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Parasite ova from Roman levels at two sites within the Fortress of Eboracum: two sites from the Bedern area of York.

An Ancient Monuments Laboratory Report

July, 1984

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Introduction

Recent work on waterlogged medieval archaeological deposits in York has shown that parasite eggs survive in many layers and that they are often present in high concentrations (Jones, 1982; Hall et al., 1983). Intestinal parasites produce large numbers of eggs which are shed into the gut lumen; often in excess of 1,000 ova per gram faeces are passed. Parasite eggs can therefore be excellent indicators of the presence of ancient faeces. By careful consideration of egg morphology and measurements it is usually possible to identify the ova to species and so determine which kind of animal passed the faeces.

Eggs of the human whipworm, Trichuris trichiura (L.), and the maw-worm, Ascaris lumbricoides (L.), have frequently been reported from soil samples of medieval date (Jones, op. cit.). Finds of parasite ova in Roman contexts are, however, sparse. Records are mainly from Roman forts: for example, at Kunzing, Vilshofen, W. Germany, eggs of T. trichiura were found (Specht, 1964). Roman levels at Valkenburg-on-Rhine in the Netherlands yielded ova of Oxyuris equi (Schrank) (Jansen and Over, 1966). Samples from a ditch at the Antonine fort of Bearsden, Scotland (Dickson et al., 1979, Knights et al., 1983 and Jones and Maytom, forthcoming) produced abundant eggs of T. trichiura from the lower levels, while at least one Roman grave from the large inhumation cemetery of Poundbury, Dorset, also produced trichurid ova (Jones, forthcoming a). The fills of a Roman sewer system at Church Street, York, contained structures resembling eggs of Ascaris and Trichuris (Wilson and Rackham 1976) but the eggs were not sufficiently well preserved to allow specific identification. The Bedern well provided an ideal opportunity to examine waterlogged deposits from within the Fortress of Eboracum.

Methods and materials

During the later phases of biological investigations on soil samples yielding abundant Roman pottery at the Bedern area of York, a small number of samples were selected for

parasitological investigation. Material was examined from the fills of a Roman well (1973.13) and two enigmatic pits from the Bedern/Aldwark site (1975.14). The sediment filling the well, although containing well preserved animal and plant macrofossils, was largely composed of mineral particles. Context 1703 contained more organic matter than other layers but was a sandy clay loam. The pit fill layers were organic silty loams.

It is important to stress that the date of the infilling of the well has not yet been precisely determined. Although almost all the dateable finds from the well are demonstrably Roman, a single sherd of coarse pottery was found in the well fills and this may be Anglian (A. Mainman pers. comm.). The Bedern/Aldwark pits are either of late Roman or early post-Roman date.

A small amount of soil was examined using a smear technique to determine if parasite ova were abundant in the well samples. The only sample (context 1703 sample 10) which gave a positive result to the smear was examined using the Stoll egg counting method (modified) for faecal samples (Ministry of Agriculture, Fisheries and Food, 1977, 3). In addition, three well samples (1702, 3; 1708, 21 and 1739, 25) which gave negative results to the smear test and 6 pit samples (samples 1, 10 and 11 from pit 21; and samples 7, 8 and 12 from pit 25) from Bedern/Aldwark were examined following the Stoll egg counting method. Three gram subsamples of soil were disaggregated in 42 ml of tap water and filtered through a 250 micron meshed sieve to remove coarse particles. Microscope slides were prepared by placing 0.15 ml aliquots of the filtrate on standard 3" by 1" slides with two or three drops of warmed glycerine jelly and positioning a 50 by 22 mm coverslip. The slides were scanned at X 120 and all parasite ova measured using a eyepiece micrometer at X 400. Where possible three measurements were taken on trichurid ova: total length (including polar plugs), length minus polar plugs, and width. Length and width were recorded for other ova. The egg measurements were processed using the computer package STATPAK.

Results 1: The Roman Well

Only one sample from the well and one from the pits gave a positive result on detailed study. Context 1703, sample 10, contained two kinds of parasite ova. The most abundant were barrel-shaped structures with two polar plugs, the egg shells were smooth and readily recognized as Trichuris sp. The other kind of egg was the highly characteristic fertilized ovum from the genus Ascaris. Within the British Isles, these two kinds of parasite only occur together in pigs and man. Ascaris ova from A. suum (pig) and A. lumbricoides (man) are identical in size and shape, but T. trichiura ova are approximately 5 microns smaller in total length and width than T. suis ova. Table 01 and 02 gives details of the dimensions and numbers of eggs.

The identification of trichurid ova from archaeological deposits has been discussed elsewhere (Jones, 1982, Hall et al., 1983 and Jones, 1983). Identification is most conclusive if eggs are abundant and well preserved i.e. possess two complete polar plugs as the measurement which gives the clearest discrimination between T. trichiura (man) and T. sius (pig) is the total length including the polar plugs (Beer, 1976). Only four complete ova from the present sites were measureable and while the mean total length and range are consistent with T. trichiura there are insufficient data to allow identification. Width of ova can also be used to discriminate between the two species (Beer, 1976). Figure 01 shows the width and length minus polar plugs of human and pig whipworm ova compared with data from the Bedern well ova. There can be little doubt that the trichurid ova are T. trichiura, the human whipworm. By association the Ascaris ova are A. lumbricoides.

Two three-gram subsamples were disaggregated and four counts made of each subsample. From these egg-count data it is possible to calculate the mean concentration of parasite ova per gram deposit for each kind of ovum. Table 02 gives the full results and show that the mean concentration of Trichuris ova per gram deposit is in excess of 600.

The Trichuris ova were classified according to their state of preservation. The classes were as follows: complete

(possessing two polar plugs), ova with eroded plugs, ova with no plugs, and crumpled or broken ova. This system of classification was used to discuss the state of preservation of trichurid ova recovered from pits and other layers at Coppergate and Oslo (Jones, forthcoming a, b, c and d). The number of ova which fall into each of the classes (see Table 03) can be used to determine whether the material is well, moderately well, or badly preserved. The majority lacked polar plugs, a small number possessed two plugs, while a single ovum was slightly crumpled. This pattern is typical of moderately well preserved material and is the most common condition encountered when examining archaeological faecal deposits.

Results 2: The Pits at Bedern/Aldwark

A single trichurid ovum lacking polar plugs and measuring 54 by 32 microns was recovered. A large number of indigenous British mammals, from mice to men, can be parasitized by trichurid nematodes and it is only possible to identify trichurid ova to species if large numbers of ova can be measured; it has therefore not been possible to identify this ovum to species.

Discussion

The parasite ova from context 1703 indicate that some human faeces was incorporated into the well fills. Interpretation must be cautious for it is impossible to know how many parasite eggs were present in ancient faeces. People can harbour small burdens and generally produce low feacal egg-counts or they may be heavily parasitized usually giving high faecal egg-counts. Modern accounts of people parasitized with Trichuris show that egg counts can be under 100 ova per gram fresh faeces for people harbouring small numbers of worms, while in excess of 400,000 ova per gram have been recorded from a particularly severely parasitize person. There is no objective method for estimating the amount of non-faecal material which may have been mixed with human excrement neither is it possible to estimate the amount which may have been lost by fermentation by micro-organisms.

Despite these unquantifiable factors it is possible to make some suggestions when the data are compared with recent finds from medieval deposits.

Evidence from post-Roman urban sites is beginning to indicate that in Britain the nematodes Ascaris and Trichuris were common parasites of man. Archaeological latrine deposits from the medieval levels at the Bedern and from Anglo-Scandinavian pits at 16-22 Coppergate give trichurid egg-counts of between 1500 and 60,000 opg.

There is an increasing number of records from medieval urban sites suggesting that parasites probably infested most people for much of their lives. The little evidence available from Roman and Anglian towns suggests a similar patern of parasitic infestation. It seems reasonable, therefore to use experience of parasite egg concentrations obtained from medieval material to interpret cautiously the Bedern Roman well data.

The apparent abundance of parasites in the past is not as surprising as at first it might appear for these same parasites are today common in human populations living in crowded conditions and provided with inadequate means of sewage disposal. Under such conditions casual and indiscriminate defecation frequently occurs causing low concentrations of parasite ova to be distributed in and around dwellings. Low concentrations of parasite ova must be seen within this context and cannot, therefore, be used to indicate the presence of ancient human faecal layers. Rather, they show that a small amount of faeces has been incorporated into a layer and that the eggs are best interpreted as forming part of the urban background biota.

It is clear from a cursory examination of the sediment forming context 1703 that the layer is a mixture of inorganic soil particles and organic matter, largely wood, which was dumped into the well. In this context a mean egg-count of over 600 Trichuris ova per gram suggests that human faeces was a small component of the well fills. The layer is not primarily faecal, however, the concentration of parasite ova is too high to be explained as a component of the urban background biota (Jones, forthcoming c). As there were only a few damaged ova it is likely that that faeces were deposited in the well fairly soon

after they had been passed, indeed it is possible that the human excrement was voided directly into the well.

Conclusions

The concentration of parasite ova recovered from the Bedern Roman well, context 1703, indicate that human faeces formed a minor component of the well fills. The condition of eggs is typical of 'moderately well-preserved' material (Jones, forthcoming e) and is parallelled in many archaeological assemblages from other sites.

The pits at Bedern/Aldwark failed to produce evidence that substantial quantities of faeces were incorporated into their fills. Small numbers of parasite ova are present in many urban soil samples. Such finds are impossible to identify to species without a great expenditure of effort. Low concentrations of parasite eggs must be seen as a normal component of the background biota in towns.

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Figure 01

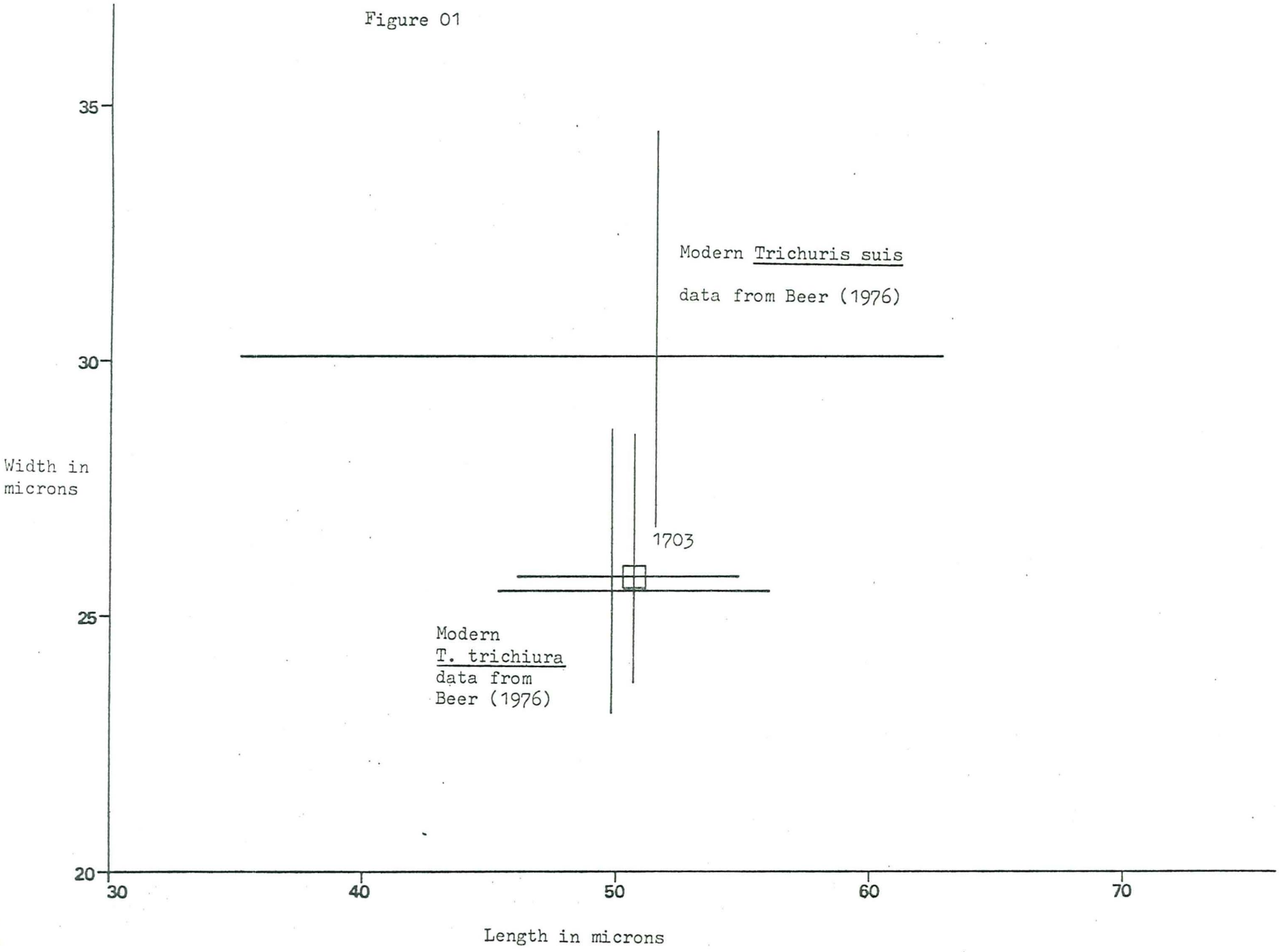
35
30
25
20
30
40
50
60
70
Width in microns
Length in microns
Modern Trichuris suis
data from Beer (1976)
1703
Modern
T. trichiura
data from
Beer (1976)

TABLE 01: PARASITE OVA FROM THE BEDERN ROMAN WELL (context 1703), YORK

Trichuris ova

Measurement	Range	Mean	S.E.	n
Length - polar plugs	46.1-54.8	50.7	0.35	38
Width	23.7-28.6	25.8	0.17	38
Total length + pp	54.8-58.5	55.9	0.9	4

Ascaris ova

Length	a, 72.2 b, 77.5	2
Width	a, 57.3 b, 59.8	2

all measurements in microns

TABLE 02: EGG-COUNT DATA FOR THE BEDERN ROMAN WELL

Sample code	Count	No. *Trichuris* ova	No. *Ascaris* ova
1703 s. 10	P1/1	10	1
	P1/2	5	2
	P1/3	4	0
	P1/4	4	0
1703 s. 10	P2/1	4	0
	P2/2	9	0
	P2/3	6	0
	P2/4	9	0
	Total	51	3

mean concentration of ova per gram (51 X 100)/8 = 637.5

TABLE 03: CONDITION OF THE OVA FROM THE BEDERN ROMAN WELL

Trichuris ova

No. observed	No. + 2 pp	No. + 1 pp	No. + 0 pp	No. broken/crumpled
51	4	3	43	1

Ascaris ova

3	2	-	-	1

CAPTIONS

TABLE 01

All measurements in microns. S.E. = Standard error of the mean.
n = number measured.

FIGURE 01

Length (minus polar plugs) and width of Trichuris ova.

T.t. Range and mean measurements of a sample of modern Trichuris trichiura ova (data from Beer, 1976)

T.s. Range and mean measurements of a sample of modern Trichuris suis ova (data from Beer, 1976)

1703 Range, mean and standard error of the mean (box) of Trichuris sp. ova from context 1703, Bedern, York.