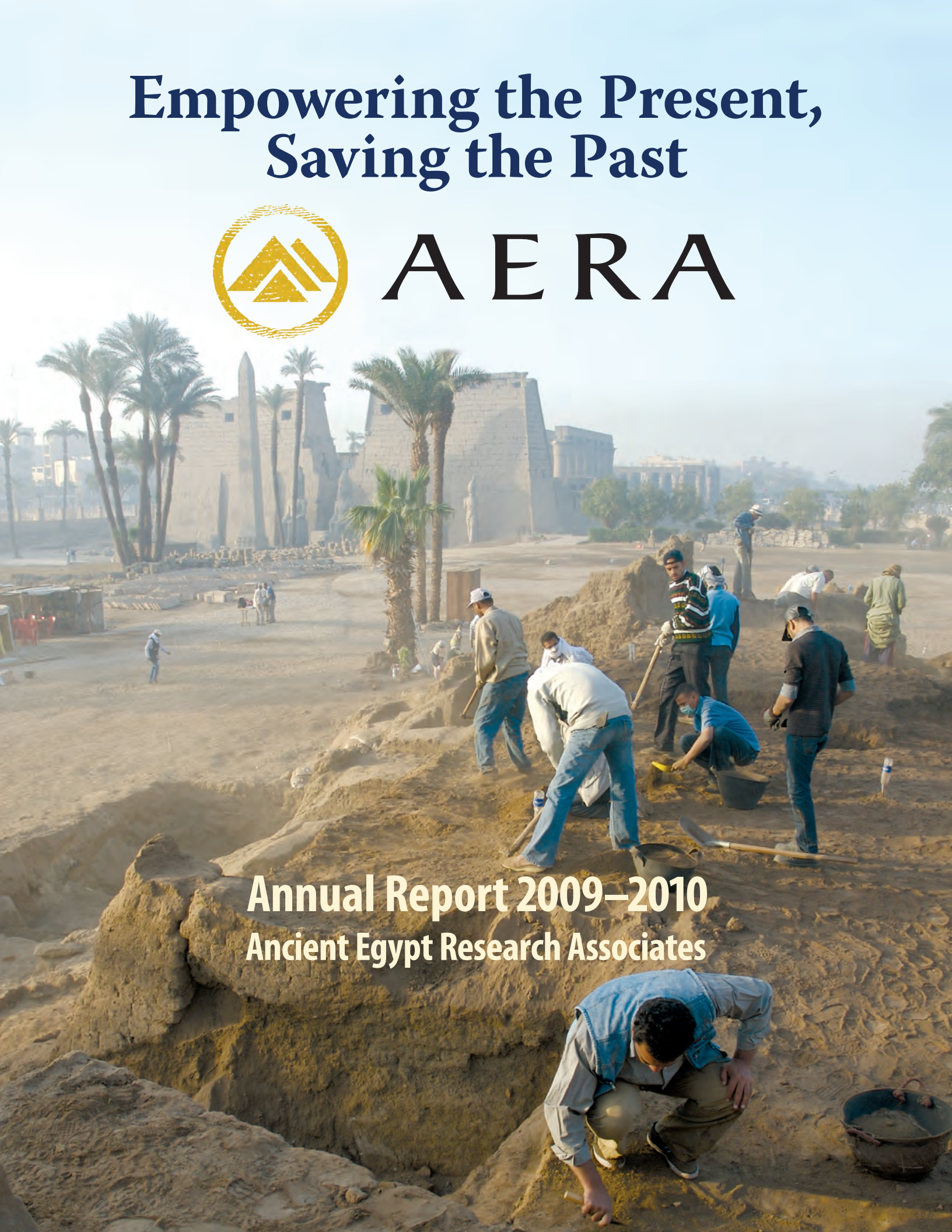
Empowering the Present, Saving the Past

AERA



Annual Report 2009–2010

Ancient Egypt Research Associates

AERA

Contents

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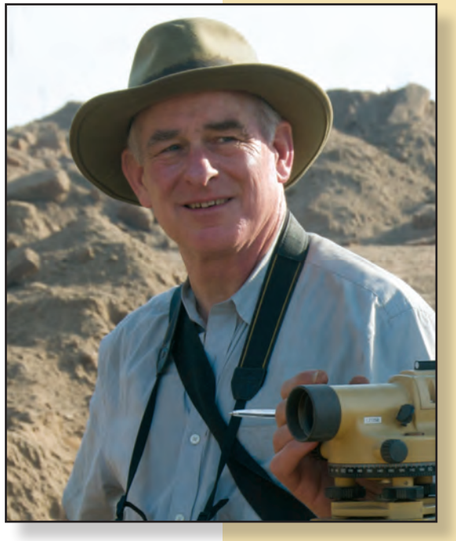
Ancient Egypt Research Associates is a 501(c) (3), tax-exempt, non-profit organization dedicated to research on Ancient Egypt.

Cover photo: The Salvage Archaeology Field School-2, Luxor. Students clear the summit of the Luxor Town Mound, the last remnant of old Luxor (story on page 5).

AERA 2009-2010 A Message from Mark Lehner



About this time last year, all of us at AERA looked forward to another all-too-rare "study season" at Giza. During a study season, instead of excavating and generating reams of new material and data, we analyze material in hand, and focus on writing reports that we can publish. Of course it was tempting to push on in places like the Valley Complex of Queen Khentkawes, where we made such impressive discoveries in 2009. But we knew any excavation would not only bring to light more of this impressive architecture, but also generate thousands of pottery fragments, ancient plant remains, animal bone, pottery, and sealings.

No, we hoped to take a breather and responsibly catch up with analyzing and reporting what we had found so far. We held our last study season—the only prior study season during 20 years of work at Giza—in 2003. That single-season "breather" allowed us to begin an organization of our records that evolved into our database, Geographic Information System (GIS), Data Structure Reports (DSRs), and to hone our adaptation of the MOLAS (Museum of London Archaeological Service) style of excavation and recording. That single 2003 season that we took off from intensive excavation, and the organization of our records that resulted, allowed us to get our publication train moving: *Giza Reports*, the final reports of our excavation areas; *Giza Occasional Papers*, preliminary reports on each season from 2004 until 2009; *AERA Field School Manuals*, the *AERAGRAM* newsletter; the *AERA E-Bulletin*, and now, in progress, the first of our *Giza Studies* series (see below).

Yes, these catch-up working "vacations" from intensive archaeological exploration are catalytic indeed! And after seven years operating under our new archiving system, we needed another break from intensive excavation. So we planned to spend 2010 in our Giza Field Laboratory and in our newly acquired AERA Egypt Center. Field School Directors Mohsen Kamel and Ana Tavares put much time into carefully planning the first Analysis and Publication Field School (APFS), where graduates and teachers of our field school program would work in tandem with the AERA team learning how to prepare publishable reports.

And then came the call from Luxor…again.

In Fall 2009, Mansour Boraik, General Director of Luxor for the Supreme Council of Antiquities (SCA), called to say that authorities demolished the early 20th Century palace of Yassa Andreus Pasha along the Luxor river road. The pasha's builders had cut the foundations of his palace deep into the ancient layers of the old Luxor Town Mound. Now, the removal of the palace left these layers free-standing. The municipal and state authorities planned to level this stratified remnant of 2,000 years of Luxor history. Mansour asked if AERA would organize and run another salvage excavation field school to excavate the mound scientifically in order to save the embedded information about ancient Luxor.

It was a request that the AERA team, as passionate field archaeologists with a love of excavating ancient settlements (as opposed to tombs and temples), could not refuse. And so the 2010 season in Egypt found Mohsen Kamel and AERA team members directing a massive, 100-person archaeological expedition to excavate 2,000 years worth of deposits from periods 2,500 to 4,500 years later than our Old Kingdom settlement

sites at Giza. Once again, as we did with AERA's first Salvage Archaeology Field School (SAFS-1) in Luxor in 2008, we had to mount a major expedition 300 miles away from our home base.

With the encouragement of Gerry Scott, John Shearman, and Michael Jones of the American Research Center in Egypt (ARCE), and the financial sponsorship of ARCE with USAID funds, we carried out two field schools back to back between January and May. With a sigh, we therefore report that far from a "breather" from field work, 2010 was once again as ambitious as any season in recent years, and, we are happy to report, as successful, if not extraordinarily so. In the body of this report we relate the extra-ordinariness of our SAFS-2 success in Luxor.

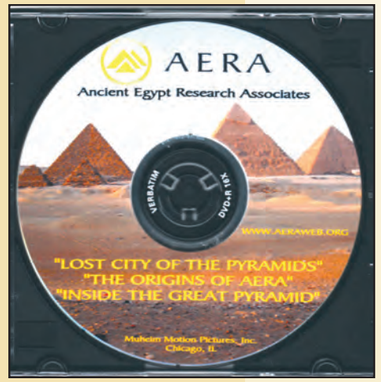
Within nine days of concluding SAFS-2 in Luxor, and about a week of tandem directing with Mohsen, Ana Tavares began directing the Analysis and Publication Field School session in Giza. This was the first use of our newly refurbished villa and newly built staff building at our AERA Egypt Center—and what a use it was, with up to 60 students, teachers, and staff working on the premises each day.

You might think that with the emergency fielding of such a large project as the SAFS-2 and with the APFS-1, our hoped-for publication train did not leave the station. But we managed to push the juggernaut on its way. Thanks to the direction of Richard Redding, Chief Research Officer; John Nolan, Associate Director; Wilma Wetterstrom, Science Editor; Ali Witsell, Associate Editor; and Mary Anne Murray, Archaeological Science Director, more than four publications not only left the station but arrived in print for distribution.

Allow me to list and summarize our major achievements. We are pleased to relate the stories of these accomplishments in our 2009–2010 Annual Report.

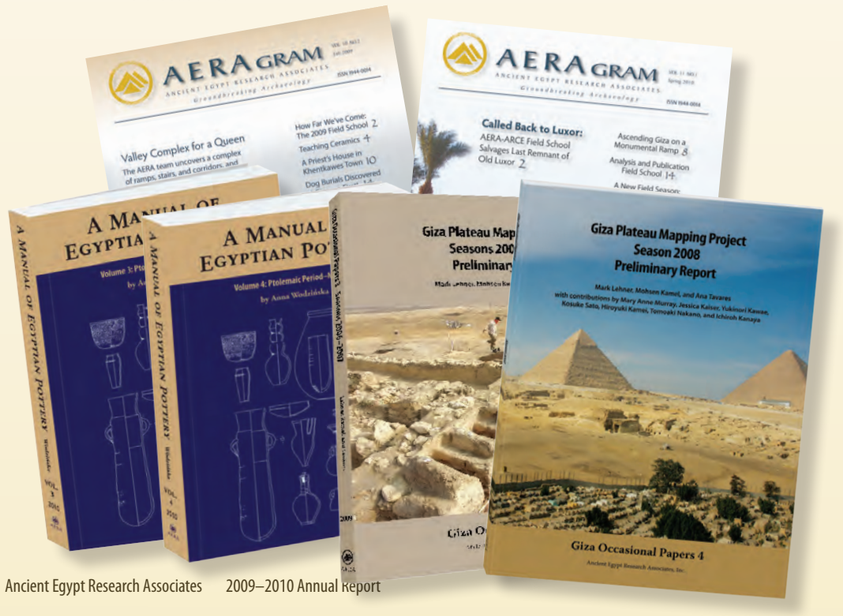
Accomplishments

- **Salvage Archaeology Field School (SAFS-2), Luxor**
  Mohsen Kamel directed a team of 106 teachers, students, and workers that excavated the old Luxor Town Mound layer by layer down to modern street level, thereby saving some 2,000 years of settlement history and capturing a pottery sequence that will become a reference for future archaeologists.
- **Analysis and Publication Field School (APFS), Giza**
  Ana Tavares directed the first Analysis and Publication Field School for graduates of AERA's Beginners, Advanced, and Salvage Archaeology programs, to teach inspectors of the Supreme Council of Antiquities (SCA) how to publish archaeological reports on the numerous excavations they supervise all over Egypt for the benefit of the greater scholarly community.
- **Archaeological Science Program**
  Mary Anne Murray opened the Giza Field Laboratory from March 1 until May 30 for analysis of material culture from the Lost City of the Pyramids excavations. In tandem with the Analysis and Publication Field School, team members analyzed human skeletal remains, clay sealings, stone objects, botanical samples, and ceramics. Some of the leading ceramicists working in Egypt analyzed pottery of later antiquity from our excavations of burials in the ruins of the Old Kingdom settlement.
- **Building the AERA Egypt Center**
  By working directly with builders, brick layers, plasterers, and finish workers, Richard Redding, Mohsen Kamel, and Sayed Salah, Grounds Manager, were able to complete a structure of three bedrooms, which sleep six staff members, a laundry room, and storage magazine for $30/square foot. They completed this and the main villa in time for occupancy and heavy use during the Analysis and Publication Field School.
- **Consulting for SCA Dewatering**
  AERA team members provided information and assistance to a team from Cairo University and to the US company, AECOM, who studied the causes for the high groundwater in the southeastern parts of the Giza Plateau. We provided ground survey and GIS maps, and helped supervise a small trench on the northern side of the Wall of the Crow to test for groundwater and capillary rise in the monuments. I wrote a report on the desired groundwater level in the area of the Sphinx, and joined a committee called by SCA Chairman Dr. Zahi Hawass to assess AECOM's proposals.
- **Capital Zone Walkabout 2010**
  Ana Tavares organized the second set of meetings (the first was in 2006) and tours at sites in the zone that hosted ancient Egypt's administrative "capitals," with the aim of reviewing and comparing results pertinent to settlement archaeology, the movement of the Nile across the valley, quarries, and questions of harbors at the pyramid sites. This year British, German, Czech, and American participants held a workshop in the new AERA villa and toured sites at Giza, Abusir, and Dahshur.
- **Geophysical Survey of the Lost City Site and Sphinx**
  Glen and Joan Dash conducted a radar survey of the northwestern part of the Lost City of the Pyramids, immediately south of the Wall of the Crow, to test for patterns indicative of the older, lower level of the settlement. During April, for Dr. Zahi Hawass, Glen, Joan, Matthew McCauley and myself focused the Dash team radar on the northwestern corner of the Sphinx sanctuary, where we probed the mysterious masonry box attached to the Sphinx's left rear haunch and the area from this box to the passage in the Sphinx rump that Dr. Hawass and I investigated in 1980 (http://www.drhawass.com/blog/radar-survey-great-sphinx-giza).
- **Completed: *Clay Sealings and 4th Dynasty Administration***
  AERA Associate Director John Nolan finished his five-year study of the clay sealings from Pottery Mound. These fragments derive from seals on string and peg door locks, ties of bags, boxes, papyrus documents, and ceramic vessels. The hieroglyphic patterns impressed on the sealings by incised cylinders serve as indices to the early government that ordered the Egyptians to build the largest pyramids, Sphinx, and temples at Giza. John's work makes an important contribution to studies of the early state by archaeologists, anthropologists, and political scientists. John submitted his study for his PhD dissertation at the University of Chicago, which he passed with Honors.
- **New Series: *Giza Studies***
  By the end of the fiscal year, AERA embarked on a new series, *Giza Studies*, to publish analytical studies beyond descriptions of fieldwork but including dissertations that derive from AERA's fieldwork. By the end of the year, AERA's publications team had laid out John Nolan's *Clay Sealings and Fourth Dynasty Administration*. Work is in progress on Anna Wodzińska's study *Egyptian Pottery of the End of the Fourth*



Dynasty from Giza, in which Anna makes use of the immense corpus of pottery from the Lost City site. Anna received her PhD on the basis of this dissertation at the University of Warsaw. Next in line for Giza Studies: my own PhD dissertation, *Archaeology of an Image: The Great Sphinx of Giza*, which I submitted to Yale University 20 years ago.

- **Season Reports Up to Date: *Giza Occasional Papers***
  Working through part of the prior fiscal year and into the first half of this year, Wilma Wetterstrom and Ali Witsell produced two volumes, numbers 3 and 4 of our *Giza Occasional Papers* (GOP) reporting on our seasons 2006–2007 and 2008. The draft of GOP5 covering our ambitious season 2009 is now complete. This publication will bring AERA up to date on excavation season reports.
- ***Pottery Manual*, Volumes 3 and 4: AERA *Field School Manuals***
  Wilma and Ali also produced the final two volumes, 3 and 4, of Anna Wodzińska's *A Manual of Egyptian Pottery*, the first of AERA's *Field School Manual* series. We already see high demand for AERA's *Pottery Manual*, which will serve as the basic field reference for ceramics for many years in the future.
- **NOVA Film on the Sphinx**
  On January 19, 2010, the PBS NOVA science series aired the documentary, "Riddles of the Sphinx," in which I appeared with my old friend, Dr. Zahi Hawass. Produced by Gary Glassman of Providence Pictures, the film tied for the highest NOVA audience of the season, and established a link to AERA's website on the PBS website.
- **DVD on AERA's Mission**
  AERA was happy to complete a DVD synopsis of our work produced by Mark Muheim of Muheim Motion Pictures, and filmed by Mark and Wayne Ewing, during March of AERA's busy 2009 field season. I worked with Mark on the editing and story line during the late summer and fall of 2009. We now have a compelling video that introduces viewers to the reasons for and range of our research shot on location during one of our most ambitious field seasons.



Rising to the Call: Salvage Archaeology Field School-2

Early January 2010 found an AERA team in Luxor within a stone's throw from the Nile River, atop a long mound nearly as high as a two-story building, a chunk of old Luxor that contained 2,000 years of stratified buildings and living floors. The team—instructors and students of the second AERA-ARCE Salvage Archaeology Field School (SAFS-2)—had a mandate: take the mound down to ground level in seven weeks, excavating stratigraphically; that is, record and excavate each single deposit separately.

Rising Again to a Call from Luxor

Last year when we laid plans for our 2010 field season, we did not envision a Luxor mission. But in October, Mansour Boraik, General Director of Luxor for the Supreme Council of Antiquities (SCA), put out a call for help. The last remnant of the old Luxor town mound within the Luxor Temple archaeological preserve was coming down as part of the redevelopment of the site for tourism. Mansour asked the AERA team and the American Research Center in Egypt (ARCE) for help in removing what was left of the mound behind two early 20th century AD palaces.

Fifty years earlier, sweeping excavations removed old Luxor for a stretch of 350 meters (1,148 feet), and a thickness of 7 to 15 meters (23 to 49 feet), from the front of Luxor Temple. Over this stretch, in the four years from 1958 to 1962, the authorities took down the last 2,000 years' worth of houses and settlement layers. Mansour saw an opportunity to salvage the information remaining in this final remnant of old Luxor, and to continue the training of SCA inspectors that AERA began through the first Salvage Archaeology Field School (SAFS-1) in 2008 (*AERAGRAM* 9/1), which took place farther north along the Avenue of the Sphinxes.

With the approval of Dr. Zahi Hawass, Vice Minister of Culture and SCA Chairman, Mansour proposed we launch a second salvage field school excavation for SCA inspectors. The AERA Field School—up to 50 teachers, supervisors, and students, and as many workers—is a formidable archaeological force. As with SAFS-1 in 2008, our task was to save the information from archaeological deposits slated for complete removal.

In less than three months, Co-Field School Directors Mohsen Kamel and Ana Tavares pulled together the SAFS-2 proposal, budget, staff, crew, and arrangements in Luxor. They could not have done this without the help of Dr. Gerry Scott, Director of ARCE, who provided emergency funding; John Shearman, ARCE Associate Director in Luxor, who provided trucks, transportation, tents, and team lunches; Michael Jones, Egyptian Antiquities Project Director; and Janie Abd El-Aziz, Grants Administrator, who provided financial advice and reviewed the budget.

The Avenue of the Sphinxes leads to the Luxor Temple. Between 1958 and 1962 authorities cleared the last 2,000 years' accumulation of occupation in front of the temple in order to reconstruct the Avenue of the Sphinxes. The Luxor Town Mound, adjacent to a 20th century "palace," is the last remnant of that occupation. View to the southwest.

Above: SAFS-2 at work on the old Luxor Town Mound during week three. On the left, Trench A and the southeast corner "Red Zone." On the right, Structure 3 running most of the length of the Mound. In the background, the Tewfik Andreus Palace. View to the north.

Right: SAFS-2 students (from left) Mohamed Hussein and Mostafa Mohamed Saleh Taha take measurements in order to map the summit of the mound. Team members wore masks to protect against the dust. View to the north.

The Mound

Old Luxor rose upon a mound of its own building, demolition, dumping, and rebuilding. By medieval Islamic times the town had risen seven meters (23 feet) above the New Kingdom floor level within and around Luxor Temple, and even higher to the north. Starting in the 1880s, antiquities authorities cleared the town from inside the temple. Between 1958 and 1962 they removed most of the old town mound to the north, demolishing nearly 2,000 years of houses and settlement deposits dating from Roman, Medieval, and early modern periods. They left standing a piece of the mound where builders had cut down through the ancient layers to make the foundations and back walls of the two early 20th century "palaces" for Yassa and Tewfik Andreus, brothers who were Pashas (Lords) of their time.

Tackling the Mound!

On January 9, 31 students, 14 supervisors, 3 professional contract archaeology instructors, and 60 workers assembled for the first day of the mission. Students came from a large pool of applicants from Luxor and Upper Egypt whom Mohsen Kamel, Ana Tavares, and Mark Lehner had interviewed in November with Shaban Abd El-Gawad of the SCA. The supervisors were all SCA inspectors who had graduated from the AERA Beginners and Advanced Field Schools at Giza and had worked with the 2008 SAFS in Luxor.

Divided into four teams, the SAFS-2 archaeology students learned basic skills and standard archaeology practice on the job, as they tackled the systematic deconstruction of the

mound. Seven students trained in archaeological illustration under Yasser Mahmoud from Abydos. Five students studied ceramics with Pamela Rose, Bettina Bader, and Aurelia Masson. Both of these latter teams were nearly overwhelmed by the amount of material from the excavations. But then so were the four teams of excavators.

Before the SAFS-2 team could tackle the mound, workmen had to clear the debris from the recent demolition of the Yassa Andreus palace. So for the first few days students and supervisors practiced basic survey and recording skills. Normally, in our Beginners Field School, we would spend more time with basics. But here the field school archaeologists had a job to do, and if they did not do it, information might be lost forever! So very soon work became very hard, and very demanding, and for the first-timers, this field school was a bit like learning to swim by being thrown in the water.

As soon as the rubble was gone, two SAFS-2 teams mapped the features showing in the sides of the mound. In the eastern face, the 1958 to 1962 excavations had chopped right through

Above: Illustration students learn to draw pottery. From left: Haibatallah Abdallah Mohamed, El Sayed Mamdouh el-Sayed, Adel Kamel Tohamy (in light shirt), and Said Ebrahim Abd el-Hamid el-Assall. Right: Stone block from a Pharaonic monument used in building early 20th century walls.

five rooms filled with the rubble of one very large mudbrick building (Structure 3). On the west, the removal of the Yassa Andreus palace exposed the cut through the mound that its builders had made a hundred years ago. Here much modern refuse that had fallen down into the space between the palace and the cut through the ancient layers now filled spaces between remnants of walls. Two other excavation groups mapped the top of the Mound (the "Summit"), and one group worked at the southeastern corner documenting a "Red Zone" of burnt earth left by some intense industrial activity during the Roman period, and a wide trench that a University of Chicago team, directed by Donald Whitcomb and Janet Johnson, excavated in 1985.

Layers Through Time

With truly professional efficiency, under the guidance of Mohsen Kamel, Senior Archaeologist James Taylor, and professional archaeologists Amelia Fairman, Daniel Eddisford, and Daniel Jones, the team took down the mound like an elevator descending through time.

For a brief few days at the beginning of the season, the SAFS-2 team came into intimate contact with the detritus of the lives of the early 20th century AD palace servants, finding their old letters, bottles, clay pigeon houses, and even magical spells in the ruins of their small back-palace quarters (Structures 1 and 2). A hundred years ago, masons built those walls on foundations they made of reused sandstone and alabaster blocks with hieroglyphic texts. They probably found these temple fragments, some perhaps of Luxor Temple itself, lying about

long after people had broken them off abandoned pharaonic monuments. The palace builders set the foundation stones into the ash and mudbrick debris layers marking the destruction and abandonment of the phase below.

Working down, layer by layer, the SAFS-2 teams next pulled away a black velvet shroud of ash that enveloped the entire Summit. This fine powder blew up into the face and was noxious to the lungs, requiring every excavator to wear a surgical mask. By the end of many days on the Mound, the dedicated diggers looked like chimney sweeps!

Fragment of an Ancient Neighborhood

The excavators worked down through mudbrick tumble, the debris filling enormous pits, and collapsed roofing—a frozen turbulence from the destruction of the next oldest horizon of ancient buildings. By the end of January, underlying ruins of walls and buildings (Structure 6) saw light for the first time in possibly half a millennium. Provisionally, this complex cannot be later than the 10th century in date. Its mudbrick walls stood as high as a meter (3.3 feet). Structure 6 extended across the whole of the island Summit (and who knows how much farther in its day), and consisted of at least 11 rooms arranged around a central courtyard paved by a red brick floor. Parts of several houses made up this fragment of an ancient neighborhood—like a fragment of an ancient papyrus text, the rest of the manuscript gone forever.

But the team had to work on. The elevator descended deeper into time. As soon as they had mapped the walls, grain silos, storage bins, and pavements, SAFS-2 team members deconstructed each and every piece. But their three-dimensional mapping allows that the whole can be put back together —graphically—like an archaeological Lego set. Such is the goal of stratigraphic excavation and recording.

The two SAFS-2 Summit teams worked down through older demolition and ash layers under Structure 6. After seven weeks in the wind, dust, cold, and then extreme heat, they had to pick up the pace, now frantic to reveal on Summit north

Structure 9, a series of chambers with coins strewn all over the floors and one pot chock full of coins. On Summit south, they brought to light Structure 10, in which the three-meter high (9.8 feet) walls of vaulted rooms had seen heat so intense from some mysterious industry that the interior surfaces had literally melted, or vitrified, sending long drips of silica from the mudbricks running down toward the scorched-red floors.

Roman Period Complex in Phase

By the end of the season the excavators on the Summit had brought the site "into phase." That is to say, the ancient structures that they had articulated in the eastern, western, and southern sides of the Mound had all been occupied during the same period. For all the excavation groups, this brought together life on the island of Luxor that once spread

Clockwise from top: Supervisor Saad Bakhit records the plastered, painted walls of a Roman period room.
Supervisor Hanan Mahmoud brushes a silo in a Medieval complex.
SAFS-2 teams map rooms along the keel-like wall running the length of the Mound.
A student maps a wall in Structure 10. The gray sections vitrified as the result of very intense heat.

from the huge stone temple for hundreds of meters along the Nile. (On the north the Mound runs on behind the still-standing Tewfik Andreus Pasha Palace).

The Mound was now like the skeleton of an overturned boat. One long, thick wall ran keel-like north to south for the length of the Mound. Perpendicular walls to the west defined the vitrified and coin-containing chambers of Structures 9 and 10. Perpendicular walls to the east formed the chambers of Structure 3.

One SAFS-2 team of excavators had been working in Structure 3 all season. At the southern end they found holes that people had punched through the thick keel-wall between the vaulted, vitrified chambers of Structure 10 and the lower-lying chambers of Structure 3, where they found bins, benches, and bakeries with round ovens and hearths in small niches. Meanwhile, the team at the southern base of the Mound had expanded from Structure 11, under the Red Zone at the southeast corner, to the southwest, where they revealed Structure 12 with a beautifully plastered and painted room of the Roman period, complete with decorative apsidal niche. The whole complex appears, provisionally, to date to the Roman period.

Mission Accomplished!

The second Salvage Archaeology Field School finished excavations on February 25 with its basic mission largely accomplished in seven weeks. The team stratigraphically excavated the remnant of the old Luxor Town Mound (LTM) nearly down to its western base, just slightly above the level of the nearby corniche (river road).

The work was tricky and precarious; in places the Summit was only 2.10 to 3 meters (6.9 to 9.8 feet) wide. Excavators had to be careful not to tumble off the edge while troweling or pick-axing, plotting features, drawing plans, filling out forms, bagging artifacts, and photographing, often in clouds of fine ash and dust whipped up by wind. The work was physically hard, up and down the Mound many times a day, standing long hours in precarious positions, hacking away with mattock or scraping with trowels (as archaeologists and workers did together).

During the final, eighth week, SAFS-2 members bore down on the less glamorous, but utterly essential post-excavation chores. They processed their data, producing a good quality archive (including hundreds of drawings and stratigraphic feature forms). They prepared a full report documenting what they found. All of this was critical if we were to leave Luxor confident that they or others can take up where we left off. Much archaeology remains to be done on the ancient town inside the Luxor Temple enclosure.

The success of SAFS-2 reinforces our realization that the field schools, so generously supported by the American Research Center in Egypt (ARCE) through USAID funds, can be a formidable—yet efficient—archaeological force.

The SAFS-2 team maps the Roman era complex in the final weeks of the field school.

Publish or Perish:
The Analysis and Publication Field School 2010

An excavated site that has not been published is as lost as a bulldozed site. Even if excavators make a comprehensive record, the archive itself might be lost, and the data goes "cold" as time passes. Thus, we have placed great emphasis on publishing AERA's work in a timely manner—possibly the most time-consuming and expensive part of any project.

Since the first AERA-ARCE Field School in 2005, we have trained Supreme Council of Antiquities (SCA) inspectors in all the skills needed to record and analyze an archaeological site. But we felt that the program was not complete until we could help the students bring the results of their work to publication. Our field schools become truly effective when the graduates not only excavate and record archaeological sites to modern standards as part of their jobs throughout Egypt, but also publish reports on this work.

So on March 20, nine days after the Salvage Archaeology Field School-2 graduation (story on page 5), we launched the first Analysis and Publication Field School (APFS) in our new Giza headquarters (story on page 18).

By the Numbers

The APFS completes a comprehensive field school program consisting of the Beginners Field School for learning basic skills in archaeological excavation and recording; the Advanced Field School with concentrations in excavation, ceramics, osteoarchaeology for human remains, survey and mapping, and archaeological illustration; and the Salvage Archaeology Field School (SAFS) for teaching rescue archaeology within real-world situations and settings. In six years we have run seven field schools graduating over 200 SCA inspectors.

We carried out the APFS from March 20 to May 13, 2010, with 29 students, 8 SCA supervisors, and 10 non-Egyptian teachers over and above members of the regular AERA archaeological team and house staff, which brought our total to around 75. Most of the students had already completed the Beginners and Advanced Field Schools. The SCA supervisors had taught in previous cycles of the field school program plus one or both salvage field schools in Luxor.

Aiming High

We set ourselves a very ambitious task—to produce an archaeological publication in eight weeks. The accepted ratio of fieldwork to publication time is 1:3. For each full month spent in the field archaeologists normally need three months of analysis and post-excavation work before a publication is ready. In the field school we proposed to publish excavated areas in only 6 to 12 weeks. Ideally we should have had 18 to 36 weeks to prepare a full publication. Therefore, we worked under constant pressure to produce results. We had clear deadlines and milestones for each week. These were revised and adjusted, but the basic aim of producing a publishable manuscript at the end of the field school had to be met.

But how do you keep 30 people focused and motivated in front of their computer screens for two months? Teamwork is easier to pace and organize when we are excavating. A team of "writers" is much harder to motivate. Criticism and edits are sometimes difficult to accept. Tasks end up unevenly distributed. Those good at IT miss out on library research. The more fluent writers assume most of the burden in preparing text. With the pressure to produce results, it was a challenge to make sure that all participants worked on all stages of the research, analysis, and writing process and became reasonably proficient.

Facing page: The APFS archaeologists working on the publication of Area MSE look over a site matrix (diagram showing the relative sequence of deposits). From left: Osama el-Nahas, Amr Zakaria, Ashraf Abd el-Aziz, Mohamed Hatem, and Ayman Ashmawy.
Above: Ceramicist Mohamed Naguib examines the fabric of MSE sherds as part of the ceramics team's project to analyze and write up this collection of pottery.

The Structure

We assigned APFS archaeologists to six groups. Three groups of archaeologists wrote up the results of previous field school excavations in our Lost City site. An osteology team worked on reports of burial excavations. The ceramics group prepared pottery for publication. Another team specialized in graphics. The groups worked on the following projects:

- **Bakery AA: Household Production**
  We believe that the small bakery in Area AA, at the western edge of the site, was for household baking rather than for producing bread on a large scale for groups of workers. It features a small, square baking room and an emplacement for a mixing vat similar to features in House Unit 1, a large residence in the Western Town. The students' research on this bakery contributed to an understanding of household production in the larger industrial site.
- **Bakery EOG: Government Production**
  The EOG bakery, located in the area "East of the Galleries," belongs in a class with other "industrial" bakeries that we find in this part of the site. This bakery (D), one of a series of at least four (A-D) long bakeries in the EOG production zone, is the largest bakery found at the site.
- **MSE Excavation Report: Mysteries of the Pedestals**
  Main Street East (MSE) includes the Eastern Boundary Wall to the east of the Gallery Complex and a long row of pedestal structures like others throughout the site. These curious structures must have been an integral part of provisioning the pyramid workers. In tackling the mystery of the pedestals, the MSE team contributed to our understanding of an elementary structure of everyday life in this settlement.
- **Working "from Scratch:" APFS Ceramics**
  The ceramics group analyzed a large corpus of material from the MSE area, thereby working in tandem with the MSE archaeologists. They tackled the project starting "from scratch," effectively compressing months of work into an intense eight weeks. (see page 13).
- **Burials from the Chute**
  APFS osteologists prepared an article on 19 human burials excavated during the 2009 Advanced Field School near the Chute, a fieldstone corridor in the far northwestern sector of the site. Each student took responsibility for analyzing and writing up six burials. They analyzed the material in the lab (for sex, age, measurements, and pathologies), set up a database for their material, and read and summarized comparative material from the Lost City site as well as comparative material from other sites (including non-Egyptian material).
- **Graphics for All**
  The graphics group prepared maps, plans, line drawings, and photographs to illustrate the articles of all the other APFS groups, including overall site and area maps, sections, elevations, and object and ceramic drawings. They used both traditional hand drafting as well as digital drawing techniques.

In addition to these groups, two other field school students trained in archaeobotany and archaeozoology (pages 13–14).

Cascading Information, Delegating Tasks

Throughout the APFS we adopted a system of "cascading" information: one student (occasionally a supervisor) became familiar with a particular task and would then instruct and

guide the team through the process. We encouraged the groups to be autonomous and reduced passive learning to a minimum. The teams prepared and implemented their own work plans and effectively ran the field school, taking on tasks as varied as searching online research resources, preparing PowerPoint presentations, keeping the first aid boxes stocked, and looking after IT equipment.

The entire APFS team really pooled their resources and knowledge. Those who could read French and German translated articles for their colleagues. The IT-savvy students helped others throughout the program (see Mini-Conference, page 14). The Excel- and Access-proficient students held workshops on databases. We shared our e-libraries and other research resources.

Ready for Press!

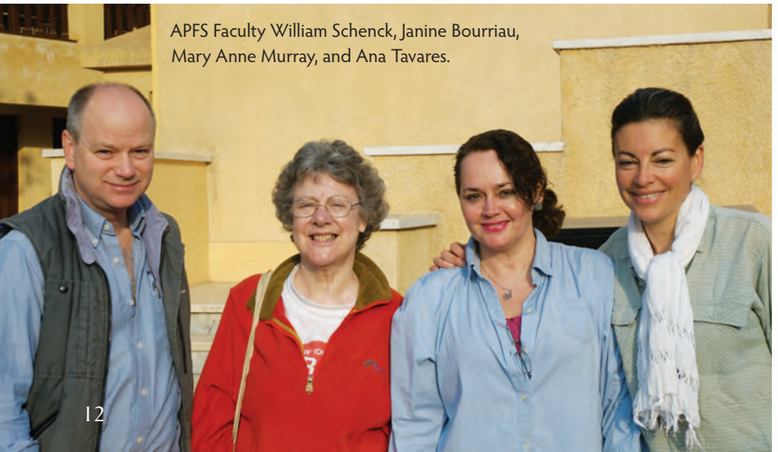
Scholars nowadays place great emphasis on a theoretical framework and explicit research models. However, every archaeologist's first obligation is to publish a comprehensive description of data. Without these descriptive reports all subsequent interpretative studies will be flawed, if not impossible. Our program emphasized this first obligation.

The six APFS groups impressively brought together all the information from the previous field school digs and their analysis this season: data forms and diaries, notes, photographs, and last but not least, maps and drawings, which the graphics team, under Will Schenck's professional guidance, prepared to publication quality for each contribution. The outcome of the Analysis and Publication Field School 2010 was a 250-page compilation of archaeological reports entitled, *A Glimpse of Ancient Lives: Preliminary Reports from the Heit el-Ghurab Site at Giza*. These reports make an important contribution to the published record of the Lost City site and Old Kingdom studies in general.

Top: Osteology instructor Scott Haddow, students Maha Siah Abd el-Tawib and Mahmoud Ali, and Osteo Supervisor Afaf Wahba examine an arm bone.
Students Shaima Montaser (left) and Hussein Rikabi (far right) study plans of the MSE excavation with Supervisor Rabee Aissa.

With the APFS we have come full circle. Our graduate students and supervisors can now carry out excavations, analyze material culture, and bring their results to publication. We are very proud of the quality of their work.

Graduates of the AERA-ARCE Field Schools are now involved in challenging and high profile excavations throughout Egypt. Currently a team of AERA graduate archaeologists, surveyors, illustrators, and ceramicists is working in front of the Sphinx and the Khafre Valley Temple at Giza. Later this summer another field school team starts on a newly discovered Early Dynastic burial site in Armant. Throughout Egypt, from Alexandria to Luxor, other graduates continue their work.



APFS Faculty William Schenck, Janine Bourriau, Mary Anne Murray, and Ana Tavares.

Archaeozoology students Emily Kaspari and Rasha Nasr abd el-Mageed buy (right) and prepare (left) fish for drying and preservation as comparative skeletons.

Archaeozoology

Rasha Nasr abd el-Mageed learned the basics of faunal analysis as she worked her way through animal bones from the AA Bakery. Under the tutelage of AERA archaeozoologist Richard Redding, she learned to distinguish bone elements, prepare comparative reference skeletons, identify bone to species, and determine age and sex. In the final weeks of the program Rasha wrote up her results (discussed on page 16) in a paper that is good enough to be published in any professional journal.

Ceramics Opportunity Extraordinaire!

For teaching analysis and publication of pottery we were honored to have a powerful team of specialists that would be the envy of any graduate program in Egyptian archaeology: Janine Bourriau (one of the preeminent ceramicists working in Egyptian Archaeology), Peter French and Sabine Laemmel (leading authorities on Egyptian pottery of the Late Dynastic periods and later antiquity), and Teodozja Rzeuska (main ceramicist of the AERA field schools and a well known specialist in Old Kingdom pottery).

The ceramics group had the most demanding and ambitious program. They undertook to record and analyze "from scratch" over 30 large sandbags full of ceramic sherds from excavations in MSE (Main Street East). Their aim was to tackle the material as if they were facing a new site, as they would have to do with pottery retrieved from excavations in their inspectorates.

The students applied the full methodology they had learned in previous field schools. They painstakingly washed and marked all sherds, sorted the sherds by fabric, identified vessel types, and described surface treatment and ware. They created their own ceramic typology and fabric classification and prepared their own ceramics recording forms.

The team expected to find the usual Old Kingdom pottery: bread molds, beer jars, and little else. But amongst the thousands of fragments they examined, a handful stood out: sherds with potmarks, sherds with residues of copper, and sherds dating from the Pre-Dynastic Period. These fragments raised questions, such as what the potmarks might mean—a label indicating contents or a destination? But the students did not have time within the field school schedule to research possible answers. They also needed additional time in order to place the ceramics in context.

Teodozja Rzeuska, ceramics instructor, looks over MSE pottery sherds in the yellow tent we use for the Field School.

So, determined to submit a complete publication, they continued their work beyond the field school graduation. They managed to prepare a catalogue, with their own inked drawings, and a complete discussion covering shaping methods, surface treatment, fabrics, and decoration. We are very proud of their achievements and their perseverance in completing everything for publication.

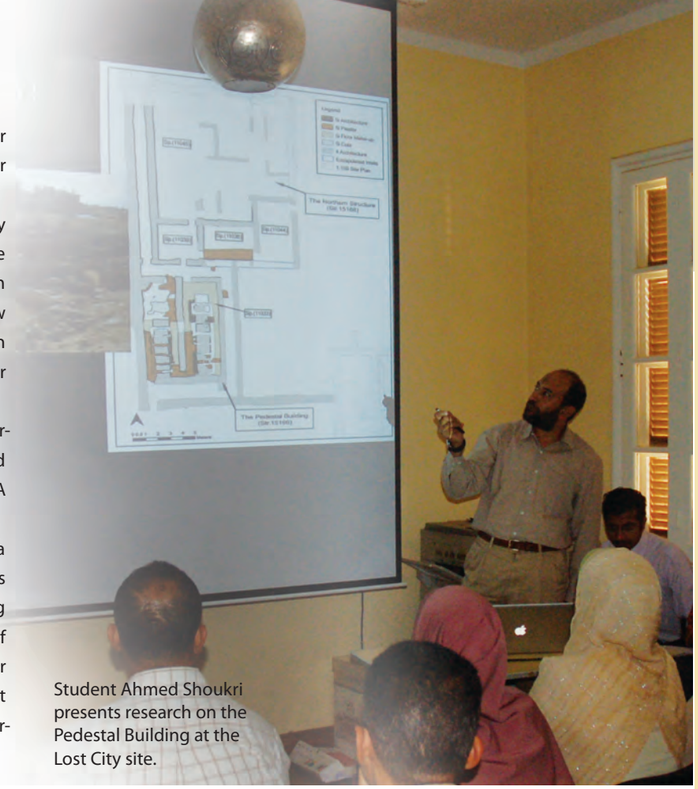
APFS Mini-Conference, April 27–28

They may have been nervous, but each student and supervisor confidently gave a 15-minute PowerPoint presentation during our APFS Mini-Conference.

Most students were presenting research for the first time. They had to choose a topic, write a short abstract and title, and assemble and deliver the presentation. The more experienced APFS team members mentored the others. They made sure the students knew how to prepare images and use PowerPoint. They gave feedback on the talk, corrected spelling, and helped the students rehearse their presentations.

A student committee organized the entire event. They corrected titles and abstracts, set up a presentation schedule, and printed a booklet of abstracts. A chairman ran each session. A graphics students designed a poster for the event.

We intended the students to gain experience in presenting a short, concise, and well thought-out presentation to their peers, as they might at an academic conference or colloquium. Following the conference the participants gave a short self-assessment of their performance and the whole group offered suggestions for improving the presentations. Students and supervisors felt that the conference was a highlight of the APFS and a very empowering experience.



Student Ahmed Shoukri presents research on the Pedestal Building at the Lost City site.

Archaeobotany

Training with AERA archaeobotanist Mary Anne Murray, Rabab el-Gandy analyzed plant remains from a house at the Khentkawes Town site. In the process she learned how to use flotation to recover plant remains, how to identify plant samples, and how to carry out basic statistical analyses. In her home village in the Delta she began assembling her own collection of comparative specimens. Rabab displayed a real talent for archaeobotany and helped to write a substantial final report on plant remains from the house in the Khentkawes Town. (Her results are discussed on page 17.)

Archaeobotany student Rabab el-Gandy measures the volume of a flotation sample before she begins to sort its contents under the microscope.

Thanks to ARCE and USAID

Both the Analysis and Publication Field School and the Salvage Archaeology Field School-2 were supported by the American Research Center in Egypt (ARCE) Egyptian Antiquities Conservation Project (EAC) funded by USAID (Award Numbers EAC-23-2009 and EAC-25-2010). For financial support and advice we thank Dr. Gerry Scott, ARCE Director; John Shearman, ARCE Associate Director Luxor; Michael Jones, EAC Project Director; and Janie Abd al-Aziz, Grants Administrator, ARCE.

Prying into Ancient Lives:

A New King and an Imported Thing
2010 Archaeological Science

A combed ware jar.

They say the devil is in the details, and in the Giza Field Laboratory, it's details we have!

Our dedicated team of specialists, working with the minutiae of material culture excavated from the Lost City of the Pyramids and nearby Khentkawes Town, carry out a CSI-like investigation into everyday life at these settlements, answering questions and making new discoveries. Dr. Mary Anne Murray oversees this interdisciplinary team. Here are some of the highlights of our 2010 Archaeological Science study season.

Old Kingdom Pottery: Questioning Combed Ware

The pottery team, headed by Dr. Anna Wodzińska, launched into a study of "combed ware," a type of pottery with patterns on the surface made by dragging a comb across wet clay. Egyptians imported combed ware jars from the Eastern Mediterranean, the region called the Levant, where archaeologists have found combed ware jars and vats in olive oil processing installations. The jars were probably used to transport olive oil.

Our Giza specimens are especially intriguing because Rainer Gerisch, our wood charcoal analyst, has found Egypt's earliest evidence of olive wood at our site. Was the wood perhaps packing material delivered with vessels of olive oil from the Levant?

Prior to our discoveries, only 56 examples of combed ware pottery were recorded for the entire Old Kingdom, nearly all in burial chambers of nobles at Giza, including that of Hetepheres I, mother of Khufu. It seems that imported combed ware vessels were luxury items, suitable as very special gifts for deceased rulers and nobles.

But our excavations at the Lost City settlement—a site sometimes characterized as the "Workers City"—have produced 18 new examples of combed ware pottery. This raises several questions. Were these high-status vessels more common than previously thought? Or, was the social makeup of the settlement more diverse than we had originally expected? Indeed, we have evidence of high-status foods and clay sealings bearing the titles of high officials (described on page 16).

The Levant covers a large area. In order to pinpoint the origin of our combed ware more specifically, Dr. Mary Ownby began a microscopic study of the sherds' composition. She and Anna will present their preliminary findings at an upcoming conference in Prague on relations between Egypt and the Near East in the Bronze Age.

Pottery of the Later Periods

No one fully understood the post-Old Kingdom pottery from the Lost City site—until now. Dr. Sabine Laemmel completed the final analysis of pottery that we recovered from later periods during our excavations from 1988 to 2009. Originally we had assumed that these pots and fragments had been offerings placed in the modest burials in the northern and northwestern parts of the site. But we were surprised to learn that less than 30% of this pottery was directly associated with burials.

Dr. Sabine Laemmel with some of the Late Period vessels that she studied.

Although some of the remaining sherds and pots may be linked to the cemetery, others do not seem to be related to funerary use.

Those used as burial offerings came from 29 graves. The 13 burials that contained Late Period (about 828–525 BC) pottery all seem to belong to a single cemetery, and frequently contain a specific type of large, two-handled storage jar. The 16 burials with early Roman period (1st to early 2nd century AD) pottery produced mainly amphorae made of Nile silt. Intriguingly, the pottery not associated with burials ranged widely in date from the New Kingdom through the late Third Intermediate Period (1539–723 BC), a span of almost 800 years.

Overall the post-Old Kingdom pottery represents a small fraction of all the ceramics recovered from our Lost City site, less than 1%, but it includes a much greater variety of pottery types than originally expected, including imports from Eastern Greece, the Levant, and Cyprus.

Sealings Team Finds Userkaf!

Dr. John Nolan and Ali Witsell—AERA's sealings team—finished registering the remaining clay sealing material from the Royal Administrative Building (RAB). The broken bits of sealings had once secured documents, doors, jars, and other containers. Their surfaces often bear impressions of incised cylinder seals that Egyptians rolled across the clay while still wet. The impressions sometimes include hieroglyphs, the only texts we have from the Lost City site—and a treasure trove of information. (See page 27 for a discussion of official seals from another area of the town.)

The collection turned out to be one of the five richest Old Kingdom sealing deposits ever excavated. Immediately, several surprises popped out, starting with the diverse range of cylinder seal types that made the impressions on the RAB sealings. They were not all seals of high officials, which we have seen in some areas of the town. Only a little over one-third of the 285 sealings with seal impressions had been made by officials of the central administration.

Surprisingly, the remaining sealings were impressed by informal, "folksy" seals that look like they had been made in households or sold in marketplaces across the country.

Another group of 105 sealings were not rolled at all; instead they show deliberate incisions. These may have been quick, temporary improvisations when a seal was either unavailable or deemed unnecessary.

Some clay fragments never made it to the final step of securing anything. RAB produced 293 pieces of sealing clay left over from making and applying sealings. Although these pieces bear no text, they still provide an important clue about the RAB. They indicate that sealings were made and applied here on site and not just brought in attached to jars, boxes, and documents.

As so often happens in archaeology, perhaps the most important surprise came at the end, just as Ali and John were busily trying to finish their work. In the course of sketching the seal impressions, they noticed that four sealing fragments appeared to bear the name of Userkaf, first king of Egypt's 5th Dynasty. Up to that point, all of the sealings we had encountered at the site bore only the names of Khafre and Menkaure, 4th Dynasty rulers. These four sealings are our first evidence that the Lost City site did not in fact die out at the end of the 4th Dynasty, when the royal house focused its attention elsewhere. Instead, it appears that the settlement on the fringes of the site persisted into the next dynasty, when Userkaf may have finished building the nearby town dedicated to the cult of Queen Khentkawes, perhaps his own mother.

Archaeozoology

Dr. Richard Redding's archaeozoology team, comprising field school student Rasha Nasr Abd el-Mageed, and Emily Kaspari, a student from the University of Minnesota, focused on animal bones recovered from two locales in Area AA along the western edge of the site, excavated in 2006–2007: the AA Bakery and the southern end of the Pedestal Building (possible storage facility). In the Pedestal Building nearly all the mammal bone (92%) was cattle, the premier source of meat for ancient Egyptians. The majority was veal, from animals less than 12 months old. Hind limbs were surprisingly far more common than forelimbs. These might have been leftover cuts from animals that were slaughtered for burial offerings, which tomb scenes consistently show as forelimbs.

The faunal evidence from the Pedestal Building closely matches the animal bone we excavated in Pottery Mound, a deposit of trash that probably came from an elite residence. Presumably the Pedestal Building deposits also came from a nearby elite household.

The animal bone in the AA Bakery reflected a slightly less rarefied diet. Cattle formed just 64% of the identified mammal bone, while sheep and goats accounted for 41%. But the majority of the cattle were under 12 months of age, marking this as nonetheless a relatively high-status garbage deposit. Moreover, cattle were significantly more plentiful here than in the RAB (23%) or the Gallery Complex (just 0.08%).

A clay sealing from RAB showing a vertical *serekh* of Menkaure on the left and a horizontal *cartouche* of Menkaure on the right.

Above: Geologist Dr. Philip LaPorta analyzed and measured about 2,000 stone objects this season. He looked at the orientation of grains in the rock to determine how this attribute was used in selecting stone for specific tasks.
Below: Detail of a fragment of roofing material from House Unit 1, showing a preserved impression of a reed mat.

Although we refer to the RAB as "royal," the relatively small quantity of cattle bone here suggests that low-status people worked in the RAB. John Nolan's observation that people frequently used folksy, informal seals within this enclosure likewise suggests low-status workers in the RAB. These workers may well have lived in the adjacent Eastern Town, while their overseers, who carried formal seals of high office, returned home every night to the large houses of the Western Town. At this point we only have the back end—probably back rooms—of the RAB, a much larger enclosure that stretches for perhaps 100 meters (328 feet) to the south under the modern soccer field. The main entrance was probably on the south end.

Archaeobotany

Dr. Mary Anne Murray and Claire Malleson finished identifying the plant remains from Area AA. Like plant material from the rest of the Lost City settlement, these remains are charred—burned in heating or cooking fires. All other plant materials would have decomposed because of moisture in the soil.

Overall plants were scarce in Area AA, probably an indication that there were few hearths or food processing activities that might scatter ash in the area. On the other hand, the Baking Room in AA produced larger quantities of plants. But these were almost entirely weeds of cereal fields. Workers probably picked them out before grinding grains into flour and probably tossed them in the hearth.

The entire Lost City site has produced a limited assortment of edible plants and by-products of crop processing compared with ancient Egyptian village sites, suggesting that plant foods were supplied to the Lost City residents nearly ready for use; cereal grains required only a final cleaning. The limited range of edible plants probably reflects the fact that the authorities had to transport food for thousands of people over long distances.

Unlike the Area AA plant remains, the collection from the Khentkawes Town site (KKT) that Field School student Rabab el-Gendy analyzed proved to be diverse and abundant. The KKT, located higher up and drier than the Lost City, also produced charred material so well preserved that the archaeobotanists were able to identify many plants to the species level. Such precise identifications of weeds and wild plants help us to describe the environment of 4th Dynasty Egypt in greater detail than is possible with more general identifications.

The diversity of the plant material suggests that the KKT settlement belonged to a different system of procuring food than the Lost City site, perhaps relying on local markets and carrying out more of the preparation within the household.

The Roof Fell Down, and So It Was Saved!

The Lost City site represents a complex architectural footprint sprawled over an area of seven football fields. However, under the best of circumstances, the archaeological remains are preserved just waist-high. How can we ever reconstruct how the ancient builders roofed these expansive structures or determine whether the buildings had more than one story?

Fortunately, it was often the roof that came down first, so we find pieces of it under the mudbrick tumble. Most of the organic components of the Old Kingdom roofs and ceilings disappeared long ago, as the levels of the groundwater fluctuated throughout the ages. However, ghost-like impressions of these lighter materials have survived, pressed into the hard mud that once held them together.

Manami Yahata documented in detail the 259 fragments of well preserved roofing material that she and Yukinori Kawae excavated from House Unit 1 in the Western Town during 2006 and 2007. By classifying these roofing fragments into groups that bear impressions of leaves, reeds, matting, and circular wooden beams, we hope to reverse-engineer the range of possible roofing techniques employed at the Lost City site by constructing our own experimental galleries in the future.

A Community of Archaeologists: The AERA Egypt Center

The Center works and we love it! Thank you everyone for your help. It is now a critical component of our operations in Giza.

AERA purchased a villa with land near the Pyramids on February 24, 2009, and in one year we developed it into a research and education center. The main goals this fiscal year were to make the center functional for our 2010 field school and season and to develop plans for additional construction.

Right on schedule we opened the AERA Egypt Center on March 1, 2010, for our 2010 season, after months of preparation.

In late November, 2009, a construction crew broke ground on our first addition to the property: a single-story brick building with rooms for our support staff, a new laundry, kitchen storeroom, and bathroom. Three months later we completed the final touches. In keeping with the Middle Eastern tradition of using rooftops, we turned the top into a large open-air classroom and work area, 13 × 60 feet, with a white tile floor. A reed-matting canopy covers half of the area and offers shelter from the sun. The remaining open area provides natural light for working. We equipped the space with three large work tables, chairs, and ample electrical outlets for computers and projectors. For privacy, the construction crew raised the outer wall of the compound 12 feet. This tall barrier, as it turns out, also buffers noise from the street, right on the other side of the compound wall, making for a quieter classroom and villa.

Meanwhile, we outfitted the villa with good quality, functional furniture. We purchased wicker furniture with cotton padding for outdoors, good wooden chairs for the dinning room, and stackable, padded metal chairs for the library/lecture room. We hired a skilled carpenter, Omar Sha'aban, who crafted floor-to-ceiling bookcases and a ladder for the archive room, four large wooden tables for the library and dining room, two beautiful map cases for our archives, and even beds.

With the support building completed and the villa furnished by February, we began moving in. The computer/GIS room allowed us to unpack all of our computers, printers, and digitizing pads. The building features wireless as well as Ethernet access in every room. Camilla Mazzucato, GIS Director, spread out her large digitizing pad. Mari Rygh and Soha Kamel organized 16 years of notes and maps on shelves and in map cases. We will never again have to pack up all our notes, books, and delicate equipment for storage during the off-season.

Facing page: The AERA team assembled in front of the AERA Egypt Center.

Clockwise from top: The new staff structure goes up. Masons lay brick walls for the rooms, placing the back wall against the outer wall of the compound.

Workmen hoist a bucket of concrete up to the roof and spread it over a mesh of rebar to form a solid surface for the upper level.

The completed staff building includes a lower level with housing for staff, laundry, and storage. The partially covered roof deck offers space for classrooms and work. The villa stands to the right.

Below: A field school group works on the rooftop of the addition. The reed mat canopy shelters them from the sun. Clockwise around the table from the left: Ahmed Shoukri, Shaima Montasar, Hussein Rekaby, Mansour Ali.

When our excellent cook, Nasr el-Nubi Mohammed, arrived on March 1, we took him shopping for new kitchen equipment. He served the historic first meal using our new stove on March 6.

The layout of the villa and grounds encourages and facilitates interaction among team members. Students and staff loved working here as well as gathering after hours. They spent long stretches each day working in the gazebo or under the pergola. We enhanced the grounds with new grass, fruit trees, and even an herb garden. Birds, including the hoopoe, were common visitors. We hope to have the fountain working by next season.

Laboratory work began on March 1, the Analysis and Publication Field School (APFS) (story on page 10) on March 20. The villa quickly filled up and every spare corner was in use. We are now planning more construction to meet our needs.

Thanks to Our Benefactors

We are grateful to generous donors whose major gifts made it possible for us to establish the AERA Egypt Center: the Waitt Family Foundation, the Ann and Robert H. Lurie Foundation, the David H. Koch Foundation, the Charles Simonyi Fund for Arts and Sciences, the Peter Norton Family Foundation, Dr. Marjorie Fisher, and the Urban Land Institute tour members on behalf of Bruce Ludwig.

Our Need and Vision

- **Two-story addition to the existing Villa** will provide a new lecture room accommodating 50 people and an expanded dining room on the first floor connected to the lounge.
- **A separate director's house** will provide an office and entertainment space.
- **Two-story dormitory** on the back of the property will house all our foreign and Egyptian researchers and teachers. Each of the 35 rooms will include a work table and bathroom.
- **New entryway** from the main road into the garden will provide access for visitors during lectures and receptions.
- **Four-meter-high wall** around the Villa will provide security and reduce noise.

AERA's goal of creating an archaeological community and center of excellence for research and teaching is now within reach. The teachers, students, and researchers, although constrained by space this season, praised the facility and cannot wait to return. They see the future.

Above left: APFS teams in the villa lounge. Afaf Wahba (left), osteo supervisor, discusses work with visitor Amira el-Morsi, osteo graduate, 2006. In the background, two excavation groups work on their projects.

Christine Clifton-Thorton (with blue scarf) tutors the APFS team in English.

Faces from the AERA Egypt Center Support staff.
Facing page: Center: Soha Kamel, Assistant Achivist. Right: Mohamed Said, Giza IT Manager.

Top from the left: Yasser Ibrahim, Cairo Business Manager; Ahmed Ezz, House Manager; Nagla Hussein, housekeeping staff; Rabea Mohamed Shahat, Gatekeeper and Guard; Ismaiel Mohamed Ahmed, housekeeping staff.

Right: Gamal el Gahlan, housekeeping staff; Mohammed Hussein, housekeeping staff; Nasr El-Nubi Mohammed, Cook; Ayman Salah Moukhtar, Assistant Cook.

Below right: Nasr El-Nubi Mohammed, Cook; Richard Redding, AERA board member and Chief Research Officer; Sayed Salah, Grounds Manager. Richard directs the AERA Egypt Center building campaign.

Below: An APFS team works on the villa porch.

Low Profile:
AERA Helps Reduce the Water Table

In AERAGRAM newsletters we kept readers abreast of rising groundwater that threatened our Lost City site for three and half years starting in 2005. By 2008 the groundwater rose as high as 16.1 meters above sea level (asl)—1.5 meters (3.28 feet) above 2004 levels (14.60–14.70 meters asl)—saturating much of the site and pooling in front of the Sphinx and Khafre Valley Temples. When we left Giza in June 2008 water stood in ponds across our excavation site.

The Supreme Council of Antiquities (SCA) asked Cairo University's Dr. Hafiz Abd el-Azim Ahmed, of the Engineering Center for Archaeology and Environment, and Dr. Reda M. el-Damak, of the Center of Studies and Designs for Water Projects, to help. Their team drilled holes around the Sphinx and the Lost City site for sampling and monitoring the groundwater. In late summer 2008, the Cairo University team set up three well pumps east of the Sphinx to test the ability of these pumps to discharge water from this low southeastern part of the Giza Plateau. Later they added five more, including one pump due east of the Khentkawes Town. A few months of continuous pumping drew the water down. When we returned to Giza in October 2008, the pools had disappeared. When we excavated the deep depression of the Khentkawes valley complex in spring 2009, we found the groundwater back to the 2004 levels (14.60 meters asl).

AECOM Study

Meanwhile, the SCA turned to the U. S. Agency for International Development (USAID) for assistance to explore solutions for the rising water table over a wider area. In March 2009, USAID contracted the American company AECOM to study the water problem, construct a groundwater model, and assess options for a wider and longer term dewatering system in the Pyramids Plateau area.

During the 2010 field season AERA team members provided maps, publications, and our own measurements of the water level at our site between 2005 and 2008. We also provided GIS (Geographical Information Systems) contour maps of the Giza Plateau and maps of the Lost City and Khentkawes

January 2008. The rising water table pooled in low areas across the Lost City site and overtook the mudbrick walls we had constructed as part of a conservation project. Workers race against the rising damp to cover wet areas of the site with clean sand.

Below: Derek Watson and workers excavate Trench 2 in Area WCN (Wall of the Crow North) in 2005. Ground water filled the deeper probe against the foundation of the Wall of the Crow.

Right: The 2010 AECOM probe in Trench 2 showed that the water table fell about 2 meters (6.6 feet). The deeper probe this season confirmed that its builders founded the Wall of the Crow upon a natural layer of gritty sand and cobbles, likely washed down from the high desert through the northern side the wadi between the Moqqatam and Maadi Formation outcrops. This probe showed no earlier occupation under the wall.

Town sites. We shared references to publications on the geology of the Giza Plateau, including geological studies of the porosity and permeability of the Sphinx limestone layers.

Dr. Zahi Hawass appointed Mark Lehner to a committee to review and assess the AECOM study and recommendations. In February and March, Mark prepared a memo, "Giza Groundwater Desideratum," in which he recommended long term target groundwater levels (between 12.50 to 13.50 meters asl) of archaeological features on the Giza Plateau. On March 30–31, Mark attended a meeting of members of the SCA, USAID Cairo office, Cairo University, and AECOM, chaired by Dr. Zahi Hawass and Dr. Sabry Abd El-Aziz, SCA Director of Pharaonic Monuments.

In the field in 2010, AERA assisted AECOM and the SCA to excavate a probe pit in our Trench 2 that Derek Watson excavated north of the Wall of the Crow in 2005 and 2006. The purpose of excavating deeper was to determine how far groundwater moves via capillary action up through the soil and into stone monuments. The idea is to keep the top of the "capillary fringe" below the foundations of stone monuments in order to prevent water from wicking up into the stone and causing damage. AECOM had calculated the rise using mathematical formulas, but needed field data.

Hanan Mahmoud of the SCA Giza Inspectorate, and an instructor in our Analysis and Publication Field School, supervised clearing the sand backfill from Trench 2, assisted by Amelia Fairman. They excavated Watson's 2006 probe about 86 to 99 centimeters (2.8 to 3.2 feet) deeper, to a maximum depth of 14.50 meters asl. The AECOM team excavated yet deeper. They found the water table at 13.44 meters asl, nearly 2 meters (6.6 feet) lower than the bottom of the foundation blocks of the Wall of the Crow (15.41 to 15.29 meters asl). AECOM determined that the capillary rise, "the demarcation line between wet and dry soil," was 1.2 meters (3.9 feet) above the groundwater. This figure, and other test pit results, helped in establishing a target level for the dewatering of the area.

Capital Zone Walkabout 2010

Climate change was very much on the mind of AERA team members and colleagues when Ana Tavares organized the second AERA-hosted "Capital Zone Walkabout" for April 9–10. Climate change is certainly a hot topic these days, at the beginning of the 3rd Millennium AD. But at Giza we discussed major climate shift in the middle of the 3rd Millennium BC, just about the time people built and lived in our Lost City of the Pyramids.

During the first Capital Zone Walkabout in 2006 we met informally with colleagues who work in the narrow neck of the Nile Valley, from the entrance of the Fayum to the apex of the Delta. Within this zone emerged settlements that ruled a major part of Egyptian territory over the long duration of ancient Egyptian history. Issues of common concern include the distribution and stratigraphy of settlements, the location and movement of the Nile and its branches, and the question of harbors near the valley temples of pyramids.

This year we hosted the second round of meetings in the new AERA Egypt Center with Miroslav Barta and Lisa Lenka (Charles University, Prague), from the Czech Institute of Egyptology mission at Abusir; Nicole Alexanian from the German Archaeological Institute mission at Dahshur; Judith Bunbury from Cambridge University; and Angus Graham from the University of Sunderland. AERA team members included Mark Lehner, Richard Redding, Mary Anne Murray, Ana Tavares, Will Schenck, and Philip LaPorta.

We discussed the relationship between the erosion of the Sphinx and 4th Dynasty settlement ruins at Giza to research that shows a southward retreat of summer monsoon rains and the drying of Saharan grasslands beginning in the north as late as 2500 BC. Judith Bunbury and Angus Graham brought to the discussion recent work at several sites along the Nile Valley from Giza to the Sudan.

We toured spots at Giza pertinent to these questions: Did people occupy the Lost City and Khentkawes Town sites before and after the transition between moister and drier conditions? If the main river channel and its levees pressed up against the western side of the valley, then migrated eastward, what does this mean for the possibility of harbors in front of the pyramid valley temples strung along the desert edge at Giza, Abusir, Saqqara, and Dahshur? We discussed the AERA team's recent discovery at the eastern end of the Khentkawes causeway of ramps, corridors, terraces, and stairs around the edge of a deep artificial depression, possibly a harbor.

Miroslav Barta and Lisa Lenka reported on their recent work in the dry bed of the Abusir Lake, long thought to have been a waterway fronting the main wadi up into the Saqqara Plateau, possibly connected to harbors in front of the valley temples of the Abusir pyramids and sun temples. Miroslav and Lisa related evidence that the Abusir Lake existed in the Old Kingdom, when it played an important role in the ideology and practical use of the landscape for ritual and funerary purposes, as it may have in later pharaonic times. Evidence for the Old Kingdom climate shift is diverse, from analysis of lake bed sediments to remains of beetles found in tombs. On the second day, when we visited Abusir, Miroslav took us across the causeway of Sahure's pyramid to a high mound piled by the early excavators. We looked down upon the locations of the valley temples of Sahure to the left (northeast) and Niuserre to the right (southeast). To the far south we could see the swale of the Abusir Lake.

To visit the excavations in-progress of the German Institute's mission at Dahshur and witness the emergence from deep desert sand of a monumental causeway, with massive mudbrick walls and a vaulted roof, had to be the most dramatic contribution to the 2010 Capital Zone Walkabout, and for this experience we are deeply grateful to Nicole Alexanian, Dirk Blaschta, and the German team. The causeway leads east from the so-called valley temple discovered in the 1950s by Ahmed Fakhry at the end of an upper stone causeway descending from the Bent Pyramid.

Geophysical survey and core drilling indicate that this impressive lower causeway ends at a rectangular enclosure, 90 meters (295 feet) wide, also buried deep under sand. Recent excavation on the southern side of the wadi revealed that the 4th Dynasty builders made a huge cut into the clay-like (*tafla*) bedrock. Then they reinforced the sides with thick mudbrick walls. In two drillings in the middle of the rectangular structure, 270 meters (885 feet) to the east of the so-called valley temple, the German team found pottery and charcoal at a depth of 14.70–13.60 meters above sea level, as low as our best estimates for the level of the Old Kingdom floodplain.

This was the highlight of the Capital Zone Walkabout 2010: a consilience of discoveries in the last two years at Dahshur and Giza of enclosures nearly a kilometer (0.6 miles) west into the desert sunk as deep as our best estimates for the level of the floodplain 4,500 years ago, one attached to Sneferu's Bent Pyramid, the other to the Khentkawes monument.

How do these deep artificial basins relate to the wadi fans of desert sediments, or to the desert edge lakes? These are somewhat opposite features, yet we imagine both lay at the mouths of the wadis. To what extent did the recently discovered basins function as harbors? How could the ancient engineers have delivered water through the high levees of a major Nile channel pressed close against the western desert? Did the Egyptians abandon early pyramid harbors as the Nile moved east across the floodplain and the monsoon rains shifted south, causing sand, in place of Nile water, to inundate?

With our colleagues, the AERA team will be hard at work on these questions until our next Capital Zone Walkabout. Stay tuned for major discoveries.

Facing page: AERA collaborators on the 2010 Walkabout. From left: Richard Redding, Miroslav Barta, Lisa Lenka, Ana Tavares, Judith Bunbury, Philip LaPorta, Nicole Alexanian, and Angus Graham.

We ended our Capital Zone Walkabout 2010 on the northwestern shore of the Dahshur Lake. Even though authorities now regulate the water level, this lake serves as an image of desert-edge lakes of old, and AERA team members have come here over the years for a sense of Pyramid Age ecology. When the water swells, ducks and geese, stands of tall, green reed, and the occasional wooden boat break up reflections of blue sky. When the water has been low, cattle, sheep, and goats graze on succulents. In the background rises the Bent Pyramid of Sneferu. Nicole Alexanian spoke of a series of elite Old Kingdom tombs on hillocks that front onto the Dahshur Lake like exclusive chalets for getaways from life meant to last forever.

Seeing Beneath the Surface: Hints of an Older City

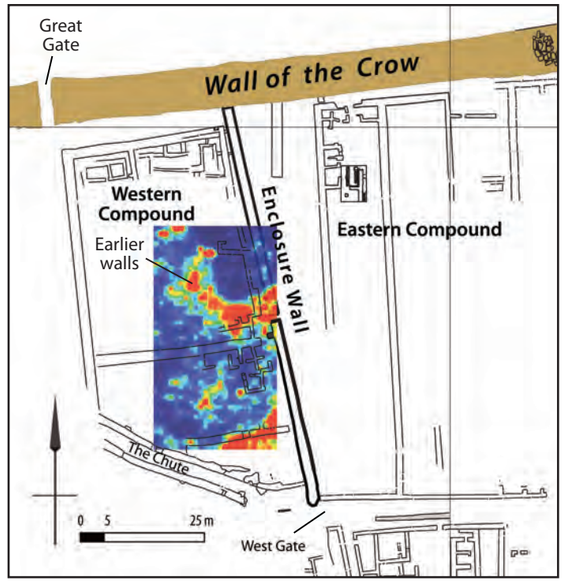
Geophysical surveys have been a regular part of AERA's activities for more than ten years. Glen and Joan Dash of the Glen Dash Charitable Foundation have deployed a variety of technologies in our efforts to "see beneath the surface," including magnetometry, electromagnetic induction (EM), and ground-penetrating radar.

In 2010, they revisited some of the areas they mapped with ground-penetrating radar during our 2001 season. Ground-penetrating radar has improved quite a bit in the last ten years, particularly in its processing methods. New software allows them to render the subsurface to much finer detail.

In 2001, their radar survey detected what may be a substantial building buried about two meters (6.6 feet) beneath the surface just to the south and east of the Great Gate in the Wall of the Crow, in an area we call the "Western Compound." Visually, the area was largely featureless. The dominant feature we see on the surface here today is the northwestern extent of the Lost City's enclosure wall.

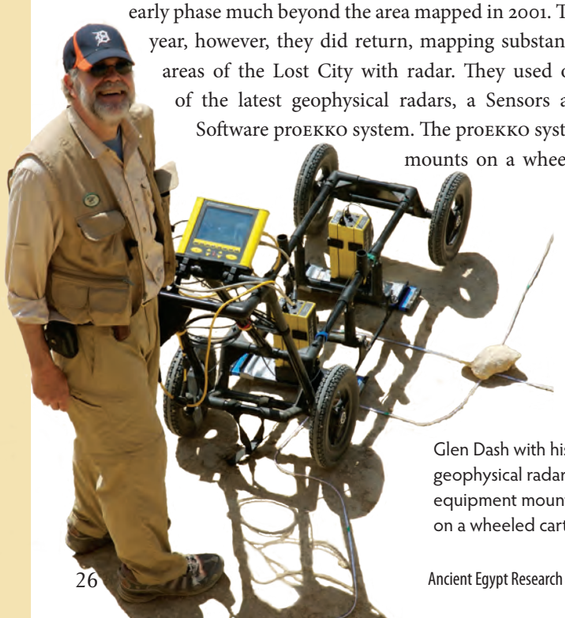
Superimposing the 2001 radar map over the site plan, we see what may be the truncated walls of a major building running under the enclosure wall. The building (if that is what it is) is itself a significant find. But the fact that it runs under the enclosure wall, and therefore predates it, may be evidence of an earlier phase of the city—essentially a first city under the second one.

Because of ongoing excavations and other activities, Glen and Joan have been unable to expand the radar search for this early phase much beyond the area mapped in 2001. This year, however, they did return, mapping substantial areas of the Lost City with radar. They used one of the latest geophysical radars, a Sensors and Software proEKKO system. The proEKKO system mounts on a wheeled cart, which allows them to ride over the surface. Earlier radars had to be dragged along the surface, potentially damaging fragile archaeological features. Over the next few months they will be processing this data. New technology will allow them to render the subsurface in two and three dimensions. Then they may be able to confirm the existence of an earlier "Lost City."



Top: The geophysical team: Glen and Joan Dash.

Above: Radar data superimposed over the site map showing the Western Compound in the northwest area of the site. The radar data, which appear to show the outlines of a building two meters (6.6 feet) beneath the surface, may indicate an earlier phase of the site.



Glen Dash with his geophysical radar equipment mounted on a wheeled cart.

Twelve Seals: Solving Mysteries of the Pyramid State

In July, Mark Lehner, Richard Redding, and Wilma Wetterstrom met with John Nolan to discuss the completion of his dissertation on the sealings discovered at Pottery Mound, a part of AERA's excavations at the Lost City of the Pyramids. "Sealings" are pieces of specially prepared clay that secured doors, jars, boxes, and papyrus documents in antiquity. Frequently, the officials who applied these sealings would roll cylinder seals, carved with their titles and the name of the reigning king, in the clay while it was still wet. For years we have discovered broken pieces of these sealings—and their texts—throughout the Lost City of the Pyramids. However, the stream of 1,199 sealing fragments excavated from Pottery Mound in 2005 was clearly a special discovery. From hundreds of tiny fragments John and Ali Witsell reconstructed 12 complete seal designs of pharaoh's high officials. The following are excerpts from the discussion.

John: We registered 1,199 sealings or sealing-related objects coming out of Pottery Mound … from three 5-meter-by-5-meter squares, of which 1,036 have seal impressions on them. From what I can tell looking at the records of other sealing finds from the Old Kingdom, this is by far one of the richest.

Mark: There was another unusual thing about this dump deposit, Pottery Mound, and it was the animal bones. Richard, what patterns were you finding in the animal bone?

Richard: Cattle dominated the faunal remains to the extent that there almost was nothing else there. Probably 90% of their protein was coming from cattle, which is pretty unusual for our site or any site.

Mark: What does that tell you about status and diet? Who gets to eat cattle?

Richard: Well, in general, cattle are preferred. If you look at any tomb scenes or the offering scenes, most of the animals being offered are cattle. In the cattle remains from Pottery Mound there exists a strong bias in terms of body parts. In general, you would expect a ratio of 1.1 hind limb fragments to 1 forelimb fragment, and we were getting right around 33 hind limb fragments for every 1 forelimb fragment. Forelimbs weren't there. They were being taken someplace else. The forelimbs are the choice meat. In all offering scenes, they force cattle down, tie them up, and start cutting off the forelimb. When they show offerings being carried off, in all the tomb scenes I have ever seen, it's always the forelimb. So what we are seeing in Pottery Mound is what's left over after the offerings are given in a temple situation.

Mark: What I hear you saying is people are eating prime beef.

Richard: Yes. …

Mark: … What type of titles were you getting on the seals, John?

John: Well, out of the Pottery Mound, the primary title we were getting was "Scribe of Royal Documents." This appeared over and over again. For the 4th Dynasty, the "Scribes of Royal Documents" were comparatively rare. In the 5th Dynasty, they become much more common. As Ali Witsell and I worked with these, we found a lot of replication, which allowed us to piece together all of the little fragments of seal impressions and restore the original inscriptions on the cylinder seals. …

Mark: But now the plot thickens, because Pottery Mound is actually in what we call the Western Town between the Royal Administrative Building and the high desert. Here, we find some of the biggest houses on the site, 400 square meters, and Pottery Mound is tight between two or three of these large houses. So, we're finding evidence of the residents eating prime beef. And now with your study and reconstructions we're finding thousands of sealing fragments impressed with official seals. We start to get suspicious about people living in the big houses. Can you rattle off some of the other titles that you are now able to read by piecing together these twelve puzzles, the Twelve Seals? …

John: …. We've got "Scribes of Royal Documents for Royal Instructions" … and "Scribes of Royal Documents for Royal Construction Projects."

Mark: Now that gets us close to the pyramids and the whole idea of excavating the town of the pyramid builders.

John: Right. These "Scribes of Royal Documents for Royal Instructions" seem to have been a tight cohort of officials. And one of their other titles is "Scribe of the King's Writing Case."

Mark: Well that sounds more important than, say, a government secretary.

John: It implies kind of an intimate, personal service to the king. And it is a subset of the Scribes of Royal Documents, who form an important class of officials at this time.

Mark: One thing to clear up right away, how do we know that these boxes, documents, and doors were being sealed and opened and resealed right there? How do we know all this stuff wasn't sent from the palace 20 kilometers away in Memphis or even from Upper Egypt to this encampment for building the pyramids?

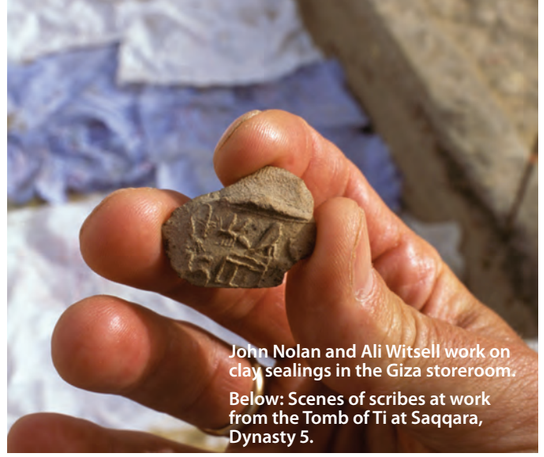
John: Well, first off, the prevalence of box sealings is a little suspicious. … Archaeologists working elsewhere in Egypt have presumed that the box sealings that they find are local. But the real evidence is … three box sealings that appeared to have been applied and removed while still wet, crumpled up, and thrown away. One in particular—Sealing 4550—is the "smoking gun" for Seal 8 of the Twelve Seals.

Mark: So basically somebody put this dab of wet clay to seal the string tie of a box, and they rolled the cylinder of this particular seal, Seal 8, over it, leaving its hieroglyphic impression, but then maybe it didn't stick or something and so they took it off and crumpled it up and threw it away.

John: And this shows that at least Seal 8 of the Twelve Seals was being applied to box sealings near Pottery Mound.

Mark: This is a real detective story. So what does Seal 8 say? What does it speak to you?

John: First, it was inscribed with the *serekh* of Menkaure, the builder of the



John Nolan and Ali Witsell work on clay sealings in the Giza storeroom.

Below: Scenes of scribes at work from the Tomb of Ti at Saqqara, Dynasty 5.

third Giza pyramid. It also bears the title, "Scribe of Royal Documents for Royal Instructions." This official was also a "Scribe of the King's Writing Case" …

Mark: But doesn't that then suggest that you might have had royal kids very close to where these sealings were found?

John: Yes.

Mark: Because you have somebody who seems to be curating the royal documents that go to teaching young people of the royal house.

John: Right, and this is a new phenomenon in that period, and there are four or five of these people all concentrated near Pottery Mound, possibly living in the big houses right next to Pottery Mound, or working there and living elsewhere.

Mark: And eating some of the best of the meat being delivered! Well, you know, its an old idea in our project. Even before we started clearing on a massive scale, we had the hypothesis that we might have a palace or part of the royal house somewhere close by. We found what essentially looks like big blocks of barracks, and the enclosure we call the Royal Administrative Building doesn't look like a place where royalty lived and slept. It looks like a place of production and storage. But, you're tending to go back to the idea of a nearby royal residence based on what is, really, the only real software from our site: the texts that we get from these sealings. If people kept documents pertaining to royal teachings in boxes and these documents in these boxes are being opened and shut, opened and shut, on our site, basically aren't you saying that royal young people and royal children were being instructed on our site?

John: Yes, it's not a new idea that … "education," in their terms, was probably more practical education. It was learning how to work, learning how the royal government worked, where the work was actually happening. What better place to be instructed than at a pyramid construction site? …. There are … biographical texts. One, for example, belongs to a fellow named Ptahshepses, an important official from the generation after the generation of Giza, who gives eight phases of his life from the reign of Menkaure at the end of the 4th Dynasty all the way through the reign of Niuserre in the 5th Dynasty. He says that during the time of Menkaure, he was…I believe the word could be translated, "nurtured (*šd=f*)" and later "in privacy in the Royal Apartments (*ip.t-ny-św.t*)."

Mark: Basically the word he uses indicates something like in the nursery, the kindergarten, or the children's private area of the royal house?

John: Yes, and it is intriguing because from other texts, this part of the royal house contains wives, children, high officials. Its been translated as "royal apartments," but it is more like a "royal quarter." …

Mark: The Western Town where we found these sealings and where these high-ranking scribes might have lived is very grid-like. Is it true that when archaeologists see grids and orthogonal plans in ancient settlements, they think these are footprints of the state?

Richard: No, not necessarily. There's been a revolution in the last 15 years in how people think about state level societies and what they call tribes, chiefdoms, and states. There's now a new category, kind of an intermediate condition between chiefdoms and state level societies called "stratified societies," which are seen as either archaic states or sometimes very highly advanced chiefdoms. And, you get that orthogonality in these stratified societies. In the settlement site at Giza we have a laboratory that I think a lot of people would be very interested in.

Mark: State formation has been a hot topic in archaeology. Many Egyptologists have their hands on data like John's sealings, data that has a lot to say about the growing up and evolution of state bureaucracies. I think it's true that until the recent generation or two, Egyptologists don't think as much as anthropological archaeologists about state formation as a general issue. … I would like you to amplify, Richard, on your phrase, "What we have at Giza is a laboratory" … Of state formation? …

Richard: Egypt has always been seen as having an interesting role in comparative studies of state development or the evolution of states. Egypt is one of the original, defining archaic states, or "Asiatic states," as Marx called the type. We now see a much more fine-grained evolution over time from chiefdoms to these archaic states or stratified societies, and then to true state societies. And there's a whole series of questions as to why these occur. People have tried to explain how and why such a complex system develops through time. They've tried to identify key points and pressures that move people from chiefdoms to stratified societies. For Egypt, nobody really knows where the transitions were. I've heard people say that the first state occurs with Dynasty 1. Others argued that it was probably sometime in the 3rd Dynasty that we saw the development of state level societies. I've always thought that it was much later. When did these very complex societies emerge? What level of complexity characterizes Egypt during the 1st Dynasty, 2nd Dynasty, 3rd Dynasty; what level was it at the 4th Dynasty?

Mark: It's an issue of how you categorize different political states—I mean "state" as in "condition"—of the social networks in the Nile Valley. We were saying that in the early Old Kingdom, at the time of the order-burst of giant pyramids, the social network within the Egyptian Nile Valley was ruled by a family. But John's study of the sealings suggests a transition away from family rule to government that is more formal and bureaucratic. What transition do you sense happening already in the 4th Dynasty in Giza on the basis of these seals that you've reconstructed?

John: I base my analysis on the stratigraphy of Pottery Mound, and, even more importantly, on Richard's analysis of the bones from two particular layers or features, as we call deposits. Feature 24,462 is one of the lowest features—the bottom of the pile. And it has significant amounts of bone. Feature 21,557 is up near the top of the pile and produces the bulk of the sealings, in general, and it also produced a large amount of bone.

Mark: So, you've got two layers: the bottom of the pile and the top of the pile and they're both significant for your sealings. …

John: … The faunal evidence indicated that those two features were locally produced and did not move much after they were deposited. And if that is the case, and with this other evidence I have of local manufacture of the sealings, it seems that we have at least those two time capsules, in the deposition of garbage in Pottery Mound from the surrounding structures …. As it turns out, the lowest deposit, 24,462, had sealings from only three of the Twelve Seals that we reconstructed. Those three seals also happen to be the only three that have the name of Khafre, …. who came before Menkaure. So they appear to be older seals. The other nine seals bear the name of Menkaure. The highest layer, 21,557, has all twelve. Now that indicated to me that all twelve were active at the top of the pile, while only the oldest three were active at the bottom of the pile…. The officials who used the three Khafre seals are not specialized at all; they are just generic "Scribes of Royal Documents"…. Later we start to see these scribes specialize. You have one who is a "Scribe of Royal Documents for Royal Construction Projects," and then there are five that appear to be "Scribes of Royal Documents for Royal Instructions." So you start to see in the reign of Menkaure a specialization for these scribes and an increase in the number of scribes at the same time.

Mark: So if I may simplify, from the bottom of the pile where you have sealings of Khafre, to the top of the pile where you have all twelve seals, including Menkaure and Khafre, you're getting more scribal titles, more elaborate scribal titles, and you think this transition towards greater complexity in the bureaucracy was happening.

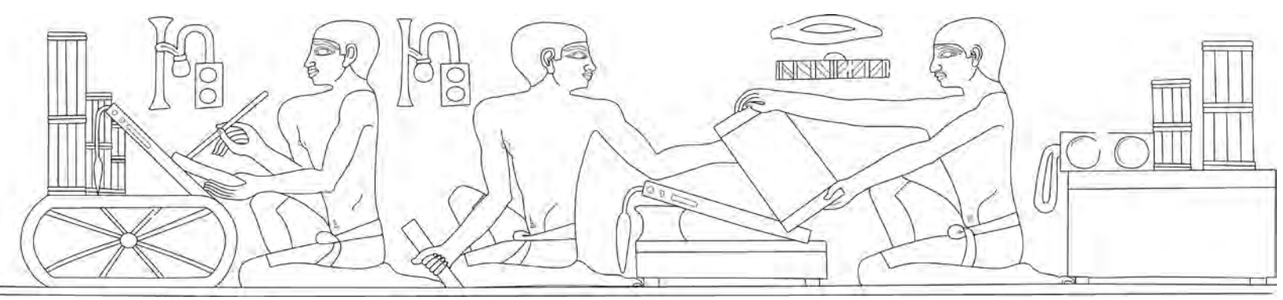
John: I also looked at titles from tombs, and they bear out that there was an increase in specialization around this time.

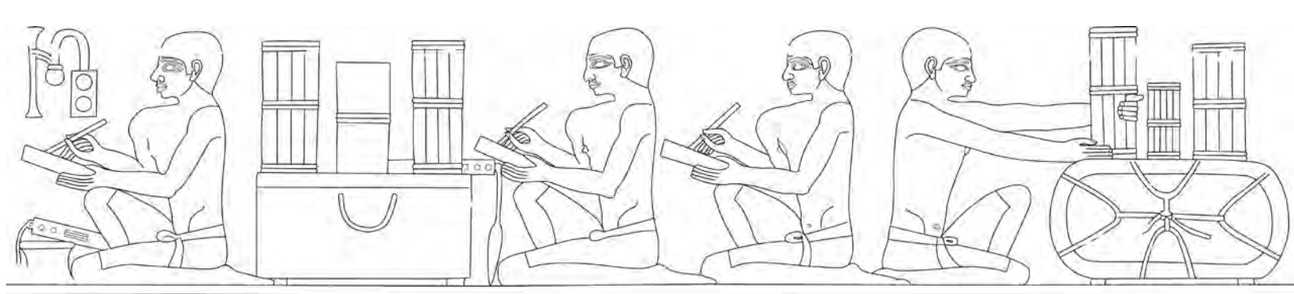
Mark: So your imprints from the bottom and the top of the pile match a pattern that you're seeing over time on the titles of the tombs … ?

John: Right.

Mark: What really impresses me is how we're going from the very general—how you categorize a social network in terms of different levels of statehood, or the condition of the social network; general principles that you can apply not only in Egypt but to other complex societies like Mesopotamia—to the very particular, like individual layers in a particular dump of garbage. This is one of the things I like about our work. We go from the extremely particular to very broad and general issues about what's happened on our planet.

Richard: Yes, as I described earlier, we've got a beautiful laboratory for the development of cultural complexity. Given the tremendous amount of material culture and information we have from historical documents, I think we have an opportunity to make a unique contribution to this whole argument about the development of cultural complexity.





Catalyzing Chronology!

The David H. Koch Pyramids Radiocarbon Dating Project Spurs ^{14}C Dating of Early Egypt

An interesting thing happened to me on my way to Giza for AERA's Analysis and Publication Field School. I stopped en route to attend a symposium, "Radiocarbon Dating and Egyptian Chronology," in Oxford, England, and learned at the start of the first session that an article I had coauthored with archaeologists Zahi Hawass, Robert Wenke, and John Nolan, and geochronologists Georges Bonani, Herbert Haas, Shawki Nakhla, and Willy Wölfli, had catalyzed the study that was about to be presented.

Published in the journal *Radiocarbon* in 2001, and referred to as Bonani et al. 2001,[1] the article summarized the results of the David H. Koch Pyramids Radiocarbon Dating Project (PRDP), which suggested a discrepancy between radiocarbon dating and Egyptologists' chronologies. Organic materials extracted from the pyramids dated significantly older than the dates Egyptologists accept for the kings who built these pyramids. Scholars took note.

Egyptologist Andrew Shortland described at the start of the conference how one day Christopher Bronk Ramsey, Director of the Oxford Radiocarbon Accelerator Unit, ran into his office with the article in hand exclaiming, "Something must be wrong with Egyptologists' chronology!" Shortland read the article and retorted, "Something must be wrong with radiocarbon dating!"

A team of geochronologists and Egyptologists from Oxford University's Research Laboratory for Archaeology and the History of Art launched a study to resolve the issue. At the two-day conference (March 17–18) they presented their findings about "the widely accepted perception of discrepancies between radiocarbon dates and the Egyptian historical chronology."

When I heard Shortland's story, I felt uncomfortable, because I thought neither the chronology nor radiocarbon dating was wrong, and I had helped instigate the study behind Bonani et al. 2001. Twenty-six years earlier I had approached Robert Wenke, then Director of the American Research Center in Egypt (ARCE), about the possibility of using ^{14}C to date organic material, primarily charcoal, embedded in the mortar between the core blocks of the of the Giza Pyramids.

Peopling the Pyramids

How did charcoal, and sometimes reed and wood, along with pottery end up in the pyramid core masonry? People slept, cooked, ate, and kept warm around hearths up on the pyramids as they built them over decades. And they burned vast quantities of wood to heat gypsum to create mortar for the core masonry. Much of the charcoal in the masonry must derive from this fuel.

The Edgar Cayce Foundation agreed to fund the dating, for such a project certainly served to test their idea that the pyramids and Sphinx originated 8,000 years earlier than Egyptologists believe.

Pyramid Sampling 1984

So began the Pyramids Radiocarbon Dating Project, at first just Robert Wenke, Melinda Hartwig, and myself climbing over pyramids extracting tiny samples of reed and charcoal. Later we were joined by Herbert Haas, then director of the Radiocarbon Laboratory at Southern Methodist University in Dallas.

Between December 12, 1983, and March 22, 1984, we collected 80 samples. Haas pretreated 76 samples at SMU and obtained ^{14}C dates on 34 samples larger than 0.8 grams through conventional (benzene scintillation) methods. He sent the smaller samples to his Swiss colleagues, Willy Wölfli and Georges Bonani, at the Institute of Particle Physics, Eidgenössische Technische Hochschule (ETH) in Zurich. Wölfli used the ETH Accelerator Mass Spectrometer (AMS) to date 30 smaller samples (2–4 milligrams). We ended up with 72 ^{14}C age estimates from 64 samples derived from 12 pyramids, 4 pyramid temples, and one 1st Dynasty tomb, with 16 dates from the Khufu Pyramid alone. The calibrated ^{14}C dates, as we published in 1987,[2] averaged 374 years older than the historical dates.

Most of our dates were on wood or charcoal samples from Old Kingdom pyramids. Was it possible we were dating wood burned as fuel long after it had been cut? Archaeologist Michael Schiffer[3] had pointed out the "old wood" problem in radiocarbon dating. Iron wood and mesquite that he collected from the surface of the Sonoran desert dated from 200 to 1,500 years before present! Not only can wood lie around for a very long time before people burn it, the inner rings of trees are "dead" to radiocarbon and will date older than the outer rings.

The David H. Koch Pyramids Radiocarbon Dating Project: 1995

Our 1984 results stood for ten years, until David Koch made it possible to investigate the glaring discrepancy further with the PRDP 1995, a collaboration of Zahi Hawass and Shawki Nakhla of the Supreme Council of Antiquities (SCA); Herbert Haas, then with the Desert Research Institute (DRI) in Los Vegas; Georges Bonani and Willy Wölfli; Robert Wenke, University of Washington; myself and John Nolan, AERA.

This time we planned to retrieve samples of short-lived plants, reed and grasses, and to collect more samples from the 1st Dynasty tombs and Middle Kingdom Pyramids—the periods that bracket the Old Kingdom. Archaeobotanist Wilma Wetterstrom set up a temporary lab in Giza and identified many of the samples.

We collected 353 samples between December 26, 1994 and February 27, 1995. Herbert Haas obtained 7 radiocarbon age-estimates by conventional methods at DRI. Georges Bonani obtained radiocarbon age estimates for 163 samples using the AMS at ETH. Unfortunately, charcoal and wood combined still predominated our samples at 79%, while grasses and twigs accounted for only 19%.

The combined 1984 and 1995 studies produced 235 new dates, including 42 from the Khufu Pyramid alone. Geochronologists calibrate "raw" ^{14}C dates (usually given BP, "before present"); that is, they adjust for fluctuations of ^{14}C in the atmosphere by a calibration curve obtained from dating rings of very old trees. The calibrated dates tended to be 100 to 200 years older than the historical dates and about 200 years younger than our 1984 dates. We also had a bigger scatter in 1995, with dates varying widely even for a single monument—400 years in the case of the Khufu Pyramid. In contrast, we had fair agreement between the PRDP dates, historical dates, and previous radiocarbon dates on reed from 1st Dynasty mudbrick tombs, and between the PRDP and historical dates on reed from mudbrick in three Middle Kingdom pyramids.

We were left with the question: Why are the radiocarbon dates from the early Old Kingdom pyramids so problematic?

Nolan Checks 2-Sigma Overlap

While we considered a number of factors—reuse of older cultural material, long use or storage before burning as fuel, and the "old wood effect"—John Nolan meticulously calibrated each ^{14}C age estimate for absolute dates BC using the program "CalibETH" described in Stuiver and Braziunas.[4] John wanted to see if the 2-Sigma range (two standard deviations from a normal distribution giving the widest probability, 95.44%) for each calibrated date at least overlapped or touched historical dates. John asked: "Do the 2-Sigma probability ranges of the set of calibrated dates for a given monument show a common overlap and touch the historical age at least somewhere in the range?"

Calibrating an Average of ^{14}C Dates

John's approach was different than the summary of PRDP results in Bonani et al. 2001. We AERA team members yielded to the preference of our Swiss colleagues to take a weighted mean value for all ^{14}C dates for a given monument, and then calibrate that mean, rather than each individual date. Bonani et al. 2001 thus gave a calibrated average date for each monument. On this point we had a fairly spirited e-mail exchange just before Christmas 1999.

Robert Wenke (left) and John Nolan log a sample for ^{14}C dating on the Giza pyramid of Menkaure in 1995. The pyramid of Khafre rises behind them. View to the northeast.

It seemed to me that averaging all the 42 dates for a pyramid like Khufu's, which builders occupied for over twenty years, made no more sense than averaging all radiocarbon age estimates for a settlement site like Akhenaten's 18th Dynasty capital city at Amarna. The Great Pyramid is more like an archaeological site than a discrete object. Calibrating a mean, even a weighted mean with a Chi square test, obscured conspicuous differences between the 1984 and 1995 dates, and silenced signals inherent in the anomalous results and wide scatter, features especially pronounced for the gigantic pyramids of the early Old Kingdom.

But that very year, 1999, AERA launched its Millennium Project, a three-year marathon to clear, map, and selectively excavate several hectares of the pyramid builders' settlement. Over the next ten years we would continue excavating the Lost City site, take on the neighboring Khentkawes Town, run seven

field schools, search out and purchase property, and refurbish an old villa to serve as the beginning of our AERA Egypt Center.

Extremely busy and preoccupied with all these projects, we left to our colleagues the summary findings reported in Bonani et al. 2001, with 17 radiocarbon date sets for monuments older than the historical-Egyptological estimates, only 6 date sets compatible, and 4 more recent—overall, a disparity between radiocarbon and Egyptological dating of the early Old Kingdom pyramids.

Back to the End: The 2-Sigma Range!

Sturt W. Manning, writing in 2003 about radiocarbon dating and Egyptian chronology for the *Handbook of Egyptian Chronology*[5] published in 2006, did not see in Haas et al. 1987[2] or Bonani et al. 2001 a problem of radiocarbon dating for Egyptian chronology. Manning stated:

> …the interpretation of Bonani et al. is based on two inappropriate starting points. First, there is no allowance for likely average sample age at time of use (i.e. "old wood" age) for random wood/charcoal samples not known to be outer tree rings, and second, *Bonani et al. use average values for the radiocarbon age of sample sets which contain significant internal variation…* (emphasis mine).[5]

Manning pointed out a compounding factor that induces old age in our pyramid samples: the well known plateau in the calibration curve for the early 3rd Millennium BC. As determined by measurements on the rings of long-lived trees, radiocarbon remained relatively constant in the atmosphere between 2900 and 2500 BC. The result: during these 400 years "several calendar periods have similar radiocarbon ages."[5] A ^{14}C date within this half-millennium can have multiple intercepts with the calibration curve, resulting in several possible calibrated dates distributed over long time spans.

To illustrate how these factors might play out on a real date for the death-age of wood that Khufu's builders might have burned as fuel, Manning did a simulated radiocarbon age for the date 2587 ± 50 BC, allowing 50 years for the average age of wood his builders used as fuel, and 50 years error margin (see figure below). He observed:

> And what we find is that the shape of the calibration curve…yields a calibrated age that seems 100-300 years too old in the main *and only just includes the real date at the very end of the calibrated range at 95.4% probability* (emphasis mine).[5]

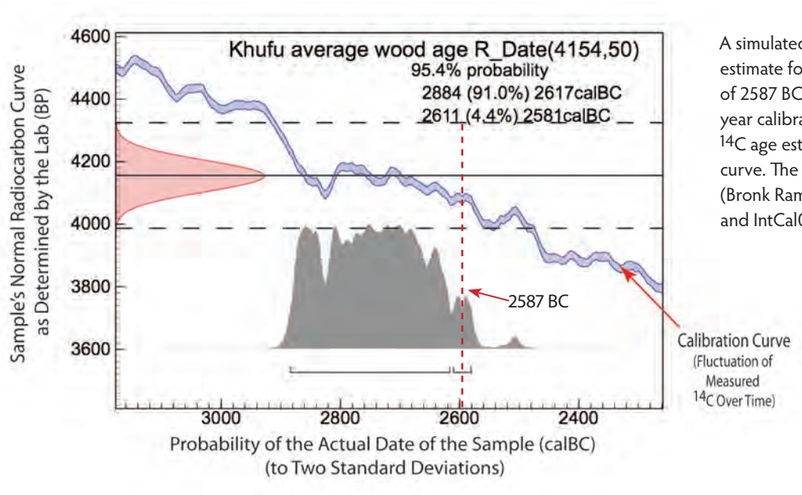
This realization is very close to the idea John Nolan pursued with calibrated dates on individual samples!

Oxford Assesses PRDP Results

In January of 2007, Joanne Rowland and Christopher Bronk Ramsey of the Oxford team contacted me about the possibility of running further measurements on any samples remaining from the PRDP and reassessing the dates we already had. To assist their re-analysis, John Nolan sent the Oxford team a copy of the Field Notebooks, the Photographic Log, and Index from our 1995 data collection.

Michael Dee headed the authors list on the Oxford team's publication in the journal *Radiocarbon*[6] of their "Reanalysis of the Chronological Discrepancies Obtained by the Old and Middle Kingdoms Monument Project," that is, the results of our PRDP, a.k.a. Bonani et al. 2001.

They first noted that our 1984/1995 project was "the most extensive chronometric study undertaken on Egyptian dynastic sites."[6] However, they focused their reappraisal on the "discrepancies observed in the dates from the 4th Dynasty monuments." Numbering 158 out of a total 269, the 4th Dynasty dates are numerous enough that the Oxford group could employ the OxCal calibration program with Bayesian outlier analysis, which statistically combines with ^{14}C measurements independent, *a priori*, temporal information, in this case the sequence of king lists accepted by Egyptologists.



A simulated calibration of a radiocarbon age estimate for a sample with a known historical date of 2587 BC. The real age is at the end of a 400-year calibrated range due to the intercept for the ^{14}C age estimate with a plateau in the calibration curve. The calibration is done using OxCal 4.1 (Bronk Ramsey, *Radiocarbon* 51 [2009]: 337–60 and IntCal09).

Rather than seeing each pyramid as an object, the Oxford group conceived the building of each pyramid as a phase, a process that included organic materials with inbuilt ages. In their terms, the *inbuilt age* of the sample—the difference between the death of the sample and the archaeological event, includes the *growth age*. Even as a tree yet lives, its inner rings are dead to ^{14}C and will radiocarbon date older than the outer rings.

Inbuilt age also includes *storage age* and *life history*. People can stockpile wood for many years. Egyptians recycled wooden boat beams to make hauling tracks. In pyramid building, wooden sledges, hammers, and levers might fall apart and splinter, and then end up fueling a hearth that warmed shivering workers and guards through a cold night. This must be partly why samples from the Djedefre and Khufu Pyramids varied in age over a 400-year period.[6]

Like Manning, the Oxford group noted at the outset that "…any averaging of the data sets would just provide an estimate of the mid-point of the measurements, which would continue to be non-systematically offset to older ages" by the factors listed above.

Developing further the idea that Manning had expressed, the Oxford team modeled the end boundary of the phase represented by the combined, individually calibrated ^{14}C dates and their probability ranges. They used algorithms to detect and marginalize outliers. They constrained the range of probability by incorporating the sequence of the king lists. Dee et al. noted, "By grouping the data into phases and producing estimates for the end boundaries it is self-evident that the calibrations shift to younger ages." These younger dates agree quite closely with those of Egyptologists for the historical reigns of the kings assigned to the 4th Dynasty pyramids. In fact, the Oxford age estimates shift slightly younger than certain Egyptological chronologies.

A Discrepancy That Informed: Heuristic!

The Oxford group concluded their reassessment of the results of the David H. Koch Pyramids Radiocarbon Dating Project by stating: "…the work of Bonani et al. (2001) remains a seminal contribution to our understanding of the chronology of Egypt, and the problems associated with ^{14}C dating this context."[6]

They went on to carry out their own new program, an extensive series of radiocarbon dates for the Egyptian Old, Middle, and New Kingdoms on samples as close as they could come to the ideal: short lived-species and secure contexts. They very recently published their new results in *Science*.[7]

From footholds in new dates, the Oxford group modeled accession dates for ancient Egyptian kings to obtain very close agreement with Egyptologists' chronologies: within 24 years for the New Kingdom, 53 years for the Middle Kingdom, and 76 years for the Old Kingdom.[8] We note that out of 10 total dates on Old Kingdom samples, they had no samples, and so no new dates, between Sneferu and Djedkare, so none for the 4th Dynasty Giza kings. These numbers once again highlight the extraordinary opportunity that David Koch presented for dating hundreds of Old Kingdom samples, including scores from the Khufu Pyramid alone.

It is well-known in science that discrepancies and anomalies—things that should not be if current mental models are correct and complete matches to the natural universe—have heuristic value! Heuristics is an aid to learning, discovery, or problem-solving.

The David H. Koch Pyramids Radiocarbon Dating Project made a seminal and catalytic contribution to radiocarbon dating and Egyptian chronology and, by extension, to the chronology of the Near East and the ancient world because, as Egyptologist Erik Hornung wrote, "Egyptian chronology is still the touchstone by which all of the other chronologies in the ancient world are measured and the issue of its reliability is thus central."[8]

~ *Mark Lehner*

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SHARING OUR WORK

Right: AERA in Japan. Yukinori Kawae presents a lecture,"Data Acquisition and Interpretations of the Tomb of Khentkawes at Giza," at the 15th Workshop of Western History, Osaka. Photo © Department of Occidental History, Osaka University.

Scholarly Publications for 2009–2010

JESSICA KAISER
"2010 Conference on Human Remains in Ancient Egypt," *Bulletin of the American Research Center in Egypt* 196:18–21, Spring 2010.

YUKINORI KAWAE
"Aiming to Go Beyond Archaeological Horizons: 3-D Data of Pyramids and Their Interpretations." *Proceedings of the 22nd International Committee for Documentation of Cultural Heritage Symposium*. 2009 (digital format).

MARK LEHNER
"Villages and the Old Kingdom." In *Egyptian Archaeology,* edited by Willeke Wendrich, 85–101. Blackwell Studies in Global Archaeology. Malden, MA, and Oxford: Blackwell, 2010.

CAMILLA MAZZUCATO
"Ancient Egypt Research Associates: Developing a GIS for the 'Lost City of the Pyramids.'" In *Egyptian & Egyptological Documents, Archives, Libraries.* Volume I. Pontremoli Editore Milano, 2010.

ANNA WODZIŃSKA
"Domestic and Funerary/Sacral Pottery from the Fourth Dynasty Giza." In *Studies on Old Kingdom Pottery*, edited by Teodozja I. Rzeuska and Anna Wodzińska, 209–224. Warsaw: Wydawnictwo Neriton, 2009.

"Work Organization in the Old Kingdom Pottery Workshop. The Case of the Heit El-Gurob Site, Giza." In *Studies on Old Kingdom Pottery*, 225–240.

"Potmarks from Early Dynastic Buto and Old Kingdom Giza. Their Occurrence and Economic Significance." *British Museum Studies in Ancient Egypt and Sudan* 13 (2009): 239–261.

A Manual of Egyptian Pottery, Vol. 3. Second Intermediate Period–Late Period, Vol. 4. Ptolemaic Period–Modern. Boston: Ancient Egypt Research Associates, Inc., 2010.

TEODOZJA I. RZEUSKA AND ANNA WODZIŃSKA, eds. *Studies on Old Kingdom Pottery*. Warsaw: Wydawnictwo Neriton, 2009.

During this past year we also submitted papers for publication that will be coming out soon. Please see our website (http://www.aeraweb.org) for a list of these forthcoming papers and a complete list of all our publications.

Lectures and Conference Presentations

JESSICA KAISER
"Graves of the Paupers?" The Kennedy Center, Brigham Young University, Utah, October 22, 2009.

"In the Shadow of the Pyramids: Giza as a Sacred Landscape during the Late Period." Department of Ancient Near Eastern Studies, Brigham Young University, Utah, October 23, 2009.

"The Late Period Cemetery in Giza." The Conference for Human Remains in Ancient Egypt (CHRAE 2010), January 29, 2010.

"Late Period Cemetery Excavations in Giza." The Northern California ARCE Chapter in Berkeley, CA, April 18, 2010.

"The Wall of the Crow Cemetery in Giza." The 61st Annual ARCE meeting in Oakland, CA, April 23, 2010.

ICHIROH KANAYA
"Toward Digitizing the Whole Giza Plateau" eHeritage Workshop, Microsoft Research Asia, National Palace Museum, Taipei, May 19, 2010.

YUKINORI KAWAE
"Aiming to Go Beyond Archaeological Horizons: 3-D Data of Pyramids and Their Interpretations." The 22nd International Committee for Documentation of Cultural Heritage Symposium. Kyoto, Japan. October 13, 2009.

(and ICHIROH KANAYA) "The Future Heritage: Scientist and Archaeologist create a 4-D Pyramid." Japan Egyptology Society in Cairo. November 22, 2009.

"The Excavations of the Western Town at Giza." 29th Ancient Egypt Workshop. Nagoya, Japan. December 5, 2009.

"Data Acquisition and Interpretations of the Tomb of Khentkawes at Giza." 15th Workshop of Western History. Osaka. June 26, 2010.

"The Excavations of the Western Town at Giza." 15th of Annual Meeting of Japanese Society for West Asian Archaeology. Tokyo. June 27, 2010.

MARK LEHNER
"At the Source: Sampling the Pyramids for Radiocarbon Analysis," Radiocarbon Dating and Egyptian Chronology Symposium, Ashmolean Museum, Oxford England, March 17-18, 2010.

"Sand, Sphinx and Silty Settlements: AERA Excavations and Climate Change," The Narragansett Chapter of the Archaeological Institute of America, Brown University, November 11, 2009.

"From the Sphinx to the Lost City of the Pyramids: A Journey of Discovery in Egypt." CEO Egypt/Nile College, Giza, Mena House Hotel.

RICHARD REDDING
"The Pig and the Chicken in Egypt." University of Michigan, Museum of Anthropology. October 22, 2009.

"The Old Kingdom," "Who Built the Pyramids and Why?" "Egypt, the Gift of the Nile." University of Michigan Alumni Nile and Red Sea Cruise Tour. January 16–19, 2010.

WILLIAM SCHENCK
"The AERA Field Schools." *The Egyptian World* Postgraduate Seminars Series, Cambridge University, UK. May 2010.

ANA TAVARES
"Recent work of Ancient Egypt Research Associates (AERA) at the Town of Queen Khentkawes, Giza." Netherlands-Flemish Institute in Cairo. March 25, 2010.

"Hands-on! The AERA/ARCE Archaeological Field-Schools." Egypt Exploration Society. Cairo. May 3, 2010.

"Heit el-Ghurab: An Unusual Settlement in the Old Kingdom 'Capital Zone'?" Abusir and Saqqara in the Year 2010 Colloquium, Czech Institute of Egyptology. Charles University, Prague. June 5, 2010.

"La ville des ouvriers au pieds des pyramides." For the opening of the exhibition "Vingt ans de fouilles a Gizeh." Centre Culturel La Coupole, La Gaude, France. June 2010.

WILMA WETTERSTROM
(and RICHARD REDDING and MARY ANNE MURRAY)
"Feeding the Pyramid Workers." Orange County Chapter of the ARCE, Bowers Museum, Santa Ana, CA, and Egypt Exploration Organization of Southern California, Los Angeles. May 8, 2010.

ANNA WODZIŃSKA
"Domestic and Votive Pottery from Giza. A View from Heit el Ghurab Site and Khentkaus Town." Functional Aspects of Egyptian Ceramics within their Archaeological Context Conference. McDonald Institute for Archaeological Research, Cambridge. July 24–25, 2009.

"Vessels and Social Status. Ceramic Material from the Pyramid Builders' Settlement at Giza." 90th anniversary conference of the Institute of Archaeology, University of Warsaw. Warsaw. December 7–10, 2009.

"Pottery from the Khentkaus Town at Giza. An Interpretation Attempt." Abusir and Saqqara In The Year 2010 Colloquium, Czech Institute of Egyptology. Charles University, Prague. May 31–June 5, 2010.

"Works of Ancient Egypt Research Associates – Heit el Ghurab Settlement at Giza. Ceramic Material from Western Town." Poles at the Nile: Archaeological Research in Egypt and Sudan during 2009–2010. Warsaw. June 4–16, 2010.

"Pottery as a Manifestation of Religion. Egyptian Votive Vessels in the Context of the Old Kingdom Funerary Complex of Khentkaus at Giza." First Interdisciplinary Conference: Seeking Origins and Manifestations of Religion, The Pułtusk Academy of Humanities. Pułtusk. June 28–30, 2010.

AERA...*on the Côte d'Azur*

This spring we brought our work to France with an exhibition, "Vingt ans de fouilles à Gizeh," at the Centre Culturel La Coupole in La Gaude, a small town in southern France. From June 8–19 visitors learned about our excavations at the Lost City site through twelve large posters illustrating the diverse work carried out by AERA. Ana Tavares, AERA Co-Field Director kicked off the exhibit with a lecture.

The posters, originally prepared for AERA's 20th anniversary celebration in Cairo in March 2009, illustrated Project History, Field Schools, Laser Scanning, GIS, and Archaeological Science as well as our studies of material culture, including ceramics, chipped stone tools, mud sealings, objects, plants, and animals. Former AERA team member Marie-Astrid Calmettes-Vermeulin translated the text into French. Mohamed Othman, a graphics group graduate of the 2010 Giza Field School, prepared the posters, painstakingly masking the English and replacing it with French text.

In the opening lecture, "La ville des ouvriers au pieds des pyramides," Ana Tavares explained how we reconstruct ancient Egyptian daily life from our excavations and also described the working life of the modern day archaeologist. The enthusiastic audience asked many questions.

Thank You to Our Contributors

AERA has been able to achieve all that we have described here in our annual report because of the generous contributions of our benefactors and members. Each and every tax-deductible donation supports AERA's archaeological excavations, the publication of our findings, and educational programs aimed at advancing knowledge about our common human heritage. We are extremely grateful to the following foundations, businesses, and individuals who generously supported our work.

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*AERA thanks Douglas Rawles and Jennifer Nelson of Reed Smith LLP for providing advice and counsel on a myriad of legal matters.

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The Analysis and Publication Field School ceramics team washes pottery sherds. To the right, the Giza Field Lab. Khufu's pyramid towers above all in the background. View to the east.

Foreground: Rasha Nasr Abd el-Mageed, APFS (Analysis and Publication Field School) student, identifies a cattle pelvis bone with the help of her instructor, Dr. Richard Redding, AERA archaeozoologist and Chief Research Officer.
Background: Rabab el-Gendy, APFS student, sorts archaeological plant remains under a microscope. Her instructor, Dr. Mary Anne Murray, AERA archaeobotanist and Director of Archaeological Science, enters plant data into a spreadsheet.

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