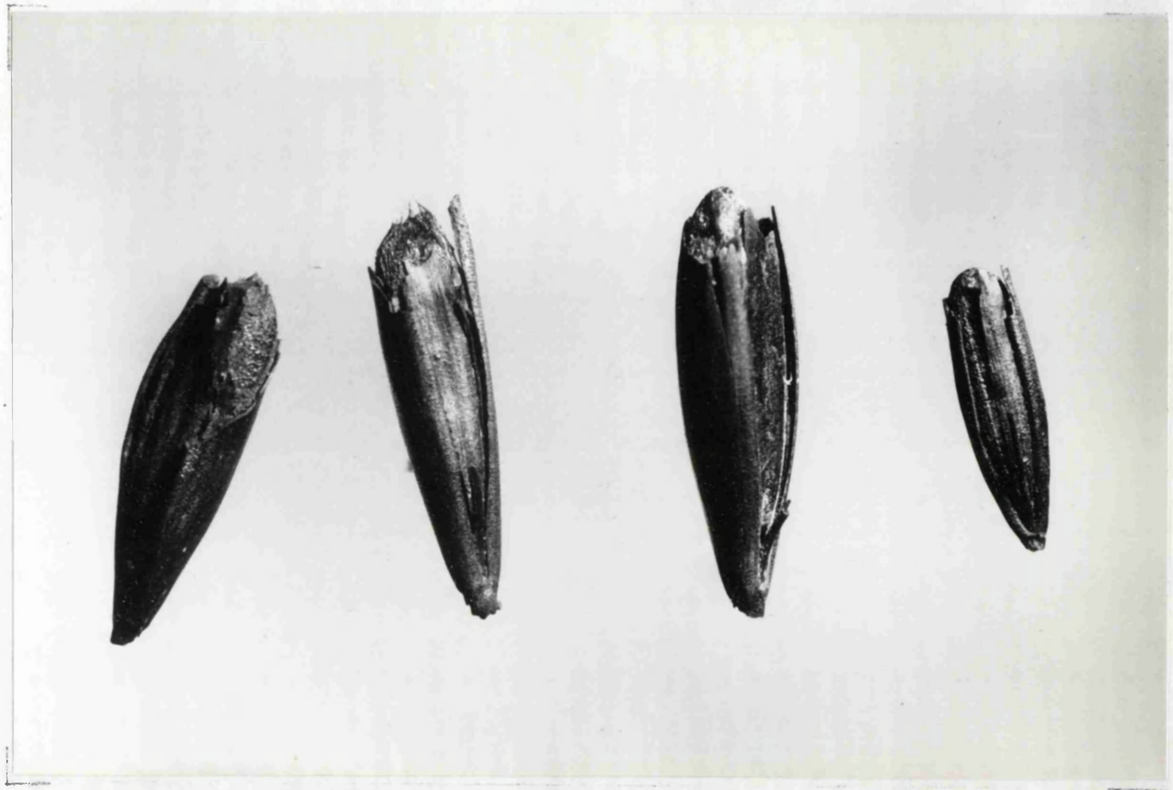

Plate 5 Avena sativa carbonised florets, Perth x 7.5

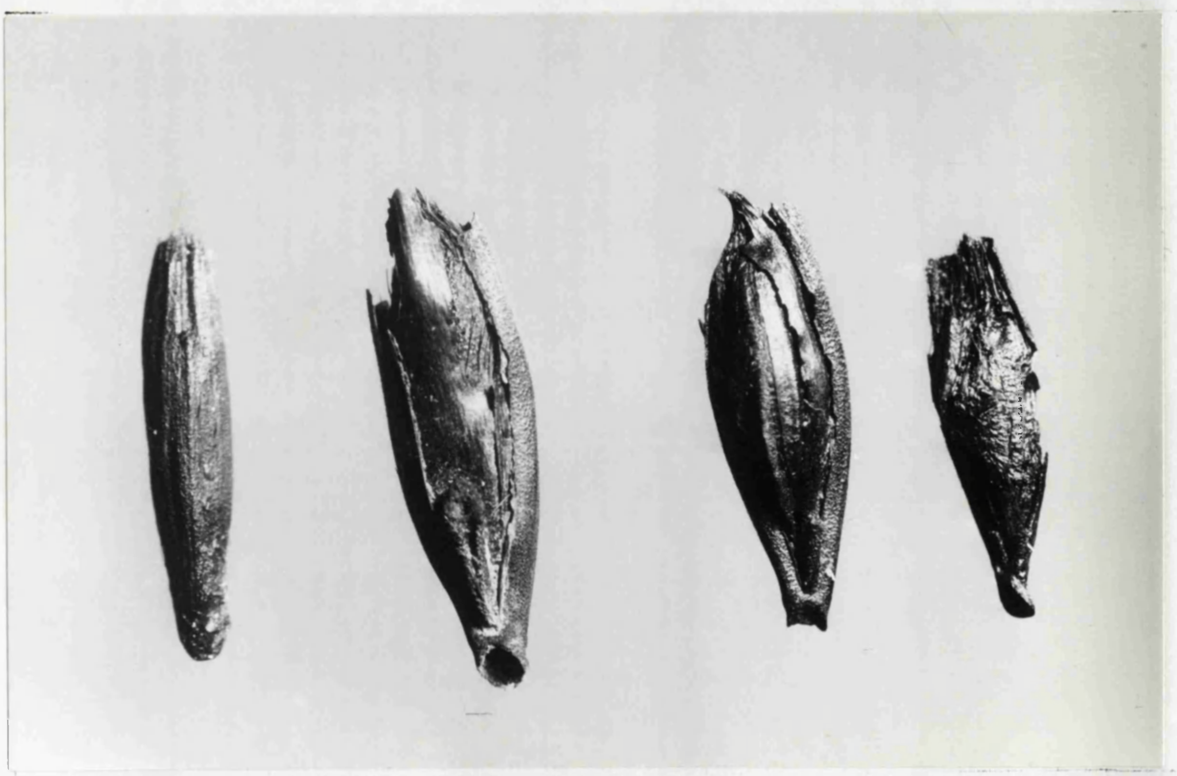

Plate 6 Avena fatua carbonised florets, Perth x 7.5

Plate 7 Secale cereale carbonised grains, Perth x 7.5

Plate 8 Vitis vinifera seeds, Elgin barrel x 7.5

Plate 9 Rubus chamaemorus seed, Perth x 7.5

Plate 10 Malus sylvestris seed, Perth x 7.5

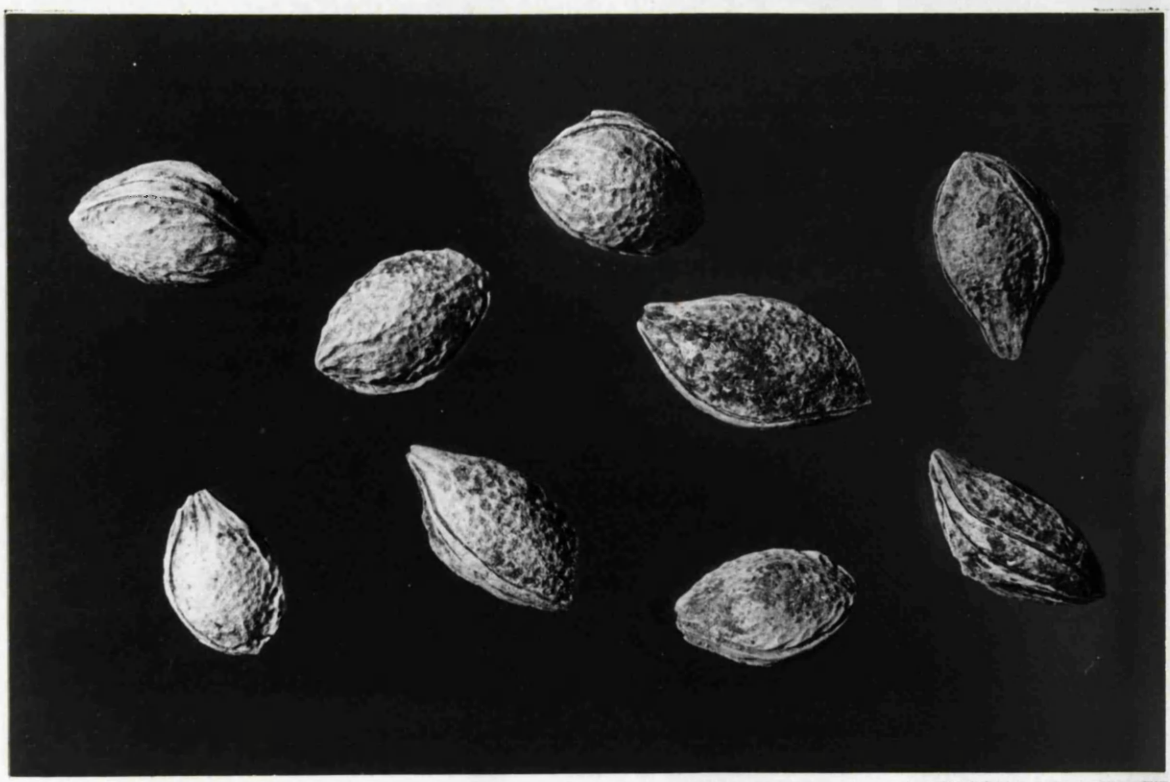

Plate 11 Prunus domestica ssp. institia stones, Elgin barrel x 2

Plate 12 Euphorbia lathyrus seed, Elgin x 7.5

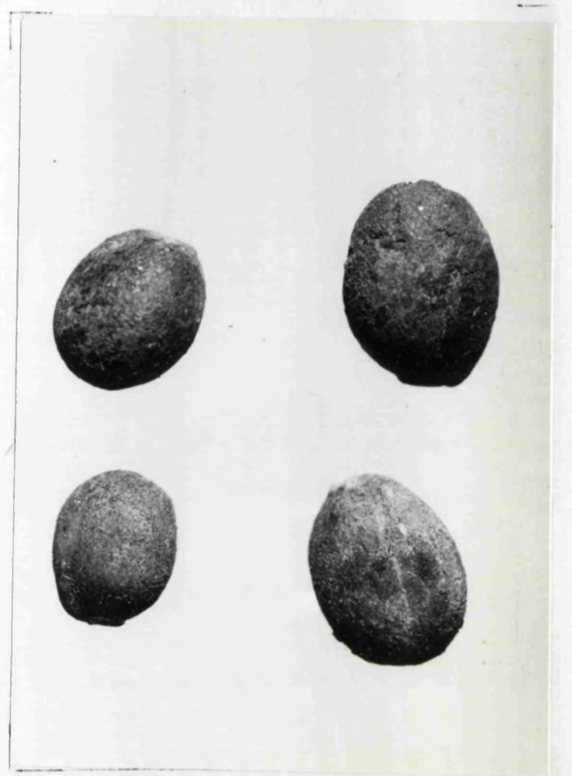

Plate 13 Cannabis sativa fruits, Elgin x 7.5

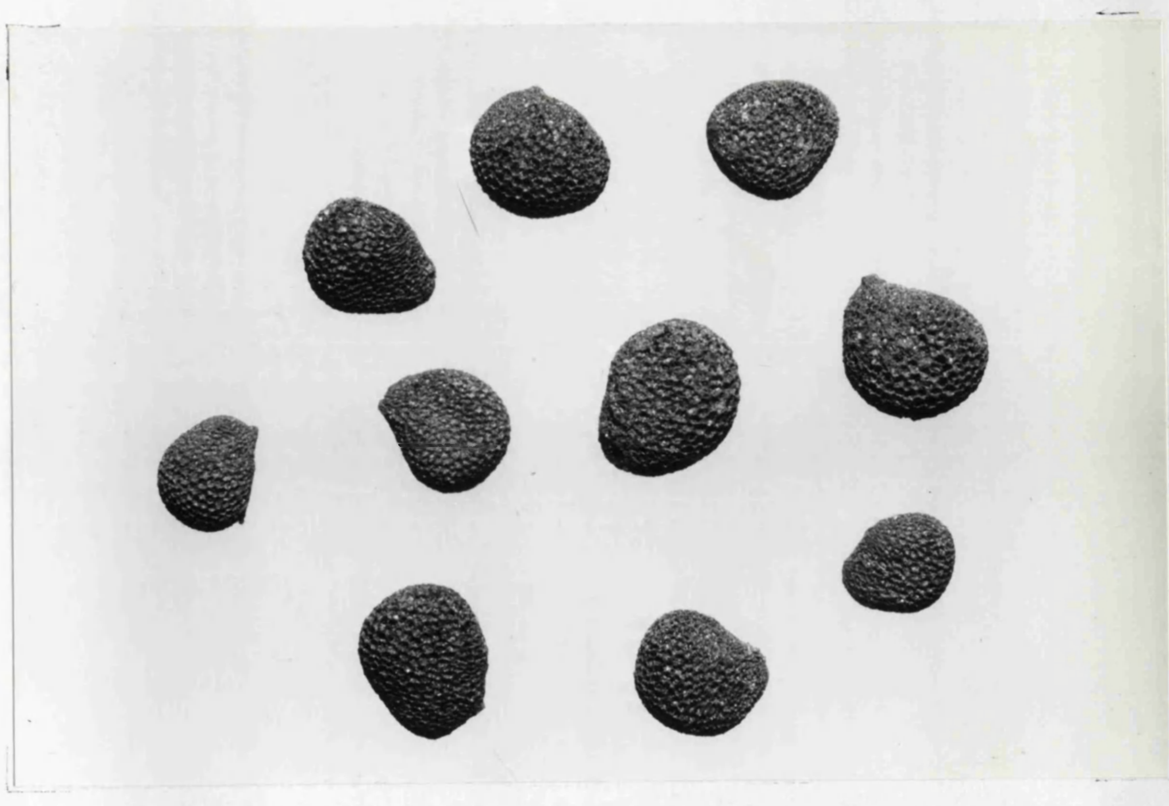

Plate 14 Atropa belladonna seeds, Elgin x 7.5

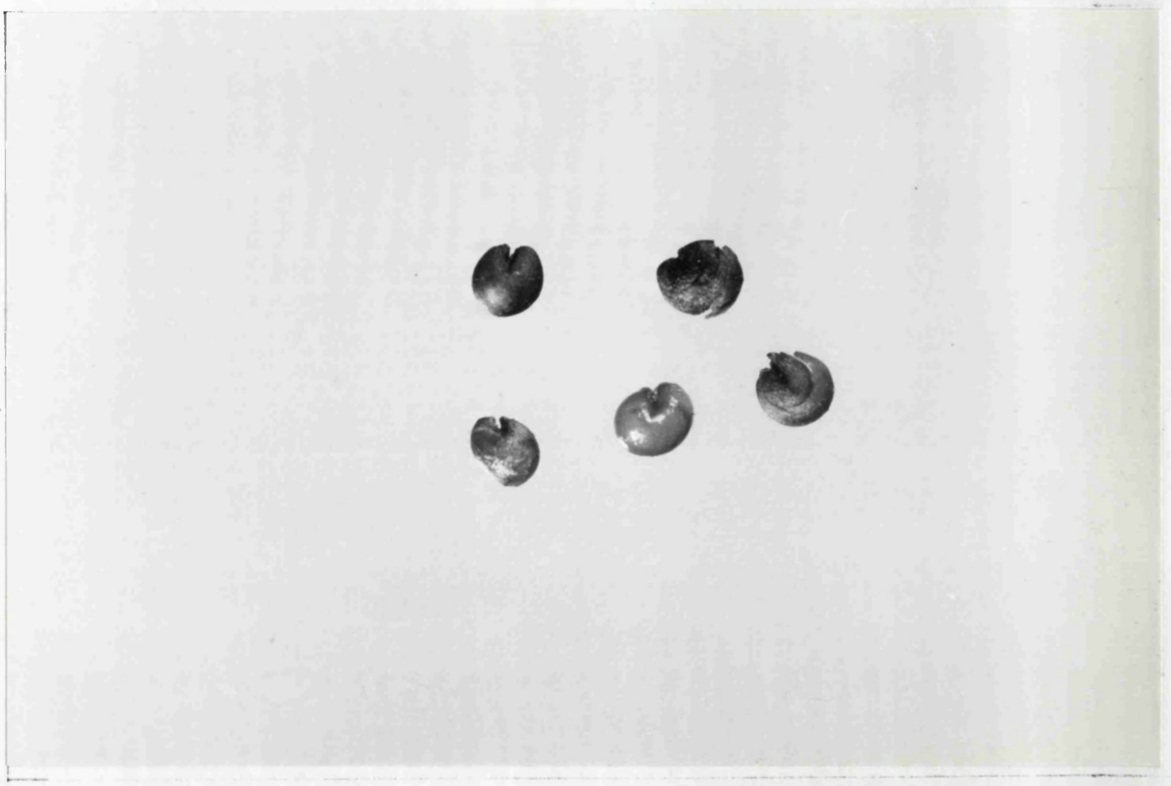

Plate 15 Reseda luteola seeds, Aberdeen x 16.25

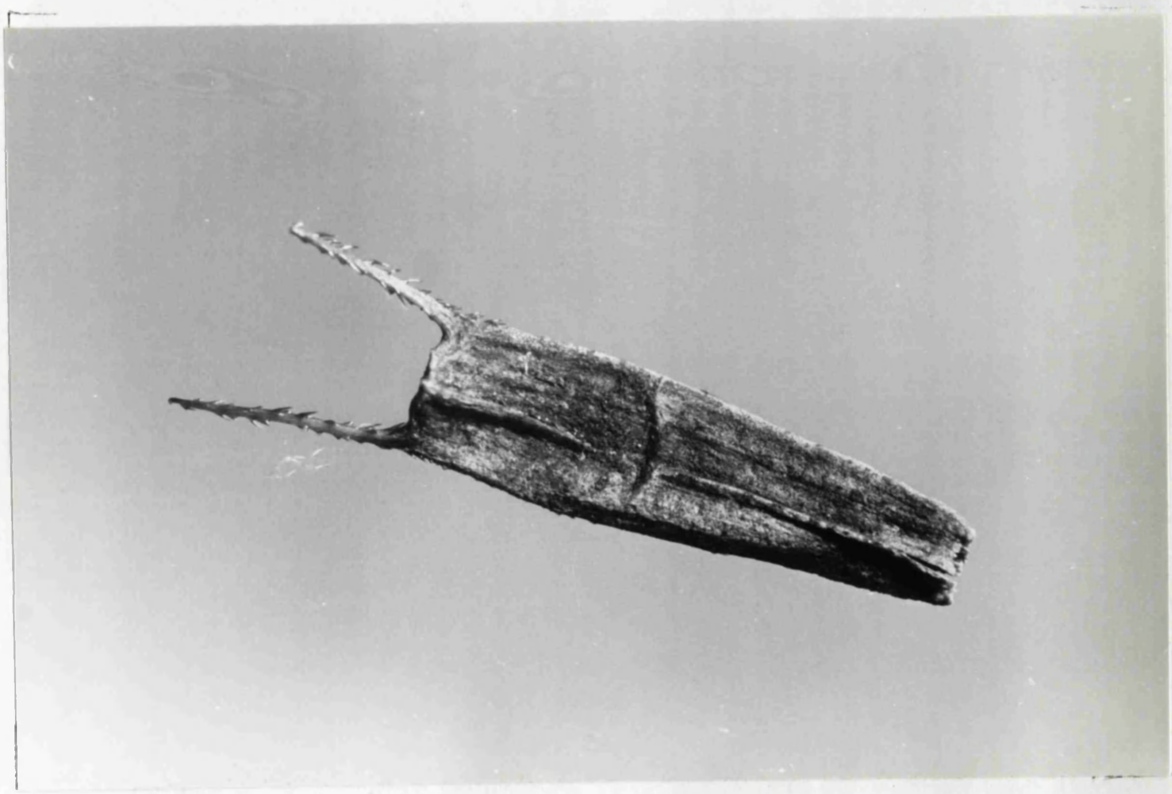

Plate 16 Bidens tripartita achene, Perth x 7.5

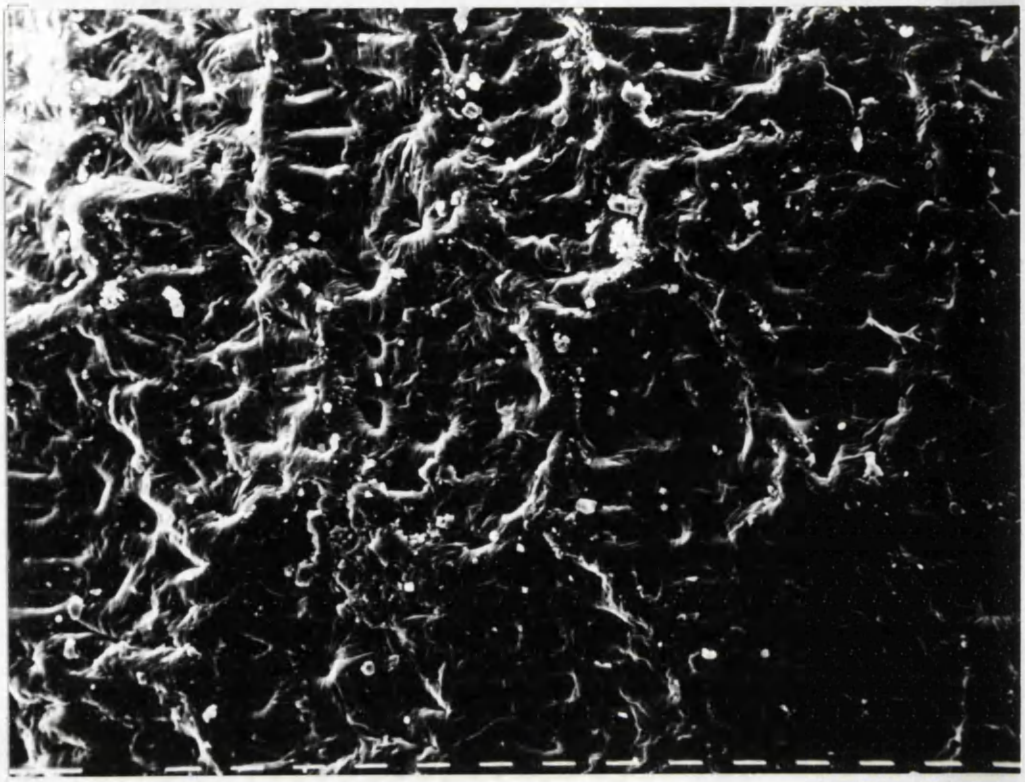

Plate 17 Scanning electron micrograph of surface of recent Brassica campestris ssp rapifera seed x 210

Plate 18 S.E.M. of surface of recent Brassica campestris ssp rapifera seed x 830

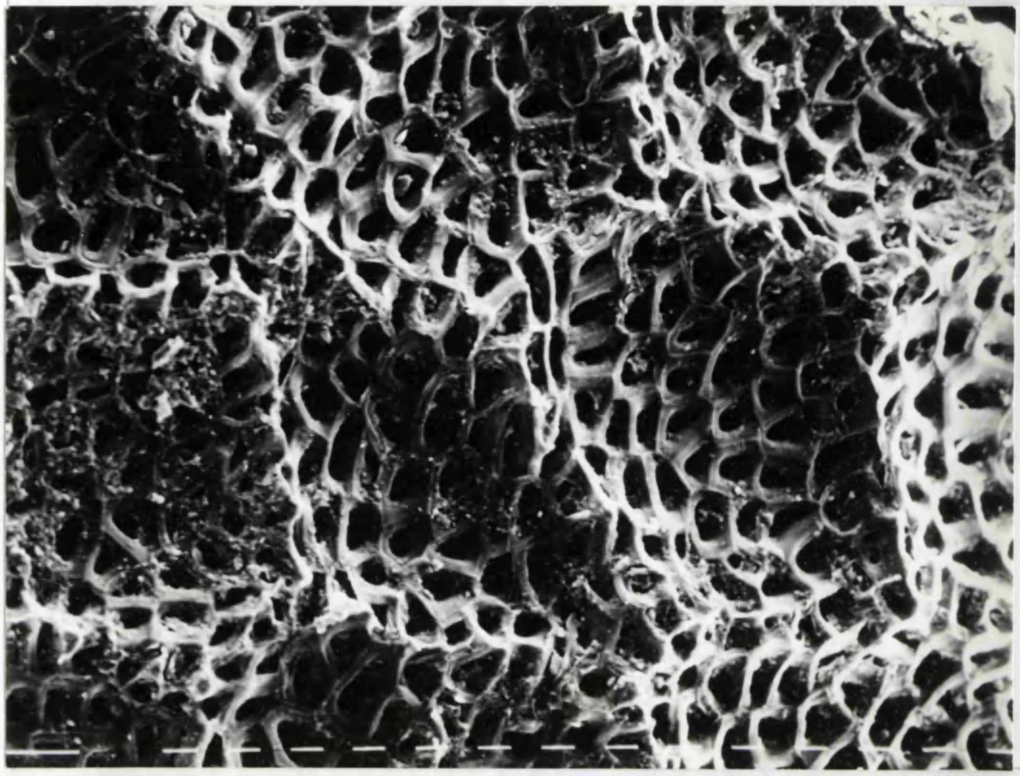

Plate 19 S.E.M. of surface of fossil Brassica campestris seed, Perth x 210

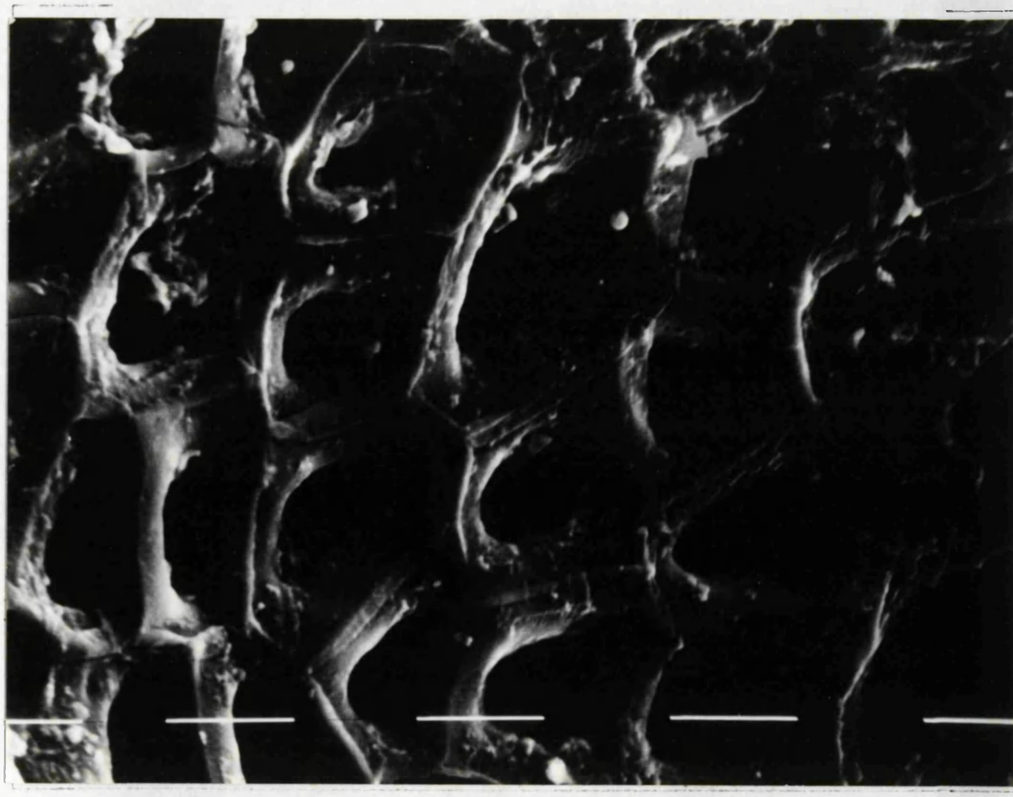

Plate 20 S.E.M. of surface of fossil Brassica campestris seed, Perth x 830

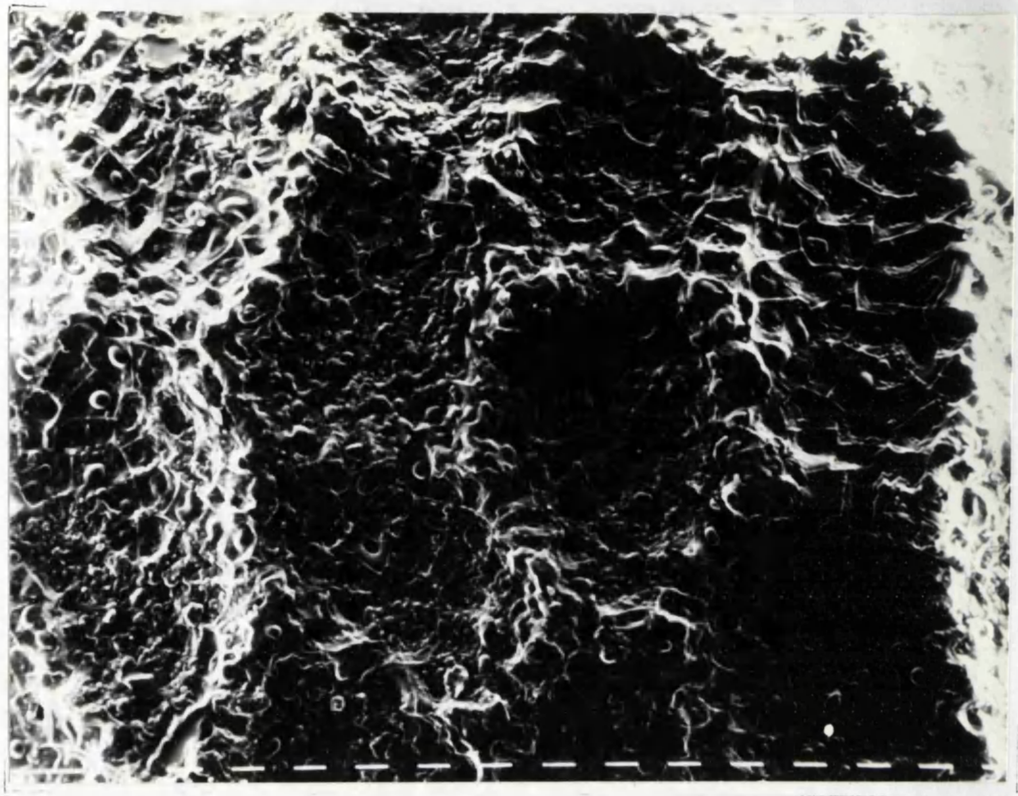

Plate 21 S.E.M. of surface of fossil <u>Brassica campestris</u> seed, Perth x 210

Appendix 3.

(Tables 12 - 15.)

Abbreviations used in tables :

P.F.	:	paraffin flotation
W.F.	:	water flotation
W.S.	:	wet sieving
P	:	pit
PH	:	post hole
SA	:	soak away
B	:	barrel
c	:	carbonised
f	:	fragment
l	:	leaf
+	:	present but not counted
oc	:	occasional
a	:	abundant
va	:	very abundant

Table 12

PERTH HIGH STREET

Context number		6048	6078	6100	6104	6131	7125	7129	7168	7169	7175	7205	7213	7218	7223	7225	7234	7234	7323	9137	9153	9153	9235	9235	9240	9251	9261	9273	9275	9277	9279	9280	9282	9285	9302	9317	9325
Method of extraction		P.F.	P.F.	P.F.	P.F.	W.S.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	W.S.	V.S.	P.F.	P.F.	W.S.	P.F.	W.S.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.
PLANTS USEFUL TO MAN																																					
Avena sativa		+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		+	+		+	+	+	+	+	+	+	+
Hordeum vulgare		+	+		+			+		+		+				+		+	+		+	+					+	+				+	+	+	+	+	
Secale cereale					+							+	+												+		+			+			+				
Triticum aestivum s.l.						+	+	+				+			+		+	+	+					+				+			+			+		+	+
Brassica sp	seed	2+1f	8	5	11+1f	1	1		7		2+c1	4+2f	6+4f	1		1+2f	1		7f	7+2f	22		3	3+4f	14+2f		3	22	1f	2	4	3	1	6+2f	1	2	13
Corylus avellana	nutshell	12f	$\frac{2}{2}$+107f	$\frac{1}{2}$+6f	2f			12f		$\frac{1}{2}$+30f	va	$\frac{3}{2}$+27f	$\frac{1}{2}$+35f	$\frac{2}{2}$+30f	45f	2f	2f	1f		$\frac{1}{2}$+67f	5f		va	va	2f	8f	1f	1f	$\frac{1}{2}$+9f	$\frac{2}{2}$+29f	5f	$\frac{1}{2}$+21f		$\frac{2}{2}$+7f	10f	4f	$\frac{1}{2}$+26f
Ficus carica	seed						2		1		1	1								1								1		1						1	
Fragaria vesca	achene							1						1	5		5						c1								c1						
Hyoscyamus niger	seed				1				1		2	1				1																1					
Linum usitatissimum	seed	1	2	1	1	1			1	1	1	1											6	3+4f													
Malus sylvestris s.l.	seed								1																						1						
Papaver somniferum	seed				1																		3														
Prunus avium	stone																13																				
P. domestica ssp institia	stone																1																				
P. spinosa	stone																				1																
Reseda luteola	seed	2	3	1				1		1		10		1	2																	1					
Rosa canina agg.	achene													1																	2						
Rubus chamaemorus	seed																						$\frac{1}{2}$														
R. fruticosus agg.	seed	1							3			2			1		1																				
R. idaeus	seed											1																									
Sambucus nigra	seed	1	1						1f				1		3								1							1		2					
Sorbus aucuparia	seed																2						3														
Vaccinium myrtillus	seed	1							1	1		3	1		5			22																			1

Botanical samples

		7320	9016	9061
Juglans regia	stone (walnut)	$\frac{2}{2}$		
Quercus sp	acorn			1
Polytrichum commune	small rope		+	

PERTH HIGH STREET

WEEDS OF WASTE PLACES AND ARABLE LAND

		6048	6078	6100	6104	6131	7125	7129	7168	7169	7175	7205	7213	7218	7223	7225	7234	7234	7323	9137	9153	9153	9235	9235	9240	9251	9261	9273	9275	9277	9279	9280	9282	9285	9302	9317	9325
		P.F.	P.F.	P.F.	P.F.	W.S.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	W.S.	W.S.	P.F.	P.F.	W.S.	P.F.	W.S.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.
Achillea millefolium	achene					4				2	1												4									1	1	1			
Agrostemma githago	seed	1f	1		1	15f			1		10						1+1f	20f	f va	16			3	1+15f				2			5	1					7
Anthemis cotula	achene		1		1										1					52			1								1						
Aphanes arvensis	achene				1							4			3					2					1				3		1				1		
Avena fatua	floret					1		c3													c1				c1												
Bromus mollis agg.	caryopsis					3													1																		
Capsella bursa-pastoris	seed	10			1	1					5																										
Centaurea cyanus	achene								3+$\frac{1}{2}$	4			1							1																1	
C. nigra	achene		1									1																									
Cerastium fontanum	seed		3		4				1		4	3	1		2	2	1						4		1				1		2			1	2		
Chenopodium album	seed	123	68	175	173	34	39	25	78	23	40	74	83	95	62	38	12	4	11	199	141	12	37	14	219		6	65	37	13	83	88	19	69	13	47	9
Chrysanthemum segetum	achene	1								$\frac{1}{2}$	1	1						1																	c1		
Cirsium arvense	achene																							1+1f								1					
C. vulgare	achene					1																							1								
Euphorbia helioscopia	seed	1			1																	$\frac{1}{2}$															
Galeopsis tetrahit agg.	nutlet	6+2f	16	9	11	1	3	5	4	2	12	3	4	2	2	6			1+1f	3+1f	4		4	3+3f	5			3	3	2	5	5	1	2	3	2	
	pericarp fragment					5												2																			
Hypochoeris radiacata	achene																						1														
Juncus bufonius	seed		3			25									1			1	2	1		4		14					2		1						1
Lapsana communis	achene		12	17	13	10+7f			4	1		6	1	2	1	5	1	2	4+1f	12	4	2	10	26+8f	2			1	5		8	6		2		4+1f	1
Leontodon autumnalis	achene		1	1f	2	1						2+1f		1+1f			1			2	2	1							1		2	3					
Myosotis arvensis	nutlet		3		2	2			1					1				1		2	1										1	2					
Odontites verna	seed																														c1						
Papaver dubium	seed								2	2										1				1													
Plantago lanceolata	seed																				c1													c2	c1		
P. major	seed																1																				
Poa annua	caryopsis		1+c1			2				c2																											
P. trivialis	caryopsis		1			37										7		2	1			3+c1		21							1						
Polygonum aviculare	fruit	16	7	5	4	5	4	4	8+1f		4	10	9	11	6	1	2			11	5			1				4	1		6	4		3	4	2	
P. convolvulus	fruit	1		1	4	1+1f	1		1	3f	1		2	7	1+1f	1		1f	7f	3+1f	3			2+7f			3	1	5		1	4		2	1	2	
P. lapathifolium	fruit	41	69	112	88	21	39	32	36	18	13	36	70	141	96	11	27	4	2f	112	37	4	22	9	56		2	38	57	2	36	30	7	15	20	31	6
P. persicaria	fruit	19	34	30	43	4	10	8	9	5	4	19	22	42	30	4	7	3		17	12	1	7	3f	15				28	1	13	27	8	9	13	8	3
Prunella vulgaris	nutlet	2	21	4	5	2	1	7	5	1		1		5	7	3		2		10	3	2	4	4	1				3	4	3	1	1	1	3	2	1
Ranunculus repens	achene	3	25	3	4	3	1	3	4	1	4	4+$\frac{1}{2}$	7	12+c1	11	11	5	2		26	5+c2		28+c2	1		2	2	3	17	16	5	1	3+c1	11	13	4	2
Raphanus raphanistrum	fruit segment and seed		3+$\frac{1}{2}$	$\frac{3}{2}$	3+$\frac{1}{2}$						1			$\frac{1}{2}$		1			15f	$\frac{3}{2}$+1f	4+c1		2+$\frac{4}{2}$	5f				1	$\frac{1}{2}$+1f	15+$\frac{3}{2}$	1	1		$\frac{1}{2}$		$\frac{1}{2}$	
	seed			1	1						c1					1							1														

Taxon	Part	6048 P.F.	6078 P.F.	6100 P.F.	6104 P.F.	6131 W.S.	7125 P.F.	7129 P.F.	7168 P.F.	7169 P.F.	7175 P.F.	7205 P.F.	7213 P.F.	7218 P.F.	7223 P.F.	7225 P.F.	7234 P.F.	7234 W.S.	7323 W.S.	9137 P.F.	9153 P.F.	9153 W.S.	9235 P.F.	9235 W.S.	9240 P.F.	9251 P.F.	9261 P.F.	9273 P.F.	9275 P.F.	9277 P.F.	9279 P.F.	9280 P.F.	9282 P.F.	9285 P.F.	9302 P.F.	9317 P.F.
Rhinanthus sp	seed					6																														
Rumex acetosa	fruit										1																									
R. acetosella	fruit	11	47	22	21	3	6	25	12	11	15	17	7	69	59	38	6	3		32	2	1	17	5	11	2	1		7		22	12	1	8	6	6
R. cf. conglomeratus	fruit															1															1					
R. crispus	fruit																														1		1			
R. sp	fruit	2	6	10	5			1+c4	3	1+2f	4	3	2		9	18	1		2f	35	4		6	1	7		1	5	2	2	11	3		1	4	1
Scleranthus annuus	fruit										2																									
Senecio cf. vulgaris	achene								1											1																
Silene sp Section Melandriformes	seed									1	1				1					2			1													
Sinapis arvensis	seed			1		1															1										1				1	
Sonchus asper	achene				1	1						1								1	1	1		1												
S. oleraceus	achene								1			1		1						1				1												
Spergula arvensis	seed	14	32	10	17	5	1	13	6	10	18	5	8	33	14	8	4	2	4	13	13	3	7	11	8	1		5	5	4	13	4	1	14	5	2
Stachys cf. sylvatica	nutlet						1																													
Stellaria media	seed	14	97	8	13	2	4	1	4+2f	10	34	3	3	10	5	24	4	3	2	9	15	2	15	3	5			2	1	5	13	12	1	3	1	7
Thlaspi arvense	seed			1		2			2f	2		2			1																		1			
Torilis japonica	fruit		1		2											1				1	1										1	1				
Trifolium pratense	calyx															1																				
T. repens	petal					20																1														
Tripleurospermum maritimum ssp inodorum	achene		1			3													1		c1		2	3							1					
Urtica dioica	achene	9	5	7	3		3	10	2	1	2	10	2	20	13	73					5		3		2				4		3	11	1		1	4
U. urens	achene				1	1	1		2	1				2	1	4						1		1f					2					1		
Vicia cf. cracca	seed												c1																							
Vicia sp.	seed				c1									c1											c1											
Viola sp subgenus Melanium	seed	1	3	2	5			2		1			1		2					4	3		1					1	1	1	3		1		c1	
Compositae	achene						1																								2					
Gramineae	caryopsis		2			11		c6	2	1	1			2			2	2				c1	2	1			1				1	1	1			
Labiatae	nutlet																															1				
Umbelliferae	fruit										1												1	1						1		c1				
Undetermined seeds		3	2	3						1	4	4		3	1	5					8			1	3	c1				2+c1	1	1	2	1	2	[illegible]

PERTH HIGH STREET

		6048	6078	6100	6104	6131	7125	7129	7168	7169	7175	7205	7213	7218	7223	7225	7234	7234
		P.F.	P.F.	P.F.	P.F	W.S.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F	W.S.
HEATHLAND PLANTS																		
Calluna vulgaris	flower/fruit	4	2	16+c2	30	1	1	1+c1	3	5	4	8		7	6			12
	seed	1	1	2						2		2		5	1	3		
	shoot		5			3	10	1	14+c3	14	7	165	1					27
	leaf			c1					8	3+c1	6	27						
Erica cinerea	seed		1				2			8	6	3		5	5			1
	leaf						1			2								1
E. tetralix	seed			1														
	leaf	1	1	1						11	49	30					1	17
Eriophorum vaginatum	leaf base spindle																	1
Galium saxatile	fruit																	
Juncus squarrosus	seed		1	5				1				1			2			
Luzula multiflora	seed																	
Myrica gale	fruit																	
	leaf fragment																	
Potentilla erecta	achene	3	1	4	3				2	1	7		3	7	8	4		
Pteridium aquilinum	frond fragment					2						1					1	+
Selaginella selaginoides	megaspore									1					1			
Viola sp subgenus Viola	seed														1			
TREES																		
Betula pubescens	fruit		1	2											1			3
Salix sp	fruit				1		1		1	1					2		1	
PLANTS OF WET HABITATS																		
Ajuga reptans	nutlet										1							
Bidens tripartita	achene																	
Caltha palustris	seed		9					1			1							
Carex spp tristigmatae	nut	4	8	9	4		2	8+c3	7	6	7	10	4	7	10	5	9	4
Carex spp distigmatae	nut	7	25	11	8	5	1	6+c1	8	4	1	6	2	13+c1	13	9	13	58
Eleocharis palustris	nut	2	1							1		2			2	1		
Epilobium parviflorum	seed		1															
Filipendula ulmaria	achene		1			13												
Galium palustre	fruit				1											1		
Glyceria fluitans	caryopsis																	
Hydrocotyle vulgaris	fruit																	
Iris pseudacorus	seed																	

		7323	9137	9153	9153	9235	9235	9240	9251	9261	9273	9275	9277	9279	9280	9282	9285	9302	9317	9325
		W.S.	P.F.	P.F.	W.S.	P.F.	W.S.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.
HEATHLAND PLANTS																				
Calluna vulgaris	flower/fruit			c1	9	1	46	35		.1		2	c1	7	4		2	2		1
	seed			1	2		23	25					1	1	2		2			
	shoot	4	3		70	16	53	32					6+c1	4	4+c2			3		
	leaf												1							c1
Erica cinerea	seed		4			5		4						1						
	leaf							1						1						1
E. tetralix	seed						2								1					
	leaf				4		4	7			2			1						
Eriophorum vaginatum	leaf base spindle						1													
Galium saxatile	fruit												1							
Juncus squarrosus	seed		6		1	13	2	35						7	1		1			
Luzula multiflora	seed											1		1				1		
Myrica gale	fruit			2		2	1													
	leaf fragment							1												
Potentilla erecta	achene		4	1	3+c1	2	2	43		2	3		c2	1+c1	4	3		.2		
Pteridium aquilinum	frond fragment	16																		
Selaginella selaginoides	megaspore																			
Viola sp subgenus Viola	seed						1													
TREES																				
Betula pubescens	fruit		1			1									2					
Salix sp	fruit			2										1		1	1	1		
PLANTS OF WET HABITATS																				
Ajuga reptans	nutlet																			
Bidens tripartita	achene												1							
Caltha palustris	seed											1	1	1					1	
Carex spp tristigmatae	nut		6	5		3					1	3	2	5+c2	1	2+c1	1	5	6	
Carex spp distigmatae	nut		21	18	3	16	6				8	1	16+c3	13	2+c1	6	8+c1	13	20+c2	c1
Eleocharis palustris	nut		3	2		1					2	2		1			4		2	1
Epilobium parviflorum	seed													c1				1		
Filipendula ulmaria	achene		1	1	1															
Galium palustre	fruit		1	1									3	2						
Glyceria fluitans	caryopsis													c1						
Hydrocotyle vulgaris	fruit		1												1					
Iris pseudacorus	seed			1						1										

		6048	6078	6100	6104	6131	7125	7129	7168	7169	7175	7205	7213	7218	7223	7225	7234	7234	7323
		P.F.	P.F.	P.F.	P.F.	W.S.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	W.S.	W.S.
Isolepis setacea	nut		2					11						1					
Juncus articulatus	seed		2			13													2
J. effusus	seed		1			25				1									2
J. sp.	seed																		
Lychnis flos-cuculi	seed	1	2			2		1			1								
Lycopus europaeus	nutlet		1					2+c3			1			2	2			1	
Menyanthes trifoliata	seed									1	1	3	2					1	
Montia fontana ssp fontana	seed	1f	1								1								
Pedicularis palustris	seed		3			1		4+1f			1						1	2f	
Potamogeton polygonifolius	fruit										1		1						
Potentilla palustris	achene	3	3		1		1	2				1	2		1				
Ranunculus flammula	achene	4	9	2		1					1	2		2		1			
R. sceleratus	achene						1			1				1					
R. sp. subgenus Batrachium	achene															3			
Senecio cf. aquaticus	achene															1			
Viola palustris	seed				3								1						
FRESH WATER INVERTEBRATES																			
Daphnia sp	ephippia						1					1				13			
Plumatella sp	statoblast		1	2											1	2			

		9137	9153	9153	9235	9235	9240	9251	9261	9273	9275	9277	9279	9280	9282	9285	9302	9317	9325
		P.F.	P.F.	W.S.	P.F.	W.S.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.
Isolepis setacea	nut													2					
Juncus articulatus	seed		1	3	15	37						2							3
J. effusus	seed			3		59					1								1
J. sp.	seed					2													
Lychnis flos-cuculi	seed	1									1		1					1	
Lycopus europaeus	nutlet	6	2		7		11				1	3		1			1		
Menyanthes trifoliata	seed																		
Montia fontana ssp fontana	seed											2		1					
Pedicularis palustris	seed		2								2	8	1				1	1	1
Potamogeton polygonifolius	fruit																		
Potentilla palustris	achene		1				1			1							1		
Ranunculus flammula	achene	20			9	3					3	6	10	1		3	8	1	1
R. sceleratus	achene																		
R. sp. subgenus Batrachium	achene																		
Senecio cf. aquaticus	achene	1		1		1								2					
Viola palustris	seed												1						
FRESH WATER INVERTEBRATES																			
Daphnia sp	ephippia						2			1				1				5	
Plumatella sp	statoblast						1							3		1	13	11	

PERTH HIGH STREET

BRYOPHYTES

		6048 P.F.	6078 P.F.	6100 P.F.	6104 P.F.	6131 W.S.	7125 P.F.	7129 P.F.	7168 P.F.	7169 P.F.	7175 P.F.	7205 P.F.	7213 P.F.	7218 P.F.	7223 P.F.	7225 P.F.	7234 P.F.	7234 W.S.	7323 W.S.	9137 P.F.	9153 P.F.	9153 W.S.	9235 P.F.	9235 W.S.	9240 P.F.	9251 P.F.	9261 P.F.	9273 P.F.	9275 P.F.	9277 P.F.	9279 P.F.	9280 P.F.	9282 P.F.	9285 P.F.	9302 P.F.	9317 P.F.	9325 P.F.
Mosses	shoot																																				
Antitrichia curtipendula								va									a	a																			
Aulacomnium palustre																						1		2													12
Brachythecium rutabulum																						4															
cf. Bryum sp.																									1												1
Ceratodon purpureus																	1																				
Dicranum scoparium																	6	3	12			12															
Eurhynchium praelongum								1											3			3									2					1	
Hylocomium brevirostre																	a	a																			
H. splendens		20	3			4		8		1		4		2			a	a	2			6		23	1						1					5	3
Hypnum cupressiforme						9	4	6			1	6		1			9	a	1		1	21		20	3					1	6				3	4	5
Isothecium myosuroides																						1		1												1	
Mnium hornum																	5	12				12															
Neckera complanata																						3															
Plagiomnium affine																	1															1					
Pleurozium schreberi												4										1		1													
Polytrichum commune										va																											
P. formosum																	3	3	1			1														1	
Pseudoscleropodium purum																															1					2	
Rhytidiadelphus loreus																	va	va	1																		2
Sphagnum palustre											1	2					12	5				1		3							31					1	1
Sphagnum sp	operculum		1																																		
	shoot		1																												1					12	
Thuidium tamariscinum																	a	a				1							1					1			
Ulota crispa																						1		3													
LIVERWORT																																					
Plagiochila asplenioides																	1																				

PERTH HIGH STREET

		6048	6078	6100	6104	6131	7125	7129	7168	7169	7175	7205	7213	7218	7223	7225	7234	7234	7323	9137	9153	9153	9235	9235	9240	9251	9261	9273	9275	9277	9279	9280	9282	9285	9302	9317	9325
		P.F.	P.F.	P.F.	P.F.	W.S	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	W.S.	W.S.	P.F.	P.F.	W.S.	P.F.	W.S.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.	P.F.
<u>CEREALS</u>																																					
Avena sativa	floret					1+7f												19f				27f		3f													2f
	carbonised floret			1	1			8+3f				1				1					5	2			1		1			1		1	5	1	1	4	2
	grain									1								3	2	1f	3		4														
	carbonised grain	3+1f		9+1f	15+1f		2+1f	8+2f	1	2+1f	2+1f	4+2f	2+2f	5+6f	4+2f	6	2f			1f	31+4f	2+2f		1f	5+1f		2+1f	5+1f		2+2f	5+3f	3	4+2f	16+3f	6	9	1+1f
	pericarp fragment					oc												a	oc			2															
Hordeum vulgare	rachis internode							1											7																		
	carbonised grain	2	5+3f		1			2		1+2f		1				2					2	1					1	2				1	4	1	2	6+2f	
	pericarp fragment																	a																			
Secale cereale	carbonised grain				3							1	2												1		1			1			1				
Triticum aestivum s.l.	carbonised grain						1	1				1			1													1						1+1f			1
	pericarp fragment					a											1	va	va					5							10					3	
Undetermined cereal	carbonised grain						1																							1f		2				1f	
<u>NEMATODE PARASITE</u>																																					
Trichuris sp	egg																		+																		

Table 13

ABERDEEN   FARQUHAR AND GILL

		209	211	213	223	229	237	239	241	245	248	249	251	252	110	43	48	54	66	68	73	305	315	120	704	707	715	720	725	730
Area								A							B			C				D		E			F			
Sample number		209	211	213	223	229	237	239	241	245	248	249	251	252	110	43	48	54	66	68	73	305	315	120	704	707	715	720	725	730
Layer number		92	74	115	149	228	212	247	169	233	257	259	176	177	79	133	163	185	234	270	300	25	66	21	44	55	59	78	79	80
Site phase number		9	9	9	7	5	3	2	4	3	8	5	6	3	3	9	9	9	5	5	3	9	10	7	8	8	7	3	3	3
Subsample volume (cm^3)		300	300	300	300	300	300	300	300	300	300	300	300	300	100	100	100	100	100	100	100	100	100	100	100	100	300	300	100	100
PLANTS USEFUL TO MAN																														
Avena sativa					+	+		+				+	+				+			+						+	+			+
Hordeum vulgare		+										+																		+
Triticum aestivum s.l.																	+												+	+
Brassica sp	seed				1+3f																						3+13f			
Corylus avellana	nutshell				1f			5f	c1f	1f		100f								2f						1f	1f			1f
Ficus carica	seed																87													
Fragaria vesca	achene		1																											
Linum usitatissimum	seed	1			2f							4f											2							
	capsule fragment				1							2																		
Papaver somniferum	seed																										1f			
Reseda luteola	seed	1																												
Rubus fruticosus agg.	seed													1+1f													2			
R. idaeus	seed	1				c1					2						374										1f			
Sorbus aucuparia	seed											1					24+ 21f	3					1					1		9
Vaccinium myrtillus	seed				1												98										8			
Vitis vinifera	seed																c1													
WEEDS OF WASTE PLACES AND ARABLE LAND																														
Agrostemma githago	seed				6												1+55f	6f	1								11f			
Agrostis sp	caryopsis				3																									
Atriplex sp	seed																													2
Bromus mollis agg.	caryopsis									1		7									1f									
Capsella bursa-pastoris	seed	2																					1			2	2			
Cerastium fontanum	seed											1	1	1													1			
Chenopodium album	seed	4+1f	2	11+ 11f	17+ 4f	c6	1			9+1f	6+6f	5	6+2f	1		2	2	7		9	2		3			1	10	1	2	20
Cirsium arvense	achene												1																	
Galeopsis tetrahit agg.	nutlet				1					11+6f		1					1										.4			1+3f
	pericarp fragment							9			6														7	8	28			

							A								B	C						D		E	F					
		209	211	213	223	229	237	239	241	245	248	249	251	252	110	43	48	54	66	68	73	305	315	120	704	707	715	720	725	730
		92	74	115	149	228	212	247	169	233	257	259	176	177	79	133	163	185	234	270	300	25	66	21	44	55	59	78	79	80
		9	9	9	7	5	3	2	4	3	8	5	6	3	3	9	9	9	5	5	3	9	10	7	8	8	7	3	3	3
		300	300	300	300	300	300	300	300	300	300	300	300	300	100	100	100	100	100	100	100	100	100	100	100	100	300	300	100	100
Juncus bufonius	seed	5	10	2	2		1		1	4		[illegible]	16	5	1	5			2		3		1	2			1	2	1	4
Lapsana communis	achene	9	3+1f	13+11f	21	1				5+14f	1	[illegible]	6				6+7f	2	1		1		7		1	1+2f	17+8f	2		12+4f
Myosotis arvensis	nutlet				1																									1
Poa annua	caryopsis	20	4		27					6		3		2									50	7			13	1	1	16
P. pratensis/P. trivialis	caryopsis	3	1		18		1	1		4		15	5	1	16	1							2				4		5	13
Polygonum aviculare	fruit	5		3	15		1					2	3			1							2				6	2		1
P. convolvulus	fruit	1f	4f	30f	1+4f	1f				20f		3f	1+2f			4f			3f	2f	1f		1			1f	3+6f	1	1f	2f
P. lapathifolium	fruit	10+4f	1+2f	4f	6+10f	c5 +4f		1	1f			2	2+1f	2+1f		1+2f				3			7	1f		4f	29+1f	2+2f	3	7+1f
P. persicaria	fruit	3+3f	1	4+2f	17			1									1f										6	2+1f	2+1f	2
Ranunculus repens	achene		1f		1					8	1+1f	1+1f	3+1f	1+1f									1							1
Raphanus raphanistrum	seed	1								1		1		½			½	1									3			1
	testa fragment		4	2	5					3		4	5	7		3	7	4	3	19	7				2	4	23			1
	fruit fragment	5	1		5	1	1			4	1	6	21	3		16	12	1	8	42	7		3			2	92			18
Rumex acetosa	fruit																													1
R. acetosella	fruit	5			8	c2			12	17	3	13	8	5	7		4	3	2	2	3		2	2			4	1	2	7
R. crispus	fruit												4+8f																	
R. obtusifolius	fruit	87	9+11f		160+ 17f				1			32														25+3f	2		1	31
R. sp	fruit			2+1f		3+c1	3+1f	c3	2+1f	1	52			2+12f	1+17f	4f	c13	4f		2	3+8f		11	8			20+4f	1	3f	
Senecio vulgaris	achene				13																								11	27
Sonchus asper	achene				3							1	1										1							
Spergula arvensis	seed	6+4f	1+7f	1+41f	10+5f		2+1f		3	7+8f	1f	2f	4+6f	2		2+2f	6+1f	6	2	25			2			2f	37+6f	1	4	3
Stachys palustris/S. sylvatica	nutlet				1																									
Stellaria media	seed	11+6f	14+8f	13+23f	35				3	60+8f	2	2	9	5+3f	26	2+3f	2	6	1	2	3		7	4	1	9	28+11f	2	6+1f	39
Tripleurospermum maritimum ssp inodorum	achene	1					1					2															3			
Urtica dioica	achene	30	1		203		1			1	3	5	5	2					1				9	1		1	14	2	86	356
U. urens	achene	20	1		1		1					4+2f	1										1				2+1f		4	27
Compositae	achene																											4		
Gramineae	caryopsis	2			8		1							6				1					2				8			
Umbelliferae	fruit					1																								
Undetermined seeds		1			2					1				2			1										1			

		A													B	C						D		E	F					
		209	211	213	223	229	237	239	241	245	248	249	251	252	110	43	48	54	66	68	73	305	315	120	704	707	715	720	725	730
		92	74	115	149	228	212	247	169	233	257	259	176	177	79	133	163	185	234	270	300	25	66	21	44	55	59	78	79	80
		9	9	9	7	5	3	2	4	3	8	5	6	3	3	9	9	9	5	5	3	9	10	7	8	8	7	3	3	3
		300	300	300	300	300	300	300	300	300	300	300	300	300	100	100	100	100	100	100	100	100	100	100	100	100	300	300	100	100
HEATHLAND PLANTS																														
Anthoxanthum odoratum	caryopsis																										1			
Calluna vulgaris	flower/fruit	37	16	1	30				2	1		5	23	9				1		15	9		4	9	1	29	10	15	4	13
	seed	7	7		14				1					6											1	1	1	8		5
	shoot	166	18+c1	2+c2	47		5		4	11		7	20+c2	27+c2		1	1	11	c1	48	4		38	4	8+c1	20	102	64	7	41
	leaf	10	55+c2	c1			11				1			c1																
	twig	59	31	131	60		3		2	6		13	111	38	1	1		9		10	13		21	22	3	va	123	154	21	6
Erica cinerea	leaf													2																
E. tetralix	fruit																								1					
	seed	1	40		2				1			3	7	5					1						27			8	8	3
	shoot		1																											
	leaf	1+c4	12+c80		7		c1		c3	c3			1+c11	c4				c1			6+c6		3	c2	32+c7	3	15+c1	c5	c13	12+c3
Eriophorum vaginatum	leaf base spindle	36	308		18				1			4	15	7	1	1		1			18	1	34	49	43	2	12	544	16	31
Juncus squarrosus	seed												1													1	4			
Luzula multiflora	seed												1																	
Myrica gale	anther											8																		
	fruit					c1																								
	leaf fragment				3							1	27	1		2														
Potentilla erecta	achene	6	1f		6+2f			1	5+2f	1f		1~	3+1f	2+1f	2						2		6	6			1+4f	1		1+2f
Pteridium aquilinum	frond fragment	155	5	3	82				7	49			17f	59			3	5			8		15	3		7	24	40	13	59
TREES																														
Betula pubescens	fruit	2			1								1											1	5	1	1	11		8
	fruit scale				1								1														1	1		1
Salix sp	bud scale			1																										
PLANTS OF WET HABITATS																														
Alopecurus geniculatus	caryopsis				2									1																
Carex spp tristigmatae	nut	1	1	1	1						1	1							1f					1+1f				9	1	
Carex spp distigmatae	nut				3				1			1c	1	2		1							1		1		3			2
Eleocharis palustris	nut									1		2																		1
Juncus articulatus	seed	3	13	5	23					1	3	8	4			1			1	2			1			1	4		2	5
J. effusus	seed	30	150	17	121	1	11		194	36	20	207	355	515	3	175	18	37	121	31	46	1	7	54		3	44	18	33	142
J. sp	seed	3	35	4	20		2		2	5	5	7	33	25	4	5	1	2	2	3	1			2		1	3		3	4
Lychnis flos-cuculi	seed												1																	
Montia fontana ssp fontana	seed	1	1f		1					1			2	1+2f				1												
Potamogeton cf. natans	fruit																										1			
Ranunculus flammula	achene	1			1			c1		1	1	29											1							

		A													B	C						D		E	F					
		209	211	213	223	229	237	239	241	245	248	249	251	252	110	43	48	54	66	68	73	305	315	120	704	707	715	720	725	730
		92	74	115	149	228	212	247	169	233	257	259	176	177	79	133	163	185	234	270	300	25	66	21	44	55	59	78	79	80
		9	9	9	7	5	3	2	4	3	8	6	6	3	3	9	9	9	6	5	3	9	10	7	8	8	7	3	3	3
		300	300	300	300	300	300	300	300	300	300	300	300	300	100	100	100	100	100	100	100	100	100	100	100	100	300	300	100	100
<u>FRESH WATER INVERTEBRATE</u>																														
Daphnia sp	ephippia	1								2																				
<u>MOSSES</u>	shoot																													
Aulacommium palustre																														
Bryum sp		4	16		3											2				1	30		1	1ℓ	7ℓ	1	2	4	7ℓ	11
Calliergon cordifolium		1							1																					
Ceratodon purpureus			1										1ℓ																	
Dicranum scoparium				2	5								1			1							1				1			1
Eurhynchium praelongum			8ℓ																								4		1	
Hylocomium splendens			3	1	16				1	1		2	246	19	1	2	1	5		1	12			2			9	4		5
Hypnum cupressiforme		144	36	140	67		2	1	15	22	6	6	112	40	4	6	39	10	2	3	36		14	13	3	369	va	143	128	164
Mnium hornum		74	100		22				13			5	24	2		1	1	8			6		9	4		34	a	14	12	37
Neckera complanata					1+3ℓ																									
Pleurozium schrebori			1																											
Polytrichum commune		30		9	12							7		1			12				4		1	1		88	4	4	13	14
P. juniperinum												1ℓ																		1ℓ
Pseudoscleropodium purum																											6+5ℓ			2+1ℓ
Rhizomnium punctatum		1			4								6																2ℓ	
Rhytidiadelphus squarrosus					1ℓ																									
R. triquetrus				1												3							1							
Scorpidium scorpioides																	7				1						a			
Sphagnum palustre		6																												
S. papillosum			+	20	+		1		1	1	2+20ℓ	2	2	14ℓ		1ℓ	5	30ℓ	13	1	20			4		5ℓ		3	12	4ℓ
Sphagnum sp	operculum	27	+						3ℓ																120		7			50
	capsule		14																						9	1			2f	3f
Thuidium tamariscinum			1+13f																						1+3f					
Ulota crispa			1	17							4		7		1		27				1						2	1		2
									15																					
<u>CEREALS</u>																														
Avena sativa	florot fragment																													20
	carbonised floret				a																									
	carbonised floret fragment				a																									
	grain				15			2				1								va						1	3			
	carbonised grain			1+1f									1														1			
	pericarp fragment				+			4									1													

								A							B				C				D		E			F			
		209	211	213	223	229	237	239	241	245	248	249	251	252	110	43	48	54	66	68	73	305	315	120	704	707	715	720	725	730
		92	74	115	149	228	212	247	169	233	257	259	176	177	79	133	163	185	234	270	300	25	66	21	44	65	59	78	79	80
		9	9	9	7	5	3	2	4	3	8	6	6	3	3	9	9	9	6	5	3	9	10	7	8	8	7	3	3	3
		300	300	300	300	300	300	300	300	300	300	300	300	300	100	100	100	100	100	100	100	100	100	100	100	100	300	300	100	100
Hordeum vulgare	rachis internode											9f																		2f
	carbonised rachis internode											1f																		
	carbonised grain	1																												
	pericarp fragment	+																												
Triticum aestivum s.l.	husk fragment																													1
	grain																													1
	pericarp fragment																+												+	+

Table 14

ABERDEEN QUEEN STREET

Area and layer number		I 3	II FN22		II FN 57/67A/57B					
Subsample number		1	1	2	1	2	3	4	5	6
Subsample volume (cm^3)		100	100	100	100	100	100	100	100	100
PLANTS USEFUL TO MAN										
Avena sativa			+		+	+	+	+	+	+
Hordeum vulgare					+	+				
Triticum aestivum s.l.					+	+	+	+	+	+
Brassica sp	seed				1+6f	4f	3+33f		2+4f	1+3f
Corylus avellana	nutshell	1f				1f	2f	3f		
Ficus carica	seed					2	1		1	4+1f
Linum usitatissimum	seed				18+75f	6+2f	1		6+11f	
	capsule fragment				8+c1	c1			1	
Prunus spinosa	stone				1				2	
Reseda luteola	seed					2				
Rubus fruticosus agg.	seed				3	6			3	
R. idaeus	seed			1	5	60	1		39	3
Sorbus aucuparia	seed				39	130			43	3
Vaccinium myrtillus	seed				131	130	13	18	89	9
WEEDS OF WASTE PLACES AND ARABLE LAND										
Agrostemma githago	seed				8f	1+37f	61f	101f	1+38f	24f
Anthemis cotula	achene								2	
Atriplex sp	seed				1	1	2			
Bromus mollis agg	caryopsis					1		2+1f	4	
Centaurea nigra	achene						½+2f			
Chenopodium album	seed	5			10	3	12+10f	39	9	2
Cirsium arvense	achene					2				
Galeopsis tetrahit agg	nutlet	3								1
Heracleum sphondylium	fruit					1				
Juncus bufonius	seed	17	3	8			1			2
Lapsana communis	achene	3			5	10	3+2f	8	10	9
Myosotis arvensis	nutlet				1		1	2		
Odontites verna	seed				2					
Papaver dubium	seed					1				
	capsule lid				1					

		H3	II FN22		II FN 57/57A/57B					
		1	1	2	1	2	3	4	5	6
		100	100	100	100	100	100	100	100	100
Poa annua	caryopsis	2			1				2	
P. pratensis/P. trivialis	caryopsis	15			2	7			1	
Polygonum aviculare	fruit	1			9	2				c1
P. convolvulus	fruit	1f				3	6f	25f	3f	
P. lapathifolium	fruit	4			7	2		2	3	2
P. persicaria	fruit	4				2	2+7f	3	2	
Prunella vulgaris	nutlet								1	
Ranunculus repens	achene	10+1f				1		1		
Raphanus raphanistrum	seed				3	5	2	14	19	
	testa fragment				2	2	23	61	28	4
	fruit fragment	1			5	7	28	84	23	9
Rumex acetosella	fruit	17			9	30	2	3	5	3
R. obtusifolius	fruit					1				
R. sp	fruit	4		1f		c2	3+14f	15f		
Silene sp Section Melandriformes	seed				2	1				
Sonchus asper	achene							2		
Spergula arvensis	seed	10			7	8	6	7	6	2
Stellaria media	seed	39			1	8+c4	35+14f	53	7	
Torilis japonica	fruit								1	
Tripleurospermum maritimum ssp inodorum	achene				1		1			
Urtica dioica	achene	1								
U. urens	achene	1								
Viola sp subgenus Melanium	seed	1+4f								
Compositae	achene					2				
Gramineae	caryopsis	+								
HEATHLAND PLANTS										
Calluna vulgaris	flower/fruit	14			3	4	3	8	4	2
	shoot	74			15	16	11	18	6	3
	twig	29			1		1	17		
Empetrum nigrum	stone					4				
Erica cinerea	leaf				4				1	
E. tetralix	leaf	1+c1	c12	c6			c2			
Eriophorum vaginatum	leaf base spindle	19	4		6	1				
Potentilla erecta	achene	2			1			1		
Pteridium aquilinum	frond fragment	101			2	2	3	11	60	3

		I3	II FN22		II FN57/57A/57B					
		1	1	2	1	2	3	4	5	6
		100	100	100	100	100	100	100	100	100
PLANTS OF WET HABITATS										
Carex spp distigmatae	nut	5			1		1			
Juncus articulatus	seed			2	1		1	1	2	1
J. effusus	seed	a	79	197	56	54	9	7	5	65
J. sp	seed		7		1					1
Montia fontana ssp fontana	seed	1				1				
Ranunculus flammula	achene									
MOSSES	shoot									
Aulacomnium palustre		11				3		1		
Ceratodon purpureus		1						1		
Dicranum scoparium		1							12	100
Eurhynchium praelongum		5			1	4		10		1
Hylocomium splendens		164			a	54	5	9	va	va
Hypnum cupressiforme		37				4	51	5	1	1
Pleurozium schreberi		14				3	7	1	13	21
Polytrichum commune		1l							4l	1+33l
P. juniperinum		2+1l								
Rhytidiadelphus loreus					12				va	38
Sphagnum palustre		+				+	7			
S. papillosum		50			2	+				+
Thuidium tamariscinum		2			32	2	1		58	26
CEREALS										
Avena sativa	floret fragment					15	28		10	2
	carbonised floret						1			
	grain				3				1	
	carbonised grain		1			1				
	pericarp fragment				va	va	oc	va	oc	va
Hordeum vulgare	rachis internode					3				
	carbonised grain					1f				
	pericarp fragment				oc	oc				oc
Triticum aestivum s.l.	pericarp fragment				va	va	va	va	va	va
NEMATODE PARASITES										
Ascaris sp	egg								+	
Trichuris sp	egg					+	+	+	+	

Table 15

ELGIN HIGH STREET

Sample number		123	168	524	550	556	556	x602	x602	x629	561	558	x601	x618	x623	x623	656	661	662	664
Context		P15	P16	P22	P20	P21	P21	P18	P18	P7	PH	SA	SA	SA	SA	SA	B	B	B	B
Method of extraction		W.F.	W.F.	W.F.	W.F.	W.F.	W.S.	W.F.	W.S.	W.S.	W.F.	W.F.	W.F.	W.F.	W.F.	W.S.	W.F.	W.F.	W.F.	W.F.
PLANTS USEFUL TO MAN																				
Avena sativa		+	+	+	+	+		+		+		+		+	+		+	+	+	+
Hordeum vulgare		+		+	+	+		+		+		+	+	+	+	+	+	+	+	+
Triticum aestivum s.l.				+	+	+				+						+	+	+		+
Atropa belladonna	seed					3		14					22	65+3f	57	3	2		1	2
Brassica sp	seed							1		3+15f			2+2f	14+5f	23+10f	1+1f			1f	29+8f
Cannabis sativa	fruit													1+3f	1+$\frac{4}{2}$	1+2f			1	2
Corylus avellana	nutshell					1f		1f					2f	$\frac{1}{2}$+12f	$\frac{3}{2}$+6f					
Euphorbia lathyrus	seed												1							
Ficus carica	seed	4	1	3	6			5				1	28	28	22	1	6	37	va	va
Fragaria vesca	achene													1+$\frac{1}{2}$					9	
Juglans regia	stone (walnut)														$\frac{1}{2}$+1f					
Linum usitatissimum	seed							4+4f					1+3f	44+11f	6+3f	3f				3+1f
	capsule fragment													19	34	4				
Malus sylvestris s.l.	seed													1						7+8f
Prunus avium	stone														1				4+$\frac{1}{2}$	362+15f
P. domestica ssp insititia	stone					6f		4f					1+7f	4f	$\frac{3}{2}$+6f				7f	32+$\frac{1}{2}$
P. padus	stone									19+46f										21
P. spinosa	stone	1f						1f						1f	1					35
Reseda luteola	seed							1						1	1			1	3	
Rosa canina agg.	achene									9					3	2f			1	48
Rubus fruticosus agg.	seed	771	5	24 }72f	12	va		8		6		1	27	48	42	2+1f	5	15	18	va
R. idaeus	seed	579	2	66	24	va		22		38	1	3	28	35	32	1+$\frac{1}{2}$	11	18	450	va
Sambucus nigra	seed			4	1	1+1f								1	1		4		1	1
Sorbus aucuparia	seed									18				1		c1				2
Vaccinium myrtillus	seed															1		3		86
Vitis vinifera	seed				c1														c5	c24+1f

WEEDS OF WASTE PLACES AND ARABLE LAND

		123	168	524	550	556	556	X602	X602	X629	561	558	X601	X618	X623	X623	656	661	662	664
		P15	P16	P22	P20	P21	P21	P18	P18	P7	PH	SA	SA	SA	SA	SA	B	B	B	B
		W.F.	W.F.	W.F.	W.F.	W.F.	W.S.	W.F.	W.S.	W.S.	W.F.	W.F.	W.F.	W.F.	W.F.	W.S.	W.F.	W.F.	W.F.	W.F.
Achillea millefolium	achene									2										
Aethusa cynapium	fruit			1+2f	2	81+43f	1	2f						3f	2		1+1f	9+12f	1+2f	
Aphanes arvensis	achene														1	1				
Agrostemma githago	seed									23f						4f				6+23f
Atriplex sp	seed														2					
Barbarea vulgaris	seed													9	15					
Bromus mollis agg.	caryopsis									2+1f										
Carduus sp	achene													1						
Centaurea cyanus	achene													1						
C. nigra	achene			1f									1	1+1f	1+1f				3+1f	14+14f
Cerastium fontanum	seed													2						
Chenopodium album	seed	320	5	13	12+4f	31	1	190		45	2	8	287	va	va	20	3	15	35	279
Chrysanthemum segetum	achene																			½
Cirsium cf. arvense	achene													2						
C. vulgare	achene							6					7	7	7					2
Euphorbia helioscopia	seed				1									1+½	1					
Fumaria officinalis	nutlet		4	3f	3+½	4								1+½				2		
Galeopsis tetrahit agg.	nutlet							3					6	10	16				1	6
Galium aparine	fruit																1			
Juncus bufonius	seed					4								12		15	2	7	185	2
Lamium purpureum	nutlet			1	1	3		4					10	22	40		1		3	1
Lapsana communis	achene					1		1		2+2f			1	3+2f	5	1f		2f	19+17f	105+67f
Papaver dubium	seed												2	12	3	3				
Plantago lanceolata	seed													c1						
Poa annua	caryopsis									14						9				
P. trivialis	caryopsis									9						6				
Polygonum aviculare	fruit					c1		8		1			94	95	109	1				16
P. convolvulus	fruit							1f		1+17f			2	24+18f	3	3f	1			2+2f
P. lapathifolium	fruit	1						11+6f		3+1f			17	47+3f	48	2f			1	6+2f
P. persicaria	fruit		c1	1	c1			3		3+1f			5	18+6f	10		2		2	12
Prunella vulgaris	nutlet													3						
Ranunculus repens	achene	1			1f	1		4+3f				1f	2+2f	31+15f	20+8f			1	10+4f	20+12f
Raphanus raphanistrum	seed									3f				16+4f	2					
	fruit segment			1				1				2		4+½						31+7f
	fruit fragment	1	2		83	132		77		107	1	41	96	314	255	1f				149
Rumex acetosella	fruit				2	16		17		15		2	18	75	32	1				137
R. obtusifolius	fruit			4									442	va	va	28				
R. sp	fruit	3			2	3		511		1f		7				29				10+4f
Scleranthus annuus	fruit													7	5			c1		

		123	168	524	550	556	556	x602	x602	x629	561	558	x601	x618	x623	x623	656	661	662	664
		P15	P16	P22	P20	P21	P21	P18	P18	P7	PH	SA	SA	SA	SA	SA	B	B	B	B
		W.F.	W.F.	W.F.	W.F.	W.F.	W.S.	W.F.	W.S.	W.S.	W.F.	W.F.	W.F.	W.F.	W.F.	W.S.	W.F.	W.F.	W.F.	W.F.
Senecio vulgaris	achene																1			
cf. Senecio sp	achene									1										
Sinapis arvensis	seed														1				1+1f	
Sochus asper	achene									1					1					2
S. oleraceus	achene																			1+1f
Spergula arvensis	seed	3						$\frac{1}{2}$		$4+\frac{16}{2}$				$3+\frac{11}{2}$	$1+\frac{2}{2}$			1		$10+\frac{5}{2}$
Stachys palustris/S. sylvatica	nutlet					4		7				1	4	25	27			1	1	2
Stellaria media	seed	10		1	7	5		56		2		3	19	208	366	7	1	2	6	91
Taraxacum officinale s.l.	achene											1		1			16	10	1	12
Thlaspi arvense	seed							4+6f					11	27+ 17f	22+ 13f	2f	26		8	12+ 78f
Trifolium repens	flower									1										
Tripleurospermum maritimum ssp inodorum	achene									1										
Urtica dioica	achene	45	1	3	7	72		101		4		11	492	va	va	105		18	58	9
U. urens	achene			2	13+2f	6		24		4		9	15	92	76	2			11+1f	10
Vicia cf. hirsuta	seed																	c1		
Viola sp subgenus Melanium	seed	2								1			1	1	2+1f			2	3	
HEATHLAND PLANTS																				
Calluna vulgaris	fruit													1		2				
	shoot									1				c1	1				c1	2+c6
Empetrum nigrum	stone													3						
Erica tetralix	leaf																			c1
Luzula multiflora	seed													1	1					
Melampyrum pratense	seed	9																		1
Polygala sp	seed														1					1
Potentilla erecta	achene							1						8+7/x	23					14
Pteridium aquilinum	frond fragment													6	1					
Selaginella selaginoides	megaspore				1									2						
Viola sp subgenus Viola	seed					1											4			
TREES																				
Betula pubescens	fruit									49			10	450	6	1				
	fruit scale									9			1	98	6					
Salix sp	fruit														3					
	bud scale									21			64	79	63					

		123	168	524	550	556	556	x602	x602	x629	561	558	x601	x618	x623	x623	656	661	662	664
		P15	P16	P22	P20	P21	P21	P18	P18	P7	PH	SA	SA	SA	SA	SA	B	B	B	B
		W.F.	W.F.	W.F.	W.F.	W.F.	W.S.	W.F.	W.S.	W.S.	W.F.	W.F.	W.F.	W.F.	W.F.	W.S.	W.F.	W.F.	W.F.	W.F.
PLANTS OF WET HABITATS																				
Carex sp tristigmatae	nut	1			5	2		7					7	41	17			13+c1	34	8
Carex sp distigmatae	nut					c1		10		2			14	43	3	3			9	4
Eleocharis palustris	nut																		1	5
cf. Glyceria fluitans	caryopsis									1										
Hypericum cf. maculatum	seed															2				
Isolepis setacea	nut				1			1					1	9		1		2	6	
Juncus articulatus	seed													1						
J. effusus	seed					10	1		2	2				7		10	11	31	188	
J. sp.	seed					1								3				3	6	
Lychnis flos-cuculi	seed													1						
Menyanthes trifoliata	seed												1							
Montia fontana ssp fontana	seed														3					1
Ranunculus flammula	achene											2	2	5	1				6	
R. sceleratus	achene							11					40	83	69	11	1	9	135	38
R. sp subgenus Batrachium	achene							2					3	4½	4				1	
FRESHWATER INVERTEBRATE																				
Daphnia sp	ephippia																		2	
MOSSES	shoot																			
Bryum sp																1				
Calliergon cuspidatum													60			2				
Ceratodon purpureus														1	3	2				108
Dicranum scoparium																				5
Eurhynchium praelongum								9		2			21	43	5	4		1	34	10
Hylocomium splendens								6		2			11	106	50	11			3	7
Hypnum cupressiforme								1		1				48	8	5	2			6
Isothecium myurum										6										
Neckera complanata										5										
Plagiomnium affine														2						
Pleurozium schreberi														6	1					4
Polytrichum formosum														12						
P. juniperinum														10						
Rhizomnium punctatum														2						
Rhytidiadelphus squarrosus														5						
R. triquetrus								6							2					12
Sphagnum palustre				12		1										12				
S. papillosum																				7
S. sp section Acutifolia																				3
Thuidium tamariscinum								4					10	17		8				

		123 P15 W.F.	168 P16 W.F.	524 P22 W.F.	550 P20 W.F.	556 P21 W.F.	556 P21 W.S.	x602 P18 W.F.	x602 P18 W.S.	x629 P7 W.S.	561 PH W.F.	558 SA W.F.	x601 SA W.F.	x618 SA W.F.	x623 SA W.F.	x623 SA W.S.	656 B W.F.	661 B W.F.	662 B W.F.	664 B W.F.
CEREALS																				
Avena sativa	floret									3										
	grain									3										
	carbonised grain	6+3f	1	13+2f	11	62+ 12f		3				2		9+3f	13+2f		44+7f	37+5f	7+4f	6+1f
	pericarp fragment									oc										
Hordeum vulgare	carbonised grain	1+2f		12	16+3f	25+ 7f		6				4	10	11+3f	27		15	26+1f	3+2f	1
	pericarp fragment									oc						2				
Triticum aestivum s.l.	grain									2						1f				
	carbonised grain			4	1	5											3	1		
	pericarp fragment									va						11				va
Undetermined cereal	carbonised grain			13		4+7f								2+1f	3			11	4	
NEMATODE PARASITE																				
Trichuris	egg									+										+