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MACROBOTANICAL REMAINS FROM THE ROMAN FORT OF BANNA (BIRDOSWALD, CUMBRIA).

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Summary

Two hundred and eighty nine bulk samples from, predominantly, the Granaries and Ditches of this Roman fort on Hadrian's Wall were analysed. Disappointingly few seeds in total were recovered from the Granaries indicating that no catastrophic fires had occurred. Almost equal quantities of wheat and barley grain were present; the wheat included spelt and bread wheat. Oats and rye were present in very small quantites. All of these species could have been for human consumption although the use of barley as cavalry horse feed is discussed, and the oats and rye are considered to have been weeds amongst other cerials. Most of the weeds related to ruderal species or those characteristic of general cultivation rather than specifically cereal cultivation. The possibility of local cereal production is also discussed. Plant remains from the Ditches indicated the presence of water in them and some disposal of rubbish and faecal material, the latter in the form of wheat/rye and barley bran. The exotic taxa normally so characteristic of Roman urban assemblages are missing, perhaps indicating a lower status fort; it is certainly somewhat remote.

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Macrobotanical remains from the Roman fort of Banna (Birdoswald, Cumbria)

J.P. Huntley

Introduction

The Roman fort at Birdoswald on Hadrian's Wall, Cumbria (NY 615663) (Figures 1 and 2) was used during much of the Roman occupation of northern England and, apparently, during the subsequent "Dark Ages". Following a period of disuse it was re-occupied from at least the 13th century until the present day. During its Roman occupation there must have been a considerable number of men stationed there, given its size, requiring considerable amounts of grain and other food. Documentary evidence suggests that the Roman government preferred to utilise a local source for food if at all possible in view of high transportation costs (Manning, 1975). If this is true then palaeoenvironmental analysis of botanical material from within and around this major fort should substantiate this.

Approximately 8% of the whole fort has been excavated and this has been prior to consolidation of the site for improving visitor access. Two main granaries have been excavated as has the area around the western gateway both inside and outside the fort perimeter walls.

The bulk of the site is not waterlogged, although parts were extremely wet during excavation, and preservation of seeds is therefore only likely to have occurred if they were carbonised. The ditch fills outside the wall were, however, waterlogged. Sampling strategies were discussed with the excavator throughout and material was collected from a wide variety of features. On-site flotation of bulk samples allowed the concentration of carbonised cereal grains *etc.* from the granaries whereas wet sieving of small samples from the ditch deposits allowed examination of rubbish disposal and dietary waste.

Excavation of this site therefore provided the first opportunity to investigate the provisioning of a Roman frontier fort that was not served by a major waterway. The long period of occupation allowed for temporal differences to be determined in an attempt to see if the army took advantage of local cereal production, if any, once they had established themselves and what happened following their withdrawal in the fifth century.

Whereas the carbonised cereal grain, if present, would indicate what was being stored in the granary it does not necessarily imply anything of the origin of that grain and this is

obviously important when looking at the overall impact of the Romans in the area. Also, with respect to the waterlogged material this does not give an overall impression of the landscape although should indicate something of the local plant communities present. To investigate the overall impact Birdoswald fort is in an ideal situation in that immediately to the north of it lies Midgeholme Moss and from which a pollen diagram has been prepared (Innes, 1988). The diagram covers the majority of the Post-Glacial period and shows evidence of clearance phases although these have not been precisely dated. By comparison with other and dated diagrams from the area (Davies and Turner, 1979) at least one of the major phases was inferred to have been during the Roman period and cereal pollen was recorded from this phase. Detailed, fine resolution analyses using material from the upper part of this moss, along with radiocarbon dates should determine both when the clearances occurred and, in more detail, what type or types of cultivation were being practised. In addition to the continuous picture of the changing vegetation derived from the Midgeholme site there are also samples from within the fort suitable for pollen analytical work. These include the so-called "morass" to the south of the South Granary and upon which its buttresses were built - this has been archaeologically dated to pre-AD 205. Buried soils have been located at two positions, the first from under the rampart of the stone fort c.AD 130-136 and a second under the Turf Wall to the west of the site. Analyses of such material should give "snap shots" of the vegetation at particular times and which, hopefully, could be slotted into the main Midgeholme sequence. In this way both the overall changes in vegetation from pre-Roman to, possibly, Medieval times can be investigated as well as the vegetation at specific times during the Roman occupation of the site.

The palynological work (Wiltshire, in prep.) is being carried out separately from the macrobotanical due to time restraints. This report therefore deals only with macrobotanical remains from excavations within the fort.

Methodology

Bulk samples of between 6 and 25 litres of material were floated on-site over 500μ mesh. Initially, and in order to investigate spatial differences, the baulks of sediment between the granary bays were divided into grids, and individual samples taken from a selection of grid squares. Following drying the residues were dispatched to Fort Cumberland for sorting. Very few carbonised fruits and seeds were recovered from these residues. The flots were retained for sorting in the Biological Laboratory. This was carried out at magnifications of up to x40 and the seeds/fruits were identified by comparison with modern reference material held in the above laboratory. Nomenclature throughout follows Clapham, Tutin and Moore (1987). Where identification was imprecise and two or more species were possible a "type" was used such that:

Ranunculus repens-type includes *R. repens, R. acris* and *R. bulbosus,*

Carex hostiana-type includes *C. hostiana, C. flacca, C. panicea, c. binervis* and *C. sylvatica*, and

Rumex obtusifolius-type includes *R. obtusifolius, R. conglomeratus* and *R. crispus*.

Due to the large numbers of samples, to the results of scanning during assessment and to the limited available time it was decided to analyse all of the >1mm flots and only scan the 0.5-1.0mm fraction.

Initially each sample was treated as a separate entity and coded thus for computer analysis. In order to bulk up very low numbers of seeds all samples from any one context were then amalgamated and assigned a new 'sample' code number. Following advice from the excavator some of the contexts themselves were able to be bulked and these second amalgamations were likewise coded separately. Although somewhat complicated this method does allow analysis at various levels of detail. For reference purposes only these various assignments are detailed in Appendix I. Appendix II presents tables of data with all of the sub-samples listed (by context order as in Appendix I) and the taxa ordered alphabetically. Summary tables at the context level only are presented within the main body of text. Appendix III lists the taxa represented and their common English names. All tables of carbonised data present the actual numbers of items counted, *ie.* they do not take into account the differing volumes of sediment floated. From the earlier years of excavation these values were not precisely recorded. Given the relatively low numbers of seeds and the relatively consistent amounts of sediment floated this is not considered significant.

A limited number of samples were taken from the ditch layers. These were wet sieved in the laboratory to 500μ and stored in industrial methylated spirits. They were scanned and the first five items of any one taxon counted, subsequent items were grouped into three categories: + few, * moderate, *** abundant. The matrix of these samples was described in broad terms with values of 1 to 5; 1 signifying a few pieces, and 5 signifying over 90%.

In all of the tables the species names are prefixed with two letters. The first is either 'c' or 'w' reflecting carbonised or waterlogged preservation respectively. The second refers to the broad ecological category to which that taxon may be attributed such that:

a - arable weeds	c - cereal grain
e - exotic	g - grassland
r - ruderal	t - wood/scrub
s - cereal chaff	w - wet ground
h - heathland	x - broad or imprecisely identifiable

In addition, on the tables and in order to save computational space each sample is allowed up to three character widths for numbers of seeds *etc.*. Therefore, for four character context numbers these are split, thus 'context number' on the table equals the first two figures and 'sub-division of context' equals the second two figures. Likewise for sample numbers as necessary. The tables were all produced and manipulated using the PHYTOPAK suite of programs (Huntley, Huntley and Birks, 1981).

The samples are discussed in archaeological groupings as suggested by the excavator.

Figure 1: Location plan of Birdoswald within northern England

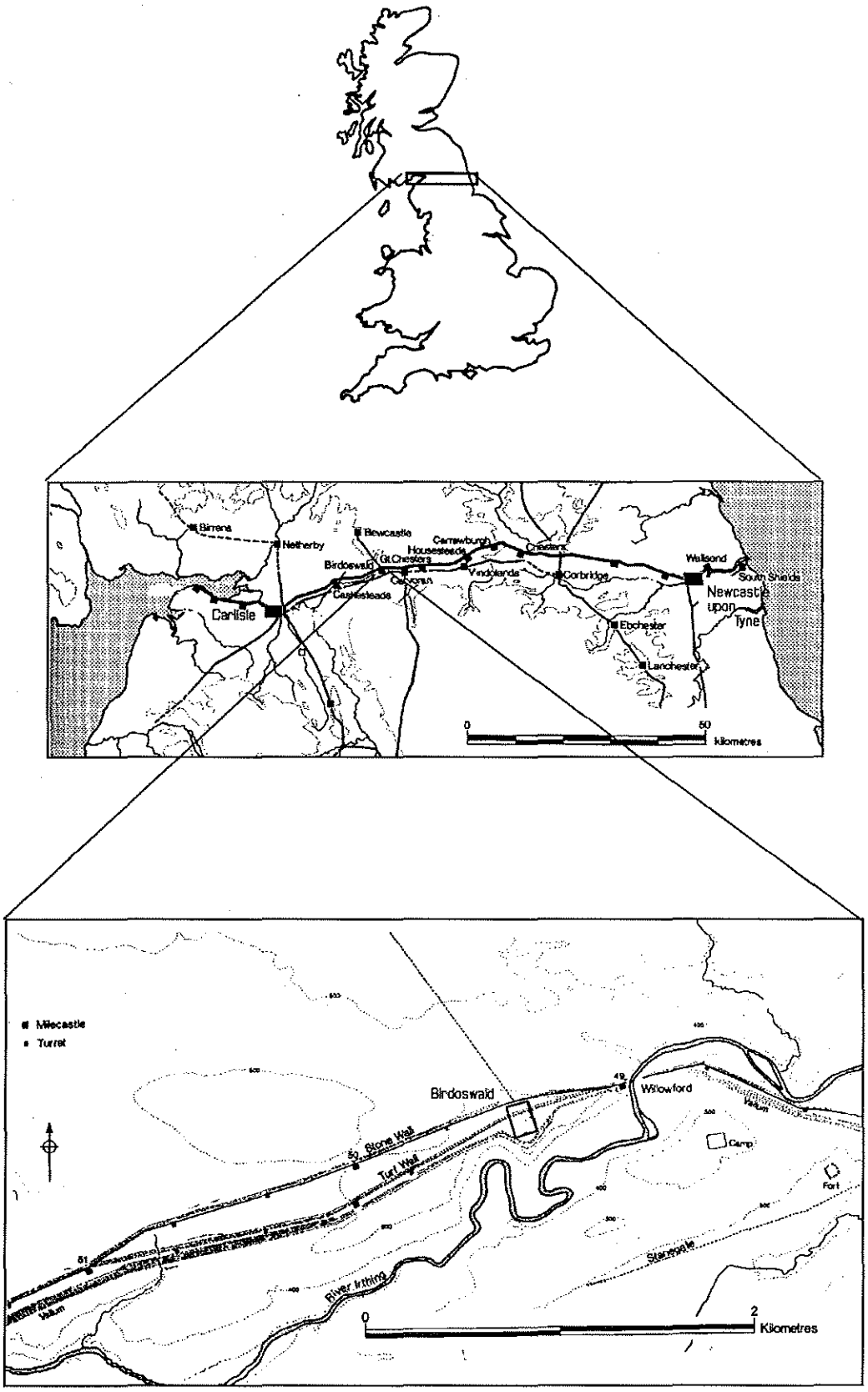
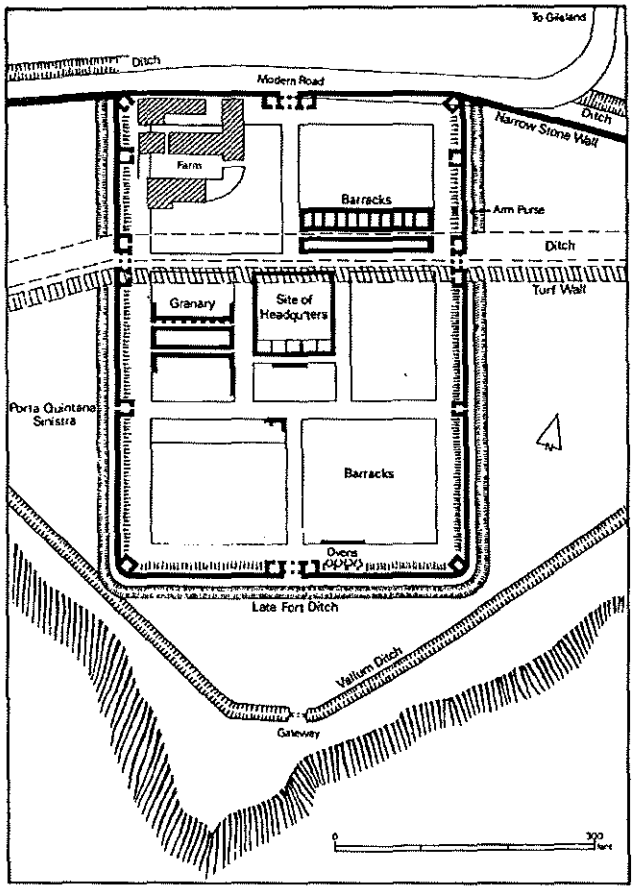
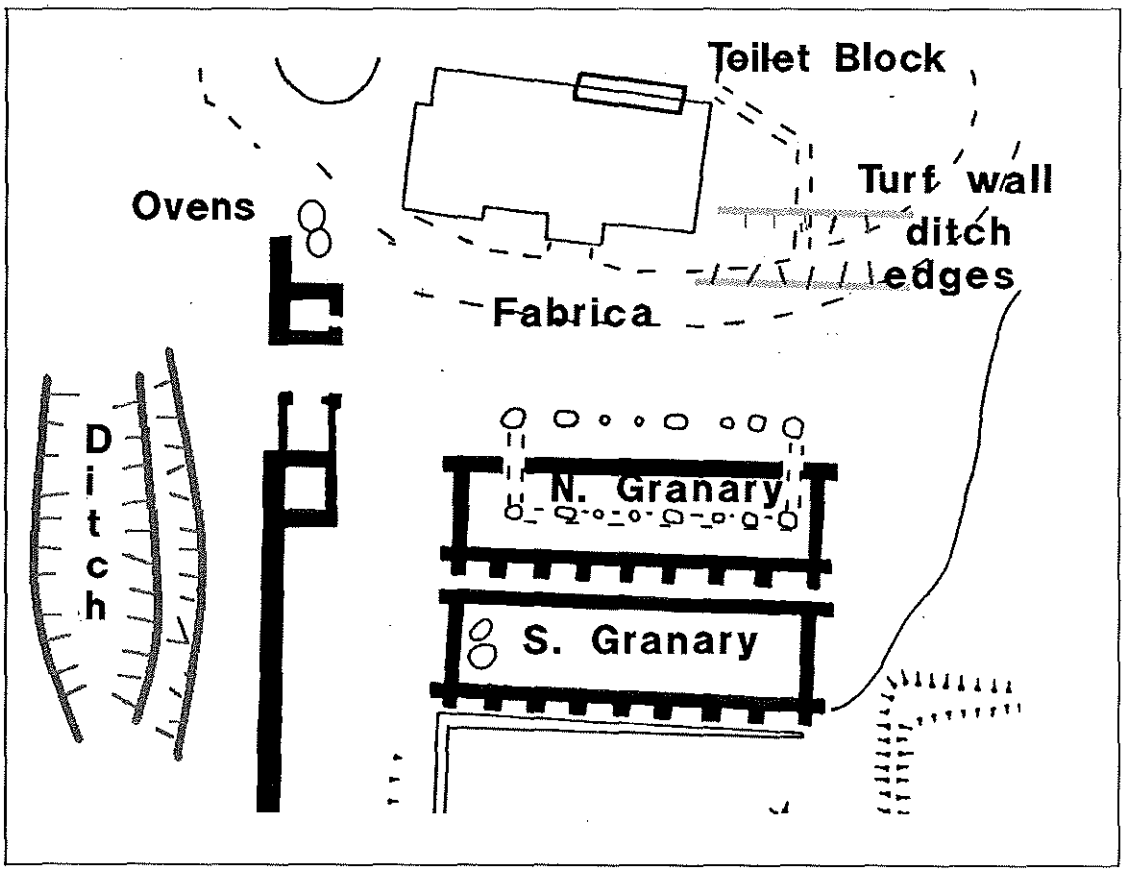


Figure 2: Site plans Birdoswald Roman Fort





Results and Discussion

A total of 289 samples were processed and examined. Of these, the majority were from the granaries:

Group	# samples	# contexts
South Granary	137	51
North Granary	79	11
Ditch	7	7
Ovens	3	3
Toilet Block	18	7
The Black	1	1
Fabrica	26	26
Turf Wall	5	5
Miscellaneous	8	8
Non-biological	5	5
TOTALS	289	124

The majority contained only carbonised plant remains, only those from the Ditch, The Toilet block and Turf Wall contained any waterlogged material. This is not surprising given the overall nature of the site. A few samples from the Granaries contained the occasional waterlogged elderberry seed (*Sambucus nigra*) but these were not tallied. They could reflect modern contamination during excavation or differential preservation since they are woody and resistant to decay. Very few were present in the waterlogged samples and it is considered that they almost certainly represent modern contamination, bushes being present in the former garden adjacent to the house.

Overall rather few seeds were present and it was decided that best interpretation would have to be the "archaeological group" (South Granary *etc.*) or site level and not at specific period level. All securely dated samples came from late second to fourth century material.

The plant species

As stated in the introduction, each taxon was attributed to one ecological category. This is somewhat simplistic because many taxa will grow in a variety of habitats although each may be considered as characteristic of a more limited number. Figure 3 presents the percentages of each ecological category of carbonised remains with the exception of heathland where the heather flowers and shoots were simply qualified. Cereal grains formed the majority of remains (c.70%) with ruderals, wet ground, arable weeds, cereal chaff and unclassified each between 4-6% and wood/scrub, grassland and exotics at less than 3%. Given the fact that the material is carbonised and that natural fires are rare in Britain it is not surprising that the majority of seeds are related to human activities. Looking purely at the cereal grains (Figure 4) wheat, barley and indeterminable grains are in almost equal proportions. Oats and rye are represented by low values. Only wheat and barley chaff were present.

Wheat is, just about, the most common cereal recovered from the site as a whole (34.4% of cereal grains). Three categories of wheat were defined - *Triticum aestivum* (bread wheat)(3.9%), hexaploid wheat (27.4%) and indeterminable wheat (68.7%). The bread wheat was clearly defined by plump grains having a rounded top and bottom and with a steep embryo. They were similar to modern *T. aestivo-compactum s.l.*. The hexaploid grains tended to be longer and thinner than the bread-wheat (itself also a hexaploid) and with less steep embryos. They were, on the whole, not well enough preserved or complete for measurements to be taken. There were no clear dorsal 'humps' indicative of spelt (*T. spelta*). However, the two species are extremely difficult to reliably separate on grain morphology alone particularly since at least some bread wheat seems to be of a 'long, thin' variety akin to spelt. The majority of wheat (68.7%) was simply wheat, generally poorly preserved but with the rounded ventral groove characteristic of wheats in general. Wheat chaff (straw and ear fragments) were present in low numbers and allowed some determination to species. Thirty six of the thirty eight glume bases recovered were clearly from spelt with their strong secondary venation. Six brittle rachis fragments were found and these may have been from spelt - a species which breaks into spikelets upon threshing rather than releasing free grain as bread wheat does. The rachis in bread wheat remaining largely as a single unit. The relatively low numbers of chaff fragments indicates that the material identified is probably cleaned grain ready for immediate use although there may, of course, be preservational factors of relevance. The grain is not very well preserved and the more delicate chaff fragments may have completely eroded away.

In spite of possible preservational problems there is strong evidence that both bread wheat and spelt were being used at Birdoswald although their overall relative proportions are not known.

Where this wheat was being obtained from is not known. It is rather unlikely that it was being grown in the immediate area given the altitude and high rainfall of the area. It is possible that it was being brought in from a supply fort such as that at South Shields whose granaries contained large amounts of both spelt and bread wheat (van der Veen, 1988). It is assumed that the wheat was being used almost solely for human consumption.

Barley is the next most common cereal grain recovered (29.1%). More than half of the grains showed the remains of the glumes and the longitudinal dorsal ridges characteristic of hulled barley. Other than one grain with the transverse wrinkles of naked barley the rest were too badly preserved for determination. The naked grain appeared to have a twisted embryo suggesting that it was a lateral grain from the 6-row variety. Any significance attributed to one grain is minimal. Of the hulled barley the majority were too poorly preserved to be certain of the position of the embryo although a few were clearly twisted. The 6-row *H. vulgare* is almost certain, therefore, to have been used although whether the 2-row *H. distichon* was as well is not known.

Although wheat growing may have been extremely marginal in the area at this time when the climate was, perhaps, only slightly warmer than that of today (Lamb, 1977) barley production is more likely. The plants will tolerate wetter conditions than wheat although do not

grow on such heavy, clay soils. They will also ripen in shorter summers than wheat. If barley was being produced very close to the fort then its pollen would be expected from Midgeholme Moss. However, if it was being grown on the fertile valley soils nearer to Hexham, some few miles away, then the pollen would not be present. Barley is reported as being a punishment food for the military (Davis, 1971) but he does not give further details. IF barley could be grown locally and IF the other supply routes were cut for any reason then barley could have become a normal food. It does make tasty bread and takes little more effort to remove the glumes from it than from those of spelt. It could also have been fermented to produce a beer, although it must be said that none of the grains recovered here showed any evidence of having sprouted during a malting process. The other, more major, use for barley was as horse feed although modern horse owners' dispute its use since it often causes modern animals to become bloated. A hard-working cavalry or draught horse may well have had a more active and efficient digestive system than modern "pet" animals. Although there is strong evidence that the fort was an infantry garrison draught animals would, no doubt, have been used and it is therefore possible that some of the barley was destined as horse-feed.

Figure 3: Proportions of ecological groups for the site as a whole

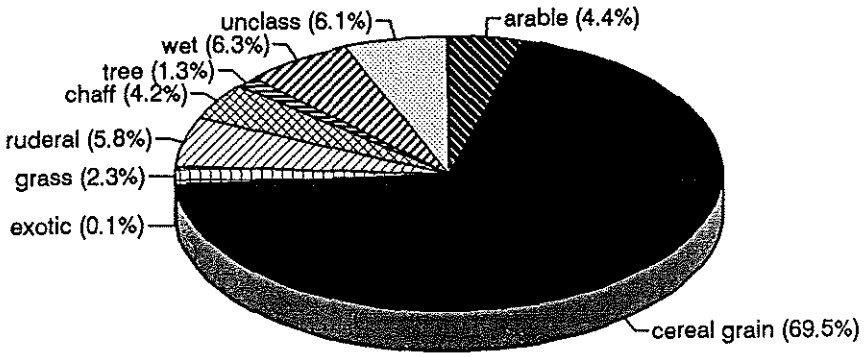
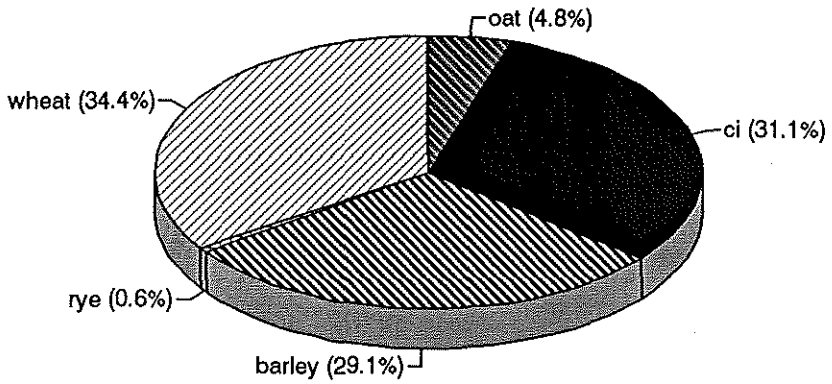


Figure 4: Proportions of cereal grains for the site as a whole



Oats formed 4.8% of the cereal grains. There was no oat chaff at all and therefore it is not possible to determine whether they were cultivated or not. In view of their low proportions it is suggested that they were weeds amongst the other crops. The same may be said of the seven grains of rye which were found. It is interesting to speculate whether the rye indicates that some of the wheat was being imported from the Continent along with its weed seeds.

The only other record attributable to exotic taxa, those not naturally growing in Britain including cereals, is one seed from *Vicia faba*, the Celtic bean. This is a early type of the modern broad bean. Legumes, in general, are poorly preserved and are therefore considered to be very under-represented in the archaeological record. That legumes were popular with the Romans is not in doubt, Apicius records book five for legumes alone (Edwards, 1984). For a fort such as Birdoswald they would have been a valuable addition to any diet - they can easily be transported in the dry state, which is also relatively light weight, and they store for long periods (winter!).

In material preserved through waterlogging an additional exotic taxon was recovered although from material that was not securely dated to the Roman period, it may have being from early Medieval times. This was the fig, *Ficus carica*, a native of southern Europe. Its fruits have certainly been imported for a long time and, from evidence at Carlisle (Huntley, 1990), was a favourite with the Romans - or at least was used by them in quantity.

Arable weeds accounted for 4.4% of the total carbonised seeds. Few were from those plants classified as traditional arable weeds - cornflower and corncockle. They were mainly from cultivated fields and would have been weeds amongst any crops. They included various species of *Polygonum*, the knotgrass and redshank family. Ruderal vegetation was represented by 5.8% of the seeds. This vegetation is generally found on disturbed ground such as along track and field edges and in odd corners or abandoned/fallow ground. At least some of the taxa could have grown amongst crops, eg. *Veronica hederaefolia* and *Galium aparine*, and some would also have been 'at home' in grassland - *Vicia sativa* and *Rumex acetosella*. As with much vegetation there is a continuum from newly colonised open soil to established grassland with a dense cover of plants. It is only people who insist of definite boundaries between types.

Grassland (2.3%) species such as *Plantago lanceolata* and *Rumex acetosa* indicate communities similar to those present today. They may have been grazed and evidence brought into the fort by the animals or may have been cut as hay. There are no seeds characteristic of traditional herb-rich hay meadows, for example *Rhinanthus minor* (yellow rattle). Their absence may be due to the nature of preservation - why should hay crops particularly be burnt? Such species are in evidence from deposits at the nearby Housesteads fort (Clapham, 1988).

Woodlands/scrub is scarcely represented and, as discussed elsewhere in this report, it consists principally of hazelnut shell fragments. These are likely to have been collected locally and eaten and discarded casually.

The wet ground element (6.3%) consists mainly of sedges with a moderate component of cotton grass. The taxa suggest usage of local acid bogs and wet moorland. Some of the sedges were probably growing in damp grassland but the nutlets cannot be identified, reliably, to more than two groups and each of these have a very broad potential ecological range. They almost all prefer wet substrates for growth though. Their presence in the carbonised record may indicate disposal of dung or soiled bedding from animals grazed on such ground; today the communities are sheep grazed throughout the north of England. Cattle are less likely to have been grazed on such ground through low nutrient levels. The few achenes from the lesser spearwort may have been accidently burnt following natural dispersal from the ditches, the waterlogged data providing evidence for such vegetation being present.

The south Granary

Limited excavation of the south granary was possible prior to consolidation. The deposits overlying the flagstone floor were removed, the flags lifted and the sub-floor layers excavated. There were three discontinuous sections of these sub-floor fill layers that were sampled:

i) Western end (lateral sleeper walls). Two samples were taken from a clay/loam layer between sleeper walls west of wall 452. These were the earliest deposits post-dating the sleeper walls and were considered to represent the primary, deliberate back-fill. Other than one unidentifiable cereal grain only heather twigs (*Calluna vulgaris*) and hazelnut fragments (*Corylus avellana*) were recorded. A further sequence from this general area but east of wall 447 was considered to be a secondary, deliberate backfill (Table 1). A total of 24 samples from 11 contexts were analysed. The cereal grains were poorly preserved with more than half of them unidentifiable. Barley was more abundant than wheat although any significance attributed to this must remain doubtful owing to the low total numbers. A selection of weeds were represented but predominantly indicate wet ground and ruderal vegetation rather than classical weeds of cereal fields. No chaff was recovered.

Table 1: Birdoswald South Granary - secondary backfill west

	Bio.lab. code	564	565	568	571	577	580	583	587	590	593	596	620
291	wxContext number	264	271	272	277	276	278	292	280	290	291	293	
335	wxSample number	10	10	10	10	10	10	10	10	10	10	10	
942	xxSub-division of sample	59	61	62	63	64	65	69	66	67	68	70	
941	xxNo. of sub samples amalgamated	2	1	2	2	5	2	2	3	2	2	2	25
943	xxNo. of contexts amalgamated												11
2102	ccAvena grain			1	1	1			3		1		7
2124	ccCerealia undiff.	7		1	7	2		4	4		2	3	30
2105	ccHordeum hulled		1		3		1			2	1	1	9
2125	ccHordeum indet.							1	1			3	5
2106	ccHordeum naked				1								1
2107	ccHordeum twisted							1					1
2110	ccHordeum twisted naked				1								1
2117	ccTriticum aestivum grain	1											1
2118	ccTriticum sp(p). grain	2			3		2		1	1	1	1	10
2059	caPolygonum periscaria												1
2049	cgPlantago lanceolata	1			1								2
2068	crRumex acetosella										2		2
2069	crRumex obtusifolius-type				1						1		2
2087	crVicia sativa								1				1
2095	ctCorylus avellana nut frag.	1			1								2
2014	cwCarex (lenticular)	1											1
2015	cwCarex (trigonous)	3			1			1			1		6
2740	cwEriophorum lat/angustifolium					2							2
2159	cwRanunculus flammula				1								1
2103	cxBromus sp(p). grain		1						4				5
2433	cxPolygonum sp(p).			1									

II) Central area (channels between solid filled bunkers). This area had a sequence similar to that above and was thought to form an intermediate stage in the back-filling of the granary. At least the upper fills were placed in preparation for the laying of flagstone floor 62. Table 2 presents the context data from the 14 samples analysed. Three of the samples contained no identifiable seeds. The remaining samples produced more barley than wheat grains again with a small number of oat grains. Chaff from both wheat and barley were recovered. Three of the glume bases of wheat were clearly attributable to spelt (*Triticum spelta*) with their strong secondary venation. Preservation, from the identification point of view, was generally better than in the samples from the western area.

Table 2: Birdoswald South Granary - central

	Bio.lab. code number	597	598	601	604	605	606	607	608	611	614	621
291	wxContext number	298	299	303	304	305	306	308	311	313	314	
335	wxSample number	1	1	10	10	10	10	10	10	10	10	
942	xxSub-division of sample			73	74	75	76	77	78	79	80	
941	xxNo. of sub samples amalgamated	1	1	2	2	1	1	1	1	2	2	14
943	xxNo. of contexts amalgamated											10
2102	ccAvena grain			1							1	2
2124	ccCerealia undiff.						7					7
2105	ccHordeum hulled					1	7	3				11
2125	ccHordeum indet.	1		1		2						4
2343	ccTriticum (hexaploid)										1	1
2118	ccTriticum sp(p). grain	1		1		2		2	1			7
2113	csHordeum rachis internode										1	1
2119	csTriticum floret scar			1								1
2261	csTriticum glume base						1					1
2382	csTriticum spelta glume			1			1				1	3
2053	caPolygonum aviculare			1								1
2059	caPolygonum periscaria			1								
2069	crRumex obtusifolius-type										1	1
2014	cwCarex (lenticular)						2					2
2015	cwCarex (trigonous)			2		1	2	2			1	8
2258	cwEleocharis sp(p).						1					1
2740	cwEriophorum lat/angustifolium			1								1
2103	cxBromus sp(p). grain	1						1	1			3
2432	cxGramineae <2mm										1	1

iii) Eastern area (longitudinal sleeper walls).

In the western section an unexcavated layer which pre-dated the main alterations was noted. It consisted of a dark-grey, silty loam and interpreted as having fallen through the interstices of the flagstones from a superior floor. In this respect it is considered to almost certainly represent the stored material. In the eastern area this was also apparent and sampled intensively such that every alternate metre square along the spaces between the sleeper walls was sampled. Ten sub-samples were analysed and the combined data are presented in Table 3. As with most of the above areas, barley was the most common cereal grain. Wheat was present and, here, at least some of the grains had the characteristic blunt and rounded shape, with steep embryo, of bread wheat (*T. aestivum*). The brittle rachis recovered possibly belongs to spelt as do some of the hexaploid grains. Sedges (*Carex* spp) and brome grass (*Bromus* sp) were the most common wet ground and weed seeds recovered.

Table 3: Birdoswald South Granary - primary east

	Bio.lab. code	555	561	619
291	wxContext number	237	235	
335	wxSample number	10	10	
942	xxSub-division of sample	53	55	
941	xxNo. of sub samples amalgamated	5	5	10
943	xxNo. of contexts amalgamated			2
2102	ccAvena grain	1	1	2
2124	ccCerealia undiff.	9	3	12
2105	ccHordeum hulled	14	7	21
2125	ccHordeum indet.	4	7	11
2343	ccTriticum (hexaploid)	4		4
2117	ccTriticum aestivum grain	1	1	2
2122	csTriticum brittle rachis internode		1	1
2118	ccTriticum sp(p). grain	5	3	8
2748	cgGramineae 2-4mm		1	1
2067	cgRumex acetosa	1		1
2029	crGalium aparine	4		4
2069	crRumex obtusifolius-type	1		1
2095	ctCorylus avellana nut frag.	1		1
2015	cwCarex (trigonous)	5	4	9
2103	cxBromus sp(p). grain	1	2	3
2093	cxGramineae undiff.	1		1
2433	cxPolygonum sp(p).		1	1

Overlying this was a deliberate backfill of silty loam with quantities of stony rubble again placed in preparation for the laying of flagstone floor 62. (Table 4). Sixteen sub-samples were analysed and their data amalgamated. Barley was predominant with, in one sample, large numbers, for this site, of barley rachis internodes. These indicate at least the presence on-site of whole ears of grain and, by implication, relatively local production. Barley is free threshing in that the grain is easily removed from the ear and it is most likely to be transported any distance as threshed grain. This is in comparison with, for example spelt wheat, whose ears need to be parched before the grain will fall free. Consequently it is regularly transported in the form of spikelets, thus removing some of the coarse chaff, leaving final threshing to be carried out at the site of use. Interestingly, two species of the classical cereal weeds were represented in this group of samples. The cornflower (*Centaurea cyanus*) and *Valerianella dentata* (no common name) are both rare plants today in Britain but are traditionally associated with cereal crops. Do they represent an aspect of cereal cultivation or of cereal importation at Birdoswald? Their seeds are somewhat smaller than cereal grain, particularly the *Valerianella*, and would therefore be expected to have been removed during processing if grain had been imported

from afar. On the other hand, Greig (forthcoming) has suggested that cornflower macrofossil records may indicate importation of cereal during the Roman period since the species only rarely occurs in samples from this date and that it subsequently and rapidly spread. However, pollen records of *Centaurea cynaus* (Godwin, 1975) from Britain indicate that is has been present for the last 6000 years or so.

Table 4: Birdoswald South Granary - secondary backfill, east

	Bio.lab. code	530	531	532	533	534	535	536	537	540	541	544	545	546	547	618
291	wxContext number	83	83	83	94	94	173	162	161	234	239	233	232	231	230	
335	wxSample number	10	10	10	10	10	10	10	10	10	10	10	10	10	10	
942	xxSub-division of sample	8	9	10	18	22	24	36	42	47	48	49	50	51	52	
941	xxNo. of sub samples amalgam	1	1	1	1	1	1	1	1	2	1	2	1	1	1	16
943	xxNo. of contexts amalgamate															14
2017	caCentaurea cyanus						1									1
2059	caPolygonum periscaria							1	1			1				3
2280	caValerianella dentata							2								2
2102	ccAvena grain							1	1	1	1		1			5
2124	ccCerealia undiff.						3		1	1	2		3			10
2105	ccHordeum hulled						8		20			1			1	30
2125	ccHordeum indet.									1	2	1	1			5
2118	ccTriticum sp(p). grain			1			1		2	2		1			1	8
2748	cgGramineae 2-4mm										1					1
2049	cgPlantago lanceolata								1					1		2
2029	crGalium aparine					1										1
2069	crRumex obtusifolius-type					1							1			2
2113	csHordeum rachis internode								17				1			18
2122	csTriticum brittle rachis in									1						1
2382	csTriticum spelta glume								3		1					4
2342	csTriticum spikelet fork									1						1
2015	cwCarex (trigonous)						1				1					2
2385	cwCarex hostiana-type							1								
2103	cxBromus sp(p). grain				1				9		1	1				12

Once this backfilling had been completed flag stones were laid as a floor (62). Immediately overlying them, the first occupation layer, were thin layers of dark silt. These were overlain by a succession of contexts, predominantly black-grey silty layers, reflecting late occupation within the south granary. These deposits, from both ceramic and coin evidence, are equivalent to those of the North Granary (see below). A total of 22 samples were analysed from the 13 contexts associated with these layers in the South Granary (Table 5). As with the majority of samples from this site the numbers of seeds were low, only a total of 61. Barley grains were the most common, predominantly hulled, with undifferentiated wheat the next most abundant. One spelt glume base was recorded but no other chaff. Weeds included species characteristic of wet ground as well as arable weeds - they may indicate that crops were being grown upon rather damp and heavy soils although may simply reflect input from local vegetation by agents such as feet.

Table 5: Birdoswald South Granary - late occupation ?east

	Bio.lab. code	505	626	526	529	617
291	wxContext number	107	84	165	175	
335	wxSample number	10	?	10	10	
942	xxSub-division of sample	04		37	44	
941	xxNo. of sub samples amalgamated	1	17	2	2	22
943	xxNo. of contexts amalgamated					13
2124	ccCerealia undiff.		11			11
2105	ccHordeum hulled		16	1		17
2125	ccHordeum indet.	1	4			5
2111	ccHordeum straight hulled		1			1
2343	ccTriticum (hexaploid)		4			4
2118	ccTriticum sp(p). grain	2	7	1		10
2382	csTriticum spelta glume	1				1
2029	crGalium aparine		1			1
2069	crRumex obtusifolius-type		1			1
2095	ctCorylus avellana nut frag.			1	2	3
2015	cwCarex (trigonous)			1		2
2740	cwEriophorum lat/angustifolium		1			2
2103	cxBromus sp(p). grain	1	1			2
2432	cxGramineae <2mm		1			1

Over these layers, in the south of the building, was a surface of roofing stone upon which were two black layers - 189, 190 and two dark grey deposits 118,159. A further sequence of black-grey silt layers (contexts 127, 121, 115x2, 81(no sample) and 187). The relationship of these layers with two hearths remains unclear but there were later deposits clearly associated with the hearths. The main one was 101, a charcoal-rich silty layer, and which had the most remains recovered. However, since 15 samples were taken from this one context this fact is not necessarily significant. Little may be said of any sample other than barley was again most common (Table 6).

Above the occupation layers of the south granary lay a compact, soil-like layer containing a high proportion of rubble and interpreted as a layer formed during abandonment of the building (contexts 68, 69). Although 8 samples were analysed very few seeds were present and this suggests either a rapid fill of more or less sterile material from elsewhere or a period of inactivity.

Table 6: Birdoswald South Granary - late occupation, cannot be bulked

	Bio.lab. code	504	494	495	484	473	500	501	502	450	490	478
291	wxContext number	190	118	159	127	121	115	115	187	101	69	68
335	wxSample number	10	10	10	10	10	10	10	10	10	10	10
942	xxSub-division of sample	43	33	34	29	2	38	39	40	1	32	3
941	xxNo. of sub samples amalgamated	1	3	1	5	5	1	1	1	15	4	4
2102	ccAvena grain									1		
2124	ccCerealia undiff.					3				6	2	
2105	ccHordeum hulled	3				3				11		
2125	ccHordeum indet.		1		1					1	1	
2343	ccTriticum (hexaploid)									1		
2118	ccTriticum sp(p). grain	1		1	2	1				3		
2382	csTriticum spelta glume		1									
2072	chSieglingia decumbens									1		
2069	crRumex obtusifolius-type											1
2015	cwCarex (trigonous)											1

The reasoning behind taking samples along a transect was to see if spatial differences through the granary could be determined - were different cereals being stored in different parts. Given the extremely low numbers of seeds from any sample this was unfortunately impossible. The details of all sub-samples of sample 1001 from context 101 are thus given below (Table 7) for record purposes only.

Table 7: Birdoswald South Granary - comparison of sub-samples from sample 1001

Bio.lab. code		456	461	466	460	452	453	455	458	454	463	465	464	451	462	457
291	wxContext number	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101
335	wxSample number	A	B	C	D	E	F	G	H	J	K	L	N	O	P	Q
2124	ccCerealia undiff.	2				1			1							2
2102	ccAvena grain						1									
2105	ccHordeum hulled		2			3				1				1		
2125	ccHordeum indet.	5	1								1	1				
2343	ccTriticum (hexaploid)								1							
2118	ccTriticum sp(p). grain				1	1					1	1				
2072	chSieglingia decumbens															1

Table 8 presents the amalgamated data from all sub-samples within the above groups with the exception of the material from the late occupation deposits which could not be bulked. The table clearly shows that more barley grains were recovered than any other cereal and that wheat was the next most common. Small amounts only of oats were present and these may have been growing as weeds amongst the other cereals. No oat chaff was found and this is the only material by which cultivated and wild oats may be separated. The barley was mainly hulled although one grain with the transverse wrinkles characteristic of naked barley was recovered. A few grains with twisted embryos were present indicating that, as expected, at least some of the barley was the 6-row *Hordeum vulgare*. This is the type of barley predominantly grown in northern Britain until the medieval period.

There are few differences, overall, between these various phases of activity although the primary fill at the western end is very species-poor. This may, at least in part, be related to the fact that only two contexts were analysed from it. However, the two contexts representing primary fill at the east end were considerably richer in numbers of seeds.

The fact that the majority of seeds are from cereal grains indicates that we are most likely to be looking at material that was being stored in the granary. If it was simply any botanical material being used on the site more seeds of ruderals and grassland taxa would, perhaps, be expected, although this then brings in the question of how that material was carbonised. It is obvious how spelt wheat can preserve since the spikelets need to be parched to remove the grain from the glumes. Likewise barley if it is being malted. How this material is then distributed around a site is unclear and it is often the archaeology itself that allows some interpretation. In the case of Birdoswald, from the fact that many of the cereal grains have been recovered from granaries it has been inferred that those cereal grains are representative of what was actually being stored in those granaries. Whilst this may certainly be true to some extent the absolute concentrations of material are sufficiently low that such an interpretation should be be treated with caution. Many contexts will have low numbers of burnt seeds in them and these are sometimes called background levels - indicating usage on-site somewhere but not specifically. Some of the Birdoswald ones probably represent this. However, from "control" samples taken primarily for non botanical reasons (see below under Non Biological Samples) numbers of seeds in this so-called background assemblage are considered to be quite low for this specific site. Archaeologically the material presented in Table 3 is considered to almost certainly represent the stored product but the various backfill deposits are less clear. They may have originated from storage products immediately above but may have been collected from elsewhere on the site. In any case they are considered to represent the cereals that were in use

on the site during the 4th century. An interesting thought (Carruthers *pers. comm.*) as to how material in a granary may be charred - were the granaries fumigated with something during the annual clean out and which accidentally burnt some of their contents?

Table 8: Birdoswald South Granary - summary

	Bio.lab. code	622 1W	620 2W	621 C	619 1E	618 2E	617 LE
941	xxNo. of sub samples amalgamated	2	24	14	12	16	22
943	xxNo. of contexts amalgamated	2	11	10	2	14	13
2017	caCentaurea cyanus					1	
2053	caPolygonum aviculare			1			
2059	caPolygonum periscaria		1			3	
2280	caValerianella dentata					2	
2102	ccAvena grain		7	2	2	5	
2105	ccHordeum hulled		9	11	21	30	17
2125	ccHordeum indet.		5	4	11	5	5
2106	ccHordeum naked		1				
2111	ccHordeum straight hulled						1
2107	ccHordeum twisted		1				
2110	ccHordeum twisted naked		1				
2343	ccTriticum (hexaploid)			1	4		4
2117	ccTriticum aestivum grain		1		2		
2118	ccTriticum sp(p). grain		10	7	8	8	10
2124	ccCerealia undiff.	1	30	7	12	10	11
2748	cgGramineae 2-4mm				1	1	
2049	cgPlantago lanceolata		2			2	
2067	cgRumex acetosa				1		
2129	chCalluna vulgaris twigs	9					
2029	crGalium aparine				4	1	1
2068	crRumex acetosella		2				
2069	crRumex obtusifolius-type		2	1	1	2	1
2087	crVicia sativa		1				
2113	csHordeum rachis internode			1		18	
2122	csTriticum brittle rachis internode				1	1	
2119	csTriticum floret scar			1			
2261	csTriticum glume base			1			
2382	csTriticum spelta glume			3		4	1
2342	csTriticum spikelet fork					1	
2095	ctCorylus avellana nut frag.	1	2		1		3
2014	cwCarex (lenticular)		1	2			
2015	cwCarex (trigonous)		6	8	9	2	2
2258	cwEleocharis sp(p).			1			
2740	cwEriophorum lat/angustifolium		2	1			2
2159	cwRanunculus flammula		1				
2103	cxBromus sp(p). grain		5	3	3	12	2
2432	cxGramineae <2mm			1			1
2093	cxGramineae undiff.				1		
2433	cxPolygonum sp(p).				1		

Key: 1W primary backfill, west end
2W secondary backfill, west end
C central area
1E primary backfill, east end
2E secondary backfill, east end
LE late occupation, east end

North Granary

From a fill of the pre-north granary timber slot only one context (1350) was sampled. It contained no seeds. There were considerable numbers of non-carbonised elderberry seeds, otherwise it contained moderate amounts of glassy charcoal. It is considered that the elderberry seeds is evidence of modern contamination. Although they are robust and easily recognisable and therefore could be the result of differential preservation the total absence of other waterlogged remains makes this a less likely option.

The main sequence of samples was taken from contexts (Table 9) in the interspaces between the sleeper walls and which were considered to represent accumulation in the late 4th century. This is contemporary with late-occupation in the South Granary (see above). In the area with no flagstones surviving the lower backfill consisted of a dark brown clay-silt with charcoal flecks. The 26 samples analysed from the three contexts represented contained similar assemblages. Wheat, either indeterminable or hexaploid) was common although one sample contained more barley. Weed seeds were not common; those present predominantly indicated a mixed type of cultivation and were not from the classical cornfield weeds. In the southernmost interspace there was a layer of gravelly, dark soil (1566). Two samples were taken and both contained low numbers of a hexaploid wheat. With the presence, also, of spelt glumes bases, it is suggested that the wheat was probably spelt; however, bread wheat grains were also recovered. The occasional rye and oat grain was found as well as moderate numbers of indeterminable cereal grains. Very little else was present. Apart from the fact that it contained considerably fewer taxa, the overall assemblage was similar to that from the contexts described above. Other layers from this phase include 1566 and 1585. Samples from these contained less well preserved material and fewer grains. they were indeterminable cereal and indeterminable wheat. Overall, the six contexts sampled from this area contained moderate numbers of wheat, of various levels of identification, and indeterminable cereal. Barley was about half as common as either of these two categories.

Table 9: Birdoswald north Granary - gradual silting layers, context level

	Bio.Lab. code number	875	660	671	681	684	685	689
291	wxContext number	15	14	15	15	15	15	15
455	xxSubdivision of context	19	20	21	22	66	60	85
335	wxSample number	11	10	11	11	11	11	11
942	xxSub-division of sample	3	4	5	6	11	12	13
941	xxNo. of sub samples amalgamated	4	7	10	9	2	1	3
2001	caAgrostemma githago				1			
2055	caFallopia convolvulus			1				
2057	caPolygonum lapathifolium		1	1				
2058	caPolygonum periscaria	1	6	17	12			1
2102	ccAvena grain	1		1	3	2		
2124	ccCerealia undiff.	4	11	40	32	23	1	4
2105	ccHordeum hulled			3	3			
2125	ccHordeum indet.		9	15	40			2
2115	ccSecale cereale grain		2	1		1		
2343	ccTriticum (hexaploid)			26	1	28		
2117	ccTriticum aestivum grain					3		
2118	ccTriticum sp(p). grain	7	14	3	29			9
2049	cgPlantago lanceolata				1			
2072	chSieglingia decumbens	1						
2023	crChenopodiaceae undiff.			1	1			
2029	crGalium aparine		1	3	1			
2050	crPlantago major			1				
2066	crRaphanus raphanistrum pod frag.		1					
2068	crRumex acetosella			3				
2069	crRumex obtusifolius-type	5	7	7	4			1
2079	crUrtica dioica							1
2383	crVeronica hederifolia			2				
2123	csCulm nodes			4				
2113	csHordeum rachis internode	1						
2122	csTriticum brittle rachis internode	1	1					
2382	csTriticum spelta glume	5	1	2	7	4		1
2095	ctCorylus avellana nut frag.			4	1			1
2014	cwCarex (lenticular)	1				1		
2015	cwCarex (trigonous)			1	2	1		
2385	cwCarex hostiana-type	2						
2258	cwEleocharis sp(p).				2			5
2159	cwRanunculus flammula			1	1			
2008	cxArrhenatherum elatius - tuber		1					
2103	cxBromus sp(p). grain	2	3	1	5			1
2432	cxGramineae <2mm			1				
2035	cxLabiatae undiff.			1	1			
2039	cxLegume <4mm	1						
2041	cxLegume >4mm		1					
2230	cxStachys sp.		1					
	Total number of taxa	23	26	34	29	18	12	20

The upper fills were loose and friable, thus allowing possible contamination. A total of thirty two samples from four contexts were analysed (Table 10). As with nearly all of the material from this site indeterminable cereals were the most common with numbers of wheat almost equal. Barley was moderately common.

The problem with all of these samples is that there was a certain amount of intrusive Medieval pottery and therefore their provenance cannot be absolutely determined. However, they are as well sealed as many archaeological contexts and it is mainly in comparison with the flagstone-sealed South Granary contexts that they appear somewhat problematic.

Table 10: Birdoswald north Granary - upper sealing layers, context level

	Bio.Lab. code number	867	638	645	870	652
291	wxContext number	14	14	14	14	14
455	xxSubdivision of context	16	18	03	03	17
335	wxSample number	10	10	10	10	10
942	xxSub-division of sample	91	93	91	96	92
941	xxNo. of sub samples amalgamated	8	10	6	2	6
2017	caCentaurea cyanus	1		1		1
2057	caPolygonum lapathifolium		1			
2059	caPolygonum periscaria	2	6	3		4
2075	caSpergula arvensis		1			
2094	caStellaria media			1		
2102	ccAvena grain	6	8	2		5
2124	ccCerealia undiff.	37	33	33	4	42
2105	ccHordeum hulled		22	13	1	18
2125	ccHordeum indet.	28	2	10		8
2115	ccSecale cereale grain					1
2343	ccTriticum (hexaploid)	9	14			
2118	ccTriticum sp(p). grain	19	11	33		42
2748	cgGramineae 2-4mm		1			
2049	cgPlantago lanceolata	2				1
2067	cgRumex acetosa			3		
2072	chSieglingia decumbens			1		1
2023	crChenopodiaceae undiff.	1		1		2
2027	crConium maculatum		2			
2029	crGalium aparine		1			7
2068	crRumex acetosella	1	1			2
2069	crRumex obtusifolius-type	6	5			4
2087	crVicia sativa		1			
2123	csCulm nodes			2		
2114	csHordeum 6-row rachis internode	1				
2122	csTriticum brittle rachis internode		1			
2382	csTriticum spelta glume	4	3			1
2095	ctCorylus avellana nut frag.	2	3	2		1
2362	ctRosa sp.					1
2418	ctRosa thorn		1			
2015	cwCarex (trigonous)	1				
2385	cwCarex hostiana-type			1		
2159	cwRanunculus flammula		1			
2008	cxArrhenatherum elatius - tuber		1			
2103	cxBromus sp(p). grain	2	3			2
2432	cxGramineae <2mm			1		
2064	cxRanunculus repens-type	1	1			
	Total number of taxa	28	33	25	13	28

In summary (Table 11), the North Granary contains samples which are less well securely dated than those from the South Granary mainly because the building became silted up gradually through time. This may account, at least in part, for the moderate numbers of poorly preserved cereal grains. Wheat was most common with moderate amounts of barley also present. The oats may have been from grain deliberately grown as a crop or from weeds - the lack of oat chaff precludes further interpretation. Weeds seeds are moderately abundant although never dominant. Species characteristic of waste ground and broad cultivation are more common than those characteristic of arable fields alone. Overall this may reflect a higher proportion of background material rather than purely reflecting what had been stored in the granary.

Table 11: Birdoswald north Granary - summary data

Bio.Lab. code number		627	690	691
943	xxNo. of contexts amalgamated	1	6	7
941	xxNo. of sub samples amalgamated	1	31	34
2001	caAgrostemma githago			1
2017	caCentaurea cyanus		3	
2055	caFallopia convolvulus			1
2057	caPolygonum lapathifolium		1	2
2059	caPolygonum periscaria		15	36
2075	caSpergula arvensis		1	
2094	caStellaria media		1	
2102	ccAvena grain		24	6
2124	ccCerealia undiff.		145	115
2105	ccHordeum hulled		53	6
2125	ccHordeum indet.		48	66
2115	ccSecale cereale grain		1	4
2343	ccTriticum (hexaploid)		23	53
2117	ccTriticum aestivum grain			3
2118	ccTriticum sp(p). grain		105	62
2748	cgGramineae 2-4mm		1	
2049	cgPlantago lanceolata		1	1
2067	cgRumex acetosa		3	
2072	chSieglingia decumbens		2	1
2023	crChenopodiaceae undiff.		3	2
2027	crConium maculatum		2	
2029	crGalium aparine		8	5
2050	crPlantago major			1
2066	crRaphanus raphanistrum pod frag.			1
2068	crRumex acetosella		4	3
2069	crRumex obtusifolius-type		15	21
2383	crVeronica hederifolia			2
2087	crVicia sativa		1	
2123	csCulm nodes		2	4
2114	csHordeum 6-row rachis internode		1	
2113	csHordeum rachis internode			1
2122	csTriticum brittle rachis internode		1	2
2382	csTriticum spelta glume		8	20
2095	ctCorylus avellana nut frag.		8	6
2362	ctRosa sp.		1	
2418	ctRosa thorn		1	
2014	cwCarex (lenticular)			3
2015	cwCarex (trigonous)		2	4
2385	cwCarex hostiana-type		1	
2258	cwEleocharis sp(p).			7
2159	cwRanunculus flammula		1	2
2008	cxArrhenatherum elatius - tuber		1	1
2103	cxBromus sp(p). grain		7	12
2432	cxGramineae <2mm		1	1
2035	cxLabiatae undiff.			2
2039	cxLegume <4mm			1
2041	cxLegume >4mm			1
2064	cxRanunculus repens-type		2	
2230	cxStachys sp.			1
	Total number of taxa	11	43	44

Inspite of the less tightly dated samples, the data are interesting in that wheat is apparently more common than barley. This is in direct comparison with the South Granary where barley is most abundant. Although this may partly reflect the slightly different dating provenances it is also possible that the different cereals were, in fact, stored in different granaries. To remove bias with respect to the number of sub-samples analysed and, hence, volume of soil sieved to produce the numbers of grains, Table 12 presents the summary data for the two granaries expressed as percentages of total seeds in any context group.

Table 12: Percentage, ecological summary data for the two granaries.
(values of 2% or less are represented by +)

Bio.code nos	622	620	621	619	618	617	627	690	691
CI	+	33.7	12.5	14.5	9.3	18.3	-	29.2	25.0
Triticum	.	12.4	14.3	16.9	7.4	23.3	-	25.8	25.7
Hordeum	.	16.9	26.8	38.6	32.4	36.7	-	20.3	15.7
Avena	.	7.9	3.6	2.4	4.6	.	-	4.8	+
Secale	.	.	.	.	.	.	-	+	+
wheat chaff	.	.	8.9	+	5.6	+	-	+	4.8
barley chaff	.	.	+	.	16.7	.	-	+	+
culm nodes	.	.	.	.	.	.	-	+	+
total arable	.	+	+	.	5.6	.	-	4.2	8.7
ruderals	.	5.6	+	6.0	2.8	3.3	-	6.6	7.6
grass	.	2.2	.	2.4	2.8	.	-	+	+
wet	.	11.2	21.4	10.8	+	6.7	-	+	3.5
tree	+	2.2	.	+	.	5.0	-	+	+
heath	*	.	.	.	.	.	-	+	+
unclass	.	6.7	7.1	6.0	11.1	5.0	-	2.2	4.1
TOTAL SEEDS	2	89	56	83	108	60	0	497	460

Besides the numbers of grains indicating that barley was more common in the South Granary, these percentage values also reflect this. Interestingly, the two groups of samples from the earliest deposits associated with the buildings both contain little or no plant material. This obviously suggests that grain usage was minimal at this time. Barley chaff was particularly abundant during one phase of activity in the South Granary representing nearly 17% of all remains. With barley grain accounting for a further 32% here it is suggested that barley was actually being threshed, or at least partially processed, in the immediate vicinity. As stated above it is also likely that the crop was being locally produced in view of the quantity of chaff found here.

With respect to the non-cereal remains, an interpretation is more difficult. Classical arable weeds, those only found in associated with cereal crops, are rare. These would include species such as cornflower (*Centaurea cyanus*) and corn cockle (*Agrostemma githago*). They do, however, prefer lighter, more sandy soils than those generally found around Birdoswald today. Various *Polygonum* species, the knotweeds, also grow in cultivated fields but are not necessarily associated with cereals. Any weeds growing amongst the cereals are likely to have been harvested with them and hence their seeds would be mixed with the cereal grain. Although subsequent sieving and processing aims to remove all such weed seeds some inevitably remain and these would become carbonised with the grain. Their presence is thus explainable simply.

An explanation for the representation of grassland, wetland and ruderal species is not always obvious. Ruderals growing around the site may be accidentally caught up with the cereals and become burnt, the same may be true for grassland species. Some of these may, also, have been growing amongst the cereals. Wet ground taxa are more problematic again particularly when they reach values of more than 20%. In all of the earlier South Granary groups the wet species are common. This may reflect wet conditions around the fort, but why

should so many seeds have become carbonised? Perhaps the granaries were also used to store hay or flooring material.

Most of the tree group are, in fact, fragments of hazelnuts and are considered to represent casual disposal following consumption of the nuts. They are the most common item recovered from the residues, being found in almost all of them.

The Ditch (Table 13)

The butt end of the ditch outside the west gate was fully excavated. During site phase 8 the south carriageway through the gate was blocked and the ditch re-cut three times (numbered 4th, 5th and 6th ditches).

The 4th ditch was filled by the mid-3rd century. Two contexts were analysed from it, context 1605 (sample 1114) was representative of the whole fill whereas context 1796 (samples 1124 and 1125) from the top fill. The two upper fills gave rather different botanical assemblages. Sample 1124 was dominated by fragments of sedges *etc*, and other, unidentifiable organic material. It was not cereal debris. There was little or no mineral material and very few seeds. Sample 1125 contained a certain amount of mineral material and was much more heterogeneous in its organic content with wood, charcoal, monocot fragments, bryophyte fragments *etc*.. It also contained a wide variety, and moderate numbers, of seeds with grassland and ruderal species most commonly represented. There was some cereal debris including tiny fragments of barley bran. Sample 1114 was more similar to 1124 in that it consisted of predominantly monocot. fragments with few seeds. Wheat-rye periderms were present in low numbers but there was little other evidence for cereals. *Daphnia* eggs were common. Interpretation is not clear. The cereal remains suggest some input of rubbish. There is little evidence for faecal material (*viz* bran) but neither is there strong evidence for hay/animal dung since no seeds of plants characteristic of such vegetation being recorded. The generally high values of monocot fragments could indicate that the ditch was thoroughly vegetated over with sedges *etc*., but that there was still some water in it for the *Daphnia* (water fleas) to be present. It could also indicate a layer of flooring material which had been dumped. A third alternative would indicate dung from animals which had been grazing pastures, with little vegetation flowering or seeding, rather than being hay fed. However, given the archaeological evidence that the ditch was totally silted before being re-cut and the fact that there is waterlain silt on the berm as well indicates that the ditch was probably well vegetated over - even indicating a period of dis-use or poor use.

The 5th ditch was filled by the late-3rd to early 4th centuries. Two contexts from the top levels were sampled. Context 1760 (sample 1128) was a heterogeneous mixture of mineral, wood, fine organic material, clinker, charcoal and bryophytes. Seeds were moderate in numbers and represented a variety of taxa. Grassland plants were commonly represented but there were also considerable numbers of seeds from the annual nettle (*Urtica urens*). This species grows in open situations and is a weed of moderately nutrient-rich soils. Context 1496 (sample 1102) was more organic with little mineral material. It contained more seeds from species characteristic of ruderal/waste situations with fewer representatives of grassland or open, weedy conditions. The nettle seeds, which were common, were definitely from the stinging nettle (*Urtica dioica*). There were moderate numbers of henbane (*Hyoscyamus niger*) seeds; this is a powerful drug plant although it does also grow as a ruderal and it may be that this is the role it played here. It also contained a few seeds from lesser spearwort (*Ranunculus*

sceleratus) which is an aquatic plant common in and by slow streams and muddy ponds, it prefers mineral-rich substrates.

The 6th ditch was filled by the mid- to late-4th centuries. Context 1755 (sample 1123) was from the top of this fill. It contained moderate amounts of mineral material but also large amounts of bracken frond fragments. Otherwise the organic material was fairly well humified and also well mixed with large amounts of silt and clay. This caused distinct problems when washing the samples through sieves. *Daphnia* eggs were again present, as were seeds of the water crow foot, indicating at least some open water. Besides the usual mix of grassland and ruderal taxa, cereal debris was more important in this sample than any of the other ditch samples analysed. Moderate numbers of wheat glumes (one of which was clearly spelt) and one barley rachis internode were seen. In addition, whole skins (periderms) of oats and barley and fragments of wheat/rye and barley bran were recovered. It is likely that this sample represents rubbish being thrown into the ditch. It is suggested that both faecal material and soiled bedding is probably represented but it is more difficult to suggest whether this is human, animal or a mixture. By comparison with sites such as Carlisle it could be that animal bedding/dung is indicated given the lack of seeds from exotic taxa such as figs and coriander which are almost invariably present in faecal material from Carlisle (Huntley, 1990). However, the almost total lack of figs *etc.* from this site as a whole may indicate that Birdoswald troops were not consuming such luxuries.

A second context from this fill was analysed - 1499 (sample 1107). It, too, contained large amounts of clay/silt lumps and was similar, but impoverished, in its botanical assemblage to the above sample. It contained more wheat/rye bran fragments but lacked the bracken component altogether. It therefore probably represents either a different dumping episode or may reflect the natural, background silting of the ditch with some infiltration of faecal material.

Overall, these samples indicate that the ditch was kept moderately clear throughout these phases of use although initially there was a period of natural silting possibly reflecting less activity on the site. During the later phases of use it does seem that some rubbish was thrown into it. This seems to have been a mixture of bedding/flooring material with some faecal material. The latter may have been from people although the lack of exotic food species, perhaps, suggests not. The bran fragments present indicate that wheat/rye and barley were being consumed. The presence of water flea eggs and a few seeds from aquatic species suggests that the ditch contained at least some water most of the time. This is reinforced by the fact that on-site drains were excavated and which ran into the ditch.

Table 13: Birdoswald - Ditch raw data table

Bio.Lab. code number		692	693	694	695	696	697	698
291	wxContext number	17	17	16	14	17	17	14
455	xxSubdivision of context	55	60	05	99	96	96	96
335	wxSample number	11	11	11	11	11	11	11
942	xxSub-division of sample	23	28	14	07	25	24	02
827	xxCoarse sand/gravel				2	3		
828	xxSilt and clay	3			3	1		
940	xxClinker/Ind.waste		1					
832	xxAmorphous organic material		1		1	1	3	2
826	xxPeat/coarse organic	3	3		1		5	3
831	xxMonocot. fragments	1	1	5		1	4	
830	xxWood fragments	1	2			2		2
823	xxCharcoal fragments	1	1		2	2		1
269	wxBryophyte fragments	1	1	2	1	1	1	
621	wcbran fragments	1	1		1	1		
388	wxLegume flower	1		1	1	1		
272	wxtree bud	1		1	1	1		
829	xxFly puparia				1			
825	xxInsect fragments	1					1	
1	waAgrostemma githago		1		2			
195	waAphanes arvensis	1						
231	waGaleopsis tetrahit					1		1
94	waStellaria media	1				2		
214	waUrtica urens	+	*	1	+	2		1
421	wcAvena periderm	2						
259	wcCerealia/large Gramineae	5	2	1		2		
125	wcHordeum - indet.	2			3	+		
422	wcHordeum periderm	1						
658	wcTriticum undiff.	6			*	1		
408	wcTriticum/Secale periderm	1	1					
790	wgBellis perennis				1			
410	wgLeontodon autumnalis/hisp(p).		1					
42	wgLinum catharticum					1		
465	wgRhinanthus minor agg.				1	1		
67	wgRumex acetosa	3	1			2		+
218	whCalluna vulgaris flowers			1				
129	whCalluna vulgaris shoots/twigs	1		1				
2129	chCalluna vulgaris twigs	1				1		
155	whPteridium aquilinum -frond fr	**						
55	wrFallopia convolvulus					2		
206	wrHeracleum sphondylium		1					
315	wrHyoscyamus niger							+
53	wrPolygonum aviculare	3	1			1		1
58	wrPolygonum lapath/persicaria	2			*			
57	wrPolygonum lapathifolium	1	1		1			1
59	wrPolygonum persicaria	2	4		2	2		1
68	wrRumex acetosella	1	1			2		1
69	wrRumex obtusifolius-type				1	1		
241	wrSonchus asper	1	2		2			1
79	wrUrtica dioica	+	4	1		3		*
113	wsHordeum rachis internode	1						
261	wsTriticum glume base	+	1		1	1		
382	wsTriticum spelta glume	1				1		
500	wtAlnus glutinosa	2						
398	wtBetula tree catkin scale	1						
95	wtCorylus avellana nut fragment				1	1		1
63	wtPrunella vulgaris		1			1		
418	wtRosa - thorn							1
362	wtRosa sp(p).				1			
154	wtRubus fruticosus					2		+
14	wwCarex (lenticular)	+	4	1	2	+	2	2
15	wwCarex (trigonous)	2	2		2	4		5
385	wwCarex hostiana-type	2	2		2	3		1
325	wwEleocharis palustris					3		
178	wwMontia fontana ssp(p). chondr	1						
319	wwRanunculus sceleratus	3						4
390	wwSphagnum sp(p)	+		3		1		
174	wwStellaria graminea					1		
484	wxAjuga reptans							1
23	wxChenopodiaceae undiff.			1				
142	wxCirsium sp(p).		2	2				
432	wxGramineae <2mm		+	3		+		
144	wxJuncus sp(p).		4			1		
558	wxLamium undiff.							1
252	wxLuzula sp(p).	1						1
185	wxPotentilla sp(p).		1	2		3	1	*
64	wxRanunculus repens-type	4	+			+		+
83	wxVeronica sp(p).					1		
	Total number of taxa	53	41	25	37	52	17	36

The Ovens

Ovens had been built into the ramparts at various times and places. Samples taken from them gave no evidence for their use although contained large amounts of charcoal - no doubt their fuel. The only seed recovered was one poorly preserved wheat grain. Heather remains were moderately common as was charcoal of pine, oak and a fine-grained wood from either birch, alder or hazel (or a mixture). The pieces of oak are interesting since the species is not likely to have been that common in the area. It is perhaps material either left over from structural work or perhaps rotten wood from earlier activities. The alder/birch/hazel is more likely to have been from locally growing trees and scrub - possibly from Midgeholme Moss area although may have been brought to the fort specifically as fuel. Pine, too, is interesting in that it may well have been growing locally although is rare today. The heather may well have been a kindling fuel since it burns rapidly and would not produce a sustained heat.

The plant remains give no evidence as to function of the ovens - whether they were used in food preparation or for industrial purposes.

Toilet Block

Modification of a building to provide new toilet facilities for visitors allowed excavation of underlying deposits post-dating the Basilica and pre-dating the early 17th century farm. Eighteen samples were analysed from seven contexts (Table 14). They contained both carbonised and waterlogged material.

Three groups of samples were delimited by the excavator:

Context 1488 contained only three carbonised cereal grains - one oat, one hexaploid wheat and one bread wheat.

Fifteen samples from four contexts were amalgamated and most of which contained only carbonised material. Those from context 1100 contained waterlogged seeds as well. The carbonised seeds were the expected cereal grains (oats, barley and wheats) with some fragments of heather and indications of ruderals, grassland and wet ground. The waterlogged seeds represented grassland and ruderal communities and were similar to those from the Ditch samples. Seeds of henbane (*Hyoscyamus niger*) were quite common and may indicate its use as a drug although, as stated above, it is also an opportunistic plant of weedy, waste places.

The third group of samples (two from two contexts) contained predominantly waterlogged material with only three cereal grains recorded (two barley and one indeterminable). There was more indication of nitrophilous, waste ground with the occurrence of stinging nettles (*Urtica dioica*) but fewer ruderals otherwise. There was also one fig pip indicating at least some use of this fruit - although not necessarily in any quantity!

Nothing specific may be inferred from these samples given the long span of time that they represent.

Table 14: Birdoswald Toilet Block context and summary

	Bio.Lab. code numbers	876	883	889	893	894	895	896	897	898
291	wxContext number	14	14	14	14	15		15	15	
455	xxSubdivision of context	88	89	90	91	53		3	52	
335	wxSample number	10	10	10	11	11		11	11	
942	xxSub-division of sample	97	98	99	00	10		01	09	
941	xxNo. of sub samples amalgamated	1	6	5	3	1	15	1	1	2
943	xxNo. of contexts amalgamated	1					4			2
2055	caFallopia convolvulus			1			1			
2059	caPolygonum periscaria		1				1			
2102	ccAvena grain	1		1	1		2			
2124	ccCerealia undiff.		3	4			6		1	1
2105	ccHordeum hulled			5			6			
2125	ccHordeum indet.			1	3	1	5		2	2
2115	ccSecale cereale grain			1			1			
2343	ccTriticum (hexaploid)	1	2		1		3			
2117	ccTriticum aestivum grain	1	2	1			3			
2118	ccTriticum sp(p). grain				2		3			
2086	ceVicia faba						1			
2748	cgGramineae 2-4mm			1			1			
2049	cgPlantago lanceolata			1			1			
2218	chCalluna vulgaris flowers		+	+			+			
2068	crRumex acetosella			1						
2069	crRumex obtusifolius-type		2	1	1		4			
2015	cwCarex (trigonous)		1				1			
2159	cwRanunculus flammula		1				1			
2432	cxGramineae <2mm		2				2			
75	waSpergula arvensis				+		+			
94	waStellaria media				+		+	+		+
215	weFicus carica							1		1
67	wgRumex acetosa				+		+			
11	wrBrassica sp(p).				+		+			
315	wrHyoscyamus niger				+		+			
36	wrLapsana communis				+		+			
69	wrRumex obtusifolius-type							+		+
241	wrSonchus asper				+		+			
79	wrUrtica dioica							+		+
95	wtCorylus avellana nut fragment							+		+
392	wtFragaria vesca							+		+
519	wwCaltha palustris				+		+			
14	wwCarex (lenticular)							+		+
15	wwCarex (trigonous)				+		+	+		+
159	wwRanunculus flammula/cf. flammula							+		+
23	wxChenopodiaceae undiff.				+		+			
142	wxCirsium sp(p).						+			
505	wxMyosotis undiff.				+		+			
64	wxRanunculus repens-type				+		+	+		+
77	wxTrifolium sp(p).							1		1

The Black

This was an extensive layer of very dark grey to black silty loam covering much of the site and possibly relating to a period of abandonment. Context 2961 was analysed but contained no seeds although quite large amounts of plant vegetative remains were present. These consisted of burnt, flaky grass/cereal stems and leaves. It could be said that this may reflect abandonment during which vegetation on the area was periodically burnt. However, it may simply reflect preservational conditions or a large amount of dumped material. If lack of seeds did indicate abandonment then Birdoswald was abandoned at regular intervals!

Fabrica

A selection of samples were analysed from the Fabrica, an industrial area lying to the north of the granaries. Only context 3704 contained any quantity of plant material and this was predominantly from heather with 34 wheat grains as well. This may have been the remains of a

fire. The remaining 25 samples contained few seeds. Although the contexts were individually sampled a summary table (Table 15) for all of them is, perhaps, the most useful to use.

Table 15: Fabrica summary data

Total #contexts 26

Agrostemma githago	1
Fallopia convolvulus	2
Polygonum lapath./pers.	1
Raphanus pod frag.	1
Rumex acetosella	1
R. acetosa	18
R. obtusifolius-type	3
Plantago lanceolata	3
Danthonia decumbens	3
Calluna fragments	+
Gramineae <2mm	6
Gramineae 2-4mm	1
Legume <4mm	1
Matricaria sp.	1
Ranunculus repens-type	7
Carex (lenticular)	2
Carex (trigonous)	16
Eleocharis palustris	9
Eriophorum lat./ang.	3
Ranunculus flammula	1
Bromus	25
Avena	7
Hordeum hulled	32
Hordeum undiff.	6
Triticum (hexaploid)	20
T. aestivum	6
T. sp.	69
Indet. cereal	35
wheat brittle rachis frag.	1
wheat glume	1
Legume >4mm	1

As with most samples from this site, cereals are most common. The moderate numbers of brome-grass seeds suggest weedy crops and emphasise the problems in extracting weed seeds of a similar size and shape to the cereal grains during processing. The numbers of seeds from wet ground taxa perhaps reflect cultivation on heavier soils.

The fact that many of the samples contained considerable quantities of clinker and industrial waste and little plant material reinforce the general interpretation of the area as industrial.

The Turf Wall

Five contexts were sampled from features relating to the original Hadrianic turf Wall lying to the south of the West Gate and between the fort curtain wall and ditch. All of the samples contained only waterlogged seeds amongst a moderately well humified matrix Table 16). There were also quantities of ?burnt lumps of a peaty material. The abundance of seeds was low and the taxa represented were predominantly from wet habitats. This may well indicate conditions in the area prior to any building. One of the samples (context 2897) contained moderate numbers of cereal or large grass caryopses. Given their lack of fragmentation it is most likely

that they represent either cereal waste from animal fodder/bedding rather than human faecal material.

Table 16: Birdoswald Turf Wall

	Bio.Lab. code number	929	930	931	932	933	934
291	wxContext number	28	29	40	30		40
335	wxSample number	11	11	11	40		12
942	xxSub-division of sample	58	66	95	41		
455	xxSubdivision of context	97	94	29	2		64
941	xxNo. of sub samples amalgamated					4	
943	xxNo. of contexts amalgamated					4	
14	wwCarex (lenticular)	1		1	3	5	
15	wwCarex (trigonous)	2		1		3	
259	wcCerealia/large Gramineae	8		1		9	
392	wtFragaria vesca			1		1	
162	waFumaria sp(p).					1	
257	wwIsolepis setaceus	1				1	
53	wrPolygonum aviculare			2		2	
59	wrPolygonum persicaria			1		1	
159	wwRanunculus flammula/cf. flammula	2		1	1	4	
210	wtSambucus nigra	1				1	
241	wrSonchus asper	1				1	
	Total number of taxa	16	9	16	11	18	8

Miscellaneous and non-biological samples

Thirteen samples were analysed from a variety of features whose primary sampling had been for non botanical reasons. This allowed a brief examination of material acting as a control for the site. Only eighteen seeds in total were recovered and were predominantly from cereal grains (see Appendix II). They simply show that the background levels for this site are probably quite low implying that even a few tens of cereal grains may well indicate usage/disposal in the relatively near vicinity.

General summary and conclusions

Macrobotanical remains were preserved both by waterlogging and carbonisation. The waterlogged material was obtained from ditch samples predominantly and gave strong indications that water was lying in those ditches. Other than seeds of water and wet-ground plants the majority of seeds were from ruderals. These, it is suggested, are likely to have been growing in and around the fort. There is limited evidence for the disposal of some rubbish. Cereal periderms and fragments, of wheat/rye and barley, were identified and these probably represent faecal material.

The carbonised seeds were mainly from cereals and associated weeds as is to be expected from a British site where naturally occurring fires are rare. Wheat was the most common cereal recovered and the evidence demonstrates that both bread wheat and spelt were used. Barley was almost as common as wheat and there are indications that the two types were kept separate, with wheat in the North Granary and barley in the South Granary. However, the overall low totals of grain lead this to be only a supposition. Burnt seeds and fragments of grasses and grassland plants present within the granaries possibly indicate that these buildings were also used to store hay at some stage. Rye and oats were present but in very low amounts and they are considered to represent weeds growing amongst the wheat and/or barley only. The weed seeds are more characteristic of cultivation in the broad sense rather than of pure arable cultivation.

With respect to the cereals, chaff and straw fragments of spelt and barley were recovered. None of them were in great quantities but this may be a reflection of poor total numbers and/or preservational problems. Large amounts could indicate local production. It is suggested that local climatic and edaphic conditions could have been suitable for barley cultivation although are unlikely to have been appropriate for wheat. Palynological evidence may help elucidate this important question.

Charcoal identified from various ovens and hearths indicates a probable local supply of fuel and it is suggested that the oak found was from structural off-cuts or rotten timber from earlier actvities. There is no botanical evidence for the uses of these features and it may well be that they were for industrial purposes rather than domestic ones.

Although the total number of seeds recovered from the site as a whole is low, given the numbers of samples analysed, it was a worth while study. They provide data for a period not well covered, the third - fourth centuries, and in a central area of the north also poorly covered. Site conditions may have encouraged poor preservation but it is considered more likely that the catastrophic fires needed to preserve large amounts of grain *etc.* just did not occur. They provide an impoverished comparison with van der Veen's (*op cit.*) South Shields granaries and Huntley's (*op cit*) Carlisle fort and vicus. This is particularly obvious with respect to the waterlogged data. Birdoswald consistently lacks the exotic taxa so common in contextually

comparable material from Carlisle although the Carlisle ditch fills are mainly second to early third century in date. It may suggest that Birdoswald really was an outpost fort on the frontier with Carlisle remaining a higher status/ more luxury area in the hinterland. Birdoswald compares favourably with Housesteads (Clapham, *op cit*) and Peel Gap, a tower on Hadrian's Wall (Huntley, 1989).

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Appendix I: Samples, contexts and bulk assignments

SOUTH GRANARY

Primary deliberate backfill between sleeper walls of south granary (contexts may be bulked) - late 4th century

Context	Sample	Bio.code
336	1082	615
344	1083	616
all contexts		622

Secondary deliberate backfill between sleeper walls of south granary at west end (contexts may be bulked) - late 4th century

Context	Sample	Bio.code	Context	Sample	Bio.code
264	1059A	562	278	1065 both	580
	1059B	563	292	1069 top	581
264	1059 A+B	564		1069 bot	582
271	1061 top	565	292	1069 both	583
272	1062 top	566	280	1066 top	585
	1062 bottom	567		1066 bot	584
272	1062 both	568		1066B top	586
277	1063 top	569	280	1066 all	587
	1063 bottom	570	290	1067 top	588
277	1063 all	571		1067 bot	589
276	1064A	572	290	1067 both	590
	1064B top	575	291	1068	591
	1064C top	573		1068 bot	592
	1064C bot	574	291	1068 both	593
	1064 top	576	293	1070 top	594
276	1064 all	577		1070 bot	595
278	1065 top	578	293	1070 both	596
	1065B top	579	all contexts		620

Intermediate deliberate backfill between sleeper walls of south granary at west end (contexts may be bulked) - late 4th century.

Context	Sample	Bio.code	Context	Sample	Bio.code
298	1071	597	306	1076	606
299	1072	598	308	1077	607
303	1073	600	311	1078	608
	1073 bot	599	313	1079	610
303	1073 both	601		1079 bot	609
304	1074	602	313	1079 both	611
	1074 bot	603	314	1080	612
304	1074 both	604		1080 bot	613
305	1075	605	314	1080 both	614
			all contexts		621

Primary deliberate backfill between sleeper walls of south granary at east end (contexts may be bulked) - late 4th century.

Context	Sample	Bio.code	Context	Sample	Bio.code
237	1053A	551	235	1055A	556
	1053B	550		1055B	557
	1053C	548		1055C	558
	1053D	552		1055D	559
	1053E	553		1055E	560
	1053F	554	235	1055 A-E	561
	1053G	549	all contexts		619
237	1053 A-G	555			

Contexts within south granary reflecting late occupation: (may be bulked) - late 4th to early 5th century

Context	Sample	Bio.Code	Context	Sample	Bio.code
107	1004	505		1030D	517
84	1011	506		1030E	519
84	1012	507		1030F	515
84	1013	508		1030G	518
84	1014	509		1030H	520
84	1015	510	84	1030 A-G	523
84	1016	511	84	all	626
84	1017	512	165	1037A	525
84	1020	513	165	1037B	524
84	1021	514	165	1037 A+B	526
84	1030A	521	175	1044B	528
	1030B	522	175	1044D	527
	1030C	516	175	1044 B+D	529
			all contexts		617

Secondary deliberate backfill between sleeper walls of south granary at east end. Contexts can be bulked - late 4th century.

Context	Sample	Bio.code	Context	Sample	Bio.code
83	1008	530	161	1042A	537
83	1009	531	234	1047A	539
83	1010	532		1047B	538
83	all	624	234	1047 A+B	540
94	1018	533	239	1048	541
94	1022	534	233	1049A	543
94	all	625		1049B	542
173	1024	535	233	1049 A+B	544
162	1036	536	232	1050	545
			231	1051	546
			230	1052	547
			all contexts		618

Contexts reflecting late occupation within south granary but which cannot be bulked - late 4th to early 5th century.

Context	Sample	Bio.code	Context	Sample	Bio.code
101	1001A	456	68	1003A	474
	1001B	461		1003B	475
	1001C	466		1003Bii	476
	1001D	460		1003C	477
	1001E	452	68	1003 A-C	478
	1001F	453	127	1029A	479
	1001G	455		1029B	480
	1001H	458		1029C	481
	1001J	454		1029D	482
	1001K	463		1029E	483
	1001L	465	127	1029 A-E	484
	1001M	459	157	1031A	485
	1001N	464	69	1032A	489
	1001O	451		1032B	486
	1001P	462		1032C	488
	1001Q	457		1032D	487
101	1001 A-Q	450	69	1032 A-D	490
121	1002A	471	118	1033A	491
	1002B	470		1033B	492
	1002C	469		1033C	493
	1002D	472	118	1033 A-C	494
	1002E	468	159	1034	495
121	1002 A-E	473	120	1035A	496
				1035B	497
				1035C	498
			120	1035 A-C	499
			115	1038	500
			115	1039	501
			115	both	625
			187	1040	502
			183	1041A	503
			190	1043	504

NORTH GRANARY

Fill of pre-granary timber slot

Context	Sample	Bio.code
1250	1088	627

Upper unsealed silting. May be bulked

Context	Sample	Bio.code
1416	1094A	862
	1094B	860
	1094D	866
	1094E	863
	1094F	861
	1094G	859
	1094J	865
	1094K	864
1416	1094A-K	867
1418	1093A	634
	1093B	637
	1093C	635
	1093D	630
	1093E	629
	1093F	636
	1093G	631
	1093H	632
	1093J	628
	1093K	633

Context	Sample	Bio.code
1418	1093A-K	638
1403	1091A	644
	1091B	640
	1091C	642
	1091F	641
	1091H	639
	1091J	643
1403	1091A-J	645
1403	1096A	868
	1096B	864
1403	1096A-B	870
1417	1092A	651
	1092B	646
	1092C	650
	1092D	649
	1092E	648
	1092J	647
1417	1092A-J	652
all contexts		690

Unsealed north granary, gradual silting. Contains intrusive, Medieval material. May be bulked but not very reliable - late 4th century onwards

Context	Sample	Bio.code
1519	1103A	873
	1103B	874
	1103C	871
	1103D	872
1519	1103A-D	875
1520	1104A	656
	1104C	653
	1104D	654
	1104H	655
	1104J	657
	1104B	658
	1104E	659
1520	1104A-J	660
1521	1105A	662
	1105B	666
	1105C	661

Context	Sample	Bio.code
	1105D	663
	1105E	669
	1105F	667
	1105G	668
	1105H	664
	1105J	665
	1105K	670
1521	1105A-K	671
1522	1106A	677
	1106B	672
	1106C	675
	1106D	678
	1106E	673
	1106G	680
	1106H	674
	1106J	679
	1106K	676

Context	Sample	Bio.code
1522	1106A-K	681
1566	1111A	682
	1111B	683
1566	1111A-B	684
1560	1112	685
1585	1113A	686
	1113B	687
	1113D	688
1585	1113A-D	689
all contexts		691

DITCH

Context	Sample	Bio.code
1496	1102	698
1499	1107	695
1605	1114	694
1755	1123	692
1760	1128	693
1796	1125	696
1796	1124	697

OVENS

Context	Sample	Bio.code
2659	1134	899
2606	1132	900
1413	1095B	901

TOILET BLOCK

modern sandy

Context	Sample	Bio.code
1488	1097	876

buried soil

1489	1098A	882
	1098B	879
	1098C	877
	1098D	881
	1098E	878
	1098F	880
1489	1098A-F	883
1490	1099A	884
	1099B	885
	1099C	886
	1099D	887
	1099E	888
1490	1099A-E	889
1491	1100C	891
	1100D	892
	1100E	890
1491	1100C-E	893
1553	1110	894
all contexts		895

buried soil (mixed)

1503	1101A	896
1552	1109	897
all contexts		898

THE BLACK

Context	Sample	Bio.code
2961	1165	902

FABRICA

Context	Sample	Bio.code
1364	1087	903
1377	1090	904
2628	1133	905
2755	1138	906
2823	1150	907
2894	1160	908
2939	1161	909
3704	1168	910
3706	1169	911
3759	1170	912
3772	1172	913
3812	1176	914
3910	1178	915
3894	1180	916
3899	1181	917
3909	1182	918
3911	1183	919
3919	1184	920
3944	1187	921
4051	1194	922
4119	1197	923
4096	3006	924
4190	3012	925
4219	3017	926
4210	3018	927
4242	3021	928

TURF WALL

Backfill of ditch

Context	Sample	Bio.code
2897	1158	929
2994	1166	930
4029	1195	931
4041	3002	932
all contexts		933

Stake hole

4064	1200	934

MISCELLANEOUS

Context	Sample	Bio.code
255	1058	935
344	1081	936
2765	1139	937
3943	1188	938
2701	1135	939
2595	1131	940
2588	1130	941
351	1084	942

NON-BIOLOGICAL SAMPLES

Context	Sample	Bio.code
1668	1119	943
1690	1120	944
1748	1122	945
4065	3001	946
3943	1185	947

Appendix II: Raw data tables

All subsamples in context order as Appendix I, taxa in alphabetical order
Total number of taxa include both botanical taxa and "archaeological" taxa such as context number, excavation code etc..

Birdoswald South Granary primary backfill contexts, plus part of secondary deliberate backfill

	Bio.Lab. code number	615	616	562	563	565	566	567	569	570	572	575	573	574	576
290	wxSite code no.	19	19	19	19	19	19	19	19	19	19	19	19	19	19
450	xxExcavation	32	32	32	32	32	32	32	32	32	32	32	32	32	32
451	xxExcavator	14	14	14	14	14	14	14	14	14	14	14	14	14	14
454	xxDate-year	91	91	91	91	91	91	91	91	91	91	91	91	91	91
452	xxAnalyst	1	1	1	1	1	1	1	1	1	1	1	1	1	1
291	wxContext number	336	344	264	264	271	272	272	277	277	276	276	276	276	276
335	wxSample number	10	10	1	2	1	1	2	2	1	1	21	31	32	11
942	xxSub-division of sample	82	83												
453	xxDate-month		4												
2102	ccAvena grain						1			1		1			
2103	cxBromus sp(p). grain					1									
2129	chCalluna vulgaris twigs	9													
2014	cwCarex (lenticular)				1										
2015	cwCarex (trigonous)			2	1					1					
2124	ccCerealia undiff.			3	4		1			4				2	
2095	ctCorylus avellana nut frag.		1	1					1						
2740	cwEriophorum lat/angustifolium													2	
2105	ccHordeum hulled					1				3					
2125	ccHordeum indet.						1								
2110	ccHordeum twisted naked								1						
2049	cgPlantago lanceolata			1						1					
2433	cxPolygonum sp(p).						1								
2159	cwRanunculus flammula									1					
2069	crRumex obtusifolius-type								1						
2117	ccTriticum aestivum grain			2						3					
2118	ccTriticum sp(p). grain				1										
	Total number of taxa	10	11	12	11	9	11	7	10	14	7	8	7	9	7

Birdoswald South Granary remainder of secondary deliberate backfill at west end

	Bio.Lab. code number	578	579	581	582	585	584	586	588	589	591	592	594	595
290	wxSite code no.	19	19	19	19	19	19	19	19	19	19	19	19	19
450	xxExcavation	32	32	32	32	32	32	32	32	32	32	32	32	32
451	xxExcavator	14	14	14	14	14	14	14	14	14	14	14	14	14
454	xxDate-year	91	91	91	91	91	91	91	91	91	91	91	91	91
452	xxAnalyst	1	1	1	1	1	1	1	1	1	1	1	1	1
291	wxContext number	278	278	292	292	280	280	280	290	290	291	291	293	293
335	wxSample number	1	1	1	2	1	2	21	1	2	1	2	1	2
2102	ccAvena grain							3			1			
2015	cwCarex (trigonous)			1							1			
2124	ccCerealia undiff.			3	1	1	1	2				2		3
2105	ccHordeum hulled	1								2	1		3	
2125	ccHordeum indet.			1				1						1
2107	ccHordeum twisted				1									
2068	crRumex acetosella										2			
2069	crRumex obtusifolius-type											1		
2117	ccTriticum aestivum grain							1		1				
2118	ccTriticum sp(p). grain		2									1	1	
2087	crVicia sativa					1								
	Total number of taxa	8	8	10	9	9	8	11	7	9	11	10	9	9

Birdoswald South Granary intermediate deliberate backfill at west end

	Bio.Lab. code number	597	598	600	599	602	603	605	606	607	608	610	609	612	613
290	wxSite code no.	19	19	19	19	19	19	19	19	19	19	19	19	19	19
450	xxExcavation	32	32	32	32	32	32	32	32	32	32	32	32	32	32
451	xxExcavator	14	14	14	14	14	14	14	14	14	14	14	14	14	14
454	xxDate-year	91	91	91	91	91	91	91	91	91	91	91	91	91	91
452	xxAnalyst	1	1	1	1	1	1	1	1	1	1	1	1	1	1
291	wxContext number	298	299	303	303	304	304	305	306	308	311	313	313	314	314
335	wxSample number	1	1	1	2	1	2	10	10	10	10	1	2	1	2
942	xxSub-division of sample							75	76	77	78				
453	xxDate-month							2	2	4	2				
2102	ccAvena grain				1									1	
2103	cxBromus sp(p). grain	1								1	1				
2014	cwCarex (lenticular)								2						
2015	cwCarex (trigonous)				2			1	2	2					1
2124	ccCerealia undiff.								7						
2258	cwEleocharis sp(p).								1						
2740	cwEriophorum lat/angustifolium				1										
2432	cxGramineae <2mm														1
2105	ccHordeum hulled							1	7	3					
2125	ccHordeum indet.	1						2							
2113	csHordeum rachis internode													1	
2053	caPolygonum aviculare				1										
2059	caPolygonum periscaria				1										
2069	crRumex obtusifolius-type													1	
2343	ccTriticum (hexaploid)													1	
2119	csTriticum floret scar				1										
2261	csTriticum glume base								1						
2118	ccTriticum sp(p). grain	1			1			2		2	1				
2382	csTriticum spelta glume				1				1					1	
	Total number of taxa	11	8	7	15	7	7	14	17	14	12	7	7	12	9

Birdoswald South Granary primary deliberate backfill at east end

	Bio.Lab. code number	551	550	548	552	553	554	549	556	557	558	559	560
290	wxSite code no.	19	19	19	19	19	19	19	19	19	19	19	19
450	xxExcavation	32	32	32	32	32	32	32	32	32	32	32	32
451	xxExcavator	14	14	14	14	14	14	14	14	14	14	14	14
454	xxDate-year	91	91	91	91	91	91	91	91	91	91	91	91
452	xxAnalyst	1	1	1	1	1	1	1	1	1	1	1	1
291	wxContext number	237	237	237	237	237	237	237	235	235	235	235	235
335	wxSample number	1	2	3	4	5	6	7	1	2	3	4	5
2102	ccAvena grain						1						
2103	cxBromus sp(p). grain					1				1			1
2015	cwCarex (trigonous)	1					2		2				2
2124	ccCerealia undiff.	1	1	2	1		4	1		1		2	
2095	ctCorylus avellana nut frag.							1					
2029	crGalium aparine	1	3										
2748	cgGramineae 2-4mm												1
2093	cxGramineae undiff.			1									
2105	ccHordeum hulled			1	1	4	1	7		1		1	5
2125	ccHordeum indet.	1	1	1					2				5
2433	cxPolygonum sp(p).									1			
2067	cgRumex acetosa			1									
2069	crRumex obtusifolius-type		1										
2343	ccTriticum (hexaploid)			1	1		1	1					
2117	ccTriticum aestivum grain						1					1	
2118	ccTriticum sp(p). grain		1			1		3			1	1	1
	Total number of taxa	11	12	13	10	10	13	12	9	11	8	11	13

Birdoswald South Granary late occupation within south granary, may be bulked

	Bio.Lab. code number	505	506	507	508	509	510	511	512	513	514
290	wxSite code no.	19	19	19	19	19	19	19	19	19	19
450	xxExcavation	32	32	32	32	32	32	32	32	32	32
451	xxExcavator	14	14	14	14	14	14	14	14	14	14
454	xxDate-year	91	91	91	91	91	91	91	91	91	91
452	xxAnalyst	1	1	1	1	1	1	1	1	1	1
291	wxContext number	107	84	84	84	84	84	84	84	84	84
335	wxSample number	10	10	10	10	10	10	10	10	10	10
942	xxSub-division of sample	4	11	12	13	14	15	16	17	20	21
453	xxDate-month	2	2	2	3	2	2	2	2	2	4
2103	cxBromus sp(p). grain	1									
2015	cwCarex (trigonous)										
2124	ccCerealia undiff.		1		1			1			
2095	ctCorylus avellana nut frag.										
2740	cwEriophorum lat/angustifolium								1		
2029	crGalium aparine						1				
2432	cxGramineae <2mm										
2105	ccHordeum hulled		2								
2125	ccHordeum indet.	1					2				
2111	ccHordeum straight hulled										
2069	crRumex obtusifolius-type										
2343	ccTriticum (hexaploid)							3		1	
2118	ccTriticum sp(p). grain	2		1							2
2382	csTriticum spelta glume	1									
	Total number of taxa	14	12	11	11	10	12	12	11	11	11

	Bio.Lab. code number	521	522	516	517	519	515	518	520	525	524	528	527
290	wxSite code no.	19	19	19	19	19	19	19	19	19	19	19	19
450	xxExcavation	32	32	32	32	32	32	32	32	32	32	32	32
451	xxExcavator	14	14	14	14	14	14	14	14	14	14	14	14
454	xxDate-year	91	91	91	91	91	91	91	91	91	91	91	91
452	xxAnalyst	1	1	1	1	1	1	1	1	1	1	1	1
291	wxContext number	84	84	84	84	84	84	84	84	165	165	175	175
335	wxSample number	1	2	3	4	5	6	7	8	1	2	2	4
942	xxSub-division of sample												
453	xxDate-month												
2103	cxBromus sp(p). grain								1				
2015	cwCarex (trigonous)									1			
2124	ccCerealia undiff.	2			1		2	2					
2095	ctCorylus avellana nut frag.										1		2
2740	cwEriophorum lat/angustifolium					1							
2029	crGalium aparine												
2432	cxGramineae <2mm						1						
2105	ccHordeum hulled			1	2	1	2	2	5		1		
2125	ccHordeum indet.	1					1						
2111	ccHordeum straight hulled						1						
2069	crRumex obtusifolius-type						1						
2343	ccTriticum (hexaploid)												
2118	ccTriticum sp(p). grain				1		2		1		1		
2382	csTriticum spelta glume												
	Total number of taxa	9	7	8	10	9	14	9	10	8	10	7	8

Birdoswald South Granary secondary deliberate backfill at east end

	Bio.Lab. code number	530	531	532	624	533	534	535	536	537	539	538	541	543	542	545	546	547
290	wxSite code no.	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19
450	xxExcavation	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32
451	xxExcavator	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
454	xxDate-year	91	91	91	91	91	91	91	91	91	91	91	91	91	91	91	91	91
452	xxAnalyst	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
291	wxContext number	83	83	83	83	94	94	173	162	161	234	234	239	233	233	232	231	230
335	wxSample number	10	10	10		10	10	10	10	10	1	2	10	1	2	10	10	10
942	xxSub-division of sample	8	9	10		18	22	24	36	42			48			50	51	52
453	xxDate-month	3	2	2		2	2	4	4	4			4			4	2	4
2102	ccAvena grain								1	1	1		1			1		
2103	cxBromus sp(p). grain					1				9			1	1				
2015	cwCarex (trigonous)							1					1					
2385	cwCarex hostiana-type								1									
2017	caCentaurea cyanus							1										
2124	ccCerealia undiff.							3		1		1	2			3		
2029	crGalium aparine						1											
2748	cgGramineae 2-4mm												1					
2105	ccHordeum hulled							8		20				1				1
2125	ccHordeum indet.											1	2	1		1		
2113	csHordeum rachis internode									17						1		
2049	cgPlantago lanceolata									1							1	
2059	caPolygonum periscaria								1	1				1				
2069	crRumex obtusifolius-type						1									1		
2122	csTriticum brittle rachis intern											1						
2118	ccTriticum sp(p). grain			1	1			1		2	1	1		1				1
2382	csTriticum spelta glume									3			1					
2342	csTriticum spikelet fork											1						
2280	caValerianella dentata								2									
	Total number of taxa	10	10	11	8	11	12	15	14	19	9	12	17	12	7	15	11	12

Birdoswald South Granary late occupation, context 101

Bio.Lab. code.	456	461	466	460	452	453	455	458	454	463	465	459	464	451	462	457
xSite code no.	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19
xExcavation	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32
xExcavator	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
xDate-year	91	91	91	91	91	91	91	91	91	91	91	91	91	91	91	91
xAnalyst	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
xContext number	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101	101
xSample number	1	2	3	4	5	6	7	8	10	11	12	17	14	15	14	15
cAvena grain						1										
cCerealia undiff.	2				1			1								2
cHordeum hulled		2			3				1			1		1		
cHordeum indet.	5	1								1	1					
hSieglingia decumbens																1
cTriticum (hexaploid)								1								
cTriticum sp(p). grain				1	1					1	1					
Total number of taxa	9	9	7	8	10	8	7	9	8	9	9	8	7	8	7	9

Birdoswald South Granary late occupation, contexts 121 and 68

	Bio.Lab. code number	471	470	469	472	468	474	475	476	477
290	wxSite code no.	19	19	19	19	19	19	19	19	19
450	xxExcavation	32	32	32	32	32	32	32	32	32
451	xxExcavator	14	14	14	14	14	14	14	14	14
454	xxDate-year	91	91	91	91	91	91	91	91	91
452	xxAnalyst	1	1	1	1	1	1	1	1	1
291	wxContext number	121	121	121	121	121	68	68	68	68
335	wxSample number	1	2	3	4	5	1	2	29	3
2015	cwCarex (trigonous)								1	
2124	ccCerealia undiff.			1		2				
2105	ccHordeum hulled	1	1		1					
2069	crRumex obtusifolius-type								1	
2118	ccTriticum sp(p). grain					1				
	Total number of taxa	8	8	8	8	9	7	7	9	7

Birdoswald South Granary late occupation, remaining contexts

Bio.Lab. code number	479	480	481	482	483	489	486	488	487	491	492	493	496	497	498	500	501	502	503	504
xSite code no.	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19
xExcavation	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32
xExcavator	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
xDate-year	91	91	91	91	91	91	91	91	91	91	91	91	91	91	91	91	91	91	91	91
xAnalyst	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
xContext number	127	127	127	127	127	69	69	69	69	118	118	118	120	120	120	115	115	187	183	190
xSample number	1	2	3	4	5	1	2	3	4	1	2	3	1	2	3	10	10	10	10	10
xSub-division of sample																38	39	40	41	43
xDate-month																3	4	2	4	4
cCerealia undiff.							1		1											
tCorylus avellana nut frag.															1					
cHordeum hulled													2		2					3
cHordeum indet.					1	1						1								
cTriticum sp(p). grain	1				1															1
sTriticum spelta glume										1										
Total number of taxa	8	7	7	7	9	8	8	7	8	8	7	8	8	7	9	10	10	10	10	12

Birdoswald north Granary - context 1416

	Bio.Lab. code number	862	860	866	863	861	859	865	864	867
290	wxSite code no.	19	19	19	19	19	19	19	19	19
450	xxExcavation	32	32	32	32	32	32	32	32	32
451	xxExcavator	14	14	14	14	14	14	14	14	14
452	xxAnalyst	1	1	1	1	1	1	1	1	1
454	xxDate-year	91	91	91	91	91	91	91	91	91
453	xxDate-month	2	2	2	2	2	2	2	2	2
291	wxContext number	14	14	14	14	14	14	14	14	14
455	xxSubdivision of context	16	16	16	16	16	16	16	16	16
335	wxSample number	1	2	4	5	6	7	10	11	10
942	xxSub-division of sample									91
941	xxNo. of sub samples amalgamated									8
2102	ccAvena grain		1	1		2	1	1		6
2103	cxBromus sp(p). grain				1	1				2
2015	cwCarex (trigonous)	1		1						1
2017	caCentaurea cyanus					1				1
2124	ccCerealia undiff.	8		4	5	9	6	4	1	37
2023	crChenopodiaceae undiff.							1		1
2095	ctCorylus avellana nut frag.			1					1	2
2114	csHordeum 6-row rachis internode					1				1
2125	ccHordeum indet.			6	5	12	3	5	2	28
2049	cgPlantago lanceolata					1	1			2
2059	caPolygonum periscaria		1			1				2
2064	cxRanunculus repens-type						2			1
2068	crRumex acetosella					1				1
2069	crRumex obtusifolius-type	1		1		3	1			6
2343	ccTriticum (hexaploid)	9								9
2118	ccTriticum sp(p). grain	3	3	6		3	3		1	19
2382	csTriticum spelta glume			1		3				4
	Total number of taxa	14	12	17	12	21	16	13	13	28

Birdoswald north Granary - context 1418

	Bio.Lab. code number	634	637	635	630	629	636	631	632	628	633	638
290	wxSite code no.	19	19	19	19	19	19	19	19	19	19	19
450	xxExcavation	32	32	32	32	32	32	32	32	32	32	32
451	xxExcavator	14	14	14	14	14	14	14	14	14	14	14
452	xxAnalyst	1	1	1	1	1	1	1	1	1	1	1
454	xxDate-year	91	91	91	91	91	91	91	91	91	91	91
453	xxDate-month	6	6	6	6	6	6	6	6	6	6	
291	wxContext number	14	14	14	14	14	14	14	14	14	14	14
455	xxSubdivision of context	18	18	18	18	18	18	18	18	18	18	18
335	wxSample number	1	2	3	4	5	6	7	8	10	11	10
942	xxSub-division of sample											93
941	xxNo. of sub samples amalgamated											10
2008	cxArrhenatherum elatius - tuber		1									1
2102	ccAvena grain		4		1		1		1	1		8
2103	cxBromus sp(p). grain	1	1		1							3
2124	ccCerealia undiff.	7	5	1	10		2		4	1	3	33
2027	crConium maculatum		2									2
2095	ctCorylus avellana nut frag.		2						1			3
2029	crGalium aparine		1									1
2748	cgGramineae 2-4mm								1			1
2105	ccHordeum hulled	2	10				2	2	3	3		22
2125	ccHordeum indet.					1					1	2
2057	caPolygonum lapathifolium	1										1
2059	caPolygonum periscaria		6									6
2159	cwRanunculus flammula		1									1
2064	cxRanunculus repens-type		1									1
2418	ctRosa thorn	1										1
2068	crRumex acetosella		1									1
2069	crRumex obtusifolius-type		2		1	1			1			5
2075	caSpergula arvensis			1								1
2343	ccTriticum (hexaploid)		13	1								14
2122	csTriticum brittle rachis internode		1									1
2118	ccTriticum sp(p). grain	4			2	2			1	2		11
2382	csTriticum spelta glume		2								1	3
2087	crVicia sativa		1									1
	Total number of taxa	15	26	12	14	12	12	10	16	13	12	33

Birdoswald north Granary - context 1403 (samples 1091 and 1096)

	Bio.Lab. code number	644	640	642	641	639	643	645	868	869	870
290	wxSite code no.	19	19	19	19	19	19	19	19	19	19
450	xxExcavation	32	32	32	32	32	32	32	32	32	32
451	xxExcavator	14	14	14	14	14	14	14	14	14	14
452	xxAnalyst	1	1	1	1	1	1	1	1	1	1
454	xxDate-year	91	91	91	91	91	91	91	91	91	91
453	xxDate-month	6	6	6	6	6	6		2	2	2
291	wxContext number	14	14	14	14	14	14	14	14	14	14
455	xxSubdivision of context	3	3	3	3	3	3	3	3	3	3
335	wxSample number	1	2	3	6	8	10	10	1	2	10
942	xxSub-division of sample							91			96
941	xxNo. of sub samples amalgamated							6			2
2102	ccAvena grain		1			1		2			
2385	cwCarex hostiana-type					1		1			
2017	caCentaurea cyanus	1						1			
2124	ccCerealia undiff.	8	7		5	9	4	33	4		4
2023	crChenopodiaceae undiff.					1		1			
2095	ctCorylus avellana nut frag.					2		2			
2123	csCulm nodes					2		2			
2432	cxGramineae <2mm				1			1			
2105	ccHordeum hulled			4	6	2	1	13		1	1
2125	ccHordeum indet.	3				4	3	10			
2059	caPolygonum periscaria					2	1	3			
2067	cgRumex acetosa					3		3			
2072	chSieglingia decumbens						1	1			
2094	caStellaria media					1		1			
2118	ccTriticum sp(p). grain	9	9		6	6	3	33			
	Total number of taxa	13	12	10	13	21	15	25	10	13	13

Birdoswald north Granary - context 1417

	Bio.Lab. code number	651	646	650	649	648	647	652
290	wxSite code no.	19	19	19	19	19	19	19
450	xxExcavation	32	32	32	32	32	32	32
451	xxExcavator	14	14	14	14	14	14	14
452	xxAnalyst	1	1	1	1	1	1	1
454	xxDate-year	91	91	91	91	91	91	91
453	xxDate-month	6	6	6	6	6	6	
291	wxContext number	14	14	14	14	14	14	14
455	xxSubdivision of context	17	17	17	17	17	17	17
335	wxSample number	1	2	3	4	5	10	10
942	xxSub-division of sample							92
941	xxNo. of sub samples amalgamated							6
2017	caCentaurea cyanus			1				1
2059	caPolygonum periscaria	3	1					4
2102	ccAvena grain	2	1			2		5
2124	ccCerealia undiff.	18	8	2	6	6	2	42
2105	ccHordeum hulled	12		2	2		2	18
2125	ccHordeum indet.					5	3	8
2115	ccSecale cereale grain	1						1
2118	ccTriticum sp(p). grain	15	9	8	1	6	3	42
2049	cgPlantago lanceolata			1				1
2072	chSieglingia decumbens		1					1
2023	crChenopodiaceae undiff.	1			1			2
2029	crGalium aparine	4	1	2				7
2068	crRumex acetosella		1			1		2
2069	crRumex obtusifolius-type		1			2	1	4
2382	csTriticum spelta glume	1						1
2095	ctCorylus avellana nut frag.						1	1
2362	ctRosa sp.						1	1
2103	cxBromus sp(p). grain						2	2
	Total number of taxa	18	17	15	13	15	17	28

Birdoswald north Granary - context 1519

	Bio.Lab. code number	873	874	871	872	875
290	wxSite code no.	19	19	19	19	19
450	xxExcavation	32	32	32	32	32
451	xxExcavator	14	14	14	14	14
452	xxAnalyst	1	1	1	1	1
454	xxDate-year	91	91	91	91	91
291	wxContext number	15	15	15	15	15
455	xxSubdivision of context	19	19	19	19	19
335	wxSample number	1	2	3	5	11
942	xxSub-division of sample					3
941	xxNo. of sub samples amalgamated					4
2059	caPolygonum periscaria		1			1
2102	ccAvena grain	1				1
2124	ccCerealia undiff.		4			4
2118	ccTriticum sp(p). grain	2		5		7
2072	chSieglingia decumbens		1			1
2069	crRumex obtusifolius-type	3	1	2		5
2113	csHordeum rachis internode		1			1
2122	csTriticum brittle rachis internode		1			1
2382	csTriticum spelta glume	4	1			5
2014	cwCarex (lenticular)				1	1
2385	cwCarex hostiana-type					2
2325	cwEleocharis palustris			2		
2103	cxBromus sp(p). grain	1	1			2
2039	cxLegume <4mm	1				1
	Total number of taxa	14	16	11	9	23

Birdoswald north Granary - context 1520

	Bio.Lab. code number	656	653	654	655	657	658	659	660
290	wxSite code no.	19	19	19	19	19	19	19	19
450	xxExcavation	32	32	32	32	32	32	32	32
451	xxExcavator	14	14	14	14	14	14	14	14
452	xxAnalyst	1	1	1	1	1	1	1	1
454	xxDate-year	91	91	91	91	91	91	91	91
453	xxDate-month	3	3	3	3	3	3	3	3
291	wxContext number	15	15	15	15	15	15	15	15
455	xxSubdivision of context	20	20	20	20	20	20	20	20
335	wxSample number	1	3	4	7	10	2	5	10
942	xxSub-division of sample								4
941	xxNo. of sub samples amalgamated								7
2008	cxArrhenatherum elatius - tuber					1			1
2103	cxBromus sp(p). grain		1			1	1		3
2124	ccCerealia undiff.	2	3			1	4	1	11
2029	crGalium aparine					1			1
2125	ccHordeum indet.	1	1			7			9
2041	cxLegume >4mm						1		1
2057	caPolygonum lapathifolium					1			1
2059	caPolygonum periscaria		2			3	1		6
2066	crRaphanus raphanistrum pod frag.				1				1
2069	crRumex obtusifolius-type		1			1	5		7
2115	ccSecale cereale grain					2			2
2230	cxStachys sp.						1		1
2122	csTriticum brittle rachis internode						1		1
2118	ccTriticum sp(p). grain		2			8	4		14
2382	csTriticum spelta glume					1			1
	Total number of taxa	11	15	9	10	20	17	10	26

Birdoswald north Granary - context 1521

	Bio.Lab. code number	662	666	661	663	669	667	668	664	665	670	671
290	wxSite code no.	19	19	19	19	19	19	19	19	19	19	19
450	xxExcavation	32	32	32	32	32	32	32	32	32	32	32
451	xxExcavator	14	14	14	14	14	14	14	14	14	14	14
452	xxAnalyst	1	1	1	1	1	1	1	1	1	1	1
454	xxDate-year	91	91	91	91	91	91	91	91	91	91	91
453	xxDate-month	2	2	2	2	2	2	2	2	2	2	
291	wxContext number	15	15	15	15	15	15	15	15	15	15	15
455	xxSubdivision of context	21	21	21	21	21	21	21	21	21	21	21
335	wxSample number	1	2	3	4	5	6	7	8	10	11	11
942	xxSub-division of sample											5
941	xxNo. of sub samples amalgamated											10
2102	ccAvena grain	1										1
2103	cxBromus sp(p). grain									1		1
2015	cwCarex (trigonous)						2					1
2124	ccCerealia undiff.	2	3	4	7		4	2	5		13	40
2023	crChenopodiaceae undiff.			1						2		1
2095	ctCorylus avellana nut frag.				2						3	4
2123	csCulm nodes		1									4
2055	caFallopia convolvulus			1							3	1
2029	crGalium aparine											1
2432	cxGramineae <2mm							1			3	3
2105	ccHordeum hulled	2			1							1
2125	ccHordeum indet.		7	3			3			2		3
2035	cxLabiatae undiff.			1								15
2050	crPlantago major										1	1
2057	caPolygonum lapathifolium			1								1
2059	caPolygonum periscaria			14						2	1	17
2159	cwRanunculus flammula			1								1
2068	crRumex acetosella										3	3
2069	crRumex obtusifolius-type		2	1	1		1	1		1		7
2115	ccSecale cereale grain										1	1
2343	ccTriticum (hexaploid)		2	2						7	15	26
2118	ccTriticum sp(p). grain	1			1			1				3
2382	csTriticum spelta glume			2								2
2383	crVeronica hederifolia										2	2
	Total number of taxa	13	14	20	14	9	13	13	10	15	18	34

Birdoswald north Granary - context 1522

	Bio.Lab. code number	677	672	675	678	673	680	674	679	676	681
290	wxSite code no.	19	19	19	19	19	19	19	19	19	19
450	xxExcavation	32	32	32	32	32	32	32	32	32	32
451	xxExcavator	14	14	14	14	14	14	14	14	14	14
452	xxAnalyst	1	1	1	1	1	1	1	1	1	1
454	xxDate-year	91	91	91	91	91	91	91	91	91	91
453	xxDate-month	2	2	2	2	2	2	2	2	2	
291	wxContext number	15	15	15	15	15	15	15	15	15	15
455	xxSubdivision of context	22	22	22	22	22	22	22	22	22	22
335	wxSample number	1	2	3	4	5	7	8	10	11	11
942	xxSub-division of sample										6
941	xxNo. of sub samples amalgamated										9
2001	caAgrostemma githago									1	1
2102	ccAvena grain	1								2	3
2103	cxBromus sp(p). grain									5	5
2015	cwCarex (trigonous)						1			1	2
2124	ccCerealia undiff.	1	3		3	1	2	4	1	17	32
2023	crChenopodiaceae undiff.						1				1
2095	ctCorylus avellana nut frag.				1						1
2258	cwEleocharis sp(p).					1	1				2
2029	crGalium aparine		1								1
2105	ccHordeum hulled	2				1					3
2125	ccHordeum indet.	6	1	1	2	2	2	7	1	18	40
2035	cxLabiatae undiff.		1								1
2049	cgPlantago lanceolata								1		1
2059	caPolygonum periscaria				12						12
2159	cwRanunculus flammula				1						1
2069	crRumex obtusifolius-type				1		2	1			4
2343	ccTriticum (hexaploid)								1		1
2118	ccTriticum sp(p). grain	2	2				5	3		17	29
2382	csTriticum spelta glume									7	7
	Total number of taxa	14	14	10	15	13	16	13	13	17	29

Birdoswald north Granary - contexts 1566,1560 and 1585

	Bio.Lab. code number	682	683	684	685	686	687	688	689
290	wxSite code no.	19	19	19	19	19	19	19	19
450	xxExcavation	32	32	32	32	32	32	32	32
451	xxExcavator	14	14	14	14	14	14	14	14
452	xxAnalyst	1	1	1	1	1	1	1	1
454	xxDate-year	91	91	91	91	91	91	91	91
453	xxDate-month	6	6		6	2	2	2	
291	wxContext number	15	15	15	15	15	15	15	15
455	xxSubdivision of context	66	66	66	60	85	85	85	85
335	wxSample number	1	2	11	11	1	2	4	11
942	xxSub-division of sample			11	12				13
941	xxNo. of sub samples amalgamated			2	1				3
2102	ccAvena grain	2		2					
2103	cxBromus sp(p). grain							1	1
2014	cwCarex (lenticular)	1		1					
2015	cwCarex (trigonous)		1	1				1	
2124	ccCerealia undiff.	20	3	23	1		2	2	4
2095	ctCorylus avellana nut frag.						1		1
2258	cwEleocharis sp(p).							5	5
2125	ccHordeum indet.						2		2
2059	caPolygonum periscaria							1	1
2069	crRumex obtusifolius-type						1		1
2115	ccSecale cereale grain	1		1					
2343	ccTriticum (hexaploid)	17	11	28					
2117	ccTriticum aestivum grain	2	1	3					
2118	ccTriticum sp(p). grain					1	3	5	9
2382	csTriticum spelta glume	3	1	4			1		1
2079	crUrtica dioica							1	1
	Total number of taxa	16	14	18	12	10	15	16	20

Birdoswald - Ditch raw data table

Nodum code nos.		692	693	694	695	696	697	698
291	wxContext number	17	17	16	14	17	17	14
455	xxSubdivision of context	55	60	05	99	96	96	96
335	wxSample number	11	11	11	11	11	11	11
942	xxSub-division of sample	23	28	14	07	25	24	02
827	xxCoarse sand/gravel				2	3		
828	xxSilt and clay	3			3	1		
940	xxClinker/Ind.waste		1					
832	xxAmorphous organic material		1		1	1	3	2
826	xxPeat/coarse organic	3	3		1		5	3
831	xxMonocot. fragments	1	1	5		1	4	
830	xxWood fragments	1	2			2		2
823	xxCharcoal fragments	1	1		2	2		1
269	wxBryophyte fragments	1	1	2	1	1	1	
621	wcbran fragments	1	1		1	1		
388	wxLegume flower	1		1	1	1		
272	wxtree bud	1		1	1	1		
829	xxFly puparia				1			
825	xxInsect fragments	1					1	
1	waAgrostemma githago		1		2			
195	waAphanes arvensis	1						
231	waGaleopsis tetrahit					1		1
94	waStellaria media	1				2		
214	waUrtica urens	+	*	1	+	2		1
421	wcAvena periderm	2						
259	wcCerealia/large Gramineae	5	2	1		2		
125	wcHordeum - indet.	2			3	+		
422	wcHordeum periderm	1						
658	wcTriticum undiff.	6			*	1		
408	wcTriticum/Secale periderm	1	1					
790	wgBellis perennis				1			
410	wgLeontodon autumnalis/hisp(p).		1					
42	wgLinum catharticum					1		
465	wgRhinanthus minor agg.				1	1		
67	wgRumex acetosa	3	1			2		+
218	whCalluna vulgaris flowers			1				
129	whCalluna vulgaris shoots/twigs	1		1				
2129	chCalluna vulgaris twigs	1				1		
155	whPteridium aquilinum -frond fr	**						
55	wrFallopia convolvulus					2		
206	wrHeracleum sphondylium		1					
315	wrHyoscyamus niger							+
53	wrPolygonum aviculare	3	1			1		1
58	wrPolygonum lapath/persicaria	2			*			
57	wrPolygonum lapathifolium	1	1		1			1
59	wrPolygonum persicaria	2	4		2	2		1
68	wrRumex acetosella	1	1			2		1
69	wrRumex obtusifolius-type				1	1		
241	wrSonchus asper	1	2		2			1
79	wrUrtica dioica	+	4	1		3		*
113	wsHordeum rachis internode	1						
261	wsTriticum glume base	+	1		1	1		
382	wsTriticum spelta glume	1				1		
500	wtAlnus glutinosa	2						
398	wtBetula tree catkin scale	1						
95	wtCorylus avellana nut fragment				1	1		1
63	wtPrunella vulgaris		1			1		
418	wtRosa - thorn							1
362	wtRosa sp(p).				1			
154	wtRubus fruticosus					2		+
14	wwCarex (lenticular)	+	4	1	2	+	2	2
15	wwCarex (trigonous)	2	2		2	4		5
385	wwCarex hostiana-type	2	2		2	3		1
325	wwEleocharis palustris					3		
178	wwMontia fontana ssp(p). chondr	1						
319	wwRanunculus sceleratus	3						4
390	wwSphagnum sp(p)	+		3		1		
174	wwStellaria graminea					1		
484	wxAjuga reptans							1
23	wxChenopodiaceae undiff.			1				
142	wxCirsium sp(p).		2	2				
432	wxGramineae <2mm		+	3		+		
144	wxJuncus sp(p).		4			1		
558	wxLamium undiff.							1
252	wxLuzula sp(p).	1						1
185	wxPotentilla sp(p).		1	2		3	1	*
64	wxRanunculus repens-type	4	+			+		+
83	wxVeronica sp(p).					1		
	Total number of taxa	53	41	25	37	52	17	36

Birdoswald ovens

	Bio.Lab. code number	899	900	901
290	wxSite code no.	19	19	19
450	xxExcavation	32	32	32
451	xxExcavator	14	14	14
452	xxAnalyst	1	1	1
454	xxDate-year	91	91	91
291	wxContext number	26	26	14
455	xxSubdivision of context	59	6	13
335	wxSample number	11	11	10
942	xxSub-division of sample	34	32	95
2218	chCalluna vulgaris flowers	9		
2129	chCalluna vulgaris twigs	9	9	
2118	ccTriticum sp(p). grain		1	
	Total number of taxa	11	11	9

Birdoswald Toilet Block all samples

Bio.Lab. code number	876	882	879	877	881	878	880	884	885	886	887	888	891	892	890	894	896	897
wxSite code no.	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19
xxDate-year	91	91	91	91	91	91	91	91	91	91	91	91	91	91	91	91	91	91
wxContext number	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	15	15	15
xxSubdivision of context	88	89	89	89	89	89	89	90	90	90	90	90	91	91	91	53	3	52
wxSample number	10	1	2	3	4	5	6	1	2	3	4	5	3	4	5	11	11	11
xxSub-division of sample	97															10	01	09
ccAvena grain	1									1				1				
wrBrassica sp(p).															9			
chCalluna vulgaris flowers				9		9			9									
wwCaltha palustris															9			
wwCarex (lenticular)																	9	
cwCarex (trigonous)							1											
wwCarex (trigonous)															9		9	
ccCerealia undiff.		1	1	1						3								1
wxChenopodiaceae undiff.															9			
wxCirsium sp(p).														9				
wtCorylus avellana nut fragmen																	9	
caFallopia convolvulus								1										
weFicus carica																	1	
wtFragaria vesca																	9	
cxGramineae <2mm				1	1													
cgGramineae 2-4mm										1								
ccHordeum hulled										5								
ccHordeum indet.									1				1		3	1		2
wrHyoscyamus niger															9			
wrLapsana communis															9			
wxMyosotis undiff.															9			
cgPlantago lanceolata								1										
caPolygonum periscaria						1												
wwRanunculus flammula/cf. flam																	9	
wxRanunculus repens-type															9		9	
wgRumex acetosa															9			
crRumex obtusifolius-type		1				1		1					1					
wrRumex obtusifolius-type																	9	
ccSecale cereale grain				1						1								
wrSonchus asper															9			
waSpergula arvensis															9			
waStellaria media															9		9	
wxTrifolium sp(p).																	1	
ccTriticum (hexaploid)	1				1	1								1				
ccTriticum aestivum grain	1				1	1				1								
ccTriticum sp(p). grain													1		2			
wrUrtica dioica																	9	
ceVicia faba										1								
Total number of taxa	12	10	9	12	11	13	9	11	10	15	8	8	11	11	22	11	20	11

Birdoswald The Black

	Bio.Lab. code number	902
290	wxSite code no.	19
450	xxExcavation	32
451	xxExcavator	14
454	xxDate-year	91
291	wxContext number	29
455	xxSubdivision of context	61
335	wxSample number	11
942	xxSub-division of sample	65
	Total number of taxa	9

Birdoswald Fabrica

Bio.Lab. code number	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919
wxSite code no.	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19
wxContext number	13	13	26	27	28	28	29	37	37	37	37	38	39	38	38	39	39
xxSubdivision of context	64	77	28	55	23	94	39	4	6	59	72	12	10	94	99	9	11
wxSample number	10	10	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
xxSub-division of sample	87	90	33	38	50	60	61	68	69	70	72	76	78	80	81	82	83
caAgrostemma githago																	
ccAvena grain		2						3								1	
cxBromus sp(p). grain				1	1			10	1		1			1		1	1
chCalluna vulgaris flowers								9									
chCalluna vulgaris twigs								99									
cwCarex (lenticular)					1			1									
cwCarex (trigonous)								2						10			
ccCerealia undiff.			2	3	1			7			5	1	1				
cwEleocharis palustris								4						4			
cwEriophorum lat/angustifolium																	
caFallopia convolvulus								2									
cxGramineae <2mm			1		1			2									
cgGramineae 2-4mm				1													
ccHordeum hulled			3					15			1						1
ccHordeum indet.				1					3	1						1	
ccHordeum straight hulled											1						
cxLegume <4mm																	
cxLegume >4mm																1	
cxMatricaria sp(p).																	
cgPlantago lanceolata								1			1						
caPolygonum lapth./persicaria								1									
cwRanunculus flammula								1									
cxRanunculus repens-type														7			
crRaphanus raphanistrum pod frag.														1			
cgRumex acetosa														17			
crRumex acetosella			1											1			
crRumex obtusifolius-type								1									
chSieglingia decumbens								2									
ccTriticum (hexaploid)				4							11			4			
ccTriticum aestivum grain								5									
csTriticum brittle rachis internode								1									
csTriticum glume base														1			
ccTriticum sp(p). grain					4			34	1			1	1		2	1	3
Total number of taxa	9	10	13	14	14	9	9	28	12	10	15	11	11	18	10	14	12

Fabrica contin./

	Bio.Lab. code number	920	921	922	923	924	925	926	927	928
290	wxSite code no.	19	19	19	19	19	19	19	19	19
454	xxDate-year	91	91	91	91	91	91	91	91	91
291	wxContext number	39	39	40	41	40	41	42	42	42
455	xxSubdivision of context	19	44	51	19	96	90	19	10	42
335	wxSample number	11	11	11	11	30	30	30	30	30
942	xxSub-division of sample	84	87	94	97	6	12	17	18	21
2001	caAgrostemma githago								1	
2102	ccAvena grain						1			
2103	cxBromus sp(p). grain	1	3			4				
2218	chCalluna vulgaris flowers	9								
2129	chCalluna vulgaris twigs	9								
2014	cwCarex (lenticular)									
2015	cwCarex (trigonous)					2	1		1	
2124	ccCerealia undiff.	2	8			1	2			2
2325	cwEleocharis palustris						1			
2740	cwEriophorum lat/angustifolium	1							2	
2055	caFallopia convolvulus									
2432	cxGramineae <2mm		2							
2748	cgGramineae 2-4mm									
2105	ccHordeum hulled	4	6			1	1			
2125	ccHordeum indet.									
2111	ccHordeum straight hulled									
2039	cxLegume <4mm						1			
2041	cxLegume >4mm									
2379	cxMatricaria sp(p).					1				
2049	cgPlantago lanceolata		1							
2058	caPolygonum lapth./persicaria									
2159	cwRanunculus flammula									
2064	cxRanunculus repens-type									
2066	crRaphanus raphanistrum pod frag.									
2067	cgRumex acetosa								1	
2068	crRumex acetosella									
2069	crRumex obtusifolius-type		1				1			
2072	chSieglingia decumbens					1				
2343	ccTriticum (hexaploid)		1							
2117	ccTriticum aestivum grain									1
2122	csTriticum brittle rachis internode									
2261	csTriticum glume base									
2118	ccTriticum sp(p). grain	2		1		18	1			
	Total number of taxa	16	16	10	9	16	17	9	13	11

Birdoswald Turf Wall

	Bio.Lab. code number	929	930	931	932	933	934
290	wxSite code no.	19	19	19	19	19	19
450	xxExcavation	32	32	32	32	32	32
451	xxExcavator	14	14	14	14	14	14
452	xxAnalyst	1	1	1	1	1	1
454	xxDate-year	91	91	91	91	91	91
291	wxContext number	28	29	40	30		40
335	wxSample number	11	11	11	40		12
942	xxSub-division of sample	58	66	95	41		
455	xxSubdivision of context	97	94	29	2		64
941	xxNo. of sub samples amalgamated					4	
943	xxNo. of contexts amalgamated					4	
14	wwCarex (lenticular)	1		1	3	5	
15	wwCarex (trigonous)	2		1		3	
259	wcCerealia/large Gramineae	9		1		9	
392	wtFragaria vesca			1		1	
162	waFumaria sp(p).					1	
257	wwIsolepis setaceus	1				1	
53	wrPolygonum aviculare			2		2	
59	wrPolygonum persicaria			1		1	
159	wwRanunculus flammula/cf. flammula	2		1	1	4	
210	wtSambucus nigra	1				1	
241	wrSonchus asper	1				1	
	Total number of taxa	16	9	16	11	18	8

Birdoswald Miscellaneous

	Bio.Lab. code number	935	936	937	938	939	940	941	942
290	wxSite code no.	19	19	19	19	19	19	19	19
450	xxExcavation	32	32	32	32	32	32	32	32
451	xxExcavator	14	14	14	14	14	14	14	14
452	xxAnalyst	1	1	1	1	1	1	1	1
454	xxDate-year	91	91	91	91	91	91	91	91
291	wxContext number	255	344	27	39	27	25	25	351
455	xxSubdivision of context			65	43	1	95	88	
335	wxSample number	10	10	11	11	11	11	11	10
942	xxSub-division of sample	58	81	39	88	35	31	30	84
2102	ccAvena grain								1
2103	cxBromus sp(p). grain							1	
2014	cwCarex (lenticular)								1
2015	cwCarex (trigonous)							1	
2124	ccCerealia undiff.							3	
2105	ccHordeum hulled							3	
2111	ccHordeum straight hulled							1	
2049	cgPlantago lanceolata								1
2068	crRumex acetosella								1
2069	crRumex obtusifolius-type							2	
2343	ccTriticum (hexaploid)							2	
	Total number of taxa	8	8	9	9	9	9	16	12

Birdoswald Non-biological samples

	Bio.Lab. code number	943	944	945	946	947
290	wxSite code no.	19	19	19	19	19
450	xxExcavation	32	32	32	32	32
451	xxExcavator	14	14	14	14	14
452	xxAnalyst	1	1	1	1	1
454	xxDate-year	91	91	91	91	91
291	wxContext number	16	16	17	40	39
455	xxSubdivision of context	68	90	48	65	43
335	wxSample number	11	11	11	30	11
942	xxSub-division of sample	19	20	22	1	85
14	wwCarex (lenticular)				1	
	Total number of taxa	9	9	9	10	9

Appendix III: Taxa represented and their English names

Column 1 - numbers of seeds from the whole site; column 2 - preservation and ecological group; column 3 - Latin name; column 4 - English equivalent where appropriate.

2	ca	Agrostemma githago	corn cockle
4	ca	Centaurea cyanus	corn flower
4	ca	Fallopia convolvulus	black bindweed
1	ca	Polygonum aviculare	knotgrass
3	ca	Polygonum lapathifolium	pale persicaria
1	ca	Polygonum lapth./persicaria	
56	ca	Polygonum periscaria	redshank
1	ca	Spergula arvensis	corn spurrey
1	ca	Stellaria media	chickweed
2	ca	Valerianella dentata	
58	cc	Avena grain	oats
373	cc	Cerealia undiff.	
190	cc	Hordeum hulled	hulled barley
158	cc	Hordeum indet.	
1	cc	Hordeum naked	
4	cc	Hordeum straight hulled	
1	cc	Hordeum twisted	
1	cc	Hordeum twisted naked	
7	cc	Secale cereale grain	rye
113	cc	Triticum (hexaploid)	wheat
16	cc	Triticum aestivum grain	bread wheat
283	cc	Triticum sp(p). grain	
1	ce	Vicia faba	Celtic bean
5	cg	Gramineae 2-4mm	grasses
12	cg	Plantago lanceolata	ribwort plantain
22	cg	Rumex acetosa	sorrel
++	ch	Calluna vulgaris flowers	heather
+++	ch	Calluna vulgaris twigs	
6	ch	Danthonia decumbens	heath grass
5	cr	Chenopodiaceae undiff.	
2	cr	Conium maculatum	hemlock
19	cr	Galium aparine	cleavers
1	cr	Plantago major	plantain
2	cr	Raphanus raphanistrum pod frag.	wild radish
13	cr	Rumex acetosella	sheep's sorrel
54	cr	Rumex obtusifolius-type	dock
2	cr	Veronica hederifolia	speedwell
2	cr	Vicia sativa	vetch
6	cs	Culm nodes	
1	cs	Hordeum 6-row rachis internode	
20	cs	Hordeum rachis internode	
6	cs	Triticum brittle rachis internode	
1	cs	Triticum floret base	
2	cs	Triticum glume base	
36	cs	Triticum spelta glume	
1	cs	Triticum spikelet fork	
21	ct	Corylus avellana nut frag.	hazel
1	ct	Rosa sp.	rose
1	ct	Rosa thorn	
11	cw	Carex (lenticular)	sedges
62	cw	Carex (trigonous)	sedges
1	cw	Carex hostiana-type	
9	cw	Eleocharis palustris	spike rush
8	cw	Eleocharis sp(p).	
13	cw	Eriophorum lat/angustifolium	cotton grass
5	cw	Ranunculus flammula	lesser spearwort
2	cx	Arrhenatherum elatius - tuber	false oat grass
71	cx	Bromus sp(p). grain	brome grass
12	cx	Gramineae <2mm	
1	cx	Gramineae undiff.	
2	cx	Labiatae undiff.	
2	cx	Legume <4mm	
2	cx	Legume >4mm	
1	cx	Matricaria sp(p).	
2	cx	Polygonum sp(p).	
9	cx	Ranunculus repens-type	buttercups
1	cx	Stachys sp.	
*	wa	Spergula arvensis	
**	wa	Stellaria media	
*	wa	Fumaria sp.	
*	we	Ficus carica	
*	wc	Cerealia/large Gramineae	
*	wg	Rumex acetosa	
*	wh	Calluna vulgaris shoots/twigs	

***	wh	Pteridium aquilinum -frond frag.
*	wr	Brassica sp(p).
*	wr	Hyoscyamus niger
*	wr	Lapsana communis
*	wr	Polygonum aviculare
**	wr	Polygonum lapath/persicaria
*	wr	Polygonum lapathifolium
*	wr	Polygonum persicaria
*	wr	Rumex acetosella
*	wr	Rumex obtusifolius-type
*	wr	Sonchus asper
***	wr	Urtica dioica
*	ws	Triticum glume base
*	ws	Triticum spelta glume
*	wt	Corylus avellana nut fragment
*	wt	Fragaria vesca
*	wt	Sambucus nigra
*	ww	Caltha palustris
**	ww	Carex (lenticular)
*	ww	Carex (trigonous)
*	ww	Carex hostiana-type
*	ww	Isolepis setacea
*	ww	Montia fontana ssp(p). chondr.
*	ww	Ranunculus flammula/cf. flammula
*	ww	Ranunculus sceleratus
*	ww	Sphagnum sp(p)
*	wx	Chenopodiaceae undiff.
*	wx	Cirsium sp(p).
*	wx	Myosotis undiff.
**	wx	Ranunculus repens-type
*	wx	Trifolium sp(p).