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Summary

Bronze Age coprolites and samples of amorphous concreted material found in excavations at Brean Down, Somerset, were examined for parasite cysts and eggs (ova). The majority of the specimens did not contain parasite eggs and the balance of evidence suggests these samples were canine droppings. A few contained small numbers of eggs of *Trichuris* and *Ascaris* and a small number gave cysts of parasitic protozoa. The size of *Trichuris* ova suggested the eggs were from the human species, *Trichuris trichiura*. The results demonstrate that parasite ova can survive in a recognisable form within faecal concretions in Bronze Age deposits which are not continuously wet or waterlogged.

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Summary

Bronze Age coprolites and samples of amorphous concreted material found in excavations at Brean Down, Somerset, were examined for parasite cysts and eggs (ova). The majority of the specimens did not contain parasite eggs and the balance of evidence suggests these samples were canine droppings. A few contained small numbers of eggs of *Trichuris* and *Ascaris* and a small number gave cysts of parasitic protozoa. The size of *Trichuris* ova suggested the eggs were from the human species, *Trichuris trichiura*. The results demonstrate that parasite ova can survive in a recognizable form within faecal concretions in Bronze Age deposits which are not continuously wet or waterlogged.

Introduction

A total of 64 specimens of coprolites and samples of concreted material, collected mainly from Bronze Age occupation deposits, were submitted to the Environmental Archaeology Unit, University of York, for identification and comment. Given the post-excavation timetable of the project that some material was needed for display, it was impossible to take standard sized samples from the specimens or to examine all samples submitted. The author selected 47 samples for detailed investigation bearing in mind the condition and provenance of the submitted material and the need to survey the material adequately.

During the course of the investigation three main kinds of material were recognized. Some of the submitted samples were clearly coprolites, being of a shape and size consistent with canine faeces and containing small splinters of mammal bone. The excavator expressed the desire that at least some coprolites were not destroyed during the analysis. Consequently, a number were examined visually and left for posterity.

There was also a group of samples which stongly resembled the coprolites in the nature of their composition and inclusions, but were fragmentary or of an unusual colour. These have been described as 'possible coprolites'.

A third group comprised amorphous concretions of unknown origin. These were variable in colour and form, but several were notable for their glassy appearance when broken.

A small number of vitrified slag-like samples and a few dry silty clay samples were examined visually and rejected for parasitological analysis.

Table 01

Catalogue of samples selected for parasitological investigation

1. Coprolites

Context	Sample	Description	Amount examined (g)
52	60095	Three fragments buff coloured with abundant bone fragments	1.0
53	3895	Buff coloured, with bone fragments 64.5 x 34.75 mm	6.0
53	4123	Pale buff to mid brown with small bone fragments	1.0
53	4514	Buff to light grey brown, slightly flattened with glassy patches at perimeter	3.0
53	4989	Buff, flattened irregular with bone fragments	3.0
53	5268	Dark grey brown with white powdery areas 26 x 19.5 mm 7.9 g.	1.5
53	5393	Slightly flattened, pale buff exterior with reddish interior	1.0
53	60398	Pale buff, slightly flattened, 62mm x 22 mm visible plant remains	1.0
89	5773	Pale buff with abundant bone fragments	3.0

Possible coprolites

Context	Sample	Description	Amount examined (g)
5B	227	Two fragments, buff coloured	3.0
5C	230	Buff coloured	1.0
13	705	Light buff fragments	3.0
53	4609	Light brown, locally reddish, dry crumbly with small bone fragments	1.0
53	5769	Buff, crumbly fragment	2.0
53	60311	Light brown with white patches, brittle some bone fragments	3.0
53	60340	Ginger brown sand covered	3.0
53	60342	Slightly flattened, buff to brown with some bone fragments	3.0
53	60364	Dark brown with white to grey patches	1.0
53	60820	Buff exterior with mid yellowish brown glassy sections	3.0
61	6205	Buff, crumbly	3.0
125	5764	Pale buff	3.0
132	5774	Dark buff with small bone fragments	6.0
139	5819	Flattened buff exterior with glassy section	2.0
139	5832	Flattened and vesicular	2.0
139	6019	Buff, squashed with bone fragments	6.0
153	5890	Flattened, with abundant bone fragments	3.0
163	60829/A	Pale yellowish brown to reddish brown-mid grey	6.0
168	6021	Pale buff to mid brown with glassy section in part	1.0

Amorphous concretions

Context	Sample	Description	Amount examined (g)
53	4120	Dark grey brown flattened, with white and pale yellow areas	2.0
53	5141	Two fragments buff exterior, dark reddish glassy interior	2.0
53	5618/A	Dark brown glassy flattened	3.0
	5618/B		1.0
	5618/C		1.0
	5618/D		1.0
	5618/E		1.0
	5618/F		1.0
	5618/G		1.0
53	5696	Light brown, crumbly	1.0
53	60313	Very light grey exterior with brown interior crumbly	1.0
53	60335	Light grey, amorphous, flattened, glassy in section	2.0
53	60338	Very light grey exterior with hard, dark brown interior	1.0
53	60341	Dark grey brown with white patches with reddish interior,	1.0
79	60260	Flattened dark reddish brown glassy	1.0
107	4985	Amorphous concretion composed largely of sand particles	1.0
115	60319	Irregular pale reddish brown to gingery brown, flattened	6.0
115	60337/1	Mid brown glassy nodules	1.0
115	60337/2	White to mid grey with reddish brown section vesicular	1.0
156	5880/1	Dark to mid brown glassy compressed	6.0
156	5880/2	Dark to mid brown glassy	6.0
157	6044	Dark grey brown, possibly burnt	6.0
162	5926	Pale grey to mid-dark brown	6.0
163	60829/A	Dark reddish brown to dark grey brown	6.0
163	60829/B	Dark grey brown concretion	3.0

Table 02

A number of samples (including well preserved coprolites) were examined but not dissagregated in order that they can be preserved. This list also includes samples which were obviously not of faecal origin.

Samples which were not faecal in origin

16	2810	Pale grey clay
53	5758	Light yellowish brown, vesicular material, probably inorganic in origin
62	60497	Light yellowish brown sandy concretion ?possibly a root void fill
62	60494	See above
62	60492	See above
89	60277	Olive brown flattened amorphous concretion
112	60397	Concreted sand

Unexamined coprolites (kept for posterity)

16	60037	Small fragments of pale buff ?dog coprolite
53	3894	Pale buff, slightly curved, circular sectioned ?dog coprolite
53	4021	Pale buff to pale grey to dark brown ? dog coprolite with abundant splinters of mammal bone
89	5773	Two small ?coprolites + sand
89	60394	Small fragment of buff ?dog coprolite
93	5788	Pale greyish buff terminal fragment of ?dog coprolite
95	5021	Flattened vesicular corpolite with abundant bone fragments
129	5852	Two fragments of dog coprolite with sand
129	5986	Slightly flattened ?coprolite
139	5819	Two fragments of slightly flattened dog coprolite with bone and charcoal
153	6037	Slightly flattened coprolite with abundant bone fragments

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. Sub-sample of selected concretions was placed in a a 120 ml wide-mouthed bottle with measured aliquots of dilute hydrochloric acid in a ratio of 1 gm sample to 14 ml dilute acid. The bottle was allowed to stand for 24 hours and gently shaken by hand to assess if the concretions were thoroughly disaggregated. Once disaggregated the mixture thoroughly shaken and poured through a freshly flamed sieve of 250 micron mesh-aperture to remove coarse particles. A 0.15 ml aliquot of the filtrate was covered by a 22 X 50 mm coverslip and scanned at X 120 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. In addition, length minus polar plugs was recorded for trichurid ova. 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 results of visual examination are presented in Tables 01 and 03, those for microscopic examination are presented in Table 03.

Table 03 Results of parasitolological investigation

Context	Sample	Finds on microscopical examination
1. Coprolites		
52	60095	1 oocyst, Isospora or Eimeria
53	3895	0 parasite remains, A, P
53	4123	0 parasite remains, A, F
53	4514	0 parasite remains, A
53	4989	1 ovum, Trichuris, P
53	5268	0 parasite remains, F
53	5393	1 ovum Trichuris, 1 ovum Ascaris F
53	60398	0 parasite remains, F
89	5773	0 parasite remains, A, F

Abbreviations, A = Arthropod cuticle fragments, C = Charcoal, D = Diatom, F = Fungal spores, P = Pollen grains, PM = Plant microfossils, usually pieces of plant tissue or isolated cells

Possible coprolites

Context	Sample	Microscopic finds
5B	227	0 parasite remains, A, F
5C	230	0 parasite remains, A, F
13	705	0 parasite remains, F
53	4609	1 ovum Trichuris, 1 ovum Ascaris F, P
53	5769	2 cysts of testate amoebae, A
53	60311	1 fragmentary ovum, Trichuris, C, F, P
53	60340	0 parasite remains, A, F
53	60342	1 ovum, Trichuris, A, F
53	60364	0 parasite remains, A, C, P
53	60820	0 parasite remains, A, F
61	6205	0 parasite remains, A, F
125	5764	0 parasite remains
132	5774	0 parasite remains
139	5819	1 ovum, Ascaris, F
139	5832	0 parasite remains, F
139	6019	0 parasite remains, A, F
153	5890	0 parasite remains, A, F
163	60829/A	0 parasite remains
168	6021	0 parasite remains, F, P

Abbreviations, A = Arthropod cuticle fragments, C = Charcoal, D = Diatom, F = Fungal spores, P = Pollen grains, PM = Plant microfossils, usually pieces of plant tissue or isolated cells

Amorphous concretions

Context	Sample	
53	4120	0 parasite remains, A, F
53	5141	0 parasite remains
53	5618/A	5 ova, *Trichuris*, A, F
	5618/B	3 " " F
	5618/C	4 " "
	5618/D	3 " " 1 ovum *Ascaris*
	5618/E	1 ovum "
	5618/F	3 ova " F
53	5696	0 parasite remains, C, F
53	60313	0 parasite remains, C
53	60335	1 ovum, *Trichuris*, A, F
53	60338	0 parasite remains
53	60341	1 ovum *Trichuris*, 1 ovum *Ascaris*, F
79	60260	0 parasite remains, A
107	4985	1 ?oocyst
115	60319	0 parasite remains, A, F, PM
115	60337/1	1 ovum, *Trichuris*, A, P
115	60337/2	0 parasite remains, F
156	5880/1	0 parasite remains, A, F, PM
156	5880/2	3 ova, *Trichuris*, A, F, PM
157	6044	0 parasite remains, PM, grass fragments
162	5926	0 parasite remains, A, F
163	60829/A	1 oocyst, *Isospora* or *Eimeria*
163	60829/B	0 parasite remains, D, F

Abbreviations, A = Arthropod cuticle fragments, C = Charcoal, D = Diatom, F = Fungal spores, P = Pollen grains, PM = Plant microfossils, usually pieces of plant tissue or isolated cells

Only three of the coprolite samples produced parasite ova or cysts while four of the possible coprolite samples gave a positive result. The amorphous concretions rarely contained parasite ova or cysts but samples of layer 53 (5618) and 156 (5880) gave the highest counts.

It is apparent from the table of results that many coprolites and concretions did not contain parasite ova while those that did give positive results yielded low concentrations of ova.

Two kinds of ova were observed. One, a barrel-shaped structure sometimes possessing two polar plugs, was typical of whipworms - the genus Trichuris - and was present at a maximum concentration of 500 ova per gram concretion. 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 usually cause little harm to the host, while heavy worm burden can cause prolapse of the rectum, diarrhoea and blood in the faeces.

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.

All but one of the Trichuris ova lacked polar plugs and two fragmentary ova were observed. Many of the eggs were thin-walled. Thus, the condition of the ova can be described as generally poorly preserved.

Because such small numbers of parasite ova were seen in the samples, the eggs measurements from all samples were analyses as a single group. Table 04 gives the dimensions of the Trichuris ova from Brean Down.

Table 04. Dimensions of Trichuris ova

Dimension		St.Dev.	SEM	n
Total length	55.8	-	-	1
Mean length -pp	50.0	1.6	0.4	13
Min. length -pp	46.8	-	-	
Max. length -pp	54.0	-	-	
Mean width	26.7	1.9	0.5	13
Min. width	25.2	-	-	
Max. width	32.4	-	-	

Abreviations:- -pp = minus polar plugs; Min. = minimum; Max. = Maximum; St.Dev. = Standard deviation; SEM = Standard error of the mean; n = number of observations.

All measurements in microns.

From these measurements and statistics it is clear that the *Trichuris* ova are not from *Trichuris vulpis* the whip-worm of dogs but that they are of a size consistent with *T. trichiura* the human whip-worm. It is possible that individual eggs are from other species, e.g. *T. muris*, but taken as an assemblage this small sample is strongly suggests the presence of human whip-worms.

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).

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 300 mm 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. *Ascaris* ova were present in very small numbers. All were fertilized and two were were broken.

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*.

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 Brean Down compare closely with those obtained from faecal concretion samples in Anglo-Scandinavian deposits at 16-22 Coppergate (Jones, 1985).

Discussion

1) Coprolites

No human coprolites were recognized. The coprolites were clearly passed by a medium sized carnivore judging from their size and inclusions. Many contained splinters and other fragments of broken mammal or bird bone typical of those found in carnivore faeces. They are most likely to be canine in origin despite the disappointing lack of parasite ova and cysts specific to dogs.

The small numbers of parasite ova and cysts in the three coprolites with positive results are not specific to dogs. The oocysts could not be assigned to species, however, the size of the *Trichuris* eggs indicate that eggs of the human whip-worm, *Trichuris trichiura* were present. These must have been inadvertently ingested by dogs.

Both evidence from parasite ova and bone fragments clearly testify to the role of waste disposal agents played by dogs at Brean. This result will have serious implications for the analysis of bone assemblages, for experiments by Payne and Munson (1985), Walters (1984) and others have shown that scavenging dogs destroy a very high percentage of the bone they ingest.

2) Possible coprolites

The nature of these samples, their inclusions and concentrations of parasite cysts and ova are broadly similar to those of the coprolites from this site. Thus, it is reasonable to conclude that they are most likely to be dog droppings which have been squashed and deformed.

3) Amorphous concretions

Most of the concretion samples also gave negative results or low counts of parasite ova and it is not clear if they are flattened canine droppings, perhaps chemically altered, human faeces or some other form of organic deposit.

One sample (5618) is particularly interesting for it gave counts of up to 500 Trichuris ova per gram. It is not possible to estimate accurately egg concentrations per gram fresh faeces because the process of mineralization which has preserved the concretions and coprolites has changed the specific gravity of the fresh faeces. Mineralization, and the aggregation of non-faecal material in the concretions, means that the observed egg counts are likely to be very different from egg counts on fresh material. Work on a coprolite from 6-8 Pavement, York, (Jones, 1983) and the specific gravity of the concretions (2.0-2.2) suggest that egg counts should be doubled to give an approximate egg concentration for the fresh deposit.

This is relevant for sample 53 5618 which gave egg counts of 100-500 poorly preserved ova per gram. This sample certainly contained eggs of the human parasites T. trichiura and Ascaris. Although caution must be exercised when considering the egg concentration data it is likely that the concentration of eggs per gram fresh deposits was in the region of 1,000. While such a concentration may be found in the faeces of a dog that has recently ingested human excrement containing many thousands of parasite ova, it seems more likely that this sample is poorly preserved human faeces.

A sample (6044) of amorphous concretion from context 157 failed to contain parasite ova but was unusual as it was composed of plant material, mainly grass fragments. These were of a shape and size consistent with those found in recent herbivore dung. Although there is not sufficient evidence to prove that this sample was dung, it is clearly and organic residue rich in small fragments of grass.

Conclusions

The majority of samples submitted for parasitological investigation appear to be dog droppings. One sample contained relatively high numbers of Trichuris ova and may be of human origin. It is clear that some dogs were ingesting human parasite ova. Dog coprolites have preserved small numbers of human parasite ova and bear witness to the fact that the Bronze Age inhabitants of the site haboured intestinal parasites.

Whilst the number of samples producing parasite ova is small, it is most significant that any trace of human parasites can be detected in such ancient material excavated from a site which was not waterlogged and where survival of organic materials other than bone and shell was poor. It is hoped that this study will inspire others to follow the example set at Brean Down and in future more archaeologists will explore the possibilities afforded by the study of such unsavoury material.

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