

## BREAD OR FLATBREAD?

## An archaeological attempt to reconstruct Roman bread

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*This publication presents an attempt to reconstruct bread-making in Roman times, from grinding the grain to baking. It aims to shed light on the quality of grist and flour ground with Roman hand mills and the bread made of them. During the archaeological experiment, the duration of the grinding process, the quality of the flours, and the texture and taste of the final products were examined and compared to products of modern food industry.*

**Keywords:** Roman hand mill, Roman bread, flour, yeast, sourdough, panis, sieve

## RESEARCH HISTORY

‘Nature has nothing to do with whether I eat poor men’s bread or one made of fine flour’ (SENECA [1917], 119.3). As suggested by ample hints in the writings of ancient authors, one of the staple foods of Romans was bread. We cannot know for sure what bread meant to them or, more precisely, whether the concept of bread as we know it today fits the bread of the Romans. Sources do not mention a specific recipe, nor do we have any data on the quality of the flour they used for bread that could be interpreted using the terms and concepts of the modern food industry, leaving us with the question: can today’s bread as a bakery product be compared with Roman bread? Well, the opinions of the researchers of the Roman Period are divided on this issue (GRÜLL 2013, 29; Roth 1999, 47; JUNKELMANN 1997, 113), but most of them agree that the quality of Roman bread was inferior to that of today’s bread. This view is based on the fact that in the Roman Period, neither the technology applied for processing grains nor the properties of the cultivated grain types were suitable for providing flour to produce bread that matched today’s food industry standards. My current professional interest is the research of Roman hand mills, including the morphological examination of millstone finds from the Roman *castrum* of Mikháza (Călugăreni, Romania); that allowed me to notice the technical excellence of this hand tool, eventually leading to the idea of starting grinding experiments with a 2nd-century AD Roman hand mill replica I had made earlier. In my opinion, the results of the experiment series shed some light on the quality of Roman bread, qualifying current hypotheses about the topic.

Making leavened bread is a simple process. The ingredients of today’s bread dough are fine flour, leavening agent (yeast), water, and salt, which become mixed, kneaded, raised, shaped, and finally baked in an oven. The process was known already



Fig. 1. Mosaic from Saint-Romain-en-Gal, Rhone-Alpes, 3rd century AD ([source](#))

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Fig. 2. Oven and hand mill in a Roman legionary camp, Lautagne F, 1. century AD ([source](#))

by the Romans and has remained unchanged since ancient times. The archaeological record of the period abounds with bread ovens (Fig. 1) identical to the rural East European domed earthen ovens still used today. The record of several Roman military camps yielded hand mills, clay ovens (Fig. 2), and grain seeds representing species still grown today. Pliny dedicates a full chapter of *History of Nature* to the various leavening agents (PLINY [1938], XVIII.26) and even describes how to make them from must, barley, chickpeas, and sourdough. These are not the same as the yeast used by the food industry today, but their role and effect are identical, as they also contain yeast fungi. During leavening, the yeast produces

volume-enhancing carbon dioxide in the dough, which is retained by the elastic gluten network consisting of the insoluble proteins from the (wheat or other gluten-producing) flour and water. As a result, the bread will have a characteristic spongy and soft structure. It can be seen that the only ingredient of Roman bread that cannot be determined is flour, more precisely, the quality of the flour used—that is why flour is the key. The forming of gluten strands that retain the carbon dioxide, water, kneading, and sufficiently fine flour are needed. A morphological analysis of Roman hand mills may give a possible clue about the quality of Roman Period flours. Bread-making was institutionalised during the Imperial Era, all parts of the process, from grinding to kneading and baking, having been the task of special guilds (*pistores*) in the big cities. Bakeries ground the grains with large mills, dry mills known as ‘Pompeian-type’, powered by animal or human power, and even water mills. In contrast, flour was produced with hand mills in the *villa rusticas*, the countryside, and the army. Most people in the countryside used hand mills (see VIRGIL [1918]). The importance of hand mills increased for the Roman army after the Marian military reforms in the 1st century BC: the central supply of the army (*frumentum*) only included bread—one of the basic foods—in the form of grain, which

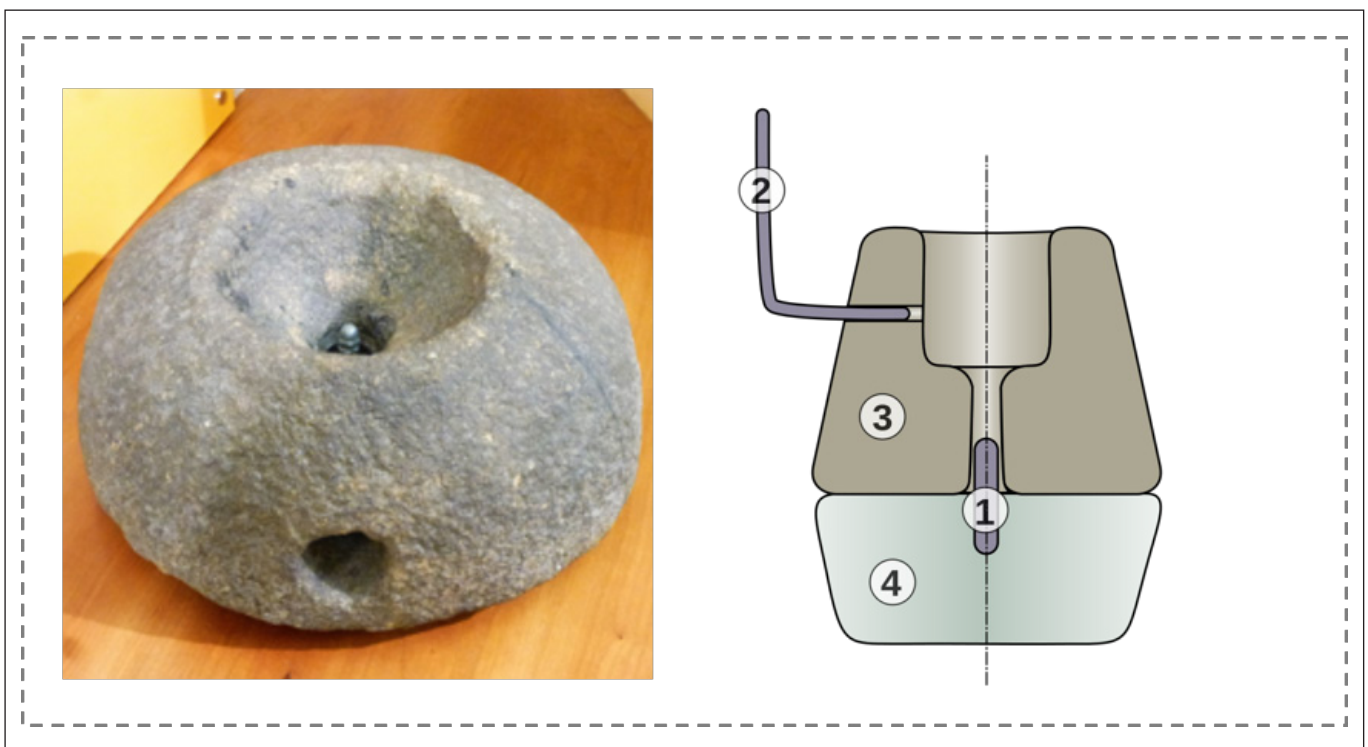


Fig. 3. Celtic-type rotary quern



Fig. 4. Replica of a Roman hand mill from Mikháza (made by László Szekernyés, photo by Attila Henn)



Fig. 5. Geometrical furrows on the 2nd-century AD Roman hand mill from Mikháza (photo by László szekernyés)



Fig. 6. Geometrical furrows on the replica hand mill (photo by Attila Henn)

had to be processed locally. Therefore, a hand mill was included in the equipment of every *contubernium*, a unit of eight to ten soldiers practically living together (GOLDSWORTHY 2004, 90). Conclusively, hand mills as basic tools reached every corner of the Empire in huge quantities with the Roman army and became known among the civilian population in the settlements around each *castrum*. Also, hand mills became standardised thanks to the army, and the optimal and most efficient version was developed. Roman hand mills, therefore, also influenced the quality of everyday bread. The Roman hand mill, a perfected version of the Celtic rotary quern (Fig. 3), had several characteristics that radically influenced the quality of the grist. One of these was raw material: Romans preferred hard and compact lava stone or, in the lack of that, very compact conglomerates for their hand tools as those, being wear-resistant, did not contaminate the flour with stone powder and dust during grinding. That was important as flour could not be cleaned later. While fine stone particles can be removed from semolina and coarse semolina by washing, fine flour cannot be treated this way. The second characteristic was size: Celtic rotary querns were smaller, with the stones' size rarely exceeding 35 cm in diameter because such a short way between the grinding surfaces was enough to break the grains into semolina. The stones of Roman military hand mills (Fig. 4) were larger, ranging 37–42 cm, while civilians used millstones up to 52 cm in diameter (LÁNG & WILSON 2023), which not only made grinding easier but also secured a longer route for the grains between the stones, thus grinding them into fine flour. The third characteristic was the design of the grinding surface (Figs. 5–6), descending slightly at an angle of around 0–10 degrees. That meant slow passage for the grist and seeds between the stones; besides, the grinding surfaces were sharpened (SZEKERNYÉS & PÁNCZÉL 2021), which also increased the efficiency of grinding. In summary, the Roman hand mill was designed to grind uncontaminated fine flour. Of course, the basic ingre-



Fig. 7. Bakery. Pompeii, Casa del Forno ([source](#))

dient of good bread has always been proper grain. We have information about the grain types grown in the Roman Period (PLINY [1917], XVIII.10) and the characteristics of the bakery products made of them. Among all grain varieties, Egyptian wheat with particularly high gluten content and some native European wheat types with considerable gluten content (einkorn, emmer, and spelt) must be highlighted, as gluten content is pivotal for making a leavened dough. Archaeological excavations have proven that the infrastructure for making bread of a quality meeting the modern food industry standards was available in the Roman Period (Fig. 7).

### THE ARCHAEOLOGICAL EXPERIMENT

Together, the Egyptian naked wheat, the Roman oven, fine horse hair or grass sieves, and hand mills provided a combination of physical and chemical characteristics suitable for making high-quality bread. As for the professional skills of Roman bakers, it is enough to quote the ancient authors (PLINY [1917], XVIII.28): the seasoning, shapes, and other characteristics of the prepared loaves reflected several centuries of experience, evidencing that they possessed the necessary knowledge. Another question is, what was the taste and texture of Roman bread like? Well, it can only be answered with the help of experimental archaeology. That is why I tried to reconstruct the entire production process, from grinding to baking, under the same technical conditions and using the same amounts of raw materials (Fig. 8). I compared the quality of the flour with today's standards and analysed the dough and the final product according to physical characteristics and taste by recording the opinions of a test group. During the archaeological experiment, I made every bread according to the same recipe and used industrial yeast as a leavening



Fig. 8. Reconstructed Roman domed oven in Mikháza (Călugăreni), Mikháza Archaeological Park of the Muzeul Județean Mureș, Romania (by László Szekernyés)

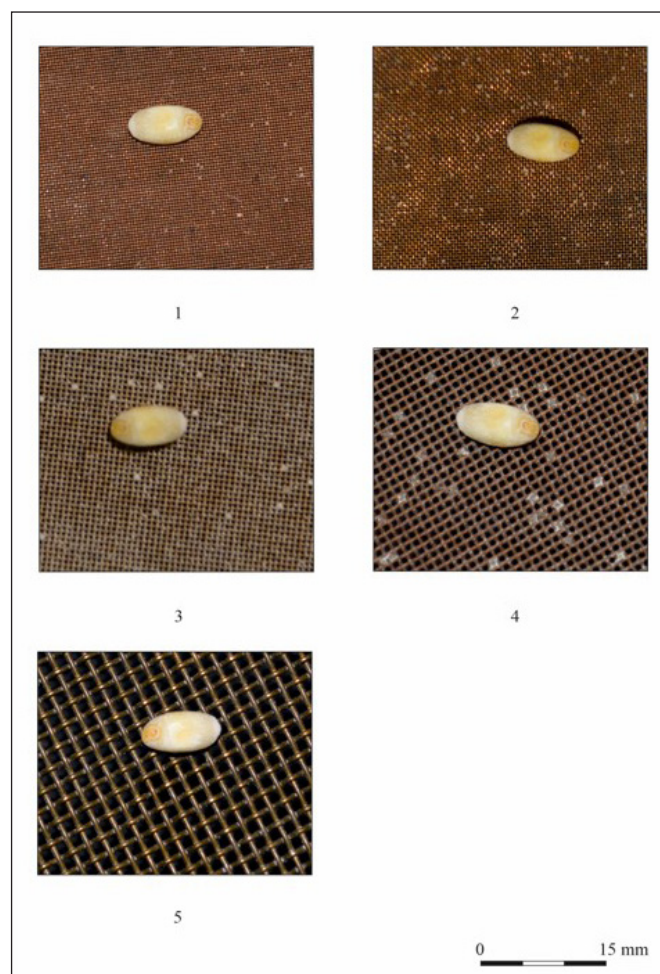


Fig. 9. Industrial sieves. 1, 180  $\mu\text{m}$ , 2, 250  $\mu\text{m}$ , 3, 315  $\mu\text{m}$ , 4, 500  $\mu\text{m}$ , 5, 2000  $\mu\text{m}$  (photo by László Szekernyés)

Table 1. Classification of modern industrial flours according to grain size

Wheat flour BF 55	Fine wheat flour BL 55	Whole grain wheat flour BTKL	Wheat Graham flour BGL	Rye flour RL
360µm/100% 160 µm / max.25%	315µm/100% 250 µm/min.95%	500µm/min.85% 315 µm/min.70%	>2000 µm/100% 315 µm/min.70%	250µm/100%

Table 2. Grain size of the diverse flours produced with a Roman hand mill

Cereal type	Grinding cycles/ Duration	Sifting size µm				
		>2000	<500	<315	<250	<180
Bread wheat	5 / 12'20 "	4%	85%	65%	41%	9%
Spelt	7/16 '50 "	14%	60%	39%	23%	2%
Einkorn	5/11 '10 "	7%	73%	52%	35%	5%
Rye	7/13 '10 "	40%	46%	-	-	-
Barley	7/11 '15 "	63%	-	-	-	-
Millet	5/9 '10 "	3%	87%	31%	3%	-

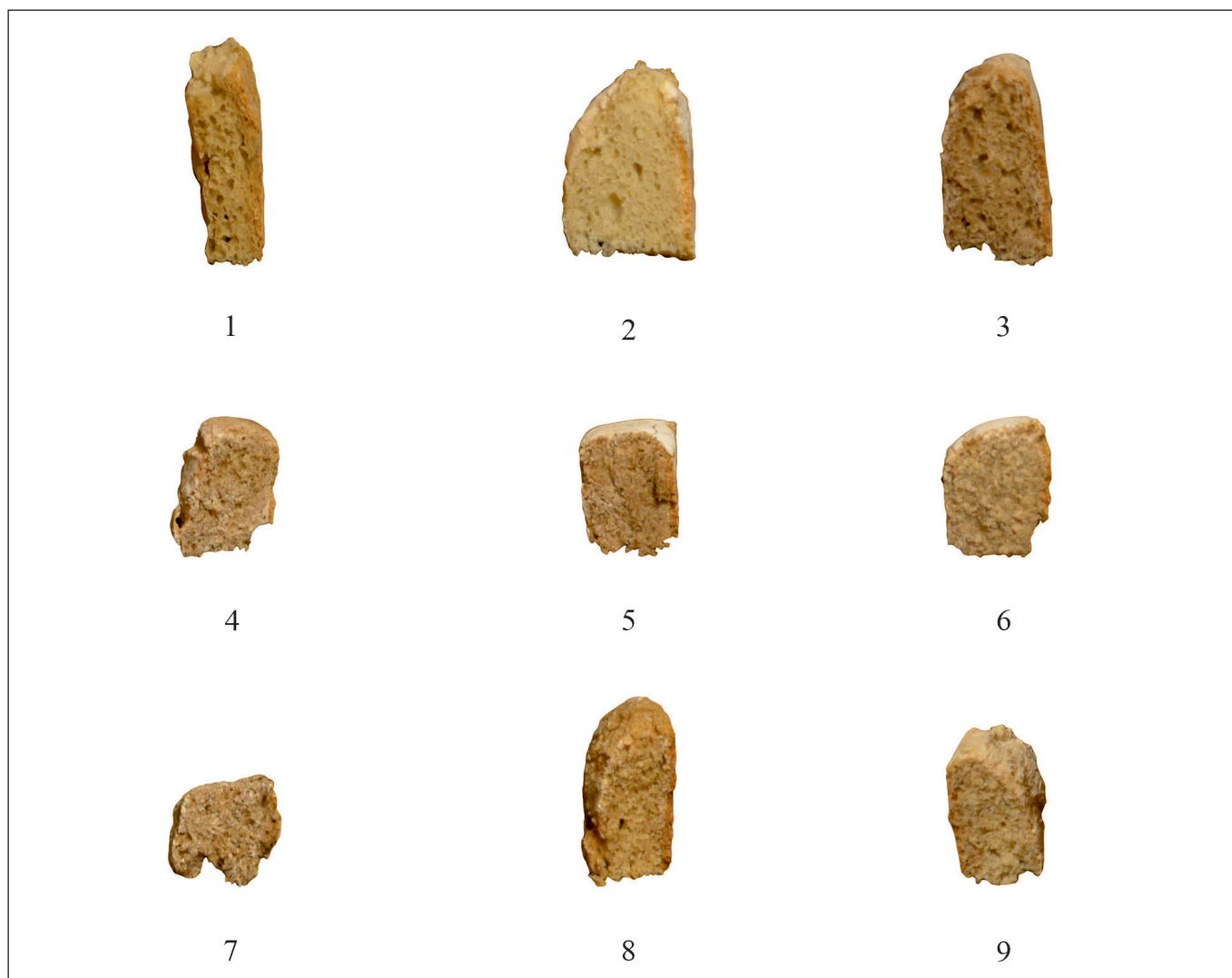


Fig. 10. Samples of the breads enlisted in Table 3 (photo by László Szekernyés)

agent (the physicochemical effect of which on the final product is identical to that of leavening agents used in Roman times). For grinding, I used the replica of a 2nd-century AD Roman hand mill from Mikháza, made from a similar stone material (andesite). The goal was to obtain the finest flour possible, similar in appearance and quality to modern flours. After grinding, all flours were sifted through industrial sieves (Fig. 9) and compared with modern standards (Table 1, standards after *Codex Alimentarius Hungaricus* 2-201). By summarising and evaluating the results in a sheet (Table 2), it can be seen that Roman hand mills were capable of producing flours matching in quality today's fine, whole grain, and Graham flours from different types of wheat. Making such fine flours was, of course, time-consuming, and must have included repeated re-grinding and sifting. The four portions of flour produced in the experiment were baked into loaves of the same size (Fig. 10), following the same recipe (100 g flour, 5 g yeast, salt, approximately 0.7 dl water). The character and taste of the different breads produced were also summarised in a sheet (Table 3).

Table 3. Evaluation of breads (test group opinions)

Flour type (by industrial standards)	Dough texture	Bread texture	Taste
White bread, emmer BL55	Very soft	Well-risen, soft	Very tasty
White bread, wheat BL55	Soft	Well-risen, soft	Very tasty
White bread, spelt BL55	Medium soft	Medium-risen, soft	Tasty, sweet
Whole grain bread, spelt BTKL	Medium hard	Poorly risen, dense, soft	Tasty, sweet
Rye bread (> 2000 µm 20%, < 500 µm 20%)	Very hard	Did not rise, dense, crumbly	Bitter, with a sweet aftertaste
Barley bread (> 2000 µm)	Very hard	Poorly risen, dense, crumbly	Slightly sweet
Rye bread with semolina (> 2000 µm 80%, < 2000 µm 20%)	Very hard	Poorly risen, dense, crumbly	Sour, with a bitter aftertaste
Whole grain bread, emmer BTKL	Soft	Risen, soft	Tasty
White bread, mixed (einkorn 15%, spelt 15%, wheat 70%) BL55	Soft	Well-risen, soft	Very tasty

## RESULTS

The opinion of the test group showed surprising similarity with Pliny's description of different Roman breads. According to him, the Parthian bread or *aquaticus*, made from very high-quality sifted wheat flour, had a light, airy, spongy texture (PLINY [1917], XVIII.27). Rye bread was 'dense, heavy, dark in colour, bitter in taste, difficult to digest, and only suitable for avoiding starvation'. According to Pliny, the finest flour (which he calls *siligo* or *pollen*) could be made from bread wheat. Also, its flour made the most dough, which indicates that it could absorb the most water, i.e., it had a very high gluten content. That was the most expensive Roman flour. Pliny found bread made of spelt to be particularly sweet (PLINY [1917], XVIII.20). '*Utrum hic panis sit plebeius an siligineus*', Seneca also makes a clear distinction between the quality of different bread types; also, the officers of the Roman army and the soldiers on holidays received '*panis militaris mundus*', white bread (JUNKELMANN 1997, 112).

## CONCLUSION

In summary, the bread Romans ate could have been very high quality, similar to today's white bread. However, this quality was not affordable for everyone, as its production must have been expensive and time-consuming. Ordinary citizens and soldiers ate whatever bread they could, made from bran, whole wheat flour, or something similar to Graham flour, while the wealthy ate *panis siligineus*, white bread.

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