



## Memphis Site and Community Development: *Ambitious Plans, Big Challenges 2*

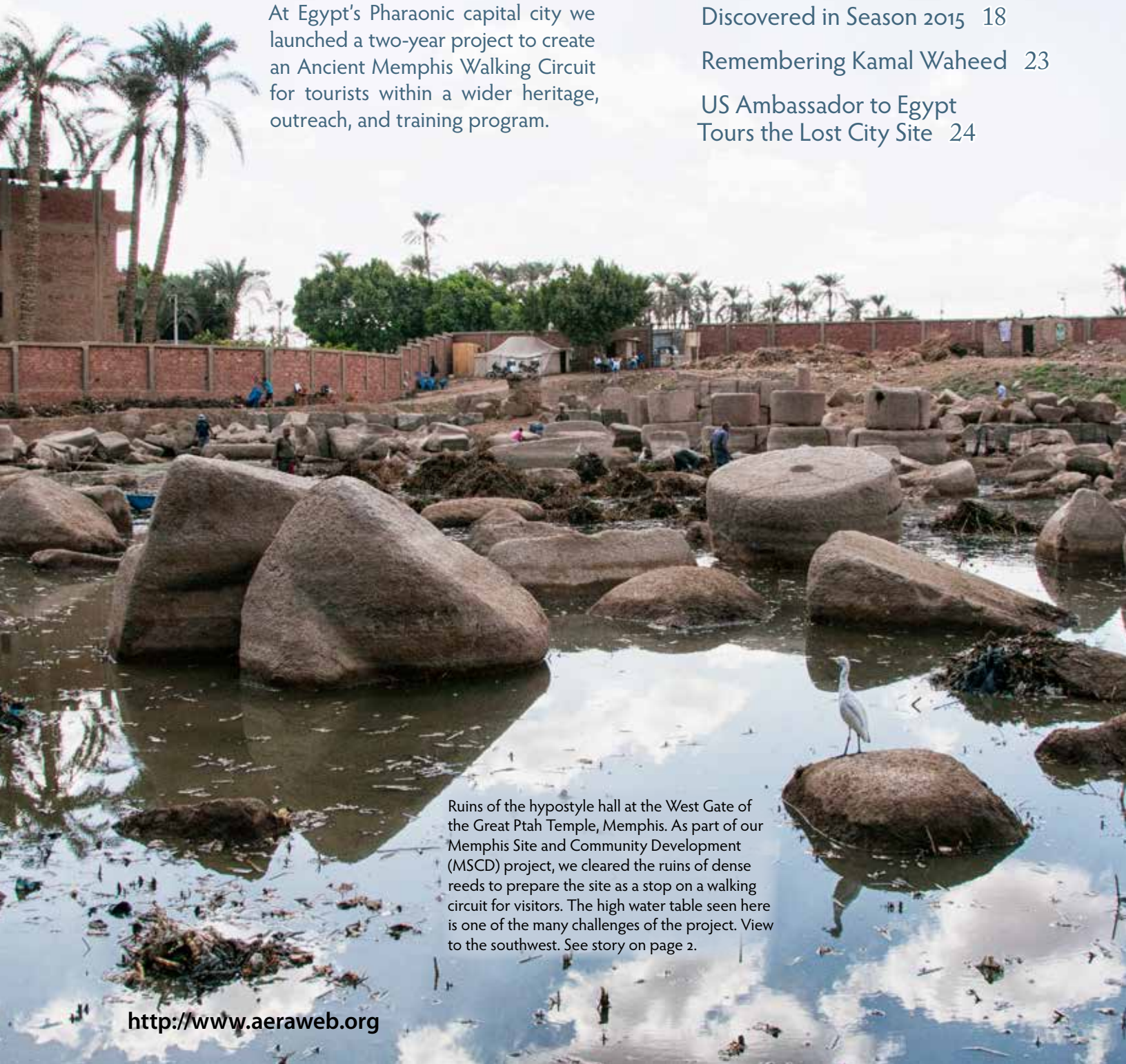
At Egypt's Pharaonic capital city we launched a two-year project to create an Ancient Memphis Walking Circuit for tourists within a wider heritage, outreach, and training program.

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Ruins of the hypostyle hall at the West Gate of the Great Ptah Temple, Memphis. As part of our Memphis Site and Community Development (MSCD) project, we cleared the ruins of dense reeds to prepare the site as a stop on a walking circuit for visitors. The high water table seen here is one of the many challenges of the project. View to the southwest. See story on page 2.

# Memphis Site and Community Development: *Ambitious Plans, Big Challenges*

In 1799 the Napoleonic Commission identified the site of long-lost Memphis, administrative capital of ancient Egypt through much of Pharaonic history.<sup>†</sup> Since then archaeological missions have mapped, surveyed, and excavated portions of the city, located 14 miles due south of Cairo. But most of Memphis goes unrecognized and unappreciated, except by specialists. We hope to help resurrect some of Memphis for visitors and local residents through our two-year Memphis Site and Community Development (MSCD) project. The project began last August, funded by a grant from USAID-Egypt.

Memphis played a major role in ancient Egypt's history, but little of it can be seen today. A difficult site to take in, it sprawls over a vast area—estimated to be 23 square miles—much of it still buried, much of it decayed mudbrick, much of it waterlogged. It is an undulating landscape covered in tall reeds and spiny camelthorn shrubs, punctuated by pools of water. Remnants of temples, walls, and chapels lie half-submerged

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<sup>†</sup>David Jeffreys, *The Survey of Memphis VII: The Hekekyan Papers and Other Sources for the Survey of Memphis*, EES Memoir 95, London: Egypt Exploration Society, page 63, 2010.

September 2015, the Ptah Temple West Gate before cleaning. The brick wall, built by the Ministry of Antiquities in 2011, encloses this small part of the Ptah Temple. Multi-story residential structures crowd against the wall on the north, east, and south. Amel Waheed took the photo when the ground water was low. It rose 2.8 feet to a peak in February. View to the south.

in water or vegetation. Modern development sprawls over the ruins of the ancient city and presses up against monuments previously excavated.

Today visitors tour the Open Air Museum and Sculpture Garden to view a colossal, recumbent limestone statue of Ramses II and statuary and inscribed blocks resting on pedestals. But unawares they pass by other sites where archaeologists have excavated important components of Memphis: the Great Temple of Ptah, the city god; the temple-house of the sacred Apis bull; a Hathor Temple; a chapel to Ptah; the White Walls Chapel dedicated to the capital city itself; and ancient residential neighborhoods (photo on page 4). Very few visitors realize the importance and magnitude of this center of Pharaonic Egypt as they stroll across its ruins (see sidebar on facing page). These sites offer a unique opportunity for tourists to experience the rich cultural heritage of Egypt's ancient capital.

## Memphis Site and Community Development Project

Our grant from USAID-Egypt was for programs that “conserve, preserve and promote...effective management of Egypt's cultural heritage resources with the aim of enhancing cultural tourism potential.”

We proposed a Memphis Walking Circuit that would draw attention to some of the important monuments usually overlooked as well as to the greater archaeological site. Since we had already thoroughly cleared and investigated one settlement area

*(continued on page 5)*



# MEMPHIS: THE ONCE-GREAT CAPITAL CITY LOST AND REDISCOVERED

The story of Memphis reads like an ancient legend: a great city flourished for more than 3,000 years; then was abandoned, lost, and finally rediscovered.

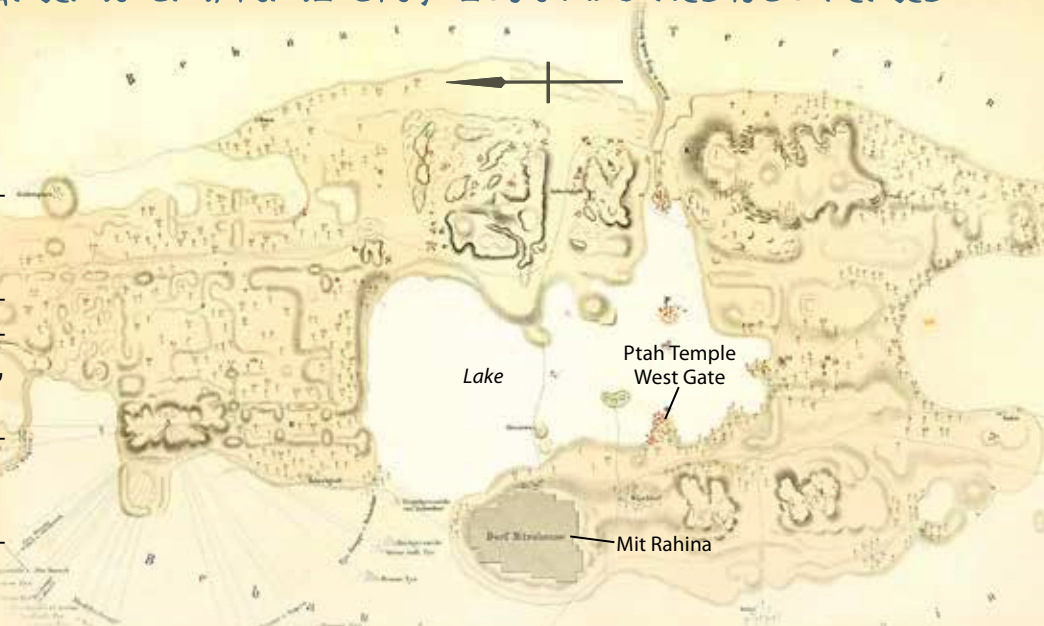
The tale begins with Menes, the legendary king who unified Egypt in 3000 BC and established his royal residence on the Nile at the strategic junction of Upper and Lower Egypt. Menes's city remained the administrative capital through the Old Kingdom, parts of the Middle and New Kingdoms, and during the Late and Ptolemaic periods. Located at the crossroads of the Western and Eastern Desert trade routes, Memphis was also a cosmopolitan trading center and probably reached its maximum extent during the Ptolemaic period. Even when it was not the official seat of government, Memphis nonetheless held its place as a major city until the Islamic Conquest in 641 AD, when it was eclipsed by the Islamic fortress of Fustat (Cairo) and was depopulated.

The name Memphis survived, but the location of this once-great city in the Nile Valley zone between Giza and to the south of Saqqara was lost. Based on Classical authors' accounts, European travelers speculated about its location for centuries. But the site was not definitively pinpointed until 1799, by Napoleon's scientific expedition to Egypt.

But even today, more than two centuries after Napoleon, much of ancient Memphis remains "lost," despite the work of numerous archaeological missions. Over the millennia a variety of forces have eaten away or buried the fabric of the city: Nile sediments, high Nile floods, the eastward migration of the Nile channel across the settlement, looting, recycling of stone and mudbricks, cultivation, and development. For millennia, the annual Nile inundation kept growth in check, confining villages to the mounded ruins of Memphis. But with the construction of the low dam at Aswan from 1898 to 1902, which regulated the flood, settlement began to spread down onto the floodplain. A second, much larger wave followed after the High Aswan Dam was built between 1960 and 1970 and permanently stanching the flood.

The oldest occupation at Memphis known so far is a First Intermediate period cemetery on Kom el-Fakhry (see photo on page 4), where our AERA-ARCE<sup>†</sup> Field School worked in 2011. But Old Kingdom pottery and other traces of this period have been found in drill cores and mixed within later settlement deposits.

Most of Memphis that has been studied dates to the New Kingdom or later. Construction on the Great Ptah Temple (shown on page 4), the heart of the city and its religious and administrative center, may have begun in the 18<sup>th</sup> Dynasty, but most of what can be seen today dates to 19<sup>th</sup> Dynasty king Ramesses II. However, there was almost certainly an earlier Ptah Temple.



Map of Mit Rahina and the central Memphis ruin zone, produced in 1843, published in *Denkmäler aus Ägypten und Nubien I*, by Karl Lepsius, Berlin: Nicolaische Buchhandlung, 1929, Plate 9. The "lake" was fed by ground water, as today, and by the annual Nile inundation, which covered the floodplain for six to eight weeks between August and November. Note the small area Mit Rahina occupied in 1843 compared with today's town, which presses at the Ptah Temple West Gate (see photo on the facing page).

Our knowledge of Memphis can be credited to archaeologists, cartographers, and others, starting with the Napoleonic expedition, which prepared the "first accurate and detailed map of the ruin field."<sup>‡</sup> With 19<sup>th</sup> century improvements in cartography, the map that G. G. Erbkam produced for Karl Lepsius, published in 1929 (see caption above), was superior to earlier ones; it was the first detailed topographic map of Mit Rahina and the central Memphis ruin zone.

In the early 20<sup>th</sup> century, Flinders Petrie mapped the enclosure walls surrounding the Great Ptah Temple (shown on page 4), a vast area of nearly 68 acres. Through the 20<sup>th</sup> century foreign and Egyptian archaeologists worked in various areas of Memphis, focusing primarily on temples, chapels, palaces, monumental statuary, and stelae. Most of these were first discovered by accident, such as during road building.

From the 1980s into the 1990s, the Egypt Exploration Society's Survey of Memphis (SoM), directed by David Jeffreys, took a regional and environmental approach. The SoM surveyed, mapped, and assessed the archaeological sites in Memphis; carried out a wider regional survey; studied the hydrogeology of the Memphis region and proposed a shifting Nile River and town; and excavated the settlements at Kom Rabia (see map on page 4).

Much remains to be discovered at Memphis. In the meantime, we hope our MSCD project will help visitors appreciate the city's components that archaeologists have documented, as well as grasp the significance of this once-great capital.

<sup>†</sup> ARCE is the American Research Center in Egypt.

<sup>‡</sup> Jeffreys, *The Survey of Memphis*, page 64. See full citation on the facing page.

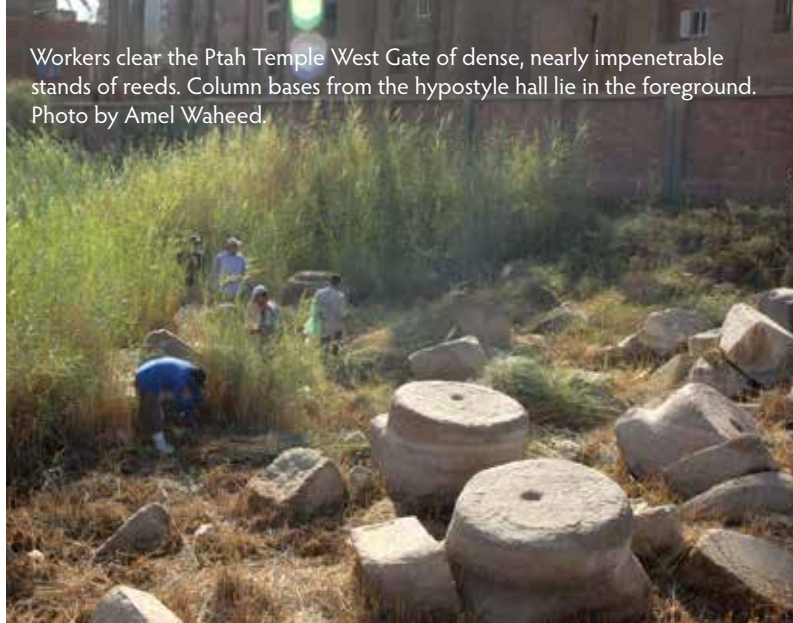


Above and left: Google Earth satellite view of Mit Rahina, the village that engulfs central Memphis. Inset: Sites to be treated in the Memphis Site and Community Development (MSCD) project outlined in green and described on the facing page. Kom el-Fakhry is one of the ten mounds (*kom* in Arabic) scattered across the ancient Memphis landscape. Here the AERA 2011 Mit Rahina Field School excavated part of a Middle Kingdom settlement and First Intermediate Period cemetery. Kom Rabia, another mound, was the site of the Egypt Exploration Society excavations from 1984 to 1991, which included late Middle Kingdom and New Kingdom settlement. The work also included structures dating to the Second Intermediate Period. Map prepared by Rebekah Miracle, AERA GIS.

Below: Shots of two of the sites prior to cleaning and clearing. Photos by Mark Lehner.



Workers clear the Ptah Temple West Gate of dense, nearly impenetrable stands of reeds. Column bases from the hypostyle hall lie in the foreground. Photo by Amel Waheed.



## Sites Selected for the Walking Circuit

Shown on the map, facing page.

- 1. Great Ptah Temple, West Gate** - one of four gates at the axial entrances to the temple, which was the core of the city. Its foundations are still visible. But most of the temple site lies under modern buildings or cultivation. The wall that once enclosed the compound—a vast 67 acres—is gone, but its approximate configuration is known (indicated with the blue/pink line on the facing page). Most of what we see of the West Gate was built for Ramesses II (1290–1224 BC), using materials taken from other sites, including Giza (see sidebar on page 6). Ptah, a god of craft and creation, came into prominence in the 5<sup>th</sup> Dynasty.
- 2. Apis House** - the embalming house of the iconic Apis bulls.
- 3. White Walls Chapel** - a modest-looking structure, contains a statue of the patronymic deity Ptah, flanked by Tjesmet, embodiment of the temple wall of Ptah, and Mennefer, the personification of the city itself. This structure commemorates an important new stage in the development of the capital during the Ramesside period. At present the site is overgrown, abandoned and inaccessible to visitors. “White Walls,” or *inbw-hd*, probably referring to a building, was another name Pharaonic Egyptians called the city.
- 4. Tombs of the High Priest of Ptah** - just outside the southwest corner of the New Kingdom Ptah Temple. This area includes large mudbrick granaries and the massive temple enclosure wall. The architecture of the stone tombs is unusual.
- 5. Chapel of Ramesses II** - dedicated to Ptah, is one of a series of chapels that stood outside the main Ptah Temple enclosure. The area has suffered because of exposure to ground water and salt since its discovery.
- 6. Hathor Temple** - built by Ramesses II, has spectacular column capitals in the traditional form of Hathor as a human visage with bovine ears. The temple has been the subject of previous conservation assessments.
- 7. Open-Air Museum and Sculpture Garden** - displays various pieces that come from sites in the proposed circuit. The most prominent is the famous limestone colossal statue of Ramesses II.
- 8. Sekhmet Temple** - honors the lion-headed lady, Sekhmet, consort of Ptah and goddess of rage and fever, befriended by physicians.

(continued from page 2)

of Memphis during our 2011 Mit Rahina Field School,<sup>†</sup> we believed that we could prepare the other major sites in central and southern Memphis to offer an unusual opportunity for tourists to glimpse outcrops of Egypt’s ancient capital. Showing the sites increases awareness of their need for conservation and maintenance. Increased tourism generates opportunities for the local population. Our MSCD proposal included plans to engage the living communities of the central Memphis area as well as people in the tourist industry.

We partnered with Sara Perry<sup>‡</sup> of the University of York to train young Inspectors working for the Ministry of Antiquities (MoA) in the theory and practice of community archaeology. We proposed to implement the Walking Circuit within a wider heritage and outreach training program that integrated the local community and all stakeholders—everyone with a possible stake in the archaeological sites of Memphis—in the management of cultural resources.

## Ambitious Plans

We planned to clean the sites and monuments within the archaeological circuit and then survey and document present conditions, as well as assess means to conserve them. The trainees would then go on to study cultural heritage management, helping to develop the Memphis Walking Circuit and social media related to Mit Rahina’s cultural heritage, which would allow visitors to experience each of these sites as an “archaeological” dig into ancient Memphis.

## Desk-Based Research

We began the first session of Year 1 last August by assembling an extensive database on Memphis, including its history, archaeology, and a bibliography. AERA GIS Director Rebekah Miracle integrated the archaeological and historical data into a Geographical Information System (GIS) for greater Memphis, which trainees will use as they help develop the Memphis Walking Circuit.

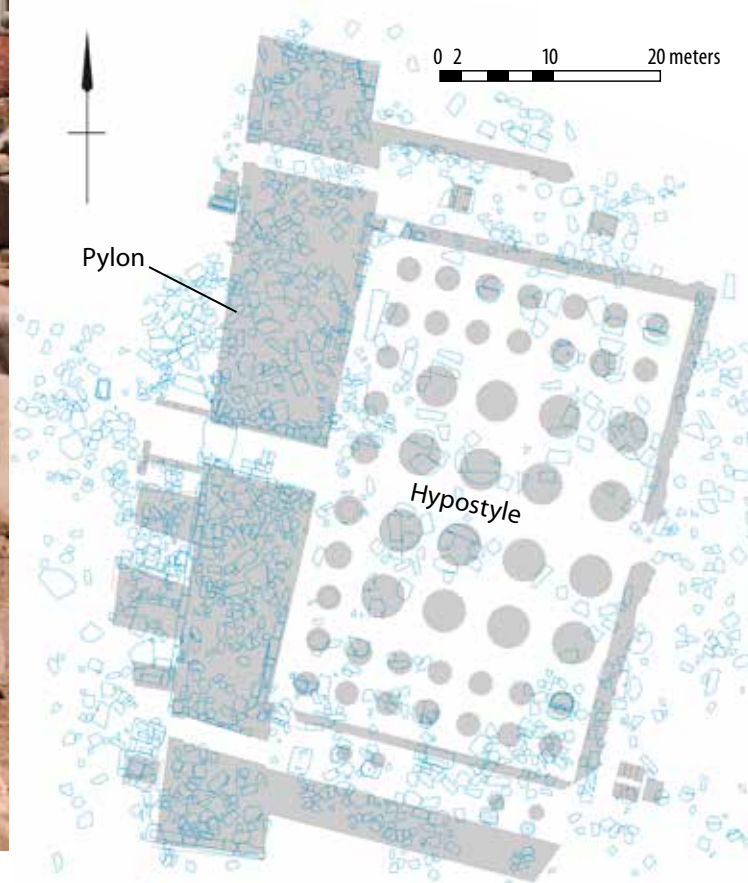
## Cleaning and Clearing

On September 19 Freya Sadarangani, Co-Field Director with Mohsen Kamel, and Daniel Jones, Archaeology Supervisor, launched the field work with a cleaning-and-clearing operation at four of the eight sites we selected to prepare for the Walking Circuit (see photo on the facing page and sidebar on the left).

<sup>†</sup> “Memphis, a City Unseen: Joint AERA-ARCE-EES Beginners Field School Excavates Oldest Part of Egypt’s Ancient Capital City,” by Ana Tavares and Mohsen Kamel, *AERAGRAM* 13-1, pages 2–7, Spring 2012. All back issues of *AERAGRAM* are available for free download at our website: [aeraweb.org](http://aeraweb.org).

<sup>‡</sup> Director of Studies of Digital Heritage, Director of Studies of Archaeological Information Systems, and Lecturer in Cultural Heritage Management in the Department of Archaeology at the University of York.

Mohammed Gabr surveys the Ptah Temple West Gate after workers removed the dense vegetation. Photo by Amel Waheed.



We started with the West Gate of the Great Ptah Temple, the largest and most challenging site to clear. Thick vegetation, mostly reeds, covered the low areas east and southwest of the gate's pylon (a massive wall that forms a gateway). A team of 35 workers from the local area cleared away reeds and rubbish, working at times in the water-filled depression of the West Gate. Once they finished clearing the Ptah Temple West Gate, they moved on to the Apis House and Hathor Temple.

Cleaning the sites proved to be very challenging. The tall, nearly impenetrable reeds at the Ptah Temple West Gate were not to be defeated. No sooner had our workers cleared them away than new shoots began to emerge, ready to reclaim the reeds' territory. Camelthorn proved equally intractable at the other sites we cleared. Long-term solutions for keeping the sites clear of this invasive vegetation have to be implemented. The lush growth threatens the ancient ruins with root disturbance.

Map of the Ptah Temple West Gate and hypostyle, a monumental columned hall, prepared in 1908 (in gray) by W. M. Flinders Petrie. The map shows the pylon that opened to the hypostyle. Map after *Memphis I*, by W. M. Flinders Petrie, London: School of Archaeology in Egypt and Quaritch, 1909, plate ii. Superimposed over Petrie's map are the blocks of stones (blue outlines) that the AERA team drew, photographed, and surveyed in 2015. The blocks include loose carved pieces of granite, basalt, quartzite, calcite, and limestone, many inscribed and decorated. Drawing by Rebekah Miracle, AERA GIS.

Lowering the water table through pumping, as has been done at Giza (see story on the back page), would discourage the water-loving reeds. It would also address the threat that water poses for the ruins and the visitor experience. This fall, standing water (shown on the cover) forced archaeologists and workmen to wear rubber boots at times, even hip waders in the deepest pools. But note that we worked while the water was at its low point. In January–February (generally peak tourist



### Borrowing from the Past: Memphis-Giza Connections

The kings who built their capital at Memphis "borrowed" extensively from earlier monarchs' monuments. The photo on the left shows one example along the northern side of the hypostyle hall in the Great Ptah Temple: a panel of black basalt resting on a base of red granite casing stones. The latter were taken from a pyramid, very possibly Khafre's at Giza. Some of them show the same angle as Khafre's Pyramid, 53° 10'. Moreover, a huge graffito of Ramesses II's Chief of Works appears on the bedrock walls of the northwest corner of the Khafre Pyramid terrace, no doubt left when he was there quarrying Khafre's pyramid for stone. The black basalt could have come from the pavement of a pyramid temple, Khufu's at Giza or Niuserre's at Abusir.

On the right side of the photo, David Jeffreys speaks to guests during his work in the fall of 1993 (and provides a scale for the wall). As Director of the Egypt Exploration Society's Survey of Memphis, David surveyed, mapped, and assessed the archaeological sites in Memphis and then carried out a wider off-site survey and reconstructions of the greater Memphis area. AERA now partners with and benefits from his intimate and extensive experience with the site. Photo by Mark Lehner.



Student Miral Mahmoud Sayed and graphic designer Ian Kirkpatrick, of the University of York team, design a panel for the Memphis Walking Circuit. Photo by Amel Waheed.



Mohammed Abd el-Maksoud, Supervisor and Survey Assistant, peers into the total station eyepiece as he helps survey the Open Air Museum site, while a sphinx stares resolutely ahead. Photo by Amel Waheed.

season), the water table rises up to nearly three feet above the September–October level.

### Documenting

Our archaeologists documented the remains of the ancient sites as the workers exposed them. They numbered, sketched, and photographed nearly every block of stone—including 1,700 in the Ptah Temple West Gate—and wrote a brief description of each one. They also surveyed the sites using a total station and drafted to scale physical plans of some of the archaeological monuments and individual objects within the sites. Almost as quickly as the data was gathered, it went into our GIS, allowing Rebekah to develop plans, such as the one on the facing page.

### Training

During our first session of Year 1 we trained 32 enthusiastic young Inspectors in the Ministry of Antiquities (MoA). We were assisted by eight supervisors, all Inspectors and graduates of one of our AERA-ARCE\* Field Schools in excavation and recording methods. Four supervisors helped teach heritage management and community-based archaeology.

Sara Perry and Andrew Henderson-Schwartz taught an ambitious syllabus, which Sara had developed at the University of York and implemented at the famous site of Çatalhöyük in Turkey. Through lectures, discussion, readings, site visits, and observation, students learned the principles and methods of community-based heritage archaeology. They put these into practice as they began to develop the paths, signage, and website content for the Memphis Walking Circuit and other media about the archaeology and history of the area.

### What's Next?

We return to Memphis in April and May 2016 to finish clearing, cleaning, and documenting the remaining four sites in



Supervisor Nagwan Bahaa (left) and Archaeologist Aude Gräzer Ohara pause for a photo op while recording the blocks in the Ptah Temple West Gate. In the background workers continue to remove vegetation and trash. Photo by Amel Waheed.

our proposed eight-site Walking Circuit. In September we start the second year. Another group of young Inspectors in the Ministry of Antiquities will join us to help prepare the Walking Circuit and related materials for visitors and outreach. As they train in heritage and community archaeology, the students will not only contribute to the MSCD project, but will also develop skills they can apply in their own Inspectorates to preserve and share the proud heritage of their country.



The Memphis Site and Community Development project was made possible by the generous support of the American people through the United States Agency for International Development (USAID), Program No. APS-263-14-000008. The contents of this article are the responsibility of AERA and do not necessarily reflect the views of USAID or the United States Government.

\* ARCE is the American Research Center in Egypt.

# The Great Pyramid's Footprint: Results from Our 2015 Survey by Glen Dash

*In the last issue of AERAGRAM the author presented a brief overview of the survey of the Great Pyramid's base that he and his team undertook this past Season 2015.\* Here Glen discusses the results of that work.*

**W**hat is the exact size and orientation of the Great Pyramid? Archaeologists, scientists, engineers, and mystics have sought answers for centuries. In an effort to finally and definitively answer these questions, at least to the extent that the current condition of the pyramid permits, my foundation and Ancient Egypt Research Associates (AERA) undertook a comprehensive survey of the pyramid's base in February of 2015.<sup>1</sup> In this article, I report on the findings of that survey, the Glen Dash Foundation Survey of 2015 (GDFS 2015).<sup>2</sup>

## Our Past Work

This was not our first attempt at determining the exact size and orientation of the Great Pyramid's footprint. In the fall of 2012 we published a study which used data assembled by Mark Lehner and David Goodman in 1984.<sup>3</sup> While that study provided new, more accurate estimates of the Great Pyramid's size and orientation, it also underscored the need for a new, more

\* "What Was the Original Size of the Great Pyramid's Footprint?" by Glen Dash, *AERAGRAM* 16-1, pages 8-11, Spring 2015. All back issues of *AERAGRAM* are available for free download at our website: [aeraweb.org](http://aeraweb.org).

Casing and platform stones. The angled casing stones sit upon platform stones. The lower, outer edge of the casing and the top, outer edge of the platform provided the best places to measure the pyramid's lines. Photo by Mark Lehner.



comprehensive survey, one which used the latest available instruments. In 2015, we completed the new work.

## Tracing the Base

Originally, the Great Pyramid was clad in more than 21 acres of hard, white casing stones that the Egyptians had hauled over from quarries at Tura across the Nile. Most of those casing stones were removed centuries ago for building material, leaving the pyramid as we see it today, without most of its original shell. The photo below was taken along the pyramid's north side. In it, we see some of the pyramid's few remaining casing stones still in place. These sit on a platform that originally extended out 39 to 47 centimeters (15-19 inches) beyond the outer, lower edge (the "foot") of the casing. Behind the casing stones in the photo we can see the rougher masonry that makes up the bulk of the pyramid as it stands today.

Our mission's first task was to locate any traces that remain of the pyramid's original casing baseline, which we define as the place where the foot of the casing stones once met the platform. However, along the Great Pyramid's 920-meter (3,018-foot) periphery, we now find only 54 meters (177 feet) of casing stone in place, and much of that is badly damaged. To determine the pyramid's baseline, therefore, we needed more information than we could get by just examining the casing stones themselves. We needed also to carefully examine the top

of the platform for signs as to where missing casing stones had once stood.

Initially, the task of finding traces of the original baseline fell to Mark Lehner. Lehner started the process by examining the casing stones that did remain. In most cases, he found the casing stone's leading edge worn back, so he looked for an etched or cut line in front of the casing stone to locate its original edge (photo facing page). Lehner also looked for telltale markings on the platform, including places where the surface of the platform had been subtly worn or eroded by the now missing casing stones.

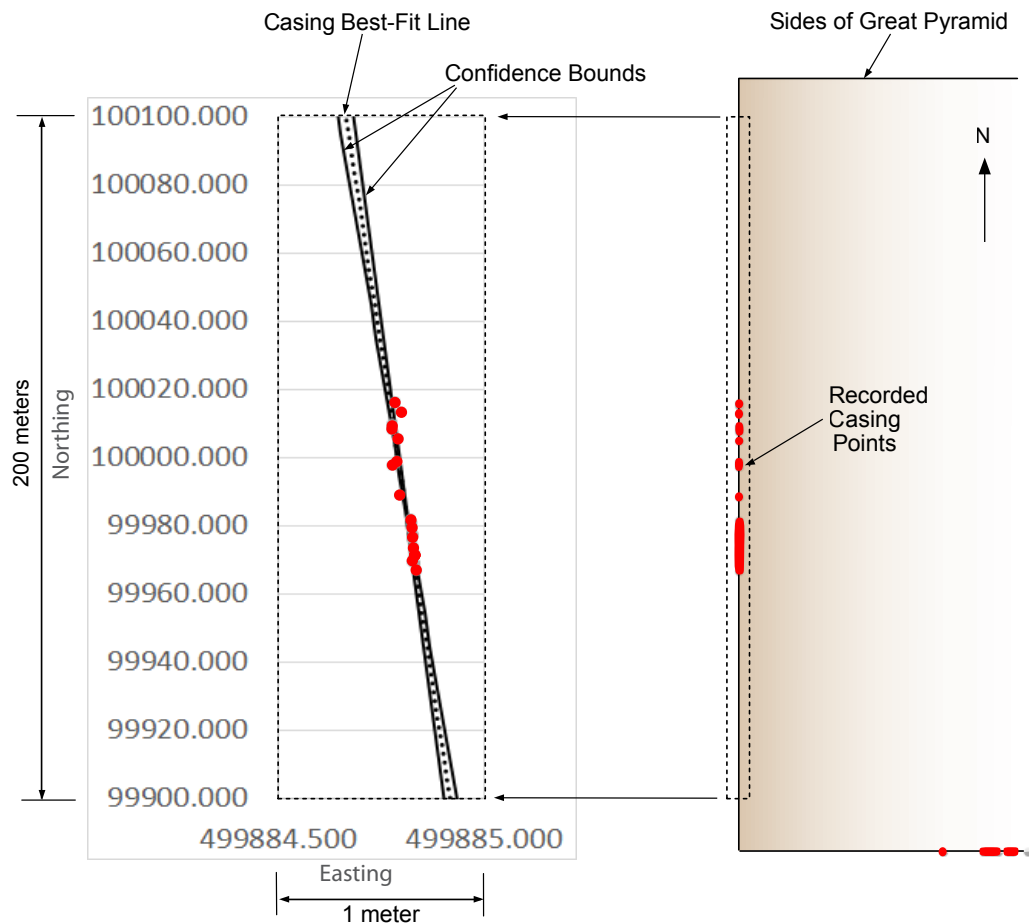
In total, Lehner identified 84 points along 155 meters (508 feet) of the pyramid's 920-meter (3,018-foot) periphery where he





Above: Searching for the pyramid's baseline. Left: An etched line in front of a damaged casing stone indicates where the edge of the casing stone once met the platform. Photo by Rebecca Dash. Right: Mark Lehner photographs a subtle line on the top of the platform revealing where a now missing casing stone once stood. Photo by Glen Dash.

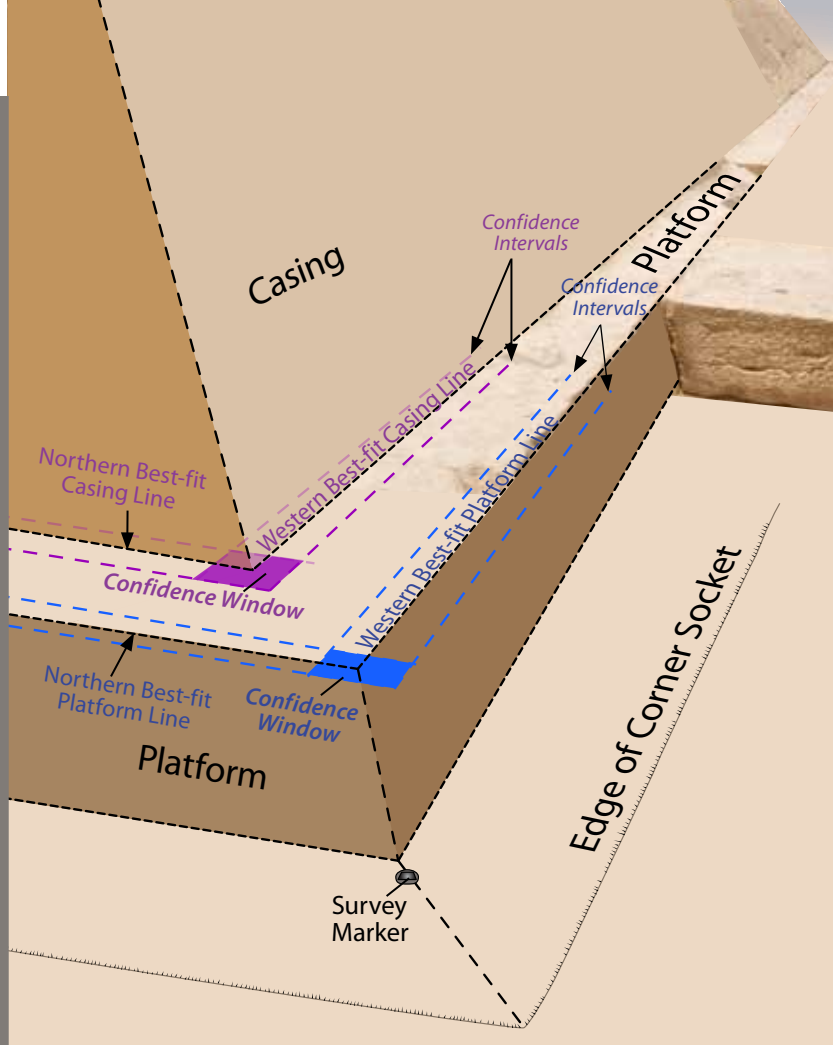
Right: Computing best-fit lines and confidence bounds. At the right is a portion of the pyramid's base showing the casing baseline points recorded on the pyramid's west side. We expand the area within the dotted lines and show that at the left. We computed a best-fit line for the data along with error bounds, known as confidence bounds. There is a 95% probability that the original casing baseline on the west side fell within these confidence bounds. The angle of the lines at the left are exaggerated due to the scale of axes being unequal.



found evidence of the original baseline. Along the remaining 765 meters (2,510 feet) of the periphery (83% of its total length), he found the pyramid too damaged to provide useful data. Nearly all the points Lehner identified were located near the center of each side. No direct evidence of the original corners remains.

Our mission also recorded the top outer edge of the pyramid's platform. In some places we found this edge well preserved, and we could record it directly. In other places, however, the top outer edge of the platform was eroded and worn. In

those places we recorded two points on the sloping face of the platform, one above the other, and used those two points to project where the top, outer edge once was. In all, we identified 176 places along 262 meters (860 feet) of the pyramid's periphery (28% of its total) where we found direct evidence of the platform's original top outer edge or were able to derive its original position.



This schematic drawing of a hypothetical pyramid corner illustrates in three dimensions the location of best-fit lines, confidence bounds, confidence windows, and the corner socket in the diagrams on pages 12–13.

### Analyzing the Data

The first step in analyzing this data set was to place it on a master grid. The grid we used was the Giza Plateau Mapping Project (GPMP) control grid established by Lehner and David Goodman in 1984 and 1985. The grid assigns every point on the plateau an address, like houses on a city map. The origin of the map is at the center of the Great Pyramid as computed by Goodman, and everything is measured from that point. For example, there is a bronze survey marker off the northeast corner of the pyramid, 115.803 meters north of the center of the pyramid and 115.610 meters to its east. By convention, surveyors do not like to work with negative numbers, so instead of making the center of the Great Pyramid ( $y=0$ ,  $x=0$ ) as one might expect, Goodman arbitrarily assigned the center a coordinate of ( $y=100000$ ,  $x=500000$ ).<sup>4</sup> Since the  $y$ -axis is our north-south coordinate (the “northing”) and the  $x$ -axis is our east-west component (the “easting”), we can express the center of the Great Pyramid as (N=100,000, E=500,000), or simply as N100,000, E500,000. That places the northeast survey marker at N100,115.803, E500,115.610.<sup>5</sup>

Once we placed all our data on the GPMP control grid, we could use a standard statistical method known as linear

regression analysis to “best-fit” lines to the data. In the graphic on the previous page, we show the casing points we recorded on the pyramid’s west side. The left side of the image expands a portion of the one on the right, showing an area one meter wide by 200 meters in length. We used Excel’s Data Analysis Package to calculate a “best-fit” line through the data, which we show as a dotted line in the figure. We also calculated error bounds around this line, known as “confidence bounds.” In theory, there is a 95% chance that the original casing baseline fell within these confidence bounds.

Once we derived best-fit lines and confidence bounds for all four sides of the casing and platform, we could find the original corners of the Great Pyramid by extrapolating those lines to see where they crossed. The schematic diagram on the left illustrates this method using the pyramid’s northwest corner as an example.

We extrapolated the north and west best fit lines and confidence bounds to the corners where they crossed, creating “confidence windows.” In theory, there is a 95% probability that the original casing and platform corners fell within these windows. On the left we also show the location of the survey marker we used and the outlines of an enigmatic cutting just outside the platform known as the “corner socket.” The corner sockets were once thought to have braced the cornerstones of the pyramid. They did not, but their actual function is still the subject of some debate.

The centerfold (pages 12 and 13) shows plans for all four corners of the Great Pyramid. Here the coordinates and dimensions for the features shown in the schematic on the left are presented for the northeast, southeast, and southwest corners, in addition to those for the northwest corner. This includes our derived GPMP coordinates of the platform and the casing corners. Around each corner point we show the associated confidence window. The window at the northwest platform corner is  $6.0 \times 5.3$  centimeters ( $2.4 \times 2.1$  inches) and at the casing corner,  $2.7 \times 4.4$  centimeters ( $1.1 \times 1.7$  inches). At this corner, the platform extended from the casing baseline 41.2 centimeters (16.2 inches) on the north and 41.9 centimeters (16.5 inches) on the west. We also show the casing corner coordinates as reported by Finders Petrie and J. H. Cole.<sup>6</sup> Finally we show the coordinates for the survey control marker at the northwest corner, G1.4.

We can use the data from these four figures to calculate the dimensions of the base of the Great Pyramid and its platform. We show these in Tables 1 and 2 on the facing page. We used the confidence bounds to calculate minimum and maximum lengths for each line (95% probability).

The average length of the four sides of the casing is 230.363 meters (755.783 feet). Petrie estimated the Egyptian cubit to be

20.62 inches (0.5237 meters) plus or minus 0.01 inch.<sup>7</sup> Assuming he was correct, that makes the average side length somewhere between 440.05 and 439.62 cubits.

Table 3 shows the orientation of the sides relative to cardinal points in minutes and seconds.<sup>†</sup> The minus sign indicates a counterclockwise rotation from cardinal points.

Table 4 shows that the mean angle of the casing is -3 minutes and 54 seconds, plus or minus 44 seconds (-3' 54" ± 44"). This is consistent with Petrie's estimate of -3' 43."<sup>8</sup>

We also examined the pyramid's "diagonals." We define the diagonals as the lines connecting the opposite corners of the casing, shown in the figure on page 14. Where the diagonals cross is the center of the base. We calculated the center of the pyramid to be N100,000.023 and E499,999.987 plus or minus 4.9 centimeters north to south or east to west.<sup>9</sup> Remarkably, as shown in the figure, the diagonals crossed to form a nearly perfect right angle. The error was just -12" of arc ± 1' 27." That means that, to a 95% probability, the angle formed by the pyramid diagonals is somewhere between 89° 58' 21" and 90° 01' 15,"

<sup>†</sup> There are 60 geographical minutes (60') in a degree, and 60 geographical seconds (60") in a minute.

with the most probable angle being the mean of these two, 89° 59' 48."‡

We can only speculate as to how the Egyptians could have laid out these lines with such precision using only the tools they had.<sup>10</sup>

We also calculated the angle of the line that runs from the center of the base of the Great Pyramid to the center of the doorway to the Pyramid Temple and compared that to the pyramid's meridian, shown in the figure on page 14. The meridian is the pyramid's north-south axis and, by definition, it bisects the diagonals. The meridian's angle is 3' 54" counterclockwise from due north. The remains of the Pyramid Temple's doorway sit about 168 meters to the east of the center of the pyramid and 52.5 meters from the pyramid's eastern casing, about 100 cubits. The line between the center of the pyramid and the center of the doorway runs at an angle of 3' 51" counterclockwise of due east. That line and the meridian crossed at the center of the pyramid to form an angle of 90° 0' 3" ± 1' 44." If not a perfect right angle, it was something very close to it. *(continued on page 14)*

<sup>‡</sup> One minute of arc (1') is about equal to the angle subtended by two fingers viewed from across the length of a football field.

**Table 1: Lengths of the Sides of the Casing Base**

Casing Side	Minimum Length (meters)	Mean Length (meters)	Maximum Length (meters)
North	230.256	230.329	230.402
East	230.295	230.334	230.373
South	230.329	230.384	230.439
West	230.378	230.407	230.436
Average		230.363	

**Table 2: Lengths of the Sides of the Platform**

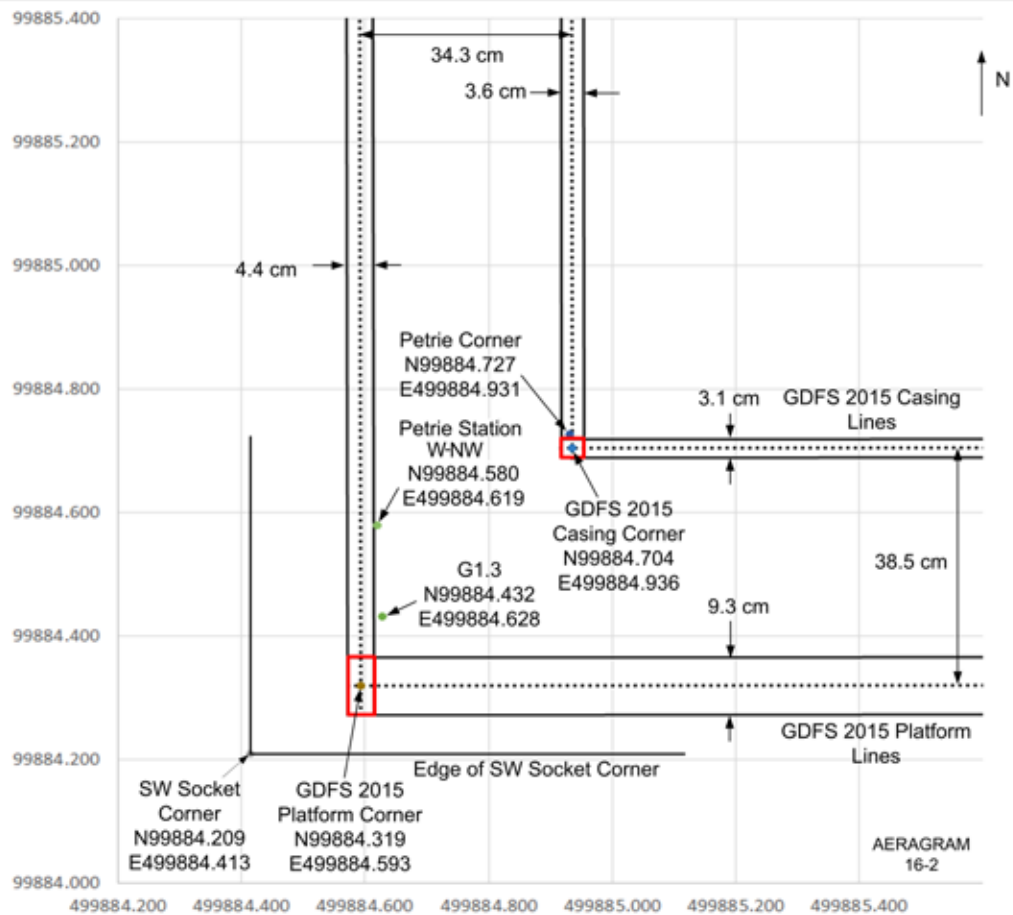
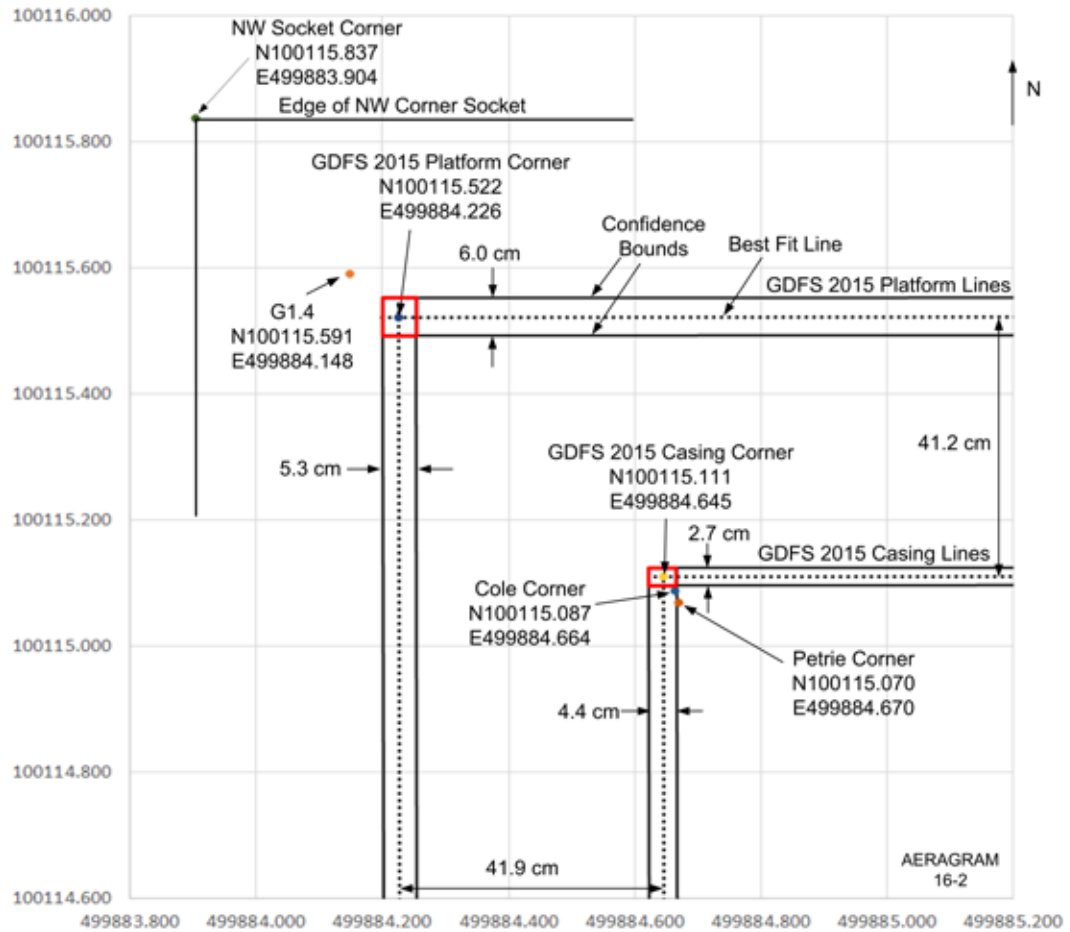
Platform Side	Minimum Length (meters)	Mean Length (meters)	Maximum Length (meters)
North	231.160	231.214	231.267
East	231.081	231.215	231.350
South	231.105	231.174	231.244
West	231.156	231.204	231.252
Average		231.202	

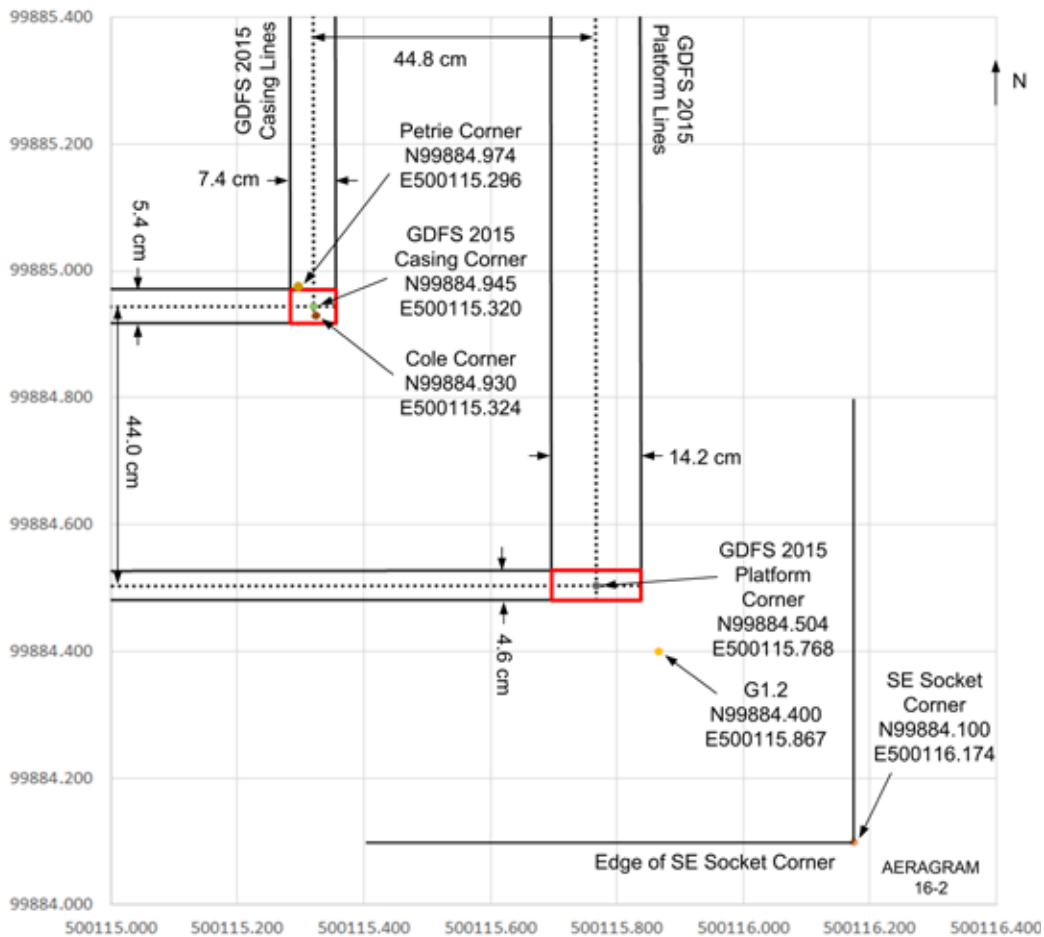
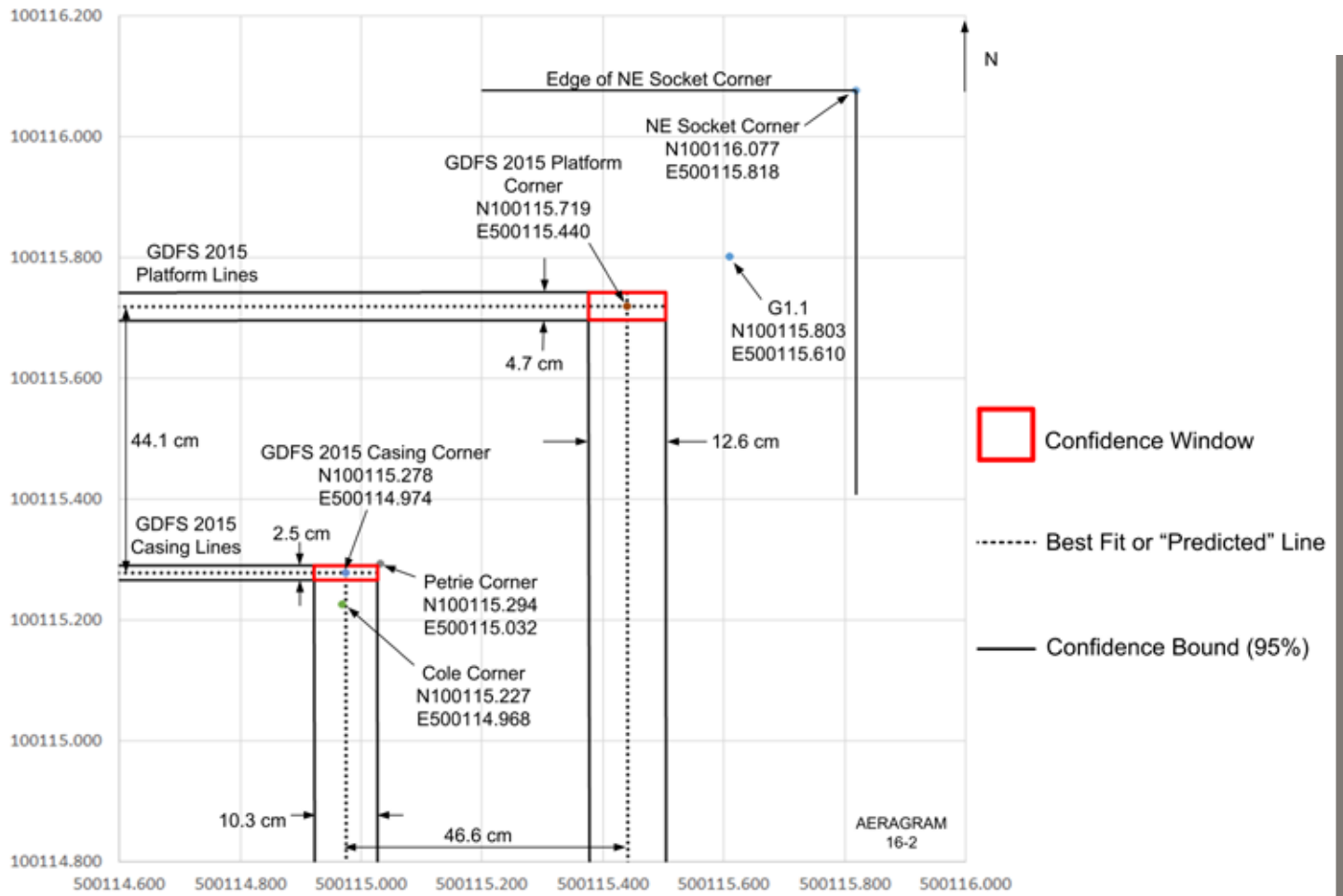
**Table 3: Angles of the Sides of the Casing Base**

Casing Side	Angle (Deviation from Cardinal Points)	Confidence Bound
North	-2' 30"	+/- 23"
East	-5' 10"	+/- 1' 19"
South	-3' 35"	+/- 38"
West	-4' 21"	+/- 35"
Average	-3' 54"	+/- 44"

**Table 4: Angles of the Platform**

Platform Side	Angle (Deviation from Cardinal Points)	Confidence Bound
North	-2' 56"	+/- 24"
East	-4' 53"	+/- 43"
South	-2' 45"	+/- 1' 0"
West	-5' 28"	+/- 43"
Average	-4' 0"	+/- 43"





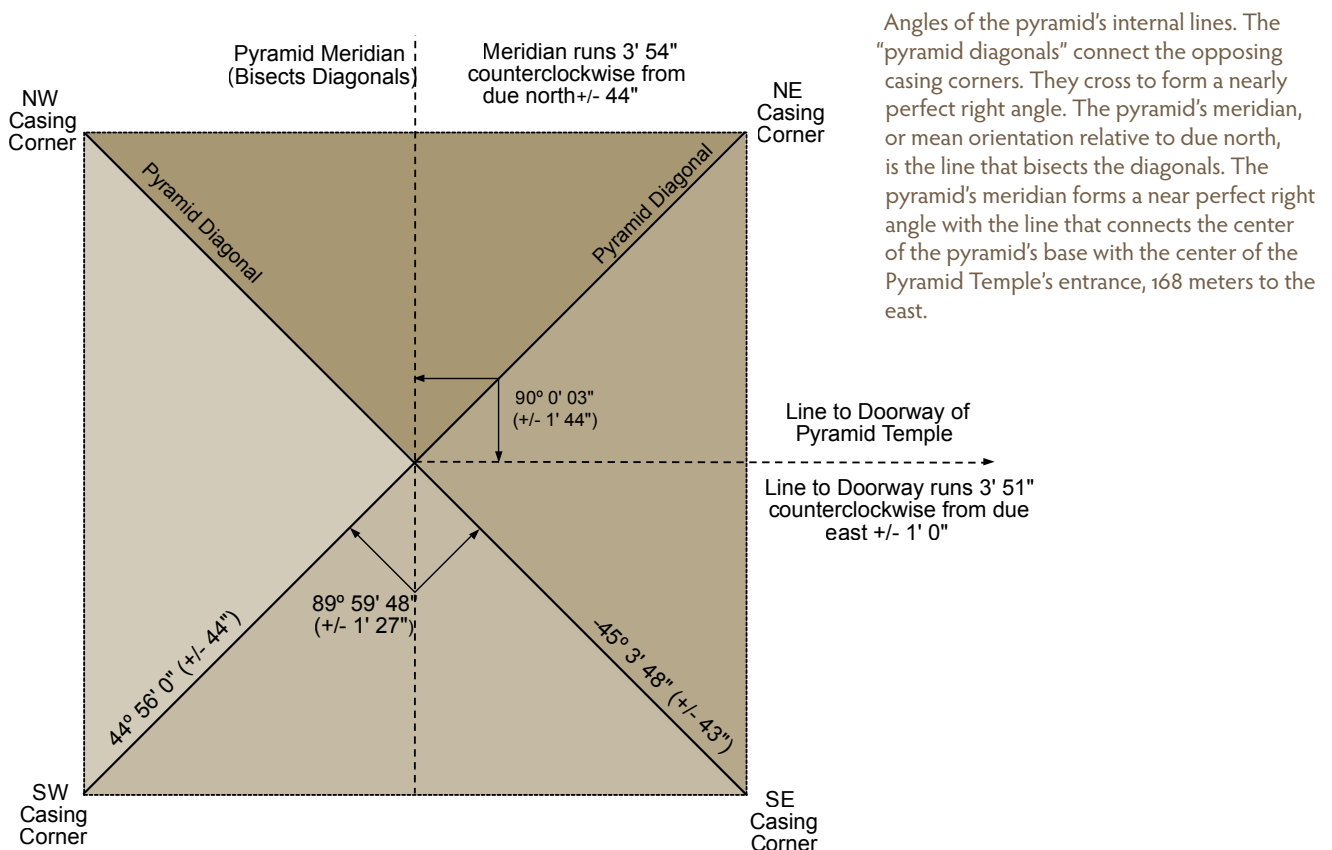
(continued from page 11)

## Conclusions

Our survey has produced new estimates for the size and orientation of the Great Pyramid. We also continue to analyze the data for new insights, and we have not been disappointed. The data show that the Egyptians possessed quite remarkable skills for their time. We hope to eventually figure out how the Egyptians laid out the pyramid with such precision, and in doing so hope to learn much about the tools and technology they had at their disposal.

1. Permission for the pyramid survey was granted to Mark Lehner and AERA as part of AERA's broader survey across the plateau. The project's chief surveyor was Joel Paulson of NV5, Inc. (San Diego, CA), who was assisted by Mohammed Abd el-Basset and Amr Zakaria of the Ministry of Antiquities. AERA's Mark Lehner oversaw the archaeological aspects of the project. He was assisted in his work by Ashraf Abd el-Aziz. Joan and Rebecca Dash of the Glen Dash Foundation assisted with the survey. I was the principal investigator. For making this survey possible, we extend our deep gratitude to the Ministry of Antiquities, Dr. Mahmoud el-Damati, Minister of Antiquities; Dr. Mustafa Amin, Chairman of the Supreme Council of Antiquities; Yusuf Khalifa, Director of Pharaonic Monuments; Dr. Mahmoud Affifi, Director of Central Administration and Middle Egypt; Shaaban Abd el-Gawad, Director of the Department of Egyptology and Museums in the Minister's Office; Hani Abu Azm, Director of Foreign Missions and Secretary of Permanent Committees; the late Kamel Waheed, General Director for Cairo and Giza; Sayeed Hassan, Director of Giza; Fedai Helmi, Chief Inspector of Giza; Giza Inspectors Mohamed Saidi and Ahmed Ezz, and Chief Inspector of the Solar Boat Project, Afifi Rohim Afifi. The author would also like to thank AERA Egypt's Executive Director Mohsen Kamel for his assistance in arranging permissions and AERA's Field Director for Season 2015, Ana Tavares, for her role in achieving a successful GDFS 2015.

2. We invite comments on this article. Any future corrections to this article will be found at <http://www.DashFoundation.org/Aeragram-16-2-errata.pdf>
3. "New Angles on the Great Pyramid," by Glen Dash, *AERAGRAM* 13-2, pages 10-19, Fall 2012. The 1984 data, in addition to having been taken without the benefit of modern total stations, had three weaknesses when used to derive the pyramid's lines. First, no measurements of the casing's actual baseline were taken on the south side of the Great Pyramid in 1984 because the base of the casing no longer exists there. In this study, we derived data for the south side by measuring the top of the casing and extrapolating where the base once fell. Second, without the benefit of south side data, our 2012 study was based on the assumption that the corners of the pyramid fell on the "pyramid diagonals," lines that connect the opposing sockets. The sockets are cuttings just outside the pyramid's four corners. In this study, we did not have to make that assumption. Third, the 2012 study had too few points to provide for narrow confidence windows.
4. As designed, the GPMP system can be used to map features up to 100 kilometers south of the Pyramid, and 500 kilometers to its west, with unlimited range to its north and east.
5. These coordinates are slightly different than those reported in *Giza Reports 1* (Boston: Ancient Egypt Research Associates, Inc., 2007). We reestablished the exact location of the survey markers as part of the GDFS 2015 effort.
6. See W. M. F. Petrie, *The Pyramids and Temples of Gizeh*, (London: Field and Tuer, 1883), Plate X, and J. H. Cole, "Determination of the Exact Size and Orientation of the Great Pyramid of Giza," (Cairo: Government Press, 1925), page 9. Both Petrie and Cole report the position of the casing corners by offset from other features such as the corner sockets. I have converted these reported positions to GPMP coordinates.
7. Petrie 1883, page 181.
8. Petrie 1883, Plate x.
9. This estimate is slightly different than Goodman's estimate because he did not have the advantage of our new findings.
10. For some of the speculation on this topic, see <http://glendash.com/blog/2014/12/03/the-great-pyramid-diagonals-do-they-point-to-a-hidden-inner-platform-within-the-pyramid/>.



## Catching Up with Yukinori Kawae: Author, National Geographic Explorer

We are pleased to congratulate AERA team member Yukinori Kawae on the publication of his book *Excavating the Pyramid Town*, the first book in Japanese about AERA's excavations and survey work at the Giza Plateau. Shinchosha Publishing Company, Ltd., one of the oldest publishing houses in Japan, released *Excavating the Pyramid Town* on September 25 (<http://goo.gl/yRowGQ>).

*Excavating the Pyramid Town* addresses three questions: who built the Giza Pyramids and how and why. The book highlights AERA's fieldwork at the Heit el-Ghurab site (also called the Lost City of the Pyramids).

Yuki has worked with AERA as an area supervisor, photographer, and laser scanning surveyor. His photos have appeared in *AERAGRAM* and our *Giza Occasional Papers* series. He supervised excavations in two important areas at Heit el-Ghurab, Pottery Mound and House Unit 1,<sup>1</sup> and carried out a 3D survey of the Khentkawes Monument at Giza with a Japanese laser scanning team.<sup>2</sup> Under AERA's auspices, Yuki and this team also did a 3D survey of the Step Pyramid at Saqqara.<sup>3</sup> Currently he is carrying out 3D scanning of Neferirkare's pyramid with the Czech mission at Abusir.

Along with the publication of his book, Yuki is celebrating another feather in his cap. The Japanese Edition of *The National Geographic* chose him as one of their 20<sup>th</sup> anniversary explorers as it marks its 20<sup>th</sup> anniversary this year. These explorers



Yukinori Kawae's recently-released *Excavating the Pyramid Town*, the first book in Japanese on AERA's work at the Heit el-Ghurab site.

represent various academic fields highlighting advances and groundbreaking fieldwork in their areas of expertise (<http://natgeo.nikkeibp.co.jp/atcl/topics/15/271114/102200025/>). *The National Geographic* Japanese Edition will introduce Yuki's recent academic research, 3D surveys of the Great Pyramid and the Khentkawes Monument, in their December issue. Since August he has been writing a series of web articles for the National Geographic Japan website.

Yuki hopes that his book and his web article series will help to inspire Japanese interest in Egypt.

*Mabruk to Yuki!*



Hironichi Matono

1. "House Unit 1 (SFW.H1): Interim Report," by Y. Kawae, in *Giza Plateau Mapping Project Seasons 2006-2007, Preliminary Report, GOP3*, by M. Lehner, M. Kamel, and A. Tavares, Boston: Ancient Egypt Research Associates, pages 88-91, 2009. "Soccer Field West, House Unit 1, 2009," by Y. Kawae and F. Sadarangani, in *Giza Plateau Mapping Project Season 2009, Preliminary Report, GOP5*, edited by M. Lehner, Boston: Ancient Egypt Research Associates, pages 135-145, 2011.

2. "Mapping Khentkawes," by Y. Kawae, *AERAGRAM* 8-2, pages 10-12, Fall 2007. "Giza Laser Scanning Survey 2006," by Y. Kawae, in *Giza Plateau Mapping Project Seasons 2006-2007, Preliminary Report, GOP3*, by M. Lehner, M. Kamel, and A. Tavares, Boston: Ancient Egypt Research Associates, pages 106-175, 2009. *AERAGRAM* and *GOPS* are available for free download at our website: [aeraweb.org](http://aeraweb.org).

3. "Saqqara Laser Scanning Survey 2008," by Y. Kawae, K. Sato, H. Kamei, T. Nakano, and I. Kanaya, in *Giza Plateau Mapping Project Season 2008, Preliminary Report, GOP4*, by M. Lehner, M. Kamel, and A. Tavares, Boston: Ancient Egypt Research Associates, pages 63-71, 2009.

# From Dig to Data to Press: AERA-ARCE Field School Students Publish their First Book of Research Papers

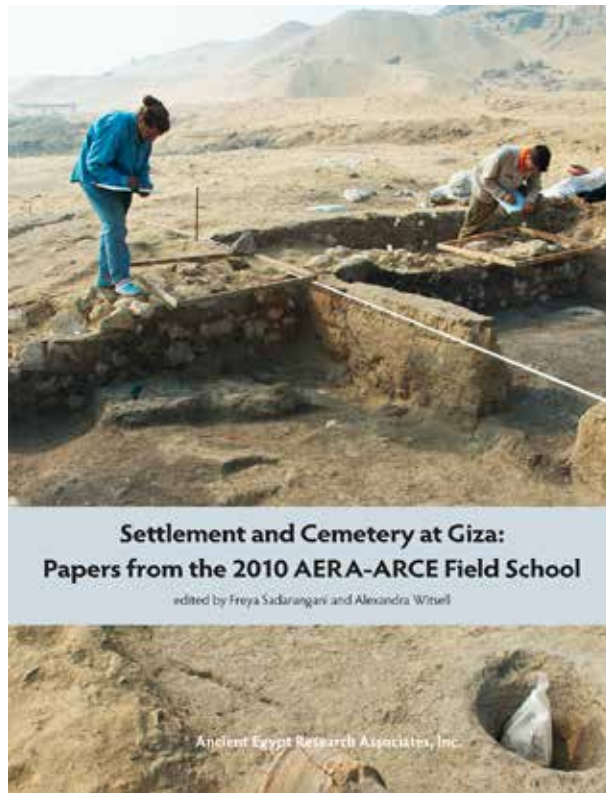
In our AERA-ARCE Field Schools for Ministry of Antiquities Inspectors<sup>1</sup> we do not train students to simply excavate and go on excavating year after year. Since our first field school, a beginners course in 2005, we have stressed the necessity of disseminating results, of publishing excavation reports and specialist studies. In 2010 we stopped talking about publication and started teaching it: we launched our first Analysis and Publication Field School (APFS), sponsored by the American Research Center in Egypt.<sup>2</sup> The culmination of that course is a 300+ page volume, *Settlement and Cemetery at Giza: Papers from the 2010 AERA-ARCE Field School*, which we released this February.

*Settlement and Cemetery*, edited by Freya Sadarangani and Alexandra Witsell, presents preliminary reports on excavations carried out by field school teams at the Heit el-Ghurab site (HeG) and specialist reports on material largely from field school excavations. Hanan Mahmoud and James Taylor (AERA archaeologist) report on a bakery in Area AA, while Rabee Eissa presents a preliminary study of the bakery in Area EOG. Ashraf Abd el-Aziz

summarizes excavations he supervised in the area Main Street East (MSE). His article is complemented by Mahmoud el-Shafey, Mohamed Naguib, and Sherif Abd el-Monaem's preliminary study of the ceramics from MSE. Rasha Abd el-Mageed's report on faunal remains from the AA Bakery rounds out Mahmoud and Taylor's study. Scott Haddow (instructor) and Afaf Wahba offer a report and a catalog of Late Period burials excavated by a field school team. Mary Anne Murray (instructor) and Rebab el-Gendy present a preliminary analysis of plant remains from House E in Khentkawes Town. Ana Tavares (APFS Co-Director) concludes the volume with a brief history of our nine AERA-ARCE Field School sessions and the philosophical and functional blueprint behind the program. Many of the illustrations in the volume were prepared by APFS students concentrating in graphics for publication.

We are proud to present our students' hard work. Their papers make an important contribution to the corpus of Giza data available to scholars and the wider public and enrich our understanding of Old Kingdom and Late Period Giza.

This 300+ page volume is now available for free download at our website: [aeraweb.org](http://aeraweb.org).



1. Our field school offers comprehensive training for Ministry of Antiquities Inspectors with a four-part program of Beginners, Advanced, Salvage, and Analysis and Publication courses, sponsored by the American Research Center in Egypt (ARCE) with USAID funding. "The AERA-ARCE Field School Program, 2005-2007," *AERAGRAM* 12-2, page 20, Fall 2011, briefly describes the field schools.

2. The 2010 APFS is described in our newsletter: "Publish or Perish: The Analysis and Publication Field School," *AERAGRAM* 11-1, pages 14-15, Spring 2010, and "Seeds and Skeletons: Training an Archaeobotanist and Archaeozoologist," *AERAGRAM* 11-2, pages 4-5, Winter 2011. The follow up 2012 course is described in "Completing Their First Book of Research Papers," AERA 2012-2013 Annual Report, page 7. *AERAGRAM* and our annual reports are available for free download at our website: [aeraweb.org](http://aeraweb.org).



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Science & Arts Editor: Dr. Wilma Wetterstrom  
Managing Editor: Alexandra Witsell

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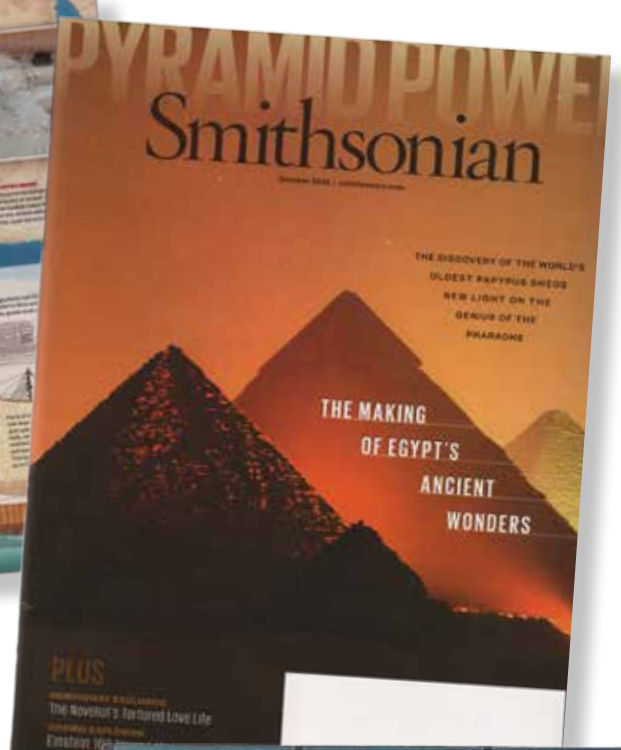
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## AERA in the Popular Press

They're 4,500 year old, yet the pyramids of Giza never cease to fascinate, especially when there are new discoveries. This fall two prominent magazines brought recent findings to the public, including AERA's work at Giza, in their cover stories.

The October 2015 issue of *Smithsonian* published "The Power and the Glory," by Alexander Stille. "The Pyramid Effect," by Zach Zorich, appeared the following month in *Scientific American*.

Stille describes the newly discovered 4<sup>th</sup> Dynasty port at Wadi al-Jarf on the Red Sea and the light it sheds on our work at Giza. His article can be read on the Smithsonian website.\*

Zorich discusses the Lost City site and how pyramid-building shaped "a social organization that changed the world." Both articles feature Mark Lehner's reconstruction of the harbors and waterways at Giza that he developed using data accumulated over the last 30 years.†

\* <http://www.smithsonianmag.com/history/ancient-egypt-shipping-mining-farming-economy-pyramids-180956619/>.

† "On the Waterfront: Canals and Harbors in the Time of Giza Pyramid-building," by Mark Lehner, *AERAGRAM* 15-1&2, pages 14–23, Spring–Fall 2014, available for free download at our website: [aeraweb.org](http://aeraweb.org).

Top right: The cover of *Smithsonian*, October 2015, featuring the pyramids of Giza. Top: A spread from Alexander Stille's article "The Power and Glory," which illustrates the routes over which the 4<sup>th</sup> Dynasty pharaohs transported goods as part of the pyramid building endeavor. The lower image shows the harbors and waterways at Giza, based on Mark Lehner's reconstruction, which we published in *AERAGRAM* 15-1&2 2014. Above right: The cover of the November 15 issue of *Scientific American* with a photo of the Great Pyramid. Right: A spread from Zach Zorich's article "The Pyramid Effect," also featuring Mark Lehner's reconstruction.



# Another Official's House Emerges in Season 2015

*We archaeologists sometimes feel like the proverbial blind men groping about an “elephant,” trying to decipher what it is, since we are often excavating only a part of something—of a building, a room, a house, a wall, a courtyard. Our “elephant” this past Field Season 2015 was a complex on the far western edge of the Heit el-Ghurab site in an area we call AA-South (AA-S). We only groped a bit of this elephant, but enough to recognize that we had a big, important creature: the office-residence of an official.\**

**A**rea AA-S (shown on the map on the facing page) climbs up the slope on the western edge of Heit el-Ghurab (HeG), directly south of an enigmatic structure we discovered in Area AA during our first excavation season, 1988 to 1989.<sup>1</sup> We named it the Pedestal Building for the two rows of pedestals that occupied most of the building (photo on page 22). This structure was one of the factors that prompted us to select Area AA-S for

\* The AA-S excavations were carried out by students in the AUC-AERA Field Training program (AFT) along with professional archaeologists. International students, enrolled through the American University in Cairo (AUC), and Inspectors in the Ministry of Antiquities trained side by side under the direction of Freya Sadarangani, Rabee Eissa, and Ashraf Abd el-Aziz, all seasoned field school instructors. To learn more about the AFT see *AERAGRAM* 14-2, page 18, Fall 2013. All back issues of *AERAGRAM* are available for free download at our website: [aeraweb.org](http://aeraweb.org).

Area AA-South operation, looking northwest. Photo by Rabee Eissa.

our 2015 excavation operations. The activities in AA-S might have been linked to the Pedestal Building and the rooms adjacent to it that we excavated in 2006–2007—possibly part of a brewery.<sup>1</sup>

On its ruin surface, AA-S showed evidence of brewing. Two circular, burnt mudbrick structures looked like supports for large vats used in heating beer malt, and ash covered the area. As it turned out, the burnt mudbricks were ovens.

We also selected Area AA-S for excavation because it was a puzzle piece that could add to our picture of its neighborhood, the Western Town, a tight mosaic of large houses, courtyards, passageways, dumps, and institutional structures.<sup>2</sup> We mapped the Western Town walls and features visible on the ruin surface, but we excavated only a small portion of it.



**AA-S**

Our AA-S operation encompassed an area about 32.8 x 65 feet (10 meters wide and almost 20 meters long) (outlined with a red dashed line on the map on page 20 and in the photo on the facing page). Because of time constraints, we were able to excavate only the northern half.

In the southern half, which appears to be an outdoor area, we dug a test trench that took in one of the circular burnt mudbrick structures. Time constraints also limited our intensive excavations to just the last occupation phase.

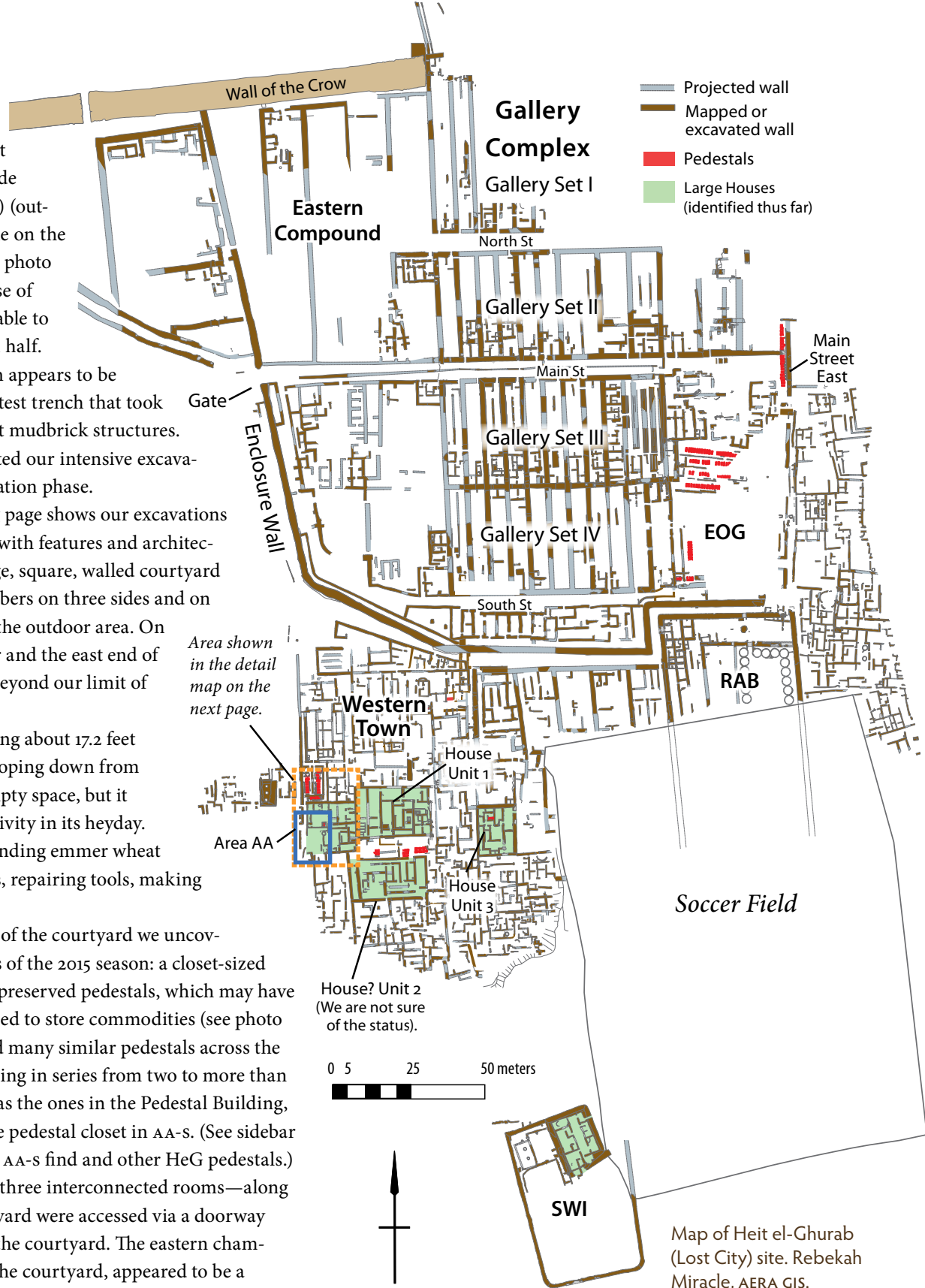
The photo on the facing page shows our excavations near the end of the season with features and architecture exposed. We see a large, square, walled courtyard surrounded by small chambers on three sides and on the fourth, the south side, the outdoor area. On the west side lies a corridor and the east end of a building that continues beyond our limit of excavation.

The courtyard, measuring about 17.2 feet (10 cubits) x 15.4 feet and sloping down from the west, was largely an empty space, but it undoubtedly saw much activity in its heyday. We can imagine people grinding emmer wheat into flour, mending clothes, repairing tools, making baskets, etc.

In the southeast corner of the courtyard we uncovered one of our major finds of the 2015 season: a closet-sized chamber with a set of well preserved pedestals, which may have supported bins or crates used to store commodities (see photo on page 22). We have found many similar pedestals across the Heit el-Ghurab site, occurring in series from two to more than a dozen, all lined up, such as the ones in the Pedestal Building, but none as complete as the pedestal closet in AA-S. (See sidebar on page 22 for more on the AA-S find and other HeG pedestals.)

The kitchen facilities—three interconnected rooms—along the north side of the courtyard were accessed via a doorway in the northeast corner of the courtyard. The eastern chamber, two steps down from the courtyard, appeared to be a storeroom. But at one time it had probably been a kitchen, as revealed by scorching under the wall plaster. The last active kitchen, the middle room, featured a hearth, lined with broken stones and mudbrick, built into the northeast corner. Ancient Egyptian bakers used such hearths for preheating bread molds. A dough-mixing vat may have once rested in a hole in the floor.

The back, western chamber had once been a kitchen too, or baking room, as suggested by its heavily scorched, unplastered



Map of Heit el-Ghurab (Lost City) site. Rebekah Miracle, AERA GIS.

walls. But it had been retired, used as an ash dump, and eventually sealed off, rendering it a dead space. However, hammerstones, broken beer jars, and other cultural material accumulated over the ash, along with collapse debris, possibly dumped after the house was abandoned.

Attached to the west side of the courtyard was a curious rectangular feature about 4 feet wide, apparently intended as a solid foundation, perhaps for a platform. It was filled with broken pottery, hammerstones, and other discarded artifacts. Above the structure rested a large pile of concentrated limestone debris, possibly derived from a collapsed superstructure.

Next to the platform, a small room once gave access from the courtyard to the corridor on the west, which stood nearly 11 inches above the courtyard floor. But at some point the opening was blocked with stones and mudbricks.

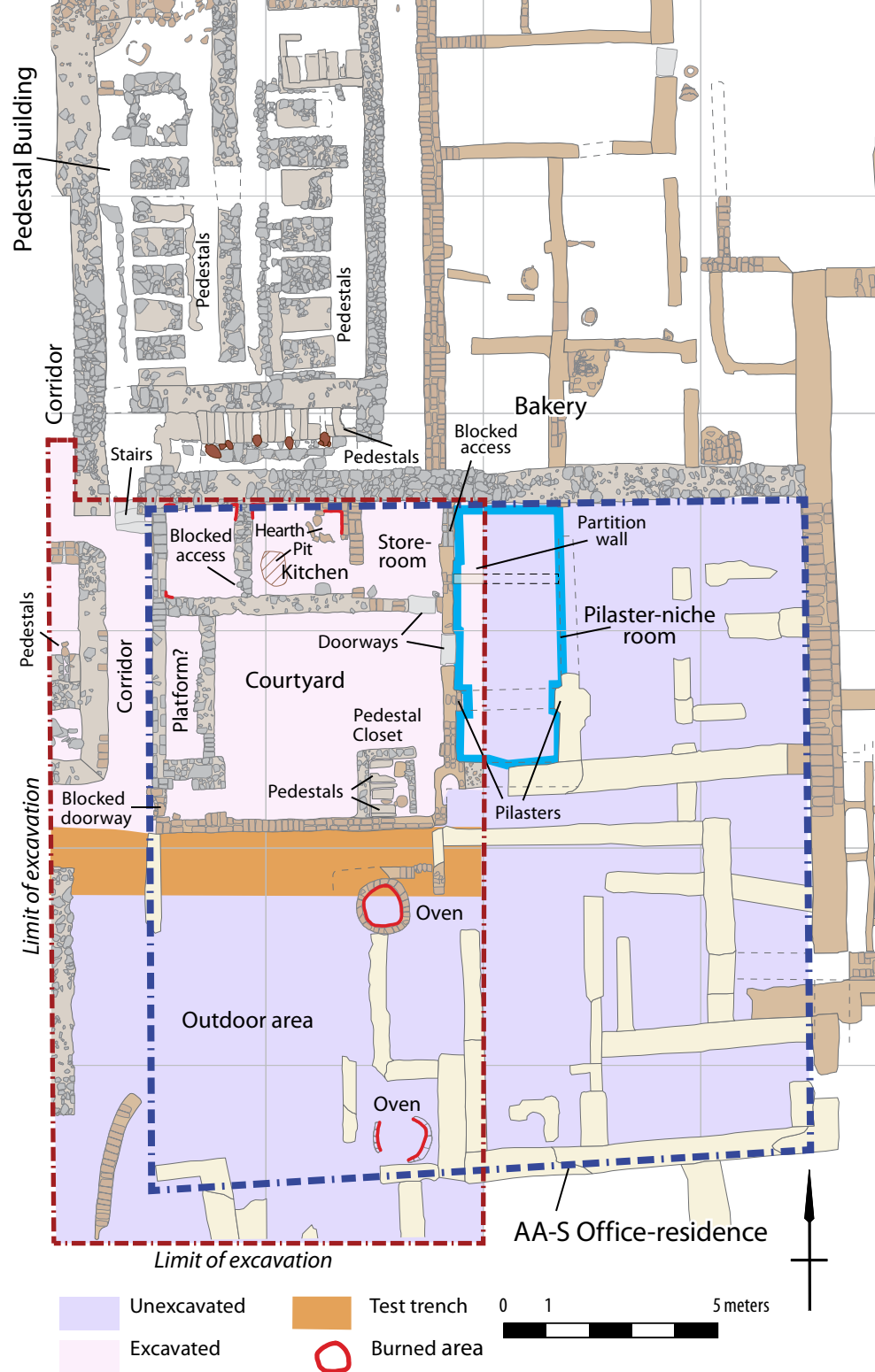
The corridor, surfaced with fine limestone fragments and bits of pottery, opened on the south to the outdoor area. On the north, it turned the southeast corner of the Pedestal Building and continued northward. At this corner, a flight of stairs led down into the Pedestal Building.

### The Pilastered Niche Room

The most intriguing 2015 find in Area AA-s was a long, narrow chamber on the east side of the courtyard. Our excavation took in a narrow swath of this north-south-oriented room, leaving most of the width yet to be excavated. However, we mapped the eastern walls as they showed in the ruin surface. Originally, the chamber was nearly 20 feet long and almost 8 feet wide. At the south end, pilasters projected from the interior faces of the walls creating a niche, about 3.7 feet deep. Inside it was a low platform for sitting or sleeping.

The AA-s chamber was similar to a hall we discovered in our other 2015 operation, Area Standing Wall Island (sw1),<sup>3</sup> which we interpreted as the office-residence of an official. In the long central room, pilasters projected from the walls at the southern end of the chamber, defining a niche, a feature we had already found in the central rooms in three other large houses at HeG (highlighted in green on the map on page 19), in twelve houses of the Khentkawes Town (κκτ), and in the residence at the Silo Building Complex,<sup>4</sup> adjacent to κκτ.

In his study of priests' houses in the Khentkawes Town,<sup>5</sup> Felix Arnold proposed that the long chambers with niches at the south end were reception halls where the master of the house received visitors and conducted business. The pilastered niche set him apart and formalized interactions with visitors. Arnold envisioned an architrave, or drum roll, completing the



Area AA-s in its context. The blue dashed line encompasses what we believe was the AA-s office-residence. But much of this area is yet to be excavated (purple). In our first field season here we dug to the final occupation floor level in the pink area. In the area south of the courtyard, we only had time to excavate a test trench (orange).

The Pedestal Building, excavated during 1988–1989, 1991, and 2006–2007, is part of a larger complex that included the bakery to the east and storage and production rooms (possibly a brewery) to the north, which we excavated during the 2006–2007 field season.

frame around the niche, although no remains of such were recovered during the 1930s excavations at the site. However, in sw1 we found chunks of fallen red-painted molded plaster lying between the pilasters, indicating that an architrave once

From the Pedestal Building looking south over AA-S. Field school students Kholoud Abd Elmady Hassen (in the foreground) and Mohammed Abd el-Maksoud map the small chamber that appears to be a storeroom for the kitchen area. A large, complete storage jar stands on the floor next to the doorway to the kitchen. In the background Rabee Eissa sits in the courtyard taking notes on the pedestal closet. Photo by Mark Lehner.



completed the frame around the niche, reflecting the importance of the individual who presided there. We made a similar find in a long, central room in House Unit 1 in HeG in 2006.

In the sw1 hall we also found limestone supports for the legs of a chair or couch, which lend further credence to the notion that the resident was a high-ranking official. These truncated pyramid-shaped stone objects are depicted in tomb reliefs and known from archaeological sites, all associated with high officials. In their tomb scenes, Old Kingdom officials are depicted seated on chairs and couches whose legs end upon pyramidal supports. Actual sets of the stone supports have been found in the 6<sup>th</sup> Dynasty governor's palace at 'Ayn Asil, as well as in the homes of high officials in 18<sup>th</sup> Dynasty Amarna.

The finds in sw1 turned our attention to similar halls in other large houses we uncovered at HeG such as in House 1, which John Nolan had determined was the seat of a scribal workshop and the residence of a high-ranking scribe.<sup>6</sup> We realized that the large houses with pilaster-niche halls served as seats of high officials.<sup>3,7</sup>

### The Big Picture

Turning to HeG as a whole, the settlement infrastructure must have been organized around large houses of prominent men, overseeing different institutions that supported the royal building works.<sup>7</sup> We imagine the king invited these powerful individuals to Giza to help build his funerary complex, assigning them a title and official seal of office. They came with an entourage, bound to them through kinship and other ties, as Barry Kemp suggested was the case with officials at Amarna.<sup>8</sup> They selected, or were assigned, a site in the new town and erected the house that would serve as their office-residence.

With the 2015 discoveries we now have four large houses with pilastered niches in the southwestern area of the site. We believe each of the resident officials managed operations that were vital to construction, administration, or the functioning

of the settlement: the sw1 official probably oversaw a stockyard and slaughter house; House Unit 1, as noted above, was the seat of a scribal workshop; and the official in AA-S managed activities on the upper slope of the settlement, probably brewing and baking.

1. "Enigma of the Pedestals: 2006–2007 Field Season," by Mark Lehner, *AERAGRAM* 8-1, pages 1–3, Fall 2007. Back issues of *AERAGRAM* are available for free download at our website: [aeraweb.org](http://aeraweb.org).
2. "Season 2004: A New Neighborhood," *AERAGRAM* 7-2, pages 1–3, Fall 2004.
3. "Discovery 2015: House of a High Official," by Mark Lehner, *AERAGRAM* 16-1, pages 2–7, Spring 2015.
4. "Conundrums and Surprises: The Silo Building Complex," *AERAGRAM* 13-2, pages 6–9, Fall 2012.
5. "Die Priesterhäuser der Chentkaues in Giza," by Felix Arnold. *Mitteilungen des Deutschen Archäologischen Instituts*, Abteilung Kairo 54, pages 1–18, 1998.
6. "Impressions of the Past: Seals and Sealings from Pottery Mound," by John Nolan and Amanda Pavlick, *AERAGRAM* 9-1, pages 2–4, Spring 2008.
7. "Giza Plateau Mapping Project," by Mark Lehner, *The Oriental Institute 2014–2015 Annual Report*, pages 76–86. Available for free download at the Oriental Institute website: <https://oi.uchicago.edu/about/annual-reports/oriental-institute-annual-reports-2011–2020>. Page 89 offers more information about town organization and high officials.
8. *City of Akhenaten and Nefertiti, Amarna and Its People*, by Barry Kemp, London: Thames & Hudson, page 44, 2012.



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## The Pedestal Puzzle

The pedestals tucked in a closet in the courtyard of the AA-s house (described on pages 18–21) are the best preserved examples we have found to date at the Heit el-Ghurab site, which has yielded many in various configurations: large groups, small sets, in closets, out in the open, aligned in rows in institutional structures—always with a gap, or slot, between pedestals (marked in red on the map, page 19).

Ever since we uncovered our first pedestals in 1988 and 1989 in the Pedestal Building (photo bottom right), we have puzzled over their function. Those first pedestals, with tops completely eroded, revealed little about their purpose, but we concluded they probably supported some sort of storage device, such as a bin, straddling the space between two pedestals. Some of our subsequent finds have offered more clues, as well as support for this idea. At the south end of the Pedestal Building, we discovered a row of pedestals in 2006 and 2007 (photo bottom left) with low mud partitions on top that appeared to define where bins might have rested. In front of the slots between the pedestals we found beer jars propped upright at the gaps, as if positioned to catch drips from whatever was stored above.

See the AA-s pedestal closet in 3D with a file, created by Kirk Roberts, at our website: [aeraweb.org](http://aeraweb.org).

Below left: The pedestals on the south end of the Pedestal Building. A beer jar leans slightly into each slot between pedestals. View to the north-west. Photo by Mark Lehner.

Below right: Fiona Baker maps the Pedestal Building during the 1991 field season. View to the south-southeast. Photo by Wilma Wetterstrom.

Left: The pedestal closet in AA-s. A bin may have straddled each gap, with the partition wall standing between the two containers. The rock in the slot on the left may have been dumped here when the settlement was abandoned or perhaps it propped up a sagging floor of a container. View to the west. Photo by Mark Lehner.

Or perhaps they served as standard measures for doling out the contents. We have also discovered bricks arranged in front of some of the gaps as though they supported jars.

Another clue to the function of the pedestals comes from the many “peg and string” sealings discovered in the vicinity of the Pedestal Building. These sealings could derive from closing and opening peg and string locks on chests straddling two adjacent pedestals.

The well preserved AA-s pedestal closet offers additional insights. The entire structure was meticulously maintained with repeated repairs to the thick plaster, while the layout assured that no one standing outside the closet could see the pedestals or observe whatever might be withdrawn from containers on them, especially if the walls were full height. This emphasis on cleanliness and privacy suggests that the stored goods were best kept in a clean, dry environment and perhaps needed to be secured.

From AA-s we also surmised that a variety of goods were stored above the HeG pedestals. Instead of jars, we found in front of the gaps a large bowl and a hole that probably once held a bowl. These may have supported baskets or skin bags while they were being filled with dry commodities. Or, perhaps liquids stored above drained into them, allowing a worker to ladle the substance into another vessel. In addition, in the building on the west edge of our AA-s excavation, we found two damaged pedestals with a jar positioned at the gap, a storage vessel, not a beer jar.

### Further Reading

1. A. Abd el-Aziz presents a detailed discussion of Heit el-Ghurab pedestals in “Prolific Pedestals: Preliminary Report on Area Main Street East (MSE),” in *Settlement and Cemetery at Giza: Papers from the 2010 AERA-ARCE Field School*, edited by F. Sadarangani and A. Witsell, Boston: AERA, pages 86–96, 2015 (also see article about the book on page 16).
2. Learn more about the Pedestal Building in “Area AA and the Pedestal Building” in *Giza Plateau Mapping Project Seasons 2006–2007 Preliminary Report, GOP3*, by M. Lehner, M. Kamel, and A. Tavares, Boston: Ancient Egypt Research Associates, pages 65–77, 2009. Both *Settlement and Cemetery* and *GOP3* are available for free download at our website: [aeraweb.org](http://aeraweb.org).



# Remembering Kamal el-Deen Waheed

*by Mohsen Kamel*

It is with great sadness that we report the passing of our good friend Kamal el-Deen Waheed this past October 22.

During his tenure as the general director of Giza Pyramids area from 2006–2010, Kamal greatly helped AERA with our field schools for inspectors in the Ministry of Antiquities. He was a firm believer in the value of training young inspectors in field methods. He always followed up on the progress of their training, encouraging them and trying his best to ensure that our training program was realized to its fullest. He believed that by training young inspectors Egypt's antiquities would benefit, as they are the guardians of their heritage.

He was instrumental in the success of AERA's Mit Rahina Field School at Memphis in 2011, continuing to help AERA from his post as director of the Saqqara area, including Memphis, by regularly visiting the school and making sure that the team received all permissions on time. He graciously provided whatever assistance he could, encouraging the team as a whole and always requesting his colleagues do their best to help with the success of the field schools. Most recently, he was very supportive of our current Memphis Site and Community Development project (see article on page 2), helping to get it off the ground by providing his time and effort.

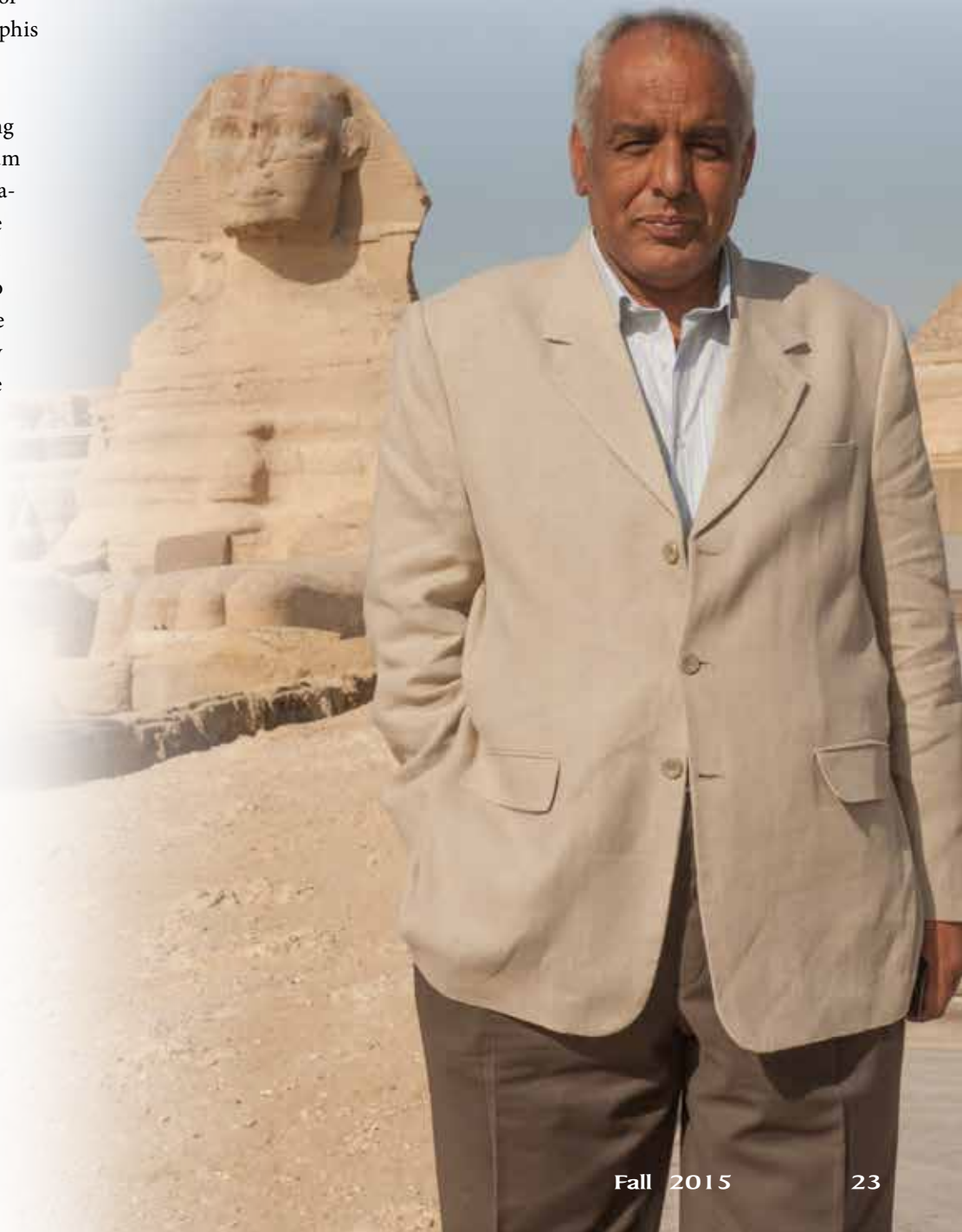
Kamal was born in Sohag in 1959, graduating from the Egyptian Antiquities Department of the University of Sohag in 1981. He began working for the Ministry of Antiquities as an Inspector at Abydos in 1985, later working in Luxor and then receiving an Inspector position at the Ministry's Giza Pyramids office in 1991.

He received a post as Chief Inspector of Saqqara in 2002, and

Kamal el-Waheed, then General Director of the Giza Pyramids, in 2010. Kamal went above and beyond for AERA every chance he could, most especially with his unwavering support of our AERA-ARCE Field Schools and our students. Photo by Mark Lehner.

served as Director of Saqqara from 2003–2006. He served as General Director of the Giza Pyramids area from 2006–2010 prior to being appointed as General Director of Saqqara from 2010–2013. He became the General Director of Embaba and Giza Antiquities in 2014, and rose to Director of the Central Department of Antiquities in Giza and Cairo in 2015, prior to his death.

He will be greatly missed as both a good friend and one who always believed in doing the best for Egypt and her monuments.





Left: AERA team members Dan Jones and Ana Tavares orient the Ambassador and his entourage before leading them on a tour of the Lost City site. From left: Dan Jones; Brian A. Shott, US Embassy Press Attaché; Ambassador Robert S. Beecroft; Farah Mansour, USAID; Ana Tavares; and Ashraf Mohie el-Din, Giza Inspector, Ministry of Antiquities. Photo by Sayed Salah.

Below: The Lost City site partially submerged in 2008. *AERAGRAM* 9-1, Spring 2008, article about the water problem. *AERAGRAM* 9-2, Fall 2008, article describing the success of the dewatering project.

## US Ambassador to Egypt Visits Giza Plateau and Lost City Site

Ambassador Robert S. Beecroft toured Giza on September 3 to see the impressive results of a joint us-Egyptian project to lower the groundwater, which had posed a serious threat to the monuments at the low southeast base of the plateau. Over a period of four years, starting in 2004, the water table rose more than three feet at our Lost City site (also called Heit el-Ghurab), saturating the mudbrick ruins of the ancient settlement and pooling in low-lying areas. Rising groundwater also seeped up toward the Sphinx and collected in excavations at the foot of the nearby Khafre Valley Temple. But thanks to the us-Egyptian dewatering project, funded by USAID-Egypt and employing strategically located pumps, the water table receded to earlier levels, kept in check with ongoing pumping.

AERA team members Ana Tavares and Dan Jones led Ambassador Beecroft, along with staff from the Embassy and USAID, on a tour of the Lost City, pointing out the enormous benefit dewatering has brought to the site and our work. They explained that not only has dewatering spared the ruins from rapid deterioration, it allowed us to resume excavations here in 2011 after a three-year hiatus due to flooding. Even in the lowest area, which was a veritable “lake” in 2007–2008 (see photo in upper right), we were able to excavate in 2011. We were especially pleased to be digging again as it allowed us to answer lingering questions about this depression; it turned out to be a large enclosure that was most likely a cattle stockyard. Dewatering the site has also made it possible to continue training inspectors in the Ministry of Antiquities—through our USAID-funded field schools—at a place that is ideal for teaching settlement archaeology.

On September 5 the USAID-Egypt Facebook posted a note on Ambassador Beecroft’s visit and quoted him as saying, “Egypt’s antiquities are a treasure for the whole world and must be protected. U.S.-Egypt cooperation on protecting the Sphinx and the Lost City of the Pyramid Builders is an excellent example of how we can work together to save Egypt’s antiquities for the whole world to enjoy.”

Ambassador Beecroft and USAID and US Embassy staff stroll across a dry Lost City site with Ana Tavares and Dan Jones as guides. Photo by Sayed Salah.



2008

Mark Lehner



Sayed Salah

One of the pumps used for dewatering the Lost City site and the Giza Plateau.





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