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A new look at old bread: ancient Egyptian baking

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Despite abundant archaeological, pictorial and textual evidence of ancient Egyptian life and death, we have little detailed information about the staple diet of most of the population. Now experimental work by a postdoctoral Wellcome Research Fellow in Bioarchaeology at the Institute is revealing how the ancient Egyptians made their daily bread.

The most famous accomplishment of the ancient Egyptians was probably pyramid building, an activity that required skill and imagination. So why are the builders of the pyramids thought to have subsisted on coarse, chaffy, gritty bread? Many Egyptologists have portrayed this dietary staple of the ancient Egyptians as a food of very poor quality. It has even been blamed for rapidly wearing down Egyptian teeth. Previously, most researchers have drawn conclusions about ancient Egyptian bread from tomb art and a few examples of surviving bread loaves, but recent archaeological research has established that ancient Egyptians could be as good at baking as they were at building.[1]

A study of Egyptian baking has value beyond satisfying curiosity about an ancient foodstuff. Together with beer, bread was one of the most important ancient Egyptian foods. All members of society ate bread and it was one of the most important offerings to the gods. From harvested crop to final product, bread preparation was a daily activity that occupied much of the population. Breadmaking thus played a central role in many aspects of Egyptian life, and an understanding of bread production reveals much about how this ancient society worked.

There is abundant archaeological evidence of bread production. Bread ovens and cereal processing tools have been excavated in houses, estates, temples, and, recently, in a complex associated with the Giza pyramids. Bread loaves or magical representations of bread were commonly included in burials, as part of the essential provisions for the journey to the afterlife. Model loaves, which probably functioned as military ration records, have been recovered from ancient forts.

Ancient loaves

Surviving loaves of bread provide the best evidence for ancient Egyptian baking (Fig. 1). They are often in excellent condition, because they have been preserved by complete desiccation in Egypt's arid climate. Most loaves have been found in tombs and burial sites, although a few examples are known from settlements. They are rare and are held in museums scattered throughout the world, but there are probably a few hundred altogether.

Examination of a well preserved bread loaf yields much information about how it was made. Ancient Egyptian loaves come in a wealth of sizes and shapes. Often they are simply disks or low oblong mounds, but bread was also made into cones, craters and triangles. Sometimes they were formed into more elaborate shapes, such as human or animal figures. The crusts are sometimes decorated with incisions, prick marks and raised strips. Occasionally the marks of fingers and hands can be distinguished, giving a little hint of the baker who made them.

By observing a loaf with simple magnification we can detect what is in it: intentional ingredients such as flour, cracked grain and flavouring; as well as unwelcome additions such as chaff, grit and ash. Among flavourings added were dates, figs and coriander seeds. The cereal most commonly identified in the loaves that still survive is emmer wheat, which today is very rarely grown. However, emmer was one of the first plants to be domesticated and it became one of the staples of human diet, especially for farmers living in the temperate Old World. Emmer and barley were virtually the only cereals that the ancient Egyptians grew, and emmer was one of their most important crops.

Because emmer is so seldom cultivated today and is unfamiliar to many people, most of those who have studied ancient Egyptian bread have not appreciated how much it differs from bread wheat, the cereal now normally used for baking. Emmer is a hulled wheat, in which the grains are enclosed by tough scale-like bracts that, when threshed, produce a lot of chaff. Its ears have two main characteristics that make it more difficult to process than bread wheat, which is not hulled and which threshes freely (Fig. 2). The central stalk of the emmer ear breaks apart fairly easily, but the chaffy bracts surrounding the grain are very tough and hard to remove. In contrast, the stalk of the bread-wheat ear is tough but the chaff falls away

Figure 1 An ancient Egyptian disk loaf (maximum diameter 14 cm) of the Ninth Dynasty (c. 1500 BC), now at the Ashmolean Museum, Oxford (museum no. 1921.1395).

Figure 2 Threshed hulled wheat (left) and free-threshing wheat (right). The threshed hulled wheat ear falls apart into spikelets whereas the chaff of free-threshing wheat falls cleanly away from the grain.

Figure 3 *Women in a Turkish village de-branning grain for bulghur using a large stone mortar and wooden mallets, 1991.*

readily. When bread wheat is threshed, it is easy to free the grain from the ear, but when emmer is threshed the ear falls apart into little packets which are known as spikelets. They consist of the grain tightly enclosed in chaff. Skilled extra work is needed to break up the chaff to free the grain without crushing it.

In ancient Egypt, cereal processing had to be carried out by hand with relatively simple technology, and the best way to find out how this was accomplished is by investigating how emmer is processed traditionally today.

Ethnographic examples of traditional cereal processing

Although emmer is now rare, it could until recently be found under cultivation in some remote mountainous areas in Europe, Turkey and Ethiopia. The number of farmers who cultivate emmer continues to shrink and traditional processing practices are dying out even more quickly. Fortunately, some records have been kept of how emmer used to be treated, and a few communities still employ traditional techniques of cereal processing.

In many areas where emmer was grown, the chaff was removed by pounding the spikelets in wooden or stone mortars with wooden pestles or mallets. The key to the process is wetting the spikelets first. The damp chaff becomes pliable and slightly sticky. Thus, when the spikelets are pounded, they are rubbed vigorously together rather than crushed. The chaff can become quite flexible and the grain can pop out of the spikelet under the pressure of pounding. The pounding causes the chaff to shear apart and release the grain. Once the damp chaff and grain mixture is dried, the chaff can be sieved and winnowed to separate it from the grain.

A process similar to de-husking emmer is the preparation of Turkish bulghur, or cracked wheat, from which the bran (the thin covering that surrounds the kernel) has been removed. Different types of wheat can be used and in some Turkish villages the old method of de-branning is still practised (Fig. 3). Mortars and mallets are used and the grain is wetted prior to pounding. The result is whole grain with the bran stripped off, just as de-husking emmer produces whole grain with the chaff stripped away. Although not precisely the same process, bulghur-making provides a useful parallel that helps us to understand emmer de-husking.

Archaeological evidence

Is today's method of emmer de-husking similar to that used by the ancient Egyptians? The archaeological record suggests that it is. Shallow stone mortars are commonly excavated from ancient Egyptian houses. In exceptional, very arid, conditions, even complete wooden pestles have been recovered. What makes the connection between the mortars and emmer de-husking secure is the evidence of plant remains from the site of Amarna, an ancient Egyptian city some 230 km south of Cairo that dates from about 1350 BC.

Part of the site of Amarna consists of a village located about 2 km from the Nile flood plain, in the highly arid eastern desert. Here, plant remains have been recovered in abundance, preserved by desiccation. Those found on archaeological sites have usually been preserved by charring through contact with fire (e.g. around ovens), which arrests their decay. Under arid conditions no such intermediary process is needed to preserve plant fragments, which survive because they are desiccated. In these circumstances plant remains can be recovered from different places where they were dropped in the course of various activities. In one ancient house of the Amarna village, a mortar was discovered set into the corner of a room (Fig. 4). Scattered on the floor around the mortar was a large quantity of emmer chaff. It ranges from complete spikelets still containing the grain, to whole spikelets with no grain inside, to shredded chaff fragments. This is precisely the scattered remains one would expect to result from pounding whole spikelets in a mortar with a wooden pestle.

One difference between the mortars used in ancient Egyptian and most mortars used now or in the recent past is that the former were much smaller. This may have been because, unlike traditional Turkish processing, emmer pounding in ancient Egypt was done in the household, not as a communal village activity. Large stone mortars are very heavy and difficult to move. These common household tools had to be reasonably transportable for ordinary people to obtain and install them. One way of investigating how the small mortars affected emmer processing, and indeed of confirming whether the shredded emmer found in the plant remains could have been produced in them, is through experimental replication.

Experiments with emmer processing

Many of the stone tools excavated at Amarna are in excellent condition and they presented an ideal opportunity to try experimental reconstruction of emmer processing. The equipment made from organic materials, such as wooden pestles and wooden and grass sieves, is not robust

Figure 4 *The foundations of a house in the workmen's village at Amarna, showing the position, against the right-hand wall, of the circular limestone mortar illustrated in Figure 5.*

Figure 5 *A limestone mortar with a built-up mudbrick and plaster rim, placed in the corner of a village house at Amarna (scale bar intervals 25 cm).*

Figure 6 *The author using an ancient Egyptian limestone mortar and replica wooden pestle to de-husk emmer wheat.*

enough to be used now. So instead I made replicas of these tools, based on specimens excavated from arid settlement sites or recovered from tombs. Excavations showed that the ancient Amarna villagers built elaborate mudbrick and plaster rims around their mortars (Fig. 5) or simply set the mortars into the ground with the rim protruding slightly. For the experiments, it was easiest to place the ancient mortar in the ground. Most Amarna village houses also had box-like mudbrick and plaster emplacements. These raised the flat grinding stones off the ground, making the milling process easier and quicker. I built a grinding emplacement that had the same construction and dimensions as the archaeological specimens.

Pounding emmer spikelets in the mortar (Fig. 6) very quickly established that water was essential for successful de-husking. The quantity is not critical, but, if there is too little, most of the spikelets fly out of the mortar, whereas too much water makes them slosh out of the shallow bowl. It does not take long to pound a measure of emmer spikelets but it requires strength and stamina. The ancient Egyptians who carried out the pounding had to repeat the process over and over again, because the small mortars could take only a limited volume of spikelets at a time. The feel of the pounding and the noise made by the pestle on the contents of the mortar change when the spikelets are shredded, so it would have been easy to tell when to stop. Apart from whole grains, which would have been removed, the resulting mixture of whole spikelets and varying sizes of shredded chaff closely resembles the archaeobotanical assemblage found around the original mortar emplacement (Fig. 7).

Although hand milling is rightly considered an arduous process, using an emplacement to raise the grindstone off the ground makes milling much quicker and easier. The miller is in close control of the grinding process, and the texture of the flour can be adjusted precisely. A few strokes of the handstone against the lower

Figure 7 *The shredded emmer chaff generated by experimental pounding as shown in Figure 6, together with whole, freed grain (scale bar intervals 1 cm).*

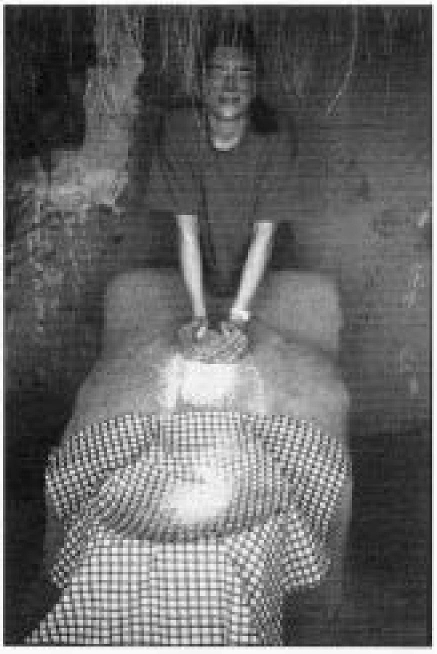

Figure 8 *The author grinding flour with an ancient Egyptian handstone and grindstone set in a replica emplacement.*

flatstone produces a coarse meal, and several more strokes rapidly create a fine flour (Fig. 8). Like the pounding process, however, the milling sequence must be repeated over and over again because only a small quantity of grain can be processed at a time.

Supplied with sufficient emmer flour, the next step in the experiment was baking emmer loaves. This proved much more difficult, and I have yet to produce palatable emmer bread. Emmer flour behaves quite differently from bread wheat, requiring much more water to make a workable dough. Each step of mixing, resting, shaping and then baking the dough needs further investigation. The addition of such flavourings as fruits also changes the characteristics of emmer dough. The final stages of Egyptian breadmaking are not necessarily straightforward and are still not fully understood.

New insights about ancient Egyptian bread

With the new data gained from archaeological, ethnographic and experimental sources, we are now in a much better position to assess the nature and quality of ancient Egyptian bread. It is true that some of the loaves that survive from ancient times are coarse and full of chaff. However, many have a very fine texture and are clean and carefully made. Some loaves are full of coarsely cracked cereal grains, but these were added deliberately to fine-textured dough made from well milled flour. The cracked grain was pre-cooked before being mixed into the bread dough, to create a sweet, chewy texture. These loaves resemble the multi-grain or granary loaves that we are familiar with today. Such additions indicate the variety of bread recipes that the ancient Egyptians used and they show that their staple food was not a monotonous product.

Ethnographic and experimental evidence confirms that the steps required to process emmer are more complex than those for bread wheat. The Egyptians were nonetheless capable of skilfully manipulating the tools and installations required for de-husking and milling emmer to produce varied and imaginative products. They were familiar with the properties of emmer flour and the methods required to produce palatable bread from it.

Given that the Egyptians were able to make sophisticated bread, the fact that some of the loaves are apparently so unpalatable, indeed inedible, needs to be explained. The context in which they were found provides a clue. Most of the loaves that survive today have been recovered from tombs or ritual sites connected with burial. The ancient Egyptian practice of making models of objects and servants, to stand in magically for the real thing, is well known. The chaff loaves were made from the byproducts of emmer bread processing and were probably intended to represent real bread; they would not have been the type of loaf actually consumed by the ancient Egyptians. As the loaves contaminated by chaff and grit were not edible, was gritty bread likely to have been responsible for the Egyptians' worn teeth? This suggestion is very unlikely, and recent work suggests that it was some other yet to be identified element of the Egyptian diet that was responsible.[2]

There is still much to be learned about ancient Egyptian bread. Many details of processing, as well as possible changes in ingredients and technology over time, remain poorly understood. Nevertheless, enough work has been done to show that one of the most valued and fundamental items of diet, the loaf of bread, was a sophisticated product that was skilfully produced and satisfying to eat.

Notes

1. Further information about the archaeology of ancient Egyptian bread can be found in the following publications by D. Samuel: "Their staff of life: initial investigations on ancient Egyptian bread baking", in *Amarna Reports V*, B. J. Kemp (ed.), 253–90 (London: Egypt Exploration Society, Occasional Publication 6, 1989); "Ancient Egyptian cereal processing: beyond the artistic record", *Cambridge Archaeological Journal* **3**, 276–83, 1993; "Investigation of ancient Egyptian baking and brewing methods by correlative microscopy", *Science* **273**, 488–90, 1996; *An archaeological study of baking and bread in New Kingdom Egypt*, PhD thesis, Department of Archaeology, University of Cambridge, 1994. The research described here was supported by the Egypt Exploration Society and funded by the British Academy and Scottish & Newcastle Breweries plc. I am grateful to Barry Kemp, the director of research at Amarna, for his support and help.
2. See J. C. Rose, G. J. Armelagos, L. S. Perry, "Dental anthropology of the Nile valley", in *Biological anthropology and the study of ancient Egypt*, W. V. Davies & R. Walker (eds), 61–74 (London: British Museum Press, 1993).