DOI: http://dx.doi.org/10.5334/ai.0811

Provisions for the pyramid builders: new evidence from the ancient site of Giza

Mary Anne Murray

The great pyramids of Giza are famous emblems of ancient Egyptian civilization, but until recently little was known about where and how the pyramid builders lived. The site of their large settlement has now been found, and excavation is revealing its complex layout and providing evidence of the plants and animals on which the builders depended for their food supply.

Between about 2550 and 2470 BC the three Egyptian pharaohs of the fourth dynasty, Khufu, Khafre and Menkaure, built their colossal pyramids and mortuary temples on the Giza plateau close to present-day Cairo. These enormous state projects would have employed thousands of conscripted labourers, whose settlement near the pyramids is being studied by the Giza Plateau Mapping Project (GPMP).[1] The first aim of the GPMP was to locate the settlement, and then to investigate the social and economic infrastructure that supported the pyramid-building enterprise in what was one of the major urban centres in Egypt in the third millennium BC.

Excavations to find the settlement of the pyramid builders eventually focused on an area of low desert south of the pyramid complex, about 400 m south-southeast of the Sphinx (Fig. 1). Excavations began here in 1988 and continued sporadically until 1998. Then, in October 1999, we began a more intensive continuing phase of excavation.

The excavations have so far revealed a substantial well planned settlement that covers some 9 ha and can be divided into at least 30 distinct areas. They include the 200 m-long Wall of the Crow, which bounds the site on the northwest, and a large royal administrative building with associated storage structures (silos) at the southeastern edge of the site (Fig. 2). An enclosure wall connects the Wall of the Crow and the royal administrative building, thus framing the main part of the site, which consists primarily of the ruins of four sets of long mudbrick galleries. Three streets cut west to east through the galleries. Scattered elsewhere throughout the site are house-like structures, bakeries and craft workshops, as well as two major domestic settlements associated with the complex, known as the Eastern and Western Towns (Fig. 1).

Dating evidence from the pottery, the mud sealings (Fig. 3) and the detailed stratigraphic phasing of the site indicates that the settlement was in use during the reign of the pharaoh Menkaure (2490–2472 BC), the builder of the final Giza pyramid. The evidence also indicates that the site was a royal facility for the production of food and other items used to support the builders of the pyramids. The tombs of these workmen are located just above the settlement in the hills to the west (Fig. 1) and are being excavated by Zahi Hawass, secretary-general of the Egyptian Supreme Council of Antiquities.

A major aim of the project is to investigate the daily life of the pyramid builders, including their food supply, by asking such questions as: what types of food did they have, did they all consume the same foods, did they have to produce it themselves or was it provided for them, and how does the Giza settlement compare in this respect with other Egyptian settlements? To address these questions, a comprehensive programme of sampling plant and

Figure 1 *Aerial view of the Giza plateau, showing the three pyramids of (from right to left) the pharaohs Khufu, Khafre and Menkaure, the Sphinx, the site of the pyramid builders' settlement (right foreground) and their cemetery (left foreground).*

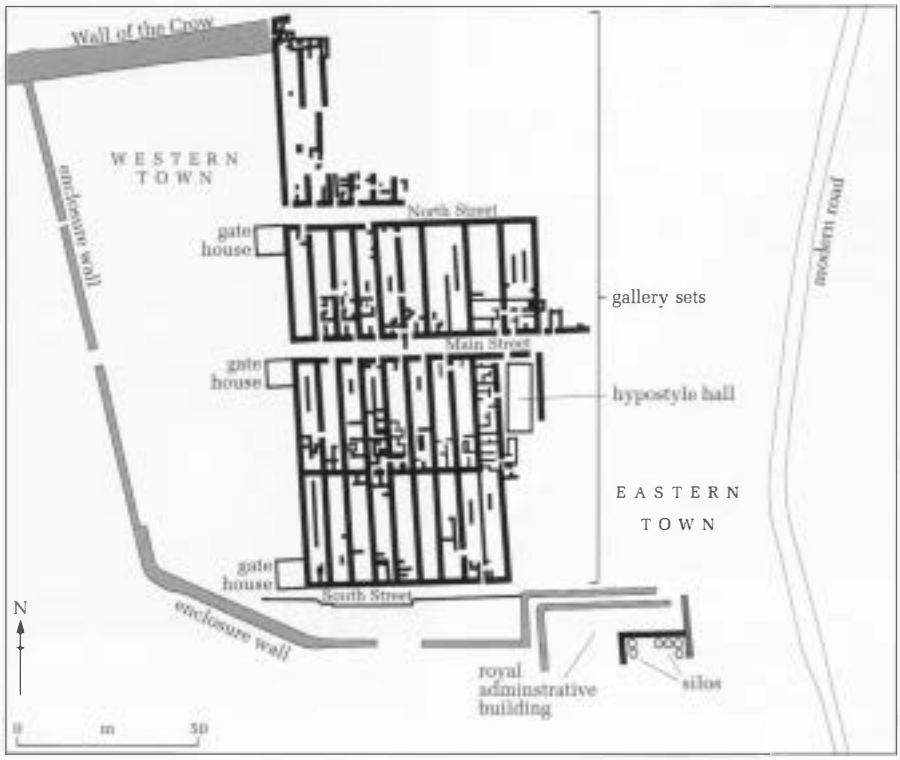

Figure 2 *Simplified plan of the settlement of the pyramid builders at Giza. Redrawn from a plan prepared by Mark Lehner, director of the Giza Plateau Mapping Project.*

animal remains was undertaken. All animal bones from the excavation were retrieved (more than 152,000 items to date) and they are being analyzed by Richard Redding of the University of Michigan. My role as the archaeobotanist for the project is to retrieve and analyze the plant remains, all of which were preserved by charring.[2] We recovered them by machine flotation, which separates out the charred plant fragments by washing excavated soil samples through sieves of 1 mm and 0.25 μm mesh size. More than 30,000 litres of soil have been processed in this way from the nearly 4000 samples collected so far, and nearly 2000 of these have been analyzed. When the plant remains have been recovered and identified, they are analyzed using a series of quantifiable indices, calculated for several variables (Table 1). However, full interpretation of the plant and animal remains depends on understanding their provenance (i.e. from what parts of the site they came), so in the next section the main features of the site are briefly described.

Table 1 The quantifiable indices and variables used in analyzing the plant remains recovered from the Giza site.

Indices
- Presence (or ubiquity) analysis
- Density of items per litre
- Ratios of crop taxa
- Number of taxa
- Fragmentation index
- Ratio of twisted to straight barley
- Density of wood charcoal
- Presence of wood charcoal vs presence of animal dung

Variables
- Site
- Sample
- Plant group: e.g. cereals, pulses, fruits, weeds, etc.
- Context type: floors, pit fills, etc.
- Interior or exterior
- Entity: rooms, buildings, etc., by phase
- Area
- Area type: bakery, house, etc.
- Phase

Figure 3 *Mud sealings were used to seal documents, jars, doors, etc. They often record information in the form of hieroglyphs such as the names of kings (which provide useful dating evidence), the contents of the object being sealed, or the destination of the sealed product.*

The layout of the settlement

The most conspicuous feature is the Wall of the Crow, which probably controlled the flow of people and materials into and out of the four sets of mudbrick galleries (Fig. 2). Each set is about 35 m long north to south and about 52 m wide (or 100 ancient Egyptian cubits). There are eight galleries in each set. Like many ancient Egyptian houses, the galleries have baking and cooking facilities in the back (southern end) and an open living area in the front, thus resembling an elongated version of what is a common Egyptian house plan. There are also low-angle platforms at regular intervals within the galleries. The function of the gallery sets is not clear, but one interpretation is that the angled platforms are bed platforms and that the galleries may have been used as a type of barracks for rotating shifts of pyramid builders.

Evidence from ancient Egyptian texts indicates that groups of unskilled workers on pyramid-building projects were temporarily conscripted, and worked in overlapping rotation in and out of these long-term royal projects. For example, graffiti from Giza depict the rivalry between two gangs of this period, the "Friends of Menkaure" and the "Drunkards of Menkaure".[3] Egyptologists infer that these gangs were

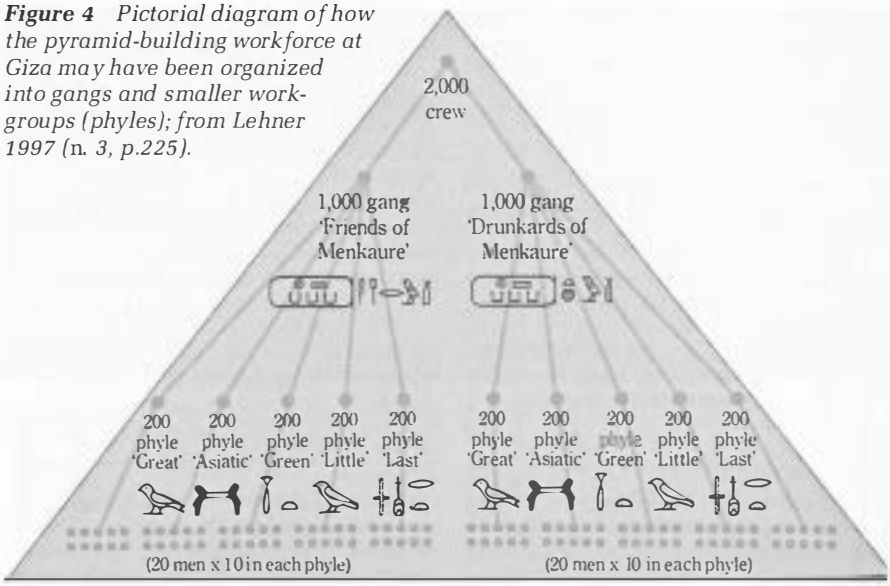

Figure 4 *Pictorial diagram of how the pyramid-building workforce at Giza may have been organized into gangs and smaller work-groups (phyles); from Lehner 1997 (n. 3, p.225).*

organized into smaller workgroups called phyles. There is uncertainty about the numbers involved in the gangs, but one estimate for Giza is that a crew of 2000 workmen would have been split into pairs of rival gangs of 1000 men each, with 200 men in each phyle (Fig. 4). If teams of 40 to 50 workmen occupied the front of a gallery, supervised by an overseer living in a house at the back, 1500–2000 men could have slept in the four sets of galleries.[4]

More than a dozen bakeries have also been identified, most of which are in the backs of the galleries or attached to them, with others scattered throughout the settlement. If a rotating labour force was housed in the galleries, these bakeries presumably produced their daily bread. The byproducts of the two types of cereal found on site, emmer wheat and hulled barley, are bread and beer, which are always found together in ancient Egypt and were likely

Figure 5 *An excavator at Giza holding an ancient bread mould from the site.*

to have been the main staples in the diet of the pyramid builders – as for most Egyptians at the time. This conclusion is supported by the fact that nearly 60 per cent of the over half a million pottery sherds from the site are from bread moulds (Fig. 5), and

Figure 6 *Experimental reconstruction of a bakery at Giza, with all the elements found in ancient bakeries at Giza.*

Figure 7 *Experimentally baked bread (using various mixtures of emmer wheat and barley) in locally made reconstructions of the type of mould used at ancient Giza.*

remains of beer jars are the second most common type of pottery. The third most common type are what are referred to as CD7 bowls, a type unique to Giza, which is likely to have been used for the consumption of both food and drink.

The textual and artistic evidence associated with Old Kingdom bakeries was also studied, and it was decided that some baking experiments were needed to help understand the archaeological evidence. A standard type of Giza bakery, which had most of the major elements found in other bakeries at the site, was chosen for experimental reconstruction (Fig. 6). During the experiment, it was found that all parts of the bakery had a function when we actually tried to bake bread, which involved experimenting with different mixtures of emmer wheat and barley, heating and stacking the bread moulds, pouring the dough and ensuring that the fire stayed at an even temperature. The bread from the first experiment proved to be barely edible (Fig. 7), but we plan further experiments and hope to learn how to improve the product.

There are also areas that were clearly used for storage. South of the galleries, for example, we found a large double-walled building. The evidence from the mud sealings found there indicates that it was some type of royal administrative building (see Fig. 2). Further excavation uncovered a huge storage facility, including eight large mudbrick silos (each one about 2.8m or 5 ancient Egyptian cubits in diameter, Fig. 8). It is likely that grain was dispensed from this central storehouse, protected behind the double walls of the administrative building. Ultimately, before the end of the fourth dynasty *c.* 2500 BC, the silos were destroyed and some 20 tonnes of limestone and granite were dumped into them.

Associated with the gallery sets there is a roofed colonnade (a hypostyle hall; see Fig. 2), which has a series of troughs, benches and column bases at regular intervals. The remains of similar troughs and benches excavated elsewhere, for example at the site of Tell Karrana in Mesopotamia,[4] show that these constructions often served as elevated platforms for the drying of grain and other foods, and in this case a concentration of fish remains from the 25 m-long colonnade points to the drying of fish. It has also been suggested that the hall may have been a common area or public space, and a concentration of CD7 bowls (used for food and drink), together with the fish and other animal remains, suggests that it may have been used as a communal eating area.

What are believed to be domestic houses are another prominent feature of the Giza settlement. They include, for example, a row of dwellings along the west side of the hypostyle hall and the so-called gate houses at the beginning of each of the three west–east streets, which were perhaps used to monitor people and goods going into and out of each set of galleries. In all, more than three dozen house units are recognizable within the settlement area. Unlike the planned layout of the main area, the Eastern and Western Towns (see Fig. 2) are self-organized domestic settlements that more closely resemble other ancient Egyptian town sites, and were probably home to longer-term residents. Small silos and ash-filled chambers suggest that residents, perhaps families, stored their own food and cooked for themselves. Excavations have shown that the Eastern Town extends beneath the modern town nearby. The mud sealings, pottery and stratigraphy all suggest that the eventual and probably intentional abandonment of the site took place at the end of the fourth dynasty, *c.* 2500 BC, soon after the reign of the pharaoh Menkaure.

Feeding the pyramid builders

So what did the pyramid builders live on? What types of food did they consume? The plant remains consist of relatively few species, primarily two cereals (emmer wheat and hulled barley), several pulses (small-seed legumes such as lentil, grass pea and bitter vetch), and fruits such as common fig, sycamore fig, Christ's thorn and possibly grape and date. The animal remains are limited to four domesticates (cattle, sheep, goats and pigs) and six species of fish (Nile perch, catfish, tilapia, tiger fish, grey mullet and puffer fish). This is a surprisingly short list and it is clear that the plant and animal assemblage from Giza lacks the diversity of food species commonly found at other ancient Egyptian settlements.

The plant samples are dominated by weeds, primarily large wild grasses and legumes, which were probably weedy contaminants of the cereals coming into Giza as offerings, tributes or tax, whether from local sources or more distant provinces. There is little evidence of nuts or roots and tubers, and, as yet, no evidence of plants providing oil or fibre; nor do the animal-bone remains contain any evidence of hunting, which is most unusual for an ancient Egyptian settlement.

Another striking feature of the plant assemblage is that, on average, the site has relatively few plants (only 3.6 plant items per litre of soil overall), which is much lower than at other settlements, such as New Kingdom Memphis (96.5) and First Intermediate Abydos (144.4).[5] The low density of plant remains and the few species represented may indicate that food preparation, fuel use and the disposal of fuel were specialized and routine activities.

When the number of items per litre is assessed by area, however, those with the highest relative density are found to be the so-called houses or domestic areas. They also generally have a higher diversity of food plants than other areas and are more

Figure 8 *Remains of large mudbrick storage silos within the royal administrative building at the Giza settlement, with the pyramids of the pharaohs Khufu and Khafre in the background.*

similar to domestic areas in other ancient Egyptian settlements. Most of the cereal, pulse, fruit remains and other food items have been found in the houses, probably because most of the food preparation took place in these dwellings. In the gallery sets, both the density of plant remains and the diversity of species are very low, which is to be expected if they were used as sleeping areas. The composition of the plant remains from the storage areas and the bakeries is similar. As yet, no storage facilities with their original contents *in situ* have been discovered, the plant material found there having been redeposited from elsewhere. The low density of items in the bakeries may be attributable to the abundance of fine ash, where most plant remains have been burned away. The hypostyle hall has the lowest plant density and diversity, but this does not exclude its having been used as an area for drying food or for communal eating, because it is improbable that plants would have become charred and been preserved in the course of either of these activities.

The evidence from the animal remains suggests clearer contrasts between different areas. As with the plants, the greatest diversity of animal species occurs in the houses. For example, the three gate houses and the royal administrative building (see Fig. 2) contained the remains of what would have been the best cuts of beef, as well as very large Nile perch. Certain houses in the Eastern and Western Towns also show this pattern, although with more sheep, goats and pigs. In contrast, the galleries and the hypostyle hall contain poorer cuts of meat from cattle, sheep and goats, as well as large amounts of small bony fish.

The plant and animal remains so far analyzed indicate that the pyramid builders themselves subsisted mainly on bread, beer, pulses, cattle, sheep, goats and catfish, whereas the inhabitants of the gate houses and the royal administrative building, who were presumably the overseers of the workmen in the galleries, had, in addition to these foods, much better cuts of meat, especially of beef and pork, and large Nile perch. The longer-term residents in the Eastern and Western Towns (where we are still analyzing individual houses in more detail) appear to have lived on a more varied diet consisting of all these foods.

There is also good evidence that the settlement was provisioned with food and fuel from elsewhere. The large amount of meat indicated by the bone remains is likely to have come into the settlement in the form of live animals, which were butchered there, an inference supported both by the finding that the cattle were mostly young males (1–2 years old) and by the lack of evidence of hunted animals. The cereals, too, probably arrived partly processed, apart from the large weeds we find, which would have been removed by hand prior to grinding the grain for baking or brewing. Wood was the main fuel used in the bakery ovens, and the analysis of wood charcoal from the site carried out so far shows that over 99 per cent of it came from acacia trees. Acacia wood is a high-quality slow-burning fuel that would have been an ideal choice for firing the bakery ovens. Unlike most other ancient Egyptian settlements, animal dung was apparently not a major fuel at Giza, and may not have been used at all.

Conclusion

The pyramid builders clearly did not live on bread and beer alone. Our investigations – which continue – have already demonstrated the great scale and complexity of this state-organized project, which depended on a major investment of natural resources and man hours (also, no doubt, woman hours), as well as many workmen's lives, as is suggested by the size of their cemetery above the settlement. Much work remains to be done as we excavate and analyze the cultural remains from this unique settlement and endeavour to understand more fully not only how it was organized but also the small details of the daily lives of the pyramid builders of Giza.

Notes

1. The GPMP is directed by Dr Mark Lehner who is affiliated to both Harvard University and the University of Chicago and who has been surveying and mapping the Giza plateau for more than 30 years. For a recent comprehensive review of the site, see M. Lehner, "The pyramid age settlement of the Southern Mount at Giza", *Journal of the American Research Center in Cairo*, **39**, 27–74, 2002. Dr Murray is the project archaeobotanist and assistant director in charge of archaeological science.
2. Dr Wilma Wetterstrom of Harvard University was the project archaeobotanist from 1988 to 1997.
3. See p. 128 in A. M. Roth, *Egyptian phyles in the Old Kingdom: the evolution of a system of social organization* (Studies in Ancient Oriental Civilization 48, Oriental Institute, University of Chicago, 1991).
4. See pp. 224–5 in M. Lehner, *The complete pyramids* (London: Thames & Hudson, 1997).
5. C. Zaccagnini, "Comments on parallel wall structures", in G. Wilhelm & C. Zaccagnini (eds), *Tell Karrana 3* (Mainz am Rhein: Philipp von Zabern, Baghdader Forschungen 15, 29–33, 1993).
6. M. A. Murray, *Cereal production and processing in Pharaonic Egypt, with particular reference to the town sites of Giza, Abydos and Memphis*, PhD thesis, Institute of Archaeology, University College London, 2000.