

Felt Konservering

Objektskonservering Lab - Jo Willey
Konserveringsseksjonen
Bergen Museum – DKS

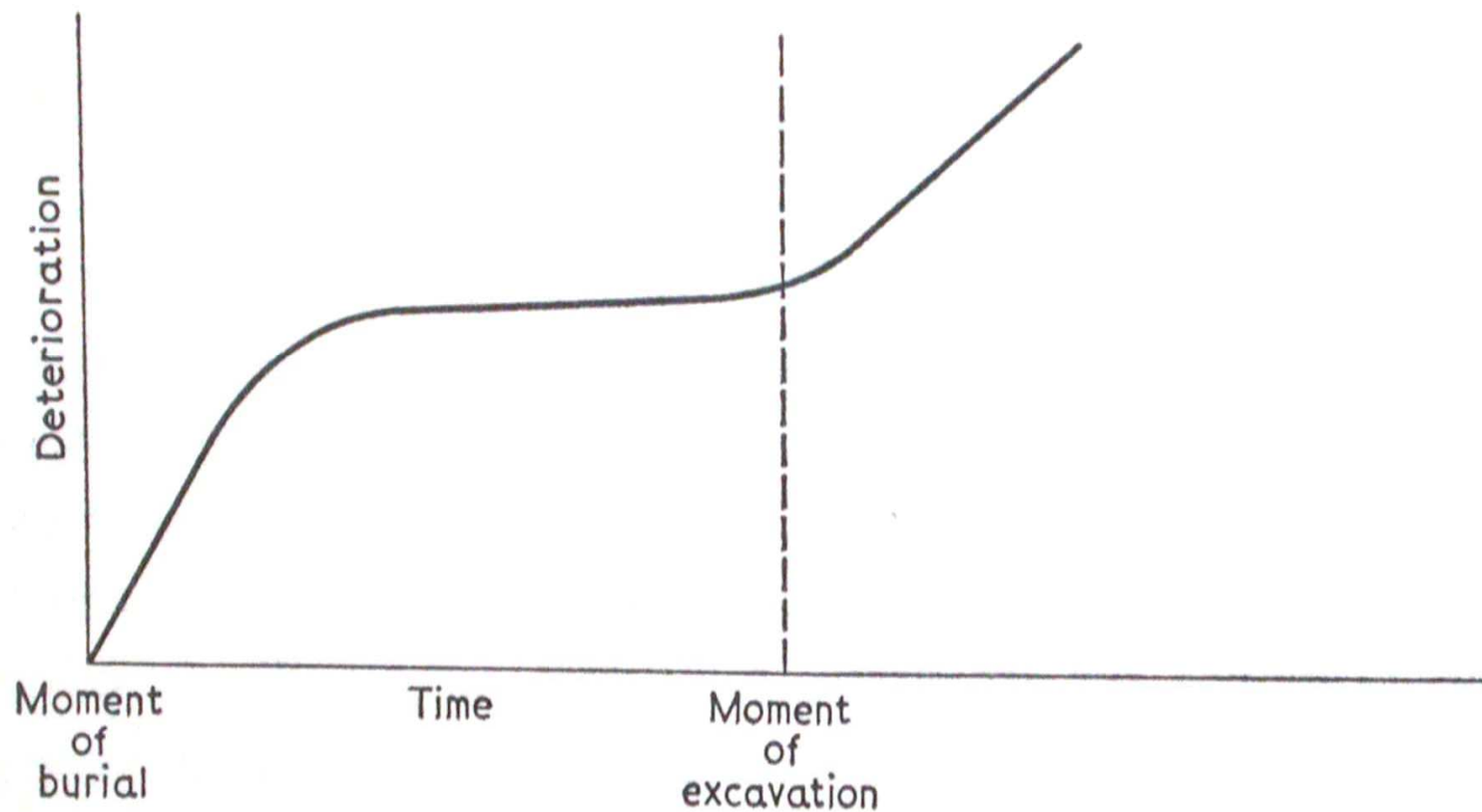


FIGURE I

Generalized graph showing approximately how a buried object adapts to its environment

Dowman, E.A., Conservation in Field Archaeology, 1970:4

Summary:

- ▶ Block lift objects in surrounding soil if possible
- ▶ Cover the excavation area to protect the objects from the weather – eg direct sunlight, rain
- ▶ Changes to the objects, eg drying, need to be carried out slowly – no direct sunlight, no heaters, cold storage conditions if possible, particularly for organic materials
- ▶ Use acid-free, stable/inert packing materials to pack and transport the objects
- ▶ Deliver the objects to a conservation lab as soon as possible

FIRST AID FOR FINDS

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The Museum of London

Third Edition, 1998

Table 1. Burial environments and their action on materials
[a] Survival of materials listed is possible

[a] POSSIBLE SURVIVAL OF MATERIAL LISTED					
DAMP BURIAL [Oxygen present]			WATERLOGGED BURIAL [Limited or no oxygen present]		
Acid Soil	Neutral or Weak Acid or Alkali	Alkaline Soil	Acid Soil	Neutral or Weak Acid or Alkali	Alkaline Soil
Gold, silver, [and their alloys]	Gold silver, copper, lead, tin, zinc [and their alloys]	Gold, silver copper, lead, [and their alloys]	Gold, silver, [and their alloys]	Gold, silver, copper, lead, tin, zinc [and their alloys]	Gold, silver copper, lead, tin, zinc [and their alloys]
Slag	Iron	Iron	Slag	Iron	Iron
Roman glass	Slag	Bone	Shale	Slag	Slag
Shale	Limestone	Limestone	Wood	Shale	Shale
Jet	Marble	Alabaster	Leather	Limestone	Limestone
Amber	All Ceramics	Marble	Keratin	Alabaster	Alabaster
Porcelain	Glass	All Ceramics	Horn	Marble	Marble
Stoneware	Bone		Amber	Amber	Amber
Earthenware	Shale		Jet	Jet	Jet
			Porcelain	Glass	Bone
			Stoneware	Wood	Wood
			Earthenware	Leather	Leather
			Textiles [proteinic fibres; silk & wool]	Textiles	Textile [vegetable fibres; flax hemp]
				Horn	All Ceramics
				Bone	
				All Ceramics	

Table 2. Post-excavation environment and its effect on excavated materials

POST-EXCAVATION ENVIRONMENTAL FACTOR	DAMAGING EFFECTS ON EXCAVATED MATERIALS
WATER is available in the atmosphere as water vapour and is measured in terms of relative humidity [see Table 4]. Very dry environments rarely occur in Britain unless artificially created by central heating systems or in very dry wintry conditions. The amount of moisture in the air varies according to the weather conditions. The interiors of poorly maintained buildings can often be very damp. Conditions are normally drier than in the burial environment.	HIGH MOISTURE LEVELS encourage micro-organisms to attack organic materials. HIGH AND MEDIUM MOISTURE LEVELS encourage corrosion of metals – particularly iron and copper alloys. MEDIUM TO LOW MOISTURE LEVELS cause waterlogged materials to dry out, producing irreversible physical damage. LOW MOISTURE LEVELS can dry out non-waterlogged organic materials, causing physical damage. FLUCTUATING MOISTURE LEVELS will cause physical damage to organic materials.
TEMPERATURE is higher than the burial environment and fluctuates more.	INCREASED TEMPERATURE speeds up chemical reactions and encourages biodeterioration. Temperature has a direct effect on the amount of moisture that air is capable of holding and influences relative humidity [Table 5].
OXYGEN is more readily available.	PLENTIFUL OXYGEN encourages all forms of chemical and biological decay.
ACID AND ALKALI will normally have been more extreme in the burial environment. Pollutant gases and poor quality packing materials can influence an otherwise fairly neutral ambient environment.	EXTREMES OF ACIDITY AND ALKALINITY affect most materials. Many excavated materials either are acidic or have the potential to become so due to chemical changes in the atmosphere [for example iron].
LIGHT is more plentiful in the atmosphere.	LIGHT encourages many aspects of biodeterioration and may fade organic dyes and pigments. Sunlight can increase ambient temperatures, which then influence the moisture retaining ability of the atmosphere.

Block lifting:

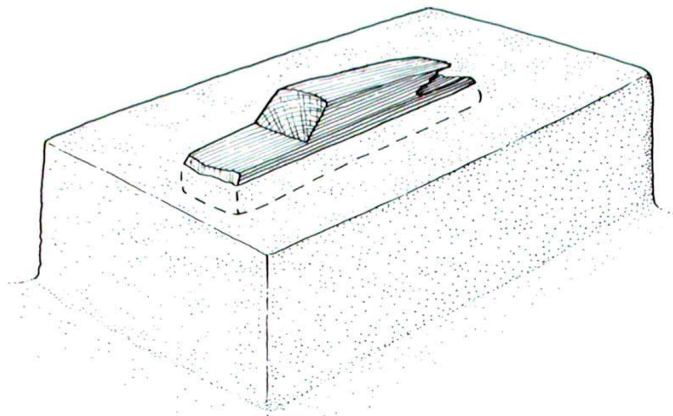


Figure 14a Object exposed on earth matrix

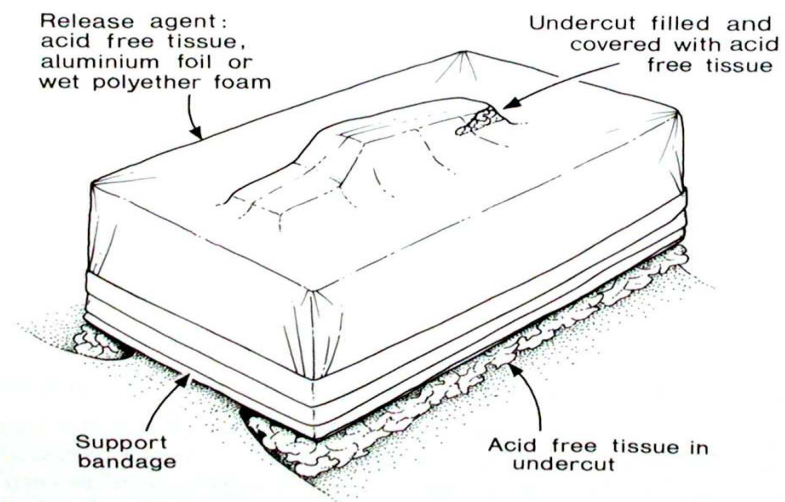


Figure 14b Object undercut at edges and supported with bandage

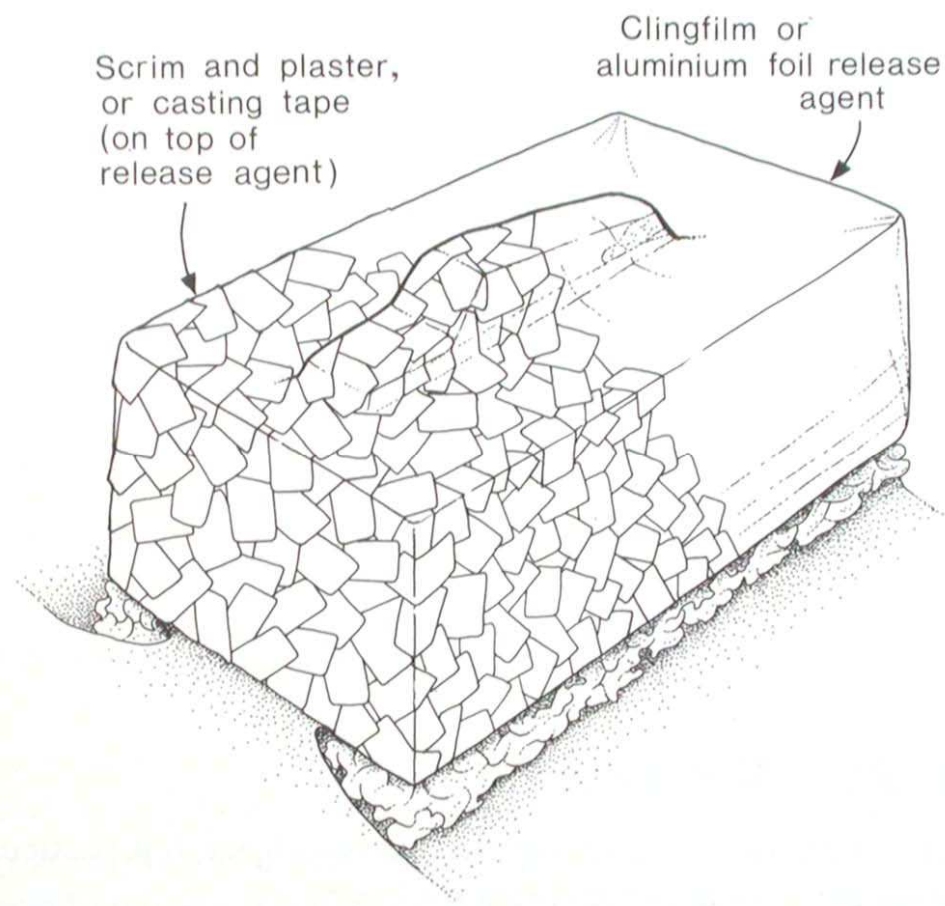


Figure 14c Object half covered with plaster and gauze support

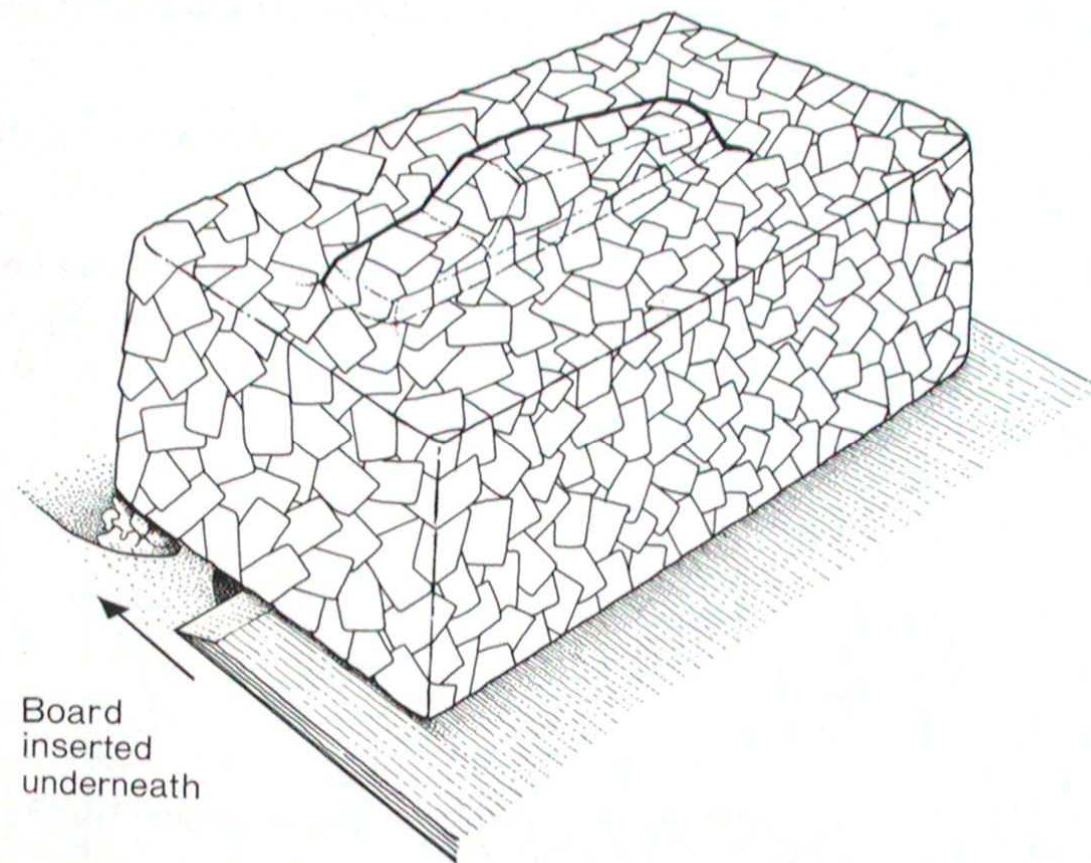


Figure 14d Object undercut for insertion of plywood base

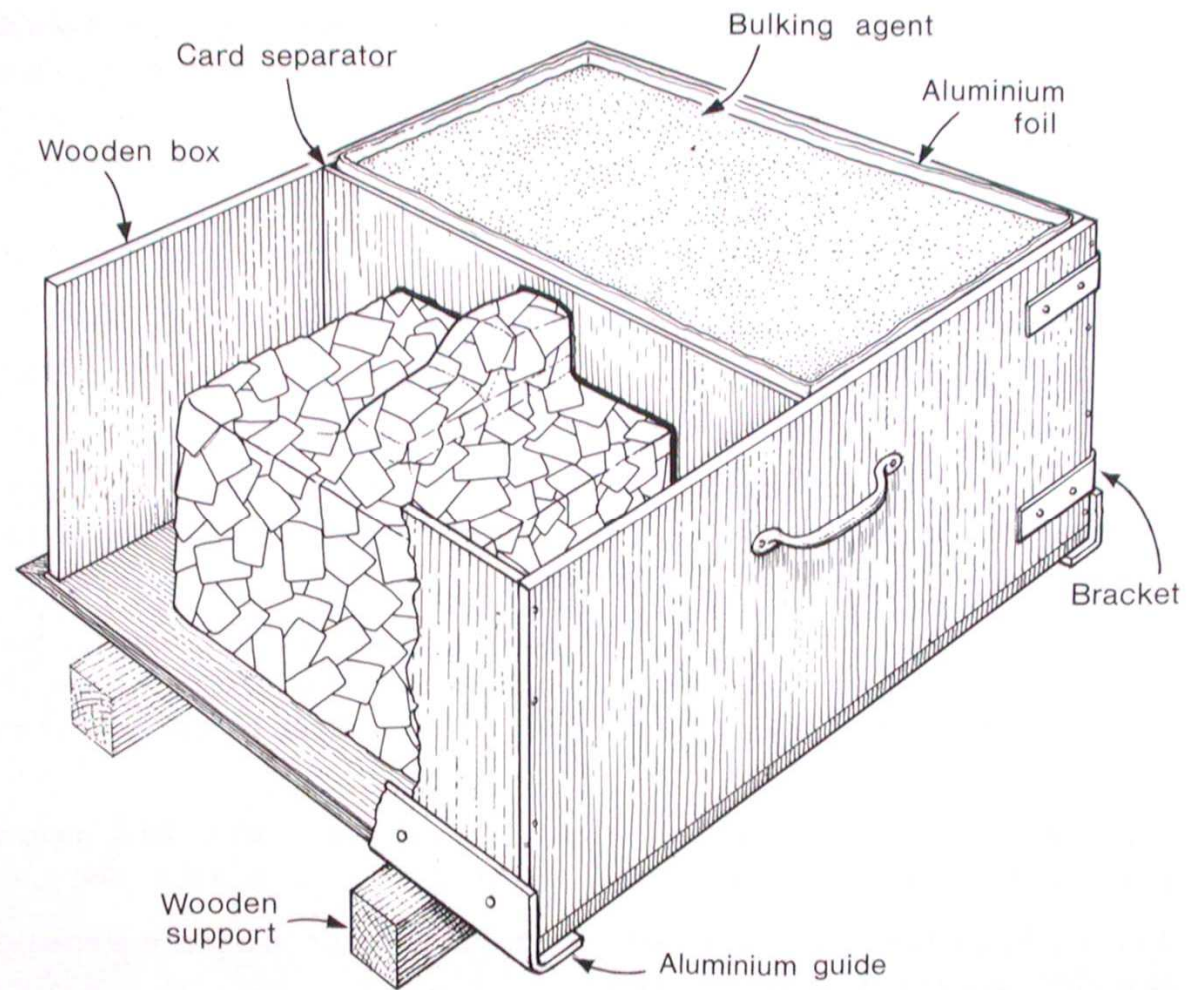
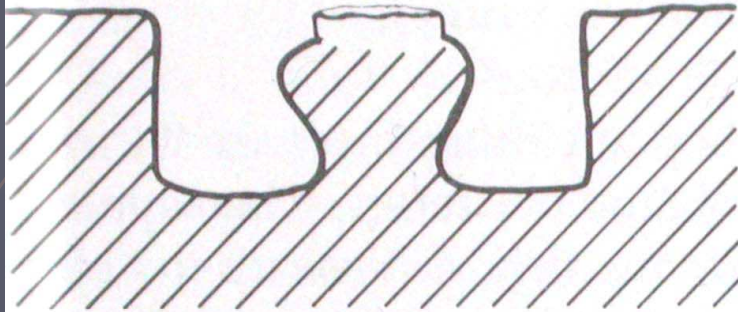
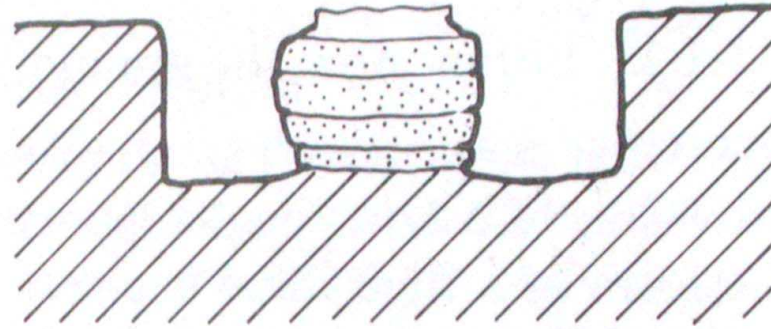


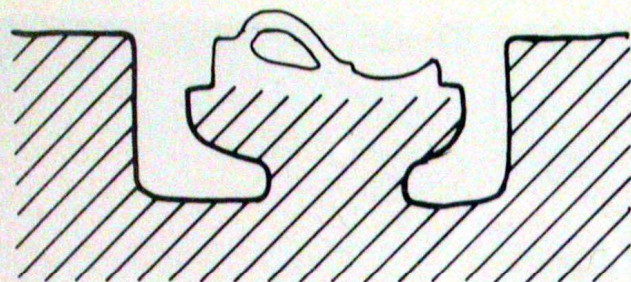
Figure 14e Box in situ and half of outer supporting block in place



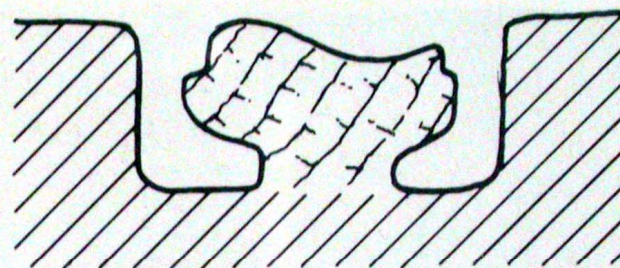
1 Object isolated on platform



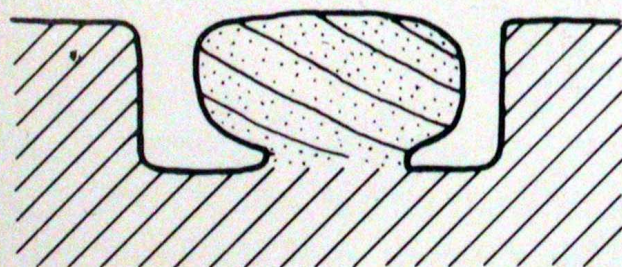
2 Platform strengthened with bandages dipped in plaster of Paris



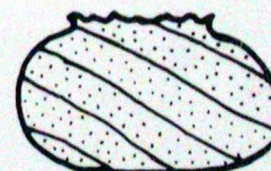
1 Object isolated on pedestal



2 Object and pedestal wrapped in damp tissue



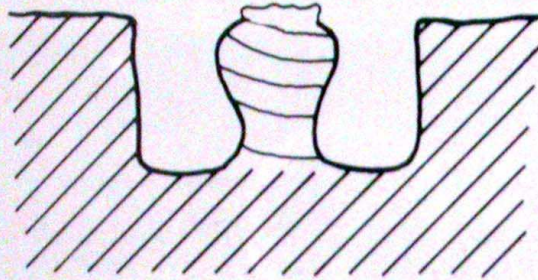
3 Object and pedestal wrapped in bandages soaked in plaster of Paris



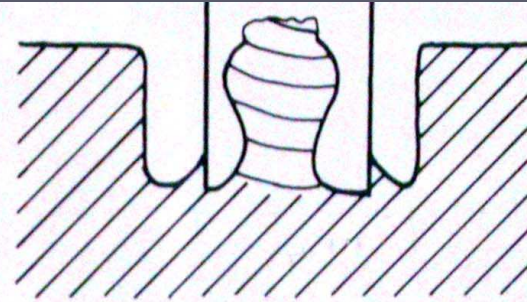
4 Object and pedestal removed from ground and inverted

Consolidation of the soil block lift:

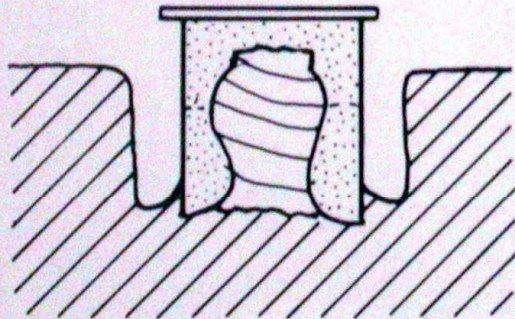
- ▶ The soil surrounding the object can be consolidated to help solidify and lift the block
- ▶ Aqueous acrylic emulsions - water based consolidants are used when the soil is damp or wet, eg. 5-10% w/v solutions of Primal AC 33 or Primal WS 24
- ▶ Solvent based synthetic resins - synthetic resins such as 5-10% w/v Paraloid B72 in acetone or ethanol are used when the soil is dry
- ▶ The consolidants are injected into in the soil around the object, with care taken not to get the consolidant on the objects



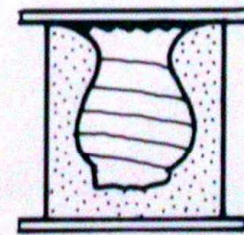
1 Object isolated on pedestal and wrapped in 'clingfilm'



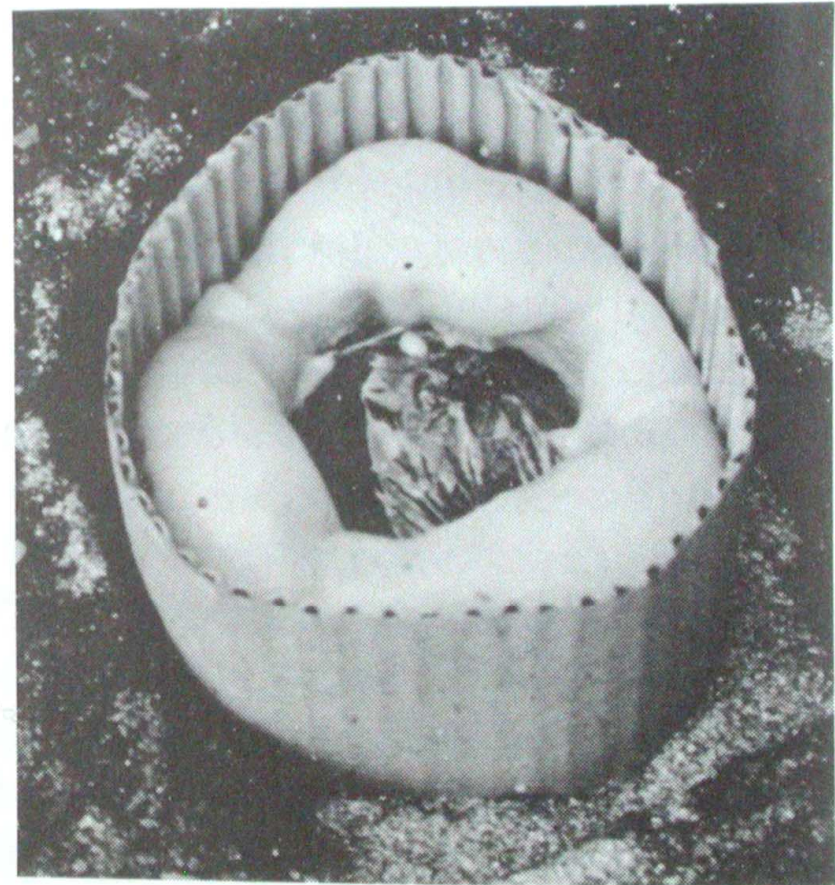
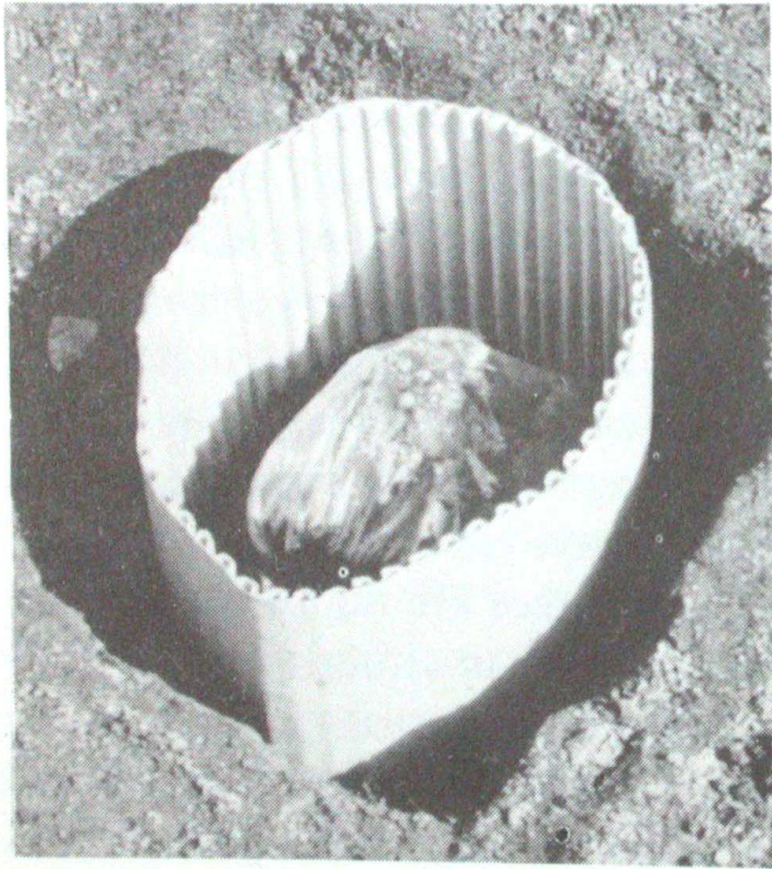
2 Collar of corrugated cardboard set in place and soil banked up



3 Foam poured in in stages and stopped with plywood lid



4 Cocoon inverted and exposed soil enclosed with lid

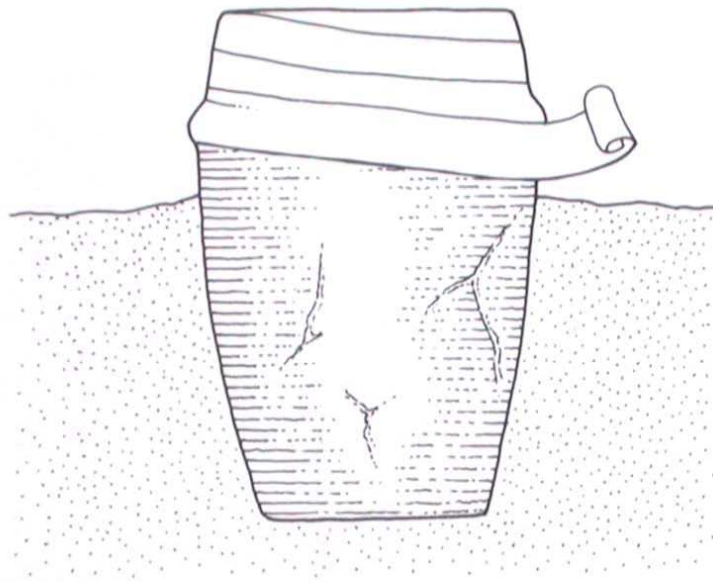


T.E.A.C., 1990: 48

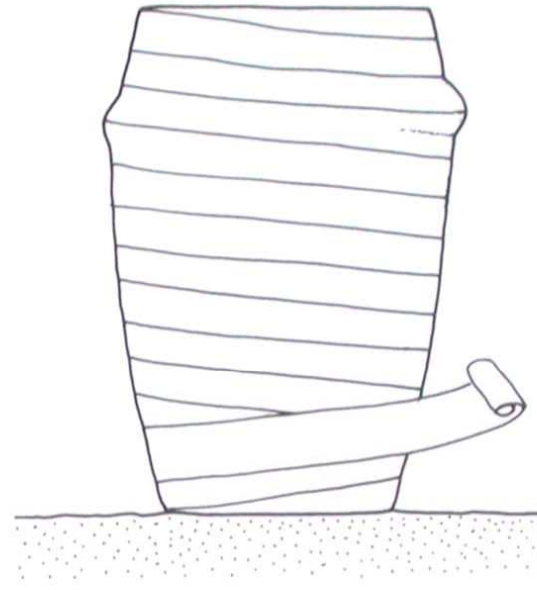


T.E.A.C., 1990: 54-55

Bandaging technique:



Bandage in one direction,
slowly excavating external earth



Bandage in opposite
direction

Figure 15 Bandage technique for the lifting of a complete fragile vessel

Transport of large objects:

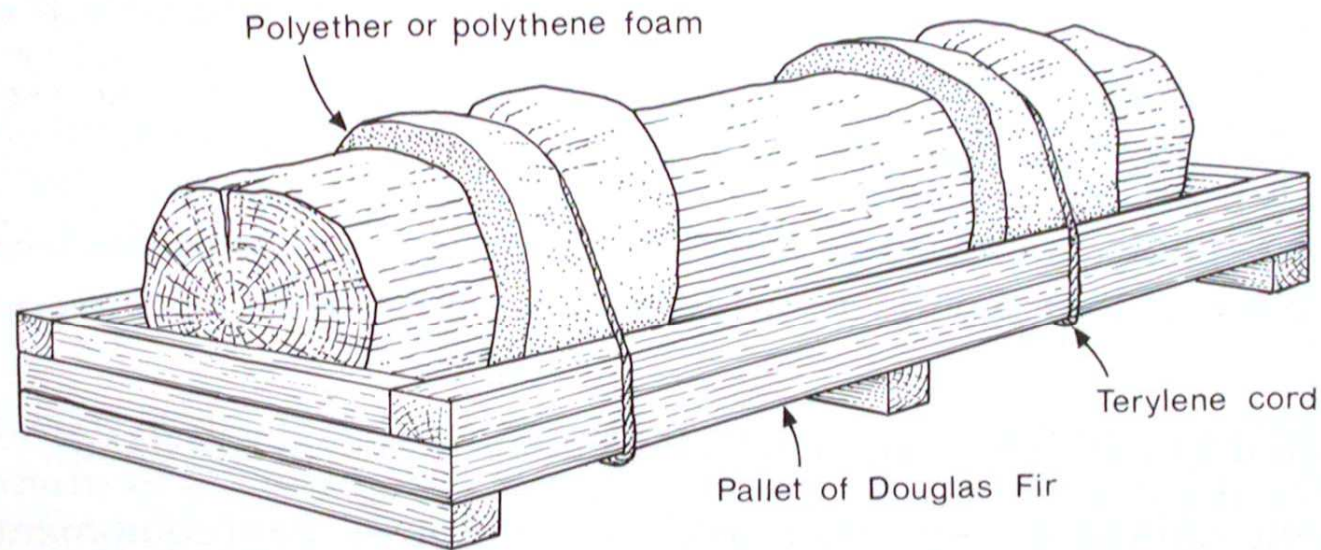
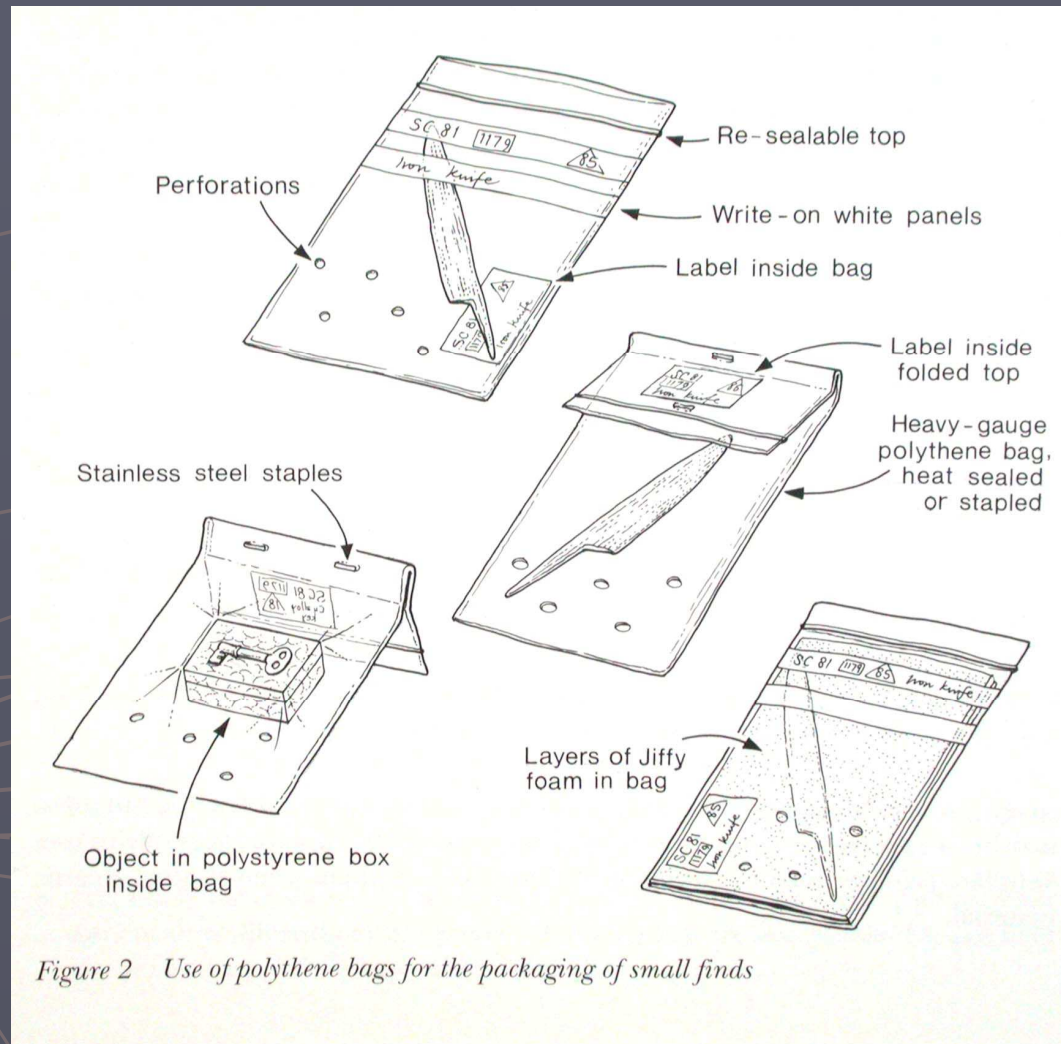


Figure 17 Lifting and moving of fragile timbers using a pallet

Packing and storage techniques:



Transparent polystyrene boxes:

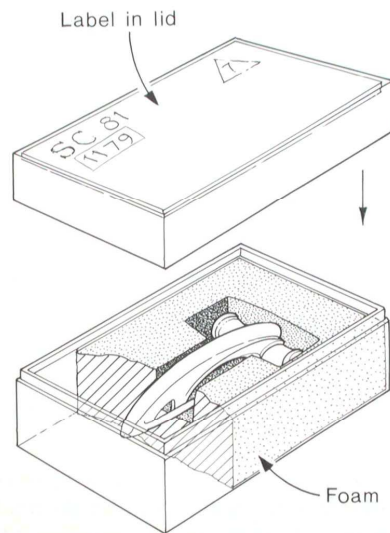


Figure 1a Method of packing small finds using polyethylene foam and polystyrene box to protect against physical damage

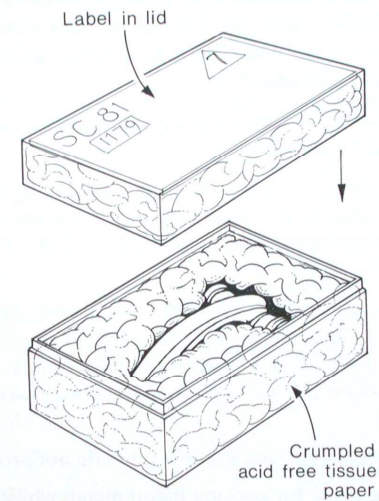


Figure 1b Method of packaging small finds using acid free tissue and polystyrene box to protect against physical damage

Dry storage using Silica Gel:

3.4.2 Using silica gel to create a dry packing environment

Metals, especially iron, are best packed in a dry microclimate – using a *polythene box* (3.3.2) and desiccated *silica gel* (3.4) (figure 3).

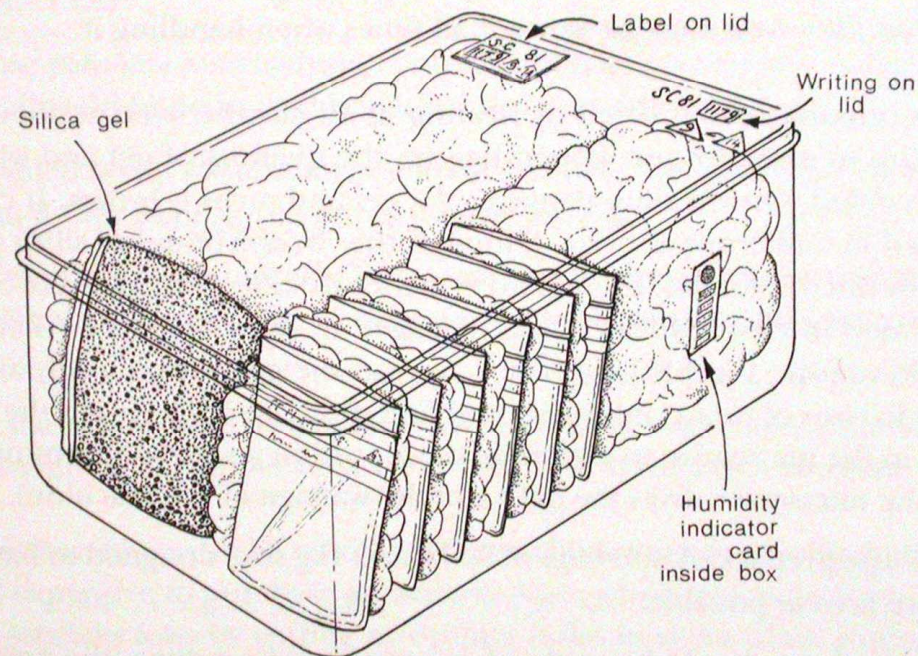


Figure 3 How to create a dry environment (low humidity) with physical protection for the storage of small finds

Silica gel:

- ▶ Blue – < 20% relative humidity – iron
- ▶ Orange – 30-40% relative humidity – most other metals
- ▶ White = Art Sorb or Air Sorb – organic materials and combinations of organic and inorganic materials – ca. 50 +/- 5% relative humidity

N.B.: The blue/orange silica gel can be desiccated and reused by heating to 100 ° C for several hours

Recommended relative humidity levels:

Table 5. Preferred levels of relative humidity for storage of materials

MATERIAL	RECOMMENDED LEVELS OF RELATIVE HUMIDITY TO INHIBIT DECAY
METALS Iron Copper alloys and other metals except lead Wet/Waterlogged metals	LOW RELATIVE HUMIDITY below 15% relative humidity. below 35% relative humidity. [Lead can be stored AT 55% relative humidity but preferably below 35% relative humidity. immersed in water – short-term only – send to a conservator ASAP.
ORGANIC MATERIALS Dry Wet/Waterlogged	55% relative humidity – minimal fluctuations wet or in 100% humidity.
INORGANIC MATERIALS Dry Wet/Waterlogged	55% relative humidity – minimal fluctuations 100% relative humidity or under water.
Building materials, slag, unworked bone, dry stone	Gradual fluctuations acceptable about 55% relative humidity.

Recommended relative humidity levels:

Anbefalt relativ luftfuktighet (RF) i Museer:

Materialer	Skader ved høy RF	Skader ved lav RF	Anbefalt RF
metall * arkeologisk jern	korrodere		< 40 % c. 15-20%
glass	glassyke	tørker ut	30-55 %.
rav	oksydasjon	krymper, sprekker	45-55 %
foto	mugg, flekker		< 40 %
papir	mugg, flekker	blir sprøtt	40-55 %
tekstiler	mugg, flekker	blir sprøtt, stivt	40-55 %
skinn, pels, lær	mugg, flekker	blir hardt, sprøtt	40-55 %
pergament	slår seg	krymper	40-55 %
tre	mugg, slår seg	krymper, sprekker	40-55 %
intarsia, finér	løsner	løsner, slår seg	40-55 %
malt tre	sprekker, maling flasser av	maling løsner	40-55 %
malerier	mugg, flekker	maling løsner	40-55%

Fra: Norsk museumsutvikling 8: 2000

Damp-high humidity storage:

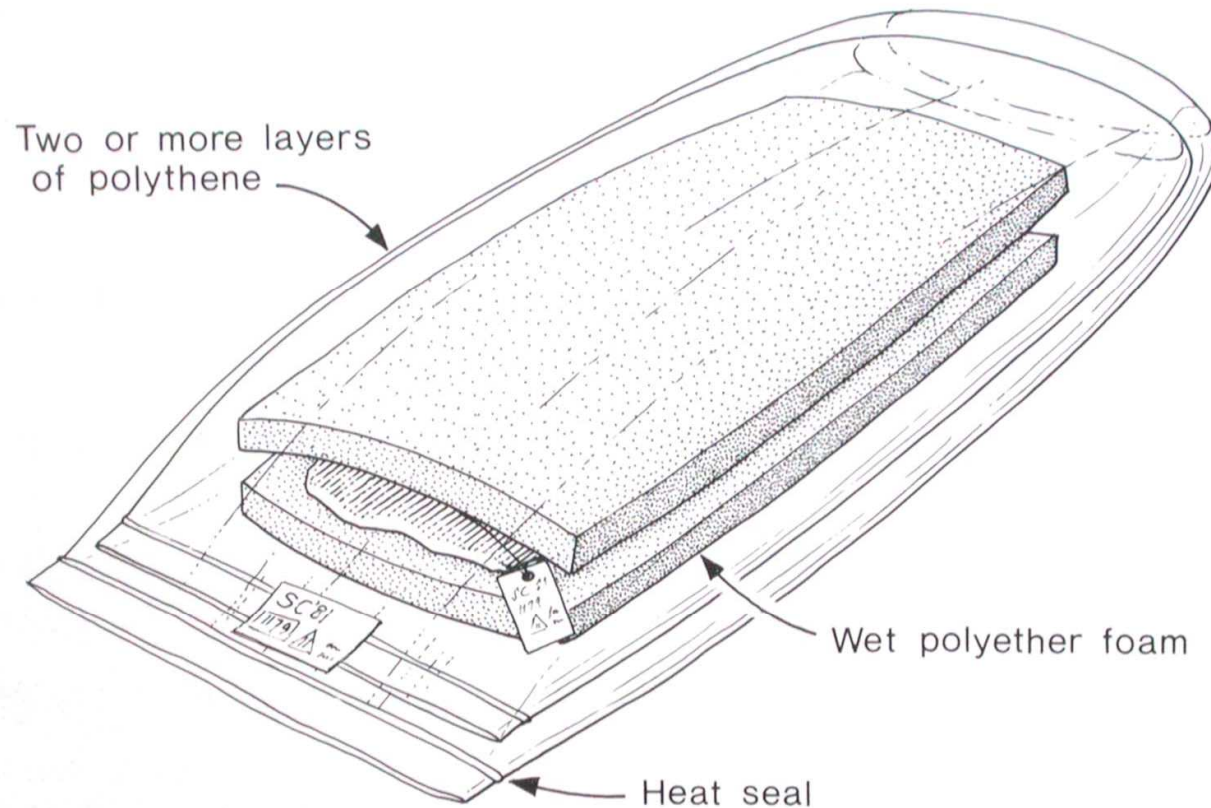
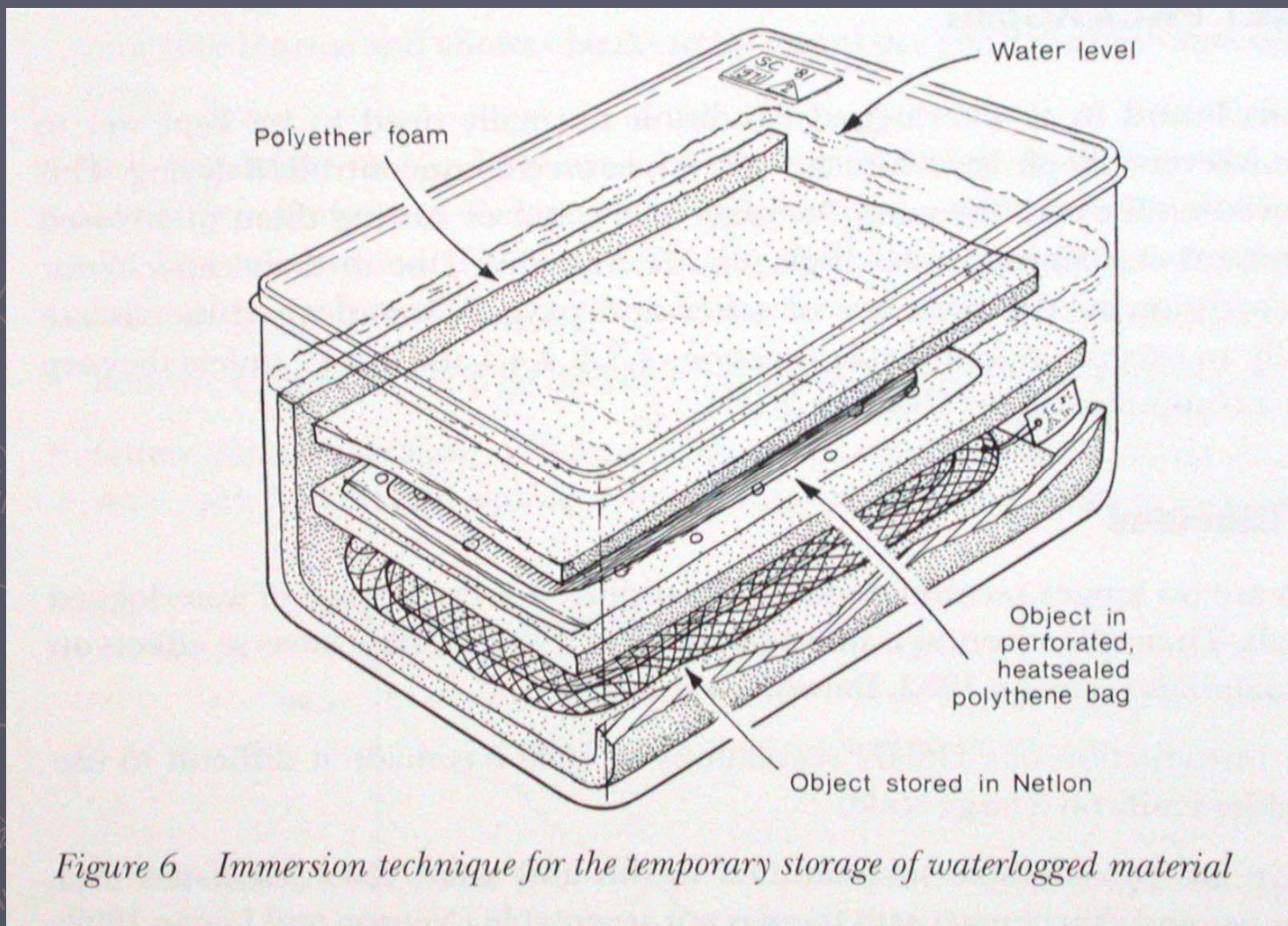


Figure 7 *High humidity (non-immersion) technique for the packing of waterlogged material*

Wet storage:



Field Conservation Kit

Materials recommended for the packing and transport of objects:

- ▶ polyethylene zip lock bags
- ▶ transparent polystyrene boxes
- ▶ polythene boxes and crates – polypropylene plastic eg 'Stewart' boxes
- ▶ acid-free cardboard boxes – if objects are dry
- ▶ acid-free tissue – if objects are dry
- ▶ polyethylene foam – various thicknesses
- ▶ polyether foam – wet storage - absorbent, doesn't float
- ▶ Tyvek labels – spun bonded polyethylene
- ▶ Self adhesive labels – for the outside of boxes and bags
- ▶ black spirit based permanent markers, black biros
- ▶ hole punch – to put holes in the polyethylene bags
- ▶ plastic cling wrap
- ▶ aluminium foil
- ▶ gloves – vinyl, nitrile

- ▶ gauze bandages
- ▶ pre-plastered gauze bandages
- ▶ plaster/gips
- ▶ plywood boards = kryssfiner
- ▶ expanding polyurethane foam -
- ▶ nylon cord = Terylene cord – doesn't stretch when wet
- ▶ aqueous acrylic emulsions – PVAs eg Primal AC 33, 5-10%
- ▶ solvent based acrylic resins – Paraloid B72, 5-10%
- ▶ syringes, paint brushes to apply consolidant
- ▶ glass jars to clean brushes and work with consolidants
- ▶ silica gel – blue/orange ca. 20%/30-35% relative humidity = R.H.
- ▶ Art Sorb/Air Sorb silica gel ca. 50+/-5% R.H.
- ▶ polyethylene bags with fine holes/plastic mesh to hold silica gel
- ▶ small digital hygrometer – to measure R.H.
- ▶ humidity cards to give an indication of the R.H.
- ▶ small glass containers to collect samples
- ▶ First Aid For Finds – field conservation manual

Materials testing:

► Qualitative

- Oddy test
- Vinegar / acetic acid test

► Quantitative analysis

- FTIR
- SEM
- Chromotography techniques eg GC.MS, HPLC

Table 7. *Bad practice for the packaging of small finds*

NEVER PACK MATERIALS USING Tobacco tins, match boxes, cigarette boxes, cheap cardboard boxes, tin boxes, brown paper bags, wage packets, envelopes, commercial carrier bags. Cotton wool, newspaper, paper flock, toilet paper, shredded paper, polystyrene spheres, non-acid free tissue, coloured tissue.

NEVER LABEL OBJECTS USING Cardboard labels, gummed labels, self-adhesive labels, paper labels, water soluble markers, markers coloured anything other than black, pencils.

NEVER ATTEMPT TO CLEAN OBJECTS ON-SITE

NEVER WRAP OBJECTS – UNWRAPPING INVARIABLY CAUSES DAMAGE

NEVER RE-WET WATERLOGGED ORGANIC MATERIALS WHICH HAVE DRIED OUT

NEVER GUESS A COURSE OF ACTION – IF IN DOUBT CONSULT A CONSERVATOR

Iron:

- ▶ Iron – dry or damp in wet soil but not waterlogged
 - polyethylene bags with holes, Tyvek labels
 - padded with thin polyethylene foam
 - dry storage < 20% relative humidity if the object consists of iron only
- ▶ Waterlogged iron
 - wet storage = immersion in water
 - transport to a conservation lab as soon as possible
- ▶ Iron slag – by-product of smelting iron
 - polyethylene bags with holes, Tyvek label, padding
 - dry storage if there is only iron metal present

Copper Alloys:

- ▶ Bronzes – dry or damp in wet soil
 - can help to block lift bronzes in surrounding soil
 - polystyrene boxes or polyethylene bags with holes, Tyvek labels, padded with polyethylene foam
 - dry storage ca. 30-35% relative humidity (R.H.)
- ▶ Waterlogged copper alloys - bronzes
 - dry out and store in dry conditions ca. 30-35 % R.H. if there are no organic materials associated
 - if there are organic materials, damp storage – inside polyethylene bags (2 layers) with moisture
 - transport to conservation lab as soon as possible
- ▶ Copper slag - polyethylene bags with holes, Tyvek labels

Silver, gold, lead, tin, pewter and zinc:

► Silver and gold

- polystyrene boxes or polyethylene bags with holes, Tyvek labels, padded with polyethylene foam
- dry storage ca. 30-35% relative humidity (R.H.)

► Lead, tin, pewter = lead/tin alloy, zinc

- lead and lead alloys need to be well padded
- use only stable, inert packing/labelling materials as lead can be damaged by the organic acid vapours given off by unstable materials
- polystyrene boxes or polyethylene bags with holes, Tyvek labels, padded with polyethylene foam
- dry storage ca. 30-35% relative humidity (R.H.)

Stone:

- wear gloves if stone objects are to be tested for organic residues and do not wash on site
- dry slowly, out of direct sunlight and watch for crystallization of soluble salts during the drying process
- do not dry or store in contact with metals, eg metal shelving, as rust corrosion can stain stone
- do not dry or store stone directly on the ground
- individually pack small stone objects after they have dried slowly
- polystyrene boxes or polyethylene bags with holes, Tyvek labels, padded with polyethylene foam

Ceramics:

► Terracotta and earthenware

- block lift or bandage if fragile
- do not wash
- dry slowly if damp or wet, out of direct sunlight and watch for soluble salts crystallizing during drying
- store in polystyrene/polypropylene boxes depending on the size, with sherds in polyethylene bags with holes, Tyvek labels, padded with polyethylene foam if necessary

► Stoneware and porcelain

- block lift or bandage if fragile
- can be washed but not recommended on site
- dry slowly if damp or wet, out of direct sunlight
- store as above

Glass:

► Dry, damp/wet

- block lift in surrounding soil if fragile
- do not wash on site
- store in polystyrene boxes if possible to provide good physical support and use polyethylene foam to provide padding around the object or acid free tissue if the glass is dry

► Waterlogged

- store wet, immersed in water in sealed polypropylene boxes or polyethylene bags – double bagging
- do not use biocides
- transport to conservation lab as soon as possible

Amber:

- ▶ Dry or damp in wet soil
 - block lift if possible, particularly if there are a string of amber beads
 - dry as slowly as possible, no sunlight/U.V. light
 - polystyrene boxes padded with polyethylene foam or acid-free tissue are recommended for storage or polyethylene bags with holes in a supporting box
 - store in 50 +/- 5% relative humidity (R.H.)
 - R.H. needs to be as stable as possible with fluctuations less than 10% in a 24 hour period
- ▶ Waterlogged
 - store wet, immersed in polypropylene boxes
 - padding with foam
- ▶ transport to conservation lab as soon as possible

Wood:

- ▶ Dry - block lift in surrounding soil if fragile
 - store in polyethylene bags or polystyrene boxes with holes, padded with thin polyethylene or acid free tissue
 - store at 50+/-5% relative humidity if possible
- ▶ Damp/wet but not waterlogged - block lift if fragile
 - store in damp environment sealed in at least 2 layers of polyethylene plastic
 - rehydrate if possible
- ▶ Waterlogged - wet storage, immersed in water in sealed polypropylene boxes or polyethylene bags
 - double bagging – no biocides
 - do not wash on site
 - do not allow to dry out

Leather:

- ▶ Dry, damp in wet soil
 - block lift if fragile and delaminating
 - store in polyethylene bags or polystyrene boxes with polyethylene foam padding and Tyvek labels
 - do not wash or clean on site
 - cold storage/refridgeration if possible
- ▶ Waterlogged
 - block lift if fragile and delaminating
 - wet storage, immersed in water in polypropylene boxes or polyethylene bags – double bagging
 - do not allow to dry out
 - do not wash or use biocides

Bone, antler and teeth:

► Dry or damp/wet

- block lift in surrounding soil if fragile
- dry objects can be stored in polyethylene bags with holes or polystyrene boxes with polyethylene foam padding and Tyvek labels
- damp objects can be slowly dried, out of direct sunlight
- store at ca. 50+/-5% relative humidity if fragile/unstable
- wet objects should not be allowed to dry out, store in a damp environment in sealed plastic bags or boxes
- rehydrate if possible

► Waterlogged

- do not allow to dry out, store wet, immersed in water in sealed polypropylene boxes or polyethylene bags – 2 layers

Summary:

- ▶ Block lift objects in surrounding soil if possible
- ▶ Cover the excavation area to protect the objects from the weather – eg direct sunlight or rain
- ▶ Use acid-free, stable/inert packing materials to pack and transport the objects
- ▶ Changes to the objects, such as drying, need to be carried out slowly
- ▶ Deliver the objects to a conservation lab as soon as possible

References:

- ▶ Cronyn, J.M., 1990
The Elements of Archaeological Conservation
- ▶ Dorman, E.A., 1970
Conservation in field Archaeology
- ▶ Watkinson, D. and Neal, V., 2001
First Aid For Finds