STUDIA TROICA
Monographien 5

2014

STUDIA TROICA

Monographien 5

Herausgeber

Ernst Pernicka
Charles Brian Rose
Peter Jablonka

EBERHARD KARLS
UNIVERSITÄT
TÜBINGEN

Herausgegeben von

Ernst Pernicka, Charles Brian Rose
und Peter Jablonka

Troia 1987–2012: Grabungen und Forschungen I

Forschungsgeschichte, Methoden und Landschaft

Teil 1

VERLAG
DR. RUDOLF HABELT GMBH
BONN

Undertaken with the assistance of the
Institute for Aegean Prehistory (INSTAP) – Philadelphia, USA

The research and compilation of the manuscript for this final publication were made possible through a generous grant from The Shelby White – Leon Levy Program for Archaeological Publications

Gefördert mit Mitteln der Deutschen Forschungsgemeinschaft (DFG)

und der

Daimler AG

Teil 1: 536 Seiten mit 42 Farb- und 194 Schwarzweißabbildungen
Teil 2: 552 Seiten mit 30 Farb- und 229 Schwarzweißabbildungen

Herausgeber:
Ernst Pernicka
Charles Brian Rose
Peter Jablonka

Wissenschaftliche Redaktion:
Stephan W. E. Blum
Peter Jablonka
Mariana Thater
Diane Thumm-Doğrayan

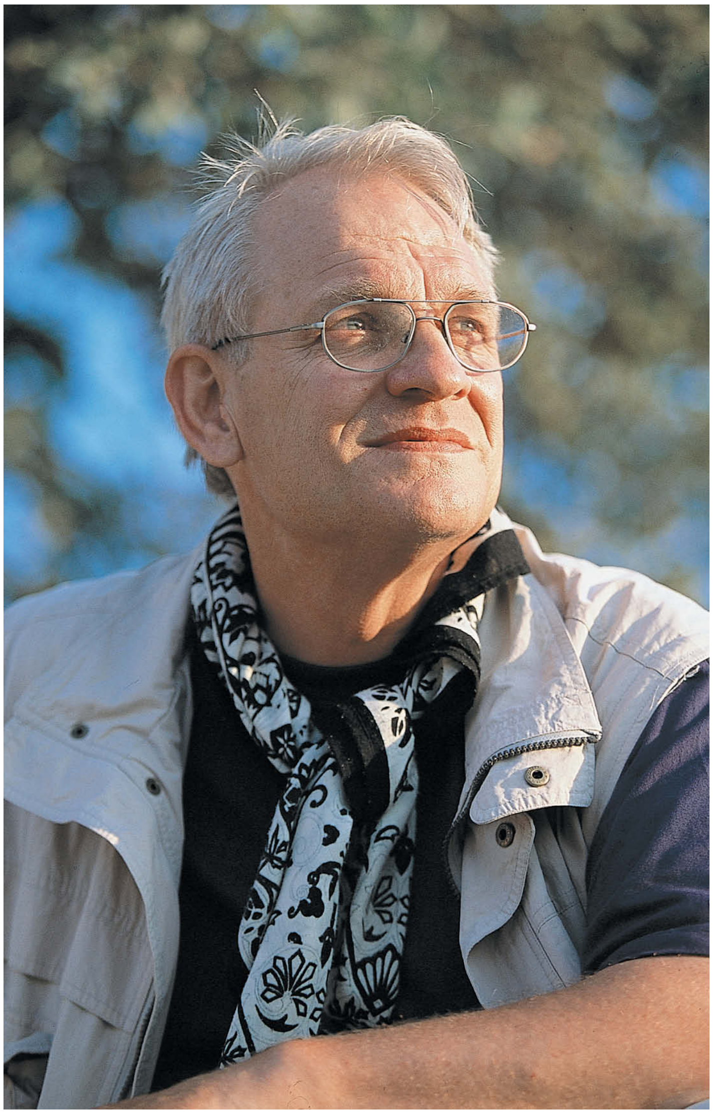
Lektorat:
Hanswulf Bloedhorn
Donald F. Easton
Dietrich und Erdmute Koppenhöfer

Layout, Satz:
Frank Schweizer, Göppingen

Druck:
Bechtel Druck GmbH & Co. KG, Ebersbach/Fils

Die Deutsche Nationalbibliothek verzeichnet diese Publikation in der Deutschen Nationalbibliografie; detaillierte bibliografische Daten sind im Internet über <http://dnb.d-nb.de> abrufbar.

ISBN: 978-3-7749-3902-8



In memoriam
Manfred O. Korfmann

26. April 1942 bis
11. August 2005

Teil 1

Teil 2

Donna Strahan and Simone Korolnik*

Archaeological Conservation

Abstract

Preservation and long-term care of the excavated finds have been part of the overall plan at the site of Troy since excavation began in 1988. The international team always included conservators working with archaeologists to help conserve and document excavated material and prepare it for long-term storage and display. This paper will discuss the steps taken to preserve the various finds, on-site conservation training and outreach efforts in the Troad.

Zusammenfassung

Konservierung und langfristiger Schutz der ausgegrabenen Funde waren Teil des Gesamtplans in Troia seit Grabungsbeginn 1988. Zu dem internationalen Team gehörten stets auch Restauratoren, die mit Archäologen zusammenarbeiteten. Ihre Aufgabe war es,, das ausgegrabene Material zu konservieren, zu lagern und für eine mögliche Präsentation zu restaurieren. Dieser Artikel schildert die Schritte, die unternommen wurden, um die große Fülle verschiedenster Funde zu konservieren; außerdem werden beschreibt die Ausbildung von Restauratoren auf der Grabung sowie restauratorische Unternehmungen in der Troas.

The role of conservation at Troy

This paper will only focus on the preservation of small finds; architectural structures were addressed by architectural conservators and will not be discussed here.[1]
The aims of conservation at Troy were as follows:

- preserve all artefacts as thoroughly and quickly as possible upon excavation,
- assist the archaeologists in identifying materials and processes,
- document treatments and information gained from the objects,
- prepare all artefacts for display or long-term storage,
- educate staff and local colleagues in basic conservation principles,
- train conservation students from university graduate programs,
- sample material for analyses and assist in the interpretation,
- provide emergency treatments to other excavations and museums in the Troad.

* Acknowledgements: we are sincerely grateful to Manfred O. Korfmann, Charles Brian Rose and Ernst Pernicka for their foresight and vision in recognizing the need to preserve the excavated finds each season. Year after year they provided the funds and support when needed to keep the laboratory thriving. Special thanks are given to the many conservators who devoted countless hours to preserve the finds at Troy, so that they may be available to scholars in the future. Thanks to Oskar Hopp for scouring the countryside looking for all of our unusual requests for laboratory supplies.

1 See contribution by Elizabeth Riorden, this volume.

Although field conservation requires compromise because of the conditions and time constraints, every attempt was made to apply the highest preservation standards. All treatments had to be finished during each two or three month excavation season, as very few objects would be available the following season. In general, treatments included documentation, cleaning, stabilization, analyses and, when necessary, restoration of missing areas. Experienced conservators were selected to supervise the work of all conservation students, auxiliary personnel and volunteers caring for the excavated finds.

Prior to each excavation season, planning and organization was carried out in conjunction with the archaeologists to ensure that sufficient staff and materials would be available. Depending on the number of trenches to be excavated, an attempt was made to anticipate the number of objects to be expected, and thus the number of conservators needed for the forthcoming season.

The conservation team

The Troy excavation project provided a rare opportunity to develop a global view of conservation methods. The conservation team consisted of a very diverse group of conservators and students from many countries with different backgrounds and training. At times there were up to four languages spoken in the laboratory. This added to the challenges of achieving success in treatments; but also provided a unique opportunity to refine and to re-define terms and techniques. Not surprisingly, this slowed things down, sometimes led to misinterpretations and frustrations; but also elation at language barrier breakthroughs. Lively discussions and demonstrations were carried out helping to develop treatments that were fresh and more effective.

On-site training

The Troy Project was considered an archaeology field school. An important part of the excavation project was the training of archaeology students and conservation students. Not only were archaeology graduate students trained in field techniques but also conservation students from various graduate programs were trained in field treatment methods. This was a major component of the lab's work. These students came from different countries, with various levels of training, as well as varying language abilities. By the end of the excavation season, there was no doubt that each conservator left the site with a broader view of materials and methods.

The team held weekly evening lectures on various subjects related to the excavation. Each season at least one lecture was devoted to conservation and preservation. The conservation lectures included the basic principles of materials deterioration; an introduction to field stabilization methods, as well as laboratory treatment methods. Members of the team were also encouraged to spend one day a week working in different departments of the site, such as in conservation, registration, photography, field excavation work, and the pottery sorting areas. This provided team members with a more holistic view of various specialities present at Troy. Non-specialists and outside visitors were continually given tours of the laboratory, guided by the site director.

Fig. 1
General view
of the conservation
laboratory at Troia
(Photo: Donna Strahan).

The laboratory

During the initial excavation seasons of 1988 and 1989, conservation was carried out at Yeniköy. In 1990 Eva Sander and Lynn Grant set up a field conservation laboratory in the Blegen excavation house on site. The laboratory consisted of a large room with electricity and running water (Fig. 1). Work spaces were made up with multiple tables and shelving. Windows in three walls provided ventilation with the aid of fans. Seasonal improvements to the laboratory ensured a useful functioning facility. The major lab equipment included two binocular microscopes, deionising columns, a conductivity meter, an ultrasonic cleaner, a flexible shaft and bits, a vacuum desiccator and scales. Various conservation materials were routinely maintained, including: general hand tools, solvents, acids, other chemicals, adhesives, lifting materials, impression and gap-filling materials and in-painting agents.

A list of conservation materials needed for the following year was tracked and provided to the German organizers at the end of each season. Whenever possible, conservation supplies were purchased within Turkey. If unavailable in Turkey, they were purchased in Germany under a field conservator's direction and then brought in by car.

General conservation procedures

All treatments were guided by the principle of›re-treatability‹, recognizing that today's conservation treatment may not last indefinitely and that future treatment techniques may be superior. Where possible, the conservation materials used could be removed in the future without damage to the object, allowing it to be treated again. When compensation for damage or loss was needed, as little restoration as possible was applied. The amount of restoration was determined by both the object's stability and the needs of the archaeologists. The initial excavation years provided an indication of the type of objects to be expected and their condition. Study of the materials and ongoing evaluation of past treatments helped determine which methods were most successful.

A typical conservation work flow for an excavated find went as follows. Prior to arriving in the lab, field numbers were assigned to the object as it was checked in through the registrars. Once it arrived in the lab a conservation laboratory log number was assigned and recorded. The condition was evaluated and a suitable treatment was planned, carried out and documented. Once out of the lab, the objects were photographed, drawn and studied by the archaeologists and specialists on site. At the end of the season objects selected by the Turkish Government representatives were packed and transferred to the Çanakkale Archaeological Museum, approximately 35 km from the site. The remaining objects were stored on site in containers.

Documentation

Since the recovery of artefacts from the site and subsequent conservation treatment may destroy the archaeological context, all field and laboratory documentation were of paramount importance. Documentation consisted of written, drawn and photographed records detailing the treatment procedures used. Significant diagnostic features relating to an object's manufacture or microstructure were also documented.

The Conservation Logbook recorded each object as it was brought into the lab from the registrars. Each object was given a laboratory number, as well as the location, date and area of excavation, and the conservator who treated the object, in and out dates from the laboratory and the treatment Conservation Daybook page. The data recorded in the Logbook helped monitor all objects present, as well as locating them within the Troy excavation system. The actual conservation treatments, condition reports and simple drawings were recorded in the Daybooks in English. Complete sets of conservation records were kept both in Germany and in the Troy laboratory. Conservation records were also entered into a computer database, although somewhat inconsistently. However, the written records can be used to update this at any time. For the number and type of object treated per year see Appendix.

Treatments at Troy

Climate and soil conditions were largely responsible for the condition of the excavated material. Generally, the soil at Troy is slightly alkaline. There are wide ranges in temperature and rainfall throughout the year. Winter and spring are wet with heavy rains, whereas summer and fall are hot and dry. Nearly all of the artefacts recovered from the excavation were inorganic materials: ceramics, metals, stone, plaster, glass. The few organic materials recovered were waterlogged wood found in wells. Bone and ivory, a combination of inorganic and organic material, were also found at the site. Aside from general stability and reconstruction issues, the most serious problems were caused by both soluble and insoluble salts. Following is a general description of treatments carried out by material.

Ceramics

Most of the ceramics were unglazed, low fired with soft bodies and thus, were often in very poor condition. A few unfired clay loom weights were recovered. However, the paucity of unfired ceramics might be due to routine sherd washing prior to arrival in the laboratory. Low fired ceramics often had soluble salt problems. This led to considerable flaking and powdering of their surfaces. When left to dry without desalination, the salts would migrate to the surface and crystallise out as a white powder, often disrupting the surface. Therefore, soluble salts removal by desalination consumed most of the lab's time. Objects with especially fragile, painted surfaces or low fired bodies presented a special challenge. In many cases, the surfaces had to be cleaned mechanically and consolidated with 3–5 % acrylic resin Paraloid B-72, an ethyl methacrylate and methyl acrylate copolymer, in acetone prior to desalination. Ceramics were first examined for traces of pigments before any treatment began. Treatments tended to be more straightforward where no pigment was found. The ceramics were soaked in baths of deionized water until the salt levels were lowered to 100 µS (microSiemens) or lower. The baths were monitored daily with a conductivity meter and changed routinely, a process that usually took over one to two weeks per container.

Many ceramics were covered with a thick, grey-white encrustation of insoluble salts from the alkaline soil. The insoluble salts were not only unsightly, but they made it impossible to create tight bonds between the sherds. Provided the clay bodies were strong enough, the sherds were first soaked in deionized water, followed by a quick bath of 3–5 % nitric acid to remove the encrustation; and then put through the desalination process and air dried.

Reconstruction began by first sealing the edges with 5 % Paraloid B-72 in acetone to create a strong layer for reattachment. The sherds were then adhered with 20–30 % Paraloid B-72 in acetone. After drying, selected losses were filled with plaster of Paris and in-painted with acrylic paints. The aim of restoration was to fill only those areas necessary for stability. When the shape of the missing area was known, missing areas were sometimes recreated in plaster. All fills were in-painted a slightly different tone than the object, so the viewer could easily differentiate the original from the restoration. For objects going on display all of the losses were filled and in-painted (Fig. 2).

Over the years, aside from general ceramic treatments, a number of special projects were also completed by the laboratory. For many seasons, the conservators prepared objects for a special travelling exhibition that was held in Germany between 2001 and 2002. The exhibition, entitled *Troia – Traum und Wirklichkeit* was organized by Manfred Korfmann in collaboration with several museums in Turkey, Germany, and other countries. This meant preparing the selected objects to a much higher degree of finish than is normally done in a field laboratory.

Another major project was the reconstruction of large ceramic storage jars (*pithoi*) that had been excavated over the years. They were generally about 1.5 meters tall, with walls about 3–4 centimetres thick and extremely heavy. After centuries of burial they were invariably broken into many pieces and their porous bodies were crumbly. Some of them were selected for the travelling exhibition, so a high degree of reconstruction was a priority. In addition to travelling, they would all be stored outdoors with only a metal roof for protection; therefore, the choice of adhesive was of paramount importance. For smaller ceramic vessels Paraloid B-72 was successfully used; however, the weight of these vessels and their exposure to very high temperature extremes outdoors meant a stronger adhesive was necessary. Still requiring a reversible adhesive, a combination of Paraloid B-72 and Paraloid B-48N were combined 1:3 in acetone/ethanol (3:1). This combination provided strength and stiffness at high temperatures along with future solubility. In 2008 the *pithoi* were re-examined and found to still be in good condition. This adhesive mixture has held up well to both travelling in Germany for one year and to Troy's high temperatures (Fig. 3).

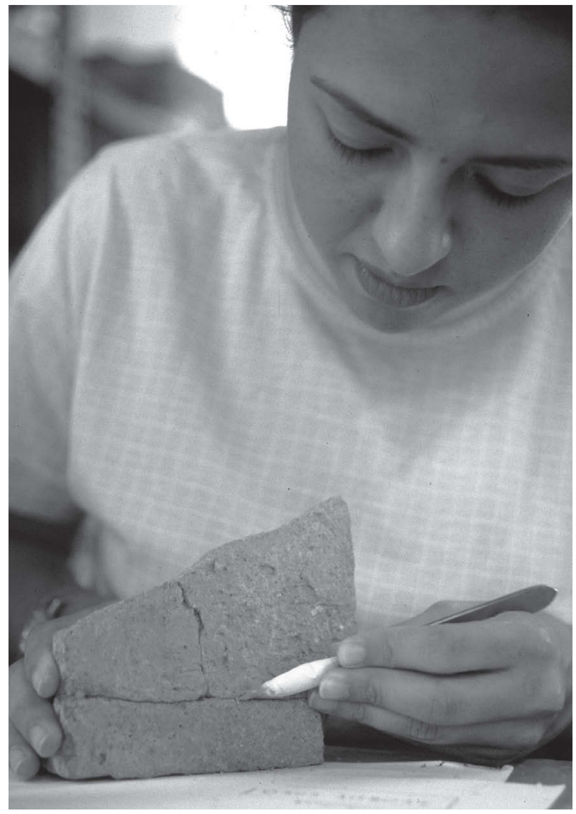


Fig. 2
Senem Uyanık reconstructing a ceramic vessel (Photo: Donna Strahan).

A Mycenaean style ceramic vessel called the »Lion Crater« provided another challenge to the lab's conservators for many seasons. Various pieces of this vessel were found at different times over a period of five years. Each year the vessel had to be reconstructed when new pieces were found during excavation. It was a true test of the treatment methods. Fortunately, because Paraloid B-72 and plaster had been used, the vessel could be de-constructed without damage. What began as half a vessel eventually became a complete pot with only minor pieces missing. If there had been any question before, this vessel confirmed the need for »re-treatability« (Fig. 4).

Metals

The metals found at Troy include copper alloys, silver, gold, iron and lead. The majority of finds were copper alloys and they tended to be heavily corroded with a range of copper oxides, carbonates and chloride products. While the oxides and carbonates were stable upon excavation, the copper chlorides (bronze disease) remained extremely active in the presence of oxygen and high humidity. Active chloride corrosion on copper alloys was treated by mechanically removing localized chloride pits and placing the object in a stabilizing bath of 3 % benzotriazole (BTA) in

Fig. 3
Simone Korolnik reconstructing pithoi
(Photo: Donna Strahan).

ethanol for half an hour. In the rare case that a copper alloy had a clay core on the interior, the BTA was applied with a brush rather than by immersion. The surfaces were then lacquered with acrylic resins Incralac or Paraloid B-72.

Frequently, as the corrosion developed, it encompassed or replaced any organic remains with which they had been in contact. These pseudomorphs could be in the form of complete replacements of the leather, wood, textiles, or feathers. Because these corrosion layers contain valuable archaeological data (manufacturing techniques, associated organic materials), they were usually preserved and not removed. Only in those instances where the chloride corrosion was unstable (bronze disease), was the localized corrosion removed. In other cases, mechanical cleaning of the surfaces revealed details obscured by corrosion layers. For joining metals, Paraloid B-48N in acetone was used. When structural support was needed, threads or woven fibreglass were used with the adhesives. Of crucial importance after treatment was the creation of dry storage conditions for all excavated metals.

Coins are of the utmost importance to the archaeologist, since they provide a unique date for their particular strata. All lab work was interrupted to treat any newly excavated coin. Copper alloys were by far most common type of coin found at Troy. Both mechanical cleaning and electrolytic reduction methods were used to remove corrosion and expose the original surface. For heavily corroded coins it was crucial to work closely with the archaeologist whose knowledge aided in the search for the designs. Impressions were made of all coins for later numismatics study.

Gold survived with little change depending on its composition. Other than light surface cleaning with ethanol there was no need of further treatment. Depending on its purity, excavated sil-

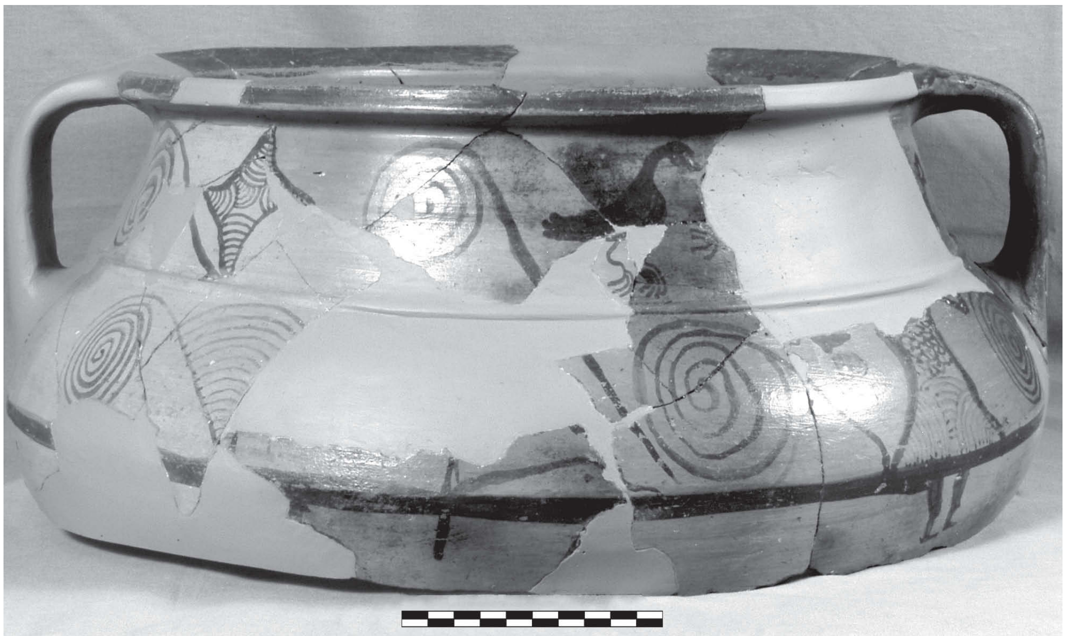


Fig. 4
The completed Lion Crater after years of repeated reconstruction (Photo: Troy Project).

ver was usually covered with green copper corrosion products or with lumpy purple-grey silver chloride corrosion. Occasionally, chemical methods, such as 5–7 % formic acid, were used to remove copper corrosion products covering the silver. When necessary, mechanical methods were used to remove some of the gummy, silver chloride corrosion, otherwise it was left alone. Buried lead was always covered with white or yellow carbonate corrosion products. Occasionally it was mechanically cleaned or reduced electrolytically.

Iron tended to be in the worst condition, often more than half of an object had been converted to iron oxide corrosion products along with deleterious iron chloride products. The surfaces were hugely inflated, cracked and crumbly. For the most part, iron objects were cleaned mechanically using a flexible shaft with suitable drill heads, degreased, dried and lacquered.

Stone, mosaics and plaster wall paintings

Most of the stone found at Troy was marble, granite, limestone or soapstone. Like ceramics, stone objects were examined first for the presence of pigments before any treatment was performed. Aside from breaks, the main conservation challenge for stone was the presence of insoluble salt encrustation. Deionised water was used to remove soil, but only mechanical methods were used to remove hardened encrustations. When stone objects were first excavated they tended to be damp and the encrustations were relatively soft. If they were allowed to dry out the encrustations hardened, making them much more difficult to remove. Therefore, the encrustations were removed as soon after excavation as possible. Smaller stone repairs were carried out with either Paraloid B-72 or Paraloid B-48N. Akemi two-part polyester resin was used to join large stone fragments. Beads and gemstones were usually cleaned with cotton swabs dampened with ethanol or deionised water.

Because scholars publishing the finds only had access to the actual objects during the excavation season, all information from the objects had to be obtained during that period.

For further study of tool marks or inscriptions, casts or molds were made of the objects. Over the years many latex rubber »squeezes« were taken of stone inscriptions for epigraphers to study them later. One of the most challenging molds taken of a stone object at Troy was from the life sized marble head of Augustus. To protect the surface the head was sealed with Paraloid B-72. Then a two-part silicone rubber mold with a plaster support was made. Once the mold arrived in Germany a plaster cast of the head was made for further study.

None of the mosaics excavated were lifted. After exposure and documentation, they were reburied with a layer of Geotextile on top of them. This would alert future excavators of their location.

During the early years of excavation many wall painting fragments were lifted from collapsed Roman houses. It was unclear what percentages of a ceiling or wall paintings were present, nor were the designs clearly understood. Most of the fragments were covered with insoluble salts that had hardened since excavation. Chemical removal of the encrustations was tested; but the best results were achieved by slow mechanical removal. Selected encrustations were mechanically removed to help determine the design. Samples of the wall plaster and pigments were taken for analyses. Each season further examination and treatment of the wall/ceiling painting fragments continued until the actual design finally became clear. This took many conservators, in consultation with the archaeologists, many hours to come to final conclusions. The results of these analyses will be reported in Ch. Brian Rose's forthcoming volumes on the Troy excavations.

Faience and glass

Most faience and glass objects had corroded during burial causing opaque iridescence along with spalling and flaking surfaces. The corroded surfaces were maintained by consolidation with Paraloid B-72 in acetone. The surfaces were cleaned with ethanol. Reconstruction was carried out with Paraloid B-72 as well.

Bone and ivory

Many small objects made from ivory or bone material from all excavation levels came into the lab for identification and treatment. Working with the Troy team's animal bone specialists, the conservators were able to complete the identification of nearly all of the worked material. The majority of the objects were made from hippopotamus tusks, bone, warthog tusks and antler. No elephant ivory was identified.

Bone and ivory objects were cleaned dry using wooden skewers, sometimes carefully swabbed with deionised water and ethanol. Fragile unstable objects were consolidated using colloidal acrylic dispersions such as Acrysol WS24 or acrylic resin solutions of Paraloid B-72 in acetone. All adhesion of bone and ivory material was carried out with Paraloid B-72 in acetone. Occasionally, to aid the team's physical anthropologists, conservators helped clean, consolidate and adhere the human skeletal remains.

Other organic materials

The only other organic material found at Troy was a few small objects made of wood that were recovered from a well during the 1994 season. These were unexpected so proper treatment chemicals, such as polyethylene glycol, were not available. They were treated using the sugar method as an emergency treatment.

Lifting in the field

Sometimes special retrieval measures were required for finds of unusual importance or those which were in very poor condition. After photography, drawing and field measurements were completed, extremely fragile objects were block-lifted in the field with their surrounding soil. They were then taken back to the laboratory and carefully excavated under a more controlled environment. This not only helped guarantee the preservation of the object, but allowed the archaeologist to continue their work, saving valuable field time.

The main lifting techniques used in the field were block lifting with a rigid framework, wrapping with a flexible strengthening material, and consolidation of the object itself. Depending on the needs, more than one method might be used at a time. First the space around the objects to be lifted was cut down. The plinth containing the objects was then protected by a barrier layer of plastic wrap or aluminium foil, and lastly, a rigid framework of plaster bandages was applied. A stiff support was pushed under the object and it was brought to the lab for micro-excavation. In other cases, a strengthening material of fabric or ultra-fine polyester webbing impregnated with polyvinyl acetate emulsion or Paraloid B-72 was fixed directly to the artefact before lifting. At times, extremely fragile objects had to be consolidated *in situ* with an acrylic resin before lifting. The first method was preferred because it caused the least interference with the object, and was relatively quick to carry out.

Unusual treatments

Aside from the expected materials and treatments, the conservators were called upon to carry out some unusual treatment requests. These requests often were last minute and results were needed immediately. Shifting teams of conservators were necessary to complete these tasks, thereby also providing a unique experience for everyone in the lab.

One such unusual request was to take impressions of tool marks used to chisel out the tunnel walls in the cave in the lower city. This request was related to the larger academic discussions and arguments that were going on outside the day-to-day excavation at Troy. Korfmann wanted to determine if the tool marks would provide proof that the cave tunnels were created in the Bronze Age. Silicone rubber impressions were made and given to experts for detailed measurements and examination.[2]

Another request was to consolidate and reconstruct some large, unusual soil forms lifted from near the sanctuary. When first encountered neither the archaeologists nor the conservators knew what these forms were. It was truly a challenge to reconstruct an unidentified object. In the end, it was through their reconstruction that they were finally identified as parts of molds for casting bronze sculpture.[3]

Fig. 5 Donna Strahan working on Çan sarcophagus (Photo: Ch. Brian Rose).

There was not always an architectural conservator present at Troy. So when the Troy III megaron in G6 was unearthed,[4] finds conservators were called upon to consolidate the mud brick walls of the building. Fortunately, Professor Frank G. Matero, Director of the Architectural Conservation Laboratory, University of Pennsylvania, and head of the conservation program at the site of Çatalhöyük, was working in Turkey that season. After several phone conversations with him, the walls were consolidated lightly by spraying dilute solutions of Acrysol WS24, an acrylic resin emulsion. Before the end of the excavation season, a temporary, protective covering was devised. The system had to allow the walls to breathe over the winter, and also protect them from wind and rain. A temporary wall of light weight, blown concrete blocks was constructed about 20 cm from the walls. Straw was stuffed between the concrete blocks and the mud

2 Korfmann 2003, 5–6.
3 Rose 1998, 80–81.
4 Korfmann 2004, 5–7.

brick. Then the tops of the walls were bridged over with newly made, fired mud bricks, thereby protecting the gap between the walls and allowing for some air flow. This method prevented the walls from trapping moisture over the winter which would have been extremely destructive. This system was put into place for several seasons until a permanent roof was built over the megaron.

Conservation out-reach

In cooperation with other museums and sites in the Troad that did not have conservators of their own, the lab was called upon to provide emergency treatments. One of the more unusual requests came from the Kabatepe Gallipoli Museum in the Gallipoli Historic National Park visible from Troy, just across the Dardanelles. Their Director brought over a leather shoe with the foot still in it from the World War I battlefield to be conserved. He wanted the shoe for display in the museum and would not consider having it re-buried. So the shoe was cleaned and the soil and bones within were stabilized.

Over the years, the Director and archaeologists from the Çanakkale Archaeological Museum asked for conservation help with a number of projects. These included materials in the museum's depots; as well as objects in situ at sites; and tomb-robbed materials brought to the museum. Conservators from Troy aided in preserving tomb material from Dedetepe while it was still in the tomb; elaborately carved wooden table legs, painted decoration on stone beds, and ivory carvings from musical instruments.[5] Material finds from the Gümüşçay sarcophagus were conserved at the museum and organic residues from some of the vessels were analyzed at the Williamstown Conservation Laboratory in Massachusetts.[6] The painted surface of the Çan sarcophagus was treated by shifting teams of Troy conservators (Fig. 5). The pigments were analyzed by Dr. Richard Newman, Head of Scientific Research, and Michele Derrick, Conservation Scientist, Museum of Fine Arts, Boston and published.[7] During the 2001 season, Turkish government officials brought an elaborate bronze mirror from a tumulus near Kumkale for conservation. Most recently, Troy conservators have been conserving material from the necropolis of Parion near Biga for archaeologists in the Çanakkale Museum.

Sampling for instrumental analyses

A field season cannot provide the necessary time or equipment for analytical studies of the materials excavated. Therefore, small samples of selected materials were taken by the conservators, registered with the Turkish Government and sent to Germany or the United States for instrumental analyses. Some of the material studied included: wall painting plaster and pigments;

5 Sevinç et al. 1998.
6 Sevinç et al. 1999.
7 Sevinç et al. 2001.

drilled metal samples for alloy composition; charcoal for dendrochronology; ceramic samples for compositional analyses; soil samples for salt analyses. The results of the various analytical studies have been reported in articles in *Studia Troica*.[8]

Packing and storage

Key to the future preservation of all excavated materials was their storage method, regardless of whether they were staying on site or going to the Çanakkale Archaeological Museum. All objects were packed for storage in the best available materials, even though they were not always archival materials.

The dry, hot summers and cold, wet winters in Western Turkey made it very difficult to control the environmental conditions. Any environmental control could only be done in closed containers. Most small objects were packed in re-sealable polyethylene boxes and bags. Those needing support were surrounded by polyethylene foam or acid-free tissue. Cotton wool was never used, as it catches on projections and rough surfaces, causing damage and leaving fibres that are difficult to remove.

Great emphasis was given to the proper packaging of all materials. The most difficult materials to store are the unstable metals. They require a relative humidity of 35 % or lower. This was achieved by placing the metals in sealed polyethylene boxes with dry silica gel. Additionally, the boxes were sealed with packing tape to help preserve the dry environment. Humidity cards were visible through the boxes for ease in determining when it was necessary to re-condition the silica gel. Yearly monitoring and reconditioning was carried out as necessary. However, those artefacts stored in the museum were not available to conservators once they were handed over to the museum authorities.

During the early years of the excavation, the storage containers were wooden crates that easily became infested with wood worms. They ate up the crates at rapid pace. As funding became available the wooden crates were replaced with polyethylene crates. These were light weight, reasonably non-destructive, repellent to pests, and cost-effective.

Collaborative conservation research

As noted above, soluble salts were a continual problem at Troy. An opportunity arose to study the soil composition and determine how its salt content might affect the condition of objects excavated from these environments. A joint Troy, Gordion, Kaman-Kalehöyük site project was initiated. Samples of soil from each stratum from a trench in the lower city and one in the Odeion were taken and sent to the lab at Kaman-Kalehöyük. The results were presented in October 1997.[9]

---

8 Mellink – Strahan 1998; Strahan 2001; Bieg 2002. See also Strahan 1996a; Strahan 1996b; Strahan – Unruh 2003; see also the contribution by Pernicka et al., this volume.

9 Johnson et al. 1997.

Summary

The importance of conservation of excavated finds has been a priority at Troy since the field project began in 1988. Throughout the years, the conservation staff has changed and the treatment methods have advanced, but the importance of preservation has remained the same. Through the guidance and diligent work of the conservators, thousands of finds have been preserved for future study and much information has been added to the archaeological data for Troy. The conservation laboratory also provided emergency treatments for archaeologists and museums throughout the Troad. Long after the field season was over, analytical study of materials from the excavation continued. The results of research and analyses have been disseminated through publications.

Bibliography

Bieg 2002 — G. Bieg, Neue Funde aus der Troas. Eine archaische Bronzepunze aus Ophryneion und ein hellenisischer Klappspiegel mit Erosrelief aus der Umgebung von Kumkale, Provinz Çanakkale. Studia Troica 12, 2002, 451–466.

Johnson et al. 1997 — J. S. Johnson – S. Carroll – D. Strahan, Evaluation of Soluble Salt Content in Soils. Preliminary Results from Three Archaeological Sites in Turkey. Western Association for Art Conservation (Phoenix 1997).

Korfmann 2003 — M. Korfmann, Die Arbeiten in Troia/Wilusa 2002 – 2002 Work at Troia/Wilusa. Studia Troica 13, 2003, 3–25.

Korfmann 2004 — M. O. Korfmann, Die Arbeiten in Troia/Wilusa 2003 – Work at Troia/Wilusa in 2003. Studia Troica 14, 2004, 3–31.

Mellink – Strahan 1998 — M. J. Mellink – D. Strahan, The Bronze Figurine from Troia Level VIIa. Studia Troica 8, 1998, 141–149.

Rose 1998 — Ch. B. Rose, The 1997 Post-Bronze Age Excavations at Troia. Studia Troica 8, 1998, 71–113.

Sevinç et al. 1998 — N. Sevinç – Ch. B. Rose – Donna Strahan – Billur Tekkök-Biçken, The Dedetepe Tumulus. Studia Troica 8, 1998, 305–327.

Sevinç et al. 1999 — N. Sevinç – Ch. B. Rose – D. Strahan, A Child's Sarcophagus from the Salvage Excavations at Gümüşçay. Studia Troica 9, 1999, 489–509.

Sevinç et al. 2001 — N. Sevinç – R. Körpe – M. Tombul – Ch. B. Rose – D. Strahan – H. Kiesewetter – J. Wallrodt, A New Painted Graeco-Persian Sarcophagus from Çan. Studia Troica 11, 2001, 383–420.

Strahan 1996a — D. Strahan, Preserving Unstable Painted Surfaces on Freshly Excavated Terracotta. Dilemmas and Decisions. In: A. Roy – P. Smith (Hrsg.), Archaeological Conservation and its Consequences. Preprints of the Contributions to the Copenhagen Congress 1996 (London 1996) 172–176.

Strahan 1996b — D. Strahan, The Trojan War Continues. The Battle for Preservation. The Walters Monthly Bulletin 49/3, 1996, 5.

Strahan 2001 — D. Strahan, Konservatorische Mitarbeit bei der Ausstellung Troia. Traum und Wirklichkeit im Archäologischen Landesmuseum Baden-Württemberg. Auftraggeber: Troia-Projekt des Instituts für Ur- and Frühgeschichte und Archäologie des Mittelalters der Eberhard-Karls-Universität (Tübingen 2001).

Strahan – Unruh 2003 — D. Strahan – J. Unruh, Conservation of Ceramic Artifacts on Archaeological Sites. Field Notes. Practical Guides for Archaeological Conservation and Site Preservation 12 (Ankara 2003).

Appendix

Summary of the objects treated in the Conservation laboratory between 1991 through 2006. 2007 through 2012 were mainly survey and study seasons with a minor number of objects coming through the laboratory.

Year	Objects conserved, total	Metals	Coins	Ceramics/TC	Stone/ Wall plaster	Bone/ Ivory	Glass/ Beads	Wood/ Leather/ Organics
1991	318	15	50	196	41	4	12	0
1992	1948	43	43	398	3	487	974	0
1993	938	80	153	567	57	30	51	0
1994	782	70	65	570	19	23	29	6
1995	483	76	58	273	28	29	19	0
1996	635	105	85	351	27	40	27	0
1997	648	113	111	314	59	25	25	1
1998	592	75	80	344	28	28	35	2
1999	542	73	91	273	53	30	21	1
2000	346	56	21	224	14	16	15	0
2001	342	83	79	156	15	2	6	1
2002	135	25	18	72	9	5	6	0
2003	163	53	20	71	13	4	2	0
2004	297	52	2	137	59	16	31	0
2005	280	85	14	135	20	8	18	0
2006	79	46	10	11	9	1	2	0
Total	8528	1050	900	4092	454	748	1273	11