

PROGRESS REPORT No3

April 13, 2000-June 21, 2000

“Documentation and Conservation of King Khasekhemwy’s Funerary Monument at Abydos”

David O’Connor, Matthew Douglas Adams

Egyptian Antiquities Project

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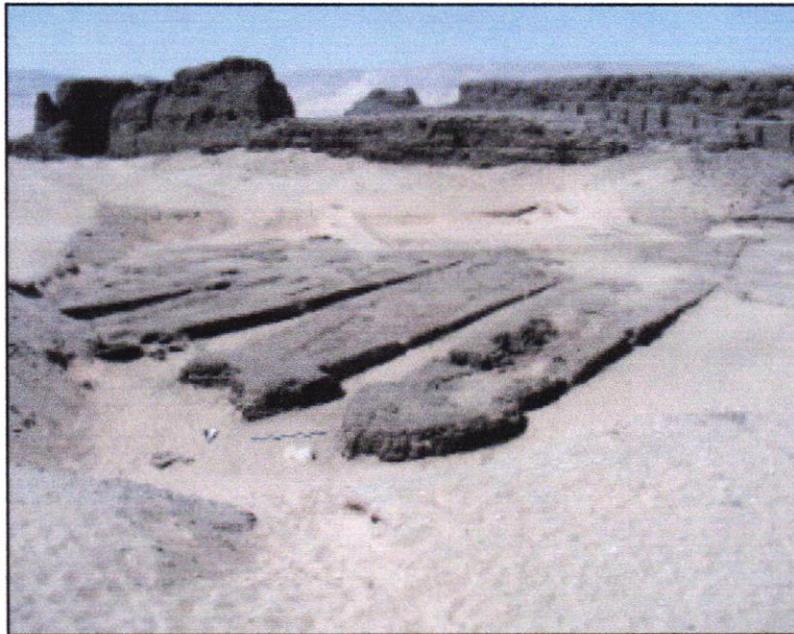
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6 APR 2001

DOCUMENTATION AND CONSERVATION OF PHARAOH KHASEKHEMWEY'S FUNERARY MONUMENT AT ABYDOS



Progress Report No. 3

April 1, 2001

David O'Connor, Sub-project Director
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Introduction

The second field season of the Egyptian Antiquities Project-sponsored sub-project "Documentation and Conservation of Pharaoh Khasekhemwy's Funerary Monument at Abydos" took place between April 13 and June 21, 2000. The aims of Field Season II were, as outlined in the Subgrant agreement, Attachment No. 2, Section 6.3, as follows:

- Establishment of a basic conservation laboratory at Abydos
- Selection of one of the 12 boat graves found in 1991 for excavation, detailed documentation, conservation, and analysis
- Excavation, documentation, and conservation of a selected Early Dynastic boat grave
- Stabilization and documentation in situ of the remains of one of the wooden boats, followed by removal for further stabilization and preservation under more controlled laboratory conditions
- Documentation of the wooden remains from a construction point of view and development of a model (on paper) of how the boat was made
- Documentation of the mudbrick structures containing the boats

These aims were successfully achieved during and after the field season, as will be discussed below in detail.

The team of Field Season II consisted of Matthew Adams, Associate Subproject Director, Lawrence Becker and Deborah Schorsch, Conservators, Cheryl Ward, Ancient Boat Expert, Dawn Landua McCormack and Nicolas Picardo, Archaeologists, and Susan White, Ceramicist. In addition, the subproject benefited from consulting visits to the site by Hiroko Kariya, conservator at the Brooklyn Museum and Chicago House, and Mr. Mohammed Mustafa of the underwater archaeology department of the Supreme Council of Antiquities.

The Sub-project Directors would like to express thanks to those who helped make Field Season II a success. Sincere thanks are due to the Supreme Council of Antiquities, Dr. Gaballa Ali Gaballa, Chairman, and its officials and representatives. Dr. Yahia el-Masry, Director General of Antiquities in Sohag Governorate provided invaluable assistance, as did Mr. Ahmed el-Khattib, Chief Inspector, Balliana. The sub-project benefited from the dedication of our inspector, Mr. Magdy el-Bedry. Particular thanks are due to the staff of the Egyptian Antiquities Project (EAP) at the American Research Center in Egypt, Cairo, for their assistance and support during Field Season II. Special thanks are due to Robert K. Vincent, Jr., Director of the EAP, for his continuing enthusiasm and support for the project. Special thanks are also due to Ms. Cynthia Shartzer, for her kind consideration and assistance in administrative matters. Mark Easton, Director of the American Research Center in Egypt, Cairo, provided extremely useful advice and support on a number of occasions. Very special thanks are due to Madame Amira Khattab, Assistant Director of ARCE, without whose many efforts Field Season II of the subproject almost certainly could not have been a success. Mr. Amir Abdel Hamid of ARCE as always assisted with many important logistical matters.

Chronology of Field Season II

The field season commenced with the arrival in Cairo on April 13, 2000, of the Associate Subproject Director. Additional members of the field team Lawrence Becker and Dawn McCormack arrived in Cairo on April 15. Deborah Schorsch, Conservator, was already in Cairo, and the Associate Subproject Director coordinated with her for her participation in the field season. The contract with the Supreme Council of Antiquities was signed by the Associate Subproject Director on April 16. Team members checked in with the security office of the SCA on April 17, with the exception of Lawrence Becker, whose clearance had not yet been approved. Team members received a security briefing from Craig Mass in the Regional Security Office of the United States Embassy on April 20. After delaying travel to Abydos for some days while actively, though unsuccessfully, trying to finalize the security clearance of Lawrence Becker, the Associate Subproject Director and team members Becker and McCormack, accompanied by Hiroko Kariya, traveled to Abydos on April 25. On April 29 the Associate Subproject Director met with Dr. Yahia el-Masry, Director General of Antiquities, Sohag Governorate, and the inspector for the season was appointed, Mr. Magdy el-Bedry. Work began on-site May 1, consisting of detailed mapping by the Associate Subproject Director and archaeologist Dawn McCormack of the topography of the area of the boat graves and the re-establishment of the location of the excavation units from the Pennsylvania-Yale Expedition's 1991 work. Excavation commenced May 4. Additional team members Cheryl Ward, Deborah Schorsch, and Susan White arrived at Abydos May 5, accompanied by Mr. Mohammed Mustafa. The work of all team members continued on site until their scheduled departures. The Boat Expert departed Abydos May 11, along with Mr. Mohammed Mustafa. Ceramicist Susan White examined material recovered from the boat grave area during the 1991 season, and initiated the analysis of the material recovered during Field Season II of the current subproject. Archaeologist Nicolas Picardo arrived at Abydos May 16, having checked in with SCA security and received a security briefing from the Regional Security Office of the U.S. Embassy while in Cairo the preceding two days. Conservator Lawrence Becker had been scheduled to leave the site May 10, but, given the delay in obtaining his security clearance, was able to arrange to stay an additional week, departing Abydos May 17. After the departure of the Boat Expert and Lawrence Becker, the Associate Subproject Director and Conservator Deborah Schorsch continued the cleaning, consolidation, and detailed documentation of the wood exposed in Boat Grave 10. Archaeologists Nicolas Picardo and Dawn Landua concentrated on the re-exposure and additional documentation of the better preserved boat graves found in 1991 and on the exploration of areas immediately to the northwest and southeast of the 12 boat graves previously known. Ceramicist Susan White departed the site May 23. On May 28 representatives of the Egyptian Antiquities Project arrived at Abydos for a site visit. During this visit the progress of the subproject with respect to both the Shunet el-Zebib and the boat graves was discussed, including the stabilization and conservation issues for the Shunet identified during Field Season I. The representatives of the E.A.P. departed May 30. The Associate Subproject Director traveled to Cairo on May 30 to do bank business at the Commercial International Bank, in response to the receipt of E.A.P. interim payment no. 1, and returned to the site June 2. Archaeologist Dawn Landua departed Abydos June 4. Conservator Deborah Schorsch, Archaeologist Nicolas Picardo, and the Associate Subproject Director concluded work on-site June 17 and departed June 18. Field Season II ended with the departure from Cairo of the Associate Subproject Director June 21.

General Comments

The startup of the field season did not take place in February, 2000, as scheduled. A late start for Field Season I (see Progress Report No. 1) and scheduling coordination with various team members necessitated an April, 2000 start to the season. Once the team was mobilized, an additional delay was encountered in gaining security clearance for Lawrence Becker, one of the two conservators. Given the extreme importance of the conservation aspects of Field Season II, the Associate Subproject Director determined to delay going to Abydos in order to attempt to resolve this situation. Various avenues were pursued, but after some days with little sign of progress, it was decided to proceed to Abydos, start the on-site work, in the hope that the situation would resolve quickly. Clearance came through within a few days of starting work at Abydos, and Mr. Becker was able to be an integral part of the field team.

The Associate Project Director, the Conservators, Boat Expert, Archaeologists, and Ceramicist worked closely and productively during the course of the field season. The complementary knowledge and skill sets of the various members of the team provided for a well balanced and integrated team.

In keeping with the plan of work for the season as outlined in the sub-grant agreement, excavation work aimed to re-expose the best candidates known from the 1991 season for evaluation of their potential for additional investigation and the selection of one boat grave for this investigation. Two areas from the 1991 excavations were re-examined. In the southeast area, 1991 units Operations 15, 17, 18, 19, 20, and 21 were re-opened, and a new unit, Operation 23, was excavated immediately south of Operation 21. These units are indicated in **Figures 1 and 2**. This re-exposed parts of Boat Graves 9, 10, 11, and 12 (see **Figures 3 and 5**). Additional documentation was undertaken on all structures, although Boat Grave 10 was examined in greater detail than the others and was the selection for the interior excavations this season. Boat Grave 10 was the location in 1991 of a small test cut which revealed with certainty that the brick structures contained wooden hulls, as the test cut showed the complete profile of the buried craft. It was jointly determined that the limited area between ancient intrusive pits in Boat Grave 10 presented the best potential for the work of the field season.

In Boat Grave 10, the 1991 test cut was re-exposed, and the area between it and a large ancient pit to the northeast was fully excavated. The excavated area within Boat Grave 10 is indicated in **Figure 3** and illustrated in **Figure 6**. The excavation entailed the careful removal of the mudbricks which had been used to fill in the wooden boat. Under the bricks, a thick layer of frass, the organic residue left by wood-consuming insects, was found, which followed the lines of the boat's hull. In some areas the original wood of the boat had been completely destroyed by insects. In many areas, however, substantial wooden remains were found. Significant lengths of the boat's wooden planks were found to be preserved under the frass, as is clearly visible in **Figure 6**. Substantial parts of five planks from the bottom of the hull were found, as well as three planks on the southeast side of the hull, and one on the northwest side. In some cases, important features relating to the boat's construction were well preserved or clearly indicated. The boat appears to have had series of closely spaced mortises running across its planks, as referred to by the Boat Expert in Attachment No. 1, and illustrated in **Figure 7**. Rope lashing appears to have been woven in and out of these holes, binding the planks together laterally. There was no

evidence of ribbing or of any other internal supporting structure. In the spaces between the planks were found the remains of bundles of what may have been tightly packed reeds, and it appears that these were used as a kind of sealant between the planks, to prevent water from penetrating the hull. No artifacts were found inside the boat in the excavated portion. The remains of the wooden hull were carefully documented in situ by systematic photography, detailed plans, section drawings, and written descriptions.

In a few areas on the southeast side of the boat in Boat Grave 10, where the wood of the hull had rested directly against bricks or mud plaster, there were the remains of pigment. Based on careful examination of these remains, it appears that the boat was, at least in part, painted yellow. Traces of similar pigment were detected on the brickwork of one other boat grave, adjacent to the remains of the wooden hull.

During the course of the excavation, the wooden remains were examined and consolidated by the Conservators, using a variety of methods, as determined by the condition of the individual pieces of wood (see Attachment No. 2). As a result, all the remains of the wooden hull in the portion of Boat Grave 10 excavated in Field Season II were able to be removed successfully for additional conservation treatment, study, and analysis and to be stored for further future analysis. Each plank or major part of a plank is stored in a specially constructed and prepared container, to ensure maximum protection and environmental stability.

In addition to the work in Boat Grave 10 and the re-examination of Boat Graves 9, 11, and 12, a new excavation unit, Operation 23, was opened at the southeast edge of the 1991 area. The work here had the aim of defining the margins of the Early Dynastic Boat Grave area more clearly. The work in Operation 23 revealed that there are two additional Boat Graves immediately to the southeast of Boat Grave 12 (see **Figures 3 and 5**). These have been designated Boat Graves 13 and 14. The architecture of Boat Grave 13, though damaged by ancient pitting and erosion, is quite clear in its overall lines in its northeastern half. Like the adjacent structures, it consisted of thick mudbrick containment walls, with the remains of a wooden hull inside. The interior of the hull appears to have been filled with brick, as in the other examples. One new aspect to Boat Grave 13 is that it was built contiguous to Boat Grave 12 (see **Figure 8**). All the Boat Graves to the northwest appear to have had at least some space between the structures at their widest part, while with Boat Graves 12 and 13, no space was left at all, and the bricks of the two abut for some meters. Boat Grave 14 was much more heavily damaged by ancient pitting. Enough remains, however, to determine that it, too, contained a wooden hull inside a mudbrick structure of the same general dimensions as the other examples. It appears to have been built contiguous to Boat Grave 13.

The stratigraphic position of Boat Graves 10 and 11 was examined relative to the remains of what appears to be a portion of the western wall of the "Western Mastaba," a royal funerary enclosure identified by Petrie and probably belonging to the later First Dynasty. It appears, from the stratigraphy, that these boat graves are earlier than the "Western Mastaba." It was determined in 1991 that the northwestern boat graves pre-date the construction of the funerary enclosure of Khasekhemwy of the Second Dynasty. This new evidence suggests that they may in fact belong to the earlier part of the First Dynasty.

In the northwestern of the two 1991 areas re-examined this season, eight excavation units were re-opened: Operations 1, 2, 5, 7, 8, 10, 11, and 12, as indicated in **Figures 1 and 2**. In addition, a new excavation unit, Operation 24, was opened immediately west of 1991 unit Operation 2. These units exposed all or part of Boat Graves 1, 2, 3, and 4, as indicated in **Figure 3**. The details and condition of the brick containing structures of these Boat Graves were re-studied and documented in detail, supplementing the data from the 1991 work. Particular attention was given to understanding the damage caused to the boat graves by ancient pitting. Boat Grave 1 appeared, based on the 1991 work, to be the least damaged by pitting of the northwesternmost examples, although its northeastern end was apparently destroyed by the construction of a later tomb shaft. Operation 24, a new excavation unit this season, was located so as to expose the area of Boat Grave 1 not seen in 1991, as well as to study the nature of the area northwest of the boats. The work in this unit revealed that long after the construction of the boat graves, several tomb shafts were dug in the area adjacent to Boat Grave 1, damaging its northwestern side (see **Figure 3**). These shafts appear to have been heavily looted in ancient times, judging by a number of small broken and highly decomposed fragments of plastered wooden coffins and broken human bones disarticulated and scattered in the sand near the mouths of the shafts. In spite of the damage from the tomb shafts and other pitting damage, Boat Grave 1, with large areas of intact brick “fill,” still appears to be the best preserved of the northwesternmost constructions. In order to gather information to help evaluate the condition of the wooden hull contained in Boat Grave 1, a small electronic device to measure temperature and relative humidity (a “data logger”), was placed in the bottom of a small ancient pit in the middle of the southeast side of the structure.¹

In all areas in which new excavation was undertaken during Field Season II, all material was fully recorded, mapped, and documented. All artifacts were collected. In Operation 10, a large deposit of rough-ware pottery jars (“beer-jar” type) were found adjacent to the northeast end of Boat Grave 2. These jars may have originally come from inside this structure, since its northeast end was pitted out in ancient times, although it is also possible that they may have come from Boat Grave 3, having been dislodged when its northeast end was destroyed, also anciently. Among these jars were fragments of two Early Dynastic seal impressions. Unfortunately they are too weathered to be read easily, although it seems clear that they do not have a royal name. Their presence suggests, however, that future work in the area could lead to a clear determination of the king (or kings) for whom the boats were interred.

Team Activities

Associate Subproject Director

- General direction of Field Season II
- Coordination of the efforts of the archaeologists, conservators, and boat expert
- Facilitation of the work of the conservators and boat expert
- Working with one of the archaeologists to complete the detailed topographic mapping of the area of the boat graves

¹ Note that this data logger was successfully retrieved during Field Season III, and the results will be presented in a future progress report.

- Supervising the excavation inside a selected boat grave
- Supervising the re-exposure of additional boat grave structures
- Supervising the documentation of the remains of additional boat grave structures, including the systematic photodocumentation of the re-exposed remains and the collection of additional mapping detail not obtained in 1991

Conservators

- Selection of conservation supplies
- Setup of conservation lab at Abydos
- Coordination with archaeologists and boat expert
- Consultation on the selection of one boat grave for interior excavation, documentation, and conservation
- Evaluation of the stabilization and conservation needs of any wooden remains exposed through excavation
- Monitoring of the local environment of the wood in situ
- Cleaning and consolidation of wood and other organic remains anticipatory to documentation
- Stabilization of wood remains for removal
- Coordination with the Associate Subproject Director and archaeologists for the removal process
- Additional consolidation of wood and other organic remains after removal
- Preparation of wood and other organic remains for storage
- Monitoring of storage conditions

Ancient Boat Expert

- Coordination with Associate Subproject Director, archaeologists, and conservators
- Consultation on the selection of one boat grave for interior excavation, documentation, and conservation
- Detailed observation of wooden boat remains for preserved features and construction details
- Coordination with Associate Subproject Director and Conservators on the documentation of the wooden boat remains
- Coordination with Conservators on consolidation techniques

Archaeologists

- Working with the Associate Subproject Director to map in detail the topography of the boat grave area
- Undertake excavation to re-expose a number of the boat graves found in 1991
- Undertake excavation to clarify the setting of the boat graves and their relationship to surrounding Early Dynastic royal monuments
- Undertake additional documentation of boat graves initially exposed in 1991
- Undertake the documentation of additional archaeological discoveries made during Field Season II

Ceramicist

- Analyze ceramics found in and adjacent to the boat graves during the initial 1991 work
- Analyze ceramics found during Field Season II

Conclusion

The major goals of Field Season II of the E.A.P. sponsored sub-project “Documentation and Conservation of Pharaoh Khasekhemwy’s Funerary Monument at Abydos” were successfully achieved. A basic conservation laboratory was established at Abydos. One of the twelve boat graves found in 1991 was selected for excavation, detailed documentation, conservation, and analysis, and this work was undertaken. The wooden boat remains found inside were consolidated, documented, and removed for further conservation and analysis. The remains of the boat were documented with reference to construction methods and materials, and information was gleaned which will permit the reconstruction (on paper) of a major segment of the excavated boat.

Abydos Northern Cemetery

Pennsylvania-Yale-
Institute of Fine Arts Expedition
June, 2000



Figure 1 - The Shunet el-Zebib, the "Western Mastaba," and the area of the excavations of Field Season II.

Abydos Northern Cemetery

Pennsylvania-Yale-
Institute of Fine Arts Expedition
June, 2000

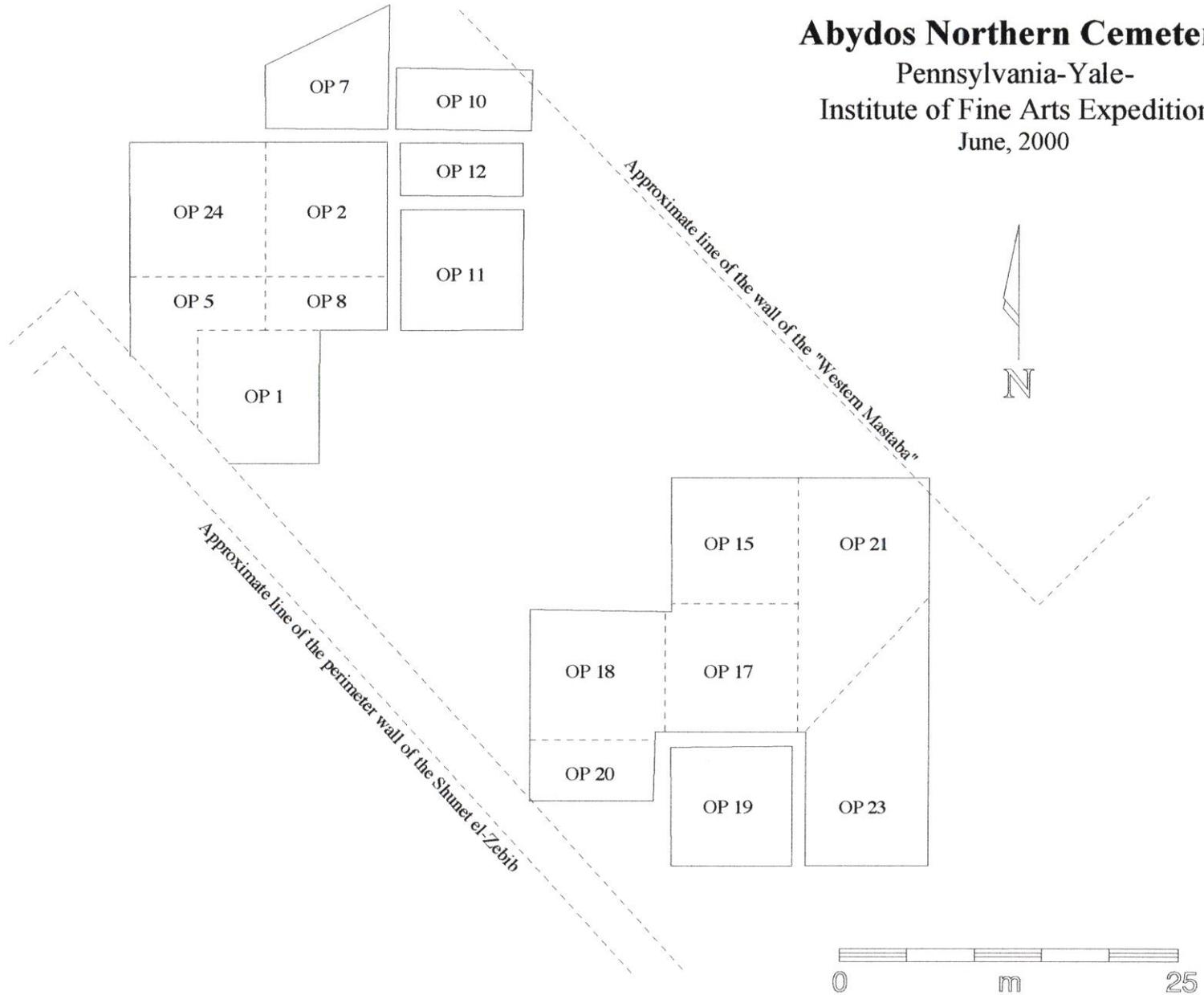


Figure 2 - Excavation unit designations. Operations 1, 2, 5, 7, 8, 10, 11, 12, 15, 17, 18, 19, 20, and 21 are units originally excavated during the Expedition's 1991 season. Operations 23 and 24 are from Field Season II.

Abydos Northern Cemetery

Pennsylvania-Yale-

Institute of Fine Arts Expedition

June, 2000

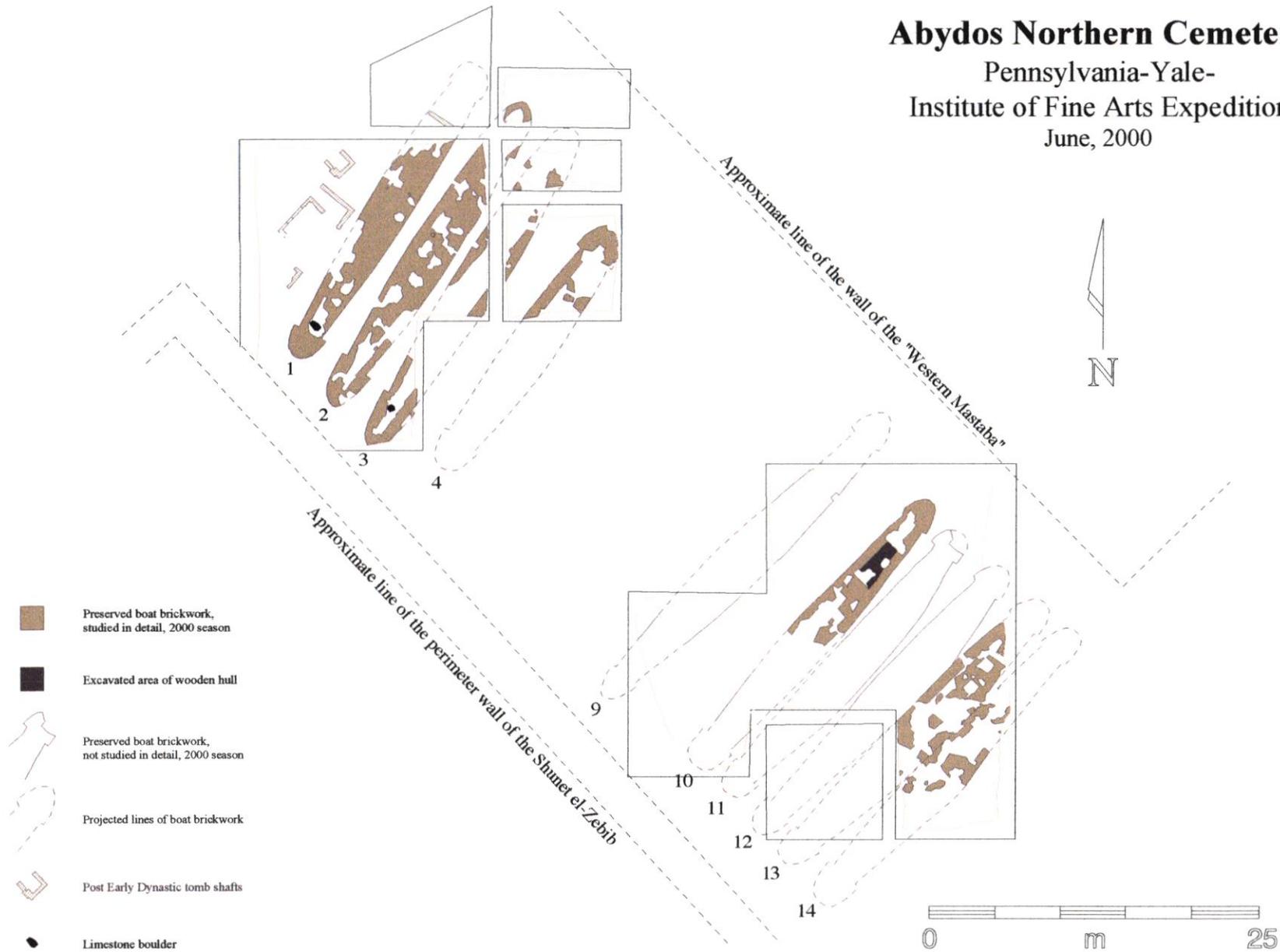


Figure 3 - Plan of the Field Season II Early Dynastic boat burial excavations. Individual boat burials are numbered.



Figure 4 – Boat Graves 1, 2, and 3, from left to right. The ancient pitting damage to the mudbrick containment structures is clearly visible. At the far left are the remains of tomb shafts, the construction of which damaged the northwest side of Boat Grave 1.



Figure 5 – Boat Graves 10, 11, 12, and 13, from right to left. The remains of Boat Grave 14 are behind 13. In the background is the Shunet el-Zebib, the funerary enclosure of Pharaoh Khasekhemwy of the Second Dynasty.



Figure 6 – The northeast portion of Boat Grave 10, showing the area of the interior of the hull excavated during field season II and the remains of the wooden planks.



Figure 7 – The bottom planks of the hull of Boat Grave 10. Mortise holes are clearly visible in several of the planks. In some cases the mortise holes have been filled with cellulose powder to protect them, indicated by the white areas on the plank second from the bottom in this photograph.



Figure 8 – Boat Grave 12 is on the right and Boat Grave 13 on the left. The area where they join is clearly visible in the center of the photograph.

Attachment No. 1
Abydos Boat Grave Excavations, 2000
Fieldwork Description and Preliminary Summary

Cheryl Ward
10 May, 2000

The 1991 discovery of 12 Boat Graves east of Khasekhemwy's funerary monument at Abydos more than doubled the number of ancient Egyptian watercraft known to exist. Clear traces of wood along the edges of the mudbrick structures suggested to the excavators that substantial remains of hulls probably would be found inside them. A single test pit, excavated in Boat Grave 10 (BB 10), showed a body section of a hull with reasonable structural integrity.

BB 10 (Operation 15, near locus 12) received most of my attention during my time at Abydos. I began by cleaning the old section cut and examining the exposed wood within the test pit. Both the north and south edges of the 1-meter-long pit have wood remains on the angled walls, but not on the bottom of the pit. A second pit (locus 12) was excavated, revealing well preserved wood on both the east and west sides of the pit as well as the edge of a bottom plank on the pit's north edge.

As mudbrick removal began in the area between the east edge of locus 12 and the old section cut, I examined the filling material and method of filling the boat's interior. A thick layer of mortar covered the uppermost level of bricks inside the boat, and bricks within the boat were set into very thick (3-5 cm) layers of mortar, with equivalent spaces between bricks. The mudbrick filling overlies a thick layer of degraded organic material, probably matting of some type (ca. 6 cm; in some cases up to 9 cm was observed). The matting, in some cases, is above a thin layer of mud plaster. Mud plaster is found both above and below wood surfaces on the sides of the vessel, but only beneath the bottom of the hull.

Approximately 3 m of the hull is now exposed. It is fragmentary for the most part, and, unfortunately much of the northern half of the hulls is extremely degraded and virtually lacking any original interior surface due to insect damage. The sides of the hull show the same type of damage: the reddish brown color remaining is actually particles of wood mixed with insect frass and desert sand rather than a solid substance. The southern half is better preserved, although much of it is missing due to the locus 12 pit.

The vessel was built using a previously undocumented style of construction. Planks which measure 11-14 cm in width and 6 cm in thickness were fastened together—indirectly—with lashing in the form of a flat strap threaded through lashing channels slanted down and out to the plank edge. Because each of the bottom planks is separated by between 2 and 5 cm of another sort of degraded insect frass/sand/organic matter and/or heavily constructed matting, I suspect that planks alternated with a non-wooden material, perhaps a bundle of reeds. The lashing mortises are the same dimensions as later examples in Egyptian watercraft: 7.5 cm long and 1.5 cm thick. Some lashing remained in mortises; samples were saved for later analysis, as were samples of matting/reeds.

The arrangement of the fastenings is not identical in the two planks on the southern half of the hull; I am frustrated at the lack of preservation on the northern side for comparison. Additional review of information and the last two hours on site may add more information here.

We are very near the end of the vessel here. Within 1.5 m along the hull, there is a 15 cm rise in slope and a narrowing of the hull by nearly 50%. There is no trace of any transverse or internal reinforcing component. There is something very curious about 25 cm below the sheer, however, and it may be that there is perhaps a shelf-like interruption of the side of the hull. More information will be gathered on this area before I leave.

In short, sufficient information on hull structure and design has been acquired to produce a preliminary report about construction practices and to reconstruct the vessel end's appearance on paper.

During the time spent recording and excavating BB 10, I saw several living termites and two gerbil holes were dug in the immediate area. Because of continuing insect damage and the risk to the wood of disturbance from animals, as well as water due to its lower elevation within the funerary complex, and because of the unique nature of the find, I recommend immediate stabilization and removal of the wood from the burial. We have disturbed it a great deal, and it is impossible to work on exposed wood after about 9 a.m. without creating potentially damaging situations due to aridity and heat. The wood has lost a great deal of its moisture during its burial, and is checked and breaks away easily.

Consolidation with Acryloid B-72 strengthens the timbers, and I recommend thorough consolidation whatever the disposition of the wood is to be.

Excavation and removal of the timber will allow it to be cared for in a more controlled environment, and I believe this can be accomplished in relative safety. It won't be possible to prevent the frass/decayed matter from deteriorating into an indistinguishable mass in some areas, but others may be more stable and retain some coherence should that be desired. Because the planks are fairly narrow, there will be less strain in the horizontal dimension. Some of them may be 2 m long, though, and there will be considerable longitudinal stress that will need careful packing and support of curved surfaces in order to achieve success in transfer.

I suggest beginning with the smallest and most stable plank (the southernmost bottom plank). Recovering the material on the sides of the vessel may best be accomplished in a block. The conservators will have to determine the most suitable method through experimentation, of course. They also will need to consider the packing and transport of the timbers over the up-and-down-dune landscape between the site and the storage place.

Boat Graves 1-9, 11 and 12

Clearance of all the Boat Graves has begun. Almost all of 1, 2, and 3 is exposed, and large sections of 11 and 12 can be seen. Wood is visible in each of the Boat Graves, but the large amount of pitting suggests that the wood will probably be fragmentary and damaged.

At this time, I emphatically recommend that no further wood be exposed. The high temperatures and low humidity cause almost instantaneous damage to these ancient organic artifacts. If large areas are exposed, the damage will be worse. We have had a difficult time managing shade and wind protection over a 2-m-long area, and better preparation for a larger-scale endeavor is necessary.

Of the exposed burials, it is Boat Grave 1 that promises the best possibility for wood preservation. Its surface is less pitted and its elevation higher than those of other burials. Substantial areas of reddish-brown color along the edges of the eastern end of the burial indicate wood, but these are also insect damaged. I recommend consolidating any surface-level wood or wood remains and keeping them covered with sand to protect them while the burials are exposed.

Excavation of a better-preserved hull will be a challenge. I recommend a scaffolding system so that excavators will not put any pressure on the sides or bottom of the hull or the mudbricks filling it. It would also benefit the boat to have a windscreen erected on its northern side with the ability to shade the hull at will.

Selecting a cooler, moister time of the year will be vital to the success of the operation. I cannot stress this strongly enough. It will protect the wood and allow more time for study before moving the hull.

Summary

The excavation of the eastern end of Boat Grave 10 has been a success from the point of view of acquiring knowledge about ancient Egyptian funerary practices, hull construction techniques, and providing critical information about the condition of wooden boats buried more than 4700 years ago. A new method of hull construction has been identified, and conservators and excavators have been exposed to issues of preservation and concern.

I recommend excavating the exposed timbers in Boat Grave 10. I recommend that no other timber be exposed until cooler and moister weather conditions are present. I also suggest that excavation design for another hull include a scaffolding system to allow excavators to work without putting any pressure on the filling over the vessel.

It has been a great pleasure to work at Abydos on this project directed by David O'Connor and Matthew D. Adams with the support and cooperation of Egypt's Supreme Council of Antiquities and the Egyptian Antiquities Project.

Attachment No. 2
Early Dynastic Boat Grave Conservation Report

Lawrence Becker
Deborah Schorsch
September 20, 2000

Description of Find: A section of Boat Grave 10 that measures approximately three meters in length was excavated. The planks uncovered were located between two intrusive pits; a third pit had been cut into the south side of the area excavated. The planks had been lashed together making use of L-shaped mortises that were aligned in rows across the hull of the boat. No clear traces of the lashing were found. Non-continuous portions of ten planks were stabilized and lifted. On the northern half of the burial both wall and bottom planks rested directly on or adjacent to sand. Bottom planks on the southern half rested on loosely spaced mud bricks and wall planks were on bricks built up in a stepped pattern. The morphology of the vessels observed in a cross section during field examination strongly suggest that the wood, which is dark brown and seems to be relatively dense, is a hardwood. It is somewhat aromatic and is characterized by an unusually high resin content. Fiber matting that appears to have been used as caulking between the planks and probably as battens over the joints was preserved, and in some areas was consolidated and lifted. Thick layers of resin were observed both between and within the grain of several planks. Yellow pigment was found on wood and frass fragments from the south wall and was preserved on the adjacent mud bricks, particularly on the east end of the pit. Several samples of pigment, including one section with the ground intact, were retrieved.

Designation of Planks: The ten planks are numbered on the basis of their position in the burial (wall or bottom) using local (Nile) directions. There are five bottom planks (BP), three of which (BP 1-3) are broken and have designated east and west sections. There are four south wall planks (SW), one of which (SW 2) has east and west sections. There is one north wall plank (NW 1). Plank fragments were assigned ANC 00 numbers according to date of retrieval.

Condition: The condition of the wood varies from plank to plank but all suffered serious deterioration. Planks on the north wall of the section excavated were almost entirely reduced to frass, which retained the original shape and dimensions of the hull. Insects had also attacked the surviving planks, severely undermining their structure, and in many cases features of manufacture on the upper surfaces were preserved in compacted frass rather than in the wood itself. It is possible that insect attack is ongoing. It was not possible to measure directly the moisture content of the wood. Even with the small amount of moisture it can be estimated to contain, however, the wood is "wet" in comparison to the extremely dry environment of the desert surface during the excavation season. The planks clearly had been exposed to a more moist burial environment for an extended period in the past as the surviving wood shows evidence of attack by fungi, which has left the wood severely checked and in many places entirely lacking physical cohesiveness. Attack from insects and fungi was especially severe on the sides of the

planks and after the removal of frass and disassociated fragments, the adjacent edges of only two planks (BP 1, west & SW 1, west) were in close contact. Some areas contain appreciable amounts of recrystallized salts. It appears that the undersides of the planks resting on mud bricks rather than directly on sand are more well preserved.

Field Conservation: Frass, loose wood fragments, matting fibers, sand and miscellaneous debris were removed from the top and sides of the plank fragments during excavation. All wooden surfaces, as soon as possible after exposure, were consolidated with acryloid B-72 (methylacrylate – ethylmethacrylate co-polymer) in acetone / ethanol dripped from syringes without needles. The consolidant sealed the surfaces, rendering the wood less vulnerable to the desiccating effect of the desert air, and improved the physical strength and cohesiveness of the plank fragments. Often several applications were necessary to attain these improved properties. Disarticulated areas or those otherwise particularly vulnerable to the breaking off and dispersal of fragments were consolidated with a brushed application of molten cyclododecane, sometimes with a nylon gossamer facing. Thin corner sections isolated by the cutting of the L-shape mortises were reinforced by packing the mortises with cellulose powder and covering the openings with nylon gossamer and cyclododecane. Pigment found on the mud bricks of the south wall was consolidated with methylcellulose.

Excavation and field conservation started in the early morning and proceeded only for as long as it was possible to shade the trench. At other times the planks were protected from heat and wind with lengths of tyvek laid directly onto their upper surfaces. Sheets of particle board formed a cover over the top of the trench.

Method of Retrieval: After the extant plank fragments had been excavated, consolidated with B-72 and documented, their upper surfaces and, where possible, their sides, were consolidated with one or more brushed-on applications of molten cyclododecane. The cyclododecane provided a temporary, rigid casing that enabled the planks to be moved. Facings of nylon gossamer were applied to areas with especially poor cohesion. Some of the consolidated planks were lifted by hand and placed directly into wooden boxes prepared with cushions for support. Others were turned to rest on their upper surfaces and fragments that fell away during this maneuver could be secured in place during the overall consolidation of the underside with B-72 that followed. In some cases, cyclododecane, without or without nylon gossamer reinforcements, was applied to the underside of these planks, which were lifted by hand and placed in boxes. The planks were shifted and lifted by hand because it was not possible to find locally a material capable of undercutting the compacted sand or mudbrick under the planks and supporting them from below.

Post-Retrieval Cleaning and Stabilization: Some planks were retrieved without consolidation of their undersides; in these instances the undersides were mechanically cleaned and treated with B-72 after they were brought from the site. Several planks received additional applications of cyclododecane on one or both sides, sometimes with nylon gossamer “band-aids”, to improve physical stability. In some instances, fragments for which an exact location was known were reattached using B-72 or cyclododecane,

with the choice of material depending on the fit of the join. Specific details of the retrieval of the plank fragments and subsequent conservation treatments are outlined elsewhere.

Storage: Thirteen wooden boxes with lids were prepared in the following manner to accommodate intact plank sections:

- 1) The bottom of the box was covered with a sheet of non-archival foam or one sheet each of non-archival and archival foam (volara).
- 2) After the foam was in place, all inner surfaces of the boxes were lined with marvelseal (aluminum foil embedded in polyethylene sheet) using permacel archival tape on the interiors of the boxes and thumb tacks on their exteriors.
- 3) Most of the planks rest directly on a sheet of archival foam; small foam wedges and archival and non-archival cushions were used in some instances for extra support.
- 4) Each plank was covered with a folded over sheet of tyvek.
- 5) Each box was covered with a sheet of marvelseal or archival quality plastic sheeting below the wooden lid.

Fragments known to have belonged to a specific plank were placed in archival ziplock bags and stored in the appropriate box. Specific details of contents and storage conditions in each box are outlined elsewhere. The boxes were placed in the magazine, where a *Trakker* data logger programmed to measure and record temperature and relative humidity for approximately one year was placed. Other wood fragments were stored in archival ziplock bags in another location, along with a few fragments of pottery found in the boat, and samples of pigment, ground, and resin.

There are three potential dangers to the planks currently stored in the magazine. Volatilization of the cyclododecane, were it to occur, would severely or irreversibly damage the planks, which would lose the structural stability afforded them by the consolidant. This seems unlikely to occur as long as the boxes remain sealed but no study of the long-term behavior of cyclododecane under these conditions has been carried out.

A second consideration is biodeterioration. When wood fragments were placed in sealed containers, the relative humidity equilibrated at approximately 20 %. Because of the relatively dry state of the wood, biodeterioration probably will not occur, even though the boxes are sealed. If the wood was suffering from insect attack when it was excavated it will continue to do so.

There is also the question of possible chemical interaction between the various materials used to cushion and support the planks and the B-72 and cyclododecane applied to their surfaces. In some instances it was necessary to seal the boxes soon after the B-72 had been applied, possibly before the solvents in the consolidant were able to evaporate completely.

It is highly recommended that several boxes be opened for evaluation during the Fall 2000 season so that we can anticipate problems that may influence planning for the further conservation treatment, provisionally scheduled for Spring, 2001. In the absence of a conservator, this should be undertaken by someone knowledgeable with the condition of the planks at the time when they were placed in storage.

Retrieval, Treatment and Storage of Matting Fragments: Four embrittled but intact fiber matting fragments located over bottom and side planks on the west side of the boat were retrieved. The smallest fragment was lifted by hand without consolidation. The

other fragments were lifted after consolidation with molten cyclododecane applied with a brush. On two fragments nylon gossamer was used to face the upper surface. After the cyclododecane was allowed to sublimate, the fragments were consolidated with a weak aqueous solution of methyl cellulose or B-72 in acetone / alcohol. Nylon gossamer facings were applied to all or part of the undersides of the two largest fragments. The matting fragments are stored in the magazine in sealed containers with Art Sorb (silica gel) conditioned to a relative humidity of approximately 30 %. Specific details of the retrieval of the matting fragments and subsequent conservation treatments are outlined elsewhere.

Future Conservation Treatment of Boat 10: Extensive conservation treatment of the planks retrieved during the Spring 2000 season is necessary to make them accessible for study and to insure their future preservation. In addition, if the retrieval of another boat is being considered, it is necessary for the planning of the subsequent project to complete treatment of the planks and to evaluate the success and suitability of their treatment and storage.

The steps outlined below would be required for most planks. For some planks the first step would be omitted; different planks require more or less consolidation, gapfilling, and cleaning.

- 1) Exposure of the underside of the plank to allow sublimation of cyclododecane.
- 2) Removal of frass, sand, debris, etc. from underside of plank.
- 3) Documentation and study of underside of plank.
- 4) Consolidation of underside of plank with B-72 and gapfilling with an inert material.
- 5) Reattachment of contiguous fragments and application of facing tissue to underside of plank.
- 6) Turning plank and exposure of upper surface to allow sublimation of cyclododecane.
- 7) Removal of frass, sand, debris, etc. from upper surface of plank.
- 8) Consolidation of upper surface of plank with B-72.
- 9) Documentation and study of upper surface of plank.
- 10) Repacking plank for long-term storage.

Some planks may require consolidation with B-72 applied in the vapor phase. The treatment of the planks will require a large amount of space that can be ventilated to facilitate the sublimation of the cyclododecane and to control the exposure of the conservator to solvents.

Other Boat Graves: During the Abydos North Cemetery Spring 2000 season, seven other Boat Graves that were excavated in 1991 were reexposed and two additional, previously unknown burials were excavated. Although the boats themselves were not excavated, in many places wood was exposed. Attempts were made to keep these exposed areas covered as much as possible during the field season and each area was covered with tyvek or locally available semi-permeable synthetic fabric before the burials were covered with backfill. A small amount of yellow pigment found on a mud brick on the north side of Boat Grave 13 was consolidated with B-72. A *Trakker* data logger programmed to measure and record temperature and relative humidity for approximately one year was buried in as close proximity as possible to exposed wood in an intrusive pit cut into the south side of Boat Grave 1. This logger should be excavated and the data downloaded during the Spring 2001 season.