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# CONSERVATION AT KAMAN-KALEHÖYÜK, TURKEY, 2008

ALICE BOCCIA PATERAKIS

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## ABSTRACT

The activities of the Conservation Department of the Kaman-Kalehöyük excavation in Turkey are reported as of 2008. The annual conservation student internship program has been reinstated and emphasis is placed on the conservation student research projects. An iron and a bronze stabilization project dating from 1999 to 2001 have been assessed and the results presented in abbreviated fashion. Plans for the expansion of the Japanese Institute of Anatolian Archaeology and the new museum at Kaman are outlined.

## 1. THE EXCAVATION

The excavation of Kaman-Kalehöyük commenced in 1986 by the Japanese Institute of Anatolian Archaeology under the auspices of the Middle Eastern Cultural Center in Japan (fig. 1). Located approximately 104 km southeast of Ankara, the site is a city mound or 'tel' of approximately 280 meters in diameter and 16 meters in height. The site lies along the ancient Silk Road trade route and represents three main cultural levels: Islamic, Iron Age (Phrygian), and Bronze Age (Hittite Empire, Old Hittite and Assyrian Colony period). The excavation provides a rare glimpse into the life of a rural settlement in Anatolia between the early Bronze Age (2300 BC) and the end of the Ottoman period (17<sup>th</sup> c).



Fig. 1. Kaman-Kalehöyük excavation (Photograph by the Middle Eastern Cultural Center in Japan)

## 2. CONSERVATION

Conservation has been an active element of the excavation since 1986 contributing to the successful collaboration today between conservators, archaeologists, and related specialists at Kaman-Kalehöyük. The site has produced thousands of artifacts. Most of the objects are in storage at the campsite, though a small part of the collection is housed in the Kirşehir Museum, located 30 miles from the excavation. Conservation assists the archaeologists and the other specialists including archaeometallurgists, zooarchaeologists, osteoarchaeologists, archaeobotanists, and geoarchaeologists in the retrieval of maximum information from the objects by carrying out material characterization examinations, technical studies, sampling procedures for analysis, non-invasive and reversible conservation treatments, and preventive conservation measures for long-term preservation.

The activities of the Conservation Department fall into four broad categories: (1) active field conservation, (2) treatment of artifacts in the conservation laboratory, (3) research and education, (4) condition surveys and storage. Conservators participate frequently in the field, aiding the archaeologists in the consolidation and lifting of fragile artifacts. Conservators oversee packing required for the successful transport of artifacts to the conservation laboratory, located 2 km from the site, and between the storage areas and the museum. Condition surveys of the collection are carried out both in-house (2 km from the site) and off-site in the Kirşehir Museum (40 km from the excavation).

## 3. CONSERVATION RESEARCH AND EDUCATION

Glenn Wharton initiated the conservation student internship program in the early 1990s. The students are trained in the field and in the conservation laboratory. Each student selects a research project that focuses on conservation materials and methods for a particular material group or aspect of the Kaman collection. The conservation students and staff publish their reports at the end of the season in the journal *Anatolian Archaeological Studies (AAS)*, published in English by the Japanese Institute of Anatolian Archaeology. The Table of Contents for every issue of the *AAS* is available on the website of the Japanese Institute of Anatolian Archaeology, [www.jiaa-kaman.org/en/aas/index16.html](http://www.jiaa-kaman.org/en/aas/index16.html). Some of the student projects from past seasons are awaiting a final assessment and write-up. Two student projects, one dealing with the stabilization of iron and the other with the stabilization of copper alloys, were assessed and finalized in 2008.

### 3.1 IRON STABILIZATION PROJECT

In 1999 and 2000 Laramie Hickey-Friedman carried out two separate tests for the stabilization of iron artifacts: alkaline sulfite desalination and anoxic/desiccated storage. Hickey-Friedman treated iron from Kaman-Kalehöyük with alkaline sulfite: one group of iron artifacts was treated at Kaman and another group was treated at the University of Delaware, Winterthur (Hickey-Friedman 2000). They have been stored in polyethylene Ziploc bags with silica gel inside closed Tupperware-like containers in the Conservation Laboratory since the completion of treatment. The silica gel was regenerated annually. Laramie Hickey-Friedman also tested the Revolutionary Preservation System (RP System) for storage of a different group of iron objects (Hickey-Friedman 2001). In 2008, both projects were assessed by examining the condition of the objects in order to compare treatment methods and storage materials.

### 3.1.1 Alkaline Sulfite Method

The results showed very clearly that the alkaline sulfite treatment method must be followed exactly as described in the literature (North and Pearson 1978; Kaman-Kalehöyük 2002). In 2008 it was determined that the iron treated at Kaman was unstable whereas those iron objects treated in Winterthur were stable. The reason for this was determined to be inconsistency in treatment method: the objects were not sealed during treatment of the objects by immersion in alkaline sulfite in Kaman, thereby allowing exposure to oxygen and causing the sulfite scavenger to convert to sulfate and reduce the efficiency of the treatment. This may be attributed to inadequate laboratory equipment.

### 3.1.2 RP System

Laramie Hickey-Friedman also tested the efficiency of the RP System for storage of a different group of iron objects (fig. 2) (Hickey-Friedman 2001). In the RP System, the object is enclosed in an Escal bag with an oxygen absorber and an oxygen indicator. Due to limited supply, RH strips could not be placed in all the bags. The bag is either heat sealed or clipped shut with specially designed clips by Mitsubishi.

During the 2008 season the iron objects and storage bags from Hickey-Friedman's RP System tests were assessed (fig. 2). Oxygen had infiltrated to varying degrees, as indicated by the color of the oxygen indicator (pink indicates an anoxic environment). In 2008 the RH in those bags with RH strips was found to be very low: less than 10% RH. Therefore the oxygen absorber proves to be an extremely efficient desiccant over the long term.



Fig. 2. Kaman iron object 01000513, CO1-644 in Escal bag with oxygen scavenger. Blue color of oxygen eye indicates the infiltration of oxygen; RH strip indicates RH less than 10% (Photograph by Alice Boccia Paterakis)

### 3.2 COPPER ALLOY STABILIZATION PROJECT

A copper stabilization project was carried out by Stavroula Golfomitsou in 2000 and 2001. She treated bronzes from the Kaman excavation as well as new test coupons at the Institute of Archaeology in London. She tested benzotriazole (BTA), 2-amino-5-mercapto-1,3,4-thiadiazole (AMT), and 1-phenyl-5-mercapto-tetrazole (PMT) corrosion inhibitors, alone and in combination, on the Kaman bronzes. 22 test groups of 10 objects each were run, totaling 220 objects. She tested both water and ethanol as the solvent. The objects have been stored in closed Tupperware-like containers with silica gel (that was regenerated annually) in the Conservation Laboratory since 2000 (fig. 3).



Fig. 3. A few of the containers holding the bronzes treated with the corrosion inhibitors (Photograph by Alice Boccia Paterakis)

In 2008, after surveying all the bronzes treated by Stavroula Golfomitsou at Kaman, it was apparent that the most successful inhibition was provided by immersing the objects for one hour in a mixture of 0.1M BTA and 0.01M AMT (10:1 BTA: AMT) in ethanol in normal atmospheric conditions. For her test results on new copper alloy coupons from the Institute of Archaeology London, see Golfomitsou and Merkel 2007.

#### 4. EXPANSION OF THE JAPANESE INSTITUTE OF ANATOLIAN ARCHAEOLOGY AT KAMAN

The Japanese Institute of Anatolian Archaeology has instigated an ambitious building project with the goal of creating an international center for the study of Anatolian archaeology (fig. 4). Two octagonal buildings will house the conservation lab, zooarchaeology lab, archaeobotany lab, offices, library, auditorium, meeting rooms, etc. The two long narrow structures on the left are the storage rooms for the collection. The residence hall is seen in the right foreground.



Fig. 4. Architectural model of the expanded Japanese Institute of Anatolian Archaeology at Kaman  
(Photograph by Alice Boccia Paterakis)

#### 5. KAMAN MUSEUM

A museum is being constructed next to the new center that will house the most important artifacts from the Kaman-Kalehöyük excavation currently housed in the Kirşehir Museum, and those yet to be discovered. The new Kaman Museum has been designed to replicate the existing *tel*, or mound, from which all the artifacts were unearthed (fig. 5). The museum is scheduled to open to the public in July 2010. The funds for the construction of the Kaman museum were donated to the Turkish Ministry of Culture by the Japanese Institute of Anatolian Archaeology. The museum will be owned and operated by the Turkish Ministry of Culture who will take on full responsibility for the collection and maintenance of the museum.



Fig. 5. Architect's rendition of the new Kaman Museum that will house the collection from the Kaman-Kalehöyük excavation (Photograph by Alice Boccia Paterakis)

## 6. FUTURE CONSERVATION PROJECTS

In the summer of 2010 the Conservation Laboratory is planning to hold a workshop on Materials Characterization and Spot Testing to be presented by Nancy Odegaard and Scott Carrlee for archaeological conservators in Turkey. A symposium for archaeological conservators in Turkey is planned for the summer of 2011 at Kaman-Kalehöyük.

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## SOURCES OF MATERIALS

RP System: Escal roll, RP-3A and RP-5A oxygen absorbers, oxygen indicators, sealing clips  
Mitsubishi Gas Chemical America, Inc.  
655 3<sup>rd</sup> Ave., New York, New York 10017  
(212) 687-9030  
<http://www.mgc-a.com/>

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