VOLUME 20, FALL 2009

THE OSTRACON

THE JOURNAL OF THE EGYPTIAN STUDY SOCIETY

The Ostracon is published annually by members of the Egyptian Study Society. The ESS is a non-profit organization whose purpose is to study ancient Egypt. It is an associate group of the Denver Museum of Nature and Science. Articles are contributed by members and scholars on a voluntary basis. Member participation is encouraged. Nothing may be reprinted in whole or part without written permission of the author.

The opinions expressed in *The Ostracon* do not necessarily represent the views of the *Ostracon* staff, the Egyptian Study Society, or the Denver Museum of Nature and Science.

Publication of The Ostracon *is supported by a grant from* THE PETTY FOUNDATION

Egyptian Study Society, Inc.
P.O. Box 40754
Denver, Colorado 80204-0754
UNITED STATES OF AMERICA

In This Issue

THE TAUSERT TEMPLE PROJECT 2009 SEASON

By Richard H. Wilkinson

Fig. 1. One of the two sections of the Tausert Temple site cleared by the University of Arizona Egyptian Expedition during its 2009 winter season.

Like researchers in any science, archaeologists usually have the advantage of standing on the shoulders of researchers who have gone before them. This is especially true in Egypt where it is often difficult to find an area which has not been visited and studied, if not actively excavated, by the great British archaeologist Sir William Flinders Petrie. Petrie was a true giant in Egyptian archaeology, and we owe much to him. His accomplishments were many, and the list of sites he excavated was amazingly long, but his work was often hurried, and sometimes, as a result, it was flawed.

The University of Arizona's excavation of the Queen Tausert's memorial temple on the west bank at Thebes is an excellent case in point. The site of Tausert's temple was examined briefly by Petrie in 1896. Since then, it has been largely ignored because it was presumed that the temple was never completed in antiquity.[1] After careful study, however, the University of Arizona Egyptian Expedition decided that this might not have been the case and that it would be worthwhile to clean carefully, record, plan, conserve and publish the remains of this temple. The Supreme Council of Antiquities[2] kindly granted us permission to begin this project in 2004. To date, we have completed field seasons at the site annually.[3] Our winter 2008–09 season was a relatively short one (a fact which was dictated by a number of constraints) conducted in late December 2008 and the first part of January 2009. Nevertheless, a good deal of valuable work was accomplished during this time.[4]

CLEARING THE TEMPLE SITE

During the course of our 2009 season, our team[5] cleared the debris from two sections of the temple in the southwest and northwest quadrants of the site—on each side of the central surface area enumerated by us[6] as S36 (Fig. 2). These two areas were chosen in order to allow us to close in on the central portion of the inner temple, which will be the focus of our next field season. Both of the areas that we cleaned this season proved to be profitable, although for different reasons. While the southern area proved to have few remaining artifacts, clearing it enabled us to uncover and properly draw a section of the temple plan that was mapped incorrectly by Petrie. On the other hand, the northern area followed the plan produced by Petrie to a reasonable extent, but produced many artifacts and small finds showing that this area was not properly excavated, either—even if dug through—in Petrie's brief examination of the site.

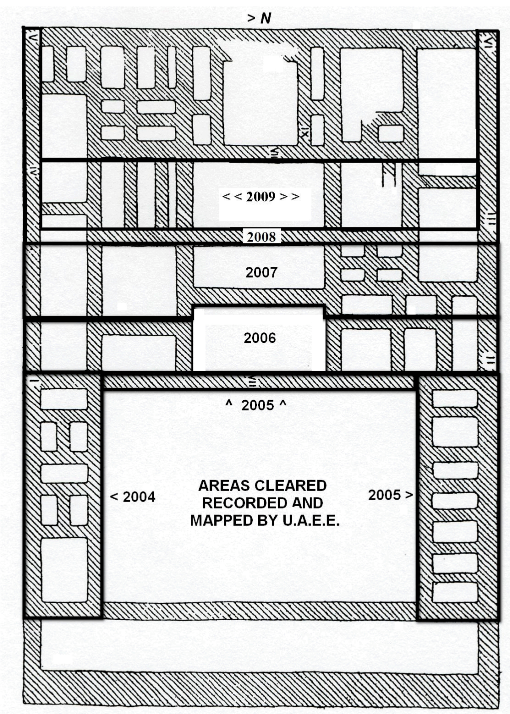


Fig. 2. Petrie's uncorrected plan of the Temple of Tausert (1897) showing the areas cleaned, recorded, and mapped by the University of Arizona Expedition since 2004. The 2009 season concentrated on the areas to each side of the central surface area labeled here "<<2009>>".

The southwestern area of the temple cleared this season consisted of the foundation trenches and surface areas (the temple's rooms) between our TA1 and TA6 on the monument's North-South axis and TB12 and TB15 on its East-West axis. Excavation of this section of the temple revealed the surface areas S37–39 that had been completely misrepresented on Petrie's plan and had to be redesignated as S37 A & B, 38 A & B, and 39 A & B, for Petrie's three surface units were actually six. Two discoveries were of particular value in this section. Of great interest to us was the fact that a number of these surface areas were covered with *dekka*—the mud and gypsum flooring material that was used to coat many of the surface areas we excavated on the northern side of the temple. The poor state of preservation of many of the surface areas on the temple's southern side meant that we found no *dekka* flooring in that area until now, but its clear presence on several of these units indicated that flooring was also in place in this part of the temple, as we suspected.

The western surface of S25 and the eastern part of S40 were also cleared. S25 yielded sherds of Amarna Blue Ware at *gebel* level nearly parallel to the point at which we found a smashed Amarna Blue vessel on a surface area on the north side of the temple in our 2006 season. The disturbed nature of the fill on S25 indicates that the rest of the vessel was probably lost at some point, perhaps to Petrie's men. Although our find of a single sherd might seem to be a small thing, the presence of this notable type of ceramic on widely separated surfaces at parallel points on the site strengthens our belief that this pottery may have been used in foundation rituals in the temple.

The area examined on the northwest side of the temple consisted of a few foundation trench and surface units around surface areas S33 and S34 that needed final clearing, along with the larger area which lay between our TA11B and TA14 on the temple's North-South axis and between TB12 and TB15 on its East-West axis.

Complete cleaning of surface area S33 was worthwhile, for we discovered another small offering pit (Fig. 3) almost identical to the one discovered in the surface of S32 in our last season. That pit contained a haunch of beef set in a bed of Persea leaves. The pit found this season on S33 was of approximately the same diameter, but not as deep, and contained only fragments of Persea leaves and seeds. The pit is located in an area which was certainly probed by Petrie's men (nearby in the same disturbed stratum, we found the sole of a shoe and a piece of cloth, no doubt belonging to one of his workmen).

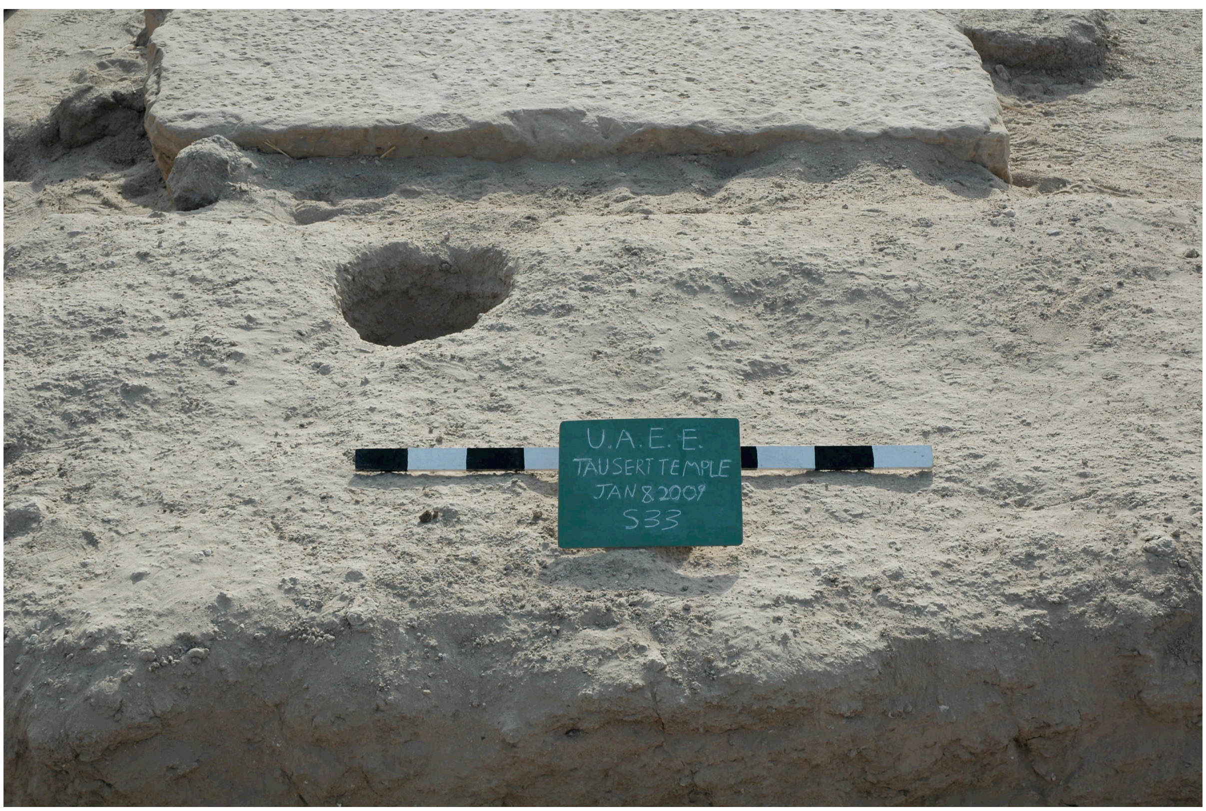
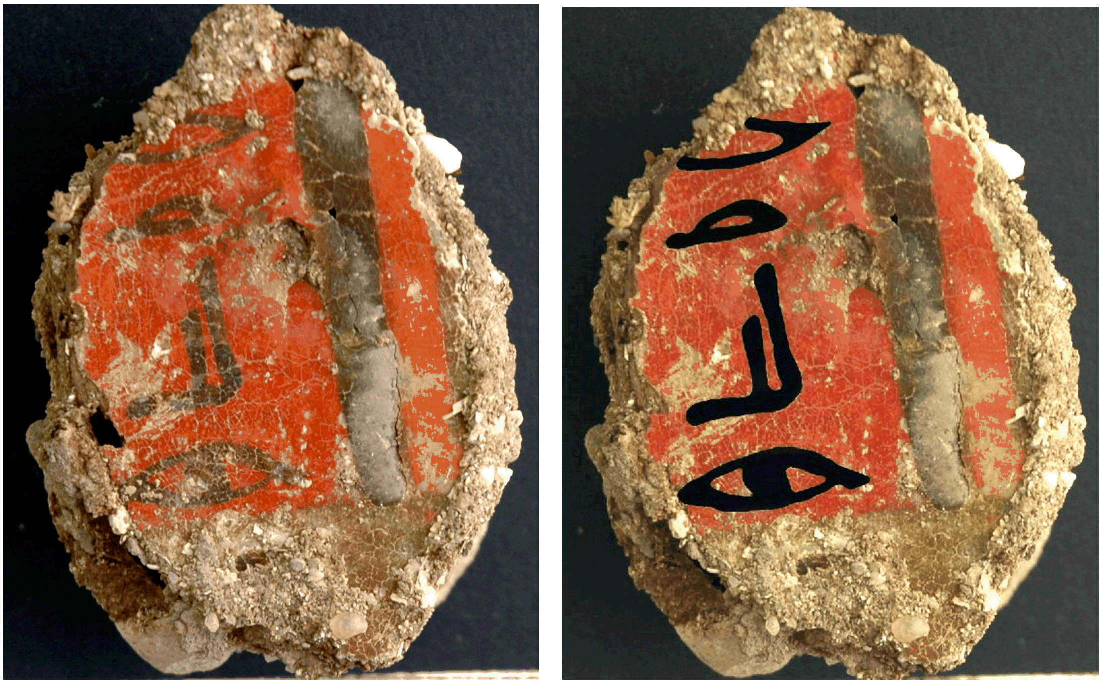


Fig. 3. Small foundation pit discovered in surface area S33 containing only fragments of Persea leaves and seeds. Unlike the nearly identical pit discovered last season, this one was in an area clearly probed by Petrie's men and had been previously robbed of its contents.



Figs. 4a & b. Example of painted coffin fragment (a), and with the hieroglyphs …rt (?) Wsir – "… (?) Osiris" highlighted (b).

Without a doubt, the pit's symbolic purpose was identical to that of the pit found earlier and was associated with the foundation rituals for the temple's expansion.

The larger surface areas between TB9 and TB14 had substantially more debris and required somewhat selective clearing, leaving some surfaces for future work. The trenches and surface units cleared produced a great number of finds, however. Most of these were human remains and remnants of burial assemblages probably associated with Third Intermediate Period tombs which we know were constructed somewhere at the rear of the temple. Among the objects we extracted from this area were several shabtis, part of a female fertility figure, many pottery sherds, faience beads, an amulet mold, and other small items, along with a great number of painted coffin fragments (Figs. 4a & b).

The area also produced many pieces of mummy cloth and mummy tissue, along with a great number of disarticulated bones, all of which indicate that the mummies were thoroughly broken up at the time that some (or all) of these tombs were robbed. The osteological material is extensive (see Fig. 5, next page), and the hundreds of bones we collected are clearly from a number of bodies (based on a great deal of duplication of bones) of different ages (based on bone sizes, epiphesial fusion, vertebral wear, etc.). Some of these human remains were in excellent condition of preservation, as with the whole hand discovered in our cleaning of the area directly east of TB14:2 (see Fig. 6, next page). This condition will certainly help in our analysis of the

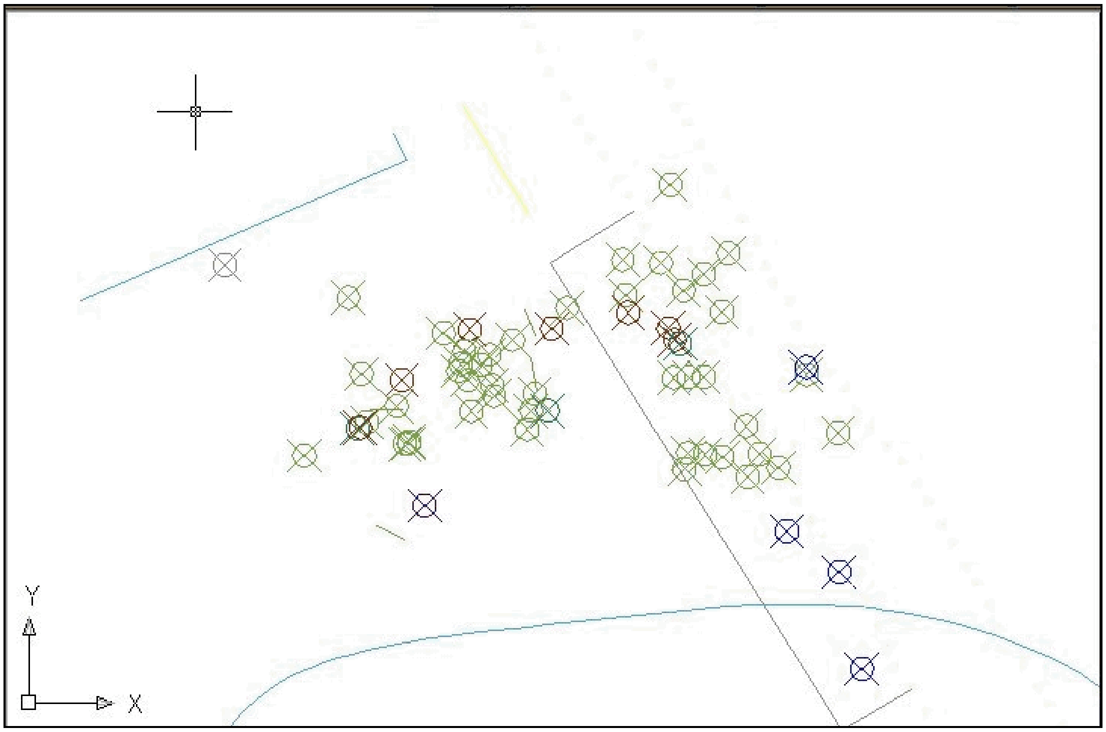


Fig. 5. Distribution of human remains (many points representing multiple finds) around surface area S41, where an intrusive (and later robbed) burial is likely situated.

osteological material. Unfortunately, Dr. Gonzalo Sanchez, our medical expert, could not be with us this season, so we have put off formal examination and analysis of the human remains until our next season. At that time, with Dr. Sanchez's help, we hope to study these human remains in detail to extract whatever information we can with regard to the number, age, sex, and health of the individuals.

Fig. 6. One of the hands discovered this season among the human remains recovered around S41. It shows the excellent state of preservation of some of the remains of the intrusive burial(s).

As we excavated along the northern edges of S30 and S41 last season, we found large construction mud bricks that are over 40 cm in length. They appear to be part of a New Kingdom room or outer wall running along the edge of this surface unit. This season, we pushed deeper into this area and found what at first appeared to be the lower two courses of a carefully made brick wall of much smaller bricks. The bricks average c. 26 cm x 13.5 cm and are just a little larger than those in the Khonsuardis temple directly to the north of us:

Sample Tausert New Kingdom bricks: 40 x 19, 42 x 19, 39 x 19, 36 x 19
Sample Tausert S41 (Third Intermediate Period?) bricks: 26 x 14, 24 x 13, 27 x 14, 26 x 13
Sample Khonsuardis Late Period bricks: 24 x 11, 20 x 10, 21 x 11, 21 x 10

These small convex-topped bricks of post–New Kingdom date were placed directly on the *gebel* flooring of S41 and formed a rectangular structure oriented on the temple's N-S and E-W axes. As we cleared this area, however, it became apparent that this was not a wall (as there is no foundation in the loose *gebel*, and no evidence of more destroyed courses), but probably a mud brick surround (Fig. 7).

Fig. 7. Mud brick structure around which most of the human remains were recovered and which may represent the surround to a tomb entrance. If this is the case, then the remains and burial assemblage fragments show obviously that the tomb was robbed in antiquity.

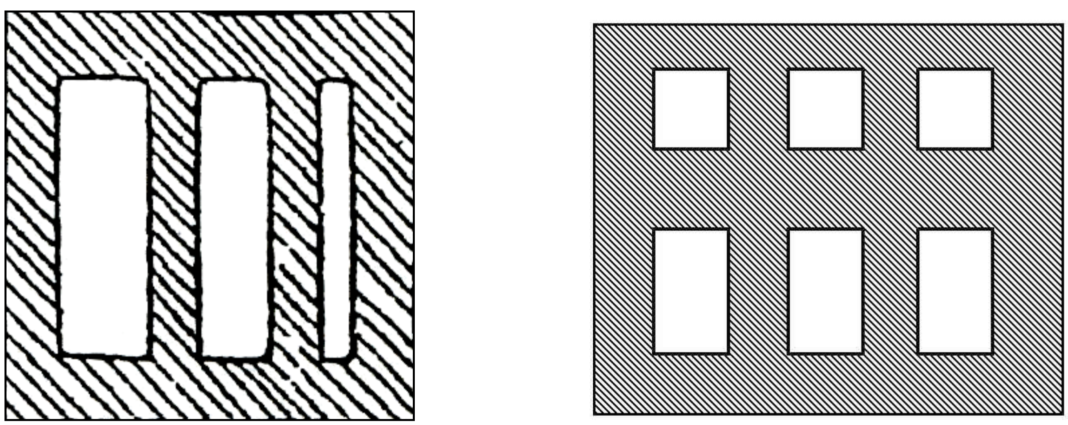
This surround, if that is what it is, runs back along the surface unit and may have bounded the entrance steps to a tomb in the *gebel* wall now under the embankment on the temple's west side. It may, however, be a mud brick surround to a burial shaft. We shall have to wait until our next season to confirm this possibility, but the presence of a tomb in this area (clearly robbed in antiquity, but not without archaeological interest and an important part of the history of the temple) seems certain.

All the artifacts found in the course of the 2009 season were catalogued and placed in storage in the SCA magazine behind the Carter House on Luxor's West Bank. The most important items will be documented in our forthcoming report.

PRODUCING A PLAN OF THE TEMPLE

We continued to make progress toward creating an accurate map of the temple, and were able to gather a good deal of data toward this goal. The AutoCAD model that we are preparing of the site was updated and developed further in our 2009 season.

As in almost every season we have worked on the Tausert site, we found and mapped areas which were considerably different from those found in Petrie's map,[7] the details of which were often not the result of excavation, but simply guessed at, apparently. A striking example of this (Figs. 8a & b) was found in our excavation of the areas enumerated by us as surface areas S37, 38, and 39, which Petrie mapped as long, unbroken surfaces of successively decreasing size running from south to north. Our excavation found that these surface areas were not only of equal—not decreasing—widths, but also were bisected by a trench unknown to Petrie (our TB13B) that formed six small surface areas of two different sizes. Once again, this example shows clearly that much of Petrie's map must have been produced by simply looking at mounds of earth covering various areas of the temple and presuming that the mounds represented underlying surfaces by their shape and size.



Figs. 8a & b. Three surface units (shown as being of decreasing size) and their surrounding trenches as depicted on Petrie's plan of the temple (a), and, as accurately mapped in our 2009 season, as six surface units—S37 A & B, S38 A & B, S39 A & B—of equal width (b).

As we have mentioned in previous reports, we plan to incorporate all our data for the site into a three-dimensional GIS model based on the completed AutoCAD model. One of our team members is an experienced computer specialist and has begun the initial work for this total matrix GIS model. The completed model will give full and immediate access to all excavation, conservation, and reconstruction data from our project. Selecting any area on the map of the temple site will show full excavation, artifact, feature, unit and conservation details for that locus. The GIS model will incorporate textual and photographic evidence as well as statistical analysis of the site's data.

PRESERVATION OF THE TEMPLE REMAINS

Although we have found no decorated blocks or other temple remains needing conservation to date, in the course of our excavation each season we have continued to assess each 2-meter unit of the temple's foundation trenches and surface areas carefully in terms of their condition. Every unit was assessed as being intact, good, fair, poor, or destroyed (using a percentage range breakdown). Units were then coded in terms of needed treatment as: 1—Very unstable, needs treatment soon, 2—Somewhat unstable, should get treatment in the near future, 3—Fairly stable, might need treatment in the future, or 4—Stable.

Fig. 9a.

Figs. 9a, b, & c.

One of the foundation trench sections (TA3:3–5) having undercut gebel walls which were stabilized in the current season.

Fig. 9a. The trench wall undercut by erosion.

Fig. 9b.

Fig. 9b. The undercut areas tightly packed with stones.

Fig. 9c. The area backfilled with sand to support and protect the eroded areas.

Fig. 9c.

As planned for this season, we began to stabilize areas of the foundation trenches that needed support or reconstruction. This need for stabilization was particularly acute in the eastern half of the temple's main trenches that bound the courtyard area (our S2). These trench units appear to have been badly damaged when their stone was robbed at some point after the reign of Tausert and, as a result, have long been exposed and have suffered considerable erosion over time. Fortunately, we were able to stabilize and protect all of the affected *gebel* walls in the eastern part of trenches TA1–3 (Fig. 9) and, where needed, the areas in trenches TA12–14.

Despite the fence that we built around the site, it is impossible to preserve the mud brick walls in the temple's foundation trenches, for the fence is routinely knocked down when we are absent and the children of local people take down the walls that we have reconstructed each season. As a result, we now plan to reconstruct some of the walls then bury them in sand with only the top surfaces of the topmost course showing where the walls are located. The walls are, of course, mapped into our site map and AutoCAD model. More difficult to preserve are the remains of superstructure walls that we are now beginning to find. These will have to be covered each season after they are recorded in order to protect them. We plan to continue this basic protective work while we also seek advice from specialists with regard to any features of the temple that may be found to need technical restoration or preservation.

PRELIMINARY CONCLUSIONS

Although we were limited by a short excavation season, we utilized a team varying from fifty to sixty workmen, which allowed us to clean two substantially sized areas of the temple site successfully, to collect a large number of artifacts, to stabilize and preserve a large number of the temple's *gebel* trench walls effectively, and to continue recording the condition of our excavation units with an eye toward further preservation work. Finally, our mapping of the newly cleared areas continues to work toward our goals of producing the first accurate map of this temple and improving our understanding of the monument's form, history and level of completion.

Based on his very limited examination of Tausert's Temple, Flinders Petrie stated that little, if any, evidence of building could be found on the site apart from a few stone foundation blocks at the very rear of the temple. Our work, however, shows that the temple was much more developed than Petrie appeared to believe and others subsequently presumed. Each season has brought new and further indications of this fact. We may now expand the list of points noted last season to include all of the following evidence of the temple's development:

1) Deep foundation trenches capable of supporting large stone superstructures were dug over the whole site.
2) Foundation deposit pits were constructed and stocked at points around the site, and small amulets and beads were sprinkled through most of the foundation trenches.
3) A deep bed of clean sand was placed in all these trenches to receive foundation stones.
4) Foundation blocks were then placed in most of the trenches. We have found many more whole and partial foundation blocks over a much more widespread area than Petrie was aware of, including a number of partial and nearly complete blocks in the front part of the temple.
5) Widespread damage to the edges of the *gebel* walls of many of the foundation trenches, especially on both sides of the temple courtyard, indicates that a great number of large foundation stones may have been pried and dragged out of their trenches.
6) Petrie does not mention building blocks, but we found a complete one sitting on top of a foundation block and hundreds of fragments of plastered blocks throughout the site. The smaller size, accessibility, and relatively easy extraction of these blocks explain why virtually none of them remain.
7) Both our initial surface survey and our ongoing excavation reveal the presence of stone fragments over the whole site. These fragments are almost invariably broken (not cut) from larger stones, indicating that stone features were demolished on the temple site on a widespread basis.
8) *Dekka*—gypsum-mud flooring—found on many of the surface units (rooms) we uncovered indicates that walls had been built around these areas already, for the *dekka* surfaces would have been destroyed in the building process if they had been put in first.
9) Plaster found on many of the stone chunks we uncovered may indicate that walls and other features were built and plastered before being demolished later for their stone.

All these facts point to the probability that Tausert's Temple was far more developed than previously believed, and that it was demolished for its stone by Sethnakht or another king of his or a subsequent dynasty. Based on the points of evidence garnered from seasons of work on this site, the knowledge gained and conclusions reached supplant previous ideas and suppositions about the monument and represent one of the most important results of our work.

NOTES

1. Petrie's cursory exploration of the site of the Tausert temple is recorded in his book: W. M. Flinders Petrie, *Six Temples at Thebes* (London, 1897), pp. 13–16.

2. We would like to thank Director General Dr. Zahi Hawass and the members of the Permanent Committee of the Supreme Council of Antiquities for granting us permission to initiate and to continue this project.
3. Summaries of our reports describing the previous seasons of the University of Arizona Egyptian Expedition's Tausert Temple Project have been published in previous issues of *The Ostracon*, and elsewhere.
4. We would like to thank Mr. Magdy El-Ghandour, Director of Foreign Missions, for his kind and continued help in arranging our work in Egypt. In Luxor, the Director of Upper Egypt, Mr. Mansour Boraik, was a great help, as always, and we thank him in particular. We also thank Mr. Ali El-Asfar, who was Director of West Bank Antiquities during our season, and Mr. Mustafa El-Waziry, who took over that office as we completed our work. Mr. Mohamed Hamdan, Director of the West Bank Missions Office, was extremely helpful, and we also thank our assigned inspector, Mr. Omar Ahmed Abuzaid, who was a great help and who participated in the excavation with us. Reis Omar Farouk Sayed El-Quftawi, along with Assistant Reis Kamal Helimy, were both a great help to us. As before, our thanks are also due to the American Research Center in Egypt, which facilitated our Expedition, and most especially to Shari Saunders and Amira Khattab, whose kind and able help we appreciate greatly. The support of a number of individuals and institutions that have made our work possible is deeply appreciated and will be specified in our preliminary (scheduled to appear in 2009) and final project reports.
5. Our project staff for this season consisted of Richard Wilkinson (director), Aaryn Brewer (AutoCAD assistant), Adam Cirzan (mapping assistant), Richard Harwood (associate director for photography and section leader), Kevin Johnson (historical and photographic assistant), Danielle Phelps (object registrar), Linda Regan Gosner (senior excavation assistant and section leader) and Mark Wilkinson (excavation assistant). We employed some sixty Egyptian workmen during the season as well as Reis, Assistant Reis, drivers and boatmen.
6. The numeration employed in our designation of trench and surface units in the Tausert site is documented in our reports and publications, but may be explained briefly here as follows. The temple's foundation trenches were assigned designations TA1–14 for East-West trenches and TB1–18 for South-North trenches (with 2-meter sub-units) in the areas cleared so far. This system makes possible a better analysis of artifact distribution than a regular grid system would allow. Surface units defined, studied, or cleaned so far are designated S1–S41.
7. Petrie 1896, Plate XXVI.

About the author:

Dr. Richard Wilkinson is professor of Egyptian archaeology at the University of Arizona and director of the University's Egyptian Expedition, which has conducted research and excavation in Egypt since 1989. He is the author of many articles and books on ancient Egypt and editor of Egyptology Today*, published by Cambridge University Press.*

ATTICA MINES, GREECE: A POSSIBLE TWELFTH CENTURY BCE REFERENCE

By Aly A. Barakat

The Harris Papyrus dates back to the Twentieth Dynasty (1196–1070 BCE). It is one of the most important ancient documents recording the life and activities of Ramesses III (1194–1163 BCE) and his achievements in the areas of policy, religion, economy, and human society.[1] Of particular relevance to this article is a passage in the papyrus that describes a mission to obtain copper from a foreign country:

> I sent my messengers to the country of Atika to the great copper mines which are in this place. Their galleys carried them; others on the land-journey were upon their asses. Their mines were found abounding in copper; it was loaded by ten-thousands into their galleys. They were sent forward to Egypt, and arrived safely. It was carried and made into a heap under the balcony, in many bars of copper, like hundred-thousands, being of the color of gold of three times. It has not been heard before, since kings reign. I allowed all the people to see them, like wonders. . . .[2]

This text is followed by another describing a mission to Serabit el-Khadim in the Sinai. The main purpose of that mission was to bring various goods to the Hathor Temple there (Fig. 1), and the text makes no reference to copper mines.

Fig. 1. Ruins of Hathor Temple at Sarbit el Khadim, Sinai. Author's photo.

Investigators have not reached a definite conclusion about the location of the "country of Atika" referred to in the Harris Papyrus. Breasted believed that Atika was an "uncertain region," accessible by both sea and land from Egypt, and therefore was probably somewhere in the Sinai Peninsula, where so much copper was obtained.[3] The same uncertainty of location was addressed by more recent researchers who suggested that the reference to Atika might refer to the Timna mines of Wadi Arabah, near the modern city of Elat at the northern end of the Gulf of Aqaba.[4]

In light of established data concerning the economic ties between Egypt and Greece during the New Kingdom, it is certainly possible that the references to Atika in the Harris Papyrus are to the Attica region of modern Greece, rather than to any areas in the Sinai Peninsula.

EGYPTIAN COPPER MINING DURING THE TWENTIETH DYNASTY

While copper is found in various sites in the Eastern Desert and the Sinai in both basement and sedimentary rocks,[5] the copper content in these sites is low, usually less than five percent. Richer ores are occasionally found as pockets, lenses, bands, and fissure or joint-filling "veinlets" in the host rocks. From the Predynastic Period onward, ancient Egyptians prospected and mined copper ores in many parts of the country.[6] The Sinai, however, was the primary location for the copper industry throughout the Predynastic period, and during the Old and New Kingdoms. Most of the accessible ores found in central Sinai at Serabit el-Khadim, Maghara, and several sites around Wadi Nasb were impregnated with secondary copper minerals such as azurite, malachite, atacamite, and turquoise[7] (Fig. 2, p. 16). Mining activities at those sites concentrated on the extraction of copper and turquoise from the associated ores. Copper smelting camps were established at those major centers. Other smaller-scale copper mining and smelting activities were scattered elsewhere in the Sinai. In addition, there were copper smelting camps that had no nearby mining works, such as at Wadi Gharandal, Seh Baba and Gebal Safariat. In the author's opinion, the smaller camps reflect a scaling back of operations in the primary copper production centers, which could be the result of one or more possible factors: (1) that the more readily accessible ore was depleted; (2) that fuel for smelting became scarcer as the available acacia trees were harvested; and (3) that there was a lack of fresh water. It is especially possible that a shortage of fuel at the primary sites may have necessitated the establishment of smaller-scale smelting camps far from the actual mining sites themselves.

By the start of the New Kingdom, the ore and fuel were nearly exhausted after more than 2,000 years of copper production from the main Sinai mining centers. Judging from the dearth of references in Egyptian texts, New Kingdom rulers paid little attention to the Sinai. Rothenberg reported that New Kingdom copper mining and smelting activity continued at the earlier sites at Wadi Nasib[8] (Fig. 3, p. 16). New Kingdom copper production from those sites was not comparable to that of previous dynasties, however. The scarcity of copper sources, which seems to have been a problem at least by the Eighteenth Dynasty, became acute in the Twentieth Dynasty, and particularly at the time when Ramesses III was trying to stabilize Egypt and protect his empire from the turmoil that was overtaking other parts of the Mediterranean basin.


Fig. 2. Impregnation of secondary copper minerals in Wadi Abu Thor, Sinai. Author's photo.


Fig. 3. New Kingdom inscription joints at Wadi Nasib copper smelting camp, Sinai. Author's photo.

ANCIENT CONTACT BETWEEN EGYPT AND GREECE

The connection between Egypt and several islands in the Mediterranean Sea extends far back in history. Ancient Egyptian texts refer to interactions with seamen coming from "the north,"[11] which probably included inhabitants of Mediterranean Sea islands as well as people from the eastern shores of the Mediterranean, the southern shores of Asia Minor and the mainland of Greece. Egyptian stone vessels have been found at Knossos in Crete dating to the Neolithic, Predynastic, and First and Second Dynasties.[12] Similarly, Petrie examined vases from First Dynasty burials in Egypt that bore characteristics of Cretan vases.[13] Based on such evidence, historians conclude that there was a vigorous trade between Egypt and Crete from at least the Twelfth Dynasty (1991–1783 BCE) until around 1000 BCE.[14] Following the expulsion of the Hyksos in 1550 BCE, Egypt exerted an increasing presence in the Aegean Sea region.

ANCIENT COPPER MINING IN ATTICA

Attica is a southern peninsula of continental Greece with Athens as its most important city. The history of Athens is one of the longest of the cities of Europe; the hilltop site of the famous Acropolis has been inhabited since early Neolithic times. The area of Attica measures 3,808 sq km, and it is rich in many different ore minerals, including copper. Before the Classical or "Golden" Age of Greece in the 5th century BCE, the mountains of Attica were heavily forested. Aggressive silver mining in the 4th century BCE led to deforestation and created the semi-desert landscape seen in many parts of the region today. There is evidence, however, that the ancient Greeks mined and smelted copper in Attica as early as the Neolithic or Early Bronze Age.[15] The study of lead isotopes in Bronze Age artifacts from Mediterranean and Near Eastern countries, moreover, suggests that Attica and Crete provided the main sources of copper used during the Late Bronze Age around the Mediterranean basin.[16] Unfortunately, there exists no direct evidence for the "great copper mines" in the "country of 'Atika'" that are mentioned in the Harris Papyrus.

Silver mining, which began later than copper mining, overtook the copper industry in importance and became the leading mining activity in Attica by the 5th century BCE. Plato emphasized the impact of silver mining on the original topography of the Attica region: "The region is a mere relic of the original country. . . . What remains is like the skeleton of a body emaciated by disease. All the rich soil has melted away, leaving a country of skin and bone."[17] The destruction caused by extensive silver mining has made it difficult to detect ancient copper mining operations in the area. Because silver was scarcer and more valuable than copper, its mining has received more attention from archaeometallurgists, whereas copper has attracted little attention. As a result, there is sufficient data on the history of silver mining, but not on copper.

Nevertheless, there is increasing evidence that Attica was the source of copper for other parts of the world during Egypt's New Kingdom.

GRECIAN ATTICA: THE HARRIS PAPYRUS REFERENCE

The evidence for the Attica region of Greece being the location of the copper mines in the "country of Atika" referred to by Ramesses III in the Harris Papyrus may be summarized as follows:

1. Harris Papyrus refers to Atika as a country that can be reached by both land and sea. The Attica region of Greece is accessible by land and sea, whereas most of the copper mines in the Sinai were accessible only by land.
2. Ramesses III considered the mission to Atika so exceptional that it not only merited mention in the Harris Papyrus, but also was cause for a public display of the copper bars that were brought back to Egypt. It is doubtful that Ramesses would have considered the mission so momentous if it had been to an area within his own country.
3. It is well documented that Egypt traded with other areas around the Mediterranean basin throughout pharaonic history and particularly during the New Kingdom. Attica had produced copper, silver, lead, zinc, and gold from ancient times. The Egyptians would certainly have been aware of the mineral wealth of that region.
4. There was a great expansion of Egyptian marine forces during the New Kingdom. Texts from that period record several sea campaigns to areas outside Egypt, of which the Egyptians appear to have been very proud.
5. Some Egyptian expeditions may have gained access to mainland Greece, and to Crete and other Aegean Sea islands, by sailing directly from the northern Egyptian coast. Other expeditions may have traveled by land through Asia Minor. (Fig. 4) A suggested scenario for such operations might be:
   a.) A mining party was transported by ship to the target island or mainland Greece to open the mines and prepare the ores; and
   b.) A smelting party traveled by land to the farthest point under Egyptian control and then used sea vessels to avoid hostile territories.

Fig. 4: Google Earth view showing the suggested sea and land routes from Egypt to Attica.

CONCLUSION

Contrary to the beliefs of some historians that the copper mines in the "country of Atika" to which the Harris Papyrus refers were located in the Sinai Peninsula, it appears probable that the mines were actually located in the Attica region of mainland Greece. Additional research into this reference may add to our knowledge of the New Kingdom and to the history of southern Greece.

NOTES

1. Hassan 2001.
2. Breasted 1906, 204.
3. Breasted in Hume 1937, 826.
4. Rothenberg 1972; 1999.
5. Hussein 1990.
6. Nassim 1949; Rothenberg 1987; Afia 1985.
7. Hilmy and Mohsen 1965; 1966; Barakat 2005.
8. Rothenberg 1987.
9. Cowen 1999.
10. Afia 1985.
11. Monet 1965.
12. Pendlebury 1930; Evans 1928.
13. Petrie 1902.
14. Hall 1909; Kantor 1941; Wells 1961; Albright 1965; Smith 1965.
15. For further discussion, see Georgakopulou 2004 and references therein.
16. Gale, et al. 2002.
17. Cowen 1999.

REFERENCES

Afia, M. S. 1985. *Ancient and Recent Mining in Egypt* (in Arabic). General Egyptian Book Organization.

Albright, W. F. 1965. "A Survey of the Archeological Chronology of Palestine from Neolithic to Middle Bronze," in *Chronologies in Old World Archaeology*. Robert W. Ehrich (ed). Chicago: University of Chicago Press.

Barakat, Aly A. 2005. "Wadi Abu Thor Ancient Copper Mine." *IAMS* 25, in press.

Bassiakos, Y. and Athanassas, C. 2003. "Prehistoric Metal Production in Greece, as Derived from Studies on Mining and Metallurgical Remains: Review and Current Results." Hellenic Society for Archeometry. 4th Symposium on Archeometry. Athens, Greece, 28–31 May 2003. http://www.archaeometry.gr/oldv/symposium2003/pages_en/abstracts/papers/theme/theme4.htm.

Breasted, James Henry. 1906. *Ancient Records of Egypt*. 4 vols. The Twentieth to Twenty-Sixth Dynasties 4. Chicago: University of Chicago Press.

Conophagos, Constantin E. 1980. *Le Laurium Antique*. Athens: Ekdotike Hellados.

Cowen, R. 1999. "Some Essays on Geology, History and People." http://www.geology.ucdavis.edu/~cowen/~GEL115/.
Craddock, Paul T. 1995. *Early Metal Mining and Production*. Edinburgh: Edinburgh University Press.
Evans, Arthur. 1921. *The Palace of Minos at Knossos: A Comparative Account of the Successive Stages of the Early Cretan Civilization.* London: Macmillan.
Gale, Noel H. and Zofia A. Stos-Gale. 1982. "Bronze Age Copper Sources in the Mediterranean: A New Approach." *Science* 216(4541):11–19.
Georgakopulou, Myrto. 2004. "Examination of Copper Slags from the Early Bronze Age Site of Daskaleio-Kavos on the Island of Keros (Cyclades, Greece)." *IAMS* 24:3–12.
Hall, H. 1909. "The Discoveries in Crete and Their Relation to the History of Egypt and Palestine." *Society of Biblical Archaeology* 31 (May):223–24.
Hassan, Selim. 2001. *Encyclopedia of Ancient Egypt*. Vol. 7. Cairo: The General Egyptian Book Organization.
Hilmy, M. E. and L. A. Mohsen. 1965. "Secondary Copper Minerals from Central Sinai." *Journal of Geology, U.A.R.* 9:1–12.
________. 1966. "Geology of Some Occurrence of Copper Minerals in Sinai." *Ain Shams Science Bulletin* 9:517-539.
Hume, William Fraser. 1937. *Geology of Egypt*. 2 vols. "The Minerals of Economic Value ... and Methods Suggested for the Dating of Historical and Geological Times." In Pt. III of *The Fundamental Pre-Cambrian Rocks of Egypt and the Sudan: Their Distribution, Age and Character*, *Vol. 2*. Cairo: Government Press.
Hussein, A. Abdel Aziz. 1990. "Mineral Deposits," in *Geology of Egypt*. Rushdi Said (ed). Brookfield, VT: A. A. Balkema. Pp. 511–66.
James, Thomas Garnet Henry. 1973. *The Cambridge Ancient History*. 2 vols. "Egypt from the Expulsion of the Hyksos to Amenophis I." Pt. 1 of *History of the Middle East and the Aegean Region c. 1800–1380 B.C.*, *Vol. 2*. Cambridge, England: Cambridge University Press.
Kantor, Helene J. 1947. *The Aegean and the Orient in the Second Millennium B.C.* Bloomington, IN: Principia Press.
Nassim, G. L. 1949. "The Discovery of Nickel in Egypt." *Economic Geology* 44(2):143–50.
Pendlebury, John Devitt Stringfellow. 1930. *Aegyptiaca: A Catalogue of Egyptian Objects in the Aegean Area*. Cambridge: Cambridge University Press.
Petrie, W. M. Flinders, and Francis Llewellyn Griffith. 1901. *Royal Tombs of the Earliest Dynasties. 1901*. London: Egypt Exploration Fund.
Petrie, W. M. Flinders, and Arthur Edward Pearse Brome Weigall. 1902. *Abydos*. *Part I. 1902*. London: Egypt Exploration Fund.
Rothenberg, Beno. 1972. *Timna: Valley of the Biblical Copper Mines*. London: Thames and Hudson.
________. 1987. "Pharaonic Copper Mines in South Sinai." *IAMS* 10/11 (June/December): 1–7.
________. 1999. "Archaeo-Metallurgical Researches in the Southern Arabah 1959–1990. Part 2: Egyptian New Kingdom (Ramesside) to Early Islam." *Palestine Exploration Quarterly* 131:150–67.

Shaw C. T. 1995. "New Kingdom Mining Technology with Reference to Wadi Arabah." In *Proceedings of the First International Conference on Ancient Egyptian Mining and Metallurgy and Conservation of Metallic Artifacts, Cairo, Egypt.* 10–12 April 1995. F. A. Esmael (ed). Cairo: SCA. 1–14.

Smith, William Stevensen. 1965. *Interconnections in the Ancient Near East: A Study of the Relationships between the Arts of Egypt, the Aegean and Western Asia*. London and New Haven: Yale University Press.

Wells, H. G. 1961. *The Outline of History: Being a Plain History of Life and Mankind*. Vol. 1. Raymond Postgate (rev). Garden City, NY: Garden City Books.

ACKNOWLEDGMENTS

The author wishes to express his gratitude to Prof. Dr. Abdel Aziz A. Hussein for reviewing the text and the suggested valuable comments. Thanks are due to Prof. Ben Rothenberg and Prof. Shaw for critical reading.

About the author:

Dr. Aly A. Barakat is an Egyptian researcher and writer. Since 1987, he has worked as a geologist for the Egyptian Geological Survey (nowadays the Egyptian Mineral Resources Authority). He holds a Ph.D. from Cairo University in geology. He has published more than 100 articles and research studies in both Arabic and English. He has a published book in Arabic about meteorites (2008), and he is the coauthor of a published book in English on prehistoric cultures in Egypt (2006).

Executing the Will of Pharaoh: The Roots of Performance Measurement in Ancient Egypt

By Steven L. Krahn

Even by today's standards, the social, artistic and technical accomplishments of the ancient Egyptians are almost overwhelming in their sophistication, beauty and sheer number. The expanse of the Egyptian kingdom, the grandeur of its many major construction projects, and its ability to mount large expeditions to distant places like the Sinai and Punt begs the fundamental question: How did they do that? This article focuses on one aspect of ancient Egyptian government: its ability to establish goals, measure status, and evaluate progress.

Historians, political scientists and Egyptologists have all commented on the stability of governmental structures and practices in ancient Egypt. Max Weber, one of the founders of public administration theory, called ancient Egypt the "historical model for all later bureaucracies."[1] A seminal study of "historical bureaucracies" was presented in 1993 by S. N. Eisenstadt in his *Political Systems of Empires*.[2] That study identified several important characteristics that permitted some empires in antiquity to develop stable and enduring governments. Foremost among the four "major features" identified by Eisenstadt was "the development of autonomous political goals by the rulers."[3] If setting such goals was a "major feature," did the ancient Egyptians also put in place systems to measure and evaluate their progress towards these goals? Using several governmental goals studied by Eisenstadt, it is possible to find evidence that the ancient Egyptians practiced what is today referred to as performance measurement.

In discussing the structure and function of the government under Amenhotep III, W. J. Murnane stated that "many of the government's . . . elements [of structure] date back to the Pyramid age or earlier."[4] While other Egyptologists who studied the subject agreed with Weber's description of ancient Egypt's government as history's first bureaucracy, they nonetheless bemoaned the lack of direct information about how this governance was achieved. Murnane noted that "virtually our entire knowledge of the pharaonic system of government depends on indirect sources [such as] moments in an official career displayed on the walls of tombs."[5] Valuable as these snapshots are, "they are frustratingly incomplete in answering the questions historians would like to ask."[6] Investigating the use of measurement systems by ancient Egyptians throughout the 2,500 years of pharaonic rule can supplement our understanding of how the kings' officials governed.

In 1998, the American Society for Public Administration (ASPA), a major professional organization for government officials, produced a guide on the newly emerging field of performance measurement in U. S. government agencies. Along with several studies by the U. S. General Accountability Office (GAO), an investigative and analytic arm of Congress, the ASPA guide provides a modern backdrop for the discussion of the measurement of governmental performance in ancient Egypt.[7] Like many sources on performance measurement, the ASPA guide appears to treat the subject as if it were invented in the 1990s. This is somewhat myopic, however, for a number of previous researchers encouraged the field of public administration to take a broader and more long-term view of its history and evaluation of performance issues.[8]

If ancient Egypt provides an example of an enduring and effective bureaucracy, is there evidence that its government measured results and progress to monitor the achievement of pharaohs' goals? In the words of the ASPA guide, can we find examples of "quantifiable, enduring measure[s] of outcomes, outputs, efficiency, or cost effectiveness"?[9]

Three areas of vital national interest to ancient Egyptians were irrigation and taxation, production of primary foodstuffs, and construction projects. Although no royal decrees announcing specific goals in these areas have been found, their measurements are consistent with the types of goals established in the historical bureaucracies studied by Eisenstadt.

HARNESSING THE POWER OF THE NILE

Built in the 1960s to replace an earlier dam opened in 1902, the High Aswan Dam produces electricity for the country and provides flood control and abundant water for consistent irrigation of crops. The power of the Nile was not always so controlled, however. James Henry Breasted, who actually observed the annual inundation in the past, described the impact of the event:

> The flood swells rapidly and steadily . . . and the maximum level continues until the end of October or into November. The waters in the region of the first cataract are then nearly 50 feet higher than at low water; while at Cairo the rise is about half that. A vast and elaborate system of irrigation canals and reservoirs first receives the flood, which is then allowed to escape into the fields. . . . Here it rests long enough to deposit its burden of rich, black earth from the upper reaches of the Blue Nile.[10]

Fig. 1. Nilometer at ancient Abu (on Elephant Island at modern Aswan).

Before the first Aswan Dam was built, a "good" inundation yielded manageable amounts of water and fertile topsoil. Too high a flood could wash away boundary markers and irrigation structures, resulting in fewer crops; too little water could result in a disastrous drought. The annual inundation of the Nile played such a vital role in the life of ancient Egyptians that the beginning of their new year, the season of Akhet, coincided with the rising of the Nile flood waters.

Effective use of Nile inundation knowledge by ancient Egyptians involved determining the height of the flood precisely. Consequently, the peak height of the Nile's floodwater became an "environmental indicator." Special structures, called nilometers, were built and maintained along the course of the river to monitor the changing height of the water. "Well-like gauges . . . were probably constructed at points along the Nile from relatively early times. Important early nilometers were constructed at Aswan and Memphis and later ones at the second and fourth cataracts in Nubia."[11] The nilometer in the far southern reaches of Egypt at Aswan (Fig. 1) was one of the most important gauges; it gave the first indication of the Nile's crest. Data collected from it assisted in the management of irrigation canals and holding ponds used to harness the river's agricultural power.[12]

The importance of this measurement is evident by its antiquity. "From the Second Dynasty onwards . . . detailed records were kept of the height of the annual inundation, a factor which had a direct effect on agricultural yields."[13] These records are still available to researchers; inundation data is found in the chronicles on the Palermo Stone.[14] During the Middle Kingdom, Egyptian hegemony was pushed southward far into Kush (modern Sudan). Nilometers there provided even earlier indications of the annual inundation.[15] Ancient Egypt provides a successful example of an environmental indicator that was used for 2,500 years of pharaonic rule and that was continuously maintained and improved.[16]

Data from nilometers was used by the ancient Egyptian government in another important way. Egypt was the first country to tax its people systematically.[17] Nilometer measurements "provided the basis for assessing the annual rate at which arable land was taxed."[18] A stable system of taxation has been described as "the precondition for the permanent existence of bureaucratic administration."[19] The system of taxation based on the height of the Nile flood had the added advantage of being easily understood by those affected by it. As Montet described the overall workings of the system:

> The assessment of the amount . . . payable . . . was based on two factors: the surface area of the nome and the height of the Nile's rising. These two items made it possible for the central administrative services to inform each governor of the exact quantities he had to hand over. In order to avoid recriminations, the basis for the assessment was made known to the general public. In the chapel of Sesostris III . . . at Karnak [for example] . . . the information is inscribed on a small monument. . . . Also inscribed on the monument was the surface area of every nome. . . . In addition, the monument gives . . . the figures for the normal levels of the flood. . . . When the flood did not reach these levels, a fact that anyone could check . . . the tax fixed for a normal year was reduced according to a scale that is unknown to us.[20]

Although the exact "scale" or level of tax is unknown to us today, estimates vary between ten and twenty percent of the produce of the land.[21] Thus, the use of a readily accessible means of measurement provided administrative officials vital information to use in two separate but related ways: effective management of irrigation and the equitable levying of taxes. This bureaucratic accomplishment was recognized by Weber, who regarded "the collective regulation of waterways for the whole country" as one of the signal achievements of ancient Egyptian administration.[22] Nilometers were so effective that they remained in active use throughout the Roman rule in Egypt, spanning a total use of more than three thousand years.[23] Their length of use meets one of the ASPA 1998 guide's criteria for performance measurement: its undeniable "endurance."[24]

FEEDING A NATION

While the ability to produce food may appear to be a somewhat mundane act, the ancient Egyptian government's generally consistent ability to feed the nation, even through periodic famines that plagued it and other countries, is one of the possible reasons for its stability. Avoiding mass starvation was cited as particularly important by Eisenstadt, who noted that in ancient Egypt, "the rulers' tendency to make themselves responsible was most evident in the systems of granaries. This system provided the entire population with grain and food during droughts."[25]

Bread and beer were two of the main staples of the ancient Egyptian diet and were identified routinely in offering prayers recorded in tombs as "the first two desired items of life."[26] As grain was a primary ingredient in both of these foodstuffs, it was a major crop in ancient Egypt. Large granaries are common features found in archeological digs,[27]as are centers where grain, bread and beer were stored for distribution to workers and officials[28] (Fig. 2, p. 26). Logically, it follows that the harvesting of grain and its transformation into bread and beer was of primary concern to the ancient Egyptian government.

Accurate measurement of grain started in the fields. After being harvested, "[t]he initial yield of grain was measured at the threshing-floor by means of wooden scoops of a given volume, which gave quantities in terms of a *hekat*," a measure equivalent to just under five liters.[29] The grain was then taken to a silo whose capacity was calculated in terms of *hekats* by agricultural officials.

Barry Kemp has noted that "for the scribes who had painstakingly followed the progress of cereals from fields . . . the essentially messy and labour-intensive processes of baking and brewing presented a challenge."[30] Due to their use of similar ingredients and the central role that yeast played in both products, breweries and bakeries were normally located together at ancient Egyptian sites. Surviving depictions show large two-room structures where the bakery was separated from the brewery by a single wall.[31] Bread-making involved separate steps of sifting, mixing, kneading, rolling, letting the dough rise and baking.[32] Brewing beer involved taking some half-baked bread from the bakery to initiate the fermentation process of the ingredients.[33] These processes were complicated and difficult to follow with any precision and would have vexed the detail-oriented, ancient Egyptian government officials.

Fig. 2. Distribution center of the Middle Kingdom at Abu (Elephantine Island).

> Baking and brewing contained elements which unavoidably thwarted a simple control of quantities as they passed from one stage to another . . . [however] input and output bore a simple relation to one another: the number of loaves of bread and jugs of beer which derived from a given quantity of grain. . . . This scale of values the Egyptians called *pefsu*, which we can translate as "baking value."[34]

As described above, the *pefsu* value represented a simple relationship between input and output. As a result, officials could avoid getting their starched kilts sullied with beer and their elaborate wigs covered with flour. After making baseline calculations, they simply monitored the number of *hekats* of grain that entered the combination bakery-brewery and then counted the standardized loaves of bread and jars of beer that came out.[35]

The *pefsu* concept represented the use of a process measurement that assisted in organizing, managing, and monitoring the production of foodstuffs. When coupled with standardized sizes for bread loaves and beer jugs, the overall *pefsu*-based system permitted ancient Egyptian agricultural officials to monitor and measure bakery-brewery output. The *pefsu*-based system provided the pharaoh with a clear "results-oriented performance framework"[36] for beer and bread production.

BUILDING THE PYRAMIDS

Recognizing ancient Egypt as the first "true bureaucracy," Weber described its "extraordinary construction activities" as another important indication of the efficacy of Egyptian administration.[37] The building of the pyramids on the Giza plateau is the most universally recognized feat of construction administration in ancient Egypt. Monumental construction projects, including a total of more than 100 pyramids,[38] can be found along the entire length of the Nile in Egypt and far into modern Sudan. The accomplishments are so extraordinary that they have led some authors to suggest the use of external aid.[39] Ancient sources, however, thoroughly discussed and analyzed by many outstanding scholars[40] have shown these feats to be within the capabilities of ancient Egyptians. The measurement tools discussed below give an indication of ancient Egyptians' comprehensive understanding of construction arts and how measuring their progress accomplished the pharaohs' goals for construction of these monuments.

Fig. 3. The Step Pyramid of Djoser, built almost 100 years before the Great Pyramid.

These detailed process measurements can be divided into two separate functions: one is construction estimation and status monitoring,[41] and the other is recording and accounting.[42] Both functions involve detailed measurement of both *efficiency* and *output*.[43]

How did the ancient Egyptians know the number of personnel and amount of materials that would be required for their major construction projects? This is the question addressed by the first function: estimation and status monitoring. In his description of this function, a recent researcher put it succinctly:

> Unit time estimates (e.g., the number of labor-days per cubic meter required for excavation) were combined with supervisors' estimates of materials to derive the amount of materials and labor required to perform each element of the work, as well as its duration.[44]

Other questions ensue. How were these unit estimates developed? How did a 4th Dynasty official like Hemienu, the designer and builder of Khufu's Great Pyramid, know that the construction of this monument was even possible during the probable lifetime of King Khufu?

First, it is important to note that when Hemienu started planning the Great Pyramid, four major pyramids had already been built by his predecessors (Fig. 3, p. 27). Therefore, Hemienu had at least two previous generations of experience in building large stone structures upon which to draw.[45] This experience led to the development of standard logistical practices associated with major construction projects. Kemp describes some of these practices:

> A typical task was the precise measurement of materials to be moved and used, whether cut blocks of stone, sun-dried mud bricks, straw and earth for making bricks, rubble or sand. A conscientious scribe would measure . . . the volume of material. . . . From [this] he could calculate the number of labor-units that would be required, using standard ratios. In one example the daily labor norm for [a man] to transport was 10 cubic cubits. From these figures the scribe could estimate the rations that would be required [to feed the work force] and produce work figures which could later be compared to what was done. In this way the supply of the three essentials for major building projects (materials, labour and rations) could be constantly monitored.[46]

Such attention to detail also led to standard practices for executing individual portions of the project. One of the standards that has come down to us, virtually in its entirety, is the important process of ramp construction that the Egyptians used to raise stones and other building materials to giddy heights (Fig. 4, p. 29). A detailed drawing of such a ramp, showing construction materials along with engineering details, is preserved in the tomb of a New Kingdom vizier at Thebes.[47] Furthermore, it became a standard mathematical problem for aspiring government officials to calculate the number of bricks and hours of labor required to construct such a ramp.[48]

In the midst of these major construction projects, a phenomenal amount of manpower and material had to be managed and monitored. This is where the recording and accounting measurements became so important. Tools such as stone adzes and wooden mallets needed to be procured, stored, and administered properly for the workforce.[49] During the Old Kingdom, copper chisels and saws were especially expensive; Romer states that "just ten of the large copper chisels were worth a year's grain ration for a workman and his house-hold."[50] Therefore, a very close watch was kept on these particular items. Officials kept track of each chisel issued, collected them as they became blunted by work, and ensured that they were "returned to the royal workshops" for recycling.[51] Consulting archived records allowed a seasoned official to know how long a copper chisel should last and to calculate how many were needed each week.

The use of chisels and other consumables such as oil and lamp wicks, pigments for paint, and wooden mallets were documented in daily records kept by the officials and consolidated into regular reports.[52] These reports provided the basis for performance measurements that officials used to estimate the number of such items needed for major construction projects.

Kemp cites an example from the Middle Kingdom where the vizier and his officials calculated the requirements needed for a quarrying expedition of more than 10,000 skilled and unskilled laborers who traveled 120 miles into the desert to obtain stone for monumental statues.[53] These calculations must have been accurate for, as the vizier proudly records, “not one man was lost.”[54]

Process measurements and records provided the basis for regular reports to the pharaoh and his vizier.[55] Romer reports that the vizier and other officials conducted “periodic inspections” of work projects and exceptional efforts were rewarded by what today might be called bonuses.[56] An example of this is found in the New Kingdom when “the vizier ordered special rations to be given to the tomb makers, so pleased was he with the progress of the work.”[57]

From the preceding example, it may be seen that measurements and records used in construction management fulfilled each of the three uses described by ASPA for performance information: accountability, management, and resource allocation.[58]

Fig. 4. Remains of construction ramp at Karnak Temple.

CONCLUSION

Just the fact that the ancient Egyptians were able to develop process measurement and recording systems that lasted for more than 2,500 years is impressive. Equally impressive was their effective use. With such techniques, Egyptian officials were able to manage the watering resources of the Nile flood; they developed and administered a tax system that was easily understood and enduring; they were able to feed a nation of several million people spread over an extensive realm; and they were able to build more and bigger public works than comparable ancient civilizations. Documented adoption of at least one of these measurement and recording systems by conquering Greeks and Romans—the nilometer and its associated irrigation and taxation systems—lent a measure of stability to the lives of the average Egyptian for another 750 years.

These measurement and recording systems contain a number of the same attributes found in modern performance measurement systems. While the U. S. Government Accountability Office has stated that a major challenge to the effective implementation of performance measurement is "the need to instill . . . an organizational culture that focuses on results,"[59] the ancient Egyptians appear to have met that challenge successfully. Bob Brier has observed that the ancient Egyptians "really were a nation of accountants."[60] It was more than just a matter of record-keeping, however. Their ability to plan, facilitated by a "focus on results" and coupled with a passion for record-keeping, allowed the pharaoh to set challenging goals with the confidence that they were achievable.

Today's practitioners of the art of performance measurement can certainly take pride in the antiquity of their branch of public administration, for it does not represent a management fad. They may also draw confidence from the demonstrated, positive impact that well-designed systems of measurement and recording can have on governmental effectiveness. By understanding these measurement systems within the context of performance measurement, Egyptologists can garner a better understanding for some of the actions associated with governing ancient Egypt. That understanding helps us recognize that there was a purpose to the exhaustive records maintained by this "nation of accountants". This additional perspective can also enhance the image of the ancient Egyptian government which too often has been viewed largely through the investigation, ranking and arrangement of officials' titles.

NOTES

1. Weber 1914, 204.
2. Eisenstadt 1993.
3. *Ibid.*, 19.
4. Murnane 1998, 175.
5. *Ibid.*, 173–4.
6. *Ibid*.
7. ASPA (1998) describes the technical difference between outputs and outcomes, the types of performance measures that can be employed, the uses of performance information, along with the need to tie performance measures clearly to the mission of agencies. GAO (2005) provides the most recent definitions of the concepts terms used in performance

measurement. Detailed quotes in the text are used to provide explanatory information, not a detailed technical discussion of performance measurement; for this, the reader is encouraged to consult these references.

8. Luton (1999, 216) urged a more comprehensive use of history as a tool for evaluating public policy. He noted, "We need to recognize that American public administration did not come into being in the 1880s." Waldo (1984, xix) was more explicit, stating that it needed to be recognized that there existed "centuries . . . of thought and experience relevant to the questions of public administration."
9. ASPA 1998, 28.
10. Breasted 1906, 8.
11. R. H. Wilkinson 2000, 73.
12. Breasted 1909, 8–9.
13. R. H. Wilkinson 1999, 114.
14. Shaw 2000, 4–5.
15. Breasted 1909, 191.
16. At Aswan, excavations show that one of the nilometers built in the Middle Kingdom underwent continuous maintenance and improvement through Roman times: a span of more than 2,000 years (GIA 1998, 32–33). Another 1,600 years later, when the author inspected it in 2008, it was still usable.
17. Warburton 1997, 319–21.
18. GIA 1998, 32.
19. Weber 1914, 208.
20. Montet 2000, 78.
21. Trigger, et al., 1983, 226; Breasted 1909, 238.
22. Weber 1914, 212–13.
23. Shaw 2000, 427.
24. ASPA 1998, 28.
25. Eisenstadt 1993, 127.
26. Quirke and Spencer 1992, 17.
27. R. H. Wilkinson 1999, 118.
28. GIA 1998, 46.
29. Kemp 1989, 122.
30. *Ibid*., 120.
31. Lucas and Harris 1999, 11; Kemp 1989, 122.
32. J. G. Wilkinson 1890, 176–77.
33. Lucas and Harris 1999, 11.
34. Kemp 1989, 120–1.
35. Only minor arithmetic problems were introduced by varying the size of loaves (the ancient Egyptians did have several varieties) or producing larger jars of beer for shipping greater distances. Kemp 1989, 124–25.
36. GAO 1997, 13.
37. Weber 1914, 212.
38. Lehner 1997, 15.
39. Graham Hancock, for example, used the pyramids as one of his examples in his controversial book, *Fingerprints of the Gods*.
40. Clarke and Engelbach 1990; Arnold 1991; Smith 2004; Brier 2007.
41. Smith 2004, 120.
42. Romer 1984, 12.
43. ASPA 1998, 17.
44. Smith 2004, 120.
45. Lehner 1997, 84–105.
46. Kemp 1989, 128.
47. Arnold 1991, 97.
48. *Ibid*.
49. Clarke and Engelbach 1990, 224; Arnold 1991, 251–90.
50. Romer 1984, 17–25.
51. *Ibid*.
52. *Ibid*., 82–84.
53. Kemp 1991, 129.
54. Breasted 1906, 215.
55. Reeves & Wilkinson 1996, 30.
56. Romer 1984, 51.
57. *Ibid*.
58. ASPA 1998, 5.
59. GAO 1997, 12.
60. Brier 1999, Vol. II, 53.

REFERENCES

American Society for Public Administration (ASPA). 1998. *Performance Measurement: Concepts and Techniques*. Washington, DC: ASAP Press.

Arnold, D. 1991. *Building in Egypt: Pharaonic Stone Masonry*. New York: Oxford University Press.

Breasted, J. H. 1906. *Ancient Records of Egypt. Volume I. The First through Seventeenth Dynasties*. Chicago: University of Chicago Press.

________. 1909. *History of Egypt from the Earliest Time to the Persian Conquest*. New York: Charles Scribner and Sons.

Brier, B. 1999. *The History of Ancient Egypt*. 4 Vols. Chantilly, VA: The Teaching Company Limited.

________. 2007. "How to Build a Pyramid." *Archeology* 60(3): 22–27.

Clarke, S. and R. Engelbach. 1990. *Ancient Egyptian Construction and Architecture*. New York: Dover Publications.

Edgerton, W. H. 1947. "The Government and the Governed in the Egyptian Empire." *Journal of Near Eastern Studies* VI(3): 152–60.

Eisenstadt, S. N. 1993. *The Political Systems of Empires*. New Brunswick, NJ: Transaction Publishers.

General Accountability Office (GAO). 1992. "Performance Measurement: An Important Tool in Managing for Results." GAO/T-92-35.

_______. 1997. "Managing for Results: Prospects for Effective Implementation of the Government Performance and Results Act." GAO/T-97-113.

________. 2000. "Managing for Results: Continuing Challenges to Effective GPRA Effective Implementation." GAO/T-00-178.

________. 2005. "Performance Measurement and Evaluation." GAO-05-739SP.

German Institute of Archeology (GIA) 1998. *Elephantine: The Ancient Town*. M. Eaton-Krauss (ed). Cairo, Egypt: Ibrahim El-Daly.

Hancock, G. 1996. *Fingerprints of the Gods*. New York: Three Rivers Press.

Kemp, B. J. 1989. *Ancient Egypt: Anatomy of a Civilization*. London, UK: Routledge Publishing.

Lehner, M. 1997. *The Complete Pyramids*. London, UK: Thames & Hudson, Ltd..

Lucas, A., and J. H. Harris. 1999. *Ancient Egyptian Materials and Industries*. Mineola, NY: Dover Publications.

Luton, L. S. 1999. "History and American Public Administration." *Administration & Society* 31(2): 205–221.

Montet, P. 2000. *Eternal Egypt*. London, UK: Phoenix Press.

Murnane, W. J. 1998. "The Organization of Government under Amenhotep III." In *Amenhotep III: Perspectives on His Reign*. David O'Connor and Eric H. Cline (eds). Ann Arbor, MI: University of Michigan Press. Pp. 173–221.

Quirke, S., and J. Spencer. 1992. *The British Museum Book of Ancient Egypt*. London, UK: Thames and Hudson, Inc.

Reeves, N., and R. H. Wilkinson. 1996. *The Complete Valley of the Kings*. London, UK: Thames and Hudson, Inc.

Romer, J. 1984. *Ancient Lives: The Story of the Pharaohs' Tombmakers*. London, UK: Phoenix Press.
Shatteman, A. M. 2008. "Is Public Performance Reporting Living Up to Its Expectations?" *Public Performance & Management Review* 32(2): 309–327.
Shaw, Ian, ed. 2000. *The Oxford History of Ancient Egypt*. Oxford, UK: Oxford University Press.
Smith, C. B. 2004. *How the Great Pyramid was Built*. Washington, DC: Smithsonian Books.
Spalinger, A. J. 2005. *War in Ancient Egypt*. Oxford, UK: Blackwell Publishing.
Taylor, F. W. 1911. *Principles of Scientific Management*. New York: Harper Brothers.
Trigger, B., B. J. Kemp, D. O'Connor, and A. B. Lloyd. 1983. *Ancient Egypt: A Social History*. Cambridge, UK: Cambridge University Press.
Waldo, D. 1984. *The Administrative State*. 2nd ed. New York: Homes and Meier.
Warburton, D. A. 1997. *State and Economy in Ancient Egypt*. Fribourg, Switzerland: University Press of Fribourg.
Weber, Max. ca.1914. "Bureaucracy." In *From Max Weber: Essays in Sociology*. Gerth, H. and C. Mills (trans./eds.). New York: Oxford University Press. Pp. 198-252.
Wilkinson, J. G. 1890. *The Ancient Egyptians*. London, UK: William Clowes and Sons, Ltd.
Wilkinson, R. H. 2000. *The Complete Temples of Ancient Egypt*. London, UK: Thames and Hudson, Inc.
________. 1999. *Symbol & Magic in Egyptian Art*. New York: Thames and Hudson.
Wilson, J. K. 1951. *The Burden of Egypt: An Interpretation of Ancient Egyptian Culture*. Chicago: University of Chicago Press.

About the author:

Dr. Dennis Krahn works as a senior engineer with the U. S. Department of Energy. His research interests center around the workings of governments in the ancient world and the application of this knowledge to contemporary governments. This is his first article for The Ostracon.

CALL FOR ARTICLES

The Ostracon: The Journal of the Egyptian Study Society

Volume 21 (2010)

Submission deadline: March 1, 2010

The Egyptian Study Society announces a call for additional articles for the 2010 (Vol. 21) publication of *The Ostracon*. The publication is currently accepting more new articles, book reviews, reviews of significant lectures or exhibits, or interpretive articles that apply to the archaeology of Egypt for publication in late fall 2010.

The Ostracon is published once a year by members of the Egyptian Study Society. The ESS is a non-profit organization whose purpose is to study ancient Egypt. It is an associate group of the Denver Museum of Nature and Science. Articles are contributed by members and scholars on a voluntary basis.

Submission guidelines are posted on the ESS website at www.EgyptStudy.org.

Please submit inquiries and materials to:

Suzanne L. Moulton-Gertig, editor
E-mail: Ostracon@egyptstudy.org

For more information about the Egyptian Study Society, see www.EgyptStudy.org.

The Ostracon and the Egyptian Study Society thanks THE PETTY FOUNDATION for its generous and continuing grant support for the publication of *The Ostracon*.