Plant materials and insect remains from excavations at Tarbat, Portmahomack, Ross-shire (Highland)

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A wide variety of samples was collected during excavations at Tarbat over the period 2004-11, including spot finds of charcoal and uncharred wood, and other charred and waterlogged plant material. Some samples were processed by wet-sieving by FAS for recovery of charred remains, and some further samples of whole sediment containing material preserved primarily by anoxic waterlogging were processed by the author and by others. In some cases the material offers insight into fuel use at and importation and use of materials from the hinterland to the site, whilst in others aspects of the past environment of the inhabitants of the site at Tarbat have been addressed through studies of plant and insect remains.

For samples of charcoal and other charred remains treated as spot finds or residues/flots from sieving, the quantity of material submitted was weighed to the nearest gramme, or so, as a rough guide to the quantity present. In some cases material was sieved to remove fine debris before being examined under the low-power binocular microscope. Charcoal was identified by examining transverse sections either from the original surface or by creating freshly-broken surfaces where necessary. For waterlogged wood, thin sections in one or more of three planes were taken with a razor blade and examined using a transmission microscope.

Some samples in which the bulk of the preservation was by anoxic waterlogging had been disaggregated by staff at Headland Archaeology during an early phase of assessment and the authors received 'flots' from paraffin flotation. Some other material had been examined at this stage by Headland Archaeology and their comments are, where relevant, subsumed into this account (OLA 7.4.2).

Lastly, a group of samples from the channel/'millpond' in Sector 2 was processed (by ARH) using one series of the two of column samples obtained by FAS. These were in the form of cling-film-wrapped slices, each of about 200-330 g in weight. They were disaggregated and sieved following the general procedures of Kenward *et al.* 1980 (with the use of sodium carbonate and boiling for some of the early-processed samples, though this was not found very effective in facilitating disaggregation). The wet residues were then checked (by ARH) for macroscopic plant remains, which were recorded semi-quantitatively on a four-point scale of abundance (from 1—one or a few items per kg of original sediment to 4—very abundant or a major component of the deposit), along with all other components of the samples. Representative insect remains observed during this stage were picked out for examination (by HKK) with paraffin flotation (again following the methodology of Kenward *et al.* 1980) used in one case.

Detailed comments on the material examined are presented in Table 1, where the order and grouping of samples follows the narrative below. Note that the deposits from the stream channel/'millpond' are treated separately (via Table 2) since their dating stretches from Phase 0 to 2.2+.

Period 0: Fill of charcoal pit/kiln

Context 3536

The material in the two samples examined was primarily charred birch roundwood (up to about 35 mm in diameter). The observation that much of the material in Sample 8538 comprised bark with tarry deposits on outside surfaces is perhaps consistent with the idea that this material was deliberately made charcoal, since tars would tend to be concentrated in the enclosed environment of a charcoal clamp. But this also raises the possibility that pitch was being produced by this kiln, as a primary product or a by-product to the charcoal.

Period 1: Fill of ditch interpreted as wood-lined and -lidded water conduit which becomes filled with sand in disuse (Sector 4)

Contexts 1325, 1337 and 1345

The series of samples from this feature were notable for their content of charred cereal remains, with both grains and chaff fragments represented, evidently discarded into the ditch rather than being burnt there. The presence of grains and rachis (ear stalk) fragments of rye, barley and free-threshing wheat might be considered to imply bulk processing of cereals nearby, charring having occurred either during the crop drying phase of processing or during a conflagration of a storage context, whilst an origin in waste from threshing is perhaps unlikely, given the paucity of weed seeds. The presence of charred debris which may have arrived in turves is perhaps the key to this material—it may have been burnt debris from a straw and turf roof (though the absence of cereal culm material might argue against that, in which case one might invoke a crop within a turf-roofed and/or walled building, both of which were destroyed by fire).

Period 2, Phase 1: fills of hearth, F535

Contexts 3305, 3406, 3467, 3473, 3499, 3500, 3502, 3528

Plant material surviving in charred form in the deposits associated with this hearth primarily comprised the coarse woody material from the basal parts of heather plants, sometimes with twig fragments from the upper parts, identified with certainty in most of the samples. There were also some charred rhizome fragments, presumably from surface-cut turves—perhaps from the organic litter layer from which the heather had been pulled. Likewise, the record of fragments of burnt peat in three samples also points to peat turves, or to the same kind of surface-deposited organic matter from an area of heathland or moorland. The traces of barley grains in four samples might represent material from straw, or accidental burning of grain intended for food, in the hearth. Charred hazel nutshell was present in two samples in this group.

Two samples from a deposit identified as a dump of spent fuel adjacent to the hearth (Contexts 3467 and 3528) yielded a very similar range of remains. Charred hazel nutshell and traces of barley grains were noted in one sample within this group.

Period 2, Phase 1: other samples

Contexts 2224, 3227 and 3570

Three samples fell outside of these Phase 1 context groups. Two consisted of willow stems (details in Table 1), whilst the organic content of a sample from 3227, the fill of a stone-lined cistern, appeared to be mainly burnt peat, or perhaps surface-cut heathland/moorland turves.

Period 2, Phase 2: (i) building material from buildings/structures

Contexts 1030, 1866, 1872, 1916, 2704

Sixteen samples from five contexts from layers of 'primary burning' relating to the destruction of Period 2 Phase 2 buildings by fire were examined and were, not surprisingly, dominated by wood charcoal (principally of oak, present in 13 samples). There were also numerous records of hazel charcoal, mostly from roundwood, typically from stems about 15 mm in diameter and therefore presumably most likely to be from wattle (they would be rather slender for roof purlins, for example), though a less formal brushwood layer within a roof is possible). There were remains of heather in many samples, sometimes in the form of small leafy shoot or twig fragments, in other cases as coarser root/basal twig material.

This is consistent with the excavators' record of Context 2704, for example as having 'contained burnt wattle and heather rope' and woven wattle, though none of this could be discerned directly from the samples as supplied. Some small charred peg-like structures in Sample 6773 may have been from roofing material—pegs might be used in the fixing of turves or other thatching material. The thatch seems most likely to have been of heather (perhaps with some cut turves as an underlay), since the grass or straw debris likely to represent cut reed or cereal stems do not seem to be present in the assemblages.

Period 2, Phase 2: (ii) hearth fills associated with Structure 9

Contexts 2468, 2777, 2786, 3196, 3198, and 3252

This group comprised material from hearths F445, 495 and 529, within the 'vellum-makers' yard' adjacent to Structure 9.

The two small samples from focal hearth 445 included charred ?heather root/twig and some barley grains, whilst much the same material was recovered from refurbished focal hearth 495 (noted during excavation as *'*containing frequent lenses of pure turf charcoal and occasional pockets of unburnt turf present as decayed brown silt'. Sample 3196, in particular, contained what appeared to be burnt peat/mor humus (the latter more likely from surface-cut turves than deeper-lying peat), with root/rhizome and sedge nutlets as further probable indicators of an origin in turves. From a sample from focal hearth 529, further burnt amorphous peat was recovered along with heather twig and ?heather basal twig/root fragments, as well as a single burnt spirorbid shell and charred and uncharred snails (spirorbids are discussed further in the next section). A second sample from another layer within the same hearth produced what might have been a tiny fragment of charred seaweed, as well as further ?heather charcoal, but the bulk of the sample seemed to be unburnt mor humus, again consistent with the excavators' observations.

Period 2, Phase 2: (iii) other deposits associated with Structure 9

Contexts 1917, 2109, 2889, 3140 and 3171

The sample from 1917, a layer of ash and burnt shell, gave the strongest evidence in this group for material from the marine littoral. There were burnt marine shells, including periwinkle, as well as charred seaweed with frequent burnt spirorbid shells. The latter live mainly as epibionts on seaweed and are unavoidably imported with their substrate. They can serve as a proxy for seaweed even when none is recorded in its own right. Closer identification of spirorbids is difficult, if not impossible, but their interpretation does not depend on knowing the species concerned. Similarly, a sample from Context 3140, recorded as a shell-rich sand, forming part of an earth and stone bank (F476), included further charred seaweed material along with marine shell, spirorbids, traces of foraminiferans (marine micro-fauna) and a few burnt snails which included two *Hydrobia* cf. *ulvae*, a species likely to have arrived with seaweed. The assemblage as a whole points to imported seaweed and shells, presumably burnt to produce a form of lime for processing skins (which process is also inferred from other evidence). A third sample rich in spirorbid shells was from Context 3171, an ashy dump; again, there were traces of burnt seaweed and some charred herbaceous material that may have originated in turves.

Quite different, yet still charred material was recovered from Context 2889, recorded as burnt structural material. Here, there was a sample comprising a mixture of what may have been burnt peat with charcoal, the latter including oak and ?heather with some fine charred herbaceous stems and fine charred moss stems, perhaps from burnt surface-cut turves. Another sample was of coarser charred herbaceous stems, perhaps from some large sedge-like plant such as bulrush or sea club-rush (*Scirpus lacustris/maritimus*) and most likely material from a thatched roof.

The sample from 2109 was a chisel handle on which mineral-replaced wood was present; the wood may have been alder but was not conclusively identified.

Period 2, Phase 2: (iv) deposits associated with Structure 7

Contexts 2295 and 3509

The sample from 2295 was material from a wooden structure, from which a willow twig provided a radiocarbon date. From Context 3509, the final backfill of a stone-lined culvert, F431, there was a single sample of very humic sand. Not surprisingly, as a final fill it probably bears no relation to the life and use of the culvert and the assemblage of plant remains was dominated by wood fragments and elder (*Sambucus nigra*) seeds, the former perhaps largely also from elder bushes. On the whole the material gave the impression of inwashed terrestrial material, though fragments of caddis larval cases stood out as the exception to this. It is perhaps significant that the only beetles recorded were of terrestrial species, one of which, *Grynobius planus*, is a wood-borer and the only beetle associated with trees to have been found in any of the assemblages which yielded insect remains.

Period 2, Phase 2: (v) deposits associated with monastic terrace

Contexts 2584, 2677 and 2697

Four samples from 2584 were from charred remains of a hurdle and were from a variety of tree species: alder, birch, hazel, oak and an unidentified conifer, together with traces of ?heather root/basal twig in one case. Generally the charcoal seemed to have come from well-grown plants which perhaps—not surprisingly—implies management of woodland for poles suitable for hurdles (providing long straight specimens) rather than casual collection from unmanaged local woods.

Charcoal from 2677, adjacent to F483 (collapsed burnt hurdle) included birch, hazel and oak, along with willow/poplar/aspen and, again, some fragment which were probably heather root/basal twig. The hurdle elements were again from well-grown stools. Lastly, a further selection of charcoal samples from a hurdle from 2697 contained alder, hazel, oak and willow/poplar/aspen as well as ?heather. The quality of growth of the rods, as marked by their ring-widths was not noted as especially good or bad, except in the case of material from one sample (SN 2697) which was hazel, perhaps from a stem perhaps 100 mm in diameter, and therefore perhaps a sail (upright) rather than a rod; here there were some tens of annual rings across the section, suggesting rather slow growth. It may be significant that a sample of this charcoal returned a radiocarbon date rather earlier than others for this phase.

Period 2 (not separately phased)

Contexts 1401, 1404, 1405 and 1407

These deposits were the waterlogged fills from the basal sequence in the monastic enclosure ditch and had been examined previously by Mhairi Hastie at Headland Archaeology. Only 0.5 l. samples had been processed and the material examined by the present authors consisted of glass jars of 'residue' and some sorted remains. HKK makes the point that much larger samples (3-5 kg) would undoubtedly have furnished rather more valuable information. The interpretative potential of these insect assemblages was very much limited by the small numbers of remains: few taxa were recovered, and it was not possible to make a reasonable judgment as to the relative importance of the various habitats suggested. The site is, of course, located in an area where many species common in more southerly locations might not be able to exist, restricting the potential range that might be recovered in any case (though this would not necessarily prevent the recovery of useful data from the insects, as it has proved possible in areas such as Iceland and Greenland, with extremely limited local faunas).

Those caveats notwithstanding, the ditch clearly contained water, at least intermittently, at the time the lowermost deposits (1407) formed, for there were both plant and insect taxa requiring a body of standing water. The bulk of the biota, though, was of terrestrial origin, with the abundance of elder seeds (and with wood and twig fragments of this species, too), perhaps suggesting scrub overhanging the ditch. Consistent with such scrubby vegetation were the moderate numbers of fruits of rough chervil (*Chaerophyllum temulentum*), docks (*Rumex*) and stinging nettle (*Urtica dioica*). Amongst the insects there were some dung beetles, pointing to the presence of nearby livestock, or of extensive grazing land more generally. Perhaps the ditch formed the boundary to a field, with the elder scrub part of a hedge line. The presence of rough chervil so far north in the 7th-8th centuries may be of some significance in terms of climatic change; this area is very much the northern limit for the species at the present time (Preston *et al.* 2002, 456, as *C. temulum*).

Much the same kind of assemblage of plant remains was seen in 1405, with very abundant elder seeds and many elder twig fragments. There were again some 'hedgerow' taxa but also present here were traces of uncharred heather (twigs, shoots and flowers), the bog moss *Sphagnum* (leaves) and bog myrtle (*Myrica gale*). They must have originated in an area of heathland or bog, perhaps via imported materials for roofing, for example. The presence of traces of arable weed seeds points to a further component from a quite different source. By contrast, the insect remains offered no evidence for human occupation in the vicinity, though as pointed out in the detailed narrative (Table 1), such taxa may be rare in deposits forming even quite close to occupation.

The theme of an elder twig/seed-rich assemblage continued into Context 1404, though with twigs of alder and willow also present. There was clearly a return to more permanently standing water at this time, evidenced by the insect remains—which included several aquatic taxa—and by the plants, amongst which were abundant water crowfoot (*Ranunculus* Subgenus *Batrachium*) achenes. Hedge/scrub communities were again indicated by the insects, as well as cultivated land, grazing land and waste places, but with none of the presumed occupation materials seen in the sample from 1405.

Finally, the uppermost fill in this sequence, Context 1401, was largely twiggy debris, including a substantial chunk of elder trunk wood and many elder seeds, along with abundant water crowfoot achenes (some of them finding their way onto the larval cases of caddis flies which lived in the ditch at the same time). Much the same kinds of habitats were represented but there was a decline in overall numbers of taxa—and here the observation that some of the wood looked as though it had become somewhat decayed before burial may be of relevance. Perhaps the ditch was drying out more frequently, leading to some decay between phases of standing water (during which material was much better preserved).

Two other samples from this sequence were timber and twigs; not surprisingly, perhaps, they, too, were elder.

Period 2/3 hearth fills in Structure 1

Contexts 1082, 1086, 11411, 1142, 1527, 1615, and 1621 (* originally context 1141; this number was also used for a context associated with Structure 5, where it is designated 11415 in this report)*

Material from focal hearth F65, Structure 1, was represented by samples from six contexts (all those listed, apart from 1527). Wood ending up as fuel—whatever its original function—comprised alder, birch, hazel, Pomoideae (perhaps rowan or hawthorn, for example), oak, and willow/poplar/aspen, with hazel, oak, and willow/poplar/aspen being the most frequently recorded. Heather root/basal twig fragments were recorded in six samples, with other parts of heather plants noted in several of them: buds, flowers, twigs—presumably from cut or pulled heather brought as fuel or from recycled heather thatch, for example. There were occasional fragments of charred root/rhizome and herbaceous material which may have arrived with surface-cut turves (especially in sample 4171, Context 1615, the principal surviving fill of the hearth). Oat and barley grains (but no wheat) were occasionally recorded, too, and five samples (from three contexts) furnished charred hazel nutshell.

The single sample from Context 1527 (the fill of a stone-lined 'flue' serving the interior of Structure 1), comprised remains of three charred barley grains from which a radiocarbon date in the 9th and 10th centuries was obtained.

Period 3: (i) fills from metal-workers' hearths

Material from hearth 148: Context 1412

The three small samples yielded remains of charcoal of oak and hazel, with, in one case, some heather root/basal twig and a little charred straw. Another sample produced a single oat grain.

Material from hearth 353: Contexts 1545, 1815

The small sample was mainly oak charcoal.

From a deposit interpreted as a metalworkers' dump by hearths F148 and F353, an iron sickle (FN 4804) was recovered and mineral-replaced wood from its handle was examined, but could not be identified.

The last sample in this group was from Context 1724, a fill from a further hearth or firepit, F299. It comprised burnt ?peat (or perhaps organic soil) and heather root/basal twig fragments.

Period 3: (ii) Fills of ditch F3 belonging to and enclosing Structure 5 (Sector 1)

Contexts 1009, 1010, 1018, 1126, 1127, 1128, 1130, 1132, 1135, 1136, 1137, 1140, 11415, 1147, 1148, 1149, 1150, 1151, 1153, 1154 and 1156 (* originally context 1141; this number was also used for a context associated with Structure 1, where it is designated 11411 in this report)*

The earliest silting onto the basal sands was represented by a single sample from Context 1156 in which the ancient (charred) remains comprised traces of barley grains and ?heather root/basal twig fragments.

This was followed by a slumping episode (Contexts 1150, 1151, 1153, 1154) from which the 13 mostly minuscule samples produced only scraps of charcoal (most of which was not identified any further, though there was some heather from two samples from 1150), traces of barley grains, and a few uncharred and presumably recent weed seeds.

A phase of burning came next. Here, the four samples from two contexts (1148 and 11415) yielded three records of oak charcoal, one of hazel, and two examples of charred heather twigs, with two of ?heather root/basal twigs. The presence of charred root/rhizome in the two samples from 11415 and of sedge nutlets in one of them perhaps points to an origin in burnt surface-cut turves.

Deposits interpreted as originating from the erosion of the bank are next in the sequence. The 14 samples (from Contexts 1132, 1135, 1136, 1140, 1147 and 1149) perhaps included material originally deposited in Period 2, since there were traces of ?burnt peat and ?charred seaweed across two of the contexts and ?heather root/basal twig in five of the samples (representing four contexts). Some lesser clubmoss megaspores in a sample from 1140 might indicate material from unburnt turves if they are not inwashed from local damp short turf. Traces of barley grains were recorded from two samples from two contexts and tentatively from a third.

From a sand deposit laid prior to levelling, four samples (from Contexts 1127, 1128, 1130 and 1137, all equivalent layers) yielded between them no more than a few barley grains. And a little oak charcoal

The latest layers in the infill of the ditch were interpreted as relating to its final levelling (Contexts 1009, 1010, 1018, 1126). Perhaps not surprisingly there were few ancient remains (but quite a few records of uncharred—presumably recent—weed seeds) in the six small samples available: the remains were much the same as in deposits below with three records of oak charcoal, two of ?heather root/basal twig fragments and a single record of tentatively identified barley (two grains).

Period 3: (iii) other deposits

The fill of a central pit in Structure 5 (Context 1027) provided two samples. In one, the sediment was most likely burnt peat, with a little charcoal and charred ?heather root/basal twig , charred heather flowers, some small barley and oat grains and a few wild radish (*Raphanus raphanistrum*) pod segments, the last a cornfield weed contaminant not easily winnowed or sieved from the crop. The other sample was as spot find of charcoal including a few oat and barley grains.

Channel/millpond section (Table 2)

The sequence of more or less sandy detritus peat had been divided in the field into three contexts, a basal layer sandy gravel (2332) grading into the lower half of the section, with a sharp change in colour between the lower context (2310) and the upper (2296) (though there was little to distinguish the two upper contexts lithologically when examined in the laboratory some years after excavation). Though labelled with the context number 2332, the lowermost sample has been assigned to 2310 here since it was indistinguishable in composition from the material immediately above it other than having a higher sand content. Since the nature of the plant and invertebrate remains in the peat was not known from the outset, the division of samples into a series of thin slices collected in the field was respected during the present analyses, and they were not aggregated into larger units. In any case, the sediment proved rather intractable: even prolonged soaking or the use of mild alkaline chemicals did not readily assist in disaggregation, the peat remaining very coherent and requiring considerable manual intervention to reduce clast size and free the contained fossils. It is likely (especially given the sandy substrates across the site) that the peat had undergone a degree of natural drying and shrinkage during the centuries after deposition which made it difficult to tease apart.

The commentary which follows is based on the more detailed sample-by-sample account in Table 2, and drawing on information in Table 6.

Period 0-1: Context 2310

The assemblages from the lowermost samples were dominated by plants of marsh and fen, primarily—in terms of identifiable matrix components—the hypnoid mosses *Drepanocladus* (whose identification to species is extremely challenging for fossil material where characters such as habit and colour are lacking), *Cratoneuron commutatum* (in a sample, 49102, taken from the second, adjacent column, and examined to provide material for radiocarbon dating), and *Scorpidium scorpioides*. The other plant taxa persistently present or recorded in significant numbers, such as lesser spearwort (*Ranunculus flammula*), toad rush (*Juncus bufonius*) and spike-rush (*Eleocharis palustris*), augmented by the records for waterside insects, such as *Chaetarthria seminulum*, were also consistent with deposition in a shallow wet feature with enough standing water to provide habitats for caddis flies and water beetles such as *Coelostoma orbiculare*, though with remains coming from organisms living in terrestrial habitats nearby. Indeed, in this latter category, beetles such as *Aphodius* (but also several other taxa) pointed to the presence of herbivore dung in the vicinity. Intriguingly, the records for charred and uncharred remains of heather even in these lower deposits suggests a very small component of occupation material may have been reaching the site of deposition, probably by wind-blow.

Period 2.2+: Context 2296

Human influence is more markedly obvious in the upper context, where records for plants of disturbed places and weeds of cultivation, such as annual nettle (*Urtica urens*), docks (*Rumex*), fat hen (*Chenopodium album*), chickweed (*Stellaria media*), corn spurrey (*Spergula arvensis*) and wild radish (*Raphanus raphanistrum*) become established. Further records of heather, especially as charred fragments, together with scattered charred grains and chaff fragments of barley (*Hordeum*) point to material from occupation. Likewise, as low in the sequence as Sample 4872 there are indications in the beetle fauna for the presence of artificial habitats associated with human occupation (via *Falagria* or *Cordalia* sp. and *Gyrohypnus ?angustatus*). At least four kinds of fly puparium were present in this assemblage, too, perhaps adding to the evidence that detritus from human occupation was present. It should be noted, though, that the only *strongly* synanthropic insect (from Sample 4868 from this context) was the spider beetle *Tipnus unicolor*, a species generally found in (by modern standards) damp old buildings. Though some of the wetland plant taxa from the earlier phase persist, and there are occasional records of waterside beetles, the moss flora is very depleted in the upper part of the peat and the taxa present are not those fen/marsh plants seen in Period 0-1. The insect fauna is increasingly dominated by terrestrial taxa, especially grazing land forms, though at the top of the sequence (Sample 4862) there are hints of a return to more marshy conditions (which also fostered better preservation and a large assemblage of both plants and insects).

Concluding remarks

Overall, the studies of plant remains have enabled us to confirm many of the field interpretations of the excavators: deposits thought to comprise or contain structural building material have generally yielded materials likely to have come from roofs and perhaps also walls, with imported heather persistently present in the assemblages. Whilst this may sometimes have arrived as cut material in its own right, the abundance of what are thought to be the coarser basal parts of the plant warn us that surface-cut turves from heather-dominated vegetation are a rich source of such material, and would also be likely to furnish the charred remains of roots/rhizomes and small clasts of burnt peat seen in so many of the samples.

Evidence for plant foods at Tarbat is very limited. Although cereal grains were quite frequently encountered, in some cases in moderately high concentrations, the grains were more usually scattered in ones or twos through many of the samples. Rachis fragments from samples from the Period 1 ditch (F129) have allowed us to show that free-threshing hexaploid wheat, barley and rye were all being exploited.

The records for wheat, with a single exception, and for rye, are all from Period 1 deposits, the later cereals being barley, with (occasionally) oats. Rye is perhaps the more likely crop to have been grown successfully so far north, so perhaps the wheat was imported, as suggested for the contemporaneous material from Hoddom, Dumfries and Galloway (Holden 2006, 152), though the presence of the rachis would perhaps be unexpected in a crop cleaned prior to shipping. Comparison with the Hoddom assemblages—which can only be tentative, given the very different nature of the depositional contexts between the sites—also reveals the very limited representation of oats at Tarbat compared with the Dumfriesshire site, where ‘tens of thousands of oats’ (*ibid*, 151) were recovered.

The insect assemblages reported here, though for the most part limited by sample size and/or quality of preservation, offer evidence (primarily through records of dung beetles and the chafer *Phyllopertha horticola*) for grazing land at various stages through the period of occupation of the site. Notable also are some elder-rich assemblages which presumably reflect patches of scrub; these

must have been close to the site of deposition in the case of the Period 2 monastic enclosure ditch, and were perhaps boundary hedges, though elder seems unlikely to have been stockproof enough to serve to contain the livestock whose dung was apparently providing a substrate for *Aphodius* and *Geotrupes* dung beetles at the same time. That the elder represents phases of neglect or abandonment of certain areas might also need to be considered.

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Table 1. Detailed notes on the plant and insect material from samples from Tarbat, Portmahomack. For each context, samples are listed in sample number order. Key: Int—Intervention; F—Feature; CN—Context number; SN—Sample number. Measurements of charcoal and wood (in millimeters) are the largest dimension recorded for the largest fragment/s. See Table 2 for material from the samples from the channel/'millpond'. Lists of taxa and other materials recorded are given in Tables 3-5.

Int	F	CN	SN	Notes
Period 0: Fill of charcoal pit/kiln				
14-24	573	3536	8538	The sample comprised a very large bag of charcoal, about 1.7 kg in weight, from which a 20 g subsample was taken at random for identification; nearly all the material was birch (to 35 mm), some of it in the form of roundwood in the range 25-35 mm diameter, with about 5% alder (to 10 mm); of the assemblage overall, about 30-40% of the fragments were in fact bark (to 25 mm), often with tarry deposits on what, in life, would have been external surfaces.
			93526	A subsample of charcoal from one of the two bags of material comprising this sample was cleaned and dried for submission for dating; the material included birch roundwood to 60 mm diameter (and at least 40 years in age), the specimen selected for dating being from the outermost part of a rod of about 25 mm in diameter, representing the last 10 years or so of 40 years' growth (the date obtained was CE 130-380).
Period 1: Fill of ditch interpreted as wood-lined and -lidded water conduit which becomes filled with sand in disuse (Sector 4)				
20	129	1325	390	Though presented as a sample of charred grain, this material comprised 1-2 g of sand and fine charcoal with a single root/rhizome fragment (to 5 mm), but no grain as such.
		1337	360	The sample comprised about 8 g of oak charcoal (to 5 mm) but also including some small charred cereal grains and heather root/basal twig charcoal (to 5 mm); there were a few tens of grains which were probably mostly barley with perhaps a little wheat and one or two tentatively identified grains of rye. With the grains there were rather a lot of rachis fragments of rye (a few tens), and a few of barley and free-threshing hexaploid wheat (no more than about 15 in total). One of the barley rachis fragments still bore marginal hairs but the spikelet insertions here and in the other specimens were rather too eroded to be sure whether this was certainly 6-row barley. No 'twisted' grains were observed.

Int	F	CN	SN	Notes
				There were from this assemblage perhaps also hints of the presence of burnt turves from the records of charred root/rhizome, herbaceous detritus, sedge nutlets and moss stems.
			361	This was a sample comprising a few grammes of charred grain, probably all barley, though with many grains distorted (perhaps 1-2 wheat grains in all) in a total of about 103 specimens; there was also a single small charred legume seed.
			381	The samples was a single fragment of ?willow/poplar/aspen charcoal to 5 mm, the rest clumps of sand with a darkish matrix.
			382	There was a very little unidentified charcoal (to 10 mm) and remains of at least two grains; the latter were very eroded and distorted and may have been wheat and/or barley.
		1345	346	[1345 was specifically a stain of plank/wood lining from the ditch] The material was about 3 g of angular charcoal (?Pomoideae to 10 mm and ?willow/poplar/aspen, to 15 mm) amongst which there were a couple of very distorted charred grains.
			347	The sample (which had been on display at Tarbat Discovery Centre and was examined as a loan from the National Museum of Scotland) consisted of about 15 cm^3 of clean charred cereal grains, weighing approx 35 g. On closer inspection, about 30% was whole grain, the rest fragments (some of which were grain, so that that there were perhaps only 100-200 more or less whole grains) and about 25% wood charcoal to 5 mm; most of the grains were rather distorted by burning and/or were broken. The more complete grains were mainly barley, with some wheat (the proportions about 45% wheat, 40% barley and 15% small ?oat or wild grass grains); there were no other weeds. A few barley and free-threshing wheat rachis fragments were also noted so this was presumably a partly-cleaned crop; also present were a few fragments of charred herbaceous stem (including grass/cereal culm nodes) and ?heather root/basal twig fragments (to 5 mm).
			347	This sample, presumably part of the same material as that just discussed, comprised about 8 g of charred grain, mainly distorted grains, rather poorly preserved, with a little charcoal (to 5 mm, including heather twig fragments) and charred herbaceous detritus; altogether, there were several tens of grains, some clearly barley and others short, squarish bread/club wheat. There were also quite frequent rye and barley rachis fragments . One of the barley fragments was

Int	F	CN	SN	Notes
				rather better preserved than the rest and seems to have come from the 6-row form. A few other rachis fragments were from hexaploid free-threshing wheat, consistent with the grains. Again, there were some hints of the presence of material from burnt turves in the form of sedge and spike-rush nutlets, heather twig fragments and charred root/rhizome material.
			348	There was about 10 g of charcoal and glassy slag (from fire ash?), with a few cereal grains and some clasts of what might be baked (black) soil; closer inspection revealed there were about 11 grains which might mainly have been wheat (though they were very distorted), though with some barley. There were also four rachis fragments of free-threshing hexaploid wheat (three were sufficiently complete to see they lacked the characteristic humps below the glume insertions of tetraploid forms) and a single barley rachis fragment. As in the other samples in this group there was some material which probably originated in burnt turves (heather root/basal-twig to 10 mm, root/rhizome to 5 mm) and a little burnt bone (to 5 mm); the other charcoal (to 10 mm) was tentatively identified as hazel.
			362	The sample comprised about 15 g of sandy soil containing a few very poorly preserved charred cereal grains, perhaps 11 more or less whole ones (plus a few fragments), of which one was barley, the rest wheat/barley, and one perhaps a large-seeded grass; the grains were generally very vesicular, puffed, and distorted.
Period 2, Phase 1: fills of hearth F535				
14-24	535	3406	4655	Charred hazel nutshell, the largest fragment selected for dating: CE 640-770
		3502	4656	(initial hearth fill) The sample comprised about 81 g of charcoal (to 15 mm) with some burnt bone (to 10 mm), the former mainly coarse ?heather root/basal twig fragments with a little willow/poplar/aspen, *Prunus* (blackthorn/cherry/plum, perhaps most likely the first of these), oak, alder, ?holly, birch and hazel. Also present were traces of charred rhizome and some burnt amorphous peat (to 10 mm). The finer fractions produced a few barley grains (no more than about 10 *in toto*), and a little more charred rhizome material.
		3305	4687	In this sample of about 23 g, there was a small amount of charred plant material and burnt and unburnt bone to 5 mm, the first of these including heather twig and ?heather root/basal twig fragments (to 5 mm) with a little hazel nutshell

Int	F	CN	SN	Notes
				and traces of cereal grains, including barley.
		3473	4658	This sample was about 6 g of charcoal to 15 mm; counts of fragments larger than about 5 mm were made as follows: willow/poplar/aspen 3; hazel roundwood 9+?3; ?heather root/basal twig 23 (some quite chunky fragments); oak 42+?1; conifer 2; ?holly 2; ?alder 3, birch 2, indet. 2.
		3499	4659	(backfill) The sample of about 89 g was mainly charcoal (to 15 mm) and burnt bone (to 10 mm) with a little burnt amorphous peat and a few barley grains (no more than about 10 *in toto*); the charcoal was mainly coarse root-twig material of heather with some hazel roundwood, birch, oak and ?*Prunus*, and there was some burnt amorphous peat.
		3500	4660	The sample consisted of about 67 g of charred heather root/basal twig (to 25 mm) and a little burnt peat (to 15 mm); there was also some charcoal of oak, hazel (including roundwood to 10 mm), and a few mostly rather poorly preserved barley grains (fewer than 10 *in toto*) and traces of weed propagules.
14-24	adj. 535	3467	4661	This sample comprised about 83 g of charred heather root/basal twig charcoal (to 15 mm, also some smaller twig fragments) with some oak and birch (to 15), pine (to 25), Pomoideae and alder (to 10), and hazel roundwood (to 15mm diameter); there were a few (<20) barley grains, often quite well preserved, as well as charred bark, peat, bone and a very few weed propagules.
		3528	4662	There was about 8.5 g of clean charcoal, much of it oak with very different ring width patterns – in some cases the rings were so thin as to be almost invisible, whilst others were much wider, but the fragments overall were never more than 20 mm in maximum dimension so no pattern over a period of many years could be discerned; a count of charcoal fragments was as follows: oak 28 (very slow-grown), 21 (moderately well-grown), 8 (well-grown, rings 1-2mm); 4 where rings could not be easily seen and 2 ?oak; 1 hazel, 2 birch; 4 indet., there were also two ?heather root/basal twig fragments (to 10 mm).
Period 2.1: other samples				
14-24	436	2224	92224	(stake in hurdle set in linear gully F436) Waterlogged willow to about 50 mm diameter; a radiocarbon date of CE 630-780 was obtained from a subsample.

Int	F	CN	SN	Notes
14-24	527	3570	8533	(wicker lining of well) A twig of about 14 yrs old and 11 mm diameter, of willow, with a little bark remaining, was selected for radiocarbon dating; the date returned as CE 600-675.
14-24	530	3227	8537	(fill from a stone-lined cistern) The subsample consisted of more or less unconsolidated dark grey-brown humic sand with some stones to 40 mm. A 3 kg subsample disaggregated in water very easily to yield much sand (about 1.3 l.) and a small washover of about 50 cm^3 consisting largely of charred material; amongst the latter were traces of charcoal, including ?heather root/basal twig fragments (both to 10 mm), and charred *Cenoccoum* sclerotia, but was mainly ?burnt peat (to 5 mm).
Period 2, Phase 2: (i) building material from buildings/structures				
26	-	1030	7	The sample comprised about 160 g of charcoal and loose sandy soil; the charcoal proved to be large oak fragments (to 70 mm, all rather to very poorly grown); there were also a few fragments of hazel roundwood (to 12 mm diam. and 12 yrs in age, with wide, then very narrow rings) and traces of bark (to 5 mm) and ?heather root/basal twig fragments (to 3 mm). A radiocarbon sample from this layer gave a date of CE 330-560.
			1005	There was about 11 g of charred material comprising a couple of pieces of charred hazel roundwood (up to 7 years old, 15 mm diameter) and a little flaky vitrified oak charcoal (to 20 mm) in a matrix of fine charcoal and a with a few modern rootlets. With these was a small assemblage of other remains including charred heather twig fragments (and some root/basal shoot material, to 15 mm) and traces of charred oat grains and some charred weed seeds (all of them rather large and probably retained with grain as contaminants after threshing and winnowing). Also present were some traces of ?burnt peat (to 5 mm) and a single nutlet of bog-rush (*Schoenus nigricans*), which may have been charred; it is perhaps most likely to have arrived as a macrofossil in peat.
14-24	-	1866	7756	This sample comprised about 20 g of dried 'flot' from wet sieving, much of it dusty soil with beads of white plant ash and a little burnt bone (both to 5 mm), but there was also some charcoal, including very poorly grown oak (to 15 mm), ?willow/poplar/aspen (to 10 mm) and some ?heather root/twig fragments (to 5 mm). The presence of modest numbers of charred sedge nutlets may indicate material from burnt peat but the other charred remains were of weeds seeds from arable and waste land. There were a few (?charred) perithecia of the fungus *Rosellinia* cf. *mammiformis* likely to have arrived on bark, and a trace of fragments of charred ?seaweed (to 5 mm).

Int	F	CN	SN	Notes
14-24	-	1872	5458	The sample was about 130 g, labelled 'flot': it comprised angular oak charcoal (to 50 mm; moderately well to poorly-grown), with a little burnt bone (to 5 mm).
			6101	About 195 g charcoal comprising large chunks of oak (to 70 mm, moderately well-grown).
			7765	About 40 g of charcoal labelled 'flot', consisting of angular, rather poorly-grown oak to (45 mm), and a little ?heather root/basal twig (to 5 mm); also present were a few well-preserved barley grains along with some weed seeds and sedge nutlets. There were a very few uncharred remains (a leaf of cross-leaved heath, *Erica tetralix*, and an achene of water crowfoot, *Ranunculus* Subgenus *Batrachium*) which, although not charred, did appear to be ancient.
			91872	There was about 110 g of charcoal and dry soil (from which barely 70 g of charcoal remained after dry-sieving to 0.3 mm): it comprised angular fragments of poorly-grown oak (to 30 mm).
14-24	-	1916	5803	Some 15 g of charcoal, comprising a few subangular fragments of moderately- to well-grown oak (to 25 mm).
14-24	-	2704	6551	About 26 g of rather coarse charcoal including one fragment of hazel roundwood (to 10 mm diam., 8 years old), a single knobbly twig fragment of holly (to 10 mm diam., approx 7 years); the largest fragments (to 40 mm) were from a conifer, perhaps pine.
			6509	About 13 g of charcoal including some hazel roundwood (to 15 mm diam., 6 years old), and non-roundwood willow/poplar/aspen (to the same size).
			6743	About 1.6 g of charcoal fragments, including one piece of hazel round wood (to 15mm diam. and 7 years old) and traces of ?birch (to 10 mm) and oak (to 20 mm).
			6773	The sample was about 190 g of charcoal comprising small charcoal fragments and much fine charcoal and soil: there were proportions of about 2:1 of holly and hazel roundwood up to 10 mm diameter and of varying lengths (one holly fragment of this diameter was 7 years old, two of hazel to 10 mm were 6 and 15+ years, and a further piece of hazel to

Int	F	CN	SN	Notes
				15 mm was 12 years old); there were also some other pieces of charcoal which were not overtly roundwood, some appearing to be small pegs. Other taxa included ?birch (to 15 mm) and ?heather root/twig (to 50 mm). A radiocarbon date was obtained for a fragment of hazel round wood: cal. CE 650-860.
			6774	The sample was about 356 g of dusty charcoal labelled 'plank'. About 10% by volume of the charcoal was examined after sieving away finer debris: there was <8 g of roundwood comprising hazel (seven were up to 10 mm, with one fragment showing 6 rings, two with 11 rings, and four with 13-14 years, and one was up to 15 mm with 12 years, all showing wide rings then very narrow ones across the radius from the centre outwards; the largest charcoal fragment (to 40 mm) was alder with a ?cut face, also showing fast then very slow-grown, narrow rings and probably several decades old. There was also some oak (to 40 mm), varying from well-grown to poorly-grown, and a little conifer charcoal, probably pine; much of the rest of the sample seemed to be ash or ashy burnt soil. The characteristic ring width change seen in some material perhaps indicates that it came from woodland which was managed such that the initial growth of newly coppice trees was very fast, but slower as the canopy developed and competition between the poles increased.
			6775	The material was very dusty charcoal weighing about 310 g (labelled 'planks'): there was much fine soil and charcoal which was sieved away to reveal charcoal fragments (to 40 mm) of rather poorly-grown oak with a little flaky bark (to 30 mm). Also present was a little conifer charcoal (probably *Pinus*, to 20 mm), with traces of hazel (to 10 mm) in small fragments embedded in soil (and very crumbly).
			7248	The sample of about 37 g of angular charcoal was labelled 'flot'; it was very dusty but containing a little roundwood of hazel (to 10 mm and 5 yrs), ?alder (30 mm), and oak (30 mm) with traces of poorly preserved charred barley grains and charred elder seeds; a little uncharred bark (to 10 mm) was also noted and there were some other uncharred (and presumably modern) plant remains.
			92704	The material was submitted in three bags; (i) just moist sandy humus/humic sand, apparently raw sediment, weighing 145 g; (ii) a dried ?residue of 125 g of charred heather twig and shoot fragments (with a little basal twig/root material); there were also quite a lot of small pale yellow to slightly orange ?peat ash clasts and traces of burnt bone (to 25 mm); a single rounded fragment of very poorly grown oak (to 25 mm) was also noted; (iii) a third bag with two fragments of mica (to 10 mm).

Int	F	CN	SN	Notes
Period 2, Phase 2: (ii) hearth fills associated with Structure 9				
14-24	445	2468	5489	A sample of <1 g of small charcoal fragments, including ?heather basal twig/root (to 10 mm); a separate sample from this context for dating contained further ?heather and two charred barley grains.
14-24	495	2777	92777	Moist, fine-grained charred material weighing about 575 g: the material was washed to 0.3 mm (there was much fine charcoal) and the residue was found to consist of charred heather root/basal twig and a little sand.
		2786	7202	About 14 g of charcoal, mainly heather root/basal twig (to 10 mm) with traces of willow/poplar/aspen (to 10 mm) and cinder-like 'char' fragments (to 10 mm); a separate sample of material for dating included further heather root/twig fragments and a single large charred barley grain.
		3196	7494	About 5 g of oak (to 15 mm) and heather root/basal twig charcoal (to 10 mm), with traces of charred root/rhizome (to 5 mm) and sedge nutlets, along with ?burnt peat/mor humus (to 3 mm), these last items suggesting the presence of burnt peat or turves; a single charred barley grain was also noted.
14-24	529	3198	7493	About 12 g of 'flot' which appeared to be dusty charcoal and tiny ash beads; it was rewashed and dried before examination: after washing the sample comprised about 8 g of charcoal heather twig and ?willow/poplar/aspen, to 5 mm), all still very strongly silt-coated, with some ?charred amorphous peat (to 5 mm). There were also a couple of snails (one of them burnt), plus a burnt spirorbid shell, likely to have arrived originally on seaweed.
		3252	7497	The original 'flot' of about 33 g was quite dusty and may even have been unwashed material; it was soaked and washed to 0.3 mm and this reduced the dry weight to 20 g. It was found to consist of blackish, lightly concreted sand, perhaps slightly burnt peaty soil, with some charcoal, much of it ?heather root/basal twig (to 15 mm), and one tiny (<1 mm) fragment that might have been burnt seaweed. A small amount of undisaggregated matrix was wetted and examined in a 'squash' under a cover slip on a microscope slide and this suggested that much of this material was in fact *unburnt* mor humus.
Period 2, Phase 2: (iii) other deposits associated with Structure 9				

Int	F	CN	SN	Notes
14-24	-	1917	91917	The material from this sample consisted of sieved, dried residues and some sorted material totalling about 110 g. The largest fragments (to 35 mm) were of fused glassy ash, slightly calcareous when tested with dilute HCl; some other clasts were darkish semi-fused sand and charcoal or other charred plant matter; spirorbids, sometimes fused into ash clasts, were frequent. One bag contained burnt marine mollusc shell, including periwinkle, *Littorina*, another charred plant material which was from seaweed (to 15 mm). The finer fractions were mainly burnt spirorbid shells with a few small gastropods, marine shell fragments, charred seaweed and tiny (to 2 mm) fragments of cancellous bone.
		2109	SF4716	Mineral-replaced wood from a chisel handle was examined for the purposes of identification; in a few places a transverse section was visible which seemed to show aggregate rays and radial pore files suggesting the wood used was alder.
		2889	92889	There seem to have been two samples from this context, one of which was charcoal and soil, the former comprising fragments of moderately well-grown oak to 40 mm, with some ?heather root/basal twig (to 5 mm) and ?burnt peat; also present were some charred herbaceous stems, probably rush/grass and traces of unburnt bone to 5 mm were noted. The presence of charred moss stems may indicate that material from turves was a part of the material here, though moss stems might also be charred in this way within roofing that had been made of cut vegetation. The other sample consisted of further charred monocot stems, some with epidermis carrying a finely warty/papillose surface which may indicate that they were from a large sedge or, in view of the absence of clearly trigonous stems, more likely bulrush, *Scirpus lacustris*, or sea club-rush, *S. maritimus*, but no definitive identification has been possible to date.
		3140	7481	[sandy silt rich in shells and shell fragments - actually part of earth and stone bank 14-24/F476] There was barely 10 g of 'flot' comprising coarser material, to about 15 mm, which seemed largely to be charred seaweed stipe and thallus, with a little wood charcoal, there were also quite a few (?burnt) spirorbid shells and root/rhizome fragments, a single charred wheat grain, fragments of ?burnt marine mollusc shell, traces of foraminiferans, and some grey burnt snails that appeared to be non-marine The fine fraction comprised calcareous ?plant ash. Prof. Terry O'Connor kindly examined two snails and confirms that they are 'lightly charred *Hydrobia* sp., probably *H ulvae*', a species of shallow intertidal/estuarine habitats and likely to be part of a seaweed holdfast community.
		3171	7483	The sample comprised just a couple of grammes: it was mainly fine dusty sediment, with shells which were nearly all

Int	F	CN	SN	Notes
				spirorbids with a trace of snails, and a little charred seaweed and charred herbaceous detritus (the latter perhaps from turves); the fine calcareous material may have been ash.
Period 2, Phase 2: (iv) deposits associated with Structure 7				
14-24	431	3509		(late, final backfill of stone-lined culvert) The sediment in this sample consisted of moist, dark brown to black sandy silty amorphous organic detritus to sandy peaty silt, with some stones (including rotted sandstone) to 15 mm, the matrix working more or less plastic, and apparently disaggregating very easily. The 2 kg (1.25 l.) sample examined yielded a large residue of about 850 cm^3 (though quite a large proportion had not, in fact completely disaggregated even after a long period of soaking), of which about 500 cm^3 was clean sand plus some iron-rich concretions (perhaps at least some of which were actually bone); the residue also yielded some bone of small mammals and fish. The 'washover' of about 350 cm^3 of humic material including some very decayed wood (to 60 mm), probably elder, though there were also some conifer wood fragments (to 5 mm) which often exhibited one straight side as if originating as chips from woodworking. Amongst the other plant remains were quite frequent charred fragments of ?heather root/basal twig (to 10 mm) and traces of charred leafless heather twig (to 5 mm), with traces of uncharred hazel nutshell. The presence of traces of charred moss stems and root/rhizome (to 5 mm) perhaps indicate some material from inwashed burnt turves. The 1-2 mm fraction consisted very largely of uncharred elder seeds and a small range of other propagules also preserved by anoxic waterlogging were noted in this and the <1 mm fraction, the more abundant of these being were toad rush (*Juncus bufonius*) seeds but with blackberry and raspberry (*Rubus* spp.) also present, and with moderate numbers of stinging nettle achenes. There were a few mostly rather decayed beetle fragments and traces of fragments of caddis larval cases, together with moderate numbers of earthworm egg capsules (probably from inwashed soil). On closer inspection of some insect material sorted from the sample, it was found that moderate numbers of fossils were present, but they were both fragmented and generally chemically decayed (brown/orange in colour), and some ever further degraded. Only terrestrial species were present, including the wood-borer *Grynobius planus* (Fabricius) (the only specifically identified beetle from this sample, and the only tree-associated beetle from the site).

Int	F	CN	SN	Notes
	404	2295		(stake, possibly from Structure 7) [collapsed hurdle and stake alignment from 14-24/F404] The sample comprised several twigs, clearly not all the same species; a large one, identified as willow (with bark), was selected for radiocarbon dating (the date returned as CE 650-780).
Period 2, Phase 2: (v) deposits associated with monastic terrace				
14-24	483	2584	2584	(stake) The material, selected for dating, was a fragment of hazel roundwood from within a larger stem, with about 10 years' growth represented (other fragments in the sample were oak or from larger hazel stems; the date returned was CE 600-770.
			6565	About 10 g charcoal which essentially comprised seven angular fragments of well-grown oak (to 35 mm) with birch (from a smallish stem, maybe 40 mm diam.); three fragments were (all?) from a 'dowel'-shaped stem from within a piece of hazel at least 9 years old.
			6745	About 5 g of charcoal, including flaky charred bark (to 45 mm), perhaps from pine, in view of the conifer charcoal (to 10 mm) which was also present; there were, in addition, traces of charred ?heather root/basal twig (to 20 mm).
			7519	About 20 g of charcoal, essentially comprising six fragments of subangular alder charcoal (to 50 mm, >12 years old, very well-grown and about 70 mm in extrapolated diameter).
	adj. 483	2677	6553	(charcoal spread) About 9 g charcoal in the form of clean roundwood fragments of hazel to 15 mm diameter (and 15 years old) and 20 mm (12 years), all except the outermost couple of rings being quite wide.
			6557	The 35 g of angular charcoal comprised five large (to 55 mm) fragments, the largest with the impression of a rod on one side, itself perhaps from a stem of about 50 mm diameter; all the material was hazel to about 20 years in age and well-grown throughout. There were also five fragments of heather root/basal twig to 35 mm.
			6560	About 190 g of angular to somewhat rounded charcoal to 45 mm, including large birch fragments (perhaps the bulk), some hazel (including a twig of 13 years, though only 8 mm in diameter) and a little well-grown oak (to 30 mm) and

Int	F	CN	SN	Notes
				willow/poplar/aspen (to 25mm).
			7255	Some 8 g of angular charcoal which included ?hazel (to 20 mm), ?Pomoideae (to 15 mm) and oak (to 10 mm) with some ?heather root/basal twig to 10 mm.
	-	2697	2697	A sample was taken for dating from the fragments of a slow-grown hazel rod perhaps originally 100 mm diameter and representing some tens of years of growth; the date returned was CE 410-570.
			6581	The 90 g sample contained quite a lot of sand, some of it more or less cohering perhaps because it had been burnt/baked; the charcoal comprised flaky oak (to 15 mm), hazel (to 20 mm) that might have been from roundwood, and traces of ?alder (to 20 mm), with some hazel twig and ?burnt peat (both to 5 mm).
			65811	(a second bag with the sample 6581, so renumbered; it was within a second of the two larger bags containing these samples) About 35 g of essentially 11 large charcoal fragments including alder (to 60 mm), hazel (to 40 mm) and willow/polar (to 45 mm).
Period 2 (not separately phased) Waterlogged fill of basal sequence of monastic enclosure ditch, Sector 1 (contexts considered in stratigraphic order, with lowermost first				
25	132	1407	743	The material received comprised two jars of residue and a small tube from the processing of a 0.5 l. sample by Headland Archaeology. The residues were briefly re-sieved and their volume was approx 275 cm^3, of which nearly half by volume was sand, the rest rather decayed wood, including elder (*Sambucus nigra*) twig and wood fragments (to 20 mm in maximum dimension). There were some clasts of undisaggregated humic silty sand rich in enclosed elderberry seeds, though all the sediment seemed rather oxidized (this matrix material was recorded as looking very much like inwashed soil). The 1-2 mm fraction consisted almost entirely of elder seeds—with, in at least one case, three seeds still in life-position from within a berry, indicating that the fruits are likely to have dropped from overhanging trees into the water of the ditch. Taxa represented by modest numbers of remains were rough chervil (*Chaerophyllum temulentum*), very typical of hedges and shaded field margins, stinging nettle (*Urtica dioica*) and docks (*Rumex* spp.)., which together seem to point to perennial vegetation on ground that had been disturbed but which had become colonised when that disturbance ceased. Only one plant taxon represented aquatic habitats: water crowfoot, *Ranunculus* Subgenus

Int	F	CN	SN	Notes
				Batrachium (though water flea, *Daphnia*, ephippia, were noted during the recording of plant material). Modest numbers of insect fossils, mostly beetles, were recovered (so that a 3-5 kg subsample would almost certainly have provided an interpretatively useful assemblage). Preservation was neither good nor bad (modal E and F both 3.5). There were some aquatics (a hydroporine and a *Limnebius* sp.), though not enough to suggest permanent water. The presence of a few dung beetles (*Aphodius* and *Geotrupes*) suggests that there may have been livestock nearby, or a landscape dominated by grazing land.
		1405	1650	As with the sample from 1407, there were two jars of residue from a 0.5 l. sample, and a small tube containing some remains previously sorted by Headland Archaeology. The residue was briefly resieved and the volume of material found to be approximately 250 cm^3. The material consisted primarily of twiggy wood debris of elder (to 50 x 15 mm) and a little sand with very abundant elder seeds floating at the surface. The wood was all rather decayed (perhaps rather more so than the twigs). There was also some bark, probably again of elder, and some Y-forking branch fragments at the <10 mm diameter scale, some of which, at least, were elder (though with other taxa, too young to identify, also likely to be present). Some small leaf fragments were noted, though these were perhaps not as abundant as stated in Headland Archaeology's assessment report; of these, some may have been willow (*Salix*). The taxa represented by modest numbers of remains again comprised rough chervil, stinging nettle and docks, as in the sample from 1407, and traces of upright hedge-parsley (*Torilis japonica*) fit well with the interpretation of scrub or a hedge margin, as do traces of thorns from blackthorn or hawthorn (*Prunus spinosa/Crataegus* sp.) and prickles from rose (*Rosa*). In contrast, some other remains seem likely to have arrived from some distance away, perhaps via material from human occupation. In this category are the traces of twig fragments and flowers (one containing seeds) of heather (*Calluna vulgaris*), and leaf fragments of bog myrtle/sweet gale (*Myrica gale*) and bog moss (*Sphagnum*), all representative of peatland (and perhaps arriving in peat or other material procured from such a habitat), and the annual weed of cultivated land, black bindweed (*Bilderdykia convolvulus*), with a few other weeds of cultivated land and disturbed places. A single plant—the freshwater stonewort (an alga), *Chara*, represented by its oogonia—indicated aquatic deposition, but there were again some water flea ephippia.

Int	F	CN	SN	Notes
				A moderate number of insect fragments was recovered, so that a 3-5 kg subsample might have produced a useful assemblage. Preservation was generally fairly good (modal E and F both 3.0), though some fossils were considerably more decayed or fragmented. There were two *Aphodius*, and some other taxa often found in dung, including *Cercyon haemorrhoidalis*. Other ecological groups such as weeds and damp moss were represented only by one or two individuals. In contrast to the hints from the plant assemblage, there were no species categorised as 'house fauna' or otherwise strongly synanthropic, so the insect assemblage offered no hint of nearby human occupation, although it appears that such species may sometimes be rare in deposits formed even within metres of a structure (e.g. Kenward 2009, 373-5).
		1404	745	As before, the material comprised two jars of residue and a small tube, from a 0.5 l. sample processed by Headland Archaeology. The residue was briefly resieved and its volume found to be approximately 400 cm^3, of which quite a large proportion was small elder twig fragments (to 50 x 10 mm in maximum dimension), some with 'Y' or 'X' branching. Twig material of alder (*Alnus*) and willow was also present. The material was all rather pale in colour and well preserved, with some hydrogen sulphide evident in the jar containing the coarser fraction. Also present were rather frequent leafless moss stems (perhaps recorded as 'roots' in Headland Archaeology's report); these were probably mostly from species of *Drepanocladus* and *Eurhynchium*, the taxa identified from other (leafy) material in the sample, although there were also some ?pteridophyte roots as in other samples in this sequence). The nature of the sedimentary matrix was revealed through the presence of some clasts of undisaggregated slightly sandy silty humic detritus/humic silt. Once again the 1-2 mm fraction was rich in elder seeds, but there were also abundant achenes of *Ranunculus* Subgenus *Batrachium*, representing a group of plants of standing or gently flowing water and drying mud of ponds and streams. All the other identifiable plant remains were present in trace amounts, though none was prominently indicative of aquatic habitats (some water flea ephippia were noted, however)—there were plants of hedge and scrub habitats (as in the stratigraphically lower samples), and a few weeds of cultivated land and waste places. Quite large numbers of insects were recovered, bearing in mind the small subsample size, and preservation was good (modal E and F both estimated at 2.0). A wide range of habitat types was indicated. Aquatics included the ubiquitous *Agabus bipustulatus*, as well as a hydroporine and an *Anacaena* sp (the last typical of waterside litter and mud). The weevil *Notaris acridulus* lives by water or in damp places, and some of the other terrestrial insects may well have exploited similar environments. There were at least three species of *Aphodius* dung beetles, fragments of *Geotrupes*,

Int	F	CN	SN	Notes
				and various other taxa often found in dung, such as *Onthophilus striatus* (Forster). Grassland was indicated by the chafer *Phyllopertha horticola* and by a click beetle. Together these suggest grazing land. Damp ground with litter and moss was suggested by various Carabidae and the staphylinids *Acidota* sp. and *Olophrum* sp. There were a few plant feeders, among them the nettle weevil *Cidnorhinus quadrimaculatus* (Linnaeus).
		1401		The material again comprised two glass jars of residue and a small tube, representing a 0.5 l. sample processed by Headland Archaeology. The residue was briefly re-sieved and the volume of detritus was approximately 250 cm^3. Some of the wood fragments looked as though they had become somewhat decayed before burial. Clasts of undisaggregated sediment revealed the matrix of the deposit to have been slightly sandy organic silt to silty detritus mud. The residue consisted of twiggy wood debris, the larger twigs, and a flattish fragment of trunk wood 50 x 20 mm, being elder, *Sambucus nigra* (see also Sample 728 and 1401, below) and elder seeds were abundant. As in the sample from 1404, the other abundant taxon was water crowfoot (indeed some fragments of large caddis fly larval case were peppered with the achenes of this plant, the fly larvae having selected them from the bottom of the body of water to help build their cases). Present in modest numbers were seeds of two plants of rather different habitats, though perhaps both likely to have tolerated some shade from scrub or trees: red campion (*Silene dioica*) and woody nightshade (*Solanum dulcamara*). The remaining plant taxa were represented by only very few remains and included some likely to have grown in wetland and others, like rough chervil, perhaps from dry scrub margins. A small group of insect remains was recovered, showing a considerable degree of fragmentation (modal F = 4.0), most taxa being represented by single sclerites, or one or two fragments of one sclerite. Chemical preservation seemed rather better (modal E = 3.0). There were a few water beetles and some taxa associated with waterside situations or damp places (e.g. *Lesteva* or *Geodromicus* sp., *Elaphrus* sp., *Olophrum* sp.). There was a limited range of terrestrial taxa, probably representing a fauna such as was noted in the other samples from this feature.
			728	A timber sample consisting of a chunk of elder (*Sambucus nigra*) trunk to 120 mm in maximum diameter and perhaps at least 25 years old.
			1401	*Sambucus nigra* twigs to about 150 x 15 mm.

Int	F	CN	SN	Notes
Period 2/3 hearth fills in Structure 1 (NB contexts 1082, 1086, 1142 and 11411 appear to relate to disuse and disturbance)				
11	65	1615	4171	(principal surviving fill of F65) About 10 g of fine charcoal, some perhaps willow/poplar/aspen (to 10 mm) but mainly heather root/basal twig fragments and some leafless twig fragments, all to 10 mm; the records of some charred ?grass culm fragments and unidentified root/rhizome, with charred sedge and spike-rush nutlets, perhaps points to the presence of material from burning of turves.
11	65	1621	3994	(overlying 1615) A few grammes of fine (<2 mm) charcoal and other fine debris including coal; no identifications possible.
11	65	11411		(overlying 1621)
			319	About 1-2 nuts'-worth of charred hazel nutshell fragments.
			618	A few grammes of charcoal, mainly oak (to 25 mm), the rest unidentified.
			3935	About 30 g of charcoal with a trace of bone (to 25 mm), the former mainly willow/poplar/aspen (to 35 mm, on the basis of checking a subsample of 10 fragments at random); there were also traces of heather root/basal twig charcoal, flowers and buds. Traces of charred oat and barley grains were also noted, one of the latter showing an emerging radicle and therefore the beginnings of germination. There was a small assemblage of charred weed seeds, all in very small numbers but the finer fractions had rather frequent charred sedge nutlets.
			4011	This residue from a 10 l. sample comprised about 290 g of mainly angular 'gravel', largely consisting of burnt (mainly) cancellous (mainly) bone (to 25 mm) and charcoal (to 40 mm); the latter included rather frequent heather root/basal twig and traces of hazel, as well as Pomoideae. There were also some fragments of charred root/rhizome and traces of burnt marine shell (to 5 mm).
			4012	About 25 g of charcoal including (mainly) ?heather root/basal twig fragments (to 20 mm) and at least two oak wood chips to 20mm.

Int	F	CN	SN	Notes
			4015	Four fragments, less than one whole nut, of charred hazel nutshell.
			4182	One fragment of Pomoideae roundwood, perhaps from a stem 30 mm diameter.
			4188	Several fragments of charcoal (perhaps originally a single fragment) from roundwood of willow/poplar/aspen, perhaps from a stem whose original diameter was 30-40 mm.
11	65	1082	85	A very little charcoal, to 5 mm, with twig fragments to 10 mm, but not identifiable; also present were some bone fragments to 10 mm.
			3385	A small amount of somewhat rounded to subangular charcoal, the species list being rather broad, though with only a very few specimens of any one type: ?alder, Pomoideae, oak, willow/poplar/aspen, heather root/basal twig and bark, all to 10 mm.
			3390	A single fragment (less than half) of a charred hazel nut.
			3392	About 95 g of marine mollusc shell fragments, apparently the >4 mm fraction of a processed sample; also present were a few fragments of charcoal of oak and willow/poplar/aspen to 10 mm and a little bone, burnt and unburnt, to the same size, and metallic slag to 5 mm.
		1086	94	A trace of tiny (<4 mm) unidentified charcoal and bone.
			368	A few fragments of charcoal of oak (to 15 mm) and a very finely diffuse-porous type which could not be identified (to 10 mm).
		1142	100	A few grammes of small wood charcoal (too small to identify) and the odd fragment of bone, heather root/basal twig (all to 5 mm), charred moss stem fragments and a single barley grain.

Int	F	CN	SN	Notes
			525	Fragments from what may once have been a single piece of charred roundwood, perhaps originally up to 30 mm diameter, of willow/poplar/aspen.
			532	A very few grammes of angular alder/hazel (to 15 mm) and oak (to 20 mm).
			534	A few grammes of wood charcoal: hazel (to 25 mm), birch (to 20 mm), ?Pomoideae (to 15 mm) and oak and willow/poplar/aspen (to 10 mm).
			547	A few grammes of charcoal, perhaps originally one larger fragment (of willow/poplar/aspen, to 15 mm) and a bone fragment (to 30 mm).
			554	Three fragments of charred hazel nutshell, the rest angular charcoal, most of it diffuse-porous but rather distorted and difficult to break to get useful surfaces—some, at least, was alder (to 10 mm).
			562	A few grammes of angular charcoal, perhaps largely fragmented from one or a few larger pieces and apparently all hazel (to 10 mm).
	-	1527	1527	(fill of stone-lined 'flue' serving interior of Structure 1) Two-and-a-half barley grains (weight 24 mg) from which a radiocarbon date of CE 1020-1180 was obtained.
Period 3: (i) fills from metal-workers' hearths				
14-24	148	1412	3864	About 1.5 g of charcoal of oak (to 20 mm) and heather root/basal twig (to 10 mm).
			3872	About 0.9 g of charred hazel nutshell and a single charred oat grain.
			3873	About 22 g of dusty charcoal which was rinsed and re-dried, the new dry weight being about 13 g; the sample was primarily charcoal, of which most was oak (angular and very brittle, to 15 mm) with traces of hazel (to 10 mm), heather twig (to 5 mm) and root/basal twig (to 10 mm), with a little charred straw. Some uncharred straw and a small range of

Int	F	CN	SN	Notes
				weed and other seeds are considered to be modern contaminants.
14-24	353	1815	7198	About 10 g of oak charcoal to 10 mm with one small (to 5 mm) fragment of bone, perhaps from a fish.
14-24	-	1545	4804	(metal-workers dump adjacent to Period 3 hearths 14-24/F148 and 14-24/F353) Mineral-replaced wood from the handle of iron sickle was examined to essay an identification: in a few places on detached fragments of metal carrying replaced wood a transverse section visible which looked like diffuse-porous type, but no secure identification was possible.
14-24	299	1724	1724	(fill of Period 3 hearth/fire pit) [charcoal-rich sandy fill of working pit 14-24/F299] The sample consisted of burnt ?peat (or perhaps just burnt richly-organic soil) and heather root/basal twig fragments.
Period 3: (ii) Fills of ditch F3 belonging to and enclosing Structure 5 (Sector 1)				
(silting onto basal wind-blown sand)				
25	3	1156	266	Barely 1 g of sand and modern weed seeds (and earthworm egg capsules), with perhaps 1-2 charred barley grains and traces of charred ?heather root/basal twig fragments to 3 mm.
(slumping episode)				
25	3	1150	286	About 5 g of fine charred plant materials, mainly heather twig (to 5 mm) and ?heather root/basal twig (to 10 mm) with a trace of modern weed seeds.
			305	About 10 g of charred ‘twiggy’ fragments, which could all have been heather root/basal twig, even the larger fragments (to 20 mm).
			306	About 6 g of pure ?plant ash concretions/beads (to 10 mm).
		1151	259	About 7 g of sand with a tiny trace of unidentifiable charcoal to 2 mm.

Int	F	CN	SN	Notes
		1153	294	A few fragments of charred and uncharred material, the former comprising unidentifiable charcoal (to 2 mm) and a single barley grain.
			314	Three fragments of charred plant material of uncertain identification, perhaps from grains.
			315	A few milligrammes of very poorly preserved charcoal and a few fragments of burnt ?tooth (both to 5 mm).
			317	Traces of (uncharred) modern weed seeds.
			1153	Several barley grains, selected for dating.
		1154	265	A few scraps of charcoal (to 2 mm), one ?barley grain, and some modern weed seeds.
			293	Two, perhaps three, very eroded barley grains, plus some (uncharred) modern seeds, and a matrix of a few hundred milligrammes of what might have been uncharred peaty humic sediment, the whole sample barely a gramme in weight.
			311	Four small (to 5 mm) fragments of charcoal, one of which might have been bark rather than wood; the others were diffuse-porous but not identified.
			312	A few scraps of uncharred modern weed seeds.
(phase of burning)				
25	3	1148	258	A little over 3 g of sand and charred plant material which all seemed to be oak charcoal (to 5 mm).
			303	A sample of 2.2 g of angular charcoal, all apparently oak (to 10 mm).
		11415	256	[C1141 in this area, cf. 1141 in Int. 11 which is designated 11411] A sample of about 13 g, but much of it sand and fine charred debris, probably mostly from heather (of which there were some twig fragments to 3 mm) and tentatively

Int	F	CN	SN	Notes
				identified root/basal twig fragments to 5 mm); also noted were charred root/rhizome (to 5 mm) and sedge nutlets, perhaps from burnt turves; there was at least one charred barley grain.
			278	A sample of 9.6 g of charcoal to 25 mm, mainly ?heather root/basal twig fragments, with heather twig (to 5 mm) and charcoal of hazel (5 mm) and oak (15 mm) as well as charred root/rhizome (10 mm) perhaps from turves, and a trace of burnt bone (to 5 mm).
(deposits formed from erosion of bank)				
25	3	1132	235	A sample of no more than about 3 g 'charcoal' of which most was probably just burnt humic soil; there were a very few fragments of unidentified charcoal (to 5mm), and perhaps one fragment of charred seaweed (to 10 mm).
			246	A single ?barley grain and traces of modern weed seeds.
			247	A little over 3 g of material, mainly stones, bone and burnt bone and ?burnt peat, but perhaps at least one scrap of charred ?heather root/basal twig (to 5 mm).
		1135	227	[sand with stones under windblown sand C1134] About 3-4 g oak charcoal (to 10 mm).
			229	<5 g angular charcoal: all oak (to 25 mm).
			281	15.5 g angular charcoal to 15 mm: all of it seemed to be oak.
			289	15 g of material, mostly sand, but with a little oak charcoal (to 10 mm) and some uncharred (modern) weed seeds.
		1136	249	About 18 g of sand with a single fragment of charred ?heather root/basal twig (to 5 mm) and some modern weed seeds.
			250	There was <1.5 g of very degraded charcoal including some coal (both to 5 mm) and a couple of barley grains, with maybe also some burnt and unburnt peat (to 5 mm).

Int	F	CN	SN	Notes
		1140	297	Fine charcoal and sand, in total about 3 g: nearly all the material was charred heather root/basal twig (to 10 mm), but there were quite a few megaspores of lesser clubmoss (*Selaginella*) which may represent unburnt turf soil.
			309	About 3 g of ?heather root/basal twig (to 20 mm), charred root/rhizome (to 5 mm) and some oak charcoal (to 10 mm).
		1147	299	A few modern (uncharred) weed seed fragments.
		1149	263	A few scraps of charcoal (to 2 mm) with some sand and modern seed fragments.
			313	Barely 0.5 g of charcoal including ?heather root/basal twig and oak (both to 5 mm) and half a barley grain.
(sand deposit laid prior to levelling (inc. C1137=C1127=C1128))				
25	3	1127	232	The tiny sample was barren of ancient material.
		1128	248	A single ?barley grain and some uncharred modern seeds and rootlets.
		1130	236	[sand fill in centre of F3 under C1129 and over C1128] <0.5 g of oak charcoal to 10 mm.
		1137	301	Eight charred barley grains and a single modern weed seed.
(layers relating to final ditch levelling)				
25	3	1009	267	Barely 2.5 g of charcoal and some sand: the former was poorly-preserved oak to 10 mm.
		1010	231	A few tiny scraps of charcoal to 2 mm.
		1018	268	A little over 2 g of charcoal, almost all in one angular fragment of well-grown oak to 30 mm.

Int	F	CN	SN	Notes
		1126	230	Two charred barley grains with some uncharred (and probably recent) weed seeds.
			237	Just <2 g of charcoal and some sand: perhaps mainly coarse charred ?heather root/basal twig (to 15 mm), with a trace of oak (to 10 mm).
			257	Probably mostly heather root/basal twig (to 10 mm), rather worn; also a trace of charred root/rhizome (to 5 mm).
Period 3: (iii) Other deposits				
25	13	1027	285	(Fill of central pit within Structure 5) Although collected as 'charcoal', this material was actually 40 cm^3 of mainly amorphous humic sediment, most likely burnt peat (to 5 mm) with a little charcoal (to 5 mm, including ?heather root/basal twig fragments) and some very small barley and oat grains. There were also a few wild radish pod segments, and traces of charred heather flowers. The rather frequent tiny fly puparia in the fine fraction were presumably post-depositional.
			1027	A few barley and oat grains in a matrix of fine charcoal, with and some other (unidentifiable) charred plant material; some of the barley grains (about 63 mg in weight) were selected for possible dating.

Table 2. Detailed notes on the plant and insect material from samples from Tarbat, Portmahomack, from the channel/'millpond' section. The order here is stratigraphic, with the samples from the lower context considered first. Key: Int—Intervention; F—feature; CN—Context number; SN—Sample number; Wt—weight of sample processed (in kilogrammes); Vol—volume of residue recovered (in litres). Measurements of charcoal and wood in millimeters are the largest dimension recorded for the largest fragment/s. A sample from the second of the two column sequences which was used to provide material for AMS dating is interpolated at the appropriate stratigraphic level. A list of taxa and other material recorded is given in Tables 3-5.

Int	F	CN	SN	Wt	Vol	Notes
Period 0-1: earliest fills of stream channel (peat/drift interface)						
14-24	-	2310	4886	0.375	0.215	Unconsolidated, locally rather humic, sand which disaggregated very easily to give a residue of about 140 cm^3 of sand and a washover of 75 cm^3 of humic material. This comprised plant detritus, including abundant very decayed shoots of the moss *Drepanocladus*, species of which are mainly found in marshes and fens. The other plant taxa present were all consistent with such a habitat: abundant nutlets of spike-rush (*Eleocharis palustris sensu lato*) and moderate numbers of propagules of rushes (toad rush, *Juncus bufonius,* and ?jointed rush, *J.* cf. *articulatus*), and lesser spearwort (*Ranunculus flammula*). The presence of modest number of caddis fly larval cases points to aquatic deposition within a body of standing water or flowing water. Although a number of the taxa recorded in trace amounts were also from marshes or fens, there were a few which must have originated in other habitats, notably trampled places (knotgrass, *Polygonum aviculare* agg.) and cultivated land (corn spurrey, *Spergula arvensis*). Traces were present too of charred material likely to have washed or blown from occupation deposits: a little charcoal to 5 mm in maximum dimension, including some charred root/basal twig fragments thought to be from heather. Only a few insect fossils were recovered, but their preservation was fair. The only identified beetles were *Coelostoma orbiculare* (found at water margins) and *Cercyon melanocephalus* (generally in rather foul decaying matter).
			4885	0.355	0.260	This sample was about two-thirds by volume sand, with a slab of dense sandy humic material as in other samples from this part of the sequence. The modest-sized residue of about 260 cm^3 included about 60 cm^3 of sand, the rest being undisaggregated peaty sediment with traces of fine twigs to 10mm and some herbaceous detritus and root fragments. As in sample 4886, the more abundant plant taxa were from low vegetation in a marsh or fen: spike-rush

Int	F	CN	SN	Wt	Vol	Notes
						and lesser spearwort, with sedges (*Carex*) also moderately common. There were quite a lot of leafless moss stems, probably again from *Drepanocladus*, which was identified once more via leafy shoots, or from *Philonotis* (another good indicator of spring, flushes and mires), which was also present; caddis larval cases were again quite common. Traces of seeds of blinks (*Montia fontana*) represent another denizen of such habitats. There were traces of charred ?heather root/twig fragments (to 5 mm) and of sclerotia (resting bodies) of the soil fungus *Cenococcum,* but no other charred remains. There were few insect fossils, but they were fairly well preserved and included some entire sclerites. There was a single *Aphodius*, representing terrestrial habitats, and *Coelostoma orbiculare* and *Plateumaris discolor*, representing waterside, the latter associated with *Carex* spp. according to Philp (2006, 270).
			(49102)	(0.105)		This sample was examined ahead of most of the others reported here to provide material for AMS dating. The material was recorded as a sandy detritus peat rich in moss, mainly slightly abraded *Cratoneuron commutatum* up to about 20 mm long. The fruits and seeds were mainly well preserved, with sedges the most abundant, along with modest numbers of achenes of lesser spearwort, marsh pennywort (*Hydrocotyle vulgaris*), blinks, and marsh cinquefoil (*Potentilla palustris*), all consistent with a marsh or fen habitat. Moderate numbers of caddis larval cases were again recorded. There was no indication of human activity except perhaps via a trace of fine (<2 mm) charcoal.
			4884	0.220	0.550	This was a dark brown, slightly sandy detritus peat with some rootlets and one localised patch of sand. After sieving the residue was found to be mainly small fragments of herbaceous detritus, root fragments, and undisaggregated sediment. There was a trace of tiny (<2 mm) charcoal fragments. Sedge nutlets again dominated the assemblage, along with lesser spearwort, and with smaller numbers of spike-rush and ?jointed rush seeds. *Drepanocladus* shoots were again moderately frequent and a further moss of marshes and fens, *Scorpidium scorpioides*, was also noted, together with seeds of blinks. Caddis larval cases were moderately common once more. A trace of pale persicaria (*Polygonum lapathifolium*) nutlets may indicate a plant growing further off on disturbed soils, although it characterises drying mud at the edges of ponds where the 'disturbance' is presumably caused by changing water levels. Moderate numbers of insect fossils were recovered, with generally good chemical preservation and a

Int	F	CN	SN	Wt	Vol	Notes
						range of fragmentation from whole sclerites to small fragments. There were no true aquatics other than some caddis fly larval cases, but waterside conditions were indicated by *Dryops* sp., *Chaetarthria seminulum*, one of the waterside *Ceryon* species, and *Grypus equiseti*, the last being associated with horsetails (*Equisetum* spp.). There were some other taxa likely to have co-habited with these, but also more fully terrestrial forms such as *Silpha atrata*, *Aphodius contaminatus*, *Nebria brevicollis* and a *Ceutorhynchus* (*sensu lato*) species.
			4883	0.195		This was a dark brown,slightly sandy detritus peat with some rootlets. The volume of the residue was not recorded. Fine roots formed the bulk of the material here, along with other herbaceous detritus. The moderately frequent remains of plants represented by fruits and seeds were sedges, ?jointed rush and lesser spearwort. The mosses present consisted of trace amounts of *Drepanocladus* (amongst which a shoot or two of *D. vernicosus*) was identified. A trace of fat hen (*Chenopodium album*) seeds points to the possibility of some disturbance or cultivation nearby, whilst traces of heather flowers must surely have arrived from occupation material. The tube containing extracted insect fossils was broken on receipt, but remains of *Pterostichus nigrita* suggested damp ground, and an *Aphodius* most probably derived from dung.
			4882	0.210	0.350	This sample was another dark brown, slightly sandy detritus peat with some rootlets. Even after a very long period of soaking the sieved material remained difficult to break down and much of the residue comprised undisaggregated peat crumb largely composed of rootlets. Some clasts were of somewhat lighter, slightly orange-brown, more amorphous material which may have been reworked material arriving by inwash. The largest component of plant material was fine roots, with rather frequent sedge nutlets, toad rush (*Juncus bufonius*) seeds, lesser spearwort achenes and unidentified herbaceous detritus. Moderately common taxa were spike-rush, ?jointed rush, buttercup (*Ranunculus* Section *Ranunculus*) and the tiny seeds of pearlwort (*Sagina*), perhaps a coloniser of bare mud by the water's edge. Caddis larval cases were moderately common, again. The moss stems here were very decayed: mainly 'nerves' and stems with little or no lamina remaining.

Int	F	CN	SN	Wt	Vol	Notes
						Where leaves survived, *Drepanocladus* was again recorded, in modest amounts, with *Scorpidium scorpioides* the only other moss taxon identified. Again, too, there were traces of charred root/twig material from ?heather (to 2 mm) but no other indications of occupation material. There were rather few insect remains, with chemical preservation moderately good through to somewhat pale, and with fragmentation generally considerable. Aquatic and waterside habitats were indicated by *Coelostoma orbiculare* and a donaciine, while fairly dry terrestrial conditions were suggested by *Calathus fuscipes*. The fauna of dung was represented by *Aphodius* sp. and *Geotrupes* sp., while *Cercyon lugubris* (=*obsoletus*) and a second *Cercyon* may have come from dung also.
			4881	0.265	0.400	This was a dark brown, slightly sandy detritus peat with some rootlets and the large residue (even after soaking for a long period) was of roots with some herbaceous detritus amongst disaggregated peat clasts. As in the sample beneath this, there were some slightly paler and apparently less strongly structured clasts which might have been reworked. Sand made up perhaps an eighth of the residue volume of the 400 cm^3. The more abundant plant remains present as propagules were sedges, lesser spearwort and buttercup, with modest numbers of remains of spike-rush, ?jointed rush and pearlwort, and with caddis cases also quite common. The taxa present in trace amounts here included *uncharred* remains of heather (flowers and twig fragments, the latter to 10 mm). The mosses here were again *Drepanocladus* and *S. scorpioides*. A trace of stinging nettle achenes marks the first appearance of a plant whose remains become much more abundant in the upper part of the sequence. The few insect remains were chemically rather well preserved but substantially fragmented. There were a few aquatics (*Coelostoma orbiculare* and a hydroporine), and other taxa likely to have lived in moss or litter in damp places. *Calathus fuscipes* suggested drier conditions, while two species of *Aphodius* together with *Phyllopertha horticola* are perhaps indicative of grazing land.
			4880	0.260	0.400	The sample of dark brown, slightly sandy detritus peat with some rootlets gave a residue that consisted mainly of roots with no identifiable remains particularly abundant. The more frequent taxa were again sedges, spike-rush, toad rush and lesser spearwort, with moderate amounts of the moss *Scorpidium*

Int	F	CN	SN	Wt	Vol	Notes
						scorpioides. All the taxa present in trace amounts were much the same as in the layer beneath. This sample was subjected to paraffin flotation and this produced a single dish of rootlets, with some (mostly orange-brown fragmented) insect fossils. There were a few aquatics (three *Ochthebius ?minimus*). Most of the recorded insects had little ecological significance, but an *Aphodius* and a *Phyllopertha horticola* add to the impression of nearby grazing land obtained from the sample assemblages as a whole.
			4879	0.195	0.400	The dark brown slightly sandy detritus peat with some rootlets and small localised patches (to 10 mm) of sand was rich in rootlets with many sedge nutlets and some herbaceous detritus. Moderately common taxa were spike-rush, toad rush, ?jointed rush, lesser spearwort and buttercup, with the moss *Scorpidium scorpoioides* and a trace also of *Drepanocladus*. Traces of caddis larva cases indicated at least some standing or flowing water. There were a few, rather well preserved, insect remains, including an *Aphodius* dung beetle, the remaining few taxa, including *Elaphrus cupreus*, suggesting waterside habitats.
			4878	0.210	0.400	This sample was further dark brown, slightly sandy detritus peat with some rootlets, and rootlets formed a large proportion of the disaggregated material, in which there were abundant sedge nutlets and lesser spearwort achenes. Smaller amounts of the moss *S. scorpioides* were again present, along with some herbaceous detritus and traces of heather flower, twig fragments (to 5 mm) and fat hen seeds. Spike-rush was present only in very small amounts, in contrast to the frequency with which it occurred lower in the sequence. There were also some small (<1 mm) clasts of black ?burnt humic material, perhaps burnt peat. This sample yielded moderate numbers of insect sclerites, with preservation generally rather good, though a few more decayed. Most remains were fragmented, though in one case (a *Hydroporus*) the body sclerites had remained together. There were indications of water and waterside habitats (e.g. the *Hydroporus*, and *Ochthebius* sp., *Agabus bipustulatus*, *Chaetarthria seminulum*, *Dryops* sp.), but also good representation of dry land. Terrestrial taxa included an *Aphodius*, *Carabus clatratus*, *Ctenicera cuprea* and *Phyllopertha horticola*. There appears to have been open ground nearby, perhaps grazed. The

Int	F	CN	SN	Wt	Vol	Notes
						identification of *C. clatratus* is notable; this is northern a beetle of bogs and moorland.
			4877	0.235	0.550	Much of the residue from disaggregation of this dark brown, slightly sandy detritus peat with some rootlets was, as in 4878, rootlets. Sedge nutlets were abundant as were achenes of lesser spearwort, but no identifiable taxa scored 2 on the 4-point scale of abundance. There were traces of the moss *Calliergon* cf. *giganteum* (a species of wet places like fens and flushes where there is some base-rich water) and *Scorpidium scorpioides* as well as of heather flowers. The small insect fauna from this sample was generally well preserved (sometimes reddened). Aquatic and waterside habitats were indicated by an *Ochthebius* species, *Coelostoma orbiculare*, *Chaetarthria seminulum*, *Elaphrus cupreus* and *Dryops* sp. There was little evidence of terrestrial habitats; some *Pterostichus* were probably of species likely to live near water.
			4876	0.215	0.550	A dark brown, rather sandy detritus peat with some rootlets with a low concentration of identifiable remains within a residue dominated by sand and rootlets. Identifiable remains never scored more than 2 on the 4-point scale of abundance, the more frequent taxa being toad rush seeds and stems of the moss *Calliergon* cf. *giganteum* (there may also have been material of *C. sarmentosum*, by contrast a species of wet sites with mineral enrichment, though not a calcicole). Amongst the rarer remains there were again traces of heather flowers and twig fragments (to 5 mm) and a single fragment of an orache (*Atriplex* sp.) seed, representing a plant perhaps most likely to have lived on disturbed ground, though some species are widespread on shorelines (and the proximity of the site to the coast should be recalled in this regard). The insect remains, rather few in number, ranged from moderately well preserved to somewhat rotted, but the sclerites were not especially fragmented. Aquatic deposition was suggested by *Agabus bipustulatus* and *Ochthebius ?minimus*, while in contrast an *Aphodius*, *Phyllopertha horticola* and *Cercyon ?haemorrhoidalis* may well have originated in grazing land. The leaf beetle *Gastophysa viridula* typically feeds on docks and is common in pastureland.
			4875	0.270	0.400	The large residue from this dark brown, sandy detritus peat sediment included herbaceous stem fragments and fine roots. There were moderate numbers of sedge nutlets, toad rush seeds, and lesser

Int	F	CN	SN	Wt	Vol	Notes
						spearwort and stinging nettle achenes, and the taxa recorded in trace amounts included two whole pod segments of wild radish (*Raphanus raphanistrum*), each with a seed inside—a pretty secure indicator of cultivated land, especially in the company of corn spurrey, fat hen and orache. At the same time, a trace of heather twig fragments (to 5 mm) was also present. The few insect remains were mostly poorly preserved, but included an *Aphodius*.
			4874	0.100		This small sample was examined ahead of the main body to provide seeds for AMS dating. There was some herbaceous detritus amongst the undisaggregated peat forming the bulk of the residue, along with modest numbers of fat hen and chickweed (*Stellaria media*) seeds; taxa present in trace amounts included orache and knotweed along with elder, prickly sow-thistle (*Sonchus asper*) and annual nettle (*Urtica urens*), these last three appearing for the first time in this sequence and representing a significance increase in plants of disturbed habitats close to the boundary between contexts 2310 and 2296 observed in the field.
Period 2.2+: upper fills of 'millpond' (peat/drift interface)						
		2296	4873	0.100		This was another small sample examined ahead of the main body to provide seeds for AMS dating. The crumbly dark brown sandy detritus with some fragments of birch twig yielded a very few remains (though it was only rather cursorily examined beyond the attempted recovery of material for dating); these again included fat hen, chickweed and annual nettle. The only other identified remains were sedge nutlets.
			4872	0.220	0.200	The sediment here was a dark brown, rather sandy detritus peat with some rootlets. Although appearing superficially similar to the sediments assigned to Context 2310, this material passed the sieves relatively easily during disaggregation and was much less structured (and more humified) than in the lower context. Recorded from the residue for this sample were some woody debris, including what was thought securely to be a wood chip (to 10 mm). The twigs present were mainly bark 'shells' with the wood largely

Int	F	CN	SN	Wt	Vol	Notes
						decayed within; one fragment (to 30 mm in length) may have been elder. Seeds of annual weeds were predominant here, orache, fat hen and chickweed being abundant, and with wild radish (pod segments and seeds), prickly sow-thistle, corn spurrey and annual nettle all moderately common. There were much sparser hints of wetland in the form of moderate numbers of sedge nutlets and traces of lesser spearwort and rush seeds. Some taxa not recorded lower in the sequence were seen here, including yarrow (*Achillea millefolium*), flixweed (*Descurainia sophia*) and hemp nettle (*Galeopsis* Subgenus *Galeopsis*), all consistent with vegetation where there is more disturbance, probably through human activity. The insect remains were very much as 4871 in quality and quantity, though less fragmented, but included some taxa suggesting artificial habitats associated with human occupation (notably *Falagria* or *Cordalia* sp. and *Gyrohypnus ?angustatus*). At least four kinds of fly puparium were present, perhaps adding to the evidence that detritus from human occupation was present. There were no aquatics. Additional identifications were *Anotylus rugosus* and *Megasternum obscurum*.
			4871	0.275	0.150	The residue was mainly undisaggregated sandy humic sediment with about 10 cm^3 of sand. The most abundant seeds were again of fat hen and chickweed, with moderate numbers of toad rush, wild radish, prickly sow-thistle, corn spurrey and annual and stinging nettles. To these were added a modest range of other taxa of no particular ecological character, but almost none of them indicators of damp ground or wetland—most were probably from weeds in the broadest sense. There were traces of charred and uncharred ?heather root/twig fragments (to 5 mm) and, for the first time in the sequence, a few rather distorted charred barley (*Hordeum*) grains and traces of ?burnt peat and charcoal (to 5 mm). There were only a few insect fragments, mostly well comminuted, with preservation good to poor (reddish). As in the case of 4870 there were waterside taxa, here including *Chaetarthria seminulum* (Herbst), but the presence of some chinonomid midge head capsules indicates open water. *Megasternum obscurum* and *Anotylus rugosus* were the only other taxa named beyond genus.
			4870	0.245	0.150	The residue was of sandy humic material, mostly only partly disaggregated, with a little sand and some rather decayed woody and herbaceous fragments. The presence of a trace of caddis larval cases indicates that some standing water survived at this stage, and indeed the area must have remained wet year-

Int	F	CN	SN	Wt	Vol	Notes
						round or—presumably—some evidence of desiccation in the form of cracks in the peat would have been visible on excavation. The most abundant propagules were from chickweed and stinging nettle, with modest numbers from sedges, fat hen, rushes, lesser spearwort, docks, prickly sow-thistle, corn spurrey and annual nettle, a mixture suggesting shallow water with a marginal flora but with disturbed ground nearby. The inclusion of some occupation waste seems likely since there was a modest range of charred remains, including rare charred barley grains and rachis and cereal awn fragments, along with a little charcoal (to 10 mm), charred twig (to 5 mm) and ?heather root/twig fragments (to 3 mm) and a trace of uncharred leafless heather twigs. Insect remains were present in small numbers, with preservation ranging from good to poor (reddened). There were two typical waterside plant feeders (a donaciine and *?Notaris acridulus*), but most of the named taxa can be found in many situations. The presence of an *Aphodius* together with *Cercyon analis* and *Megasternum obscurum may* indicate dung nearby, but all could be transported and the last two can also be found in rotting plant remains of other kinds. The only other specific identification was of *Clivina fossor*.
			4869	0.220	0.175	The residue consisted largely of undisaggregated very sandy humic sediment and a little sand. Many remains of the plant remains were noted as being very abraded/decayed, suggesting a terrestrial origin, albeit with deposition in water (there were caddis larval cases, though, as before, no strictly aquatic plant taxa). The more abundant plant macrofossils were from sedges, fat hen, toad rush, lesser clubmoss, buttercup, wild radish, docks, chickweed and annual and stinging nettles, a mixture which reflects deposition into a damp area from disturbed/cultivated land that was presumably nearby. The rarer taxa were all consistent with this, and again there were traces of charred material in the form of barley grains, ?heather root/twig, charcoal (to 10 mm), and ?burnt peat. There was only a small number of fragments of insects, mostly poorly preserved (brown to orange in colour). They gave little indication of local ecology, though none were aquatic.
			4868	0.290	0.100	The residue was of plant debris and undisaggregated sediment and included some sand. Fat hen seeds were abundant, with modest numbers of remains of sedges, wild radish pod segments, dock fruits and chickweed seeds, as well as charred barley grains and rachis fragments (the latter sometimes well

Int	F	CN	SN	Wt	Vol	Notes
						enough preserved to suggest they were from the 2-row form, the former carrying glumes which indicated that they were hulled). The less robust uncharred remains were noted as being rather degraded. The list of components was very similar to that from 4869, with charcoal (to 5 mm), charred heather (and other) twigs and ?burnt peat as well as the cereal remains. Insect remains were represented by only a few fragmented sclerites, with variable preservation. All the identified taxa were terrestrial (some able to live in waterside situations), including an *Aphodius* and the synanthropic spider beetle *Tipnus unicolor*, the only strong synanthrope identified from this sequence of deposits. Other than these, only *Tachinus ?laticollis* and *Anotylus rugosus* were named beyond the generic level.
			4867	0.330	0.125	About two fifths of the residue by volume was sand with a few angular stones (to 10 mm), the rest undisaggregated humic sediment and plant material. Amongst the uncharred remains, dominated by seeds of fat hen and elder, with some sedge, toad rush, buttercup and dock, chickweed and stinging nettle propagules, there were, again, modest numbers of barley grains (some of them rather well preserved, with the husk present), and traces of chaff (a rachis segment) of this cereal, as well as some awn fragments (not identified further but probably also barley). Other charred remains included ?burnt peat and at least one root/rhizome fragment (to 5 mm), the latter thought likely to represent burnt turves (in the sense of grass sods rather than peat *per se*). A few insect fragments had been recovered, mostly poorly preserved but a few in better condition. Terrestrial (some damp ground) taxa, including one *Aphodius*, were present. *Tachinus ?signatus*, *Cercyon analis* and *Megasternum obscurum* may all have lived in rather foul decaying matter nearby.
			4866	0.210	0.120	The residue was mostly very decayed wood and undisaggregated sediment with some sand. The assemblage of seeds was dominated again by elder, with modest amounts of buttercup and stinging nettle, with charred heather twig fragments and some uncharred twigs to 15 mm in maximum dimension. Heather was also represented by traces of charred shoots and perhaps also by root/basal twig fragments. As in the samples immediately below this one, the uncharred remains were recorded as being rather worn. In contrast to the mosses recorded in the lower half of the sequence, the one taxon here was *Eurhynchium praelongum*, a widespread species of shaded terrestrial habitats—almost a ‘weed’

Int	F	CN	SN	Wt	Vol	Notes
						in bryological terms. Amongst the non-plant component, some small scraps of fish and mammal bone pointed to the inclusion of occupation debris, to accompany the charred cereal and wood charcoal. Only a few insect fragments, ranging from well preserved to somewhat decayed, were present, all five recognisable taxa representing terrestrial habitats. *Pterostichus melanarius* and *Megasternum obscurum* were the only specific identifications.
			4865	0.215	0.100	The residue of undisaggregated very humic sand to sandy mud (with about 15% fine sand). The macrofossil assemblage was again dominated by abundant elder seeds with many stinging nettle achenes, and modest numbers of seeds/fruits of willow-herb (*Epilobium*), blinks and buttercup, the rarer taxa including charred heather twig and charcoal (to 5 mm) with a rather limited range of interpretatively not very diagnostic taxa. There were modest numbers of insect remains, with preservation rather good to well rotted and reddish. A terrestrial fauna was present, with indications of damp ground (perhaps waterside) but no aquatics. A single *Aphodius* probably derived from herbivore dung.
			4864	0.240	0.150	With the undisaggregated sandy humic material (including a little sand) were some short lengths of willow twigs to 25 x 5 mm, some small decayed bone fragments, and a trace of charcoal (the latter two components both to 5 mm). Elder seeds and buttercup and stinging nettle achenes dominated the macrofossils, with moderate numbers of remains of mouse-ear chickweed (*Cerastium*), toad rush, blinks (perhaps two subspecies), and lesser spearwort. There seemed to be some increase in the range of taxa representing tall herb vegetation typical of fens and wet meadows in the presence here of meadowsweet (*Filipendula ulmaria*) and ragged robin (*Lychnis flos-cuculi*)—with the abundant buttercup achenes, a lightly grazed damp meadow is perhaps not too fanciful an interpretation. Preservation of uncharred remains was much better here than in the two or three samples beneath, perhaps consistent with a return to somewhat wetter conditions. Only a few insect fragments were recovered, some entire and generally well preserved chemically, though others more decayed.

Int	F	CN	SN	Wt	Vol	Notes
			4863	0.100		A 100 g sample was used to provide material for dating by AMS and it was only rather cursorily examined. The crumbly dark brown sandy, gritty, well-humified humic silt, with bone fragments to 60 mm (some of them very rotted), and a little very decayed wood (to 5 mm). There were rather few seeds, only elder and buttercup reaching an abundance of '2'. Some herbaceous stem fragments had the appearance of flax cultivated (*Linum usitatissimum*) but were not identified more closely (and are excluded from the other tables in this report).
			4862	0.305	0.150	A small proportion of the residue was sand, the rest undisaggregated humic sediment, with a small content of decayed wood fragments (to 10 mm) and other plant remains. Preservation was generally much better than in the underlying sample, suggesting another phase of increased wetness in the 'pool'. Abundant taxa were toad rush, blinks (two subspecies) and lesser spearwort, together suggestive of short turf by a pond or in a very wet meadow. This is reinforced by the presence of modest numbers of seeds of ragged robin and caryopses of sweet-grass (*Glyceria* sp.), the other more frequent taxa being rushes, buttercups, elder and stinging nettle. There were modest numbers of earthworm egg capsules, likely to be washed in from well-drained soils nearby, whilst caddis larval cases also scored '2' and proved that deposition remained aquatic. There was a single charred barley rachis fragment, but no grains, and the only other charred material was a trace of ?heather root/twig. Scraps of uncharred leafless heather shoot were also present. Rather abundant, moderately fragmented, beetles were present, mostly chemically well preserved, though some more decayed. There were insufficient remains for a reliable interpretation, however, with identification limited particularly as many of the fragments were pieces of legs, abdomens and undersides. There were some aquatics and a significant proportion of taxa likely to occur in waterside habitats, especially damp litter and perhaps moss (among these was an *Olophrum* species, either *piceum* or *fuscum*, also noted in several of the other samples). Among the terrestrial forms, two individuals of an *Aphodius* and one *Geotrupes* hint at an appreciable amount of dung in the surroundings. In addition, there were hints of herbaceous vegetation, perhaps in grassland, which was suggested particularly by the weevil *Hypera punctata*, which feeds on *Trifolium* (clovers) (Philp 2006, 289, as *H. zoilus* (Scopoli)).

Table 3. Complete list of plant taxa recorded from deposits excavated at Tarbat, Portmahomack. Nomenclature and taxonomic order follow Tutin et al. *(1964-90) for vascular plants and Smith (1978) for mosses. Numbers of records by phase are presented as a crude measure of frequency, with numbers in parentheses indicating additional tentative identifications. Material was preserved by anoxic waterlogging unless otherwise indicated. 'f'—fragment(s) only, recorded.*

**—Material of* Montia fontana *was recorded from many of the samples from the 'channel/millpond' sequence and initially it was thought that three subspecies (*fontana, chondrosperma, *and* variabilis*) were present. They ideally need to be revisited and have simply been rendered as* M. fontana *here.*

Taxon, vernacular name	Parts recorded	0	0-1	1	2	2-1	2-2	2-2+	2/3	3
No. contexts		1	2	3	4	11	21	1	7	27
No. samples		2	14	11	6	11	42	12	24	53
Selaginella selaginoides (L.) Link [lesser clubmoss]	megaspore(s)		3					8		1
cf. *Equisetum* sp(p). [?horsetail]	rhizome fragment(s)		1					1		
Filicales [fern]	pinnule fragment(s)		3							
cf. *Pteridium aquilinum* (L.) Kuhn [?bracken]	pinnule fragment(s)							1		
Coniferae [conifer]	charcoal fragment(s)					1	4			
Pinus sp(p). [pine]	charcoal fragment(s)					1				
Salix sp(p). [willow]	bud(s)							1		
	twig fragment(s)				1	1	1	1		
	wood fragment(s)					1				
cf. *Salix* sp(p). [?willow]	twig epidermis fragment(s)				1					
Salix/Populus sp(p). [willow/poplar/aspen]	charred roundwood fragment(s)								1	
Salix/Populus sp(p). [willow/poplar/aspen]	charcoal fragment(s)			(2)		2	4(2)		6	
Myrica gale L. [bog myrtle/sweet gale]	leaf fragment(s)				1					

Taxon, vernacular name	Parts recorded	0	0-1	1	2	2-1	2-2	2-2+	2/3	3
Betula [birch]	charcoal fragment(s)	2				5	2(2)		1	
	twig fragment(s)							1		
Alnus glutinosa (L.) Gaertner	bud(s) and/or bud-scale(s)				1					
	charcoal fragment(s)	1				2(1)	3(2)		1(1)	
	twig fragment(s)				1					
cf. *Alnus*	mineral-replaced wood fragment(s)						1			
Betula/Corylus [birch/hazel]	charcoal fragment(s)								1	
Corylus [hazel]	charcoal fragment(s)			(1)		4	7(1)		2	2
	charred roundwood fragment(s)					2	9			
	roundwood fragment(s)						2			
Corylus avellana L. [hazel]	nut(s) and/or nutshell fragment(s)		1			1	1			1
	charred nut(s) and/or nutshell fragment(s)					3			5	1
Quercus [oak]	charred wood chip(s)								1	
	charcoal fragment(s)			1		6	19		6	17
Urtica dioica L. [stinging nettle]	achene(s)		4		4		1	10		
U. urens L. [annual nettle]	achene(s)		1					6		
Polygonaceae [dock/knotweed family]	charred fruit(s)								1	
Polygonum aviculare agg. [knotgrass]	fruit(s)		2		2			5		
	charred fruit(s)					1	2			1
P. hydropiper L. [water-pepper]	fruit(s)				1					
P. persicaria L. [persicaria/red shank]	fruit(s)				3			1		
P. persicaria/lapathifolium [persicarias]	fruit(s)							1		

Taxon, vernacular name	Parts recorded	0	0-1	1	2	2-1	2-2	2-2+	2/3	3
P. lapathifolium L. [pale persicaria]	fruit(s)		2							
Bilderdykia convolvulus (L.) Dumort. [black bindweed]	fruit(s)				f			2, f		
	charred fruit(s)						1			
Rumex acetosella agg. [sheep's sorrel]	fruit(s)		5					5		
Rumex sp(p). [docks]	fruit(s)		3		4		1	8		
	charred fruit(s)						2		1	
	flowering stem fragment(s)				1			1		
Chenopodiaceae [goosefoot family]	charred seed(s)						1			
Chenopodium album L. [fat hen]	seed(s)		5		1		1	10		
	charred seed(s)						3			
Atriplex sp(p). [oraches]	seed(s)		3		1		1	3		
	charred seed(s)						2			
Montia fontana sensu lato[blinks]*	seed(s)		8					3		
Stellaria media (L.) Vill. [chickweed]	seed(s)		2(1)		1		(1)	11		
S. neglecta Weihe in Bluff & Fingerh. [greater chickweed]	seed(s)				(1)			1		
S. cf. *alsine* Grimm [?bog stitchwort]	seed(s)		1					1		
Stellaria sp(p). [stitchworts/chickweeds]	seed(s)				2			1		
Stellaria/Cerastium sp(p). [stitchwort/mouse-ear chickweed]	seed(s)		1					1		
Cerastium sp(p). [mouse-ear chickweeds]	seed(s)		1		2			4		
Sagina sp(p). [pearlworts]	seed(s)		3					1		
Spergula arvensis L. [corn spurrey]	seed(s)		2		1			5		
	charred seed(s)						1		1	

Taxon, vernacular name	Parts recorded	0	0-1	1	2	2-1	2-2	2-2+	2/3	3
Lychnis flos-cuculi L. [ragged robin]	seed(s)							2		
Silene dioica (L.) Clairv. [red campion]	seed(s)				2					
Silene sp(p). [campions, etc.]	seed(s)						1			
Ranunculus Section *Ranunculus* [meadow/creeping/bulbous buttercup]	achene(s)		7		1			10		
R. flammula L. [lesser spearwort]	achene(s)		14					8		
	charred achene(s)			1						
R. Subgenus *Batrachium* [water crowfoots]	achene(s)				3		1	1		
Ranunculus sp(p). [buttercups, etc.]	achene(s)				1					
Cruciferae [cabbage family]	pedicel(s)							1		
Descurainia sophia (L.) Webb ex Prantl [flixweed]	seed(s)							1		
cf. *Cardamine* sp(p).	seed(s)							2		
Brassica sp(p). [cabbages, etc.]	seed(s)							1		
Brassica sp./*Raphanus raphanistrum* L. [brassica/wild radish]	seed(s)							1		
Raphanus raphanistrum L. [wild radish]	charred pod segments and/or fragment(s)			1		2	1	2		1
	pod segments and/or fragment(s)		1					6		
	seed(s)							5		
Filipendula ulmaria (L.) Maxim. [meadowsweet]	achene(s)				1			1		
Rubus idaeus L. [raspberry]	seed(s)				2		1	2		
Rubus fruticosus agg. [blackberry/bramble]	seed(s)				1		1	4		

Taxon, vernacular name	Parts recorded	0	0-1	1	2	2-1	2-2	2-2+	2/3	3
Rubus sp(p). [blackberries, etc.]	seed(s)							1		
Rosa sp(p). [roses]	prickle(s)				2					
Potentilla palustris (L.) Scop. [marsh cinquefoil]	achene(s)		1							
P. anserina L. [silverweed]	achene(s)		1		1					
P. cf. *erecta* (L.) Räuschel [?tormentil]	achene(s)		1		1					
Potentilla sp(p). [cinquefoils, etc.]	charred achene(s)			2						1
Pomoideae (*Crataegus/Malus/Pyrus/Sorbus)* [hawthorn/apple/pear/rowan etc.]	charcoal fragment(s)			(1)		1	(1)		2(1)	
Crataegus sp./Prunus spinosa [hawthorn/sloe]	thorn(s)				1					
Prunus spinosa L. [sloe]	fruitstone(s)				1					
Prunus sp(p). [sloe/plum/cherry, etc.]	charcoal fragment(s)					1(1)				
cf. Leguminosae [?pea family]	charred cotyledon(s)						1			
Euphorbia helioscopia L. [sun spurge]	charred seed(s)						1			
Ilex aquifolium L. [holly]	seed(s)				1					
	charcoal fragment(s)					(2)	2			
Viola sp(p). [violets/pansies, etc.]	seed(s)							1		
	charred seed(s)								1	
Epilobium sp(p). [willow-herbs, etc.]	seed(s)							2		
Umbelliferae [carrot family]	umbel(s)				1					
Hydrocotyle vulgaris L. [marsh pennywort]	mericarp(s)		2							
Chaerophyllum temulentum L. [rough chervil]	mericarp(s)				4					
Conium maculatum L. [hemlock]	mericarp(s)							1(1)		

Taxon, vernacular name	Parts recorded	0	0-1	1	2	2-1	2-2	2-2+	2/3	3
cf. *Apium graveolens* L. [?wild celery]	mericarp(s)							1		
Heracleum sphondylium L. [hogweed]	mericarp(s)				1					
Torilis japonica (Houtt.) DC. [upright hedge-parsley]	mericarp(s)				1					
Erica tetralix L. [cross-leaved heath]	charred leaf/leaves							1		
	leaf/leaves						1			
cf. *E. tetralix*	seed(s)							1		
Calluna vulgaris (L.) Hull [heather, ling]	charred bud(s)								1	
	charred flower(s)/capsule(s)			1			1		2	1
	flower(s)		5		1					
	charred root and/or basal twig fragment(s)			2		4	4		5	1
	charred shoot fragment(s)						1	2		
	shoot fragment(s)				1			3		
	charred twig fragment(s)			1		5	4	4(2)	1	4
	twig fragment(s)		4		1		1	1		
	root and/or basal twig fragment(s)		(1)				2	(2)		1
cf. *Calluna vulgaris*	charred root and/or basal twig fragment(s)		2	1		4	14	7	1	14
Galium aparine L. [goosegrass, cleavers]	charred fruit(s)						2		2	
Galeopsis Subgenus *Galeopsis* [hemp-nettles]	nutlet(s)							1		
Galeopsis sp(p). [hemp-nettles]	nutlet(s)							1		
Stachys sp(p). [woundworts]	nutlet(s)				2		1			
Solanum dulcamara L. [woody	seed(s)				2					

Taxon, vernacular name	Parts recorded	0	0-1	1	2	2-1	2-2	2-2+	2/3	3
nightshade]										
Veronica beccabunga-type [brooklime/water/marsh speedwells]	seed(s)		1							
Sambucus nigra L. [elder]	seed(s)		1	1	4		1	9		
	charred seed(s)						1, f		1	
	twig fragment(s)				5					
	wood fragment(s)				4					
Campanula sp(p). [bellflowers, etc.]	seed(s)							2		
Achillea millefolium L. [yarrow]	achene(s)							2		
Arctium sp(p). [burdocks]	achene(s)				1					
Carduus/Cirsium sp(p). [thistles]	achene(s)				2			2		
Sonchus asper (L.) Hill [prickly sow-thistle]	achene(s)		1		2			5		
S. oleraceus L. [sow-thistle]	achene(s)				1					
Lapsana communis L. [nipplewort]	achene(s)				3					
Alisma sp(p). [water-plantains]	carpel(s) and/or seed(s)				3					
cf. *Iris pseudacorus* L. [?yellow flag]	seed(s)							1		
Juncus inflexus L./*J. effusus* L./*J. conglomeratus* L. [hard/soft/compact rush]	seed(s)		1					1		
J. bufonius L. [toad rush]	seed(s)		11		1		1	8		
J. cf. *articulatus* L. [?jointed rush]	seed(s)		10					2		
Juncus sp(p). [rushes]	seed(s)		1		2			6		
Gramineae [grasses]	waterlogged caryopsis/es							4		
	charred caryopsis/es			(1)			1			
Glyceria sp(p). [sweet-grasses]	caryopsis/es				2			2		
Gramineae/Cerealia [grasses/cereals]	charred culm node(s)			1						

Taxon, vernacular name	Parts recorded	0	0-1	1	2	2-1	2-2	2-2+	2/3	3
Gramineae/Cerealia [grasses/cereals]	charred culm fragment(s)							1		
Gramineae/Cerealia [grasses/cereals]	charred caryopsis/es						1			
Gramineae/Cerealia [grasses/cereals]	waterlogged caryopsis/es		1							
Cerealia indet. [cereals]	charred caryopsis/es			4		1				
Cerealia indet. [cereals]	charred awn(s)/awn fragment(s)							3		
Cerealia indet. [cereals]	charred culm fragment(s)									1
Triticum 'aestivo-compactum' [bread/club wheat]	charred caryopsis/es			2						
Triticum sp(p). [wheats]	charred caryopsis/es			2			1			
	charred free-threshing hexaploid rachis fragment(s)			4						
Triticum/Hordeum sp(p). [wheat and/or barley]	charred caryopsis/es			2						
Secale cereale L. [rye]	charred rachis fragment(s)			2						
cf. *S. cereale*	charred caryopses			2						
Hordeum sp(p). [barley] (* - including hulled grains)	charred caryopsis/es			7		5	5	5*	3	10(4)
(* - including 2-row forms)	charred rachis fragment(s)			4*				4*		
Avena sp(p). [oats]	charred caryopsis/es			(2)			1		1	4
Scirpus setaceus L. [bristle club-rush]	nutlet(s)		2		1			2		
Eleocharis palustris sl [common spike-rush]	nutlet(s)		10					1		
	charred nutlet(s)								1	
Eleocharis sp(p). [spike-rushes]	nutlet(s)				1					
	charred nutlet(s)			1						
Schoenus nigricans L. [bog-rush]	nutlet(s)						1			

Taxon, vernacular name	Parts recorded	0	0-1	1	2	2-1	2-2	2-2+	2/3	3
Carex cf. *paniculata* L. [?greater tussock sedge]	charred nutlet(s)					1				
Carex sp(p). [sedges]	nutlet(s)		14		2			8		
	charred nutlet(s)			2			3		2	1
Mosses	all were leaf/leaves and/or shoot fragment(s)									
Sphagnum sp(p).					1					
Bryum sp(p).			1							
Philonotis sp(p).			1							
Cratoneuron commutatum (Hedw.) Roth			1							
cf. *Amblystegium* sp(p).								1		
Drepanocladus vernicosus (Mitt.) Warnst.			1							
Drepanocladus sp(p).			9		1					
Scorpidium scorpioides (Hedw.) Limpr.			8					1		
Calliergon cf. *giganteum* (Schimp.) Kindb.			2							
Calliergon sp(p).			1							
Homalothecium sp(p).					2					
Eurhynchium cf. *praelongum* (Hedw.) Br. Eur.								2		
Eurhynchium sp(p).					1			2		
'Algae'										
Chara sp(p).	oogonium/ia				1					

Taxon, vernacular name	Parts recorded	0	0-1	1	2	2-1	2-2	2-2+	2/3	3
Fungi										
Rosellinia cf. *mammiformis* (Persoon ex Fries) Cesati & de Notaris	perithecia (?charred)						1			
Cenococcum	charred sclerotia		1			1				

Table 4. Components other than identifiable plants from deposits at Tarbat, Portmahomack, recorded during examination of plant remains. Numbers in parentheses indicate less certain identifications.

Taxon	0	0-1	1	2	2-1	2-2	2-2+	2/3	3
No. contexts	1	2	3	4	11	21	1	7	27
No. samples	2	14	11	6	11	42	12	24	53
ash						3(1)			
'ash beads'					1	11		5	3
ash concretions									2
glassy ash						1		1	
glassy slag			1			1			
metallic slag					1			1	
burnt peat fragments					4(1)	(4)	(4)		(4)
?burnt peat/mor humus						1			
?peat ash						1			
?peat fragments									1
burnt soil			1			(2)			1
bark fragments		3		2		3	2		
bark fragments (charred)	1				2	2		2	
charcoal	1	5	7		7	8	9	13	13
dicotyledon leaf fragments		3		1			1		
herbaceous detritus		14		1			4		
herbaceous detritus (charred)			2			1		1	
leaf abscission pads				2					
moss (charred stem fragments)			1			2	1	1	
moss (leafless stems)		4		2			2		
'pinched' stems (charred)						1			
rhizome fragments		6							
rhizome fragments (charred)					2				
root bark/epidermis fragments				2					
root/rhizome fragments		2							
root/rhizome fragments (charred)			4			3	3	2	4
root/rootlet fragments		13		1			4		
seaweed (charred)						3			
twig bark fragments				2					
twig fragments		9		1			7		
twig fragments (charred)		1					2	1	
wood chips							1		
wood fragments				2		1	6		
wood fragments (min)									1

Taxon	0	0-1	1	2	2-1	2-2	2-2+	2/3	3
woody root fragments				2					
caddis larva cases		13		2		1	9		
Daphnia (ephippia)				4					
earthworm egg capsules		6		4		1	10		
fly puparia		9		4			10		
foraminifera						1			
mites		2		4			2		
burnt marine mollusc shell fragments						2		1	
marine mollusc shell fragments								1	
snails						4			
snails (charred)						1			
spirorbids						3			
spirorbids (burnt)						1			
bone fragments					3	6	4	5	2
burnt bone fragments			1		5	3	2	1	2
burnt fish bone					1				1
burnt mammal bone								1	
burnt teeth					1				1
fish bone					2	1	1	1	
mammal bone								2	
small mammal bone						1			
coal								1	2
concretions					1				
gravel								2	
grit		2		3		2	4		
sand		14		4	1	6	12		5
stones		3		2	5	5	5		1

Table 5. Complete list of invertebrates recorded from the Channel/Millpond deposits at Tarbat, Portmahomack. Nomenclature and taxonomy for beetles follow Kloet and Hincks (1964-77). Typical habitat: w – aquatic; d – damp ground, waterside mud or moist litter; f – foul matter or dung (including species often but not exclusively, found in such habitats); t – typically terrestrial; ss – strongly synanthropic. Each '+' indicates presence in one sample.

Taxon	Typical habitat	0-1	2-2+
Saldidae sp.	d		+
Delphacidae sp.		++	
Trichoptera sp. (case)	w	+	
Carabus clatratus Linnaeus	t	+	
Elaphrus cupreus Duftschmid	d	++	
Nebria brevicollis (Fabricius)	t	+	
Clivina fossor (Linnaeus)	t		+
Bembidion spp.			+
Pterostichus diligens/strenuus	d	+	
Pterostichus melanarius (Illiger)	t		+
Pterostichus nigrita (Paykull)	d	++	
Pterostichus sp.		++++	+
Calathus fuscipes (Goeze)	t	++	
Agonum spp.	d	++	
Carabidae spp.		++	+
Hydroporus sp.	w	+	
Hydroporinae sp.	w	+	
Agabus bipustulatus (Linnaeus)	w	++	
Helophorus aquaticus/grandis	w		+
Coelostoma orbiculare (Fabricius)	w	+++++	
Cercyon analis (Paykull)	f		++
Cercyon ?haemorrhoidalis (Fabricius)	f	+	
Cercyon lugubris (Olivier)	f	+	
Cercyon melanocephalus (Linnaeus)	f	+	
Cercyon sp.		+	
Cercyon sp. (aquatic form)	d/w	+	+++
Megasternum obscurum (Marsham)	f		++++++
Chaetarthria seminulum (Herbst)	w/d	+++	+
Ochthebius ?minimus (Fabricius)	w	++++	
Leiodinae sp.			+
Catops sp.			+
Silpha atrata Linnaeus		+	
Silphinae sp.			++
Olophrum sp.	d	+	++++

Taxon	Typical habitat	0-1	2-2+
Platystethus sp.		+	
Anotylus nitidulus (Gravenhorst)	d/f		+
Anotylus rugosus (Fabricius)	d/f		+++++
Stenus sp.		++	+++++
Lathrobium sp.			+
Gyrohypnus ?angustatus Stephens	f		+
?*Xantholinus* sp.			+
Philonthus sp.			+
?Heterothops sp.			+
Quedius sp.			++
Staphylininae spp.		++++	++++
Tachinus ?laticollis Gravenhorst	f		+++
Tachinus ?signatus Gravenhorst	f		++++
Tachyporus sp.		+	
Falagria/Cordalia sp.			+
Aleocharinae sp.			+
Geotrupes sp.	f	+	+
Aphodius contaminatus (Herbst)	f	+	
Aphodius spp.	f	+++++++++	+++++
Phyllopertha horticola (Linnaeus)	t	++++	
Cyphon sp.	d		+
Byrrhidae sp.	t	+	
Dryops sp.	d	+++	
Ctenicera cuprea (Fabricius)		+	
Elateridae sp.		+	+
?Cantharidae sp.		+	
Tipnus unicolor (Piller & Mitterpacher)	ss		+
Meligethes sp.			+
Cryptophagus sp.			+
Plateumaris discolor (Panzer)	d	+	
Donaciinae sp.	d	+	++
Gastrophysa viridula (Degeer)		+	
Chrysomelinae sp. indet.			++
Halticinae sp.			+
Phyllobius/Polydrusus sp.		+	
Hypera punctata (Fabricius)	t		+
?Notaris acridulus (Linnaeus)	d		+
Grypus equiseti (Fabricius)	d	+	
Ceutorhynchus (s. lat.) sp.		+	+
Ceutorhynchinae sp.		++	+

Taxon	Typical habitat	0-1	2-2+
Curculionidae (s. lat.) spp.		++	+++
Coleoptera sp. (larva)			+
Bibionidae sp.		+	
Chironomidae sp. (larva)	w		+
Diptera spp. (puparium)		++++++	+++++
Hymenoptera Parasitica		+	
Acarina sp.		++	++

Table 6. Plant taxa from the channel/millpond sequence at Tarbat, Portmahomack. Nomenclature and taxonomic order as in Table 3 (though authors of Latin names and vernacular names are omitted here), and with the stratigraphically lowermost at the left-hand side. A few taxa of limited interpretative value (usually because they are not identified beyond family or genus, or are only tentatively identified) are also omitted. Numbers are the semi-quantitative abundance score on a four-point scale for that sample; numbers in parentheses indicate tentative identifications.

**—see note concerning* Montia *in the caption to Table 3.*

Taxon and parts	**4886**	**49102**	**4885**	**4884**	**4883**	**4882**	**4881**	**4880**	**4879**	**4878**	**4877**	**4876**	**4875**	**4874**	**4873**	**4872**	**4871**	**4870**	**4869**	**4868**	**4867**	**4866**	**4865**	**4864**	**4863**	**4862**
	2310													2296												
Selaginella selaginoides [megaspore(s)]						1			1			1				1	2	2	2	2	2	1	1			
Filicales [pinnule fragment(s)]		1		1	1																					
Salix sp(p). [bud(s)]																										1
[twig fragment(s)]																								1		
Betula sp(p). [twig fragment(s)]															1											
Corylus avellana [nut(s) and/or nutshell fragment(s)]	1																									
Urtica dioica [achene(s)]							1	1				1	2			2	2	3	2	1	2	2	3	3		2
U. urens [achene(s)]														1	1	2	2	2	2	1						
Polygonum aviculare agg. [fruit(s)]	1													1		1	1	1	1					1		

Taxon and parts	4886	49102	4885	4884	4883	4882	4881	4880	4879	4878	4877	4876	4875	4874	4873	4872	4871	4870	4869	4868	4867	4866	4865	4864	4863	4862
P. persicaria [fruit(s)]																										1
P. lapathifolium [fruit(s)]				1					1																	
Bilderdykia convolvulus [fruit fragment(s)]																1										
[fruit(s)]																	1	1								
Rumex sp(p). [flowering stem fragment(s)]																		1								
[fruit(s)]			1										1	1		2	1	2	2	2	2		1			1
Rumex acetosella agg. [fruit(s)]	1					1	1	1						1		2	1	1	1					1		
Chenopodium album [seed(s)]	1				1					1			1	2	1	3	3	2	2	3	3	1	1			1
Atriplex sp(p). [seed(s)]												1	1	1		3			1	1						
Montia fontana sensu lato [seed(s)]*	1	2	1	1		1	1	1	1												1		2	2		3
Stellaria media [seed(s)]							(1)						1	2	1	3	3	3	2	2	2	1	1	1		1
S. neglecta [seed(s)]																	1									
S. cf. *alsine* [seed(s)]					1																					1
Cerastium sp(p). [seed(s)]						1															1		1	2		1
Sagina sp(p).						2	2	1																		1

Taxon and parts	4886	49102	4885	4884	4883	4882	4881	4880	4879	4878	4877	4876	4875	4874	4873	4872	4871	4870	4869	4868	4867	4866	4865	4864	4863	4862
[seed(s)]																										
Spergula arvensis [seed(s)]	1												1			2	2	2	1	1						
Lychnis flos-cuculi [seed(s)]																								1		2
Ranunculus S. *Ranunculus* [achene(s)]	1				1	2	3	1	2				1				1	1	2	1	2	2	2	3	2	2
R. flammula [achene(s)]	2	3	2	3	2	3	3	2	2	3	3	1	2	1		1	1	2	1	1				2	1	3
R. Subgenus *Batrachium* [achene(s)]																								1		
Descurainia sophia [seed(s)]																1										
Brassica sp(p). [seed(s)]																			1							
Brassica sp./*Raphanus raphanistrum* [seed(s)]																2										
Raphanus raphanistrum [charred pod segments and/or fragment(s)]																	1				1					
[pod segments and/or fragment(s)]													1			2	2	1	2	2	1					

Taxon and parts	4886	49102	4885	4884	4883	4882	4881	4880	4879	4878	4877	4876	4875	4874	4873	4872	4871	4870	4869	4868	4867	4866	4865	4864	4863	4862
[seed(s)]																2	1	1		1	1					
Filipendula ulmaria [achene(s)]																								1		
Rubus idaeus [seed(s)]																								1		1
R. fruticosus agg. [seed(s)]																			1		1	1		1		
Rubus sp(p). [seed(s)]																			1							
Potentilla palustris [achene(s)]		2																								
P. anserina [achene(s)]									1																	
P. cf. *erecta* [achene(s)]													1													
Viola sp(p). [seed(s)]																1										
Epilobium sp(p). [seed(s)]																						1	2			
Hydrocotyle vulgaris [mericarp(s)]		2						1																		
Conium maculatum [mericarp(s)]																					1		(1)			
cf. *Apium graveolens* [mericarp(s)]																								1		
Erica tetralix [charred																							1			

Taxon and parts	4886	49102	4885	4884	4883	4882	4881	4880	4879	4878	4877	4876	4875	4874	4873	4872	4871	4870	4869	4868	4867	4866	4865	4864	4863	4862
leaf/leaves]																										
cf. *E. tetralix* [seed(s)]																				1						
Calluna vulgaris [charred shoot fragment(s)]																	1					1				
[charred twig fragment(s)]																				1		2	1	1		
[flower(s)]					1		1			1	1	1														
[shoot fragment(s)]																	1	1								1
[twig fragment(s)]							1			1		1	1			1										
cf. *C. vulgaris* [charred root and/or basal twig fragment(s)]	1		1													1	1	1		1	1	1				1
[charred twig fragment(s)]																			1		1					
[root and/or basal twig fragment(s)]						1										1										
[root fragment(s)]																	1									
Galeopsis sp(p). [nutlet(s)]																		1								
G. Subgenus *Galeopsis* [nutlet(s)]																1										
Veronica beccabunga-type [seed(s)]							1																			
Sambucus nigra														1				1	1	1	3	3	3	3	2	2

Taxon and parts	4886	49102	4885	4884	4883	4882	4881	4880	4879	4878	4877	4876	4875	4874	4873	4872	4871	4870	4869	4868	4867	4866	4865	4864	4863	4862
[seed(s)]																										
Campanula sp(p). [seed(s)]																	1	1								
Achillea millefolium [achene(s)]																1	1									
Carduus/Cirsium sp(p). [achene(s)]																	1	1								
Sonchus asper [achene(s)]														1		2	2	2	1		1					
Juncus inflexus/J. effusus/J. conglomeratus [seed(s)]							1											1								
J. bufonius [seed(s)]	2	1	1	1	1	3	1	2	2			2	2			1	2	1	2	1	2			2		3
J. cf. *articulatus* [seed(s)]	2	1	1	2	2	2	2	1	2	1						1								1		
Juncus sp(p). [seed(s)]				1														2	1	1	1		1			2
Gramineae [waterlogged caryopsis/es]																1	1		1				1			
Gramineae/ Cerealia [charred culm fragment(s)]																				1						
Gramineae/ Cerealia [waterlogged caryopsis/es]													1													

Taxon and parts	4886	49102	4885	4884	4883	4882	4881	4880	4879	4878	4877	4876	4875	4874	4873	4872	4871	4870	4869	4868	4867	4866	4865	4864	4863	4862
Cerealia indet. [charred awn(s)/awn fragment(s)]																		1		1	1					
Glyceria sp(p). [caryopsis/es]																								1		2
Hordeum sp(p). [charred caryopsis/es]																	1	1	1	2	2					
[charred rachis fragment(s)]																		1		2	1					1
Scirpus setaceus [nutlet(s)]	1								1									1						1		
Eleocharis palustris sl [nutlet(s)]	3	2	2	2	1	2	2	2	2	1											1					
Carex sp(p). [nutlet(s)]	1	3	2	3	2	3	3	2	3	3	3	1	2	1	1	2	1	2	2	2	2	1				
Bryum sp(p).							1																			
Philonotis sp(p).			1																							
Cratoneuron commutatum		4																								
cf. *Amblystegium* sp(p).																							1			
Drepanocladus vernicosus					1																					
Drepanocladus sp(p).	2		1	2	1	2	1	1	1			1														
Scorpidium				1		1	1	2	2	2	1		1					1								

Taxon and parts	4886	49102	4885	4884	4883	4882	4881	4880	4879	4878	4877	4876	4875	4874	4873	4872	4871	4870	4869	4868	4867	4866	4865	4864	4863	4862
scorpioides																										
Calliergon cf. *giganteum*											1	2														
Calliergon sp(p).													1													
Eurhynchium cf. *praelongum*																						1		1		
Eurhynchium sp(p).																							1			1