Second National Conference
on Engineering Heritage,
Melbourne, 20-22 May 1985

Treatment of Artefacts — Conservation or Destruction

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1 INTRODUCTION

Many artefacts in archaeological sites and on display are not only of historical interest but have the potential to reveal much about the manufacturing and artistic trends of earlier times. Artefacts, particularly those of a ferrous nature, which are exposed to the elements for extended periods of time show signs of varying degrees of deterioration. This is particularly true for articles recovered from sea water which can suffer from extensive chemical and/or mechanical degradation. Since artefacts from these sites tend to exhibit the greater degree of damage greater care and different conservation techniques are required compared to land based artefacts. Consequently this paper has a bias towards the treatment of marine artefacts.

The natural reaction of many people who find articles of interest is to retrieve these for private displays with little or no concern for conservation. Consequently it is not unusual to find these artefacts spalling, flaking and even disintegrating with time. It should be stressed that it is not only individuals who are guilty of a lack of appreciation for subsequent conservation. However governments, companies, amateur groups and individuals are becoming more aware of the need for conservation.

To recover artefacts requires more than merely picking them up, if it is desired to retain their surface features and physical characteristics for future generations. On site conservation, storage and laboratory conservation are all important and the procedures used for the more common materials are outlined below.

2 ON SITE CONSERVATION

Whilst completely immersed in a fresh water or marine site for an extended period of time an artefact is generally in a relatively stable environment. The same is not necessarily true for some land base sites and areas of changing environment such as with partially buried or immersed structures. However once this environment is disturbed an increased rate of corrosion will often occur. Consequently on-site conservation and laboratory conservation facilities should be available when the artefacts are recovered. When removing an artefact from its site, especially a water site it is important that it be handled in a manner that will cause the least damage. Leaving the concretions intact protects the underlying metal from excessive chemical deterioration due to changing environments and provides protection against mechanical damage.

Some materials are more prone to irreversible damage after recovery and it is necessary for the on-site archaeologist, conservator to distinguish between different groups of materials. This generally requires experience in the field, particularly in the behaviour of different materials in different environments. A simple magnet will distinguish the majority of ferrous alloys from the common non-ferrous metals and alloys. If any doubt exists the artefact should be kept wet until it arrives at the conservation laboratory. Suggested on-site conservation procedures for some selected materials are listed below :

2.1 Ferrous Artefacts

As mentioned earlier the retention of the concretions on the surface is important. It is also important to prevent the concreted artefact from drying out particularly if it has been in a marine or salty environment. If the artefact is allowed to dry out then the harmful chlorides will concentrate and oxygen will be freely available for accelerated corrosive attack. Ferrous artefacts, particularly those where the concretions have been removed or extensively damaged should be placed in an alkaline solution with a pH of 10-13. A suitable solution would be 2% sodium hydroxide in water. Sea water would be suitable if fresh water was in limited supply. In this environment continued corrosion would be negligible.

Since moisture is required for continued corrosion, dehydration can be used as a storage method. This would necessitate the removal of the concretions which would harbour moisture and then placing the artefact in a sealed container with an adequate amount of dried dessicant, such as silica gel, which changes colour as it becomes saturated with moisture. Regular inspections are required to ensure that the dessicant is in a suitable condition. This method is not recommended for small concreted fragile articles since the removal of the concretions may result in extensive mechanical damage.

2.2 Copper and its Alloys

Copper and copper alloys do not generally corrode rapidly in most naturally occurring environments. However if they are electrically connected to a less active metal and/or subjected to erosive conditions corrosion can be accelerated. Recovered copper based artefacts can be stored dry for short periods of time. If prolonged storage is necessary prior to conservation then the artefact should be either immersed in inhibited fresh water or kept completely dry by sealing the artefact in containers with a dessicant.

2.3 Silver Artefacts

No special storage conditions are generally required for silver artefacts and they can be stored dry. They should, however be handled with great care so that any mechanical damage to the corrosion products, and therefore surface features, be avoided.

2.4 Lead and Lead Alloys

As with silver, lead artefacts can generally be stored dry in an unpolluted atmosphere.

2.5 Ceramics

Ceramics and similar artefacts should not be allowed to dry out. Instead they should be stored in water containing a fungicide such as panacide. This is especially true if they are from a marine environment in which case they should be stored in sea water.

2.6 Wooden Artefacts

Waterlogged wood is generally prone to cracking if it is allowed to dry out in air. Consequently such wood is stored in water containing a bactericide until controlled drying can be performed.

3 CONSERVATION TECHNIQUES

No conservation procedures should be used until a thorough examination has been performed. For example it has been known for concreted copper base artefacts from a fresh water site to have been mistaken for corroded iron and were consequently cleaned in inhibited acid along with iron articles. The result was a copper coating on the surface of these iron artefacts. Therefore concretions and generally corrosion products should be gently removed before a final decision is made as to the procedures to be adopted.

During conservation a complete record should be kept of details of procedures used. A short description of some procedures used to conserve artefacts is shown below.

3.1 Ferrous Artefacts

Of the common metallic materials iron tends to be the most susceptible to corrosion in marine, fresh water and land sites. The type of conservation technique employed is generally determined by the environment from which the artefact has been removed. If the environment is such that a high chloride level exists, such as in a marine or a high salt environment, then these chlorides should be reduced to a low concentration. Procedures which have been used have included one or more of grit blasting, protective coatings, thermal decomposition, alkali sulphite reduction, acid pickling, washing in caustic soda and electrolysis. Each method has its advantages and limitations and the selection of the method should take into account the nature and condition of the artefact, its final display requirements and the funds available.

For artefacts with a high associated chloride level and sufficient solid metal remaining, the most appropriate method would be electrolysis possibly followed by grit blasting (providing no surface features are to be retained) and then an application of a suitable paint system depending on preparation and the display site (Kentish, Dillon 1982). A suitable method for artefacts with a low associated salt content would be simple washing in inhibited acid followed by an inhibited fresh water wash and the application of a protective coating system. As with artefacts from a marine type environment the need for specific surface preparation and the choice of a coating system are inter-related. However the nature of the artefact itself will greatly determine the type of preparation and coating.

3.2 Copper and its Alloys

The conservation of copper based artefacts generally depends on the presence of bronze disease which occurs in the presence of chlorides and humid conditions (AMDEL, 1979). Bronze disease can be treated by immersion for lengthy periods of time in 2% sodium bicarbonate and 2% sodium carbonate solutions, preferably with distilled water. This procedure will require several solution changes.

If an artefact is not suffering from bronze disease then the corrosion products can be removed by soaking in a 10% citric acid, 2% thiourea solution followed by thorough washing. Before using this acid clean consideration should be given to the presence of any protective green-brown patina with respect to its value as an antique.

The protective patinas which form on copper based alloys do not normally necessitate the application of a protective coating. However if a clean metal surface is to be retained a clear acrylic lacquer should be applied. This is only suitable for indoor display and storage of artefacts.

3.3 Silver Artefacts

The corrosion products which form on silver artefacts may include silver sulphide, silver chloride and possibly copper corrosion products. Silver can become brittle after extended periods in a marine environment and consequently artefacts should be handled with care. A successful method for treating extensively corroded silver,especially from a marine environment was developed by Ian MacLeod and Neil North (MacLeod, North 1979). This includes acid removal of concretions and foreign corrosion products, washing, reduction of silver corrosion products to metallic silver followed by further washing and brushing.

3.4 Lead and Lead Alloys

Lead artefacts generally only require cleaning which can be performed by immersing in 10% hydrochloric acid followed by thorough cleaning and drying. Care is required in storing lead as vapour from organic acids which is commonly found in wood cabinets may damage lead.

3.5 Ceramics

The major damage experienced with ceramics, apart from mechanical damage, is incorrect treatment. If acids are used to remove concretions, fragile and iron containing glazes could be damaged. Another form of permanent damage can result from storing ceramics dry if they have been in a salty environment. These salts would crystallise on drying and damage the body and glazes of the ceramic. The safest method of removing the concretions is by gentle mechanical means, particularly when they are wet. The salts should be removed by a series of washes starting with an initial chloride level similar to the level in the environment from which the ceramic was removed. The chloride level of the wash water should gradually be reduced to low levels (Olive and Pearson).

3.6 Wood

The major problem associated with the recovery of waterlogged wood is the subsequent cracking during the drying operation. Numerous different techniques have been used (Grathen 1982). These have included air drying, freeze drying, acetone-rosin treatment, silica deposition (TEOS) and bulking with polyethylene glycol (PEG).

Many variables affect the treatment procedures. The type of wood and the extent to which it has degraded has a major influence on the success of the conservation operation. Each method has its advantages and disadvantages. A method which has proved successful is the dehydrating of wood by replacing the water with PEG commencing at a low concentration with gradual increases. Elevated treatment temperatures (60°C) accelerates the treatment and controls the growth of fungus.

Dried wood has been satisfactorily consolidated using polyvinyl butyral resins preferably by vacuum impregnation or by brushing (Barclay 1981).

4 CASE STUDIES

4.1 Cannon Ball - Lack of On-Site Conservation

When cast iron corrodes it forms a graphitised layer which generally retains the original surface and dimensions of the artefact. This graphitised layer is very weak and is easily broken. If such artefacts are removed from a water site the surface layers readily spall and break away from the core. Figure 1 shows a cannon ball where the graphitised layer has spalled after being allowed to dry out after recovery from a marine site.

4.2 Anchor - Lack of any Conservation

Figure 2 shows an anchor at AMDEL after initial electrolysis treatment. This anchor had been on display, after recovery, for an extended period of time. Since no conservation had been performed subsequent corrosion was extensive and during electrolysis the corrosion products fell off the anchor in relatively thick sheets. A second anchor from the same wreck did not suffer as badly since it was cleaned and painted prior to the original display of the anchor.

4.3 Cast Iron - Incorrect Electrolysis

During electrolytic treatment of ferrous artefacts hydrogen can be evolved from the artefact. If the applied voltage is too high the hydrogen can result in exfoliation of the fragile graphitised layer as is shown in Figure 3.

4.4 Water Fountain - Poor Material Selection During Conservation

During the life of a fountain a copper plate had been inserted behind the taps and in contact with the cast iron body. Figure 4 shows that the presence of this copper plate had accelerated the corrosion of the cast iron due to direct metal contact in a moist environment.

4.5 Glass House - Inadequate Maintenance

Conservation of an artefact is rarely ever completed as it should always include regular inspections and maintenance. No protective coating system is perfect and they all have a finite life. However it is common that the maintenance is neglected and eventually a major restoration job is required. This glass house shows such an example where the paint film has long since failed. (Figure 5).

5 CONCLUSIONS

Objects have survived, some in relatively good condition for long periods of time. The recovery of artefacts without adequate conservation facilities or without suitable knowledge of conservation may result in the rapid deterioration of the artefact. Depending on the type of material this increased deterioration may commence immediately the artefact is disturbed. The conservation of an artefact should commence at the time of recovery and it is an on-going process during display and storage.

The common procedures used on site and in the laboratory to treat various artefacts have been briefly outlined. However it should be remembered that all methods have their advantages and limitations. The conservator should be aware of any possible shortcomings in the chosen procedure and therefore should regularly inspect the artefact for outbreaks of corrosion.

6 REFERENCES

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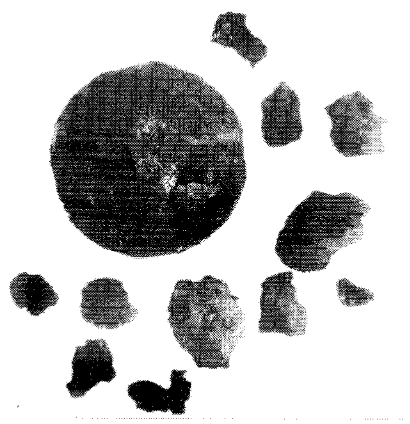

Figure 1 Cast iron cannon ball showing spalling of the graphitised corrosion layer

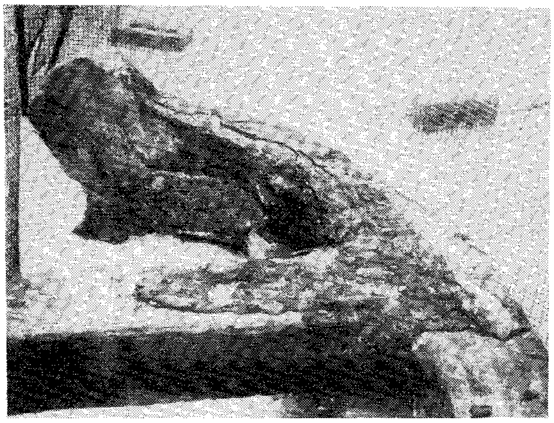

Figure 2 Wrought iron anchor. During electrolysis the corrosion products, as a consequence of no original conservation, fell off the anchor

Figure 4 Section of a water fountain showing accelerated attack of the cast iron due to contact with a copper plate

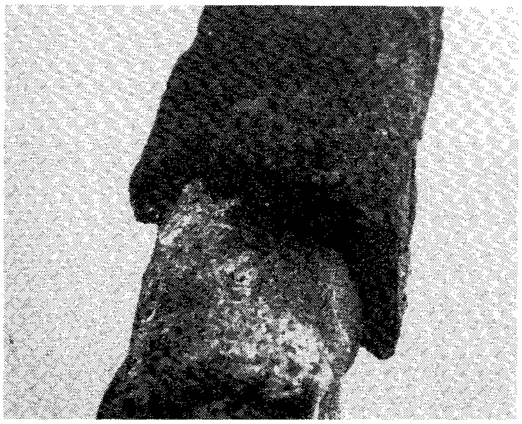

Figure 3 A length of cast iron where the fragile graphitised layer has partially exfoliated

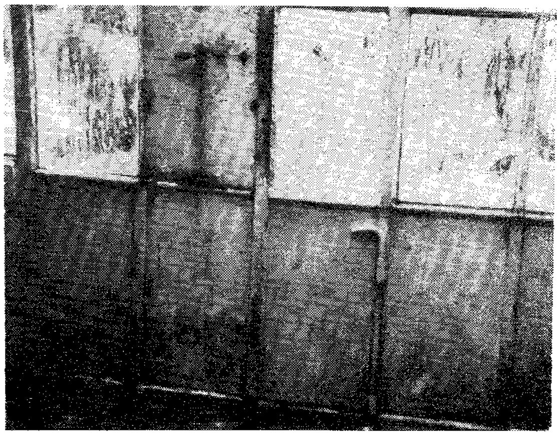

Figure 5 Section of a glass house showing the ourbreak of corrosion