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Cost effectiveness of methods of recovering microscopic organic remains from archaeological deposits

COST EFFECTIVENESS OF METHODS OF RECOVERING MACROSCOPIC ORGANIC REMAINS FROM ARCHAEOLOGICAL DEPOSITS

By H C M Keeley

INTRODUCTION

Scientists working in the field of environmental archaeology generally have two main aims:- (a) to reconstruct the past landscape and (b) to investigate certain aspects of human culture, such as agricultural practices and economy. In order to do this it is necessary to extract relevant organic material from archaeological deposits, which may be well-drained (1) or poorly drained (2).

In (1) the following materials may be preserved: bone, molluscan shells, calcified insect remains, pollen and carbonised or mineralised plant material. In (2) it is possible for an immense variety of organic materials to be found (eg seeds, fruits, insect remains, wood, feathers, textiles, leather). These categories may be subdivided according to soil type, pH, organic matter content, degree of compaction by overlying deposits etc which will affect the degree and nature of preserved materials, but in general freely drained archaeological deposits will contain a much more restricted range of organic materials than waterloggged deposits and this will influence the choice of sample size and recovery method employed.

The following rather limited survey was carried out to investigate the cost effectiveness of the main recovery methods in use in the United Kingdom. Although many environmentalists were approached, unfortunately not all provided information.

SAMPLE SIZE

Choice of sample size varies considerably between workers for a given material in a given deposit (from 1 Kg to 25 Kg), although there seems to be a preference for 5 Kg samples. Work in the Environmental Archaeology Unit, University of York, showed that wide variations in intersample results was obtained when a 10 Kg sample was divided into 1 Kg subsamples for extraction, indicating the necessity for large samples (5 to 10 Kg).

RECOVERY METHODS

Four main recovery methods are used: (a) by hand flotation in water, (b) water sieving (after some form of pretreatment to aid breakdown eg hydrogen peroxide or sodium hydroxide solution), (c) by hand flotation in paraffin, and (d) machine flotation.

(a) Water Flotation

The sample is mixed with water and material which floats is collected for sorting and identification. This method is not recommended as recovery is usually incomplete.

(b) Water Sieving

The sample may be pretreated (eg Calgon for disaggregation of clay samples; H_2O_2 or NaOH for peat samples) and is then washed through a series of sieves (smallest mesh 300 μ or 425 μ depending on the worker). The residues are then sorted. Recovery of insect remains is not very good using this method.

(c) Paraffin Flotation

Samples are steeped or sometimes rubbed in paraffin for a minimum of 30 mins to allow separation to take place and silt to settle. Water flotation is then carried out. The paraffin aids flotation and this method is particularly good for recovering insect remains. The float is then sorted; some workers also sort the residue.

(d) Machine Flotation

This technique was originally developed for recovery of carbonised material (especially grain) from archaeological deposits in Western Asia (Jarman et al, 1972; Williams, 1973). The basic system involves a large drum of water with a spout on one side near the top, to which sieves are attached. A bubbler is placed in the drum; detergent and paraffin are added to the water plus the sample. Organic matter floats over onto the sieves and is then sorted.

It was realised that the original models were not ideal for use in temperate conditions and therefore various modifications have been made, including incorporation of a sieve inside the drum to improve efficiency of recovery (Lapinskas, 1974) Opinion is very much divided as to the suitability of machine flotation for use in British archaeology.

RESULTS

Table 1 shows time taken by various workers to separate, sort and identify organic remains from archaeological sites. Cost involved in processing samples depends on individual wages/salaries.

Table 2 summarises entomological investigations carried out on two Somerset Levels sites by M Girling (Ancient Monuments Laboratory).

A flotation machine has been used to recover organic material from archaeological sites on the proposed M3 route in Hampshire (Lapinskas, 1974) and botanical remains have been identified by P Murphy (University of Southampton). A detailed analysis of sample treatment is as follows:-

Approximately 10 mins is required to take and record one sample on site. These are then air-dried for 2 or 3 days (no person time involved). The average sample size is 6373.89 cc and 15 samples are machine floated per day. Daily output is thus 95,608.35 cc requiring 12.75 man-hours, ie 7498.67 cc per man-hour. It was noted that samples of heavy clay loam texture may take twice as long to float as samples from ashy layers. The times quoted include water sieving. Boxing, listing samples, etc requires 1 hour per 20 to 30 samples.

The flotation machine cost approximately £90 to build. It is estimated that the cost involved in processing one sample to the presorting stage, is 65p (based on a volunteer rate of £3 per day). To this must be added sorting and identificatio time. A salaried research worker earns much more than £3 per day, and thus sample processing costs will typically be quite high, eg the Environmental Archaeology Unit, University of York, estimate that it can cost up to £100 to process one sample.

TABLE 1. INFORMATION OBTAINED FROM A NUMBER OF ENVIRONMENTALISTS RELATING TO TIME REQUIRED TO RECOVER ORGANIC REMAINS FROM ARCHAEOLOGICAL DEPOSITS

ırce of ɔrmation	Soil Type	Weight (Kg) or volume (cc) of sample	Separation (A)				Sorting (B)				Identification	Miscellaneous
			By-hand flotation in water		Water sieving (after breakdown with H_2O_2, NaOH etc as required		By-hand flotation in paraffin		Machine Flotation			
			A	B	A	B	A	B	A	B		
ɔnmental ɔology York	Unspecified	5-10 Kg					2-3 hrs	2-8 hrs			3 to 4 days for general range of material	
ling ab)	Unconsolidated sands and silts	2-3 Kg					20-40 mins	Varies from a few minutes to several days for the richest samples (organic silts, fen peats, etc)			Insects: A sample containing 50 taxa (no rarities) about 1 day; rich sample 2 to 3 weeks	
	Compacted organic silt						30-90 mins					
	Organic clay (soak in $CaCO_3$ solution up to 24 hrs)						30-90 mins					
	Humified peat	up to 2 Kg depending on density					30-60 mins + 30 mins to settle					
	Fibrous peat (disaggregate 30 mins and soak up to 5 days)						30-90 mins + 30 mins to settle					
	Felted peat (disaggregate 60 mins and soak up to 5 days)											
	Unhumified peat (disaggregate 30 mins, boil 60 mins)						30-60 mins + 30 mins to settle					
ig Birming- eological atory)	Unspecified	5 Kg					4 hrs ∓ 2	1 day ∓ 4 hrs			Seeds: Two days to 1 week per sample	Preparation of subsample for pollen counting and calculation ⅋s 6 hrs ∓ 2
pax ab)	Clay	1 Kg	45 mins	10 mins	15 mins	1 hr	1 hr	30 mins			Charcoal: About 12 samples per day (approx 100g; 200 fragments)	
	Calcareous Sandy Loam		10 mins	10 mins	10 mins	1 hr	30 mins	30 mins				
	Peat		15 mins	45 mins	15 mins	4½ hrs	45 mins	2½ hrs				
	Organic loam		10 mins	45 mins	10 mins	4 hrs	45 mins	2 hrs				
	Unspecified	7500 cc							1 hr	24 mins to 4 hrs. Mean 1 hr 36 mins		
k rtment chaeo- rsity a pton	Calcareous	1868 cc	11.6 mins	14.4 mins			46.6 mins					
	Sandy	1236 cc	7.8 mins									
	Boulder Clay	444 cc	15.8 mins									
	Peaty	800 - 1500 cc					30-40 mins					

TABLE 2 ENTOMOLOGICAL INVESTIGATIONS ON TWO SOMERSET LEVELS SITES

Operation	(1) Stileway (Woodland fauna)	(2) Meare Lake (Peat Bog fauna)	Time taken (per sample)	
			(1)	(2)
ample preparation	Well humified peat samples required no pretreatment and washed down in about 40 mins. 2-4 flotations, about 10 mins	Felted, fibrous and unhumified peat types requiring boiling or soaking for several days Flotations had to be left for 30 mins or more to settle. 5 days were spent preparing 6 samples	80 mins	6 hours
orting	Richest samples up to 6 hours, others 3-4 hours	30 mins to 10 hours	4 hours	3 hours
dentification	8 days for the richest samples, less as the fauna became more familiar	3 to 4 hours for "acid-bog" faunas, several days for richer samples	4 days	2 days
ata collection			2 hours	1 hour
and total	4 days, 7 hours and 20 mins per sample	2 days and 10 hours per sample		

DISCUSSION AND CONCLUSIONS

It is clear that sample size, preparation and recovery method employed vary widely between individual workers, depending partly on personal preference and partly on the material of primary interest. Separation times vary according to sample type and method used. Sorting and identification times depend on the richness of the sample and the experience of the worker. There is a case for standardising sampling and separation techniques in order to obtain reproducibility of results.

The most important conclusion to be drawn from this survey is that the recovery and identification of organic remains from archaeological deposits is an extremely time-consuming and therefore expensive activity. It cannot be over-emphasised that such work must be justified in terms of information output, which requires rigorous selectivity by scientists and archaeologists in the choice of material to be studied.

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