Field Conservator's Report: 2010 Season

Anna SHEPHERD
Bergen, NORWAY

1.0. INTRODUCTION

The 2010 conservation season was conducted between 2nd of July and the 25th of August. This team consisted of the Conservation Director, Alice Boccia Paterakis (2nd July to 16th July), the Field Conservator, Anna Shepherd (2nd July to 25th August), the Preventive Conservator Melissa Mariano (4th July to 15th August), and two conservation interns, Tessa de Alarcon (2nd July to 14th August) from the UCLA/Getty program, Los Angeles, and Sofia Lo Bianco (2nd July to 15th August) from the University of Melbourne.

The season began with a Materials Characterization workshop, conducted by Nancy Odegaard and Scott Carlee, which ran from the 6th of July to the 8th of July inclusive.

The new Kalehöyük Archaeological Museum was opened to the public on the 10th of July, the ceremony for which was attended by the Conservation Department.

The first artifacts to be treated this season were those from the Büklükale site that had been excavated in 2010 prior to the arrival of the conservation team. After completion of these artifacts, the artifacts from the new Kalehöyük Archaeological Museum that were identified as actively corroding during the Museum Survey were treated and returned to the museum storeroom and exhibition space. This included the artifacts excavated at the end of the 2009 season from both Büklükale and Yassıhöyük after the departure of the 2009 conservation team.

After this, treatment began on artifacts that had been identified during the 2009 Metals Survey. Simultaneously, work was carried out on artifacts that were being excavated from Kaman-Kalehöyük.

Additional work throughout the season included a survey on the artifact storerooms, a report for which was written outlining areas of concern and recommendations for each area. A safety evaluation was conducted on the laboratory, and an audit was conducted on the chemical inventory. An update of the Laboratory Manual was undertaken to ensure that all of the documents are in line with current laboratory practices.

2.0. MATERIALS CHARACTERIZATION WORKSHOP

This year a Materials Characterization workshop was conducted between 6th to the 8th of July inclusive. The workshop was conducted by Nancy Odegaard and Scott Carlee, two of the co-authors of the textbook "Materials Characterization Tests for Objects of Art and Archaeology" (2000; Archetype Publications Ltd, London). The purpose of this workshop was to train attendees in the implementation of various chemical spot tests in order to accurately identify various materials.

The workshop had five attendees, three from the JIAA conservation staff, one conservation student from UCLA/Getty Conservation program, Los Angeles, and one archaeology student from the University of Pennsylvania.

The samples tested during the workshop were both unspecified samples of soils, salts and organic materials collected both from the buildings and grounds around the institute, and also from artifacts in the laboratory. This gave the attendees the chance to practice identifying both unknown materials, and identifying materials relevant to archaeological conservation.

Photo1 Nancy Odegaard instructs conservation student Elizabeth Drolet

Photo 2 Preventive Conservator Melissa Mariano examining a sample

Over the season, the staff was able to put the skills obtained during this workshop to positively identify active chloride corrosion and lime plaster remnants on artifacts. This knowledge was also applied to the identification of potentially unstable materials used for the exhibition and storage of the artifacts in the museum.

The equipment purchased for the workshop has been incorporated into the laboratory equipment, and will be invaluable for use in future seasons.

3.0. KAMAN-KALEHÖYÜK ARCHAEOLOGICAL MUSEUM SURVEY

The Museum Survey of the condition of the artifacts in the museum was undertaken during the 3rd week of the field season. Since the museum was newly opened, a full condition survey was conducted of all artifacts that are in the storeroom and on exhibition in the museum. This was done to ensure that there is a record of all artifacts in the museum on the Museum Survey Database, and to give a baseline for all future surveys conducted on these artifacts. A museum staff member was required to be present at all times whilst the Conservation Department was conducting the survey.

Any artifacts that were considered unstable were identified and put aside to be brought to the laboratory for conservation treatment. After the survey, a total of 96 artifacts were brought to the laboratory, 52 of which were from the museum storeroom, eight of which were removed from the display cases. Of the remaining 36, 19 were artifacts from Büklükale and 17 artifacts from Yassıhöyük that had been accessioned by the museum before any conservation treatment had been undertaken.

Of the 60 unstable artifacts brought to the laboratory, 31 were bronze artifacts displaying bronze disease, six were iron artifacts displaying active corrosion, and one was a structurally unstable pottery. The remaining 29 artifacts were brought back for supports to be constructed, or to have the silica gel in the storage boxes replaced.

The artifacts were treated over a period of two weeks. After discussions with the Director of the museum, it was decided that the artifacts would be placed into RPSystem storage. Due to the fact that each of the artifacts came from different years, and subsequently various areas of the storeroom, it was decided that the artifacts would be packed in individual bags.

Of particular interest in this survey is that five of the 31 copper alloy artifacts were treated in the 2009 season. 2009 was the first season in which the artifacts were not given a chemical treatment to stabilize the corrosion, with the intention to be given passive preventive conservation with the use of RP System. The artifacts that were in the museum were not stored in RP System, and consequently signs of active corrosion were apparent after one year in storage.

Of specific interest in the proceeding Museum Surveys will be the percentage of 2009 artifacts displaying bronze disease in comparison to those given similar treatment in 2010 and stored in the RP System™. Refer to the 2010 Preventive Conservation report for more information on the Museum Survey.

4.0. ARTEFACT TREATMENT

Over the season, a total of 129 artifacts were treated. Of these, there were 80 from Büklükale, 33 from Kaman-Kalehöyük, and 16 from Yassıhöyük. Of the 33 treated from Kaman-Kalehöyük, 3 were previously uninventoried artifacts that were identified during the Metals Survey in 2009 as historically significant.

The following table is a breakdown of the numbers by material type.

Material	Number of Previously Untreated Artifacts	Number of Re-treatments
Copper/ copper alloy	94	31
Iron	14	6
Silver	4	
Lead	2	
Wood	5	
Baked clay	5	1
Stone	2	
Glass	1	
Gold	1	
Clay	1	

4.1. Copper/Copper Alloy

In continuation from the treatment protocols established in the 2009 season, all metal artifacts were given mechanical cleaning only. Any loose pieces were adhered to the artifacts using a 40% w/v solution of Paraloid B72 in ethanol:acetone 3:1. The artifacts were not given a surface coating after treatment.

The only exception to this treatment protocol was the artifacts from the Museum exhibition cases. Since there is currently no data on the environment inside the display cases in the Museum, the seven copper/copper alloy artifacts that were removed from the display cases were treated chemically. After mechanical removal of active corrosion, the artifacts were immersed in a 0.1M BTA (benzotriazole) 0.01M AMT (2-amino-5-mercapto-1,3,4-thiadiazole) mix in ethanol. Artifacts were immersed in this solution for one hour. After immersion, the surfaces were cleaned off with ethanol. This solution was selected on the basis of research initially conducted at Kaman Kalehöyük by Stavroula Golfomitsou, in which she found that this solution provided the best long-term inhibition on copper/copper alloy artifacts from Kaman-Kalehöyük.

4.2. Iron

All iron was mechanically cleaned of loose soil and loose flakes of corrosion. Bulk corrosion removal was only undertaken on iron artifacts when the voluminous corrosion was disguising the artifact. Any loose pieces were adhered to the artifacts using a 40% w/v solution of Paraloid B72 in ethanol:acetone. The artifacts were not given a surface coating after treatment.

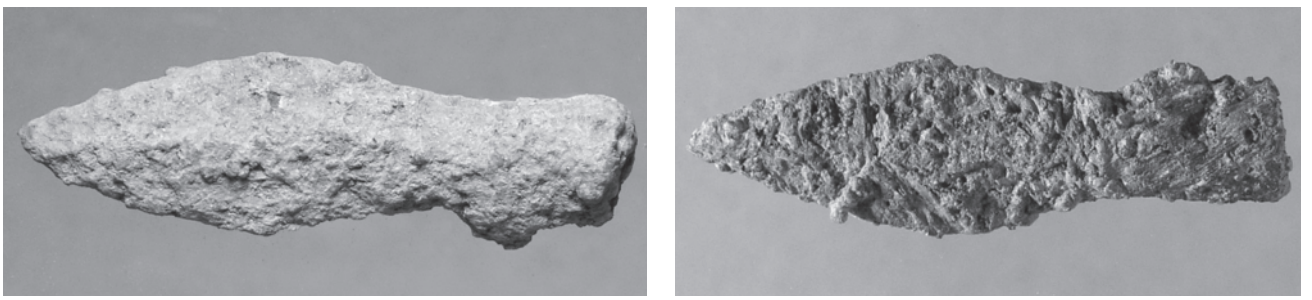

Photo 3 Spearhead before and after treatment with retained psuedomorphic details

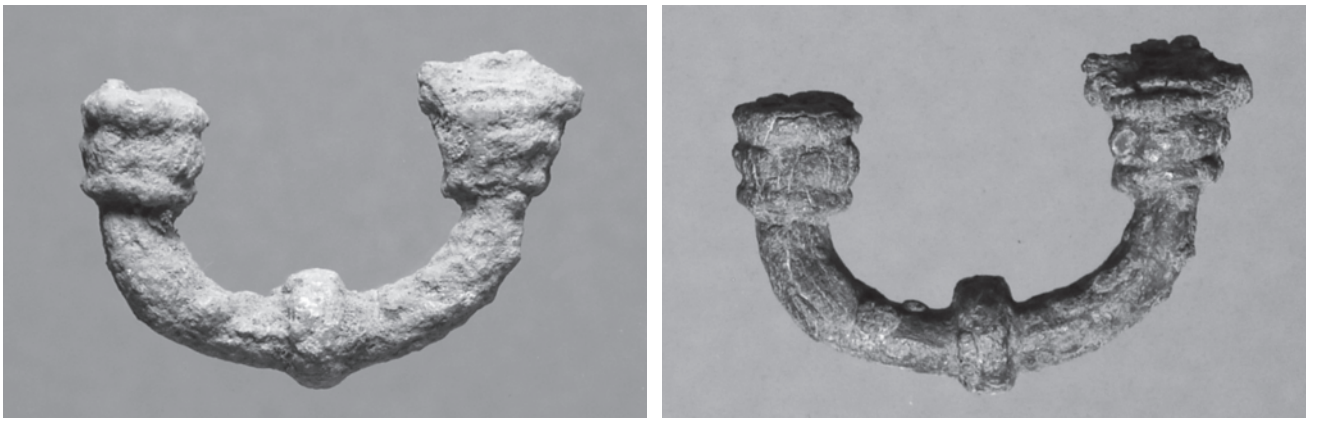

Photo 4 Fibula before and after treatment

4.3. Silver

Silver surfaces were cleaned of soil by swabbing with solvent. In some small areas, some mechanical cleaning was undertaken to remove the solidified soil.

4.4. Lead

Lead artifacts were mechanically cleaned of soil and loose corrosion. Care was taken during the treatment of lead to ensure that all conservators were aware it was being treated, and consequently were wearing appropriate Personal Protective Equipment (PPE) while in the vicinity.

4.5. Wood

Two of the five wood artifacts that were treated were given surface cleaning. One of the wooden beads was structurally unstable, and a 30% w/v solution of Paraloid B72 in aetone:ethanol 3:1 was applied under the loose areas.

Of particular interest were three sections of charred wooden floor excavated from Büklükale. These were consolidated on site before lifting. The wood was first cleaned of all surface dirt and any small excess fragments of charcoal. Further consolidation was conducted with a 5% solution of Paraloid B72 in acetone:ethanol 3:1. After cleaning and consolidation of the reverse, the structure of the wood could very clearly be seen. The wood is stable, however cannot be handled.

Depending on the final intentions, it may be necessary to construct museum mounts for these pieces. If so, consideration should be made if it is possible to display both sides.

4.6. Baked Clay

Baked clay artifacts were cleaned of loose soil with bamboo skewers, pins and brushes. One vessel was reconstructed- the join edges of the ceramic were consolidated with a 5%w/v solution of Paraloid B72 in acetone, and the pieces adhered together using a 40% w/v solution of Paraloid B72 in acetone:ethanol 3:1.

One baked clay pot from the Museum was cracked and consequently structurally unstable. A 20% w/v solution of Paraloid B72 was wicked into the cracks to stabilize the cracks.

Of particular interest was a Hittite tablet that was brought in for conservation prior to analysis by Mark Weeden. The surface of the tablet was covered in soil and plaster. In order for the markings to be read, it was necessary to clean the surface. The tablet was cleaned by each of the conservators for several days under the microscope with bamboo skewers, pins and scalpels.

4.7. Glass

One glass bead was brought into the laboratory displaying signs of iridescence. The glass was rinsed for one hour under running tap water and then dewatered in a bath of ethanol.

4.8. Stone

Three stone seal artifacts were brought into the laboratory. The surfaces were cleaned of soil, and an impression made of each of the seals.

4.9. Gold

The gold surface was cleaned of soil by brushing and immersion in ethanol.

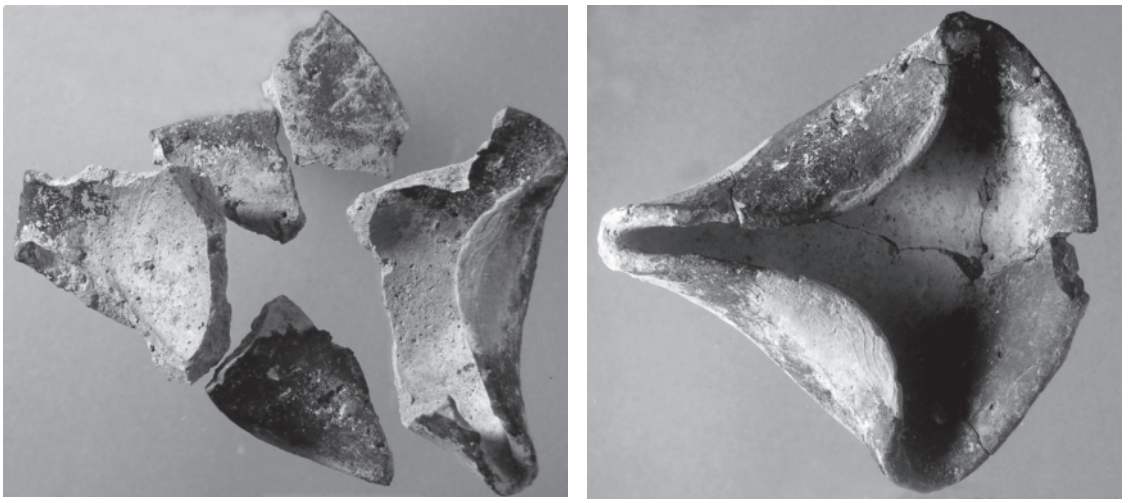

Photo 5 Ceramic vessel before and after conservation treatment

4.10. Clay

One bulla was brought into the laboratory. The clay was quite fragile, and was consolidated with a 5% w/v solution of Paraloid B72 in xylene.

5.0. HEALTH AND SAFETY

Health and safety of personnel is tantamount in the laboratory, so this season an emphasis was placed on the current health and safety practices. An inventory was undertaken of all the chemicals currently stored in the laboratory, analyzing their use and their respective health, environment and incompatibility ratings.

The current chemical storage facilities include a two compartment Justrite polyethylene acid cabinet with a capacity of 30L, which is used to store both acids and other chemicals in solution, and an unsealed, unventilated, unlocked metal cupboard in which the rest of the chemicals, including volatile solvents, are kept.

Incompatible chemicals are currently stored together, which is extremely dangerous, particularly in an area that is prone to earthquakes. The reaction between these chemicals can be explosively violent. Highly incompatible substances, such as oxidants, must be stored separately.

The oxidizing agents were placed in a sealed polyethylene container, in an attempt to keep these separated. In addition, the storage cabinets were given HazMat labels, including irritant, corrosive, flammable, cancer hazard, poison and oxidizing, and a chart describing the hazard ratings. It must be ensured that permanent labels are affixed to the new storage cabinets. A glove chart was also affixed to the shelving to ensure that the correct gloves can be selected when working with chemicals.

During the audit, each of the chemicals was examined for expiration or purchase dates, and correct labeling. There are currently many containers of chemicals that have highly inappropriate safety labeling, including chemicals of known carcinogenic, mutagenic and tumorigenic properties.

Since the shelf life of these unlabelled chemicals is unknown, they have been set aside for disposal. Attempts were made to find a hazardous waste disposal company that could dispose of these chemicals and waste from the season appropriately, however a company could not be procured. It is very important for the safety of the staff, the building and the environment that a waste disposal company is found for next season.

Environmental and heath ratings of chemicals change as new research is undertaken, so whilst undertaking the inventory of the chemicals, the corresponding Material Safety Data Sheets (MSDS) were examined for accuracy. It was found that most of the MSDS were out of date, and therefore were replaced. In addition, there were many MSDS pertaining to chemicals that are no longer used in the laboratory. Those that described particular conservation related brand substances have been retained in a separate folder for future reference. It is essential that the amount of chemicals stored on site is kept to a minimum, and that the MSDS are updated regularly.

Photo 6 Consolidation of a fragile ceramic piece before lifting

Photo 7 Conservators Elçin Baş and Anna Shepherd preparing a wooden post for block lifting

6.0. STORAGE AREAS

There are now six separate buildings that have been designated as storage areas. The current storeroom, the Depo storeroom, is located beneath the temporary accommodation area. There is two new storage areas, climate-controlled and non-climate controlled, in the courtyard of the Institute. This season, three additional buildings have been commissioned as storage areas, which includes the old Conservation Laboratory, to house Kaman-Kalehöyük artifacts, the former Photographic Studio, to house Büklükale artifacts, and the former Analytical Laboratory, to house Yassıhöyük artifacts. Currently, artifacts are only stored in the Depo Storage room and the former Photographic Studio.

A survey on the conditions of the storerooms was undertaken, the intention of which was to outline the current and potential problems that could be encountered. The main areas of focus were building alterations to improve the environment within, the internal furnishings, and the risks to the collections, such as fire, water, security and biological activity. Recommendations were made in regard to each specific issue.

This season was an advantageous time to undertake a survey of the storerooms, as once artifacts begin to be housed in these areas, any repairs or maintenance, particularly structural alterations, become logistically difficult. It is therefore hoped that the recommended repairs can be undertaken in the immediate future.

The survey of the Depo storage uncovered some minor leaks and biological growth, of which temporary measures were undertaken to contain. It is understood that in the following year, the accommodation will be removed from above the Depo storeroom, and in doing so, the water source removed. It will therefore be necessary in the following season to undertake a full disinfection of all the affected artifacts.

In order to make an informed recommendation on which areas are most suitable for certain material types, a full analysis of the environmental data must be conducted. In conjunction with the report on the storage areas, HOBO dataloggers were placed in each of the storerooms in order to obtain one years worth of comparable data on the environmental conditions. It would be most advantageous if a repeat of this analysis could be undertaken after the suggested building alterations had been completed.

For more information on the storerooms, please refer to the 2010 Preventive Conservation report.

7.0. FIELD WORK

The Conservation Department was required on site several times this season for consolidation and lifting of fragile artifacts. Artifacts that were excavated included two extremely corroded metal pieces, wooden posts, and a large ceramic vessel found placed over a hearth, which required consolidation and facing of Japanese tissue and cheesecloth before lifting.

In sector 56, large areas of charred wooden floor and posts were revealed. Of these areas, seven different sections that were in particularly good condition were selected for dendrochronology and carbon-14 dating.

All of the lifting blocks were constructed of a layer of plastic cling film or aluminum foil, which was then covered with plaster bandages.

On site training on block lifting was given to Sho Sugimoto, who will assist conservator Elçin Baş in excavating fragile finds after the conservation season has concluded.

8.0. STUDENT PROJECTS

Two Conservation interns, Tessa de Alarcon and Sofia Lo Bianco, undertook internships this season.

Tessa de Alarcon is undertaking the UCLA/Getty Conservation Program, Los Angeles. Her research was a continuation of the research conducted from 1999 by Stavroula Golfomitsou on the efficiency of corrosion inhibitors for archaeological copper alloys. In an attempt to reproduce the results that were obtained during previous testing,

Tessa conducted experiments on 25 uninventoried bronze pieces that were displaying signs of active corrosion, or bronze disease. Five samples were placed in solutions for each varying treatment. Solutions of 0.25M BTA (benzotriazole), and a mixture of 0.1M BTA (benzotriazole) and 0.01M AMT (2-amino-5-mercapto-1,3,4-thiadiazole) were used, and the time immersed was 1 hour and 24 hours. The samples were then placed in humidity chambers to promote corrosion formation, and each of the 5 experimental groups was observed for signs of active corrosion. It is hoped that the results from this experiment will assist in the selection of the most efficient bronze inhibiting solutions for future treatments.

Sofia Lo Bianco is currently in her second year of the Masters in Conservation at the University of Melbourne. Her research this year was to create a Risk Assessment document of the Museum, the storage areas, and the JIAA institute building where the laboratory is located.

The purpose of this document is as a predecessor to the creation of an Emergency Preparedness Plan. Various topics were investigated for risks to both artifacts and staff. The topics included fire, water, biological agents, contamination, physical forces, criminal activity, contaminants, light and ultraviolet radiation, temperature, relative humidity, custodial neglect and health and safety.

Photo 8 Intern Tessa de Alarcon examining a copper alloy piece for 'bronze disease'

Photo 9 Intern Sofia Lo Bianco analyzing the fire hydrants in the Kaman-Kalehöyük Archaeological Museum

9.0. LABORATORY METHODOLOGY MANUAL

Upon arrival at the site, it was noted that many of the methodologies outlined in the Laboratory Manual were out of date or no longer applicable; therefore a full review of the Laboratory Manual was undertaken.

The current treatment procedures do not include chemical treatment as a standard, and many of the products originally advised in the Laboratory Manual are no longer appropriate, therefore new documents were created outlining current treatment procedures for the different materials that are encountered in the laboratory. In addition, updated documents were created explaining use of the databases and computer systems.

It is important that these documents are regularly reviewed and maintained, particularly in view of the fact that there is often new staff each season.

10.0. RECOMMENDATIONS

10.1. Health and Safety

Conservation treatments require a number of hazardous chemicals, and it is crucial that staff is supplied with the correct safety information and equipment for using such chemicals.

It is absolutely imperative that a ventilated, fire resistant, lockable solvent cabinet be purchased for the laboratory. There are currently chemicals stored in the unventilated cabinet that are known carcinogens, mutagens, tumorigens and reproductive effectors. It is unacceptable that staff is exposed to such hazardous chemicals due to inadequate storage facilities.

In addition, the buildup of such a mixture of volatile organic vapors in a confined area is an extreme fire hazard, and poses risk to the safety of the entire facility.

A chemical hygiene plan should be created, which will cover all aspects of the chemicals storage, use and disposal. In addition, it would be beneficial if all staff were given a safety briefing upon arrival so that they are familiar with all the equipment and emergency procedures, and an emphasis given to updating safety information and equipment when necessary.

There is currently two water hose fire extinguishers housed in the laboratory, however both of these are out of date. In consideration of the equipment and chemicals used in the laboratory, it is highly advisable that these be replaced with two dry chemical fire extinguishers.

10.2. Equipment

An x-ray machine is an invaluable tool in the analysis, identification and treatment of corroded archaeological metals, and would be a great advantage for the Conservation Department.

Currently, there is no means of identifying the metal core beneath the corrosion products prior to removal of corrosion. An x-ray is able to give information on the underlying material, thereby facilitating the removal of corrosion products and reducing the risk of inadvertent losses. In addition, and x-ray can show small areas of metal such as gold and silver gilding which may be fragmented and locked in the corrosion layers..

There are currently many small metal finds that are not inventoried. Time constraints prevent all of these artifacts from being cleaned of soil and corrosion. It is likely that some of these may be historically significant pieces, and will not be identified. Bulk x-rays of small finds could be undertaken to see what, if any metal, is beneath the accretions.

Currently there is only one gooseneck optical fiber light in the laboratory for use with the microscopes. In order to overcome this, desktop lamps were rigged up to microscopes to illuminate the artifacts being worked on, the light from which was both inadequate, causing severe eye strain and in some cases constantly watering eyes, and was uncomfortably hot to work under. Proper lighting equipment would ensure that the best possible treatment can be given to the artifacts, and avoid adverse health effects.

The computer that is used in the laboratory is quite old, resulting in wasted time during data entry. In addition, the continual power cuts results in constant loss of information, which must be reentered. It would be of great benefit if the current iMac desktop could be replaced with a laptop. This would not be affected by power cuts, and would be able to be used in the storage areas when necessary.

10.3. Storage areas

Suitable storage conditions decrease the chance of deterioration, ensuring the long-term preservation of the artifacts, and reducing necessary treatment times. It is highly recommended that the building repairs be conducted on the storerooms as soon as possible, particularly in relation to the ongoing problems in the Depo storeroom, and on the new storerooms that are currently unoccupied.

10.4. Museum

It would be greatly beneficial if Museum staff members were given training and workshops on the appropriate handling and storage techniques for artifacts. In addition, in order to ensure the preservation of the artifacts in the collection, it is necessary to conduct testing on the materials used to construct both the display cases and the storage shelves to ensure the safe display and storage of artifacts.

11.0. ACKNOWLEDGEMENTS

The Conservation Department would like to thank Dr. Sachihiro Omura and Dr. Masako Omura for their dedication to the Conservation Department, and their ongoing support and infinite patience, and Dr. Kimiyoshi Matsumura for his knowledge and assistance, particularly with relation to the growing conservation databases.

Many thanks also go to Alice Boccia Paterakis for her endless and greatly appreciated support and knowledge throughout the season, and for her dedication in improving all aspects of the Conservation Department.

The Conservation Department would also like to thank all the staff and students at the JIAA for their knowledge, assistance and friendship over the season.

12.0. BIBLIOGRAPHY

Heally, Colleen
2013 "Field Conservator's Report 2009 Season", *AAS* XVIII, pp. 73-81.

Lipcsei, Laura
2006 "Conservation Director's Report 2005 Season", *AAS* XV, pp. 103-109.

Odegaard, N., S. Carroll and W.S. Zimmt
2005 *Material Characterization Tests for Objects of Art and Archaeology* (2nd edn), London.

Zaitseva, Nina
2007 "Conservation Report 2006", *AAS* XVI, pp. 85-96.

Anna Shepherd
Conservator
akshepherd@gmail.com