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PARASITOLOGICAL INVESTIGATIONS ON SAMPLES OF SEDIMENT FROM EXCAVATIONS AT 7-9 ALDWARK, YORK. (Y.A.T. SITE CODE 1985.5).

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Summary

Seventy-three sub-samples of sediment collected from a variety of archaeological features on the site at 7-9 Aldwark, York (site code 1985.5) were examined for parasite ova and other microfossils. The sampled deposits ranged in date from pre-Roman to medieval, though most of the samples were taken from the Roman defensive works surrounding the fortress. Twenty-nine of the sub-samples contained moderately well-preserved ova of the genera Trichuris and/ or Ascaris. Furthermore, twenty-seven sub-samples contained structures which closely resembled the shells of free-living testate protozoans.
The concentration of the ova from five sub-samples suggests that human faeces were a major component of two Anglo-Scandinavian pits, contexts 114 and 137. Seven other sub-samples from the same two pits were also shown to have contained faecal matter, though in lesser quantities. Thirteen further sub-samples (mostly from medieval features, though four were of Roman date) probably contained only a 'background' level of redeposited ova.

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INTRODUCTION

A selected group of seventy-three sub-samples of sediment, collected from fifty-seven contexts, was submitted to the Environmental Archaeology Unit, University of York, for parasitological examination in order to determine if traces of human faeces could be recognized.

METHODS

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 sodium pyrophosphate solution. The bottles were allowed to stand for twenty-four hours and gently shaken by hand to assess if the material was thoroughly disaggregated. Once disaggregated 42ml of water was added. Some samples were subjected to whisking using a mixer-emulsifier in five bursts of about five seconds each. After shaking the mixture thoroughly, 0.15 ml aliquots of the suspension were placed on a microscope slide, covered by a 22 x 50 mm coverslip and scanned at x80 using a transmission microscope.

Where possible, the ova were measured using an eyepiece graticule calibrated to a stage micrometer. Length and width were recorded for all eggs, up to a maximum of 10 ova of each kind per slide. In the tables below, 'total length' includes both polar plugs for ova with uneroded 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.

RESULTS

Twenty-nine of the samples contained ova of one or both of two kinds of intestinal nematode. One, a barrel-shaped structure possessing two polar openings, was typical of whipworms (the genus Trichuris) and was present in twenty-five samples. The other kind of egg was typical of the genus Ascaris, the large roundworm, and occurred in ten samples. Twenty-seven samples contained shells of testate amoebae at concentrations of up to 500 per gram. These are free-living protozoans that inhabit a wide range of soil types and appear to be of little interpretive value. Pollen grains, fungal spores, phytoliths and diatoms were present in many of the samples.

Table 01:
Numbers of parasite ova and testate amoebae shells per gram

Sample	Context	Phase	Context type	Trichuris x100/g	Ascaris x100/g	shells x100/g
1/v	40	R	layer	0	0	1
4	47	R	layer	0	0	1
5	47	R	layer	1	0	1
6	52	Q	pit 51	0	0	0
7	54	Q	pit 51	2	0	1
10	67	Q	pit 68	0	0	0
11	70	Q	pit 76	1	0	0
12	66	Q	pit 68	0	0	0
13	69	R	-	2	0	0
14	73	R	-	0	0	0
15	69	R	-	0	0	1
16	72	R	layer	1	0	0
18	83	Q	pit 68	1	0	0
19	86	S	robber trench	0	0	0
20	87	Q	pit 76	1	0	0
*22	86	S	robber trench	1	0	0
24	90	P	layer	0	0	4
27	93	P	-	1	0	5
28	101	6	rampart	0	0	0
29	99	P	layer	1	0	0
30	105	6	rampart	0	0	0
*31	108	-	-	0	0	0
32	110	6	rampart	0	0	0
33	111	14	pit 114	5	0	0
34	112	14	pit 114	37	2	3
35	112	14	pit 114	38	1	2
36	113	S	demolition deposit	1	0	1
37	112	14	pit 114	86	1	3
38	117	14	pit 114	21	1	1
39	117	14	pit 114	5	0	2
40	119	15	pit 120	0	0	1
43	127	15	pit 121	0	0	2
47/v	134	14	pit 137	2	0	2
50	111	14	pit 114	6	0	3
53	139	-	-	1	0	2
56	141	14	pit 137	15	0	5
58	141	14	pit 137	42	3	0
62	142	14	pit 137	44	6	4
82	143	14	pit 137	9	0	0
83/1	142	14	pit 137	-	-	-
83/2	142	14	pit 137	-	-	-
87	146	9	-	0	0	0
91	155	6	rampart	0	0	0
92	159	6	rampart	0	0	0
95	142	14	pit 137	9	0	2
96	167	6	rampart	0	0	0
97	162	6	rampart	0	0	0
99	160	8	-	0	0	0
100	160	8	-	0	0	0
101	175	8	-	0	0	0
103	164	6	rampart, turf block	0	0	0
104	182	6	rampart	0	0	0
105	184	6	rampart	0	0	0

Table 01 - continued

Sample	Context	Phase	Context type	Trichuris x100/g	Ascaris x100/g	shells x100/g
106	187	6	rampart	0	0	0
107	190	6	rampart	0	0	0
108	191	6	rampart	0	0	0
109	193	-	-	0	0	0
111	175	8	-	0	1	2
112	175	8	-	0	0	0
113	175	8	-	0	0	1
114	195	4	layer	0	0	0
115	196	3	ground surface	0	0	1
116	196	3	-	0	0	0
116/2	196	3	-	0	0	0
117	210	2	pre-Roman feature	0	1	0
122	80	Q	pit 76	0	0	0
123	127	15	pit 121	0	0	2
124	199	5	-	0	1	0
125	200	5	-	0	0	0
126	201	5	-	0	1	1
127	202	5	-	0	0	0
128	204	5	-	0	0	1
129	128	11	layer	0	0	0

N.B. Samples marked '*' should be disregarded due to modern contamination.

A note on the phasing

The phasing is briefly described in an archive report by P. Tomlinson (in prep.) and can be summarised as follows:

pre-Roman	phases 1 to 3
Roman	" 4 to 13
Anglo-Scandinavian	" 14
Medieval	" 15, P, Q, R and S.

Trichuris ova

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

Table 02:
Size of the Trichuris ova

	standard length µm	width µm
mean	50.2	27.0
median	50.0	26.3
minimum	38.8	23.8
maximum	56.3	35.0
standard deviation	2.9	1.9
SEM	0.3	0.2

number of ova measured: 88
SEM = standard error of the mean

Despite the existence of five anomalously wide ova, 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 the bog corpse, Lindow Man (Jones, 1986); and egg measurements of Trichuris ova from the Viking-age human 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 formerly thought to cause little harm to the host, while heavy worm burdens could 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 possible to say that sub-samples 34, 35, 37, 58 and 62 were faecal in origin, possibly mixed with other materials. These samples originated from three contexts: 112, 141 and 142 which were fills of two phase 14 Anglo-Scandinavian pits, 114 and 137. The concentration of Trichuris ova fell within the range of 3,700 to 8,600 ova per gram.

In addition, samples 33, 38, 39, 50, 56, 82 and 95 had a substantial faecal component (500 to 2,100 ova per gram). These samples came from five contexts: 111, 117, 141, 142 and 143, which were also fills of pits 114 and 137.

Trichuris ova were present in thirteen other samples at concentrations of less than 500 ova per gram (see Table 01). These ova can best be interpreted as as part of the 'urban background fauna' (ibid).

Ascaris ova

The second 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 ten samples (see Table 02) being most abundant in sample 62 (600 ova per gram). It is notable that the only ova to survive from the Roman deposits were all of the genus Ascaris.

Table 03
Size of the Ascaris ova

	length µm	width µm
mean (fertilised ova)	70.83	60.83
mean (unfertilised ova)	79.50	55.75
minimum (all ova)	65.00	40.00
maximum (all ova)	100.00	70.00

number of ova measured: 8

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

Preservation

The condition of the Trichuris ova was assessed by considering the numbers which fell into the following categories:

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

The Ascaris ova, fertilised or unfertilised, were divided into the following categories:

1. complete, i.e. with an intact mammillated outer layer.
2. decorticated, i.e. lacking some or all of the mammillated outer shell.
3. broken.

Table 04
Preservation of the Trichuris ova

Sample	Number of ova				
	2pp	1/2pp	0pp	broken	total
5	0	0	1	0	1
7	0	0	2	0	2
9	0	0	1	0	1
11	0	0	1	0	1
13	0	0	2	0	2
16	0	0	1	0	1
18	0	1	0	0	1
20	0	0	1	0	1
22	0	0	1	0	1
27	0	0	0	1	1
29	0	0	0	1	1
33	0	0	5	0	5
34	0	1	36	0	37
35	0	2	36	0	38
36	0	0	1	0	1
37	0	15	71	0	86
38	0	11	10	0	21
39	0	0	5	0	5
47/v	0	1	1	0	2
50	0	0	6	0	6
53	0	0	1	0	1
56	0	5	10	0	15
58	0	1	41	0	42
62	0	41	3	0	44
82	0	5	4	0	9
95	0	1	8	0	9
totals	0	84	248	2	334
%	0	25.1	74.3	0.6	100.0

Table 05
Preservation of the Ascaris ova

Sample	complete			decorticated			broken	grand totals		
	f	uf	total	f	uf	total	total	f	uf	total
34	2	0	2	0	0	0	0	2	0	2
35	1	0	1	0	0	0	0	1	0	1
37	1	0	1	0	0	0	0	1	0	1
38	0	0	0	1	0	1	0	1	0	1
58	2	0	2	1	0	1	0	3	0	3
62	3	2	5	0	0	0	1	3	2	6
111	0	1	1	0	0	0	0	1	0	1
117	0	1	1	0	0	0	0	1	0	1
124	0	0	0	0	1	1	0	1	0	1
126	0	0	0	0	1	1	0	1	0	1
totals	9	4	13	2	2	4	1	11	6	18
%	50.0	22.2	72.2	11.1	11.1	22.2	5.6	61.1	33.3	100.0

Abbreviations:
2pp = with two polar plugs
1/2pp = with one or two polar plugs
0pp = with no polar plugs
f = fertilised
uf = unfertilised

Most (74.3%) of the Trichuris ova did not possess polar plugs. Incomplete ova with one or two plugs comprised 25.1% and only a small number of broken or crumpled ova were present. Thus, the average condition of all these ova can be described as only moderately well preserved. It should be noted that Rouffignac (1987) has recently shown that the polar plugs of ancient Trichuris trichiura ova gradually disintergrate when the sample is allowed to dry out.

Most of the Ascaris ova were rather better preserved, with 72.2% being complete. Most of the ova (61.1%) were fertilised.

The shells of testate amoebae were well preserved, with 95% recorded as being complete.

CONCLUDING REMARKS

Both Ascaris and Trichuris eggs have been widely reported from archaeological deposits in Britain and mainland Europe including the Danish bog burials (Jones, 1982) and Lindow Man (Jones, 1986). The egg measurments from these sub-samples from excavations at 7-9 Aldwark, York compare closely with those obtained from Lindow Man (Jones, 1986) and from modern data.

There can be no doubt that human faeces formed a major component of the fills of two Anglo-Scandanavian pits (114 and 137) excavated at 7-9 Aldwark, York. Finds of large numbers of Trichuris trichiura and Ascaris ova are the evidence for this conclusion.

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