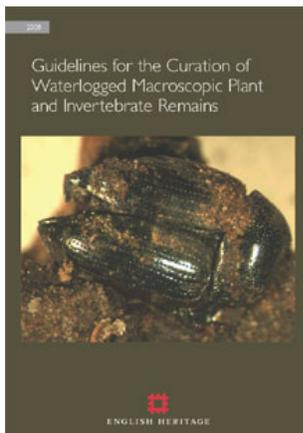




Historic England

Guidelines for the Curation of Waterlogged Macroscopic Plant and Invertebrate Remains



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Although this document refers to English Heritage, it is still the Commission's current advice and guidance and will in due course be re-branded as Historic England.

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We welcome feedback to help improve this document, which will be periodically revised. Please email comments to guidance@HistoricEngland.org.uk

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Guidelines for the Curation of Waterlogged Macroscopic Plant and Invertebrate Remains



ENGLISH HERITAGE

I Introduction

The aim of this document is to provide guidance on the curation (ie treatment, handling and storage) of small (up to c 50mm) organic remains, primarily specimens or parts of plants and insects, recovered during excavation, sampling or analysis of waterlogged or anoxic archaeological deposits. For information on the value and applications of macroscopic plant remains and invertebrate analysis in archaeology, and for guidance on sampling and analysis procedures, see the English Heritage *Environmental Archaeology Guidelines*: http://www.english-heritage.org.uk/upload/pdf/cfa_environmental.pdf

These guidelines for macroscopic organic remains are intended primarily for environmental archaeological specialists involved in the analysis of plant and invertebrate remains and collections managers responsible for the curation of archaeological site archives. They should also be of interest to local government archaeological officers responsible for the production of archaeological briefs, project managers, site finds and environmental officers, and others involved directly or indirectly in the handling and managing of waterlogged organic remains. Non-archaeologist researchers will also find this document useful, for example in studies of natural waterlogged deposits.

2 General curation requirements

The logical conclusion of any investigation or analysis of environmental archaeological remains is the appropriate archiving of the materials as documentation of the work carried out and to enable the materials to be restudied. For general information and guidance on archaeological archives see: <http://www.helm.org.uk/server/show/nav.7717>

Each category of material will have its own specific requirements concerning archiving and curation. However, the main requirements of an archive are:

- that the storage medium protects and conserves the fossil material to prevent or minimise further degradation or deterioration;
- that the material remains suitable for other forms of analysis in the future, ideally including scientific dating;
- that specific remains are easy to locate, remove and replace;
- and that the system is simple to set up, remains low maintenance and uses space economically.



Fig 1 Well preserved plant and invertebrate remains from archaeological samples: clockwise from upper left, seeds of bogbean (*Menyanthes trifoliata*); rachis nodes of rye (*Secale cereale*); seed of opium poppy (*Papaver somniferum*); mangold flea beetle (*Chaetocnema concinna*).



Fig 2 Handling equipment: left to right, fine 'hard' watchmaker's forceps; two pairs sprung 'soft' forceps; paintbrushes.

3 Recommendations concerning the curation of waterlogged plant and invertebrate remains

These recommendations are made against the background of experience gained in the environmental archaeological archives at the National Museum of Denmark, Copenhagen and discussions with members of English Heritage's research staff, Regional Science Advisors, Environmental Studies and Scientific Dating teams.

i Handling

Small fragile plant and insect remains are best handled using 'soft' forceps and/or a fine paintbrush. Transfer of fine material between containers should be carried out and checked under a low-power microscope. Larger, more robust remains can be handled gently using 'hard' forceps and it may not be necessary to monitor transfer under a microscope. Material should be kept wet or damp at all times – under no circumstances should it be allowed to dry out.

ii Methods of storage

It is recommended that remains are stored in small containers filled with an appropriate storage medium (see below). Storage containers should be glass or plastic tubes with a tight-fitting plastic stopper, but without a cardboard insert, as this is likely to degrade. An appropriate size should be used to accommodate the specimen. Small tubes c 50mm long and 10mm in diameter will suffice in most cases. Medium-sized and large containers should be stocked for larger specimens, such as hazelnuts, acorns and olive stones, and for large invertebrates. Each container size should form its own series (see below).

The tubes can be stored in removable racks, or in another system that ensures that they are held in numbered sequence, such as polystyrene test tube holders or cardboard dividers, preferably within large airtight boxes. The former make it easy to locate and replace specific tubes and the latter will decrease markedly the rate of evaporation of the storage medium in the tubes. The tubes should be filled to just below the base of the stopper; checking and topping up should then only be necessary at five-year intervals – or possibly even less frequently.

Individual or small numbers of small plant and invertebrate remains (for example Chironomids) can also be mounted on microscope slides under cover slips, using a proprietary mounting medium such as Euparal or Aquamount. This method renders the specimens easy to label, store, relocate and re-examine under the microscope. However, slide-

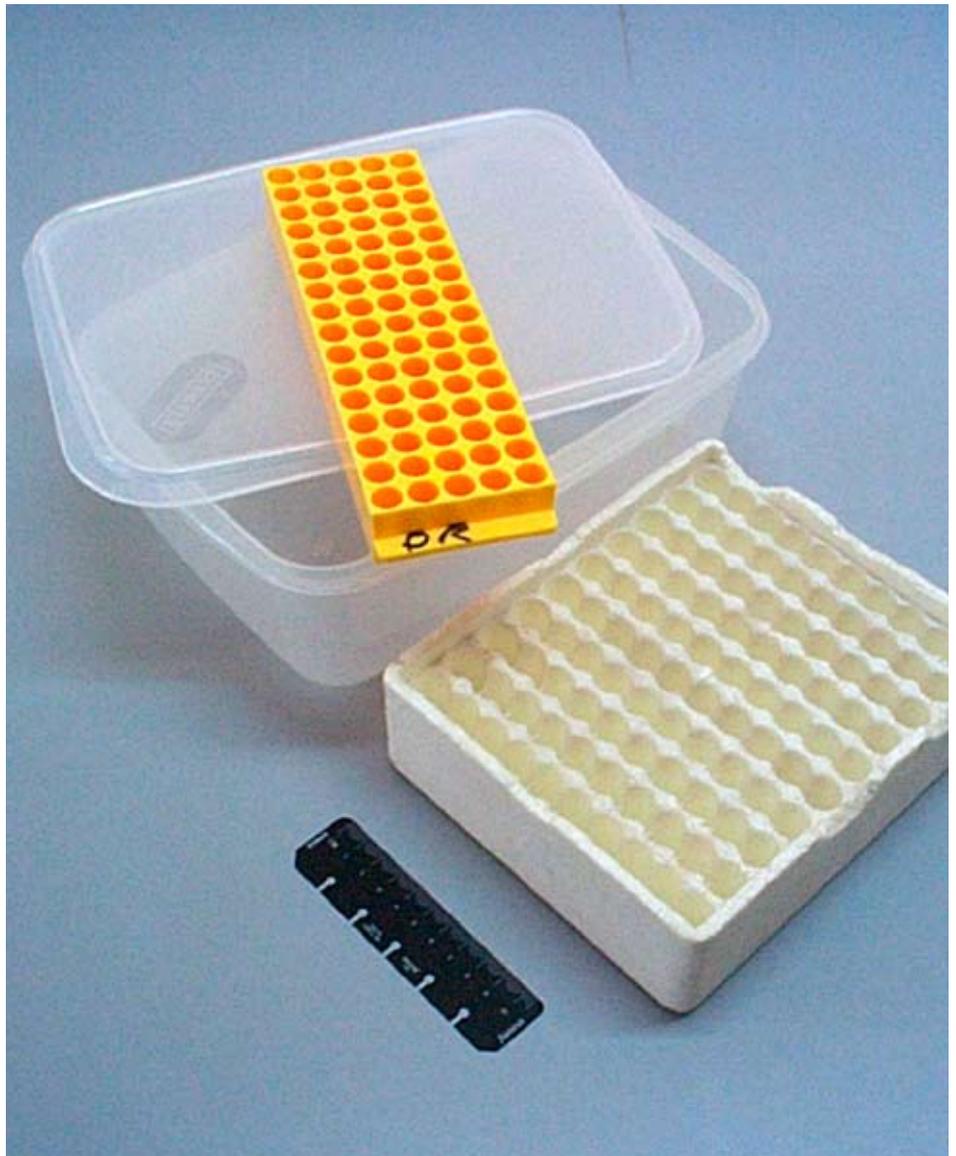


Fig 3 Suitable containers, racks and airtight boxes: clockwise from upper left, high quality 'jam jars' in plywood boxes used for large macrofossils and sediment samples (National Museum, Copenhagen); small cork-stoppered vials in cardboard racks – now superseded by plastic stoppers (National Museum, Copenhagen); alternative racking systems and a storage box.

mounting is not suitable for large items and it is time consuming to prepare large numbers of remains in this way. It is also difficult to reverse the process to release the remains, and the mounting medium renders them unsuitable for

radiocarbon dating. Mounting on slides is useful in some cases, for example when dealing with special problems of identification, but it is not recommended for general storage purposes.

iii Container identifiers

Each tube (or slide) should be clearly and indelibly marked with a unique (preferably numerical) identifier before use. The identifier can also be supplemented – but not replaced – by a bar code. If several series of containers are used to accommodate organic remains of different sizes, this should be denoted by a prefix. For example: SM = small containers, MD = medium containers, LG = large containers; SL = mounted slides. Addition of a site-specific (alpha-numeric) suffix is highly recommended.

There should be a label both inside and outside the tube. Labelling inside the tube should be in pencil on non-recycled paper as even waterproof ink is eventually dissolved, and recycled paper tends to disintegrate in the recommended storage media (see below). Another option is to use stamped or perforated number labels, which avoids the use of pencil. External labels can be computer generated, printed on appropriate-sized good quality, self-adhesive labels and secured on the tubes with good quality, acid-free document tape. Each airtight box should also be marked externally with the range of numbered tubes it contains. The tube identifiers and tube contents should be recorded in a database, spreadsheet or recording system conforming to the MIDAS data standard <http://www.midas-heritage.org.uk>. A paper back-up record is also advisable. The database or spreadsheet should be updated when tubes are added to, removed from or returned to the system, and notes made of any changes in the tube contents.

Specific identifiers should not be re-used if a particular tube is emptied (for example when all contents are used for a radiocarbon date), but should be recorded as empty, and a note added in the database on the fate of its contents.

It should always be possible to locate the whereabouts of a particular container; to list its contents and to produce a list of all other tubes containing material from the same sample or site. It is also useful to be able to locate all tubes from different sites containing similar material.

The labels, particularly the external ones, will deteriorate with time. They should be checked whenever the level of storage medium is checked.

iv Storage medium

Ostracod and mollusc remains are normally stored dry. For all other categories of uncharred plant and invertebrate remains, 70% ethanol has been found to be a suitable medium. Under normal circumstances, the use of ethanol is non-toxic to humans and animals but halts the

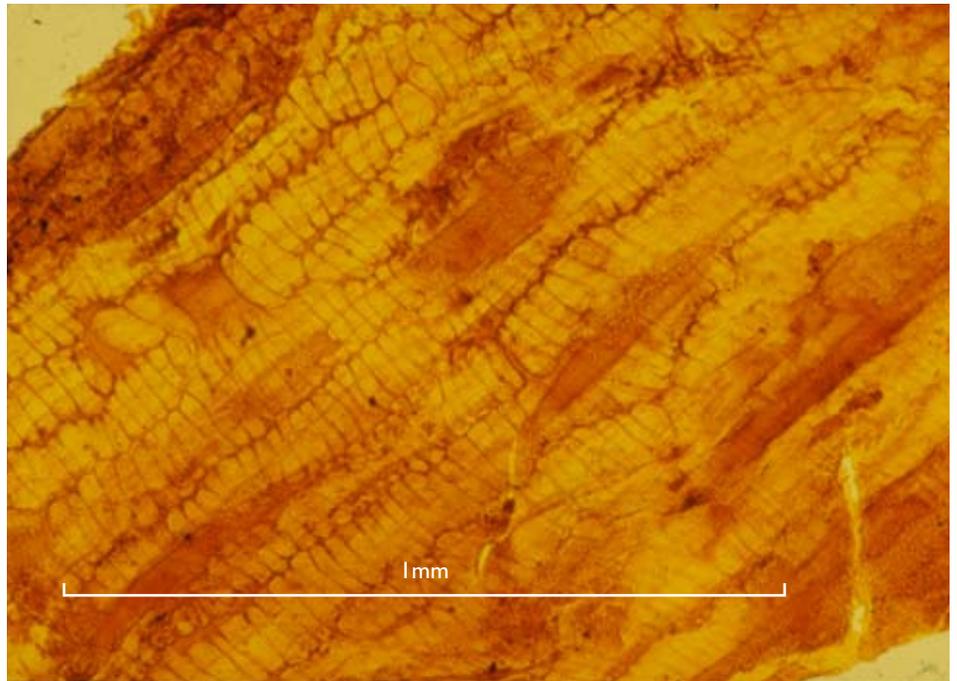


Fig 4 Archaeological plant macro remains archived on slides: top, bran (seed coat) of rye (*Secale cereale*); bottom, stipules of meadow vetchling (*Lathyrus cf. pratensis*).

Table 1 Examples of labels bearing unique container identifiers.

	prefix denoting container series, eg SM; MD; LG	unique (alpha-) numeric identifier	site-specific suffix
example 1	SM	00101	5629 RICH
example 2	LG	00010	0661 SILB
example 3	MD	04001	4641 GRND

Example 1: small container (SM) no. 101 in the series containing small remains from site 5629 Richborough. It would suffice to use either a site number (5629) or a site code (RICH) for the suffix; there is less chance of ambiguity and possible later duplication with a site number.

Example 2: large container (LG) no. 10 containing large remains from site 0661 Silbury Hill.

Example 3: medium container (MD) no. 4001 containing medium-sized remains from site 4641 Groundwell Ridge.

growth of most micro-organisms and other organisms that can damage the preserved remains. It is, however, highly flammable and is a controlled substance requiring special permission for its use and storage. Industrial methylated spirit (IMS) is similarly effective, but is considerably more toxic and should be handled accordingly.¹ Plant remains stored in 70% ethanol or IMS retain their shape, size and structure. The main risk to the specimen is associated with mechanical damage from drying out as the ethanol, then the water, evaporates. However, if a specimen dries out, it has been found that it will often recover satisfactorily if re-immersed in 70% ethanol or IMS. The ethanol or IMS vapour resulting from evaporation presents a risk of fire or explosion. This situation can be alleviated by using a double containment system, as described above. This risk is low when only small amounts of ethanol or IMS are being used.

Another potential problem with ethanol or IMS storage concerns subsequent use of the stored remains for radiocarbon dating; both ethanol and IMS contain carbon atoms, which can influence the dating result. Ethanol is less problematic, as it can be extracted from the stored material, although this can involve a

long process of soaking in a chemical solution (eg methanol) for a few days, accompanied by water rinses and oven drying, during which at any point the material may disintegrate. Furthermore, there can be no guarantee that the ethanol has been removed fully, especially if it has been incorporated into the structure of the specimen. Freeze-drying is another possibility and is definitely the best option for remains that are likely to be needed for dating. Freeze-drying gives ideal material for dating, but the process may have deleterious effects on the morphology of the remains.

The use of AGF² and FAA³, previously common practice, should be avoided, as formaldehyde solution is toxic if inhaled or swallowed, or if it comes into contact with the skin. It is also a category 3 carcinogen. Distilled water is also unsuitable, as it is no longer sterile once the plant material has been added and bacterial, algal and fungal growth will quickly ensue.

v Archiving procedure

All identified and potentially identifiable remains from an analysed sample should be archived. Common and easily identifiable remains of different species from the same sample can be stored in the same container. Less

common remains or those that are difficult to distinguish from others (ie those most likely to be revisited) should be kept separate, either by archiving them alone in a tube, or (to save space) together with other uncommon remains from which they clearly differ. However, avoid putting too many of these kinds of macrofossils in one tube.

It is not essential for remains from the same sample or the same site to be archived in consecutively numbered tubes. It does, however, make it easier to administer the system if this is the case, or at least if remains from the same sample or site occupy discrete blocks of identifier numbers.

vi Storage facilities

The airtight boxes containing the racks of containers should be stored on accessible racks and be kept cool, dark and well ventilated.

¹ IMS is of severe toxicity if swallowed or inhaled, affects the nervous system and can cause blindness. It is of moderate toxicity if it enters the eyes and can cause irritation or dermatitis if it comes into contact with the skin. It is flammable and a mixture of its vapour and air is potentially explosive.

² AGF solution comprises glycerine, 70% IMS and 40% formalin (formaldehyde solution) in the proportions 60:30:2 by volume.

³ FAA solution comprises 95% ethanol, 96% acetic acid, 37–45% formaldehyde and water in the proportions 70:15:10:5.

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Cover: mangold flea beetle (*Chaetocnema concinna*).

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