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PARASITOLOGICAL INVESTIGATIONS ON SAMPLES OF ORGANIC SEDIMENT FROM EXCAVATIONS AT CASTLE STREET, CARLISLE, CUMBRIA.

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Summary

Sixteen samples of organic sediment collected from a variety of layers and features at the site at Castle St. Carlisle, were examined for parasite eggs (ova) and other microfossils. The sampled deposits ranged in date from A.D. 80-150. Eight of the samples contained well-preserved ova of the nematode genera Trichuris and Ascaris. In addition, one sample contained eggs of the intestinal parasite of horses, Oxyuris equi. It is thought that this is the first time eggs of O. equi have been reported from archaeological deposits in Britain. Other kinds of microfossils were present, but not in sufficient numbers to justify definitive identification.

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INTRODUCTION

A group of 16 samples of organic sediment was submitted to the Environmental Archaeology Unit, University of York, for parasitological examination in order to determine if traces of human or animal faeces could be detected.

Table 01:

A brief description of the material submitted for examination presented in order of phases assigned by excavators.

Sample	Context	Phase	Feature type
128	1697	2	pit fill
109	1567	2/3	pit fill
110	1569	2/3	pit fill
130	1747	2/3	internal pit fill underlying hearth
92	1495	3A	fill of gulley/drain
93	1499	3A	internal trample/dereliction accumulation
102	1560	3A	external soil accumulation
106	1572	3A	floor surface
91	1493	3B	extensive dump demolition deposit
61	1123	4A	collapsed wall/roof or levelling deposit
73	1232	4A	extensive organic soil accumulation
84	1301	4A	external organic accumulation associated with curved fence/pen structure
64	1134	4A/B	floor/trample deposit
52	963	5	extensive open area surface deposit
38	795.2	6A	floor/trample layer
48	964	6A	internal soil accumulation

METHODS AND MATERIALS

The samples were examined using a technique based on the procedure outlined by the Ministry of Agriculture, Fisheries and Food (1977, 3) for examining modern faecal samples. Weighed amounts (6 g) of each sample were placed in a 120 ml wide-mouthed bottle with 42 ml of dilute sodium pyrophosphate solution. The bottles were allowed to stand for 24 hours and gently shaken by hand to assess if the material was thoroughly disaggregated. Once disaggregated 42 ml of water was added. Some samples were subjected to whisking using a mixer-emulsifier in five bursts of about five seconds each. The mixture was then thoroughly shaken and poured through a freshly flamed sieve of 250 micron mesh-aperture to remove coarse particles. Measured (0.15 ml) aliquots of the filtrate were mixed with warmed glycerol jelly, covered by a 22 x 50 mm coverslip and scanned at x80 using a transmission microscope. Where possible, eggs were measured using a eyepiece graticule calibrated to a stage micrometer. Length and width were recorded for all eggs, up to a maximum of 10 ova per slide (though up to 19 ova were measured on a few slides). In the tables below, 'total length' includes both polar plugs. Where the plugs were eroded or absent the 'standard length', which does not include the polar plugs, is given.

Recent experiments have shown that although parasite ova can withstand the rigours of pollen analysis, the size of the eggs can be modified by the process (Hall, Jones and Kenward, 1983). Accurate identification is therefore only possible if samples are carefully prepared using reagents which do not affect egg size.

Additional subsamples of sample 52, which produced Oxyuris

equi ova, were subjected to a flotation technique using saturated magnesium sulphate solution following the procedure described by Burden et al. (1976).

RESULTS

The findings of this investigation are presented in Tables 02 and 03 below.

Table 02 Summary of findings

Sample	Context	Phase	Kinds of microfossils
128	1697	2	P
109	1567	2/3	Trichuris, testate amoebae
110	1569	2/3	testate amoebae, PM
130	1747	2/3	Ascaris
92	1495	3A	Trichuris, testate amoebae, F, P
93	1499	3A	F, PM, P
102	1560	3A	Trichuris, Ascaris, F, PM
106	1572	3A	testate amoebae, PM
91	1493	3B	Ascaris, testate amoebae, PM
61	1123	4A	testate amoebae
73	1232	4A	Trichuris, testate amoebae
84	1301	4A	Trichuris, testate amoebae
64	1134	4A/B	testate amoebae
52	963	5	Oxyuris equi, Trichuris, ?Fasciola testate amoebae, P
38	795.2	6A	-
48	964	6A	testate amoebae, PM

The helminths were represented by eggs. The testate amoebae by shells.

Abbreviations: F = Fungal spores, P = Pollen grains, PM = Plant microfossils, usually pieces of tissue or isolated cells

Table 03:
Numbers of parasite ova per gram

Sample	Context	Trichuris x100/g	Ascaris x100/g	Others x100/g
128	1697	0	0	0
109	1567	2	0	0
110	1569	0	0	0
130	1747	0	1	0
92	1495	3	0	0
93	1499	0	0	0
102	1560	4	2	0
106	1572	0	0	0
91	1493	1	0	0
61	1123	0	0	0
73	1232	3	0	0
84	1301	1	0	0
64	1134	0	0	0
52	963	1	0	1 Oxyuris equi 1 ?Fasciola
38	795.2	0	0	0
48	964	0	0	0

N.B. Numbers in columns are actual ova counted, these should be multiplied by 100 to obtain the estimated concentration per gram untreated sediment.

Table 03 clearly shows that parasite ova were not present in large numbers in any deposit. It is interesting to observe that none of the five samples of internal deposits produced parasite ova while eight of the eleven samples of external deposits contained ova. With such small numbers of ova and of samples it is unwise to draw detailed conclusions from this result. However, it does show that faecal matter was present, albeit in small

amounts, in layers accumulating around buildings.

The most important finds from this site are eggs of the species Oxyuris equi, a common parasite of horses. Initially a single ovum was seen in sample 52, a further subsample of this deposit subjected to magnesium sulphate flotation yielded a second ovum. Samples 128, 130, 102, 92, 84, 73, 52 contained parasite ova of the nematode, Trichuris (whipworm). Ascaris ova were present in samples 130, 102 and 92. Other microfossils, notably shells of testate amoebae (probably of the genera Centropyxis or Cyclopyxis), fungal spores and pollen grains, were present in low concentrations in most samples. These objects are common in waterlogged urban archaeological deposits but are considered to be of little interpretive significance.

None of the samples examined contained sufficient concentrations of ova to suggest that faeces were a major component of the deposits. Concentrations of 100-500 ova per gram, as found in the samples from Castle St., are frequently reported from urban sites and indicate that only small quantities of human or other animal excrement were present in the sampled layers (Jones 1985).

Oxyuris equi ova

Oxyuris equi is a nematode which infests the large intestine of horses and produces highly distinctive, slightly asymmetrical, roughly oval, ova possessing one polar opening. Only two ova were observed from sample 52. These measured 87.6 x 43.8 and 91.3 x 42.0 microns. Soulsby (1982) and others agree that the size range for this species is 80-95 x 40-45 microns).

Oxyuris equi occurs in the large intestine of equines in most parts of the world. The males and young females inhabit the caecum and colon. After fertilization the mature females migrate down to the rectum and crawl out through the anus. Eggs are laid in clusters on the skin in the perineal region. Infected animals are often restless, conspicuously rubbing the base of their tails on any suitable object. This behaviour ensures the distribution of eggs. Infection is by ingestion of eggs.

This report presents the first evidence that the common intestinal nematode of horses, Oxyuris equi (Schrank) was present in the Roman period in Britain. This find is seen as particularly interesting in the light of recent work on insect remains from Castle St. (Kenward & Morgan, 1985) and from archaeological reports which suggested that one building at this site may have temporarily been used as a stable (McCarthy & Dacre 1983).

This is not the first record for Oxyuris equi from Roman deposits. Working on samples from the site of Valkenburg on Rhine in the Netherlands, Jansen & Over (1966) reported ova of this nematode in 1st century deposits. Deposits dated from 100 B.C. to A.D. 500 from excavations at Feddersen Wierde in north-west Germany also yielded O. equi ova (Jansen and Over, 1962). Similar finds have also been made in samples from Annetwell Street, Carlisle (Jones and Hutchinson forthcoming).

Trichuris ova

The size of the Trichuris eggs from all the samples can be described by the following statistics:

Table 04:

Statistics of dimensions of the Trichuris ova

	Total length	Length minus polar plugs	Width
mean	56.6	50.25	25.9
standard deviation	2.1	2.3	1.05
SEM	0.5	0.4	0.2
n	15	29	29

Abbreviations: SEM = standard error of the mean,

n = number of measured ova.

N.B. Egg dimension data from all samples were pooled to calculate the figures given in Table 04.

The above statistics leave no room for doubt that these ova were from the human whipworm T. trichiura. The comparison of egg size was based on modern measurements of whipworm eggs gleaned from several sources including: parasitological textbooks, data given by Beer (1976) for the whipworms of man and pig; the size of whipworm eggs from Lindow Man (Jones, 1986); and egg measurements of Trichuris ova from the coprolite from 6-8

Pavement, York (Jones, 1983).

Whipworms are parasitic nematodes which infest the lower intestine and caecum of many mammals throughout the world. Eggs are produced in large numbers and shed into the gut lumen and passed with faeces. Light infestations were thought to cause little harm to the host, while heavy worm burdens can produce diarrhoea, dysentery, blood in the faeces and prolapse of the rectum. Recent work has suggested that dysentery caused by T. trichiura infections may be a major determinant of chronic malnutrition in children, and that the importance of this parasite in world public health has been grossly underestimated (Cooper, Bundy and Henry, 1986). Concentrations of Trichuris trichiura ova in the region of 5000 ova per gram are common in faecal samples from patients harbouring this parasite today.

Jones (1985, 112) has suggested some guidelines for the interpretation of ovum concentration data from archaeological deposits. Using these figures it is suggested that the eight samples which contained Trichuris ova at concentrations of less than 500 ova per gram (see Table 02) contained small amounts of faecal material which are best seen as one component of the 'urban background fauna' (Jones op. cit.).

Ascaris ova

The third kind of egg present possessed a mammillated outer shell characteristic of the large roundworm - genus Ascaris, a common parasite of pigs and man. Ascaris worms can grow to 30 cm and, like the whipworm, produce large numbers of eggs which are passed with faeces. The larvae, which hatch from ingested embryonated eggs, migrate through the host tissues and can cause considerable damage. Nevertheless, many people harbouring small numbers of worms do not suffer severe symptoms. Ascaris ova were present in 3 samples (see Table 02) and were not abundant in any sample.

Unfortunately, the ova of A. lumbricoides and A. suum, the large roundworms of man and pigs respectively, produce ova of identical size. However, because they were associated with Trichuris trichiura ova, the Ascaris ova from this site are assumed to be A. lumbricoides.

?Fasciola ovum

One ovum, measuring 146.0 x 91.3 microns was tentatively identified as ?Fasciola sp. Fasciola ova have been reported from a number of sites (Jones 1982) but as the parasite can infest horses, man, dogs and other mammals its interpretive value is limited.

PRESERVATION

The condition of Trichuris ova, the most abundant kind of egg present, were assessed by considering the numbers which fell into the following categories:

1. complete, i.e. possessing two polar plugs (2pp).
2. damaged, i.e. the shell is complete but the condition or absence of one or both plugs suggest that the ovum is beginning to disintegrate (1/2pp).
3. shell complete but lacking any trace of polar plug (0pp).
4. shell broken or crumpled.

Roughly half of the Trichuris ova possessed both polar plugs and no broken fragments were seen. Thus, the condition of all the ova can be described as well preserved. The small numbers of Ascaris and Oxyuris ova were also well preserved.

CONCLUDING REMARKS

This report presents the first evidence for the common intestinal nematode of horses, Oxyuris equi (Schrank), in Roman levels in the Britain Isles.

The evidence from parasitological investigations demonstrates the presence of horses on or very near the site. Consequently, the interpretation of some of the structures as stables, which was based on the interpretation of assemblages of insect remains, can now be advanced with greater confidence.

It is important to mention that the sample from Castle Street which produced Oxyuris ova was a layer which formed in an open area servicing buildings which lay beyond the limit of the excavation. Thus, it was not the kind of context often given a high priority for environmental investigation. This experience confirms the value of rapidly scanning samples from a wide range of deposits for biological remains and should encourage archaeologists to collect samples from as wide a range of deposits as possible, not to restrict sampling to obvious features such as pitfills and floors.

Both Ascaris and Trichuris eggs have been frequently reported from archaeological deposits in Britain and the discovery of low concentrations from Castle Street is consistent with the gradually emerging view that small amounts of human faecal matter accumulated in external deposits. The results add weight to the view that intestinal helminths were ubiquitous parasites of urban man in north-west Europe during the Roman period.

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