

The Conservation of Archaeological Leather

Although many readers will already be familiar with the principles and methods of dealing with wet archaeological leather, the subject is important enough to merit some attention here. Little has changed in the methods recommended in an article on the subject as long ago as 1979 (Goubitz 1979). That article was prompted by the then frequently disastrous treatment of leather finds. Finders of waterlogged material did all sorts of things to prevent decomposition and to keep the leather supple. The intentions were good, but the means and methods often were wrong. With a few exceptions, much has since changed for the better.

Every piece of archaeological leather has potential value and merits conservation. When a single bucketful is found during an excavation, the question of conservation does not pose a problem. It is when enormous quantities are found that a selection may be practical. In such cases, an expert in the material can determine the quality of the find in order to determine how much is of immediate interest. Ironically, individual finds in a small assemblage will generate more interest from the excavators than those in a large one. This often puts greater emphasis on smaller finds which have little impact, while the larger finds, containing more information, are not investigated fully.

Whatever the case may be, leather from the soil archive has so far been preserved by the groundwater, which protected it against desiccation and bacterial decay. Therefore it is important that excavated leather is kept submerged in water until adequate conserving treatment can be undertaken.

Conservation is necessary to stop the leather from drying out; otherwise it would shrink and become hard like cardboard. This in itself is no disaster, as will be explained below, but the result will be unsightly and brittle. Incomplete drying, during a prolonged period of moist conditions in a plastic bag, will allow fungal growth to develop; this is fatal for leather. The sooner intervention takes place, the better. If immediate treatment is not possible, the find can be kept in water for a period of weeks or a few months. It should be well submerged and kept in a cool, dark place. If a delay of months is expected, an addition of formalin (to make a 3% solution) is necessary to prevent fungal and bacterial activity. A disinfectant (Dettol) may also be used since formalin is not always easy to obtain. Alternatively, preservation in a freezer is a good method for keeping leather from decaying for a period of up to two years: the leather will rarely be damaged by the formation of ice crystals.

Prior to any conservation, a thorough cleaning of the find is very important, because this makes visible the structure of the leather, its texture, quality and grain, and any technical features such as stitch-holes. For this, household or special deter-

gents are used together with water. An ordinary washing-up liquid in lukewarm water is fine for a preliminary soak. Then the worst of the dirt is removed with the fingers. This will allow one to assess how strong the leather is and how stubborn the dirt. Only after this initial evaluation may soft artist's paintbrushes be employed to clean the surface. Hard clay may be softened by a few hours' soaking with the addition of some water softener for household appliances, e.g. Calgon: a coffee-spoonful of Calgon to a litre of water. No attempt should be made to give the leather a clear brown colour with acids or bleaching agents. The dark brown or black ground colour should be accepted as the state of the object. The original colour cannot be ascertained, though usually it would have been black.

Iron, from an object belonging to the shoe (a buckle or nail), from another artefact buried close by or as a constituent of the soil, may make the leather hard. Sometimes this leaves rusty accretions on the leather. A solution of EDTA (Tritiplex) in demineralised water will usually remove most of the rusty remains.

Using acids should be avoided as much as possible.

Ultrasonic equipment is also useful for cleaning leather. The aim of conservation is to immediately replace the groundwater or rinsing water that has permeated the leather by an impregnating agent that fills up the empty leather cells and keeps the fibres supple without the leather having to dry first. For this, products are used that will act with the water that is still contained within the leather. Glycerin is such a chemical, but it has the disadvantage of encouraging fungal growth. Polyethylene glycol (Peg) produces roughly the same effect as glycerin, without attracting fungi and with longer effectiveness.

Alternatively, chemicals are used for first dehydrating the leather, without drying it out completely. By means of alcohol or other dehydrating agents 80% of the water is extracted from the leather; the remaining small amount of water will be no obstacle in the subsequent oil impregnation.

The freeze-drying method for conserving leather is another option, though one that requires expertise in using it and in assessing its long-term effects. In the author's experience, it is difficult to achieve the essential goal: a result that is neither too dry nor too moist. For this reason, he is inclined to discourage the use of this method, which is expensive, time-consuming, and not always successful. There are far simpler, cheaper and safer methods; though it should be realised that every conservation method has its pros and cons.

The literature about conservation indicates that methods and results may vary from country to country, and that a single agent may produce different results in different countries.

Naturally, there is some variation in the composition of the chemicals, in the agents used for tanning leather, and soil environment, while local atmospheric conditions may also play an important role.

Availability of products and financial considerations will often instigate a national "tradition" in terms of chemicals: people will continue to use their tried and tested products. The Dutch have their traditional methods and chemicals, two of which are Peg and castor oil.

Sometimes chemicals that are only suited for modern leather (for saddles, book bindings, upholstery or footwear) are applied to archaeological leather - with predictably disastrous results. Archaeological leather may often have the appearance of modern leather, but its properties are dramatically altered. Wet archaeological leather may feel supple, but after conservation it will become stiffer and its inherent weakness can rarely be improved.

For a treatment with polyethylene glycol, Peg 600 is used. The molecular weight of six hundred is the most appropriate for leather - that is, in the Netherlands. Because of the comparatively high atmospheric humidity in the Netherlands, leather treated with Peg 400 will tend to "perspire". The hygroscopic property of Peg 400 is too strong for Dutch conditions. Peg 400 has been used with success in other countries having a lower atmospheric humidity. Peg may be obtained in a diluted or undiluted form. In the latter case, 100 vol. % of Peg should be diluted with the addition of 40 vol. % of water.

The cleaned and partially air-dried, though still moist leather is immersed in this mixture for at least 36 hours. This should provide adequate conservation. After dripping dry and drying in the air, the leather may be stored in perforated polythene bags. Occasional checking of its condition is advisable; so is a repetition of this treatment every ten years. In such cases a brief immersion of ca. 5 minutes will suffice. Peg treatment offers long-term protection of leather objects against decay. It is less suitable for leather which is being considered for restoration.

For restorable objects, conservation with oil is better, because glues will not hold on Peg-impregnated surfaces. Leather that is to be restored must sometimes be strengthened with glue or backed with glued or stitched-on backing material of various kinds. Moreover, oil-impregnated leather will have a more attractive colour and later some gloss may be restored to the surface with a soft brush - but only if the leather is strong and smooth enough.

There are various oil mixtures that may be prepared or bought ready-made. As with all conservation products, it is important first to perform a few tests and not to apply the oil immedi-

ately to the most visible part, even if others have achieved splendid results with it. Most oils should be diluted. It is important to use the right diluent. For instance, there are many kinds of alcohol but only a few are suitable for making a proper dilution rather than a suspension. If one is using castor oil, tertiary butyl alcohol is the right diluent, in order to avoid flocculation of the liquid. Some glycerol is added to the castor oil and alcohol mixture for an improved hygroscopic effect. The proportions used at the R.O.B.'s leather unit are: 35 vol. % oil; 15 vol % glycerol; 50 vol. % butyl alcohol. A smaller proportion of oil seems inadvisable; though it might be increased, as might the glycerol, by 5 to 10 vol. %. No other ingredients are added. The simpler the composition, the easier it is to trace what went wrong, if anything should go awry. The leather fragments to be impregnated with this mix should be dehydrated in advance, because oil and water do not mix. Ordinary methylated spirits (alcohol methylatus) can be used for dehydrating.

The dehydration takes about 36 hours and oil impregnation about 48 hours. The lengths of time quoted in this chapter should be regarded as minimum periods; no harm will be done if a day longer is allowed.

Prior to impregnation, it is advisable first to make a registration drawing of the leather shoe parts and fragments, before any further shrinkage occurs.

Timely drawing is particularly important for the parts of an object intended for restoration, which usually involves their being stitched together. The drawings should show and include notes about all technical and other relevant features such as decoration, because once the object has been reassembled many of such details will no longer be visible (See Traces).

In the last quarter of the 20th century, much has changed in the field of conservation. Unfortunately, the great quantity of leather finds by both amateurs and professionals has meant that the care for these finds has not always been adequate. Lack of funds, time and space, and - in too many cases - lack of interest among the profession are responsible. These are familiar problems for various disciplines within archaeology.

It is a waste of historical material and frustrating to the finder when the carefully excavated leather goes to rot. Those who find leather but are not in a position to conserve it are advised to take the following course of emergency action. The leather finds, dirty or washed, should be dried on newsprint in a cool place. They should also be covered by the paper, so that the drying process occurs as slowly and evenly as possible. Ideally, the items should be turned over every few hours. The leather will now become hard, but not much can go wrong. Indeed, it can still be impregnated at a later stage. In that case it must first be soaked in water, so that by absorbing water it may

swell and regain its original suppleness. Possibly some loss of suppleness will occur, but this is always preferable to the leather being attacked by fungi or bacteria. No attempt should be made to restore dried-out leather to its former pliability by directly applying to it products such as oil or dubbin. This is absolutely useless, as testified by many instances presented to the R.O.B.'s leather unit. For leather items that originally were rigid and hard, such as knife sheaths and casings, this problem is less pressing; occasionally even good results may be achieved in this way. The oil or grease should be used very sparingly; else the leather will suffocate. It should be kept in mind that after 1500, objects of leather, especially footwear, were made of harder and more rigid material and conservation will do little to alter this.

When conserving leather, including that of any third party, it is very important to keep a record of what was used to treat the leather, and in the case of restoration to note what materials were used and in which areas. If an artefact is later cared for by others, they will need to know how it was treated and when, where and by whom. Any laboratory working in the field of conservation or restoration will for this reason draw up a conservation report. Future conservation can then take earlier treatments into account.

The restoration of leather objects falls outside the scope of this book, but a few words of advice may be helpful. Of course it is important to use the correct glues, if glueing is required. There are various textile glues on the market which are also suitable for leather. No rubber-based glue should be used.

This will attack the leather and eventually come undone as well. If at all possible, the shoe should be stitched together again in the original way. The thread should be of a neutral shade of brown, and not too thick or too thin, to prevent it tearing out or cutting into the stitch-holes. The order in which parts were put together should be carefully studied in advance, so that one can properly stitch even the smallest seams. The threads and stitches should be kept taut during stitching, so that the seams are properly closed. For this reason the thread should not be too smooth, which can be achieved for instance by using shoemakers' wax on it. For backing weak or damaged leather, chamois may be used. The best is used chamois, which has been dyed brown with a textile dye suitable for nylon. For stitching, darning needles and curved carpet needles may be used, as long as these will freely draw a thread through the stitch-holes in the leather. Very convenient are the so-called "wire bristles", which are of flexible metal, and are available from good leather-craft shops. Only if one is absolutely certain about their shape should one consider replacing lost or badly fragmented parts by new leather. If the new leather is dyed a lighter shade, it will always be clear which part is original and which is a reconstruction in new leather. Deciding when such reconstructions are desirable is partially a matter of ethical consideration.