WINCHESTER
A CITY IN THE MAKING

Archaeological excavations between 2002 – 2007
on the sites of Northgate House, Staple Gardens and the former Winchester Library, Jewry St

Section 14

Analysis of samples for eggs of intestinal parasites and other microfossils
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Abstract

Forty-one samples, comprising mineralised concretions or sediment from deposits thought to be "cessy", were examined for intestinal parasite ova. Eggs of two nematodes were observed in only three samples. Ova with two polar openings were identified to the genus *Trichuris* and larger ova with characteristically mammilated outer shell were attributed to the genus *Ascaris*. Measurements of trichurid ova were taken, the size of the overall eggs and their association with *Ascaris* ova indicate that the species present is *Trichuris trichiura*, the human whipworm.

Introduction

The presence of ancient human faecal material in medieval deposits in Winchester was first reported by Taylor (1955) who found three kinds of intestinal parasites in well stratified peat like samples associated with a timber tank structure. In more recent years the presence of *Ascaris* and *Trichuris* ova in urban archaeological deposits have been recorded in several northern European medieval settlements. Currently, the presence of parasite ova, especially when associated with food plant macrofossils (notably fruit seeds and cereal remains), is considered to be a key indicator for the presence of human and other faeces in archaeological deposits (Kenward and Hall 1995). Ova of *Trichuris* and *Ascaris* are highly recognisable microfossils and are usually present in large number – up to 60,000 ova per gram in some anoxic deposits – and can provide an early indication of the presence of human faeces (Reinhard and Bryant 1992; Jones 1982). Eggs of these two worms possess sufficient diagnostic characters to allow generic identification based on morphological features following microscopic examination (Thienpont *et al.* 1986).

The samples in the present study contrasted markedly with those described by Taylor: they varied considerably in colour, texture and moisture. None were highly organic peat like material with visible straw-like structured peats of the first Winchester find. Some of the current samples consisted of concreted mineral material collected from bulk soil samples. Most of these appeared in the hand to be aggregations of inorganic soil particles bound together in an inorganic matrix. A few were iron rich and resembled small pieces of industrial residue, probably iron-rich slag. Others resembled coprolites and on closer inspection contained inclusions, notably small splinters of large mammal bones, indicating they were canine (probably dog) droppings. The remaining soil/earth samples also varied, ranging from dark grey brown clay with low organic content, to friable very dark grey organic silt. Brief details of each sample are provided in Table 1.

Methods and materials

Concreted samples were disaggregated in 10 ml of 1M hydrochloric acid. After approximately two weeks digestion in acid, and with the aid of gentle disaggregation using a freshly cleaned glass rod, small aliquots of the resulting suspension were transferred to a microscope slide, a cover slip applied and the slide scanned for parasite ova and other microfossils. Few of the samples had completely disaggregated, but all produced a suspension of mineral and organic particles. The results of this investigation are summarised in Table 1.

The unconsolidated earth samples were processed following the procedure outlined by Dainton (1992). This technique was developed in order to speed up the examination of archaeological earth samples for parasite remains and recent work (Jones 2008) has demonstrated that it is both reliable and cost-effective.

Slides were examined and parasite ova measured using an Olympus BX51 transmission microscope with an Olympus DP70 camera linked to a personal computer running the image processing programme Soft Imaging System analySIS. Measurements of trichurid ova were taken following Beer (1976) and data presented in Table 2.

Results

The concreted samples, although most unpromising at first sight, proved to be the most productive with two samples yielding parasite ova. The presence of 8 ova in context CC2177 (a Phase 4.2 pit) is convincing evidence for the presence of significant amounts of faeces, probably of human origin. The other sample (CC2010 – a Phase 4.2 pit) yielded a single trichurid ovum and while this too may be interpreted as evidence for the presence of faecal matter, low concentrations of parasite ova have relatively little interpretive value.

Given the low organic content of the earth samples, it is not surprising that most failed to produce cellular structures on microscopic examination. Several, however, did contain brown particles which might best be described as 'amorphous organic particles'. Nearly all samples contained small charcoal fragments. Only one of the earth samples (NH2399 – a Phase 4.2 pit/well) produced a single trichurid ovum.

All of earth samples were dominated by small mineral particles, mostly angular, transparent clasts, probably quartz grains. Relatively few other diagnostic microfossils were observed.

The mean width of trichurid ova from CC2177 was 26.4 microns and the standard length (length minus polar plugs) was 50.0 microns.

Discussion

The identification of parasite eggs from archaeological deposits has been reviewed and discussed recently by Dark (2004). Precise identification depends on accurate measurements of both modern and well documented archaeological finds. The measurements of a sample of the Winchester trichurid ova were compared with modern data provided by Beer 1976 and Elmehaisai (1987). The latter analysed measurements of ova from 6 modern species of *Trichuris* taken from cattle, sheep, dogs, mice, pigs and human trichurid ova recovered from the Iron Age body of Lindow Man. Elmehaisi gives that the mean width of the human whipworm ova to be 26.1 microns (3.6 microns smaller than its closest relative *T. muris*. The Winchester eggs produced a mean width of 26.4 microns (0.3 microns larger than that given for Lindow Man). Taken alone the width measurement is very convincing evidence for the Winchester eggs being from the human whipworm *T. trichiura*.

The mean measurements for the standard length (length minus polar plugs) of 50.0 microns also is closest to those for the human species, but here the Winchester ova are on average 1.4 microns smaller than those from Lindow Man. The other modern five species examined in Elmehaisi's study produced ova with far larger mean standard length ranges: 54.3 microns (*T. globulosa*) to 74.8 microns (*T. vulpis*).

Together the measurements provide convincing evidence that the trichurid ova from Winchester (CC2177) are from the human parasite, *Trichuris trichiura* and their presence in samples indicates the presence of human faeces, albeit poorly preserved.

The texture of all the samples examined contrasted strongly with samples of organic material from excavations in York (Kenward and Hall 1995). The Winchester material in general contains relatively small amounts of organic material when examined macroscopically. Nevertheless, the results of this investigation clearly demonstrate that the samples, both concretions and unconsolidated earth samples do contain parasite ova and most contained amorphous organic particles lacking cellular structure.

The rapid method for scanning earth samples allowed for more rapid processing of samples than the 'modified Stoll technique' used for most of the York samples (for details see Kenward and Hall 1995 and references therein).

Conclusion

Measurements taken on ancient trichurid ova from a sample of concreted material recovered by wet sieving earth samples from the Winchester samples has provided good evidence that the worms responsible for the eggs were the human whipworm, *Trichuris trichiura*.

Parasite eggs were found in only two of the samples of concretions and one of the earth samples. Samples with large numbers of eggs are highly likely to be taken from cesspits. Those with small numbers of ova may also be from cesspits, but here the concentrations of ova and the state of organic particles suggest that there has been much biological decay of the organic matter. It is also possible that a significant amount of non-faecal matter has contributed to these deposits, effectively masking the human ordure.

These conclusions may be strengthened if botanical analysis if the same contexts reveals the presence of food plants commonly ingested by humans. Two coprolites are thought to be of canine origin on the basis of their morphology and presence of splinters of mammal bone found within each. Neither produced parasite ova.

The results presented in this report indicate that faecal material, almost certainly of human origin, and dog faeces are present at the site.

Section 14 Tables

Table 1. Samples of coprolite and other concretions from Winchester (Northgate House & Winchester Discovery Centre).

Context No.	Sample No.	Description in hand	Result from microscopic examination
CC1016	CC107	Dark grey-brown earth. Wet.	Charcoal fragments, little organic material. No parasite ova
CC1026	CC109	Light grey granular soil concretion	No parasite ova
CC1154	CC111	Very light grey concretions? Canine coprolite	Some amorphous organic matter. No parasite ova
CC1170	CC112	Mid brown mineral concretion ?slag	No parasite ova
CC1380	CC131	Light grey brown mineral concretion	Few charcoal fragments. No parasite ova
CC1388	CC133	Mid grey-brown clay loam. Mostly mineral.	Few charcoal fragments. Very little organic material. No parasite ova. Many mineral particles stained brown, ? iron deposit?.
CC1429	CC145	Grey brown vesicular mineral concretion	No parasite ova
CC1491	CCBH3<7>	Mid grey dry earth with chalk fragments	No parasite ova
CC1492	CCBH3<6>	Light grey dry clay with chalk fragments	No parasite ova
CC1501	CCHA1<2>	Light grey mineral earth with chalk fragments	No parasite ova
CC1502	CCHA5<12>	Dark grey brown earth with chalk fragments	No parasite ova
CC1550	CC155	Mid grey brown mineral concretion	Much mineral material. No parasite ova
CC1713	CC165	Single piece of iron rich concretion ? slag	No parasite ova
CC1725	CC171	Light yellowish grey brown mineral concretion	Little organic matter. No parasite ova
CC1769	CC170	Grey brown mineral concretion ?slag	No parasite ova
CC1802	CCHA6<16>	Light grey dry earth with chalk fragments	No parasite ova
CC2010	CC204	Mid grey brown mineral concretion	Much amorphous organic matter. **One trichurid ovum**
CC2177	CC220	Light-mid brown concretion	Much amorphous organic matter**. 5 *Trichuris* 3 *Ascaris* ova.**
CC2283	CC242	Grey brown open textured mineral concretion	No parasite ova
CC2290	CC251	Fragment of ? canine coprolite. Visible bone fragments	No parasite ova
CC2333	CC262	Small fragment ?canine coprolite. Visible bone fragments.	Few charcoal fragments. Some amorphous organic matter. No parasite ova.
CC2397	CCHA2<6>	Mid grey brown mineral earthy with chalk fragments	No parasite ova

Context No.	Sample No.	Description in hand	Result from microscopic examination
CC2397	CCHA2<4>	Dark grey brown earth with chalk fragments	No parasite ova
CC2414	CC265	Light yellowish grey mineral concretions	No parasite ova
CC3017	CC300(a)	Coprolite fragment, 25 mm diametre X17 mm. Bone fragments visible. Canine coprolite	Very little organic matter. No parasite ova.
CC3017	CC300(b)	Light grey mineral concretion	Much mineral. No parasite ova
CC3083	CC306	Light grey mineral soil concretion	Much charcoal. No parasite ova
CC3180	CC320	Light grey granular mineral concretions	No parasite ova
CC3260	CC323	Coprolite fragment 13 mm diameter X 35 mm. Pointed end. Almost certainly canine coprolite.	Not examined microscopically.
CC3276	CC329	Open texture concretion. One medium sized fish vertebra, Gadidae. Shell, tile, charcoal and chalk fragments.	Much charcoal. No parasite ova
NH2114	NH151	Dark grey brown loam, wet earth. Mostly mineral.	Charcoal fragments, some? Cellular material, a few phytoliths. No parasite ova.
NH2134	NH152	Mid grey brown clay earth	Few phytoliths, little organic matter. No parasite ova
NH2276	NH163	Grey brown wet earth. Mostly mineral.	Charcoal fragments. No parasite ova.
NH2399	NH173	Dark grey-brown mineral earth.	Much inorganic material, some charcoal. **One *Trichuris* ovum.**
NH2411	NH175	Dark grey-black earth.	Much charcoal. Two fungal spores, no parasite ova.
NH3168	NH212	Dark grey brown clay loam. Chalk flecks	No parasite ova
NH3175	NH208	Mid-dark grey brown moist clay earth	Mineral based a few charcoal fragments. No parasite ova
NH3434	NH220	Very dark grey-brown loam.	Much charcoal. Few organic particles. No parasite ova.
NH4340	NH258	Dark grey brown wet earth. Mostly mineral.	Charcoal fragments, no parasite ova.
NH4680	NH290	Dark grey brown loam. Mostly mineral	Few organic particles. No parasite ova.
NH4743	NH554	Very dark grey-black earth. Some chalk fragments	Charcoal fragments. No parasite ova or other microfossils

Table 2. Measurements of trichurid ova from sample of context CC2177.

Sample and Context Number	Length minus polar plugs in microns	Width in microns
CC2177	54	24
CC2177	45	27
CC2177	48	27
CC2177	48	26
CC2177	52	28
CC2177	52	28
CC2177	52	25
CC2177	47	26
CC2177	48	27
CC2177	52	26
Mean	**50.0**	**26.4**

Note: Only 5 trichurid ova were observed in the first slide examined. Additional aliquots of suspension of this sample were examined to obtain 10 length and width measurements**.**

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