THE BRITISH MUSEUM
illuminating world cultures

Report No. 2001/31/M/5

Short report on the conservation and restoration of the gold 'bowl' (N004) from Mapungubwe, Northern Province, South Africa.

Introduction

The gold 'bowl', N004, from Mapungubwe, Northern Province, South Africa, was delivered to the Department of Conservation at The British Museum, London, UK, on 18th October 2000, for the purpose of conservation and restoration. The 'bowl' was deposited with Marilyn Hockey in the Department of Conservation by Professor A. Meyer of the Department of Anthropology and Archaeology at the University of Pretoria, Republic of South Africa.

Treatment

Work began on the object in July 2001. Temporary stabilization materials (reversible adhesive and nylon tissue), which had been applied by M. Hockey in Pretoria in April 1999, were removed. The 'bowl' had been previously restored in the 1970's or 80's at the University of Pretoria and had been soldered together with lead solder. Some of this had been removed by MH in 1999. It was now possible to remove the remains of the solder much more effectively, using facilities at the British Museum, including an air abrasive machine. This allowed torn and folded edges, previously obscured by solder, to be restored and repaired, enabling more true joins to be made. The 'bowl', once dismantled, was in some sixteen fragments. The use of a stereomicroscope at x7 to x40 magnification was essential for accurate matching of join edges and enabled some previously misplaced fragments to be correctly positioned.
All repairs and joins were made with cellulose nitrate adhesive and nylon tissue backing. Some larger gaps in the gold were filled with epoxy resin detachable fills. The larger fills were covered with 23.5 carat gold leaf, toned in with pigments in thinned cellulose nitrate lacquer.

Conclusion

Work on the 'bowl' was completed in November 2001. While still a fragile archaeological artefact, it is now in a stable condition, restored to display standards and safe for careful handling. A fuller report on the treatment will be prepared for the Mapungubwe archive at the University of Pretoria.
The 'bowl' was collected from the British Museum Department of Conservation by Ms Sian Tiley, curator of the SASOL African Heritage Mapungubwe Exhibition, University of Pretoria, on 21st November 2001. Ms Tiley, with the 'bowl', boarded a flight for South Africa on the same day, having been escorted to the airport by Marilyn Hockey.

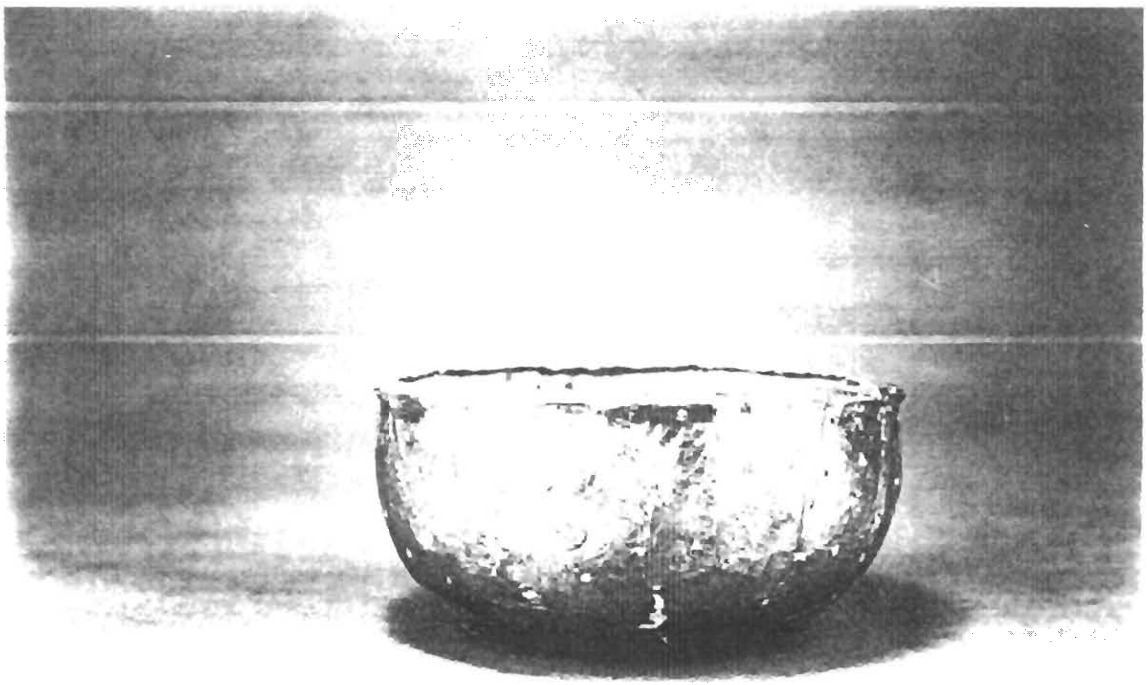
Marilyn Hockey
Senior Conservator
Inorganic Materials Group

Dr Andrew Oddy
Keeper of Conservation

26 November 2001

Department of Conservation
Telephone +44 (0)20 7323 8638
Facsimile +44 (0)20 7323 8636
conservation@thebritishmuseum.ac.uk

Great Russell Street
London WC1B 3DG
Switchboard +44 (0)20 7323 8000
www.thebritishmuseum.ac.uk



22.4.99

THE BRITISH MUSEUM

DEPARTMENT OF CONSERVATION

REPORT ON THE CONSERVATION OF GOLD ARTEFACTS FROM MAPUNGUBWE

Marilyn Hockey

1. Introduction

1.1 The University of Pretoria (UP) has in its care the Greefswald Archaeological Collection of artefacts, excavated at two of the most prominent Iron Age sites in South Africa, Mapungubwe and K2. The sites are situated in the central Limpopo River valley and are the settlement sites of subsistence farming communities of apparent high social rank which existed in this region from approximately AD 1000 to AD 1300.[1] Both sites were proclaimed as national monuments in the 1980's and they, and the surrounding area, are expected soon to be proclaimed a world heritage site.

1.2 The Greefswald Archaeological Project was established by the UP in 1933, following the discovery of graves with gold funerary objects on Mapungubwe Hill. The project has consisted of several phases of excavation and publication, culminating in the current Phase Four, involving a programme of research and collection management.

1.3 The Greefswald Archaeological Collection includes a variety of materials such as pottery, glass beads, artefacts made of gold, copper, iron, bone and ivory, animal skeletal remains and human skeletal remains. The core collection was proclaimed as a National Heritage in 1997. As part of the collection management programme, conservation assessments of parts of the collection are being carried out and it is planned to establish a permanent display of artefacts from the main sites in 1999. The display will form part of an *Africa Exhibition* in the Arts Building on the main University of Pretoria campus.

1.4 As part of the preparations for this display, UP identified the need to commission conservation and restoration work on parts of the collection, a priority being the major gold artefacts. It is understood that there are no specialists in the field of archaeological metalwork conservation at present working in South Africa; consequently assistance was sought abroad. In November 1998 Dr Johan Hendrikz, Director of Marketing and Communication at UP, approached the Keeper of the Department of Conservation at the British Museum (BM), Dr WA Oddy, with a request for participation in the Mapungubwe conservation project. Dr Oddy had previously visited South Africa in 1983, in order to

carry out a technological study of the goldwork.[ii] An agreement was reached whereby Marilyn Hockey (MH), a senior conservator specializing in fine metalwork at the BM, was to travel to Pretoria at the end of February 1999 to assess and carry out work on the Mapungubwe gold artefacts. The length of the visit was to be six to eight weeks.

1.5 On 1st March 1999 MH arrived in the Department of Anthropology and Archaeology at UP, where the Mapungubwe gold is housed under the immediate care of Prof. Andre Meyer. During the first week an examination of all the gold items was carried out. At the same time an assessment of condition was made, treatments proposed for objects required for exhibition and rough time estimates calculated (see Appendix 1).

2. The Mapungubwe gold artefacts

2.1 The Mapungubwe gold comprises three virtually complete objects made from sheet gold, numerous fragments of sheet, numerous tiny gold nails, beads, fragments of wire, and several body ornaments consisting of rings or bundles of rings which were made by winding gold strip into a tight helix to form a tube with the ends joined by inter-winding. The strip was wound around a core of plant fibre.

2.2 The pieces generally regarded as the major items in the collection are the three complete objects; the golden rhinoceros, the sceptre and the bowl. They were made from thin sheet gold, shaped over an underlying former by folding and creasing. The sheet was held in place with gold nails hammered in along the seams and edges. The fragments of sheet all appear to be parts of objects made in the same way. Some still retain nails in their original positions. Some of the fragments seem to form parts of decorative plates or fitments, but the majority of them appear to be from animal figures like the rhinoceros. The size of the fragments ranges from a few square millimetres to several square centimetres.

2.3 Various metallurgical studies of the gold have taken place in the course of the Greefswald Project (see A.Meyer). Current research is being undertaken by D.Miller of the University of Cape Town. The gold is believed to be of generally high purity, but with some sheet containing up to 10% of silver[iii]. This was borne out by the initial examination where the sheet was found to be still very malleable, with little brittleness to indicate intercrystalline corrosion, except for some fragments with a paler colour and tarnished edges, which are noticeably harder and may therefore contain a higher percentage of silver.

2.4 Microscopic examination of the complete objects and fragments resulted in the identification of at least four different types of gold, grouped according to similarity of thickness, malleability, surface texture (front and back) and, to some extent, colour. The smaller fragments were sorted and re-bagged according to these groupings.

3. Condition assessment

3.1 All of the gold in the Mapungubwe collection is currently stored in sliding, drawer-type cardboard boxes, which are stackable. Most of the objects and fragments are secured in individual cutouts in polyethylene foam sheet inserts. Smaller objects such as beads and nails and the smaller fragments of sheet are encapsulated in heat-sealed polyethylene bags. Each cut-out is labelled with the registration details of its object or fragment and each bag of fragments is labelled with a registration number. This aids security and tracking of objects, but registration numbering has necessarily been, to an extent, random and the arrangement makes the task of sorting and matching fragments difficult.

3.2 The current storage is adequate, safe and sound in principle, but the gold, particularly the sheet objects and fragments and the helix bangles, are extremely fragile and vulnerable. It cannot be emphasised too much that they must be handled extremely carefully and handling in any event should be kept to an absolute minimum.

3.3 With the exception of a few single beads and fragments of wire all the gold artefacts were excavated between 1933 and 1935. The majority of them are in "as excavated" condition. That is, they are covered with a layer of soil, the sheet is distorted and torn, the helix bangles are, in some cases, stretched and broken, the fibre cores in many cases lost or fragmenting. There are also some iron corrosion deposits (from associated iron objects) on the helix bangles. In addition some of the sheet items display small groups of tiny dents and punctures, together with bright gouge and scratch marks, probably the result of unearthing with a sharp instrument.

3.4 The condition and vulnerability of the sheet gold varies with its thickness and malleability. Some of the pieces, such as the main rhinoceros and fragments of similar thickness, while torn and weakened where they have been distorted, are more robust than others. The sceptre is made from thinner sheet and is consequently quite badly dented and torn, with many breaks. Some of the fragments of sheet are so thin as to be almost classifiable as foil and some of these have been completely flattened. Most of the sheet objects and fragments have torn and broken edges. These are extremely susceptible to further damage from handling and even from movement within their storage boxes. Even the most careful handling inevitably causes further bending, crumpling and eventual detachment of parts of the gold.

3.5 A certain number of the objects made from gold sheet have been previously cleaned. Some of these have also been repaired with soft solder, probably a lead alloy. The latter group includes the main rhinoceros, the sceptre, bowl, funnel, part of a second rhinoceros and four decorative plaques. This treatment is believed to have been carried out in the early 1980's. The cleaning method is not known. The use of soft solder was an unfortunate choice. While initially achieving the repair and physical stabilization intended, it has the long term effect of causing further damage, with the added disadvantage of being only partly reversible. It is unsightly and an unsympathetic material to use on thin gold, having been applied in thick, heavy globules. Where the solder is applied, the gold is rendered immobile. Inevitable movement of the thin gold

adjacent to the solder will eventually cause it to tear at the edge of the globule. This has already occurred in several cases. Furthermore, penetration of the solder into the gold may have made it more brittle in that area, particularly if the solder was overheated.

4. Treatment proposals for the gold

4.1 The gold beads (of all types), the nails and the fragments of wire are stable and safe in their present condition. Any soil deposits adhering to them are causing no deterioration and cleaning to remove them would be purely cosmetic. This might be required in certain cases if the objects are to go on exhibition. Many of the beads are loose, in sealed polyethylene bags, but some are strung, either on modern wire or thread. The thread is deteriorating. Re-threading on new polyester thread would be safer and certainly desirable if any are to go on exhibition.

4.2 The helix bangles are very fragile and most of them are damaged to a greater or lesser degree, by having the helix wire stretched, distorted and/or broken. The plant fibre cores have suffered consequent fragmentation and loss. Some repair to the helix wires is possible, in those cases where it might be deemed appropriate to reverse damage caused during and since excavation. This would be a delicate and lengthy procedure. Cleaning is made problematical by the delicacy of the plant fibre cores, but some improvement in appearance may be possible in objects chosen for display.

4.3 The fragments of gold sheet are highly vulnerable in their present state. Minimal movement and handling will reduce the risk of damage, but the optimum solution would be to have them cleaned, repaired and associated fragments identified and brought together to construct whole or part objects which would be more stable and self-supporting. A beginning was made on this task, when fragments associated with parts of two other rhinoceros (C5 and N2822) were identified and brought together. Completion of this work on the rest of the collection would be a lengthy project for the following reasons:

i. The large number of fragments, including eight bags each containing numerous smaller fragments, makes the task of simply identifying likely matches extremely time-consuming, especially with the present arrangement where each fragment is identifiable only by its position in the boxes and must therefore be returned immediately to that position. Painting numbers on the fragments would make sorting and matching much easier.

ii. Matching fragments is not always a question of joining simple break edges in two flat sheets, it is often complicated by the fact that breaks have occurred along or under pleats and overlaps. The granular nature of the sheet gold, and the resulting way in which it breaks or tears, means that many broken edges appear superficially to match. Microscopic examination is therefore usually required to confirm joins.

iii. Fragments which form parts of at least two other rhinoceroses and fragments of other animals, including possible horns and a bovine muzzle (fragment C97), were recognised. However, after a thorough survey of the pieces, the conclusion was drawn that there are probably more animals or items represented than there are fragments to make complete

objects. That is to say, many fragments are not present, making reconstruction more difficult.
iv. The repair and reconstruction of individual fragments and composite pieces is, in itself, a painstaking and time-consuming procedure, involving cleaning, reshaping, accurate alignment of numerous joins, and securing them with adhesive and support backings.

4.4 Some of the fragments of animals and of decorative plates had been previously cleaned and four of them repaired with soft solder. The three major pieces, the rhinoceros, sceptre and bowl, had been similarly treated and mounted on supports made from wood or, in the case of the rhinoceros, expanded polystyrene. Neither of the wood supports was a good fit for the object and this had caused crumpling, indentation and tearing in the gold. It was proposed that they be removed from the supports, the soft solder removed, together with deposits of dirt, old glue and moulding materials (wax, modelling clay and rubber) and the objects be repaired and reconstructed.

5. Priorities established for the order of work

5.1 UP's primary objective in instituting the conservation project on the Mapungubwe artefacts was to prepare them for permanent exhibition in mid-1999. Following the initial assessment by MH it was recognised that only a certain amount of work on the gold artefacts could be completed in the six to eight week period of her stay[iv]. In consultation with Prof. Meyer, an order of priorities was established in which the most vulnerable objects, which were also to go on exhibition, were selected for treatment first.

5.2 The sceptre was identified as being in the most fragile, vulnerable and least displayable condition. Work was begun on this object first and when it had reached an advanced stage, treatment was started on the rhinoceros. Finally on 8th April, work began on the bowl.

5.3 Where time allowed, cleaning and small repairs were to be made if possible to other objects selected for exhibition.

5.4 The cleaning, repair and possible reconstruction of the many fragments of gold sheet is a long-term project. It was possible to identify and clean only a few fragments of two other rhinoceros. This was done in the period before work could begin on the main artefacts.

6. Conservation carried out

6.1 Conservation work was completed on two of the three main objects: the rhinoceros and sceptre. They were removed from their old mounts and dismantled. The solder was removed, they were cleaned, then repaired and reconstructed using a reversible adhesive and backing material (see Appendix 2 – Object Treatments)

6.2 One of the disadvantages of the previous application of soft solder is that it is not a truly reversible treatment. The aim of the present treatment was to remove the damaging bulk of it in order to restore the flexibility of the gold in those areas and to clear and unite broken edges where they had been obscured by the solder. When the solder is applied it fuses with the surface of the gold and it is not possible to remove it completely without some abrasion of the surface. Where possible the solder was removed mechanically using a chisel-tipped needle to lever it away. Where necessary some abrasion was carried out to further reduce the deposit, but in most cases a film or trace of solder can still be seen on the gold. Where it was impossible to obtain enough leverage, the bulk of the solder was removed with a soldering iron. This method was less desirable, since once re-heated the solder became intractable to further mechanical removal.

6.3 The bowl was considered to be undisplayable in its current condition. It was therefore taken off its wood mount, the solder was the removed and the fragments were cleaned. The bowl however, was so deformed and the disintegration caused to the break edges by the solder so severe that it proved impossible to adequately reconstruct the object in the time available.

6.4 Objects numbered C5 and N 2822 (parts of two rhinoceros) were cleaned. Fragment C96 was identified as belonging with N2822 and was cleaned. Fragments C105, C126, C128 and a fragment from bag C50 were identified as belonging with C5. They were also cleaned, but there was no time to reconstruct them.

6.5 All other objects selected for exhibition and many of the other fragments and pieces were checked and cleaned by Sian Tiley. Repairs were made by MH.

6.6 Examination and conservation treatments were carried out in a room used as a laboratory by the UP Department of Archaeology and made available to MH for the duration of her stay. The room had some daylight, two sinks and cold running water. A binocular microscope with zoom magnification of x10 to x40 was loaned by the UP Department of Metallurgy. Solvents, disposable gloves, glass beakers, and paper towelling were provided by Ms Talita Fourie, conservator at the National Cultural History Museum. A soldering iron was obtained for the purpose of removing solder and three cameras (black and white, slides and digital) were made available. Other equipment and tools were brought from England by MH.

7. Conclusion and recommendations

7.1 A conservation assessment has been made of the all of the Mapungubwe gold. Recommendations for future work are to have the sheet gold fragments, the helix bangles and the bead strings treated in order to ensure their long-term preservation. This could entail possibly a year's work.

7.2 The bowl was unfortunately not reconstructed. A reconstruction should probably be attempted in the future, but it will be a difficult and time-consuming task. A truly satisfactory reconstruction may not be possible.

7.3 While the arrangements described in paragraph 6.4 above were adequate for the treatments actually accomplished, it should be pointed out that work of this nature, and particularly on objects of this importance, should be carried out in a fully equipped metals conservation laboratory. The facilities (including Health and Safety equipment) available in such a laboratory would have allowed greater flexibility in choice of methods and more scope for mounting options.

7.4 The time in which MH was to carry out the conservation work – six, later extended to eight weeks – was necessarily allotted before an assessment of the objects had been made. In the event it proved only long enough to complete some of the essential requirements for exhibition. It would have been more beneficial for the work to be paced over a longer time scale in a fully equipped laboratory. This notwithstanding, most of the aims of the visit were achieved. Two of the three main objects, major pieces of restoration work, were completed and prepared for exhibition, as were all of the other minor objects selected for display.

---

[i] The Archaeological sites of Greefswald - Stratigraphy and chronology of the sites and a history of investigations. A.Meyer. University of Pretoria. 1998.

[ii] Gold in the Southern African Iron Age - A technological investigation of the Mapungubwe and other finds. Andrew Oddy. *Gold Bulletin*, 1984, 17, (2).

[iii] D.Miller, *pers.comm.* and *Gold Bulletin*, forthcoming.

[iv] Mapungubwe Gold Conservation Project – Progress Report. Marilyn Hockey. 30th March 1999.