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PARASITOLOGICAL INVESTIGATIONS ON
SAMPLES OF ORGANIC SEDIMENT FROM
EXCAVATIONS AT ROUGIER STREET,
YORK. (1981.12).

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Summary

Thirty-six samples of organic sediment collected from a
variety of features at the site at Rougier Street, York
(site code 1981.12) were examined for parasite ova and
other microfossils. The sampled deposits ranged in date
from the mid second century A.D. to the early thirteenth
century. Many of the samples contained well preserved
ova of the genera Trichuris and Ascaris. In addition,
four samples contained structures which closely
resembled the cysts of free-living testate protozoans.
The finds demonstrate that human faeces were a major
component of several of the medieval pit fills. Human
faeces were also present in the fill of a second century
channel and in one other layer, though ova were either
sparse or absent from most of the Roman deposits.

Authors' address :-

Environmental Archaeology Unit
University of York
York
North Yorkshire
YO1 5DD

0904 430000 x5531/ 5849

INTRODUCTION

A group of 36 samples of organic sediment, collected from 34 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.

Table 01:
A brief description of the material submitted for examination

Sample	Context	Feature	Date
4	1108	timber pit – lining	early 13th century
5	1109	" " "	" " "
5/1	1104	coprolite	" " "
7	1112	pit fill	" " "
7/1	1112	" "	" " "
9	1114	timber pit – lining	" " "
12	1117	pit fill	" " "
14	1121	" "	" " "
16	1091	" "	" " "
19	1126	" "	" " "
20	1134	" "	" " "
22	1143	" "	Anglo-scandinavian
27	1162	layer	early 4th century
29	1142	timber pit – lining	Anglo-scandinavian
30	1144	pit fill	early 13th century
35	1116	layer	4th – mid 9th cent.
36	1128	"	" " " "
57	1222	"	late 2nd century
59	1222	"	" " "
65	1262	"	" " "
65/1	1262	"	" " "
68	1288	"	" " "
71	1292	"	" " "
74	1307	"	" " "
79	1205	"	" " "
82	1320	"	" " "
85	1326	"	" " "
95	1329	channel fill	mid – late 2nd cent.
96	1329	" "	" " " "
97	1329	" "	" " " "
101	1334	" "	" " " "
106	1362	layer	" " " "
119	1379	channel fill	" " " "
124	1381	" "	" " " "
132	1373	" "	" " " "
135	1399	" "	" " " "
135/1	1399	" "	" " " "
138	1383	" "	" " " "
139	1408	" "	" " " "
145	1404	" "	" " " "
145/1	1404	" "	" " " "

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 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 5 bursts of about 5 seconds each. The mixture was then thoroughly shaken and poured through a freshly flamed 250 micron aperture meshed sieve 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 x 80 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, usually a maximum of 10 ova of each kind per slide were measured (though up to 19 ova were measured on a few slides). In the tables below, 'total length' includes both polar plugs for ova with rounded 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

Many of the samples contained ova of two kinds of intestinal nematode. One, a barrel-shaped structure possessing two polar openings, was typical of whipworms - the genus Trichuris. The other kind of egg was typical of the genus Ascaris, the large roundworm. Four samples contained cysts 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 02:
Numbers of parasite ova and testate amoebal cysts per gram

Sample	Date	Trichuris x100/g	Ascaris x100/g	cysts x100/g
4	e.13th	40	2	0
5	"	97	34	0
5/1	"	0	0	1
7	"	15	2	0
7/1	"	60	7	0
9	"	60	7	0
12	"	6	1	0
14	"	0	0	0
16	"	0	0	0
19	"	166	3	0
20	"	24	8	0
22	ang-scand	13	1	0
27	e.4th	0	0	0
29	ang-scand	1	0	0
30	e.13th	1	0	0
35	4th-m.9th	0	0	0
36	4th-9th	0	0	0
57	1.2nd	2	0	0
59	"	4	0	0
65	"	0	0	0
65/1	"	0	1	0
68	"	0	0	0
71	"	0	0	0
74	"	1	0	0
79	"	0	0	0
82	"	0	0	0
85	"	0	0	0
95	m.-1.2nd	0	1	0
96	"	0	3	0
97	"	1	0	1
101	"	3	0	0
106	"	5	0	2
119	"	0	0	0
124	"	7	2	0
132	"	1	3	0
135	"	4	1	0
135/1	"	2	0	0
138	"	11	2	5
139	"	0	0	0
145	"	1	0	0
145/1	"	1	0	0

Abbreviations: e. = early, m. = mid, l. = late
ang-scand = Anglo-scandinavian

N.B. Numbers in columns are acutal ova counted, these should be multiplied by 100 to obtain the estimated concentration as ova per gram deposit.

Trichuris ova

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

Table 03:
Size and basic statistics of the Trichuris ova

	all ova (microns)	2nd cent. ova (microns)	13th cent. ova (microns)
mean total length	55.6	55.2	55.3
standard deviation	2.1	2.0	1.5
SEM	0.5	0.6	0.7
n	19	13	5
mean standard length	48.9	50.4	48.2
standard deviation	3.0	2.3	3.0
SEM	0.2	0.4	0.3
n	147	38	98
mean width	25.6	26.0	25.4
standard deviation	1.5	1.7	1.4
SEM	0.1	0.3	0.1
n	147	38	98

Abbreviations: SEM = standard error of the mean
n = number of measured ova
cent. = century

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). As can be seen from Table 03, no statistically significant differences in size were noted between the total length and width of the medieval and Roman ova.

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 possible to say that samples 4, 5, 7/1, 9, 19 and 20 were faecal in origin, possibly contaminated with other materials. The abundance of Trichuris

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ova fell within the range of 2,000 to 20,000 ova per gram. All of these are from early 13th century pits.

In addition, samples 7, 12, 22, 106, 124 and 138 had substantial faecal contamination (500 to 2,000 ova per gram). Samples 7 and 12 were from early 13th century pits, 22 was from an Anglo-scandinavian pit fill, 106 was a mid to late 2nd century layer and 124 and 138 were fills of a channel from the same period. Trichuris ova were present in 14 other samples at concentrations of less than 500 ova per gram (see Table 02). 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 16 samples (see Table 02) and notably abundant (3,700 ova per gram) only in sample 5, an early 13th century pit fill.

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.

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 mammilated outer layer.
2. decorticated, i.e. lacking some or all of the mammilated outer shell.
3. broken.

Table 04
Condition of the _Trichuris_ and _Ascaris_ ova

Trichuris ova	all ova		2nd cent.		13th cent.	
	No.	%	No.	%	No.	%
complete (2pp)	19	3.6	13	30.2	5	1.1
damaged (1/2pp)	34	6.4	13	30.2	20	4.3
" (0pp)	460	87.5	15	34.9	433	92.3
broken	13	2.5	2	4.7	11	2.3
TOTAL	526	100.0	43	100.0	469	100.0

Ascaris ova	all ova		2nd cent.		13th cent.	
	No.	%	No.	%	No.	%
complete (f)	10	12.8	3	23.1	0	0.0
" (uf)	18	23.1	5	38.4	13	22.8
" (f+uf)	28	35.9	8	61.5	13	22.8
decort'd (f)	0	0.0	0	0.0	0	0.0
" (uf)	41	52.5	2	15.4	38	66.7
" (?)	2	2.6	0	0.0	2	3.5
" (f+uf+?)	43	55.1	2	15.4	40	70.2
broken	7	9.0	3	23.1	4	7.0
TOTAL	78	100.0	13	100.0	57	100.0

Abbreviations:
No. = number of ova
% = percentage of ova
2pp = with two polar plugs
1/2pp = with one or two polar plugs
0pp = with no polar plugs
f = fertilised
uf = unfertilised
? = not known if fertilised or unfertilised
cent. = century

Most (87.5%) of the _Trichuris_ ova did not possess polar plugs and 6.4% were damaged and had only one or two plugs. Only a small number of broken or crumpled ova were present. Thus, the average condition of all the ova can be described as only moderately well preserved.

There was a large difference in preservation between the 13th and 2nd century ova. Of the 13th century ova, 92.3% had no polar plugs, indicating relatively poor preservation. The 2nd century ova however, were significantly better preserved with 60.4% still possessing one or both polar plugs. Clearly the Roman ova, though much older than the medieval ones, came from deeper deposits where the degree of waterlogging was greater. This results suggests that the condition of ova is related to the

degree of waterlogging in the deposit. Rouffignac (1987) has recently shown that the polar plugs of ancient _Trichuris trichiura_ ova gradually disappear when the sample is allowed to dry out.

Most of the _Ascaris_ ova (55.1%) were decorticated. The differences in preservation between the 13th and 2nd century _Trichuris_ ova are repeated for the _Ascaris_ ova: 70.2% of the medieval ova were decorticated, whilst only 15.4% of the Roman-period ova were. Though decorticated ova may be present in fresh human faeces it seems probable that the large proportion of decorticated _Ascaris_ ova from the medieval deposits is a consequence of preservational factors.

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 results from these samples from excavations at Rougier Street, 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 several of 13th century pits excavated at Rougier Street, York. Finds of large numbers of _Trichuris trichiura_ and _Ascaris_ ova are the evidence for this conclusion.

Human faeces were also a significant contaminant of a 2nd century layer and the fills of a channel of the same period.

As a result of preservational factors both the _Ascaris_ and _Trichuris_ ova from the Roman deposits were significantly better preserved than those from the medieval strata.

ACKNOWLEDGEMENTS

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