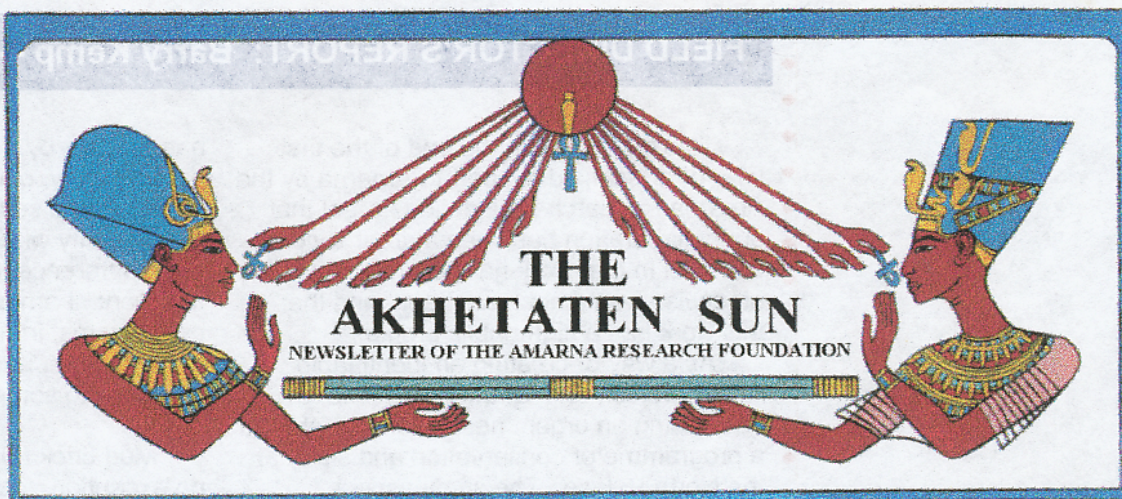


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A word from the President...

October 5, 1997

Dear Fellow TARF Member:

The 1997 TARF tour, "In Search of Nefertiti" is now all but history. We are high above the Atlantic, on our way back to the United States and fresh salad. We are also all very tired and fulfilled. While we didn't find Nefertiti, we certainly searched in enough places. We spent three days at el-Amarna, where the group visited the North Rock Tombs, the South Rock Tombs, the desert altars, the Royal Tomb, Kom el Nana, and had a special two-hour tour of the North Palace with Barry Kemp accompanying us. He explained the structure, discussed plans for the future, and the excavation from the front of the palace to the river edge. Barry also went with us to the desert altars. On the final day Barry gave the group a full tour of the central city including the two Aten temples, the King's Palace, and the home of Tutmose, the sculpturer.

While in the Minia area, we also visited the tombs of the Nomarchs in Beni Hassan. I would be quick to add that other groups visiting the central Egypt area were not as fortunate, as they did not have TARF connections. The very few we talked with who even got into the area were limited to ½ day: a couple of the North Tombs, the North Palace, the Central City and Beni Hassan.

Of course, the rest of the tour time was well occupied with stops at Karnak, Luxor Temple, West bank (including a visit to the tomb of Nefertari), the tomb of Ramose in Qena, the Giza Plateau, Sakkara (where we

got to see the early tomb of Horemheb!), Abu Sir, the Egyptian museum and the Khan el Khalili.

Will there be another tour next year? I doubt it very much. We have had several people express an interest in such a tour, but we had that this year and in the end we only had thirteen participants, including three TARF officers and my thirteen year old grandson. In other words, of all the interest indicated early in the year, only nine members signed up, and five of those became members especially to take the trip. Our tour company, Museum Tours, Inc. indicated in the future it might be possible to make an Amarna area side trip attached to one of its regular tours, but they doubted they would want to make another special trip into middle Egypt, given the attendance on this tour.

In any event, we are almost home - tired - but with the plains of el Amarna still deeply imbedded in our minds.

Sincerely yours

Robert A. Harawald

FIELD DIRECTOR'S REPORT: Barry Kemp — August 1997

This report marks the end of the first year of direct field support to Amarna by the Amarna Research Foundation. I feel that our collaboration has been a great success, not least in that work has been done which otherwise would not have been, and that this work has a high public profile.

As a way of creating an identifiable TARF project, and, at the same time, of addressing an urgent need, we have started a programme of conservation and study at the North Palace. The study aspect involves continuing to make fresh plans and other records of the building preparatory to publishing a full account, something which has never been done. Conservation is urgently needed to arrest the now rapid decay of the mud brickwork which has, in the seventy years during which it has been exposed, lost something of the order of half of its original mass.

We all have to recognise the constraints under which the work is done. None of the archaeological staff is actually employed on the various projects: all are skilled volunteers who have to find time in their lives and schedules to spend time in Egypt. We are very fortunate, in Kate Spence and Surésh Dhargalkar, of having the services of two professional architects, Kate with much field experience in archaeology, and Surésh with a lifetime in building conservation. Nonetheless, none of us — including myself — is able to spend more than between two and three months in Egypt in any one year. Everyone involved has to accept that progress is bound to be slow and will extend over many years. Rome was not built in a day, nor Amarna reborn.

In some ways this is no bad thing. Conservation of mud brickwork is a tricky business since one is working with a material of variable quality which is basically weak and which, when used in real-life buildings, needs regular repair. An open unroofed set of walls invites the most severe kinds of degradation. Slow progress allows us to monitor the effectiveness of what we have done and to modify our procedures as we go.

Nonetheless we have identified certain areas where we feel that we can improve our performance. Primarily this involves reducing our dependence on traditional

hand labour by acquiring more equipment. I have already, over the summer, been able to arrange for a second shipment to Egypt of good-quality wheelbarrows which make a huge difference to the pace of all aspects of fieldwork. I am currently trying to locate other useful items, in particular a mechanical cement mixer and a mobile water-tanker in response to some of the points raised by Surésh.

Mud brick ruins, and the North Palace is no exception, are too fragile to allow unrestricted visitor access. Our repairs will therefore be seen only from a distance by the majority of visitors. We are not aiming at a dramatic improvement in what can be seen. Walls will have straighter edges and be better defined, but our real purpose is to arrest or at least slow down the rate at which the building is disappearing.

As I write this I am three weeks away from returning to Amarna for a period of identical duration to that of the Spring. I have a small team but, alas, neither Kate nor Surésh can come (although they have promised to return next Spring). The supervising at the North Palace will therefore be done by me. I don't mind doing this at all; for one thing, it keeps me in touch with the practicalities of the work. However, I will be kept busy because I shall, at the same time, be keeping an eye on the parallel project at the Small Aten Temple to lay out the sanctuary in new stone blocks. Fortunately, at both places, I can rely on a good deal of local assistance, including the skills and conscientiousness of our builders. This little group of men has worked for us for many years.

At the same time, the study of the ground south of Great Palace will continue. This time I plan to extend excavation into ground that has not been examined before. People should not hold their breath in anticipation, however. The desert has here been planed down almost to the base of any ancient walls. But a few centimetres should be enough to follow any signs of how this part of the city was laid out, and any evidence will be new evidence and so very welcome.

I do hope very much that the Board and Members of TARF are satisfied with the way things are working out. I am certainly delighted by the level of interest and support, and impressed with your dedication, not least that shown in producing the Akhetaten Sun.

The team consisted of myself (Barry Kemp), Ann Cornwell, Ian Dennis, Surésh Dhargalkar, Jane Faiers, Lucia Gahlin, Rainer Gerisch, Patrick Gilbert, Dr. M.A. Leahy, Dr. Rosemary Luff, Michael Mallinson, John Muir, Gwilym Owen, Dr. Pamela Rose, Dr. Delwen Samuel, Dr. Margaret Serpico, and Kate Spence. The Egyptian Antiquities Organization was ably represented by Inspector Atta Makramalla Mikhail assisted by Assistant Inspector Bassem Bahgat and Conservator Ahmed Abd El-Daim. A debt of gratitude is due to the Supreme Council of Antiquities, and to its General Secretary Dr. Ali Hassan, for renewing the concession at Amarna, and to Mahmoud Hamza, Samir Anis, Yahyia Zakaria and their colleagues in the inspectorates of el-Minia and Mallawi for enabling the work to begin promptly and to run smoothly.

Please accept my sincerest thanks. I look forward to greeting many of you at Amarna next month.

Tell El-Amarna — Spring 1997

We went into the field with a larger team than in September and so were able to work on a larger scale and to tackle a wider range of tasks. Most of us arrived at Amarna on March 13th; the last members left on April 12th.

The fieldwork was partly a straight continuation of what we had been doing in September, but now we were also able to begin in earnest on TARF's plan of repairs to the North Palace. Amarna is a big site, and this meant that the two main theatres of work were separated by about two miles. We have no vehicle of our own, but by having a village pickup-truck in attendance for most of the time both our main inspector (Mr. Atta) and I were able to keep an eye on progress at both of them.

North Palace

Our most important task was to get started at the North Palace. Kate Spence and Surésh Dhargalkar, both of them architects, divided the work between them. Kate knows the North Palace and its documentation from the 1920s well and is keen to contribute towards the eventual publication. As a further step in this direction she supervised several pieces of work aimed at improving our knowledge. One involved reclearing the stone portal in the middle of the thick wall or pylon which divides the building into an eastern and a western part. More of the gypsum foundation layer was preserved than expected, and many more details were planned than had been done when it was first cleared in 1924. One mysterious part of the palace is the large depression in the middle of the rear court. It is presumably the site of an ancient well or lake or sunken garden (or all three) but it has never been seriously investigated. The excavators of the 1920s dumped a lot of their spoil into it, leaving us only small spaces into which to sink trenches that did not involve removing a lot of earth. By means of a deep trench down the south side it was possible to follow the steeply dipping bedrock for five and a half metres beneath the present surface, into a flattish layer of silt. There was

insufficient time to complete this probe, but our intention is to continue. Kate also continued the outline replanning of the Palace, concentrating on the south-east corner area.

Surésh took charge of the programme of repairs to the walls of the North Palace that the three of us had agreed upon. It was going to need a lot of new bricks made to the correct ancient sizes and so we set up a brick-making operation just outside the barbed-wire enclosure around the palace, on the south side. We used some new moulds made specially for the job in strong marine plywood by a supporter of our work in Cairo, Dick Keen of the building contractors Keminco. Very soon closely set lines of bricks lay on the ground drying in the sun. Mud bricks are tricky things to make well and we are still experimenting to find the best way. In addition to standard-formula bricks we also produced batches made with various additives, including ash and animal dung. Some of the latter set rock hard but were also very heavy and are not necessarily well suited to blending in with ancient bricks.

The place chosen for the first repairs is the range of rooms on the north side of the garden court in the north-east corner of the palace. Many of the walls are in a terrible rotted condition, yet it would be wrong to seek to rebuild them to too great an extent. The result would then no longer be an ancient monument. One wants to retain as much ancient brickwork as possible and to keep our own insertions fairly discrete. We also have to recognise that we cannot prevent further weathering.



North Palace: room 9, west wall during restoration

Surésh has spent much of his professional life looking after ancient buildings (mostly Windsor Castle and Buckingham Palace) and knows the importance of making a step-by-step record of all changes made. For each wall he has made a drawing of what he has done, as well as taking "before" and "after" photographs. Each section of each

wall needs its own schedule of repair and close supervision of the builders we employ. Some sections require new facing, some need to be rebuilt, others require just pointing of the joints or very local infills of new material. A persistent problem is the loss of timber beams originally set into the brickwork. Once gone, a deep groove is left which weathering opens up. Our solution here is to fill them with mud and gravel and to inset the fill slightly to preserve its different character. In the coming season we are going to experiment with an industrial wood stain as a way of keeping more of the original character. A simple step which we use widely is to spread a layer of very gravelly mortar over the tops of walls. This is where brickwork is very vulnerable to dampness, and experience has shown that this is a good protective measure. Dampness is much more of a problem than might be imagined for a desert location. We had no rain whilst working there, but on one day the site was shrouded in fog, the moisture from which the bricks absorbed.

By the end of our season Surésh had supervised repairs to all of the rooms on the north side of the court, with the exception of the famous "Green Room" where the wall paintings of marsh life were found in the 1920s. We decided to leave this for a future season since it requires rather more work than the other rooms. Some of the rickwork here belongs to a temporary structure built over the ancient walls after the paintings had been discovered, and some of this perhaps needs to be carefully removed. We are also left with a good pile of new bricks ready for a continuation of the work in the autumn.

Surésh has written his own report on his work, which I am enclosing. He has also made many recommendations for improving the efficiency of our operation. I am currently investigating some of these, which involve the use of more machinery. Already twenty extra wheelbarrows have been imported into Egypt from the UK, a gift from another supporter (Alf Baxendale).

Buildings south of the Great Palace (042.1 and .2)

Readers will recall that one of our schemes is to improve our knowledge of the extensive royal buildings in the Central City. Much of what can be done involves looking

again at what is left of buildings first dug by John Pendlebury in the 1930s. Even though they have suffered badly since then, by spending more time on them we always finish up knowing more. In September last we recleared a strip of ground along the west side of the so-called Coronation Hall of Smenkhkara, where Pendlebury had discovered the remains of an enigmatic pair of pavilions which had been built partly in brick and partly in stone. This time we moved the excavations further west and cleared a second strip parallel to the first. This took us into the area where the farmers have planted trees. We much appreciated the shade although, in being now well inside the area where they also tether their livestock, we found even more of the ground to be covered with an iron-hard layer of congealed animal dung which had to be levered off with iron bars. It turned out to possess a quiet unexpected power to preserve ancient foundations of gypsum concrete. This season's strip of ground was chosen to include the edge of the foundation for one of the pavilions. Beneath only a few centimetres of dark hardpan there the gypsum was, in not much worse condition than when Pendlebury saw it.

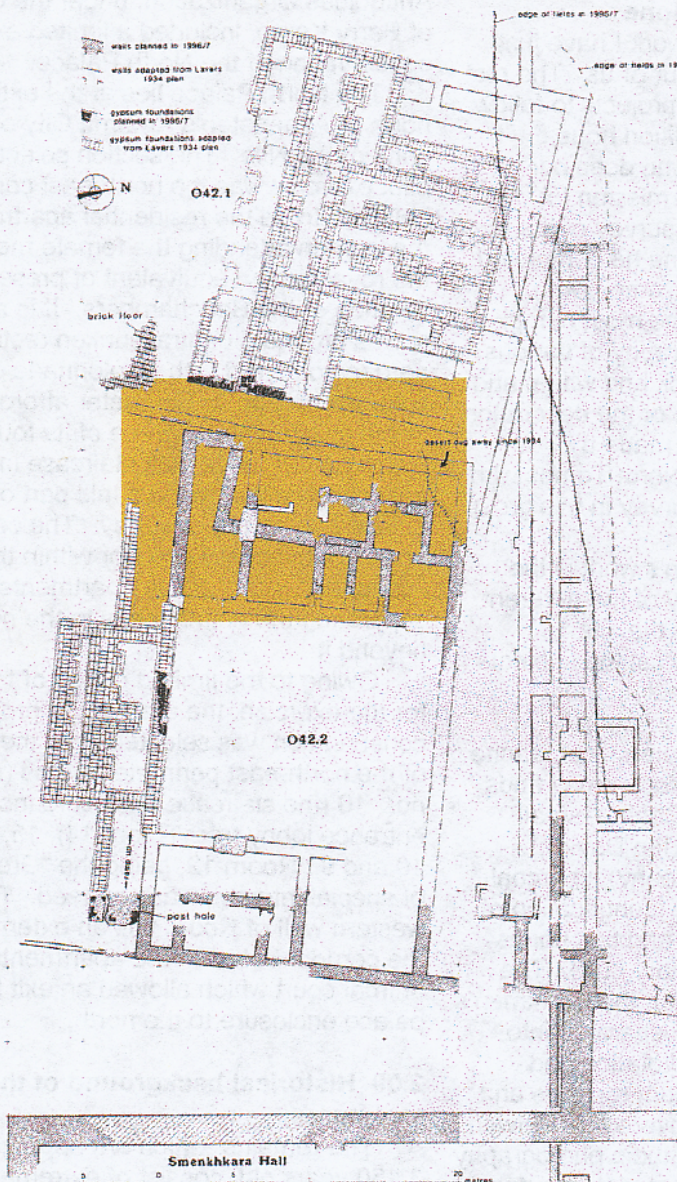
Our new plans make it much easier to interpret what Pendlebury had found. His architect, Ralph Lavers, had inexplicably compressed the buildings. Although some of what he saw has now gone for ever, we have sufficient reference points to stretch out his plan to how it should be. Moreover, some walls appeared that, in his day, were hidden beneath the floors. In particular we were able to follow a long thick wall belonging to the western pavilion as it runs across the site of the eastern pavilion but clearly predates it. Finding evidence for major rebuildings during Amarna's brief history is becoming quite normal. We also discovered an area of brick paving in front of the western pavilion, which suggests that it had a brick forecourt in front of the stone part.

Like all stone buildings at Amarna the original stonework of the pavilions had been removed in antiquity. When this was done inevitably some blocks were broken. In removing a small part of one of Pendlebury's dumps we found it to contain a lot of small broken pieces of stone, mainly from columns. One of them mentions the "House of Rejoicing," a general term for the royal buildings of the Central City.

By the end of the season I felt that we had gained most of what we could expect from this exercise in re-examination. What I would like to do now, as time and circumstances permit, is to take the excavation southwards outside the limits of Pendlebury's work. It is all too clear that everything close to the cultivation is eroded down to the last few centimetres. But this is all that might be required to reveal whether these pavilions stood in their own courtyards, or faced down wide streets running to the south. We know very little about this part of Amarna.



Ground south of the Great Palace. View to the south of the foundations of walls of buildings 042.1 and 042.2.



← 042.1 and 042.2 site plan
The colored inset corresponds to the photo above.

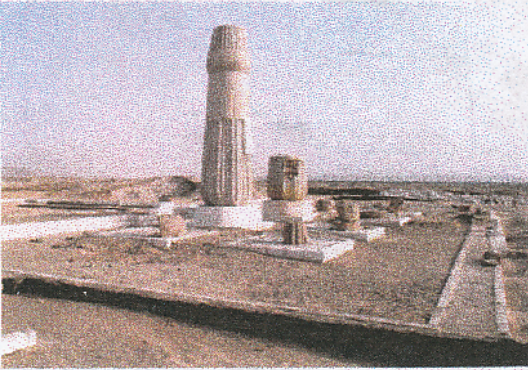
Small Aten Temple

The excavations I have just described are within short walking distance of the Small Aten Temple. Our work there is now exclusively the laying out of the plan of the stone sanctuary in new stone blocks, as I have previously described. We have a reliable and skilled builder (Mr. Shahada) who maintains a reasonable rate of progress, requiring only periodic inspection. The Spring season saw much more done on the wide pylon that crossed the sanctuary and on the forecourt. Here I got Shahada to lay out a row of rectangles beside and in front of the two partially rebuilt columns. Only the top surface of the rectangles shows above ground, but they provide bases on which to set up some of the large original sandstone pieces of column so that visitors can see for themselves the evidence on which we have based our reconstructions. Lifting the pieces into place was quite a challenge. We have some lifting tackle, but, in the end, much had to rely on

the strength, skill and determination of our workforce, of whom a Pharaoh could be proud.

Small Aten Temple

Marking out the Sanctuary with new limestone blocks. Pieces of the sandstone column drums have been mounted on square pedestals, the edges of which are to be buried.



Acknowledgements

The work at the North Palace was funded by the Amarna Research Foundation (Denver), Robert Hanawalt (Denver), and John Taylor (Dallas); Gwilym Owen's South Tombs survey by the Thomas Mulvey Fund and the Fieldwork Fund of the McDonald Institute for Archaeological Research of the University of Cambridge; Dr. Rosemary Luff's work by the Leverhulme Foundation; Dr. Delwen Samuel's work by Scottish and Newcastle Breweries; Ian David's by the G.A. Wainwright Fund. The Cairo office of the Egypt Exploration Society generously covered the cost of the purchase of two replacement hot-water heaters for the expedition house; Richard Keen of Keminfo kindly supplied new and improved brick-moulds for the North Palace conservation.

Other work done

The fieldwork I have just described involved only four of us. The rest of the team had their own projects to follow, mostly based at the expedition house. Gwilym Owen, however, who does our photography, also had permission to continue his photographic survey of the rock tombs at Amarna. This time he completed his schedule in the South Tombs, with pictures of a selection of the most complete texts, large-format photography of various subjects in colour and black and white, and some 35 mm photography of the decoration and architecture. He also made a preliminary survey of the North Tombs with a view to continuing his survey in this group next year.

Much of the expedition's work is the slow and painstaking study of the different categories of material that the site produces. Here I can only list the subjects covered: Eighteenth Dynasty pottery (Pamela Rose and Ann Cornwell), Byzantine pottery (Jane Faiers), Canaanite amphorae (Margaret Serpico), small finds from both periods (Lucia Gahlin), small finds from the glass kilns (Ian David), inscribed material (M.A. Leahy), charcoal from both periods with the identification of species (Rainer Gerisch), and fish bones from both periods (Rosemary Luff). The numerous soil samples from the Workmen's Village excavations were separated into their component parts by flotation and extensive collections of plant remains and related material were recovered by Delwen Samuel and John Muir. Studio photography of various categories of material was done by Gwilym Owen, in particular of Late Roman pottery vessels and decorated sherds, and pieces of statuary.

Amarna Research Foundation
Report on Conservation of The North
Palace at Tell el-Amarna
March -- April 1997
by Surésh Dhargalkar, LVO, RIBA
(Conservation Architect)
August 1997

1.00 The site

This year's fieldwork and programme of co-operative archaeology with the Egyptian Antiquities Organization, under the direction of Barry Kemp, included a limited exercise in conservation of the North Palace.

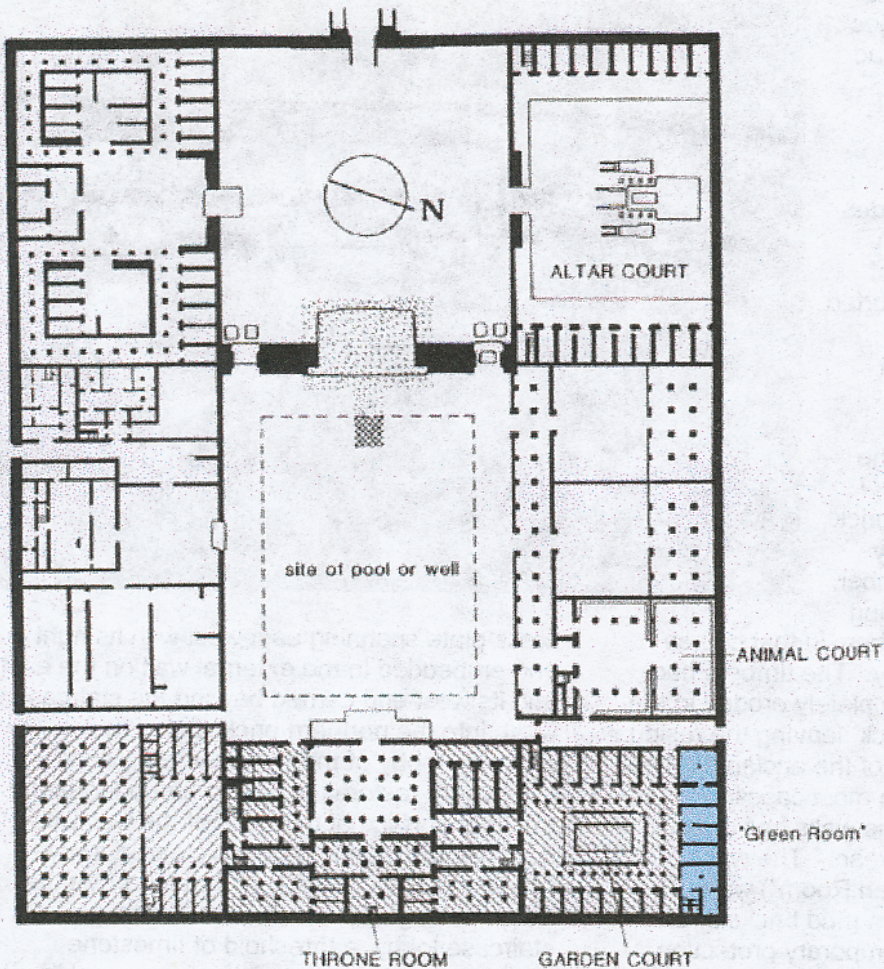
The North Palace lies at the extreme north of Akhenaten's Amarna City on the east bank of the Nile. The section selected for the pilot exercise was the north-east corner believed to be the residential apartments of the women attending the female members of the royal family, equivalent of present day's Women of the Bedchambers. It is a cluster of rooms around a central sunken rectangular garden courtyard with a colonnade of single columns around its perimeter affording access to the apartments on three of its four sides. Remains of a brick built staircase in the north-east suggest that at least this part of the palace had an upper storey. The central north-south access corridor within the palace lies to the west of these apartments, separating the animal pens to the north-west beyond it.

Owing to the limited period of four weeks for the exercise, the area of the proposed conservation was selected from the remains of the north-east perimeter rooms (see plan): nos. 16 (the staircase enclosure including its entrance lobby from Room 14), 15, 14, 13, 11, 10 and 9. Room 12, being the "Green Room" of special interest, was omitted. The western wall of Room 9 is an external wall to the corridor between the apartments and the animal court which allowed an exit from the palace enclosure to the north.

2.00 Historical background of the structure

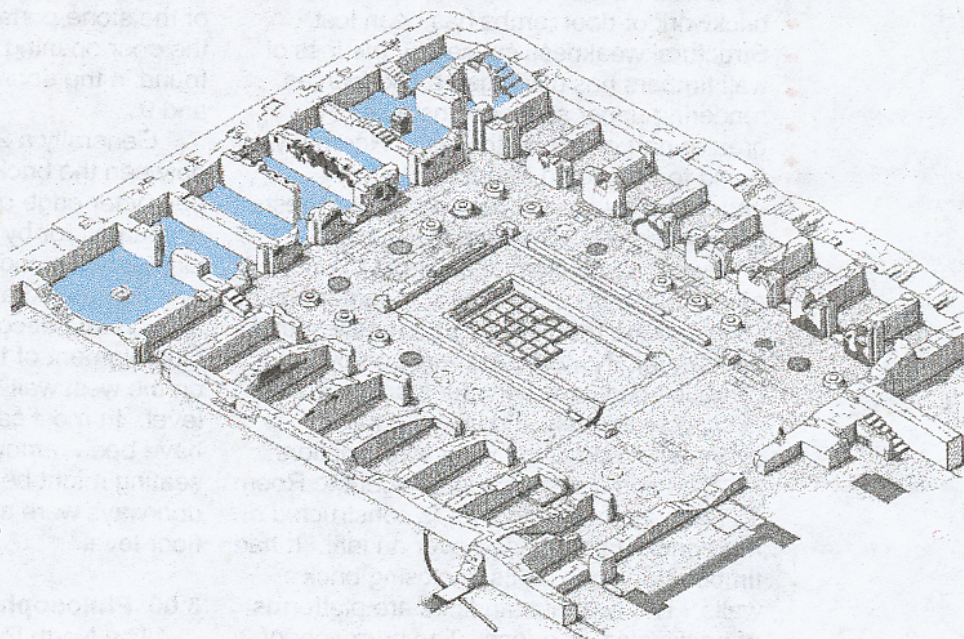
The remains, which are approximately 3,150 years old, consist of extremely weathered mud brick walls of average 90cms height. The severe erosion is due to the poor quality of ancient mud bricks (which lack tensile strength), destruction of timber lacing

North Palace



above
North Palace site plan
- blue area from top to
bottom are rooms 9
through 16.

right
North Palace Garden Court
- blue area corresponds to the
above site plan and shows
concentration of conservation.



in the walls by termite attack, and the effect of environmental conditions on a roofless structure. The prevailing northerly wind has, on occasions, a sand-blasting effect, and when it rains the mud bricks dissolve and the residual water on top surfaces dampens the bricks, forming a crusty surface following the immediate long, hot sunny periods. This crust is blown away by the strong winds, thus weakening the structure further. There is also considerable humidity in the atmosphere during nights in the Spring and during the occasional mists which softens the exposed bricks. Evidence of this was clear on a couple of days during the season of Spring 1997.

The walls were constructed of mud bricks, apparently made of Nile clay, sand, cattle dung and ash (?) and sun baked. The ancient composition has not, however, been exactly determined. The mortar appears to be of the same constituents as that of the bricks. The bricks measured on average 350 mm (stretcher) x 170 mm (header) x 90 mm (height) with a horizontal mortar joint of 20 mm and the vertical of 10 mm depth. There is a variance in the size of the bricks (the stretchers vary from 330 mm to 350 mm) and particularly in the thickness of mortar joints. There are traces of ancient plaster on some surfaces including rare flakes of ultramarine blue pigment used for wall decoration. The brick laying was very coarse as wall surfaces

were plastered, yet the pattern of bonding is generally uniform with a course of stretchers followed by that of headers, both adjusted where required to accommodate cross timber inserts.

photo

Excavation of the North Palace showing unexcavated area in the foreground, the Garden Court in the middle and the encroaching irrigated crops in the background. Rooms 9 - 16 at left of excavation.

The thickness of internal walls averages 720 mm. All walls had rough timber binder plates at regular intervals in lieu of a single course of brickwork on both sides of the wall, and such timbers in the face of the walls were supported by either square or round dowel-shaped cross timber bearers passing through the entire thickness of the wall. These were interspersed in the brick courses immediately below the lateral timber plates and the spacing of headers or stretchers in that course adjusted accordingly. The timbers had been, however, completely eroded in the past by termite attack, leaving the residual location and shape of the ancient timbers very much extant in most cases.

The height of the walls has greatly diminished over the years. The walls of Room 12 (the "Green Room") were extended by modern mud bricks in the 1920s to provide temporary protection during the work of recording and removing the ancient decorative plaster. Most of the brickwork of door jambs has been lost. Structural weakness caused by the loss of wall timbers has dislodged brick courses rendering upper sections unstable. A greater part of the north wall to Room 9 was found to be riddled at base level with enormous cavities occupied by bees' nests of honeycombs. Some of the ancient brickwork, particularly that within the body of the thickness of the walls, is remarkably solid and the mud bricks structurally sound and strong. Nonetheless, erosion by climatic conditions continues and, aided by nesting of animals and insects, will eventually reduce the walls to extinction.

The dog-leg staircase adjacent to Room 15 (see photo on page 10) is constructed of mud bricks laid on edge over an infill. It had timber strings on all its enclosing brick walls. The two mid-landings are platforms of bricks also on edges. The brickwork of the upper was supported on a heavy timber



cross-plate spanning east-west with its right end embedded in the external wall on the east and its west end carried beyond the staircase width into the northern brick wall of the entrance lobby of the staircase enclosure.

Where restoration was to be undertaken, the floor surface at the base of the wall was carefully brushed and debris cleared away to reveal the brick courses at that level. At the door opening between Room 15 and the staircase lobby, a threshold of limestone pieces embedded in gypsum was revealed. It clearly indicated the markings of the position of the stone portal against the brick jambs of the door opening. A similar threshold was found in the door opening between Rooms 10 and 9.

Generally a 20 mm gap was found between the brick wall surface and the perimeter edge of the floor. This was accounted for by the thickness of the wall plaster finish, indicating that the floor finish was completed after the wall plaster had been applied and decorated. In Room 9, residual blue pigment of the wall decoration was found on the west wall, about 20 mm below the floor level. In most cases the limestone thresholds have been removed, but buried traces of their seating might be discovered and identified if doorways were cleared down to below the floor level.

3.00 Philosophy of conservation

The North Palace has lost considerable material within the last 70 years since it was

first excavated and part of the remains have been re-enveloped by the sand. Unlike buildings at Pompeii, it is not protected by roofs and therefore its conservation should be an on-going exercise relying upon planned maintenance. However, owing to the extensive dilapidation, the philosophy of conservation has to take its lead from the necessity of structural stabilization. There are no elements of structure in this section other than the walls which clearly define the various forms of accommodation. No foundations of walls, if existing, have yet been exposed in the recent excavations.

The planned programme of structural stabilization envisages replacement of the lost elements of the load-bearing mud brickwork with fresh brickwork which possesses compatible mortar jointing, together with replacement of the lost timber plates and cross-bearers with similar material or their equivalent. There is also a need to re-build the brickwork of the door openings and to recreate the profile of their jambs as a way of stabilizing the extremities of walls. I consider it permissible to carry out a very limited degree of restoration using both displaced ancient bricks and newly made bricks and with a new compo-

this ancient monument. It is to be hoped that, with a reasonable planned maintenance in future by the Egyptian Antiquities Department, the programme of conservation will be sustained into the foreseeable future.

The quality, strength, colour and appearance of the proposed new hand-made mud bricks can only replicate those of the ancient ones after careful analysis of the Nile clay, sand, and other possible components of the ancient sun-baked bricks. This analysis demands determination of the particular source of the clay, type and source of the sand, and establishment of the properties of any fibrous vegetable matter in it. Indeed, the composition of silica, alumina, chalk and iron etc. in these constituents are of vital importance. The mortar mix may have been similar to that of the mud bricks but its cohesive yet flexible constituents need to be established. Consideration should be given to the addition of lime to the mix. Such an addition would be permissible as lime in the form of white caustic alkaline earth (calcium oxide) by burning limestone was known in building works during the 18th Dynasty.

Presently it appears that replacement of timber plates in the walls with new wood is not practical. Experience has shown that new timbers will quickly be eroded again by termite attack. There is at present neither a known preventative measure, say, by application to or impregnation of timber by a chemical against termite attack, nor an indigenous timber impervious to this attack. It is therefore necessary that the cavities left by the eroded timber are filled with mortar bedding to achieve structural stability. To draw attention to the location of these past timbers the mortar infills need to be accentuated by rendering their surfaces with stone and gravel chippings, or by applying a colour dye/stain to the surface to create an appearance of timber. However, further research must be done to see if real timber can be used for replacement.

4.00 Restoration work

Having established the philosophy and guidelines of the proposed conservation, manufacture of handmade mud bricks on site was organised on an area of flat ground immediately to the south of the palace, outside the barbed-wire fence where the only gateway is located. The basic

ingredients, sand and clay, were brought in by tractor and trailer through agreements with local farmers. As the season progressed much discussion took place over the composition that we should use, and a good deal of experimentation was carried out. A detailed report by Kate Spence is appended.

Two new brick moulds, made to the average size of North Palace bricks, were supplied, made from marine ply, which is water-resistant, and fitted with metal reinforcements at the corners and with metal handles. Each was also provided with a top cover made from the same material and also fitted with a handle. This is needed to keep the brick in place when the mould itself is removed. A small team of men was employed, two for the mixing of the mud and two for the making of the bricks, all of whom had worked in this capacity previously for the expedition. A stock of bricks was produced which were left to dry in the sun on the ground. They became ready for use during the season. A mortar mix of the same constituents as that of the bricks was also made from time to time.

There were many constraints in the working methods. Water had to be brought to the site in buckets or wheelbarrow from a distance of approximately a kilometre, resulting in delays and loss of water in transit. Large quantities of clay, sand, dung and ash were deposited side by side, and the mixing was done by the labourers by scooping the quantities, *ad hoc*, in a mound in close proximity to the deposits. This meant that definitive proportions could not be maintained. Hand-mixing was laborious as well as unsatisfactory. The mortar mix and newly made cured bricks had to be carted in one wheelbarrow-load at a time from the mixing site outside the gate of the secured compound to the building site within the compound approximately 200 metres away. Consideration should be given to the use in the future of a mechanical mixer, to the acquisition of a mobile water tank, and to an increase in the number of wheelbarrows, the stock of which is shared amongst the various expedition projects.

Despite these constraints, the performance of the local bricklayer and his mate, who were probably the only skilled workers amongst the hired labourers, was creditable. They were hard working, willing to learn and innovative. The implements of labour were basic, consisting of one spade,

- one shovel, two trowels, two hammers, a chisel, a small crowbar, one line, a string plumb line and one spirit level. There was no handy supply of water on the building site.

- Priority was given to the structural stabilization of the north walls of the suite of rooms selected. The work progressed from north-east, beginning with Room 15, to the north-west, ending with Room 9. Room 12 (the "Green Room") was left unattended to, as it would form part of the future conservation work with the benefit of knowledge of the previous work done to the existing structure in the 1920s. The central pillar in Room 15 was also left alone, for traces of the original paintings still survive, protected by loose bricks and sand heaped against the faces. This requires specialist attention.



*North Palace
Reconstructed staircase,
adjacent to Room 15,
using new bricks laid on
edge for stair treads.*

Limited reconstruction was carried out on the staircase, including replacement of the brick treads themselves with new bricks laid on their edges. Low-level repairs were done to the jambs which define the door openings between Room 14 and the staircase lobby, between Rooms 15 and 14, between Room 14 and the Garden Courtyard, and between Rooms 10 and 9. More significant repairs were done to the badly eroded west wall of Room 9, and a capping course was added to what remained of the central pillar in Room 9. All

- cavities left by eroded timber plates and cross-bearers in all perimeter walls and internal walls were infilled with mortar mix and structurally stabilized (except for those on the surfaces of the walls which face south, on to the courtyard). Large internal cavities created by animal burrows or insect nests were also infilled with new brickwork.
- The heights of the various walls were restored to the same level as when we started and, where possible, the top surfaces were rendered with mortar and stone chippings to reduce future erosion. Where possible, ancient mud bricks from within the thickness of the existing walls were re-used on the surfaces together with new bricks.

The whole exercise took 21 working days on site.

5.00 Observations

5.01 Materials and supply

Although considerable discussion took place as the work proceeded between ourselves and representatives of the Egyptian Antiquities Organization as regards the specification of the new mud bricks, a thorough analytical statement of the constituents of the ancient mud brick is not available for comparison. The new bricks used in the exercise were found to be extremely brittle. The failure in achieving a reasonable crushing strength in the new mud bricks can be attributed to many factors, but primarily our lack of knowledge of the source and cohesive strength of the Nile clay.

One possibility is to use lime in the mix. But what percentage would be adequate to achieve the required strength without changing the colour of the brick? If slaked lime were to be used, it ought to be mixed with the clay and left in a slightly slurred form for a period of evaporation prior to mixing other components. This would eliminate variation in colour rendering.

5.02 Site facilities

Lack of electrical supply or any alternative fuel on site made matters more laborious. Mix for bricks and mortar was never consistent. A diesel or petrol fuelled concrete mixer might prove more efficient in terms of speed as well as getting the percentage of constituents right. Water supply on site would be an ever-present problem but perhaps a hose line from the river source with a diesel pump at the river and water butts on site for storage could be considered.

The labourers need to be trained better in getting the mix to the right proportions and educated in the philosophy of what constitutes right material and its proper transportation. It is, of course, acknowledged that we have no sufficient manpower or time to engage ourselves in this training.

5.03 Brick moulds

The new brick moulds, although an improvement on ones made locally from ordinary wood, were still not strong enough to withstand rough handling of the course mix and, in particular, the forces released by the compaction method that is used in filling the mould with mud. The moulds ought to be with metal lining to inner surfaces similar to those

Notes on Brick-making for
Archaeological Restoration
by Kate Spence of Christ's College,
Cambridge
14th July 1997

- used in the U.K. for hand-made bricks.
- The lateral sides of the mould should be elongated for additional structural support and the handles secured more firmly. The top ramming board used was adequate.
- The bricklayers spent some time in scraping off the sand stuck to the bottom surface of the dried bricks. The bricks should be cast on some sort of matting (date palm fronds?) on the desert floor and not cast on the ground as was done. Adequate time must be allowed to ensure curing of the bricks in the sun before they are used. Unused bricks ought to be stored under a cover of matting.

- The progress of work on site was monitored by occasional site visits by one or two inspectors of the local office of the Egyptian Antiquities Department. The dialogue invariably steered towards the mix for the bricks. The second batch of the mud bricks without the cement as desired by the EAD was equally unsatisfactory in the crushing strength. It is hoped that the mortar will hold these bricks together *en masse*.

- At the next programme of conservation on site, the bricks must be ready beforehand for laying. Hence, new moulds and mix for the bricks ought to be determined as soon as possible, new moulds sent to Amarna in advance and the bricks made, dried in the sun for at least a month and ready under a cover for the work from the first day of our arrival on site. The brick making should be carried out under supervision preferably of the advance party of the fieldwork in September 1997 and in accordance with procedure and equipment mentioned above.

- Lack of knowledge of colloquial Arabic language proved a disadvantage, although this did not prove to be a serious problem in our liaison with the bricklayers. A crash course in basic Arabic is therefore considered desirable.

The following notes are based on work undertaken in the North Palace at el-Amarna in March-April 1997 to find suitable methods of brick-making for consolidation of the structure. The project draws on experience gained during the conservation of the Small Aten Temple at el-Amarna which began in 1988. Bricks made in the Small Aten Temple were made from old and broken bricks extracted from spoil heaps on the site. It was not possible to use this source of material in the North Palace as there is insufficient brick rubble, and it was therefore necessary to experiment with the use of agricultural mud as an alternative. This soil has different chemical properties and requires a different approach.

The results of the experiments will not be known until next season as many of the bricks were not completely dry at the end of the working period, precluding assessment of weight, appearance and strength. Full assessment of their suitability can only be made after many years of exposure to weathering factors.

Technically, the use of agricultural mud for building purposes is illegal in Egypt, but there appears to be little enforcement of this law, and it is generally accepted that agricultural mud is the best material for mud construction.

Approaches to brick making

Mud bricks are still produced in Egypt today, and are commonly used for the construction of huts and animal shelters in agricultural areas, although new houses are now almost always constructed of concrete or stone blocks. These mud bricks tend to be small and are made with a wet mix of mud and sand, and with chaff if it is available. They can be produced very quickly and are sun-dried. They can be used for building within a few days of production.

This method of brick-making is essentially identical to that which was used by the ancient Egyptians, and bricks made in this way have been used in archaeological conservation

Hand-made bricks
being used in
renovating Room 9
of the North Palace.



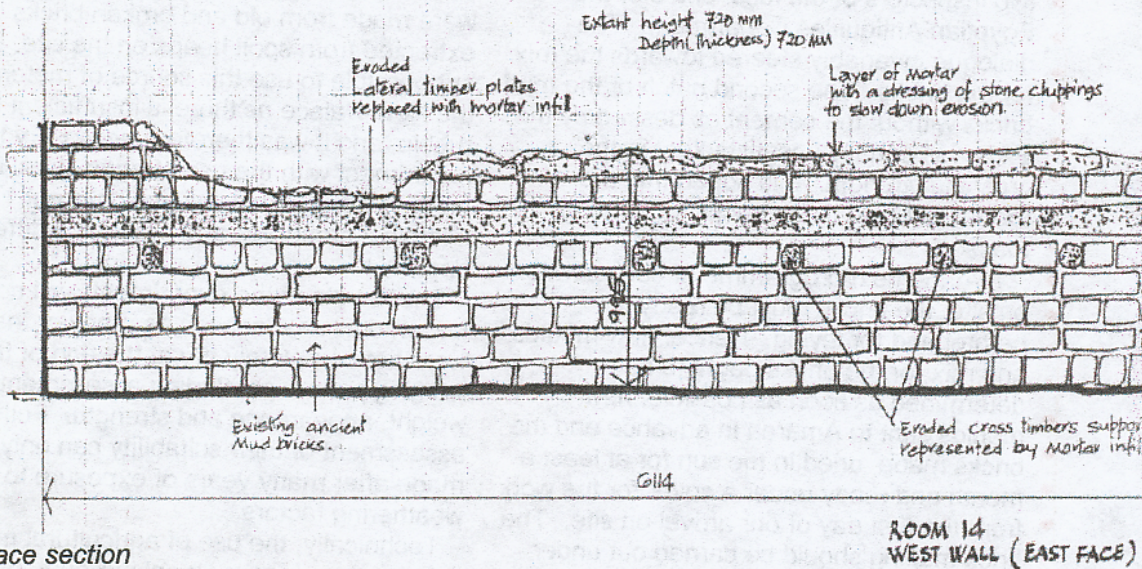
work, for example by the French at Karnak, and the SCA at various sites.

Ancient bricks are now considerably harder and stronger than modern bricks made by this method owing to long-term chemical changes which gradually cement the brick particles together. Modern bricks made by this method will be relatively soft and porous and will weather quite rapidly, particularly given the increased rainfall of modern times and the exposure of denuded archaeological sites to wind damage. Our intention at Amarna has been to find ways of producing harder bricks which will weather better and provide more lasting protection.

The constituents of the basic materials used to make bricks can vary hugely throughout the country, and from place to place within a single site. Chemical analysis can aid decisions as to precise quantities of different materials to be added, or what should be used in a given situation, but, as the precise nature of the material used may change with every load, and given the difficulties in controlling the precise amounts of each substance that is used in what inevitably becomes a rather ad hoc measuring and mixing process, experimentation ultimately plays an important role in the design process.

Small Aten Temple bricks

The method of making new bricks at the Small Aten Temple was designed by Richard Hughes of Ove Arup and Partners. Displaced and broken ancient bricks were collected from the spoil heaps in the temple; These were broken up, soaked and mixed with 2% cement to



North Palace section showing use of bricks and mortar infill for restoration.

One can make extremely hard bricks by simply compacting mud, but inserting extremely hard bricks into an existing structure can be a mistake as the additional weight of these dense blocks may damage the ancient structure, and the variation in hardness and porosity may encourage differential weathering and actually speed up the erosion of the original fabric. The hand-compact bricks used at Amarna seem to strike a suitable balance between these extremes.

The addition of different constituents to the mud mix can alter the appearance of bricks by causing a whitening of the surface. This is acceptable as long as it is not too pronounced: a mild discoloration helps to differentiate between the ancient and modern brickwork.

stabilize the soil and reduce porosity (ancient mud is not very 'sticky' and without cement does not make adequate bricks). The mortar was mixed to a dry consistency similar to the 'bread-crumbs' consistency used in baking: it should be well mixed and damp, and form loose lumps of material which, when squeezed in the hand, can be made to stick together into a firm lump. The mortar was then rammed into the moulds in layers and compacted with wooden beaters, and the mixture held in place with a lid while the mould was removed.

North Palace bricks

At the North Palace, there is no ready supply of broken ancient bricks which can be reconstituted to make new bricks. It was therefore necessary to use new soil, the

properties of which were unknown. In its raw state, the mud used for brick-making tends to contain too much clay and is too sticky to make bricks, and will also tend to crack badly as clay shrinks. The material must therefore be tempered by the addition of sand or chaff or both. We have tended to avoid the use of straw and chaff, as the organic material encourages termites, and have used sand to temper the clay. It is interesting to note that the properties of the various different types of soil available in any area are well known to the villagers, and they all know the relevant proportion of sand to use with each type of soil to make bricks when straw and chaff are unavailable.

Gebel clay, sand and cement

The first bricks were made from clay extracted from a pit in the desert near the north tombs. This was delivered by mistake, and was sandy in colour with lumps of grey clay. The clay was mixed with sand, the proportions being roughly 33-40% clay to 66-60% sand approximately 2% cement was then added to the mixture.

After a few hours it became apparent that these bricks would be unsuitable: the damp bricks were cracking and crumbling soon after, if not during, production. When they were completely dry, these bricks proved very weak and crumbled readily when picked up; they were also light and sandy in colour, unlike the ancient bricks in the palace. These bricks were discarded.

'Blue' clay, sand and cement

The brick-making continued with a delivery of *khart azrac*, 'blue earth', a heavy, clayey soil from the river bank. It is dark brown in colour and of an even consistency. It is this soil that the villagers consider most suitable for making bricks. It is again mixed with clean sand, the proportions being 66%-75% soil to 33-25% sand (depending on the precise clay content of the soil: this is determined by assessing the stickiness of the material). To this was added c.2% cement to stabilize the soil, which was mixed to a dry consistency (as above) and rammed into moulds. The bricks were dried under plastic to allow the cement to 'go off': all bricks which are made with cement must be dried slowly under plastic to allow the cement to fully hydrate and 'go off'.

It proved quite difficult to get the mud

well mixed: the clay is hard and needs to be very wet before it will mix easily and evenly with the sand and cement, but because a dry consistency is required in order to compact the soil it is not possible to hydrate the mixture to its optimum level. Because of the need to soak the soil, it can also be difficult to keep a check on the proportions of sand and soil. (These were not problems faced at the Small Aten Temple because the sand and soil were ready-mixed in the ancient bricks; however, significant variation in the proportion of the constituents may explain the variation in the strength of the new bricks made in the temple.)

These bricks are reasonable hard and are suitable for use in consolidation work. When dry, they have a light-coloured surface, presumably caused by the leeching of salts to the outside of the brick.

Inspectors' experimental bricks

Our inspectors, Mr. Bessim and Mr. Ahmed, made some experimental bricks using locally available substances as an alternative for cement, which they feel should not be used in the new bricks as it is alien to the ancient materials, and also contains salts which discolour the bricks and which could harm the ancient structures. They made bricks containing ash, and bricks containing ash and animal dung. There is no evidence that these substances were used in ancient brick making on the site, but they are used elsewhere in the world to stabilize soils. Animal dung, which is light, chaffy and very strong, is frequently added to soil for the construction of ovens in the villages.

These bricks proved strong, although those made with ash alone were discoloured with a salty surface similar to that produced by the cement, and were also very dense. Although we are trying to improve on the strength of the ancient bricks in order to slow down the process of deterioration, it is important not to introduce anything too hard or dense into the existing brick-work as this could damage the structure, and would also cause differential weathering.

The bricks made with ash and dung were less discoloured than the cement or ash bricks, and were strong without being too dense. We therefore made several hundred bricks using these substances.

Ash and dung bricks (dry)

The bricks were made using substances

in the following proportions. Soil 55-60% (depending on clay content); sand 20%-25%; ash 15%; dung 5% (this was a modification of an earlier mixture which was soil 50%; sand 30%; ash 10%; dung 10%). The ash was brought from the remains of fires next to the local fields and after an extensive survey of local animal dung, a supply of the dry powdery dung and chaff which collects where cows and water-buffaloes are tethered (Arabic: *dims*) was selected. Maintaining an adequate supply of these materials (especially the ash) for production of large numbers of bricks would be a problem. The mixture was kept dry and the bricks were rammed. Although they were left in the sun these bricks were slow to dry, presumably because of the density caused by ramming and because of water retention by the organic substances.

Ash and dung bricks (wet)

Because of problems with cohesion caused by the dryness of the mud mixture, Mr. Bessim decided to make a further run of bricks using the same proportions of dry constituents, but adding considerably more water to make a sloppier mixture more akin to traditional Egyptian bricks. This allows the constituents to be more thoroughly mixed, and also considerably speeds up the brick-making process, although as a result the bricks tend to slump when the mould is removed, and they may shrink on drying; they will also be more porous.

The ash and dung bricks were not completely dry when we left the site, so it was not possible to test them for strength. However, from preliminary observations it appears that they will be at least as strong as the cement bricks. One possible problem may be a greater porosity than the cement bricks, and this will also be examined before making a decision on which type of brick to produce next season. Lime has also been suggested as an alternative to cement, and experiments will be made using this as a binder next season.

Brick moulds

The moulds used for the production of local bricks are weak and poorly made and are inadequate for the production of rammed bricks. Our moulds were made from thick marine-equivalent ply with reinforced steel corners; next season we will be experimenting with metal-lined hardwood

moulds. Handles are needed at both ends to remove the mould, and the sides must be around 0.5 cm higher than the required depth of the brick to allow the lid to be easily positioned before removal of the mould. The handle of the lid must be broad and flat as the lid is held in position with the foot during the extraction process.

Lesser Tombs in the Royal Wadi Bob Hanawalt

In the last issue of the *Akhetaten Sun* I promised I would write a few words about the Royal Valley tombs, other than Akhenaten's, at El-Amarna. I have often wondered about them, and it appears that very little information is available, often to be found only in footnotes dealing with some other phase of Amarna history.

Last spring (Mar 97) I had the opportunity to visit these tombs along with Barry Kemp, a few tourist police, and a couple other employees of Kemp and the EES. I was quite surprised at the size of the tombs, as one is led to believe that there is very little to them. Two have openings equal in size to those of the Kings in the Royal Valley at Thebes.

The Royal Valley at Tel-Amarna is located in the Wâdi Abû Hasâhel el-Bahri about four and a half miles from the Amarna plain. The wadi drains the surrounding high plain for a number of square miles and during the infrequent rainstorms can be the drainage trough for quite a volume of water, as both ancient and recent floods attest. The opening is quite wide — a quarter of a mile or so — and then naturally narrows as it slowly ascends to the level of the high plain. The wadi is very barren, and about two to three hundred yards wide for most of its length.

Near the mouth of the wadi are a couple of small branches that have been termed the North Branch and the South Branch. (The main wadi continues eastward where larger branches join it.) Akhenaten's tomb is in the North Branch. The three tombs we are concerned with are located up the South Branch about 260 yards from the main wadi and approximately 600 yards from the Royal tomb.

For want of names, the tombs are identified by an adjective modifying "Tomb". One is known as the "Long Tomb," one has "No Name", and the last is called the "Large



*Long Tomb entry descent
Amarna Royal Wadi*



*Plaster detail broken
from ceiling of Long
Tomb - Amarna Royal
Wadi.*



*Tunnel into Long Tomb
with 3 plaster door jams.
Amarna Royal Wadi.*

Tomb." The Long Tomb and the tomb with No Name share a common spoil dump and are located about 50 feet apart. Pottery shards around them are quite common and represent several different levels, from the 18th Dynasty through the Roman period to modern times.

The Long Tomb is

entered by descending a flight of stairs to a well-defined jamb, from which a straight shaft of approximately 50 feet descends. Two other door jams are evident. There is still quite a bit of plaster on the door jams and ceiling. For a true Amarnophile this tomb is well worth the trouble to visit. The tomb with No Name has very incomplete steps and is rather difficult, but not impossible to enter. In addition to very poor entrance stairs, it also has an unfinished set of stairs about 40 feet from the entrance. Opposite the stairs is the start of a small side room. The tomb continues into a room approximately 20 feet deep, where a column has been started in the back wall.

The Large Tomb is located in the south side of the main wadi. It has a nice entrance with stairs, but is pretty much filled up with mud. It has never, to my knowledge, been cleared. The ceiling descends to the mud level and disappears from view. When we visited the tomb, there was still standing water from the November 1996 flood. It would be interesting to know what lies under the mud, although it is speculated it would be similar to the other two tombs.

No one knows who the tombs were intended for, although there have been some theories. There was a piece of pottery with the name of Nefernefrure on it found in the spoil dump of the Long Tomb and No Name Tomb. The piece's present location is unknown, although I am sure it would not reveal anything. There has also been speculation that one of the tombs was being prepared for Tutankhamon, but was abandoned when he moved back to Thebes, or Memphis, or wherever with the court.

There is one other known tomb opening in the Royal wadi. Opposite the Royal tomb, it is covered with spoil and talus and only goes about 5' into the cliff. If there are other tombs they are yet to be found.

(Photo credits for article: Ryan Hanawalt)

MEET YOUR HONORARY TRUSTEE: William Joseph Murnane



William Joseph Murnane was born in White Plains, New York, but spent most of his childhood in Venezuela. Although attracted as a boy to New World archaeology, he found himself increasingly drawn in college to ancient classical and Near Eastern studies, and in 1966 he entered the University of Chicago's graduate program in ancient history. While continuing to train in a broad range of subjects he concentrated on ancient Egypt, ultimately writing a dissertation on pharaonic coregencies that was later published by the Oriental Institute (Chicago, 1977: this is now out of print, but an updated second edition is in progress).

By the time he received his Ph.D. in history (1973) Murnane had already begun what would turn out to be a lengthy career as an epigrapher in Egypt. After "seasoning" with the University of

Pennsylvania's Dira-abu-el-Nagga Project (1972), he was hired by the Epigraphic Survey of the University of Chicago's Oriental Institute: he was to remain at "Chicago House" for the next fourteen years, spending the winter months (October through April) in Egypt and even visiting the Sudan in 1980. During this time he took part in the expedition's field work at Karnak (Knonsu Temple and Sety I battle reliefs), Luxor (processional colonnade) and Medinet Habu (the "small temple"). Taking advantage of the access to the monuments which came from his work in Egypt, as well as the superb library at Chicago House, Murnane spent his spare time during each season on research and writing, publishing numerous articles and books – among them The Road to Kadesh (Chicago, 1985; 2nd ed. revised 1990: an analysis of Egyptian foreign policy from the Amarna age into the earlier Nineteenth Dynasty); United with Eternity (a concise

EDITOR'S BOOK REVIEW
Linda Anderson

guide to the monuments at Medinet Habu: Cairo, 1980); and The Penguin Guide to Ancient Egypt (London, 1983; revised and expanded 1996).

Murnane also developed a number of his own field projects in Egypt during his years at Chicago House, notably in the Great Hypostyle Hall at Karnak: what began as a "rescue" of unpublished drawings left by the founding director of the Chicago House, Harold Nelson, would become a lifelong commitment to publish the reliefs and inscriptions in the building, with the initial volume (Chicago, 1982) to be followed by others as the project continues into the next millennium.

In 1986 Murnane left Chicago House and, after a year of visiting at Berkeley, he joined the History Department at Memphis State University (now the University of Memphis): he is now a tenured full professor and is associated with that university's Institute of Egyptian Art and Archaeology. Apart from his work with the Karnak Hypostyle Hall expedition, he is also on the editorial boards of the journal *KMT* and a translation series "Writings from the Ancient World" sponsored by the Society of Biblical Literature.

Murnane's interest in the Amarna age dates back to his years in graduate school at Chicago. His dissertation included, of necessity, extended discussions of the period's much-debated coregencies; and his research at Karnak later disposed of another prop in the case for Akhenaten's alleged joint reign with Amenhotep III (*JARCE* 16 [1979]:11-27). With Charles Van Siclen he undertook a fresh survey of the boundary stelae at el-Amarna (1983-1989) which resulted not only in a much improved text but also the first accurate account of the various sites (London, 1993). He is also the translator of Texts from the Amarna Period in Egypt (Atlanta, 1995), in which he has tried to include all but the most repetitive records from this time. He will act as a consultant for the Amarna exhibition which is being organized for 1998 by the Boston Museum of Fine Arts.

Books by William J. Murnane

Dr. Murnane's writings contain acknowledgment lists that read like "Who's Who of Egyptology," pages of bibliographic abbreviations, and extensive footnotes and appendices, making for excellent research material. However, I will quickly add that the text is very interesting and layperson understandable. Earlier texts were a little insufficient in indices but this seems corrected in later works.

The Road to Kadesh - A Historical Interpretation of the Battle Reliefs of King Sety I at Karnak
Studies in Ancient Oriental Civilization - No. 42

The Oriental Institute ©1985, 1990
"Explores the significance of Sety I's wars as part of the pattern of Egyptian/Hittite relations...Egypt allowed Asiatic local warfare as long as the winner observed their obligations to Egypt...they would not tolerate disruption of ports or trading routes."

The Boundary Stelae of Akhenaten (co-authored with Charles C Van Siclen III)
Kegan Paul International
© 1993

Accompanied by numerous line drawings of positioning on sites, photos, and pages of Hieroglyphs clearly noting those restored, carved over, missing areas, and those interpreted differently by past archeologists. The first Appendix lists fragments no longer in situ, where the known pieces are, which might still be buried at the site and which might surface in collections.

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