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PARASITOLOGICAL INVESTIGATIONS ON SAMPLES OF ORGANIC SEDIMENT FROM HUNTER'S WALK, CHESTER.

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Summary

Three samples of organic sediment collected from a large pit at the site of Hunter's Walk, Chester, (site code HW80) were examined for parasite ova and other micro-fossils. All samples contained well preserved ova of the genera Trichuris and Ascaris. In addition, one sample contained structures which closely resembled the oocysts of coccidian protozon parasites. The finds demonstrate that human faeces were a major component of the pit fills.

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Introduction

A group of 3 samples of moist dark brown organic sediment, collected from contexts 285, 315 and 317 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**

Site Code	Number	Description
HW86	285 20	Very dark brown moist humic silt
HW86	315 28	Very dark grey-brown humic silt
HW86	317 30	Dark grey-brown moist humic silt

All samples were collected from a large pit.

The samples were examined using a technique based on the procedure outlined by the Ministry of Agriculture, Fisheries and Food (1977 p 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. The mixture was then thoroughly shaken and poured through a freshly flamed 250 micron aperture meshed sieve to remove coarse particles. Measured aliquots of the filtrate were mixed with warmed glycerine 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.

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

The samples contained large numbers of 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. All samples yielded parasite ova and consisted mainly of amorphous organic matter with a few fungal spores.

Table 02: **Numbers of parasite ova and cysts per gram X 100 in the Chester pit**

Site Code	Number	No. Trichuris	No. Ascaris	No. Oocysts
HW86	285 20	40	14	41
HW86	315 28	57	27	0
HW86	317 30	91	124	0

Table 03: **Condition of Trichuris and Ascaris ova in Chester pit**

Site Code	Number	Complete	1/2 pp	0 pp	Fg	Complete	Dec	Fg
HW86	285 20	10	14	16	1	12	0	2
HW86	315 28	14	15	28	0	19	5	2
HW86	317 30	36	18	18	19	111	7	6

Abbreviations: 1/2 pp = one or two eroded polar plugs, Fg = fragments, Dec = Decorticated

Trichuris ova were present at a concentration of between 4,000 and 9,000 ova per gram deposit. Concentrations of Trichuris trichiura ova in the region of 5000 ova per gram are common in faecal samples from patients harbouring this parasite. Whipworms are parasitic nematodes which infest the lower intestine and caecum of a 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 burden can produce prolapse of the rectum, diarrhoea, dysentry and blood in the faeces. Recent work has suggested that dysentry caused by Trichuris 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).

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

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

Most of the Trichuris ova possessed polar plugs, roughly 30% possessed plugs and only a small number of broken or crumpled ova were present. Thus, the condition of the ova can be described as moderately to well-preserved.

The size of the Trichuris eggs from the three samples is described by the following statistics: length including polar plugs (mean 57.2 microns, n = 30, SEM = 0.4 microns), length minus polar plugs (mean 51.3 microns, SEM = 0.4 microns) and width (mean 26.8 microns, SEM = 0.3 microns) of the Chester samples Trichuris ova leave no doubt that they 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).

Table 04: **Basic statistics of the Trichuris ova from the Chester pit**

Sample 285 20

	n	mean	maximum	minimum	SEM
Total length	10	56.2	59.4	54.0	0.6
Length minus polar plugs	10	50.4	52.2	46.8	0.5
Width	10	26.4	28.8	25.2	0.4

Sample 315 28

	n	mean	maximum	minimum	SEM
Total length	10	57.6	61.2	54.0	0.8
Length minus polar plugs	10	50.4	54.0	50.4	0.5
Width	10	26.1	28.8	25.2	0.4

Sample 317 30

	n	mean	maximum	minimum	SEM
Total length	10	57.9	61.2	54.0	0.7
Length minus polar plugs	10	52.1	55.8	48.6	0.8
Width	10	27.9	32.4	25.2	0.8

n = number of observations; SEM = Standard error of the mean

all measurements in microns

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 can grow to 30 cm and, like the whipworm, produces 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. A single Ascaris ovum was present.

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 large numbers of Trichuris trichiura ova, the Ascaris ova are assumed to be A. lumbricoides.

It is interesting to note that in two of the samples Trichuris ova are more abundant than those of Ascaris, while in sample 317 30 Ascaris were the most abundant. Most archaeological latrine pit sediment samples are dominated by Trichuris ova and it is most unusual to find Ascaris ova to be the most common. Several factors may be responsible. It is possible that differential sedimentation caused unusually large numbers of Ascaris ova to settle into 317 30. Alternatively, pig faeces rich

with eggs of A. suum may have been incorporated into the deposits. Other explananations are also possible. Regrettably, the samples did not yield any clues indicating why sample 317 30 gave such a large count for Ascaris ova.

Most of the Ascaris ova were well-preserved fertilized eggs, although a small number of decorticated ova were noted. These may be present in fresh human faecal samples and cannot be used to indicate the condition of the material.

Table 05: **Basic statistics of the fertilized Ascaris ova from the Chester pit**

Sample 285 20

	n	mean	maximum	minimum	SEM
Total length	10	74.7	82.8	68.4	1.7
Width	10	51.8	61.2	46.8	1.7

Sample 315 28

	n	mean	maximum	minimum	SEM
Total length	10	66.6	86.4	54.0	2.9
Width	10	52.6	57.6	46.8	1.2

Sample 317 30

	n	mean	maximum	minimum	SEM
Total length	10	74.5	90.0	68.4	2.2
Width	10	54.3	61.2	50.4	1.1

n = number of observations; SEM = Standard error of the mean

all measurements in microns

In addition, sample 285 20 gave large counts of small structures which closely resembled the oocysts of an intestinal coccidian protozoan probably Eimeria or Isospora. Coccidia are common protozoan parasites of the epithelial cells of the intestine of vertebrates. The oocysts from sample 285 20 were roughly pear-shaped structures which could not be further identified although they appeared to possess a terminal micropyle. They measured approximately 21.1 X 16.6 microns. It is not possible to identify these structures to species with certainty, but oocysts of this size are produced by Isospora belli Wenyon, the organism that causes human coccidiosis. Coccidian protozoa infest a large number of vertebrates and invertebrates. Those from the Chester sample may be from parasites which infected man, or they may be pseudoparasites - parasites of non-human animals which were inadvertently ingested by humans, or they may have entered the pit with non-human faeces.

In addition, a few miscellaneous objects were observed including small numbers of fungal and fern spores, pollen grains fragments of insects and mites, and fragments of charcoal.

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 this sample at Poundbury compare

closely with those obtained from Lindow Man (Jones, 1986). Eimeria or Isospora oocysts have been reported in archaeological deposits by Walker (1985) and Jones (1987).

Conclusion

There can be no doubt that human faeces formed a major component of the fills of the large pit excavated at Hunter's Walk, Chester. Finds of large numbers of Trichuris trichiura and Ascaris ova are the evidence for this conclusion.

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